

Welfare level of traditional fishermen in the Karimunjawa Islands

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Abstract. This study aims to analyze the welfare level of traditional fishers in the Karimunjawa Islands using a multidimensional approach that integrates economic and social indicators. The study was conducted on Karimunjawa Island and Kemujan Island, the two largest islands in the Karimunjawa Islands, from November 2025 to January 2026. The research approach used the quantitative survey, with the unit of analysis of traditional fishing households operating traditional fishing gear (including handlines, spears, and scoop nets). A total of 100 respondents were selected through a purposive sampling method, where the respondent criteria were the head of the household was an active fisherman and that traditional fishing was his primary source of livelihood. The analysis results indicate that the welfare level of traditional fishers in the Karimunjawa Islands is in the moderate category (score 2.20). The lowest-scoring welfare indicators generally relate to average years of schooling, budget expenditures, and fresh water sources, while the highest-scoring indicators generally relate to housing conditions and drinking water sources. These findings emphasize the importance of a multidimensional approach to assessing the welfare of traditional fishers as a basis for formulating more equitable and sustainable coastal management policies.

Key Words: Karimunjawa, multi-gears fishing, policy, socio-economics, traditional fishers.

Introduction. Traditional fishers are a socio-economic group that is highly dependent on the sustainability of coastal and marine resources, particularly in developing countries, including the Karimunjawa Islands (Indonesia). This dependence makes the welfare of small-scale fishers highly vulnerable to environmental degradation, fluctuations in fishing seasons, and changes in coastal resource management policies. In the Karimunjawa Islands (Jepara Regency), the majority of coastal communities rely on small-scale fishing for their livelihoods using traditional fishing gear, primarily handlines. This situation makes fishing households highly sensitive to ecological changes, restrictions on access to fishing grounds due to conservation area zoning, and increasing pressure from tourism developing in Karimunjawa. Then, it becomes crucial to find the institutional factors that support the stability of fishers livehold (Aceves-Bueno et al 2023).

Fishermen's welfare cannot be confined solely to income indicators but encompasses economic, social, and subjective dimensions. Access to fishery resources, economic resilience to seasonal catch variability, market access, and perceived life satisfaction are important components in assessing the welfare of traditional fishers. Therefore, a multidimensional approach is increasingly recommended in small-scale fisheries studies to capture the complexity of fishers' socio-economic conditions (Eriksson et al 2019; FAO 2024).

The Karimunjawa Islands are a marine conservation area aimed at protecting coral reef ecosystems and biodiversity. The implementation of marine protected areas (MPAs) has the potential to provide long-term ecological benefits, such as fish stock recovery and resource spillover effects. However, conservation policies can also have short-term socio-economic impacts on fishers if not accompanied by adequate participatory mechanisms, compensation, or alternative livelihoods, including gender empowerment (Charles et al 2016; Westlund et al 2017; Stacey et al 2021; Turnbull et al 2021).

In addition to economic factors, non-economic aspects such as education, health, social connectivity, and access to information technology also influence the welfare of small-scale fishers (Putri et al 2024). Based on these conditions, this study aims to analyze the welfare of traditional fishers in the Karimunjawa Islands using a multidimensional approach that integrates economic and social indicators. The research results are expected to provide a scientific basis for formulating coastal management and marine conservation policies oriented towards ecological sustainability and improving fishers' welfare.

Material and Method

Location and time of research. This research was conducted in the Karimunjawa Islands (5°40'39"– 5°55'00" S and 110°05' 57"–110°31' 15" E), specifically on Kemujan Island and Karimunjawa Island, the two largest islands in the archipelago (Figure 1). The study was conducted from November 2025 to January 2026.

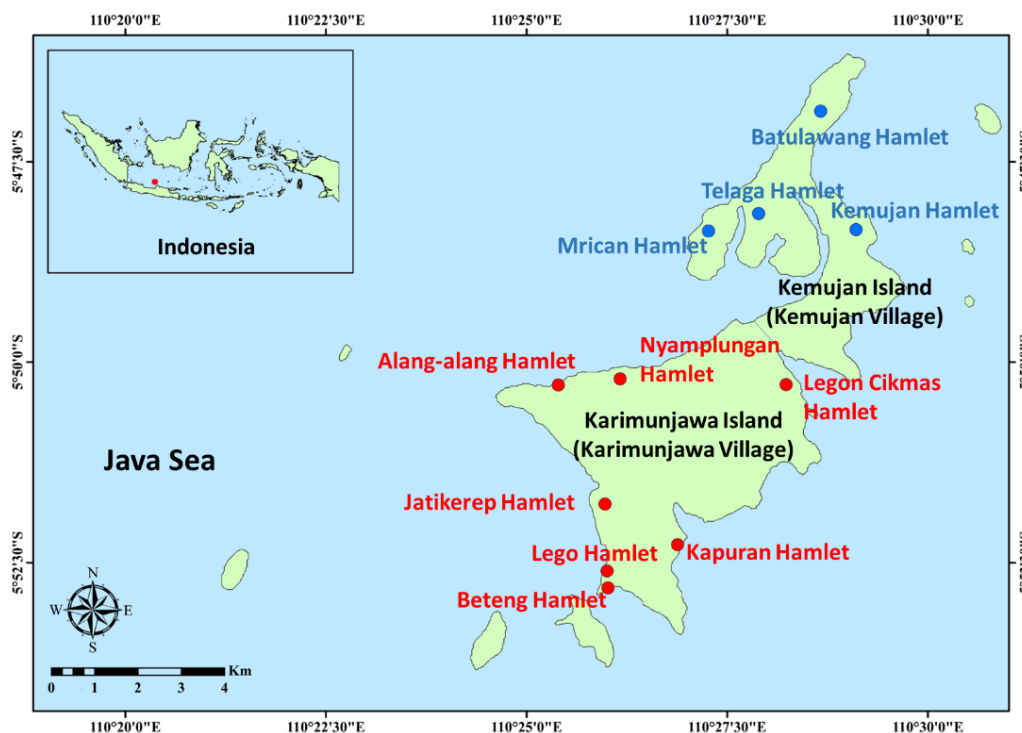


Figure 1. Research location.

Research design and sampling technique. This study used a quantitative socio-economic survey approach. The unit of analysis was traditional fishing households using traditional fishing gear (including handlines, spears, and scoop nets). A total of 100 respondents were selected using a purposive sampling method with the following criteria: (1) the head of the household works as an active fisherman, and (2) relies on traditional fishing as the primary source of income. This approach is commonly used in studies of the welfare of small-scale fishers to ensure the relevance of the data to the research objectives (Allison & Ellis 2001; Béné et al 2009).

Data collection. Primary data were collected through structured interviews using a questionnaire. The information collected included household socioeconomic characteristics, fisheries income, consumption expenditure, access to health services, and ownership of productive assets.

Fishermen's welfare analysis. Fishermen's welfare was analyzed using a multidimensional approach with reference to BPS (people's welfare in 2024) which includes socio-economic indicators (Table 1). Each indicator was scored from 1 to 3, with a score of 1 indicating low welfare, a score of 2 indicating moderate welfare, and a score of 3

indicating high welfare. Economic indicators included household income, boat ownership, and budget allocation. Social indicators included housing conditions (household ownership, type of flooring, walls, and roof), and access to health and education facilities. This study used welfare indicator from Central Bureau of Statistics (BPS) 2024. The 2024 BPS indicator assessment approach is widely used in studies of the welfare of fishermen and coastal households to maintain a comparative balance of socio-economic conditions.

Table 1

Welfare indicator	Welfare indicator		
	Score		
	1	2	3
Income (IDR/month)	< Minimum wage*	1.0-1.2 minimum wage*	> 1.2 minimum wage*
Average years of schooling	< 12 years	12-15 years	> 15 years
Boat ownership	No boat	Own 1 boat	Owns \geq 2 boats
Employed family members	Only head of household	2 people in one household	> 2 people in one household
Expenditure budget	Food consumption budget > 50% of income	Food consumption budget 30-50% of income	Food consumption budget < 30% of income
House ownership	Boarding/rental	Owned by parents	Self-owned
Building area per capita**	< 7.2 m ²	7.2-9.0 m ²	> 9.0 m ²
House floor type	Earthen floor	Cement plaster	Ceramic
House wall type	Wood/bamboo	Half wall	Wall
House roof type	Asbestos, zinc	Tile, without ceiling	Tile with ceiling
Toilet	Public toilet	Family toilet (outside house)	Family toilet (inside house)
Family transportation tool	None	1 item (motorcycle)	2 item or more (motorcycle, car)
Freshwater source	Well	Local water company supplier	More than 1 source
Drinking water source	Well	Spring	Refillable water from supplier
Access to health facilities (Community Health Center)	Far (more than 5 kilometers)	1-5 kilometers	Near (less than 1 kilometer)
Access to high school educational facilities	Far (more than 5 kilometers)	1-5 kilometers	Near (less than 1 kilometer)

Note: *The minimum wage for Jepara Regency in 2025 is IDR 2.61 million/month (Central Java Governor Regulation Number 561/45 of 2024); ** minimum standard of building area: 7.2 m²/capita (BPS 2024).

Data analysis. Data were analyzed descriptively and quantitatively to describe the welfare of small-scale fishers. Scores for each indicator were summed and then averaged to obtain a household welfare score. Welfare categories were determined based on the average score: a score < 1.67 indicates low welfare, a score of 1.67-2.33 indicates moderate welfare, and a score > 2.33 indicates high welfare.

Results and Discussion. The Karimunjawa Islands are located in the Java Sea, approximately 80 km north of Java, and consist of more than 20 small islands. This area has been designated a marine national park due to its rich coral reef, seagrass, and mangrove ecosystems. Most coastal communities in Karimunjawa rely on small-scale artisanal fisheries for their livelihoods, using traditional fishing gear such as handlines, and spearfishing. Artisanal fishers play a crucial role in strengthening local food security but

are highly vulnerable to environmental changes, seasonal changes, and conservation area management policies (Yuliana et al 2020; FAO 2024).

Respondent profile. All respondents in this study were artisanal fishers, with diverse fishing gear characteristics and socioeconomic conditions (Figure 2). Handlines were the dominant fishing gear, while a small number of respondents used spears and scoop nets. The dominance of hand-line fishing indicates that fishing activities in the study area are still small-scale, selective, and adapted to the characteristics of coral reef waters and conservation area regulations. This pattern aligns with previous findings in the Karimunjawa Islands and other small-scale fishing areas in Indonesia (Stacey et al 2021).

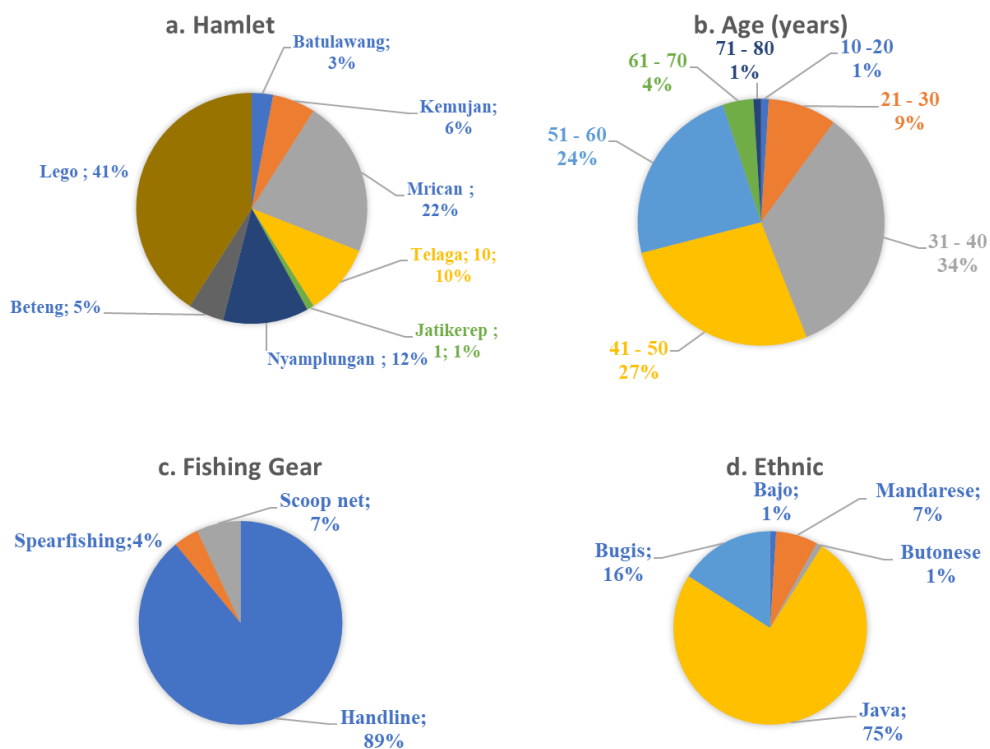


Figure 2. Respondent profile.

Demographically, respondents varied in age, with an average age of 44.03 years. This age structure reflects the dominance of experienced fishers in traditional fishing activities, but also indicates limited involvement of younger generations in the fisheries sector. Similar conditions have been reported in various small-scale fishing communities in Southeast Asia, where the fisheries sector faces challenges to regeneration due to income uncertainty and increasing alternative livelihood options (Cinner et al 2009; Eriksson et al 2019).

The socio-economic conditions of respondents indicate varying levels of welfare. Differences in income, ownership of productive assets, housing conditions, and access to health and education services indicate heterogeneity in welfare among fishermen households. This variation is influenced by the type of fishing gear, fishing intensity, and access to resources and markets. This welfare heterogeneity is consistent with the multidimensional welfare approach in small-scale fisheries studies, which emphasizes that fishers' welfare is determined not only by economic factors but also by social and institutional dimensions (Wibowo et al 2023; Wijayanto et al 2023).

Welfare level. The welfare level of fisher respondents shows a tendency for traditional fishers in the Karimunjawa Islands to be in a moderate condition. The lowest indicator is access to educational facilities, while the highest indicator is access to drinking water.

The result from welfare analysis from Karimunjawa fishers shows that the overall condition of fishermen is in the moderate category with an average score of 2.20 (Table 2). In terms of physical assets, such as house ownership, building quality, boat ownership, and

access to drinking water and sanitation, the level of welfare is considered prosperous. However, several socioeconomic aspects still show weaknesses, particularly in the areas of education, the number of employed family members, and access to educational family facilities, which are classified as less prosperous. The fishers household income is classified into middle income class, but expenditure is quite high because the majority of income is spent for basic needs. This indicates that although housing and asset conditions are good, improving the quality of human resources and diversifying income sources is still urgently needed. Karimunjawa Island and Kemujan Island also experience limited supplies of freshwater, especially during the dry season. Several wells are brackish water, so people of Karimunjawa Island and Kemujan Island tend to use refilled water as a source of drinking water supplier. This refilled water service is provided by refilled drinking water depots that use filtration technology (using sand and activated carbon filters), ultraviolet (UV), and ozonation to kill bacteria.

Table 2

Welfare level of Karimunjawa fishermen

<i>Welfare indicators</i>	<i>Min</i>	<i>Max</i>	<i>Average</i>	<i>Notes</i>
Income (IDR/month)	1	3	1.85	Moderate, average IDR 2.88 million per month
Average years of schooling	1	3	1.25	Low, most only graduated from elementary school
Boat ownership	2	3	2.84	Most own boats
Employed family members	1	3	1.19	Mostly depend solely on the working head of the household
Expenditure budget	1	3	1.54	Not welfare, average 66% of income for food needs
House ownership	1	3	2.89	Welfare, most own their own house
Building area per capita	1	3	2.94	Affluent, average 17.4 m ² per capita
House floor type	1	3	2.92	94% use ceramic tiles
House wall type	1	3	2.89	93% use walls
House roof type	1	3	2.41	55% use tiles with a ceiling
Toilet	2	3	2.88	88% have a family toilet inside the house
Family transportation tool	2	3	2.02	Moderate, all respondents own a motorcycle
Fresh water source	1	2	1.62	62% use water from local water company supplier, 38% use well
Drinking water source	1	3	2.98	Welfare, 99% use refilled drinking water
Access to health facilities (Community Health Center)	1	3	1.95	Moderate
Access to high school educational facilities	1	1	1.00	Not welfare
Overall			2.20	Moderate

Source: observational research on fishermen in Karimunjawa, 2024.

Discussion. Generally the fisher in Karimunjawa can be categorized into moderate level of welfare. The welfare of traditional fishers is influenced by the interaction of several dimensions, including economic (income and ownership of productive assets), access to resources, human capabilities (education, and health), market access, infrastructure conditions, social capital (including social networks and cooperatives), and adaptive capacity to external shocks. Income from marine catches and ownership of productive capital (including boats and fishing gear) determine a household's ability to meet basic needs (Stacey et al 2021; Zharif et al 2022). Furthermore, access to broader markets and

opportunities for business diversification (including aquaculture and tourism services) can improve income stability and long-term welfare (Aceves-Bueno et al 2023).

Fish marketing in the Karimunjawa Islands is dominated by 15 fish collectors in Kemujan Village and 8 fish collectors in Karimunjawa Village. Fishermen in the Karimunjawa Islands tend to have relationships with fish collectors (patron-client). If they need capital or funds for living expenses, they will borrow from collectors (fish trader). Consequently, they must sell their catch to collectors to repay their debts, with collectors determining the price of the fish. Fishermen's ability to utilize advances in information technology can be enhanced to improve access to information on fish prices, weather forecasts, and market potential, thereby improving the welfare of small-scale fishers (Putri et al 2024). Institutional factors such as compliance and participation in MPA management, and the effectiveness of local governance have been shown to mediate the impact of conservation on the welfare of coastal communities (Cinner et al 2009; Eriksson et al 2019). The absence of fisheries cooperatives on Karimunjawa and Kemujan Islands highlights the need to strengthen fisher institutions. In Karimunjawa, hand lines are the dominant fishing gear for coral reef fisheries, with catches generally consisting of diverse species (including squid, mackerel, red snapper, and yellowtail) with an average small to moderate size. Handline fishing captures a relatively broad trophic spectrum, but is not as efficient as spearfishing for coral reef fish species (Humphries et al 2019; Hapsari et al 2023).

Traditional fishers in Karimunjawa face structural and situational constraints. First, they face barrier in accessing resources and establishing MPA zones. Restrictions on fishing areas without compensation or alternative livelihoods have the potential to cause economic vulnerability for some fishing households (Eriksson et al 2019). Secondly, limited production capital (vessels, fuel, freezers, and fishing gear) limits productivity and the capacity to respond to fluctuations in catches. Third, weak market access and supply chains (the dominant role of fish collectors and limited logistics infrastructure) can reduce fish prices and profit margins for fishers (Stacey et al 2021). Fourth, vulnerability to shocks (including climate change and seasonality) can reduce the frequency of fishing trips and lower incomes. This requires a business diversification strategy that is often difficult to implement in some coastal areas and small islands (Uddin et al 2022; Al-Hafidz et al 2024). Fifth, workforce regeneration, where the high average age of fishermen and the low interest of the younger generation threaten the sustainability of a skilled workforce (Cinner et al 2009). Sixth, fishermen's education also hinders their understanding of the situation and conditions in Karimunjawa, which directly restricted zone borders a designated National Park area. Some fishermen consider fishing zone restrictions detrimental and hinder access to employment. This is also influenced by fishermen's lack of basic knowledge about environmental sustainability (Putro et al 2016). Finally, limited institutional capacity (including community involvement in policy design, financial support, and technical training) hinders the implementation of equitable and effective solutions (Campbell et al 2013; FAO 2024). Karimunjawa is home to several ethnic groups, the majority of whom are Javanese. Inter-ethnic relations in Karimunjawa are relatively good. The common languages spoken are Indonesian and Javanese. Several ethnic groups living in Karimunjawa have maritime cultural characteristics, such as the Bugis, Buton, Bajo, and Mandar (Nirmala 2018).

Several studies suggest the need for a holistic approach to improve the welfare of fishers, including: (1) designing participatory peace and alternative livelihood schemes when implementing MPA zoning; (2) strengthening market access (cold chain infrastructure and fish marketing cooperative institutions) and digital literacy for fishers; (3) expanding access to microfinance and technical capacity building programs; and (4) integrating multidimensional welfare indicators into MPA monitoring to ensure social outcomes in addition to ecological ones (Stacey et al 2021; Turnbull et al 2021). This approach, if implemented effectively, could help balance conservation goals and improve the welfare of small-scale fishers in Karimunjawa.

Conclusions. The study of artisanal fisher welfare level in Karimunjawa can be categorized as moderate welfare level. The welfare level indicators that refer to the lowest score is access to educational facilities, meanwhile the highest indicator score is drinking water

sources. These results demonstrate the importance of multidimensional welfare studies, not solely using an economic approach. Improving the welfare of fishermen in the Karimunjawa Islands requires strengthening fishermen's institutions, diversifying businesses, empowering gender equality, and providing necessary public facilities. Furthermore, fishermen's knowledge is crucial for understanding Karimunjawa's status as a conservation area, ensuring a synergy between resource interests and welfare.

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

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