International Journal of Ecology and Environmental Sciences 45 (4): 395-402, 2019
ISSN: 2320-5199 (Online)

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Islands of Coastal Karnataka – A Unique Journey of Discovery

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ABSTRACT

This article summarises various information on coastal islands of Karnataka to develop a baseline information structure which will be useful for the purpose of conservation and development planning through the applicable regulatory mechanisms. First, the islands were identified with the help of bhuvan database and satellite imageries and verified with google images for mapping purpose and they have been classified as inhabited islands, un-inhabited islands, and islets/rocky outcrops. The details of geography, demography, shoreline characteristics, transportation, agriculture & industrial activities, biodiversity and, environmental issues & hazards pertaining to individual islands were collected and attempted to compile to provide comprehensive information in one compendium. Also, the information on ecologically sensitive areas and geomorphological features of coastal zone of Karnataka were presented along with tourism creating potential of the places. This baseline information on coastal islands provided in this work would serve as a useful reference for planners, policy makers, academicians and all those interested in becoming familiar with the coastal islands of Karnataka.

Key Words: Coastal Islands;, Baseline Information; Biodiversity; Environmental Issues; Ecologically Sensitive Areas.

INTRODUCTION

Islands maintain many of the world's most unique and vulnerable plants, animals and ecosystems, while also playing an important role in the health, welfare and cultural diversity of the people living there. Due to their small size, isolation and fragility of island ecosystems, their renowned biological diversity is under threatened. They are particularly vulnerable to global climate change, climate variability and sealevel rise. Any rise in sea level will have significant and profound effects on their economies and living conditions.

Karnataka is one of the coastal states of India, sharing its coastline along the Arabian Sea. The length of the coastline is approximately 320 km covering three coastal districts namely Dakshina Kannada, Udupi and Uttara Kannada and eight talukas and 1,044 coastal villages. Agriculture and fishery are the two major industries for livelihood and source of income for the local people. Activities of ports and harbours are also taking place in the north Karnataka coast with one major port at Mangalore and ten minor ports in other areas. The Karnataka coast has different geomorphological features which include several river mouths, lagoons, bays, creeks, cliffs, spit sand dunes, and long beaches. Major problems that the coast has been facing include erosion, migration of river mouths, siltation of ports and harbours (ChenthamilSelvan, et.al. 2014). Fourteen rivers that drain into the Karnataka coast and important estuaries of the region are Netravati-Gurpur, Gangoli, Hangarkatta, Sharavthi, Aganashini, Gangavali and Kalinadi.

In the present study, island-wise information such as geographical area, geology, climate, socio-economic profile, political profile, ecological profile and informa-

tion on previous studies and surveys were collected through review of existing reports, literature and published documents. Distance to nearest port, mainland and airport for those inhabited islands were calculated using the IRS LISS IV satellite imageries. Ground truth information, carried out during February-March 2019, was also used wherever possible to improve upon the accuracy of the data. Brief information on islands and coastal zone of Karnataka is given below:

COASTAL ISLANDS OF KARNATAKA

Geography

As far as the coastal Islands of Karnataka are concerned, few islands are located off shore Karnataka coast in the Arabian sea, the major group being St. Mary's Island which is 4 km off the coast from Malpe beach and other small islands and islets are distributed in the river and estuarine environment. There are about 94 coastal islands in the state of the Karnataka, as estimated based on the NRSC's Bhuvan database and information available with the NITI Aayog, Govt of India (2018). Out of 94 Islands listed, 23 islands are inhabited, 56 are uninhabited and 15 islands are listed out as uncertain. However, from the current literature review and ground truth surveys conducted in 2019, there observed changes in the statistics of inhabited and uninhabited islands. The information on inhabited islands, whether continental or riverine type, their location, geographical coordinates, area, length of coastline and seismic sensitivity has been given in Table 1. At present, the inhabited islands of coastal Karnataka are Arge Island, Basavaraja Durga Island, Netrani or Pigeon Island, Kodithale Island, Bhattan Kudru, Bal Kudru and three such other islands whose name is not known.

The land area of almost every island is less than 2 sq. km. Around 90 percent of islands are covered under the Uttara Kannada and Udupi districts whereas, only a few islands are located in the coastal and riverine environment of Dakshina Kannada district (Figure 1). As per the Seismic Zone Map of India, the entire coastal region where the islands are located is covered partly under the Moderate Damage Risk Zone 3 (Medvedev-Sponheuer–Karnik scale MSK VII) and partly under the High Damage Risk zone III (Medvedev- Sponheuer-Karnik scale MSK VII) (NDMA 2016). The three coastal districts of Karnataka (Dakshina Kannada, Udupi and Uttara Kannada) have three distinct agro-climatic zones range from coastal flatlands in the west and undulating hills and valleys in the middle and high hill ranges in the east adjoining Western Ghats of Karnataka. Between the mountain and the Arabian Sea, a narrow strip of coastal plains is present with varying width with about 20 km being the average and maximum height of hinterland as 150 m, with 70-75 m as average (MoEF 2010). The soil type of Karnataka coast is a mixture of laterite rock and clay (Prajapati 2010).

Demography

The information on island wise population is currently not available. However, the district wise population of all three coastal districts is 2,089,649 (Dakshina Kannada), 11,77,361 (Udupi) and 14,37,169 (Uttara Kannada), as per the Census of 2011. The average population density of this coastal region is 253 persons km^{-2} (337 in Dakshina Kannada, 290 in Udupi and 132 in Uttara Kannada). Tulu and Kanada are the local languages in the coastal areas of Karnataka, while other languages like Hindi, English, Tamil, Telugu, Malayalam, Konkani, Gujarati, Marathi, Urdu are also spoken.

Shoreline Characteristics

The coastline of Karnataka extends over a 320 km in length with numerous river mouths, lagoons, bays, creeks, cliffs, sand dunes and long beaches. The continental shelf off Karnataka has an average width of 80 km and the depth of shelf break is between 90 and 120 meters (Prajapati 2010). The details of erosion and accretion for islands are not available. However, as far as the coastline is concerned, three types of erosion have been observed namely, erosion occurring along the open beaches, erosion occurring mouths of rivers and estuaries and erosion at tidal reach of rivers (MoEF 2010). It was estimated that about 30 percent of the coast is facing moderate soil erosion while 16 percent of the coast is facing severe soil erosion. The erosion problem has been observed more severe in costline of Dakshin Kannada and Udupi districts (ChenthamilSelvan et al. 2014). As per the findings of the Avinash Kumar et al. (2010), the nearshore bathymetry of the coastal stretch Talapadi beach - Padubidri beach near Mangalore area, assessed using General Bathymetric Chart of the Ocean (GEBCO) data and with the help of Naval Hydrographic Chart, revealed that depth contours were closely spaced in the southern part compared to the northern part of Talapadi

Figure 1. Locations of Islands along the coast of Karnataka

Figure 2. Locations of ports along the coast of Karnataka

beach to Padubidri stretch, suggesting that the northern part is wider and shallower compared to the southern part of this particular stretch.

Infrastructure, Communication and Transportation

The Karnataka state has twelve minor ports between Karwar in the north and Mangalore in the south which include Karwar, Belekeri, Tadri, Pavinakuruva, Honnavar, Manki, Bhatkal, Kundapur, Hangarkatta, Malpe, Padubidri and old Mangalore (Figure 2). Out of these ports, Karwar is the only all weather port designed for handling of all types of commodities including petroleum products, while the other ports are riverine anchorage lightarage ports. As per the information available with department of ports of the State Karnataka, the State has got 335 ferries out of which, 35 are operated in Uttara kannada district, 20 are in Dakshinna Kannada district and 13 are in Udupi district respectively. These ferry services are mainly provided to cater shore to shore transportation of men and materials of the remotest rural areas, which are not connected either with road or rail transportation. The details of nearest port and distance for inhabited islands are given in Table 1. The nearest airport for these islands would be Mangalore and Goa International airports.

Agriculture, Commercial and Industrial Activities

The traditional communities residing near coastal areas are primarily depending on fishing including shell fish, sand collection and lime shell collection. In the agriculture activities, paddy is the main cereal crop grown in the wetlands of coastal Karnataka. Large varieties of paddy crops are grown abundantly in the coastal region as compared to other ecological regions (Prajapati 2010). Ports, harbours, mining industries, aquaculture farms, boat repairing activities, tourism resorts and other commercial establishments have been taken place along the coastal stretch of Karnataka. According to the State of Environment Report-2015, environmental clearance has been given by the Ministry of Environment, Forests and Climate Change for several infrastructure projects such as conveyers and pipelines, fertilizer, ports and harbors including jetties and berths and metallurgical industries, hotels and beach resorts, fish meal and oil units (EMPRI 2015)

Tourism

Other than wildlife sanctuaries, places of temples for spiritual tourism, monuments and water falls, the major tourism attractions concerning coast and islands include beautiful beaches, St. Mary's Island which is famous for columnar joint rocks (Basaltic rocks), Netrani Island for scuba diving and few riverine islands for water sports and boat riding. The possible locations for development of beach tourism in coastal Karnataka would include Gokarna Om beach, Marawanthe beach, Murudeshwar, Dandeli across Kali river, Ullal beach in Mangalore and Devbagh beach in Karwar. The islands of St. Mary's near Malpe beach of Udipi and Kurmagad Island near Karwar need to be protected and managed for tourism development (Dalal MacDonald 2003).

Biodiversity and Conservation

The large number of rivers, estuaries (26) and hilly environment that extents from western ghats make the coastal districts of Karnataka a very rich in biodiversity. Among the fishery resources, mackerels, sardines, anchovics and other clupeids form the dominant pelagic fishing while catfishes, Sciaenids, Perches, sharks and etc. constitute the deep sea fishing (Prajapati 2010).

As far as mangrove is concerned, coastal regions of Karnataka has recorded 14 species of mangroves belonging to 8 families The dominant species include *Rhizophora mucronata, Acanthus ilicifolius, Acrostichum aureum, Aegiceras corniculatum, Avicennia marina, Avicennia officinalis, Bruguiera cylindrica*. Among the riverine islands, mangrove species that were recorded include *Acanthus ilicifolius, Acrostichum aureum, Aegiceras corniculatum, Avicennia alba, A. officinalis, Rhizophora mucronata, Sonneratia alba*, and *S. caseolaris* (Suma and Gowda 2013).

Corals of fringing type are found around Netrani Island. Fourteen species of corals were recorded. Further, 4 species of sponges, 15 species of bivalves, 48 species of gastropods and 8 species of nudibranchs were found from this Island (Prajapati 2010). Among the threatened species in the island environment, one grouper fish (*Cheilinus undulatus*) under endangered category and one species (*Rhincodon typus*) under vulnerable category of IUCN red list were observed in Netani Island ecosystem. In ST.Mary's Island 390 marine fish species, 3 species of sea turtles, 4 species of whales, 4 species of dolphins have been observed and recorded (Prajapati 2010).

Table 1. Geography for inhabited Islands of coastal Karnataka

Island name	Type of Island	Location	Distance to the nearest Port	Geographical Coordinates	Total Area of the Island, km^2	Coastline Length, km
Arge Island	Continental	Arabian Sea. near Karwar Port.	3.82 km from Karwar Port	14˚44' 23.46.72" N 74° 9' 20.80.44" E	0.13	1.67
Unnamed Island	Riverine	Arabian Sea. near Belekeri fishing harbour.	0.81 km from Karwar Port	14°42'50.40"N 74°16'7.32" E	0.13	1.61
Unnamed Island	Continental	Arabian Sea. near Belekeri fishing harbour.	0.81 km from Belekeri Fishing Harbour Port	14°42'46.80"N 74°16'19.20" E	0.05	0.95
Bellari Gudda Island	Continental	Arabian Sea. near Belekeri beach.	1.82 km from Belekeri Fishing Harbour Port	14°42'18.00"N 74°15'9.72" E	0.01	0.32
Magtodev Island	Continental	Arabian Sea. near Bela beach.	5.82 km from Belekeri Fishing Harbour Port	14°39'39.60"N 74°16'35.40" E	0.02	0.64
Basavaraja Durga Island	Continental	Arabian Sea. nearby Pavinakurve beach.	35. 51 km from Belekeri Fishing Port	14°18'50.40"N 74°24'7.20" E	0.18	1.96
Unnamed Island (submerged island)	Continental	Arabian Sea. near Alvekodi 1.38 km	0.58 km from Tenginaundi Fishing Harbour	14°1'48.00"N 74°30'35.28" E	0.09	0.0
Netrani Island	Continental	Arabian Sea. near Murudeshwar beach	19.6 km from Tenginaundi Fishing Harbour	14°0'57.60"N 74°19'36.48" E	0.31	2.34
Hog Island (Jallikund Gudda)	Continental	Arabian Sea. nearby Bhatkal.	8.66 km from Bhatkal Port	14°0'32.40"N 74°28'51.24" E	1.77	1.77
Unnamed island	Continental	Arabian Sea. Near Karikal village, Bhatkal	9.0 km from Bhatkal Port	13°58'30.00"N 74°31'26.04" E	0.21	_
Babu Kudru	Riverine Island	in Panchagangavali river,	1.55 km from Udupi.	13°38'38.40"N 74°41'3.48" E	1.63	1.63
Unnamed island	Riverine Island	in Panchagangavali riverx	1.4 km from Udupi.	13°37'58.80"N 74°40'37.92" E	1.2	1.15
Kodithale Island	Riverine Island	in Panchagangavali river	Udupi 38.0 km	13°27'46.80"N 74°41'48.48" E	2.89	2.89
Unnamed Island – a part of Kodithale Island	Riverine Island	in river Padukere, Udupi.	38.0 km from Udupi	13°27'36.00"N 74°41'53.88" E	0.58	0.58
Bhattan Kudru	Riverine Island	in Sita river, Udupi	3.0 km from Hangarkatte Port	13°26'59.19"N 74°42'50.38" E	0.17	0.75
Bal Kudru	Riverine Island	in Sita river, Udupi district.	3.0 Km from Hangarkatte Port	13°26'42.00"N 74°42'56.88" E	0.15	2.5
Unnamed Island	River Island	in Suvarna River, Udupi.	3.0 Km from Hangarkatte Port	13°25'26.40"N 74°42'1.08" E	0.03	0.85
Coconut Island	Continental	Arabian Sea. near Maple Port.	5.0 km from Maple Port	13°22'48.00"N 74°40'23.52" E	0.06	0.85
North Island Malpe Light House	Continental	Arabian Sea. near Maple Port, Udupi.	1.30 km from Maple Port	13°20'38.40"N 74°41'4.20" E	0.10	_
Black Rock	Continental	Arabian Sea. near Maple Port, Udupi.	3.53 km from Maple Port	13°16'58.80"N 74°42'1.80" E	0.01	_
Unnamed Island	Riverine Island	in Nethravathi River.	0.59 km from Mangalore Port	12°52'1.20"N 74°49'41.88" E	0.10	_
Unnamed Island (rock)	Continental	Arabian Sea near Maple Port, Udupi.	12.40 km from Maple Port	12°51'36.00"N 74°49'48.00" E	0.06	_
Unnamed island (rock)	Continental	Arabian Sea near Mangalore coast.	12.40 km from Maple Port	12°51'14.40"N 74°49'54.48" E	0.01	_

Environmental Issues and other Hazards

The coastal zone of Karnataka with better developed geographical areas and resource potential provides for economic development. The issues are mainly associated with population pressure, waste water disposal, natural disasters, coastal erosion, siltation of navigable channels of harbours, impact of aquaculture, ingress of sea water, impact of industry and coastal highways and expansion of unplanned tourism (EMPRI 2015). It was noted during the field survey that sand mining activities are undertaken around few of the riverine islands which perhaps cause for erosion and accretion around islands and affect ecology of the island ecosystem, if continued in unsustainable manner. The findings of the earlier research work indicate that beaches of Someshwar, Ullal and Sasihitlu are gradually receding, whereas Talapadi, Thannirbhavi and Panambur beaches are prograding (Hariharan et al. 1978, Reddy et al. 1982, Kunte and Wagle 1991, Kumar and Jayappa 2009).

Udupi coast in Karnataka state is vulnerable to accelerated sea level rise (SLR) due to its low topography and its high ecological and touristy value. As per the study conducted by Dwarakish et al (2009), while calculating the coastal vulnerability index (CVI) to know the high and low vulnerable areas and areas of inundation due to future SLR, it was observed that out of the 95 km stretch coastline of Udupi, 59% was at very high risk, 7% was at high, 4% was at moderate and 30% in the low vulnerable category.

CONCLUSION

The information provided on islands will serve as a useful reference for planners, policy makers, academicians and researchers and all those interested in becoming familiar with the islands of Karnataka. It is suggested that a separate database on coastal islands of India need to be developed for future studies on island protection and management, as most of existing island-related databases worldwide focus on Small Island Developing States (SIDS) especially from within the United Nations system. There is also a need to assess the current status of ecology of various islands of coastal India and identify suitable islands for conservation and development purposes.

ACKNOWLEDGEMENTS

We wish to thank the Director, NCSCM, Chennai for providing supportfor the research work. All the authors of this article participated in field survey to various islands for collection of island related information and also review of existing published reports/documents, as part of institution project of the Centre.

Author contributions: R. Sridhar conceptualized the study, conducted field study, developed methodology and helped in preparing the manuscript; V. Sachithanandam contributed to methodology development and helped in field data collection and analysis; K. Manmadhan helped in field study and data analysis; N. S. Swarnakumar helped in the field study, data analysis and preparation of the manuscript.

REFERENCES

Avinash Kumar, A.; Narayana, C. and Jayappaa, K.S. 2010 Shoreline changes and morphology of spits along southern Karnataka, west coast of India: A remote sensing and statistics-based approach. Geomorphology 120 :133–152

Chenthamil Selvan, S.; Kankara, R. S.and Rajan, B. 2014. Assessment of shoreline changes along Karnataka coast, India using GIS & Remote Sensing Techniques. Indian Journal of Geo-Marine Sciences 43(7): 1286-1291.

Dalal Mott MacDonald, 2003. Study Report on Preparation of 20 Years Perspective Plan for Development of Sustainable Tourism in Karnataka. Government of India, Ministry of Tourism and Culture, New Delhi. 379 pages.

Dwarakish, G.S.; Vinay, S.A.'; Usha Natesan, Toshiyuki Asano, Taro Kakinuma, Katta Venkataramana, B. Jagadeesha Pai. and Babita, M.K. 2009. Coastal vulnerability assessment of the future sea level rise in Udupi coastal zone of Karnataka state, west coast of India. Ocean & Coastal Management 52: 467-478.

Environmental Management & Policy Research Institute (EMPRI), 2015. State of Environment Report, Karnataka-2015, Bengaluru. 514 pages

Hariharan, V.; Reddy, M.P.M., and Kurian, N.P. 1978. Littoral and rip currents and beach profiles off Someshwar. Indian Geographical Journal 53: 14–20.

Kumar, A. and Jayappa, K.S. 2009. Long and short-term shoreline changes along Mangalore coast, India. International Journal of Environmental Research 3: 177–188.

Kunte, P.D and Wagle. B.G. 1991. Spit evolution and shore drift direction along South Karnataka coast, India. Giornale di Geologia 153: 71–80.

Ministry of Environment and Forests. 2010. Coastal Issues and Concerns: Challenges for the Research Community. Prepared by Consortium of Coastal Academic Institutions for the

National Centre for Sustainable Coastal Management (NCSCM). Anna University, Chennai. 68 pages.

NDMA. 2016. National Disaster Management Plan, 2016. National Disaster Management Authority, Government of India. May 2016, New Delhi, 155 pages.

Prajapati, R.C. 2010. Biodiversity of Karnataka at a Glance. Karnataka Biodiversity Board, Government of Karnataka, Bengaluru. 96 pages.

Reddy, M.P.M.,; Hariharan, V. and Kurian, N.P. 1982. Beach stability along the coast from Ullal to Thannirbhavi near Mangalore. Indian Journal of Marine Sciences 11: 327–332.

Suma, and Gowda P.V. 2013. Diversity of Mangroves in Udupi District of Karnataka State, India. International Research Journal of Biological Sciences 2(11): 11-17.

Received 27 October 2019
Accepted 13 December 2019