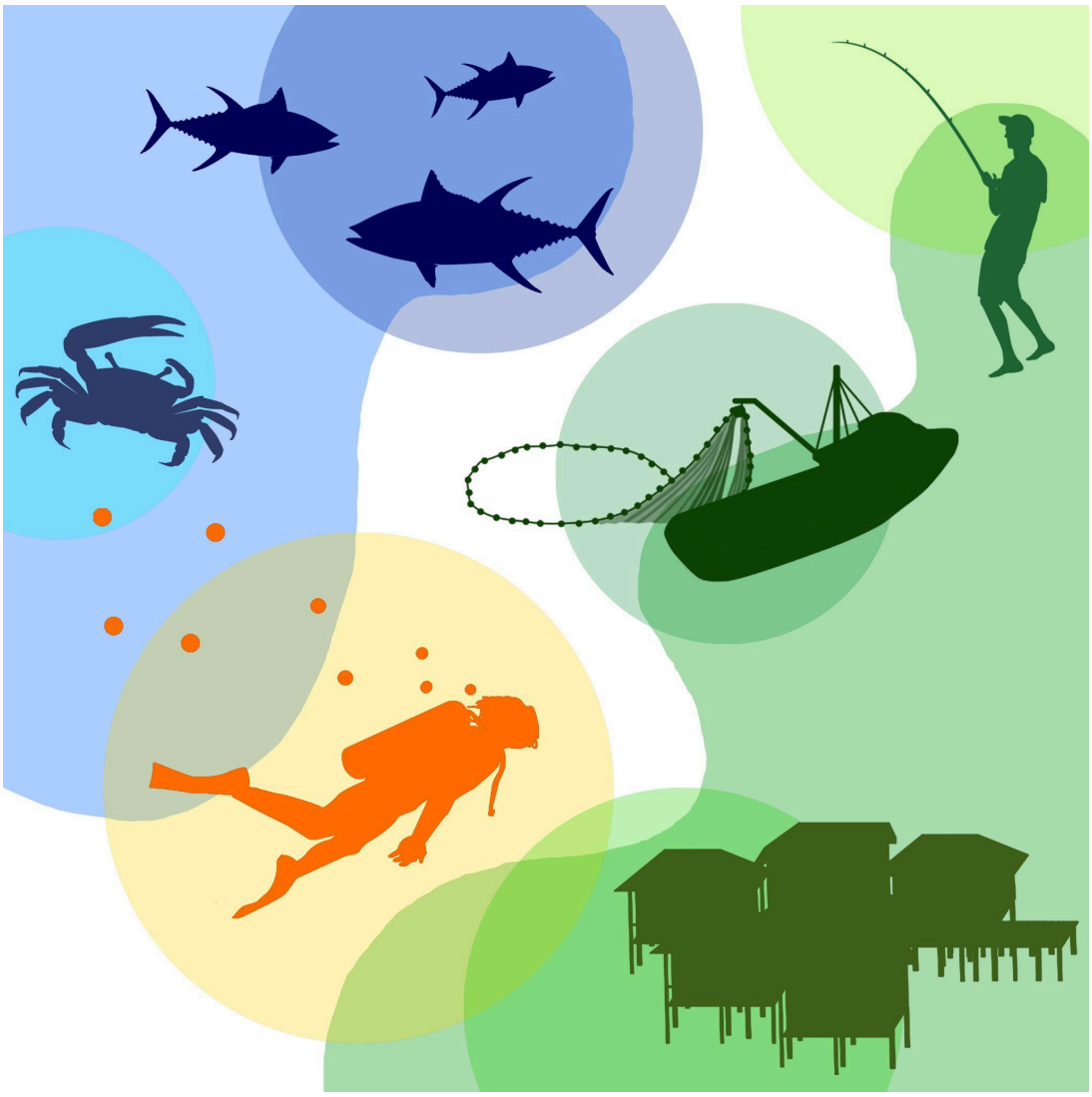
POLICY BRIEF

MARINE BIODIVERSITY IN SUPPORT OF HUMAN WELLBEING



Authors: Anna-Luise Schönheit, Femke Vulto, Jacqui Vogel, Jamaldeen Akanbi, Saray Quirant Perez, Victoria Campón-Linares

Bergen Summer Research School 2026

INTRODUCTION

Marine biodiversity is suffering under current climate change. Species are disappearing at rates that can be comparable with previous mass extinctions (Ceballos et al., 2015). Changes in environmental conditions are shifting species distributions into new areas due to direct and indirect impacts of climate change on marine ecosystems (Palacios-Abrantes et al., 2022; Pinsky et al., 2013). Some regions are gaining species and driving increased competition with endemic species, while others are losing established populations with essential roles in ecosystems, as well as in human communities that have relied on these natural resources for generations (Oremus et al., 2020). In many cases, there are significant equity and well-being concerns that arise along with these biodiversity and ecosystem changes (IPBES 2019).

Environmental management has historically relied on the biophysical components of natural resource management while ignoring the human dimensions and complex socio-ecological processes (Pascual et al., 2021). There are many examples of challenges relating to biodiversity loss and related human impacts, but integrated and effective solutions are difficult to define across different temporal and spatial scales (Harvey et al., 2025). We provide a few specific examples of this biodiversity loss and human well-being interface and propose widely applicable solutions to address these challenges. Nevertheless, we recognise that these solutions are based on localised studies in specific regional contexts, and while it is difficult to implement one-size-fits-all solutions, this approach is applicable to other cases around the world with parallel governance structures or similar climate expectations for the future (O'Brien et al., 2024).

Example #1: Food security and conflict in Nigeria

Nigeria provides a compelling case study of the links between marine biodiversity, human well-being, food security, and conflict. Coastal and marine ecosystems, particularly the mangrove forests and estuaries of the Niger Delta and Gulf of Guinea, support millions of livelihoods through fishing, aquaculture, transportation, and ecosystem services. However, climate change, overfishing, coastal erosion, oil pollution, and habitat degradation are reducing key fish stocks that provide an important source of protein for coastal communities. Given the importance of fish in Nigeria's diet, declining marine productivity threatens food security, nutrition, and household incomes, particularly among vulnerable populations. These challenges are compounded by rapid population growth and rising demand for marine resources, placing additional pressure on already stressed ecosystems (FAO, 2024; IPCC, 2023). Marine biodiversity loss also has social consequences, increasing competition over dwindling fisheries and contributing to conflicts between artisanal and industrial fishers in the Niger Delta. Oil-related environmental degradation has further undermined traditional livelihoods, fueling grievances, poverty, and social unrest. Climate-induced pressures on food systems have also intensified migration and competition over natural resources, while the loss of sustainable livelihoods may increase vulnerability to criminal activities, piracy, or recruitment into armed groups. Addressing marine biodiversity loss could therefore help reduce these sociocultural risks. Integrated approaches that combine biodiversity conservation, livelihood diversification, community-based fisheries management, and inclusive governance are critical for enhancing food security, reducing conflict risks, and promoting long-term human well-being in Nigeria and other coastal communities (Pascual et al., 2021; IPBES, 2019).

Example #2: Coastal communities and sea level rise in Ghana

Climate change is accelerating global sea-level rise at unprecedented rates (IPCC, 2023; WMO, 2025). Ghana's coastal regions are among the most affected, with sea-level rise and coastal erosion threatening livelihoods, biodiversity, infrastructure, and settlements (Codjoe et al., 2017). The situation has intensified in recent years, with shoreline retreat reaching several metres in some locations and up to 100 metres in the most severely affected areas (Appeaning, 2024). Sea flooding is particularly evident along the eastern coast of the Volta Region, threatening an area inhabited by roughly 800,000 people (Boateng, 2012; Codjoe et al, 2017). Coastal districts such as Keta and Anloga have become highly vulnerable, with communities experiencing the loss of homes, farmland, and critical infrastructure (Boafo et al., 2025).

Coastal erosion has also forced the inland relocation of several villages and displaced thousands of people, undermining traditional fishing and salt production industries that have sustained local economies for generations (Ankrah, 2018; Roland et al., 2019; Abu et al., 2024). Beyond economic losses, displacement has adversely affected community well-being. Recurrent displacement has contributed to cultural and heritage erosion, weakened community identity and place attachment, and increased stress, anxiety, and fear (Abu et al., 2024). Addressing these challenges requires moving beyond predominantly hard-engineered coastal protection measures towards more inclusive adaptation strategies that integrate local knowledge, social equity, and the lived realities of affected communities (Boafo et al., 2025).

Example #3: Invasive blue crabs in Tunisia

Maritime traffic and climate change have dramatically reshaped fisheries in Tunisia's Gulf of Gabes, where blue crabs (*Portunus segnis*) have invaded coastal waters. Native to the western Indian Ocean, blue crabs first entered the Mediterranean in the early twentieth century following the opening of the Suez Canal and have become increasingly common as the Mediterranean warms (MedECC, 2020; FAO, 2021). Since 2014, these changes have driven a rapid expansion of blue crab populations, making them a dominant species in the local ecosystem. The invasion was initially perceived as a threat to fishers' livelihoods. Blue crabs displaced target species such as clams and damaged fishing gear, reducing catches and increasing costs. However, government-subsidised crab pots enabled fishers to adapt by targeting blue crabs as a commercial species. This shift has generated significant economic benefits. By 2021, approximately 30 processing factories in the region handled 7,600 tonnes of crab per year, with an estimated value of £20 million (Mili, 2021). In addition, chitin extracted from crab shells is processed into chitosan for biomedical applications, generating even higher returns than crab meat. By 2026, Tunisia's blue crab fishery is expected to supply growing demand from South Korea, Thailand, and Vietnam, providing greater stability and new economic opportunities for local fishing communities. This is a unique example of positive adaptation to climate-driven change, which can be a model for other regions.

POLICY RECOMMENDATIONS

The following recommendations outline different policy options for protecting marine biodiversity while also supporting human well-being. They are based on the three example cases but are designed to be adaptable to other coastal and marine contexts.

- **Strengthen links between fisheries protection with food security and conflict prevention:** Marine biodiversity policy should focus on communities that depend on the sea for food and income. When fish stocks decline, people may face hunger, poverty, migration, and conflict. Example #1 shows that protecting fisheries can reduce pressure on vulnerable communities. Promoting community-based fisheries management, including local users in the decision-making process, and fostering sustainable use are potential ways forward.
- **Adopt context-specific nature-based solutions:** Governments should protect and restore coastal ecosystems to strengthen climate resilience and reduce exposure to sea-level rise, coastal erosion, and storm surges. Ecosystem-based approaches, including mangrove restoration, can enhance marine biodiversity while providing natural coastal protection. As illustrated in Example #2, such measures can help vulnerable coastal communities in Ghana address displacement risks, safeguard livelihoods and cultural heritage, and reduce migration pressures.
- **Promote adaptation to new or invasive species:** Climate change can bring new or invasive species into marine ecosystems. In some cases, these species could become a source of income if they are carefully managed. Example #3 shows how fishers in Tunisia adapted by turning invasive blue crabs into a commercial product. However, this should be treated as an adaptation strategy, not as a motivation to further spread invasive species. Policy should only support climate-supported economic gain only when it also limits ecological harm.

REFERENCES

- Abu, M., Heath, S. C., Adger, W. N., Codjoe, S. N. A., Butler, C., & Quinn, T. (2024). Social consequences of planned relocation in response to sea level rise: Impacts on anxiety, well-being, and perceived safety. *Scientific Reports, 14*(1), 3461. https://doi.org/10.1038/s41598-024-53277-9
- Ankrah, J. (2018). Climate change impacts and coastal livelihoods; an analysis of fishers of coastal Winneba, Ghana. *Ocean & Coastal Management, 161*, 141–146. https://doi.org/10.1016/j.ocecoaman.2018.04.029
- Appeaning, K. A. (2024). *Ghana's coastline, swallowed by the sea*. UNESCO. https://courier.unesco.org/en/articles/ghanas-coastline-swallowed-sea
- Boateng, I. (2012). *An assessment of the physical impacts of sea-level rise and coastal adaptation: A case study of the eastern coast of Ghana.*
- Boafo, Y. A., Sackey, E. K., & Lartey, D. L. (2026). 'We live on borrowed land': Coastal erosion, place-based loss, and community adaptation in Ghana's Volta Region. *African Geographical Review, 1–21.* https://doi.org/10.1080/19376812.2026.2630635
- Ceballos, G., Ehrlich, P. R., Barnosky, A. D., García, A., Pringle, R. M., & Palmer, T. M. (2015). Accelerated modern human–induced species losses: Entering the sixth mass extinction. *Science Advances, 1*(5), e1400253. https://doi.org/10.1126/sciadv.1400253
- Codjoe, S. N. A., Nyamedor, F. H., Sward, J., & Dovie, D. B. (2017). Environmental hazard and migration intentions in a coastal area in Ghana: A case of sea flooding. *Population and Environment, 39*(2), 128–146. https://doi.org/10.1007/s11111-017-0284-0
- FAO. (2021). *From invasive species to priced export: The evolution of blue crab fisheries and the livelihoods of Tunisian fishers*. FAO Newsroom. https://www.fao.org/newsroom/story/From-invasive-species-to-prized-export/en
- FAO. (2024). *The State of World Fisheries and Aquaculture 2024: Blue Transformation in Action*. Rome, Italy: FAO. https://doi.org/10.4060/cd0683en
- Harvey, C. J., Clay, P. M., Selden, R., Moore, S. K., … Wise, S. (2025). Embracing social-ecological system complexity to promote climate-ready fisheries. *Reviews in Fish Biology and Fisheries, 35*(2), 633–658. https://doi.org/10.1007/s11160-025-09926-x
- Intergovernmental Panel on Climate Change. (2023). *Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Geneva, Switzerland: IPCC.
- IPBES. (2019). *Global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services* (Version 1). Zenodo. https://doi.org/10.5281/zenodo.6417333
- IPCC. (2023). *Climate Change 2023 Synthesis Report – Summary for Policymakers*. https://doi.org/10.59327/IPCC/AR6-9789291691647.001
- MedECC. (2020). *Climate and Environmental Change in the Mediterranean Basin – Current Situation and Risks for the Future. First Mediterranean Assessment Report* (Cramer, W., Guiot, J., & Marini, K., Eds.). Union for the Mediterranean, Plan Bleu, UNEP/MAP. https://doi.org/10.5281/zenodo.7224821
- Mili, S. (2021). Development of the fishing and commercialization of the blue crabs in Bizerta and Ghar EL Melh lagoons: A case study of promotion opportunities of blue growth in Tunisia. *Journal of Aquaculture & Marine Biology.*
- O'Brien, K., Garibaldi, L., & Agrawal, A. (2025). *IPBES Transformative Change Assessment: Full report*. Zenodo. https://doi.org/10.5281/zenodo.17099472
- Oremus, K. L., Bone, J., Costello, C., García Molinos, J., Lee, A., Mangin, T., & Salzman, J. (2020). Governance challenges for tropical nations losing fish species due to climate change. *Nature Sustainability, 3*(4). https://doi.org/10.1038/s41893-020-0476-y
- Palacios-Abrantes, J., Frölicher, T. L., Reygondeau, G., Sumaila, U. R., Tagliabue, A., Wabnitz, C. C. C., & Cheung, W. W. L. (2022). Timing and magnitude of climate-driven range shifts in transboundary fish stocks challenge their management. *Global Change Biology, 28*(7). https://doi.org/10.1111/gcb.16058
- Pascual, U., Adams, W. M., Díaz, S., Lele, S., Mace, G. M., & Turnhout, E. (2021). Biodiversity and the challenge of pluralism. *Nature Sustainability, 4*(7), 567–572. https://doi.org/10.1038/s41893-021-00694-7
- Pinsky, M. L., Worm, B., Fogarty, M. J., Sarmiento, J. L., & Levin, S. A. (2013). Marine taxa track local climate velocities. *Science, 341*(6151). https://doi.org/10.1126/science.1239352
- Roland, A. A., Erasmus, H. O., & Rosina, A. K. (2019). Impacts of climate variability on salt production in Ghana: Case of Songor Salt project. *Journal of Sustainable Development, 12*(1), 1. https://doi.org/10.5539/jsd.v12n1p1
- WMO. (2025). *Future Sea-level Rise Is Certain, but the Amount and Speed Are Uncertain*. https://wmo.int/media/magazine-article/future-sea-level-rise-certain-amount-and-speed-are-uncertain