Biodiversity Conservation Efforts in Coastal Ecosystem: A Legal Strategy

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Abstract- ***Coastal ecosystems are vital areas that support a wide variety of life and provide important services like climate regulation, fisheries, and shoreline protection. However, they face increasing threats from human activities such as uncontrolled coastal development, pollution, habitat loss, and climate change. This paper looks at the legal measures taken in India to conserve biodiversity in coastal ecosystems and evaluates how effective the laws and judicial actions are. It examines important laws such as the Environment (Protection) Act of 1986, the Coastal Regulation Zone (CRZ) Notifications, and the Biological Diversity Act of 2002 within the context of coastal governance. The study analyzes how the Indian judiciary has expanded environmental law, especially through public interest litigation and the use of precautionary and public trust principles, to see how it affects biodiversity protection. It also identifies gaps in enforcement, coordination among regulatory agencies, and community involvement. By combining legal analysis with perspectives on environmental policy, this research suggests a more unified, science-based, and participatory legal approach to enhance biodiversity conservation in coastal areas, ensuring long-term ecological health and socio-economic well-being.***

Indexed Terms- ***Coastal biodiversity, environmental law, CRZ Notification, Indian judiciary, public interest litigation, sustainable development, ecological governance, and biodiversity conservation strategy are all important topics.***

This paper aims to:

- ***Explore the legal and institutional framework that governs biodiversity in coastal ecosystems in India.***
- ***Look at how the judiciary protects coastal biodiversity through important case laws.***
- ***Discuss the challenges involved in conservation efforts and propose solutions.***
- ***By examining both the laws and court decisions, this paper highlights how legal tools and judicial creativity have influenced biodiversity conservation in India's coastal areas.***

I. INTRODUCTION

India has a vast coastline that stretches over 7,500 kilometers. It includes nine coastal states and two island territories. This long coastal area supports many different ecosystems, such as mangroves, coral reefs, estuaries, salt marshes, and lagoons. These ecosystems are crucial for keeping ecological balance and for the livelihoods of millions who rely on fisheries, agriculture, and tourism.

Coastal ecosystems offer many services, including shoreline stabilization, nutrient cycling, carbon storage, and nurseries for various marine species. However, despite their ecological value, coastal areas face growing pressure from rapid industrial growth, urban expansion, tourism development, and impacts from climate change, such as rising sea levels and coastal erosion.

India has signed several international environmental treaties and has developed a strong legal framework for protecting biodiversity. However, issues with governance, competing land-use priorities, and a lack of grassroots awareness often weaken the enforcement of these laws.

Marine biodiversity includes the wide range of life forms that exist in the world's oceans, covering ecosystems, species, and genetic diversity. Oceans make up about 70% of the Earth's surface and host millions of species, many of which are still unknown. Marine ecosystems, from the shallow coastal areas to

the deep ocean floors, provide many ecological, economic, and social benefits. Given the rising environmental challenges around the world, conserving marine biodiversity is a major focus for sustainable environmental management.

Marine biodiversity covers an extensive range of life forms, from tiny virioplankton to large marine mammals, all adapted to various habitats ranging from shallow seas to the deepest ocean trenches (Ormond et al., 1997). The total number of species in the ocean varies greatly depending on the methods and sources used for estimation. So far, around 300,000 marine species have been formally identified and described. It is thought that the oceans might host between 500,000 and 2 million species, with about 2,300 new species discovered each year. This rich diversity includes not just animals, plants, and fungi, but also protists and countless microorganisms like bacteria and archaea. Microbial diversity, in particular, is extremely high and hard to measure, likely representing the majority of species in marine ecosystems. These figures highlight how much marine biodiversity is still unexplored, especially in areas that lack research, such as the deep sea, Polar Regions, and remote coastal ecosystems. The challenge of discovering this hidden diversity is significant due to the size of ocean habitats and the difficulties involved in studying them.

Marine ecosystems provide a wide range of services. These include food supply, climate regulation, support through primary production and nutrient cycling, and cultural value. Marine biodiversity plays a key role in keeping ecosystems healthy and supporting important services like fisheries, tourism, and coastal protection. It helps ensure food security and provides livelihoods for millions. It also offers bioactive compounds that benefit medical and pharmaceutical fields. Phytoplankton, seaweeds, and sea grasses are vital for capturing carbon, which helps combat climate change (Beaugrand et al., 2010). Coastal habitats like coral reefs, mangroves, and seagrass meadows protect shorelines from erosion and storm surges. This reduces the effects of natural disasters and rising sea levels. Furthermore, marine biodiversity drives nutrient cycling, which is essential for the health of marine ecosystems (Duarte, 2000). It supports recreational activities such as diving and wildlife watching, which significantly contribute to tourism revenue. Additionally, the genetic diversity of marine organisms is important for adjusting to environmental changes and improving the resilience of aquaculture against diseases and changing conditions (Worm and Lotze, 2021).

Biodiversity is often measured by species richness, or the number of species in a particular area. However, biodiversity includes more than just counting species; it covers different levels of biological organization. These levels range from genetic diversity within populations to species diversity within communities and community diversity across landscapes and ecosystems. Within an ecosystem, we can understand biodiversity through three main parts: composition, structure, and function. These connected elements create a framework that includes four nested levels of biological organization, reaching from genes to Eco regions.

In this context, "Eco region" refers to large marine areas defined by their unique oceanographic and ecological features. This makes them important for planning and management. This classification method was first developed to monitor biodiversity in land systems. Cogan et al. (2009) later adapted it for marine environments. Their work showed how studies on marine biodiversity and habitat mapping could support Ecosystem-Based Management (EBM). This method has the potential to connect basic biodiversity science with real-world strategies for managing ocean spaces and resources.

Significance of marine biodiversity and environment in the context of SDGs

Marine biodiversity and healthy marine environments are essential for meeting the United Nations Sustainable Development Goals (SDGs). They directly support SDG 14, which focuses on life below water, by promoting sustainable ocean use. They also contribute to other goals, such as SDG 13 on climate action, by helping with carbon storage in ecosystems like mangroves and coral reefs. Marine biodiversity supports livelihoods and food security through SDGs 1 and 2. It also drives economic growth in sectors like fisheries, tourism, and biotechnology, linked to SDG 8, while maintaining clean water systems under SDG 6. Additionally, it boosts health related to SDG

3 and encourages sustainable consumption noted in SDG 12. The link between marine and terrestrial ecosystems, highlighted in SDG 15, shows the need for coordinated conservation efforts. Protecting marine biodiversity is crucial for building resilience, supporting human well-being, and achieving the 2030 Sustainable Development Agenda.

COASTAL REGULATION ZONE: A JOURNEY FROM 1991 TILL 2019

The Environment (Protection) Act, 1986, referred to as 'EPA' here, was created following the decision made at the United Nations Conference on the Human Environment in Stockholm in June 1972. There was an urgent need for general legislation to address environmental safety. Efforts to improve economic conditions have increased over time, impacting fragile ecosystems and threatening the lives and livelihoods of local people. The coastal ecosystem is also affected by these developments, putting marine life at risk. To meet the needs of a growing population, we must use resources found in coastal areas. Therefore, protecting those resources is essential. The Government of India, using the authority granted by the EPA and the Environment (Protection) Rules, 1986, referred to as 'Rules,' has issued notifications to manage the activities in and around coastal areas across India. Coastal zones must be regulated to prevent deterioration and provide legal protection for coasts and other water bodies under the Coastal Regulation Zone (CRZ).

COASTAL REGULATION ZONE NOTIFICATION OF 1991

The first Notification was issued in 1991. The Coastal Regulation Zone Notification, 1991 (hereafter 'Notification of 1991') was announced under the powers given by Section 3(1) and 3(2)(v) of the EPA and Rule 5[3] of the Rules. The Central Government placed certain restrictions on starting and expanding industries and on operating specific processes in certain locations. The Notification of 1991 applies to coastal areas such as seas, bays, estuaries, creeks, rivers, and backwaters affected by tides, stretching up to 500 meters from the High Tide Line (HTL) and the land between the Low Tide Line (LTL). It required State Governments and Union Territories to create a Coastal Zone Management Plan (CZMP) to identify and classify the Coastal Regulation Zone within their areas. The Notification of 1991 also gave powers to State Governments, Union Territories, and Local authorities to control development activities within the CRZ. It required approval from the Ministry of Environment and Forests, Government of India, for certain projects. These included construction activities related to defense needs, operational works for ports, harbors, and lighthouses, thermal power plants, and any projects with investments over five crores. The coastal areas under the notification were classified into four zones: CRZ-I, CRZ-II, CRZ-III, and CRZ-IV.

CRZ-I includes areas that are ecologically sensitive and significant. This category covers national parks, marine parks, sanctuaries, and other biologically sensitive areas, as well as those with heritage or historical importance. It also encompasses the space between the Low Tide Line (LTL) and High Tide Line (HTL). The regulation prohibits any construction within 500 meters of the High Tide Line but allows for certain constructions like treated effluent discharge systems, facilities for seawater cooling, oil and gas pipelines, and activities essential for infrastructure.

CRZ-II consists of developed areas that are near or along the shoreline. This category permits the construction and reconstruction of buildings in compliance with local laws. However, these buildings must match the surrounding landscape and local architectural style.

CRZ-III includes areas that do not fall under CRZ-I or CRZ-II. These are mainly rural regions that are not heavily built up. It introduces a 'No Development Zone' extending up to 200 meters from the HTL. Activities allowed in this zone include agriculture, horticulture, gardening, pasturing, parks, playfields, forestry, and salt production. New construction is not permitted; only repairs to existing structures are allowed. Between 200 meters and 500 meters of the HTL, the construction of hotels, resorts, and residential units is allowed under Annexure II of the Notification, with specified measurements.

CRZ-IV covers the islands of Andaman, Nicobar, Lakshadweep, and other small islands except those

classified under CRZ-I, CRZ-II, and CRZ-III. There are restrictions on construction within 200 meters of the HTL. The use of corals and sand from beaches and coastal waters, as well as dredging and underwater blasting around coral formations, is also prohibited.

In a significant decision, the Supreme Court upheld the demolition of a residential building that was constructed in violation of the CRZ Notification of 1991. In the case of The Kerala State Coastal Zone Management Authority (KSCZMA) vs. Maradu Municipality, known as the Maradu Apartments Demolition Case, a bench of the Supreme Court, including Justice Arun Mishra and Justice Naveen Sinha, ordered the demolition of five waterfront apartment complexes in Maradu Municipality, Kerala, due to violations of CRZ rules.

Maradu is about 7 km from Kochi. A gram panchayat was established in 1953 for local administration but was converted into a municipality in 2010. In 2006, the panchayat issued building permits to four companies: Alpha Ventures Private Limited, Holy Faith Builders and Developers, Jain Housing and Construction, and K.V. Jose, for five apartment complexes. These permits were issued without the mandatory approval from KSCZMA, which oversees environmental issues related to the CRZ. KSCZMA determined that the construction was taking place in critically vulnerable areas categorized under CRZ-III. In CRZ-III, no construction is allowed within 200 meters of the coast, while CRZ-II has a limit of 50 meters. At the time, the location was classified as CRZ-III. Following KSCZMA's directive, the gram panchayat issued a notice to the builders, alleging violations of CRZ rules, as KSCZMA's permission is necessary for granting construction permits in CRZ-III areas.

In response, the builders approached the High Court seeking an interim stay on the order to allow construction. The Single Judge Bench granted the stay, arguing that Maradu was well developed and should be classified as CRZ-II, despite being inaccurately labeled as CRZ-III. KSCZMA then appealed to the Supreme Court for the alleged violation of CRZ rules.

The Supreme Court appointed a technical committee to determine whether Maradu falls under CRZ-II or CRZ-III. Based on the committee's findings supporting CRZ-III classification, the Supreme Court ruled that the permission granted by the panchayat was illegal and void, so no development should have occurred. As a result, the Supreme Court ordered the demolition of the apartments.

On the amount of compensation, a bench of the Supreme Court featuring Justice Arun Mishra and Justice S. Ravindra Bhat ordered on 27th September 2019 that the State Government must pay Rs. 25,00,000 (Rupees Twenty-Five Lakhs) to each flat owner being evicted in the case within four weeks. This amount will be recoverable from the builder, promoter, or the individuals and officials responsible for the construction. A dispute arose regarding the fairness of this amount since it was paid to the builders many years ago. During this time, the value of the apartments has increased. Therefore, in another order dated 22nd November 2019, the Supreme Court instructed the respective builders to deposit Rs. 61.50 Crores to be disbursed. In this order, the Supreme Court also stated that this would not prevent flat owners from filing appropriate civil or criminal cases to address their grievances according to the law.

The law typically operates on the idea of prospective effect, meaning changes or amendments to the law usually do not apply to actions taken in the past. It is important to note that the order to demolish the apartments was based on the Supreme Court's finding that the construction violated the CRZ Rules of 1991 and the 1996 KCZMA Plan, which classified the area as CRZ III, not CRZ II. However, under the 2011 notification, the area was classified as CRZ II. This means that after the demolition, new buildings could be constructed in the same location without violating the CRZ Rules. One could argue that this makes the demolition an action based on a technicality.

In another decision from the Bombay High Court regarding Goa Foundation vs. Goa State Coastal Zone Management Authority, the issue revolves around the criteria for determining the High Tide Line, which is essential for marking the Coastal Regulation Zone (CRZ). This case concerns the construction of the Goa Marriott Resort, located near

Gaspar Dias Beach in Panaji, where the Mandovi River meets the Arabian Sea. The Goa Foundation filed a writ petition, claiming the hotel breached the Coastal Regulation Zone restrictions. Authorities stated that the hotel was 1.5 km away from the High Tide Line when granting construction permission. However, the Commissioner's report indicated that the swimming pool is only 20 meters from the High Tide Line, and the hotel itself is 30 meters from the river, falling under CRZ II. Hence, the permission granted violated the CRZ notification. On the other hand, authorities argued they granted permission according to the CRZ notification, claiming no violation occurred. Following the direction of the division bench of the High Court, two reports were prepared to show there was no CRZ violation by the hotel. The Division Bench rejected the first report, leading to the current petition concerning the second report.

The second report introduced soil erosion as a factor for determining the High Tide Line, a method not used in Goa or elsewhere. It was argued that this report created an absurd outcome, positioning the High Tide Line in the river water, contradicting the very concept of the High Tide line.

The High Court directed authorities to draw a line parallel to the High Tide Line from the nearby lighthouse, and to assess whether any hotel construction is on the river side of this line. They were instructed to take necessary action against the hotel if a violation was found.

The Court emphasized that the case primarily dealt with the violation of the CRZ notification, which should be assessed according to CRZ rules. It noted that this situation was not genuinely due to missing data; rather, established principles had been disregarded. There was an attempt to create a complicated situation to favor a specific establishment.

The Court stated, "The burden is on those who wish to build in the coastal zone to demonstrate that their actions are environmentally sound. If the data is lacking, the conclusion is that the project proponent has not met their burden. Thus, in this case, any absence of data does not benefit the hotel but is unfavorable to it."

Acknowledging its own limitations in determining the High Tide Line and its distrust in the authorities, the Court assigned the responsibility of identifying the High Tide Line and the parallel line to the National Centre for Sustainable Coastal Management (NCSCM) in Chennai. This authority, under the Ministry of Environment and Forests, was established for better coastal protection, conservation, rehabilitation, management, and policy design. The Court annulled the GSCZMA's impugned decision and its second report, directing it to consult NCSM for identifying the tide lines.

In conclusion, the notification had several shortcomings as it did not consider biological diversity, demographic patterns, and the distribution of natural resources. This oversight led to confusion and uncertainty among communities involved in fishing and related activities. Furthermore, there was no clear process for obtaining CRZ clearance, monitoring after the clearance was granted, or implementing measures to control pollution within the CRZ. Consequently, following various amendments to the 1991 notification, it was deemed necessary to consolidate and issue a new notification, which came into effect in 2011.

COASTAL REGULATION ZONE NOTIFICATION OF 2011

Notification of 2011 focused on three main objectives: protecting the livelihoods of traditional fisher folk communities, preserving coastal ecology, and promoting economic activity. Special provisions were made for several areas, including the Sunderban Mangroves, Chilka, Gulf of Kutch, Kundapur, and Karwar. It mandated the establishment of the Coastal Zone Management Authority (CZMA) for State Governments and Union Territories, giving it specific powers and functions. Initially, the Notification of 1991 did not establish the CZMA; however, an amendment was made to create the CZMA in each state. To improve the implementation of the Notification of 2011, the National Coastal Zone Management Authority (NCZMA) and State Coastal Zone Management Authority (SCZMA) were created. The Ministry of Environment and Forests

has already provided details about the composition, tenure, and mandate of the NCZMA and SCZMA. A District Level Committee, chaired by the District Magistrate, will include three representatives from local traditional coastal communities, including fisherfolk. The Notification of 1991 did not provide a mechanism for formal approval and regularization of dwelling units for fisher folks, tribals, and coastal communities. The current notification has addressed this with specific conditions.

Projects listed under the Notification of 2011 will also require an Environmental Impact Assessment as outlined in the 2006 Notification. The 2011 Notification detailed the process for obtaining clearance for permitted activities through separate forms. It was consolidated under the 2011 Notification. The CZMA of State Governments and Union Territories must prepare the Coastal Zone Management Plan (CZMP). The preparation of the CZMP should involve full participation from local communities.

The classification of Coastal Regulation Zones (CRZ) has been reviewed, leading to some changes. CRZ-I areas include ecologically sensitive locations and geomorphological features essential for maintaining coastal integrity. In addition to areas already listed in the Notification of 1991, the Notification of 2011 has also included habitats for various marine species, such as turtle nesting grounds, horseshoe crab habitats, seagrass beds, bird nesting grounds, and salt marshes. CRZ-II, CRZ-III, and CRZ-IV have largely remained unchanged. However, areas needing special attention for environmental protection, such as those within the Municipal limits of Greater Mumbai, Kerala—including backwaters and backwater islands—and CRZ in Goa, have also been addressed. Special areas like the Critically Vulnerable Coastal Areas (CVCA), including the Sunderbans in West Bengal and other ecologically sensitive regions identified by the EPA, were recognized.

Significant details about CRZ areas requiring special consideration within the Municipal limits of Greater Mumbai, Kerala, Goa, and others have been included. Areas in Greater Mumbai facing environmental issues like pollution, mangrove degradation, waste disposal, and road construction need to be identified. Furthermore, a Slum Rehabilitation Scheme has been introduced in specified areas, with the State Government responsible for implementing slum redevelopment through other parastatal agencies. Provisions for fishing and related activities have been emphasized, particularly in Kerala. Areas classified as CRZ-I serve as No Development Zones, which are habitats for turtles and other species protected under the Wildlife Protection Act of 1972.

The Notification of 2011 has addressed various issues specific to ecologically sensitive areas. The goal was to protect these fragile regions by tightening regulations. To review the Notification of 2011, a six-member committee was formed, led by Dr. Shailesh Nayak, Secretary of MoES. The committee will examine issues related to coastal states and union territories regarding the CRZ Notification of 2011, as well as identify errors, inconsistencies, and opportunities for procedural simplification.

SHAILESH NAYAK COMMITTEE REPORT

During the preparation of the report, the committee held meetings with state governments. They also considered the implications of the 2011 notification. After examining issues related to the coastal environment, community hardships, and the need for economic growth, the committee made the following recommendations:

- The Ministry should formulate a concrete proposal since the loss of fragile ecosystems causes irreversible damage, affecting local communities. Naturally occurring barriers like mangroves, coral reefs, and sea grass protect against cyclones.
- Promote eco-tourism based on the model from the International Union for Conservation of Nature.
- Identify ecologically sensitive areas under CRZ-I using scientific assessments and create measures for protection and conservation.
- The Ministry of Culture should identify structures and areas with historical, archaeological, and heritage value for protection and conservation.
- Protect and regulate activities that harm the integrity of water bodies and their beds.

- Address the disposal of sewage, effluents, and solid waste.
- Regulations in CRZ-II and CRZ-III have affected state town and country planning laws, and states need to tackle these issues. Overlapping issues have also arisen since the notification overrides the town and country planning regulations of states or union territories.
- Provide housing with basic infrastructure for communities living in coastal areas.
- There is ambiguity and difficulty in interpreting the 2011 notification, including the demarcation of HTL/LTL and the boundaries of CRZ-I, II, III, and IV.
- Economic and social development must occur in coastal communities.
- Shoreline changes have been acknowledged, and it is essential to identify the reasons behind these changes.
- The Ministry should explore new initiatives to protect and conserve the coastal ecosystem.

Based on these recommendations, a draft notification was submitted to the government. The Central Government later issued a new notification, replacing the earlier 2011 notification. This decision came after reviewing the recommendations and objections from the public, leading to the Coastal Regulation Zone notification of 2019 on January 18, 2019.

Threats to marine biodiversity

The global marine environment is undergoing major changes due to stressors like climate change, overfishing, illegal wildlife trade, eutrophication, and the introduction of invasive species, habitat destruction, and marine pollution (Gray, 1997). Biodiversity loss in marine ecosystems rarely happens in isolation; it usually results from various factors acting on their own or together. The global marine Living Planet Index (LPI) shows a significant decline. Populations of marine mammals, birds, reptiles, and fish dropped by 49% between 1970 and 2012, indicating a serious loss of biodiversity (WWF, 2015). The response to the declining state of marine environments has typically been slow, fragmented, and reactive. Efforts to tackle this environmental crisis are further complicated by the view of marine ecosystems as a global shared resource. This lack of ownership and accountability among countries decreases the motivation to take strong action. It highlights the need for coordinated international solutions to protect and restore marine biodiversity. Furthermore, the impacts of climate change and other environmental shifts pose complex challenges for current laws and management strategies, calling for flexible and forward-looking methods.

Many coastal and shelf ecosystems have been significantly damaged from their original conditions, which weakens their ability to provide essential services. A major challenge in marine ecology understands how ecosystem services are affected by habitat and community structures, the biodiversity they support, and their resilience to various disturbances. As humans continue to rely on the marine environment, there is an increasing need for comprehensive management approaches that consider entire ecosystems, including human interactions. Ecosystem-Based Management (EBM) and Ecosystem Approaches to Management (EAM) have become key strategies for achieving sustainable use of marine resources. These approaches aim to regulate human activities to ensure resource sustainability, highlighting biodiversity conservation as vital for maintaining ecosystem function and long-term adaptability. For effective biodiversity conservation, resource managers need strong scientific insights into biodiversity patterns and their roles within managed ecosystems.

The loss of marine biodiversity greatly affects ecosystems, reducing their resilience to environmental stressors like climate change, pollution, and invasive species, which can lead to ecosystem collapse. It disrupts ecosystem functioning by changing primary productivity, nutrient cycling, and food web dynamics due to the loss of key species. Biodiversity loss impacts coastal communities that rely on fisheries and tourism, while extreme weather events linked to ecosystem degradation cause significant infrastructure damage and financial losses.

II. LEGAL AND POLICY FRAMEWORK FOR COASTAL BIODIVERSITY CONSERVATION

India's approach to conserving biodiversity, especially in coastal areas, is supported by a strong legal and policy framework. This framework combines international obligations with local environmental laws. Its goals are to manage human activities along the coast, protect ecosystems, and encourage the sustainable use of marine and coastal resources.

2.1 International Instruments

India, as a signatory to various international treaties and conventions, is bound to uphold global commitments towards biodiversity conservation:

- Convention on Biological Diversity (CBD), 1992

India ratified the CBD in 1994. Under Article 8 of the convention, countries are obligated to conserve biological diversity, especially in coastal and marine areas. The CBD's ecosystem approach and the Aichi Biodiversity Targets have influenced India's National Biodiversity Action Plan.

- Ramsar Convention on Wetlands, 1971

This treaty provides a framework for the conservation and wise use of wetlands. India has designated several coastal wetlands (e.g., Chilika Lake, Point Calimere) as Ramsar sites, thereby ensuring their ecological character is maintained through legal and policy measures.

- United Nations Convention on the Law of the Sea (UNCLOS), 1982

UNCLOS emphasizes sustainable use of marine resources, protection of the marine environment, and regulation of marine pollution. India's maritime zones and Exclusive Economic Zone (EEZ) management are influenced by UNCLOS principles.

2.2 National Legal Frameworks

India has enacted several laws to address biodiversity conservation in coastal ecosystems:

- Environment (Protection) Act, 1986

This umbrella legislation empowers the central government to take measures for protecting and improving the environment. It serves as the basis for issuing various notifications, including the Coastal Regulation Zone (CRZ) notifications.

- Coastal Regulation Zone (CRZ) Notification, 2011 (amended in 2019)

Issued under the Environment Protection Act, the CRZ notification classifies coastal stretches into different zones (CRZ I–IV) with varying levels of protection and permissible activities.

CRZ-I: Ecologically sensitive areas (e.g., mangroves, coral reefs)

CRZ-II: Urban areas developed up to or close to the shoreline

CRZ-III: Rural and relatively undisturbed areas

CRZ-IV: Areas around islands and waters up to 12 nautical miles

The 2019 amendment relaxed some restrictions, raising concerns over environmental degradation.

- Wildlife (Protection) Act, 1972

Protects coastal and marine species through the establishment of protected areas, such as marine national parks and sanctuaries (e.g., Gulf of Kachchh Marine National Park). It also includes species found in coastal ecosystems in its schedules.

- Forest (Conservation) Act, 1980

Applicable to mangroves and coastal forests. It restricts the diversion of forest land for non-forest purposes without prior central approval.

- Biological Diversity Act, 2002

Enacted to implement the objectives of the CBD. It promotes conservation, sustainable use, and fair sharing of benefits arising from the use of biological resources. The Act mandates the creation of:

- National Biodiversity Authority (NBA)
- State Biodiversity Boards (SBBs)
- Biodiversity Management Committees (BMCs) at local levels
- Wetlands (Conservation and Management) Rules, 2017

Provide guidelines for conservation and sustainable use of wetlands, many of which are located in coastal zones.

- Fisheries and Aquaculture Policies

These include guidelines on sustainable fishing practices, marine resource management, and protection of critical habitats like spawning and nursery grounds.

2.3 Institutional Framework

- Ministry of Environment, Forest and Climate Change (MoEFCC)

Nodal ministry for formulating environmental policy and CRZ regulations.

- National Coastal Zone Management Authority (NCZMA) and State Coastal Zone Management Authorities (SCZMAs)

These bodies oversee the implementation of CRZ rules and assess environmental clearances for coastal development projects.

- National Biodiversity Authority (NBA)
  Regulates access to biological resources and ensures benefit-sharing with local communities.
- State Biodiversity Boards and BMCs
  Play a key role in documenting People's Biodiversity Registers and conserving local biodiversity.

III. JUDICIAL INTERVENTIONS AND LANDMARK CASE LAWS

The Indian judiciary, particularly the Supreme Court and High Courts, has been essential in promoting environmental law and protecting biodiversity in coastal regions. By using Public Interest Litigations (PILs), the courts have broadly interpreted constitutional guidelines and environmental laws. They have prioritized ecological issues in development planning.

- Indian Council for Enviro-Legal Action v. Union of India, (1996) AIR 1996 SC 1446

This case involved the discharge of toxic chemicals by industries along the coastal region of Gujarat, particularly impacting villages near Bichhri. The pollution rendered water unfit for human use and destroyed agricultural land.

The Supreme Court held the polluting industries strictly liable for environmental damage and ordered them to pay for the restoration of the environment.

The Court emphasized two key principles:
Polluter Pays Principle
Precautionary Principle

These principles became foundational for future coastal biodiversity conservation rulings. It also expanded the interpretation of Article 21 (Right to Life) to include the right to a healthy environment.

- S. Jagannath v. Union of India (Shrimp Farming Case), AIR 1997 SC 811

The petitioner challenged the unregulated expansion of commercial shrimp farming in coastal areas, which were causing salinization of agricultural lands, degradation of mangroves, and displacement of coastal communities.

The Supreme Court banned aquaculture activities within 500 meters of the High Tide Line (HTL) in CRZ areas unless carried out through traditional or improved traditional methods. The ruling:

Recognized environmental rights of local communities

Ordered the closure of non-compliant aquaculture farms

Mandated the creation of an Aquaculture Authority
This judgment was pivotal in establishing environmental equity, where the livelihoods and ecological rights of the marginalized were protected against commercial exploitation.

- Goa Foundation v. Diksha Holdings Pvt. Ltd., (2001) 2 SCC 97

The petitioner sought the demolition of a resort built in violation of CRZ regulations on a fragile beach in Goa.

The Court ordered the demolition of illegal structures and emphasized the binding nature of CRZ Notifications. It declared that violations of environmental regulations would not be regularized merely due to investment or completion status. The case strengthened the enforceability of

environmental norms in the tourism-driven coastal economy of Goa.

- Puducherry Environment Protection Association v. Union of India, (2012) SCC Online Mad 1963

The case was filed against rampant illegal constructions and encroachments on coastal land in Puducherry, endangering sand dunes and marine life.

The Madras High Court ordered the demolition of unauthorized buildings and restoration of natural features such as dunes and coastal vegetation. The judgment reinforced the ecological integrity of coastal zones and emphasized strict adherence to CRZ guidelines, even against influential developers.

- Vaamika Island v. Union of India, (2021) 7 SCC 706

The petitioner challenged CRZ clearance granted for luxury development on Vaamika Island in Kerala, an ecologically sensitive area.

The Supreme Court quashed the environmental clearance, asserting that:

- Development must not come at the cost of ecological degradation
- The eco-centric approach must be preferred over the anthropocentric

This case highlighted the growing judicial focus on climate resilience, long-term sustainability, and the rights of nature.

These cases showcase the evolving environmental jurisprudence in India, where the courts have emerged as powerful custodians of coastal ecology. They have not only interpreted laws liberally to uphold environmental values but have also directed policy changes and administrative action to enforce these laws effectively.

- Recent cases related to biodiversity conservation efforts in coastal ecosystem in India

1. Mangrove Restoration in Chennai's Buckingham Canal

Under the Green Tamil Nadu Mission, a 250-meter section of the Buckingham Canal in Kazhipattur, Chennai, has been turned into a lively mangrove forest. The project involved planting 12,500 saplings from five mangrove species, including Avicennia marina and Rhizophora varieties. They used the 'fishbone' technique to improve water flow. These mangroves serve as natural barriers against coastal flooding, absorb carbon, support wildlife, and prevent land erosion. The project is now expanding to other coastal areas, with plans to plant 160,000 saplings along the Kosasthalaiyar Estuary in Ennore.

2. Operation Olivia: Record Olive Ridley Turtle Nesting in Odisha

The Indian Coast Guard's annual conservation effort, 'Operation Olivia,' has greatly helped achieve a record nesting season for Olive Ridley turtles. In February 2025, more than 698,000 turtles nested safely at the Rushikulya river mouth in Ganjam district. The operation includes extensive marine and aerial monitoring to protect the endangered species. This involves stopping boats engaged in illegal fishing and encouraging local fishing communities to adopt turtle-friendly practices.

3. National Coastal and Marine Habitat Restoration Symposium in Kochi

In February 2025, the Wildlife Trust of India, in collaboration with the Kerala Forest and Wildlife Department and the Ecological Restoration Alliance, hosted the National Coastal and Marine Habitat Restoration Symposium in Kochi. The event emphasized the importance of restoring mangroves and coral reefs to enhance the resilience, biodiversity, and sustainability of marine habitats. Notable initiatives include mangrove restoration in Kannur, Kerala, and coral reef recovery in Mithapur, Gujarat.

4. Coastal Risk Reduction through Mangrove Plantation in Maharashtra

In Palghar district, Maharashtra, a project aimed at strengthening coastal ecosystem resilience and enhancing community-led climate adaptation is underway. The initiative involves mangrove and native coastal species plantation across 10 villages, with a projected carbon sequestration of approximately 1,440 tons of CO_2 annually from the third year onward. The project directly impacts over 35,500 individuals and indirectly benefits approximately 350,000 people vulnerable to climate change.

IV. ROLE OF THE JUDICIARY IN STRENGTHENING COASTAL BIODIVERSITY LAW

The Indian judiciary, especially the Supreme Court, has consistently interpreted environmental rights as an integral part of the right to life under Article 21 of the Constitution. It has played an instrumental role in transforming India's environmental governance, particularly in coastal biodiversity conservation, by judicially innovating and enforcing the law beyond statutory texts.

Constitutional Provisions Interpreted by the Judiciary

- Article 21 – Right to Life

The judiciary has interpreted this article to include the right to a clean and healthy environment. This broad interpretation has enabled the courts to intervene in cases of ecological degradation, including those affecting coastal ecosystems.

- Article 48A – Directive Principle of State Policy

It mandates the State to protect and improve the environment and safeguard forests and wildlife. Though non-justiciable, the courts have invoked this article to interpret environmental obligations.

- Article 51A(g) – Fundamental Duty

Citizens are duty-bound to protect and improve the natural environment. The judiciary has emphasized this duty in cases involving coastal encroachments and environmental damage.

Doctrines Developed and Applied by the Judiciary

- Public Trust Doctrine

Applied in several coastal conservation cases (e.g., Goa Foundation case), this doctrine holds that natural resources like the sea, beaches, and wetlands are held by the government in trust for the public and cannot be exploited for private gain.

- Precautionary Principle

Mandates preventive action in the face of uncertainty. Courts have ordered halts to development projects near sensitive coastal areas without conclusive environmental studies.

- Polluter Pays Principle

Adopted in Indian Council for Enviro-Legal Action v. Union of India, this principle requires polluters to bear the cost of environmental harm and restoration.

- Sustainable Development

A central doctrine in Indian environmental jurisprudence, ensuring that developmental activities do not compromise ecological integrity—frequently applied in CRZ-related rulings.

- Intergenerational Equity

A relatively modern doctrine used to stress the conservation of biodiversity and ecosystems for future generations, especially in climate-sensitive coastal zones.

Judicial Oversight and Enforcement Mechanisms

- Environmental Impact Assessments (EIAs)

Courts have mandated stricter and more participatory EIA procedures before granting CRZ clearances.

- Appointment of Committees

In many coastal disputes, courts have appointed expert committees to inspect sites, assess violations, and recommend conservation measures.

- Directions to Government Agencies

Courts have issued binding directions to central and state governments to implement CRZ rules, clear illegal encroachments, restore mangroves and wetlands, and strengthen monitoring mechanisms.

- Demolition Orders and Restoration

In cases such as Puducherry Environment Protection Association, courts have not hesitated to order the demolition of illegal constructions in coastal zones and directed ecological restoration.

Expansion of Environmental Rights as Human Rights

Indian environmental jurisprudence has taken a progressive turn by recognizing that environmental protection is essential for the enjoyment of fundamental human rights. Coastal communities, often marginalized and vulnerable, have found in the judiciary a powerful ally against environmental injustice.

The courts have thus served not only as interpreters of law but as active guardians of the coastal commons, ensuring that development is tempered with ecological and social responsibility. This section highlights how the Indian judiciary has gone beyond the black letter of the law to creatively and

constitutionally enforce environmental principles, especially in fragile coastal regions.

V. CHALLENGES IN BIODIVERSITY CONSERVATION

Despite having a relatively strong legal and institutional framework, biodiversity conservation in coastal ecosystems in India faces several persistent and emerging challenges. These issues are legal, administrative, ecological, and socio-economic in nature, often overlapping and reinforcing one another.

1- Weak Enforcement of CRZ Norms

While the Coastal Regulation Zone (CRZ) Notification aims to balance development with ecological protection, enforcement remains inconsistent due to:

- Ambiguous demarcation of CRZ boundaries
- Delays in the preparation and approval of Coastal Zone Management Plans (CZMPs)
- Lax monitoring by State Coastal Zone Management Authorities (SCZMAs)
- Political interference and lack of coordination between central and state agencies

2-Urbanization and Infrastructure Development

Rapid urban expansion and port-led industrialization have led to:

- Conversion of coastal wetlands and mangroves into real estate
- Expansion of ports, SEZs, and tourism infrastructure in ecologically fragile zones
- Encroachments on buffer zones critical for biodiversity and flood regulation

3-Climate Change and Sea Level rise

Rising sea levels, increased coastal erosion, and extreme weather events such as cyclones pose severe threats to coastal biodiversity. These impacts include:

- Salinization of freshwater ecosystems
- Submergence of habitats like estuaries and coral reefs
- Migration or extinction of species unable to adapt

4- Conflicts Between Conservation and Livelihoods

Traditional coastal communities—especially artisanal fishers and marginal farmers—often face restrictions due to conservation projects or CRZ-related prohibitions. These tensions arise from:

- Inadequate recognition of customary rights
- Top-down conservation policies with limited community participation
- Displacement or exclusion from traditional fishing and resource collection areas

5- Inadequate Scientific and Technological Capacity

Biodiversity monitoring and habitat mapping in coastal areas require updated scientific data and geospatial tools, which are often lacking due to:

- Limited investment in marine biodiversity research
- Absence of baseline ecological assessments before granting clearances
- Poor integration of traditional ecological knowledge with scientific models

This lack of robust data undermines environmental impact assessments (EIAs) and weakens decision-making.

Together, these challenges underscore the gap between environmental law in principle and environmental protection in practice. Addressing them requires a systemic, participatory, and ecosystem-based approach to coastal management.

VI. ACCORDING TO THE CONVENTION ON BIOLOGICAL DIVERSITY

(CBD) of 1992, biological diversity means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part. This includes diversity within species, between species and of ecosystems.

Biologist E.O. Wilson has a more detailed definition (Wilson 1988):

‘The variety of life at every hierarchical level and spatial scale of biological organizations: genes within populations, populations within species, species within communities, communities within landscapes,

landscapes within biomes, and biomes within the biosphere.'

The Biological Diversity (Amendment) Act, 2023, represents a significant update to India's biodiversity governance framework, originally established by the Biological Diversity Act, 2002. Enacted on August 3, 2023, this amendment aligns India's legislation with international commitments under the Convention on Biological Diversity (CBD) and the Nagoya Protocol, aiming to balance biodiversity conservation with sustainable utilization and equitable benefit-sharing.

Key Objectives of the Amendment

- Streamlining Access and Benefit-Sharing (ABS): The amendment introduces clearer distinctions between Indian and foreign entities regarding access to biological resources and associated traditional knowledge. It simplifies procedures for Indian entities, particularly those involved in traditional medicine systems like AYUSH, while maintaining stringent requirements for foreign entities to ensure fair and equitable benefit-sharing.
- Promoting Cultivation of Medicinal Plants: To reduce pressure on wild medicinal plant populations, the amendment encourages their cultivation. This move supports the sustainable use of biodiversity and aligns with India's traditional healthcare practices.
- Facilitating Research and Innovation: By decriminalizing certain offenses and replacing them with monetary penalties, the amendment aims to foster a more conducive environment for research, patent applications, and the transfer of research results, thereby promoting innovation while ensuring compliance with biodiversity conservation norms.
- Revised Definitions: New terms such as "access," "codified traditional knowledge," "derivative," "folk variety," and "landrace" have been defined to provide clarity and address emerging issues in biodiversity management .
- Decriminalization of Offenses: Certain violations under the Act have been decriminalized, replacing criminal penalties with monetary fines ranging from ₹1 lakh to ₹50 lakh, to encourage compliance without harsh punitive measures .
- Exemptions for AYUSH Practitioners: Practitioners of traditional Indian medicine systems (AYUSH) are exempted from certain benefit-sharing obligations, aiming to promote the use of traditional knowledge while raising concerns about equitable benefit distribution .
- Simplified Intellectual Property Processes: Indian entities seeking intellectual property rights based on biological resources are now required to register with the National Biodiversity Authority (NBA) before the grant of such rights, streamlining the process and promoting innovation .

These amendments aim to foster a more conducive environment for research and innovation while ensuring the conservation and sustainable use of India's rich biological diversity.

VII. IMPLICATIONS AND CONSIDERATIONS

While the amendment aims to simplify processes and support the sustainable use of biodiversity, it has raised concerns among environmentalists and community groups. Critics argue that exemptions for some entities may weaken the framework for fair benefit-sharing and could compromise efforts to conserve biodiversity. Protecting the rights and knowledge of local communities is an important factor in implementing the amended Act.

VIII. COMPLEMENTARY REGULATIONS

In addition to the Biological Diversity (Amendment) Act, 2023, the Coastal Regulation Zone (CRZ) Notification, 2019, is an important regulatory framework for coastal ecosystems. The CRZ Notification focuses on conserving and managing ecologically sensitive areas (ESAs) such as mangroves, coral reefs, and turtle nesting grounds. It prohibits certain development activities to protect these fragile habitats.

CONCLUSION

The conservation of coastal biodiversity is now a legal and ecological necessity, not just an environmental ideal. Coastal ecosystems, including mangroves, coral reefs, estuaries, and tidal marshes, play a crucial role in maintaining ecological balance,

protecting shorelines, and supporting livelihoods. However, rapid urbanization, climate change, pollution, overfishing, and unregulated tourism have seriously threatened these fragile ecosystems. In this situation, creating and enforcing solid legal strategies is essential.

India's legal framework for biodiversity conservation, especially in coastal areas, has changed significantly through laws, policies, and court decisions. Key laws like the Environment (Protection) Act of 1986, the Coastal Regulation Zone (CRZ) Notification of 2011, the Wildlife Protection Act of 1972, and the Biological Diversity Act of 2002 provide a layered legal structure. These laws are supported by international agreements like the Convention on Biological Diversity (CBD) from 1992, which India has signed, reinforcing the country's duty to protect coastal biodiversity.

Despite having a legal framework, implementing conservation strategies encounters many challenges. Issues such as poor enforcement, lack of coordination among agencies, insufficient public involvement, and clashes between development and conservation complicate the situation. Nevertheless, court actions, especially by the Supreme Court and High Courts in India, have been crucial in shaping environmental law. Important cases like Indian Council for Enviro-Legal Action v. Union of India (1996) and M.C. Mehta v. Kamal Nath (1997) have upheld key principles like the polluter pays principle, public trust doctrine, and precautionary principle, which are now fundamental to Indian environmental law.

Recent changes, like the draft CRZ Notification of 2019, aim to balance development needs with environmental protection, indicating a shift toward more flexible and inclusive legal strategies. Involvement of communities through Biodiversity Management Committees (BMCs) under the Biological Diversity Act is another positive step, although it needs more support and capacity building.
In conclusion, successful biodiversity conservation in coastal ecosystems requires a detailed and unified legal strategy. This approach should connect laws with scientific knowledge, judicial oversight, community involvement, and international commitments. While India has made noteworthy strides, a more decentralized, participatory, and ecosystem-focused method is necessary to strengthen coastal biodiversity resilience. Improving institutional mechanisms, increasing transparency, and building local skills will be vital in achieving coastal conservation goals. Only then can we ensure that the legal strategies in place lead to meaningful results for both nature and society.

RECOMMENDATIONS

To address the multifaceted challenges facing coastal biodiversity in India, a multi-pronged strategy that integrates legal, ecological, institutional, and community-based approaches is essential. The following recommendations aim to reinforce the effectiveness of conservation efforts:

Strengthening Legal and Regulatory Frameworks

- Revise and Reinforce CRZ Notifications:

The CRZ framework should be reviewed to balance ecological protection with sustainable development. Amendments must not dilute ecological safeguards. Clear demarcation of CRZ zones using GIS and satellite technology is essential to reduce ambiguity.

- Integrate Climate Adaptation into Coastal Laws:

Legal provisions must explicitly incorporate climate resilience—such as protection of blue carbon ecosystems (mangroves, seagrasses)—into coastal planning and regulation.

- Recognize Customary and Community Rights:

Legal reforms should provide statutory recognition to the customary fishing and habitation rights of traditional coastal communities to ensure inclusive conservation.

Enhancing Institutional Coordination and Capacity

- Strengthen Coastal Zone Management Authorities (CZMAs):

Allocate adequate funds, technical staff, and digital infrastructure to National and State CZMAs for proactive monitoring and enforcement.

- Create Integrated Coastal Management Cells:

Establish multi-stakeholder coordination bodies at state levels to harmonize actions between departments of environment, fisheries, forest, tourism, and disaster management.

- Capacity Building and Training:

Train officials, EIA consultants, and judicial officers on emerging issues in marine biodiversity, environmental law, and participatory conservation.

Promoting Scientific Research and Ecological Monitoring

- Invest in Marine Biodiversity Research:

Establish regional centers for marine biodiversity, with a focus on under-researched ecosystems like coral reefs and mudflats. Encourage collaborations with marine biologists and oceanographers.

- Develop Coastal Biodiversity Indices:

Implement biodiversity indicators and early warning systems to monitor ecological health and biodiversity loss.

- Improve EIA Mechanisms:

Make Environmental Impact Assessments more transparent, data-driven, and participatory. Mandate post-clearance ecological audits.

Community Participation and Livelihood Integration

- Strengthen Biodiversity Management Committees (BMCs):

Empower BMCs to participate in coastal conservation planning, monitor violations, and document traditional knowledge through People's Biodiversity Registers (PBRs).

- Promote Community-Based Coastal Resource Management:

Involve local fishers, women's groups, and youth in mangrove restoration, coral reef protection, and waste management initiatives.

- Sustainable Livelihood Alternatives:

Support eco-tourism, sustainable aquaculture, and green infrastructure development that align with conservation goals.

Judicial and Quasi-Judicial Oversight

- Establish Environmental Benches:

Designate permanent green benches in High Courts and empower the National Green Tribunal (NGT) with more marine experts.

- Implement Court Directives Promptly:

Governments should ensure timely and transparent implementation of judicial orders, especially in coastal conservation cases.

- Periodic Judicial Review of CZMPs:

The Supreme Court or NGT could periodically assess state-level Coastal Zone Management Plans for compliance with CRZ norms and ecological standards.

Public Awareness and Education

- Environmental Literacy Campaigns:

Launch awareness programs on coastal biodiversity in schools, fishing communities, and tourist regions using local languages and media.

- Digital Tools for Transparency:

Use mobile apps and online portals for citizen reporting of CRZ violations and for disseminating biodiversity data.

By integrating these recommendations into policy and practice, India can build a more resilient, inclusive, and ecologically sound coastal management regime that secures both biodiversity and community well-being.