Sustainability status of marine fisheries management based on code of conduct for responsible fisheries (CCRF) in Rokan Hilir Regency, Riau Province

Hazmi Arief, Darwis, Firman Nugroho, Chicka W. Yanti, Rindi Metalisa, Ulfa R. Pradini

Department of Socio-Economic Affairs, Faculty of Fisheries and Marine, Universitas Riau, Pekanbaru, Indonesia. Corresponding author: H. Arief, hazmi.arief@lecturer.unri.ac.id

Abstract. This research aims to evaluate the sustainability of marine fisheries management in Rokan Hilir Regency, based on the Code of Conduct for Responsible Fisheries (CCRF). The study took place from June to July 2024 in Rokan Hilir Regency. It utilized both primary and secondary data, with analysis conducted using the Rapfish method. The study examined various dimensions, including ecological, economic, social, institutional, and technological factors. The findings indicate that the sustainability status of capture fisheries resources in Rokan Hilir Regency is rated as fairly sustainable, with a score of 51.57. The ecological dimension received the highest score at 56.39 (fairly sustainable), followed by the economic dimension at 54.27 (fairly sustainable), the technological dimension at 51.81 (fairly sustainable), the institutional dimension at 50.96 (less sustainable), and the social dimension scored the lowest at 47.67 (less sustainable).
Key Words: fishermen, rapfish method, sustainable, small-scale fisheries.

Introduction. Coastal area management aims to improve the welfare of the community, especially small scale fisheries. Coastal fisheries play a vital role in supporting the livelihoods, food security, nutrition, and overall well-being of coastal communities. They are also a crucial aspect of ensuring the sustainability of fisheries resources (Stacey et al 2021; Adawiyah et al 2021; Warren & Steenbergen 2021; Putra & Rahaju 2022). The sustainability of fisheries is a challenge, given that fishery products are a necessity for current and future generations, so utilization rates will continue to increase in line with local and global consumption needs (Aguw et al 2021). On the other hand, fish stocks are renewable (Rinaldo et al 2019; Kristiana et al 2021). Imbalanced and unsustainable exploitation of resources can occur when their exploitation exceeds capacity or when fishing activities prioritize one aspect to the detriment of others (Hidayah et al 2020). Therefore, the sustainability of capture fisheries needs to be assessed comprehensively, covering various aspects, including ecological, economic, social, institutional, and technological aspects (Pradini & Arief 2022; Gea et al 2023).

Rokan Hilir Regency, one of the primary fish-producing regions in Riau Province, is home to a diverse array of marine capture fishery resources (Arief et al 2023). The fleet and fishing gear currently in use are relatively basic and require modernization to support sustainable fishing practices. The amount of production generated is still limited according to the fishing area based on the size of the fleet owned (2-3 GT). The total production of marine capture fisheries in Rokan Hilir reached 51006 tons in 2023, an increase from the previous production of only 51610 tons in 2022 (Department of Fisheries Rokan Hilir Regency 2023). The potential of marine capture fisheries resources is exploited using various types of fishing gear such as nets, traps, trammel nets, longlines, and other types of fishing gear.

The potential of abundant fisheries resources has lead fishermen to continuously exploit these resources to meet their livelihood needs (Ferina 2021). The utilization of fishery resources should be carried out through regulated fishing practices that prioritize sustainability. However, in some cases, fishing activities may occur uncontrollably and persistently, often exacerbated by the introduction of excessive fleets and fishing gear. This can lead to the overexploitation of both of small and large fish species, posing a significant threat to ecosystems and jeopardizing the long-term sustainability of fishery resources. If this increase in use is not taken into account, it can have a negative impact on existing fish stocks and lead to their unsustainability (Marasabessy et al 2018; Bayyinah et al 2021).

The sustainability status of capture fisheries management in Rokan Hilir Regency underscores the challenges of implementing policies that effectively plan and develop fish resource utilization in accordance with sustainable fisheries principles. These principles encompass ecological, economic, social, institutional, and technological dimensions, which are interconnected and vital for achieving sustainable and environmentally sound fisheries development, as outlined in the Code of Conduct for Responsible Fisheries (CCRF).

The problem-solving approach in this research aims to identify and analyze the sustainability status of ecological, economic, social, institutional, and technological aspects of marine capture fisheries management in Rokan Hilir Regency. The main objective is to address issues related to the sustainability of fish resources and to improve the welfare of coastal communities, particularly small-scale fishers. In this case, the research aims to understand how the principles of sustainable fisheries can be applied to the management of marine capture fisheries in Rokan Hilir District. In addition, this research also aims to identify the leverage attributes that influence the management of marine capture fisheries in Rokan Hilir Regency, which can then be used as a basis for stakeholders to make policy in the waters of Rokan Hilir Regency by multidimensionally reviewing for the realization of sustainable fisheries.

Material and Method. The study was conducted from June to July 2024 in Rokan Hilir Regency, Indonesia. This research utilizes both primary and secondary data. Primary data was collected through direct fieldwork, focusing on the ecological, economic, social, institutional, and technological conditions of fisheries resources in Rokan Hilir Regency. This data was gathered through interviews with fishermen and various relevant stakeholders. Secondary data was sourced from available records in related agencies, such as the Department of Fisheries and Bappeda Rokan Hilir, which include fisheries production statistics, the number of fishing gear, and fleet information. The study involved 90 respondents, all of whom were fishermen operating in the WPP 571 Malacca Strait, along with 8 stakeholders, including representatives from the Department of Fisheries, fisheries extension workers, academics, and community leaders in Rokan Hilir Regency.

Data analysis. The Rapfish software (Rapid Appraisal for Fisheries) employs a multidimensional scaling method to assess the sustainability of capture fisheries management. This analysis encompasses five dimensions: ecological, economic, social, institutional, and technological aspects (Irawan et al 2022). Rapfish is a rapid, multidisciplinary, and objective method for assessing the sustainability of fisheries. It evaluates various aspects of sustainability through attributes or indicators that align with the FAO Code of Conduct for Responsible Fisheries. These attributes are analyzed using multidimensional scaling to establish two reference points: good and bad.

This research utilizes 39 attributes, including 7 attributes within the ecological dimension: the level of fishery exploitation, trends in Catch Per Unit Effort (CPUE), the level of collapse, the size of fish caught, immature catch (pre-maturity), discarded bycatch, and target species); eight attributes within the economic dimension: employment of local labor, access to capital, fishery product marketing, fisher average income, income contribution to the district/province's GDP, revenue sources from capture fisheries for fishermen, ownership, and level of fisheries subsidies; eight attributes within the social dimension: development of the number of fishers, education level of fishers,

status and frequency of conflicts, economic empowerment programs for fishers, involvement of fishers in decision-making, participation of family members, role of fishers in sustainability, and frequency of extension and training; eight attributes within institutional dimension: the role of fishermen in policy, socialization of legislation, the presence of fishermen groups in fisheries management, availability and role of local community leaders, institutional conflicts, the role of formal institutions supporting fisheries resource management, illegal fishing, and justice in law; eight attributes within technology dimension: fish landing sites, boat size, type of boat engine, use of fishing gear, type/nature of fishing gear, environmentally unfriendly fishing, fish handling before sale, and technological assistance from the government.

The scores are based on field observations, interviews, and questionnaires. Scores range from 1 to 4, depending on the circumstances of the study site. Bad scores indicate the least favorable conditions for sustainability management, whereas good scores signify the most favorable conditions for sustainability management (Erwina et al 2015; Hartati et al 2021). The sustainability index scale ranges from 0-100. In this study, four categories of sustainability status were defined (Patawari et al 2022): 0-25 (unsustainable), 26-50 (less sustainable), 51-75 (quite sustainable), and 76-100 (sustainable). According to Kavanagh (2001), the Rapfish method utilizes Monte Carlo analysis, conducted 25 times, to ascertain the error value. Furthermore, leverage analysis is performed to identify which attributes within each sustainability dimension are the most influential. Leverage analysis was used to identify sensitive attributes that influence sustainability. There are three rules for determining the sustainability level of attributes: a) the law of extremes, b) the law of the mean (RMS value exceeding the average or mean value), and c) the Pareto optimality principle. The method for identifying sensitive attributes related to sustainability employs a 75% Pareto analysis by aggregating attributes with the highest RMS values (Hutasuhut et al 2024). The stress value can measure how close the distance value of two dimensions is to the multidimensional distance value. The quality of the analysis is evaluated using two metrics: the stress value (denoted as S) and the coefficient of determination (R^2). A strong analysis is defined by a low stress value ($S<0.25$) and a high R^2 value, which suggests that the multidimensional scaling model aligns well with the data (Pitcher & Preikshot 2001; Kavanagh & Pitcher 2004). Validity testing was performed through Monte Carlo analysis, which compared the sustainability index to the Monte Carlo index value. This analysis included a series of simulations aimed at evaluating how different uncertainties, such as those associated with scoring and the ordination process, affect the sustainability status of capture fisheries in the Rokan Hilir Regency.

Results and Discussion

Ecological dimension. The ecological dimension serves as the foundation for the utilization of fisheries resources, while also prioritizing environmental conservation to prevent environmental harm (Junaidi et al 2022). According to the Rapfish analysis, the sustainability index for the ecological dimension of capture fisheries management in Rokan Hilir Regency is 56.39, as illustrated in Figure 1.

The ecological dimension's sustainability status falls within the quite sustainable range, with a score between 51 and 75. Leverage analysis identifies three key sensitive attributes influencing this dimension: size of fish caught (RMS=8.51), level of collapse (RMS=7.02), and trend in catch per unit effort (RMS=6.29). The identification of these sensitive attributes was achieved through a combination of leverage analysis and Pareto analysis (Kusbimanto et al 2013).

Economic dimension. The economic dimension aims to optimize capture fisheries that can yield economic benefits or be financially sustainable for fishermen. The Rapfish analysis indicates that the sustainability index for the economic dimension of capture fisheries management in Rokan Hilir Regency is 54.27 (Figure 2).

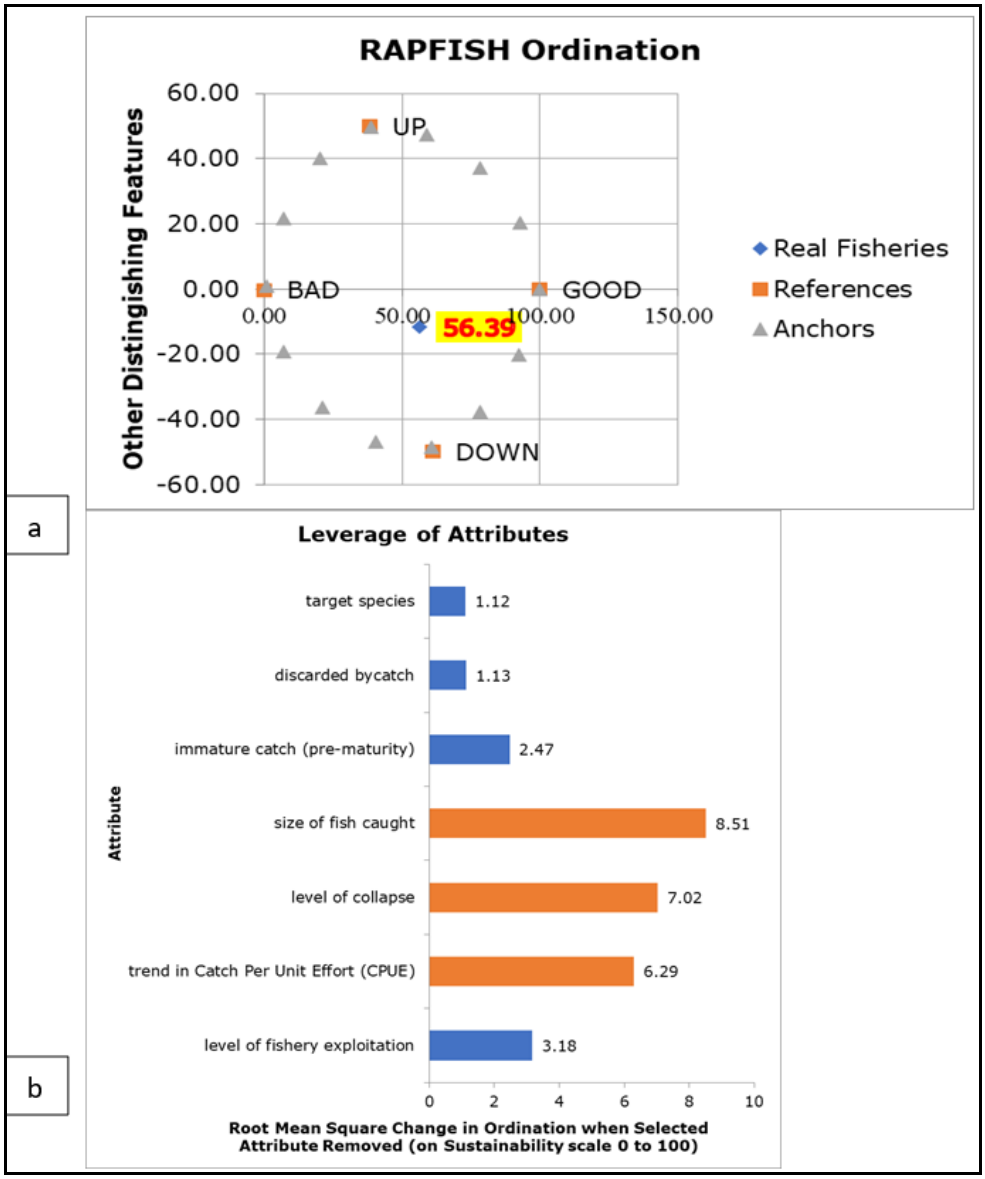

Figure 1. Sustainability index values (a) and leverage analysis in ecological dimension (b).

The sustainability status of the economic dimension is classified as quite sustainable, with a score ranging from 51 to 75. According to the leverage analysis, the three sensitive attributes influencing the economic dimension are the average income of fishermen (RMS=9.01), revenue sources from capture fisheries for fishermen (RMS=7.46), and ownership (RMS=5.72). These three sensitive attributes need to be evaluated to ensure the sustainability of capture fisheries management in Rokan Hilir Regency. The first sensitive attribute, the average income of fishermen, is below the regional minimum wage in Rokan Hilir, which could impact the sustainability of resources as it may drive fishermen to exploit fisheries resources excessively to earn higher income. The second sensitive attribute is the income source from fisheries for fishermen in the research location, where fishing is the main occupation. The income from capture fisheries plays a significant role in the fishermen's economy, leading them to strive for excessive catches. The third sensitive attribute is the ownership of fishing gear in the research location, which is locally owned. Maintaining local community ownership of fishing gear is essential, as a lack of control over ownership may result in heightened resource exploitation.

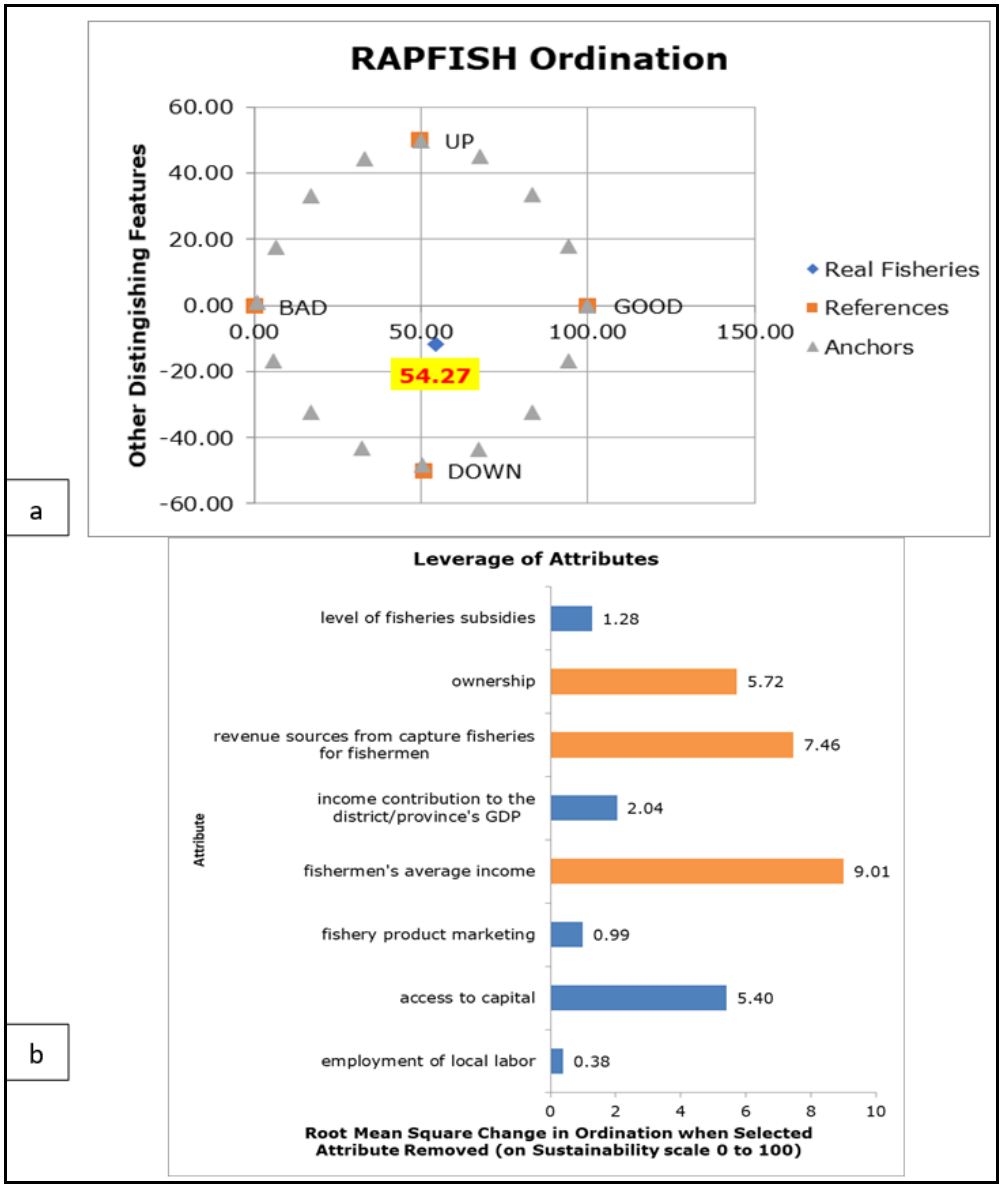

Figure 2. Sustainability index values (a) and leverage analysis in economic dimension (b).

Social dimension. According to the Rapfish analysis, the sustainability index for the social dimension of capture fisheries management in Rokan Hilir Regency stands at 47.67 (Figure 3).

The sustainability status of the social dimension is categorized as less sustainable, with a score ranging from 26 to 50. Leverage analysis identifies three sensitive attributes that impact this dimension, including the involvement of fishers in decision-making (RMS=6.80), status and frequency of conflicts (RMS=6.07), and education level of fishers (RMS=2.89). These three sensitive attributes need to be evaluated to ensure the sustainability of capture fisheries management in Rokan Hilir Regency. The first sensitive attribute, the involvement of fishers in decision making at the research site, can be concluded to be lacking. Fisher involvement is crucial, so that fishers are no longer objects, but subjects who have the right to determine a better future for themselves. The second sensitive attribute, the status and frequency of conflicts, is a social disturbance because fishers feel unsafe in carrying out fishing activities. Prolonged conflicts can lead to a decrease in catch and directly result in a decreased income, causing fishers to expand their fishing areas and engage in other violations to compensate for the income loss due to conflicts. The third sensitive attribute, the education level of fishers, will affect the utilization and management patterns of fisheries resources. Low levels of fisher

education will impact the sustainability of capture fisheries. This is in line with the research by Siswanto & Nugraha (2016), which states that the average education level of fisher communities in the coastal areas of Madura is only at the elementary school level.

Institutional dimension. Institutional dimension is related to the rules and regulations that form the basis of management and the organization that implements the management. The Rapfish analysis indicates that the sustainability index for the institutional dimension of capture fisheries management in Rokan Hilir Regency is 50.96, as illustrated in Figure 4.

The institutional dimension is classified as less sustainable, with a score ranging from 26 to 50. Leverage analysis identifies four sensitive attributes affecting this dimension: institutional conflicts (RMS=5.51), illegal fishing (RMS=4.08), the role of formal institutions in supporting fisheries resource management (RMS=3.32), and the socialization of legislation (RMS=2.71).

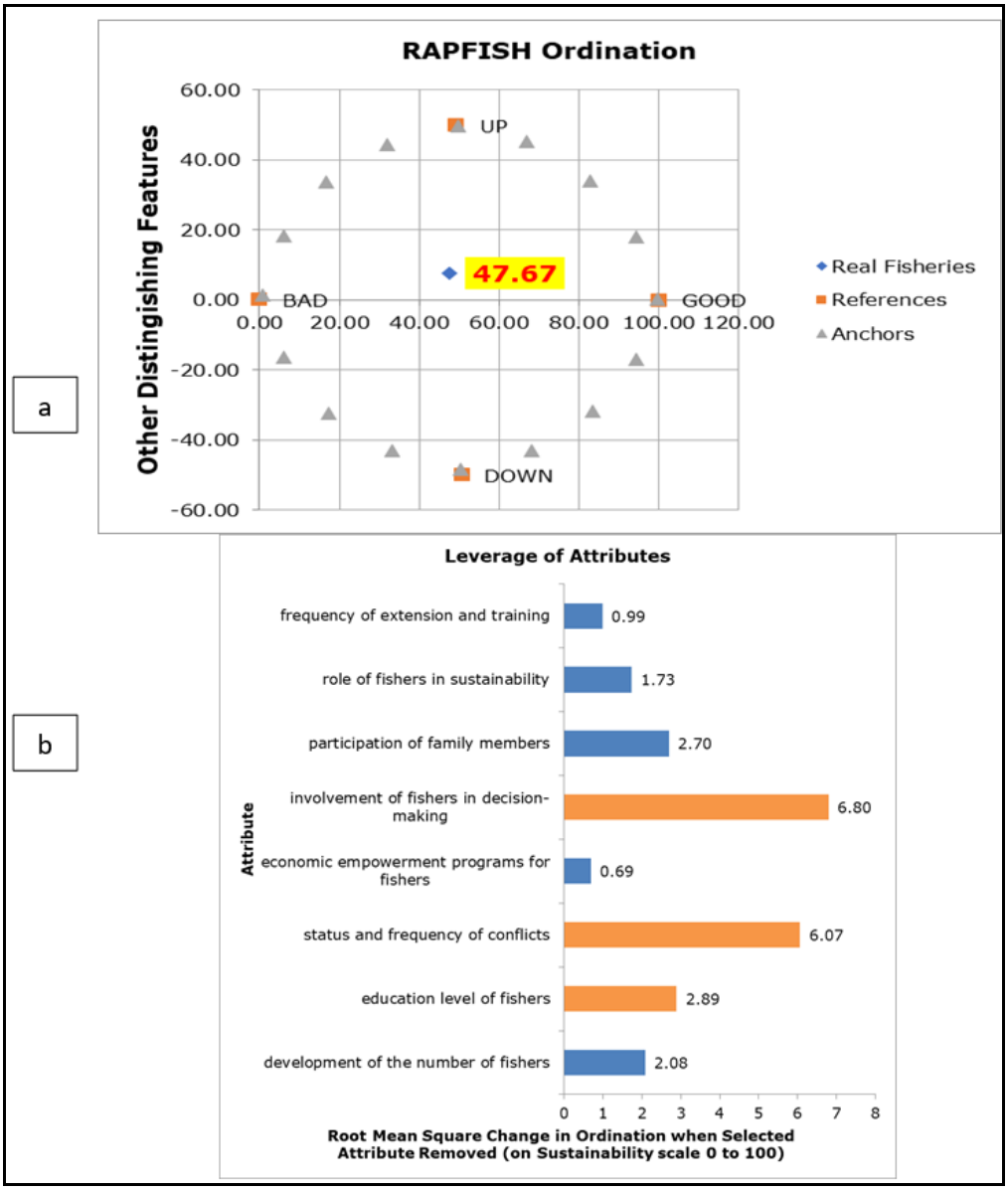

Figure 3. (a) Sustainability index values and (b) leverage analysis in social dimension.

These attributes should be assessed to prevent disruptions in the sustainability of capture fisheries management in Rokan Hilir Regency. Institutional conflict is the most sensitive

attribute. Based on interviews with fishermen, there have been no institutional conflicts among fishermen in Rokan Hilir Regency. This needs to be maintained, as conflicts can affect the sustainability of capture fisheries management. The second sensitive attribute, illegal fishing, is a prohibited activity in the utilization of fisheries resources, constituting a violation of the law (Chapsos & Hamilton 2018; Kuemlangan et al 2023). The third sensitive attribute is the role of formal institutions in supporting fisheries resource management. As per interviews with fishermen, these institutions have not significantly contributed to fisheries resource management. Their role is crucial in various aspects such as monitoring fishing areas, overseeing regulation implementation, and other activities related to fisheries resources.

Technological dimension. The technology dimension is related to efforts to increase the efficiency and effectiveness of fishing. According to the Rapfish analysis, the sustainability index for the technological dimension of capture fisheries management in Rokan Hilir Regency is 51.81 (Figure 5).

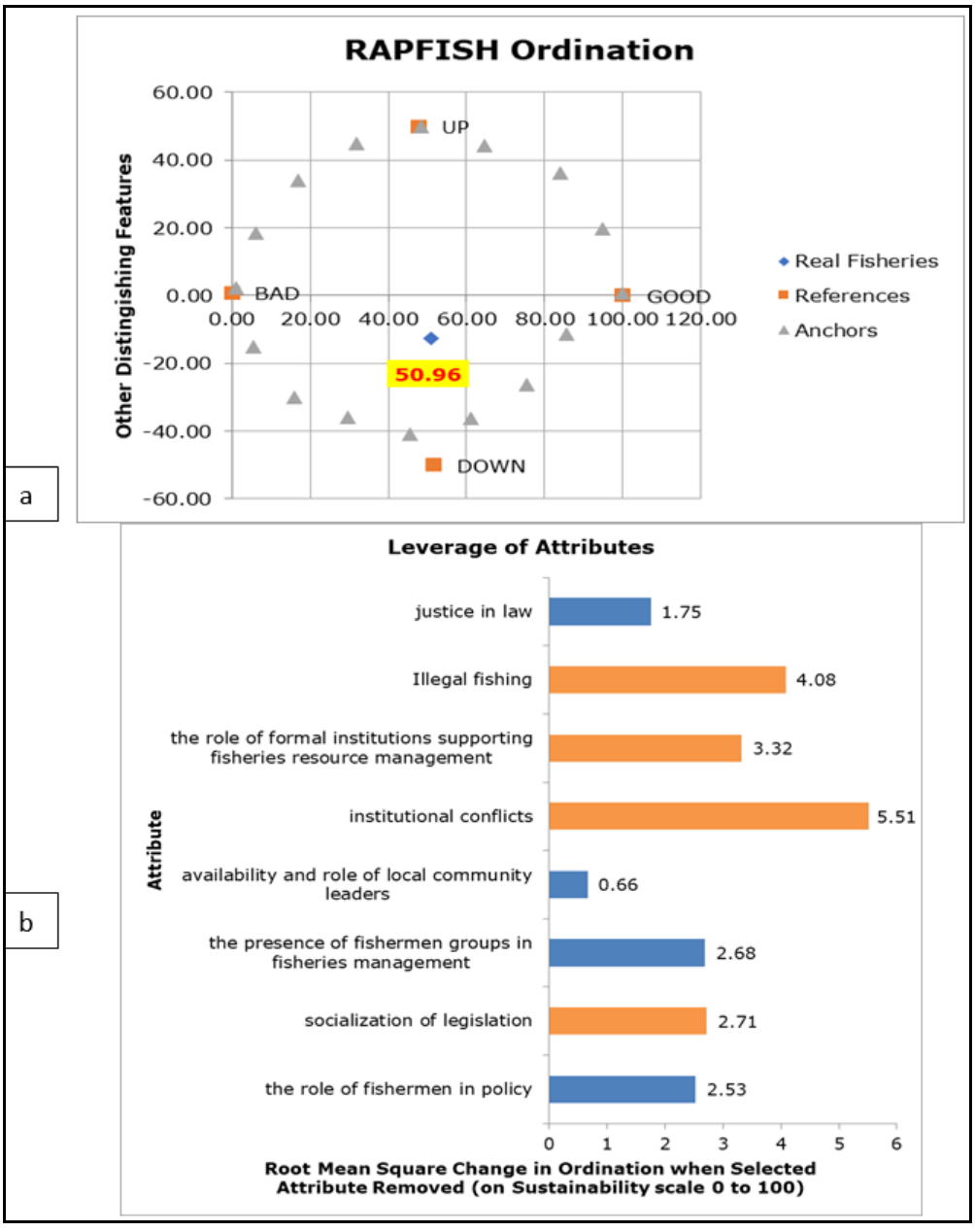

Figure 4. (a) Sustainability index values and (b) leverage analysis in institutional dimension.

The sustainability status of the technological dimension is categorized as quite sustainable (score between 51-75). Based on the leverage analysis results, only one sensitive attribute affects the technological dimension, namely the type/nature of fishing gear (RMS=5.47). This sensitive attribute needs to be evaluated to ensure that it does not disrupt the sustainability of capture fisheries management in Rokan Hilir Regency. In the technological dimension, the type or nature of fishing gear has the highest RMS value, but this does not have a negative impact on the sustainability of capture fisheries.

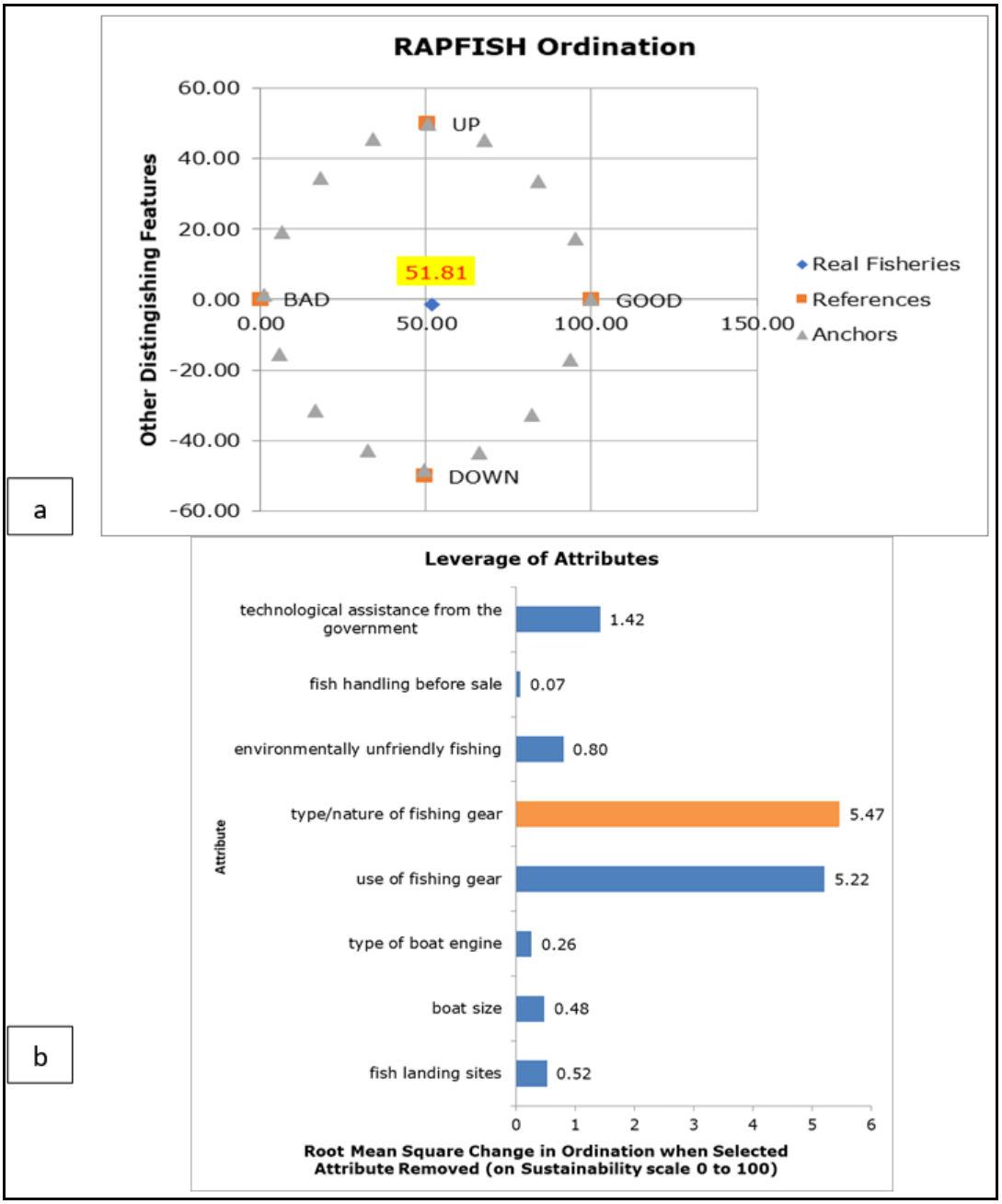

Figure 5. Sustainability index values (a) and leverage analysis in technological dimension (b).

The fishing gear used in Rokan Hilir Regency can be divided into two groups based on the way it works: static fishing gear and dynamic fishing gear. The primary type of fishing gear used in Rokan Hilir Regency is the gill net. The use of gillnet does not pose a risk to fishermen, as they are introduced into the water, while the boat is in motion (Lisna et al 2018; Grimaldo et al 2018).

Sustainability status of capture fisheries in a multidimensional approach. Based on the partial Rapfish results obtained for each dimension, the sustainability index values are as follows: ecological dimension 56.39 (quite sustainable), economic dimension 54.27 (quite sustainable), social dimension 47.67 (less sustainable), institutional dimension 50.96 (less sustainable), and technological dimension 51.81 (quite sustainable). The sustainability status values derived from the MDS analysis for each dimension are illustrated in kite diagrams, offering a clearer overview of the sustainability status across various dimensions (Figure 6).

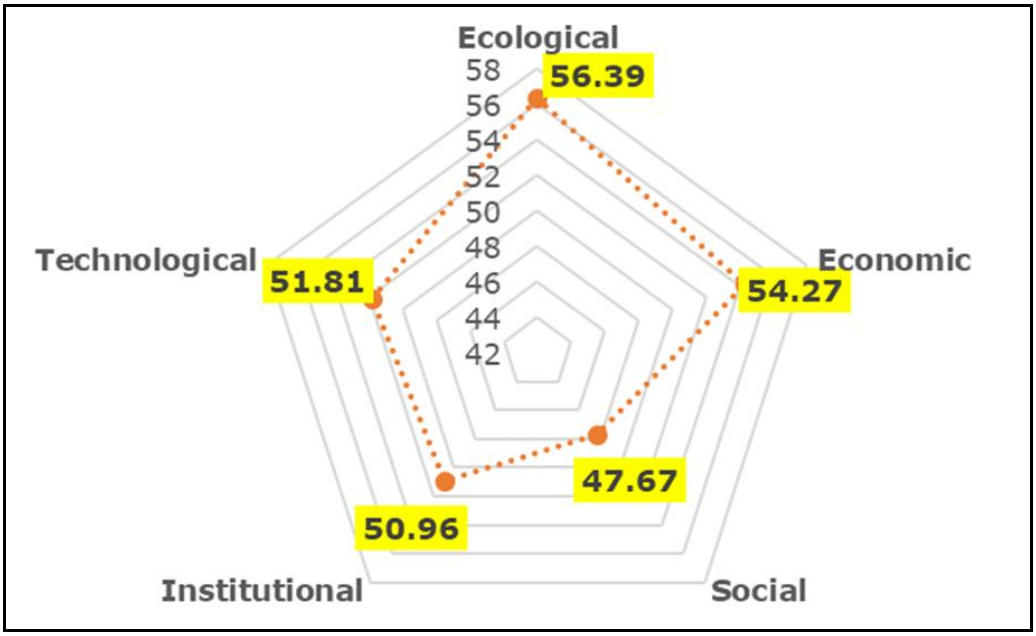

Figure 6. Kite diagram of capture fisheries in Rokan Hilir Regency.

Based on the weighting results between sustainability dimensions, it was found that the level of multidimensional sustainability of the capture fisheries in Rokan Hilir Regency is quite sustainable. The position of the kite diagram points indicates the sustainability status based on the analyzed dimensions. Values or indexes approaching 100 indicate a better sustainability status, and conversely, approaching 0 indicates a worse sustainability status (Pitcher & Preikshot 2001). Therefore, this kite diagram can show which attributes and dimensions are used for consideration in fisheries management.

Validity test and accuracy test of multidimensional scaling (MDS). The results of the MDS sustainability index in relation to the Monte Carlo simulations are shown in Table 1.

Table 1

Comparing multidimensional scaling (MDS) and Monte Carlo sustainability index scores

Dimension	*MDS (%)*	*Monte Carlo (%)*	*Difference (%)*
Ecological	56.39	56.24	0.15
Economic	54.27	53.56	0.71
Social	47.67	48.20	0.53
Institutional	50.96	50.40	0.56
Technological	51.81	51.75	0.06

Table 1 shows that the sustainability index obtained from each dimension is not very different. Fauzi & Anna (2005) states that a difference of less than 5% suggests minimal scoring errors for each attribute, limited variation due to differing opinions, stable results

from repeated analyses, and the ability to avoid data entry mistakes. Thus, it is known that the sustainability analysis of capture fisheries in Rokan Hilir Regency conducted using the Rapfish method has a high level of confidence.

Goodness of fit. The fit of the MDS analysis is assessed through the stress value, with a score below 0.25 signifying a good model fit (Alder et al 2000). In this research, the analysis produced a stress value under 0.25, indicating that the model is dependable and appropriate for evaluating the effectiveness of sustainable capture fisheries management in Rokan Hilir Regency, as illustrated in Table 2.

Table 2

Goodness of fit assessment parameter

Dimension	*Stress*	R^2
Ecological	0.14	0.94
Economic	0.14	0.94
Social	0.14	0.95
Institutional	0.14	0.95
Technological	0.14	0.95

The accuracy of the MDS analysis (goodness of fit) based on the Rapfish results yielded a coefficient of determination (R^2) between 0.94-0.95 or 94-95%, which means that the sustainability index estimation model is good and adequate for use (Kavanagh 2001). The stress value obtained was 0.14. This determination value approaches 95-100% and the stress value is less than 25%, indicating that the MDS analysis model obtained has high accuracy in assessing the sustainability index of capture fisheries in Rokan Hilir Regency.

Conclusions. The sustainability status of capture fisheries resources in Rokan Hilir Regency, with a score of 51.57, is considered fairly sustainable. This suggests that current efforts align with the principles outlined in the Code of Conduct for Responsible Fisheries (CCRF). CCRF emphasizes the importance of managing fisheries resources sustainably in ecological, economic, social, institutional, and technological aspects. The ecological dimension, which has the highest score (56.39), reflects good efforts in maintaining environmental balance, in line with the CCRF principle of promoting conservation and responsible resource utilization. However, the lower scores in the social and institutional dimensions indicate the need for improvement in terms of social justice and institutional roles, which are also the main focus of CCRF in promoting active community participation and fair law enforcement. Therefore, to achieve truly responsible and sustainable fisheries management, further efforts are needed to strengthen the social and institutional dimensions in accordance with CCRF guidelines.

Acknowledgements. The authors would like to express their gratitude to the colleagues who assisted during the experiments. This study was funded by LPPM Universitas Riau under the Riset Unggulan Universitas Riau scheme, with Contract Number 14825/UN.19.5.1.3/AL.04.2024.

Conflict of Interest. The authors declare that there is no conflict of interest.

References

Adawiyah S. E., Hermanto A., Yasya W., Kristanti R., Chrisye M., 2021 [Access to natural resources on poverty and food security]. Sosio Informa 7(2):172-185. [In Indonesian].

Aguw Y. O., Waha C. J. J., Karwur D. B., 2021 [Utilization of fisheries resources based on law enforcement and justice in the marine and coastal areas of North Sulawesi Province]. Lex et Societatis 9(3):67-79. [In Indonesian].

Alder J., Pitcher T. J., Preikshot D., Kaschner K., Ferriss B., 2000 How good is good?: A rapid appraisal technique for evaluation of the sustainability status of fisheries of the North Atlantic. Fisheries Center 8(2):136-182.
Arief H., Yanti C. W., Metalisa R., Pradini U. R., 2023 Potential and utilization level of giant tiger prawn (*Penaeus monodon*) in Rokan Hilir Regency, Riau Province. AACL Bioflux 16(6):2973-2982.
Bayyinah A. A., Nurkhasanah D., Elinah, 2021 [Analysis of environmentally semi trammel net based on code of conduct responsibilities fisheries (CCRF) in Cirebon waters]. Jendela ASWAJA 2(2):1-9. [In Indonesian].
Chapsos I., Hamilton S., 2018 Illegal fishing and fisheries crime as a transnational organized crime in Indonesia. Trends in Organized Crime 22(3):255-273.
Erwina Y., Kurnia R., Yonvitner, 2015 [Sustainability status of fishery resources in the waters of Bengkulu]. Jurnal Sosial Ekonomi Kelautan dan Perikanan 10(1):21-34. [In Indonesian].
Fauzi A., Anna S., 2005 [Modeling fisheries and marine resources for policy analysis]. Gramedia Pustaka Utama, Jakarta, 343 p. [In Indonesian].
Ferina N. N. D. A., 2021 [Adaptation strategies of fishermen in Kenjeran, Sukolilo Larangan Subdistrict, Surabaya Regency, East Java Province in facing their ecology]. Jurnal Indonesia Sosial Teknologi 2(1):115-127. [In Indonesian].
Gea E. K., Warningsih T., Arief H., 2023 [Sustainability status of four-finger threadfin (*Eleutheronema tetradactylum*) management in Sinaboi Sub-District Rokan Hilir District, Riau Province]. Jurnal Perikanan dan Kelautan 28(3):316-323. [In Indonesian].
Grimaldo E., Herrmann B., Tveit G. M., Vollstad J., Schei M., 2018 Effect of using biodegradable gill nets on the catch efficiency of Greenland Halibut. Marine and Coastal Fisheries 10(6):619-629.
Hartati H., Martini E. S., Marissa F., Ridhowati S., 2021 Sustainability study of household scale fisheries management using RAPFISH modified method: a case study in Sungsang 1, Banyuasin II District. AACL Bioflux 14(2):953-964.
Hidayah Z., Nuzula N. I., Wiyanto D. B., 2020 [Sustainability analysis of fisheries management in Madura Strait East Java]. Jurnal Perikanan Universitas Gadjah Mada 22(2):101-111. [In Indonesian].
Hutasuhut W. R., Hendrik, Arief H., 2024 Sustainability of vaname shrimp (*Litopenaeus vannamei*) farming in Bantan District Bengkalis Regency Riau. Asian Journal of Aquatic Sciences 7(3):412-421.
Irawan A., Karyoto, Alamsyah H. K., 2022 [Sustainability status and leverage factors of ecological and economic dimensions in capture fisheries management in Tegal City]. Jurnal Perikanan dan Kelautan 12(2):132-142. [In Indonesian].
Junaidi R., Efizon D., Adriman, 2022 [Sustainability status of management terubuk fish (*Tenualosa macrura*) in Bengkalis District]. Asian Journal of Aquatic Sciences 5(2):301-314. [In Indonesian].
Kavanagh P., 2001 RAPFISH: A rapid appraisal technique to evaluate the sustainability status of fisheries. Fisheries Research 49:255-270.
Kavanagh P., Pitcher T. J., 2004 Implementing Microsoft Excel software for Rapfish: A technique for the rapid appraisal of fisheries status. Fisheries Centre Research Reports 12(2):1-75.
Kristiana H., Malik J., Anwar N., 2021 Estimation of the status of small-scale fisheries resources in Semarang City. Journal of Tropical Fisheries Management 5(1):51-58.
Kuemlangan B., Amidjogbe E.-R., Nakamura J., Tomassi A., Hupperts R., Bojang B., Amador T., 2023 Enforcement approaches against illegal fishing in national fisheries legislation. Marine Policy 149:105514.
Kusbimanto I. W., Sitorus S. R. P., Machfud, Poerwo I. F. P., Yani M., 2013 [Sustainability analysis of urban transportation infrastructure development in the Mamminasata Metropolitan area of South Sulawesi Province]. Jurnal Jalan-Jembatan 30(1):1-15. [In Indonesian].

Lisna, Vincentia A., Noferdiman, Amelia J. M., 2018 [Inventory of fishing gear in Tungkal Ilir District, Tanjung Jabung Barat, Jambi]. Aquasains 6(2):595-600. [In Indonesian].
Marasabessy I., Fahrudin A., Imran Z., Agus S. B., 2018 Sustainable coastal and marine management strategies of Nusa Manu and Nusa Leun Islands in Central Maluku Regency. Journal of Regional and Rural Development Planning 2(1):1-22.
Patawari A. M. Y., Anna Z., Hindayani P., Dhahiyat Y., Hasan Z., Putri I. A. P., 2022 Sustainability status of small-scale fisheries resources in Jakarta Bay, Indonesia after reclamation. Biodiversitas 23(4):1715-1725.
Pitcher T. J., Preikshot D., 2001 RAPFISH: A rapid appraisal technique to evaluate the sustainability status of fisheries. Fisheries Research 49:255-270.
Pradini U. R., Arief H., 2022 Sustainability status of baung fish in public waters, Kampar Regency, Riau Province. IOP Conference Series: Earth and Environmental Science 1118:012078.
Putra T. S., Rahaju T., 2022 [Community empowerment in coastal areas in Kupang Village, Jabon Subdistrict, Sidoarjo District]. Policy and Maritime Review 1(1):24-34. [In Indonesian].
Rinaldo I., Diamantina A., Soemarmi A., 2019 [Development of regulation and implementation of fisheries supervisory duties in Indonesia]. Diponegoro Law Journal 8(1):433-442. [In Indonesian].
Siswanto A. D., Nugraha W. A., 2016 [Sampang's coastal problems and potentials]. Jurnal Kelautan 9(1):12-16. [In Indonesian].
Stacey N., Gibson E., Loneragan N., Warren C., Wiryawan B., Adhuri D. S., Steenbergen D. J., Fitriana R., 2021 Developing sustainable small-scale fisheries livelihoods in Indonesia: trends, enabling and constraining factors, and future opportunities. Marine Policy 132:104654.
Warren C., Steenbergen D. J., 2021 Fisheries decline, local livelihoods and conflicted governance: An Indonesian case. Ocean & Coastal Management 202:105498.
*** Department of Fisheries Rokan Hilir Regency, 2023 [Total capture fishery production]. 88 p. [In Indonesian].

Received: 18 September 2024. Accepted: 01 November 2024. Published online: 10 April 2025.
Authors:
Hazmi Arief, Department of Socio-Economic, Faculty of Fisheries and Marine Affairs, Universitas Riau, HR. Soebrantas Street, Pekanbaru, 28293 Riau, Indonesia, e-mail: hazmi.arief@lecturer.unri.ac.id
Darwis, Department of Socio-Economic, Faculty of Fisheries and Marine Affairs, Universitas Riau, HR. Soebrantas Street, Pekanbaru, 28293 Riau, Indonesia, e-mail: muhammaddarwis.alriaui@gmail.com
Firman Nugroho, Department of Socio-Economic, Faculty of Fisheries and Marine Affairs, Universitas Riau, HR. Soebrantas Street, Pekanbaru, 28293 Riau, Indonesia, e-mail: fnoegroho@gmail.com
Chicka Willy Yanti, Department of Socio-Economic, Faculty of Fisheries and Marine Affairs, Universitas Riau, HR. Soebrantas Street, Pekanbaru, 28293 Riau, Indonesia, e-mail: chicka@lecturer.unri.ac.id
Rindi Metalisa, Department of Socio-Economic, Faculty of Fisheries and Marine Affairs, Universitas Riau, HR. Soebrantas Street, Pekanbaru, 28293 Riau, Indonesia, e-mail: rindi.metalisa@lecturer.unri.ac.id
Ulfa Rizki Pradini, Department of Socio-Economic, Faculty of Fisheries and Marine Affairs, Universitas Riau, HR. Soebrantas Street, Pekanbaru, 28293 Riau, Indonesia, e-mail: ulfarizkipradini28@gmail.com

How to cite this article:
Arief H., Darwis, Nugroho F., Yanti C. W., Metalisa R., Pradini U. R., 2025 Sustainability status of marine fisheries management based on code of conduct for responsible fisheries (CCRF) in Rokan Hilir Regency, Riau Province. AACL Bioflux 18(2):836-847.