Advance and unedited reporting material

Eighty-first session
Item 72 (b) of the provisional agenda*
Oceans and the law of the sea: sustainable fisheries, including through the 1995 Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, and related instruments

Actions taken by States and regional fisheries management organizations and arrangements in response to relevant paragraphs of General Assembly resolutions 64/72, 66/68, and 77/118 on sustainable fisheries, addressing the impacts of bottom fishing on vulnerable marine ecosystems and the long-term sustainability of deep-sea fish stocks

Report of the Secretary-General

Summary

The present material has been prepared pursuant to paragraph 239 of General Assembly resolution 79/145. The Secretary-General, in cooperation with the Food and Agriculture Organization of the United Nations, was requested to report to the General Assembly at its eighty-first session on the actions taken by States and regional fisheries management organizations and arrangements in response to paragraphs 113, 117 and 119 to 124 of resolution 64/72, paragraphs 121, 126, 129, 130 and 132 to 134 of resolution 66/68 and paragraphs 181, 203 to 207, 209, 210, 213, 215 to 222 and 257 of resolution 77/118, with a view to ensuring the effective implementation of the measures therein and to make further recommendations, where necessary. This report is to facilitate the conduct of further review of these actions at the present session.

The report is a follow-up to earlier reports prepared by the Secretary-General (A/61/154, A/64/305, A/66/307, A/71/351, A/75/157 and A/77/155). It should be read in conjunction with earlier interim reports of the Secretary-General on the measures taken by States and regional fisheries management organizations and arrangements to implement resolution 61/105 (A/62/260, paras. 60–96, and A/63/128, paras. 63–78).

* A/81/150.

Contents

Abbreviations

ABNJ	areas beyond national jurisdiction
CAOFA	Agreement to Prevent Unregulated High Seas Fisheries in the Central Arctic Ocean
CCAMLR	Commission for the Conservation of Antarctic Marine Living Resources
CM	Conservation measure
CMM	Conservation and management measure
FAO	Food and Agriculture Organization of the United Nations
GFCM	General Fisheries Commission for the Mediterranean
ICES	International Council for the Exploration of the Sea
NAFO	Northwest Atlantic Fisheries Organization
NEAFC	North-East Atlantic Fisheries Commission
NPFC	North Pacific Fisheries Commission
RFMO	regional fisheries management organization
RFMO/As	regional fisheries management organizations and arrangements
SEAFO	South East Atlantic Fisheries Organization
SIOFA	Southern Indian Ocean Fisheries Agreement
SPRFMO	South Pacific Regional Fisheries Management Organization
UNEP	United Nations Environment Programme
VMEs	vulnerable marine ecosystems

I. Introduction

1. Pursuant to relevant General Assembly resolutions, considerable efforts have been undertaken to protect deep-sea ecosystems which, due to their specific characteristics, are particularly vulnerable to the impact of anthropogenic pressures, including bottom fishing activities.

2. Since the adoption of resolution 61/105 twenty years ago, the General Assembly has been monitoring how States and regional fisheries management organizations and arrangements (RFMO/As) address the impact of bottom fishing on vulnerable marine ecosystems (VMEs) and the long-term sustainability of deep-sea fish stocks. Since then, it has conducted reviews of actions taken by States and RFMO/As in response to its resolutions on sustainable fisheries of 2009, 2011, 2016 and 2022.

3. In resolution 79/145, the General Assembly recalled its decision, in paragraph 223 of resolution 77/118 of 9 December 2022, to conduct, in 2026, a further review of the actions taken by States and RFMO/As in response to paragraphs 113, 117 and 119 to 124 of resolution 64/72, paragraphs 121, 126, 129, 130 and 132 to 134 of resolution 66/68 and paragraphs 181, 203 to 207, 209, 210, 213, 215 to 222 and 257 of resolution 77/118, with a view to ensuring the effective implementation of the measures therein and to make further recommendations, where necessary, and to precede that review with a two-day workshop.

4. The Assembly also requested the Secretary-General to report to it at its eighty-first session. The Secretary-General invited States, regional economic integration organizations, RFMO/As and the Food and Agriculture Organization of the United Nations (FAO) to provide information.

5. In response, submissions were received from 14 States (Argentina, Australia, Azerbaijan, Canada, Japan, New Zealand, Norway, Qatar, Romania, Spain, Sri Lanka, Türkiye, the United Kingdom of Britain and Northern Ireland and United States of America), FAO and five RFMO/As.[1] The Secretary-General wishes to express his appreciation for the submissions received.[2]

II. Overview of the impact of bottom fisheries on vulnerable marine ecosystems and the long-term sustainability of deep-sea fish stocks

6. The present section provides an update of the previous reports of the Secretary-General on the current knowledge of VMEs and bottom fishing as well as the impacts of bottom fishing (see A/61/154, A/64/305, A/66/307, A/71/351, A/75/157, and A/77/155). It summarizes the latest research findings and highlights some of the priority science challenges to further the understanding of VME ecology and the impacts of bottom fisheries on deep-sea ecosystems. Furthermore, it highlights some of the research conducted to inform fisheries impact mitigation approaches and strengthen ecosystem-based fisheries management by RFMO/As.

A. Vulnerable marine ecosystems: an updated review

[1] CCAMLR, GFCM, NAFO, NEAFC, and SIOFA. In addition, information was used from SPRFMO's annual report to the United Nations, as well as research from publicly available sources. It is noted that CCAMLR, while not an RFMO/A, undertakes such functions for the purposes of the implementation of relevant General Assembly resolutions.

[2] The full text of the contributions received is available at: www.un.org/depts/los/bottom_fishing_workshop.htm. An advance and unedited version of the report, containing full citations is also available.

7. The VME concept has gained wide usage in scientific and management literature.[3] This report focuses on the key literature that is particularly relevant since the last report.

1. Defining vulnerable marine ecosystems

8. Defining VMEs is a long-standing challenge as noted previously (A/61/154, A/64/305, A/66/307, A/71/351, A/75/157, and A/77/155). Because of the increasing availability of deep-sea imagery, a recommendation for a scientific community consensus on how to define a VME from single images was developed[4] on the basis of the components of the FAO definition of a VME.[5]

9. This same study[6] also compiled a table of the taxa designated as VME indicator species in each RFMO/A region. The only taxa that were consistently considered as VME indicators in all of the RFMO/As were Scleractinian and Antipatharian corals as well as Octocorals. Sponges were included in all RFMO/As except the NPFC (which has added them[7]). For the remaining taxa there was a high degree of inconsistency among RFMOs as to whether they were considered VME indicators or not.

10. A key challenge with VME identification continues to be determining the threshold densities of VME indicator taxa within the context of the “Structural Complexity” criterion of the FAO Guidelines. Evidence is emerging that a single threshold value may not be suitable to be applied for all taxa in a given RFMO area because of natural variability in density of occurrence. In response to this challenge, a group of scientists in CCAMLR have developed an imagery-based approach to VME identification for the Southern Ocean that yields an assemblage-level index of vulnerability to fishing that helps to account for differential abundances or densities among taxa.[8]

2. Discoveries of New VME Areas

[3] Due to the large number of published studies during the period under review, this overview does not purport to be exhaustive, but illustrative of major trends.

[4] Baco AR, Ross R, Althaus F, Amon D, Bridges AEH, Brix S, Buhl-Mortensen P, Colaço A, Carreiro-Silva M, Clark M, Du Preez C, Franken M-L, Gianni M, Gonzalez-Mirelis G, Hourigan T, Howell K, Levin LA, Lindsay DJ, Molodtsova TN, Morgan N, Morato T, Mejia-Mercado B, O’Sullivan D, Pearman T, Price D, Robert K, Robson L, Rowden AA, Taylor J, Taylor M, Victorero L, Watling L, Williams A, Xavier JR, Yesson C. 2023. Towards a scientific community consensus on designating Vulnerable Marine Ecosystems from imagery. PeerJ 11:e16024 DOI 10.7717/peerj.16024.

[5] FAO. 2009. International guidelines: management of deep-sea fisheries in the high seas. Available from https://www.fao.org/in-action/vulnerable-marine-ecosystems/background/deep-sea-guidelines/en/.

[6] Baco AR, Ross R, Althaus F, Amon D, Bridges AEH, Brix S, Buhl-Mortensen P, Colaço A, Carreiro-Silva M, Clark M, Du Preez C, Franken M-L, Gianni M, Gonzalez-Mirelis G, Hourigan T, Howell K, Levin LA, Lindsay DJ, Molodtsova TN, Morgan N, Morato T, Mejia-Mercado B, O’Sullivan D, Pearman T, Price D, Robert K, Robson L, Rowden AA, Taylor J, Taylor M, Victorero L, Watling L, Williams A, Xavier JR, Yesson C. 2023. Towards a scientific community consensus on designating Vulnerable Marine Ecosystems from imagery. PeerJ 11:e16024 DOI 10.7717/peerj.16024.

[7] NPFC-2022-SSC BFME03-WP18, 2nd Meeting of the Small Working Group on VME, 20 July 2022.

[8] Charley Gros, Jan Jansen, Candice Untiedt, Tabitha R R Pearman, Rachel Downey, David K A Barnes, David A Bowden, Dirk C Welsford, Nicole A Hill, Identifying vulnerable marine ecosystems: an image-based vulnerability index for the Southern Ocean seafloor, *ICES Journal of Marine Science*, Volume 80, Issue 4, May 2023, Pages 972–986, https://doi.org/10.1093/icesjms/fsad021. The approach incorporates 3 components: (a) an abundance-based VME index, (b) a richness based-VME index, and (c) a confidence index for each image. Within each of these components, the values are weighted by a “vulnerability to fishing” score that was previously calculated for each of the 53 VME indicator morpho-taxa that occur in the CCAMLR area. The combined analyses of these components This approach was designed for areas where the primary bottom fishing is long-lining and may not be as applicable for trawled areas.

11. Since the last report, numerous discoveries of new areas of VMEs have been reported,[9] including: (1) on the deep slopes of Galapagos[10], (2) along the Sala y Gomez Seamounts that extend from Chile to Easter Island[11] where over 100 species new to science, including many VME indicator taxa, were discovered, and (3) massive and highly biodiverse deep sea reefs were discovered off the coast of Argentina[12]. These discoveries continue to add evidence that VMEs are widely distributed throughout the world's oceans.

3. Regional and Global Data Syntheses

12. *General Deep-Sea Reviews*. Several regional review studies have been undertaken through the formally endorsed UN Decade of Ocean Science (2021–2030) Challenger 150 program on the benthic fauna of both the high seas and within exclusive economic zone areas, including the Central and South Atlantic[13], the North Atlantic[14], and the East and Central North Pacific[15]. An additional review of the Indian Ocean deep sea also was published since the last report[16]. This literature includes information on the distribution and management of VMEs and VME indicator taxa within each region.

13. *Deep-sea Corals.* As noted above, several groups of deep-sea corals are recognized as VME indicator taxa across all RFMO/As, including scleractinians, or stony corals. A comprehensive global review of the distribution of deep-sea and cold-water scleractinian corals published since the last report provides evidence that scleractinian reefs VMEs are very widespread in the deep-sea, with the composition of

[9] For Example: H.K. Meyer, A.J. Davies, E.M. Roberts, J.R. Xavier, P.A. Ribeiro, H. Glenner, S.-R. Birkely, H.T. Rapp, Beyond the tip of the seamount: Distinct megabenthic communities found beyond the charismatic summit sponge ground on an Arctic seamount (Schulz Bank, Arctic Mid-Ocean Ridge) 2023. Deep Sea Research Part I: Oceanographic Research Papers, 191: 103920. https://doi.org/10.1016/j.dsr.2022.103920; Soares, A., Hilário, A., Carreiro-Silva, M., Ramos, S., Pita, C., & Xavier, J. R. (2025). Fishers' Local Ecological Knowledge of vulnerable marine ecosystems indicator species on the Portuguese continental shelf and upper slope. *Ecosystems and People*, *21*(1). https://doi.org/10.1080/26395916.2025.2566067; Carranza, A., Limóngi, P., Gurdek-Bas, R., Loureiro, A., Pérez Orsi, H., Azcárate, A., Santos, S., & Muniz, P. (2024). Identifying vulnerable marine ecosystems from imagery in the Uruguayan continental shelf: . *Marine and Fishery Sciences (MAFIS)*, *37*(4), 583-592. https://doi.org/10.47193/mafis.3742024010705; Beckmann LM, Eveborn L, Kenchington E and Waller RG (2026) Hotspots beyond borders: quantitative assessment of Vulnerable Marine Ecosystems on the Corner Rise seamounts with implications for conservation planning. Front. Mar. Sci. 13:1752067. doi: 10.3389/fmars.2026.1752067; Devon R Warawa, Christopher N Rooper, Jessica Nephin, Jackson WF Chu, Sarah Dudas, Anders Knudby, Samuel Georgian, Janelle MR Curtis. Identifying VMEs on Cobb Seamount using visual data. 2023. NPFC-2023-SSC BFME04-WP13; Hanna, C. (2024). Exploring hidden reefs: a study of seamount benthic diversity along the south-west Indian ocean ridge [Master's thesis]. University of Oxford.

[10] https://schmidtocean.org/healthy-deep-sea-coral-reef-and-new-seamounts-in-the-galapagos/.

[11] https://schmidtocean.org/underwater-mountains-harbor-abundant-life/.

[12] https://schmidtocean.org/argentinas-deep-sea-is-more-biodiverse-than-scientists-thought/.

[13] Amelia E.H. Bridges, Kerry Howell, Teresa Amaro, Lara Atkinson, David Barnes, et al. Review Of The Central And South Atlantic Offshore And Deep-Sea Benthos: Science, Policy and Management. Oceanography and Marine Biology, 1, CRC Press, pp.127-218, 2023, 9781003363873. ⟨10.1201/9781003363873-5⟩. ⟨hal-04272486⟩.

[14] Allcock, A.L., Diva J. Amon, Amelia E.H. Bridges, Ana Colaço, Elva Escobar-Briones, et al.. 2025. Deep-sea ecosystems of the North Atlantic Ocean: discovery, status, function and future challenges, Deep Sea Research Part I: Oceanographic Research Papers, 226: 104580, https://doi.org/10.1016/j.dsr.2025.104580.

[15] Girard, F., Alfaro-Lucas, J.M., Baco, A.R., Barry, J.P., Bigham, K.T., Beckmann, L.M., Brandt, A., Clark, L., Davies, M.A., Drazen, J.C., Dunham, A., Preez, C.D., Briones, E.E., Gartner, H., Harris, M.K., Johannes, K.N., Kahn, A., Kaiser, S., Kennedy, B.R.C., Levin, L.A., Monferrer, N.L., Powell, A., Rooper, C.N., Smith, C.R., Stevenson, A., van der Grient, J.M.A. 2026. State of deep-sea science and conservation in the Northeast Pacific: implications for policy and management. Progress in Oceanography. 244: 103718. https://doi.org/10.1016/j.pocean.2026.103718.

[16] Elin A. Thomas, Todd Bond, Jess L. Kolbusz, Yakufu Niyazi, Denise J.B. Swanborn, Alan J. Jamieson, Deep-sea ecosystems of the Indian Ocean >1000 m. 2024. Science of The Total Environment, 957: 176794, https://doi.org/10.1016/j.scitotenv.2024.176794.

the reefs varying among geographic regions. [17] Similar compilations are not yet available for other deep-sea coral taxa.

14. *Hydrothermal Vents.* A recent large scale-review of western Pacific hydrothermal vents from Japan to New Zealand found that there were two biogeographic regions of vent fauna, each with high levels of endemism and beta diversity.[18] A recent review of the 12 known vent fields in the Indian Ocean compared observations to the FAO VME criteria and found that all sites met the criteria for protection under the FAO Guidelines based on their uniqueness, rarity, and fragility. [19]

4. Habitat suitability modelling for VME taxa

15. Habitat suitability modeling continues to be an invaluable tool for modeling the distribution of VME indicator taxa. Such models have been built for many deep-sea taxa since the last report, in studies that include multiple VME indicator species and evaluate the effectiveness and accuracy of various aspects of the modeling process.[20] Studies also highlight that incorporating abundance data (instead of presence -only or presence-absence data), and including multiple species, provides more accuracy in the prediction of VME locations.[21]

16. On a global-scale, two high-resolution suitability models for deep-sea corals have been published. One predicts the distribution of four species of habitat-forming Atlantic octocorals and 6 species of reef-forming scleractinians.[22] This high resolution modeling effort provides a summary of the environmental data for each species' occurrence, the predicted distribution of each species, as well as the parameters most strongly correlated with occurrence for each species.[23] An independent validation of the predictions of the study in the NPFC area supported its accuracy. [24]

17. Another global-scale suitability modeling effort for deep-sea scleractinians used a novel approach of separating out reef vs individual colony occurrence for the 5 most

[17] Cordes, E. and F. Mienis, editors. 2023. *Cold-Water Coral Reefs of the World*. Springer. 293pp.
[18] Tunnicliffe, V., Chen, C., Giguère, T., Rowden, A. A., Watanabe, H. K., & Brunner, O. (2024). Hydrothermal vent fauna of the western Pacific Ocean: Distribution patterns and biogeographic networks. Diversity and Distributions, 30, e13794. https://doi-org.proxy.lib.fsu.edu/10.1111/ddi.13794.
[19] van der Most N, Qian P-Y, Gao Y and Gollner S (2023) Active hydrothermal vent ecosystems in the Indian Ocean are in need of protection. Front. Mar. Sci. 9:1067912. doi: 10.3389/fmars.2022.1067912.
[20] For example: Bennion, M., Rowden, A.A., Anderson, O.F., Bowden, D.A., Clark, M.R., Althaus, F., Williams, A., Geange, S.W., Tablada, J. and Stephenson, F. (2025), The Use of Image-Based Data and Abundance Modelling Approaches for Predicting the Location of Vulnerable Marine Ecosystems in the South Pacific Ocean. Fish Manag Ecol, 32: e12751. https://doi.org/10.1111/fme.12751; Howell, Kerry L., Amelia E. Bridges, Kyran P. Graves, et al. "Performance of Deep-Sea Habitat Suitability Models Assessed Using Independent Data, and Implications for Use in Area-Based Management." *Marine Ecology Progress Series* 695 (2022): 33–51. https://www.jstor.org/stable/27179515.; Nolan, M.K.B., Marchese, F., Purkis, S.J. *et al.* Habitat suitability models reveal extensive distribution of deep warm-water coral frameworks in the Red Sea. *Commun Earth Environ* **5**, 709 (2024).; Gros C, Jansen J, Dunstan PK, Welsford DC and Hill NA (2022) Vulnerable, but Still Poorly Known, Marine Ecosystems: How to Make Distribution Models More Relevant and Impactful for Conservation and Management of VMEs? Front. Mar. Sci. 9:870145. https://doi.org/10.1038/s43247-024-01830-9; Anna-Leena Downie, Nils Piechaud, Kerry Howell, Christopher Barrio Froján, Mar Sacau, Andrew Kenny, Reconstructing baselines: use of habitat suitability modelling to predict pre-fishing condition of a Vulnerable Marine Ecosystem, *ICES Journal of Marine Science*, Volume 78, Issue 8, November 2021, Pages 2784–2796, https://doi.org/10.1093/icesjms/fsab154.
[21] For example: Gros C, Jansen J, Dunstan PK, Welsford DC and Hill NA (2022) Vulnerable, but Still Poorly Known, Marine Ecosystems: How to Make Distribution Models More Relevant and Impactful for Conservation and Management of VMEs? Front. Mar. Sci. 9:870145. doi: 10.3389/fmars.2022.870145; Fabrice Stephenson, Ashley A Rowden, Owen F Anderson, C Roland Pitcher, Matt H Pinkerton, Grady Petersen, David A Bowden, Presence-only habitat suitability models for vulnerable marine ecosystem indicator taxa in the South Pacific have reached their predictive limit, *ICES Journal of Marine Science*, Volume 78, Issue 8, November 2021, Pages 2830–2843, https://doi.org/10.1093/icesjms/fsab162.
[22] Ibid.
[23] Temperature, depth, salinity, terrain ruggedness index, carbonate saturation state, and chlorophyll were found to be the most important factors in determining the global distributions of these species.
[24] NPFC SWG VME. Objective 2c: Model Validation Using VME Observations. 24 October 2025.

abundant deep-sea scleractinian species[25]. This study provides the predicted distributions for each of the species which indicate a high likelihood that coral reefs are present across large areas of the disphotic and aphotic, cold, deep oceans between approximately 200 and 1200 m and at temperate and tropical latitudes, even above the Arctic Circle.[26]

18. The first global habitat suitability model for deep-sea sponges combines results from three different modelling approaches, to show suitable sponge habitat is predicted for most hard substrate areas of the deep sea including along continental shelves and slopes, around islands, and in the vicinity of seamounts and trenches, particularly along the margins of the Atlantic, Pacific, and Indian oceans. [27]

19. All of these studies[28,29] provide valuable predictions of very high probabilities of coral and sponge VMEs in unexplored areas.

5. Connectivity of VMEs

20. High levels of genetic diversity and genetic connectivity among populations are associated with high resilience to disturbance from human activities.[30] Therefore, obtaining an understanding of these topics is critical for management of VMEs. Connectivity studies include population genetic/genomic studies as well as larval dispersal modeling.

21. A larval dispersal modelling study of 18 high seas seamounts in the North-west Pacific that are targeted for mining showed that all of the seamounts were part of the same dispersal network, but not all were equally connected to each other.[31]

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[25] Cordes, E., Mienis, F., Gasbarro, R., Davies, A., Baco, A.R., Bernardino, A.F., Clark, M., Freiwald, A., Hennige, S., Huvenne, V., Buhl-Mortensen, P., Orejas, C., Quattrini, A.M., Tracey, D., Wheeler, A.J., Wienberg, C. A Global View of the Cold-Water Coral Reefs of the World. In: *Cold-Water Corals Reefs of the World*. E. Cordes and F. Mienis editors. Springer. 19, https://doi.org/10.1007/978-3-031-40897-7_1.
26 Ibid. The most important factors related to the occurrence of these species were bottom temperature and slope, with reefs more likely to form in areas of higher surface and bottom currents and higher dissolved oxygen. The models from this study are also publicly accessible.
[27] Jichao Yang, Tongbo Xu, Xuelei Zhang, QinZeng Xu, Guoyu Xu, Guanhong Zhai, Minxing Dong, 2026. Global distribution of suitable habitats for deep-sea sponges based on machine learning, Deep Sea Research Part I: Oceanographic Research Papers. 227: 104642, https://doi.org/10.1016/j.dsr.2025.104642. Hotspots include the North Atlantic (e.g., the North Sea and the Norwegian Sea), the North Pacific (e.g., near the Japan Trench and the Aleutian Islands), and parts of the Antarctic continental shelf".
[28] Cordes, E., Mienis, F., Gasbarro, R., Davies, A., Baco, A.R., Bernardino, A.F., Clark, M., Freiwald, A., Hennige, S., Huvenne, V., Buhl-Mortensen, P., Orejas, C., Quattrini, A.M., Tracey, D., Wheeler, A.J., Wienberg, C. A Global View of the Cold-Water Coral Reefs of the World. In: *Cold-Water Corals Reefs of the World*. E. Cordes and F. Mienis editors. Springer. 19, https://doi.org/10.1007/978-3-031-40897-7_1.
[29] Jichao Yang, Tongbo Xu, Xuelei Zhang, QinZeng Xu, Guoyu Xu, Guanhong Zhai, Minxing Dong, 2026. Global distribution of suitable habitats for deep-sea sponges based on machine learning, Deep Sea Research Part I: Oceanographic Research Papers. 227: 104642, https://doi.org/10.1016/j.dsr.2025.104642.
[30] For Example: Kardos M, Armstrong EE, Fitzpatrick SW, Funk C. (2021). The crucial role of genome-wide genetic variation in conservation. *Prock. Natl. Acad. Sci. U.S.A. 188*(48). https://doi.org/10.1073/pnas.2104642118; Parvizi, E., Fraser, C.I. and Waters, J.M. (2022). Genetic impacts of physical disturbance processes in coastal marine ecosystems. *Journal of Biogeography*, *49*(10), pp.1877-1890; Pearman, P.B., Broennimann, O., Aavik, T., Albayrak, T., Alves, P.C., Aravanopoulos, F.A., Bertola, L.D., Biedrzycka, A., Buzan, E., Cubric-Curik, V. and Djan, M. (2024). Monitoring of species' genetic diversity in Europe varies greatly and overlooks potential climate change impacts. *Nature ecology & evolution*, *8*(2), pp.267-281.
[31] Saito, Naoki, Hiroki Kise, Travis W. Washburn, Eri Ikeuchi, Akira Iguchi, Hiroko Kamoshida, and Atsushi Suzuki. 2025. "Seamount Larval Dispersal Networks: A Potential Strategy for Conserving Ecological Connectivity from Deep-Sea Mining." Ecological Applications35(7): e70086. https://doi.org/10.1002/eap.70086. Some were identified as key stepping stones for the broader network and loss of populations on those seamounts would result in fragmentation of the chain of connectivity. Additionally, specific seamounts were identified as key larval sources for the network, meaning loss of those populations would impact all seamount populations downstream. Model results were verified with Argo floats and population genetic studies of amphipods.

22. A number of recent studies focus on connectivity and genetic diversity of key structure-forming VME indicator taxa with ranges that extend into High Seas areas, particularly of coral and sponge taxa, but also other invertebrates. For example, a population genetic study of 16 populations of the precious coral *Hemicorallium laauense* species on seamounts near Hawaiian Archipelago that have never been trawled showed very low levels of connectivity among populations and relatively high levels of self-recruitment.[32]

23. Connectivity studies were also published for the scleractinian coral *Desmophyllum (Lophelia) pertusum*, a key structure-forming VME indicator taxon, across the Mediterranean Basin,[33] *Geodia hentscheli,* a ground-forming sponge, across its full range in the North Atlantic and Arctic,[34] the sponge *Phakelia ventilabrum* across the northeast Atlantic[35], and the sponge *Pheronema carpenteri* in the Azores.[36]

24. Collectively, these and many additional studies indicate that connectivity among VME indicator species, particularly for populations on seamounts, is incredibly complex[37]. Connectivity may vary by the spatial scale and species examined, with strong influences of oceanographic currents and life history strategies. Unexpected genetic breaks created by a number of factors such as depth[38], oceanographic fronts[39], and

[32] Morgan, N.B., J. Andrews, and A.R. Baco. 2023 Population genetic structure of the deep-sea precious red coral *Hemicorallium laauense* along the Hawaiian Ridge. *Marine Biology* 170:150. https://doi.org/10.1007/s00227-023-04282-5. See also Baco, A.R., N.B. Morgan, E.B. Roark, V. Biede. 2023. Bottom contact fisheries disturbance and signs of recovery of precious corals in the Northwestern Hawaiian Islands and Emperor Seamount Chain. *Ecological Indicators*. 148 (2023) 110010. https://doi.org/10.1016/j.ecolind.2023.110010.

[33] Matos, F.L., Aguzzi, J., Company, J.B. and Cunha, M.R. (2024), Gone with the stream: Functional connectivity of a cold-water coral at basin scale. Limnol Oceanogr, 69: 217-231. https://doi-org.proxy.lib.fsu.edu/10.1002/lno.12444.

[34] Sergi Taboada, Cristina Díez-Vives, Marta Turon, María Belén Arias, Carles Galià-Camps, Paco Cárdenas, Vasiliki Koutsouveli, Francisca Correia de Carvalho, Ellen Kenchington, Andrew J Davies, Shuangqiang Wang, Marta Martín-Huete, Emyr Martyn Roberts, Joana R Xavier, David Combosch, Ana Riesgo, Connectivity and Adaptation Patterns of the Deep-Sea Ground-Forming Sponge *Geodia hentscheli* Across Its Entire Distribution, *Molecular Biology and Evolution*, Volume 42, Issue 7, July 2025, msaf145, https://doi.org/10.1093/molbev/msaf145.

[35] Taboada S, Whiting C, Wang S, Ríos P, Davies AJ, Mienis F, Kenchington E, Cárdenas P, Cranston A, Koutsouveli V, Cristobo J, Rapp HT, Drewery J, Baldó F, Morrow C, Picton B, Xavier JR, Arias MB, Leiva C and Riesgo A (2023) Long distance dispersal and oceanographic fronts shape the connectivity of the keystone sponge Phakellia ventilabrum in the deep northeast Atlantic. Front. Mar. Sci. 10:1177106. doi: 10.3389/fmars.2023.1177106.

[36] Viegas C, Juliano M and Colaço A (2024) Larval dispersal and physical connectivity of Pheronema carpenteri populations in the Azores. Front. Mar. Sci. 11:1393385. doi: 10.3389/fmars.2024.1393385

[37] For Example: Morgan, N.B., J. Andrews, and A.R. Baco. 2023 Population genetic structure of the deep-sea precious red coral *Hemicorallium laauense* along the Hawaiian Ridge. *Marine Biology* 170:150. https://doi.org/10.1007/s00227-023-04282-5. See also Baco, A.R., N.B. Morgan, E.B. Roark, V. Biede. 2023. Bottom contact fisheries disturbance and signs of recovery of precious corals in the Northwestern Hawaiian Islands and Emperor Seamount Chain. *Ecological Indicators*. 148 (2023) 110010. https://doi.org/10.1016/j.ecolind.2023.110010.; Matos, F.L., Aguzzi, J., Company, J.B. and Cunha, M.R. (2024), Gone with the stream: Functional connectivity of a cold-water coral at basin scale. Limnol Oceanogr, 69: 217-231. https://doi-org.proxy.lib.fsu.edu/10.1002/lno.12444.

[38] For Example: Sergi Taboada, Cristina Díez-Vives, Marta Turon, María Belén Arias, Carles Galià-Camps, Paco Cárdenas, Vasiliki Koutsouveli, Francisca Correia de Carvalho, Ellen Kenchington, Andrew J Davies, Shuangqiang Wang, Marta Martín-Huete, Emyr Martyn Roberts, Joana R Xavier, David Combosch, Ana Riesgo, Connectivity and Adaptation Patterns of the Deep-Sea Ground-Forming Sponge *Geodia hentscheli* Across Its Entire Distribution, *Molecular Biology and Evolution*, Volume 42, Issue 7, July 2025, msaf145, https://doi.org/10.1093/molbev/msaf145.

[39] For Example: Taboada S, Whiting C, Wang S, Ríos P, Davies AJ, Mienis F, Kenchington E, Cárdenas P, Cranston A, Koutsouveli V, Cristobo J, Rapp HT, Drewery J, Baldó F, Morrow C, Picton B, Xavier JR, Arias MB, Leiva C and Riesgo A (2023) Long distance dispersal and oceanographic fronts shape the connectivity of the keystone sponge Phakellia ventilabrum in the deep northeast Atlantic. Front. Mar. Sci. 10:1177106. doi: 10.3389/fmars.2023.1177106.

retentive flow patterns[40] are also common. Co-distributed species may also have completely different levels of connectivity[41]. Studies further indicate that genetic diversity must also be considered, as it is well-established that low genetic diversity can make species less resilient to disturbance and human impacts.[42]

B. Deep-sea fish stocks

25. Deep-sea fishes are species that live in depths greater than 200 m, although they may not spend their entire life cycle exclusively in the deep sea and adults may also inhabit shallower waters.[43] Estimates suggest that over 300 deep-sea fish species are commercially exploited across 26 taxonomic orders.[44] Among these, Gadiformes dominate, with 83 species accounting for around 30 percent of deep-sea fishery species, and within this group the family Macrouridae alone comprises 59 species, nearly equal to the 57 species of Chondrichthyes (chimaeras, sharks, and rays).[45] The Food and Agriculture Organization reports global catches for 125 deep-sea species[46], and 115 of these species are currently commercially exploited through bottom trawling, contributing a mere ~0.5% to the total global capture fisheries.[47] Of these, 47 have stock assessments as of 2025 and 25 additional stocks are listed as unknown but planned to be assessed.[48]

26. Deep-sea fishes generally exhibit life-history traits associated with low productivity, including slow growth, late maturity, and long lifespans, although these patterns vary along a continuum of depth and environmental conditions rather than forming a strict deep versus shallow distinction.[49] On average, longevity increases with depth, while metabolic rates, reproductive output, and natural mortality tend to decrease, resulting in species that are less resilient to sustained fishing pressure.[50,51] Fish biodiversity also increases between depths of 400–1,000 m.[52]

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[40] For Example: Viegas C, Juliano M and Colaço A (2024) Larval dispersal and physical connectivity of Pheronema carpenteri populations in the Azores. Front. Mar. Sci. 11:1393385. doi: 10.3389/fmars.2024.1393385.

[41] Miller, K., Gunasekera, R. A comparison of genetic connectivity in two deep sea corals to examine whether seamounts are isolated islands or stepping stones for dispersal. *Sci Rep* **7**, 46103 (2017). https://doi.org/10.1038/srep46103.

[42] For example: Pearman, P.B., Broennimann, O., Aavik, T., Albayrak, T., Alves, P.C., Aravanopoulos, F.A., Bertola, L.D., Biedrzycka, A., Buzan, E., Cubric-Curik, V. and Djan, M. (2024). Monitoring of species' genetic diversity in Europe varies greatly and overlooks potential climate change impacts. *Nature ecology & evolution*, *8*(2), pp.267-281.

[43] Food and Agriculture Organization of the United Nations (FAO). (2014). Deep-sea fisheries in areas beyond national jurisdiction. FAO. https://openknowledge.fao.org/server/api/core/bitstreams/df05a680-4c42-46f0-9abc-6b5df0545ba3/content.

[44] Priede IG. Deep-sea fishes: biology, diversity, ecology and fisheries. Cambridge University Press; 2017 Aug 10.DOI: 10.1017/9781316018330.

[45] Ibid.

[46] Food and Agriculture Organization of the United Nations (FAO). (2014). Deep-sea fisheries in areas beyond national jurisdiction. FAO. https://openknowledge.fao.org/server/api/core/bitstreams/df05a680-4c42-46f0-9abc-6b5df0545ba3/content.

[47] Victorero, L., Watling, L., Deng Palomares, M.L. and Nouvian, C., 2018. Out of sight, but within reach: A global history of bottom-trawled deep-sea fisheries from> 400 m depth. Frontiers in Marine Science, 5, p.322663.

[48] Sharma, R., Barange, M., Agostini, V., Barros, P., Gutierrez, N.L., Vasconcellos, M., Fernandez Reguera, D., Tiffay, C., & Levontin, P., eds. 2025. *Review of the state of world marine fishery resources – 2025*. FAO Fisheries and Aquaculture Technical Paper, No. 721. Rome. FAO.https://doi.org/10.4060/cd5538en.

[49] Watling, L., Victorero, L., Drazen, J. and Gianni, M., 2020. Exploitation of deep-sea fishery resources. Natural Capital Exploit. Deep Ocean, pp.71-90.https://doi.org/10.1093/oso/9780198841654.001.0001

[50] Drazen, J.C. and Haedrich, R.L., 2012. A continuum of life histories in deep-sea demersal fishes. Deep Sea Research Part I: Oceanographic Research Papers, 61, pp.34-42.https://doi.org/10.1016/j.dsr.2011.11.002.

[51] Rigby, C. and Simpfendorfer, C.A., 2015. Patterns in life history traits of deep-water chondrichthyans. Deep Sea Research Part II: Topical Studies in Oceanography, 115, pp.30-40.https://doi.org/10.1016/j.dsr2.2013.09.004.

[52] Clarke, J., Milligan, R.J., Bailey, D.M. and Neat, F.C., 2015. A scientific basis for regulating deep-sea fishing by depth. Current Biology, 25(18), pp.2425-2429.DOI: 10.1016/j.cub.2015.07.070.

27. Despite a general understanding of these broad patterns, significant knowledge gaps remain compared to shallow-water fisheries, particularly regarding species-specific life histories and population connectivity, including for sharks. Given their low productivity, high vulnerability to overexploitation, and the persistence of key knowledge gaps, deep-sea fishes are generally considered poorly suited to support sustainable, high-intensity fisheries.[53,54,55]

C. Impacts of bottom fishing on vulnerable marine ecosystems and deep-sea fish stocks

1. Impacts to Vulnerable Marine Ecosystems

28. *Defining SAIs to VMEs.* The FAO provides a definition for significant adverse impacts (SAIs) to VMEs.[56] RFMOs are also increasingly focusing efforts on defining and characterizing SAIs for their respective regions, which has yielded many new reports of SAIs found in the scientific literature. This report focuses on the key literature and reports that are particularly relevant within this timeframe.

29. Work in several high seas regions is pushing forward the effort to define SAIs. One of the larger cumulative efforts at characterizing SAIs has been undertaken by NAFO for the western Atlantic region on the Flemish Cap and Grand Banks.[57] Studies examined the correlation between trawling intensity and the removal of biomass in VMEs, indicating that deep-sea areas may be significantly more sensitive to the effects of bottom trawling than are shallower habitats.[58, 59]

30. *Evidence of SAIs to VMEs.* A number of studies during the review period have documented significant adverse impacts from bottom trawl fisheries. For example, several studies of seamount deep-sea coral communities on the seamounts of the Northwestern Hawaiian Ridge and Emperor Seamount Chain in the NPFC Convention

[53] Sala, E., Mayorga, J., Costello, C., Kroodsma, D., Palomares, M.L., Pauly, D., Sumaila, U.R. and Zeller, D., 2018. The economics of fishing the high seas. Science advances, 4(6), p.eaat2504.DOI: 10.1126/sciadv.aat2504.
[54] Coemert, N., Deniz, T. and Göktürk, D., 2025. Sustainable Fisheries and Non-Target Species Management: A Seasonal and Depth-Based Study in the Deep-Sea Fisheries of Antalya Bay. Sustainability, 17(11), p.5040.https://doi.org/10.3390/su17115040.
[55] Roberts, C., Béné, C., Bennett, N., Boon, J.S., Cheung, W.W., Cury, P., Defeo, O., De Jong Cleyndert, G., Froese, R., Gascuel, D. and Golden, C.D., 2024. Rethinking sustainability of marine fisheries for a fast-changing planet. NPJ Ocean Sustainability, 3(1), p.41.https://doi.org/10.1038/s44183-024-00078-2.
[56] FAO. 2009. International guidelines: management of deep-sea fisheries in the high seas. Available at https://www.fao.org/in-action/vulnerable-marine-ecosystems/background/deep-sea-guidelines/en/.
[57] Kenny, A.J., Pierre Pepin, James Bell, Anna Downie, Ellen Kenchington, Mariano Koen-Alonso, Camille Lirette, Christopher Barrio Froján, Neil Ollerhead, F. Javier Murillo, Mar Sacau, Susanna Fuller, Daniela Diz. 2025. Reference points for assessing significant adverse impacts on deep sea vulnerable marine ecosystems, Ecological Indicators. 172: 113296, https://doi.org/10.1016/j.ecolind.2025.113296. In this region VME biomass data from extensive scientific surveys were compared to fishing intensity from VMS data to determine not only where SAIs might have occurred, but also the threshold fishing intensity that might lead to SAIs to different VME functional groups (e.g. large gorgonians, large sponges). This study found that many VME areas occurred outside established VME protection zones, but inside the fishing footprint for the region and were therefore at risk of SAIs.
[58] Ibid.
[59] Hiddink, J.G., Jennings, S., Scriberras, M., Szostek, C.L., Hughes, K.M., Ellis, N., Rignsdorp, A.D., McConnaughey, R.A., Mazor, T., Hillborn, R., Collie, J.S., Amoroso, O.R., Parma, A.M., Suuronen, P., Kaiser, M.J., 2017. Global analysis of depletion and recovery of seabed biota after bottom trawling disturbance. Proc. Natl. Acad. Sci. 114 (31), 8310. https://doi.org/10.1073/pnas.1618858114.

Area have shown evidence of SAIs to these communities.[60, 61, 62] One detailed study provided evidence that the abundance, diversity and 4 metrics of ecosystem function for the benthic communities were all negatively correlated with increased visual evidence of fishing.[63] Community structure also differed significantly with evidence of fishing, with areas with lower evidence of fishing having denser and more diverse VME communities including corals and sponges.

31. Studies in both the North and South Pacific, which focused on recovery timelines for VME indicator taxa from bottom fishing activities, show evidence that recovery may be possible, but only over extended timelines of over 20 years.[64, 65, 66,]

32. An extensive study of seamount deep-sea coral reef communities within the EEZ of Australia[67] showed that 88% of the 51 seamounts surveyed showed some signs of trawling damage to the deep-sea reefs. The trawling impacts to these VMEs was strongly determined by depth, with shallower depths showing much greater impacts than deeper areas.

33. Habitat suitability modeling is increasingly being used to look at the overlap between the trawl fisheries footprint and areas of suitable habitat for VME indicator taxa,

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[60] Baco, A.R., *N.B. Morgan, E.B. Roark, *V. Biede. 2023. Bottom contact fisheries disturbance and signs of recovery of precious corals in the Northwestern Hawaiian Islands and Emperor Seamount Chain. *Ecological Indicators*. 148 (2023) 110010. https://doi.org/10.1016/j.ecolind.2023.110010 (The study indicated that while some recolonization of these corallids is possible, the timeline for recovery would be greater than 5-20 years.).

[61] Baco, A.R., *N.B. Morgan, and E. B Roark. 2020. Observations of Vulnerable Marine Ecosystems and Significant Adverse Impacts on High Seas Seamounts of the Northwestern Hawaiian Islands and Emperor Seamount Chain. *Marine Policy*. 115: 103834. https://doi.org/10.1016/j.marpol.2020.103834 and Baco, A.R., E. B Roark, *N.B. Morgan. 2019. Amid Fields of Rubble, Scars, and Lost Gear, Signs of Recovery Observed on Seamounts on 30-40 year Time Scales. *Science Advances*. 5: eaaw4513. https://doi.org/10.1126/sciadv.aaw4513. (Documented evidence for SAIs include 1) Large areas of prime coral habitat on several seamounts that were devoid of fauna and instead showed numerous scars from bottom contact gear, with 19–29% of AUV survey images on High Seas sites showing evidence of scars. 2) Patches of coral stumps, from both octocorals and extremely long-lived gold corals were observed. 3) Expansive areas of coral rubble from scleractinian reefs were observed on multiple seamounts. 4) Evidence of both fishing and SAIs is further supplied by presence of lost gear observed on every seamount, including many observations of coral rubble in or around the nets, lines, floats, etc entangled in corals or laying across the coral beds. 5) Lower total megafauna abundance on fished seamounts compared to protected seamounts).

[62] Biede, V.C., N.B. Morgan, E.B. Roark, A.R. Baco. 2025. On a Trawled North Pacific Seamount, Reductions of Benthic Megafauna Abundance, Diversity, and Ecosystem Function are Correlated with Increased Evidence of Fishing. *Marine Environmental Research*: 212: 107587, https://doi.org/10.1016/j.marenvres.2025.107587.

[63] Biede, V.C., N.B. Morgan, E.B. Roark, A.R. Baco. 2025. On a Trawled North Pacific Seamount, Reductions of Benthic Megafauna Abundance, Diversity, and Ecosystem Function are Correlated with Increased Evidence of Fishing. *Marine Environmental Research*: 212: 107587, https://doi.org/10.1016/j.marenvres.2025.107587.

[64] Baco, A.R., *N.B. Morgan, E.B. Roark, *V. Biede. 2023. Bottom contact fisheries disturbance and signs of recovery of precious corals in the Northwestern Hawaiian Islands and Emperor Seamount Chain. *Ecological Indicators*. 148 (2023) 110010. https://doi.org/10.1016/j.ecolind.2023.110010 (The study indicated that while some recolonization of these corallids is possible, the timeline for recovery would be greater than 5-20 years.).

[65] Baco, A.R., *N.B. Morgan, and E. B Roark. 2020. Observations of Vulnerable Marine Ecosystems and Significant Adverse Impacts on High Seas Seamounts of the Northwestern Hawaiian Islands and Emperor Seamount Chain. *Marine Policy*. 115: 103834. https://doi.org/10.1016/j.marpol.2020.103834 and Baco, A.R., E. B Roark, *N.B. Morgan. 2019. Amid Fields of Rubble, Scars, and Lost Gear, Signs of Recovery Observed on Seamounts on 30-40 year Time Scales. *Science Advances*. 5: eaaw4513. https://doi.org/10.1126/sciadv.aaw4513.

[66] Goode, S. L., Rowden, A. A., Clark, M. R., Bowden, D. A., & Stephenson, F. (2025). Early signs of recovery suggested by changes in the structure and function of deep-sea megabenthic communities on a seamount 19 years after fishing. Deep Sea Research Part I: Oceanographic Research Papers, 220, 104488. https://doi.org/10.1016/j.dsr.2025.104488.

[67] Williams, A., Althaus, F., Maguire, K., Green, M., Untiedt, C., Alderslade, P., Clark, M. R., Bax, N., & Schlacher, T. A. (2020). The Fate of Deep-Sea Coral Reefs on Seamounts in a Fishery-Seascape: What Are the Impacts, What Remains, and What Is Protected? Frontiers in Marine Science, 7. https://doi.org/10.3389/fmars.2020.567002.

to assess where VMEs may have been lost to fishing before they were documented.[68] For example, one study in the New Zealand EEZ[69] used this approach and determined that 9 of 10 VME indicator taxa had dropped below an 80% "good state" threshold[70] in at least one bioregion and also found a loss of 0-40% of VME area in the remaining bioregions predicted to have VMEs.[71]

34. Less scientific attention has been given to the ecological impacts of bottom-set static gears, including longlines, gillnets, and traps, compared to mobile gears such as trawls.[72] This likely reflects the larger, well-documented footprint of trawling versus the more localized impacts of static gear. However, static gears can operate in complex, rocky habitats where trawling is not feasible, increasing interactions with vulnerable benthic communities.[73] Bottom longlines can damage corals and sponges during deployment and retrieval, with repeated exposure altering community composition by disproportionately affecting structurally complex larger organisms, with potential consequences for ecosystem dynamics.[74,75] A number of studies provide evidence of impacts of such gears in different fisheries.[76, 77, 78, 79]

2. Impacts to Deep-Sea Fish Stocks

35. Previous reports of the Secretary-General have consistently discussed the scale and ecological consequences of bottom fisheries documenting widespread overexploitation across multiple ocean regions (see A/61/154, A/64/305, A/66/307, A/71/351, A/75/157, and A/77/155). These reports note that bottom trawling is a highly efficient but particularly destructive fishing method, linked to rapid declines in both target and non-target species. They also underscore the persistent underestimation of

[68] For example: Anna-Leena Downie, Nils Piechaud, Kerry Howell, Christopher Barrio Froján, Mar Sacau, Andrew Kenny, Reconstructing baselines: use of habitat suitability modelling to predict pre-fishing condition of a Vulnerable Marine Ecosystem, *ICES Journal of Marine Science*, Volume 78, Issue 8, November 2021, Pages 2784–2796, https://doi.org/10.1093/icesjms/fsab154.
[69] Fabrice Stephenson, Edoardo Zelli, Matthew Bennion, Ashley A. Rowden, Owen F. Anderson, Malcolm R. Clark, Jordi Tablada, Jan Geert Hiddink, Laura Kaikkonen, Brittany Finucci, Dianne M. Tracey, Joanne I. Ellis, Conrad Pilditch, Lyndsey P. Holland, Shane W. Geange. 2025. Large-scale assessments of bottom trawling effects on Vulnerable Marine Ecosystems can significantly under-represent impacts, Journal of Environmental Management, 395: 127672, https://doi.org/10.1016/j.jenvman.2025.127672.
[70] Derived from Hiddink, J.G., Valanko, S., Delgary, A.J., van Denderen, P.D., 2023. Setting thresholds for good ecosystem state in marine seabed systems and beyond. ICES J. Mar. Sci. 80, 698–709.
[71] Fabrice Stephenson, Edoardo Zelli, Matthew Bennion, Ashley A. Rowden, Owen F. Anderson, Malcolm R. Clark, Jordi Tablada, Jan Geert Hiddink, Laura Kaikkonen, Brittany Finucci, Dianne M. Tracey, Joanne I. Ellis, Conrad Pilditch, Lyndsey P. Holland, Shane W. Geange. 2025. Large-scale assessments of bottom trawling effects on Vulnerable Marine Ecosystems can significantly under-represent impacts, Journal of Environmental Management, 395: 127672, https://doi.org/10.1016/j.jenvman.2025.127672.
[72] ICES. 2024. Joint ICES/NAFO Working Group on Deep-water Ecology (WGDEC). ICES Scientific Reports. 6:77. 129 pp. https://doi.org/10.17895/ices.pub.27041425.
[73] Ibid.
[74] Sampaio, I., Braga-Henriques, A., & Pham, C. (2012). Cold-water corals landed by bottom longline fisheries in the Azores (north-eastern Atlantic). Journal of Marine Biological Association of the United Kingdom, March, 1–9. https://doi.org/10.1017/S0025315412000045.
[75] Pham, C. K., Diogo, H., Menezes, G., Porteiro, F., Braga-henriques, A., Vandeperre, F., & Morato, T. (2014). Deep-water longline fishing has reduced impact on Vulnerable Marine Ecosystems. Scientific Reports, 4(4837), 1–6. https://doi.org/10.1038/srep04837.
[76] Brewin, P. E., Farrugia, T. J., Jenkins, C., & Brickle, P. (2021). Straddling the line: high potential impact on vulnerable marine ecosystems by bottom-set longline fishing in unregulated areas beyond national jurisdiction. ICES Journal of Marine Science, 78(6), 2132–2145. https://doi.org/10.1093/icesjms/fsa.
[77] De la Torriente, A., Serrano, A., Fernández-Salas, L. M., García, M., & Aguilar, R. (2018). Identifying epibenthic habitats on the Seco de los Olivos Seamount: Species assemblages and environmental characteristics. Deep Sea Research Part I: Oceanographic Research Papers, 135(June 2017), 9–22. https://doi.org/10.1016/j.dsr.2018.03.015.
[78] Dias, V., Oliveira, F., Boavida, J., Serrão, E.A., Gonçalves, J.M. and Coelho, M.A., 2020. High coral bycatch in bottom-set gillnet coastal fisheries reveals rich coral habitats in southern Portugal. Frontiers in Marine Science, 7, p.603438. https://doi.org/10.3389/fmars.2020.603438.
[79] Morato, T., Dominguez-Carrió, C., Mohn, C., Ocaña Vicente, O., Ramos, M., Rodrigues, L., Sampaio, Í., Taranto, G.H., Fauconnet, L., Tojeira, I. and Gonçalves, E.J., 2021. Dense cold-water coral garden of Paragorgia johnsoni suggests the importance of the Mid-Atlantic Ridge for deep-sea biodiversity. Ecology and Evolution, 11(23), pp.16426-16433.https://doi.org/10.1002/ece3.8319.

catches in high-seas fisheries, especially in mixed deep-sea bottom trawl operations, where significant volumes of non-target species are captured and frequently discarded at sea based on a global study documenting the history of deep-sea bottom trawl fisheries.[80]

36. Deep-sea fish stocks remain among the least understood and most vulnerable marine resources.[81,82,83,84] Available data shows that 28% of assessed stocks are overfished, while only 19% are exploited at maximum sustainable levels and 17%remain underfished.[85] Notably, a further 36% of stocks are of unknown status,[86] reflecting existing data limitations and uncertainty in the assessment and management of deep-sea fisheries.

37. The lack of scientific stock assessments for some managed stocks, despite their vulnerability to overexploitation, makes it difficult to quantify the impacts of fishing activities on these stocks, suggesting a need for precautionary measures.[87, 88, 89, 90.] Baseline information was also limited, with only three impact assessments including data on the status of target stocks.[91]

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[80] Victorero, L., Watling, L., Deng Palomares, M.L. and Nouvian, C., 2018. Out of sight, but within reach: A global history of bottom-trawled deep-sea fisheries from> 400 m depth. Frontiers in Marine Science, 5, p.322663. https://doi.org/10.3389/fmars.2018.00098.

[81] Medeiros-Leal, W., Santos, R., Sigler, M.F. and Mildenberger, T.K., 2025. Dwindling deep-water fish stocks in the Azores: The first quantitative assessment. Fisheries Research, 285, p.107371.https://doi.org/10.1016/j.resconrec.2023.106907.

[82] Medeiros-Leal, W., De Barros, M., Silva, H.G., Crespo-Neto, O., Mildenberger, T.K., Aires-Silva, A., Pinho, M. and Santos, R., 2025. Deep-sea and deeply vulnerable: Assessing the conservation status of the kitefin shark (Dalatias licha). Global Ecology and Conservation, p.e04026.https://doi.org/10.1016/j.gecco.2025.e04026.

[83] FAO. 2022. The State of World Fisheries and Aquaculture 2022. Towards Blue Transformation. Rome, FAO. https://doi.org/10.4060/cc0461en.

[84] McMillan, P.J., Hart, A.C., Horn, P.L., Tracey, D.M., Ó Maolagáin, C., Finucci, B. and Dunn, M.R., 2021. Review of life history parameters and preliminary age estimates of some New Zealand deep-sea fishes. New Zealand Journal of Marine and Freshwater Research, 55(4), pp.565-591.https://doi.org/10.1080/00288330.2020.1840404.

[85] Food and Agriculture Organization of the United Nations (FAO), 2025. Report on cross-sectoral impacts on deep-sea fisheries in the high seas. Rome: FAO.https://openknowledge.fao.org/handle/20.500.14283/cc4046en.

[86] Ibid.

[87] North Pacific Fisheries Commission (NPFC) (2022) Report of the 2022 NPFC performance review. Tokyo: NPFC. https://www.npfc.int/system/files/2023-07/Report%20of%202022%20NPFC%20Performance%20Review.pdf.

[88] South Pacific Regional Fisheries Management Organisation (SPRFMO), 2025. Conservation and Management Measure 03a-2025: Deepwater species in the SPRFMO Convention Area. Available at: https://www.sprfmo.int/assets/Fisheries/Conservation-and-Management-Measures/2025-CMMs/CMM-03a-2025-Deepwater-Species.pdf.

[89] North Pacific Fisheries Commission (NPFC) (2025) Report of the 6th Meeting of the Small Scientific Committee on Bottom Fish and Marine Ecosystems (SSC BFME06), Nagoya, Japan, 8–10 December. https://www.npfc.int/ssc-bfme06-draft-report-adopted.

[90] Kaikkonen, L., Amaro, T., Auster, P.J., Bailey, D.M., Bell, J.B., Brandt, A., Clark, M.R., Drazen, J.C., Du Preez, C., Escobar-Briones, E. Giacomello, E.,et al., 2024. Improving impact assessments to reduce impacts of deep-sea fisheries on vulnerable marine ecosystems. Marine Policy, 167, p.106281.https://doi.org/10.1016/j.marpol.2024.106281.

[91] Ibid.

38. Some deep-sea stocks show evidence of overfishing.[92, 93, 94, 95] A recent stock assessment for one species of orange roughy in SPRFMO area, conducted in 2024, estimated the stock at just 35% of its original (virgin) spawning biomass.[96] Large declines and the loss of historical spawning aggregations have been documented in New Zealand orange roughy fisheries, which straddle into the high seas area under the competence of SPRFMO.[97, 98, 99, 100, 101] For pelagic armorhead in the North Pacific, depletion analyses suggest historically low biomass levels,[102] while for splendid alfonsino there is evidence of an elevated risk of overfishing, including fishing the fish before they reach reproductive maturity leading to reduced spawning potential.[103] Historically, the pelagic armorhead fishery collapsed within a decade of intensive exploitation, due to overfishing, and more than 50 years later the stocks are yet to recover, and recent analyses continue to indicate low biomass.[104,105] Deep-sea fisheries, particularly bottom trawl fisheries, are also often characterized by high levels of bycatch

[92] NEAFC (2024). *Recommendation on Regulatory Measures for the Protection of Blue Ling in the NEAFC Regulatory Area (ICES Division XIV) from 2024 to 2027* https://faolex.fao.org/docs/pdf/mul224147.pdf
[93] ICES. 2024. Orange roughy (Hoplostethus atlanticus) in subareas 1-10, 12 and 14 (the Northeast Atlantic and adjacent waters). In Report of the ICES Advisory Committee, 2024. ICES Advice 2024, ory.27.nea. https://doi.org/10.17895/ices.advice.25019432.
[94] Iwamoto, T. 2015. Coryphaenoides rupestris. The IUCN Red List of Threatened Species 2015: e.T15522149A15603540. https://dx.doi.org/10.2305/IUCN.UK.2015-4.RLTS.T15522149A15603540.en. Accessed on 10 April 2026.
[95] Fiorentino, F., Garofalo, G., Gristina, M., Bono, G. and Basilone, G. (2024). Learning from the history of red shrimp fisheries in the Mediterranean. ICES Journal of Marine Science, 81(4), 652–664. https://doi.org/10.1093/icesjms/fsae031.
[96] Dunn, M.R. (2024) Assessment of the Challenger Plateau orange roughy stock for 2024. New Zealand Fisheries Assessment Report 2024/58. Presented at the 12th Meeting of the Scientific Committee, South Pacific Regional Fisheries Management Organisation (SPRFMO), Lima, Peru, 30 September–5 October. https://www.sprfmo.int/assets/Meetings/02-SC/12th-SC-2024/Deepwater/SC12-DW05-NZL-Assessment-of-the-Challenger-Plateau-orange-roughy-stock-for-2024.pdf.
[97] Ministry for Primary Industries (MPI), 2026. Review of proposed spawning area closure to orange roughy fishing in East and South Chatham Rise (ORH 3B) from 1 June 2026: Discussion document. Wellington: Ministry for Primary Industries. Available at: https://www.mpi.govt.nz/dmsdocument/71294.
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[99] South Pacific Regional Fisheries Management Organisation (SPRFMO) (2025) Report of the 13th Meeting of the Scientific Committee (SC13), Wellington, New Zealand, 8–13 September 2025. https://www.sprfmo.int/assets/Meetings/02-SC/13th-SC-2025/SC13-REPORT-ADOPTED-13SEPT2025_rev5.pdf.
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[101] South Pacific Regional Fisheries Management Organisation (SPRFMO), 2025. Conservation and Management Measure 03a-2025: Deepwater species in the SPRFMO Convention Area. Available at: https://www.sprfmo.int/assets/Fisheries/Conservation-and-Management-Measures/2025-CMMs/CMM-03a-2025-Deepwater-Species.pdf.
[102] Ibid.
[103] North Pacific Fisheries Commission (NPFC) (2024) Yield per recruit (YPR) and spawning biomass per recruit (SBPR) analyses for splendid alfonsino (NPFC-2024-SSC BFME05-WP09 Rev.1). 5th Meeting of the Small Scientific Committee on Bottom Fish and Marine Ecosystems (SSC BFME05), December 2024. https://www.npfc.int/system/files/2024-12/NPFC-2024-SSC%20BFME05-WP09%28Rev1%29%20YPR%20and%20SBPR%20for%20SA.pdf.
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[105] Victorero, L., Watling, L., Deng Palomares, M.L. and Nouvian, C., 2018. Out of sight, but within reach: A global history of bottom-trawled deep-sea fisheries from> 400 m depth. Frontiers in Marine Science, 5, p.322663. https://doi.org/10.3389/fmars.2018.00098.

and broad ecosystem impacts.[106, 107, 108, 109] Recent research has confirmed that deepwater sharks and rays are among the most severely impacted marine species, with 99.3 percent of species threatened by overfishing.[110] Nearly 88% are caught as bycatch in fisheries targeting other deep-sea species.[111]

39. Deep-sea fisheries, particularly bottom trawl fisheries, are often characterized by high levels of bycatch and broad ecosystem impacts[112,113,114,115]. The effects of deep-sea fishing across the full range of non-target species remain poorly documented; however, studies of bycatch species have shown that some populations have experienced severe declines as a result of incidental capture.[116, 117] In the Mediterranean, studies have documented up to 434 species in the discards of a single localized bottom trawl fishery, including species of commercial value.[118] New Zealand and Australia have reported that 231 species and 281 genera of VME indicator taxa, as well as some un-named species, have been observed as bycatch in the high seas bottom fisheries in the Southwest Pacific and Tasman Sea.[119] NPFC has identified 128 species of fish caught in bottom fishery surveys on the Emperor Seamount Chain on the high seas of the North Pacific.[120] In the SIOFA area, deep-sea sharks are frequently recorded as bycatch in longline fisheries.[121]

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[107] Clark, M.R., Althaus, F., Schlacher, T.A., Williams, A., Bowden, D.A. and Rowden, A.A., 2016. The impacts of deep-sea fisheries on benthic communities: a review. ICES Journal of Marine Science, 73(suppl_1), pp.i51-i69.https://doi.org/10.1093/icesjms/fsv123.

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[110] Finucci, B., Pacoureau, N., Rigby, C.L., Matsushiba, J.H., Faure-Beaulieu, N., Sherman, C.S., VanderWright, W.J., Jabado, R.W., Charvet, P., Mejía-Falla, P.A. and Navia, A.F., 2024. Fishing for oil and meat drives irreversible defaunation of deepwater sharks and rays. Science, 383(6687), pp.1135-1141.DOI: 10.1126/science.ade9121.

[111] Ibid.

[112] Foster, S.J., Ascione, S.J., Boyd, I.B. and Vincent, A.C., 2026. Global diversity of marine fishes caught in bottom trawl fisheries. Reviews in Fish Biology and Fisheries, 36(1), p.40. https://link.springer.com/article/10.1007/s11160-026-10043-6.

[113] Clark, M.R., Althaus, F., Schlacher, T.A., Williams, A., Bowden, D.A. and Rowden, A.A., 2016. The impacts of deep-sea fisheries on benthic communities: a review. ICES Journal of Marine Science, 73(suppl_1), pp.i51-i69.https://doi.org/10.1093/icesjms/fsv123.

[114] Victorero, L., Watling, L., Deng Palomares, M.L. and Nouvian, C., 2018. Out of sight, but within reach: A global history of bottom-trawled deep-sea fisheries from> 400 m depth. Frontiers in Marine Science, 5, p.322663. https://doi.org/10.3389/fmars.2018.00098.

[115] Jarvis, C. & Brennan, M.L. (2024). History of trawling and ecological impact. In C. Jarvis (Ed.), Threats to our ocean heritage: Bottom trawling (pp. 9–25). Springer Nature Switzerland.DOI:10.1007/978-3-031-57953-0_2.

[116] Aranha, S.G., Dias, E., Marsili, T., Barkai, A., Queiroz, N., da Rocha, P.P. and Teodosio, A., 2025. Unravelling the deep: Assessing the bycatch of deep-sea elasmobranchs in crustacean bottom trawl fisheries in Portugal. Marine Policy, 173, p.106555.https://doi.org/10.1016/j.marpol.2024.106555.

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[119] SPRFMO (2023) Cumulative Bottom Fishery Impact Assessment for Australian and New Zealand Bottom Fisheries, 2023, SC11–DW01_rev1, 11th Meeting of the Scientific Committee, Panama City, 11–16 September, p. 174. https://www.sprfmo.int/assets/Meetings/02-SC/11th-SC-2023/Deepwater/SC11-DW01_rev1-Cumulative-Bottom-Fishery-Impact-Assessment-for-AUS-and-NZL-bottom-fisheries-2023.pdf

[120] NPFC (2024) The field guide for identifications of fishes of the Emperor Seamount Chain captured by bottom fisheries. Tokyo: NPFC. https://www.npfc.int/system/files/2024-04/NPFC%20Fish%20ID%20Guide%20Emperor%20Seamounts.pdf.

[121] SIOFA (2023) Report of the workshop on deepwater sharks in the Southern Indian Ocean Fisheries Agreement (SIOFA) Area (WSDWS-2023 Report), Santa Cruz de Tenerife, Spain, 20–21 March. https://siofa.org/sites/default/files/2023-04/WSDWS-2023-Report.pdf.

3. Cumulative Impacts to VMEs and Deep-sea Fish Stocks

40. Humans are causing a number of additional global-scale impacts on deep-sea ocean ecosystems that will act synergistically to amplify any deleterious effects of fisheries. These include increased temperatures, ocean acidification, decreased oxygen saturation, potential changes in deep-water circulation, changes in nutrient availability, and changes in particulate organic carbon flux to deep water.[122,123]

41. Habitat suitability modeling is again a useful tool for assessing potential impacts of these changes.[124] These efforts consistently show shifts in habitat (poleward and deeper), and loss of available habitat area for both fish stocks and VME indicator taxa.[125, 126, 127]

42. Recent research shows that 32 commercially exploited deep-sea fish species are highly vulnerable to ocean warming, deoxygenation, and acidification, which threatens their long-term survival and places them at a greater risk of local, or even global, extinction than previously estimated due to the combined pressures of climate change and fishing.[128]

43. Studies often conclude that projected areas which might provide a safe haven from climate change impacts (climate refugia) do not overlap with current protected areas.[129, 130, 131] Moreover, continued bottom trawling has been shown to threaten the

[122] Sweetman, A.K., A.R. Thurber, C.R. Smith, L.A. Levin, C. Mora, C.-L. Wei, A.J. Gooday, D.O. B. Jones, M. Rex, M. Yasuhara, J. Ingels, H.A. Ruhl, C.A. Frieder, R. Danovaro, L. Würzberg, A.R. Baco, B. Grupe, A. Pasulka, K.S. Meyer, K.M. Dunlop, L.-A. Henry, J.M. Roberts. 2017. Major impacts of climate change on deep-sea benthic ecosystems. *Elementa: Science of the Anthropocene* 5: 1-23. https://doi.org/10.1525/elementa.203.

[123] Ross T, Du Preez C, Ianson D. Rapid deep ocean deoxygenation and acidification threaten life on Northeast Pacific seamounts. Glob Change Biol. 2020;26:6424–6444. https://doi.org/10.1111/gcb.15307

[124] Samuelsen A, Schrum C, Yumruktepe VÇ, Daewel U and Roberts EM (2022) Environmental Change at Deep-Sea Sponge Habitats Over the Last Half Century: A Model Hindcast Study for the Age of Anthropogenic Climate Change. Front. Mar. Sci. 9:737164. doi: 10.3389/fmars.2022.737164.

[125] Morato T, González-Irusta J-M, Dominguez-Carrió C, et al. Climate-induced changes in the suitable habitat of cold-water corals and commercially important deep-sea fishes in the North Atlantic. Glob Change Biol. 2020;26:2181–2202. https://doi.org/10.1111/gcb.14996.

[126] Zelli,E., Joanne Ellis, Conrad Pilditch, Ashley A. Rowden, Owen F. Anderson, Shane W. Geange, David A. Bowden, Fabrice Stephenson. 2025. Identifying climate refugia for vulnerable marine ecosystem indicator taxa under future climate change scenarios, Journal of Environmental Management. 373: 122635. https://doi.org/10.1016/j.jenvman.2024.122635.

[127] Fragkopoulou, E., L. P.Gouvêa, V.Balogh, E. A.Serrão, and J.Assis. 2025. "Global Cold-Water Coral Biodiversity Redistribution Under Projected Climate Change." Global Change Biology31, no. 10: e70563. https://doi.org/10.1111/gcb.70563.

[128] Cheung, W.W., Wei, C.L. and Levin, L.A., 2022. Vulnerability of exploited deep-sea demersal species to ocean warming, deoxygenation, and acidification. *Environmental Biology of Fishes*, *105*(10), pp.1301-1315. https://doi.org/10.1007/s10641-022-01321-w.

[129] Anderson, O. F., Stephenson, F., Behrens, E., & Rowden, A. A. (2022). Predicting the effects of climate change on deep-water coral distribution around New Zealand—Will there be suitable refuges for protection at the end of the 21st century? Global Change Biology, 28, 6556–6576. https://doi-org.proxy.lib.fsu.edu/10.1111/gcb.16389.

[130] Zelli,E., Joanne Ellis, Conrad Pilditch, Ashley A. Rowden, Owen F. Anderson, Shane W. Geange, David A. Bowden, Fabrice Stephenson. 2025. Identifying climate refugia for vulnerable marine ecosystem indicator taxa under future climate change scenarios, Journal of Environmental Management. 373: 122635. https://doi.org/10.1016/j.jenvman.2024.122635.

[131] Georges, V., Vaz, S., Carbonara, P. et al. Mapping the habitat refugia of Isidella elongata under climate change and trawling impacts to preserve Vulnerable Marine Ecosystems in the Mediterranean. Sci Rep 14, 6246 (2024). https://doi.org/10.1038/s41598-024-56338-1.

viability of areas that could serve as natural climate refugia for VMEs, further undermining their resilience.[132,133,134]

44. Climate-driven impacts are further compounded by bottom trawling, which, in addition to impacting deep-sea habitats, also releases stored carbon from sediments, further exacerbating climate change impacts. Research has identified bottom trawling as a significant source of carbon emissions to the atmosphere and a driver of localized ocean acidification in heavily trawled areas. [135,136, 137]

III. Actions taken by States and regional fisheries management organizations and arrangements to address the impact of bottom fisheries on vulnerable marine ecosystems and the long-term sustainability of deep-sea fish stocks

A. Actions taken by regional fisheries management organizations and arrangements with competence to regulate bottom fisheries

45. The present section describes actions taken to give effect to the relevant paragraphs of General Assembly resolutions 64/72, 66/68, and 77/118 by RFMO/As with the competence to regulate bottom fisheries: the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR), the General Fisheries Commission for the Mediterranean (GFCM), the Northwest Atlantic Fisheries Organization (NAFO), and the North-East Atlantic Fisheries Commission (NEAFC), the North Pacific Fisheries Commission (NPFC), the South East Atlantic Fisheries Organization (SEAFO), the South Indian Ocean Fisheries Agreement (SIOFA) and the South Pacific Regional Fisheries Management Organization (SPRFMO).[138]

1. Identifying vulnerable marine ecosystems and assessing the significant adverse impact of bottom fishing

46. Various RFMO/As submitted information regarding the identification of VMEs and assessments of the impact of bottom fishing activities on VMEs, as set out below.

[132] Anderson, O. F., Stephenson, F., Behrens, E., & Rowden, A. A. (2022). Predicting the effects of climate change on deep-water coral distribution around New Zealand—Will there be suitable refuges for protection at the end of the 21st century?Global Change Biology, 28, 6556–6576. https://doi-org.proxy.lib.fsu.edu/10.1111/gcb.16389.
[133] Georges, V., Vaz, S., Carbonara, P. et al. Mapping the habitat refugia of Isidella elongata under climate change and trawling impacts to preserve Vulnerable Marine Ecosystems in the Mediterranean. Sci Rep 14, 6246 (2024). https://doi.org/10.1038/s41598-024-56338-1.
134 Zelli,E., Joanne Ellis, Conrad Pilditch, Ashley A. Rowden, Owen F. Anderson, Shane W. Geange, David A. Bowden, Fabrice Stephenson. 2025. Identifying climate refugia for vulnerable marine ecosystem indicator taxa under future climate change scenarios, Journal of Environmental Management. 373: 122635. https://doi.org/10.1016/j.jenvman.2024.122635.135 Atwood, T.B., Romanou, A., DeVries, T., Lerner, P.E., Mayorga, J.S., Bradley, D., Cabral, R.B., Schmidt, G.A. and Sala, E., 2024. Atmospheric CO2 emissions and ocean acidification from bottom-trawling. Frontiers in Marine Science, 10, p.1125137.https://doi.org/10.3389/fmars.2023.1125137
135 Atwood, T.B., Romanou, A., DeVries, T., Lerner, P.E., Mayorga, J.S., Bradley, D., Cabral, R.B., Schmidt, G.A. and Sala, E., 2024. Atmospheric CO2 emissions and ocean acidification from bottom-trawling. Frontiers in Marine Science, 10, p.1125137.https://doi.org/10.3389/fmars.2023.1125137
136 Ibid.
137 Le Bris, N. and Levin, L.A., 2020. Climate change cumulative impacts on. Natural capital and exploitation of the deep ocean, p.161.https://doi.org/10.1093/oso/9780198841654.003.0009.
[138] Unless otherwise indicated, the information provided is from the contributions of the relevant organizations.

47. In CCAMLR, eight new VMEs were notified under conservation measure 22-06 and 22-09 and six new VME risk areas were notified under conservation measure 22-07 during the reporting period.[139] Its Contracting Parties continued to provide revised bottom fishing impact assessments as part of their annual notification process to fish in the CCAMLR Convention Area under conservation measure 22-06. These assessments were available for review by the Scientific Committee to advise the Commission on the avoidance of significant adverse impacts.

48. GFCM reported that its dedicated working group on VMEs continued analysing the distribution of VME indicators and evaluating their overlap with fishing effort when possible. Its recent work had included dedicated sessions on key VME-forming species and providing technical input into emerging proposals and monitoring strategies for fisheries restricted areas.

49. GFCM also noted that it maintained a database on sensitive benthic habitats and species, with its related annual data call, which stored and facilitated analysis of records of VME indicator species, including both presence and absence data, across deep-water areas inside and outside national jurisdiction. The database directly supported scientific advice provided by the GFCM Scientific Advisory Committee on Fisheries, including the identification of potential VMEs and priority areas for spatial protection. Some management plans adopted since 2022 include provisions for the assessment of impacts on VMEs.[140]

50. Within its Convention Area, NAFO has identified 27 areas as being vulnerable to bottom contact gears and subsequently closed these areas to bottom fishing.[141] NAFO reported that its Scientific Council had completed two significant impact assessments on VMEs in the NAFO Regulatory Area. It was in the process of completing a third assessment, which would strive to include an evaluation of the trade-offs between VME biomass, areal extent and fishing opportunities, as well as information on the ecological significance of each of the proposed closure areas.

51. NEAFC reported that recent scientific advice from the International Council for Exploration of the Sea (ICES) had indicated that no new VME habitat records for the NEAFC Regulatory Area had been added since 2021. It noted that ICES was planning a benchmarking process for its VME advice in 2027, which would likely include considering the effects of static gear on VMEs, the VME index, the effects of analytical resolution and approaches for defining buffer zones. NEAFC noted that the process could lead to a change to VME advice by ICES in the future.

52. NPFC had updated its conservation and management measures for bottom fisheries and the protection of VMEs in the Northwestern Pacific Ocean and the Northeastern Pacific Ocean, most recently in 2025, to strengthen its impact assessment framework.[142] The measures required, inter alia, pre-fishing assessment of significant

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[139] https://vmeregistry.ccamlr.org/.

[140] For example, the Multiannual management plan for the sustainable exploitation of demersal stocks in the Strait of Sicily (Recommendation GFCM/45/2022/4), requires the scientific committee to assess the impacts of demersal longlines, gillnets and trammel nets targeting the spawning stock of European hake in the Strait of Sicily, Recommendation GFCM/45/2022/6 on a multiannual management plan for the sustainable exploitation of giant red shrimp and blue and red shrimp stocks in the Ionian Sea (geographical subareas 19 to 21), required the identification of the fishing footprint on vulnerable marine ecosystems and the identification of essential fish habitat areas for juveniles and spawners of the deep-water red shrimp.

[141] https://www.nafo.int/Fisheries/VME.

[142] NPFC, *Conservation and Management Measure for Bottom Fisheries and Protection of Vulnerable Marine Ecosystems in the Northwestern Pacific Ocean (CMM 2025-05)* (10 July 2025) <https://www.npfc.int/system/files/2025-07/CMM%202025-05_For%20Bottom%20Fisheries%20and%20Protection%20of%20VMEs%20in%20the.pdf> accessed 25 February 2026.

adverse impact for any new areas[143] and obliged members to publicly disclose the results[144]. It also established science-based standards and criteria consistent with applicable FAO guidelines[145]; mandated the submission of impact assessments to, and the evaluation of such assessments by the Scientific Committee[146]; and specified the data, evidence, and monitoring tools necessary to support and ensure robust impact assessments.[147] NPFC has developed VME indicator taxa lists,[148] and standardized species identification guides and templates used by observers and workshops to improve VME detection.[149] Three VMEs on Cobb Seamount were protected in 2024 following efforts to map the distribution of VME indicator taxa, identify VMEs and their associated communities.[150]

53. Information on activities by SEAFO indicated that it had updated its list of VMEs indicator species and other species in collaboration with FAO, to ensure that the identification and protection of VMEs was based on the latest scientific data. It was also preparing projects to train scientists on VME identification and quantification from survey videos.[151] No VME encounters had been recorded to date in the SEAFO Convention Area.[152]

54. SIOFA reported that it had strengthened its scientific foundation for impact assessment through targeted data collection, stock monitoring, and ecosystem research. Furthermore, its Scientific Committee conducted a comprehensive review of the proposed new lobster fishery in 2024–2025, including a dedicated impact assessment on potential effects on benthic habitats and associated VMEs. SIOFA had also completed a project producing the first regional VME habitat suitability map, which further refined understanding of transboundary dynamics for Patagonian toothfish through genetic stock structure studies to support more precise impact assessments in shared stocks.

55. SPRFMO indicated that a new protocol for reviewing bottom fishing footprints was tested and that several Members had submitted updated benthic impact assessments. Upon the presentation of an updated quantitative impact assessment for bottom fisheries, the twelfth meeting of its Scientific Committee convened in 2024 recommended adopting the proposed Encounter Review Standards to enhance the assessment and management of VMEs.[153] In 2024, SPRFMO also initiated a process to assess and potentially implement protective measures for the ecologically significant area in the Salas y Gomez and Nazca Ridges Area, where future bottom fishing could occur.[154]

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[143] Ibid., para 4(C–D) <https://www.npfc.int/system/files/2025-07/CMM%202025-05_For%20Bottom%20Fisheries%20and%20Protection%20of%20VMEs%20in%20the.pdf> accessed 25 February 2026.
[144] Ibid., para 4(E).
[145] Ibid., para 4(D).
[146] Ibid, Annex 3 (Scientific Committee Assessment Review Procedures for Bottom Fishing Activities).
[147] Ibid, Annex 2 (Science-Based Standards and Criteria for Identification of VMEs and Assessment of Significant Adverse Impacts on VMEs and Marine Species).
[148] Ibid.
[149] NPFC, *VME Taxa Identification Guide: Western North Pacific Ocean* (Tokyo, 2020) <https://www.npfc.int/system/files/2020-09/NPFC%20VME%20taxa%20ID%20guide.pdf> accessed 25 February 2026.
[150] Contribution of Canada.
[151] https://www.un.org/Depts/los/general_assembly/contributions80/27SEAFO.pdf.
[152] SEAFO, Report of the 22nd Annual Meeting of the Commission (26-27 November 2025), p. 4 < http://www.seafo.org/MeetingsDetails?MeetingID=cb36defe-82a9-4a64-aca1-274e47683628>.
[153] https://www.un.org/depts/los/general_assembly/contributions80/28SPRFMO.pdf.
[154] 2025 Annual report of SPRFMO.

56. Information was received that some RFMO/A impact assessment processes are also requiring consideration of cumulative impacts.[155]

2. Closing areas containing vulnerable marine ecosystems to bottom fishing until conservation and management measures are adopted

57. All deep-sea fishing RFMO/As have put in place area-based management measures to restrict fishing activities in areas where VMEs may occur.

58. CCAMLR reported that, through Conservation Measures (CMs) 2206, 2207 and 2209, it prohibits bottom fishing in areas assessed as high risk or designated as VMEs. CCAMLR continues to maintain a registry of VMEs and VME risk areas in Antarctic waters, which in 2025 recorded 61 VMEs and 87 VME risk areas.

59. GFCM reported that a new fisheries restricted area was established in 2024 to protect VMEs and deep-sea habitats in the Otranto Channel in the Adriatic Sea.

60. NAFO noted that the VME areas closed to bottom fishing represent approximately 14% of the NAFO Regulatory Area.

61. Upon recommendation by the ICES in 2022, NEAFC renewed all its closures until 31 December 2027.

62. Information on activities by SEAFO indicated that it has closed approximately 505,000 km^2 to bottom fishing.

63. SIOFA reported that, building on CMM 17 from 2024, which establishes a formal framework for regulating exploratory fisheries requiring prior impact assessment and limiting effort, gear, and duration, CMM 18 (2025) significantly expanded spatial closures, and prohibiting bottom fishing across ecologically sensitive zones identified through scientific review.

64. In 2025, SPRMO amended CMM03 on the Management of Bottom Fishing in the SPRFMO Convention Area. This CMM established a comprehensive framework for the protection of VMEs through spatial closures, encounter protocols, and continuous scientific evaluation, thereby upholding the organization's commitment to sustainable fisheries management and marine biodiversity conservation.[156]

3. Adopting and implementing conservation and management measures, including the development of protocols for encounters with vulnerable marine ecosystems

65. In areas where fishing is permitted, RFMO/As adopted and implemented various types of conservation and management measures to address the impacts of bottom fishing on VMEs and the long-term sustainability of deep-sea fish stocks in accordance with resolutions 64/72, 66/68, and 77/118. These include the establishment of fishing footprints where fishing is allowed to continue, exploratory fishery management and encounter protocols.

66. In CCAMLR, all high seas toothfish fisheries are conducted under the CMs for exploratory fisheries, which require detailed data collection, participation in tagging programs, international scientific observers to be present on all vessels, and

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[155] See NEAFC contribution, New Zealand and United States contributions (regarding SPRFMO).
[156] https://www.un.org/depts/los/general_assembly/contributions80/28SPRFMO.pdf.

compliance with catch limits and bycatch limits set out in the CMs. Research fisheries also comply with the reporting under CMs 22-06 and 22-07.

67. GFCM reported that it adopted management plans addressing deep-sea fisheries, including requirements for mapping deep-sea fisheries footprints and provisions for measures to prevent any significant adverse impacts on VMEs. For instance, GFCM established the multiannual management plan for the sustainable exploitation of demersal stocks in the Strait of Sicily, through its Recommendation GFCM/45/2022/4. It further reported on the adoption of a multiannual management plans for the sustainable exploitation of giant red shrimp and blue and red shrimp stocks in the Strait of Sicily,[157] for the sustainable exploitation of giant red shrimp and blue and red shrimp stocks in the Ionian Sea,[158] and for sustainable demersal trawl fisheries targeting giant red shrimp and blue and red shrimp in the Levant Sea.[159]

68. GFCM further reported that it adopted technical elements for the protection of VMEs in the GFCM area of application. These elements include a VME encounter protocol in the GFCM area of application and related VME indicator lists for the Mediterranean Sea. GFCM also adopted technical elements for mapping existing deep-sea fishing areas in the GFCM area of application, as well as technical elements for the establishment of an exploratory deep-sea bottom fishing protocol in the GFCM area of application.

69. NAFO noted that it has continued to implement its Precautionary Approach Framework. At present, precautionary reference points are available for 10 of the 17 stocks managed by NAFO and 3 of the 6 coastal State stocks. NAFO recently revised its Precautionary Approach Framework in 2024, and will seek to define and/or update reference points for all stocks under the revised framework as they undergo full assessments.

70. NEAFC reported that its encounter protocols have been expanded and clarified several times, requiring a temporary closure to be applied in all instances of encounters above a threshold level. The position of the encounter and extent of the possible VME is assessed using sea-bed mapping, and the results submitted to ICES for evaluation. Subsequent management action, and the possible lifting of the temporary closure or notification of a VME closure, is based on the subsequent advice by ICES and recommendations by the Permanent Committee on Management and Science (PECMAS).

71. NEAFC reported that it adopted a resolution on climate change considerations in 2023, committing NEAFC to consider the potential impacts of climate change not only on all relevant NEAFC stocks but also on non-target species and related ecosystems.

72. Through CMM 2025-05, NPFC set out an objective to ensure the long-term conservation and sustainable use of the fisheries resources in the Convention Area while protecting the marine ecosystems of the North Pacific Ocean in which these resources occur.[160] The measures in this CMM aim to prevent significant adverse impacts on VMEs in the Convention Area, acknowledging the complex dependency of fishing resources and species belonging to the same ecosystem within VMEs.[161]

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[157] Recommendation GFCM/45/2022/5.
[158] Recommendation GFCM/45/2022/6.
[159] Recommendation GFCM/45/2022/7.
[160] https://www.npfc.int/system/files/2025-07/CMM%202025-05_For%20Bottom%20Fisheries%20and%20Protection%20of%20VMEs%20in%20the.pdf.
[161] https://www.npfc.int/system/files/2025-07/CMM%202025-05_For%20Bottom%20Fisheries%20and%20Protection%20of%20VMEs%20in%20the.pdf.

73. Information on activities by SEAFO indicated that it had implemented encounter protocols requiring vessels to cease fishing and move 2 NM upon encountering VMEs above thresholds. The SEAFO Commission agreed to incorporate into the SEAFO IUU vessel list those vessels included on the IUU lists of NAFO, NEAFC, CCAMLR and SIOFA.[162] The SEAFO website provides information, in accordance with the provisions on lost gear contained in Article 8 of the SEAFO System, regarding lost gear in the SEAFO Convention Area. SEAFO had also initiated research programmes to improve the understanding of fish stocks and marine ecosystems, including stock assessments, habitat mapping and the study of impact of fishing on marine biodiversity. SEAFO Contracting Parties also took part in a workshop organized by the FAO Deep-Sea Fisheries Project on an Ecosystem Approach to Fisheries. Its Scientific Committee was conducting a review of its conservation measure on reducing incidental by-catch of seabirds.[163]

74. SIOFA reported that, in 2023, the SIOFA Meeting of the Parties had informally adopted precautionary total allowable catches (TACs) of its main target species, including the formal adoption of a new TAC for Portuguese dogfish (Centroscymnus coelolepis) in Subarea 2, informed by the average annual catch in a 5-year reference period. SIOFA noted that a dedicated research initiative examining the impacts of climate change on deep-sea ecosystems and fish stocks is underway for the period 2025–2026, as an effort to integrate climate-related considerations into its management framework.

75. SIOFA also reported that its CMM 17 (2024) established a formal framework for the regulation of exploratory fisheries, requiring the submission of prior impact assessments and imposing limits on fishing effort, gear types and the duration of operations. Furthermore, in 2025, its Scientific Committee had applied a precautionary approach in declining to endorse a proposed extension of bottom fishing activities following an assessment indicating uncertainties regarding potential significant adverse impacts on VMEs.

76. Information on activities by SPRFMO indicated that it had established a defined VME encounter protocol that includes threshold levels and indicator species and incorporates a biodiversity component in addition to assessments focused on single taxa. According to the 2025 Annual Report of SPRFMO, CMM 03 mandates that Members and Cooperating Non-Contracting Parties submit annual reports detailing benthic bycatch data.[164] Pursuant to Decision 06-2024, a second Performance Review had been conducted covering on one had the progress achieved since the First Performance Review and on the other hand providing advice on key topics critical to SPRFMO’s success namely, Governance, Building a High Performing Secretariat, Data Collection and Information Management Systems, Fisheries management, and Improving Engagement.[165]

4. Establishing mechanisms to promote and enhance compliance with applicable measures

77. CCAMLR reported that it has established a monitoring programme to ensure systematic data collection and reporting by both research and fishing vessels. CCAMLR’s conservation measures on exploratory fisheries required detailed data collection, participation in tagging programs, international scientific observers to be present on all vessels, and compliance with catch and bycatch limits set out in the

[162] http://www.seafo.org/Management/IUU.
[163] https://www.un.org/depts/los/general_assembly/contributions80/27SEAFO.pdf.
[164] https://www.un.org/depts/los/general_assembly/contributions80/28SPRFMO.pdf.
[165] https://sprfmo.int/assets/Meetings/01-COMM/13th-Commission-2025/Reports/SPRFMO-Second-Performance-Review-1.-Main-Report.pdf.

conservation measures. Research fisheries also had to comply with the reporting under specific conservation measures.

78. GFCM reported that recommendation GFCM/45/2022/11 required Contracting Parties or Cooperating non-Contracting Parties to establish minimum monitoring, control and surveillance measures such as the annual submission of authorized vessel lists, monitoring of fishing activity and navigation within fisheries restricted areas, and systematic reporting of inspection results. GFCM noted that it assessed compliance annually, with Contracting Parties or Cooperating non-Contracting Parties reporting on monitoring, control and surveillance measures through dedicated questionnaires, which supported the assessment of transposition of relevant GFCM decisions into national legislation and the evaluation of compliance across the network of fisheries restricted areas.

79. NEAFC reported that its binding recommendations were backed up by a comprehensive scheme of control and enforcement, including measures to ensure all fishing vessels were notified and authorised to fish in the regulatory area. The monitoring and catch information generated under the scheme could be used to enforce NEAFC regulations during inspections at sea as well as through port State control. Additionally, the NEAFC Secretariat was tasked with sending alerts to Contracting Parties should any vessel enter the regulatory area but outside existing fishing areas and exhibit behaviour that could be consistent with bottom fishing. The Scheme was being updated and improved each year, overseen by the Permanent Committee on Monitoring and Compliance.

80. NEAFC further reported that it was in a process of transitioning to an electronic reporting system (ERS) based on the United Nations fisheries language for data exchange (UN/FLUX). This system, relying on electronic logbooks kept onboard by vessels, would improve the accuracy and timeliness of data exchanged between Contracting Parties and the secretariat, including data on fishing gear. The transition was expected to assist in reporting of VME encounters and to improve fisheries enforcement services.

81. To enhance transparency, NEAFC noted that it had made its annual compliance reports and its authorized fishing vessel lists publicly available, and that information on fishing gear carried by vessels would soon also be made available to the public.

82. Both NEAFC and NAFO noted their decisions to report certain VME bottom fishing closure areas as Other Effective Area-based Conservation Measures (OECMs) to the secretariat of the Convention on Biological Diversity and for inclusion in the World Database on Protected and Conserved Areas. NEAFC was considering whether to report other areas restricted to bottom fishing as OECMs, including what changes to existing measures might be needed to be adopted in order to meet the relevant criteria.

83. NEAFC also reported that its Monitoring and Compliance Committee was considering options for Contracting Parties to improve transparency of investigations into the alerts on bottom fishing outside existing bottom fishing areas. The secretariat had introduced a system to reduce the number of false positive bottom fisheries alerts it circulated to Parties to help focus compliance investigations.

84. NEAFC further noted the need for cooperation and coordination under the Agreement on Marine Biological Diversity of Areas beyond National Jurisdiction (BBNJ Agreement), in particular with regard to the implementation of provisions on measures such as area-based management tools, including marine protected areas, and environmental impact assessments, to ensure that VME closures under NEAFC were taken into account.

85. Information on activities by NPFC indicated that it had revised its compliance monitoring scheme, most recently in 2025, through which the NPFC, with the assistance of its Technical and Compliance Committee, aimed to ensure that all members and cooperating non-contracting parties implemented and complied with their obligations. The purpose of the compliance monitoring scheme was also to assess the actions of members and cooperating non-contracting parties in response to alleged violations by their flagged vessels or nationals, not to assess compliance by individual vessels or persons.[166] NPFC's vessel monitoring system was now fully operational, requiring member States to use real time satellite position fixing transmitters while operating in the convention area, and to notify the commission of their intention to enter or exit the area.[167]

86. Information on activities by SEAFO indicated that it had adopted a joint approach with NAFO, NEAFC, CCAMLR, and SIOFA on sharing information about vessels engaged in IUU fishing.[168] SEAFO also updated its system of observation, inspection, compliance and enforcement in 2024.[169]

87. SIOFA reported that it had adopted CMM 16 in 2024, which established standardized vessel monitoring system data collection, enabling spatial and temporal analysis of fishing efforts. It had also revised, in 2023, CMM 10 on monitoring, control and surveillance, to enhance at-sea and port-based enforcement capacity to ensure compliance with relevant measures.

88. SPRMO reported that the revision of CMM 07 on Port Inspections outlined the updated procedures and minimum standards for conducting port inspections, improving consistency and transparency in inspections across the SPRFMO Area. Its Compliance and Technical Committee continued to discuss the implementation and operation of the SPRMO vessel monitoring system. A working group to develop electronic monitoring standards also continued to operate.[170]

5. Review of identifications, assessments and measures

89. CCAMLR noted that it assesses the long-term sustainability of toothfish stocks on a regular basis relative to its precautionary reference limits and decision rules. The CMs in place to manage these fisheries (CMs 41-01 to 41-11) are also regularly reviewed. CCAMLR Members and the Secretariat continue to conduct research and develop management advice to inform the Commission about avoiding significant adverse impacts on VMEs and managing deep-sea fish stocks within sustainable limits.

90. GFCM reported that it adopted a set of minimum standards under Recommendation GFCM/45/2022/11 to support coherence and effectiveness across the Fisheries Restricted Area (FRA) network. These standards define essential elements for the design and monitoring of FRAs, including conservation objectives, appropriate spatial boundaries, monitoring requirements and review procedures. The minimum standards now serve as a benchmark for reviewing older FRAs and ensuring consistency across all spatial measures, including those aimed at conserving VMEs

[166] NPFC, Conservation and Management Measure for the Compliance Monitoring Scheme, CMM 2025-13 (10 July 2025) < https://www.npfc.int/system/files/2025-07/CMM%202025-13_For%20the%20Compliance%20Monitoring%20Scheme_0.pdf>.
[167] https://www.npfc.int/npfc-2024-vessel-monitoring-system-overview.
[168] http://www.seafo.org/Management/IUU.
[169] http://www.seafo.org/media/458c7145-c639-4d87-ae9d-ff63babc086c/SEAFOweb/pdf/System/SEAFO%20SYSTEM%202024_pdf. https://www.un.org/depts/los/general_assembly/contributions80/27SEAFO.pdf.
[170] https://www.un.org/depts/los/general_assembly/contributions80/28SPRFMO.pdf.

and essential fish habitats (EFHs). This approach supports adaptive management and strengthens the capacity to assess and review the effectiveness of measures over time.

91. NAFO reported that, in 2021, it reviewed the boundaries of its VME closures on the basis of a new analysis by the Scientific Council. As a result, all of the existing closures were extended for another five years, and five of these closed areas were increased in size. A further four new VME closures were established for an interim period of two years, which were then reviewed further by the NAFO Scientific Council, and it was later agreed to maintain the closures. The expansion and extension of the area closures on seamounts and VMEs were based on the significant adverse impact (SAI) analysis. NAFO reported that is currently in the process of reviewing its existing VME bottom fishing closure areas taking into account new methods and information.

92. NEAFC reported on the outcome of its review of Recommendation 19:2014 on the protection of VMEs in 2024. ICES advised NEAFC that the recommendation had been effective in protecting VMEs from Significant Adverse Impacts in both the closed areas and in the restricted bottom-fishing areas. However, there was insufficient evidence to assess whether the recommendation had been effective in providing protection within the existing bottom fishing areas, given the potential issues with encounter thresholds and the move-on rules, where there had been no reports of encounters. ICES also advised that the list of VME indicators needed updating.

93. NEAFC reported that every five years it reviews the effectiveness of the regulations on the protection of VMEs from significant adverse impacts, taking into account any new scientific advice. VME closures are usually, but not always, for a fixed period of between 1 and 5 years, and the measures controlling these closures are reviewed prior to the end date. Closures are normally extended, often with a modification of the boundaries. The 2025 Annual Meeting started the process of reviewing and renewing the closures leading up to the next review in 2027.

94. NPFC reviewed and adopted the SC09 recommended amendments to CMMs 2024-05 and 2024-06 concerning bottom fisheries and the protection of VMEs in the North Pacific.[171] For CMM 2024-05, applicable to the Northwestern Pacific Ocean, the revisions comprised: (1) translation table of VME indicator corals between common and scientific names of cold-water corals among the VME indicator taxa; and (2) two new bottom fishing area closures.[172] For CMM 2024-06, applicable to the Northeastern Pacific Ocean, the revision included a translation table of VME indicator corals between common and scientific names of cold-water corals among the VME indicator taxa.[173] The Commission will regularly review, and as appropriate, revise this CMM considering the best available science and the recommendations of the NPFC Scientific Committee, and with reference to relevant guidance adopted by UNGA and FAO.

95. Information on activities by SEAFO indicated that it had engaged in an annual review of existing fishing areas and spatial distribution of VME encounters.[174] It also updated stock status reports regularly and published them as repositories of current information.[175] Major stock status and assessment updates will be conducted in 2026.

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[171] The 9th Commission meeting report, available at: https://www.npfc.int/sites/default/files/2025-12/COM09%20Final%20Report.pdf.

[172] https://www.npfc.int/revised-cmm-2024-05-conservation-and-management-measure-bottom-fisheries-and-protection-vulnerable.

[173] https://www.npfc.int/revised-cmm-2024-06-conservation-and-management-measure-bottom-fisheries-and-protection-vulnerable.

[174] Annual Commission Report 2025 p. 4 http://www.seafo.org/MeetingsDetails?MeetingID=cb36defe-82a9-4a64-aca1-274e47683628, http://www.seafo.org/Management/VME-Protection.

[175] http://www.seafo.org/SEAFO-Bodies/Scientific-Committee/SC-Documents, Annual Commission Report 2025 p. 4 http://www.seafo.org/MeetingsDetails?MeetingID=cb36defe-82a9-4a64-aca1-274e47683628.

SEAFO conducted an interim review of VME bycatch mapping, with plans for more detailed VME hotspot mapping in the stock status report of the Patagonian toothfish.[176]

96. SIOFA noted that bycatch mitigation has been progressively strengthened: CMM 12 on shark conservation has been revised nearly annually since 2022 to reflect emerging best practices, while CMM 13 on Seabird bycatch was updated in 2025 to reinforce requirements for seabird bycatch mitigation tools (e.g., bird-scaring lines, weighted branch lines, night setting) in bottom fisheries. CMM 10 (Monitoring, Control and Surveillance), revised in 2023, enhances at-sea and port-based enforcement capacity to ensure compliance with these measures.

97. SIOFA reported that it has embedded iterative review into its governance cycle. The adoption of CMMs 17 and 18 in 2024–2025 represents a substantive review and modernisation of existing bottom-fishing controls, particularly in light of evolving scientific understanding of VME distribution and vulnerability. These updates were informed by SC evaluations, external expert input, and lessons learned from monitoring data.

98. In relation to an Ecosystem-Based Approach and VME Protection, SPRFMO tested a new protocol for reviewing bottom fishing footprints, and several Members submitted updated benthic impact assessments. While the SPRFMO IUU Vessel List remained empty, the 13th Annual Meeting of the Commission amended CMM 04 to prohibit subsidies to listed vessels and operators. The Commission also reviewed its IUU fishing listing procedures.[177]

B. Actions taken by States to regulate bottom fisheries

99. States reported on a range of measures implemented to regulate bottom fishing activities and protect VMEs from the adverse impacts of bottom fishing, though it was not always clear which measures had been implemented since the last report. States further reported that these measures were guided by existing frameworks, which included the Convention, FAO Guidelines, conservation and management measures adopted by relevant RFMO/As, as well as relevant UN General Assembly Resolutions.[178] Argentina, Australia, Canada, Norway, Sri Lanka, the United Kingdom, and the United States also reported that actions taken in this respect were guided by the precautionary approach, the ecosystem-based approach, and best available scientific evidence. Some States reported that they did not engage in bottom fishing activities, with Azerbaijan reporting that no deep-sea bottom fishing activities occurred in the Caspian Sea,[179] and Qatar reporting that Qatari-flagged vessels did not engage in deep-sea bottom fishing activities.[180]

1. Identifying vulnerable marine ecosystems and assessing significant adverse impacts from bottom fishing

a. Identifying VMEs.

[176] Annual Scientific Committee Report 2025 p. 4 http://www.seafo.org/MeetingsDetails?MeetingID=6b02aaab-6b58-4390-af79-6ba78e410374.

[177] https://www.un.org/depts/los/general_assembly/contributions80/28SPRFMO.pdf.

[178] Contributions of Argentina, Australia, Canada, Japan, New Zealand, Norway, Sri Lanka, the United Kingdom, and the United States.

[179] Contribution of Azerbaijan.

[180] Contribution of Qatar.

100. Several States reported on activities undertaken to identify vulnerable marine ecosystems, though it was not clear in some cases whether such activities had taken place since the previous report.[181]

101. Argentina reported on its Project "Ecosystems and Straddling Fisheries in the Adjacent Area," aimed at strengthening scientific knowledge in the area adjacent to its EEZ, in which numerous areas were identified and classified as MPAs.[182] The project employed multifrequency echosounders, underwater imaging systems, and the collection of benthic organism and sediment samples, and other forms of marine scientific research, for the identification of marine ecosystems.[183]

102. Australia reported actively contributing scientific expertise and data to support CCAMLR's processes for identifying and protecting VMEs, including through data inputs to the CCAMLR VME Registry.[184]

103. Canada reported that as a result of research cruises to the Cobb Seamount Chain in the NPFC convention area to map the distribution of VME indicator taxa, identify VMEs and their associated communities, three existing VMEs on Cobb Seamount were protected in 2024, with further analyses of research cruise data ongoing.[185] It further noted that this research had resulted in a newly published identification guide for corals that applied to the eastern North Pacific, with a particular emphasis on seamount species.[186] In addition, research on methods to quantitatively identify VMEs from VME indicator taxa density using the FAO criteria had been developed and applied to the NPFC area.[187]

104. Japan reported conducting annual surveys of the Emperor Seamounts since 2008, using drop cameras and other observation tools to identify VMEs, noting that when VMEs were identified through those surveys and follow-up analysis, it submitted proposals on specific conservation measures to protect these VMEs at NPFC meetings.[188]

105. Norway reported that since 2005, it has systematically mapped a total of approximately 300,000 square kilometers of bathymetry data of the Norwegian sea floor through the MAREANO sea floor mapping program, which mapped depth and topography, sediment composition, contaminants, biological communities and biotopes/habitats in Norwegian waters, which was important to identifying VMEs.[189]

106. Over the period 2018–2023, Romania conducted the "Preliminary Identification Study of Potential National Areas Where Marine Fishing Should Be Restricted (ROnFRAs)" which integrated data obtained from multiannual research campaigns on macrozoobenthos, ichthyology, spatial analyses, and biotic indicators recognized at both European and regional levels, to identify essential and vulnerable marine habitats for fishery resources along the Romanian Black Sea coast.[190]

107. Spain reported on ongoing activities to locate VMEs across multiple RFMOs through onboard scientific observers, annual research campaigns, and mandatory catch reporting. In particular, Spanish vessels operating in NAFO, SIOFA, SEAFO, and

[181] Contributions of Argentina, Australia, Japan, Norway, Romania, the United Kingdom, and the United States.
[182] Contribution of Argentina.
[183] Contribution of Argentina.
[184] Contribution of Australia.
[185] Contribution of Canada.
[186] Contribution of Canada.
[187] Contribution of Canada.
[188] Contribution of Japan.
[189] Contribution of Norway.
[190] Contribution of Romania.

SPRFMO were required to record and report all VME encounters, with this data used to establish protective area closures.[191] At the EU level, Spain also noted it operated within a framework that had designated 87 protected zones in the Northeast Atlantic, restricting bottom fishing at depths beyond 400–800 meters to safeguard sensitive habitats like coral reefs and seamounts.[192]

108. Guided by the OSPAR North-East Atlantic Environment Strategy (NEAES) 2030, the United Kingdom highlighted its work within OSPAR to identify, map, and protect VMEs in the North-East Atlantic, particularly on the high seas.[193] The United Kingdom also noted that it played an active role in regional efforts that provided scientific evidence through ICES to improve VME identification and management.[194]

109. The United States reported launching new research initiatives aimed at mapping and assessing sensitive benthic ecosystems since the previous bottom fishing review, which had prioritized the discovery of vulnerable marine environments to ensure that management measures are supported by the best available data.[195] These initiatives included the Northeast Deep-Sea Coral Initiative (2023–2027) which in the 2024-2025 filed season focused on analysing biological connectivity, helping scientists predict the location of deep sea coral and how coral larvae disperse; the Beyond the Blue: Illuminating the Pacific campaign (2024–2026), which had charted over 100,000 square miles of Pacific seafloor focusing on characterizing deep-sea coral and sponge communities, seamounts, and maritime heritage sites at depths of up to 6,000 meters; Seascape Alaska, an ongoing public-private partnership effort that had mapped 38% of Alaska's seafloor utilizing multibeam sonar and ROVs to identify high-density deep sea coral areas and other benthic habitats at depths exceeding 4,000 meters; the West Coast Initiative, which since 2022 had added more than 36,000 coral records to the national database that informed sanctuary designs; and the National eDNA Strategy under which in 2025, new DNA primers (genetic keys) were finalized specifically to detect octocorals and black corals, allowing scientists to confirm the presence of these slow-growing habitat-formers in vast, unexplored regions of the Pacific and Arctic.[196]

b. Impact assessment.

110. Argentina described its Ecosystem Dynamics and Anthropogenic Pressures programme, under which its National Institute for Fisheries Research and Development (INIDEP) planned a research campaign to be carried out between February and March 2026 and replicated in subsequent years, which had as its main objective the evaluation of benthic communities and the determination of the current status of MPAs, using historical data from the Spanish Atlantis Project as a reference.[197]

111. Japan reported conducting assessments of potential impacts of fishing activities on marine species or any VMEs in the Emperor Seamounts in 2008, the results of which were made publicly available.[198]

112. New Zealand reported that it and Australia had submitted a Cumulative Bottom Fishery Impact Assessment for Australian and New Zealand bottom fisheries in the SPRFMO Convention Area to the SPRFMO Scientific Committee in 2023, which

[191] Contribution of Spain.
[192] Contribution of Spain.
[193] Contribution of the United Kingdom.
[194] Contribution of the United Kingdom.
[195] Contribution of the United States.
[196] Contribution of the United States.
[197] Contribution of Argentina.
[198] Contribution of Japan.

provided a description of management arrangements and fisheries, the status of main stocks, ecological risk assessments of demersal teleosts and deepwater chondrichthyans, fishery interactions with marine mammals, reptiles, seabirds and benthic habitats, a risk assessment of benthic habitats and performance of management measures.[199] An updated assessment was submitted in 2025.[200] New Zealand also reported on its work leading the 2025 review of the SPRFMO Bottom Fishery Impact Assessment Standard.[201]

113. As part of its ROnFRAs study, Romania reported on its analyses, including through fish stomach content examinations, which confirmed the essential role of circalittoral benthic habitats in sustaining turbot and sturgeon populations and demonstrated the high vulnerability of circalittoral benthic habitats to anthropogenic pressure, especially bottom fishing carried out with towed gears such as beam trawls.[202]

114. Under its third-cycle marine strategy assessment, Spain reported evaluating the impact of bottom trawling on benthic habitats using SoS indicators, which measure environmental health by tracking 'sentinel species', the most trawling-sensitive organisms in a given habitat. By measuring how the abundance of these species correlated with trawling intensity across different habitat types, scientists generated spatial maps predicting environmental status across Spanish waters. The assessment determined that Good Environmental Status (GES) was not being achieved in some trawled benthic habitats, which exceeded the critical threshold of 25% adversely affected seafloor adopted by the European Union in 2023.[203]

115. Sri Lanka reported supporting regional scientific research and capacity-building initiatives aimed at improving understanding of ecosystem impacts and enhancing the sustainability of fisheries resources.

116. Within the framework of the "Sensitive Marine Ecosystems" concept, Türkiye reported it conducted periodic sampling in trawl-closed areas, seasonal closure zones, and marine protected areas in order to assess the impacts of bottom fishing on benthic habitats and sensitive ecosystems.[204]

117. The United States reported on its work within RFMOs since the last bottom fishing review, to improve impact assessments, including through the development of a standardised approach for evaluating cumulative fishing impact under SPRFMO.[205]

2. Measures to regulate bottom fishing vessels or prohibit bottom fishing

a. Actions taken to protect VMEs and the long-term sustainability of stocks

118. States reported on a wide range of conservation and management measures which had been implemented to regulate bottom fishing vessels and/or prohibit bottom fishing activities, though many of these actions pre-dated the reporting period. These measures included closure of areas, restrictions on certain fishing activities, the use of license and permitting systems, restrictions on the use of fishing gear, area-based management tools, and monitoring, control and surveillance mechanisms.[206] Many

[199] Contribution of New Zealand.
[200] Contribution of New Zealand.
[201] Contribution of New Zealand.
[202] Contribution of Romania.
[203] Contribution of Spain.
[204] Contribution of Türkiye.
[205] Contribution of the United States.
[206] Contributions of Argentina, Australia, Japan, Norway, Spain, Sri Lanka, Türkiye, the United Kingdom, the United States.

respondents reported that these activities were guided by the conservation and management measures adopted by relevant RFMO/As.[207]

119. Australia reported that vessels under its flag that engaged in fishing in the SPRFMO Convention area and the SIOFA area operated under permits issued by the Australian Fisheries Management Authority, the conditions for which implement the conservation and management measures adopted under those RFMO/As. Bottom fishing activities in the CCAMLR Convention Area were managed consistent with relevant conservation and management measures, as well as applicable General Assembly resolutions. Australia further reported on its work within these RFMO/As, including its co-sponsorship of a 2025 proposal in SIOFA that resulted in the adoption of 12 new Benthic Fishery Closures, its work in 2022 in SPRFMO to review the appropriate level of protection required to prevent significant adverse impacts on VMEs, and its 2024 joint submission with New Zealand of a Bottom Fishing Impact Assessment in SPRFMO.[208]

120. Canada reported that vessels under its flag undertaking fishing activities on the high seas, or the EEZ of another state, were subject to domestic licensing requirements, which require compliance with Canadian domestic laws on the high seas. It highlighted its participation in a number of RFMO/As, including NAFO and NPFC.[209] It noted its engagement in NAFO on the 2021 review of the boundaries of its VME closures, resulting in the 2022 extension of existing closures and addition of four new VME closures.[210]

121. Japan reported that Japanese-flagged fishing vessels undertook bottom fishing activities in areas falling within the competence of the following RFMO/As: NPFC, CCAMLR, SEAFO, NAFO and SIOFA. It highlighted a number of steps it took to ensure its vessels complied with the conservation and management measures adopted under those RFMO/As, including those prohibiting the expansion of bottom fisheries into areas where no such fishing currently occurs, limiting fishing efforts to agreed levels, and closing areas (including seasonally) to prevent adverse impacts on VMEs and protect fish stocks. Japan further reported on its work within these RFMO/As, including its co-sponsorship of the 2025 conservation and management measure in SIOFA to establish new closure areas to protect VMEs.[211]

122. New Zealand reported that, as a member of SPRFMO and CCAMLR, its flagged vessels have undertaken bottom fishing in these Convention areas, and acted consistently with the applicable conservation and managements measures established therein, including through its domestic permitting system. It also reported on developments which have occurred in these organizations since 2022. It noted that it contributed to the work of SPRFMO, including presenting two assessments of deep-sea stocks in 2022, jointly leading analysis on the impacts of bottom fishing on species of concern, and contributing to development of measures which quantified and mapped bycatch of VME indicator taxa. In CCAMLR, it reported on the closure of further VMEs as well as ongoing management of marine protected areas. [212]

[207] Contributions of Australia, Japan, Norway, Spain, Sri Lanka, the United Kingdom, the United States.
[208] Contribution of Australia.
[209] It is noted that while COAFA is not generally considered an RFMO because large-scale commercial fishing still has not commenced in the Arctic, it is undertaking RFMO-like functions in preparation for future fishing activities. It is currently considering issues related to identifying VMEs in the CAOFA Area and whether to develop conservation and management measures to protect VMEs. See https://vlab.noaa.gov/documents/22926311/0/CAOFA-2025-COP4-R-Final-with+appendices.pdf.
[210] Contribution of Canada.
[211] Contribution of Japan.
[212] Contribution of New Zealand.

123. Norway reported that it implemented conservation and management measures established by relevant RFMO/As that Norway participates in (CCAMLR, NAFO and NEAFC), such as the renewal of existing NEAFC area closures in 2022 and the outcomes of the NAFO review of bottom fisheries measures in 2021. These measures include area closures, spatial and temporal limitations on fishing activities, restrictions on fishing gear, guidelines for management of deep-sea species, and regular review of closed areas and other measures to protect VMEs.[213]

124. Spain reported that, as part of its evolving marine strategy, it had taken action to reduce the pressure on the marine environment caused by bottom trawling. These measures included the designation of no-trawling zones in VMEs, gradual incorporation of more sustainable trawling gear, and exclusion of trawling in sensitive habitats within marine protected areas. It also reported that it complied with the relevant measures adopted by RFMO/As. Outside of areas regulated by an RFMO/A, Spain had closed 9 areas in the Southwest Atlantic to bottom trawling by Spanish-flagged vessels, for the protection of marine mammals.[214]

125. Sri Lanka reported that its flagged fishing vessels operating in areas beyond national jurisdiction must obtain prior authorization, which required compliance with national regulations as well as the applicable conservation and management measures adopted under relevant RFMO/As. It further noted that it does not authorize fishing practices which have a significant adverse impact on benthic habitats in areas where such practices are prohibited under applicable RFMO/A measures.[215]

126. The United Kingdom reported that its flagged vessels engaged in bottom fishing activities beyond its EEZ must receive relevant licensing and authorization under domestic regulation, as well as comply with applicable conservation and management measures adopted by RFMO/As and international law. Through its participation in OSPAR, NEAFC and CCAMLR, it reported on a number of measures that had been taken to address bottom fishing impacts and protecting VMEs. It also noted that it had contributed to the designation of marine protected areas in the OSPAR area and CCAMLR Convention area, as well as the adoption, in 2021, of the OSPAR North-East Atlantic Environment Strategy which aimed to establish a network of MPAs, and support the joint work of OSPAR–NEAFC on bottom fishing closures.[216]

127. The United States reported that bottom fishing activities in areas beyond national jurisdiction were subject to prior authorization, and that United States-flagged vessels were not permitted to conduct bottom fishing on the high seas outside of an RFMO/A regulatory area. It noted that relevant domestic legislation required that all United-States flagged vessels to maintain a valid permit and adhere to a range of requirements, including with respect to monitoring and reporting. The United States also reported that it participated in several RFMO/As, where it had worked to strengthen a range of fisheries management measures.[217]

b. Monitoring, control and surveillance measures and mechanisms to promote and enhance compliance.

[213] Contribution of Norway.
[214] Contribution of Spain.
[215] Contribution of Sri Lanka.
[216] Contribution of the United Kingdom.
[217] Contribution of the United States.

128. Many respondents reported on actions taken to carry out surveillance of fishing activities and on mechanisms to promote and enhance compliance with conservation and management measures, primarily on the basis of pre-existing measures.[218]

129. Australia reported that it had taken measures to monitor and promote compliance with conservation and management measures, including through the use of onboard observers, vessel monitoring systems and electronic monitoring.[219]

130. Canada reported that it took measures to monitor, control and surveil activities, to support compliance with applicable fishery regulation, including port inspections, electronic tracking and high seas enforcement operations.[220]

131. Similarly, Japan reported that it had taken various domestic actions to ensure that its fishing vessels complied with relevant conservation and management measures, through monitoring, control and surveillance measures such as patrols and vessel monitoring systems.[221]

132. New Zealand reported that there is 100% observer coverage on all of its flagged vessels using trawl gear and at least 10% observer coverage for vessels using bottom line fishing gear in the SPRFMO Convention Area. It also noted that it implemented the CCAMLR Catch Documentation Scheme for toothfish, and conducted aerial and surface patrols in the Pacific and Southern Oceans to monitor IUU fishing.[222]

133. Sri Lanka reported that it had taken a number of compliance and enforcement steps to deter IUU fishing, including the imposition of penalties for non-compliance.[223]

134. The United Kingdom reported that its flagged vessels engaged in fishing in the NEAFC regulatory area, must, in accordance with NEAFC conservation and management measures, comply with a comprehensive electronic reporting system for fish catch reporting, to enable more effective monitoring of compliance with bottom-fishing closures and restricted areas.[224]

c. Action taken to protect vulnerable marine ecosystems in areas under national jurisdiction

135. A number of respondents also identified measures taken to address the effects of, regulate, or prohibit, bottom fishing in areas within their national jurisdiction.[225] Some of the actions reported by States related to new measures taken in the current reporting period, while also reporting on existing measures.

136. Argentina reported that it had established management regimes for two fisheries located on its continental shelf, which imposed measures directed towards sustainable development of fishing activities and minimizing impacts on benthic ecosystems. Argentina further reported the creation of two marine protected areas, which regulate fishing activities in accordance with fisheries management plans, and has closed other areas (such as those identified in Federal Fisheries Council Resolution No. 6/2020) to

[218] Contributions of Australia, Japan, Sri Lanka, the United Kingdom.
[219] Contribution of Australia.
[220] Contribution of Canada.
[221] Contribution of Japan.
[222] Contribution of New Zealand.
[223] Contribution of Sri Lanka.
[224] Contribution of the United Kingdom.
[225] Contributions of Argentina, Australia, Norway, Romania, Spain, Sri Lanka, Türkiye, the United Kingdom, the United States.

trawling activities. The regulation of fishing gear, including the marking and traceability of trawl nets, was also implemented.[226]

137. Australia reported that demersal trawl was allowed only in limited areas of its national jurisdiction, and estimated that only 3.5% of its national seabed had been trawled in recent years. It further noted a range of actions which were taken to mitigate the impact of trawl fishing, including imposing TACs, quota systems for target species, spatial and seasonal closures, licensing limits and restrictions on allowable trawl gear.[227]

138. Canada reported on its domestic legislation and policy relating to the protection of VMEs within its national jurisdiction, including the protection and conservation of 15.55% of its marine territory by the end of 2025. It highlighted the continuation of national policies to ensure fisheries were managed sustainably, which provided that new or expanded bottom-contact fisheries were subject to risk assessments. It also noted that it continued to apply a framework which assessed whether gear restrictions, modified fishing practices, or closures were required.[228]

139. Norway reported that it regulated bottom fishing activities in the Norwegian EEZ, in accordance with the requirements of resolution 61/105 and which are based on the FAO Guidelines. These regulations, initially adopted in 2011, were amended in 2019 to further enhance the protection of VMEs, including by closing additional areas and modifying the licensing process for bottom fishing activities. Norway also reported on the protection of VMEs, outlining domestic regulation which protected designated cold-water reefs, and designated marine protected areas in places with vulnerable/rare bottom habitats.[229]

140. Romania reported it had, in 2025, established a National Fisheries Restricted Area, where the use of towed bottom fishing gears is limited.[230]

141. Spain reported that it had adopted a series of measures, including spatial and temporal closures or restrictions, and the use of technology on fishing gear to limit interactions with the marine environment. It also reported that a range of domestic and EU regulations further elaborated prohibitions and limitations with respect to trawling in the Mediterranean.[231]

142. Sri Lanka reported on its Fisheries and Aquatic Resources Act, No. 2 of 1996, which prohibited bottom trawling by its vessels, as well as prohibiting the possession and use of prohibited gear both within and beyond national jurisdiction.[232]

143. Türkiye reported that it continued to regulate bottom fishing activities, including with respect to area, depth, season and fishing gear. It implemented a series of area-based measures, including the designation of the Kethiye- Kaş and North Aegean Marine Protected Areas in 2025, which prohibit bottom trawling and similar bottom-contact fishing gears in sensitive marine ecosystems. As a result, approximately 21,000 km² of marine waters were closed to all trawl fishing, and approximately 16,000 km² of marine waters were closed to bottom trawling specifically, as well as prohibiting bottom trawling in waters of 1,000 meters depth and deeper.

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[226] Contribution of Argentina.
[227] Contribution of Australia.
[228] Contribution of Canada.
[229] Contribution of Norway.
[230] Contribution of Romania.
[231] Contribution of Spain.
[232] Contribution of Sri Lanka.

144. The United Kingdom reported that its Blue Belt Programme provided for marine conservation and sustainable management of the marine environment of United Kingdom Overseas Territories, including with respect to managing bottom fishing impacts.[233]

145. The United States reported that it had implemented several measures within its EEZ to mitigate significant adverse impacts from deep-sea fisheries on vulnerable benthic habitats. These include 2025 updates to area-based fisheries management regulations to reflect best available science, revising, in 2025, fisheries measures in the Monterey Bay National Marine Sanctuary to prohibit all commercial groundfish gear that contacts the seafloor to facilitate coral research and restoration, as well as the establishment in 2024 of the new Chumash Heritage National Marine Sanctuary.[234]

3. Other actions

146. *Closure of high seas areas without a competent RFMO/As.* Canada reported having entered into the CAOFA, and that following ratification by the tenth and final signatory, the CAOFA entered into force on June 25, 2021. It further noted that the entry into force of CAOFA prevents commercial fishing from taking place in the central Arctic Ocean, for an initial period of 16 years, until the parties have a greater scientific understanding of the area and ecosystem-based measures are in place to regulate any commercial fisheries. Spain reported that in areas without RFMOs it had closed nine zones in the Southwest Atlantic—where the presence of VMEs has been detected—to bottom fishing.

C. Actions taken by States and competent regional fisheries management organizations and arrangements in cooperating to undertake marine scientific research, collect and exchange scientific and technical data and information and develop or strengthen data-collection standards, procedures and protocols and research programmes

147. States reported that their fisheries management is utilizing science-based decision-making[235] and internationally recognized best practices[236] to ensure the sustainable management of marine living resources.

148. Some States highlighted international cooperation in scientific research aimed at improving the understanding of ecosystem impacts and enhancing the sustainability of fisheries resources.[237]

149. Argentina highlighted ongoing research undertaken for the identification of marine ecosystems through seabed mapping, benthic ecosystem modelling, and the collection of environmental data, including in relation to climate variability and ocean acidification, as well as studies analyzing the interaction between fishing activity and benthic communities.[238]

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[233] Contribution of the United Kingdom.
[234] Contribution of the United States.
[235] Contributions by Argentina, Australia, Azerbaijan, Japan, Norway, Qatar, Romania, Sri Lanka, Türkiye, United Kingdom, United States of America.
[236] Contributions by Azerbaijan, Sri Lanka.
[237] Contributions by Azerbaijan, Sri Lanka, the United Kingdom.
[238] Contribution by Argentina.

150. Australia reported on its system of data collection procedures and protocols related to fishery data, including those required by RFMO/As, and highlighted its contributions to the developments of new bottom fishing measures aimed at strengthening protection for VMEs, a stock assessment framework, and bottom fisheries impact assessment standards under different RFMO/As.[239]

151. Japan reported on conducting annual scientific surveys in the Emperor Seamounts such as seabed surveys to identify VMEs and monitoring surveys to set catch limits on specific species, informing conservation and management measures, including under the NPFC, which are also subject to periodic reviews.[240]

152. Norway highlighted the importance of its MAREANO sea floor mapping programme and scientific research for the detection of VMEs and for effective fishing operations, serving as a basis for decision-making.

153. Qatar reported on implementing a number of scientific research projects related to the rehabilitation of damaged marine habitats including coral reef areas, the enrichment of fish stocks and the feeding of juvenile fish.[241]

154. Romania reported on a study aimed at identifying essential and vulnerable marine habitats for fishery resources along the Romanian Black Sea coast, which provided the scientific basis for the establishment of a national Fisheries Restricted Area.[242]

155. Spain reported on specifications and standardized methods for monitoring and assessment under the European Union’s Marine Strategy Framework Directive. It further reported on the collection of ecosystems and stock sustainability data, including VME indicators, through annual research campaigns and its scientific onboard observation programme within the framework of various RFMO/As. Further research is being conducted on bottom trawling impacts on marine mammals as well as on incorporating technological innovations such as semi-pelagic trawl doors or the use of midwater longlines.[243]

156. Sri Lanka reported on its cooperation with the FAO and the Indian Ocean Tuna Commission (IOTC) with respect to the collection and submission of fisheries data, including catch, effort and bycatch data.[244]

157. Türkiye reported on conducting scientific studies on several commercially important species, noting also periodic sampling to assess the impacts of bottom fishing on benthic habitats and sensitive ecosystem components. Furthermore, Türkiye has established an uninterrupted time series on demersal and benthopelagic species since 2017, allowing for trend analyses of stock status, projection modelling and the evaluation of management scenarios.[245]

158. The United Kingdom, and Spain reported on the active contribution of their scientists to the work of different RFMO/As.[246] The United Kingdom further reported on the collection and submission of data required by RFMO/As, including on VME identification and management, and highlighted research undertaken under the UK Blue Belt Programme to examine the impacts of fishing gear on deep-sea habitats and VMEs.[247]

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[239] Contribution by Australia.
[240] Contribution by Japan.
[241] Contribution by Qatar.
[242] Contribution by Romania.
[243] Contribution by Spain.
[244] Contribution by Sri Lanka.
[245] Contribution by Türkiye.
[246] Contributions by Spain and the United Kingdom.
[247] Contribution by the United Kingdom.

159. The United States of America reported on research initiatives aimed at mapping and assessing sensitive benthic ecosystems, prioritizing the discovery of VMEs, with the goal of informing management decisions.[248]

160. Several RFMO/As shared information on their initiatives to conduct marine scientific research, including on the impact of bottom fishing on VMEs, which is informing the adoption or adjustment of management and conservation measures.[249]

161. SEAFO had undertaken research programmes involving stock assessments and stock assessment models, habitat mapping, and the impacts of fishing on marine biodiversity, and had an agreement with CCAMLR regarding the tagging of Patagonian toothfish and related data sharing.[250]

162. SIOFA reported on ongoing research on climate impacts on deep-sea ecosystems and fish stocks, and on the completion of genetic stock structure studies, which included parts of the CCAMLR Convention area, refining the understanding of transboundary dynamics for Patagonian toothfish and supporting more precise impact assessments in shared stocks.[251]

163. The GFCM reported on gathering scientific information, including through surveys at sea, to inform potential additional long-term measures for demersal fisheries in the Strait of Sicily.[252] In addition, the GFCM noted the conclusion of four subregional pilot studies to evaluate environmental and socioeconomic impacts of a shift in the depth limit for bottom trawling from 1,000 m to 800 m.[253]

164. SPRFMO reported on the compilation and review of relevant scientific information and data related to the Salas y Gomez and Nazca Ridges area to inform potential conservation measures and on an agreement with Chile and Peru on data-sharing for biodiversity indicators in this context.[254]

165. Some RFMO/As highlighted their participation in regular exchanges and international fora, mediated through the FAO or bilaterally with other RFMO/As, to cooperate on matters of mutual interest, exchange information, and develop and implement best practices.[255]

166. Some RFMO/As reported on efforts aimed at improving data management, including in cooperation with other RFMO/As.[256] NEAFC reported on forming a joint advisory group on data management with NAFO.[257] SPRFMO reported on strengthening electronic reporting to improve the timeliness and quality of data submissions, as well as expanding cooperation with other RFMO/As in this area, exploring alignment of observer data formats and inspection reporting tools.[258] NEAFC highlighted that its transition to an electronic reporting system, based on electronic logbooks, allowed for haul by haul reporting, including on fishing gear.[259]

167. The United States of America reported that new scientific review standards, developed under SPRFMO, such as the Encounter Review Standard, Habitat Suitability Index models and the Bottom Fishery Impact Assessment Standard, have contributed

[248] Contributions by Norway, the United Kingdom, the United States of America.
[249] Contributions by GFCM, NAFO, NPFC, SEAFO, SIOFA.
[250] Contribution by SEAFO, page 2.
[251] Contribution by SIOFA, pages 1, 2 and 3; SIOFA SER2022-TOP1 report.
[252] Contribution by GFCM, page 3; Resolution GFCM/47/2024/1.
[253] Contribution by GFCM, page 3, Resolution GFCM/46/2023/1.
[254] SPRFMO 2025 Annual Report, pages 2, 4 and 6.
[255] Contributions by NEAFC, NPFC, SPRFMO, and Norway (reporting on NAFO).
[256] Contribution by NPFC, page 4; SPRFMO 2025 Annual Report, page 4.
[257] Contribution by NEAFC, page 16.
[258] SPRFMO 2025 Annual Report, page 2 and 4.
[259] Contribution by NEAFC, pages 4, 9 and 10.

to advanced protection for VMEs.[260] It also highlighted that WECAFC is working towards refining VME identification protocols and enhancing data collection frameworks, and noted that the precautionary approach applied under the CAOFA focuses on gathering scientific and Indigenous Knowledge to gain a better understanding of the ecosystem before the authorization of fishing. [261]

168. CCAMLR reported that it maintained a registry of VMEs and VME risk areas in Antarctic waters and prohibited fishing within them.[262] GFCM noted that its database on sensitive benthic habitats and species aimed to store data and facilitate analysis of all known VME indicator records in the Mediterranean and the Black Sea, covering deep water areas inside and outside national jurisdiction.[263]

169. Some RFMOs reported on their initiatives to enhance transparency, including by making documents and reports publicly available and contributing data and scientific expertise to regional and global knowledge-sharing platforms.[264] NEAFC noted that its authorized fishing vessel lists had been published since 2020, and that the fishing gear carried by vessels would become visible to the public from 2026.[265]

D. Recognition of the special circumstances and requirements of developing States

170. Due consideration should be given to the special circumstances and requirements of developing States in the implementation of the relevant provisions of General Assembly resolutions 64/72, 71/123 and 77/118. Several States and regional fisheries management organizations (RFMOs) reported providing support to developing countries in implementing these resolutions and RFMO requirements, including through technical cooperation, capacity-building, and the sharing of best practices.

171. Australia noted the special circumstances and requirements of developing States, while emphasizing the importance of conducting bottom fishing impact assessments (BFIAs) to support the continued review of bottom fishing activities, noting that such assessments can be resource-intensive. In particular, it highlighted the challenges that developing States may encounter in fully implementing the relevant General Assembly resolutions and the requirements of RFMO/As and further recalled the importance of exchanging best practices and strengthening scientific and technical cooperation, consistent with paragraph 122(a) of resolution 64/72.

172. Japan reported that it provided capacity-building assistance to developing States, directly or through international or regional organizations, to support the conservation and sustainable use of fish stocks and the protection of VME.

173. Sri Lanka highlighted its support for regional scientific research and capacity-building initiatives aimed at improving the understanding of ecosystem impacts and strengthening the sustainability of fisheries resources.

174. The United States acknowledged the importance of collaboration across States and international organizations in relation to the implementation of certain technical aspects of the FAO Guidelines. It reported that the National Oceanic and Atmospheric Administration (NOAA) is a partner in the Global Environment Facility's Areas

[260] Contributions by the United States of America and SPRFMO.
[261] Contribution by the United States of America.
[262] Contribution by CCAMLR, page 2; https://vmeregistry.ccamlr.org/ .
[263] Contribution by GFCM, page 4; https://www.fao.org/gfcm/data/maps/sbhs/en/ .
[264] Contributions by SIOFA, pages 2 and 3; NEAFC, page 9.
[265] Contribution by NEAFC, page 9.

Beyond National Jurisdiction Program on Deep Seas, currently in its second phase, which assists developing States in implementing the FAO Guidelines.

175. Several RFMOs have specific measures aimed at developing the capacity of State Parties, including with respect to measures to address the impacts of bottom fishing on VMEs and the sustainability of deep-sea fish stocks.

176. CCAMLR reported that its Members and Secretariat continued to support developing States by providing capacity-development funding, scholarship programmes, and internships. It established the General Capacity Building Fund, which it has used to strengthen member States' capacity in ecosystem monitoring, stock assessment analysis, taxonomic identification using new technologies, and electronic systems for monitoring fisheries and marine ecosystems. CCAMLR also established the General Science Capacity Fund in 2009 to secure wider participation of young scientists and facilitate the exchange of information by providing scholarships, which to date have benefitted 21 early career scientists.

177. GFCM reported that it provides technical guidance and training for its Contracting Parties and Cooperating non-Contracting Parties on species identification, data collection and submission, and support for survey-at-sea. These initiatives are conducted as part of its support for the implementation of measures and principles of VME protection and sustainable bottom fisheries. In parallel, GFCM provided targeted support to strengthen national capacities, including training for national inspectors and technical assistance for installing monitoring, control and surveillance tools such as vessel monitoring systems.

178. The South-East Atlantic Fisheries Organization (SEAFO) conducted training workshops and capacity-building programmes for its member States to strengthen their implementation of, and compliance with, their obligations under SEAFO and relevant United Nations instruments. SEAFO also participated in the CORDAP Coral Cartography Project to improve knowledge and capacity-building opportunities. SEAFO is a partner in this project as co-owner of the VME data collected in the SEAFO Convention Area. Furthermore, SEAFO undertook observer training and capacity-building activities through the FAO Deep-Sea Fisheries Project.

179. NAFO also undertakes capacity-building initiatives, in coordination with the FAO ABNJ Deep-Sea Fisheries Project, to promote capacity building in other RFMOs, thereby sharing knowledge and experience in fisheries management, science, and governance.

180. NEAFC reported participating in capacity-building projects in developing countries. The project activities entail sharing knowledge and experience in areas such as fisheries management, fisheries monitoring, control and surveillance, electronic port State control, electronic reporting systems, and other relevant fields. NEAFC Secretariat also supports capacity-building and promotes cross-sectoral engagement among regional intergovernmental organizations and bodies.

181. NPFC facilitated training for capacity building or travel support to attend relevant science meetings in 2024 by dedicating a separate fund (the Scientific Committee Fund), as well as providing capacity building needed to assist members and Cooperating Non-Contracting Parties in attaining compliance with the Convention and the conservation and management measures adopted by the Commission.

182. SEAFO has undertaken capacity-building projects in collaboration with FAO and other partners aimed at strengthening fisheries management and compliance capacity between 2024 and 2025, including the Workshop on Cross-Sectoral Interactions with Deep-Sea Fisheries in Areas Beyond National Jurisdiction in Rome, and the FAO Deep-Sea Fisheries Project Observers Training Workshop in Walvis Bay,

Namibia, in January 2026. It also participated in the CORDAP Coral Cartography Project to improve knowledge and capacity-building opportunities. SEAFO is a partner in this project as co-owner of the VME data collected in the SEAFO Convention Area.

183. SIOFA reported that it is actively considering the capacity-building needs of developing States and reviewing mechanisms to provide them with the support and assistance required to implement their Agreement obligations, as well as SIOFA harvest control rules and management strategy evaluation.

184. SPRFMO reported providing support to developing State Contracting Parties to enable their participation in the meetings of the Commission and its subsidiary bodies through the Developing States Fund. Eligible Members may also receive financial assistance from the Fund for specific technical and capacity-building projects.

IV. Activities of the Food and Agriculture Organization of the United Nations

185. FAO reported on its activities to support sustainable and responsible fisheries, though the implementation of its *Code of Conduct for Responsible Fisheries* and its associated international plans of actions and guidelines, most notably the *International Guidelines for the Management of Deep-sea Fisheries in the High Seas.* It also reported on a review of the implementation of the FAO Guidelines undertaken in 2024.

A. Support for the management of deep-sea fisheries

186. From 2022 to present, FAO has been providing a range of support to States and RFMOs, in particular through its “Deep-sea Fisheries under the Ecosystem Approach” (DSF) project, as part of the Global Environmental Facility funded Common Oceans Program Phase II (2022-2027).[266] The objective of the project is to ensure that deep-sea fisheries in areas beyond national jurisdiction are managed under an ecosystem approach that maintains demersal fish stocks at levels capable of maximizing their sustainable yields and minimizing impacts on biodiversity, with a focus on data-limited stocks, deepwater sharks and vulnerable marine ecosystems.

187. Through the DSF Project, FAO established the Deep-sea Fisheries Technical Forum an online community to facilitate ongoing collaboration, information exchange and discussion among project partners and a wider community of stakeholders with an interest in deep-sea fisheries in areas beyond national jurisdiction. It organized a Symposium on the Ecosystem Approach to Fisheries Management in collaboration with NAFO and ICES,[267] a Workshop on the Application of the Precautionary Approach to the Management of DSF stocks, a global workshop on deepwater sharks,[268] a Workshop on cross-sectoral interactions with deep-sea fisheries.[269]

188. In response to recent adoptions of climate change resolutions by NAFO, NEAFC, NPFC, and SPRFMO, FAO supported consultancies for these four RFMOs,

[266] The DSF project is implemented by FAO and executed by GFCM, in collaboration with co-financing partners, which include the seven RFMOs responsible for the management of deep-sea fisheries stocks in ABNJ, as well as other international and national organizations.[266]

[267] The Symposium focused on the implementation of the ecological components of EAFM, including retained species, non-retained (discarded) species, and ecosystem considerations, and brought together 94 in-person participants and over 300 online viewers of the proceedings. Day one reviewed advancements in scientific approaches, day two addressed management challenges, and day three discussed the tools and guidance needed to advance implementation. The agenda, presentations, and recordings of the Symposium can be viewed at: https://eafm-symposium.nafo.int/.

[268] The Workshop considered the quantity and quality of catch reporting, reporting formats and ecological risk assessment (ERA) approaches for deepwater sharks.

[269] The Workshop explored the interactions between deep-sea fisheries and two other sectors in the ABNJ, the biodiversity conservation and deep-sea mining sectors.

to examine how climate change considerations could best be incorporated by the scientific committees (SC) and Commissions of these RFMOs. An online workshop considered the results of the consultancies with the aim of presenting the common conclusions and recommendations, as well as identifying any next steps required.[270]

189. FAO is cooperating with ICES to support and improve stock assessments on data-limited stocks, through a series of workshops aimed at developing methodologies for the assessment of data-limited deep-sea fisheries stocks. The outputs of this work will be collated on an online, open-access digital platform hosted by ICES.

190. In order to address the lack of a global overview that provides a consistent view of the spatial extent (distribution) and intensity (effort) of the use of fishing gears likely to come into contact with the seafloor in areas beyond national jurisdiction , FAO is working with six RFMOs to develop a global map of spatial bottom fishing effort.

191. In addition, FAO continues to host the Vulnerable Marine Ecosystem Database[271] (VME Database), which was developed specifically in response to a request from the UN General Assembly (61/105, paragraph 90) to create a database of information on VMEs in areas beyond national jurisdiction . The database is updated on an annual basis and is linked to the data providers (e.g. RFMOs and other multi-lateral bodies), and users have access to the primary source of information through direct links.

B. Actions taken to review measures put in place to address the impacts of bottom fishing on vulnerable marine ecosystems and the long-term sustainability of deep-sea fish stocks

192. In 2024, FAO published a review of the implementation of the FAO Guidelines by the competent RFMO/As and CCAMLR.[272] The review adopted a thematic approach, exploring the implementation of the Guidelines with respect to selected indicators related to fisheries stocks and assessments, VMEs and monitoring, control and surveillance (MCS). The review found that implementation of the Guidelines has been primarily directed towards the protection of VMEs, resulting in a significant change in the way bottom fisheries are managed, but that less progress has been made on the sustainable management of many deep-sea fish stocks. FAO’s analysis indicates that well-managed bottom trawl fisheries are characterized by assessed stocks, controlled levels of effort, protection of sensitive habitats, and compliance with technical regulations, and that spatial protection measures must be complemented by effective fisheries management and governance frameworks in order to achieve long-term fish stock sustainability.

C. Capacity-building

193. In support of the General Assembly’s resolutions on sustainable deep-sea fisheries and the protection of vulnerable marine ecosystems, the EAF-Nansen Programme has contributed to regional implementation efforts. In the SEAFO Convention Area, surveys with the R/V Dr. Fridtjof Nansen have provided critical

[270] Workshop participants highlighted the need for capacity building for RFMO decision makers, improved communication among scientists and managers, and guidance for the development of RFMO climate change roadmaps.
[271] https://www.fao.org/fishery/geoserver/factsheets/vme.html.
[272] Thompson, A.B. and Reid, K. 2024. *Review of the implementation of the International Guidelines for the Management of Deep-sea Fisheries in the High Seas*. FAO Fisheries and Aquaculture Technical Paper, No. 703. Rome, FAO. Available at: https://doi.org/10.4060/cd0243en.

information on the distribution of deep-sea fish stocks, benthic habitats and vulnerable marine ecosystems, improving scientific advice for management and contributing to the adoption of area-based conservation measures. The Programme has also collaborated with the SIOFA under the DSF Project, with scientists from SIOFA member States participating in research cruises and receiving practical training in deep-sea ecosystem surveying, thereby strengthening regional scientific capacity and contributing to the improvement of methods for enhancing the knowledge base for ecosystem-based management in the southwestern Indian Ocean. Beyond specific partnerships, the EAF-Nansen Programme supports regional fisheries bodies more broadly by developing methods, data and expertise that can be applied across regions to improve science-based management of deep-sea fisheries and the protection of VMEs. Under its current phase (2024–2028), the Programme will continue to provide scientific knowledge, advice and capacity development in support of sustainable deep-sea fisheries and ecosystem conservation.

194. FAO reported on its capacity-building activities in support of sustainable deep-sea fisheries, including: support provided on the precautionary approach to the NPFC through an informal workshop to explore "science-based management options available for operationalizing the precautionary approach as outlined in the Convention for NPFC priority species"; observer training for SIOFA and the SEAFO; and the organization of a three-week research cruise in the Indian Ocean, including scientists from 11 countries, which mapped underwater landscapes and vulnerable marine ecosystems, identified deep-sea shark species, and studied seabirds and marine mammals.

195. Moreover, through the South West Indian Ocean Fisheries Commission (SWIOFC), an FAO Regional Fishery Advisory Body which does not adopt binding conservation and management measures for bottom trawl fisheries, FAO supports member countries in strengthening stock assessment capacity, promoting ecosystem-based management approaches, improving monitoring, control and surveillance systems, and facilitating regional exchange on bycatch mitigation and habitat protection.

V. Concluding observations

196. In the 2030 Agenda for Sustainable Development, States made a commitment to end destructive fishing practices and sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impact, including by strengthening their resilience, and to work to restore them so as to achieve healthy and productive oceans by 2030.

197. The twentieth anniversary of the adoption of General Assembly resolution 61/105 presents an important opportunity to take stock of the progress achieved in the protection of VMEs from the impacts of bottom fishing and in ensuring the long-term sustainability of deep-sea fish stocks. During this time, States and RFMO/As developed and implemented different frameworks to maintain, strengthen and restore the health and resilience of deep-sea ecosystems by minimizing the impacts of bottom fishing, in line with General Assembly resolutions and the FAO Guidelines. They have also continued their efforts to conserve and manage deep-sea fish stocks which remain vulnerable to overexploitation, including by applying ecosystem and precautionary approaches to fisheries management.

198. During the period under review, States and RFMOs have continued to further develop and fine-tune the measures put in place, in part in response to an increased understanding of deep-sea ecosystems including the status of deep-sea fish stocks. They have also begun responding to new challenges impacting deep-sea ecosystems,

such as climate change, as well as to legal developments relating to the protection of marine biodiversity. The entry into force, on 17 January 2026, of the Agreement under the United Nations Convention on the Law of the Sea on the Conservation and Sustainable Use of Marine Biological Diversity of Areas beyond National Jurisdiction, has provided an opportunity to strengthen measures through cross-sectoral cooperation, but its implementation will also present challenges for fisheries managers.

199. Recent scientific studies have broadened the understanding of what constitutes VMEs, as well as where VMEs are likely to occur. There is also an improved understanding of how bottom fishing impacts VMEs, how effective measures are at mitigating impacts and the timeline for recovery once fishing activities are halted. However, additional research is still needed with regard to deep-sea fish stocks, including non-target stocks, to better assess their status and the impacts of different levels and types of fishing activities on their long-term sustainability.

200. As evidenced by the third World Oceans Assessment,[273] scientific understanding of vulnerable marine ecosystems and the impacts of bottom fishing on them continues to evolve. It is therefore important to periodically review and adjust measures to ensure that they continue to be fit for purpose. Where information continues to be uncertain, unreliable, or inadequate, it is important that the precautionary approach be applied in accordance with the United Nations Fish Stocks Agreement and that the absence of adequate scientific information not be used as a reason for postponing or failing to take conservation and management measures.

[273] https://www.un.org/regularprocess/woa3.