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Impact of Land Use /Land Cover Changes on Physical Space for Fishers in Kanyakumari Coast, India

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Abstract

This paper investigates the increasing human activity within the coastal zone causing concern for the conservation and utilization of the coastal ecosystem goods and services for sustainable development and minimizing socioeconomic vulnerability of the coastal communities. The specific objective of the study is to delineate the spatial changes due to demographic factors within the coastal zone which is of interest for the conservation planners. The study utilized the population census data for 1991, 2001 and 2011 to map the demographic changes within CRZ and outside CRZ area. The identification of villages and boundaries of CRZ, spatial and temporal changes in the land use and land cover was presented by using the satellite image data for the year 1990, 2000 and 2013. The changes in the overall employment pattern of coastal villages of Kanyakumari reflect the current macro level changes that are happening in India. The people dependent on agriculture and allied activities have declined from 11 percentto 3 percentduring the period of two decades (1991-2011). Whereas the percentage of population dependent on services (tourism and related activities) has doubled from 14 % to 31 % indicating the growth of service sector as a potential source of employment with higher income opportunities. The results show that during the last 10 years the population density of the selected fishing villages has declined indicating the general trend in rural-urban migration. The commercial built up area of the selected villages within 500 meters have increased from 1.88% in 2001 to 5.40 % of the total area in 2013. On the other hand the vegetation and water coverage have declined by 30 per cent. The average per capita open area for all the 12 coastal villages has declined from 526.09 sq. m in 1991 per person to 80.94 sq. min 2011 indicating a decline by 6-7 times. The average per capita area available for an individual fisherman in less than 500 meters from HTL has declined from 5584.67 sq. min 2001 to 1092 sq. mrepresenting a decline by 5 times. On the other hand the decline in the per capita availability in greater than 500 meter area was from 3399 sq. mto 445 sq. mrepresenting a decline by 8 times and is half of the area available compared to CRZ area. The CRZ notification originally notified during 1991 and revised in 2011 prohibiting many of the development activities along the shoreline, has reduced the rate of growth of commercially built-up area compared to outside 500 meter zone. However, the enormous increase in human activity attracted by the free availability of coastal common resources presenting a case of free rider problem has not been addressed completely by the notification.

Introduction

Coastal population in India is around 300 million out of 1.20 billion as per Census of 2011 and is growing at the rate of 2.0%, much higher than the average annual population growth rate of 1.5 % during 2001-2011. The 73 coastal districts (out of a total of 593) have a share of 20% of the national population live within 50km of the coastline. The coast also includes 77 cities and towns, including some of the largest and most dense urban agglomerations -

Mumbai, Kolkata, Chennai, Kochi and Visakhapatnam. India is one of the 10 most industrialized countries in the world. It is 8th largest economy which is growing at the rate of 6-7 % per annum. There are 13 major ports and 187 minor ports in addition to 2 more planned along the India's 7,516 km (including island territories). India is the sixth largest producer of fish with an annual potential yield of 3.92 million tonnes (CMFRI, 2011). An estimated 200,000 traditional crafts carry out traditional fishing and there are about 35,000 mechanized fishing boats which are enhancing their fishing capacity annually. India has a land mass of 3,287,263 km^2, a land frontier of 15,200 km and exclusive economic zone of 2.02 million km^2. Peninsular India and the island territories comprise 9 states and 4 Union Territories. Coastal population in India is around 300 million out of 1.20 billion as per 2011-12 Census and is growing at the rate of 2.0%, much higher than the average annual population growth rate of 1.5 percentduring 2001-11. The 73 coastal districts (out of a total of 593) have a share of 20 percentof the national population, and nearly 300 million people live within 50km of the coastline. The coast also includes 77 cities and towns, including some of the largest and most dense urban agglomerations - Mumbai, Kolkata, Chennai, Kochi and Visakhapatnam. India is one of the 10 most industrialized countries in the world. It is 8th largest economy which is growing at the rate of 6-7 percentper annum. There are 11 major ports and 148 minor ports along the India's 7,516 km (including island territories).

Meyer and Turner (1992) shows that the human impact on environment is a product of not only the number of people but also the level at which they consume and the character of material and energy flows in production and consumption. The role of human activities in altering the coastal ecosystem services and its impact on human wellbeing is the main focus of the present paper. Improved understanding of problems related to coastal land management within the coastal regulation zone provides the foundation for evaluating the alternative options for decision making (Bhat and Bhatta, 2004). This paper contributes to the understanding of how human activities affect coastal ecosystem in spite of the existence of regulatory system. The land use changes and hence coastal ecosystem services are linked to broader demographic, economic, social and political forces (Tobar, I M 2012). The coastal land management decisions may result in trade-offs in the delivery of different ecosystem services. It is important to understand the consequences of such land use changes on the capacity of different ecosystems to provide services to poor coastal communities.

Coastal resources are increasingly being used for promoting economic growth and also as a sink for land-based pollutants. The dependence of coastal communities on diverse coastal ecosystems is acute in most of the developing counterosion of the capacity of these resources would setback the prospects of tackling poverty. The MEA (2005) pointed out that degradation coastal ecosystems could have uneven impacts on poor communities. As per the 2010 Marine Census, it was estimated that 47 % of ~4.0 million fishers in India live below the poverty line and most of them are traditional fishers (CMFRI, 2010). Thus any decline in the share of fish produced would lead to loss of income to the coastal community.

The social wellbeing approach for developing coastal management plan involves three main components namely meeting basic human needs, freedom and quality of life. The significant

increase in coastal population, infrastructure development attracting settlements along the shoreline, rising fishing assets, fishing intensity, income and tourism development are some of the factors causing concern on its likely impact on coastal ecosystem goods and services. Therefore, it is important for coastal planners to consider differential impact on different stakeholder groups while preparing the management plan. In the present study we focus on the changes in the physical availability of space for occupation related activities of the traditional fishing communities.

National Environmental Policy, 2006 (Govt. of India 2006) has emphasized that "traditionally, village commons water sources, grazing grounds, local forests, fisheries etc. have been protected by local communities from over exploitation through various norms, which may include penalties for disallowed behaviour.M.S. Swaminathan Committee (2009) on Policy and legal framework for Integrated Coastal Zone Management has emphasized that need for the conservation of the coastal areas is the habitats of fishing communities. These communities are in double danger as well – ironically, from conservation and from development. On one hand, these communities are marginalized and even alienated from their lands because of the need for conservation in marine parks or forested islands and on the other, they are in jeopardy because of large development projects which displace them and take over their lands and livelihoods. Their land is today prized for tourism and high-end housing projects. Future policies for coastal area management must reverse these trends and find approaches to conserve and protect vulnerable ecosystems and secure livelihoods and habitats of its people". The state is also promoting different types of development projects to cater to the needs of the increasing coastal population and also projects to provide infrastructure services. These developments are shrinking the space available for traditional activities and have increased vulnerability of the communities (Rodrigues, 2010). Increasingly, the beach spaces traditionally used by fishing communities are leased out to private organizations for providing tourism services and maintenance of sanitation which were hitherto maintained by the local self-governments.

Methodology

Spatially explicit data on land cover and land use exist for most of the coast. Contiguous areas of a given land cover type can be delineated. It is proposed to select a few villages within 500 meters and a few outside 500 meters from the high tide line to understand the physical and socioeconomic changes with regulatory institutions governing the coastal space allocation. The CRZ 1991 and 2011 imposes restrictions on buildings and constructions within 500 meters and hence it is expected that the fishers should have been able to enjoy better physical space availability for their dwelling and traditional fishery related activities within 500 meters.The study utilises the population census data for the coastal villages from 1991, 2001 and 2011 to delineate the temporal and spatial changes in the demographic, physical and socioeconomic changes in the coastal areas which are predominantly inhabited by fishers and other traditional coastal communities. The population census data for 1991, 2001 and 2011 in addition to Marine Census data for two successive periods 2005 and 2010 were used to capture the socioeconomic and demographic changes in the coastal fishing

community. The availability of per-capita fishing space was estimated by dividing the fishers' population with open spaces such as landing centres, open spaces and sandy beaches presuming that they would be available for all traditional activities of fishers.

Study Area

Located in the southern fringe of Indian coast, the transition zone between east and west coast, the Kanyakumari coast constitutes as essential part of the coastal ecosystem for its fish, tourism and services sector. Some of the villages in this region have undergone changes during tsunami disaster in 2004 and thereafter economic growth. A set of fishing villages in Kanyakumari district which are located within 500 meters from HTL and just outside 500 meters (I km from the HTL) are selected for detailed study. Kanyakumari District is a densely populated coastal district with the fishing community (all Catholic, mostly Mukkavars) living on a very thin strip of coast near the sea. In the present study we selected 12 fishing villages for an in-depth analysis of shrinking fishing space for traditional fishing activities. Those villages that were listed as fishing villages in the Marine Census report (CMFRI, 2010) were selected. The fishing villages are densely populated and houses are often right near the high tide line or bang on the seawall. The increasing population in fishing villages (and the prosperity of some sections) is leading to some fishing families buying land in the nearby areas and moving out. According to local fishers association, in some parts, there is spill-over of the fishing villages into the neighbouring agrarian areas creating a new zone of mixed-communities. However, in other areas, there are informal ban on fishing communities buying land in neighbouring agrarian villages. Fishing families face no problem in terms of housing permits on account of CRZ, but there is a general shortage of land and severe congestion. As in other districts described earlier, here also the gaps on the coast between fishing villages are outside the control of the fishing community and it is in these areas that sand mining, etc., take place. The Panchayats are seen as external bodies and fishing communities generally do not strongly identify themselves with them. The table 1 provides the names of the fishing villages, area, total population and density in the 12 selected villages of Kanyakumari dist.

Fig.1 Coastal Villages of Kanyakumari District

Coastal Kanyakumari : At a Glance
Total Area of Kanyakumari District ---- 1672 sq. km
Total area of coastal villages -- 294.22 sq. km
Total area of villages within 1 km from shore: 73.26 sq. km
Area within 500 m from shore --- 36.63 sq. km
Area > 500 m - < 1 km from shore --- 36.63 sq. km

Results and Discussion

Understanding the relationship between population growth, land use/land cover changes taking into account the historical rights of coastal communities is the main focus of the present analysis. The study considers two decadal changes in the coastal village population, density; land use /land cover changes for 11 coastal fishing villages of KanyaKumari district, Tamil Nadu. Following section presents the results of the data analysis. Table 1 presents the list of all the 22 coastal villages with respective physical area of the Kanyakumari district. From this list a list of 11 fishing villages were randomly selected for the analysis.

Table 1 Coastal villages of Kanyakumari District

S.No.	Village Name	Area (sqkm)
1.	Kollencode	14.68
2.	Ezhudesam	12.09
3.	Pudukadai	9.95
4.	Keezhkulam	14.61
5.	Midilam	16.29
6.	Balapallam	9.32
7.	Reethapuram	12.65
8.	Kolachel	4.70
9.	Kallukuttam	14.28
10.	Manavalakurichi	12.55

S.No.	Village Name	Area (sq km)
11.	Kadiapatnam	21.23
12.	Ganapathipuram	22.22
13.	Dharmapuram	13.98
14.	Madhusoothanapuram	15.80
15.	Thengamputhur	13.77
16.	Thamaraikulam	11.90
17.	Kudiyiruppu	4.55
18.	Agasteeswaram	9.68
19.	Kanyakumari	11.88
20.	Azhagappapuram	17.16
21.	Levinjipuram	20.63
22.	T.Karungulam	14.38

Table 2 presents the details of the 11 selected fishing villages of Kanyakumari district with population and area of the each of the selected village. The results show that the density has marginally declined from 988 to 901 during 2001 to 2011. The high population density indicates the urbanization that is going on in this tourism area. Kanyakumari district is second most densely populated district in Tamil Nadu state.

Table 2 Population and density of the selected villages

S.No	Villages	Area (sq. km)	Total population (no.)		Population density(no/sq.km)	
			2001	2011	2001	2011
1.	Agasteeswaram	9.68	4632	7638	478	789
2.	Dharmapuram	13.98	19684	6196	1408	443

3.	Ezhudeesam	12.06	18776	16478	1556	1366
4.	Kadiapatnam	21.22	16428	26589	774	1253
5.	Kanyakumari	11.88	8228	9773	692	822
6.	Keezhkulam	14.61	12403	13097	848	896
7.	Kolachel	4.69	10176	9836	2169	2097
8.	Madhusoodhanapuram	15.8	14842	5928	939	375
9.	Manavalakuruchi	12.54	10412	10969	830	874
10.	Tamaraikulam	11.89	10749	11776	904	990
11.	Thengamputhur	13.76	3733	91	271	6.61
	Average	12.91	11823.91	10761	988	901

The changes in the overall employment pattern of coastal villages of Kanyakumari reflect the current macro level changes that are happening in India. During the decade 2001-2011 there was a marginal decline (0.62%) in rural population of the coastal Kanyakumari indicating migration of rural to urban areas. The Table 3 shows that the people dependent on agriculture and allied activities have declined from 11 percentto 3 percentduring the period of two decades (1991-2011). Whereas, the percentage of population dependent on services (tourism) has doubled from 14 % to 31 % indicating the growth of service sector as a potential source of employment with higher income opportunities.

Table 3 Structural changes in the employment

Year	**1991**	**2001**	**2011**
Total Population	80307	130063	118371
		(0.61)	(-0.62)
Percentage of			
Agriculture &allied activities	11.43	4.42	2.95
		(-0.37)	(-0.39)
Industrial workers	2.88	1.81	1.82
		(0.017)	(-0.08)
Services	14.10	25.75	30.67
		(1.95)	(0.08)
Others (including non-workers)	71.57	68.01	64.54
Overall		(-0.005)	(-0.13)

Source: Population Census data 1991, 2001 and 2011

During the last 10 years the fishers' population (Marine Census CMFRI 2005 and 2010) in coastal villages have also increased in absolute terms although in some of the villages there was decline in the fishing population. The villages located within 500 meters have shown an average increase in fishing population by 34 percentand outside 500 500 meters have shown an increase of 5 percent. Thus the tendency to move closer to coast by fishers is very high in spite of restrictions imposed on construction activities by coastal regulation zone notification. The effectiveness of controlling the movement of population towards to the coast to reduce development pressure through CRZ and other regulations have not yielded good results in Kanyakumari dist.

Table 4 Changes in fisher's population in the fishing villages

Taluk	Distance from sea shore(m)	Fisher population		
		2005	2010	%
Kanyakumari	<500	7942	7770	-2.17
Kesavanputhenthurai	<500	1743	1655	-5
Kovalam	<500	3807	3820	0.34
Pallam	<500	2582	2429	-5.9
Periyakkadu	<500	898	886	-1.3
Pillaithoppu	<500	1368	1800	31.6
Puthenthurai	<500	1253	1350	7.74
Rajakkamangalamthurai	>500	3998	4367	9.23
Kolachel	>500	8136	9947	22.3
Kurumpannai	<500	3121	4272	36.9
Melakadiyapattinam	<500	3627	4730	30.4
Periyavillai	>500	1695	2877	69.7
Inayam	<500	4465	4362	-2.3
Enayamchinnathurai	<500	1115	5128	360
Ezhudesamchinnathurai	>500	5129	1031	-80
Keezhamidalam	<500	1473	1905	29.3
Marthandanthurai	<500	4985	6374	27.9
Melmidalam	<500	1956	2041	4.35
Poothurai	<500	4410	4178	-5.3
Overall	<500	2882	3088	34
Overall	>500	3736	5097	5.30

Note: The extreme values such as 360 % in Enayamchinnathurai have been excluded as out-layer.
Source: Marine Census Data CMFRI, ICAR, 2005 and 2011

The area of each village within 500 meters and outside 500 meters selected for analysis are presented in Table 5. It indicates that although each village boundary and /or the size are different the total area is same since the area was obtained exactly by dividing the total 1 km distance from the shoreline.

Table 5 Areaof the selected Fishing Villages

S.No.	Villages	Area (sq. km)	
		< 500 m	500 m - 1km
1.	Agasteeswaram	1.81	1.87
2.	Dharmapuram	197	2.04
3.	Ezhudeesam	2.08	2.11
4.	Kadiapatnam	1.60	1.46
5.	Kanyakumari	3.09	2.92
6.	Keezhkulam	1.46	1.56
7.	Kolachel	1.42	1.22
8.	Madhusoodhanapuram	0.88	0.94

9.	Manavalakuruchi	1.71	1.78
10.	Reethapuram	1.15	1.26
11.	Tamaraikulam	1.14	1.04
12.	Thengamputhur	2.15	2.26
	Total Area	20.46	20.46

Table 6 presents the percentage changes in the land use /land cover in the selected villages of the district. The share of area under settlements, industries, commercially and socially built-up area has increased significantly both in less-than 500 meter zone and greaterthan 500 meter zone. On the other hand the share of vegetation, open spaces, water bodies and other area suitable for fishery related activities have declined during 2001-2013. Further the rate of shrinkage of area for fishery related activities is significantly high during 2005-2013.

Table 6 Land use/Land cover changes in the selected fishing villages(figures in percentages)

	<500m(20.46 sq.km)			>500m(20.46 sq.km)		
Year /land use area(in percentage)	2001	2005	2013	2001	2005	2013
Settlements	37.39	48.25	62.49	34.87	46.86	67.67
Vegetation	36.58	26.06	11.85	48.86	38.74	13.88
Open land with scrub	9.11	6.20	3.14	11.65	8.91	5.41
Sandy area	10.20	9.13	7.62	-	-	-
Water body	2.24	1.86	1.34	2.25	1.91	1.45
Port and harbours	1.29	1.50	2.30	-	-	-
Industries	1.00	1.75	2.93	0.50	1.15	2.10
Social built up area	0.27	0.50	1.29	0.67	1.22	2.35
Commercial built up area	1.88	3.35	5.40	1.81	3.26	5.66
Quarries	0.64	0.56	0.50	0.35	0.29	0.25
aquaculture	0.69	1.38	1.84	0.67	1.09	1.49

The increase in the share of commercially built-up area is almost same for less than and greater than 500 meter zone. It indicates that the regulatory measures such as CRZ could not reduce the developmental activities.The changes in the per-capita open area available for the overall population are presented in Table 7. There has been significant decline in the area available per person during the two decadal periods due to enormous increase in the built-up area.The per capita open area representing the common ecosystem services has declined significantly.

Table 7 Per capita open area in the selected villages for the overall population

Villages	Total area available (sq km)			Total Population (Nos.)			Per capita space available (in sq. meters)		
	1991	2001	2011	1991	2001	2011	1991	2001	2011
Agasteeswaram	2.55	1.93	0.98	6190	4632	7638	404.69	404.69	121.41
Dharmapuram	3.29	2.67	1.20	3915	19684	6196	849.84	121.41	202.34
Ezhudeesam	3.06	1.82	0.94	17803	18776	16478	161.87	80.94	40.47
Kadiapatnam	2.34	1.65	0.93	10993	16428	26589	202.34	80.94	40.47

Kanyakumari	4.31	3.59	2.09	2454	8228	9773	1740.15	445.15	202.34
Keezhkulam	2.42	1.97	0.91	13490	12403	13097	161.87	161.87	80.94
Kolachel	0.43	0.40	0.40	4640	10176	9836	80.94	40.47	40.47
Madhusoodhanapuram	1.11	0.80	0.38	1550	14842	5928	728.43	40.47	80.94
Manavalakuruchi	2.95	2.56	1.64	10643	10412	10969	283.28	242.81	161.87
Tamaraikulam	1.70	1.33	0.94	3327	10749	11776	526.09	121.41	80.94
Thengamputhur	3.78	3.14	1.95	5302	3733	-	728.43	849.84	-
Average	**2.54**	**1.99**	**1.12**	**7300**	**11823**	**11828**	**526.09**	**242.81**	**80.94**

The average per capita open area for all the selected coastal villages has declined from 526.09sq. m in 1991 per person to 80.94sq. m in 2011 indicating a decline by 6-7 times.

The per capita area availability of open area per individual fisher has been estimated separately for less-than 500 meters from HTL and greater than 500 meters from HTL and presented in table 8 and 9. Based on the data available on fishers' population and total open spaces (open spaces and sandy beaches) per capita area available for fishers activities have been obtained by dividing the total open area by the total fishing population. The average per capita area available for an individual fisherman in less than 500 meter area has declined from 5584.67 sq. meters in 2001 to 1092.65 sq. meters representing a decline by 5 times. On the other hand the decline in the per capita availability in the greater than 500 meters from HTL was from 3399.36 sq. meters to 445.15 sq. metersrepresenting a decline by 8 times and is half of the area available compared to CRZ area. Thus the regulatory measures such as CRZ has resulted in reducing the intensity of development compared to the area just outside CRZ (>500 meters – 1 km)

Table 8 Per-capita availability of area/fisherman (Area <500 meters from HTL)

Name of villages	Population (Nos.)				Area available			
	Total		Fishing& allied		Total area (in sq km)		Per capita space available (in sq. m)	
	2001	2011	2001	2011	2001	2011	2001	2011
Ezhudesam	18776	16478	94	128	0.08	0.04	890.31	364.22
Keezhkulam	12403	13097	20	63	0.17	0.11	8296.06	1659.21
Kolachel	10176	9836	460	24	0.08	0.08	202.34	3197.02
Kadiapattinam	16428	26589	505	847	0.37	0.20	728.43	242.81
Dharmapuram	19684	6196	1387	191	0.48	0.31	364.22	1618.74
Madusudhanapuram	14842	5928	850	451	0.11	0.05	121.41	121.41
Thengamputhoor	3733	91	16	1	0.74	0.59	46134.20	-
Thamaraikulam	10749	11776	1068	612	0.28	0.22	242.81	364.22
Agasteeswaram	4632	7638	99	45	0.29	0.10	2954.21	2266.24
Kanniyakumari	8228	9773	1064	830	0.70	0.47	647.50	566.54
Manavalakurichi	10412	10969	189	310	0.21	0.15	1092.65	485.62
Average	130063	118371	5752	3502	0.32	0.21	5584.67	1092.65

Note: *For the purpose of arriving at the per capita available only area under open spaces and beaches have been included*

Table 9 Per-capita availability of area/fisherman (Area >500 meters-1 km)

Name of villages	Population (Nos)				Area available			
	Total		Fishing and allied activities		Total area (in sq km)		Per capita space available (in sq. m)	
	2001	2011	2001	2011	2001	2011	2001	2011
Ezhudesam	18776	16478	94	128	0.06	0.04	687.97	364.22
Keezhkulam	12403	13097	20	63	0.08	0.05	3844.52	849.84
Kolachel	10176	9836	460	24	0.04	0.02	80.94	849.84
Kadiapattinam	16428	26589	505	847	0.27	0.15	526.09	161.87
Dharmapuram	19684	6196	1387	191	0.17	0.08	121.41	404.69
Madusudhanapuram	14842	5928	850	451	0.08	0.06	80.94	121.41
Thengamputhoor	3733	91	16	1	0.48	0.30	29865.83	-
Thamaraikulam	10749	11776	1068	612	0.13	0.06	121.41	80.94
Agasteeswaram	4632	7638	99	45	0.11	0.05	1133.12	1092.65
Kanyakumari	8228	9773	1064	830	0.34	0.24	323.75	283.28
Manavalakurichi	10412	10969	189	310	0.15	0.08	768.90	242.81
Overall	130063	118371	5752	3502	0.17	0.10	3399.36	445.15

There has been general decline in the number of non-mechanized fishing units in the country due to decline in fish availability within the territorial waters. In Kanyakumaricoast thenumber of non-mechanized units (families owning) located within 500 meters has declined from 1720 units in 2005 to 631 units in 2010 indicating the non-viability of these units

Table 10 Distribution of fishing units in coastal zone of Kanyakumari

Within CRZ (< 500 meters)	**2005**	**2010**	**% change**
Mechanised	141	181	28.37
Outboard	1085	1227	13.09
Non- mechanised	1720	631	-63.31
Outside CRZ (>500m-1km)	**2005**	**2010**	**% change**
Mechanised	112	38	-66.07
Outboard	110	279	153.63
Non-mechanised	529	387	-26.84

Source: Marine Census Report, CMFRI 2005 and 2010

The changes in the location of fishing units (within and outside 500 meters) and fishing intensity expressed in terms of different category of fishing (mechanized, motorised and non-motorised) shows the increasing need for accessing the coastal resources for their occupation. Most of the mechanised fishers) who were hitherto outside CRZ area have moved into the CRZ area which is reflected in the data presented in Table 10. The number of mechanised units declined by 75 outside CRZ and the same was increased by 40 units within CRZ area. The outboard engine fishing boats have increased by greater than two fold outside CRZ and by a small percentage within CRZ. The results presented in table 10 clearly shows that there

has been drastic decline in traditional fishing units indicating a decline in their catch rate and hence converting themselves into outboard engine boats to enable themselves to go for fishing into longer distance and duration.

Conclusions

Land use/land cover changes modified by humans in response to specific development needs are the common reasons affecting the availability of coastal space for fishers' activities. Such changes also affect the coastal fish production, biodiversity, water availability and other ecosystem services. This article presents an approach to know the changes in coastal physical space availability for fishers. The macro level change in physical space availability has been delineated through secondary and spatial data analysis. The results clearly indicate the declining availability of per capita physical space over the last 10 years in spite of decline in the number of traditional fishers due to growth of commercially built-up area and decline in open spaces and vegetation. There has been significant decline in the per capita availability of physical space both within 500 meters and outside 500 meters although the rate of decline in less than 500 meter-zone from HTL was relatively less compared to area in greater than 500 meters. The analysis suggests that the rate of decline was accelerated in recent years indicating the vulnerability of coastal fishers to reduced space and declining benefits of coastal commons. It also indicates the decline in the reduction of provisioning and supporting services of coastal ecosystem. A detailed assessment of the real status at the ground level and the factors affecting the accessibility and governance (social, economic and religious) would be required to develop appropriate strategies to protect the livelihood opportunities of the coastal fishers. The literature suggests that the coastal ecosystem provide maximum number of services listed by the Millennium Ecosystem Assessment (UNEP 2006). Hence efforts need to be initiatedto reduce congestion of human activities along the coast in order to protect the flow of ecosystem services on a sustainable basis.

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