

Importance of Mangrove Conservation and Valuation to Women and Men – A Case Study of Pichavaram Mangroves in India

PIYASHI DEBROY^{1*}, R. JAYARAMAN², M. KRISHNAN¹ and KEITH R. CRIDDLE³

¹Central Institute of Fisheries Education, Mumbai – 400061, Maharashtra, India

²Department of Fisheries Economics and Management, Fisheries College and Research Institute, Tamil Nadu Fisheries University, Tuticorin – 628008, Tamil Nadu, India.

³School of Fisheries and Ocean Sciences, University of Alaska Fairbanks, Juneau, Alaska – 99801

Abstract

The study was carried out in MGR Thittu village in the vicinity of the Pichavaram mangroves in the Cuddalore district of the state of Tamil Nadu in India. The objective of the study was the economic valuation of the Pichavaram mangroves for the villagers of MGR Thittu, using the Contingent Valuation Method (CVM) for estimating the indirect use values of the mangroves. In estimating the Willingness To Pay (WTP) for conservation and management of the mangroves within the CVM framework, about 73% of the respondents from MGR Thittu were willing to pay for the conservation and management of the Pichavaram mangroves. Seventy five per cent of the female respondents interviewed were willing to pay, in comparison to 71% of the male respondents who were willing to pay. This brings into focus the fact that women along with men can be very dynamic conservationists and managers of natural resources in the community-based management process.

Introduction

“Women’s uses of the environment prove to be sufficiently different from those of men to represent a distinct habitat, in the ecological sense.”

Brown and Switzer (1991)

Women have special knowledge of natural resource systems, and are also the ones hit hardest by environmental degradation (Resurreccion 2013). Despite this, and for many reasons, women have not been well incorporated into natural resource management activities, particularly coastal resource management (OXFAM 2003), and these limitations have been primarily because of traditional division of labour along gender lines (Montebon et al. 2004).

* Corresponding author. E-mail address: piyashi.debroy@gmail.com

In spite of women having to bear the brunt of the impacts of deterioration of the environment, their ability to participate in natural resource management is limited (D'Agnes et al. 2005).

The Cultural Consensus Model assumes cultural homogeneity which states that no subcultures exist within the society being studied (Romney et al. 1986). This emphasises that a handful of the oldest, most well recognised members and senior individuals possess the majority of knowledge held within the community. Thus, the maximum of the researcher's time is spent interviewing them where in indigenous societies, cultural norms grant men greater public access and recognition than women. It is in this context that the Cultural Consensus Model was rejected by Hess and Ferree (1987) who stated that male and female roles in the field of ethno-biological research studies are differentiated enough to represent subcultures in both spatially and temporally distinct zones (Reichel 1999). Even the effect of resource-degradation is said to be gender-biased (Siar and Caneba 1998).

Mangroves are plant communities of trees and shrubs growing in saline and brackish coastal habitats. They are considered to be unique forest ecosystems owing to the fact that they are found at the interface of land and brackish water environments, thereby acting as important shelter grounds for feeding and breeding for fisheries resources and other forms of wild life. They are now also considered to be potential weapons to combat global warming and climate change. However, in spite of their ecological importance, mangrove ecosystems are increasingly under threat owing to anthropogenic activities including clearing and pollution and adverse climatic impacts. When mangroves are converted for business purposes such as shrimp farms, women are the main losers because they lose access to a communal source of food and cash income (Agarwal 1992). In a study of perception of dependency on mangroves at Nijhum Dwip in Bangladesh, Iftekhar and Takama (2008) found that female-headed households have higher dependence on mangroves than those led by males. These gender differences mean that women's participation should be taken into consideration while developing mangrove management plans (IUCN 2007).

For the last two decades in India, the M. S. Swaminathan Research Foundation (MSSRF) has been instrumental in addressing gender concerns, including in the Pichavaram mangroves (Fistrek 2010). Therefore, the area chosen for the present research study was in the Pichavaram mangroves in the state of Tamil Nadu in the south-eastern coast of India bordering the Bay of Bengal (Fig. 1). In this mangrove system, 51 small and large islets are interspersed in a vast expanse of the water along with forests. The Pichavaram mangroves are well known worldwide both on the research front and for eco-tourism.



Fig. 1. Locale of the study area - Pichavaram mangroves in the Cuddalore district of Tamil Nadu state in the south-eastern coast of India.

The back waters in the mangroves are inter-connected by two river systems, viz. the Vellar and the Coleroon river systems (Fig. 2) which offer abundant scope for water sports, rowing, kayak and canoeing.



Fig. 2. Google map image of the Pichavaram mangroves.

The fishery of the Pichavaram mangroves is dominated by prawns constituting the bulk (81.1%), followed by finfish (7.1%) and crabs (4.1%) (Rajendran 2004) (Table 1). This fishery supports the livelihoods of numerous fishing and farming communities of seventeen hamlets of the Cuddalore district which utilise the mangrove resources. According to MSSRF, the villages T. S. Pettai, Vadakku Pichavaram, Killai Fisher Colony, MGR Nagar and Kalaingar Nagar, which are under direct physical coverage of the mangrove wetlands, were protected from the fury of the 2004 Indian Ocean tsunami. These hamlets are located about 500 m to 2.5 km away from the sea and 50 to 500 m away from the mangroves. The villages around the

Pichavaram mangroves affected by the tsunami were Chinnurpettai, Madavamedu, MGR Thittu, Mulukuthurai, Chinnavaikal, Kannaginagar and Pillumedu. Among the seventeen fishing hamlets, there are nine fishing hamlets and eight agricultural farming hamlets. People from eight hamlets intensively use the mangrove resources, and the people belonging to a few of the hamlets such as C. Manambadi, Killai, Pichavaram, T. S. Pettai and Thillaividangan utilise the wood, non-wood and fishery resources. In the fishing hamlets, the majority of the people have been traditional fishers. In a few of these fishing hamlets, people belonging to the *Irular* tribe live and they fish only in the mangrove waters. They fish not from boats and with nets but by groping and searching in knee-deep water for prawn, and by building bunds that confine fish during high tides and allows the fish to be captured during low tide. Bunding, however, adversely affects the mangroves by changing water circulation.

Table 1. Fishery resources of Pichavaram mangroves.

Fishery resources	Distribution	Source
Prawns (81.1%)	20 species, prominent are <i>Penaeus indicus</i> (H. Milne Edwards, 1837) , <i>Penaeus monodon</i> (Fabricius, 1798) , <i>Penaeus semisulcatus</i> (De Haan, 1844) , <i>Metapenaeus dobsoni</i> (Miers, 1878), and <i>Metapenaeus monoceros</i> (Fabricius, 1798) Also a breeding ground of <i>Macrobrachium sp.</i>	Rajendran (2004)
Finfish (7.1%)	180 species, commercially important ones belong to Mugilidae, Chanidae, Clupidae, Pomodasyidae and Gerridae	Rajendran (2004), Prince-Jeyaseelan (1981), and Prince-Jeyaseelan, (1998)
Crabs (4.1%)	30 species, important commercial ones are mud crabs	Rajendran (2004)
Others (7.7%)	birds (200 species), mollusks (20 species), plants (86 species), bacteria (52 species), fungi (23 species), seaweeds (22 species), phytoplankton (82 species), zooplankton (95 species), meiobenthos (40 species) and macrobenthos (52 species)	Rajendran (2004)

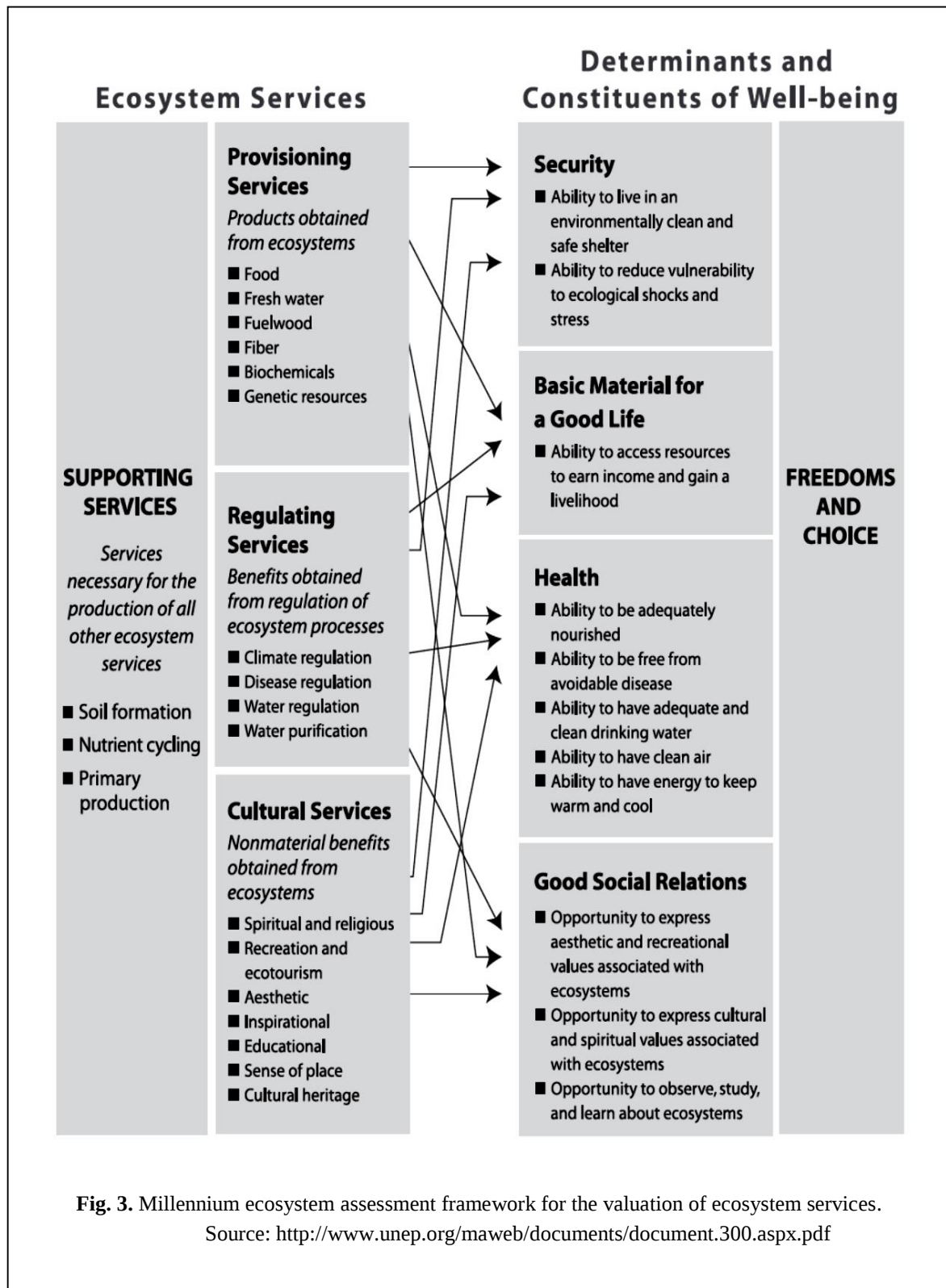
More specifically, the study area concerned is the New MGR Thittu, which was recreated only after the 2004 Tsunami caused human casualties, and washed away the livestock and much of the household property of the villagers of old MGR Thittu Island. However, more importantly, throughout the tsunami and its aftermath, the villagers were grateful to the Pichavaram mangroves which, according to them, saved the villagers who survived. However, the villagers of MGR Thittu are not allowed by the Government to visit the nearby mangrove patches in the island where they lived before the December 2004 Tsunami. The lightly wooded mangrove patches in the old island were reported as a place where the women folk travelled and spent their leisure time.

Materials and Methods

Secondary data were used to provide the general profile of the village of MGR Thittu, its population and the district within which it lies, fish landings and the harvest of mangrove products in the village. For the collection of primary data, purposive sampling (a non-probability sampling technique) was used to interview the villagers of MGR Thittu. Purposive sampling is used in ethno botanical studies to make comparisons of specific knowledge and cultural practices (Neupane et al. 2002; Tongco 2007), and in case studies (Dolisca et al. 2007; Parlee and Berkes 2006), and also for sampling informants with a specific type of knowledge or skill (Li et al. 2006). Among the different methods of purposive sampling, the theory-based or operational construct method was used. Theory-based sampling is a qualitative research process that involves finding manifestations of a theoretical construct of interest to elaborate, e.g. expressed willingness to pay, and then examining the construct. The sampling framework can be used to study the interaction between a person and the environment (Patton 1990). Sampling decisions are made throughout the entire research process. Participants are selected based on their knowledge of the topic and based on emerging study findings (Ploeg 1999). The sample size was not determined prior to the study, but rather in the sample of villagers of MGR Thittu where the willingness to pay for the mangroves was found to exist, it was used to examine the phenomenon of the expressed willingness to pay from the sample. It was attempted to interview all the villagers of the MGR Thittu who were available during the interview time and were interested to participate in the interviewing process.

The frame-work of the economic valuation of mangroves was organised on the basis of provisioning, regulating, cultural and supporting services of the Millennium Ecosystem Assessment (2005) classification framework of the UNEP (Fig. 3).

The data were collected from 120 villagers of MGR Thittu village. An attempt was made to interview the representative of each household in the village who was present in the house during the interview. This was done through in-person survey methods after conducting a pilot study. Frequency and percentage analysis were used to analyse the general characteristics of the respondents such as age, sex, family size, and education. The respondents' opinion on the utility of products and services obtained from the mangroves, and concerns about the Pichavaram mangroves were ranked on pre-determined scales. Opinions about the villagers' participation in the management of mangroves were also considered. The Contingent Valuation Method (CVM) was used to analyse the respondents' willingness to pay (WTP) for the protection of mangroves, and the amount the respondent would be willing to pay for this purpose. The open-ended elicitation format of the CVM was used. In the CVM, the stated aim was to improve the status of the surrounding Pichavaram mangroves so that the villagers would be able to continue to receive the same level of goods and services that they obtained from the mangroves in the past. The objective of the study was to find out if the respondents would be willing to pay a sum of money every year for achieving the stated aim. If they were willing to



pay a sum of money for the purpose, they were asked how much money they would be willing to pay for it. The payment vehicle chosen for the study was a hypothetical donor organisation. The WTP of the non-respondents was estimated so as to obtain a figure for the total population of the village with the mean of the WTP of the male and female respondents in separate

categories. The WTP of the whole population of the village was summed to denote the existence value of the Pichavaram mangroves for the villagers of MGR Thittu.

Particulars of Contingent Valuation Method in the economic valuation of mangroves

The components of the values of the mangrove ecosystem which were estimated through CVM are the values obtained from fish and other aquatic animals as food, firewood, fodder, roofing materials, timber, smoke as mosquito repellent, traditional medicine, honey and black tea (provisioning services); recreation, eco-tourism, spiritual, religious, and aesthetic (cultural services); prevention of soil erosion, primary production, carbon sequestration, waste assimilation and biomass export (supporting services); and protection against storm, tsunami, floods and heavy winds and water purification (regulating services).

Results

Socio-economic profile of the respondents

Among 120 respondents, 72 (60%) respondents were female and 48 (40%) were male (Table 2). The age of the female respondents ranged from nearly 15 to 50 years with a mean of 30 years, whereas that of the male respondents ranged from 20 to 75 years with a mean of 40 years. Most of the female respondents as well as the male respondents were educated up to high school level. The majority of the female respondents (52.7%) had small families with the number of family members ranging from one to four, compared to the male respondents, for which the majority (58.3%) had large families with the number of family members ranging from five to eight.

Table 2. Summary statistics of the male and female respondents.

Socio-economic information	Male (n = 48)	Female (n = 72)
Age (years)	20 to 75 (mean = 40)	15 to 50 (mean = 30)
Education (% literate)	High School literate = 52 College graduates = 25 Illiterate = 20 Other categories (primary literate, vocational training etc= 3)	High School literate = 42 College graduates = 28 Illiterate = 28 Other categories (primary literate, vocational training etc. = 2)
Family size (number of family members 1 to 4 = small family, more than 5 = large family) (Percentage of respondents)	Small family = 41.7 Large family = 58.3	Small family = 52.7 Large family = 47.3

Opinion of the villagers about uses of the Pichavaram mangroves and concerns

The most important uses of mangroves, as ranked according to the opinions of the respondents, in order of priority, are ecological functions of the mangroves, mangroves being

a site of natural fish breeding, mangroves being a source of fish catch, firewood, timber, medicine, fodder, roofing materials, smoke for functioning as mosquito repellent, and mangroves as a source of eco-tourism. The most important concerns of the villagers about Pichavaram mangroves are strengthening coastline against tsunami, biodiversity conservation, sustainability of fish production, improving awareness of the surrounding villagers about the importance of Pichavaram mangroves, arranging alternative livelihood for the villagers, and potential impact of pollution from eco-tourism in the Pichavaram mangroves. According to the present government regulations, the only authority for the management of the Pichavaram mangrove forest is the State Forest Department. The villagers, therefore, are not allowed to utilise the mangrove resources for firewood and timber. It is for this reason that the villagers sometimes resort to entering the forests for collecting firewood and timber for their subsistence illegally.

It was unique to observe that the women of MGR Thittu were involved with the mangroves in their daily lives in diverse ways. The women, and not the men, are mostly involved in collecting firewood from the mangrove patches, and the women have the habit of spending their leisure time by visiting the mangroves. The women, again mostly, and not the men, collect timber for hut construction, if required, especially in the case of financially poor people who cannot afford to have a well-built house on their own. The women, as well as men, have survived the devastating effects of Tsunami, and have the opinion that the mangroves helped in reducing the speed of the high water waves which entered the village during the Tsunami.

Willingness to pay

Among the 72 female respondents, 75% of respondents were willing to pay for the sake of Pichavaram mangrove conservation and development. Among the 48 male respondents, 71% respondents were willing to pay for the Pichavaram mangroves. Since the samples of the respondents were randomly selected from their populations, the differences in the percentage of the WTP for the female and male categories were not statistically significant. The mean of the amount the female respondents were WTP was around INR. 686 per year (USD 15, as per the approximate currency exchange rate during the year 2010: 1 USD = INR. 45), and ranged from INR. 50 (USD 1.11) to INR. 6,000 (USD 133) per year (Table 3). There were five female respondents who were treated as outliers and stated that they would pay more than INR. 1,000 per year. The mean of the WTP of the male respondents was INR. 916 (USD 20) per year with range from INR. 100 (USD 2) to INR. 6,000 (USD 133) per year. The number of outliers in the sample for WTP for the male respondents was only one who was willing to pay INR. 6,000 per year. The WTP of the females for the entire population of the village with a population of 166 females during the research period, as extrapolated from the total WTP of the sample, was found to be nearly INR. 85,064 (USD 1,890) annually, and that of the male respondents, with a total population of 177 males in the village, was extrapolated from the sample, to be nearly INR. 1, 14,500 (USD 2,545) annually. Therefore, the total WTP of the population of the village of MGR Thittu summed up to around INR. 199,564 (USD 4,435) annually.

Table 3. Descriptive statistics of the female and male WTP values.

Particulars	Results	
	Female	Male
Sample size	56	32
Range (INR per year)	50 to 6000	100 to 6000
Mean	685.98	916.25
Median	500	500
Standard Deviation	1042.21	1424.46

When the respondents who were not willing to pay any money were asked to cite their reasons for their unwillingness to pay, the most important reason given was that the government and not the villagers should pay for the stated purpose. Some of the villagers could not afford to pay; and some of the villagers were not interested in the matter (Table 4).

Table 4. Reasons for not unwillingness to pay (n=32).

Reasons	Percentage
Government should pay	34.37
Cannot afford to pay	31.25
Not interested in this matter	21.87
Money would be wasted	12.5

Management of Pichavaram mangroves

There is strict monitoring by the State Forest Department against unauthorised access to the mangroves near the village of MGR Thittu. When the villagers were asked about their satisfaction with the current management regime, they reported that they were not totally satisfied. They provided two alternatives as their choices of management, viz; either they should be provided total authority to manage the mangroves, or there should be co-management of the adjacent Pichavaram mangroves involving the State Forest Department and the villagers.

Discussion

The total existence value of the Pichavaram mangroves with the MGR Thittu villagers shows how importantly the villagers, despite being from financially disadvantaged backgrounds (as revealed during interviews and from observations during the interviews), value their mangrove resources and are willing to pay a large sum of about INR. 200,000 per year. As seen in forestry management regimes in different regions across the world (Dolisca et al. 2007), the villagers had expressed a strong desire for a co-management system along with the government in the conservation and utilisation of mangroves.

In the context of co-management of the Pichavaram mangroves with the State Forest Department, the women of MGR Thittu can play an important role in the management of the mangroves. In a similar study, it was found that indigenous Australian women expressed a strong desire to be involved in decision-making in relation to climate-change adaptation policies (Petheram et al. 2013). Women can play an important role in supporting their families by supplementing their household income when the income from fishing is not sufficient (D'Agnes et al. 2005). There are potential roles of women in the sustainable utilisation of the resources of Pichavaram mangroves, which could help them in gaining employment to support their families financially. Maintenance of a nursery of different mangrove plant species which can be used for the purpose of plantation for restoration efforts has already been taken up by pioneering institutions such as M. S. Swaminathan Research Foundation, Chennai. There are similar institutions also in Sri Lanka that involve women to manage household mangrove nurseries through workshops, which provide livelihood to women who lost their livelihood because of the destruction caused by the December 2004 Tsunami (GNF 2007). The women can take up crab fattening as a commercial venture at larger scales. This has already been initiated by NGOs such as Balamurugan Foundation, Angalaman Foundation and MSSRF in MGR Thittu, as narrated by the respondents during interviews.

Conclusion

There should be greater awareness in general about the economic value of the Pichavaram mangrove conservation for fisheries sustainability and production. The awareness of women about the importance of mangroves as a fishery resource habitat should be raised more widely to help generate support for sustaining the mangroves and also for preventing adverse effects (Villamor et al. 2013). The results are specific to the MGR Thittu village regarding the conservation and management of Pichavaram mangroves as a fishery resource during the research study period. Women's, as well as men's, importance in valuing fisheries resources such as the Pichavaram mangroves needs to be recognised and documented as demonstrated by the result that the Total Economic Value of the Pichavaram mangroves is influenced by women's, as well as men's, perceptions of the utility of mangroves.

Acknowledgement

The authors acknowledge their gratitude to the Organising Committee and the sponsors of the 4th Global Symposium on Gender in Aquaculture and Fisheries for providing the opportunity to present the paper in the 10th Asian Fisheries Forum held during 30 April to 04 May 2013. The authors are also thankful to the Students' Grant provided by the Tamil Nadu State Council of Science and Technology for helping them to carry out the field survey in the Pichavaram mangroves.

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