

Towards stewardship of oceans: Role of G20 countries

Life originated in the ocean and thus it is the single most reason to protect the ocean environment. Oceans supply food, energy, mineral resources and are storehouses of biodiversity; they influence weather and climate and provide an ecosystem for sustaining human life and other biota. Oceans are the major source of fossil-fuel-based energy and influence the economy of the world and thus also are of strategic importance. It is imperative that future growth and prosperity will be dependent on oceans in view of the impacts of climate change on sustainability. For the same reason, the UN Conference on Sustainable Development in 2012, stressed expanding the green economy to a blue economy. The conservation and sustainable utilization of the oceans, seas and marine resources have been identified as one of the UN Sustainable Development Goals (SDGs). Considering the importance of ocean development, UNESCO/International Oceanographic Commission (IOC) has declared the current decade as the 'Decade of Ocean Science' to deliver the science needed to achieve SDG-14, 'Life under Water'. Prime Minister Narendra Modi has recognized the vital role of the ocean-dependent economy for future development and very aptly articulated the importance of the blue economy as follows: 'To me, the blue chakra or wheel in India's flag represents the potential of the blue revolution, or the ocean economy'. As oceans are going to play a stellar role in global development, it is vital that G20 under India's Presidency gives sufficient importance to develop the blue economy for global good.

The major issues to be addressed for the development of the blue economy are given below.

Sustainable fisheries: Global population is likely to touch 9 billion by 2050. Dependence on the marine fishery for nutrition requirements will rise in future. Fish stocks have been dwindling due to changes in primary and secondary production and the livelihood of coastal communities has been affected. It has also been observed that many fisheries are moving poleward in view of the warming of the seas. Considering this scenario, the understanding of the physical, biological and chemical processes, and the development of models for the prediction of fish stocks at the short-term, annual and decadal time scales is a critical need so that fishing is restricted within the biologically sustainable limits.

Conservation and preservation of coastal and marine ecosystems: Coral reefs, mangroves and seagrasses are vital ecosystems and are critical for sustaining fishery, other biota and services. Knowledge about their structure, functions

and vulnerability to climate change and anthropogenic pressures, is a critical need (Nayak, S., *Environ. Policy Law*, 2020, **52**, 277–288; doi:10.3233/EPL-219036). The Mangrove Alliance for Climate launched by the UAE and Indonesia during COP-27 is a welcome step towards achieving this goal. The programme of the Census of Marine Life and the resultant International Ocean Biogeographical Information System provided a wealth of information about marine life. It is necessary to undertake such surveys periodically.

Harmful algae: Increase in the frequency of heavy and extremely heavy rainfalls has enhanced river runoff, polluting coastal waters with nutrients resulting in increasing the harmful algal blooms. The frequency and intensity of such blooms have increased, leading to mass mortality and morbidity of marine organisms. Efforts are needed to develop an early warning system for fishers for avoiding such areas for fishing and controlling nutrient pollution.

Coastal pollution: An assessment of impact of spatial distribution of marine litter including microplastics on coastal and marine ecosystems, ecosystem goods and services and on fisheries has to be undertaken in view of increasing coastal development. An integrated model comprising climate change and impacts, land use policy and socio-economic conditions must be developed. The developed economies in the world should invest in understanding the generation of plastic waste, their transport to the coast and movement across the oceans (Nayak, S., *Environ. Policy Law*, 2021, **51**, 35–238; doi:10.3233/EPL-210048).

Coastal and deep-sea minerals and freshwater from sea: Coastal and offshore mineral deposits provide many strategic minerals such as titanium, rare earth, thorium, nickel and cobalt needed for industrial and economic growth. The recently concluded 'High Seas Treaty' envisages regulating anthropogenic activities to ensure sustainable utilization of these resources and the benefits are to be shared equitably among all the countries. As the activities along the coast flourish, the demand for fresh water will also increase in the coastal areas. Low-temperature Thermal Desalination (LTTD) technology has been utilized for many years in the Lakshadweep Islands. Collective investments in terms of technical expertise in designing seawater intake and ocean platforms, finances and human resources to establish offshore desalination plants capable of generating 10 million l/d of fresh water, to serve coastal populations and developmental activities are required.

Ocean energy: As we phase down the use of fossil fuels for energy generation, we need to look to the ocean for new energy sources. The recent exploration of gas hydrates (ice-like crystalline forms of methane and water) has been promising and appropriate technologies must be developed for their utilization. The offshore wind farms are to be promoted and necessary port infrastructure has to be set up. Experiments to harness ocean thermal energy and ocean currents need to be adequately supported.

Coastal tourism: Beach tourism has been flourishing in all G20 countries and India has been actively pursuing to identify 'Blue Flag' beaches, a certification issued by the Foundation for Environmental Education, Copenhagen. Blue Flag beaches have beautiful landscapes, excellent water quality, are safe, and have environment-friendly infrastructure. This certification process ensures development along with environmental education and should be promoted.

Hazards and response mechanism: Extreme events such as cyclones, floods in coastal urban centres, coastal erosion, etc. have been increasing due to the impacts of climate change. An improvement in the prediction and development of early warning systems and response mechanisms is a major requirement. The identification of vulnerable areas along the coast due to episodic events and sea level rise is required to safeguard investments made for industrial and infrastructure development.

Small islands development: One of the major requirements is availability of freshwater on small islands. The LTTD technology has been used to provide drinking water to six islands on the Lakshadweep Islands. In addition, mariculture and ornamental fishery should be promoted to ensure livelihood.

Shipping, industries, infrastructure: The increasing trade, shipping and infrastructure development are likely to place pressure on marine ecosystems. The development of sustainable technologies for port development and shipping (electrical propulsion) needs to be promoted.

Ocean observations, including from satellite and aerial platforms, are critical to understanding ocean processes, modelling and forecast weather, sea state and hazards to ensure the safety of human lives and facilitate human activities. Building capacity for sustained observations is the key to understanding physics, biogeochemistry, biology and ecosystems. Ongoing International Indian Ocean Expedition-2 (IIOE-2) supported by the UNESCO/IOC, Scientific Committee of Oceanographic Research and Indian Ocean Global Ocean Observing System, has provided a platform for the international community to explore the Indian Ocean and acquire new knowledge for the benefit of the society.

During the last decade, ocean-related issues have been discussed in the G20 forum. The G20 Action Plan on Marine Litter (Germany, 2017), the Osaka Blue Ocean Vision (Japan, 2019), the Coral Research and Development Accelerator Platform (Saudi Arabia, 2020) and the Conservation, Protection, Restoration and Sustainable use of biodiversity (Italy, 2021) are important initiatives to focus on oceans. The discussions on Blue Economy were initiated under the Indonesian Presidency in 2022.

India has been at the forefront of adopting a blue economy and it is pertinent that under India's G20 presidency, it is accorded a high priority to promote a sustainable and climate-resilient blue economy, accelerating ecosystem restoration and enriching biodiversity. The idea is to develop approaches and mechanisms to promote the sustainable and equitable economic development of ocean resources while ensuring a healthy ocean environment and addressing the impacts of climate change. This is in tune with the SDG-14 of the United Nations and India-led global movement on Mission LiFE (Lifestyle for Environment) to protect and preserve the environment.

The development of ocean economy is likely to face threats from natural hazards, climate-induced extreme weather events, sea level rise, ocean acidification and impacts of human activities. Managing coastal zones for ensuring ecological and livelihood security along with advancing developmental activities is a challenge. The coastal and marine spatial mapping should be employed to understand the risks involved, and accordingly, developmental activities should be planned.

There is now consensus that macroeconomic decisions about the blue economy will need environmental data. The economic growth prospects in the ocean beyond 2030 will be limited without large investments to support ocean environments. We need to design a framework to bring together disparate data sources by developing an accounting system for oceans.

It is now certain that after 2030, when the impacts of climate change would be more visible, the dependence on ocean is going to increase to sustain the economy and ensure livelihood. It is the need of the day to promote the 'Digital Ocean' by integrating scientific data along with environmental, social and economic data to ensure ocean health and ushering blue economy. It will be very useful for the G20 countries to share their knowledge about ocean science and technology, best practices followed for building partnerships, securing financial resources, etc. An institutional framework and governance structure has to be developed for sustainable utilization of resources.

Effective communication with all stakeholders, academia, industries, non-governmental organizations, and governments including policymakers, is necessary to ensure that the scope and objectives of such development are relevant to society. Responsible stewardship of oceans is an investment that will pay dividends for generations to come. This is an opportunity to renew our commitment to oceans, and thus of the planet Earth, for the benefit of mankind. The motto 'One Earth, One Family, One Future' should bring together the global community to reap the benefits of 'One Ocean' while preserving its environment.

Shailesh Nayak

National Institute of Advanced Studies,
Indian Institute of Science Campus,
Bengaluru 560 012, India
e-mail: shailesh@nias.res.in