Mangrove Forest and Local Livelihood: A Study in two villages of Mahakalapada Block, Odisha

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Abstract

Mangrove forests along the coastal belt of Orissa, especially mangrove ecosystems in the estuarine areas of Mahanadi delta of Orissa rich in varied resources, support livelihood of lakhs of people living adjacent to these forests. They act as refuge against cyclones, storms and tidal surges which is recurrent in this area. Apart from a major source of fuel, fodder and timber, mangrove wetlands harbor fishes, crabs and serve as an ideal habitat for prawn farms the soil being fertile mangrove forests are cleared for agriculture purpose. Other minor uses of mangrove include collection of medicinal plants, collection of molecules, shells for lime making, etc. In view of this scenario the study was carried out in two villages of the Mahakalapada block of Kendrapara district in Odisha with the objectives to understand the livelihood of the people based on their skill and resources. The study also tries to access the role of mangrove for life and livelihood of the people in the coastal ecosystem. Different methodologies have been used to satisfy the various objectives of the study. Techniques of simple statistics have been applied for analysing the data and getting the results to derive a logical conclusion. The analysed data has been presented based on the objectives of the study in the form of tables and graphs, which are described, interpreted and conclusions drawn. Utilising the data of 168 households from two villages, the study found that coastal community has strong economic straps with the coastal ecosystems with which they interact and interfere in various ways. The study also reveals that conservation of mangrove forest by involving the community is the best approach and there should be a committee in the Panchyata level for coordinating the activities of the village committee and resolve the conflicts between the villages. The study gives an ample opportunity to understand the local livelihood of the coastal community and their dependency on mangrove forest.

Keywords: Mangrove forest, Joint Mangrove Management (JMM), Coastal livelihood and Ecosystem

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I. INTRODUCTION

Mangrove wetlands are prominent features of the coastal zone of tropical countries. It consists of a mangrove forest and its associated water bodies. A mangrove forest harbours a group of plant species that grow well in the estuarine areas where the substratum is composed of accumulated deposits of river borne sediment (Selvam et al, 2010). A mangrove forest is interested by a number of tidal canals, channels and creeks and large open water bodies where the water level varies daily due to tidal inflow and outflow as well as seasonally due to freshwater discharge. Wetlands are important repositories of biological diversity and are among the world's most productive ecosystems. They help regulate water flows, remove sediment and pollutants and provide essential habitats for diverse fauna. They are threatened in many parts of the world by drainage for agriculture or urban expansion, conversion to aquaculture ponds, over grazing and in forested wetlands, logging. Biodiversity is usually analyses at three level the variety of communities and ecosystem within which organisms live and evolve the variety of species themselves and the genetic variation within those species. The degradation of the whole ecosystem such as forests, wetlands and coastal waters is in itself a major loss of bio-diversity and the single most important factor behind the current mass extinction of extinction of species (John Ryan, 1992).

The mangrove wetland is a multiple-use ecosystem that performs a number of protective, productive and economic functions to sustain the ecological and livelihood security of the coastal communities. Mangrove forest and associated wetlands are: i) Act as a barrier against cyclones and prevent entry of saline water inland during storm surges, ii) Act as buffer against floods and prevent coastal erosion, iii) Provide nursery grounds for a number of commercially important fish, prawns, crabs and molluscs, iv) Enhance fishery production of nearby coastal waters by exporting nutrients and detritus, v) Provide habitats for wildlife ranging from migratory birds to estuarine crocodiles. The economic value of the mangrove wetland stems from i) Availability of wood products ranging from timber, poles, posts to firewood, ii) Availability of non-wood products such as fodder, honey, waxes, thatching materials, etc., iii) Availability of aquatic products such as fishes, prawns, crabs, molluscs, clams and oysters.

According to the Forest Survey of India (1999) the total area of the mangrove wetland is about 4.87 lakh ha of which 56.7% are on the east coast, 23.5% on the west coast and the remaining 19.8% on the Andaman and Nicobar islands (Amrutha et al.2012). Mangrove is highly productive marine and estuarine ecosystem. Mangrove produces a large amount of waste such as leaves, stems, etc. This waste is rapidly degraded into small particles called detritus and is in turn eaten by estuarine species such as shrimp, some fish and small crustaceans on which birds, predatory fish and people depend for their food. Thus the mangrove has the capacity to support major fishery farms. They are important nursery grounds for commercial shrimp and fish seedlings as they discourage oceanic predators due to their shallow waters. The large-scale destruction of mangrove has adversely affected the productivity of nearby fisheries and consequently the economic conditions of fisherman households. The conversion of mangrove forest into shrimp farms in the coastal areas in Asia, including India, is nothing but redistribution of income from poor fishermen to rich investors, mostly non-fishermen marine product industrialists and merchants. The destructions of mangrove forest in India, China, Thailand and other Asian countries is synonymous with the destruction of the fishing grounds of the traditional fishermen leading to their occupational displacement. The area of the mangrove wetlands of India has been estimated from 5 to 6.81 lakh ha (Selvam et al, 2002). The major mangrove wetlands of India area located along the east coast of India. All along the east coast the tidal amplitude as well as the periodicity of freshwater flow decreases from the Sunderban mangrove in the north to the Pichavaram and Muthupet mangrove located at the southernmost end of the east coast (Table 1).

Table-1: Status of mangrove forest in India

Mangrove area	States	Tidal amplitude (m)	Freshwater inflow	Area (ha)	Species diversity
Sunderbans	West Bengal	4 to 6	Perennial	400000	48
Bhitarkanika	Odisha	2 to 4	July to Jan	30000	36
Godavari	A.P	1.5 to 2	Juy to Nov	33200	16
Pichavaram & muthupet	Tamilnadu	0.20 to0.50	Oct to Dec	14000	13

Source: Atlas of Mangrove Wetland of India 2001

A brief account of the ecology of mangrove wetlands is given for a better understanding of this ecosystem. The health of the mangrove in terms of hydrological and soil conditions and the wealth of the mangrove wetlands in terms of species diversity, biomass and productivity are determined by the following factors (a) Degree of protection against high-energy waves, (b) Quantity and duration of freshwater inflow, (c) Larger tidal amplitude with gently sloping coastline (d) Sediment supply. Although there are many mangrove species, but most of the villagers in the study area know only certain variety of species because of their widespread use. The scientific names of the local species according to their uses are at (Table -2).

Table 2: Popular Mangrove Species

Sl.No	Local Name	Scientific Name	Use
1	Bani	Avecinna Officinals	Grazing, Fuel wood, House Construction, Fishing
2	Rai	Rhizophora apiculata	Fuel wood
3	Hental	Phoenix paludosa	House construction, mats, Fuel
4	Harakancha	Acanthus ilicifilus	Fencing
5	Kaliachua	Bruguiera pavviflora	Fuel wood
6	Guan	Ecoecaric agallocha	Fuel wood, Fencing
7	Keruan	Sonneratia apetala	Fuel wood
8	Sundari	Heritiera formes	House const, Fishing implements

Source:-Field Survey

II. MANGROVE FOREST IN ODISHA

Mangrove forests along the coastal belt of Odisha especially mangrove ecosystems in the estuarine areas of Mahanadi delta of Odisha rich in varied resources, supports the livelihood of lakhs of people living adjacent to these forests. They act as a refuge against cyclones, storms and tidal surges which is recurrent in this area. Apart from a major source of fuel, fodder and timber, mangrove wetlands harbour fishes, crabs and serve as an ideal habitant for prawn farms the soil being fertile mangrove forests are cleared for agriculture purpose. It is also noticed that large herbs of buffalo and cattle are being reared in this area with an intentions of sufficient availability of fodder from these forests. Other minor uses of mangrove include collection of medicinal plants, collection of mollaces, shells for lime making, etc. In addition the mangrove occupies a niche that no other ecosystem could have possibly colonized.

The mangrove all along the Odisha coast are threatened due to the high density of population in these areas and competing demand for land for agriculture and prawn farming. The mangrove belt in Kendrapada district called the Bhitarkanika mangrove forests, comprising the areas between in the Dhamara mouth to Barunei on the coast, has been notified as Bhitarkanika Sanctuary (672 Sq.km.). Part of this area (145 Sq.km) is notifies National Park. This letter stretch of mangrove is the only area, which is relatively well preserved. Mangrove vegetation in the Mahanadi delta region between Barunei mouths to Mahanadi mouth (Paradip) is fragmented and degraded due to large-scale encroachment of these areas. Further south, the sparse mangrove vegetation occurs along the coast from Mahanadi mouth to Devi mouth. Degraded mangrove also occurs to the north of Dhamara mouth up to Chudamani in Bhadrak District coast, and also on Subarnarekha mouth in the Balasore District (Wild life Conservation of Odisha, Forest and Environment Department, Govt of Odisha).

Table-3: Mangrove forest covered in Odisha

District	Area under Dense Mangrove cover (km^2)	Area under Mangrove open forests (km^2)	Total Area (km^2)
Balasore	0	3	3
Bhadrakh	11	8	19
Jagatsinghpur	4	1	5
Kendrapada	179	13	192
TOTAL	**194**	**25**	**219**

Source:-Rajnagar DFO Office

III. METHODOLOGY

Objectives of the Study

Having seen the various aspects of mangrove forest and the dependency of the people dwelling besides the forest. The study was a comparative analysis in the two villages. The one village which totally depend upon the forest and other one conserving the forest. We made a comparative study on their livelihood by keeping this objective in mind. These are as follows

i. Role of Mangrove for life and livelihood of the people in coastal ecosystem.
ii. To understand the livelihood of the people in the study area based on their skill and resources.
iii. To identify causes of depletion of mangrove if any and what are the techniques of conservation with involvement of different stakeholders.

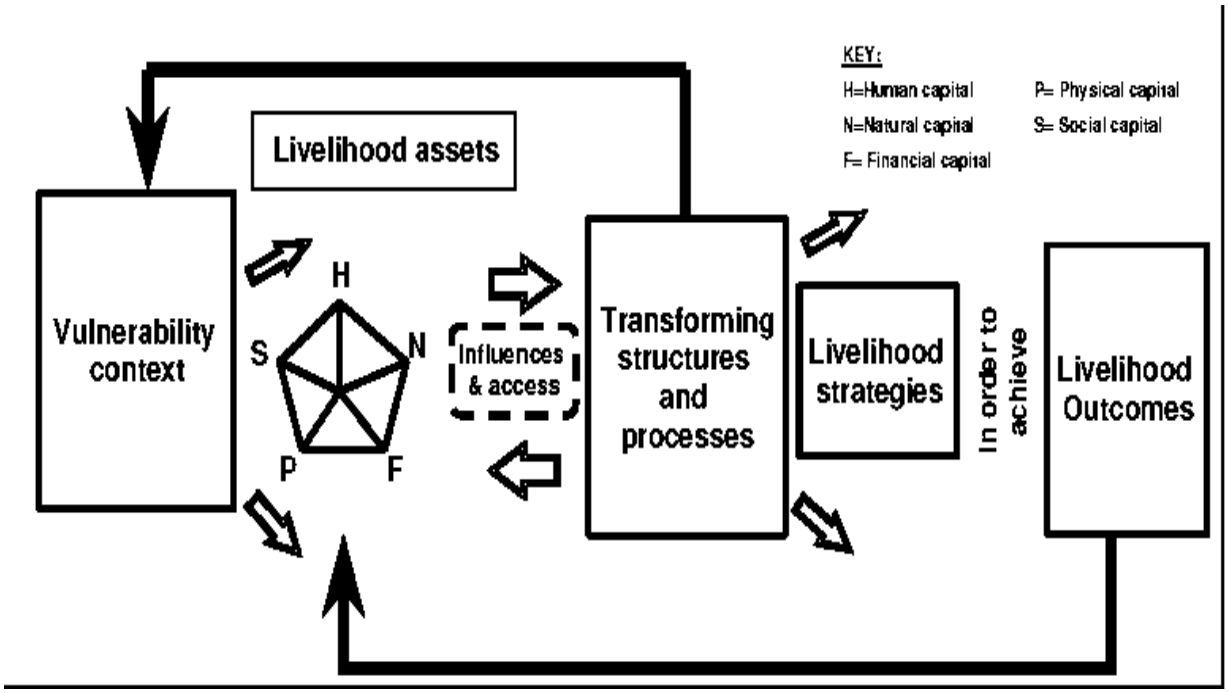
Sampling: The sampling we used for this study is totally based on the objective. The first purposive sampling was used for selecting the study location such as selection of a district, selecting block, selecting panchayat and selecting village and the mangrove area for conducting the study. The base used for this sampling was coastal people who have been residing besides the mangrove forest for the last fifteen to twenty years. As per our study we selected the two villages named as Kalatunga and Kharnasi under the two different panchayat of Mahakalapara Block which is one of the coastal blocks in the Kendrapara district of Odisha.

Data Sources & Tools used: In view of the nature of the study and time available to complete the study it was required to use both type of data sources i.e. primary as well as secondary. Primary data source was also used to cross check the information gathered from secondary data source.

Categories of respondents: To know the dependency on mangrove of different livelihood we have taken the help of different section of people. As per our objective and nature of study we selected different categories of respondents to understand the issues in depth and from various perspectives. This helped in triangulating the information and coming to conclusion. The main respondents in this study were Farmers Community, Fisherman Community, Wage Labour & Other Service holder, Forest Guard and other Officials and different section of the village people.

IV. MANGROVE FOREST AND LIVELIHOOD

Livelihood comprises the capabilities, assets and activities required for a means of living: a livelihood is sustainable which can cope with and recover from stress and shocks, maintain or enhance its capabilities and provide sustainable livelihood opportunities for the next generation, which contributes net benefits to other livelihood at the local as well as global levels in the long run (Orinya, 2016). A slightly different definition by Ellis (2000) “livelihood comprises the assets (natural, physical, human, financial and social capital) the activities and the access to these that together determine the living gained by the individual or household”(p-10). Livelihood in the study village is not so much differing than other coastal area. The main occupation in this village is agriculture and fishing. In the lean period people generally move to other village for wage labour and brick line work. The entire livelihoods in the study areas are not sustainable. Shocks, Trend and Seasonality are more or less in every activity. Due to this, their economic condition is very miserable. To give them a sustainable livelihood some other alternative should be suggested for the habitat. To understand the livelihood of the study area, DFID framework is being used and explains all the livelihood activity.



Fuel: Most of the mangrove species are very good fuel wood. The villagers generally use cow dung; fuel wood and straw for fuel. Almost all the household make cow dung cake as fuel. Generally women are involved in the process of making the cake. Around 43% of households use cow dung for three to nine months. Whereas highest percentage i.e. 60% of the households use straw as fuel for three to six months (Table-4). So the dependency of the people on straw is high as compare to the cow dung.

Table -4 Percentage Distribution of sample HH for Fuel needs from various sources for different period in Months

Months	Straw	Cow Dung	Mangrove Plant	Homestead Plant
0-3	3.77	11.32	100.00	73.58
3-6	60.38	43.40	0.00	26.42
6-9	28.30	43.40	0.00	0.00
9-12	7.55	0.00	0.00	0.00

Source – Field Survey

Grazing: Leaves of the Bani are very favorable fodder for cattle and buffalo's. Most of the villagers are having cows and bullocks and some households have the goats. There is no common pasture in the village. The study found that around 17% of households leave their cattle and goats to the mangrove forest for grazing although it is only side by the forest (Table-6). 83% of households do not leave their live stocks to mangrove forests for grazing and only 4% of the households leave their live stocks to mangrove forest for grazing for three months (Table-5).

Table 5: Percentage Distribution of sample HHs for Mangrove Uses for grazing and fuel wood by the sample HH for different time Period (Months)

Months	Grazing	Fuel wood
0	83.02	86.79
1	5.66	5.66
2	7.55	3.77
3	3.77	3.77
Total	**100**	**100**

Source – Field Survey

Housing: In the past most of the species of mangrove forest was for house construction. Hental, Korue, Sundari, Bani, sisumer are the plants mostly used for house construction. Especially rua from the Hental is very strong and can't be destroyed by the white ants. So it was widely used for house construction by the coastal area people. But due to rapid deforestation the Hental species has become rare species in this area. Although most of the houses in the village are thatched, leaving some of the households most of the households have not used mangrove for their house construction rather they have used bamboo for housing purposes. Only 25% of families used mangrove plant for their house construction although they did it when there is natural breaking of plants due to cyclones (Table-6). The dependency of Kharnasi village on mangrove forests for housing purposes is very high compared to Kalatunga village.

Graph 1: % of HH depending on Mangroves

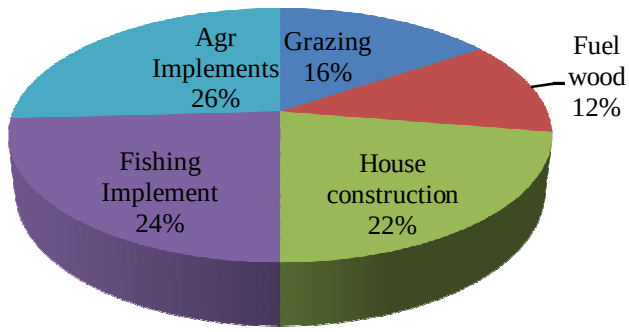


Table -6 Percentage Distribution of sample HHs for meeting different needs from mangrove plants

Particulars	Grazing	Fuel wood	House construction	Fishing Implement	Agri Implements
No of Households	16.98	13.21	24.53	26.42	28.30

Source – Field Survey

Timber for Fishing and Agricultural implements: The fishermen who go to river and sea for fishing with traditional boats (called Dingi) use mangrove plants for making oar, and some sticks required while fishing. 26% of households use mangrove plants for fishing purposes (Table-7). Among the fishermen, highest 13% of the families use mangrove plants for fishing purposes whereas wage labour group do not use mangrove plants for fishing purposes. Mangrove species namely Sundari, Bani and Bandari are used for making agricultural implements. Although a plant called Babul is very good for making agricultural implements are plentily available and most of the villagers use tractor for ploughing purposes. 29% of the households still depend on mangrove plants for agricultural purposes. (Table-7) Again those households whose main occupation is cultivation, among them, 13% of the households use mangrove plants for making agricultural implements. Households having main occupation as wage labour do not depend on mangrove plants for agricultural implements.

Table 7: Percentage Distribution of sample HHs for Mangrove Uses for House construction, Fishing implements & Agricultural Implements according to different occupational groups.

Main Occupation	House Construction	Fishing Implements	Agricultural Implements	Total
Cultivation	5.66	9.43	13.21	52.83
Fishing	13.21	13.21	9.43	26.42
Wage Labour	3.77	0.00	0.00	11.32
Others	1.89	3.77	5.66	9.43
All	**24.53**	**26.42**	**28.30**	**100.00**

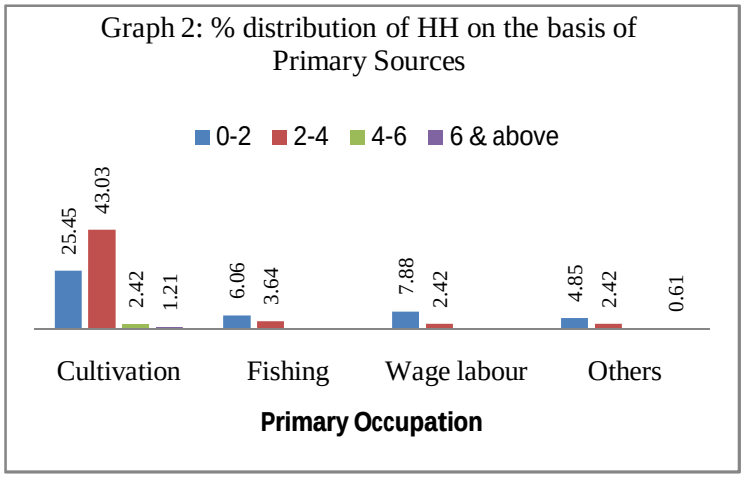
Source – Field Survey

Honey and Wax: Honey and wax were produced in large quantity when there was dense mangrove forest in the past. But because of the sparse forests, honey and wax collection within the mangrove forest has been reduced a lot. But now those people having bee boxes are getting very good income from honey because of presence of the mangrove forest in nearby places. The bees can travel 3 km distance for collecting honey. So honey production is a good source of income which has a direct relation with the mangrove forest.

Fishing: Fishing is the measure sources of income of the two study villages, although agriculture is the main occupation. Almost all the households in the villages are involved in fishing in some forms or other. The villagers are involved in fishing from sea, river, pond, canal and mangrove creeks. Because of the coastal nature of the village, even the river and canal fishing is also salt-water fishing. Fishing from ponds that is nearer to the saline bond is also salt-water fishing and away from the sea coast is sweet water fishing. According to the villagers the dependency of people on fishing has been drastically reduced in last 25 years due to getting less fish from

river and sea by spending more time, manpower and money. Although various factors responsible for the decline i.e. increase in the people involved in fishing, large scale fishing by mechanized boats and trawlers and pollution of the water, deforestation of mangrove is one of the major factors for rapid decline in fish caught. Although the villagers had involved in highly profitable prawn farming business in a small-scale basis, but due to their bad experience of loosing the business they are no more interested to do the same. Generally the investment for prawn farming is very high compared to the capacity of the villagers. It needs a lot of care and responsibility for the prawn farm by consultation with the specialists or slight negligence leads to loss of the whole return. As these prawn farms are nearer to the sea due to its nature of salt water aquaculture, at any time there is every chance of sea wave flushing out the farm due to cyclone, high tide and heavy rain. Because of the highly risk nature of the above activity and lower economic status of the villagers, they could not bear the losses out of their investment. They were compelled to stay away from the activity but leased their own farms to outsiders i.e. contractors, businessmen etc. to get some income. Gradually the people have diversified their occupation. In addition to cultivation, people in Kalatunga village became engaged in other wage labour activities i.e. soil, brick lines, masonry, etc. and also started migrating outside the village permanently for livelihood.

Deforestation of mangrove led to decline in amount of fishes, especially prawn seedlings and crabs from creek and canal. Creeks are the waterways within the mangrove forest and the canal within the village has the connection to the mangrove creeks. As mangrove forest is a very good nurturing ground for prawns and crabs, due to loss of this area the amount of crabs and prawn seedling has been gone down drastically in both creeks and canals. But due to recent conservation measures there was a check on the trend. Although there is no special evidence about the increase in fishes in the rivers and the sea due to the mangrove but the seedling of prawns, and crabs, fishes caught in the coast is directly proportional to the intensity of mangrove in the area. As mangrove creeks act as nurturing grounds for the prawns, crabs and fishes in the coast, the eggs given by the prawns and fishes in the sea flow to the coast during high tide and the seedlings get the required nutrition for the healthy growth. So one can directly relate the dependency on coastal fishing to the dependency on mangrove. So even fishing from the sea coast, river estuaries, mangrove creeks and canals formed due to the distributaries of rivers. The dependency of people in Kalatunga village on fishing as well as fishing from different sources of depends on various factors. It all depends on (i) their asset positions both agricultural land and the productivity, (ii) skills of the family members and availability of work for them, (ii) their owning of fishing assets like boat and net.



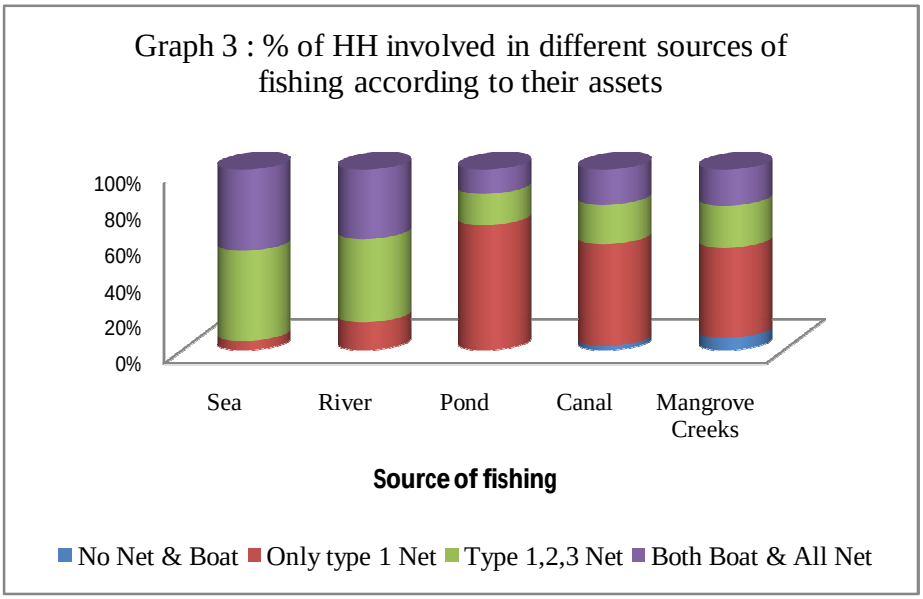
People having more agricultural land with high productivity have taken cultivation as their main occupation. The agricultural lands in the villages are of two types. Firstly the agricultural land nearby the canal, where there is flooding of land by water canals in the rainy season due to lack of drainage facility. This leads to salinity and low productivity. Secondly, the agricultural land away from this canal and saline bond, where productivity is comparatively high. Those people having first type of land have less productivity compared to the second type of land. In this position people prefer share cropping with wage labour activity and fishing. It can be seen that the percentage of households having land size from 2 to 4 acre are involved in cultivation as main occupation is 43% (Table -8). On the other hand those households whose main occupation is fishing have no land. At the same time those households whose main occupation is wage labour have land of 4 acre and above (Table-8).

Table 8: Percentage distribution of households on the basis of primary sources of livelihood & landholding size

Land in acre	Cultivation	Fishing	Wage labour	Others	Total
0-2	25.45	6.06	7.88	4.85	44.24
2-4	43.03	3.64	2.42	2.42	51.52
4-6	2.42	0.00	0.00	0.00	2.42
6 & above	1.21	0.00	0.00	0.61	1.82
Total	**72.12**	**9.70**	**10.30**	**7.88**	**100.00**

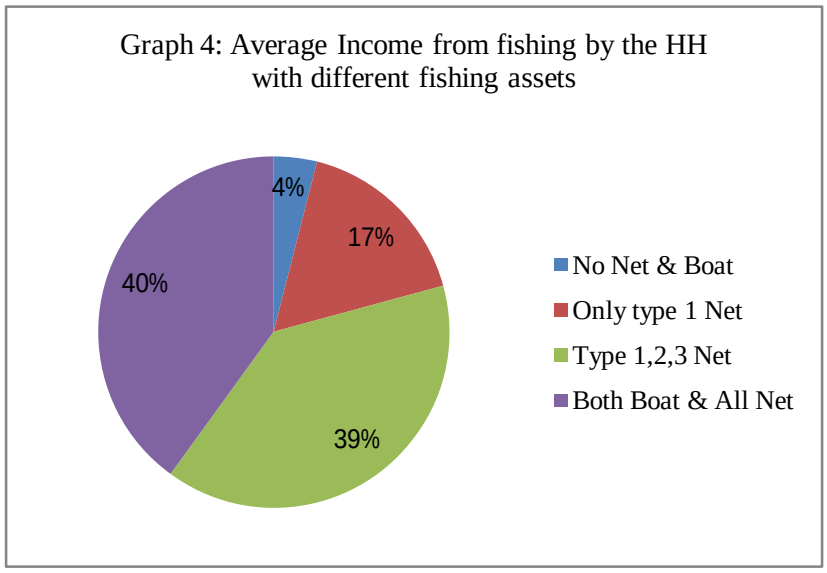
Source: Field Survey

The occupation of the family also depends on the skills of the family members in different activities. There are people the villages having various skills for example, brick line, soil and masonry etc. Certain people who are skilled and can withstand hard labour in the day time and get regular income from these wage labour activities, whereas they are unskilled in fishing and as a result could not get regular income from fishing. With their low economic status, they could not even afford to invest so much on fishing assets like nets and boat and keep these assets idle for certain period when wage labour activities are available and fishing caught is less due to seasonality. On the other hand, those who are involved in river and sea fishing catch the fishes during night time starting evening 6 o' clock to morning 6 o'clock for 12 hours being awakened. As they have to catch fishes at time when more fishes can be caught, they are irregular in their eating and sleeping habits. So their health does not permit them to do hard labour work for a longer period. Generally women members of the family do not go outside for wage labour activities barring a few involved in agricultural wage labour activities within the village due to very poor condition. But women members in most of the families are involved in catching fishes from canals, creeks and ponds.



The preference of sources of fishing also depends on the type of assets they have. None of the villagers have mechanized boat for fishing. Those boats available in the village are traditional boats made up of wood cost varying from five thousand rupees to six thousand rupees according to the size of the boat. They also use mangrove for oaring. The life of the boat is around three years. Minimum number of two persons is needed for catching fishes in this boat. Those having boat go for fishing in river and sea. They do not go deep sea fishing but catch fishes within two kilometres from the coast. Those who do not have boat can hire boat at the rate of Rs200/- per month. Most of the villagers have throwing net which is used mainly in ponds, canals, creeks and river. But people who have a larger share of income from fishing use mono-filament gill net of different points of according to the size of the fish they wanted to catch. This is mainly of two types, middle and large size. These net are purchased in kg based on the quality of thread varying from Rs250/- to Rs700/- per kg. Prawn nets have to touch the ground as the prawns generally move on the ground in water.

There is a relation between the type of nets and boat owned by the persons and the sources of fishing. Households having no net and boat do not go to sea and river for fishing but 4% of the households go for mangrove creeks and 2% of households go for canal fishing (Table-9).Those households having only throwing net, among them 68% of households involved in pond fishing, 49% of households involved in canal fishing and only 2% go for sea fishing that is by hiring or going as a share in group fishing (Table-9). Among the households having throwing net and mono-fillament gill net of points middle and large size, 19% of households depend on sea fishing, 23% depend on river fishing, 19% canal fishing and 13% fishing in mangrove creeks (Table-9). Among the households having all the three types of nets and boat, 17% households depend on both sea



and canal fishing, whereas 11% households depend on mangrove creeks (Table-9). From the above analysis it can be interpreted that those having assets like net & boat go for river and sea fishing than canal and creek fishing.

Table 9: Percentage Distribution of HHs on the basis of Fishing Assets and Sources of Fishing

Fishing Assets	Sea	River	Pond	Canal	Mangrove Creeks
No Net & Boat	0.00	0.00	0.00	1.89	3.77
Only type 1 Net	1.89	7.55	67.92	49.06	28.30
Type 1,2,3 Net	18.87	22.64	16.98	18.87	13.21
Both Boat & All Net	16.98	18.87	13.21	16.98	11.32

Source- Field Survey
Note: # Type 1-Throwing net
* Type 2-Mono-fillament gill net of point (20-30)
@ Type 3- Mono-fillament gill net of point (60-80)

There can be a relation between the fishing assets one have and, average income from fishing. Those households who do not have net and boat have annual average income Rs1525/-, those households having only throwing nets have annual average income Rs6521/-, those households having all types of nets have annual average income Rs15267/- and those having both nets and boat have annual average income Rs15520/-. (Table-10) The above figure shows that when fishing assets holding of the households increase, the average income also increase. There is very small difference in the average income of the households having all types of nets and households having both boats and nets. This is because most of the villagers who possess three types of nets also possess the boat. Some of the villagers who do not have any net and boat go for catching prawn seedling, crabs from the creeks and canals. But annual average net income is Rs8083/-, which is higher than cultivation (Table-10).

Table: -10 : Average annual income from fishing by the HH with different fishing assets (Rs)

Fishing Assets	Avg Income(Rs)	No of HHs
No Net & Boat	1525	3
Only type 1 Net	6521.58	38
Type 1,2,3 Net	15266.67	12
Both Boat & All Net	15520	10

Source – Field Survey

Seasonality: The fishing amount caught by the fishers varies from season to season. Although all round the year fishes were caught, but in certain seasons like October and November, when winter season starts, the fishing amount increased tremendously both in sea and river. Whereas in summer season the amount goes down. So from September to march there is both sea and river fishing regularly. But from April to August, the fish catch was reduced and the occasionally there was fishing. From March to May due to breeding season of the olive riddle turtle, fishing within 12k.m. of the sea shore was banned. Even the type of fish catch differs according to the season. From August to October medium size fishes and prawns are found whereas from October to February big prawns and fishes are caught in the river and sea. Even in a month there is up and down season.

Large amount of fishes can be caught in the up season i.e. 15 days during high tide days of full moon light and full dark night. But during other days the catching is not so remunerative. So generally the fishermen go for fishing in up seasons and take rest in down seasons. Those having boats go to river and sea through the creeks to catch fish. They leave their home during the high tide from 2 to 4 p.m. and reach the destination after 2 to 3 hours. Then they involve in fishing from evening 6 o' clock to morning 6 o' clock. They come back to home in the morning and take rest in the day time and again go in the same time. Similarly catching of prawn seedling is done from February to May. Crabs are caught around the year with variation of quantity. Those who go for catching seedlings and crabs go during high tide twice a day for 6 to 8 hours a day.

Women and Fishing: In this Kalatunga village, women have active participation in fishing. Especially catching seedlings and crabs from mangrove creeks are specialization area for the women. They even catch prawn, fish by groping and bunding and throwing nets in the ponds and canals.

Table 11: Involvement of men & women in fishing from different sources from sample HH

Persons	Sea	River	Pond	Canal	Mang. Creeks
Women	0	0	10	11	15
Men	11	16	43	35	10

Source – Field Survey

Generally women do not go to river and sea for fishing. Involvement of women in creek fishing is higher than men (Table-11). It can be shown that 15 women go for creek fishing and 10 men go for creek fishing from the total sample households. But in all other cases, men involvement is more than women.

Vulnerability

The fishermen and women face a lot of problems in fishing .The vulnerability can be classified as due to(a) Injures while fishing (b)Natural Calamities while fishing (c) Disease because of fishing (d) Harassments in fishing. These are as follows

- **Injures while fishing**:-The fisher folks suffer injures in the legs and hands while fishing. Their legs and hands is cut by the snails and other sea fishes and crabs. While they are moving within the mud and water, even they could not know about the cutting and unlimited bleeding occurred. As a result they have to stop fishing up to the healing up to the injuries. The poor have to suffer a lot in the form of loss of man-days. As a result the condition of the poor further deteriorates.
- **Natural Calamities while fishing:-**The fisherman communities have to suffer a lot due to natural calamities. Natural calamities like cyclone, high wave and Tsunami destroy the life and assets not only when they are in the sea or river but also when they are in their home near the coast. Because of their occupation they can't go very far from the coast. They have to stay near the coast for watching their boats and fishing implements. So they have to bear the burden of natural calamities.
- **Disease because of fishing**:-Fishing occupation is also leading to certain diseases. Fisherman women have to stay a longer period in the water in an unhygienic condition. So the cold, cough fever diarrhoea are very much rampant. Due to irregular eating and sleeping habits, they also suffer from disease like gastroenteritis, weakness in the body.
- **Harassments in fishing**: - Although forest was under Joint Mangrove management but there was no specific rule for catching fishers, prawns and crabs within the mangrove creeks by the villagers. Village samiti is also stake holder in this forest; there even harassments of forest guard those who go for fishing into the mangrove creeks. The forest guard charges bribe of Rs 50-100/- per month who catches seedlings and Rs 50/-per month who catches crabs. Those who can not give the bribe are harassed in the way of abuse and confiscation of the net and container with the amount caught. Even the boat owners who go for fishing to river and sea have to give certain amount of rupees to the mafias such as in Paradeep they are called as bati.

Agriculture

Agriculture is one of the primary occupations for the villagers but they are able to cultivate only single crop paddy because of no irrigational facilities. Besides paddy some people also do potato but only for own consumption which is just equal to their investment in money term due to less market price in the market. The agriculture land in the villages can be divided into two parts. One is fertile which are away from the saline canal and saline bond. The other one is comparatively less fertile near to the canal and saline bond. From these lands there is always a problem of drainage due to flood during the rainy season. They have to desalt the land for further cultivation. Besides their own land, some of the people are cultivating in encroached land but they are not ready to reveal the exact size of the land. People generally cultivate the salt resistant paddy of local variety such as Valuki, Panikoili, Patani and Sworna. The most prominent use of variety is Valuki which generally gives produce 7 to 8 qu. in a normal year whereas Sworna gives 16 to 18 qu. in a normal year but because of high cost of in doing Sworna most of the people do Valuki. The cost of Sworna is almost double the cost of Valuki.

Most of the people also do share cropping within or near by the villages. For the share cropping both expenditure on agriculture and produce will be equally divided between the land owners and the share croppers. However the average net income from the cultivation by the villagers is Rs 6759 (Table-12). Although people generally tell their primary occupation as cultivation but actually the share cultivation to total income than other occupation is very low. Cultivation suffers the seasonality of employment as only single crop from June to December.

Table-12: Average AI (Rs), Average Persons and Average, Income per Person (Rs) on the basis of Occupation

Occupation	Avg Income(Rs)	Avg Persons	Avg Income per Person(Rs)
Cultivation	6759.43	1.64	4114.44
Fishing	8082.92	1.57	5143.68
Wage Labour	9350.94	2.2	4250.43
Others	2835	0.83	3402
All	**26332.92**	**1.58**	**16666.41**

Source – Field Survey

Wage labour

Seasonality in cultivation, lack of fishing opportunities, compels the villagers to go for wage labour activities. Certain people are permanently migrated to Delhi, Gujarat and Andaman for different works and annually send money back to their home. Other type of wage labour whose main occupation is cultivation or fishing also go for wage labour activities. According to the season skilled wage labours are there who are skilled in masonry, carpenter go for these works just after cultivation. Most of the wage labours go outside the village for 5 to 6 months starting from January to May for bricklean work just after harvesting. They go in group on a contractual basis. Their wage rate varies from Rs 180 to Rs 250 per day depending on their skills. During the agricultural period certain poor class families also go for agriculture wage labour activity for which they get Rs 150 to Rs 200. No women members go outside for wage labour activity. But the poor women go for agriculture wage labour activity within the village. Mostly women take care of the home and children and elder in the home when the male members go outside for wage labour activity. The average annual income from wage labour activity is Rs 9350 which is very high compare to other sources of income (Table-12). Even wage labour activity is treated as a coping mechanism when agriculture is failed due to various factors.

Other Occupation

Other occupation groups includes school teacher in the EGS School in the village, agents of Tubro, Boat driver, barber. Those who are doing business like hotel, brick lines, labour and goat rearer. Other occupation groups also involved in cultivation and fishing. But because of their regular work in this sector they do not go for wage labour activities. The percentage of other occupation group in the village is very less, who are doing hotel business in the nearest Jagatjore market are getting regular income out of it followed by up and down season. Even for bricklines business fishing business means acting as intermediary group and prawn from business and labour contractor also do their work on a seasonal basis. For all these groups rainy season as a drawn season when the involved in agricultural work and do their business in other season. Barber, boat driver and goat rearer school teacher and Tobro agents have to do their work irrespective of the season but with the agriculture work. The average persons involved in this sector can be given like 0.83 and the average income from this sector is Rs2835/-. (Table-22) This is due to less opportunity in the villages for other livelihood activities, although, some households get very good income from other livelihood activities.

V. SUGGESTIONS AND CONCLUSION

Conservation of any of the resources needs awareness and motivation of people to see the importance of the resources, the interest and will of the other stake holders like government, NGOs and private bodies. Conservation of mangrove is very crucial to sustain coastal biodiversity and protect people from natural calamities and to provide sustained livelihood to the people, of course in a regulated way. Looking at the seriousness of the problems in conservation of the mangrove following measures can be suggested.

a) Involvement of people for conservation of mangrove forests is the most valid approach. But selection of villages for Joint Mangrove Management (JMM) is most the important. The coastal people who are directly or indirectly getting benefit from the mangrove forest should be included. It may be the case that the villagers at far distance places are exploiting the forest resources more than the nearer villages. All these villages should be incorporated with specific duties for forest protection according to their suitability and capacity. Conservational approach should be integrated with the developmental approaches. There need not be separate structure for the JMM. But it should be the structure of Gramsabha but a separate representative group from the Gramsabha can be empowered to meet the responsibility. Certainly the representative groups cannot be the political representatives. There should be self regulated rules and regulations regarding the use of mangrove forests in tandem with government rules and regulations. Along with other developmental issues protection of mangrove forest should be undertaken. In this way intra village conflict can be solved in the Gramsabha.

b) Government should empower the gram sabha and panchayata level committees to solve the cases in the village and panchayata level. Looking at the seriousness of the case it should be referred to the forest department for proper legal enforcement.

c) NGOs should be involved in the process as a capacity builder and enabler to address various issues arising out of the conservation. They can contribute in a big way in mobilising the public opinion and motivating local people towards protection of the forests. At any time if there is breach of law from any side of the stakeholder this group can really make a difference by filing Public Interest Litigation (PIL) and empowering people to fight.

d) Legal enforcements should be streamlined to solve the cases regarding encroachments and violators of the forest laws as soon as possible.

e) To address the encroachment issues there should be proper coordination among the various departments, viz., Revenue, Police and Forest, etc.

f)From the study, it reveals that the provision of alternative supply of firewood and timber may reduce the dependency of people on the forest. Large scale agro forestry for meeting the firewood needs may be promoted. In the study villages, Gobar gas plants (cow dung) can be promoted because of high concentration of cattle. Furthermore, fuel efficient chullas should be promoted to economise fuel consumption. Whatever alternatives supplied that should be accessible to the villagers. In addition to it, Grazing land should be created in every village by evicting the people from encroached agricultural lands.

g) Support for alternative livelihoods than fishing and agriculture can raise the socio-economic status of the villagers. When population pressure from these activities will be reduced, the engaged families can gain. Besides agriculture horticulture, apiculture can be a very good opportunity. Eco-tourism is a very good option to engage these people in hospitality, business and promotion of other traditional and modern handicrafts.

h) Fishing activities should be conducted but in a regulated way by making federations. In this way the problems of the fishing communities can be addressed by creating a space for market by eliminating the intermediaries.

i) Promotion of SHGs to strengthen the women for involvement in the conservation process. Addressing credit and vulnerability issues through microfinance and micro insurance with other support services is of great importance.

The study of the two villages clearly depicts the picture of dependency of people on the mangrove for life and livelihood in the coastal ecosystem. Mangrove forest has a direct effect on the livelihood of the people. Especially fishing is the main livelihood in these areas and fishing is influenced by the mangrove. But the deforestation is mainly for fuel and other household needs which goes against the mangrove concentration. The more the dependency on mangrove for grazing, fire wood, housing, the more will be the deforestation. Natural fishing which is for the local interest is not affecting mangrove but prawn farm which is against the local interest and for the large economic gain of the state and mafias is one of the main cause of deforestation. So mangrove forest not only protects human being and assets but also give livelihood to the local communities.

REFERENCES

1) Amrutha.V.Audipudi,N.Pradeep Kumar and A.Sudhir (2012), Phosphate Solubilizing Microorganisms Associated with Chollangi Mangrove Soil in East Coast of India, International Journal of Scientific & Engineering Research, Volume 3, Issue 11
2) John Ryan (1992), Conserving biological diversity, World Watch Institute, [Online] Available at: https://www.thefreelibrary.com/Conserving+biological+diversity-a012109852]
3) Orinya Sunday (2016), Communal Conflict, Internal Displacement and Livelihood Security: An Analysis of the Agila Situation, International Journal of Humanities Social Sciences and Education (IJHSSE), Volume 3, Issue 10, PP 80-88.
4) V. Selvam, L. Gnanappazham, M. Navamuniyammal, K. K. Ravichandran and V. M. Karunagaran (2002), Atlas of Mangrove Wetlands of India, M. S. Swaminathan Research Foundation, pp.4
5) V.Selvam, K.K.Ravichandaran, V.M.Karunakaran, K.G.Mani, Evanjalin Jessie Beula and L.Gnanappazham (2010), Pichavaram mangrove wetlands: Situation Analysis, International Union for Conservation of Nature and Natural Resources.
6) Wildlife Conservation of Odisha, Forest and Environment Department, Goverment of Odisha, [Online] Available at: http://odishawildlife.org/mangroves.html.

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