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EDITORIAL

SDG 14: life below water- viable oceans necessary for a sustainable planet

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Oceans and marine sources are an indispensable part of our livelihood and providing environmental, social and economic benefits to a large proportion of human population. They cover about three quarters of earth's surface and constitute 99% of the living space by volume. They are responsible for absorbing nearly 25% of the carbon dioxide produced by humans thus mitigating the impact of global warming[1]. But due to injudicious human activities, earth's largest ecosystem is at stake, affecting lives of billions of people. Today, oceans and marine ecosystems are going through triple environmental crises- (1) impact of climate change (2) loss of biodiversity (3) water pollution from land activities, resulting in rising ocean temperature, ocean acidification and sea level rise[2]. These three drivers are not deteriorating oceans but also jeopardizing the well-being, livelihoods and food security of people, particularly those living in coastal areas. Studies suggest that by the end of the century, marine species richness near equator and Arctic is likely to decline. Moreover, all global warming levels in deep sea ocean will cause faster movements of temperature niches by 2100 and warming over 2°C will increase the chances of extinction, extirpation and ecosystem collapse (Cooley et al. 2022). Further, global sea level has also increased by 8–9 inches since 1880, and 2022 witnessed a new record of sea level rise by 101.2 mm (4 inches) above 1993 levels[3]. United Nations (UN) has listed "life below water" as its 14th sustainable development goal (SDG) that focuses on protection and ensuring sustainability of oceans, seas and marine resources including reduction of pollution, acidification, over-exploitation and conservation of their ecosystem. SDG 14 is directly linked to other SDGs as oceans act like a carbon sink, contribute to food production and are responsible for coastal economies as well as livelihoods. SDG 14 contains seven targets and means of implementation which aim at transforming human behaviour towards sustainable behaviour towards ocean and marine resources and taking actions to preserve and protect these ecosystems.

The first and foremost target i.e. 'target 14.1 aims at prevention and reduction of marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution by 2025.' Studies have shown that marine litter is dominated by plastics. A report by International Union for Conservation of Nature (IUCN) (2021) on 'marine plastic pollution' states that 400 million tons of plastics are generated every year for variety of applications. Of these, at least 14 million tons of plastic ends up in oceans every year[4]. World Wide Fund for Nature (WWF) estimates suggest that between 86 and 150 million metric tonnes (MMT) of plastic has accumulated in the oceans and the pace is increasing by the day. The report also claims that plastic production is projected to double by 2040, whereas pollution caused by plastic will be tripled. This will in turn result in four fold increase in macro-plastic concentration in the ocean by 2050 and about 50 fold increase in micro-plastic

[1] https://www.undp.org/sustainable-development-goals/below-water.

[2] https://www.worldbank.org/en/topic/oceans-fisheries-and-coastal-economies.

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[3] https://www.climate.gov/news-features/understanding-climate/climate-change-global-sea-level.

[4] https://www.iucn.org/resources/issues-brief/marine-plastic-pollution.

concentration by 2100[5]. The Great Pacific Garbage Patch which is the largest of the five offshore plastic accumulation zones in the world's oceans covers an area equivalent to 1.6 million square kilometres i.e. twice the size of Texas or thrice the size of France. The mass of the patch accounts for approximately 100,000 tonnes (4–6 times the mass of previous calculation) and weight is estimated to be more than 740 Boeing 777s[6]. There are several other garbage patches in the oceans around the globe, which are visible through satellite imaging. On the other hand, anthropogenic activities like fossil fuel burning, food and wastewater production are the root cause of nutrient pollution in marine resources. These activities cause high amounts of nitrogen and phosphorous in the marine environment leading to nutrient enrichment known as "eutrophication". This in turn results in hypoxic conditions called 'dead zones' causing declining water quality and loss of biodiversity[7]. Human activities have generated about 120 million tonnes of reacting nitrogen, and around two thirds of it ends up in contaminating air, water, soil, marine and coastal habitats. In the same way, nearly 20 million tonnes of phosphorous mined every year is responsible for polluting oceans, which is over 8 times the natural rate[8]. There are over 500 dead zones around the world with a surface area of over 245,000 km², which is roughly equivalent to that of United Kingdom[7].

'Target 14.2 is to sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans by the 2020.' To achieve climate change mitigation, it is important to protect, restore and conserve marine and coastal ecosystems including mangroves, salt marshes and sea-grasses as they are capable of capturing and storing carbon. As per estimates of Blue Carbon Initiative (2021), coastal ecosystems are responsible for only 2% total oceanic area but still account for 50% of the total carbon sequestrated in ocean sediments. Similarly mangroves absorb 6.4 billion tons of carbon at a global scale. Kelp forests, coastal peat-lands, soft-bottom benthic habitats also have been identified to play crucial role in global carbon cycle[9]. The conflict between growing human demands for ocean space and declining marine life under anthropogenic pressure gave rise to the establishment of institution governance arrangements (Chalastani et al. 2021). Marine/maritime Spatial Planning (MSP) has emerged as a potential integrated management approach for analysing and planning the spatial and temporal distribution of human activities in sea areas[10]. It can bring long term stability and clarity for economic operators by augmenting the potential of maritime activities (ecosystem and biodiversity conservation, renewable energy production, maritime transport, fishing, aquaculture and tourism), establishing space for their development and transforming conflicts into solutions while also ensuring the health of marine ecosystems (Chalastani et al. 2021). MSP is being implemented worldwide with different levels of implementation processes. There are countries having MSP in its nascent stage where joint learning and capacity building along with improved cooperation is required. On the other hand, there are areas where arrangements of MSP exist but strategies to facilitate coordination would be required[11]. It is critical to adopt nature based approaches for managing marine and coastal ecosystems. A recent report claims that there are 46 countries that have included marine and coastal nature based approaches in their updated Nationally Determined Contributions (NDCs)[12]. However more work is needed and concrete proposals need to be encouraged in a comprehensive, consistent and holistic way in order to develop MSPs in all seas and oceans of the globe.

'Target 14.3 is to minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels.' With increasing trend of climate change, ocean acidification has become a global menace threatening marine life and aquaculture, causing food web disruptions and impairing services provided by oceans. When CO_2 reacts with sea water it gets converted to carbonate, thereby decreasing the oceanic pH, causing its acidification. Report by Intergovernmental Oceanographic Commission of UNESCO (IOC-UNESCO) (2022) states that ocean acidification has increased by 30–40% since pre-industrial era and open ocean surface pH is projected to decrease by 0.3 units between 2081 and 2100 relative to 2006-2015[13]. Additionally, warming oceans and acidification have resulted in large scale coral bleaching across the world. A report by Global Coral Reef Monitoring Network (2020) states that world has lost around 14%

[5] https://wwfint.awsassets.panda.org/downloads/wwf_impacts_of_plastic_pollution_on_biodiversity.pdf.

[6] https://theoceancleanup.com/great-pacific-garbage-patch/.

[7] https://www.unesco.org/en/articles/ocean-pollution-addressing-root-causes-nutrient-over-enrichment.

[8] https://www.unep.org/explore-topics/oceans-seas/what-we-do/addressing-land-based-pollution/global-partnership-nutrient-0#:~:text=Worldwide%2 C%20the%20number%20of%20coastal,13%20systems%20in%20recovery)%3B.

[9] https://www.thebluecarboninitiative.org/.

[10] https://oceans-and-fisheries.ec.europa.eu/news/european-commission-report-implementation-maritime-spatial-planning-directive-good-progress-more-2022-05-03_en.

[11] https://sdgs.un.org/partnerships/joint-roadmap-accelerate-marine-maritime-spatial-planning-worldwide.

[12] https://ocean-climate.org/wp-content/uploads/2021/10/coastal-and-marine-ecosystemDEF.pdf.

[13] https://unfccc.int/sites/default/files/resource/COP27%20Poster_OA_IOC_V2.pdf.

of coral reefs between 2008 and 2019, which is equivalent to nearly 11,700 square kilometres of coral (more than all the living coral in Australia)[14]. The Sustainable Development Goal Report (2023) reveals that stations for reporting ocean acidification data have tripled from 178 in 2021 to 539 in 2023. However, data remains scarce in regions including coastal Asia and Africa and the open waters of the South Atlantic, Pacific, Indian and Southern Ocean[15]. The United Nations endorsed Ocean Acidification Research for Sustainability (OARS) programme from Global Ocean Acidification Observing Network (GOA-ON) has been developed for understanding the science of ocean acidification that includes impact on marine life and sustainability of marine ecosystems (estuarine, coastal, and open ocean environments). The programme has key components that include: (1) improvement of regional collaborative efforts, (2) enhancing capacity building in science, (3) addressing the threat of ocean acidification through co-designing and implementing observation and research, (4) delivery of the output and communication to policy makers as well as communities[16].

'Target 14.4 is to effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics by 2020.' Fishing is one of the significant reasons behind loss of ocean biodiversity. Our World in Data report claims that fish and sea food consumption has increased by 4-folds since last 50 years, which has put pressure on fish stocks significantly at a global level[17]. WWF reports that overfish stocks have more than tripled in half a century and has put one third of sharks, rays and chimaeras at risk of getting extinct[18]. Cases of illegal, unreported and unregulated (IUU) fishing are rising in all types and dimensions of fisheries. These activities are responsible for loss of 11–26 million tonnes of fish every year with an economic loss accounting for US$10–23 billion[19]. Moreover subsidies provided to support fishing industry is another key driver of overfishing resulting in a global fishing fleet of up to two and a half times more than needed[18]. To combat the IUU fishing, Agreement on Port State Measures had been set up and as of May 2023, the agreement had increased its signatories by three fold since 2016 to reach 75 Parties, including the European Union in order to efficiently cover States, and 60% of port States. There has been some progress between 2018 and 2022 at the global level in implementing instruments to take actions against IUU fishing[15]. However more compliant and concerted efforts are needed to develop a stringent framework along with strong legislation to monitor the illegal activities in fisheries.

'Target 14.5 focuses on conserving at least 10 per cent of coastal and marine areas, consistent with national and international law and based on the best available scientific information by 2020.' In order to safeguard biodiversity of oceans and alleviate destructive activities, setting up of marine protected areas (MPAs) is a primary tool that must be increased substantially. Latest World Bank (2023) report on SDG 14 suggests that currently, there are 18,422 marine protected areas, which cover an estimated 30 million square kilometres surface. Although MPAs cover 8.2% of ocean waters, still only 2.9% of ocean is regarded as highly protected[20]. Around 34% of marine Key Biodiversity Areas are most crucial sites but they are still not being covered[21]. Overall, the marine protected area expansion has fallen short of achievement and thus it is important to reconcile these shortcomings through transformed governance and monitoring beyond the boundaries.

'Target 14.6 aims to prohibit certain forms of fisheries subsidies which contribute to overcapacity and overfishing, eliminate subsidies that contribute to illegal, unreported and unregulated fishing and refrain from introducing new such subsidies, recognizing that appropriate and effective special and differential treatment for developing and least developed countries should be an integral part of the World Trade Organization fisheries subsidies negotiation by 2020.' Subsidies are critical for national policy but have the capability to distort markets and in contributing unjust trade activities. Fishing subsidies were accounted to be as high as $35 billion worldwide, of which $20 billion directly goes to over-fishing[22]. A global World Trade Organisation (WTO) Agreement has been adopted at the 12th Ministerial Conference (MC12) on 17 June 2022 for banning harmful fisheries subsidies, which is a major step towards protecting ocean sustainability, as it is a key driver for the continuously lowering of fish stocks. This is a historic achievement where a first international/multilateral agreement fully focussing

[14] https://gcrmn.net/wp-content/uploads/2022/05/Status-of-Coral-Reefs-of-the-World-2020-Summary-for-Policymakers.pdf)

[15] https://unstats.un.org/sdgs/report/2023/The-Sustainable-Development-Goals-Report-2023.pdf.

[16] http://www.goa-on.org/oars/overview.php.

[17] https://ourworldindata.org/fish-and-overfishing.

[18] https://www.worldwildlife.org/threats/overfishing.

[19] https://www.un.org/en/observances/end-illegal-fishing-day.

[20] https://datatopics.worldbank.org/sdgatlas/goal-14-life-below-water?lang=en.

[21] https://oneoceanhub.org/slow-progress-towards-global-marine-protected-area-targets-reflections-for-the-post-2020-global-biodiversity-framework/.

[22] https://unctad.org/project/regulating-fisheries-subsidies.

on SDG target has come into force[23]. Moreover, data from Extended Report on SDG 14 (2022) suggests that average degree of implementation of international instrumentation against IUU fishing has improved between 2018 and 2022 with global aggregated indicators risen from 3 to 4 (out of maximum score of 5). This shows that countries have made an overall progress of nearly 75% in implementation of international instruments in 2022 as compared to 70% in 2018. Small Island Developing States (SIDS) have also shown improvement from medium level of implementation in 2018 and 2020 to high level of implementation in 2022. However, Least Developed Countries (LDCs) often face challenge of implementation thus remaining at medium level from 2018 to 2022[24]. While improvements have been shown in several regions, it is needful to maximize the efforts to combat IUU fishing and other disturbances causing harm to sustainability of oceans.

'Target 14.7 aims to increase the economic benefits to Small Island developing States and Least Developed Countries from the sustainable use of marine resources, including through sustainable management of fisheries, aquaculture and tourism by 2030.' Oceans have become the centre stage for a range of economic activities which are projected to escalate to $3 trillion by 2030 from $1.5 trillion in 2010. Oceans have also been the pillar of international trade as more than 80% of the volume of global trade goods move through marine transport and percentage is even higher for developing countries[25]. Additionally, Food and Agricultural Organization report (FAO 2022) states that fisheries and aquaculture production reached an all-time high, recording 214 million tonnes in 2020, comprising 178 million tonnes of aquatic animals and 36 million tonnes of algae[26]. Furthermore, coastal tourism is also at the forefront that contributes to economy and estimated to be comprised of USD 220 billion of ocean consumer products and services globally (Karani and Failler 2020). Concept of sustainable blue economy is a top priority today and is being considered in coastal and island regions through national and regional initiatives. It is a new economic frontier and is a great opportunity for LDCs and SIDS to tap into this concept by linking ocean resources to economic growth and sustainable use. Maximizing marine and coastal activities will encourage tourist-reliant economies, which in turn will make SIDS and other such regions resilient to future shocks[27].

'Target 14.a focuses on increasing scientific knowledge, developing research capacity and transferring marine technology, taking into account the Intergovernmental Oceanographic Commission Criteria and Guidelines on the Transfer of Marine Technology, in order to improve ocean health and to enhance the contribution of marine biodiversity to the development of developing countries, in particular small island developing States and least developed countries.' The global extent of scientific intervention is expanding steadily and has contributed in identifying various stressors and delicate ecological limits of oceans. The Intergovernmental Oceanographic Commission (IOC) of UNESCO is a body (recognised by United Nations Convention on the Law of the Sea (UNCLOS)) that facilitates international cooperation based upon marine/ocean sciences so as to enhance management of oceans, coasts and marine resources. This way IOC helps to promote growth and development of scientific applications in order to promote knowledge, capacity, economic and social progress as well as peace and sustainability[28]. IOC enables its 150 Member States to closely monitor and coordinate programmes that include: (1) ocean research to strengthen knowledge about oceans and coastal ecosystems, (2) maintain and integrate global ocean observations data and information systems, (3) early warning systems and preparedness against climate hazards, (4) improvement of science-policy interface, (5) enhancing ocean governance through knowledge base and regional cooperation, (6) capacity building in all above functions[29]. However, there are persistent gaps in utilizing and undertaking ocean science to a global level. Ocean science requires human, institutional, technical and financial resources, which remains dominated mostly in high income countries. Also, most scientists in this area are from developed countries and there is always a shortage of experts in LDCs and SIDS[30]. Second Global Ocean Science Report by UNESCO's IOC claims that lack of financial flow is another driver hampering the implementation and growth of scientific development in marine/ocean research. UNESCO 2020 Report reveals that States contribute only 1.7% of their research budget to ocean sciences (0.03–11.8%, depending on the country), which is way less than they spend on other scientific fields[31]. Moreover, women and many other underrepresented groups still do not have access and long term stability in ocean science professions, which is another barrier (Harden-Davies et al. 2022).

[23] https://www.wto.org/english/tratop_e/rulesneg_e/fish_e/fish_e.htm.

[24] https://unstats.un.org/sdgs/report/2022/extended-report/Extended-Report_Goal-14.pdf.

[25] https://unctad.org/publication/review-maritime-transport-2021.

[26] https://www.fao.org/3/cc0461en/cc0461en.pdf.

[27] https://www.iisd.org/articles/deep-dive/small-islands-large-oceans-voices-frontlines-climate-change.

[28] https://www.ioc.unesco.org/en.

[29] https://www.unep.org/explore-topics/oceans-seas/what-we-do/working-regional-seas/partners/intergovernmental.

[30] https://sdgs.un.org/sites/default/files/202,205/ID_6_Increasing_scientific_knowledge.pdf.

[31] https://www.unesco.org/en/articles/new-unesco-report-voices-concern-over-inadequacy-funding-ocean-research.

'Target 14.b: Provide access for small-scale artisanal fishers to marine resources and markets.' Increasing progress in the degree of legal/regulatory/policy/institutional framework is much needed especially for small scale fisheries communities. The target directly aims at small scale fisheries that are responsible to sustaining livelihoods of many people through food security and nutrition, income generation and preservation of cultural traditions (FAO 2021). Half a billion people depend on small scale fisheries, which accounts for 90% of employment in the sector[24]. The International Year of Artisanal Fisheries and Aquaculture 2022 report mentions high degree of adoption of regulatory frameworks supporting small scale fisheries with an average global score rising significantly in 2022 as compared to 2018, although reporting rates have majorly declined[24].

"Target 14.c is to enhance the conservation and sustainable use of oceans and their resources by implementing international law as reflected in United Nations Convention on the Law of the Sea, which provides the legal framework for the conservation and sustainable use of oceans and their resources, as recalled in paragraph 158 of The Future We Want". United Nations Convention on the Law of the Sea (UNCLOS) also referred to as 'constitution of the nation' has set up a legal framework under which all activities pertaining to oceans and seas must be carried out with regard to sustainable use of oceans and its resources. The Convention acknowledges the advantages of establishing a legal order that will ease international communication and facilitate peaceful use of seas and oceans, efficient utilization of their resources and conservation of marine environment. This way it creates a balance between social and economic development and sustainable management of oceanic resources. In addition to this, UNCLOS also assesses the rights and obligations of coastal states as well as contains provisions relating to the rights of countries under special circumstances (e.g landlocked states) and dealing peaceful settlements of disputes[32].

The benefits provided by oceans, seas and marine ecosystems are immeasurable and our well-being is intricately tied to it. Role and projected growth of blue economy is already doubling in size per decade and stands equivalent to seventh largest economy on the planet (Nash et al. 2020). SDG 14 is strongly linked to other SDGs, particularly SDG1 (No Poverty), 2 (Zero Hunger), 3 (Good Health and Well-being), 8 (Decent Work and Economic Growth), 9 (Industry, Innovation and Infrastructure), 12 (Responsible Consumption and Production), 13 (Climate Action), 15 (Life on Land) and 16 (Peace, Justice and Strong Institutions) [33]. Despite this, SDG 14 has remained one of the most under implemented goals with major challenges lying in regions and income groups associated with oceans (Haas 2023). Out of ten targets, four targets (i.e., 14.2, 14.4, 14.5, and 14.6) were due in 2020 but no country could achieve it within the given timeframe (Andriamahefazafy et al. 2022). Despite being part of already existing initiatives such as Aichi Targets, regional fisheries management organizations (RFMOs) and International Maritime Organisation, targets of SDG 14 has shown slowest progress (Haas 2023). For us to move towards achievement of targets of SDG 14, substantive efforts that include cross-sectoral measures and integrated approaches must be designed and implemented involving all stakeholders in line with ecosystem approaches. It is needful to develop effective policy, resourcing and their implementation at the local and regional levels, as these are central to society's capacity to meet SDG 14. According to Reimer et al. (2021), in case of local level, setting up locally managed marine areas, gear restriction areas, and fisheries closures can help in achieving targets 14.2, 14.4 and 14.5. At regional level half of the measures adopted by general regional fisheries management organisation are helping in achievement of targets related to fisheries (target 14.4 and 14.6) and marine ecosystem (14.2 and 14.5) (Haas et al. 2021). Strong long-term monitoring schemes within individual areas can be helpful for giving valuable insights regarding effectiveness of marine protected areas under multi-stressor environment (Kriegl et al. 2021). Moreover, flow of funding towards SDG 14 must be increased and needs to be focussed at improving underfunded research entities as well as towards countries that are far from achieving the targets (Andriamahefazafy et al. 2022). According to a study by Johansen and Vestvik (2020), a financial gap of US$ 149.02 billion per year exists in order to achieve SDG 14. Investment in data processes and stock assessment tools is also imperative that will facilitate in advancing SDG 14. Report by Asian Development Bank (2022) states that strengthening resilience of coastal and marine tourism against climate change threats is necessary in order to safeguard ecosystem and livelihoods of people dependent on tourism. This could be achieved by building up interventions in areas which are as follows: (1) policy, planning and financing, (2) infrastructure/nature based solutions, (3) diversification across markets and operational practices[34]. Moreover, amalgamating data science, engineering approaches as well artificial intelligence (such as machine learning) can give fresh perspectives on ocean dynamics. In this regard, a space based global maritime surveillance and security monitoring system like Automated Identification System (AIS) is proving to be a breakthrough for ocean science,

[32] https://www.un.org/en/chronicle/article/achieving-sdg-14-role-united-nations-convention-law-sea.

[33] https://wwfeu.awsassets.panda.org/downloads/wwf_sdg14_policy_report_1.pdf.

[34] https://www.adb.org/news/features/these-actions-coastal-and-marine-tourism-can-have-bright-future.

which can be used for ship traffics and disrupting fishing activities like IUU fishing[35]. In the same context, Europe's Global Navigation Satellite System (GNSS) called Galileo, a highly accurate global positioning system, has been developed and deployed in collaboration between the European Union and European Space Agency (ESA)[36]. SeaSearch is another powerful tool which gives a more comprehensive picture of maritime situation. This allows coast guards, navy and lighthouse authorities about any suspicious and abnormal activities or emergency states[37]. These new algorithms will help in predicting climate and weather, modelling and distribution of habitat, species detection, resource management, coastal water observation and oceanic pollution (e.g. oil spills)[38]. We need to have a well curated and expansive data for microplastics to facilitate understanding and mitigation of microplastic pollution in marine environment. The NOAA (National Oceanic and Atmospheric Administration) National Centres for Environmental Information (NCEI)'s project on micro-plastic data was launched in July 2021 that assembles micro-plastics information from large ocean surveys, citizen-science led initiatives and literature surveys. This openly accessible repository with archived information about micro-plastic monitoring is accessible to stakeholders so as to enhance a global understanding about this environmental pollution and to formulate stringent policies and management of micro-plastics (Nyadjro et al. 2023). Another critical issue that needs equal attention is underwater testing of explosives, which is one of the strongest sources of anthropogenic pollution and is capable of penetrating across direction of any ocean basin. The explosion in naval ship shock trials produces nearly a total source level (SL) of more than 300 decibels (dB). The sound and energy of seismic surveys has potential to cause mortality, organ rupture, hearing impairment or behavioural disturbances in marine species (Harding and Cousins 2022). Noise or sonic pollution due to increased traffic, mining, under-water tests, oil mining, sonar-based navigation etc. is also detrimental to the residing species, including both vertebrates and invertebrates, causing impeding impact to their feeding, migration and breeding. The noisy naval routes have been observed to be less rich in diversity in comparison to calm and noise free areas. Noise pollution has thus resulted in shrinking habitats for marine species[39]. More research and regulations are required to check the anthropogenic sounds and provide solutions for noise free propellers and drilling options. Global initiatives against unorganised and unsustainable tourism activities also need to be taken into account, which is causing enormous contribution in marine litter. Improper disposal of trash litter causes substantial pressure on local waste management systems resulting in overflow of landfills and sewage plants, which in turn can be detrimental to local communities and wildlife. Lastly, implementing best practices in sea food industry and other marine sectors and change in dietary patterns for nutritional needs can also play a crucial role in uplifting the pressure from marine ecosystem.

Healthy, resilient as well as productive marine ecosystem is not only essential to species living below water and to people whose livelihood rely on the 'Sustainable Blue Economy' but also for the species living on land, including humans. This can be achieved only when we use our ocean services in a sustainable manner. Only in this way, we can achieve targets of socio-economic benefits for marine sectors and communities, to global food security and resilience from impacts of climate change, which will be crucial to sustain life on earth.

References

Andriamahefazafy M, Touron-Gardic G, March A, Hosch G, Palomares MLD (2022) Sustainable development goal 14: to what degree have we achieved the 2020 targets for our oceans? Ocean Coast Manag 227:106273

Chalastani VI, Tsoukala VK, Coccossis H, Duarte CM (2021) A bibliometric assessment of progress in marine spatial planning. Mar Policy 127:104329

Cooley SD, Schoeman L, Bopp P, Boyd S, Donner DY, Ghebrehiwet S-I et al (2022) Oceans and Coastal Ecosystems and their services. In: Roberts H-O, Tignor DC, Poloczanska M, Mintenbeck ES, Alegría K, Craig A, Langsdorf M, Löschke S, Möller S, Okem V, Rama A B (eds) Climate Change 2022: impacts, adaptation and vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Pörtner. Cambridge University Press, Cambridge, UK and New York, NY, USA, pp 379–550

Haas B (2023) Achieving SDG 14 in an equitable and just way. Int Environ Agreements 23:199–205

Haas B, Haward M, McGee J, Fleming A (2021) Explicit targets and cooperation: regional fisheries management organizations and the sustainable development goals. Int Environ Agreements Polit Law Econ 21:133–145

Harden-Davies H, Amon DJ, Vierros M, Bax NJ, Hanich Q, Hills JM (2022) Capacity development in the Ocean Decade and beyond: key questions about meanings, motivations, pathways, and measurements. Earth Syst Gov 12:100138

Harding S, Cousins N (2022) Review of the impacts of anthropogenic underwater noise on marine biodiversity and approaches to manage and mitigate them. Tech Ser no. 99. Secretariat of the Convention on Biological Diversity, Montreal, 145 pages

Johansen DF, Vestvik RA (2020) The cost of saving our ocean–estimating the funding gap of sustainable development goal 14. Mar Policy 112:103783

[35] https://sdg.esa.int/activity/automated-identification-system-ais-3998.

[36] https://sdg.esa.int/activity/galileo-4056.

[37] https://sdg.esa.int/activity/seasearch-4635.

[38] https://www.un-ilibrary.org/content/books/9789216040048.

[39] https://time.com/5,936,110/underwater-noise-pollution-report/.

Karani P, Failler P (2020) Comparative coastal and marine tourism, climate change, and the blue economy in African large Marine ecosystems. Environ Dev 36:100572

Kriegl M, Ilosvay XEE, von Dorrien C, Oesterwind D (2021) Marine protected areas: at the crossroads of Nature Conservation and fisheries Management. Front Mar Sci 8:2021

Nash KL, Blythe JL, Cvitanovic C, Fulton EA, Halpern BS, Milner-Gulland EJ (2020) To achieve a sustainable blue future, progress assessments must include interdependencies between the Sustainable Development Goals. One Earth 2(2):161–173

Nyadjro ES, Webster JAB, Boyer TP, Cebrian J, Collazo L, Kaltenberger G et al (2023) The NOAA NCEI Marine microplastics database. Sci Data 10:726

Reimer JM, Devillers R, Claudet J (2021) Benefits and gaps in area-based management tools for the ocean sustainable development goal. Nat Sustain 4:349–357