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Livelihood Status as Small Scale Fishers on The North Coast of Madura Island, Indonesia

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Livelihood Status as Small Scale Fishers on The North Coast of Madura Island, Indonesia

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ABSTRACT

The fisheries sector plays an important role in the economy and food security, especially for coastal communities. This condition makes fishermen often face constraints related to limited resources, including access to natural, financial, social, physical and human resources. This study aims to analyze the livelihood status of small-scale fishers on the north coast of Madura using the Livelihood Assessment Index (LAI). The research was conducted in Banyu Sangkah Village, Tanjung Bumi Sub-district, Bangkalan District, and Pasongsongan Village, Pasongsongan Sub-district, Sumenep District, from June to December 2024. The research sample consisted of 200 fishermen using simple random sampling technique. Data were collected through observations and interviews, then analyzed using descriptive analysis and LAI. The results show that fishermen face challenges in natural and financial capital, with the potential of ecotourism that has not been maximized and low financial literacy. Meanwhile, physical, human, and social capital are better, reflected in the ownership of adequate fishing gear, high literacy levels, and good social relations.

Keywords: Livelihood Assessment Index, North Coast of Madura, Small Scale Fishermen

INTRODUCTION

The fisheries sector in Indonesia plays an important role in the national economy and food security, especially for coastal communities. The development of total fisheries production in Indonesia has shown an increasing trend, especially in the last two decades, making Indonesia the second largest producer of fisheries and aquaculture products in the world after China (Muslim et al., 2023; Su et al., 2020). According to the Ministry of Marine Affairs and Fisheries (2023) in 2023 fisheries production increased by 4%, from 22.26 million tons in 2022 to 23.13 million tons in 2023. This increase is the result of the synergy of government policies, technological innovation, and increased human resource capacity in the fisheries sector (Efendi et al., 2023; yasrizal et al., 2023). This great potential is also

supported by Indonesia's ocean area, which is one of the largest in the world, and the existence of 17,001 islands spread across the archipelago (Badan Pusat Statistik, 2023). This is able to make a major contribution in the economic, environmental and social fields for coastal communities (Natasya Azhar, 2024).

Madura's marine fisheries production in 2022 reached 111,612 tons (BPS, 2023). In particular, Bangkalan and Sumenep districts are dominated by pelagic and demersal fish, such as tuna, mackerel, snapper, sardines, and layur. However, the diversity of fish species has decreased due to various climatic factors, such as weather fluctuations, erratic rainfall, storms and high waves. This has an impact on fisheries productivity in the Madura region (Pratama & Nugraha, 2021). The decreasing abundance of fish makes it difficult for fishermen to meet the basic needs of their families, such as food, education, and health (Wayudi et al., 2023). The decline in fishermen's fishing income has a significant impact on the economic and social conditions of coastal communities because fishing is their main source of livelihood (K. Tikadar et al., 2021). On the other hand, a fisherman's livelihood also determines the social status and welfare of the family and the fishing community as a whole. When catches decline, their ability to fulfill their needs is jeopardized, which in turn weakens their economic and social status in the community. Conversely, when catches increase, the livelihood status of fisher households also improves because higher income allows for more stable fulfillment of daily needs (Andriani & Nuraini, 2021).

The existence of small-scale fisheries in coastal Madura not only provides income from fishing, but also creates various derivative business opportunities that have the potential to improve the welfare of local communities by providing additional income (Sunariyah et al., 2024). However, fishermen often experience problems related to inadequate income and limited business capital, which causes a welfare gap (Adha et al., 2021) In addition, the lack of alternative livelihoods is a problem for coastal fishermen in Bangkalan and Sumenep, where almost the entire community depends on fishing for income (Salim, 2018). The absence of buffer forests or access to viable agricultural land makes fishermen entirely dependent on fishing. The sustainable livelihoods approach suggests that fishermen's income, employment and food security are entirely dependent on the catch (Islam et al., 2014). However, fishermen's income often does not make ends meet due to their dependence on natural conditions (Pattimahu et al., 2023), coupled with limited finances that force many fishermen to rely on informal loans due to lack of access to formal financing (K. K. Tikadar

et al., 2022). The Livelihood Assessment Index (LAI) analysis will assist in understanding the strengths and weaknesses of fishers' livelihood assets, such as human, financial, physical, natural and social capital. This information can be used as a basis for formulating more effective strategies to improve fishers' welfare (Ahmed et al., 2021a).

It is important to analyze the livelihood status of small-scale fishers using the Livelihood Assessment Index (LAI) developed based on the Sustainable Livelihood Framework (SLF). The SLF is used to evaluate the livelihood status of households and identify issues of concern for small-scale fishing communities in terms of livelihood assets such as human, financial, physical, natural and social capital (Vatria, 2021). In addition, not many have conducted similar research on livelihood assessment focusing on fisher households in coastal areas using the Livelihood Assessment Index by considering various aspects of livelihoods. Therefore, the purpose of this study is to analyze the livelihood status of small-scale fishers on the north coast of Madura using the Livelihood Assessment Index.

RESEARCH METHOD

This research was conducted on the north coast of Madura Island, namely Banyu Sangkah Village, Tanjung Bumi Subdistrict, Bangkalan District, and Pasongsongan Village, Pasongsongan Subdistrict, Sumenep District from June to December 2024. The determination of the research location was carried out purposively. Bangkalan and Sumenep districts were chosen because they have the highest value and capacity of marine capture fisheries on Madura Island, with a total volume of 47,667 tons and 26,607 tons. The value of capture in Bangkalan district reached Rp1,029,332,098 and Sumenep district reached Rp1,350,309,659 (BPS, 2024). Banyu Sangkah and Pasongsongan villages were chosen because they have fishing ports, namely PPI Banyu Sangkah UPT PPP Pasongsongan, which show great potential in the field of capture fisheries.

The types and sources of data used in this research are primary data. Primary data was collected through observation and in-depth interviews with fishermen of Banyu Sangkah and Pasongsongan Villages using questionnaires to assess the livelihoods of small-scale fishers using a livelihood assessment index of five livelihood capitals as well as gaining a deeper understanding of human, financial, physical natural and social capital. The questions in the questionnaire were organized in an open-ended form to allow for a wide range of answers and relevant data to complete the research.

The population of this research is small-scale fishermen in Banyu Sangkah Village, Bangkalan Regency and Pasongsongan Village, Sumenep Regency consisting of crew members and fishing masters, namely 4,000 in Banyu Sangkah Village and 1,660 in Pasongsongan Village, so that the total population of fishermen is 5,660. Then from this population, a sample of 200 fishermen was taken. According to Giner-Sorolla et al. (2024) using 200 samples is a good compromise between accuracy and efficiency. The larger the sample size, the higher the cost and time required, so this size is often chosen to maintain this balance. The sampling method used in this study is a simple random sampling approach. In this method, each individual has an equal chance of being selected in the sample from the population (Stockemer, 2018). The simple random sampling method ensures that everyone in a population has an equal probability of being selected as an answer. It is also an unbiased and impartial selection method (Sharma, 2017).

This study used descriptive statistical analysis such as averages and percentages, to provide a clear picture of the socioeconomic conditions and livelihood capital of fishermen (Tikadar et al., 2022). Descriptive analysis is also used to generate a picture of the data that has been obtained through respondents' answers in the field and interpret the object as it is (Rohmah & Purnomo, 2019). After that, LAI was estimated to determine the strongest and weakest capital among the five capitals.

According to (DFID, 1999) LAI was developed based on the Sustainable Livelihood Framework by considering the five capitals in livelihoods and can be determined as follows: Fishermen's livelihood= f (human, financial, physical, natural, and social capital).

The livelihood status of small-scale fishers is assessed through fishers' access to different types of capital. To select indicators that represent fishers' livelihoods, first review the existing literature. After that, the indicators were revised and modified if necessary. Table 1 shows the livelihood indicators used in this study.

Table 1

Variables Used For Livelihood Capital Assessment

Capital	Indicator	Operational Definition
Human	Reading literacy level (%)	Respondents' ability to understand texts
	Writing literacy level (%)	Respondents' ability to express ideas through writing
	Training (%)	Provision of knowledge, skills and experience to individuals
	Sanitation facilities (%)	Toilets, handwashing stations, garbage disposal sites
	Frequency of illness	Number of fishermen experiencing illness in one month
	Revenue (kg/day)	Amount of fish caught in one day
Finance	Income (month)	Average amount of money earned in one month
	Savings (%)	Money saved from remaining income
	Formal loans (%)	Funds borrowed from formal financial institutions, such as banks or cooperatives
	Informal loans (%)	Funds borrowed from individuals or groups outside of formal financial institutions
Physical	Nets (%)	Tools used to catch fish, made of woven thread material
	Hook (%)	ool used to catch fish by attaching bait to the hook
	House structure (type of house)	Ceramic, plur or no plur
	Electricity (watts)	Electricity power used by respondents
	Jewelry (%)	Valuable accessories owned by the respondent's wife
	Mobile phone (%)	Average number of respondents who own a communication device
Nature	Distance of house to the sea (m)	How far the house is from the coastline, measured in meters
	Closest distance to tourist sites (km)	How far the house is from tourist destinations, measured in kilometers
Social	Relationship with village fishermen (%)	Percentage of respondents who have a good relationship between fishermen
	Relationship with neighbors who are not fishermen (%)	Percentage of respondents who have a good relationship with neighbors who are not fishermen
	Fishing group membership (%)	Percentage of respondents who are members of a fishing organization
	NGO membership (%)	Percentage of respondents who participated in a non-governmental organization

This research uses a balanced weighting where each capital contributes equally to the overall index even though each capital consists of a different number of indicators (Ahmed et al., 2021). Each indicator is measured with different scales and units, so a prerequisite is required in the form of standardization as follows.

Indexs $= \dfrac{S - S\min}{S\max - S\min}$

Description:

S $\quad$ = Original value of the indicator

S min $\quad$ = Minimum value of the indicator

S max $\quad$ = Maximum value of the indicator

After standardization, the average value of each modal is calculated using the equation:

Mcv $\quad = \dfrac{\sum_{i=1}^{n} \text{Index } si}{n}$

Description:

Mcv $\quad$ = Main capital value

Index si = Index of indicator i

n $\quad$ = Total number of indicators in each modal

Once the values for each of the five major capitals were calculated, the weighted average of the Livelihood Assessment Index (LAI) was estimated using Eq:

LAI $\quad = \dfrac{\sum_{i=1}^{5} W\,mj\,\text{M}\,cv}{\sum_{i=1}^{5} W\,mj}$

The equation can be rewritten as follows:

LAI $\quad = \dfrac{Wh\,Hc + Wf\,Fc + Wp\,Pc + Wn\,Nc + Ws\,Sc}{Wh + WF + Wp + Wn + Ws}$

Description:

LAI = livelihood assessment index

W cj = weight of component j

Wh = Human capital

Wf = Financial capital

Wp = Physical capital

Wn = Natural capital

Ws = Social capital

RESULTS AND DISCUSSION

Livelihood status as small-scale fishers

Livelihood status was assessed by measuring the human, financial, physical, natural and social capital of small-scale fishers on the north coast of Madura Island. Emphasis is placed on skills, training, income, savings and credit, fishing gear, housing conditions, access to open water, agricultural land, shared trust and reliability, and their involvement with different types of associations

Human Capital

The results of the human capital research of small-scale fishers in Table 2 show that the average reading literacy level is 93%, ranging between 88% and 97% of fishers in Bangkalan and Sumenep. The fishermen's writing literacy level shows lower results compared to reading ability, with an average value of 90%. This shows that not all fishermen who have the ability to read can write. This is in line with Zartika Nofitri & Noveria (2020), reading and writing have a very close relationship. However, many still have difficulty in writing due to lack of practice and lack of knowledge and information needed.

The ability to catch fish can be influenced by the frequency of illnesses that indicate physical health. The more often fishermen get sick, the more their ability and skill in catching fish decreases (Islam et al., 2014). This study shows that the average frequency of illness of fisher households is 0.96 times per month. Fishermen have a low frequency of illness because 98% of fishermen have sanitation facilities and consume mineral water. Access to good sanitation can prevent the spread of disease, while consumption of clean water helps maintain health and strengthen the immune system (Ferreira et al., 2021). This has a significant impact on fishers' quality of life and productivity at sea.

Fishermen's income can be known from the amount of catch per day of fishermen, which is quite varied. The results showed that the average catch per day of Bangkalan fishermen was 1,893 kg, lower than that of Sumenep fishermen who reached 2030 kg per day. This difference is caused by more Sumenep fishermen participating in training activities that support fisheries activities compared to Bangkalan fishermen. This result is in accordance with Zain & Eriyanti (2022), the existence of training can improve the ability of fishermen in catching fish. Some training and socialization have been given to fishermen, such as training in reading the Fishing Area Forecast Map (PPDPI), training in the operation

of GPS and fish finder and so on (Salim & Kusuma, 2024). However, few fishermen took part in the training activities

Table 2

Human Capital of Fishermen's Households

Indicator	Bangkalan	Sumenep	Mean
Reading literacy level (%)	88	97	93
Writing literacy level (%)	85	95	90
Training (%)	28	35	32
Sanitation facilities (%)	97	99	98
Frequency of illness	0.87	1.04	0.96
Revenue (kg/day)	1893	2030	1961

Financial Capital

Table 3 shows that the monthly income of Sumenep fishermen is Rp 5.733.000 higher than Bangkalan fishermen who earn Rp 4,804,000. The average income of fishermen is lower than the national per capita income of Rp 6.250.000 (BPS, 2023). On average, 62% of fisher households have savings to fulfill their needs during the lean season, which often occurs from November to February (Sakina et al., 2022). Meanwhile, fishermen who do not have savings must obtain loans from formal or informal institutions to fulfill their needs. On average, 10% of fisher households take loans from formal institutions (banks, pawnshops and savings and loan cooperatives), while the other 55% of fishermen take loans from informal institutions (family, neighbors and boat captains). This finding is in line with Parappurathu et al. (2019), where fishermen prefer to borrow from informal institutions because the process is faster, the requirements are easy, and no official documents or collateral are required. These loans are also based on trust and personal relationships, so they are more flexible in terms of repayment and interest, or even interest-free

Table 3

Financial Capital of Fishermen's Households

Indicator	Bangkalan	Sumenep	Mean
Income (month)	4.804.000	5.733.000	5.268.500
Savings (%)	65	59	62
Formal loans (%)	8	11	10
Informal loans (%)	60	50	55

Physical Capital

Table 4 shows that 98% of fishermen catch fish using nets as fishing gear. While a few fishermen with 14% of the average fishermen use hooks as fishing gear. This is because the use of nets can more easily catch various types of fish in large quantities at one time and reach fishing locations easily, making nets a common fishing gear used by small to medium scale fishermen (Matrutty et al., 2023). The structure of the house is a physical asset assessed in this study, showing that on average, 73% of fishermen's house structures use ceramic tiles, and 27% of fishermen's house structures still use plur or no plur. On average, fisher households use 450 watts of electricity more than 900watts of electricity. This finding is in line with Sukron & Iskendar (2020), the use of 450watt electricity is more commonly used in rural areas due to the need and cost factors that will be incurred. In addition, jewelry and cellphone ownership are also assessed in the physical assets of fisher households, with an average value of 68% and 90%.

Table 4

Physical Capital of Fishermen Households

Indicator	Bangkalan	Sumenep	Mean
Nets (%)	98	98	98
Hook (%)	9	19	14
House structure (type of house)	78	68	73
Electricity (watts)	481,5	481,5	481,5
Jewelry (%)	72	63	68
Mobile phone (%)	93	88	0.90

Natural Capital

Table 5 shows that the natural capital indicators used in this study are the distance of the house to the sea and the closest distance to tourist sites. It shows that the average distance of houses to the sea is 410 m, ranging between 437 m and 383 m for fishermen in Bangkalan and Sumenep. In addition, the closest distance to tourist sites in Bangkalan is 0,93 km. In Bangkalan more precisely in the village of Banyu Sangkah there is a religious tourist spot, namely the Tomb of Sayyid Husein Grandson of Sunan Giri, which is never deserted by tourists. While the closest distance to tourist sites in Sumenep is more precisely in Pasongsongan village, namely Goa Soekarno, with a distance of 2,7 km.

Table 5

Natural Capital of Fishermen's Households

Indicator	Bangkalan	Sumenep	Mean
Distance of house to the sea (m)	437	383	410
Closest distance to tourist sites (km)	0,93	2,7	1,84

Social Capital

The results of the study in Table 6 show that the relationship between fishermen shows positive results, where 56% of fishermen have a very good relationship with their peers. Meanwhile, around 43% have a good relationship, and another 2% are at a moderate level of relationship. The quality of this relationship is reflected in the mutual cooperation activities carried out by fishermen, such as when one of the boats is damaged, other fishermen will help repair it. The relationship between fishermen is also seen in the rokat tase' activity, which is often held once a year, as an expression to God Almighty for the sustenance provided (Stit et al., 2021). Meanwhile, good relationships between fishermen and neighbors are often formed in social interactions such as daily activities, celebrations and so on. Maintaining good relationships with neighbors is very important, as this can help to survive when in difficult situations as well as provide financial benefits for them (Ahmed et al., 2021). In addition, it was found that around 56% of fishers are members of fishing groups. This shows that the majority of fishers recognize the important role of groups in supporting their economic and social activities, and 48% of fishers are members of NGOs, with 61% more Sumenep fishers involved in NGOs than Bangkalan.

Table 6

Social Capital of fisher households

Indicator	Bangkalan	Sumenep	Mean
Relationship with village fishermen (%)			
Very bad			
Bad			
Medium	3	0	2
Good	33	53	43
Very good	64	47	56
Relationship with neighbors who are not fishermen (%)			
Very bad			
Bad			
Medium	1	21	11
Good	13	79	46
Very good	86	56	71
Fishing group membership (%)	55	56	56
NGO membership (%)	35	61	48

Livelihood Assessment Index (LAI) of Small-scale Fishermen

The livelihood status of small-scale fishers is analyzed in this study using the Livelihood Assessment Index (LAI). The overall LAI value of fishermen on the north coast of Madura Island shows that among the five livelihood capitals, natural capital has the lowest value with a value of 0.39. This low value illustrates the limited natural resources available in the research location. One of the main causes is the distance of fishermen's houses from tourist sites, which should be an additional economic opportunity for fishermen's households. This lack of access results in the economic potential of the tourism sector not being fully utilized, thus further worsening the condition of natural capital, which is one of the main pillars in fishermen's livelihoods. This situation is in line with the research of Serang et al. (2018) that the potential for business diversification, such as ecotourism or marine tourism, has not been optimally utilized, causing coastal communities to lose opportunities to increase income outside of fisheries. Research locations located on the coast rely more on marine resources as the main natural capital, due to the lack of other natural resources such as forests. According to Samuel Sesa et al. (2023) forests can provide wood for fishermen to repair or build boats, which is an important asset to boost fishermen's businesses.

Financial capital is the capital with the second lowest value (0.43), reflecting the limited access and ability of fishermen to fulfill their business capital needs to support their businesses. The majority of fishermen in the study sites are crew members with monthly incomes ranging from IDR 3-6 million, most of which are only enough to fulfill their daily needs. The inability of most fishermen to set aside income for savings further exacerbates the condition of their financial capital (Sovia, 2022). Access to formal credit, which can be a solution in meeting investment needs, such as the purchase or repair of fishing gear, is also still very limited. This condition is caused by various obstacles, such as administrative processes that are considered complicated and fishermen's lack of understanding regarding financial management and literacy regarding formal funding programs (Nisa, 2023). As a result, many fishers are unable to access available formal credit, so they tend to rely on loans from informal sources, such as family, neighbors, and boat captains. These limitations restrict fishers from investing in better fishing gear (Dzikrullah & Chasanah. Uswatun, 2024). Therefore, it may impact fishermen's opportunity to sustainably improve their welfare (Sianturi et al., 2024).

Meanwhile, physical, human and social capital have the highest value among other capitals. This is relevant to the average age of fishermen who reach 41 years old, a productive age. Where fishermen tend to have sufficient skills and work experience. Generally, at that age fishermen are accustomed to building strong social relationships and still have quite good physical abilities. The high ownership of fishing gear such as nets and hooks also indicates that fishermen have adequate basic equipment. Human capital is supported by high levels of literacy in reading and writing, especially in Sumenep. However, access to training is low and the frequency of illness is higher in Bangkalan than Sumenep. Poor health will have a direct impact on fishers' ability to participate in training activities (Gal, 2020). Social capital is supported by social relationships with fishermen and non-fishermen neighbors. However, fishers' membership in groups or NGOs is still relatively low, as small-scale fishers tend to rely on informal social networks rather than formal organizations or NGOs (Tanzil, 2019).

Table 7

Five Capital Status of Small Scale Fishermen

| Capital	Bangkalan	Sumenep	Mean	Indicator	Bangkalan	Sumenep
Human	0.58	0.62	0.60	Reading literacy level (%)	0.88	0.97
				Writing literacy level (%)	0.85	0.95
				Training (%)	0.28	0.35
				Sanitation facilities (%)	0.97	0.99
				Frequency of illness	0.29	0.17
				Revenue (kg/day)	0.2	0.26
Financial	0.45	0.4	0.43	Income (month)	0.48	0.39
				Savings (%)	0.65	0.59
				Formal loans (%)	0.08	0.11
				Informal loans (%)	0.6	0.5
Physical	0.6	0.57	0.59	Nets (%)	0.98	0.98
				Hook (%)	0.09	0.19
				House structure (type of house)	0.78	0.68
				Electricity (watts)	0.07	0.07
				Jewelry (%)	0.72	0.63
				Mobile phone (%)	0.93	0.88
Natural	0.41	0.36	0.39	Distance of house to the sea (m)	0.37	0.39
				Closest distance to tourist sites (km)	0.44	0.33
Social	0.59	0.61	0.60	Relationship with village fishermen (%)	0.805	0.47
				Relationship with neighbors who are not fishermen (%)	0.66	0.815
				Fishing group membership (%)	0.55	0.59
				NGO membership (%)	0.59	0.61
Overall Livelihood Value					0.55	0.54
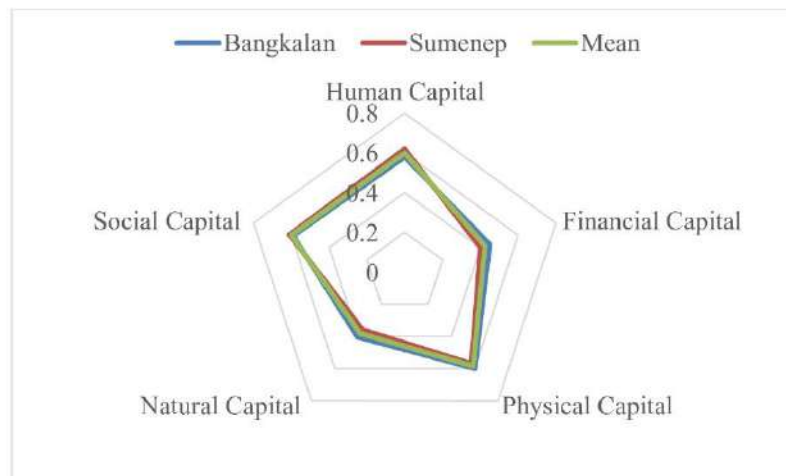
Figure 1: Livelihood Capital Index for Small-Scale Fishermen

Livelihood values in Bangkalan and Sumenep are 0.55 and 0.54. The overall LAI of small-scale fishers on the north coast of Madura Island is 0.55. Figure 1 shows the livelihood status of fishermen on the north coast of Madura Island in terms of capital, which ranges from 0 (lowest livelihood level) to 0.8 (highest livelihood level). There is an unequal distribution among these capitals. Human, social and physical capital have relatively high values, due to several factors that support each other. First, better education, access to training and skills can increase the capacity of individuals, both in fisheries and other sectors, which can increase human capital (Wantu et al., 2022). This enables communities to be better prepared for economic and environmental challenges (Azhari et al., 2023). Second, it is driven by the tradition of gotong royong and involvement in social groups, with mutual support in various activities, and marketing of catches on social capital (Nurfatimah & Ismurdiyahwati, 2022). Finally, physical capital scored high due to good access to fishing equipment as well as supporting infrastructure such as ports and fish markets, which increased the efficiency and productivity of fishers. The combination of these three capitals has a positive impact on their economic resilience and livelihood sustainability(Nur Arkham et al., 2021).

However, natural and financial capital received much lower scores, as they were affected by the low utilization of local environmental potential (tourism). Meanwhile, financial capital also shows limitations in access to formal funding. As a result of low access to natural and financial resources, it can limit fishermen's opportunities to sustainably improve their welfare (Septiya Fahmi Rezi & Ali, 2024)

CONCLUSION AND RECOMMENDATION

The results of the analysis of the livelihood status of small-scale fishers on the north coast of Madura based on the Livelihood Assessment Index (LAI) still face challenges, especially in natural capital and financial capital. Natural capital is low because the potential of ecotourism has not been optimized, while financial capital is hampered by low financial literacy and difficult access to formal funding. In contrast, physical, human and social capital are stronger, with adequate ownership of fishing gear, high levels of literacy and good social relations. This research is expected to improve fishermen's financial literacy through intensive training and mentoring programs, as well as providing easier access to formal funding. In addition, the development of ecotourism potential can be an alternative source of income for fishermen. The government and related parties are also advised to improve access to skills training and strengthen fishermen's participation in formal groups. These measures are expected to improve the welfare of small-scale fishers in a sustainable manner.

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