South Asia Bioregionalism Working Group



WEBBING A NEW NET

ENVISIONING BIOREGIONS FOR THE COASTAL AREA OF INDIA AND ADJACENT OCEAN



Image by Chanwit Whanset from Pixabay

By

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The webbing process of this document has taken longer than expected. The net was hand-made, not machine fabricated!

We would like to place on record our deep appreciation, to all the members of the South Asia Bioregionalism Working Group (SABWG) of the Vikalp Sangam which is facilitated by the Kalpavriksh Environmental Action Group, for the encouragement given to us for taking up this task. More importantly, a special word of thanks for the patience and gentle prompting of the key animators of the SABWG for ensuring that we completed our task. Also, a special word of appreciation to Vani Garg for the design work.

Envisioning entails imagining. Not all of this will materialise in real life. But we must continue to dream for better futures, different worlds.

John, Nandan, Nalini June 2023

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ABBREVIATIONS

CAE – Coastal Area Ecosystem

CRZ - Coastal Regulation Zone

EEZ – Exclusive Economic Zone

HTL – High Tide Line

KM - Kilometre

LME – Large Marine Ecosystem

LRZ – Littoral Regulation Zone

LSG – Local Self Government

LTL- Low Tide Line

NFF – National Fishworker Forum

NM – Nautical Mile

UNCLOS- United National Convention on the Law of the Sea

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ABSTRACT

Delineating marine bioregions requires understanding the historical interconnections between the lived experiences of humans with the coastal areas they inhabit, and the oceans beyond, where they make their livelihoods. It is imperative to recognise the cultural, ecological, geomorphic, political, and social dimensions of these relationships and incorporate the diverse perspectives visible in the institutional mechanisms created through these connections.

In order to reimagine bioregions, it is important to identify and address issues such as habitat degradation, coastal erosion, and pollution within the framework of the recent changes due to climate change.

The foundational bioregions which we envision are called Coastal Area Ecosystems (CAEs) at the micro (village) level. We provide examples of customary institutions, which have a vibrant past, and important characteristics that need to be considered when envisioning bioregions into the future. By aggregating the CAEs across sediment cell boundaries, we propose a mezzo-level of bioregions. Finally, taking the Exclusive Economic Zone (EEZ), which is the marine boundary of a nation-state, we have the bioregion at the macro (national) level.

It is our hope that by working towards bioregionalism, we move in the right direction to lead us to solutions that promote sustainability and ecological restoration of coastal areas and oceans beyond.



Credit: Canva Photoss

The coast is an edgy place. Living on the coast presents certain stark realities and a wild, rare beauty. Continent confronts ocean. Weather intensifies. It is a place of tide and tantrum; of flirtations among fresh and saltwater, forests and shores; of tense negotiations with an ocean that gives much but demands more. Every year the raw rim that is this coast gets hammered and reshaped like molten bronze. This place roils with power and sometimes a terrible beauty. The coast remains youthful, daring, uncertain about tomorrow. The guessing, the risk; in a way, we are all thrill seekers here."

Carl Safina

1.INTRODUCTION

Bioregionalism is the effort, and the social movement, striving to redefine and revitalise geographic spaces, which have common historical, ecological, socio-cultural attributes, and overlap with a sense of place and community of those who live within that space. At its core, it is a spatially bounded space (region) where nature and humans (bio) interact without necessarily considering, or being limited by, boundaries of nation-state or smaller governance jurisdictions.

Following Peter Berg: "A bioregion can be determined initially using climatology, physiography, animal and geography, natural history and other descriptive natural sciences. The final boundaries of a bioregion are best described by the people who have lived within it, through human recognition of the realities of living-in-place. All life on the planet is interconnected in a few obvious ways, and in many more that remain barely explored. But there is a distinct resonance among living things and the factors which influence them that occurs specifically within each separate place on the planet. Discovering and describing that resonance is a way to describe a bioregion." (Berg P, 1992)

Much of the focus of bioregionalism has been on terrestrial spaces, which may include water sources within them, such as rivers and lakes. However, much less thought has been devoted to the marine space[1], and even less to the fuzzy coastal fringes that are marked by the land and sea interface of our planet.

In this paper, we make a very preliminary effort to propose an approach to imagine a bioregionalism for the coast and the adjacent ocean. This effort at webbing a new net is based our collective experience of having worked in coastal areas, with coastal people, across many countries.

As Carl Safina opines, we know the coast is an edgy place which confronts the adjacent ocean. Tide, tantrum, power, beauty, risk, and the uncertainty of tomorrow. We are making a lot of guesses and seek the thrill of doing so!



Credit: Amala S, Google Photos

2. COASTAL AREA AND THE ADJACENT OCEAN TODAY

We begin with a brief introduction to the 'terraqueous realm which we seek to explore in this paper.

The coastlines of the world's continents measure about 312,000 km (193,000 miles) in length. If we then consider the ocean space adjacent to this coastline up to 4 nautical miles (7.5 km), we cover a surface area of 2,343,120 square kilometres – about half percent of the planet's ocean area. To this aquatic part, if we also add a terrestrial zone extending landwards from the coastline to about 10 kilometres, we are adding another 3,120,000 square kilometres -

[1] At the global level there was awareness that dividing planet's ocean space into smaller national territories is anathema to the concept of ecological integrity of natural, larger ocean bioregions. The concept of the Large Marine Ecosystem (LME) was born out of this realization. Many nation states collaborated to govern the LMEs so created in different oceans. This was a multi-country 'global-level' initiative at creating bioregions for the oceans.

 about two percent of the planet's land area[2].

This bounded terraqueous realm (commonly referred to as the coastal zone) covering just 2.5 percent of the surface of our planet, is by various estimates, the most biologically productive realm of the planet mainly due to higher concentration of nutrients. The landward side is also one of the most densely populated in human terms and accounts for a very large number of mega cities of the world. There is also an increasing spatial concentration of economic activity towards the coastal zone. The coastal zone is also the first realm of the planet to be affected by the effects of climate change such as sea level rise and extreme climatic events.

3. UNDERSTANDING THE GEOMORPHOLOGY OF THE COASTAL AREA AND ADJACENT OCEAN

Life originated in the ocean and moved onto earth!

The biosphere of the earth is sustained due to the constant and consistent interactions between atmosphere, lithosphere, and hydrosphere. This is a process which has continued for 4 billion years.

Through these interactions, nature sculptured and continued to mould the landscapes and seascapes on which human beings have carved out various niches for livelihood and habitation. The modern advanced technology-driven global, interventions considerably modified these niches, both at land, sea, and the interfaces. Perhaps one such important interface, and a highly dynamic one at that, is what we popularly call the coastal zone.

The Coastal Zone

The coastal zone is special because of many features. It is the 'tail-end' ecosystem of planet earth. This land-sea interface is fuzzy due to the power of the waves, is everchanging and generates high levels of primary productivity. Over time, human habitation has gravitated to the coastal zone, making it the most densely populated part of planet earth[3].

Marine Ecosystem (LME) was born out of this realization. Many nation states collaborated to govern the LMEs so created in different oceans. This was a multi-country 'global-level' initiative at creating bioregions for the oceans.

[2] The measures of 4 NM/ 7.5 km and 10 km are by no means sacrosanct. Some estimates consider the seaward extension to be 22 km and the landward to be 100 km. Sometimes depth of the sea and elevation of the land are taken as the limit indicators respectively. However, in this paper we have chosen to define a smaller area, using distance indicators, as it is more relevant to island nations, archipelagic states and much of developing Asia and in India.

[3] More than 600 million people, i.e., 10 percent of the world population live in low elevation coastal areas (<10 meters) (UN Fact sheet, 2017)

The modern 'development interventions and processes' which have been driven by advanced technology have considerably modified the coastal zone. There are also significant differences between coastal zones of the tropics and the temperate parts of our planet.

However, the term coastal zone has over time, in common-speak, wrongly come to connote primarily the landward realm.

Coastal Area Ecosystem[4]

In this paper, because we wish to importantly take a most holistic ecological and socio-cultural approach, we opt for using the term coastal area ecosystem (CAE) and denote clearly that it has three spatial realms: landward (coast), seaward (littoral) and interface (shoreline). The CAE is thus the basic, 'local-level', building block of a marine bioregion.

The geomorphology of the landward realm (coast) is well studied and much had been written about it. The landward realm includes headlands, promontories, rocky shores, sandy spits, barrier beaches, open beaches, embayment, estuaries, inlets, bays, marshy land, and offshore islands. Each of these features is important and has a specific role to play, for, it has shaped the livelihoods of the people who interacted with them.

Often such human interactions with these geomorphic features changed the coasts from natural to artificial. he features such as sand dunes – hills of sand shaped by the

wind -- on the landward part play an important role in protecting the inland from abnormally high tides, while harbouring their own delicate ecosystems.

The landward realm of the CAE is also where the human population density is highest and where the ground water table is high with a thin upper lens of potable fresh water.

The geomorphology of the seaward realm (littoral) is less understood as it is hidden from human view. There are two dimensions – distance and depth – which must be understood together for a proper appreciation of both the living resource distribution within the CAE and the nature of human interaction with these resources. Sunlight penetrates significantly to about a depth of 50 meters and therefore the highest primary productivity of the sea is within this depth.

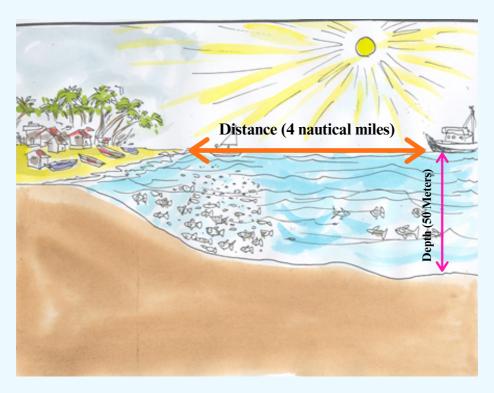


Fig 1: Understanding Distance and Depth in the CAE

It is also significant to note that the impacts of planetary climate change will be experienced much faster and more evidently noticeable in this seaward part. We are alluding here to the consequences of temperature change and the sea-level rise, and phenomena such cyclones, rogue waves and storm surges resulting from this.

The interface realm (shoreline) is where the energy exchange is most evident and significant. What the waves do to the land, and how the flow of rivers, starting from the mountains, influence the sea – particularly the littoral part of the CAE, are also less understood ecological processes. It is also along the length of this shoreline that the continuous erosion,

transportation and deposition of sediment takes place due to the combined action of waves, tides and currents.

Moreover, shorelines are not fixed. The shoreline, per se is not a static line. It is as dynamic as the waves, tides and currents. However. for planning purposes, imaginary lines are drawn based on the fluctuations and geomorphic conditions – during the low tide, when the water recedes to the lowest, a line is drawn which is the Low Tide Line (LTL) and during the highest high tide, also called spring tide, High Tide Line (HTL) is drawn.[5]

^[5] The intertidal zone between LTL and HTL is ecologically sensitive and highly vulnerable to various development activities. Recognising this, Govt of India issued a notification in Feb 1991, regulating all activities, declaring it as Coastal Regulation zone (CRZ)

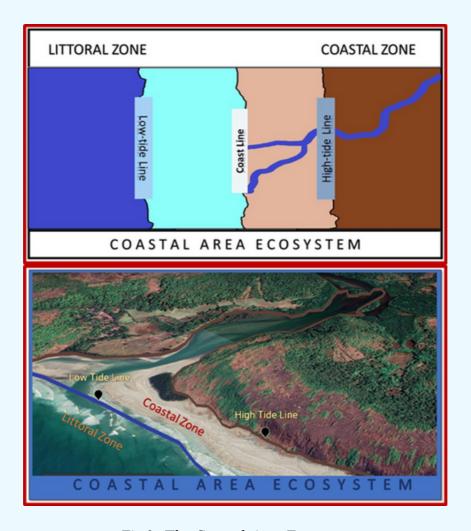


Fig 2: The Coastal Area Ecosystem

Consider delta formations the estuaries where rivers bring out sediments to the river mouths forming sandbars and spits. These geomorphic features are of relevance within the CAE and for bioregional delineation. Estuaries are a semi-enclosed coastal basin freshwater from the river and salt water from the sea mixes and therefore, is a buffer zone constantly being charged by tidal oscillations.

Rivers discharge their water, sand and sediment into estuaries and temporarily store them there, and during the surge of water due to floods, supply it to the shore. There is a delicate balance between the rate of sediment supply and removal by waves, currents, and tides. Net removal or supply of sand and sediments determine the geomorphic features, and determine whether the coast is an eroding or accreting one.

Another highly dynamic geomorphic feature of relevance here is sandy eaches. Sandy beaches are formed where low-wave energy prevails and in areas where continental shelves are wider. Sandbars formed at the estuarine mouths act as a barrier.

On the landward side, dunes are formed which are shaped by the wind.

As opposed to these low-wave energy sandy beaches, another important coastal geomorphic feature is the high-energy environment of rocky coasts. These coasts are generally steep and often vertical, where cliffs are seen.

As for the warm tropical waters of Indian coast, coral reef formations – both barrier reefs and atolls are important geomorphic features. While crystal clear water and high salinity are prerequisite for coral formations, muddy and turbid water brought down by rivers and where it mixes with salt water from the sea, a unique ecosystem evolves – the mangroves.

Taken as a whole, the CAE is the zone on the planet where intense human activity meets the constant but varying force of nature - in particular, from the adjacent ocean. The resulting interactions leave their mark on the shoreline in varying intensity – - either leaving it in its natural state, or frontier. a highly artificial creating Activities such as construction of ports and dredging (for keeping harbours open for safe passage of ships) create disproportionate hydrodynamic change that severely impacts both the bottom topography and the littoral sediment transportation resulting in erosion or accretion of the shoreline. The most prominent and long-standing human residents, in such a dynamic geography, have been marine fishing communities.

4. PROBLEMS CONFRONTING THE COASTAL AREA AND ADJACENT OCEAN

Today, our coastal areas and the adjacent ocean are under multiple pressures – ecological, economic, and social. They face numerous problems.

The first and most significant of these problems pertain to degradation of the fragile coastal habitats caused by expanding human activity which converts natural

areas into artificial surfaces. The examples include industrial activity, infrastructure for ports, protection measures against erosion, waste storage, tourism, transport, and housing. These affect shoreline and coastal dynamics. Some forms of aquatic and agrarian activities, including coastal aquaculture, mariculture, and destructive fishing, also contribute to habitat degradation.

A second pressure is that of pollution. Being a tail-end ecosystem, coastal areas and the adjacent ocean are affected by a range of pollutants from upland sources which reach the coast through the rivers. These include significant loads of agropesticides, nutrients, heavy metals and chemical compounds from industries and urban sewage. Nitrogen and phosphorus contained in the pollutants cause eutrophication of the adjacent oceans and cause blue-green algal blooms which can choke aquatic life by depriving it of oxygen.

The third pressure is the impact of climate change. This leads to increasing temperatures of shallower nearshore ocean. The cascading impact results in the following: changes in evaporation which alters wind pressure and results in unpredictable weather changes leading to cyclones, storms, sea level rise, flooding and erosion. Warmer oceans also create changes in the behaviour of key fish stocks affecting livelihood the of fishing communities.

A fourth pressure is the extraction of resources such as sand, gravel, corals, and ground water. Added to this, the impact of upstream activity such as the construction of dams across rivers in the midland and uplands, affect the hydrology of river basins located in the CAE. This affects the hydrodynamics of estuaries, starving the coast of natural sediment. Upstream runoff pollution (such as from fertilizer/pesticide residue) which is carried down the rivers affect the freshwater lens of the shallow ground water in the CAE.

All these contribute to more coastal erosion. subsidence. and saltwater intrusion into the aquifers. There is now growing realisation that these pressures enumerated above create changes in the human-nature relationships in the coastal areas and adjacent ocean. We are approaching a tipping point which calls for more creative thinking on how we can envision integrated, holistic, bio-ecological, economic, social, and cultural approaches towards coastal and adjacent ocean imaginations.

Envisioning bioregions in the oceans is a vastly different proposition compared to attempts at doing so on land. Establishing territorial rights on land (terra firma) is vastly unlike efforts at making territorial claims to the fluid aquatic milieu of the oceans (aqua mater).

5. ENVISIONING BIO-ECOLOGICAL REGIONS FOR THE COASTAL AREA AND ADJACENT OCEAN [6]

Coastal fishing people world-over have used their adjacency to the ocean as the basis for priority and preferential 'micro' access rights to the fugitive resources within the littoral realm. Coastal communities have over centuries evolved lifestyles/cultures in keeping with these specificities and by doing so have

^[6] The three-tier framework which is articulated in this Section is taken from Kurien, J, 1998.

conserved the geomorphology and productivity of the regions rather than laying claims to bounded territory.

Historic efforts at the global level to divide the ocean territory between peoples and countries were made by emperors and popes. Maritime traders generally resisted such efforts and argued for unfettered freedom of access to the seas.

More recently, nation states have jointly negotiated and arrived at a 'law of the seas' for all to follow.[7]

However, both the micro and global efforts to lay claim to ocean territory and resources have evolved over time through conflict and consensus.

A new perspective requires overlapping 'micro-global' linkages -- bottom-up and top-down -- to arrive at culturally meaningful and socio-ecologically sustainable marine bioregional territories.

A. Micro (CAE) Level

The micro level refers to the village or community, which occupies a coastal area adjacent to the ocean. They have had intergenerational historical access to the sea for fishing, collection of shells, planting mangroves and other such activities. Each village can therefore be designated as a specific CAE.

Given artisanal technological levels (craft powered by human and wind energy and gear/tackle payed out by human effort), and the presence of other fishing communities on the same coast, any village/community's seaward access, both outward and lateral, was limited.

Intra-community/village interactions

Within specified CAE. communities have had their own local governance systems that managed resource access. These systems may depend on norms articulated by the community leadership, or rights granted to certain locations through a lottery system or by the state. Rights of access to aquatic resources are controlled using appropriate technological artifacts such as nets, traps, weirs, that were used at the proper time and season in keeping with physical factors like tides.

These technological and seasonal characteristics in turn introduce diverse social relations in the community. For example, women harvesting in the near shore using small craft and gear and skilled at placing traps and men venturing further away in larger boats where collective enterprise is the norm. Another example is owners, where boat working either collectively or individually, agree to alternate as crew, getting a different share from season to season. But for the most part, the aquatic resources and realm of operation are culturally understood to be collectively owned, though accessed individually or in groups.

The sea area near the shoreline, the estuaries and creeks are the primary spawning grounds of fish life. These areas have been sensitively protected. Very elaborate and complex regimes of management have evolved within specific eco-niches. They remain in some places, but in a very diluted manner.

^[7] This is called the United Nations Convention on the Law of the Sea (UNCLOS)

Inter-community/village dynamics

The customary practice has been that, when marine resources straddle[8] across the littoral zone of a CAE, they could be claimed and accessed (harvested) by members of that village as a matter of priority. However, territorial claims were temporarily proffered only when members of adjacent villages disrespected this priority. The 'rights' were essentially over the fugitive/sedentary resources transiting across a realm at any given moment in time and not over the realm as such.

Given that each CAE had its spatial, ecological, and socio-cultural specificities, the result was a horizontal, 'bead-necklace' network of CAEs with each 'bead' having its own character. The common 'thread' on which the bead-necklace CAEs were attached would be a 'customary law'. These CAEs were indeed 'community common property.'[9]



Fig 3: Bead-Necklace Network of Coastal Area Ecosystems

Credit: Azilaa.com

These micro level CAE's can be considered as the foundation of a new bioregional understanding of the coastal areas and ocean space.

The issue of spatial delineation of land and sea of a CAE

For a meaningful and acceptable bioregion, the landward and seaward boundaries, that differ in spatial scales in terms of biology, ecology, social-economic characteristics and politico-geographical variations need to be considered.

As for the landward extension the limit of the impact of salinity intrusion (in the event of a river/stream being part of the CAE) can be one parameter. The other can be just the landward administrative boundary, of the lowest governance structure, in which the CAE is located. [10]

^[8] Straddle is the term used for fish stocks which swim across ocean territories

^[9] In Aceh Province, Indonesia, the 400-year-old customary fisher organisation called Panglima Laot (Commanders of the Sea) adopts a socio-ecological land and sea boundary for each of their village realms.

^[10] At the global scale the landward distance of the 'coastal zone' is often as wide as 50-100 kms. For our purpose of a micro-level CAE, this is clearly too wide.

For the seaward extension, an ecological basis can be the distance to which fishers venture to harvest the fish resources, or the 50-metre bathymetry line. From an administrative perspective, the maximum seaward extension can be 4 nautical miles (though the depths of the sea at this distance will vary in accordance with the structure of the continental shelf).[11]

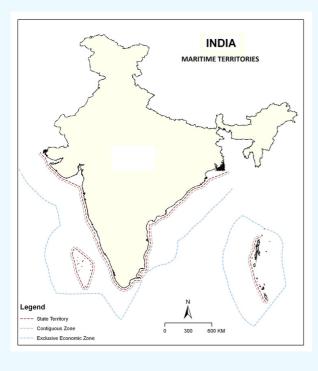


Fig 4: Seaward Extension of Maritime
Boundaries

Source: Gia Info Systems

Note also that in our Indian context, a significant share of the fishery resources (at least 20-25 percent) will be found within the (varying) depths that are coterminus with this fixed distance.

However, it should be kept in mind that unlike terrestrial systems, more than 80 percent of our ocean is unexplored, unobserved and unmapped. This, therefore, will be a major challenge to envision a bioregion that incorporates both a seaward and landward component. Perhaps traditional knowledge and wisdom of the marine fishing communities could partly resolve this dilemma.

Finally, delineation of the shoreline is perhaps a more daunting task due to its fuzzy and dynamic nature all along its length.

The major concern about the shoreline is that of erosion and accretion. Erosion and accretion are natural geomorphic processes where wind, waves, currents, and tides detach, move sediment, and deposit the same elsewhere. However, major interventions like coastal infrastructure development and also climate change, accelerate erosion-accretion, impacting life and livelihoods of millions of people.

Natural erosion-accretion is a very slow process that has continued through ages. Sediment deposited along the beaches strengthen the margin of the land. Offshore sand ridges buffer the strong waves. However, geomorphic processes of the Indian coast are, by and large, influenced by the South West and North East monsoons.[12]

During these monsoon months surging waves batter the coast with high energy, making the coasts -- already tampered by

^[11] To make the CAE a reality there is need to propose a jurisdiction of local self-government (LSG) institutions to include up to 4 nautical miles into the coastal sea. This will require a Constitutional amendment. [12] June to September by South West Monsoon and February to May by North East Monsoon.

humans and human induced climate change -- experience irreversible damage[13] making efforts at delineation a daunting exercise. While the efforts to combat climate change are being considered at the global scale, efforts to mitigate the impacts at the micro level are an ongoing challenge for the State and Local Self Governing (LSG) bodies.

Perhaps, the concept of bioregions as planning units can be linked to new perspectives that may overlap with governance boundaries like panchayats and municipalities. This could contribute more meaningfully in the direction of both mitigation of erosion-accretion effects and efforts for a more meaningful delineation. As earlier mentioned, the communities that get their livelihood from specific ecosystems, evolve their cultural and production practices through their own internal governance systems. However, with the advent of new administrative boundaries and governance, traditional systems have been largely ignored causing harm both to community cohesion and the sustainability of the resource.

Maybe these micro-level bioregions should extend beyond coastal fishing interests. However, the fishers can still be the main initiators for organising a wider set of concerns which straddle across economic sectors including, coastal recreation and tourism, coastal sports (scuba diving, surfing and the like), coastal agriculture and mariculture[14].

Widening the base in this manner, could become an important element in 'firming' up the concept of a local marine bioregion. In this way, multiple economic interests, concerned with the sustainable ecological integrity of a shared micro-CAE's, can be brought together for collective action. This would ensure a decent life, livelihood and provide for a greater democratization of the local marine bioregion.

[13] Irreversible because those hundreds of breakwaters constructed perpendicular to the coastline of the entire country are here to stay. The erosion caused by these breakwaters is mitigated by dumping stones and tetra pods or groynes which further exacerbate the damage.

14] In 1989 the National Fishworkers Forum (NFF) organised a national march with the theme 'Protect Water. Protect Life'. Commencing from both the western and eastern coastlines of Gujarat and W. Bengal respectively they marched down to meet at Kanyakumari. The march came to be popularly called the 'Kanyakumari March'. The purpose was to widen the coastal concerns from merely marine fishery issues to broader discussions about water and the coast, and its link with life. The result was that, while fishers took the lead, several other communities living on the coast participated. Issues of fresh water supply to coast inhabitants; pollution of deltas and ground water; the discharge of tourism and industry related effluents into the sea; saline intrusion into coastal ground water sources; and several other issues which adversely affected the whole coastal ecosystem got highlighted. This collective action was one of the important civil society pressures prompting the promulgation of the CRZ Notification in 1991

Socio-cultural foundations for CAE bioregions: Some Historical Roots[15]

Along many parts of the coastline of India, within each of our nine maritime states, the community-based socio-cultural (including religious) foundations of such bioregions persist[16].

These community arrangements, which we describe here, provide examples of how different communities set up institutional mechanisms to deal with the specifics of the bioregion in which their fishery resources existed. They are largely in the realm of 'customary arrangements' which continue to exist today. However, we mention them here as they provide possible indicators about how to envision new bioregions for the coastal areas and the adjacent oceans.

Ur Panchayats of the Coromandel Coast, Tamilnadu

The word "Ur" means village in Tamil. It refers to a bio-spatial territory which is usually peopled by a specific occupational group.

The Ur panchayats on the coastal tract have historically consisted of at least three levels. They are strongest at the microlevel of the CAE – the Ur, or village. The second level, which networks the microlevel institutions into groups, coincides with a sub-region (taluk) of the state. One

of the Ur panchayats in each of the subregion groupings, plays the role of the head village (talai gramam). It is this panchayat which takes the lead to call for meetings of the group. The fisher population views the head village as having more power and status because of its larger population, wealth, or socio-cultural influence. The third level includes the whole fishing population of the region. Its jurisdiction coincides with a remembered heritage of 64 villages from the ancient past. The subregional and regional organizations spring to life, only upon necessity, and their powers are limited.

At the micro-level, the Ur panchayat deals importantly with issues involving access to, and management of, the near shore marine space and fishery resources of their CAE. They also deal with conflict resolution, which is an inevitable aspect of human fishing activity across CAE's. (Bavinck M et al 2017)

Kadakkodi of Malabar Coast, Kerala

The word Kadakkodi is derived from two Malayalam words kadal (sea) and kodathy (court). This institution is rooted in popular culture and belief systems, which is linked to the social, economic, and ecological perceptions of fishermen's attitude to the concept of sufficiency with regard to use of their resources. *Kadakkodi*

^[15] One British administrator who recognised cultural and bioregions on the Indian coast was James Hornell. He observed that the boat designs of Indian fishers were co-jointly influenced by the geo-morphological of a coastal area and ethnographic and socio-cultural history in that area. He divided the Indian coast into 8 regions on this basis (Hornell, J 1920)

^[16] In some cases, they are even networked into a socio-spatial hierarchy covering larger coastal space which are peopled by one community.

is primarily a community-based system which integrates marine fisheries management and various socio-cultural functions of local fishing communities. The management goals of the kadakkodi system have evolved and got prioritised based on the community's engagements with natural environments and the socioeconomic order of the society. Being an informal organisation, kadakkodi acts as a protector and regulator of resources and fishers and contributes to resource sustainability in an unintended manner. It is difficult to differentiate its fisheries management functions from its other activities. As with most such local-level institutional arrangements, resolution of conflicts, between users of the CAE, remains one of its important functions. (Kurien J, 2001)

Koli Samaj

Koli is an umbrella term to refer to several castes and tribal groups in coastal Maharashtra, Gujarat and Goa, and they profess different religious faiths. A majority of the Koli fisher people in Mumbai are either Son-Kolis or Mahadev Kolis.

The Kolis were probably the original inhabitants (12th Century onwards) of what is Mumbai today. They considered the coastal land and adjacent ocean as their community's transgenerational inheritance. Early historical records vouch for this. British East India Company (EIC) ledgers of the late 18th century acknowledge the importance and wealth of the community.

Given their skilled seamanship, they were a great asset to the EIC in the loading and unloading operations of their vessels anchored out at sea.

In recognition for these services, the Kolis were granted exclusive rights to all the fishery, not just close to the islands but out to several miles into the sea. On land they were allowed to build their habitats on any coastal tract suitable for their business. They were also granted land to beach their vessels and dry their fish. (Mathews RD, 2005).

To this day, Kolis continue to have the rights over some of the costliest real estate on the planet (their koliwadas in Mumbai) and have their traditional rights to the parts of the adjacent sea where they place their stationary nets used for different types of tidal fishing.

Their traditional (Koli organisations Samajams) strong community are organisations which negotiate with the Mumbai metropolis authorities on their land rights. They also have significant authority with the Department of Fisheries and other government departments over questions regarding their rights at sea for fishing. Intra-community solidarity is high despite individual families and members having adopted different religions.

The Kolis are perhaps the only natural resource-dependent occupational groups in the Mumbai metropolis. There are complex historical and cultural reasons that prevented them from accessing educational and non-fishing occupational opportunities. This may partly explain why

they do not share the highly speculative 'private property right' real estate aspirations of the other communities of the metropolis. Perhaps it is the nature of fishing as an economic and social activity, and also as a kind of labour practice, that validates the commons as an essential and natural principle of economic activity rejecting property principles. Communitarian values survive.

Despite all the above factors which are favourable to Koli's establishing bioregional territorial rights, the reality is that the commercial pressures of modern life in Mumbai have slowly taken their toll on these strong communitarian values of the community.

Padu System in Pulicat Lake

Padu literally means a 'fishing site' with a temporo-spatial connotation. The use of the 'padu' as a system is evident in some fisheries of South Asia. (Mathew S, 1991) Pulicat Lake is a lagoon situated just north of Chennai city. The lagoon is organically connected to the adjacent ocean and is rich in prawn resource. The padu system in Pulicat is a traditional system of granting entitlements to adult male members of the fishing community belonging to the Pattanavars caste who reside around the lagoon. The allotments of specific 'plots' in the lagoon are made based on a lottery system. Since the plots are of varying ecological productivity, the lottery, which assigns a plot to a member for a season, helps to ensure equitable allocation across members over time.

The padu system has a governance mechanism, which includes procedures for conflict resolution and ensures members follow the rules. However, with the increase in the price of prawns due to its export potential, conflict between the members of the padu system on the lagoon and fishers living close by on the marine coast, who are not part of it, has increased. Since prawns spend a part of their early adult life in the lagoon and latter part in the adjacent ocean, there needs to be proper management of the resource at both stages in its life cycle. Consequently, the padu system, which operates only in the lagoon, plays a crucial socio-ecological role to maximise the harvest and earnings form the two connected ecosystems, to the advantage of both groups of fishers.

The examples which we have enumerated above exhibit some key characteristics which merit focusing upon in our endeavour for creating bioregions for the coastal area and the adjacent ocean.

In the case of the Ur Panchayat, it is the organisational possibility for a nested hierarchy of bio-regions. The Kadakkodi, lays emphasis on the concept of sufficiency as a foundation for sustainability of a bio-region. The Koli Samaj points to the singular advantage of access to historical records as a basis for claiming the commons within a bio-region. The Padu system highlights the importance of a strong governance mechanism for conflict resolution.

B. Mezzo Level

The mezzo-level of bioregional delineation can be achieved by the aggregation of micro-level CAEs situated within what is termed as a primary or secondary sediment cell.

The sediment cell[17], is the aquatic realm along a stretch of CAEs that fall between boundaries which partly or wholly contain sediment (sand) movement. Within a sediment cell boundary, coastal processes act as a coherent, integrated system. It is a self-contained unit. It forms, at a mezzolevel, a more coherent bioregion across CAE boundaries.

Any development within its boundaries will have minimal impact on areas outside them.

The boundaries of a sediment cell are often delineated and hugely impacted

by rivers flowing out into the sea. There are large primary sediment cells that can then be disaggregated into smaller secondary cells.

In a fluid coastal sea, the sediment cell concept may appear rather static. However, it is a helpful beginning for integrating the landscape and seascape perspectives of CAE's.

In the coastal zone seascape of India there are 27 primary cells composed of 59 secondary cells along the coastline of India's mainland.[18]

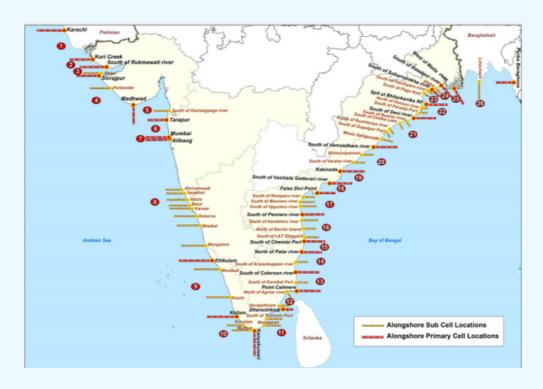


Fig 5: Sediment Cells

Source: Ramesh et al 2021

^[17] As defined by the National Centre for Sustainable Coastal Management (NCSCM), Chennai (Ramesh R et al 2021)

^[18] This compares with the landscape mapping of 35 integrated river basins disaggregated into 112 catchments and 3257 watersheds

We assume that the maximum seaward extension within this mezzo-level sediment cell to be 12 nautical miles. The depths of the sea at this distance will vary in accordance with the slope of the continental shelf. The 12 nautical miles area which surrounds our coastline is called the Territorial Sea under the United Nations Convention on the Law of the Sea (UNCLOS) (see below). The country has exclusive sovereign rights over this realm. Under our Constitution, the jurisdiction of the nine maritime states in India extends to this limit for fisheries. In our Indian context, a significant share of the fishery resources (at least 60-70 percent) will be found in this area.

Working within a sediment cell may provide a better opportunity to observe and monitor the impacts of other human interventions which may have adverse effects on the ecological integrity at the mezzo-level. Coastal erosion, caused by altered sediment transport dynamics, by built structures, is a good example. The erosion, thus caused, will badly affect all the micro-level coastal communities and other economic interests which operate at this level.

C. Macro (National) Level

The national level bioregion, within which the mezzo-level sediment cells can be subsumed, is the Exclusive Economic Zone (EEZ). The EEZ came into international recognition and enforcement with the ratification of the United Nations Convention for the Law of the Sea (UNCLOS) in 1994.

The EEZ, is that realm of ocean territory stretching outwards to 200 nautical miles from the coastal baseline, over which the coastal nation-state has sovereignty. In the part of the EEZ which is beyond the Territorial Sea, the nation-state has the rights to explore, exploit, conserve and manage the living and non-living of the water column and the underlying continental shelf (See Figure 6)

Disagreements between contiguous countries arise about defining their EEZs. Even after resolving this, the fishers may violate the EEZs of the other country. This leads to considerable conflict and political debate.

The conflicts between India and Sri Lanka; India and Pakistan; India and Bangladesh over such violations are cases in point. The case of India and Sri Lanka illustrates how bioregions, (Palk Straits) despite having a long history of social, cultural, and bioecological commonness, get overtly politicised, when new boundaries of nation-states are drawn over them.

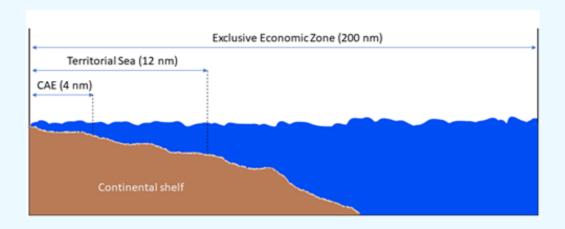


Fig 6 Exclusive Economic Zone, Territorial Sea, and CAE

Perhaps, the measure to which the postindependence Indo-Sri Lanka marine bioregion conflicts can be settled, will also depend on the degree to which we can "go back" to these historical and customary bioregions. These bioregions were realms where small-scale fisheries prevailed and biodiversity was preserved by local institutions. But their hastened demise began with the introduction of destructive fishing methods such as bottom trawling[19].

Maybe, it will be in our collective ability to make some of these 'reversals' that the prospects lie for realising the dream for new marine bioregions in South Asia.

6. WEBBING A NEW NET

Webbing a new net, with the bio-regions at three levels, requires that we envision them

[19] Bottom trawling is a fishing technique which was popularised by an Indo-Norwegian Project (INP) in the 1950s in Kerala State and also in the Palk Straits region. Trawling is a fishing technique which was innovated in the temperate ocean ecosystem. It is therefore innately unsuitable for use in tropical oceans which have a totally different ecosystem and fishery resource configuration. Trawling is an economically efficient way of harvesting prawns, that dwell at the ocean bottom, and have a lucrative export market. The funnel-shaped trawl net, dragged by the trawler, ploughs the sea-bottom for prawns. In the process it also picks up all manner of other flora, fauna, and non-living matter. Consequently, incessant trawling ruins ocean biodiversity. It is an ecological disaster! When trawling was first introduced in India (and elsewhere in Asia too), the investment required for these fishing units was far outside the reach of ordinary fishers. So, investors from outside the fishing community entered to take advantage of the profit-making opportunity. Thus began the breakdown of customary fishing community institutions. They could not handle the onslaught of destructive fishing, undertaken using alien technology, which was largely in the control of investors from outsider the fishing community.

as a nested and layered network within the EEZs of each country.

We illustrate this with a schematic diagram, that contains all the key elements of our entire discussion above.

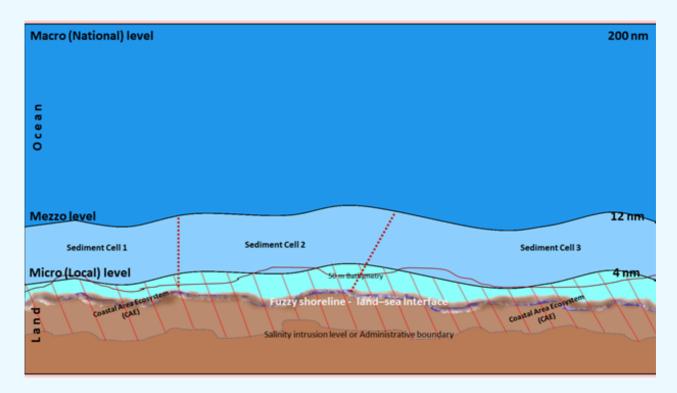


Fig. 7 Nested and layered network of all elements that make up Bioregions

To reiterate, the bioregional foundation for the coastal areas and adjacent ocean are the CAE at the micro-level.

Reviving and renewing institutional arrangements where they already exist, can be the starting point of any endeavour towards the first steps of delineating marine bioregions.

Where such local level arrangements are absent, the first measures should be to identify relevant/appropriate socio-

ecological, land-sea territorial spatial units, which can form CAEs. The process to identify such units must of essence be consultative and participatory with discussions taking place with the communities which inhabit such territory. The growing threats from climate change to the coastal area is one of the most promising opportunities and motivators for discussions on identification of such meaningful CAEs and their participatory governance.

Our suggestion for a seaward extension of territory for coastal local self-government (LSG) institutions needs to be flagged in this context. To achieve this, there needs to be pressure from the bottom-up by all coastal communities, not just fishers. Also, it is imperative that the politicians of the coastal states are convinced and committed to this concept.

We would suggest a two-stage process to achieve this.

First, we must use the fact that as per the Constitution, the 12 nautical mile limit is under the jurisdiction of the coastal state government on fishery matters. If there is a consensus among coastal states that a lower limit (4 nautical miles) be brought under the jurisdiction of coastal LSGs for the purpose of fisheries, it can be a start to creating the vital land-sea concept for CAEs. Such an amendment to the CRZ Notification may also be more easily achieved where a sub-region of CRZ IV can be notified as a 'littoral regulation zone' (LRZ)[20] and brought under the governance of LSGs.

Secondly, once there is adequate experience gained with this extension for the purpose of fisheries, the next step will be to push for 'management and governance of the LRZ with regard to the sea and all natural resources therein'.

This step may require a Constitutional amendment, which is a more complex process. However, we leave these thoughts for the legal experts to ponder over.

7. IN LIEU OF A CONCLUSION

The social movement striving for bioregionalism is international in its efforts and importantly oriented towards its focus essentially on the resources of Planet Earth. What we have attempted to achieve here is to make an initial endeavour towards envisioning bioregions which straddle both Planet Earth and Planet Ocean.

Our attempt at trying to articulate a bioregional framework for the coastal areas and the adjacent ocean essentially arises from our collective experience of five decades of work with communities for whom earth and ocean are intimately and organically united in the pursuit of life and livelihood. Their struggles to sustain marine resources, their legitimate historical and cultural claims to ocean space in which they fished, and the coastal land on which they lived, portray a mutuality of interests which cannot be separated.

Following Peter Berg, our effort was to -

[20] The original Coastal Regulation Zone (CRZ) Notification of 1991 declares the CRZ as a landward part of the coastal area ecosystem (CAE as referred in this paper) which includes the portion from the low tide line (LTL), up to 500 meters above the high tide line (HTL). Our suggestion here is for a Littoral Regulation Zone (LRZ) as the seaward part of the CAE and extending up to 4 nautical miles from the coastal baseline. See (Nandakumar D & Kurien J, 2000)

attempt envisioning bioregions best described by the experience of the people who lived within it and fostered a distinct resonance with the living and non-living resources therein.

Our framework is premised on this reality -- its past, as well as its continuing presence in present day coastal areas and adjacent oceans in India and other developing countries.

The present is the past of the future. However, it need not be a linear progression that carries with it all its socio-ecological and cultural codes. Yet, it may be wishful thinking to imagine a future which is not also anchored in the experiences and aspirations of the past and present.

We harboured these thoughts in mind as we ventured to articulate our vision of what can be the oars and sails which aid in moving us forward to the horizon of the future – where nature, women and men meld together.

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John Kurien, is a reflective practitioner. He was involved for five decades with organisational initiatives and research studies on the labouring classes in the fisheries sector in India and other countries focusing on coastal zone ecology and livelihoods. In 1984 he facilitated the first International Conference of Fishworkers and their Supporters organised in Rome, functioning as its Secretary-General and was a founder member of the International Collective in Support of Fishworkers. He has worked with fishing communities in Cambodia and Indonesia for several years facilitating co-management initiatives. He retired as Professor from the Centre for Development Studies, Trivandrum and was also Visiting Professor in Azim Premji University, Bengaluru for a decade.



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Nalini Nayak is a community organiser, trainer and researcher who has worked for over five decades in coastal communities in India, Asia, and Africa, particularly with women involved in small-scale fisheries. She has engaged in successful mangrove restoration initiatives with coastal communities in the estuaries of Manakudi, Tamilnadu and Chetwa, Kerala. She was a founder member of the International Collective in Support of Fishworkers. She presently works with informal women workers in the Self Employed Women's Association (SEWA).

ABOUT SOUTH ASIA BIOREGIONALISM WORKING GROUP

The South Asia Bioregionalism Working Group is a voluntary network of members reimagining an ecoregional and bioregional governance for South Asia. It was initiated at a Democracy Vikalp Sangam (Alternatives Confluence) in October 2019. Our ecologies in the region are contiguous and so is the culture, which the group aims to highlight through documentation, dialogues, and action.

You can read more about us on this link: South Asia Bioregionalism Working Group

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