Strength Weakness Opportunity and Threat Mangrove Ecosystem Management to Beach Development

by Agus Indarjo

Strength Weakness Opportunity and Threat: Mangrove Ecosystem Management To Beach Development

Agus Indarjo[1], Alin Fithor[2]

[1]*Postgraduate Lecturer of Marine Science Program Diponegoro University of Semarang - Scopus ID : 57201581199*

[2]*Doctoral of Coastal Resources Management Program Diponegoro University of Semarang*

afithor@gmail.com

Abstract

Semarang as a maritime city has marine tourism assets, namely Maron Beach. Tourism development in Semarang needs to be implemented with a better development pattern. This as a lack of awareness in the management of mangrove ecosystems. The objectives of this research are (1) to know the value of seawater quality standard for marine tourism, density index and mangrove diversity, (2) to formulate mangrove ecosystem management strategy using a SWOT analysis (Strength, Weakness,Opportunities,Threats). The study was conducted on October 1-20 in October 2017 with the method used in this research is a descriptive qualitative case study. Data processing is used by testing the water quality index value of the aquatic environment, density index and mangrove diversity. The results showed the calculation of the environmental quality index of waters with a value of 8.81 with a very bad category. Index of density and index of mangrove diversity with a value of 122 trees/hectare each with rare and 0,560 categories with bad criteria or unstable ecosystem stability. Maximizing the main function of mangrove as an integrated management step with Tambakharjo Urban Village becomes the key to maroon coastal resort management in Semarang city to be better.

Keywords: Maron beach, sea water quality for marine tourism, density index and diversity

1. INTRODUCTION

Coastal and marine development in Indonesia is faced with several realities and future trends. These realities and trends are related to the carrying capacity of natural resources, especially on land from time to time, while the population has increased. Demand for goods and services in the future will continue to increase so that the necessary use of natural resources, both land and sea. The coastal environment is part of the ocean resources whose existence has a strategic function for the fishermen community. Some of them are population increase, industrial activities around the coast, pollution, sedimentation, water supply.

The coastal resources of the mangrove ecosystem provide a variety of environmental products and services that support the various needs of life and various economic activities. Potential of mangrove ecosystem can give hope of sufficiency of the economic necessity of a life of society, especially those living around the mangrove ecosystem area. This relies heavily on protecting and preserving the functional integration of the natural systems of the mangrove ecosystem, and not on the conversion of mangrove ecosystems for the sole purpose of use so that their functions are lost. In accordance with the above description, the preservation of mangrove ecosystem functions that occupy coastal areas become very important in the development activities and the community economy in a sustainable manner.

Semarang, as the capital of Central Java Province, is an area that can be developed for the tourism sector. Tourism development planning is known for various theories and concepts. The concept of market-driven is more focused on the desire of tourists and market behaviour as the foundation of development. While the concept of product-driven on tourism product development. The conditions and advantages of development to product or tourism object will be a foundation in the development(Fandeli et al., 2000).

Beside to figure 1, Currently, despite being able to attract tourist arrivals, but the number of tourists has not been maximized. This as a lack of awareness in the management of mangrove ecosystems.In order to support the development effort of Maron Beach as part of the willingness of marine tourism, the case study of seawater quality, density study and mangrove diversity, as well as economic valuation for coastal recreation areas, is needed.

The objectives of this research are (1) to know the value of seawater quality standard for marine tourism, density index and mangrove diversity, (2) to formulate mangrove ecosystem management strategy using a SWOT analysis (Strength, Opportunities, Weakness, Threats) Semarang.

2. MATERIALS AND METHODS

2.1. Study area

The place used as a research location is Maron Beach Tourist Area located in Tambakharjo Village Semarang Utara Subdistrict Semarang City with a mangrove ecosystem area of 18,900 square meters, an area of observation of 52,700 square meters.

2.2. Procedures

The primary data collection method using sample survey method is data collection by recording a small population or sample of a maximum of 3 samples. Still, the result is expected to describe the population properties of the object (Arikunto, 2006).

For the abiotic measurements in this study, the samples were tested following the Decree of the State Minister of the Environment Number 51 of 2004 on Marine Water Quality Standard for Marine Tourism as contained in the following table: physics: Colour, Temperature, Brightness, Waste, and Volition. Chemistry: pH, salinity, dissolved oxygen, and biological oxygen demand.

For the analysis used descriptive qualitative analysis with case studies, namely the elaboration of the data obtained through observation and interviews about the pattern of utilization of mangrove ecosystems. After the determination of each of these analyzes, it is then used to create an Environment Waters Quality Index (IMLP) obtained from calculations based on the National Sanitation's Foundation-Water Quality Index method, NSF-WQI (Ott, 1978). The determination of the Aquatic Environmental Quality Index value is calculated using the following equation:

$$IMLP = \sum_{i=1}^{n} Wi \,.\, l_i \qquad (1)$$

The general condition of water quality pollution can be determined by comparing the IMLP values obtained from the calculation with water quality criteria according to NSF-WQI (Ott, 1978) with BOD5 analyzed.

Under biotic observations, the density or density index is the number of individual organisms per unit space. Calculated by the following formula:

K = Number of individual

Observation area (m2) $\qquad (2)$

Then the diversity index is one of the measurements of community diversity. Calculated by the following formula:

$$d = \frac{(s-1)}{logN} \qquad (3)$$

Evidence :

d = Margalef Diversity Index

s = Number of Species

N = Number of Individuals

Intake of mangrove ecosystem data was done using transect method, that is making transect line along 100 meters with width 10 meters, then recorded all type and amount of mangrove trees growing in the plot area as shown in figure 1.
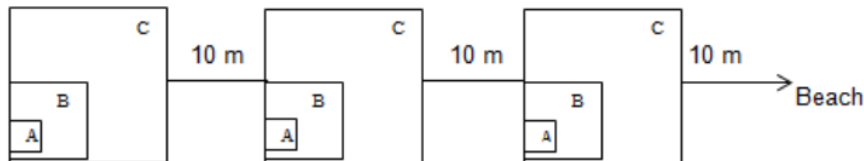

Figure 2. Model Placement of Mangrove Research Plots

Information :

Plot A: Sub-plot for seedlings, size 1 m x 1 m

Plot B: Sub-plot for stakes / sizes, size 5 m x 5 m

Plot C: Sub-plot for trees, size 10 m x 10 m

Based on the calculation of density and diversity of mangrove ecosystems, mangrove ecosystem area can be grouped into standard criteria of mangrove forest grouping. Following the Decree of State Minister of Environment Number 201 the Year 2004 regarding standard criteria of mangrove damage and Guidance on Utilization of Mangrove Damage (on tables 3 and 4 in appendix).

To formulate mangrove ecosystem management strategy in Mangrove Tourism Area Maron Beach Semarang City used SWOT analysis based on a logic that can maximize strength (Strength) and opportunity (Opportunities), but together can minimize weakness (Weakness) and threat (Threats). The strategic decision-making process is always concerned with

1103

Table 1. Result of Seawater Quality Standard For Marine Tourism

No.	Parametre	Unit	Quality Standard	Station 1	Station 2	Station 3
Physics						
1.	Colour	-	Nil	-	-	-
2.	Temperature	0.1'C	Natural	34	33	33.6
3.	Brightness	0.1 M	>6			
4.	Trash	-	Nil	-	-	-
5.	Odor	-	No smell	-	-	-
Chemistry						
6.	Ph	-	7-8.5	7.2	7.82	7.88
7.	Salinity	0.1 $\%_{oo}$	Natural	20	22.5	22
8.	DO	0.1 mg/l	>5	7.2	7.8	8
9.	BOD_5	0.1 mg/l	10	21	17	23

Strategic planning (strategic planner) should analyze vital factors (strengths, weaknesses, opportunities and threats) in existing conditions; this is called Situation Analysis. The most popular model for situational analysis is SWOT analysis (Rangkuti, 2006).

The internal conditions consisting of strengths and weaknesses and external conditions consisting of the opportunity and threats to be analyzed presented in the form to formulate the mangrove ecosystem management strategy, namely:

Based on the SWOT analysis, we can be formulated as an alternative strategy of mangrove ecosystem management in Mangrove Beach Area as follows:

1. SO strategy is to utilize the power of S (Strength) to the maximum to seize the opportunity O (Opportunities).

2. ST strategy is to maximize the potential of S (Strength) to anticipate and overcome T (Threats).

3. WO strategy is to minimize the weakness of W (Weakness) to seize opportunities O (Opportunities).

4. WT strategy is to reduce the fault of W (Weakness) to avoid T (Threats).

3. RESULTS AND DISCUSSION

3.1. Result-1

3.1.1. Calculation of Water Environment Quality Index Value: Here are the results of seawater quality standards research for marine tourism in table 1. Furthermore, this analysis is calculated at each Station:

Average at this picture has been 8.814 (Very Poor Category) The results of this study indicate the calculation of the environmental quality index of the waters with the value of 8.814 with terrible category(analysis results can be seen Table 2 in appendix).

1. Environmental quality index of aquatic Station 1

$DO = 7.2 / 7.09 = 1.01$ → $= 0.40 \times 1.01 = 0.404$
pH $= 0.30 \times 7.2 \quad = 2.16$
BOD_5 $= 0.30 \times 21 \quad = 6.3 +$
                                            8.854

2. Environmental quality index of aquatic Station 2

$DO = 7.8 / 7.21 = 1.08$ → $= 0.40 \times 1.08 = 0.432$
pH $= 0.30 \times 7.82 = 2.346$
BOD_5 $= 0.30 \times 17 \quad = 5.1 +$
                                            7.878

3. Environmental quality index of aquatic Station 3

$DO = 8 / 7.21 = 1.109$ → $= 0.40 \times 1.109 = 0.444$
pH $= 0.30 \times 7.88 \quad = 2.364$
BOD_5 $= 0.30 \times 23 \quad = 6.9 +$
                                            9.708

3.1.2. Calculation of Index of Density and Index of Mangrove Diversity: This result has been of every 122 trees/hectare with nine categories and 0.360 wrong criteria or unstable ecosystem stability, (analysis results can be seen in Table)

Table 2. Calculation of Density Index and Diversity Index on Mangrove Trees

Location	Number of Individu	Species	K	H'
Station 4	1	Rhizophora mucronata	0.19	
		Amount	0.19	0
Station 5	1	Rhizophora mucronata	0.07	
	2	Avicennia marina	0.02	
		Amount	0.09	0.230 048
Station 6	1	Rhizophora mucronata	0.06	
	2	Avicennia marina	0.03	
		Amount	0.09	0.276 435
Total account in sampling			122 of mangrove tree / hectare	

Table 3. Calculation of Density Index and Diversity Index on Mangrove Moderates

Location	Number of Individu	Species	K	H'
Station 4	1	Rhizophora mucronata	0.72	
		Amount	0.72	0
Station 5	1	Rhizophora mucronata	0.44	
		Amount		0
Station 6	1	Rhizophora mucronata	0.36	
		Amount		0

Table 4. Calculation of Density Index and Diversity Index on Mangrove Seedlings

Location	Number of Individu	Species	K	H'
Station 4	1	Rhizophora mucronata	1	
	2	Brugueira gymnorizha	1	
		Amount	2	0.30103
Station 5	1	Rhizophora mucronata	1	
	2	Avicennia marina	2	
		Amount	3	0.276435
Station 6	1	Rhizophora mucronata	2	
		Amount	2	0

4. DISCUSSION

Management strategy with SWOT analysis, SWOT stands for Strengths, Weaknesses, Opportunities, and Threats, and so a SWOT Analysis is a technique for assessing these four aspects of many planning and subjective closed.

SWOT Analysis to make the most organization's best advantage and reduce the chances of failure, by understanding to lacking, and eliminating hazards that would otherwise catch unawares.

Better still, can start to craft a strategy that distinguishes for any resources planning, it just another completing with any purpose of development, and so compete successfully market. It consist as :

4.1. Strength
• Mangrove function as an abrasion holder.

1106

• The purpose of mangroves as areas favourable to fish.
• The status of the city as a region is not free to manage and access difficulties.
• Believing mangrove is part of the family.

4.2. Weakness
• Society has not cleaned itself.
• Economic conditions are increasingly demanding.
• Community knowledge about environmental management, especially mangrove, is still lacking.
• Lack of community involvement to maintain the mangrove ecosystem.
• The low intensity of socialization of legislation on protection and conservation of mangrove <1 year.

4.3. Opportunities
• Maintaining the preservation of mangrove is not contrary to the culture of tambakharjo urban village.
• Tambakharjo village community is easy to do good.
• The city is willing to assist mangrove conservation

4.4. Threat
• Law enforcement is weak
• Violations are left
• Utilization of mangrove is not wise

The above analysis can be summarized diagram ya as follows:

Table 5. SWOT Analysis Table of Research Results

SO Strategy	WO Strategy
1. Maximizing the main functions of mangroves (S1,S2,O1,O2,O3) 2. Tambakharjo society is willing to help if the area is easy to access and easy to manage (S3,O3)(S3,O3)	1. Increase community involvement in mangrove management (W1,W2,W3,W4,O1,O2,O3) 2. Improving mangrove studies and studies (W5)
ST Strategy	WT Strategy
1. Increase public knowledge about environmental management (S3,T1,T2) 2. Improving the community econmy (S2,S3,T2)	1.Preparation of a joint management plan involving all stakeholders (W1,W2,W3,W4,T2) 2.Improved monitoring and monitoring (W4,T1)

Strength and Opportunity management strategy formulated as a way that is: (1) maximizing the primary function of mangrove as an integrated management step with Tambakharjo Urban Village is undoubtedly the key of maroon beach resort management in Semarang city to be better.

1107

5. CONCLUSION

Results The study shows the calculation of the environmental quality index of the waters with a value of 8.81 with a terrible category. Index of density and index of mangrove diversity with a value of 122 tree/hectare respectively with rare type and 0,560 wrong criteria or unstable ecosystem stability. Maximizing the primary function of mangrove as an integrated management step with Tambakharjo Urban Village becomes the key to maroon coastal resort management in Semarang city to be better.

ACKNOWLEDGEMENTS

REFERENCES

[1] APHA, AWWA, WPCF. 1992. *Standard Methods for The Examination of Water and Wastewater*. 18th Edition. Victor Graphics, Inc, USA, 3646 pp.

[2] Arikunto, S. 2006. *Prosedur Penelitian : Suatu Pendekatan Praktik*. Cetakan Pertama. Penerbit Rineka Cipta. Jakarta

[3] Basyuni, Mohammad; Putri, Lollie A.P.; Oku, Hirosuke. *Phytomedicinal Investigation from Six Mangrove Tree Species, North Sumatra, Indonesia*. ILMU KELAUTAN: Indonesian Journal of Marine Sciences, [S.l.], v. 18, n. 3, p. 157-164, june 2013. doi:http://dx.doi.org/10.14710/ik.ijms.18.3.157-164.

[4] Beloborodko, Ana. 2014. *SWOT Analysis Approach for advancement of waste-to-energy cluster in Latvia, hlm 163-169. International scientific conference Environtmental and Climate Technologies* –CONECT 2014. *Riga Technical University, Institute of Energy Systems and Environment,* Riga, Latvia. DOI-10.1016/j.egypro.2015.06.023

[5] Dahuri, H. R., J. Rais, S. P. Ginting dan M. J. Sitepu. 2004,. *Pengelolaan Sumber Daya Wilayah Pesisir dan Lautan Secara Terpadu*. Pradnya Paramita, Jakarta.

[6] Diarto, D; Hendrarto, Boedi; Suryoko, Sri. *Community Participation in The Management of The Mangrove tugurejo Forest Area Surrounding in The City Of Semarang* Jurnal Ilmu Lingkungan, [S.l.], v. 10, n. 1, p. 1-7, apr. 2012. doi:http://dx.doi.org/10.14710/jil.10.1.1-7.

[7] Effendi, H. 2003. *Telaah Kualitas Air*. Penerbit Kanisius, Jakarta.

[8] Fandeli, Chafid, dan Mukhlison. 2000. *Pengusahaan Ekowisata*. Fakultas Kehutanan Universitas Gadjah Mada, Yogyakarta. 235 hlm.

[9] Hossain KA. 2016. *SWOT Analysis of China shipbuilding industry by third eyes*. Hlm. 241-246. *10th International Conference on Marine Technology*, MARTEC 2016. *Bangladesh University of Engineering and Technology*, Dhaka, Bangladesh

[10] Keputusan Menteri Negara Lingkungan Hidup Nomer 201 Tahun 2004 Tentang *Kriteria Baku dan Pedoman Penentuan Kerusakan Mangrove*.

[11] Keputusan Menteri Negara Lingkungan Hidup No. 51 Tahun 2004 tentang *Baku Mutu Air Laut untuk Wisata Bahari*.

[12] Dahuri, H. R., J. Rais, S. P. Ginting dan M. J. Sitepu. 2004,. *Pengelolaan Sumber Daya Wilayah Pesisir dan Lautan Secara Terpadu*. Pradnya Paramita, Jakarta.

[13] Muhammad, Fuad et al. *Study of Supporting Power of Mangrove Forest Ecotourism Blanakan, Subang, West Java*. Bioma : Berkala Ilmiah Biologi, [S.l.], p. 64-72, dec. 2012. doi:http://dx.doi.org/10.14710/bioma, 14, 2, 64-72.

[14] Putra, Aditya Cahya; Anggoro, Sutisno; Kismartini. *Ecotourism Development Strategy with Mangrove Ecosystem Studies at Pramuka Island, Kepulauan Seribu*. SAINTEK PERIKANAN : Indonesian Journal of Fisheries Science and Technology, [S.l.], v. 10, n. 2, p. 91-97, feb. 2015. doi:http://dx.doi.org/10.14710/ijfst.10.2.91-97.

[15] Sasmito, Bandi; SuprayogiI, Andri. *Coastal Ecosystem Vulnerability Assessment of Demak Regency Based on Coastal Line Changes with Remote Sensing Technology and Geographic Information System*. Teknik, [S.l.], v. 38, n. 1, p. 13-20, july 2017. doi:http://dx.doi.org/10.14710/teknik.v38i1.12181.

[16] Sa'diyah, Halimatus; Hendrarto, Boedi; Rudiyanti, Siti. *Determination of Important Factorson Society Activity for The Development of The Mangrove Forests Rehabilitation Area on The Beach of Karangsong, District of Indramayu.* SAINTEK PERIKANAN : Indonesian Journal of Fisheries Science and Technology, [S.l.], v. 13, n. 1, p. 12-18, dec. 2017. doi:http://dx.doi.org/10.14710/ijfst.13.1.12-18.

[17] Rangkuti, F. 2006. *Analisis SWOT Teknik Membedah Kasus Bisnis.* Jakarta : PT. Gramedia Pustaka Utama.

[18] Thamrina, H. & Wahyu, EW. 2017. *SWOT Analysis Application: A Case Study for Indonesian Higher Education Institution. 2nd International Conference on Computer Science and Computational Intelligence 2017, ICCSCI 2017,* 13-14 October 2017, Bali, Indonesia.

[19] Wijayanto, Dian; Nuriasih, Dian Minggus; Huda, Muhammad Nurul. *Strategies of Mangrove Tourism Development in Nusa Penida Marine Protected Area.* SAINTEK PERIKANAN : Indonesian Journal of Fisheries Science and Technology, [S.l.], v. 8, n. 2, p. 25-32, feb. 2013. doi:http://dx.doi.org/10.14710/ijfst.8.2.25-32.

Strength Weakness Opportunity and Threat Mangrove Ecosystem Management to Beach Development

4   H Setiawan. "Vegetation Characteristic and Micro Environment of Mangrove Rehabilitation Forest at Coastal Areas of East Sinjai, South Sulawesi", IOP Conference Series: Earth and Environmental Science, 2019
Publication

1 %

5   Catur Retnaningdyah, Luchman Hakim, Rispah Hamzah, Arina Mana Sikana. "Water Quality Evaluation of Some Beach With Variations of Human Activities and Land Use in Spermonde Archipelago of Makassar South Sulawesi", IOP Conference Series: Earth and Environmental Science, 2019
Publication

1 %

6   R Haryanti, A Fahrudin, H A Susanto. "Analysis degradation of mangrove vegetation in Tangerang District, Banten Province", IOP Conference Series: Earth and Environmental Science, 2020
Publication

1 %

7   Francis C. Bergeron. "Multi-method assessment of household waste management in Geneva regarding sorting and recycling", Resources, Conservation and Recycling, 2016
Publication

<1 %

8   Md. Saidur Rahman, Ute Sass-Klaassen, Pieter A. Zuidema, Md. Qumruzzaman Chowdhury, Hans Beeckman. "Salinity drives growth

<1 %

dynamics of the mangrove tree Sonneratia apetala Buch. -Ham. in the Sundarbans, Bangladesh", Dendrochronologia, 2020
Publication

9   F Fahmi, T B Aulia, M Isya. "Risk analysis study on building projects in Pidie District", IOP Conference Series: Materials Science and Engineering, 2020
Publication

<1 %

10   Susena, Aziz Nur Bambang, Sri Mulyani. "Development of Environmental Education through the Adiwiyata Program (Study at: SDN Tlogosari Kulon 03 Semarang, Indonesia)", E3S Web of Conferences, 2019
Publication

<1 %

Exclude quotes   On   Exclude matches   Off
Exclude bibliography On