ECONOMIC VALUATION OF MANGROVES FOR ASSESSING THE LIVELIHOOD OF FISHERFOLK: A CASE STUDY IN INDIA

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ABSTRACT

The study was carried out in a village named MGR Thittu in the vicinity of the Pichavaram mangroves in the state Tamil Nadu in India. The objectives of the study were to review the current status of mangroves in Tamil Nadu, study the fisherfolk’s perceived role of mangroves on their livelihood, estimate the economic value of mangroves as a case study, and suggest policy measures needed for the conservation, protection, management and development of mangroves. The required data were collected randomly from 41 experts and 120 villagers. The most important concern for protecting the mangroves was found to be strengthening of coastline against Tsunami through mangrove plantation. The most important present use of the Pichavaram mangroves was their services through their ecological functions like protection against tsunami, floods and heavy winds; followed by contribution to fishery; and firewood collection. In calculating the Total Economic Value of the concerned mangrove area, the values were divided according to direct use values, indirect use values and willingness to pay estimates, and was added upto be Rs. 353,52,31,312. The economic valuation of the particular mangroves attributed an indicative price to the huge value of the mangrove resources, which is necessary for investing in protecting natural resources on the part of the government and other stake holders for protecting fisheries resources in the view point of sustainability.
Introduction

The world is now witnessing the vulnerability of fish catches pushing the livelihood of fisherfolk at stake. It is now questionable in what ways climate change mitigation measures are useful for sustaining livelihood of the fisherfolk, and how much they are really worth. Since climate change mitigation measures naturally imply conservation of natural resources, the question next is how much the worth of natural resources is from the fisherfolk’s point of view. Such natural resources include aquatic habitats which cater to the livelihood of the fisherfolk. Economic valuation of such fish habitats as mangroves is an important tool for measuring such worth for the sake of fisherfolk’s livelihood. The present study was therefore carried out in a village named MGR Thittu in the vicinity of the Pichavaram mangroves in the state Tamil Nadu in India. The village MGR Thittu was recreated after the Asian Tsunami in the year 2004 washed away many lives and property of the Old MGR Thittu Island. All throughout, the villagers were grateful to the existence of mangrove patches which saved the remaining of the villagers surviving at present. Considering this, various NGOs and research foundations like M.S. Swaminathan Research Foundation have been trying to increase mangrove vegetation in the area to protect the fisherfolk community from similar devastations in the future. Hence, the study was carried out with the objectives to review the current status of mangroves in the state of Tamil Nadu in India, to study the fisherfolk’s perceived role of mangroves on their livelihood, to estimate the economic value of mangroves as a case study, and to suggest policy measures needed for the conservation, protection, management and development of mangroves.

Fisheries in mangrove ecosystem have many benefits that provide an important justification for conducting valuation studies to use them in the tools of effective decision-making for management of fisheries. Small scale fisheries in the waters of the mangroves produce nearly 1 million tonnes of crabs, shrimps, mollusks and finfish annually equivalent to about 1.1 per cent of the world’s total fish catch (Rajendran, 2004). Mangroves provide direct employment to about 0.5 million fisherfolk, and about 1 million jobs world-wide are dependent on mangrove-associated fisheries, and the density of population dependent on mangroves was estimated at about 5.6 persons per square metre (Rajendran, 2004). Besides capture fishery, culture fishery is also prevalent in some mangrove-rich areas. Despite the many benefits provided by mangroves, they are under intense pressure from competing resource uses, in particular, firewood collection, aquaculture, wood chipping operations, hut construction, increased commercial activities and urban demands. These anthropogenic activities have a negative effect on the well being of the mangrove- dependent communities. To properly evaluate the different management strategies for mangroves in developing countries, it is crucial that the uses and values of mangroves to local communities especially the fisherfolk are identified and estimated through proper economic valuation of mangroves as fish habitats.

The economic valuation of fish habitats including coral reefs, wetlands, mangroves, marshes and others aim at capturing the value of the loss of such habitats caused by land-claim and coastal squeeze; reduction in coastal resilience; and loss of nursery area for fisheries and biodiversity. In addition to this, economic valuation studies also capture the functions of mangroves for possessing coastal defense functions, carbon reservoirs and buffers to regulate nutrient fluxes, which indirectly influence the livelihood of fisherfolk, and the valuation of which is not possible through mere observation. In India, mangroves play an extremely important role in the life and livelihood of the coastal population. In economic valuation of natural resources, individuals can assign a quantified value to the specific ecosystem where they reside, reflecting what they consider to be a combination of marketable and non-marketable values. The actual emphasis is not to put any price tag on the nature or its component parts, but to express the effect of a marginal change in environmental services in nature in terms of a rate of trade-off against other things people value (Randall, 2002; Hanley and Shogren, 2002).
Economic valuation for livelihood assessment

A livelihood is made up of the capabilities, activities and assets (including both material and social resources) of an individual that contribute to a means of living\(^1\). Livelihoods are influenced by policies, institutions and processes, and are affected by external factors such as shocks and trends (Carney, 1998). Fisheries as a livelihood can reduce economic and food vulnerability, but the fisherfolk are themselves vulnerable to external influences such as environmental degradation of fish habitats and climate change. Adding to the miseries of fisherfolk in several parts of the world, few governmental regulations prevent fishermen’s access to natural resources without having a perspective from fishermen’s point of view. An example lies in the Indian state of Orissa where the government established a marine wildlife sanctuary in the mangrove zone of Paradeep, which covers a wide area of mangroves and other coastal ecosystems considered to be under threat. Fishing is not only banned in these areas, fishers are not even allowed to travel through the creeks to their fishing grounds, and NGOs and international agencies report that these restrictions have severely hurt fishers’ livelihoods (Venkatesh, 2006).

The annual economic value of mangroves including its products and services was estimated to be $200,000 to $900,000 per ha (Wells et al., 2006). Cabahug et al. (1986) reported high valuation estimates of vicinity fish harvests from mangroves in Philippines at US $1071 per ha per year, the vicinity shrimp harvests at US $254 per he per year, the vicinity mollusk harvests at US $675 per ha per year, and the vicinity crab harvests at US $720 per year. It was also reported that 1 ha of mangroves generates 1,100 kg to 11,800 kg fisheries catch, which in developing countries corresponds to a market value of $900 to $12,400 annually (Ronnback, 2000). Even higher values were estimated for mangrove fishery in Egypt such as US $13,000 per ha per year (Spurgeon, 2002). Other values regarding the economic valuation of mangroves related to the fisherfolk’s livelihood have been cited in Table 1.

Table 1. Review of economic valuation studies of mangroves in relation to fisherfolk’s livelihood

<table>
<thead>
<tr>
<th>Study</th>
<th>Place</th>
<th>Author</th>
<th>Year</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off-site fisheries accounting to mangroves</td>
<td>Thailand</td>
<td>Christensen</td>
<td>1982</td>
<td>US $ 189 per ha per year</td>
</tr>
<tr>
<td>Annual economic value of coastal mangrove</td>
<td>U.S.</td>
<td>Costanza et al.</td>
<td>1989</td>
<td>US $ 62.66 per ha</td>
</tr>
<tr>
<td>productivity for commercial fish harvest</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fishery in mangroves</td>
<td>Fiji</td>
<td>Lal</td>
<td>1990</td>
<td>US $ 100 per ha per year</td>
</tr>
<tr>
<td>Fish harvest from mangroves</td>
<td>The Philippines</td>
<td>Schatz</td>
<td>1991</td>
<td>US $ 42 to US $ 156 per ha per year</td>
</tr>
<tr>
<td>On-site sustainable fisheries from mangroves</td>
<td>Indonesia</td>
<td>Ruitenbeek</td>
<td>1992</td>
<td>US $ 67 per ha per year</td>
</tr>
<tr>
<td>On-site crustacean and mollusk harvests</td>
<td>Vietnam</td>
<td>Nielson et al.</td>
<td>1998</td>
<td>US $ 126 per ha per year</td>
</tr>
<tr>
<td>from mangroves</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Managed off-site fisheries from mangroves</td>
<td>Thailand</td>
<td>Sathirathai</td>
<td>1998</td>
<td>US $ 147 per ha per year</td>
</tr>
<tr>
<td>Shrimp fishery dependent on mangroves</td>
<td>Pakistan</td>
<td>Khalil</td>
<td>1999</td>
<td>US $ 100 million annually</td>
</tr>
</tbody>
</table>

\(^1\) This study is based on Carney, 1998.
**Annual market value of fisheries supported by mangroves**

<table>
<thead>
<tr>
<th>Country</th>
<th>Year</th>
<th>US Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developing</td>
<td>2001</td>
<td>$3,400 per ha per year</td>
</tr>
<tr>
<td>Ronnback</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Near shore fisheries from mangroves</td>
<td>2006</td>
<td>$4,861 to $12,964</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ranasinghe and Kallesoe</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annual economic median value of mangrove related fish and crab species</td>
<td>2008</td>
<td>$37,500</td>
</tr>
<tr>
<td>Gulf of California</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aburto-Oropeza et al.</td>
<td></td>
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</tr>
</tbody>
</table>

**Methodology**

The Pichavaram mangroves are well known worldwide both on the research front and for eco-tourism. The mangroves rank among the most exquisite scenic spots with abundant and varied tourism resources. The back waters which are interconnected by the Vellar and the Coleroon river systems offer abundant scope for water sports, rowing and canoeing. In spite of the Pichavaram mangroves being small in area (1,100 ha), it has been well studied in all aspects of chemistry, biology and micro-biology by research institutes like Centre of Advanced Studies in Marine Biology, Annamalai University and the M.S. Swaminathan Research Foundation, save the economic aspects. With rich fisheries resources like prawns (81.1 per cent), crabs (4.1 per cent) and finfish (7.1 per cent), the Pichavaram mangroves supports the livelihood of numerous fishing communities of 17 hamlets of the Cuddalore district there (Rajendran, 2004). There lies an untapped potential in the villages of those fishing hamlets to estimate the resource importance of the Pichavaram mangroves in general and on the part of the Tsunami-stricken fishermen communities in particular. Therefore, the final case study had been based on the economic valuation of the mangrove resources of MGR Thittu, the village which comprises 100 per cent fishermen population, who have been dependent on the Pichavaram mangrove resources both for direct and indirect goods and services since history.

The total economic valuation of the mangroves was done according to the classification by Barbier (1993) (Figure 1). In the present study, the total economic value was classified broadly according to Use Values and Non-Use Values. The Use Values was further divided as Direct Use Values and Indirect Use Values. In the Non-Use Value part, Existence Value was taken into consideration in the research study. The Direct Use Value consisted of consumption products such as fish and non-consumption product such as recreation from eco-tourism. The Indirect Use Value consisted of benefits in the form of off-shore fisheries, carbon sequestration and storm protection. The Existence Value took into account the value perceived by the resident villagers on account of the existence of the Pichavaram mangroves.
Figure 1: Components of total economic value (adapted from Barbier, 1993)

There were 120 villagers as respondents from the village MGR Thittu, 14 expert respondents from Fisheries College and Research Institute, Tamil Nadu Veterinary and Animal Sciences University, Tuticorin, 12 expert respondents from Department of Economics, Annamalai University and 15 expert respondents from Centre of Advanced Studies in Marine Biology, Parangipettai. Pre-tested survey schedules were used to collect primary data from the villagers on the socio-personal characteristics like family size, earner-dependent ratio, education, occupation, and age; economic aspects like personal income and other investments; and about information pertaining to economic valuation of mangrove resources. The major tools of analysis used were tabular analysis, income estimation, surrogate pricing, and contingent valuation method.

Tools of analysis

Tabular analysis was used to analyze the general characteristics of the respondents such as age, sex, family size, earner-dependent ratio, education, occupation, income, fishery resources from mangroves, general awareness about the environment and mangroves, willingness to pay for the protection of mangroves, the amount each individual would be willing to pay for the conservation and management of mangroves, and stake holder’s perception in the management of mangroves. Percentage, averages and frequency analysis were used while performing tabular analysis in the study. The income estimation method was used for valuation of fishery landings of MGR Thittu village and eco-tourism from the Pichavaram mangroves. The direct economic contribution of the on-shore fisheries supported by the
mangroves in MGR Thittu with a total fishermen population of 300, was estimated from the fishermen’s monthly income, which was between Rs. 3,000 and Rs. 5,000. Further, it had been found from primary investigation that 50 boats operate daily in the village with an average monthly income of Rs. 3,000 to Rs. 4,000 per boat in the peak season (first six months of the Tamil year) and Rs. 1,500 to Rs. 2,000 per boat in the lean season (last six months of the Tamil year). It has also been obtained from primary investigation that one lakh people on an average visit the mangroves annually and 25,000 boats (overall availability of existing number of boats in terms of hours per trip) were available for them for the purpose of pleasure-boat riding. The influx of visitors was divided according to peak season (5 months) and lean season (7 months). There were 4 trips daily on an average in the peak season and 3 trips per boat daily in the lean season. The per hour boat charge was fixed by the State Tourism Department at Rs. 150, and it takes generally 2 hours for taking a full ride in the Pichavaram mangrove waters. Off-shore fisheries contribution was assumed to be 50 per cent of the economic contribution from in-shore fisheries after discussion with fisherfolk of the village and the expert respondents.

The carbon sequestration value of the mangroves was arrived at by calculating the total carbon present in the mangrove wood and sediment and multiplying it by an internationally accepted unit of value for each unit of carbon sequestered. According to Prof. Kathiresan, Centre of Advanced Studies in Marine Biology, Annamalai University, Parangipettai (personal communication shared by Prof. N. Ramgopal, Department of Economics, Annamalai University, Chidambaram), the total carbon content present in the wood and sediment of Pichavaram mangrove is 22,020 tonnes per year. Surrogate pricing was applied to valuate the storm protection function of the mangroves by estimating how much it would cost to replace the mangrove with an artificial tsunami wall. According to Dr. James of Kauranya University, Coimbatore, the cost of building the wall per metre would vary from Rs. 2,00,000 to Rs. 4,00,000 (personal communication shared by Prof. N. Ramgopal, Annamalai University). Contingent Valuation Method was applied to estimate the Non-Use Values from the Willingness to Pay (WTP) for the conservation, protection, management and development of the mangroves. The open-ended elicitation format of the Contingent Valuation Method was used where the respondents were asked about the maximum amount they would be willing to pay every month or every year through the means of a well defined means of a payment vehicle (in this case to a voluntary organization) for the improvement of the status of the mangrove resource surrounding them or concerned with them. The total WTP derived from all the respondents was then summed up, which was used to suggest policy measures for mangrove management through community-based management.

**Results**

**Review of current status of mangroves in Tamil Nadu**

In the state of Tamil Nadu, mangroves are distributed in Pichavaram, Kazhuveli, Muthupet, Ramnad and Pulicat. Of the total 4,639 sq. km (India State of Forest Report, 2009) stretch of mangrove cover in the country, the mangroves in Tamil Nadu (39 sq. km) have attracted attention of researchers owing to the devastating effects of December 2004 in this part of the country. Mangroves are well developed in Pichavaram and Muthupet. Apart from the Pichavaram mangroves, the other mangroves under concern are the mangroves of Kazhuveli, Muthupet, Ramnad and Pulicat.

**Socio-economic profile of the respondents**

The majority of the respondents both among the villagers and experts were in 26 – 35 years group, with about 36 % and 39 % respectively. There were 59 % female respondents in case of villagers and 20 % within experts. Almost 48 % of the fishermen were only primary literate (Std I – V), followed by 27 % of them who were secondary literate (Std VI – XII). The primary occupation of all the male respondents of
The village was fishing, and among the females, most of them were housewives, and the rest were engaged with NGOs and other foundations working for the welfare of the village. The experts held various faculty positions in the College departments designated with teaching, research and on-field technology dissemination services in marine science. The average family size of the village respondents was 5 with an average of 1 male, 1 female and 3 children. All the villagers had nuclear type of family. The earner-dependent ratio was found to be 2:3. Among the expert respondents, 31.7% of the total were engaged with environmental and social organizations like Rotary Club of Chidambaram, Society of Low External Input Agriculture and REEF (Regional Ecology and Environmental Federation). All the villagers were engaged with organizations like EFICOR and Reliance, and a handful of others with organizations like CREED, MSSRF, Balamurugan Foundation, Angalamman Foundation etc. All the villagers have concrete houses for individual families built by the EFICOR Organization after the Tsunami 2004. The value of each household was Rs. 2.5 lakhs approximately. Most of the villagers do not have any livestock at present because they lost all the livestock in the Tsunami 2004 after being washed away. At present, only a few of them have some poultry and goat.

The economic profile of the villagers varied according to basic private assets of individual household. It was interesting to note that the basic amenities were provided by the State Government, CREED, EFICOR, Reliance and others which included basic furniture, water supply, utensils, basic cooking facilities, life jackets, bicycle etc. The villagers also have Television sets, dish antenna, boats, gears, fridge etc. Some NGOs have provided free insurance for the villagers in the form of Life Insurance Scheme for a sum of Rs. 4,000 to Rs. 5,000. The State Government also gave them a financial subsidy in the form of loan to the villagers for a sum of Rs. 75,000 after the Tsunami 2004. In terms of fixed cost, the villagers only have to pay electricity bills at the rate of Rs. 150 to Rs. 350 bimonthly. The remaining costs are variable costs according to the specific needs of the family. The average monthly income of the respondents was found to be between Rs. 3,000 and Rs. 5,000.

**Fisherfolk’s perceived role of mangroves on their livelihood**

The most important concerns regarding Pichavaram mangrove forest with the experts in order of priority were found to be strengthening of coastline bordering the mangroves against Tsunami, marine biodiversity preservation, increasing fisheries and food resources, and protecting natural habitats and wildlife. In addition, they agreed that the most important problems concerning the natural environment in general are global warming and climate change, water pollution and greenery destruction in the order of priority. The most important uses of mangroves the experts listed out in order of priority were ecological functions such as fish breeding and contribution to livelihood in terms of fish catch.

The most important uses of mangrove forest to the villagers were ecological functions in terms of protection against Tsunami, floods and heavy winds; fish catch; and fire wood collection, which is the perceived role of mangroves in fisherfolk’s livelihood. The issues which were strongly agreed upon were protection of mangroves regardless of costs, protecting mangroves for the future generation, conserving rare species habitat, payment for protection of the mangroves and mangroves as a bioshield against Tsunami. This showed that there exists an urge among the scientific community for protection and proper management of the mangrove resources through economic valuation projects in mangroves, whereas the point strongly disagreed upon was mangrove forest destruction. The research assessment showed that the experts opined that the severity of mangrove forest destruction in Pichavaram was severe (48.78% of the respondents). The results also indicated that the rate of exploitation of the mangrove resource may increase in the future, which needs to be considered for timely action in the future. The villagers opined that the mangrove forest now is not accessible to them after Tsunami and is under the control of the State Forest Department at present. So, the mangroves in the village MGR Thittu are not subjected to destruction. However, if we consider the Pichavaram mangroves as a whole, the mangrove forest can be
said to be moderately exploited because it is a famous tourist spot, and the villagers fear pollution by means of frequent visits and dumping of wastes like plastics and non-degradable pollutants.

Most of the villagers opined that the management by the State Forest Department is strict, and the villagers were not allowed free exploitation of the resources. The villagers can only visit the mangroves occasionally for firewood collection in small amounts. The villagers further suggested that management of the mangroves by the local users would be the best, or even co-management by both the villagers and the Government would be useful.

Majority of the experts agreed to pay for the protection, conservation, management and development of the Pichavaram mangroves. About 59% of the respondents were willing to pay, and the WTP per person was found to be Rs. 913.42 per year. Overwhelming response was obtained from the villagers in terms of WTP estimates for the Pichavaram mangrove conservation and development. About 73% of the villagers agreed to pay for the mangrove conservation, and the estimated WTP per person per year was Rs. 564.46. The proportion of experts who were not willing to pay anything in monetary terms opined that the Government should pay for the conservation of the mangroves. This was followed by the opinion that NGOs and the users should pay for this. As regards to the villagers who were not willing to pay anything in monetary terms (26.66%), the main reason cited was that the Government is solely responsible to pay (34.37%), and that they cannot afford to pay (31.25%).

Economic Valuation Estimates

Direct Use Values

The main products of consumption use value found out by the research project were fish and fishery products and firewood. The main fish species included penaeid and meta-penaeid shrimps, sardines, ariidae catfishes, mugilidae, mullets and carps. The firewood consisted of timber-based products only as most of the villagers now are not dependent on firewood cooking but cook with the help of gas cylinders provided free of cost by the Tamil Nadu Government. Since the yearly average earning of 300 fisherfolk was about Rs. 50,000, the total contribution from the onshore fisheries was estimated to be Rs. 1,50,00,000. Further, with additional monthly income of boat trips both in the peak and lean season, the total contribution of the mangroves to onshore fisheries has been worked out to be Rs. 1,65,75,000 for the MGR Thittu village.

The non-consumption products are recreation services. In case of villagers, mangroves are accessible to them, and they do not need to spend anything to visit the mangroves. So, the recreational value of the mangroves from the viewpoint of the villagers could not be estimated directly. However, the recreational value of the Pichavaram mangroves from the tourist visits was estimated. The total amount earned in the peak season of tourism amounted to Rs. 3,00,00,000, and that in the lean season amounted to Rs. 2,25,00,000. The amount incurred by the visitors towards travel and accommodation for a year has been calculated after gathering data from primary sources to be Rs. 10,50,00,000. Hence, the total value from eco-tourism was added up to Rs. 15,75,00,000.

Indirect Use Values

These values come in the form of benefits mainly from the support for fisheries by mangroves, carbon sequestration function and storm protection function of the mangroves. Since the contribution from off-shore fisheries was taken to be 50% of the in-shore fisheries, the economic value of off-shore fisheries was worked out to be Rs. 82,87,500. Hirway and Goswami (2007) stated $ 150 as the value of each ton of carbon sequestered, from which it has been estimated that the total annual value of carbon sequestered is $ 3,303,000 or Rs. 15,27,63,627 in the Pichavaram mangroves, since the total carbon content present in
the wood and sediment of Pichavaram mangrove is 22,020 tonnes per year. Through surrogate pricing, the storm protection function was calculated taking into account the fact that the length of the Pichavaram mangrove along the coast is 8,000 m. The cost of constructing the so-called tsunami wall would be between Rs. 160,00,00,000 and Rs. 320,00,00,000, which excludes the cost of maintenance.

**Non-Use Values**

The non-use values have been estimated from the WTP for the conservation, protection, management and development of the mangroves through Contingent Valuation Method. In the selected case study, the total WTP of the villagers has been calculated to be Rs. 67,735, and that of experts has been calculated to be Rs. 37,450. So, the total non-use value stands to be Rs. 1,05,185.

**Suggested policy measures**

The research study showed that the Pichavaram mangroves in general have great untapped potential to contribute to the national forest wealth in general in terms of contribution to national economy in the form of crude national wealth. The particular village, MGR Thittu, which was selected for the case study, showed the great role the mangroves tend to play in performing ecological functions which convert to large scale economic investments in the form of reduction of life loss from tsunami, protection from floods, heavy winds, cyclones etc., which would otherwise incur huge opportunity costs to the country’s economy. This reason forms the baseline for the government and other stake holders to invest in the protection of natural resources like mangroves, as in this case, the Pichavaram mangroves, to avoid future losses in creating artificial structure to make up for the loss of these natural resource. Further, the Pichavaram mangroves being a famous tourist spot, helps in generating income and livelihood for the local people by means of sustainable use of the mangroves. So, this research work highlights the fact that mangrove resources need conservation, protection, management and development rather than ruthless destruction of the mangroves to create urban infrastructures and unsustainable extraction of resources for short term financial gain. The economic value of the mangrove worked out in this project (Table 2) is not an absolute value but an indication of the apparent minimum values to illustrate the fact natural resources contribute significantly to the livelihood and earnings of the resource dependent fisherfolk, and should be continuously looked into for maintaining sustainability of fishery, which if not, could turn up in great loss to the national economy.

**Table 2. Total economic valuation estimates**

<table>
<thead>
<tr>
<th>SL. No.</th>
<th>Particulars</th>
<th>Value (Rs.)</th>
<th>Total (Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Direct contribution to fisheries (MGR Thittu village)</td>
<td>1,65,75,000</td>
<td>353,52,31,312</td>
</tr>
<tr>
<td>2</td>
<td>Ecotourism</td>
<td></td>
<td>15,75,00,000</td>
</tr>
<tr>
<td>3</td>
<td>Indirect use values (benefits)</td>
<td></td>
<td>336,10,51,127</td>
</tr>
<tr>
<td>4</td>
<td>Non-use values (WTP)</td>
<td></td>
<td>1,05,185</td>
</tr>
</tbody>
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ENDNOTES

1 www.fmsp.org.uk