
Estimation of fishery sector as a Coastal Resource Zone to explore the associate problems and opportunity at Balasore Coastal District, Odisha, India

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ABSTRACT

Coastal zone is full of different resource like marine fish, mangrove forest, sand, fuel wood, etc. A considerable part of national and state income is achieved from the fishing sector. So fishing is getting popular among the unemployed youths. The profit from the fishing sectors is higher than the agriculture that's why fishing, is now getting popular among all the coastal dwellers. For this consequence the export of fish has increased in the same time country is earning huge foreign currency. In order to optimally utilize and reap the benefits without hampering the balance, it is necessary to adopt integrated coastal management strategies based on solid scientific foundation that allow for multiple uses of the resources without causing serious damage to the environment. The present endeavor deals with the fishing sector and its problems and opportunity to ensure the sustainable coastal zone management through field observation as well as secondary data analysis and satellite image analysis.

Keywords: Fishing Sector; Sustainable coastal zone management; Coastal resource; Coastal environment.

1. Introduction

The potentiality of economic prospects in coastal cities is a strong remarkable force, increases immigration of coastal region, often from reasonably depressed rural area. As a result, in near future much larger and younger populations can be expected in the coastal areas of developing countries. These future coastal inhabitants will demand employment, housing, energy, food, water and other goods and services thus presenting a considerable development challenge (Scialabba, Nadia (ed.) 1998). Although in future coastal territories will become more developed and the economies of developing countries will undoubtedly diversify to some extent through industrialization dependence on coastal resources is likely to remain strong (Boaden J.S., and Seed R., 1985). Industrial expansion often involves the processing of agricultural, fishery and forestry products together with oil refining and textile manufacture (Paul A.K., 1997). These expanded economic performances are often also dependent on coastal resources and as economic diversification increases and makes the constituent sectors more mutually dependent over coastal natural resources consequently, coastal environment is gradually declining in response to its richness (Richards John F., 1990). This is the zone of dynamic activity, constantly transforming itself to maintain equilibrium under the varying intensity of the natural processes operating here. Coastal zone is a region of diverse activity both complementary and conflicting to each other (Chakraborty P., 1991). Accelerated and unscientific developmental activities have induced catastrophic consequences. In order to optimally utilize and reap the benefits without hampering the

balance, it is necessary to adopt integrated coastal management strategies based on solid scientific foundation that allow for multiple uses of the resources without causing serious damage to the environment (Paul A.K., 1991).

2. Study area

Study area, a part of Balasore district one of the north-eastern coastal ends of Orissa. The studied coast lies in between latitude: 21°03' to 21°59' North latitude and 86°20' to 87°29' East Longitude. It is bounded by Bay of Bengal in the East, Mayurbhanj and Keonjhar districts in the West, Medinapore district of West Bengal in the North and Bhadrakh district in the South. The geographical area of the study area is 3806 Square km. Study area is crisscrossed with perennial and estuarine rivers because of its proximity to sea. Five important rivers of Orissa, namely Subarnarekha, Budhabalanga, Jalaka, Kansabansa and Sono have passed through this district from west to east before surging into the Bay of Bengal. The coastal district Balasore has a coastline of 120 km. forming 2.3% of the coastline of India. The continental shelf up to 200m depth covers an area of 6,000 sq. km, which is 1.5% of the total area of the country's continental shelf. In the northern part of Orissa, the continental shelf extends up to 120 km and in the southern part up to 40 km. Orissa has a moderate climate, consisting of three seasons, summer from March to May, rainy season from June to September-November, and winter from December to February. Of the two monsoons, the active is the S. W., during June-September, and the weak is the N. E. in November. The S. W. monsoon contributes 90% of the annual rainfall, averaging about 148 cm. Orissa's coastal area is cyclone-prone and is likely to be worst affected during the S. W. monsoon. Balasore is characterized by an extended continental shelf, intertidal flats and extensive river deltas. In recent years, Orissa is fast developing in the fisheries sector introducing a large number of mechanized boats improving techniques of fishing in indigenous sector and establishing a well-developed fishery harbor at Paradeep.

3. Methodology

Coastal resource mainly fishery sector availability for the district was assessed from various sources for the year 2011-12 to cover up needs and aspirations of the district. At the same time fishery sectors are also identify and assess through the satellite image analysis. Based on fishery resource availability, prioritization of proposals and allocation of resources to the prioritized proposal was made. Finally the present paper of coastal resource mainly fishery resource was prepared.

4. Coastal Resource Units

Coastal zone is full of different resource like marine fish, mangrove forest, sand, fuel wood, etc. In the study area present researcher has been identified several coastal resource zones (Figure 1) from where the coastal dwellers collect these types of resource to maintain their livelihood. Present researcher prepared the coastal resource zonation map in 2010 to demarcate the different resource zone. Present study considered Coastal wetland, mangrove, river, beach, marine fishing region, inland fishing region, sand dune and beach ridge as the resource zone of the study area because from these zones the local people collecting their valuable resource. After estimation of the changing scenario of two successive year(1970 and 2010) the result shows that the area of coastal wetland, river, beach and inland fishing has been increased where as the area of mangrove covered land and beach ridge has been considerably decrease at the studied coast (Table 1). So the increasing area of different

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resource zones indicates the pressure of uses is very high on that particular resource zones and vice versa.

Table 1: The percentage of resource units (land use land cover) during 1973 - 2010.

LULC Classes		Percentage of Area	
		1973	2010
Water Body		2.307899434	2.730081305
Fish Farming Zone		6.374210764	13.49143746
Water Logged Area		4.65187328	8.318345479
Wetlands		5.603530114	4.429644538
Open Scrubs		7.546111385	5.27765216
Dense Forest		18.29309339	10.80661698
Agricultural Fellow		18.62242344	12.47061402
Cultivated Land		17.60534937	14.78835193
Wetlands Fellow		7.004649975	9.578063611
Dry Fellow Land		4.048791939	5.231135153
Salt Affected Area		2.30030482	3.934959041
Settlements		4.419719759	6.688178984
Sands Deposits	1.22204233	2.254919334	

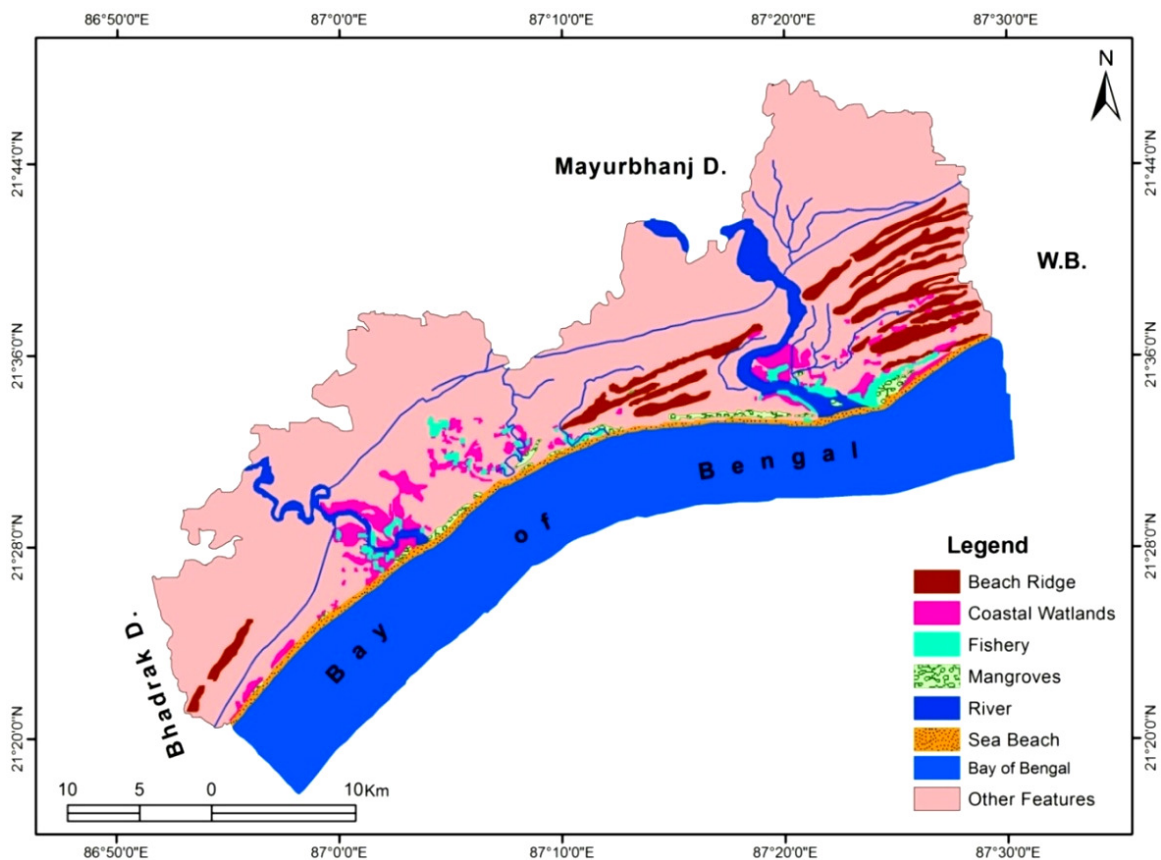


Figure 1: Areal coverage of dominant resource fields in 2010 onwards.

4.1. Fishing Sectors

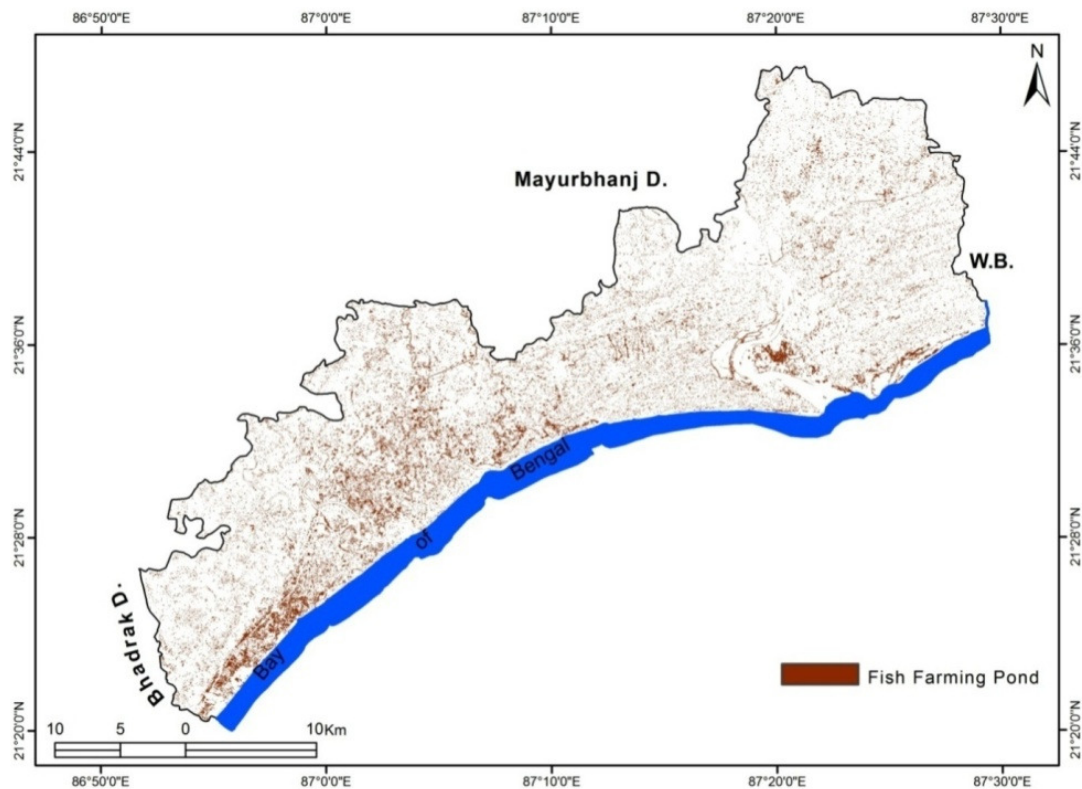


Figure 2: Localized inland fish farming pond at Balasore coastal district.

Table 2: Different fishery sectors in the coastal district of Balasore.

Capture						
Marine	No. of Fisherman	Boats		Nets		Storage Facilities (Ice Plants etc)
		Mechanized	Non-Mechanized	Mechanized (Trawl nets, Gill nets)	Non-Mechanized (Shore Seines, Stake & Trap net)	
	85000	1561	652	1561	-	-
Inland	No. Farmers Owned Ponds		No. of Reservoirs		No. of Village Tanks	
	110150		34		1925	
Culture						
Place	Water Spread Area (Hec.)		Yield (t / Hec.)		Production ('000 tons)	
Brakish water	1648.87		1.40		2.63	
Fresh water	3942.00		2.87		11.34	

Source: Annual report, 2008, District Fisheries Office, Balasore.

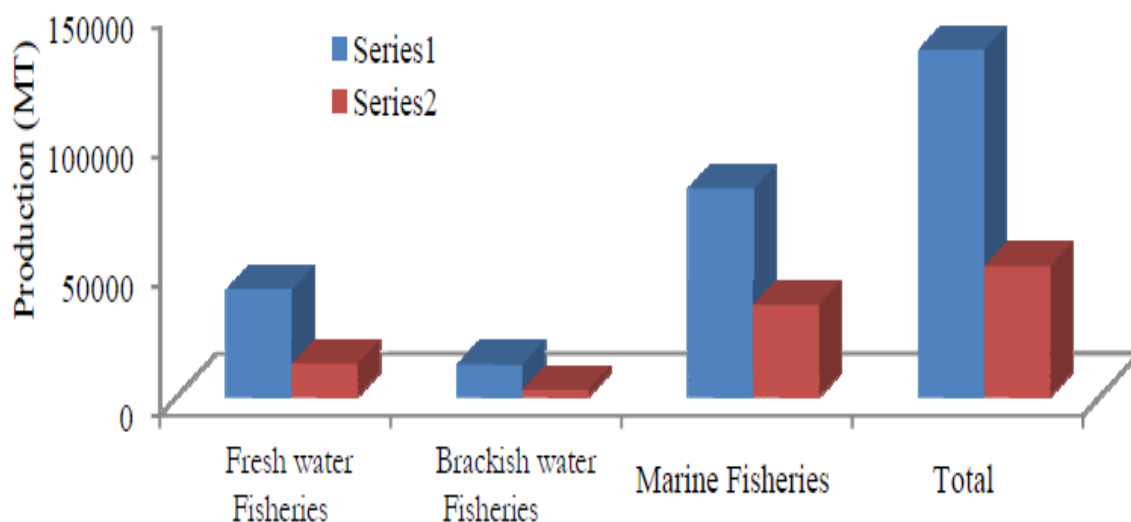
Presently fish is considered as a very important animal protein. As per ‘WHO’ guideline per capita requirement of fish is 11 kg. So the demand of fish has been increased in the vastly populated country (Burgess N., 2005). There is a huge scope of flourishing fishing sector in the present study area due to the presence of 120 km long coastline, presence of five rivers, a large number of inland water and immense population (Figure 2). A considerable part of national and state income is achieved from this fishing sector. So fishing is getting popular among the unemployed youths. The profit from the fishing sectors is higher than the agriculture that’s why fishing, which was an occupation of the ‘Ketua’ sub caste now is getting popular among all the coastal dwellers. For this consequence the export of fish has increased in the same time country is earning huge foreign currency. The total results of fishing sectors have been summarized in (Table 2).

4.2. Fish Production and Demand

The population of the district is 24.16 lakh so the requirement of fish is 26574 metric ton (according to WHO guideline, per capita requirement of fish is 11 kg/year). But the district Balasore is capable of producing 12391.77 tons of fish at present so the district also has to depend on marine fishing to meet its demand (Table 3; Figure 3). But except a small part almost all the fish are exported.

Table 3: Actual production potential vis-a-vis current level of production of fish from different sources in the district (2009-10).

Sources	Production Potential (MT)	Current Level of production (MT)	%
Fresh Water Fisheries	41291.45	12391.77	30.01
Brackish Water	12301.85	2693.25	21.89
Marine Fisheries	80250.00	35287.38	43.97
Total	133843.30	50372.40	37.64



Source: Office of District Fishery Officer-cum-CEOFFDA, Balasore 2010.

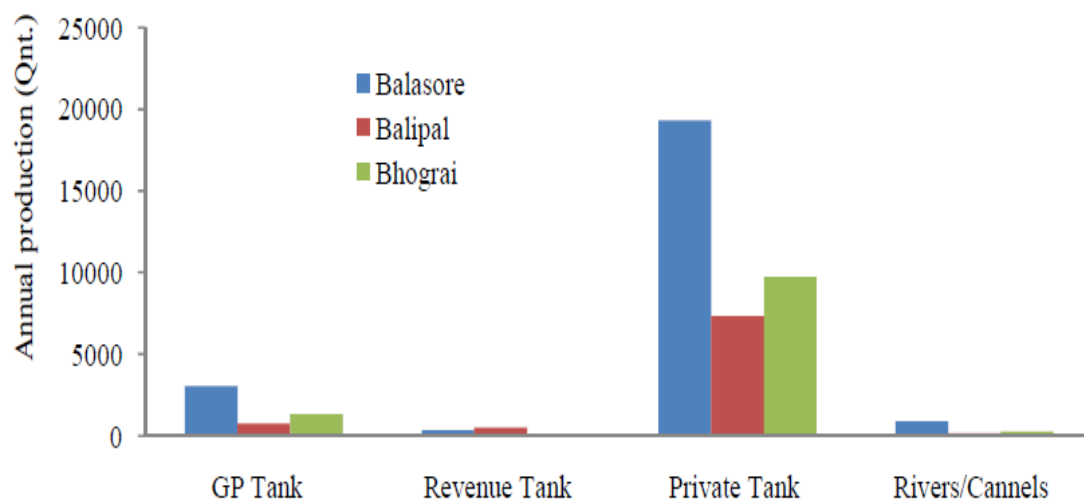
Figure 3: Level of production of fish from different sources in the district (2009-10).

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At present the sweet water fishes can meet only 5.13kg/year. It is true that there are huge inland water resources in Balasore. On the other hand the production level of sweet water fishes is 30.10%. The production level of salt water fishes and marine fishes are 21.89% and 43.97% respectively. The demand of fishes could be fulfilled if 14182.23 metric ton more sweet water fishes could be produced. So to meet up this deficiency and create employment among youths, unused and deserted resources should be utilized and the fishing sector should be developed scientifically. Despite rapid growth in total fish production a fish farmers' average annual production in Odisha is only 2 metric tons per person, compared to 172 tons in Balasore, 72 tons in Bhograi, and 6 tons per fisherman in Baliapal (Comprehensive District Annual Plan 2011-12, Balasore District, Odisha). Estimated annual fish production in inland sources shown in (Table 4; Figure 4).

Table 4: Estimated annual fish production (Qnt.) from different fresh water sources (2009-10).

Blocks	GP Tank	Revenue Tank	Private Tank	Rivers/Cannels	Total Annual Production
Balasore	3030.36	321.30	19316.34	865.00	23533.00
Balipal	750.30	498.00	7343.5	156.00	8747.80
Bhograi	1317.75	53.40	9736.5	242.00	11349.20



Source: Office of District Fishery Officer-cum-CEOFFDA & BFDA, Balasore 2010.

Figure 4: Expected annual fish production (Qnt.) from different fresh water sources (2009-10).

Brackish water aquaculture involves breeding of fish that habitat the sea like sea bass, grey mullet, tiger shrimp and mud crabs (Phillips B.F., and Melville Smith R., 2006). It is practiced in States like Odisha, West Bengal, Andhra Pradesh, Kerala and Goa. Fish farmers use a mixture of oil cakes, rice bran, locally available snail, clam or mussel meat and buffalo meat to feed the fish. In this regard estimated fish production in brackish water sources are in (Table 5).

Table 5: Estimated fish production in brackish water sources (2009-10).

Blocks	Brackish Water		Estuaries		Total Annual Production(Qnt.)
	Area (ha.)	Annual Production(Qnt.)	Area (ha.)	Annual Production(Qnt.)	
Balasore	1175.94	18768.50	180.00	138.00	18906.50
Balipal	88.80	1595.00	102.00	76.70	1671.70
Bhograi	200.60	2954.00	281.50	215.40	3169.40

Source: Office of District Fishery Officer-cum-CEOFFDA and BFDA, Balasore 2010.

In the present study area the quantity of fresh water fishing zone under three Gram Panchayat (Bhograi, Baliapal, Balasore) is 390.4 hector, under revenue tank 68.89 hector under private tank 2158.18 hector and under different of rivers and canals 835 hectors. The quantity of brackish water is 1.36 hector and under estuaries is 5.36 hector. More over 68 km. long coastline indicates the vast potential of marine fishery resources in the district. Potential resources available in the district for fresh water Pisciculture are shown in (Table 6).

Table 6: Bounciness of potential resources available in the district for fresh water Pisciculture (Hec.).

Blocks	GP Tank	Revenue Tank	Private Tank	Rivers/Cannels
Bahanaga	318.00	10.00	252.07	100.00
Balasore	252.53	32.13	1180.65	435.00
Balipal	50.02	33.20	195.63	100.00
Bhograi	87.85	3.56	782.55	300.00

Source: Office of District Fishery Officer-cum-CEOFFDA and BFDA, Balasore 2010.

So it is clear that the gap of fish resource under Balasore district is 44963 metric ton / year. To minimize the gap the trawlers must be design with modern sophisticated electronic device such as GPS which is treated as the fish finder instruments. In addition to this display board must be adopted so that the movement of fishes can be visualized taking the help of satellite.

Most marine fisheries are found in near the coast. This is not only because harvesting from relatively shallow waters is easier than in the open ocean but also because fish are much more profuse near the coastal shelf due to the large quantity of nutrients available there from coastal upwelling and land runoff (Hambrey J., Tuan L.A., and Thuong T.K., 2001). The execution of the other marine fishery resource available in Balasore district is summarized in (Table 7).

Table 7: Availability of other marine fishery infrastructure in Balasore district.

Block	Place	Type	No. of Boats in Operation					Total
			Trawler	Gillnetter	Motorised Craft	BLC	Country Craft	
Balasore	Chandipur	Jetty	407	-	65	-	30	502
	Bahabalpur	Jetty	149	187	137	-	64	537
Balipal	Massahisali	FLC	-	-	35	-	-	35
Bhograi	Panchubisa	FLC	-	-	70	-	18	88

Source: Office of District Fishery Officer-cum-CEOFFDA and BFDA, Balasore 2010.

4.3. The Problems to Spread Marine Fishing

The under mentioned causes are the problems to spread the marine fishing.

1. The scarcity of modern fishing trawler, modern fishing instrument, modern communication system and fish fed plants.
2. The ice factories are far fetching and are not adequate in numbers.
3. The number of fishing harbor, jetty and market are not adequate.
4. Model fishing village is not present in the study area.
5. The road networking and connectivity is not up to the mark.
6. Presence of a large number of middle men into the fishing trade.
7. The prediction system is very much weak.

4.4. Fishing Sector Development Strategies

Some strategies have to be implemented for the development of fishing sectors by the Odisha Government. These are as follows-

1. The production of fish has to be increased 60%, 40%, and 90% from sweet water, salt water and ocean respectively. That is 50% of present production. Saline water and sweet water should be increase 200 hector and 70 hector annually by the help of different Government scheme and it should also be continued up to five years.
2. All the fishermen living in below poverty line should be provided the low coast houses, boat and fishing net at the same time all the fishing villages should be connected by the metal road along with the electricity of Uninterrupted power supply.
3. All the unused saline water resources should be developed through the Brackish Water Fish Farmers Development Agencies (BFDA) and all the private or personal water bodies should be renovated through NREGA, RKVY, SGSY and FFDA like Government scheme.
4. In every block at least 12 fish seed nurseries should be developed along with adequate number of awareness camp, exposure visit and skill up gradation training should be arranged by the Government initiatives.
5. Each and every fisher men should be under in the different credit linkage scheme along with subsequent subsidy facilities and insurance facilities so that they can rear up the fish during the cultivation of paddy.
6. The long term lease should be provided to the large Government water bodies through the SHGs for poly culture and inland prawn cultivation by the support of MPEDA.
7. The infrastructure of the dry fish unit should be developed. The infrastructure of procurement, packaging, drying platforms and warehouse should be

developed with the help of RIDF and these should be facilitated with the bank finance.

In the process of producing food, economic resources, employment, livelihood and recreation, fisheries have to possible to adjust ecosystems because fishing may modify or influence the target resource (especially if there is overfishing of the target resource), species related with or dependent on the targeted resource (such as predators or prey), trophic associations within the ecosystem in which the fishery operates and fishing occurs (Booth J.D., 2006). Under the Code of Conduct for Responsible Fisheries, the fishing sector is expected to diminish its impacts to the minimum possible in ways that are also compatible with its own sustained subsistence. Here the study highlights some details of activities and physical targets in fisheries in (Table 8).

Table 8: Programme based physical targets in Fisheries development plan.

Programmes	Unit	Annual Plan 2011-2012 Targets
Development of Fresh Water Aquaculture under FFDA	Ha.	130
	Training to fish farmers (Nos.)	60
Integrated Development of Inland Capture Resources (Reservoir/River) (Net and Boat)	Net and Boats Nos.	25
	Ha.	120
National Fisheries Development Board (Training)	Ha.	240
	Training to fish farmers (Nos.)	120
Self Employment Programme (Training)	Training to fish farmers (Nos.)	60

Source: Comprehensive district annual plan 2011-2012(Balasore)

4.5. Fishery Development Plan

To achieve the ultimate goal of fulfilment of fish demand in domestic and internationally a long term policy and strategies allowing for the balanced and sustainable management and development of the fishery sector in the state of Odisha. So the following fishery development plan has developed by the Odisha government with the help of Central government which is shown in (Figure 5).

4.6. Fish Nurseries

A fish nursery is a "place for artificial breeding, hatching and rearing through the early life stages of animals, finfish and shellfish in particular". Hatcheries produce larval and juvenile fish (shellfish and crustaceans) primarily to support the aquaculture industry where they are transferred to on-growing systems i.e. fish farms to reach harvest size (Pillai P.P., et al., 1992). The fisheries nursery in the district is shown in (Table 9).

Table 9: Availability of Fish Nurseries in the district during 2009-10.

Blocks	Government		Private		Total Area (Hec.)
	Nos.	Area (Hec.)	Nos.	Area (Hec.)	
Balasore	1	4.68	10	4.96	9.64
Balipal	-	-	-	-	-
Bhograi	-	-	-	-	-

Source: Office of District Fishery Officer-cum-CEOFFDA & BFDA, Balasore 2010

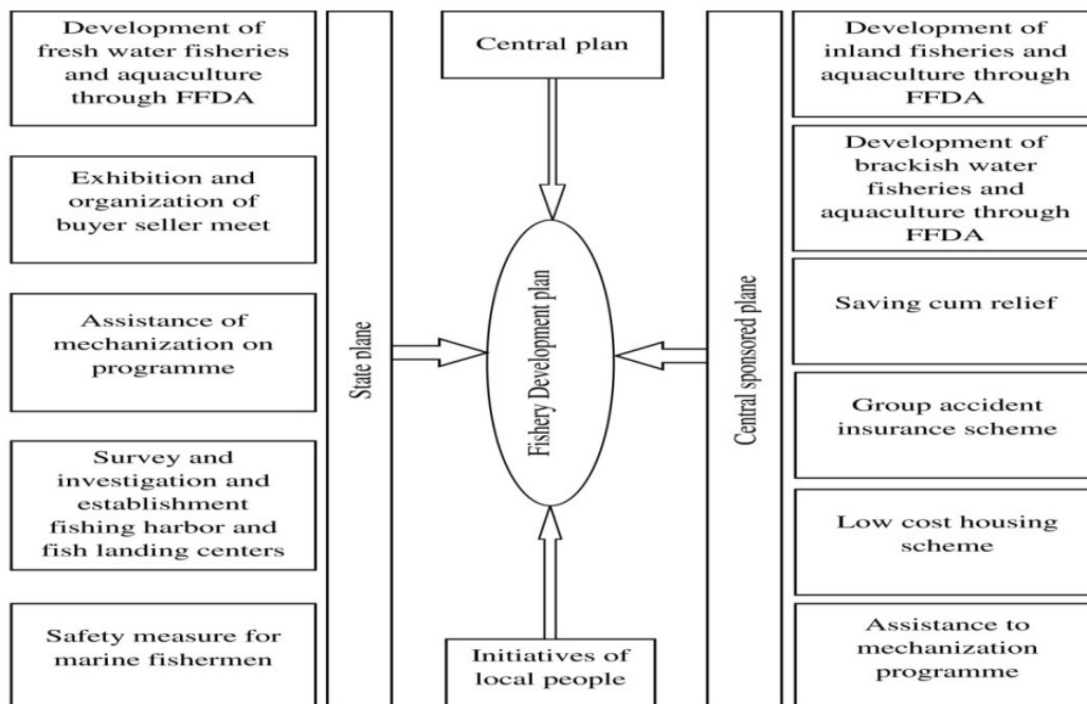


Figure 5: Integration of condensed planning for the fishery development.

4.7. Organization Involvement

Dry fish production is also now gaining a very significant momentum to state economy. Generally some costal dwellers and also some organizations are actively involves themselves for this purpose (Table 10).

Table 10: Involvement of different organization in dry fish production.

Name of the Organization	Location/Address	No. of Members
Scampi farmer's club	Gudupai, Balasore	300
SagarKanya, PMFWCS	Bishnupur, Baliapal	65
SarbaMangala, PMFWCS	Sekhpatna, Balasore	130
MaaMangala, PMFWCS	Srijanga, Balasore	65
GadaMangala, PMFWCS	Bolonga, Baliapal	90
Annapurna, FWCS	Kasaphal, Balasore	130

Source: Strategic Research and Extension Plan of Balasore district.

4.8. Shrimp Farming

In the present study area shrimp farming has been increasing rapidly for earning money. Mangrove region, flood plain, salt pans, rice field, seasonal filled pond water bodies etc. are being used as the place of shrimp farming for the last three decades. It is also found that in the field of shrimp farming loans with subsidy is available and the Fishery Department of the Government of Odisha and also the private sectors comes forward willingly (Jhingran V.G., 1999). For the gradual and rapid spreading of shrimp farming existing and traditional land use pattern is changing widely and as a result the physical and socio-economic pattern is rapidly changing. In the study area the total area of shrimp farming was 1780.56 hector in the year of 1973 which increases to 2356.92 hector in 2010. The development is nearly 38%. In this way the natural habitat and traditional land use is turning into the area of shrimp farming. So the inhabitants of coastal region should be careful about their resource use conflict.

5. Conclusion

Coastal zone, the transitional zone between land and sea, is one of the most fragile, complex and a productive ecosystem. It is bestowed with enormous resources both - living, non-living and is a potential area for recreation and harnessing non-conventional energy resources (wave and wind energy). Balasore district is a maritime district and has significant possibility for improvement of inland, brackish water and marine fisheries. The district is capable with an extended coastline stretching over 480 km with a continental shelf area of 24,000 sq km along the Bay of Bengal. It proffers remarkable prospects for development of fresh water, brackish water and marine fisheries with massive possibility for fish production, together with employment and revenue generation for socio economic affluence. Fresh water resources of the State are anticipated to be 6.75 lakh hectares (ha) including of 1.24 lakh ha of tanks/ ponds, 2 lakh ha of reservoirs, 1.80 lakh ha of lakes, swamps & jheels and 1.71 lakh ha of rivers and canals. The State's brackish water resources are of the order of 4.18 lakh ha with a breakup of 0.79 lakh ha of Chilika Lake, 2.98 lakh ha of estuaries, 32,587 ha of brackish water tanks and 8,100 ha of backwater. The fisheries prospect of Odisha is 513,667 MT and about 4 per cent of population (16.26 lakh) depends upon fisheries for their livelihood. Out of them, 8.78 lakh depend on inland fisheries and 7.48 lakh on marine fisheries. The fisheries sub-sector contributed about six per cent to the GSDP share of the agriculture sector for the year 2012-13.

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