

## Livelihood Resilience of Small Fishers Households in Rural Areas, Indonesia

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### ABSTRACT

The concept of livelihood resilience provides a unique framework for examining the utilization of livelihood capital and resilience values of farming households in ensuring sustainable communities. This study was conducted in Muarareja Village, Tegal Barat Subdistrict, Tegal City, in January-March 2019 by assessing the utilization of five livelihood capitals and livelihood resilience actions of fisher households facing social, economic, and ecological pressures. Data were collected through surveys, observations, and structured interviews, supported by a literature review. Purposive stratified-accidental sampling was used to interview fishermen from every socioeconomic class. The sample was 40 small-scale fisher households divided into 35 lower-layer fisher households and five upper-layer fisher households. Data analysis was conducted descriptively with simple tabulation to describe the condition of the study area. The results showed that social capital is the main capital utilized by lower-layer fishermen. Meanwhile, physical and financial capital are mostly utilized by upper-layer fisher households. Genealogical relationships and territorial ties in the study location make social capital dominant. Self-organization is the highest resilience action by lower-layer fisher households by prioritizing the value of trust. Meanwhile, upper-layer fishermen households have a high resilience value in the capacity of learning action on the value of experimentation. Ownership of larger production capital makes it easier for upper-layer fishermen households to make many alternatives to continue fishing. Meanwhile, due to limited ownership and access to production capital, lower-layer fishing households prioritize the value of trust between neighbors and relatives as their social safety net.

Keywords: exposure; livelihood; resilience actions; self-organization; sustainable communities

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### 1. Introduction

The households of the small-scale fishermen live in a situation of uncertainty. Their livelihoods are highly dependent on marine fish resources. Fishermen are considered a vulnerable community group to natural conditions and weather changes. Climate change is one of the challenges facing fishing communities. The negative impacts of climate change can affect various dimensions such as social, economic, and environmental. Mulyasari et al., (2021) mentioned that climate change could have a lasting impact on the way of life of fishing communities in meeting their daily needs. Suadi et al., (2022) also added that climate change also has an impact on the reduction of the catch and income, which makes the livelihood of the small-scale fishermen very vulnerable.

The economic livelihoods of small-scale fishing households are highly dependent on marine resources, making them highly vulnerable. Likewise, the statement of Hartje et al., (2018) that Poor households tend to be dependent on fishing as a source of income, so there is a strong link between food and poverty. Fishermen have the highest percentage of poverty compared to other occupations such as



restaurant waiters, construction and waste management. Poverty in fishing communities is caused not only by internal factors related to human and fish resources, but also by external circumstances in the environment, both social, economic and environmental (Humaedi, 2017). Meanwhile, the main threats to natural capital are (1) overexploitation and (2) habitat destruction and degradation. Overexploitation by small-scale fishers is triggered by an increase in the number of resource users, difficulties in maintaining resource exclusivity, and difficulties in coping with fishing pressure from outsiders. (Bennett & Basurto, 2018; Espinosa-romero et al., 2014; Javier et al., 2018; Vázquez, 2017).

Muarareja Village is where most of the community earns a living as small-scale fishermen with a boat capacity of 4-10GT. Therefore, the variable weather has a great impact on fishing activities. Due to bad weather and high waves, the fishermen of Muarareja Village often do not go out to sea. Many small fishing boats also choose to stop fishing to avoid the risks caused by extreme weather. The increase in the number of fishermen, overfishing in the northern Java Sea waters, and climate change phenomena have resulted in the restriction of livelihood activities and access to the sea for fishing households. These consequences then affect the vulnerability of livelihoods and the level of resilience of the fishing households.

In order to maintain the sustainability of their livelihood, fisher households carry out strategies by combining or activating several livelihood capitals to be able to access other livelihood capitals. According Ellis, (2000) Livelihood capital consists of natural capital, physical capital, financial capital, human capital, and social capital. A series of resilience values are also taken so that the livelihood of fisher households can be maintained. Resilience is an action related to the capacity of individuals, groups, or social-ecological systems of society to withstand pressure and increase capacity with various approaches in response to changes. (Ifejika Speranza et al., 2014). In simple terms, resilience is the ability of a system to return to its original state or the resilience of a system to pressure/change/disturbance. Resilience is a concept that cannot be generalized. This is because in analyzing resilience, it depends on the parameters used (Hafsaridewi et al 2018). Based on this, the purpose of this study is to examine the utilization of livelihood capital and resilience values of farming households against the effects of socio-economic and ecological changes and/or pressures.

## 2. Theoretical Underpinning

According to Adger (2000) resilience refers to the capacity of a community to respond effectively and adapt to disturbances or alterations. Adger (2006) also adds that a resilient community is characterized by its capacity to effectively adapt and respond to various forms of change or external pressures. The concept of resilience frequently involves the quality of adaptability (Hardy et al., 2017).

Weldegebriel & Amphune (2017) found that households that are most resilient to flooding typically have stronger social networks, greater access to natural resources, and higher levels of education. Vatria et al., research (2019) showed that livelihood resilience as a ship owner and captain is quite tough. Meanwhile, the status of livelihood resilience as crew members is less resilient. Vatria uses 11 sensitive attributes in measuring resilience, including 1) natural hazard; 2) harbor; 3) resources status land; 3) geographic isolation; 4) wife's work; 5) processing/added value; 7) ice availability; 8) remittances; 9) social security; 10) justice; 11) support.

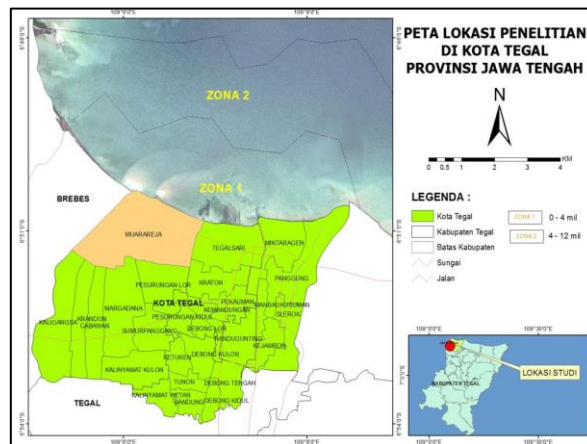
It is different from the research by Mariyani et al., (2019) which measures resilience, referring to Norris et al., (2008), which states that community resilience arises from four instruments. The main components are economic development, social capital, information and communication, and community competence. Mariyani's research results show that rainfed rice farming communities are resilient in facing the threat of food insecurity due to climate change. The community of rainfed rice farmers through a network of adaptive capacities, especially social capital.

In contrast, Sopamena research (2019) categorizes levels of resilience based on alternative frequencies in meeting life's needs. Furthermore, Amadu et al 2021 used variables of formal education and gender to determine livelihood resiliency. The livelihood resilience of fisherfolk increases with an increased level of education and varies by gender. Wintergalen et al., (2022) research said that livelihood resilience across urban and rural communities may influence how these communities and individuals build livelihood resilience. Specifically, their study results suggest that population density, isolation, and the diversity of jobs available are associated with several indicators of variables for livelihood resilience.

In this study, the authors measured livelihood resilience of small-scale fishers household in rural coastal area by adopting and modifying resilience indicators from Ifejika Speranza et al., (2014) into three proxy components who propose several proxy indicators that enable researchers to operationalize his four dimensions of livelihood security, namely buffer capacity, self-organization, learning capacity, and diversity. Empirical findings of livelihood resilience of Ifejika Speranza et al. (2014) guide our analysis: (Table 1).

**3. Research Methods**

This research was conducted in Muarareja Village, Tegal Barat Subdistrict, Tegal Regency (Figure 1) from January to March 2019. The topographic condition of Muarareja Village is a lowland directly adjacent to the Java Sea, aquaculture, and mangrove forests so community activities that develop in the Muarareja area are fisheries sector activities. The majority of people in Muarareja Village work as fishermen.(BPS, 2018).



**Figure 1.** Map of study location in Muarareja

**3.1. Data collection and Analysis**

The object of study is small-scale fishing households in Muarareja Village. The data collection method used a survey with a total of 40 respondents. Purposive sampling was used to pick the respondents, and a stratified-accidental sampling approach was used; in other words, interviews were conducted with "anyone" fisherman who might be located from any socioeconomic strata. Data collection was conducted by structured interviews using a research questionnaire.

Analysis of livelihood capital and livelihood resilience measures using a Likert scale with criteria used by Ellis, (2000) for livelihood capital analysis. While the resilience criteria use criteria from Ifejika Speranza et al., (2014) and Freduah et al., (2018) also to determine the value of buffer capacity, self-organization and learning capacity. Calculation of the total final score of each indicator by using the equation (1).

$$Y = \frac{X - \text{Minimum Score } n}{\text{maximum Score} - \text{Minimum Score}} \times 100\% \dots (1)$$

Description:

Y= Index value in percent

X= Average of Likert scale values of household resilience.

The results of the calculation of the index value (Y) are categorized using Bloom's cut-off with the criteria that a value of <60% is low, a value of 60-80% is in the medium category, and a value of >80% is in the high category. The instruments for measuring income capital and resilience values are shown in Table 1.

**Table 1.** Research Instrument

Variable	Indicator	Assessment Componen
Analysis of livelihood utilization	Capital Ownership and ability to access to livelihood capital	• Natural capital (fish resources, ponds, land)

**Table 1.** (continued)

Variable	Indicator	Assessment Componen
		<ul style="list-style-type: none"> <li>• Physical Capital (Vessels, fishing gear, boat engines)</li> <li>• Financial Capital (savings, access to loans, cooperatives)</li> <li>• Human Capital (skills, productive age, education)</li> <li>• Social Capital (Groups social gatherings, neighborhood relations)</li> </ul>
Resilience Actions Analysis	Actions to improve household resilience	<ul style="list-style-type: none"> <li>• Buffer Capacity (natural, physical, financial, human, and social capital)</li> <li>• Self-organization (reliance on own resources, cooperation, and networks, reciprocity, trust)</li> <li>• Capacity of learning (commitment to learning, knowledge of threats and opportunity, participation to access information, experimentation, knowledge transfer capability)</li> </ul>

#### 4. Result and Discussion

##### 4.1. The profile of small-scale fishers households based on the survey: fishers, climate, and socio-economic

Fishers in Muarareja are generally small-scale fishers. They were classified as small-scale fishers due to their limited capital ownership, with a boat size of 3-10GT, a sailing distance of 2-3 miles. Such a small-scale fishing sector is characterized by its limited capital, and relatively small boat size, with the boat owners, who also do the sailing (Allison & Ellis, 2001). Satria, (2015) adds that small fishermen are characterized by sailing close to the beach and labor intensive. The fishing gears widely used by small-scale fishers in Muarareja are "arad"/ mini trawl nets and "bubu" crab traps. In this study, small-scale fishers were divided into two social layers, namely the upper layer (n=5) and the lower layer (n=35), based on differences in ownership of production capital, which includes boat size (Table 2). Most fishing households in Muarareja are owner-fishermen, indicating that small-scale fishing households also have good access to and control over boats and fishing gear. Meanwhile, Muarareja's small-scale fishing households still depend on middlemen for capital and marketing of fish catches.

**Table 2.** Summary of the profile of the respondent in Muarareja.

Characteristic	Mean	%
Lower Layer (n=35)		
Age (years)	Productive Age	80
Education	Elementary School	42
Boat size	4-5 GT	100
Fishing gear (type and count)	Mini trawl (arad)	
Side Occupation	None	80
Trip duration (days)	1-2 days	100
Upper layer (n=5)		
Age (years)	Productive Age	100
Education	Elementary School	80

**Table 2.** (continued)

Characteristic	Mean	%
Boat size	8-10GT	100
Fishing gear (type and count)	None	100
Side Occupation	3-4 days	100

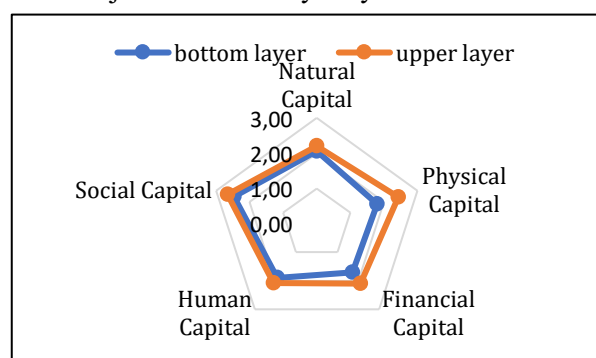
The quality of human resources of small-scale fishing households in Muarareja can be considered low regarding education. Most small-scale fishing households in Muarareja only graduated from elementary school or did not graduate from elementary school. So this significantly affects the development of the fisheries sector in Muarareja. Etuk Abasiekong & Ayuk Oluwatoyin, (2021) and Cahaya, (2019) said that The higher the level of education, the higher the productivity and the ability to manage the fishery business, and the more courage to take risks in the fishery business. But in fact, there are still many villagers who have not upgraded their education to a higher level. There are also still many villagers who have not upgraded their education to more advanced levels and are still using simple fishing gear due to ignorance and the use of modern fishing equipment.

The climate pattern in Muarareja is influenced by three seasons: the west season (rainy), the east season (harvest), and the transition. The west season occurs in October - January, the east/harvest season in February - May, and the transitional season in June - September. In 2017, the lowest air temperature was recorded in February at 25.7°C, while the highest temperature reached 29.50°C in October. The lowest average occurred in January and February at 27.3°C. These conditions are prevalent in areas bordering the coast. Air humidity ranges from 71-85%, with uneven yearly rainfall. Relatively high rainfall occurs in January-February and November-December. (BPS, 2018). In addition, the socio-economic problems that have been faced by fishermen in Muarareja in recent years are overfishing, and the high competition between fishermen that has occurred in Tegal (Nissa et al., 2019; Sudarmo, 2016)

#### 4.2. Analysis of the utilization of livelihood capital

Fishing households in Muarareja use five livelihood capitals to survive and/or achieve a better life. The natural capital includes the level of availability of fish, water, ponds and land resources. Physical capital includes the level of availability of boats, fishing gear (ATI), and fish production infrastructure. Human capital includes the skills, experimented and educated level of fishers. Financial capital includes the level of availability of savings or goods that can be converted into cash. Social capital includes fishers' social group participation, social relationship and networking. The availability of natural capital consists of fish resources that can be used to meet their food needs, provide their daily income, and provide clean water for their daily vital needs. Clean water around the coastal settlements is quite scarce and people have to either buy fresh water or treat sea water to use for their daily needs. Social capital, useful for enhancing their survival skills, depends on networks such as relatives, neighbors, formal and informal financial cooperatives, and religious institutions.

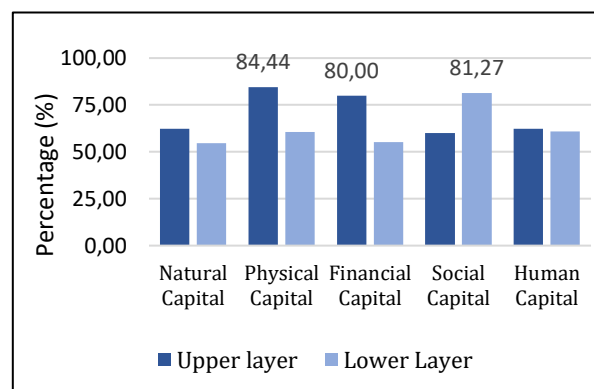
A comparison of the use of livelihood capital between upper and lower-layer fisher households in Kelurahan Muarareja is presented in Figure 1. Social capital is the most dominant capital accessed and activated by lower-layer fisher households to access the other four livelihood capitals. Meanwhile, upper-scale fisher households utilize more physical and financial capital to fulfill their needs. Overall, all small-scale fishing households in Muarareja have had fairly easy access to survive and continue their livelihood.

**Figure 2.** Utilization and access to livelihood capital for small-scale fishing households

Based on the figure, it is known that the livelihood strategy of fisher households based on the utilization of livelihood capital for both upper- and lower-layer fisher households is the highest, namely the livelihood strategy based on social capital. Muarareja Village is a coastal community formed for long ago based on strong kinship ties. Strong kinship ties mean that social interactions and exchange principles among them are quite strong. This is further strengthened by the livelihood vulnerabilities they face due to exposure, such as climate change resulting in shifts in the fishing season and high waves, social changes characterized by the density of fishermen, and economic changes due to limited capital and debt bondage. The livelihood strategy observed in Muarareja village involves the establishment of patron-client relationships, neighbourly relationships, high tolerance, membership in different saving schemes and in the social group and active participation in social activities. These practises are adopted by fisherman households during periods of famine or when they encounter financial constraints that prevent them from going out to sea. Such actions are motivated by the presence and accessibility of social capital possessed by the community. Therefore, in fishing, social capital is an essential factor to help run their livelihood activities both when fishing and not fishing. Inggrida et al 2023 mentioned that In the context of social capital, the presence of trust plays a significant role in facilitating the exchange of information relevant to individuals' livelihoods. This trust is closely intertwined with the communication dynamics that take place among members of a group, both on an individual level and within collective settings. The relationships and interactions that are formed within these contexts can yield numerous beneficial outcomes. Sopamena, (2019) adds that each household uses different sources of income, relying on a main source of income and supported by supplementary sources of income that are usually used to meet the needs of daily life.

#### 4.3. Fishers household resilience value to socio-economic and ecological stressors

Resilience actions refer to efforts to reduce pressure and maintain a sustainable livelihood. Speranza et al. (2014) divides resilience actions into three components, namely buffer capacity, self-organization, serta capacity learning. The explanation of the components of resilience is based on Speranza et al. (2014) and Freduah et al., (2018) As follows: 1) Buffer capacity includes the ability of households to withstand pressure and take advantage of opportunities to continue their livelihoods. Buffer capacity includes natural capital (ability and quality of resources), physical capital (ownership and access to boats and fishing gear), financial capital (ownership of savings and access to loans), human capital (level of education and skills outside fisheries), social capital (increased assets as a result of membership in organizations); 2) Self-Organization refers to the internal ability to control actions and freedom of action that affect livelihood output. Self-organization includes Reliance on Own Resources (distance or travel time to the fishing ground location), Reciprocity (number of jobs outside fisheries for both family heads and family members), Cooperation and Networks (number of joining groups to increase income), and Trust (trust of residents in borrowing the money); 3) Capacity of learning refers to the ability built from learning and experience as an effort to increase capacity in earning a living. The capacity of learning includes a commitment to learning (participation, access, and participation in joint activities regarding sources of livelihood), knowledge of threats and opportunities (ability to read opportunities and threats at sea), participation to access information (attendance at counseling within 12 months), experimentation (number of experiments on fishing methods in the face of uncertain weather and fish resources) and knowledge transfer capability (new abilities or actions obtained on a wide scale for the field of livelihood).



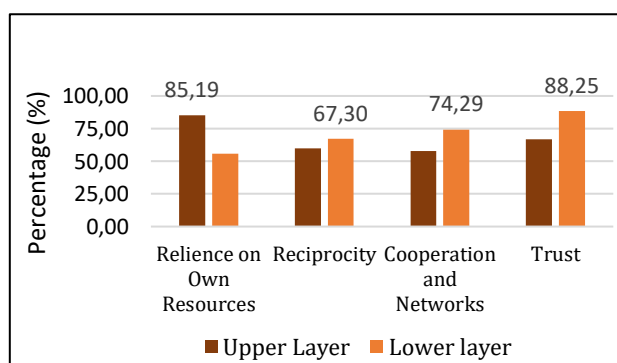
**Figure 3.** The value of buffer capacity resilience values for small-scale fisherman households

The value of the resilience of the buffer capacity of the fishing households in Muarareja have mostly medium values in both the upper and the lower strata (Figure 2). The buffer capacity is built up from the access to or ownership of a combination of tangible and intangible assets by fishers, commonly referred to as "livelihood capitals"(Daniel et al., 2019).

Even though the value of buffer capacity resilience measures is in the moderate category. However, the human capital component is still relatively low. Especially for the education level. In general, rural fishing households have lower levels of education than the wider population and may be more constrained by their education than their rural counterparts. Of these fishing households, usually about half of the fishing community have not completed basic education (i.e., < 6 years of formal education)(Manjarrez-Bringas et al., 2018; Rodríguez-Quiroz et al., 2018). The alternative livelihood opportunities available to rural fishermen generally do not require secondary or tertiary education. As a result, formal education may have less impact on the resilience of rural livelihoods, where there are few opportunities to leverage it for alternative forms of employment.

Overall, easy access to livelihood capital makes the level of resilience of small-scale fisher households quite good. Dharmawan, (2007) said that in any condition and situation, every individual or household always tries to maintain their status in life and as much as possible to continue their existence across generations through various ways (strategies) of survival by manipulating the livelihood capital available before them. In addition, each individual [or household] builds survival mechanisms through groups and communities according to the socio-cultural-eco-geographical context and locality where the individual [or household] is located.

The value of self-organization resilience actions is the resilience action with the greatest value (Figure 3). Upper class fishermen's households have the highest value of the reliance on own resources component, because they are supported by ownership of boat engines and more than one fishing gear making it easier for them to reach fishing ground locations. Meanwhile, lower-level fisherman households have the highest value of the trust component because in accessing fish resources in the sea, most of the capital used is borrowed capital from neighbors, relatives and middlemen.

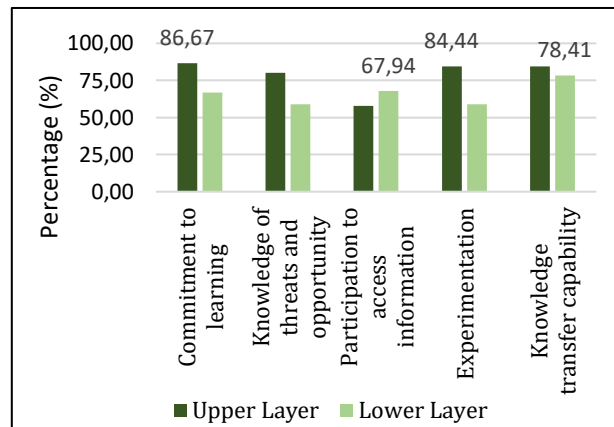


**Figure 4.** The value of self-organization resilience measures for small-scale fishing households

The value of the component and network components and the reciprocity of the lower-level fisherman households is in a fairly high category. This is caused by the ability of fishing households to carry out the division of tasks within the household. (Nissa et al., 2019) stated that one of the typologies of adaptation of small-scale fishermen is by re-organizing the household, which means that each member of the household has a role in maintaining a living by working as salted fish file laborers for fishermen's wives and going to sea for fishermen's children who are on school holidays. Metcalfe et al., (2020) added that the multiplicity of jobs and intra-sectoral diversity can increase livelihood resilience by providing fishers with more avenues to earn a living, enabling fishers to manage risks and potentially accumulate more wealth. In particular, the multiplicity of jobs allows fishers to manage risk by providing a steady alternative source of income, even when fishing becomes temporarily less profitable. Through additional income, the multiplicity of jobs has also enabled many fishers to amass more wealth than just fishing (Kaplan-Hallam et al., 2017; Méndez-Medina et al., 2020).

In addition, collective action between fishermen, either in the form of patron clients or mutual cooperation between fishermen, can reduce the level of pressure faced by fishing communities and maintain a sustainable livelihood. Bennett & Basurto (2018) stated that the network structure of fishing communities

in collective action may take the form of the establishment of local access norms and rules, the formation of associations to form cooperatives, in order to control fishing activities collectively. Rockenbauch & Sakdapolrak, (2017) add that the contribution of social networks to the building of resilience has gained increasing prominence in the literature over the past few years. Capacity of learning resilience measures show a moderate category for lower-level fishing households and a high category for upper-class fishing households (Figure 4).



**Figure 5** The value of resilience measures for the capacity of learning in small-scale fishing households

Based on the graph, it shows that the value of commitment to learning and experimentation from upper-class fishermen households is in the high category. This indicates that access to and control of fishing households over physical capital and natural capital is very easy. Having more than one boat engine and fishing gear makes it easier for them to make adjustments to their fishing gear according to the season and the target fish species. Their knowledge of the weather and the location of the target fish is also good because of their high intensity and experience at sea. Wintergalen et al., (2022) added that communities with high learning capacity can gather new knowledge and apply it to resilience building activities. The ability to identify knowledge, or the ability to identify useful knowledge and the willingness to experiment with new ideas, is an indicator of the learning ability shown by rural communities. Owusu and Andriesse (2020) suggest that fishers' level of experience in fishing is important in understanding their coping strategies/responses to shocks, including changes in fisheries management policy/regulation.

Meanwhile, the value of resilience measures from the capacity of learning is moderate. This is shown from the participation and activity of lower-level fishermen's households in participating in training and counseling conducted by related agencies, but the number of fishermen who attended was only a few people. Most fishermen's motivation to attend an extension or training activity is only when they are given assistance in the form of fishing gear or cash. Aldi et al., (2021) stated that the lack of innovation in increasing household income resulted in underdevelopment of the livelihood system being worked on.

There is a greater level of participation in information access among lower-class fishermen compared to their upper-class counterparts. The prevalence of lower-class fishermen participating in training and counselling activities conducted by relevant agencies in Muarareja is evident. In contrast, the involvement of upper-class fishermen in such initiatives is comparatively lower. According to Asyia (2021), individuals engaged in fishing activities and earning low incomes exhibit a notable degree of involvement in the attendance level category. Despite the active participation of lower-class fishermen in Muarareja in training and outreach activities, the effectiveness of resilience measures derived from their learning capacity is only moderate. Because the primary incentive for fishermen to participate in extension or training programmes is typically contingent upon receiving assistance in the form of fishing equipment or monetary support.

Furthermore, the manner in which lower-class fishermen engage in the acquisition of information can be observed through their possession of social capital. Figure 1 illustrates that individuals belonging to the lower socioeconomic class who engage in fishing activities possess a significant amount of social capital. Lower socioeconomic fishermen engage in the dissemination of information among their peers through diverse channels, including familial and communal networks, both formal and informal financial cooperatives, as well as religious establishments. According to Nissa's (2019) research, there is evidence to suggest that lower-level fishermen's households have a higher propensity to utilise social capital in accessing information. During the period characterised by family-oriented activities, a multitude of



households belonging to fishermen of lower socio-economic status make use of their social connections to transfer themselves to alternative vessels that continue to operate in the open waters. The present study examines the relationship between social capital and exposure to weather and climate factors, specifically focusing on the influence of trust in kinship ties and neighbour networks on the decision-making processes of fisherman with lower levels of social capital.

Livelihood resilience in rural areas benefits from strong self-organizational resilience measures. In contrast, livelihood resilience in rural communities is most threatened by relatively few opportunities for education and alternative employment, but benefits from strong incentives to cooperate (Wintergalen et al., 2022). Idrus et al., (2022) add that the forms of livelihood resilience practiced by fishers, such as the implementation of livelihood strategies, the optimization of social and physical capital owned, as well as asset and financial management.

## 5. Conclusion

The pressure due to socio-economic and ecological changes greatly affects the sustainability of small-scale fisherman households. Various efforts have been made by small-scale fishing households, both the upper and lower layers, namely by combining livelihood capital which is dominated by social capital for lower-level fishing households. Meanwhile, upper-class fishermen households use more physical and financial capital. Self-organization resilience actions are the most dominant resilience actions in the households of small-scale fishermen in Muarareja.

**Credit authorsip contribution statement:** **Zulfa Nur Auliatur Nissa'**: Methodology, Result and Discussion, Writing – original draft. **Ardela Nurmastiti**: review& editing. **Ratih Setyowati**: Review & editing. **Siti Mariyani**: writing, review & editing.

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