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The Coastal Regulation Zone of Goa: Oceanographic, environmental and societal perspectives

Antonio Mascarenhas

Current developmental trends along the coast of Goa offer an opportunity to evaluate the effectiveness of the Coastal Regulation Zone (CRZ) legislation. The mandatory 'No Development Zones' in proximity to, and as buffers for, ecosystems have sufficient oceanographic and environmental validity to be upheld. However, this instrument is being opposed and misinterpreted. Sectoral practices, partisan policies, unbalanced tourism, and absence of political will have all contributed to the CRZ being breached. A national authority that can interact authoritatively with multiple agencies appears to be the only way to attenuate impacts on and restore resilience of coastal ecosystems.

UNTIL the 1970s, the coastal zone of Goa was largely pristine[1,2]. Subsequently, this zone witnessed a rapid increase in population and a dramatic growth in developmental activities after tourism was avidly promoted[3,4]. Since unplanned development had started along other coastal strips of the country as well, a national legislation, known as Coastal Regulation Zone (CRZ) notification[5], was formulated in 1991. Goa became a focus of the legislation because coastal tourism is a major economic activity in the state.

Socio-economic pressures drive changes in coastal ecosystems. The international programme on Land–Ocean Interaction in the Coastal Zone (LOICZ) has identified four areas of investigations. One of these addresses changes to coastal systems due to social and economic activities. Since coastal tourism and related anthropogenic activities (Figure 1) have intensified during the last two decades[3,4], and considering various adverse impacts of tourism on coasts worldwide[6], the Goan coast offers an opportunity to test the use and effectiveness of coastal legislations with respect to human activity and ecosensitive coastal systems. This paper attempts to analyse issues related to the CRZ of Goa from oceanographic, environmental and societal viewpoints.

The coastal zone of Goa is characterized by sandy stretches and an intricate network of water bodies across lowlands. The sea front is marked by a combination of

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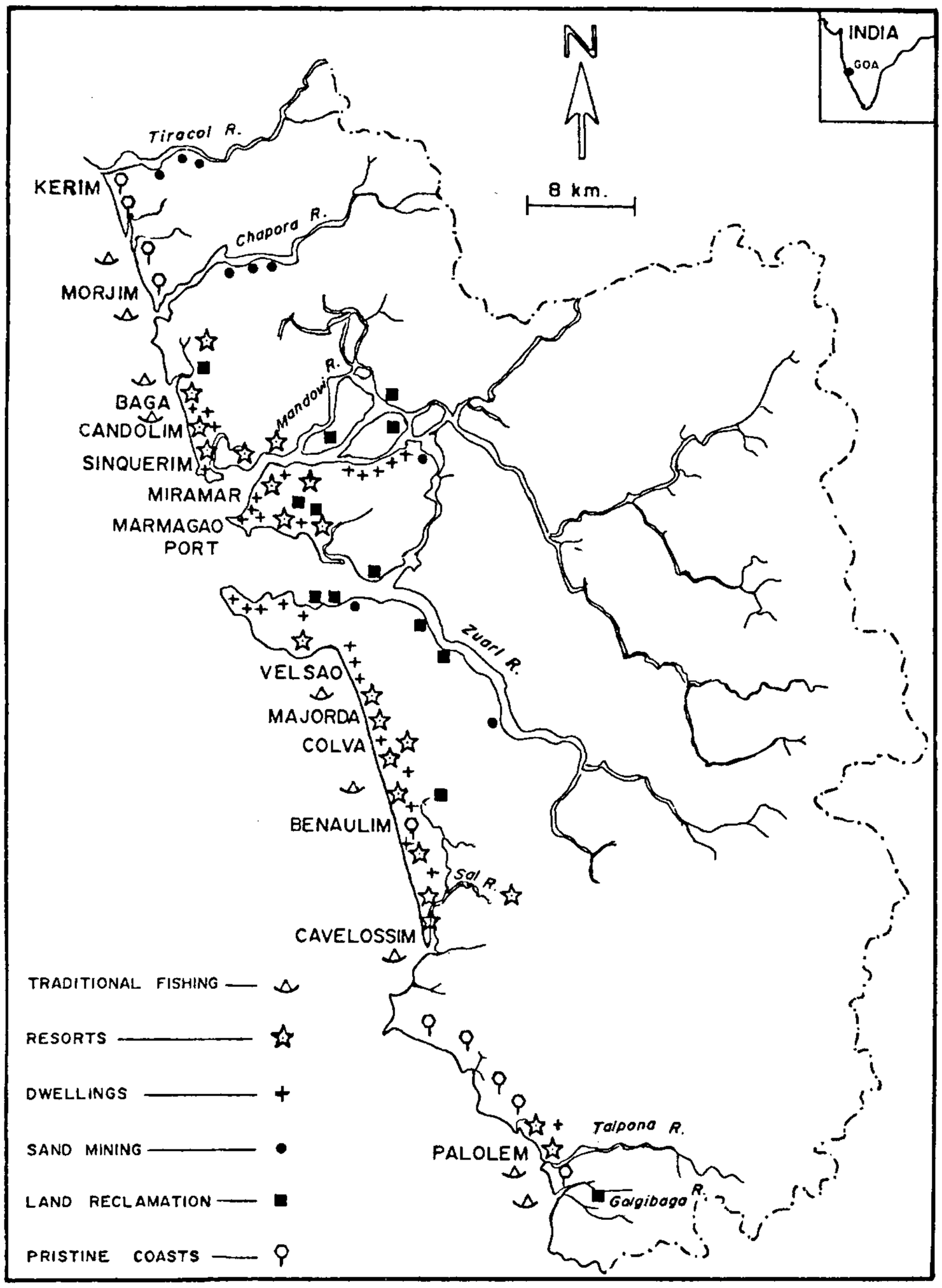

Figure 1. Map showing some anthropogenic activities along the coasts of Goa.

beaches, rocky shores and headlands. Of the 105 km long coast, more than 70 km comprise linear and wide sandy beaches, all backed by 1 to 10 m high dunes; sandy pockets and secluded coves backed by rocky cliffs are also found. The coastal plain, 20 to 35 km in width, consists of lowlands traversed by seven major and four minor river systems that experience tides. Small islands, shoals and mangrove swamps are observed within water bodies.

History and essence of CRZ notification

A number of official reports have in the past dealt with policies on coastal land use, tourism development, management of beaches, coastal area planning, infrastructure problems, conservation of coastal ecosystems, integrated rural development and improvement in the quality of life[7–11]. Although these are documents of public interest, they were rarely available to the public. Moreover, the regional plan[10] was amended several times. All these documents are now obsolete.

In 1981, a letter from the Prime Minister Mrs. Indira Gandhi to the Chief Ministers of coastal states directed that, owing to their aesthetic and environmental value, beaches had to be kept clear of all activities up to 500 m from the highest water line. Subsequently, the Ministry of Environment and Forests (MoEF) enacted the CRZ notification[5] issued under the Environment Protection Act of 1986. Its main purpose was to control, minimize

and protect environmental damage to sensitive coastal stretches from unplanned human interference. The Government of India therefore declared coastal stretches of seas, bays, estuaries, creeks, rivers and backwaters which are influenced by tidal action (in the landward side) up to 500 m from the High Tide Line (HTL) and the land between Low Tide Line (LTL) and HTL, as CRZ. The notification also imposed restrictions and formulated guidelines for various coastal activities. The notification lists various prohibited activities, regulation of permissible activities, procedures for monitoring and enforcement, coastal area classification and development regulations, norms for regulation of activities and detailed guidelines for the development of beach resorts and hotels. The CRZ notification has placed India amongst the select countries in the world that have framed laws to legally protect sensitive coastal ecosystems, and to demarcate areas for conservation.

In the notification, the CRZ is divided into four main categories[5]. CRZ I includes (i) areas that are ecologically sensitive and important, such as national parks/marine parks, sanctuaries, reserve forests, wildlife habitats, mangroves, corals/coral reefs, areas close to breeding and spawning grounds of fish and other marine life, areas of outstanding natural beauty/historical/heritage areas, areas rich in genetic diversity, areas likely to be inundated due to rise in sea level consequent upon global warming and such other areas as may be declared by the Central Government or the concerned authorities at the State level from time to time; and (ii) area between LTL and HTL. CRZ II comprises sectors that have already been developed up to or close to the shoreline; these are 'developed areas' referred to as those within municipal limits or in designated urban sectors which are already 'substantially built up' and which have been provided with drainage, approach roads and other infrastructure such as water supply and sewerage mains. CRZ III refers to areas that are relatively undisturbed and which include coastal zones in rural areas (developed and undeveloped) and also urban areas that are not substantially built up. CRZ IV only comprises insular stretches of Andaman, Nicobar, Lakhshadweep and small islands.

Although the draft was open for public scrutiny before it was notified, pressure from various lobbies led to the formation of an apex committee, appointed to look into various representations. Subsequently, the first amendment was issued in August 1994 (ref. 12). This order redefined the HTL, and proposed six amendments: distance from HTL for rivers, creeks and backwaters was reduced to 50 m; construction of basements and barbed wire fencing was granted; density of certain constructions could increase; and flattening of dunes and permanent structures for sports were banned.

Simultaneously, all coastal states were bound to formulate coastal zone management (CZM) plans classifying coastal stretches as CRZs. This task was assigned to the Goa State Committee for Coastal Environment (GSCCE). The CZM plans submitted by this committee[11] had to be re-evaluated due to some flaws[13]. Misuse of coastal spaces forced some environment-conscious citizens to file a public interest litigation[14]. After hearing the merits of coastal issues, the Supreme Court of India upheld the original CRZ notification[14].

In June 1996, The MoEF requested the National Institute of Oceanography (NIO), Goa, to delineate ecosensitive areas along the coastal stretches of Goa[15,16], based on which approval of plans was issued in September 1996 (ref. 17). This is the prevailing law which governs developmental activities along the coasts, rivers and backwaters of Goa. The law, however, has been amended twice in January[18] and July[19] 1997 respectively. The latter considered difficulties faced by local people and granted relaxation for construction of essential facilities.

Oceanographic and environmental overview

The statutory instrument which governs coastal activities needs to be analysed from a scientific perspective. This assumes significance because its validity is questioned, the regulations are misinterpreted, and its scientific basis is doubted. The concerns are listed here:

Opposition to setback lines

A vacant space of 500 m from HTL is compulsory for CRZ I and 200 m for CRZ III along the open sea front; for rivers and backwaters, the setback is 100 m or the width of river or creek whichever is less[5]. These mandatory buffer zones have met with resistance and have generated considerable debate due to the following reasons:

(a) In rural coastal undeveloped villages, the common man has reduced opportunity to expand an existing house, or build a new one.
(b) The politician keeps questioning because of the complaints from the constituents.
(c) Since the State Government is promoting upmarket tourism, many beach resorts have spurned setback rules (Figures 2 and 3).
(d) Structures along coastal hill slopes are multiplying, as CRZ laws are silent about buffer zones along promontories.
(e) New spaces for future development are being created seaward by levelling dunes (Figures 4 and 5) and reclaiming swamps (Figure 3).

These circumstances defeat the very purpose for which the laws on CRZ were enacted.

Figure 2. A resort under construction on a dune, a few meters from the water line in the Mandovi estuary, at a place prone to severe erosion. The small sandy strip remains submerged at high tide confirming that the original beach has completely eroded (December 1997).

Figure 3. Lowlands along the northern bank of river Sal at Assolna have been filled and reclaimed for tourism-oriented activities. A mangrove lined bank is converted to a built up bank resulting in reduction of mangroves and wetlands (August 1996).

Tidal action in rivers

The CRZ laws primarily seek to protect inland stretches influenced by tidal action[5]. However, some coastal user groups have sought to undermine the essence of this regulation by misinterpreting the term 'tidal action'. Their contention was that there are no tides in the estuaries and rivers of Goa, a presumption that is against empirical evidence. It is known that tides occur in the estuaries of Goa, and that the effect can be felt far inland. After intervention from the MoEF, local planners have admitted that tides indeed occur in the rivers.

Figure 4. Several rows of sand dunes have been razed to make place for residential units at Miramar. Coastal sand dunes now perform the functions of a residential area (February 1993).

Figure 5. A large dune area has been flattened, and is used as a parking lot at Candolim. Such anthropogenic activities uproot vegetation, render sand loose, and result in its excessive mobility wherein sand then blows inland (December 1997).

The HTL position

The CRZ has to be demarcated with respect to HTL which has been defined as the line reached by the highest high tide[5]. The position of this line is generally delineated using the trace of vegetation along the beach. HTL thus becomes marked by nature. However, this definition was not accepted by all, making HTL a subject of speculation. Subsequently, directions were issued to all coastal states asking them to follow the definitions and guidelines formulated by the Naval Hydrographic Office. HTL is considered as the line up to which the highest water reaches during spring tide.

Sand dunes as CRZ I

The original notification did not include sand dune ecosystems. These geomorphic features are ecologically

sensitive, geomorphologically fragile, vulnerable to stress, and act as nature's line of defence against oceanic forces[20–23]. Keeping this in mind, when the MoEF requested NIO, Goa, to identify ecologically sensitive areas, a case was made for inclusion of sand dunes as CRZ I (refs 15, 16). The MoEF accepted this. As a result, sand dune belts were classified as CRZ I by separate orders for the state of Goa[17]. No new construction up to 500 m from HTL is permitted in areas having sand dunes.

Migrating sand dunes

At several places, new sand dunes are being formed on the beach, seaward of existing dunes. Although smaller in dimension, most of them are covered by dune vegetation and are thus stable. Stable vegetated dunes can often form seaward of the HTL. As the setback is fixed from HTL, it will have to be altered from time to time. However, the notification does not have provision for such a phenomenon.

Islands accreting within rivers

Some sites within rivers have developed shoals which have gradually accreted into mangrove islands. According to CRZ laws, all uninhabited offshore islands are classified as CRZ I; however, those within rivers are not accounted for. In a recent case (presently in the court), one such island is being developed as a resort[24]. Although this activity undermines the spirit behind CRZ, the notification does not discuss issues related to such islands. As a result, such cases are bound to recur as topics of potential legal conflict.

Spits and shoals at river mouths

Three of the seven major rivers of Goa develop seasonal spits at their mouths after the monsoon. This has led to cutting off of some creeks from access to the open sea. The CRZ laws do not consider situations arising from such seasonal or short-lived natural phenomena. They need to be addressed lest they lead to misuse of coastal spaces.

Sea level rise

During the last century, the rise in sea level along western India is estimated to be 10 to 15 cm (ref. 25). In the event of a (predicted) 1 m global sea level rise, the destructive capacity of the seas will result in invasion of beaches with consequent erosion[22,23,26]. This effect may be less severe on the sandy beaches of Goa due to their appreciable gradient. In comparison, the hinterland is characterized by lowlands, some at and even below the present sea level[27]. Therefore, a nominal rise in sea levels will influence inland water bodies and particularly the low-lying 'khazan lands'. These issues involving geological, hydrographic and climatic trends have been overlooked by the local authorities in the CZM plans of Goa.

Development along coastal hill slopes

The notification does not include any guidelines for promontories, headlands, coastal hill tops and slopes. As a result, a lot of construction activity is seen along these rocky but often wooded areas[28]. It is unfortunate that the CRZ notification did not take into account these ecosystems. However, the spirit behind the regulation was to bring such ecosystems within the ambit and scope of the legislation.

Rationale of No Development Zones (NDZ)

It has been argued that the mandatory free spaces as stipulated in the notification have no scientific basis, and therefore lack justification for their existence. However, a closer look at the dynamics of these spaces reveals that NDZs are justified for the following reasons:

(a) The ecologically sensitive dune belts along Indian coasts (including the coast of Goa[3]) often extend to more than 500 m from the beach.
(b) Erosion is prevalent along the world's sandy as well as swampy coasts. About 70% of the world's sandy shores have eroded and retreated during the past few decades[22].
(c) Accelerated erosion is observed along the world's developed coastlines[21,22]. Loss of property occurs when coasts experience erosion.
(d) Sandy coasts withdraw with a sea level rise. The extent of withdrawal depends on the grain size of sand and the gradient of the shore face. Sand dunes are likely to retreat 40 to 400 m per meter of sea level rise[23].
(e) Geomorphological studies have revealed that the predicted global rise in sea levels is bound to cause rapid and extensive retrogression of wetlands, marshes and mangrove swamps[22].
(f) The effective shoreline advance or retreat of a coastal site depends on the global sea level change and local vertical crustal movements. Human activities are a complicating factor that can result in shorelines moving landward, thus invading former dry areas[26].
(g) A rising sea level could also mean greater intrusion of saline waters into estuaries and contamination of coastal acquifers, a common scenario in large urban

areas[26]. Saline intrusion has advanced several kilometers inland.

(h) Global climate change models have forecast increase in the intensity of storms and cyclones, and flooding of coastal lowlands[26].

In view of all these factors, the most cost-effective long-term solution is to set aside land to: preserve coasts for posterity, mitigate forces of the ocean, and allow future marine transgressions. Hence the need for NDZs.

Coastal issues, problems and conflicts

Human pressures on the coastal ecosystems of Goa started during the 1970s when tourism became a source of revenue. This resulted in 80% of the urban growth being located along the coastal talukas[10]. Since then, there has been a proliferation of hotels, resorts, residential flats, dwellings, small restaurants, beachside bars, roads and beach shacks along the coast. This is because most tourism and associated activities are concentrated along sandy stretches. Over 90% of domestic tourists and 99% of international tourists visit and reside along the beach front[4,29].

Although upmarket tourism and related activities have brought in a number of positive benefits in the form of employment-related opportunities[4], coastal developmental activities have induced notable environmental and societal problems. Our surveys indicate that several coastal areas are overcrowded due to a haphazard growth of structures, resulting in undesirable over-urbanization of coastal regions, loss of biodiversity, deterioration in the quality of life and adverse effects on beaches and dunes[1–4,30–32] (Figures 2, 4 and 5), mangroves[4,27], water bodies and 'khazan lands'[4,27] (Figure 3).

The purpose of the notification was to control and minimize environmental damage to coastal ecosystems. The GSCCE was empowered to enforce the provisions of the notification. This committee has difficulty in meeting the objectives because the implementation of guidelines leaves a lot to be desired[33]. This is evidenced by violations of CRZ provisions[34–39]. As a result, relentless anthropogenic activities have resulted in severe negative impacts on coastal ecosystems[3,4,27,30–32]: rapid elimination of sand dunes (Figures 2, 4 and 5), damage to dune vegetation (Figure 5), increase in mobility of sand, transport of sand inland, instability of dunes, denudation of hill slopes, deposition of sediment into estuaries, localized shoreline erosion (Figure 2), seasonal marine salt water ingress, progressive build up of plastic litter, reduction of mangroves, wetlands (Figure 3), and breeding grounds of marine life. Thus, the situation appears bleak.

The major reasons for these problems can be summarized as follows:

Hostility towards CRZ: One finds a growing antagonism to the most vital instrument devised to protect the coastal wealth of the country[33]. Although in force since 1991, the notification is not being implemented seriously.

Sectoral practices: There is a fragmentation of jurisdiction because several agencies work at cross-purposes due to reluctance to cooperate and coordinate. As a result, conflicting economic and management interests are observed.

Irregular management policies: Diverse ecosystems often need sound site-specific management skills. On the contrary, we find a lack of cooperative planning.

Ignorance about the strategic value of the coastal zone: Due to lack of awareness and ignorance about the intrinsic value of coastal ecosystems, policy and planning decisions are based on short-term economic gains. Long-term value of resources is rarely considered.

Migration of human population towards coasts: Unchecked movement of people towards sandy areas has caused anthropogenic stress on coastal systems, degradation of coastal environment and unrestrained growth of coastal strips.

Unbalanced growth of tourism: Beach tourism is the major activity that is being promoted. This has led to a concentration of resorts and undesirable pressures on coastal strips.

Lack of political will: Powerful lobbies of builders and resort owners, who have invested heavily in coastal areas, are mainly responsible for construction of illegal structures and for flouting environmental guidelines.

Lack of integrated information base: Information about various ecosystems and processes and inventories of coastal resources and habitats are hard to find. More importantly, we find a missing link between results of scientific research and coastal area planning.

Consequences of inaction

Inaction by the authorities has led to the following consequences as exemplified in north Goa:

(a) Old coastal villages are fast becoming merged into one long continuous strip of hotels and resorts[29].
(b) Existing fishing settlements are struggling for survival as developers have bought most of the coastal strips.

(c) This strip of the coast has the maximum number of hotels, guest houses, restaurants, tourism shops and beach shacks[29].
(d) There is no proper access to beaches due to a thick spread of structures[2,3].
(e) Authorities are keen in promoting international tourism as a prime policy whereas upmarket tourism is unplanned and out of tune with the present structure[4,29].
(f) Local authorities appear powerless to implement and enforce appropriate plans and policies.

Such an unplanned developmental activity makes Baga–Sinquerim (Figure 1) the most severely degraded strip of the Goan coast[3,29]. Thus, the CRZ of Goa is at stake.

For these reasons, courts have intervened in coastal matters following complaints and petitions from citizens and NGOs[2,34,36,37]. Many constructions have been stopped while some have been demolished. Similarly, courts have ordered hotels and the State Government not to allow constructions within 200 m from HTL. Courts have also ruled that disturbing sand dunes threatens coastal ecology and hence sand mining leases had to be cancelled[2]. Stay orders have been imposed in several cases. Hence, timely judicial intervention[40] has, to some extent at least, preserved the sanctity of the coastal zones.

The future

Sustainable management of human activities in coastal areas represents a complex challenge of the modern times because strategic use of the coastal zone involves short-term and long-term concerns[41–44]. Mitigation and reversal of adverse consequences of past developmental activities generally involves an introspection of long-practised traditions. Coastal issues are science and management-oriented[44], a linkage which necessitates that scientific research be made an integral component of administrative procedures. This is possible only if the interests of individuals are subordinate to those of the community.

The Earth Summit strongly recommended that coastal nations begin to adopt more integrated approaches to the management of their coastal zones[43,44]. This involves a dynamic process in which a coordinated strategy is developed and implemented for the allocation of environmental, social, cultural and institutional resources to achieve the conservation and sustainable multiple use of the coastal zone[43–46]. The key objective is to deal with cross-sectoral problems[47,48]. A sustainable solution could be arrived at through Integrated Coastal Zone Management (ICZM), a modern approach to sustainable multiple use of coastal resources.

With this objective in view, a National Coastal Zone Management Authority has been constituted recently. The mandate of the authority is to take measures for protecting and improving the quality of coastal environment by making specific recommendations to littoral states. The authority is required to inquire into cases of violations of the provisions of the Act, to review cases of violations of rules, to file complaints, and to take corrective action. The national body is also expected to deal with environmental issues related to CRZ, identify ecologically sensitive areas, examine areas vulnerable to erosion and degradation, and identify economically important stretches. Such a body could function as an effective implementing, controlling and monitoring organization. The ultimate goal of the authority is to prepare integrated CZM plans for all coastal states. Such plans with a holistic approach which includes the natural ecosystems and the human socio-economic system may well be the last chance in the battle to save the coastal zone.

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