

SUSTAINABILITY ANALYSIS OF TRADITIONAL CAPTURE FISHERIES BASED ON LOCAL WISDOM AT LHOK KUALA GIGIENG, ACEH BESAR, INDONESIA

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ABSTRACT

This research focuses on the sustainability analysis of capture fisheries based on local wisdom in Lhok Kuala Gigieng. This study aims to analyze the sustainability status of capture fisheries and determine the factors that influence the sustainability of capture fisheries in Lhok Kuala Gigieng. The method used in this study is a descriptive method with survey techniques in data collection through questionnaires. The RAPFISH analysis uses four dimensions: ecological, economic, social, and institutional. This study indicates that the sustainability index score for the ecological dimension is in a good category, and the economic dimension of the sustainability index is in the medium category. Furthermore, it also shows that the social dimension of the sustainability index is in a good category, and the institutional dimension of the sustainability index is in a good category.

Keywords: Sustainability; Local Wisdom; RAPFISH; Ecology; Economy; Social; Institutional

INTRODUCTION

Kuala Gigieng waters are located in Aceh Besar District, Aceh Province, with coordinates 5°37'09.0"N 95°23'10.4" E (BPS, 2020). These waters have fishery potentials such as marine fisheries, ponds, and rivers. Several fish with economic value live in these waters and are often caught by local fishermen. Capture fisheries sustainability has an essential role in improving marine and fisheries development, both related to improving the welfare of fishing communities, fish processors, and cultivators (Serpetti et al., 2017). This process is expected to enhance the fisheries and marine sector as a source of economic growth. Fishery activities can also contribute to sustainable development if all components related to these activities are sustainable (Kadagi et al., 2021).

According to Law Number 23 Year 2014 on Regional Government, Regional Government is the administration of government affairs by the regional government and the Regional People's Legislative Assembly according to the principles of autonomy and co-administration. The autonomy principle is implemented within the system and regulations of the Republic of Indonesia. The basis for implementing regional autonomy is required to run the government independently. For this reason, local governments must be able to explore the local potential to increase local revenue (Akpalu and Eggert. 2021). Regional autonomy increases democracy, and community participation can affect districts and cities (Jimenez et al., 2021). Therefore, local governments must pay attention to value systems and institutions that grow and develop in society and align with potential local sources (Isigi et al., 2021).

Qanun Number 9 Year 2008 on the Development of Indigenous Life and Customs, in Article 10 paragraph (1) letter (1) stipulates that the development of indigenous life and customs can be carried out through the protection of the rights of indigenous peoples, which include land, swamps, forests, seas, rivers, lakes, and other community rights. This article stipulates that the government must protect indigenous peoples' rights, including fishermen's rights, in carrying out "*hukom adat laôt*" (customary law of the sea) as local wisdom led by *Panglima Laôt*.

Panglima Laôt is the leader of fishermen who, under the customary law of the sea (*hukom adat laôt*), is tasked with coordinating fishers in their fishing business. The roles and responsibilities of the *Panglima Laôt* include supervising and maintaining the implementation of the customary law of the sea, resolving various fishing disputes, holding traditional marine ceremonies, and others (Zulmansyah, 2017). Given the prominent role of the *Panglima Laôt* in maintaining marine conservation, the existence of the *Panglima Laôt* institution is highly supported by coastal communities (Yacob et al., 2016). The customary law of the sea has also developed to keep up with advances in science and technology in the marine and fisheries sector without compromising the essence, role, and function of the *Panglima Laôt* in taking action against unscrupulous fishers who violate the customary law of the sea (Aris et al. 2020). One of the roles of the *Panglima Laôt* is to maintain the sustainability of the aquatic environment from fishing activities carried out by fishermen to ensure the sustainability of the capture fisheries business.

This study aims to determine the sustainability status of capture fisheries business based on local wisdom in Lhok Kuala Gigieng Aceh Besar. The scope of this research is limited to the ecological, economic, social, and institutional dimensions.

RESEARCH METHOD

1) Data Collection Method

The data collected in this study consisted of primary data and secondary data. Primary data was collected through direct observation of the location, discussions, and interviews using questionnaires. Interviews were conducted to determine the actions of *Panglima Laôt* in carrying out its functions and roles and fishermen's perceptions of the concept of the customary law of the sea in the fishing business. Secondary data is obtained through studies/literature review from various existing reports, government agencies, or other studies' results.

2) Data Analysis Method

This study uses the measurement of the sustainability index, which is carried out using the RAPFISH approach, an analytical technique to evaluate the sustainability of fisheries in a multidisciplinary manner (Fauzi and Anna 2005). This approach was developed based on the framework or concept of sustainable development, which refers to sustainable fisheries where the factors are set out in the FAO Code of Conduct for Responsible Fisheries (Pitcher and Preikshot 2001). The attributes of each dimension, as well as the criteria for good and bad, will refer to the concepts used in (Pitcher & Preikshot 2001), (Allahyari 2010), (Chaliluddin et al. 2015) and local wisdom values.

Table 1. Sustainability assessment status category based on MDS index value

Index Score	Categories
0 - 25	Very Poor (unsustainable)
26 - 50	Poor (Barely sustainable)
51 - 75	Moderate (Quiet Sustainable)
76 - 100	Good (Very Sustainable)

Source: Allahyari (2010)

RESULTS AND DISCUSSION

Using the results of research conducted in Lhok Kuala Gigieng and the collected data, the modus value is determined, which is then examined using Rapfish analysis to estimate its

sustainability score. Determination of the sustainability score using Rapfish analysis is based on four dimensions and 33 attributes, namely the ecological dimension (8 attributes), the economic dimension (8 attributes), the social dimension (8 attributes), and the institutional dimension (9 attributes).

The results of the ordination analysis show that, in general, the sustainability of capture fisheries activities based on local wisdom in Lhok Kuala Gigieng, Aceh Besar, based on the ecological, economic, social, and institutional dimensions, is in Good sustainability status. However, the economic dimension sustainability status is only Moderate. The aspects measured in capture fisheries activities include four dimensions of sustainability, namely the ecological dimension, the economic dimension, the social dimension, and the institutional dimension. Each of these dimensions will be explained as follows:

1) The Ecological Dimension

Based on local wisdom in Lhok Kuala Gigieng, eight criteria are presented for the ecological dimension of the analysis of the sustainability of capture fisheries. These include fishing in coral reef zones, felling trees along the shore, utilizing mangrove trees for fishing operations, and protected fishing. It also involves the monitoring and supervision of fish bombing by *Panglima Laôt*, the supervision of fish poisoning by *Panglima Laôt*, the use of potassium cyanide, and the removal of live coral reefs. The objective of the ordination analysis utilizing the score of each attribute on the ecological dimension of capture fisheries operations at the research site is to identify the relative position of each fishing activity to the ordinance, which ranges from 100 (good) to 0 (bad).

Furthermore, the analysis results of the ecological dimensions are plotted in an ordinance figure (Figure 1). Ordination analysis in the ecological dimension with three iterations resulted in a correlation squared value (R^2) of 95.02% and a stress value (S) of 13.61%. The stress value reflects the goodness of fit in multi-dimensional scaling (MDS), which indicates that the configuration size of a point can reflect the original data. A low-stress value indicates a good fit, while a high-stress value indicates the opposite condition. In the Rapfish model, the desired stress value is less than 25% (Fauzi and Anna, 2005). Thus, the analysis of the ecological dimensions in this study shows the condition of the goodness of fit, considering the stress value obtained is 13.61% ($< 25\%$).

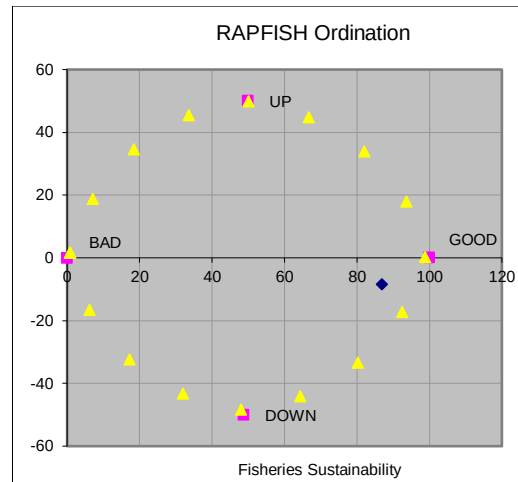


Figure 1. Ecological dimension ordination

Based on Figure 1, it can be explained that from the ecological dimension, the sustainability of capture fisheries based on local wisdom in Lhok Kuala Gigieng is at the level of the Good category (very sustainable). This is per the category of the sustainability assessment status of Allahyari (2010), with a score of 86.86. The results of this analysis are the same as those of Chaliluddin et al. (2015); and Riza et al. (2019). However, this study's results differ from those of Mahida et al. (2019), which resulted in sustainability only in the Moderate category (quite sustainable) with a sustainability index value of 53.99. Then, the results of this ordinance analysis will be analyzed with Leverage to see the influential attributes in realizing the sustainability of capture fisheries.

Leverage is calculated based on the standard error of the difference between scores with attributes and scores obtained without attributes. This analysis is essentially aimed at looking at the sensitivity of attribute reduction to sustainability scores. The results of Leverage analysis on all attributes used in the ecological dimension show the highest value of 6.27 for mangrove tree utilization for fishing operations and the lowest value of 0.56 for the attribute of catching in coral reef areas (Figure 2).

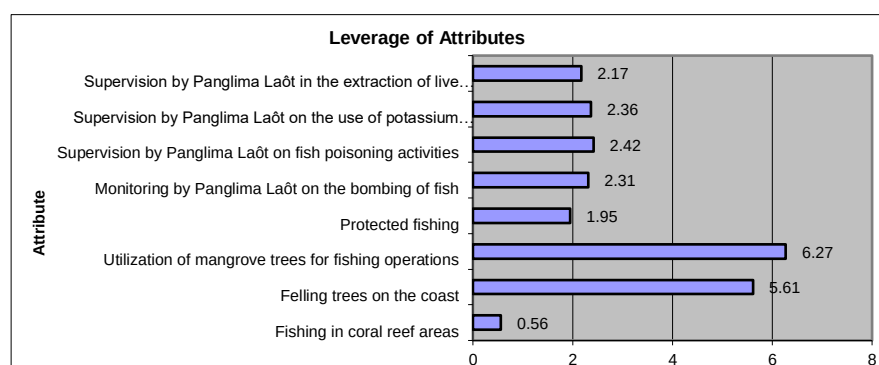


Figure 2. Leverage analysis result from attributes in the ecological dimension

On the basis of Figure 2, it can be concluded that the insufficient degree of sustainability is due to the fact that fishermen continue to use mangrove trees as pole wood in purse seine fishing operations. This wooden pole is used to prevent fish from fleeing the purse seine through an open space, which is consistent with the findings of Chaliluddin et al. (2015) and Yakob et al (2015).

2) Economical Dimension

There are eight criteria proposed on the economic dimension in the analysis of the sustainability of capture fisheries based on local wisdom in Lhok Kuala Gigieng, namely per capita income, alternative jobs, ownership (beneficiaries of ownership), fuel subsidies from the government, average income, profits (financial performance analysis), marketing of the catch, and business feasibility. The ordination analysis results using the score of each attribute on the economic dimension of capture fisheries activities at the research location are aimed at determining the relative position of each fishery activity to the ordinance, which is in the good range with a value of 100, and bad range with a value of zero.

Furthermore, the economic dimensions analysis results are plotted in an ordinance figure (Figure 3). Ordination analysis in the economic dimension with three iterations resulted in the value of squared correlation (R^2) of 94.74% and stress value (S) of 13.88%. The stress value reflects the goodness of fit in multi-dimensional scaling (MDS), which shows that the configuration size of a point can reflect the original data. A low-stress value indicates a good fit, while a high-stress value indicates the opposite condition. In the Rapfish model, the desired stress value is 25% less (Fauzi and Anna, 2005). Thus, the analysis of the economic dimension in this study shows the condition of the goodness of fit, considering the stress value obtained is 13.88% ($< 25\%$).

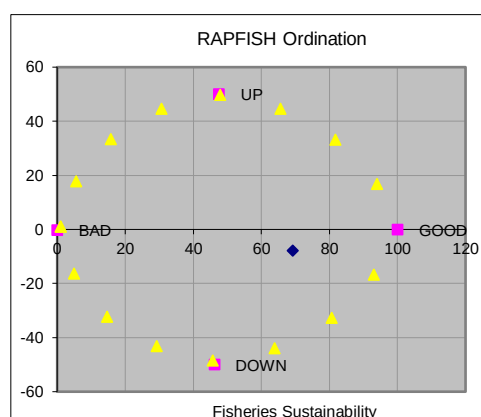


Figure 3. Economical dimension ordination

Based on Figure 3, the sustainability status of capture fisheries based on local wisdom in Lhok Kuala Gigieng is at the Moderate category level with a score of 69.08, and this corresponds to the category of the sustainability assessment status of Allahyari (2010), Aris et al. (2020) and Nurdinsyah et al. (2020). However, the results differ from Hidayah et al. (2020) research, which shows its sustainability status is at the Poor category level, with a sustainability index value of 36.08%. This result is also different from Mahida et al.'s (2019) research, where the results show that the sustainability status is at the level of the Good category. The results of this ordinance analysis will then be analyzed using Leverage to see the influential attributes in realizing the sustainability of capture fisheries.

The analysis of Leverage on all attributes used in the economic dimension shows that the figure of the business owner gets the highest value of 6.06 and the attribute of marketing of the catch gets the lowest value of 1.20 (Figure 4).

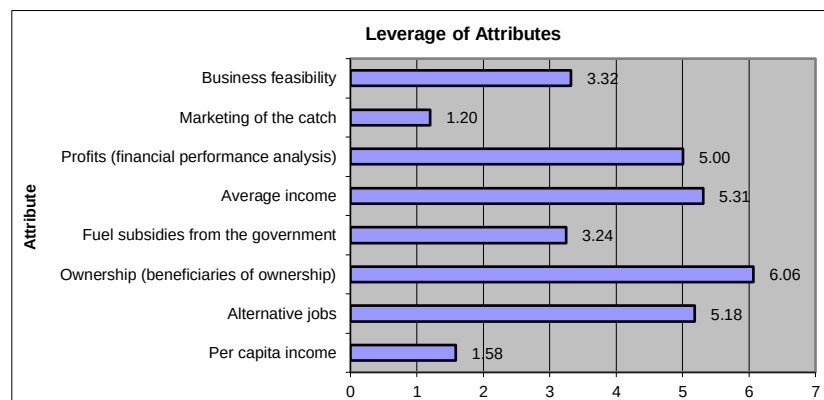


Figure 4. Leverage analysis results from attributes in the economic dimension

Figure 4 indicates that in order to raise the sustainability index of the capture fisheries category based on local knowledge, ship owners and local governments must pay special attention to the marketing of fishermen's catches. Therefore, when fishermen bring in a great haul, the price of fish does not immediately decrease. Similarly, when fishermen have a small catch, the selling price does not automatically increase (become more costly) just because there is less fish on the market. Then, it was highlighted that the difference in income between business owners and working anglers should not be too great, so that the per capita income of fishermen rises in tandem with the owner's income, allowing them to be compensated beyond the provincial minimum wage.

3) Social Dimension

There are nine criteria proposed in the analysis of the sustainability of capture fisheries based on local wisdom in Lhok Kuala Gigieng on the social dimension, namely knowledge of the environment and the surrounding area, participation of family members, the experience of fishermen, social status of fishermans towards *Panglima Laôt*, level of education of fishermans, frequency of conflicts with the existence of customary law of the sea, capture fisheries environment with provisions of customary law, socialization of the community regarding the rules of the customary law of the sea, and the frequency of meetings between residents and *Panglima Laôt*. The ordination analysis results using the score of each attribute on the social dimension of capture fisheries activities at the research location are intended to determine the relative position of each fishery activity to the ordinance, which is in the good range with a value of 100, and in the bad range with a value of zero.

Furthermore, the social dimension analysis results are plotted in an ordination figure (Figure 5). Ordination analysis in the economic dimension with three iterations resulted in a correlation squared value (R^2) of 95.40% and a stress value (S) of 13.58%. The stress value reflects the goodness of fit in multi-dimensional scaling (MDS), which shows that the configuration size of a point can reflect the original data. A low-stress value indicates a good fit, while a high-stress value indicates the opposite condition. In the Rapfish model, the desired stress value is 25% less (Fauzi and Anna, 2005). Thus, the analysis of the social dimensions in this study shows the condition of the goodness of fit, considering the stress value obtained is 13.88% ($< 25\%$).

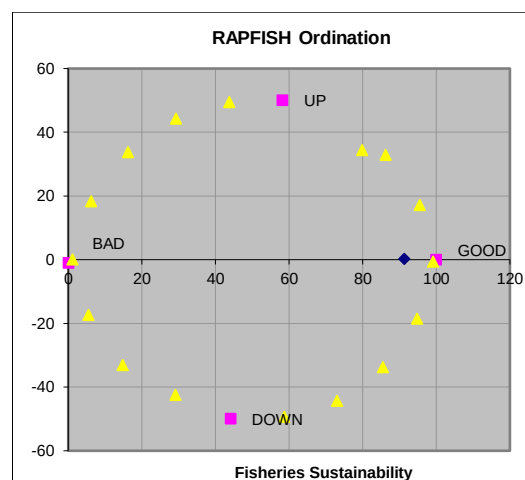


Figure 5. Social dimension ordination

Based on Figure 5, it can be explained that from the social dimension, the sustainability score is at the Good (very sustainable) category level with a score of 91.22. The results of this

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study are the same as those of Yacob et al. (2016) but different from the research of Vatria (2020) and Haya et al. (2020), where the sustainability score is at the level of the unsustainable category. The distinction in this study's findings is that fisherman in Lhok Kuala Gigieng are already familiar with and highly obedient to customary law regulations since Panglima Laôt administers Islam-based laws with consideration for social factors.

The results of the Leverage analysis on all the attributes used in the social dimension show that the attribute of fishermen's education level gets the highest value of 8.82 while the attribute of the frequency of meetings between residents and *Panglima Laôt* gets the lowest value of 0.75 (Figure 6).

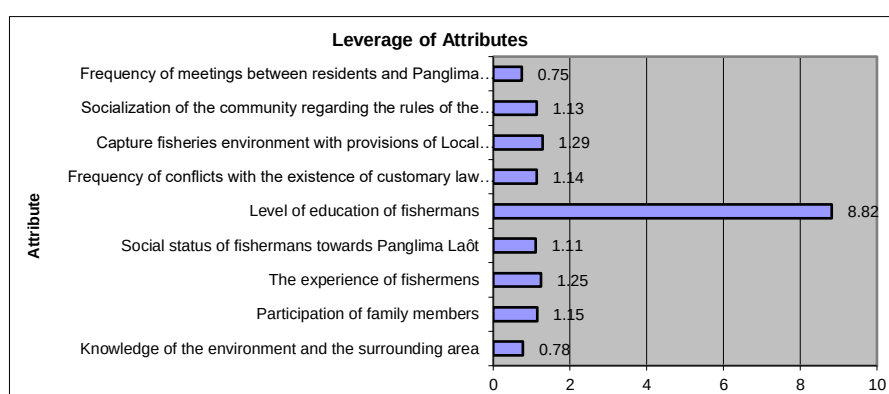


Figure 6. Leverage analysis results from attributes social dimension

According to Figure 7, the insufficient level of sustainability can be attributed to the fact that there are still a large number of poorly educated fisherman. Even some fisherman do not complete elementary school. The low quality of human resources is frequently accompanied by low productivity, which leads to low incomes and, ultimately, poverty.

4) Institutional Dimension

There are nine criteria proposed in the analysis of the sustainability of capture fisheries based on local wisdom in Lhok Kuala Gigieng on the institutional dimensions, namely the *Panglima Laôt* institution and its infrastructure, membership of the *Panglima Laôt* institution, supervision of fishing operations, the mechanism for selecting leaders, positive legal recognition of the *Panglima Laôt* institution, availability of local law enforcement personnel, enforcement of rules/sanctions for violators, justice in law, and benefits of local rules for fishermen. The ordination analysis results using the scores of each attribute on the institutional dimension of *Panglima Laôt* on capture fisheries activities at the research location are intended to determine the relative position of each fishery activity to the ordinance, which is in the good range with a value of 100, and in the bad range with a value of zero.

Furthermore, the analysis results of the institutional dimensions of the *Panglima Laôt* are plotted in an ordination drawing (Figure 7). Ordination analysis in the institutional dimension with the number of iterations is three times, resulting in a correlation squared value (R^2) of 95.31% and a stress value (S) of 13.26%. The stress value reflects the goodness of fit in multi-dimensional scaling (MDS), which shows that the configuration size of a point can reflect the original data. A low-stress value indicates a good fit, while a high-stress value indicates the opposite condition. In the Rapfish model, the desired stress value is 25% less (Fauzi and Anna, 2005). Thus, the analysis of the institutional dimensions of *Panglima Laôt* in this study shows the condition of the goodness of fit, considering the stress value obtained is 13.88% ($< 25\%$).

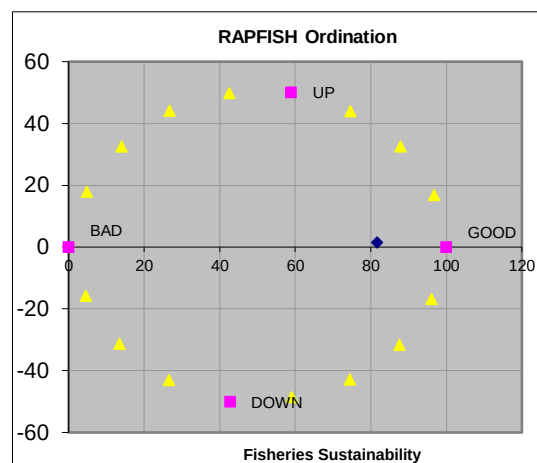


Figure 7. *Panglima Laôt* institutional dimension ordination

Based on Figure 7, it can be explained that from the institutional dimension, the sustainability score is in the Good category level with a score of 81.60 (very sustainable). The results of this study are the same as those of Yacob et al. (2016) but different from the research of Vatria (2020) and Haya et al. (2020), where the sustainability score is at the level of the unsustainable category. Nevertheless, this research is similar to the analysis of Soejarwo et al. (2019) and Hidayah et al. (2020), which received a sustainability index in the Good category. However, these results differ from Alfira et al. (2018) and Wahyudin et al. (2019), which received a sustainability index value in the unsustainable category.

The results of the Leverage analysis of all attributes used in the *Panglima Laôt* institutional dimension show that the attribute of supervision of fishing operations gets the highest value of 6.16 and the attribute of benefits of local rules for fishers gets the lowest value of 0.77 (Figure 8).

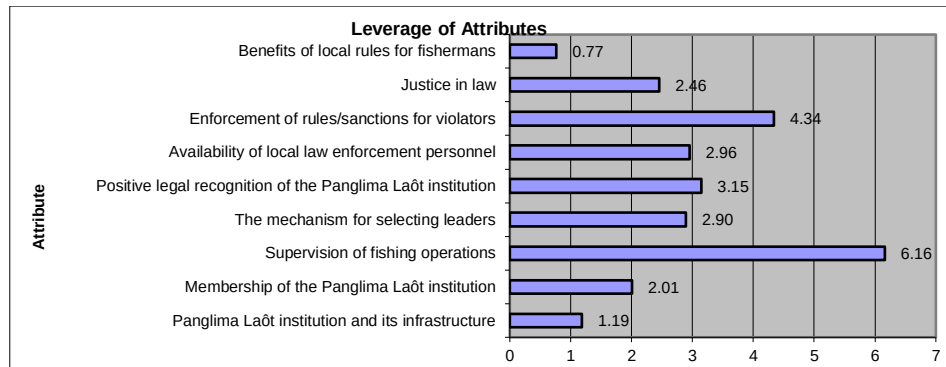


Figure 8. Leverage analysis results from attributes of the *Panglima Laôt* institutional dimension

The analysis of Leverage indicates that the value of the institutional dimension's sustainability index is affected by two factors: the influence of local figures and the supervision of fishing operations. The availability of law enforcement personnel and local supervisors is a crucial aspect in ensuring that the legal dimension of the institution governs fisheries resource management. In addition, fishermen should be included in the creation of policies to ensure the long-term viability of the fishing industry in order to strengthen their position as community leaders.

CONCLUSION

The research results on the sustainability of capture fisheries based on local wisdom in Lhok Kuala Gigieng show that; the ecological dimension of the sustainability index is in the Good (very sustainable) category with a value of 86.86. The results also show that the economic dimension is in the Moderate (quite sustainable) category with a value of 69.08, the social dimension is in the Good (very sustainable) category with a value of 91.22, and the institutional dimension is in the Good (very sustainable) category with a value of 81.60.

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References

- Akpalu W., & H. Eggert. 2021. The economic, social, and ecological performance of the industrial trawl fishery in Ghana : the Application of the FPIs. *Marine Policy*, 125 (March 2021), 104241.
- Alfira R., S. Djafar & I. Ilmiah. 2018. Sustainability Analysis of Mangrove Crab Utilization in Pangkajene and Kepulauan Coastal Areas District Rizky. *Journal of Agricultural Technology Education*, 1(December 2017), 38.
- Allahyari M. S. 2010. Social sustainability assessment of fisheries cooperative in guilan province, Iran. *Journal of Fisheries and Aquatic Science*, 5(3): 216-222.
- Aris M., A. Fahrudin, E. Riani & E. Muttaqin. 2020. Sustainability Analysis of the Marine Recreational Park (MRP) Management in Weh Island Based on Local Customary Law of the Sea (Hukum Adat Laot). *Journal of Humans and the Environment*, 25(1): 25 - 32
- Batubara S. C., M. S. Maarif, Marimin & H. E. Irianto. 2018. The Ideal Model of Supply Chain Management of Sustainability Industrial Capture fisheries in Maluku Province. *Marine Fisheries : Journal of Marine Fisheries Technology and Management*, 8(2): 137 - 148
- BPS. 2020. Aceh Besar dalam angka 2020. BPS Kabupaten Aceh Besar.
- Chaliluddin M.A., A. Purbayanto, D.R. Monintja, M. Imron & J. Santoso. 2015. Role of local wisdom in the utilization of the resource of Fish in the Aceh Jaya District, Indonesia. 2(3), 3–6.
- Haya L., M.Y. ode & M. Fujii. 2020. Assessment of coral reef ecosystem status in the Pangkajene and Kepulauan Regency, Spermonde Archipelago, Indonesia, using the rapid appraisal for fisheries and the analytic hierarchy process. *Marine Policy*, 118 (Agustus 2020), 104028.
- Hidayah Z., N.I. Nuzula, & D.B. Wiyanto. 2020. Sustainability Analysis of Fisheries Management in Madura Strait East Java. *Journal of Fisheries Universitas Gadjah Mada*, 22(2):101- 111
- Isigi N., N. Wambiji, S. Thomas, M.S. Allen, N. Robert & M. Ahrens. 2021. Challenges and opportunities for sustainable development and management of marine recreational and sport fisheries in the Western Indian Ocean. *Marine Policy*, 124 (2): 104351.
- Jimenez A., J. Guazzelli, M. Teixeira. 2021. Sustainability indicators for the integrated assessment of small-scale coastal fisheries in the Brazilian Amazon. *Journal of Ecological Economics*, 181 (March 2021): 106910.
- Kadagi N. I., N. Wambiji, S.T. Fennessy, M. S. Allen & R. N. M. Ahrens. 2021. Challenges and opportunities for sustainable development and management of marine recreational and sport fisheries in the Western Indian Ocean. *Marine Policy*, 124 (Februari 2021): 104351

- Mahida M., F.X. H. Kusumartono & P. G. Permana. 2019. Multidimensional Scaling Approach To Assess Sustainability Status of Lake Maninjau. *Jurnal Sosial Ekonomi Pekerjaan Umum*, 11(1), 29–43.
- Makino M. 2018. Understanding the integrated policy for harmonizing the marine ecosystem conservation and sustainable uses : a case of Sekisei lagoon, Japan.
- Nurdinsyah, M. A., M. Rosmiati, & G. Suantika. 2020. Sustainability Analysis And Management Strategy For White Shrimp Intensive Culture At Southern Coastal Area Of West Java. *Journal of Siosioteknology*, 19(3): 426–441.
- Pitcher, T. J., & D. Preikshot. 2001. RAPFISH: A rapid appraisal technique to evaluate the sustainability status of fisheries. *Fisheries Research*, 49(3), 255–270.
- Riza, M. S., Zulkarnaini, & Efriyeldi. 2019. Status Keberlanjutan Kawasan Lubuk Larangan Di Desa Pangkalan Indarung, Kabupaten Kuantan Singingi. *Environmental science journal*, 13(1): 66–80.
- Serpetti, N., A.R. Baudron, M.T. Burrows, B.L. Payne, P. Helaouët, P.G. Fernandes & J. J. Heymans. 2017. Impact of ocean warming on sustainable fisheries management informs the Ecosystem Approach to Fisheries. *Scientific Reports*, 7(1): 1–15.
- Soejarwo P. A., R. Yusuf & A. Zulham. 2019. Analysis of Seaweed Farming Business Sustainability in the East Sumba, East Nusa Tenggara. *Journal of Socio-Economic Marine and Fisheries*, 14(1): 37 - 46
- Vatria B. 2020. Evaluasi Keberlanjutan Mata Pencanharian Nelayan Gillnet Melalui Pendekatan Teknik Rapfish. *Manfish Journal*, 1(2): 115–128.
- Wahyudin I., M.M. Kamal, A. Fahrudin & M. Boer. 2019. Sustainability Analysis of Elasmobranch Fisheries in Tanjung Luar, East Lombok District. *Journal of Tropical Marine Science and Technology*, 11(1), 103–116.
- Yacob D., Taqwaddin & M.A. Chaliluddin. 2016. Analysis of the sustainability of capture fisheries in coastal and marine resource management based on local wisdom in Gampong Lambada Lhok, Aceh Besar District. *Journal of Disaster Science*, Universitas Syiah Kuala, 3(3), 100–104.
- Zulmansyah. 2017. *Panglima Laôt* and assistance to fishing communities. Universitas Islam Negeri Ar-Raniry, Banda Aceh.