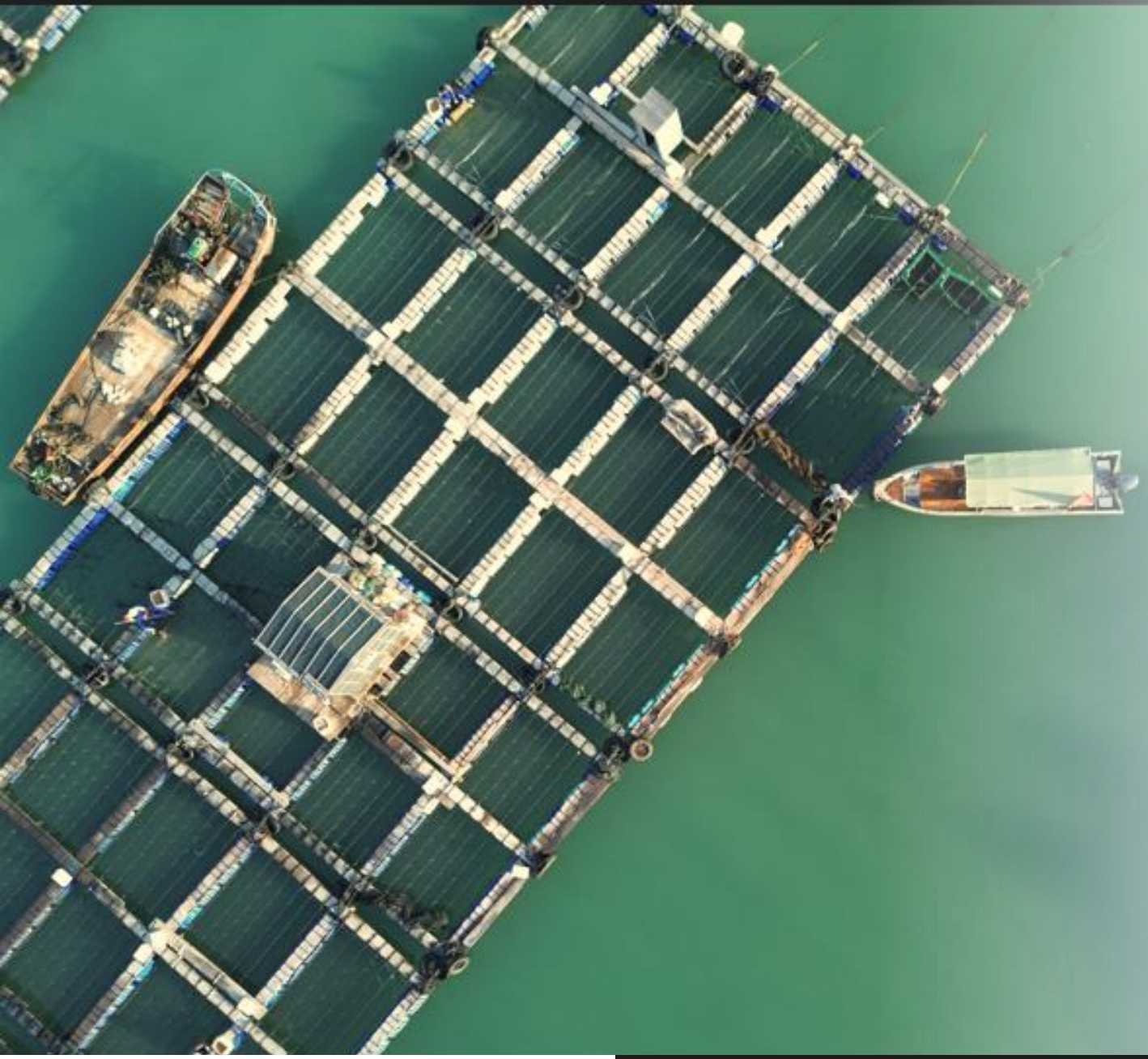


Blue Economy 101: Sustainable Oceanic Growth

Prepared by: Elroy Joe Pereira, Manish Ramaiah, Raghab Ray

Table of Contents

Module 1: Introduction to the Blue Economy

- Definition and Impact
- Ecological, Cultural, and Economic Significance
- Marine and Coastal Habitats

Definition and Impact

Definition

Sustainable use of oceanic resources for economic growth, improved livelihood, jobs while preserving the marine ecosystems.

Balances economic development, environmental sustainability, and social inclusion

Impact

Economic diversification with inclusive growth for coastal communities

Strengthened economic resilience and biodiversity protection

Key focus areas

- Fisheries and Aquaculture
- Deep Sea Resources
- Maritime Transport and Ports
- Marine Renewable Energy
- Marine Biotechnology and Research
- Tourism and Coastal Development
- Marine Conservation and Restoration

India's Vision

- Target to be leading Blue economy nation by **2047**
- Enhance Ocean based GDP contribution while ensuring **net-zero pathways**

Why the Ocean Matters

Covering over 70% of the Earth's surface, oceans are the planet's life-support system. They provide vital ecosystem services such as food security, climate regulation, and livelihoods, while also enabling global trade, cultural exchange, recreation, and sustainable economic growth.

Real time pics@ Elroy Joe Pereira

Why the Ocean Matters

Oceans produce over **50% of the oxygen** via phytoplankton and absorb nearly 1/3 of the world's of the world's carbon dioxide emissions

Ecological

Oceans are home to about 80% of all known species on Earth

Real time pics@ Elroy Joe Pereira

Oceans are central to the traditions, heritage, and identities of coastal and island peoples

Cultural

Traditional salt production in Goa

Real time pics@ Santosh Gad

Oceans generate **₹207–249 trillion** annually in goods and services and carry more than 90% of global trade

Economic

Marine and coastal resources generate nearly 3% of global GDP

Real time pics@ Elroy Joe Pereira

Marine and Coastal Habitats

Known as **Blue carbon** that captures CO_2 and store inside biomass and sediment for millennia

Real time pics@ Raghab Ray

Mangrove

They are complex halophytes, fringing along coast, abundant in tropical countries

Common species

Avicennia marina
Rhizophora stylosa

Real time pics@ Raghab Ray

Seagrass

They are underwater vegetation, surviving only by sunlight, many tropical countries

Common species

Enhalus acoroides
Zostera marina

Real time pics@ Raghab Ray

Salt marsh

They are salt tolerant herbs, grows on soft costal soil, many in temperate countries

Common species

Suaeda maritima
Spartina alterniflora

Real time pics@ Elroy

Seaweeds

Red, green, brown multicellular algae, serves as food and habitat

Common species

Ulva lactuca
Saccharina japonica

Module 2: Key Sectors of the Blue Economy

- Fisheries and Aquaculture
- Deep Sea Resources
- Maritime Transport and Ports
- Marine Renewable Energy
  - Harnessing MRE in India's Blue Economy
- Marine Biotechnology and Research
- Tourism and Coastal Development

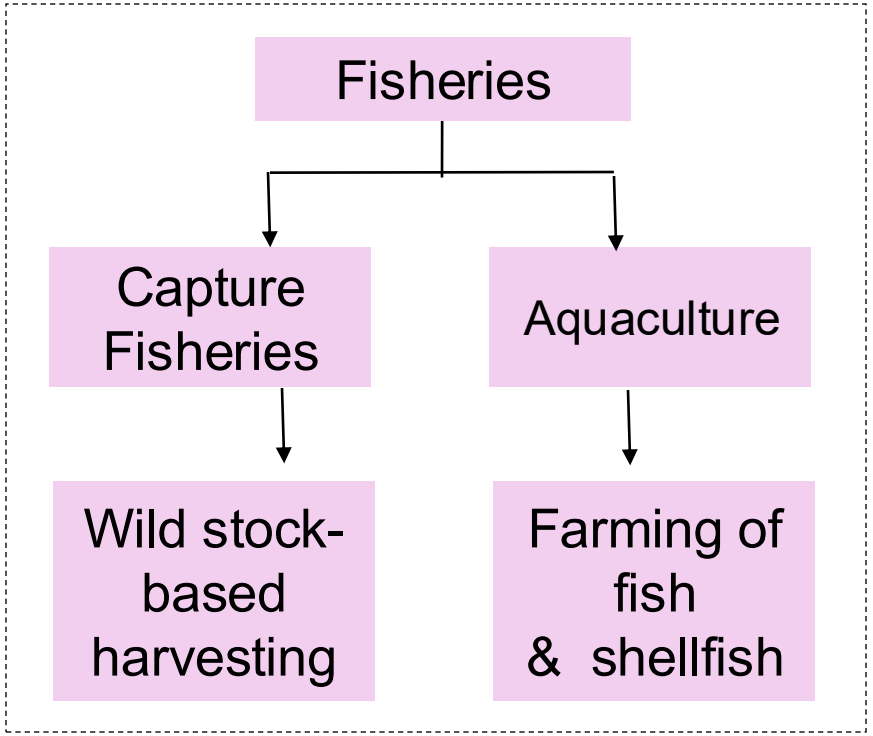
Fisheries and Aquaculture

Fisheries involve the capture, processing, and management of wild aquatic species for food, livelihoods, and trade

Traditional small-scale fishing

Real time pics@ Elroy Joe Pereira

Capture Fisheries produced **92.3** million tonnes in 2022



Contribute significantly to food security, providing **~17%** of global animal protein

Aquaculture is the farming of fish, shellfish, and aquatic plants in controlled systems for food production and economic gain

Mussel aquaculture practice

Real time pics@ Santosh Gad

Global Aquaculture Production reached **130.9** million tonnes in 2022

Fisheries and Aquaculture

Asia accounts for over **60%** of global capture fisheries production

Asia accounts for around **70%** of global aquaculture production

India is the **3rd largest** fish producer, with marine capture fisheries contributing ~3.6 million tonnes

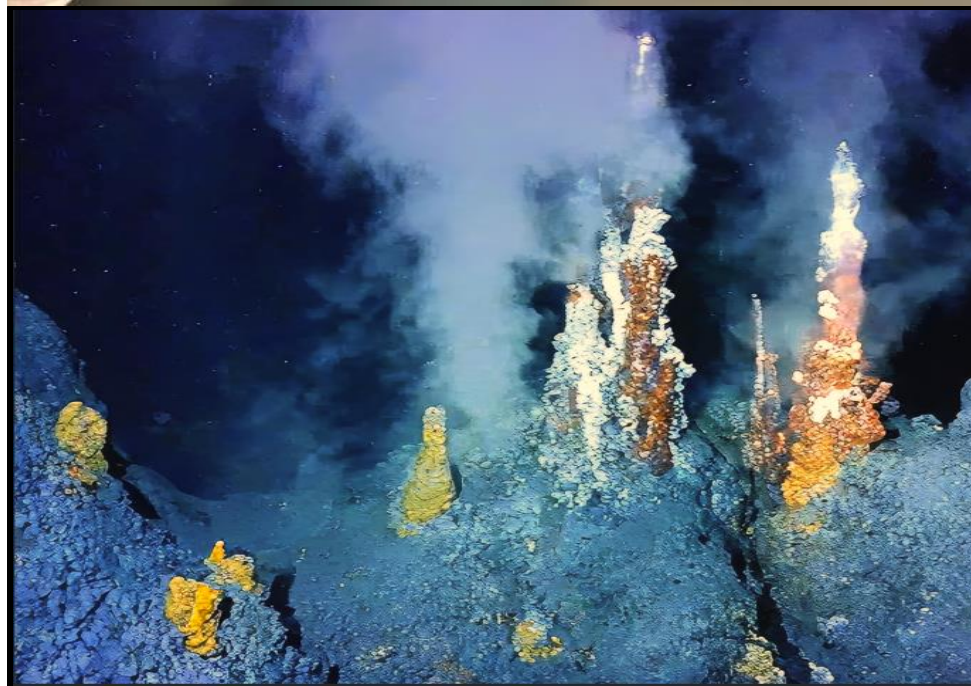
India is the **2nd largest** aquaculture producer globally, with aquaculture contributing over 75% of national fish production

Real time pics@ Elroy Joe Pereira

Deep Sea Resources

- **Origin**: Deep sea mining began during *Challenger* expedition in 1873.
- **Common source** of petroleum, natural gas and gas hydrates
- **Major Deep-Sea Mineral Types**: Polymetallic nodules, cobalt-rich Fe–Mn crusts, polymetallic sulphides, marine mud rich in rare earth elements (REEs), and marine phosphorites (deposits from the ocean *below 200m*).
- **Seafloor hydrothermal activity** promotes sulphide deposition

They are essential for manufacturing batteries, renewable energy systems and electric vehicles



Maritime Transport

80–90% of global trade by volume moves by sea

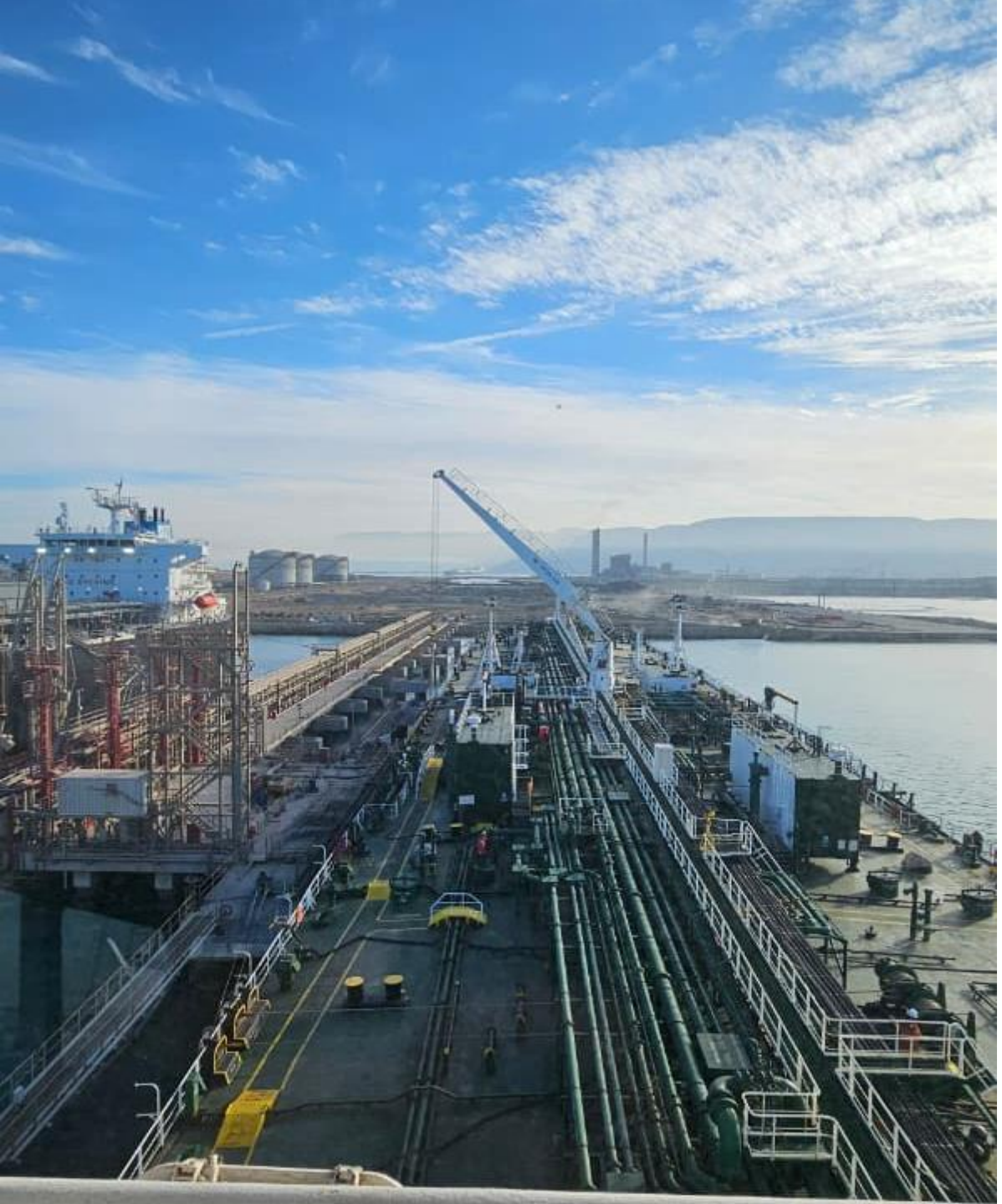
Vital enabler of coastal employment and economic integration

Contributes roughly ~3% of global CO_2 emissions

India operates the 5th largest shipping fleet in Asia and handles ~1.2 billion tonnes of cargo annually

Maritime transport remains one of the most cost-effective modes of moving goods globally, offering the lowest cost per tonne-kilometre compared to road, rail, or air.

Real time pics@ Elroy Joe Pereira



Ports

Critical nodes linking maritime transport with inland logistics and trade

Support jobs, regional development, and investment in infrastructure

Classifications of ports

by Function	*by* cargo type	*by* Governance
Seaports River ports Dry ports Fishing Passenger Industrial	Container ports Bulk/liquid ports LNG/Oil Terminals	Major ports (GoI) Minor ports (states) Private ports

India has 12 major and 200+ minor/ intermediate ports

Real time pics@ Elroy Joe Pereira

Key Initiatives & Achievements of India's Maritime Sector

Record Cargo Handling: Major & Non-Major Ports handled 1540.34 MMT cargo in 2023-24, demonstrating robust growth.

Port Infrastructure Expansion: Significant progress on new projects like the Mega Transshipment Port at Great Nicobar Island and the Vadhavan Major Port.

Digital Transformation: Successful implementation of National Logistics Portal-Marine (Sagar Setu) for enhanced efficiency.

Green Port Initiatives: Launch of "Harit Sagar" guidelines and development of Green Hydrogen Hubs at major ports.

Boosting Seafarer Employment: Remarkable 263% increase in employed Indian seafarers since 2014-15.

Global Standing: 9 Indian ports ranked in the Global Top 100 of the Container Port Performance Index 2023.

International Connectivity: Operationalization and effective management of Chabahar and Sittwe Ports.

Marine Renewable Energy (MRE)

Wave Energy
Captures energy from ocean surface waves

Ocean Thermal Energy Conversion (OTEC)
Generates power from ocean temperature differences

Salinity Gradient Energy
Energy harnessed from salt concentration differences

Tidal Energy
Electricity generated from tidal movements

Offshore Wind Energy
Wind turbines installed in ocean environments

Major Types of Marine Renewable Energy (MRE)

Marine Renewable Energy (MRE) refers to energy that is harnessed from the ocean and other bodies of water using renewable sources

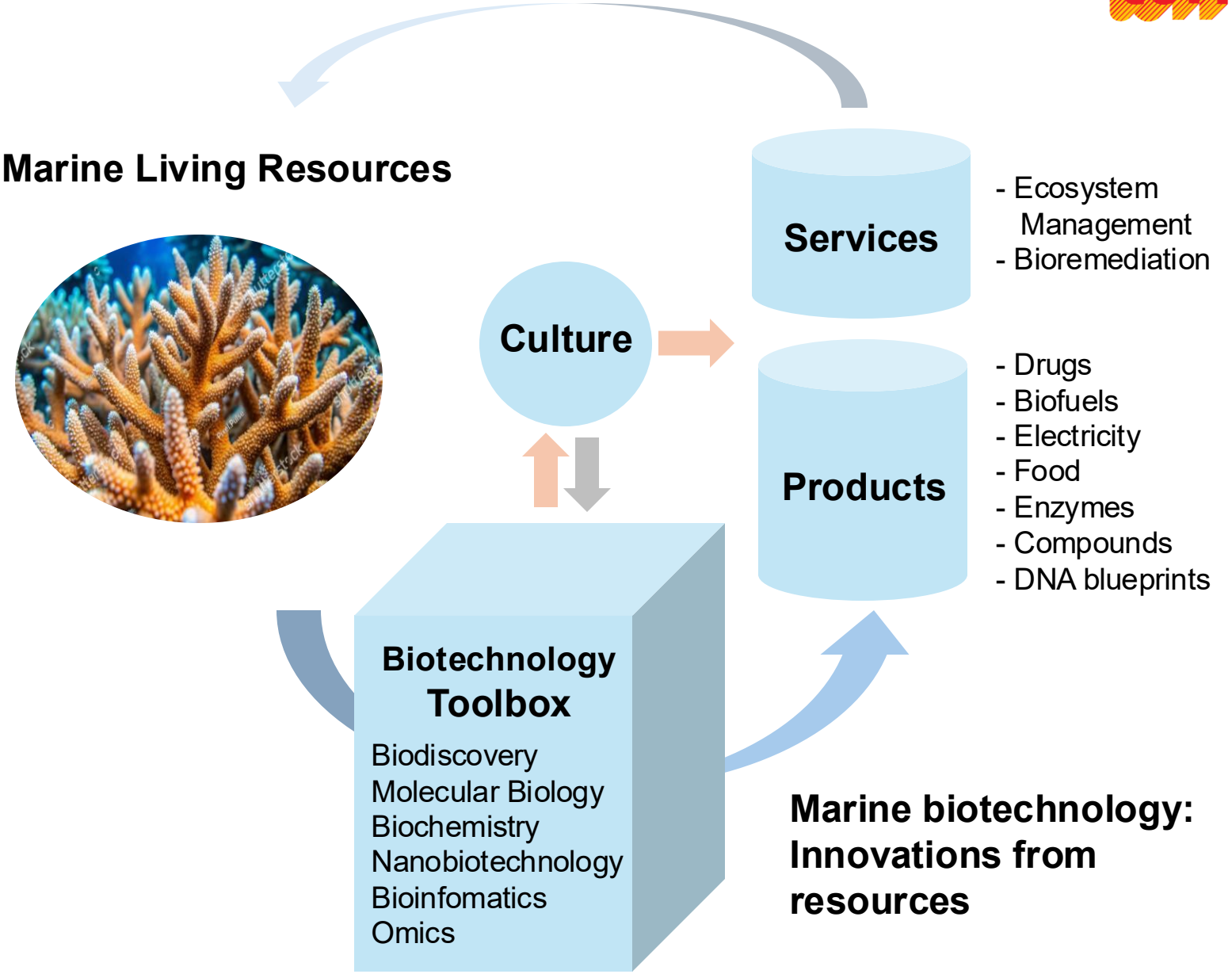
Harnessing MRE in India's Blue Economy

- **Extensive Coastal Potential:** India's 7,500 km coastline offers vast opportunities for marine renewable energy development.
- **Offshore Wind Energy:** Tamil Nadu and Gujarat lead offshore wind energy projects targeting 30 GW capacity by 2030.
- **Tidal and Wave Energy:** Pilot projects like IIT Madras's wave energy generator demonstrate tidal and wave power potential.
- **Innovative Floating Solar:** Floating solar farms in Kerala and Lakshadweep integrate solar power in marine environments.
- **OTEC: World's First OTEC-Powered Desalination Plant** at Kavaratti, Lakshadweep Islands, developed by NIOT under the Ministry of Earth Sciences, generates ~65 kW from ocean thermal energy to run a low-temperature desalination system producing 100,000 liters/day of potable water, **marking the first global integration of green energy and desalination using indigenous technology.**

Marine Biotechnology

Marine biotechnology is the application of science and technology to living organisms from marine resources, as well as parts, products or models thereof, for the production of knowledge, goods and services.

It explores the vast diversity of marine organisms to develop innovative products and solutions across food, pharmaceuticals, cosmetics, and bioenergy.



Marine Bioresources: Applications and Key Compounds

Bacteria & Fungi

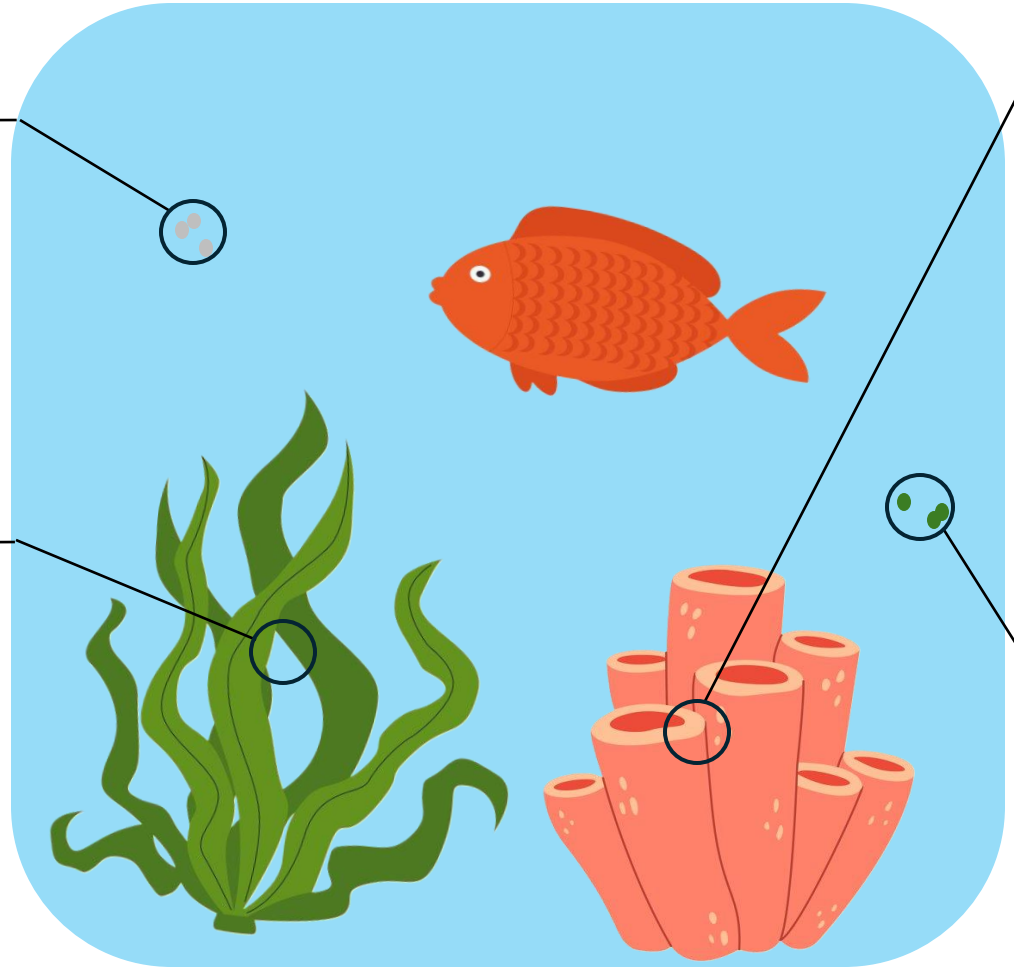
Medicine, cosmetics, biofertilizers, biomaterials, bioremediation

Ex: Taq polymerase (enzyme used in PCR)

Macroalgae and seagrasses

Food, feed, medicine, cosmetics, nutraceuticals, biofertilizers, biomaterials,

Ex: Carrageenan (thickening agent in food)
Alginates (binding agent in pharmaceuticals)
Agar (food and microbiology)
Laminarin (cosmetics)



Metazoans

like sponges, cnidarians, gastropods and tunicates

Medicine, cosmetics

Ex: Omega-3 (nutraceuticals) , Green Fluorescent Protein (molecular diagnostics)

Microalgae

Sustainable energy, cosmetics, food, feed, biofertilizers, bioremediation

Ex: Dermochlorella DG®, Alguronic Acid® (cosmetics)

The marine biotechnology market is projected to reach approximately **₹1.14 lakh crore** by **2034!**

Coastal and Maritime Tourism

Encompasses recreational activities, services, and experiences centered around coastal and marine environments, including beach tourism, cruises, water sports, diving, marine wildlife viewing, and maritime cultural heritage.

In 2023, this sector contributed **₹133 lakh crore** to the global GDP and supported **52 million jobs**

The sector's significance is underscored by its role in generating almost **₹73 lakh crore** in direct tax revenue

Real time pics@ Elroy Joe Pereira

Trends and Drivers for Coastal & Maritime Tourism

Sustainable Tourism

- Travelers increasingly consider **environmental factors** when choosing destinations.
- Businesses are adopting **eco-certifications** and **sustainable practices**.

Digitalization

- Use of online booking platforms and mobile apps.
- Helps businesses improve operations, customer experience, and market competitiveness.

Climate Change

- Rising **temperatures, sea levels**, and **extreme weather events** threaten beaches.
- Impacts include erosion, damaged amenities, reduced water quality, and decreased visitor safety.

Real time pics@ Elroy Joe Pereira

Module 3: Global Policy on Blue Economy

- UN Sustainable Development Goal 14
- Recent Initiatives of the Government of India on Blue Economy
  - Case Study in Coastal & Marine Tourism

SDG 14: Conserving and Sustainably Using Oceans

SDG 14 or **Goal 14** is one of the 17 SDGs established by the UN in 2015

Focuses on **life below water** and deals with the conservation of the marine environment which includes the seagrass beds, mangroves and the coral reefs

Consists of **10 Targets** and **10 indicators**

Core Goal of SDG 14: Conserving and sustainably using oceans and marine resources worldwide

Targets: focuses on lowering pollution to protect marine ecosystems and sustain ocean health

Supports: Oceans are critical to Global Food Security, currently supporting over three billion people through food and economic benefits

India's Blue Economy Efforts: Include sustainable fisheries, clean energy, and marine spatial planning initiatives

SDG 14 Outcome Targets

Themes

Pollution related targets

Fishing related targets

Protection related targets

TARGET	DESCRIPTION	NATIONAL INDICATORS
14.1	Reduce marine pollution (plastics, nutrients)	14.1.1: Coastal Water Quality Index 14.1.2: Percentage use of nitrogenous fertilizer to total fertilizer (N, P & K)
14.2	Sustainably manage and protect marine ecosystems	14.2.1: Number of CZMP (Coastal Zone Management Plan (for 11 coastal State/UT's)
14.3	Minimize and address ocean acidification	14.3.1: Average marine acidity (pH) measured at site of representative sampling stations
14.4	End overfishing and regulate fishing practices	14.4.1: Maximum Sustainable Yield (MSY) in fishing (in Million Tonne/Year)
14.5	Conserve at least 10% of coastal and marine areas	14.5.1: Percentage of coastal marine protected areas in relation to Territorial Seas 14.5.2: Percentage change in area under mangroves
14.6	Eliminate harmful fisheries subsidies	*National Indicator is under development*
14.7	Increase benefits to developing countries from the sustainable use of marine resources	*National Indicator is under development*

SDG 14 Implementation Targets

Themes

Fishing related targets

TARGET	DESCRIPTION	NATIONAL INDICATORS
14.A	Enhance scientific knowledge for ocean health	14.a.1: Allocation of budget resources (Budget Estimates) for Ocean Services, Modelling, Applications, Resources and Technology (OSMART) scheme
14.B	Support small-scale artisanal fishers	14.b.1: Assistance to the traditional/artisanal fishers for procurement of FRP boats and other associated fishing implements
14.C	Implement international law for ocean governance	14.c.1: Compliance of international laws

Outcome targets (14.1-14.7) focus on the results or changes we want to achieve for oceans and marine ecosystems. These are *impact-oriented*—they describe what the world should look like when the goal is achieved

Implementation targets (14.a - 14.c) focus on how to achieve the outcome targets—the resources, partnerships, and actions needed. These are *process-oriented*, describe the tools and mechanisms to make the outcomes possible.

Fostering Sustainable Blue Economy in India

₹5.79 lakh crore

Sagarmala Programme

Flagship initiative of the Ministry of Ports, Shipping and Waterways focused on port-led development to enhance coastal infrastructure and logistics.

Central investment of around **₹1,000 crore** during Phase 1 (2024 – 2027)

Green Tug Transition Program (GTTP)

Focused on phasing out diesel-powered harbour tugs across major Indian ports with zero-emission “green” tugs, aligning with global maritime decarbonization goals.

Blue Economy 2.0

A framework introduced in the Interim Budget 2024–25, that emphasizes "Coastal ecosystem restoration and climate adaptation" and "Expansion of coastal aquaculture and mariculture"

India’s Key Maritime Development Initiatives

Blue Revolution

Supports seaweed farming and mariculture as part of India's focus on marine living resources

₹3,000 crore

Swadesh Darshan Scheme

Focused on coastal tourism and developing coastal Circuits

₹1,200 Crore

(2014—2024)

₹20,050 crore investment in fisheries and aquaculture (2020-2025)

PM Matsya Sampada Yojana (PMMSY)

PMMSY, India’s flagship "*Blue Revolution*" initiative focused on enhancing sustainable fisheries and aquaculture and supporting small-scale fishers

Investment Target: **₹35,000 crore**

Maritime Amrit Kaal (MAK) Vision 2047

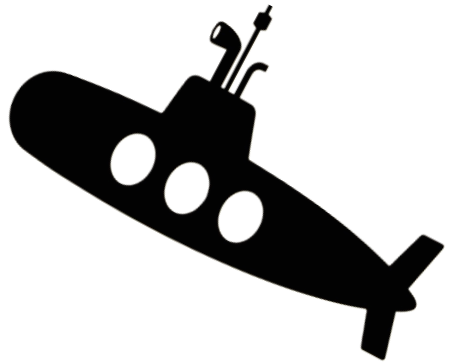
A roadmap for transforming India into a global maritime hub through green ports, digitalisation, blue economy expansion, and coastal resilience

India's Deep Sea Mission (DOM)

Samudrayaan Project- first component of deep-sea exploration through a manned submersible technology.

MATSYA 6000, a self-propelled Human Occupied Vehicle (HOV)

- Capable of transporting to depths of up to 6,000 meters beneath the ocean surface
- developed through a collaboration between National Institute of Ocean Technology (NIOT), MoES and ISRO.



The Deep Ocean Observing System (DOOS) is a network of advanced technologies and instruments designed to monitor and collect data from the deep ocean

PM's 'Samudra Manthan' vision: By exploring the ocean's depths, India is unlocking vital resources and advancing as a leader in deep-sea technology

Goa – A Case Study in Coastal & Marine Tourism

8-10 lakh tourists monthly depending on the season

↓

- Tourism contributes about **16.43%** to the State GDP
- Provides **40- 45%** of direct and indirect employment

↓

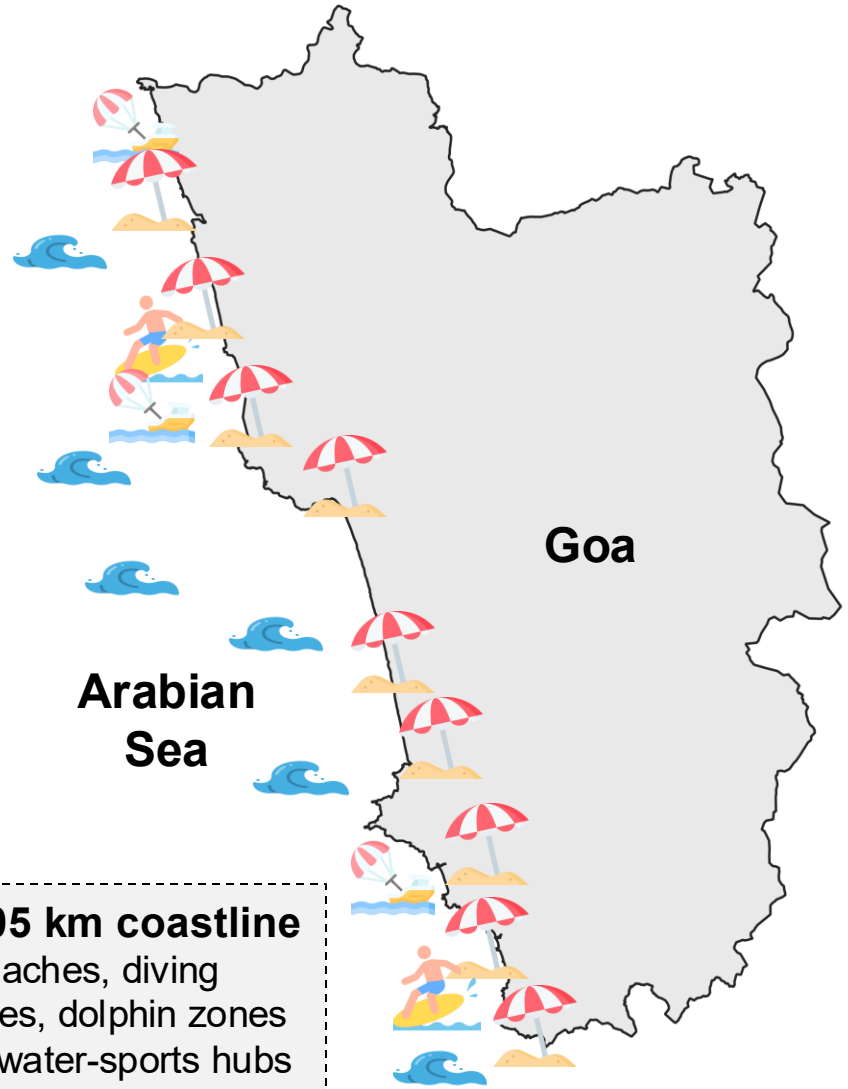
Key Challenges

- Pressure on fragile beach ecosystems
- Overcrowding & seasonal tourism peaks
- Marine pollution & waste

→

Sustainability Initiatives

- Carrying-capacity guidelines
- Community-led beach clean-ups
- Focus on eco-tourism and regenerative tourism



105 km coastline
beaches, diving sites, dolphin zones & water-sports hubs

© Elroy Joe Pereira

Module 4: Innovations and Pathways

- Monitoring and Measurement Tools
- Value Addition from Fish & Aquaculture Discards
- Value Addition from Salt
- New Pathways of Blue Economy
  - Nature-based Solutions
  - Pathways to Credit
  - Roadmap to Carbon Project
  - Sustainable Aquaculture Models
  - New Pathways to be Explored & Implemented

Cost-effective Monitoring Tools

In-situ sensors
High-throughput multi-probe systems that enable real time monitoring of physical, inorganic and greenhouse gases (like CO_2) in marine ecosystems. Such tool saves times from lab analysis, nondestructive, less expensive, and mostly accurate.

Remote Sensing
Unmanned aerial vehicle (like drone) and satellite imagery detects oil spills, litter dump on beach and offshore (marine pollution), coastal vegetation mapping (conservation), carbon mapping of above ground biomass.

Environmental DNA (eDNA)
Also known as metagenomics, this is a biomonitoring tool that detects and characterizes fauna and flora in ocean, a key tool in fisheries management, and biodiversity assessment in nature-based solutions

Measurement Tools

Multiprobe for in-situ water parameter monitoring

Aquatic Eddy covariance technique for CO_2 exchange at large spatial scale

Dynamic Chamber Method for GHG measurement at discrete location

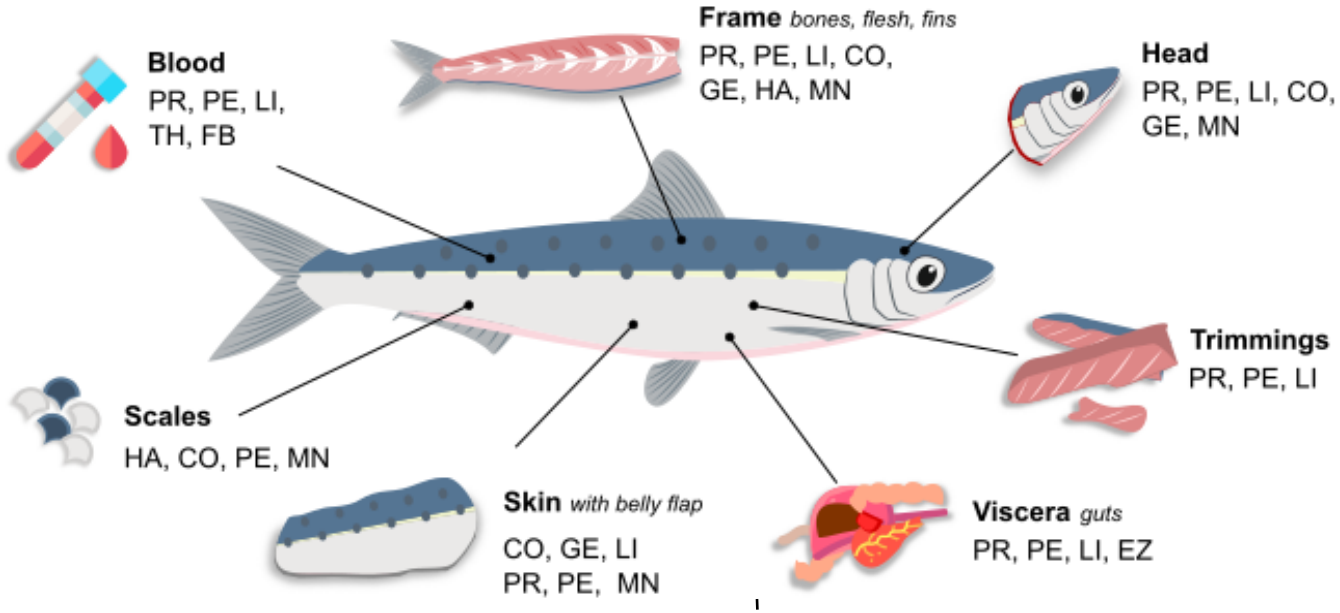
Digital soil core: In-situ soil carbon and physical features without coring

Robotic: Autonomous Underwater Vehicles (AUVs) also use AI for navigation and data collection

Real time pics@ Raghab Ray

Value Addition from Fish & Aquaculture Discards

Bioproducts from fish and aquaculture discards



Key:
PR proteins
PE peptides
LI lipids
CO collagen
GE gelatine
MN minerals
EZ enzymes
HA hydroxyapatite
TH thrombin
FB fibrin

© Elroy Joe Pereira

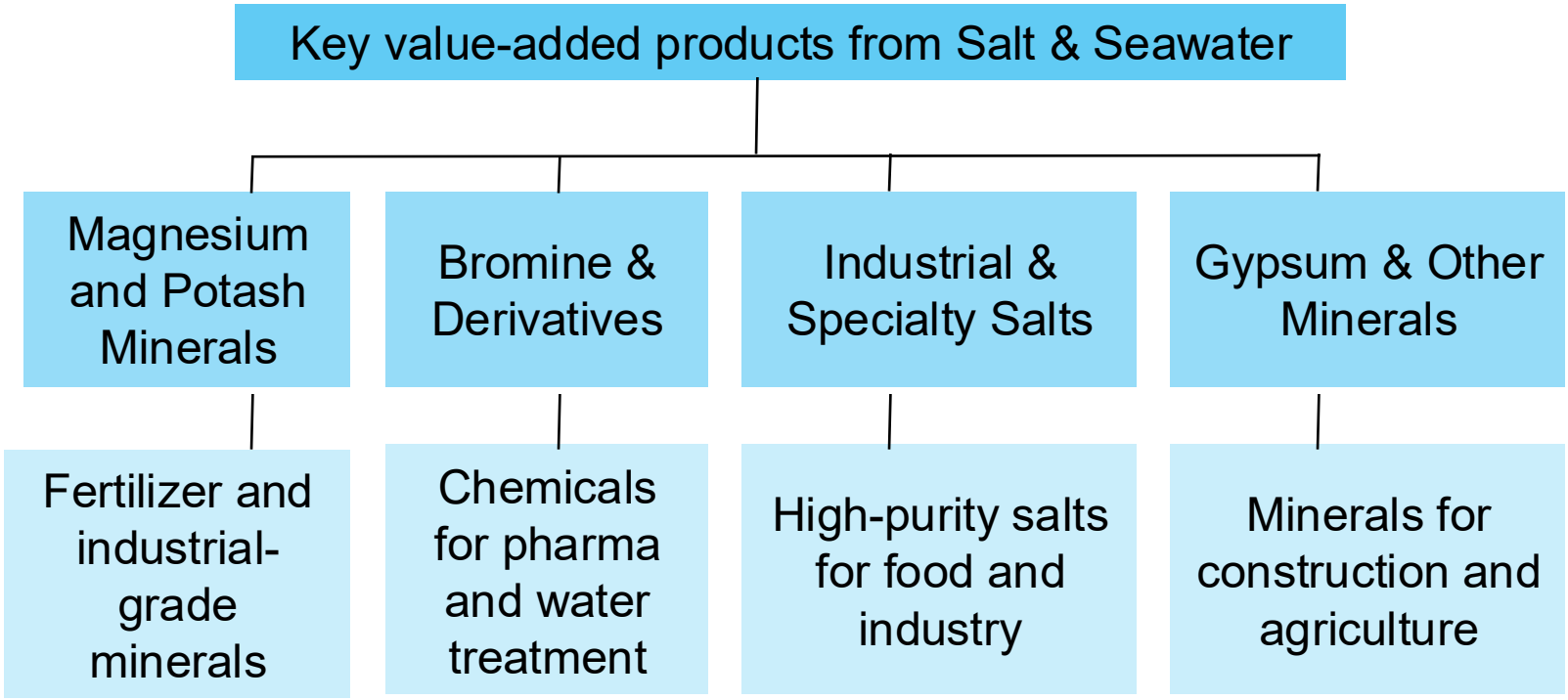
Applications of bioproducts from fish and aquaculture discards

Agriculture	Energy	Nutraceutical	Pharmaceutical	Medical	Industry
Fertiliser Compost	Biodiesel Biogas	Oil Vitamins	Omega-3 Calcium	Cartilage Collagen	Proteases Lipases

Value Addition from Salt

Salt is a resource that supports the food and renewable energy sectors.

Through improved extraction and zero-waste processing, seawater and brine can be converted into high-value marine chemicals.



India is the **3rd largest salt producer in the world**, accounting for **~28** million tonnes per year

Gujarat alone produces **over 70% of India's salt**

New Pathways of Blue Economy

Nature-based Solution (NBS)

Mechanism of protecting and sustainably managing nature that can provide 30% of the climate solution to limit global temp below 2°C by 2030

Pathways for marine systems

Conservation and Restoration of blue carbon ecosystems is a cost-effective, nutrient efficient NBS pathways that offer 14% of total emission reduction

Pathways to credit

1 credit = 1 ton CO_2 as tradable carbon

- Carbon sequestration by planting mangroves
- Avoid CO_2 emission by conserving eroded mangrove

Real time pics@ Raghab Ray

Roadmap to Carbon Project

- Start by identifying a degraded mangroves
- Clarity over Land use and ownership
- Carbon monitoring at the ground and remote sensing
- Project intervention through plantation
- Estimate Carbon added/stored during project intervention and claim credit after 5-years

Degraded mangroves

Planted mangroves

Real time pics@ Raghab Ray

Sustainable Aquaculture Models

Integrated Multi-Trophic Aquaculture (IMTA)

- Cultivates **fish, shellfish,** and **seaweed together**, mimicking natural ecosystems.
- Waste from one species becomes input for another → **low waste** & **high efficiency**.
- Supports nutrient recycling and reduces environmental impact.

Low-Trophic Aquaculture

- Farming **seaweed, mussels, oysters**—species requiring no feed or freshwater.
- Generates low-carbon protein, improves water quality, and creates blue carbon value.

Climate-Resilient Aquaculture

- Selective breeding for **temperature** and **salinity tolerance**.
- Use of renewable energy in hatcheries and farms.
- Adaptation strategies for climate-impacted coastal farmers.

Community-Based Aquaculture (CBA)

- Inclusive, small-scale aquaculture supporting **coastal livelihoods**, women's groups, and SHGs.
- Focus on local value chains and co-management.

New Pathways to be Explored & Implemented

Blue Finance Innovations

- **Tools**: Blue bonds & debt-for-nature swaps fund marine projects.
- Impact: Belize $364M debt-for-nature swap → $4M/year for reef protection.

Policy-Driven Transitions

- **Tech Integration**: Green & digital tech for multi-use ocean spaces.
- **Climate Action**: EU targets: 40% renewable ocean energy by 2030.
- **Social Equity**: Policies foster collaboration & socio-economic inclusion.

Module 5: Challenges & Impacts

- Overfishing and IUU Fishing
- Plastic Pollution and Blue Economy
  - National and Global Status
- Marine Pollution
  - Impact of Marine Pollution on the Economy
- Ocean Acidification and Biodiversity Loss
- Sea Level Rise (SLR)
- Harmful Algal Blooms

Overfishing and IUU Fishing

- **Impact**: Overexploitation of fish stocks threatens marine biodiversity and food security.
- **Risks**: IUU (Illegal, Unreported, and Unregulated) fishing undermines sustainable management.
- **Tools to combat**: Need for satellite monitoring, catch documentation, traceability, and stronger enforcement.

Overfishing is catching fish faster than they can naturally reproduce, causing stock decline and ecosystem imbalance.

Real time pics@ Elroy Joe Pereira

Plastic Pollution and Blue Economy

Sources

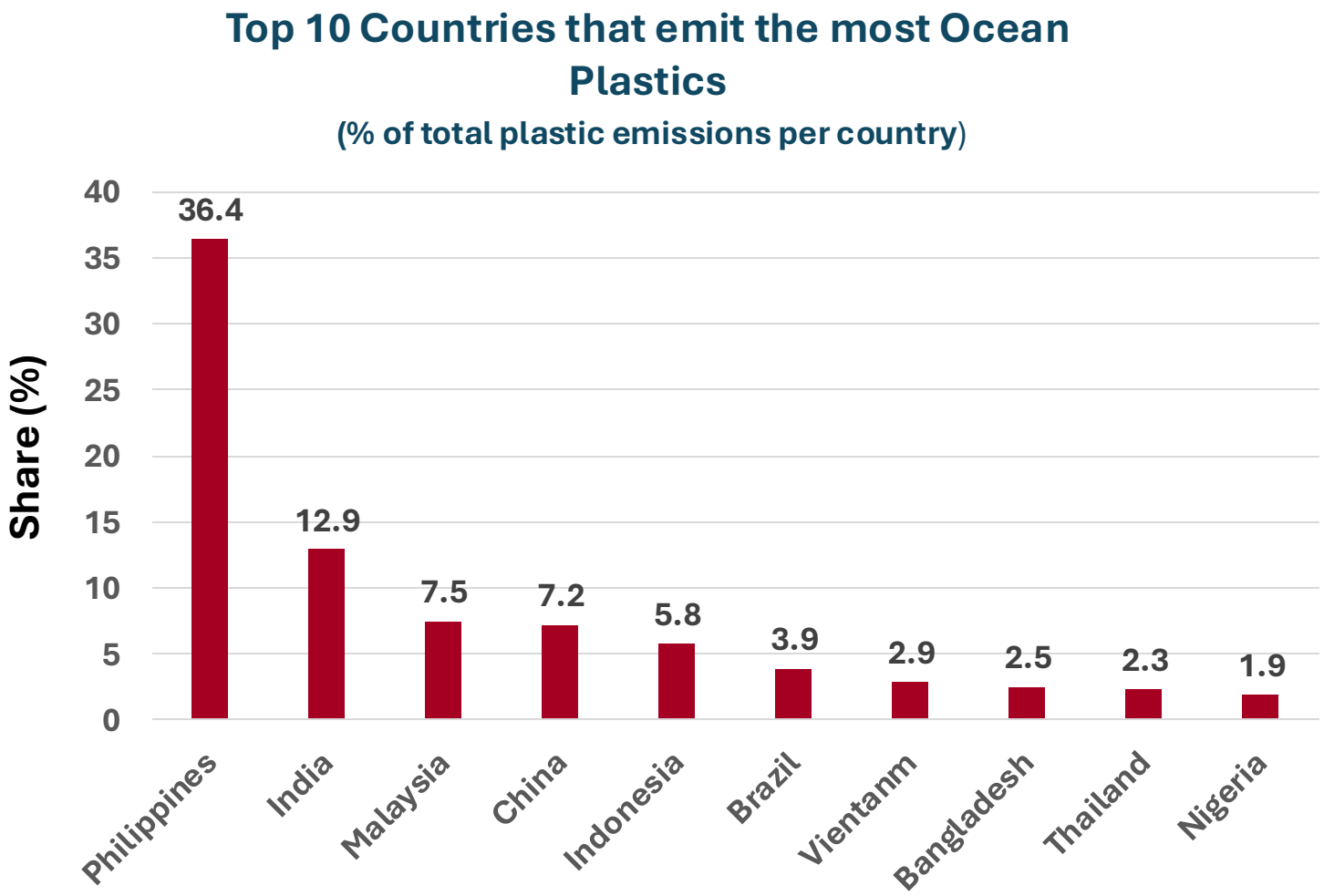
- **Land-based** – surface run off, waste disposal, tourism
- **Ocean-based** - abandoned fishing gears
- **Oil & Gas Platforms** – Poor waste management onboard
- **Sea storm events** – driven plastic fragment move to sea

Impact

- **Losses in fisheries** - plastics suffocate fish health
- **Marine Shipping Damage** – debris clogs cooling system
- **Increased clean-up cost** – Govt spends on beach trash cleanup
- **Water management burden**- rising operational and infrastructure expenses.

Casual plastic disposal at the impacted mangrove estuary in Goa

National and Global Status



- Estimated **75-199 million tons** of plastic dumped in oceans by 2025
- Roughly **14 million tons** of plastic annually enter the ocean
- **Over 80%** of plastic in the oceans is
- sourced from Asia

India's Plastic Waste Challenges

- Annual plastic generation: 9.3 million tonnes, 3.5 million tonnes mismanaged.
- Waste management: 60% recycled, 40% unaccounted.
- Government initiatives: Beach clean-up drives, awareness programs, marine litter monitoring.

Source - https://www.plasticsforchange.org/blog/india-emerges-as-the-worlds-largest-plastic-polluter-what-went-wrong-and-whats-next
https://www.downtoearth.org.in/pollution/plastic-waste-woes-a-primer-on-india-s-marine-litter-problem-87059
https://www.reusethisbag.com/articles/countries-that-pollute-most-ocean-plastics

Impact of Marine Pollution on Economy

Losses in Fisheries: Ruins fishing gear, contaminates catches, and impairs fish populations

Ecosystem Balance: Severely impacted across trophic level, lowering water quality and soil health

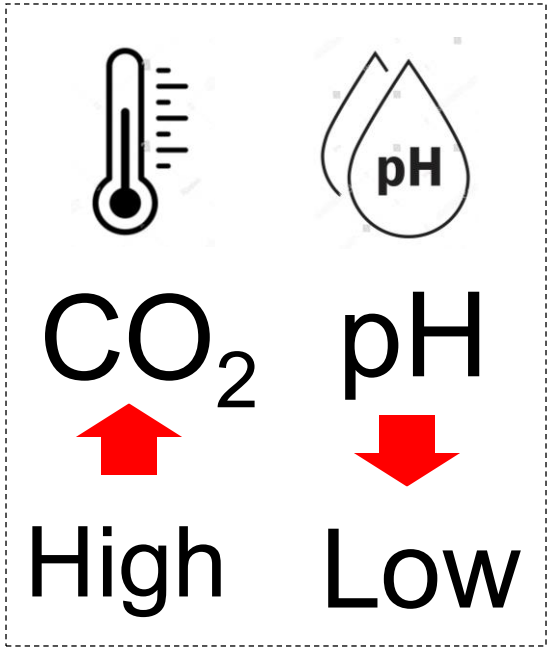
Tourism and Recreation: Polluted beaches and seas hinder coastal hospitality and recreation economics.

Increased Cleanup Costs: Governments and towns spend a lot on shoreline, port, and waterway marine trash cleanup.

Marine Industry and Shipping Damage: Debris damages ships, clogs cooling systems, and endangers navigation, raising maintenance and insurance costs.

Ocean Acidification and Biodiversity Loss

Coral growth under optimum pH and Salinity



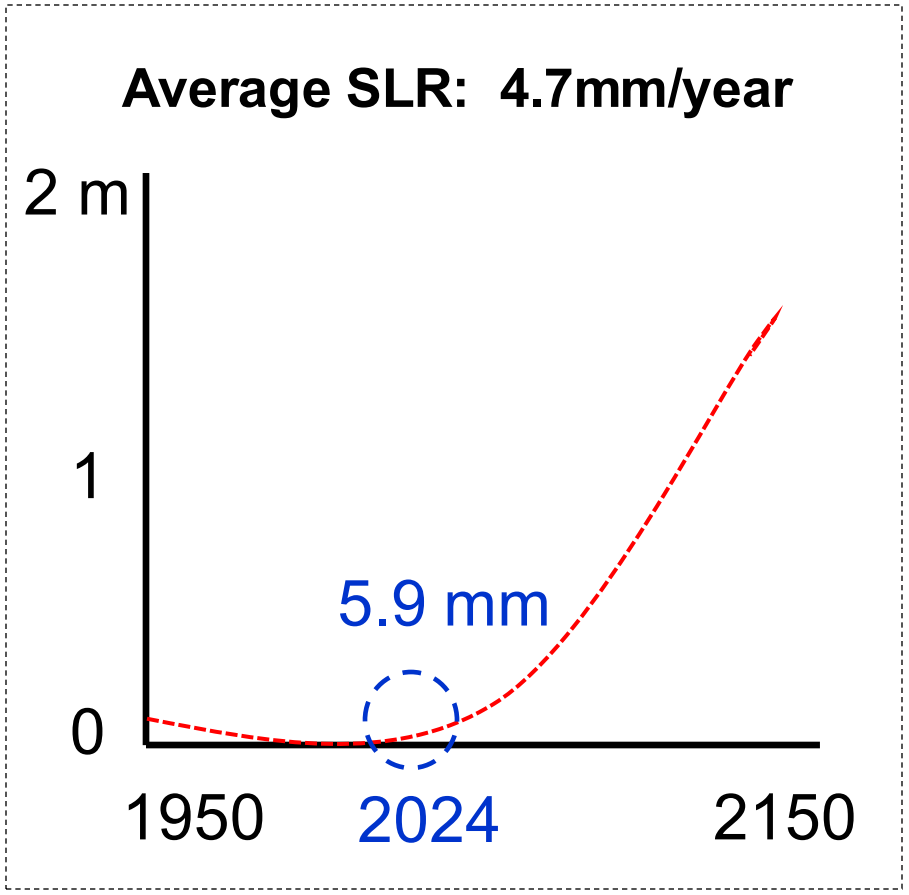
The formation of skeletons in marine organisms is highly sensitive to changes in acidity. Hydrogen ions often bond with carbonate (CO_3^{2-}), an essential component of calcium carbonate ($CaCO_3$) shells. To form calcium carbonate, shell-building marine animals such as corals and oysters combine calcium ions (Ca^{2+}) with carbonate ions (CO_3^{2-}) from seawater, releasing CO_2 and H_2O.

Air CO2
Safe level (1988): **350 ppm**
Now (2025): **428 ppm**
Time to act for our planet

Excess CO_2 uptake by the ocean lowers pH and CO_3^{2-} , leading to loss in calcifying organisms

Marine CO_2 removal pathway such as iron fertilization, ocean alkalinity enhancement

Sea Level Rise (SLR)



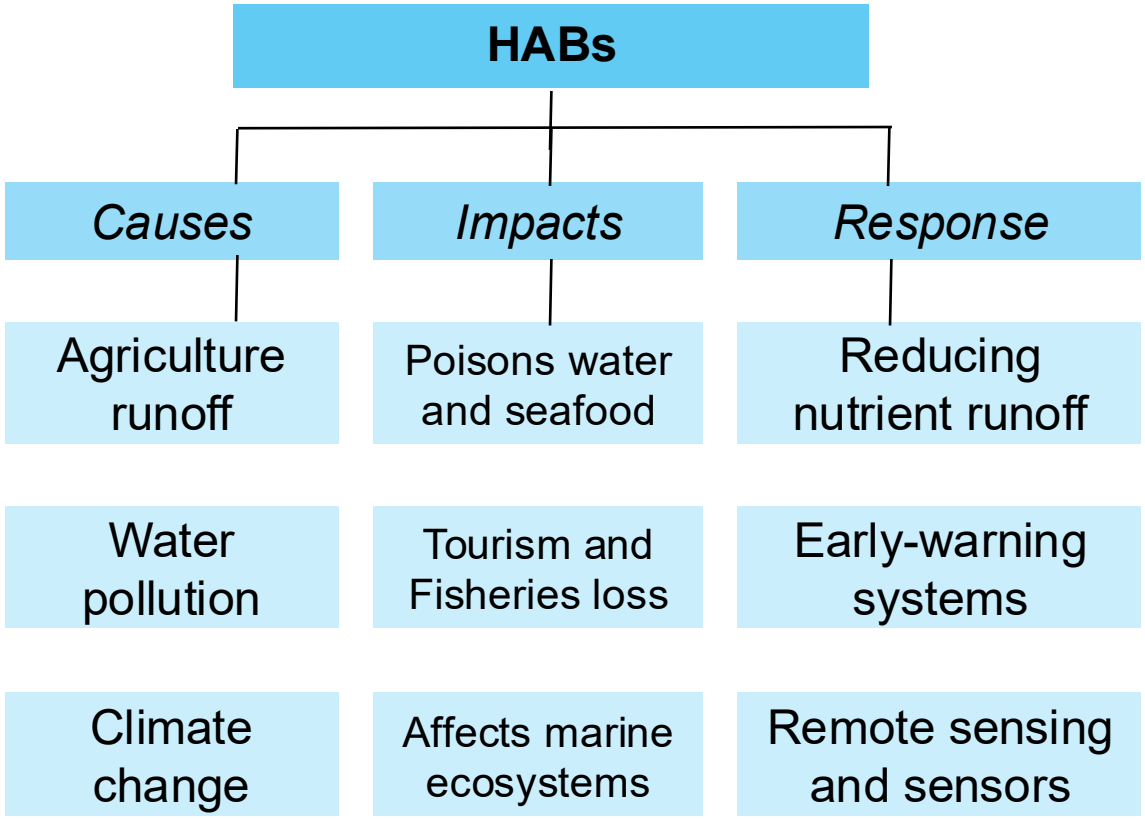
2m of SLR projected by the end of 2100 under high emission warming scenario

Decision making through actionable knowledge by science- policy-climate resilient coastal communities

One billion people will be impacted by the end of the century

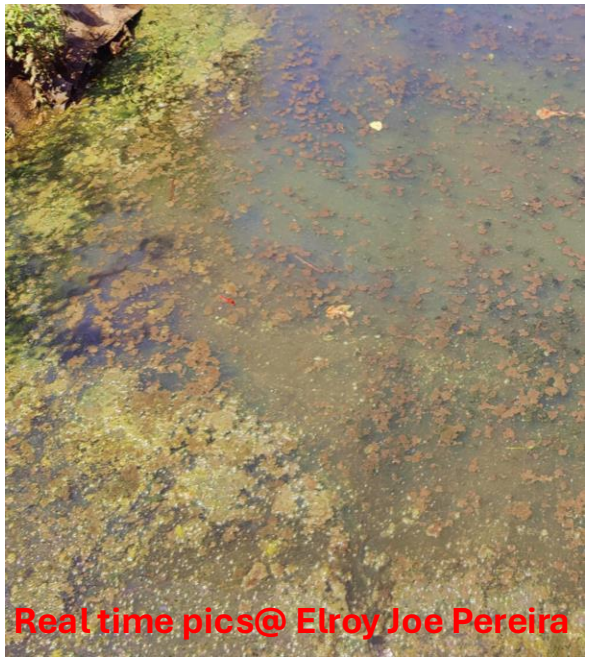
Estimated losses over **$1 trillion** by century's end due to SLR impact on coastal cities

Harmful Algal Blooms (HABs)



HABs can deplete oxygen in the water, creating "*dead zones*" where marine life cannot survive

- Excessive algae growth that causes negative impacts to other organisms.
- Occur naturally but are often intensified by **human-driven nutrient pollution**.
- **Eutrophication** caused by agriculture, wastewater, and urban runoff is a major trigger.



Visible signs of eutrophication in nearshore waters

Module 6: Current Prospects

- Career Opportunities
- Community, Citizen Science, Marine Awareness

Career Opportunities

The Blue Economy is expanding rapidly, creating new opportunities in marine research, biotechnology, fisheries science, coastal planning, and ocean data. These careers allow young professionals to contribute to innovation, resource management, and the future of ocean industries.

Marine Research & Biotechnology
Marine ecologist, biotechnologist, oceanographer

Coastal & Marine Tourism
Sustainable tourism planner, heritage site manager, marine recreation operator.

Policy, Governance & Conservation
Marine policy analyst, GIS and data specialist, NGO or UN project officer.

Sustainable Fisheries & Aquaculture
Fisheries scientist, aquaculture manager, feed technologist

Career Opportunities

Across operational, engineering, and climate-focused pathways, Blue Economy careers also span high-demand and high-risk roles. As ocean sectors evolve, skilled professionals are needed to drive safety, resilience, and nature-based climate solutions such as NbS, ARR, and REDD+ initiatives.

Nature-based Solutions (NbS)
Careers in

- Ecosystem restoration
- Blue carbon projects Designing and implementing **ARR (Afforestation, Reforestation, and Restoration)** and **REDD+ initiatives**
- Carbon accounting
- Managing coastal ecosystems

Maritime Transport & Logistics
Port operations, Ship engineer and maritime lawyer

Hazardous and High-Risk Roles
Deep-sea fishers, Diving operations, Ship crew & merchant navy personnel, Marine research expeditions

Rough seas, heavy gear, long working hours, isolation, and risks from accidents and extreme environments make these some of the most hazardous jobs on the planet!





Community Citizen Science Marine Awareness

Coastal regions face mounting pressures from climate change, urbanization, and industrial activities. With India among the top global sources of marine litter, restoring ocean health requires more than policy—it demands community participation and awareness. By fostering local stewardship, citizen-led monitoring, and ocean literacy initiatives, we can bridge science, society, and sustainability for a resilient Blue Economy.

Clean-up drives, education campaigns, & citizen programs like *Mangrove Mitras* and *MLOM*

Real time pics@ Elroy Joe Pereira

Glossary

Acidification — Reduction in the pH (i.e. increase in acidity) of ocean waters over an extended period of time, caused primarily by the uptake of carbon dioxide (CO_2) from the atmosphere.

Blue Carbon — Carbon captured and stored by coastal and marine ecosystems such as mangroves, seagrasses, and salt marshes, contributing to climate mitigation.

Eutrophication — Excessive enrichment of water bodies with nutrients—mainly nitrogen and phosphorus—leading to algal blooms, oxygen depletion, and ecosystem degradation.

Harmful Algal Blooms (HABs) — Rapid algal growth that produces toxins or depletes oxygen, causing fish kills, shellfish contamination, and ecological and economic damage.

IUU Fishing — Fishing activities that violate laws, bypass reporting requirements, or occur outside effective management frameworks, undermining sustainable fisheries.

Marine biodiversity — The variety and abundance of life in the ocean. It includes all animals, plants and microorganisms.

Marine Renewable Energy (MRE) — Energy that is harnessed from the ocean and other bodies of water using renewable sources.

Glossary

Marine Spatial Planning (MSP) — A public process of analyzing and allocating ocean space to balance ecological, economic, and social objectives.

Marine Protected Areas (MPAs) — Designated ocean zones where human activities are regulated to conserve biodiversity and ecosystem integrity.

Nature-based Solutions (NbS) — Actions that protect, restore, or sustainably manage ecosystems to address societal challenges such as climate change and disaster risk.

Overfishing — The uncontrolled catch of fish in a water course or sea area, destined to irreparably compromise its reproductive capacity.

Sea Level Rise (SLR) — Increase in global mean sea level caused by melting glaciers, ice sheets, and thermal expansion of seawater due to climate warming.

Sustainable Development Goals (SDGs) — The United Nations 2030 Agenda for Sustainable Development was adopted by Member States in 2015. This comprehensive plan includes 17 Sustainable Development Goals that encourage developed and developing countries to collaborate in a global partnership to take action on topics related to poverty, inequality, economic growth, and climate change.

References

- OECD. (2016). *The Ocean Economy in 2030*. OECD Publishing.
- FAO. (2022). *The State of World Fisheries and Aquaculture 2022: Towards Blue Transformation*. Food and Agriculture Organization of the United Nations.
- UNCTAD. (2021). *Review of Maritime Transport 2021*. United Nations Conference on Trade and Development.
- Ministry of Ports, Shipping and Waterways. *Annual Report 2024–25*. Government of India.
- OECD (2013), *Marine Biotechnology: Enabling Solutions for Ocean Productivity and Sustainability*, OECD Publishing.
- Government of India, Ministry of Commerce & Industry. (2023). Salt Commissioner's Organisation: Salt Industry Data.
- Department of Fisheries, Government of India. *Handbook on Fisheries Statistics 2022–23*.
- MPEDA. (2023). *Marine Products Export Development Authority — Export & Aquaculture Statistics*.
- CMFRI. (2023). *Annual Marine Fisheries Statistics and Assessment Reports*. Central Marine Fisheries Research Institute.
- Chauhan, A. K. (2023, January 11). Plastic waste woes: A primer on India's marine litter problem. Down To Earth. Retrieved from https://www.downtoearth.org.in/pollution/plastic-waste-woes-a-primer-on-india-s-marine-litter-problem-87059
- Lober, D. (2021, September 15). Ranking the countries that pollute the oceans with the most plastics. ReuseThisBag.com. Retrieved from https://www.reusethisbag.com/articles/countries-that-pollute-most-ocean-plastics
- Plastics For Change. (2025, February 20). India emerges as the world's largest plastic polluter: What went wrong and what's next? Plastics For Change. Retrieved from https://www.plasticsforchange.org/blog/india-emerges-as-the-worlds-largest-plastic-polluter-what-went-wrong-and-whats-next
- NITI Aayog. (2024, July 15). *SDG India Index 2023–24*. Government of India. Ministry of Statistics and Programme Implementation. (2025). *Sustainable Development Goals – National Indicator Framework, 2025*. Government of India.

References

- U.S. Department of Energy. (n.d.). *Marine energy basics*. Office of Energy Efficiency & Renewable Energy. Retrieved from https://www.energy.gov/eere/water/marine-energy-basics
- National Renewable Energy Laboratory. (n.d.). *Marine energy basics*. NREL. Retrieved from https://www.nrel.gov/research/marine-energy
- Stanford University. (n.d.). *Ocean energy*. Understand Energy. Retrieved from https://understand-energy.stanford.edu/energy-resources/renewable-energy/ocean-energy
- Chellappan, K. (2024, September 19). India's untapped ocean energy: A blueprint for powering the future. The Daily Pioneer. Retrieved from https://www.dailypioneer.com/2024/columnists/india---s-untapped-ocean-energy--a-blueprint-for-powering-the-future.html
- Koundouri, P., Akinsete, E., Alamanos, A., & Guittard, A. (2025, March 17). To save our ocean, we need a sustainable blue economy. Dialogue Earth. Retrieved from https://dialogue.earth/en/ocean/to-save-our-ocean-we-need-a-sustainable-blue-economy/ Asariparambil, N. S. J. (2025, October 23). India sets sail for Maritime Week 2025 as it eyes 'Blue Economy' future. The Week. Retrieved from https://www.theweek.in/news/maritime/2025/10/23/india-maritime-week-2025-blue-economy-future.html
- Sangomla, A. (2024, February 1). Union Budget 2024–25: New initiative to boost Blue Economy 2.0 announced. Down To Earth. Retrieved from https://www.downtoearth.org.in/climate-change/union-budget-2024-25-new-initiative-to-boost-blue-economy-2-0-announced-94212
- KPMG in India. (2025, July 17). Navigating India's blue economy landscape. Retrieved from https://kpmg.com/in/en/insights/2025/07/navigating-indias-blue-economy-landscape.html

References

- Blue Partnerships. (2025). Intervention Area: Transitioning Blue Economy Sectors. Retrieved from https://bluepartnership.eu/2025-intervention-area-transitioning-blue-economy-sectors
- Global Goals. (n.d.). Goal 14: Life Below Water. Retrieved from https://globalgoals.org/goals/14-life-below-water/
- International Finance Corporation. (2025, September 15). Guidelines for Blue Finance (Version 2.0). Retrieved from https://www.ifc.org/en/insights-reports/2025/guidelines-for-blue-finance
- Odisha Diary Bureau. (2025, October 14). PM GatiShakti – Offshore launched to strengthen integrated offshore planning and boost India's Blue Economy. Retrieved from https://orissadiary.com/pm-gatishakti-offshore-launched-to-strengthen-integrated-offshore-planning-and-boost-indias-blue-economy/
- United Nations. (n.d.). The Ocean. Retrieved from https://www.un.org/sustainabledevelopment/oceans/
- United Nations Environment Programme. (n.d.). Sustainable Blue Economy. Retrieved from https://www.unep.org/topics/ocean-seas-and-coasts/regional-seas-programme/sustainable-blue-economy
- World Bank. (2025, June 7). Accelerating Blue Finance: Instruments, case studies, and pathways to scale. Retrieved from https://www.worldbank.org/en/topic/environment/publication/accelerating-blue-finance-instruments-case-studies-and-pathways-to-scale




Thank You