

Sustainability Analysis of the Marine Recreational Park Management Based on Local Customary Law in Weh Island, Aceh Province, Indonesia

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Abstract: *Marine Recreational Park (MRP) Weh Island is a conservation area managed by Natural Resources Conservation Agency Banda Aceh. The MRP is located at Iboih village and it is also inside the area of local customary Law of the Sea, Institution of Panglima Laot Lhok Iboih. The existence of customary Law of the Sea affects the management of MRP in terms of ecology and social economy. Apart from that, the local customary management system could be used as a reference in finalizing the policy and strategy of the management of MRP Weh Island in the future. The purpose of this research is to calculate and to estimate the sustainability level of the MRP Weh Island management based on customary Law of the Sea Panglima Laot Lhok Iboih. The method used is multi dimensional scaling (MDS) that is based on three dimensions i.e. ecology, social economy, and management. The analysis result indicates that the dimension of management and social economy are arguably sustainable with index 59.98 and 56.75, while the dimension of ecology falls into less sustainable level with index 46.94. The index and sustainability status indicate that the management system based on customary Law of the Sea Lhok Iboih specifically on the dimension of management and social economy influence the sustainability of MRP Weh Island management.*

Keywords: Customary Law of the Sea, Institution of Panglima Laot, Marine Recreational Park Weh Island, management system, sustainability status.

1. Introduction

Marine Recreational Park (MRP) Weh Island had a clear status in the perspective of national legal law. In the early time of its inception, MRP Weh Island was appointed as a conservation area by Ministry of Agriculture Republic of Indonesia declared in the Decree 928/KPTS/UM/2/1982. Besides its status as conservation area, it was also categorized as Nature Preservation Area as appointed by Government Policy No. 68 Year 1998 regarding Nature Preservation Area. With the implementataion of Act No. 5 Year 1990 [1] regarding Conservation of Natural Bio Resources and its Ecosystem, MRP Weh Island was managed under the authority of Ministry of Forestry Republic of Indonesia, more specifically under Nature Conservation Agency, Banda Aceh as the field operator.

Administratively, MRP Weh Island was located in Sabang, Aceh Province. The local government acknowledged the existence of customary Law of the Sea in governing and managing the local fisheries activities. The management comprised of traditional practices on fishing as well as resolving conflicts among fishermen. All policies applicable in fisheries management was controlled by an institution that is called by local fisherman as Institution of Panglima Laot. This institution had been founded in Sabang and led by a Panglima Laot [2]. Based on the authority area, Panglima Laot was categorized into three types namely Panglima Laot Aceh Province, Panglima Laot District Area, and Panglima Laot Lhok (village/gulf) Area [3].

MRP Weh Island was located at Iboih Village and it belonged to the territory area of the Institution of Panglima Laot Lhok Iboih. The Customary Law of the Sea that was applied in this area in terms of management context were (1) Prohibition upon using bomb, compressor, trawl during fishing activities, (2) Prohibition upon fishing (fish and other biota) with nets and speargun as well as night fishing.

The management that had been done by Panglima Laot long with local community has been existed far before that area was appointed as conservation area by the government on 1982. Institution of Panglima Laot is the oldest traditional organization in the world in terms of fisheries management based on local wisdom [4]. The Institution of Panglima Laot Lhok Iboih was in the past dealing with fishermen activities and now is focusing more on the protection of coastal ecosystem in the area. This was caused by the existence of fishermen in the village that keep decreasing due to transition as the tourism guide as well as destruction threats to the coastal ecosystem. [5] The implementation of conservation area management in traditional manner is mostly dynamic and adaptively growing that is reflecting the change of social, politic, economy and culture.

There was a growing issue in the management process of MRP Weh island. The authority stated that they are facing problems with local community as well as from those who take benefit of the conservation area especially in fishing activities. Apart from that, the Nature Conservation Agency capacity was limited and the number of problems in the forest

that caused the management of MRP Weh Island was not running well [6].

The existence of Customary Law of the Sea impacted the area ecologically, socially, economically, and the management of MRP Weh Island. [6] Although local decree was the legal basis in the implementation of the MRP Weh Island, but in practice, the management was implemented based on the customary law.

The impact of MRP Weh Island management based on Customary Law of the Sea Lhok Iboih could be determined by finding the sustainability status of management based on the Customary Law of the Sea. The management system based on Customary Law of the Sea could also be used as a reference in creating the policy or strategy for the management of MRP Weh Island in the future. Therefore the purpose of this research was to calculate and estimate the sustainability status of the conservation area MRP Weh Island based on Customary Law of the Sea Lhok Iboih.

2. Research Methods

2.1 Location

The study was conducted in a conservation area of Weh Island Marine Recreational Park, Aceh Province of Indonesia (Fig.1). The MRP Weh Island has ± 2.600 hectare authority area that comprised of ± 1000 hectare water utilization zone and 1.600 hectare water protection zone.

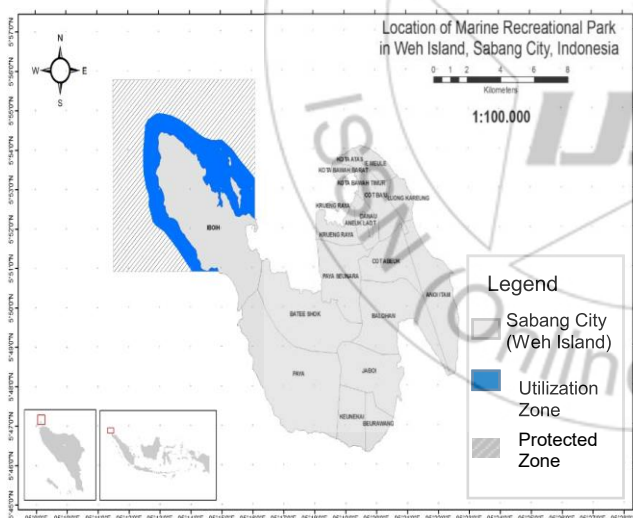


Figure 1: Research location

2.2 Data Collection

Research data consisted of primary and secondary data. The primary data was collected through in-depth interview with respondents that were selected by purposive sampling. The selected respondents were local citizens who involved in the conservation area i.e. fishermen, tour guide, local figure, customary figure, and village authority. The determination of respondents was done based on two approaches i.e. if the population is small (≤ 10) then we used census approach, otherwise we used rule of thumbs (statistical approach with minimum 30 respondents) [7]. Apart from local citizens,

interview was done with relevant instances such as Nature Conservation Agency, Official of Maritime and Fisheries Sabang City, and Nature Conservation Resort. The secondary data used in this research is the coral ecosystem data from Wildlife Conservation Society - Marine Program Indonesia dan Muttaqin research (2014).

2.3 Data Analysis

The sustainability analysis of MRP Weh Island based on Customary Law of The Sea was done using analysis methodology Multi Dimensional Scaling (MDS) with software RAPFISH (Rapid Appraisal Technique for Evaluating Fisheries Sustainability) [8]. This multidimensional analysis determine the sustainability status of management system that was relative to main points i.e. good and bad. To determine the sustainability of MRP Weh Island, we used 3 dimensions i.e. (1) Ecology, (2) Social economy, (3) Management system. Each dimension consisted of attributes that were scored according to the condition found during the research.

There were stages in analyzing with MDS. Firstly, we had to determine the dimension and attributes of sustainability. Secondly, we had to score each attributes which can describe the sustainability status of MRP Weh Island whether it was bad or good. Thirdly, we had to ordinate RAPFISH to determine the value which could describe the relative position of the management of MRP Weh Island using the value of stress (S) and coefficient of determination (R^2) to measure the goodness of fit. A good analysis result was indicated by stress value less than 0.25 ($S < 0.25$) and higher R^2 [9]. Fourthly, we had to determine the sustainability status using categories as described in [10] (Table 1). The next stage was implementing the monte carlo analysis that was used to determine the stability of the RAPFISH ordination result that was done 25 times using technique scatter plot. The stability of sustainability index was shown by converged plots. If the result indicated that was not converged or rather diverged, then we could conclude that there are inconsistencies in the analysis result. The final result was to do leverage analysis to determine the sensitive attribute of the dimension that was being utilized.

Table 1: Index and category of sustainability

Scale	Category
0 – 25	Bad (not sustainable)
26 – 50	Less (less sustainable)
51 – 75	Enough (quite sustainable)
76 – 100	Good (very sustainable)

3. Result

3.1 Dimension of Ecology

The ecology dimension had five attributes for sustainability analysis. RAPFISH analysis shown that sustainability index for ecology was 45.58 (Fig.2). This index value fall into category less sustainable (within range 25.01 – 50.00). The correlation square (R^2) result in value 0.933 which meant the result of diverse data estimation that could be explained with this analysis technique was sufficient ($>90\%$). The value of

resulting stress was 0.1668 which described the goodness of fit fall into category quite good since it was less than 0.25. The value of stress that less than 0.2 did not indicate bad goodness of fit [11].

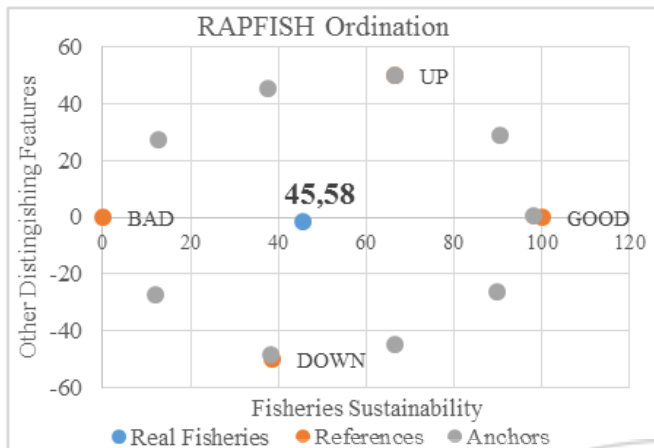


Figure 2: Sustainability index of ecology dimension.

The analysis result for leverage factor on ecology was gain with 3 attributes whom existence sensitively influence the increase and decrease of sustainability status. The sensitive attributes were abundance of coral reef fish with root mean square (RMS) 7.48, the resistance of coral bleaching with RMS 2.50, and coral recruitment with RMS 2.34 (Fig. 3).

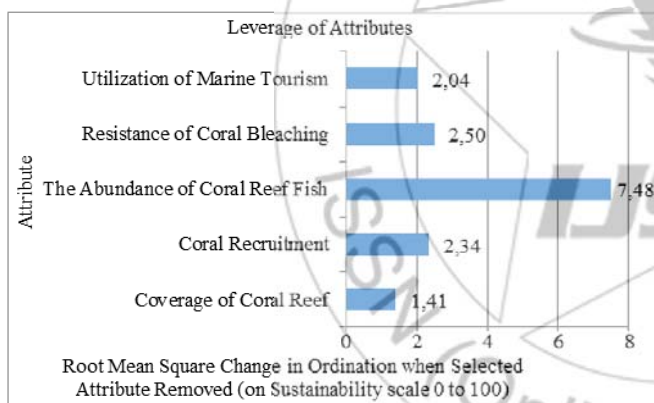


Figure 3: Analysis of leverage factor on ecology dimension

The abundance of coral fish had the highest sensitivity level compared to other attributes. Coral fish and coral reef had a very close relationship. The abundance of coral reef fish on coral reef reflected the condition of the coral reef since the fish will respond towards the change on the coral reef ecosystem, and vice versa where the coral reef would be influenced by population growth of coral fish [12].

There were a lot of factors that caused coral bleaching. Apart from the factor of nature, the coral bleaching could be also caused by human activities such as sedimentation, pollution, and fish catching using potassium or explosives. However, there was an incident at MRP Weh Island on 2010 where mass bleaching occurred that impact the decrease of coral closure rate [12]. Rising of ocean surface temperature on May-June 2010 at Andaman Sea and South China Sea had caused the massive coral bleaching and increasing rate of coral species death [13]. In total, 45 % of coral in Weh Island

were dead, 94 % of coral colony *Acropora* and 87 % of coral colony *Pocillopora* were also dead [14]. Apart from nature factor, the decreasing of coral closure rate was expected to be caused by anthropogenic factor such as the utilization of nets and potassium.

The death of coral due to bleaching was influenced by genera coral composition. Coral with branch and fast growth such as *Acropora*, *Seriatopora*, *Stylophora*, *Millepora* dan *Pocillopora* tend to have high death ratio towards coral whitening compared to compact coral with slow growth such as *Favia*, *Favites*, *Goniastrea*, *Astreopora* dan *Turbinaria* [15]. The composition of hard coral at MRP Weh Island on 2009 comprises of *Porites* 30%, *Acropora* 26%, *Pocillopora* 6%, *Montipora* 6%, *Leptastrea* 5%, *Favites* 4%, *Favia* 3%, *Galaxea* 2%, *Hydnophora* 2%, *Pavona* 1 % and others 15 % [16].

The coral recruitment attribute also had high sensitivity level. The ability of coral recruitment on a coral reef system is very important to protect the population existence and sustainability from all damages caused by environment or anthropogenic influence. The ability of coral reef recruitment was the ability of an individual colony or a coral reef system to defend themselves from environment impact, keeping the ability to recover and to develop [17].

3.2 Dimension of Social Economy

According to analysis result using RAPFISH to 7 attributes that impacted the aspect of social economy, it was found that sustainability index is 56.75 (Fig. 4). The sustainability index fall into category quite sustainable. The correlation square (R^2) was 0.944 which means the estimation of data convergence proportion that can be explained by this analytical technique was found to be sufficient ($> 90\%$). The resulted stress value was 0.1505 which indicated the goodness of fit in this category was quite good since it was less than 0.25. The sustainability index on social economy indicated that the condition of social economy was sufficiently supportive towards the development of sustainable area management with continuous improvement effort.

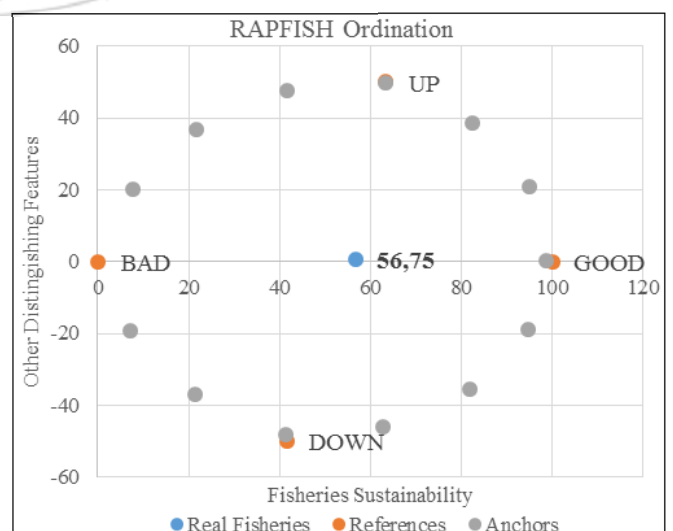


Figure 4: Sustainability index dimension of social economy

The leverage analysis result for the dimension of social economy can be observed on Fig 5. Out of 8 attributes that had been analyzed, we found three attributes that are most highly sensitive to the sustainability index of this dimension namely the local understanding of policy and sanction with *root mean square* (RMS) 2.84, the support of local community for conservation management with RMS 2.07, and the dependency of local community to the area with RMS 1.78.

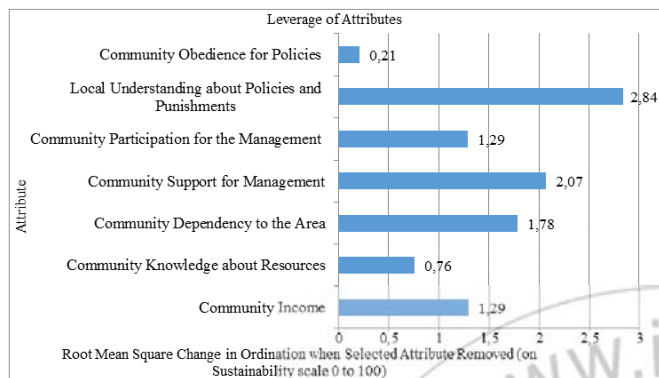


Figure 5: Analysis of leverage factor on social economy dimension

The understanding of local community regarding the policy and sanction as well as their support to the management are the primary keys for the success of this program. Local community have to understand which activities that are prohibited and which are allowed since they are at the front lines in consuming and protecting the natural resources. The limitation upon usage of net catching tools successfully reduced the habitat destruction and maintain fish biomass on management based on customary law Panglima Laot [18]. Policies and sanctions of Customary Law of the Sea Lhok Iboih is presented on Table 2.

The dependency of community towards the area can be observed through their livelihood that is relevant with ecosystem. As most of them worked as tourism worker, the dependency could give a positive impact or negative impact to the social economy and ecology condition. The dependency of the community could boost them up to protect the area intensively from the anthropogenic destruction. This high dependency could impact in negative ways if the utilization of coral reef ecosystem was done excessively without paying attention to its capacity and if too much orientation for benefit only.

Table 2. Policies and sanctions of Customary Law of the Sea, Institutions of Panglima Laot Lhok Iboih

Policy	Sanction	Area
Fishing activities could only be done by using traditional fishing tools. It was not allowed to use bomb, compressor, trawl, and potassium.	All the equipment will be confiscated and the perpetrator will be arrested by the authorities.	All area under the the Customary Law of the Sea Lhok Iboih territory
Using net for fish/biota catching is not allowed	Penalty IDR 10 million. Ship and all equipments will be confiscated for a week.	Sea Park Iboih Village (the core area of Customary Law of the Sea Lhok Iboih)

Using speargun for fish/biota catching is not allowed. Fishing is also not allowed at night.	Penalty IDR 1 Million and all equipment will be confiscated.	Sea Park Iboih Village (the core area of Customary Law of the Sea Lhok Iboih)
Days when any fishery activities are not allowed: 1. Eid'l Fitr. No fishing for 1 day. 2. Eid'l Adha. No fishing for 1 day 3. Tsunami memorial day. No fishing until the memorial ceremony finished. 4. Independenc Day every 17 August. No fishing until ceremony is finished.	Penalty 1 goat	All area under the Customary Law of the Sea Lhok Iboih territory
Fisheries activity is not allowed on Thursday from 19.00 to Jumat prayer including snorkling and diving.	Ship and all equipments are hold for a week.	All area under the Customary Law of the Sea Lhok Iboih territory
Fisheries activity is not allowed during Sea Festivity for 3 days.	Reorganizing another festivity.	All area under the Customary Law of the Sea Lhok Iboih territory

3.3 Dimension of Management

The RAPFISH analysis result for seven attributes in management aspect indicated sustainability index to be 59.98 which means it falls into category quite (Fig. 6). The correlation square (R^2) found is 0.950 which means the estimation of data convergence proportion that can be explained by this analytical technique was found to be sufficient ($> 90\%$). The resulted stress value found to be 0.1387 which described the goodness of fit falls into category quite good since it was less than 0.25. The sustainability index of management dimension is the highest compared to other dimension i.e. ecology and social economy. This indicates that the dimension of management was very supportive for management sustainability therefore the effort to improve the management should be done more intensively.

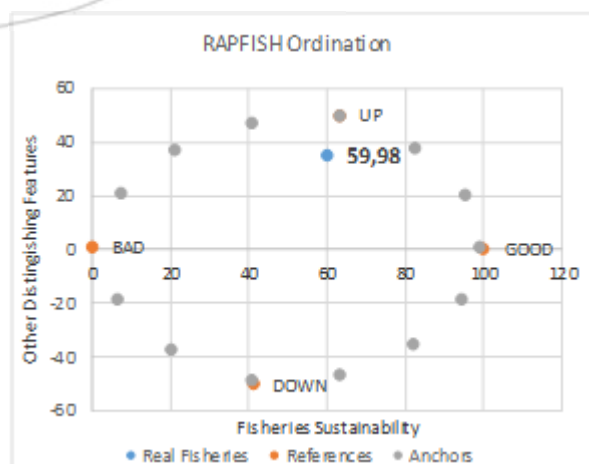


Figure 6. Sustainability index of management dimension

The analysis result for leverage factor of management dimension (Fig. 7) indicated that, out of seven attributes that influence this dimension, there are three sensitive attributes that needed more attention namely management planning (RMS= 8.81), human resource availability for management (RMS=8.70), and law enforcement (RMS=8.47).

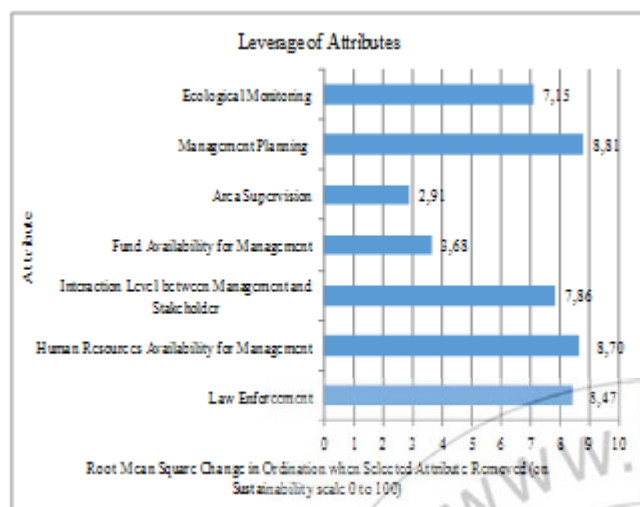


Figure 7: Analysis of leverage factor on management dimension

All three sensitive attributes could give significant contribution for the existence of the management. With management planning as the basis, it would be very easy to implement all management program and activity precisely and accurately according to the plan. The management plan would need execution for all program listed in the plan. The implementation needed human resources that are capable to achieve maximum result. The management planning along with human resources themselves would not be effective without firm law enforcement. All policies that had been listed must be obeyed by all local community and any violations must be firmly punished. According to the report from Panglima Laot Lhok Iboih, there were 11 violations that had been processed within 2009 – 2014 (Table 3).

Table 3: Violation and sanction 2009 – 2014

Time	Type of Violation	Sanction	Village
Oct. 2009	Using net for fishing	IDR 10 Million	Lhok Pasiran, Sabang
Nov. 2009	Using speargun at marine park area	IDR 1 Million	Lhok Krueng Raya, Sabang
2010	Using net for fishing	IDR 10 Million and fishing tools were confiscated for 2 years	Kota Bawah Timur, Sabang
May. 2011	Using prohibited tools to catch sea biota	IDR 100.000	-
Nov. 2011	Using prohibited tools to catch octopus	IDR 100.000 and tools were confiscated for 9 days	Jurong Bypass Cot Ba'u, Sabang
Nov. 2011	Using prohibited tools to catch shrimp	IDR 100.000 and tools were confiscated for 1 week	-
Nov. 2011	Installing beach net	IDR 50.000 and tools were confiscated for 1 week	Tepi Layeu Desa Iboih, Sabang
2011	Using prohibited tools for fishing	IDR 1 million and tools were confiscated for 10	Foreign tourist

		hour	
Jan. 2012	Using speargun for fishing	IDR 1 million	Teupi Layeu Desa Iboih, Sabang
Sept 2013	Fishing at night	IDR 100.000 and tools were confiscated for 1 week	-
Jun. 2014	Using prohibited tools to catch sea biota	IDR 500.000 000 and tools were confiscated for 1 month	-

4. Conclusion

The dimension of management and social economy has high sustainability index which meant both are quite sustainable, however the dimension of ecology is less sustainable. The incident of coral bleaching that occurred on 2010 was one of the problem that caused ecology to fall into less sustainable category. The consistency of Panglima Laot Lhok Iboih along with local community in protecting and utilizing the natural resources that was available in MRP Weh Island contributes significantly to the sustainability status of management and social economy. Therefore the management system based on Customary Law of the Sea, Institution of Panglima Laot Lhok Iboih would preserve the sustainability of MRP Weh Island.

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