Research Paper

Determinants of Eco service Valuation and Ecological Sustainability of Marine Ecosystem

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ABSTRACT: *The paper describes the result of an evaluation of critical ecosystem services derived from of marine ecosystem among resource use beneficiaries of Gulf of manner, Tamil Nadu. The empirical data related to the study were collected from the resource users through survey. The outcomes expose that there exists the difference among perceived factors that regulates the male and female resource use beneficiaries in ecosystem service evaluation with an orientation to four major factors namely, capture and culture fisheries, climatic advantage, tourism and resource for future. The resource use beneficiary's survey revealed that their vital need for sustainable tourism, responsible fishing practice, and responsible waste disposal and has identified a breach in understanding of critical role ecosystems which should be given attention to create effective awareness to increase the sustainability of marine ecosystem. There is a sign of emerging critical need of ecosystem service evaluation and ecosystem sustainability to harness the desires ecosystem to save it from tearing apart.*
KEYWORDS: *Gulf of Mannar, Ecosystem, Breach, Resource use beneficiaries, Climatic advantage*

I. INTRODUCTION

The Gulf of Mannar (GOM), the premiere Marine Biosphere Reserve in south Asia. It extends from Rameswaram to Kanyakumari in Tamil Nadu. It incorporates a shackle of 21 islands from Ramanathapuram, Tuticorin, Tirunelveli and Kanyakumari.The coast of Gulf of Mannar is compactly populated with traditional fishers and their community.

The Gulf of Mannar (GOM), is the potential livelihood security provider to the local fishers' non-local fishers. The GOM is endowed with various ecosystems viz., mangrove, sea grass, seaweed, Mud flats, estuarine, coral, sandy etc. The GOM is harbors with various economic activities namely capture fisheries, culture fisheries, seaweed farming, processing industries, non fisheries enterprises etc. it also streamed with several industries and a major port. The anthropogenic compressions on this ecosystem have increased drastically on the recent days.

The notion of Ecological service and their evaluation was initially introduced in the 1960s (5) (11) the ecological evaluation is well thought-out as the nature's functions in serving human societies. Note worth of the economic value of a bionetwork and its services is an imperative asset, because a major stipulate is the prop up of human well being, sustainability, and distributional equality (1). Innate ecosystems provide an indispensable"reference function", and donate to the upholding of human health by providing opportunities for manifestation, religious enrichment, cognitive growth, amusement and artistic experience (2)(3)(4).

Fisheries sector plays an imperative role in India's economy and in the socio-economic development of the nation. There are more than 14.90 million folks in the country hang on to fisheries sector for their livelihood. Even though, It is potential sectors to emphasis for economic development there arises the importance of sustainability ecosystem and user pay principle. In order to push and hoist the sustainability of fisheries sector, the thrust could be given to ecosystem conservation.

II. RESEARCH METHOD

Data on the determinants of ecosystem services among the resource use beneficiaries of Gulf of Mannar, includes fishers, tourists, researchers, students , non-fishers (derives benefits from Gulf of Mannar through any means) were collected randomly with the help of a questionnaire from the four districts namely Ramanathapuram, Tuticorin, Tirunelveli and Kanyakumari using binary format (yes/no). The samples were targeted to estimate factors impacts the ecosystem evaluation of the gulf of mannar, Tamil Nadu. The data were principally dichotomous excluding income which is continuous variable. The sample consisted of 120 resource use beneficiaries from four districts comes under Gulf of Mannar bioreserve Trust. Therefore, the categorical variable was labored on multivariate logit regression model

To find the relative factor effects the eco-service evaluation is identified. The difference in determinants on ecosystem on par with gender criteria were tested with Mann- Whitney U tests. The main survey was carried out between April to October 2020. In order obtain the maximum response, questionnaires were mailed and telephonic interviews were also implemented. Additionally, to comprehend the factors impacts sustainability of ecoservices between resources users were evaluated through logit regression.

Information about the factors determines ecosystem service evaluation among resource users were collected randomly with the help of a questionnaire using binary format (yes/ no).
The representation of the function is given by the formula as follows

$$F(x) = 1/1 + e^{-(\beta_0 + \beta x)}$$

Note that $F(x)$ is interpreted as the probability of the dependent variable equaling a "success" or "case" rather than a failure or non-case. It's clear that the response variables Y_i are not identically distributed $P(X_i = 1/X)$ differs from one data point X_I to another, though they are independent given design matrix X and shared with parameters (13)(14).

III. FINDINGS AND DISCUSSION

Factors determining the ecosystem service evaluation of the Gulf of Mannar ecosystems of Tamil Nadu, among the four different districts were carefully chosen for identifying factors impact the ecosystem service evaluation.

Table 1 describes the factors impact the ecosystem service evaluation of fisher folks as well as the fishery resource use beneficiaries of Gulf of Mannar Bioreserve Trust (GOMBRT). Finite numbers of parameters were selected based on the empirical means. The counted factors are Biodiversity and breeding ground, livelihood opportunity, tourism, research and education, culture heritage and future generation, climatic and mitigation purpose. The mean values arrived at male and female separately were based on Mann-Whitney u test. As far as male resource use beneficiaries were concerned, livelihood opportunity came out as the top most determinant of the eco- service evaluation (mean value=93.72). The mean value of other critical parameters that tailed in categorization was climatic and mitigation purpose (94.16), culture heritage and future generation (91.45), Biodiversity and breeding ground (90.48), tourism (79.78) and research and education (61.22). Therefore, it implies resource use beneficiaries who primarily depend on the day to day livelihood will be the majority in contributing to the ecosystem service evaluation followed by climatic and mitigation purpose, culture heritage and future generation were the reasons that have the greatest contribution on ecoservice evaluation of fishermen.

As far as fisherwomen and resource use women beneficiaries were concerned research and education (58.78), followed by tourism (40.21), Biodiversity and breeding ground (29.59), cultural heritage and future generation (28.55), livelihood opportunity (26.55) and climate and mitigation purpose (25.84) were the factors that influence choice of career among female fisheries graduates.

Table 1. Factors impact the ecoservice valuation

Variable	Mean value		P value	Decision
	Male	Female		
Biodiversity and breeding ground	90.48	29.59	<0.001**	Ho is rejected
Livelihood Opportunity	93.72	26.25	<0.001**	Ho is rejected
Tourism	79.78	40.21	<0.05**	Ho is not rejected
Research and Education	61.22	58.78	0.183	Ho is not rejected
Culture heritage and future generation	91.45	28.55	<0.001**	Ho is rejected
Climatic and mitigationpurpose	94.16	25.84	<0.001**	Ho is rejected

**Significance at 1%

Mann – Whitney test was employed to check whether there is a significant difference between the factors determining the ecoservice evaluation of marine ecosystems of Gulf of Mannar.

This employed test result revealed that Biodiversity and breeding ground, livelihood opportunity, tourism, culture heritage and future generation, climatic and mitigation purpose were the significant factors except, research and education which has influenced the ecosystem service evaluation process.

As detailed earlier, in order to determine the factor that contributes to the sustainability of the ecosystem is studied with the help of multivariate logit regression, a set of parameters were recognized through empirical means to evaluate the extent of contribution to the sustainable marine ecosystem of Gulf of Mannar, Tamil Nadu.

Table 2 Regression estimates of multivariate logit model for sustainable marine ecosystem

Factors	Coefficient	Standard error	Wald cofficient	Levels of significance	Exponential of (β)
Sustainable tourism	4.367	1.232	15.679	<0.001**	30.922
Responsible fishing and culture practice	3.376	0.928	13.242	<0.001**	29.249
Community management	4.067	0.836	12.830	<0.001**	28.560
Responsible waste disposal	3.421	0.695	10.53	<0.05*	18.43
Stringent rules	-1.4500	1.000	0.558	0.691	15.000
Income	.000	0.000	0.158	0.691	1.000
Constant	-1.633	1.152	2.008	0.156	0.195

*significant at 5%, ** significant 1%

Table 3 Hosmer and Lemeshow test

Hosmer and Lemeshow test	Chi square	Df	Level of significance
	11	8	0.809

Hosmer and Lemeshow test showed insignificant result 0.502, reveals that this model is good fit (Table 3).

Table 2 gives the regression estimates of multivariate regression model for determining of sustainable marine ecosystem. Built on the standard inferences that evolved of a multivariate logit model, log odds ratio in favor of sustainable tourism exerted a 30.92 percent which stimulates the sustainability of the marine ecosystem. The log odds for responsible fishing practice and community management and responsible waste disposal showed 29.24, 28.60, 18.43, percent   showing optimistic role in ecosystem sustainability and the log odds ratio for stringent rule works out to 15 percent against the probability of the sustainability of ecosystem.

With regard to sustainability of ecosystem, sustainable tourism, responsible capture and culture fisheries, community management and responsible waste disposal by resource users from household and industries were the factors which greatly contribute to the sustainability of marine natural resource.

As detailed from the determinants on ecosystem service evaluation fishermen, firstly, the created livelihood opportunity would propel the resource users to contribute for the ecosystem. Secondly, climate change mitigation benefits include the certain criteria such as protecting against natural calamities, shoreline stabilization, contaminant storage and detoxification, oxygen production and carbon dioxide absorption, wave attenuation, erosion control, regulation of water flow, carbon sequestration purpose. Thirdly, the factors culture heritage and future generation encompasses the attributes namely, aesthetic value, timbers, firewood, medicinal property. Fourthly, Biodiversity and breeding ground includes finfish, shell fish etc. fifthly, tourists and finally researchers and education. On the other hand, female resource use beneficiaries opine that the ecoservices evaluation depends on research and education, followed by tourism, Biodiversity and breeding ground, cultural heritage and future generation, livelihood opportunity and climate and mitigation purpose.

This study highlighted the difference among the resource use beneficiaries categorized on the genders-based perspective and their opinion in the determinant of ecosystem service evaluation of marine ecosystems of Gulf of Mannar, Tamil Nadu. It was detected that amongst the eight identified factor, male resource use beneficiaries gave supreme importance to livelihood opportunity followed by climatic and mitigation purpose, culture heritage and future generation, biodiversity and breeding ground, tourism and research and education that would affect their eco- service evaluation, Yet, there occurred a difference in the opinion of these male and females marine resource user in Gulf of Mannar. Thus, fishermen and resource dependent organizations, firm were relatively paramount at contributing to the ecosystem services. Although sustainable tourism, responsible fishing and farming practice, was the most favored criteria for the sustainability of the marine ecosystems, consequently huge efforts has to be taken for responsible use of ecosystem through co-management, community management, creating awareness among the resource users. It also has been identified that imposition of stringent rule incline people to violate the rule by 15 percent and end up in compromising the sustainable ecosystem. Interesting fact of the survey was that almost all the 5 factors out of 6 were highly influential in the encouraging the ecosystems desire towards sustainability enhancement process.

IV. CONCLUSION

In India, ecosystems services are generally derived primarily by fishers, research organizations, fisheries based and non fisheries industries dependent on marine ecosystem, fish consumers, tourism industry etc. Therefore, NGOs and Government institutes has to be involved in improving the quality and quantity of benefits obtained from the marine natural ecosystem in the present and also in future.

The sustainability of marine ecosystem is an advanced openminded perception to save the nature for near future generation. This process involves keen understanding and surveillance of the ecosystem by creating awareness in the present critical phase of transmuting from the state of under threat (UN) to extint(EX) via Extintion(EXn) process. This can be done through continuous appraisal of fisheries resources. For this to happen, customized monitoring, surveillance, co management, community management and participation has to be incorporated through training and introduction of the expertise suited to the sectoral need.

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