

LOCAL ECOLOGICAL KNOWLEDGE OF SEAGRASS SOCIAL-ECOLOGICAL SYSTEM: IMPLICATION FOR CONSERVATION AND MANAGEMENT

PENGETAHUAN EKOLOGIS LOKAL TENTANG SISTEM SOSIAL-EKOLOGI LAMUN: IMPLIKASI BAGI KONSERVASI DAN PENGELOLAAN

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ABSTRACT

Small island communities in South Sulawesi rely heavily on seagrass ecosystems for their livelihoods. Conducted from October to December 2025, this study assesses Local Ecological Knowledge (LEK) levels and their influencing factors across Sabangko, Sagara, and Salemo islands. Using a mixed-methods approach, data were collected via snowball sampling technique targeting fishers and gleaners, involved 63 questionnaire respondents and 5 semi-structured interview respondents. A multinomial logistic regression analysis was also conducted to identify the factors influencing LEK. Results indicate that 43% of respondents possess low LEK, while 28% show high levels. The regression model (Pseudo $R^2 = 0.552$) reveals that fishing gear type and income significantly drive LEK variations; gear used directly within seagrass beds increases daily interaction, fostering higher LEK through direct observation. However, critical blind spots remain regarding indirect anthropogenic threats like plastic pollution and anchoring. Economic pressures also induce cognitive dissonance, disconnecting perceived habitat health from destructive activities. Despite local perceptions of stable seagrass areas, declining fish catches highlight severe external pressures such as overfishing. Ultimately, LEK is shaped by interaction intensity and economic dependency. Enhancing environmental literacy through a holistic seascape approach is essential to align scientific insights with local knowledge for effective conservation.

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1. INTRODUCTION

Seagrass meadows are among the most valuable marine ecosystems, playing crucial ecological roles such as serving as primary producers, providing habitat for marine life, acting as natural breakwaters, preventing coastal erosion, and storing carbon (Latuconsina, 2020). From a socio-economic perspective, seagrass ecosystems are also vital for coastal and small islands communities as reliable and accesible fishing grounds (de la Torre-Castro et al. 2014; Jones et al. 2022). However, seagrass ecosystems are currently under pressure due to global damage and degradation (McKenzie et al., 2020). In Indonesia, seagrass meadows and the ecosystem services they support throughout coastal areas are in a state of critical decline (Unsworth et al., 2018). Without proper management efforts, this can lead to massive degradation and even the loss of seagrass ecosystems (Sudo et al., 2021). The impacts of this degradation are most severe for island communities, which have limited options and thus rely heavily on seagrass meadows.

For island communities, seagrass meadows are not merely ecological entities but are integral components of their livelihood systems, serving primarily as vital fishing grounds and essential food sources (Nordlund et al., 2018; Unsworth et al., 2019). Furthermore, these habitats function as a socio-economic safety net during periods of environmental or market uncertainty (Quiros et al., 2018; Unsworth et al., 2026). This high level of dependency has fostered long term experience and specialized knowledge regarding ecosystem dynamics, known as Local Ecological Knowledge (LEK). LEK represents an accumulated ecological understanding developed through sustained interactions, traditional practices, and daily experiences of coastal communities with their environment over extensive periods (Echevarría et al., 2026; Fauzi et al., 2026; Lako et al., 2023). This knowledge has been fundamental to human life, particularly in remote areas, mainly because of the high dependence of local communities on food production and other provision from the ecosystem for basic needs (Cullen et al., 2007).

In regions that often lack formal scientific data, LEK emerges as a valuable complementary source of information because it is built upon the accumulation of long-term experience, traditional practices, and communities' daily interactions with the environment (Alexopoulos et al., 2025; Cullen-unsworth et al., 2018; Idrus et al., 2025). This knowledge encompasses not only the identification of species and mapping of critical habitats but also a deep understanding of productive fishing grounds, seasonal variations, and even the behavior of specific marine organisms. Furthermore, local communities are often capable of detecting historical environmental changes (Cullen-unsworth et al., 2018), and identifying causal relationships between anthropogenic pressures and the resulting ecological impacts (Jones, Unsworth, Nordlund, Ambo-Rappe, et al., 2022). However, although LEK offers rich empirical insights for successful conservation and adaptive management, this community knowledge is often not systematically integrated into formal management planning frameworks and marine spatial policies (Alexopoulos et al., 2025; Fauzi et al., 2026).

Studies on these ecosystems from a social perspective, such as cultural and economic aspects and human interactions with seagrass, including LEK, remain under-explored (Amores & Aguilar, 2026; Fortes et al., 2018). In fact, filling these knowledge gaps is crucial because LEK can provide historical baseline data and long-term observations of ecosystem changes (Cullen-unsworth et al., 2018; Mwakha et al., 2020). Furthermore, efforts to bridge formal science with community perspectives are an urgent step toward enhancing the relevance of policies, community compliance, and the effectiveness of conservation (Amores et al., 2026; Echevarria et al., 2026). Without such integration, there is often a mismatch between management or conservation needs and the realities of community practices on the ground, which can ultimately hinder sustainability goals (Jones, Unsworth, Nordlund, Ambo-Rappe, et al., 2022). Therefore, this study aims to assess the level of LEK, identifying the factors that influence it, and understanding how island communities value seagrass. By integrating this community-based knowledge, this research is expected to provide a scientific basis for management efforts that are aligned with the socio-ecological characteristics of small island regions.

2. METHODS

2.1 Study area

This study was conducted in November - December 2025 on three islands in Mattiro Bombang Village, namely Salemo, Sagara, and Sabangko Island, Pangkep Regency, South Sulawesi (Fig. 1). The study area was selected based on the presence of seagrass and small-scale fisheries. The seagrass species composition was similar across all three islands, with *Enhalus acoroides* emerging as the most dominant species, alongside *Cymodocea rotundata*, *Thalassia hemprichii*, and *Syringodium isoetifolium* (Unpublished source).

The majority of livelihoods across the three islands are closely tied to the fisheries sector. Salemo Island, serving as the administrative center of the village, has the largest population and the highest number of fishers. Sagara Island, with a smaller population, holds the highest concentration of blue swimming crab collectors (*punggawa* or middlemen), creating a community almost exclusively composed of crab fishers. Meanwhile, Sabangko Island is the least populated, with local livelihoods divided among pond aquaculture farmers, blue swimming crab fishers, and stationary net (*sero*) fishers.

Fishing grounds are primarily determined by the type of gear deployed and the targeted species. Crab nets, set nets (*sero*), and spears (*sulo*) are predominantly operated within seagrass meadows and adjacent shallow waters. Conversely, fish nets are set in coral reef zones and deeper waters. Meanwhile, crab pot traps are deployed across diverse habitats, spanning seagrass beds, coral reefs, sandy and muddy substrates, into deeper offshore waters.

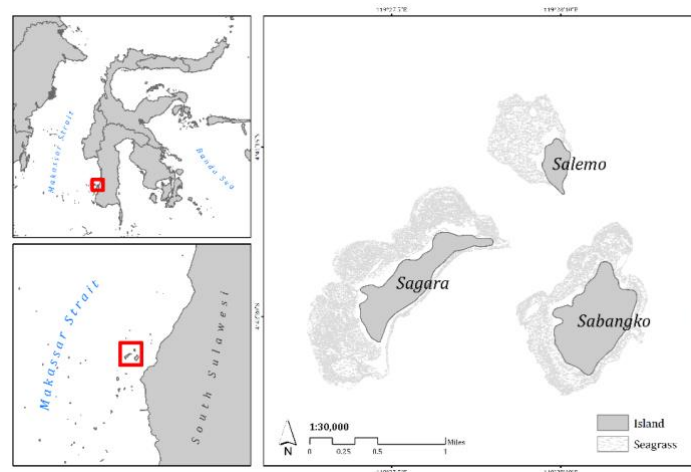


Figure 1. Study area located on three islands of Mattiro Bombang Village, Pangkep Regency

2.2 Data collection

Primary data was collected through questionnaire surveys and semi-structured interviews with fishers and local communities on three islands in Mattiro Bombang Village. We used snowball sampling technique to select total 63 respondents on three islands, comprising 63 respondents for the questionnaire survey and 5 respondents of the total for the semi-structured interviews. These respondents were selected based on their livelihoods, primarily those actively engaged in fishing or gleaning. Therefore, the respondents were fishers and gleaners. The number of respondents on each island was determined based on population density, a distinct demographic, and socioeconomic profile regarding its primary sub-sectors. The sample size of 63 respondents was determined using Parel et al. (1973) equation:

$$n = \frac{Nz^2 p(1 - p)}{Nd^2 + z^2 p(1 - p)}$$

Details:

- n : The number of respondents;
- z : Z-score (1.645) at a 90% confidence level;
- p : Proportion of the fishing population (0.50);
- d : Statistical error rate (10%);
- N : Total number of fishermen (N: 395).

A structured questionnaire was designed to gather LEK regarding the importance of seagrass to their livelihoods, as well as local changes in the seagrass socio-ecological system. The questionnaire began by eliciting respondents' knowledge of the seagrass, including its morphological characteristics, species present, and locations within their area. Respondents were then presented with a series of statements aligned with the themes, which they could agree with or disagree with based on their knowledge. Separately, in-depth interviews were conducted using a semi-structured approach to explore more deeply the substance covered in the questionnaire.

2.3 Data analysis

Data analysis was conducted using a mixed-methods approach, which combines inferential and descriptive statistics, and qualitative analysis. The inferential statistics analysis used in this study include the following:

1. Level of local ecological knowledge

Local ecological knowledge regarding the seagrass ecosystem and fisheries was measured through a series of statements presented to respondents. Their knowledge was assessed based on their responses to each statement, scored as Agree (score 2), Disagree (score 1), and Do Not Know (score 0). Scores were assigned based on alignment with the expected knowledge and factual information. The level of ecological knowledge was then calculated by comparing the total score obtained by each respondent with the maximum possible score, using the following equation (Sugiyono, 2019):

$$LEK = \frac{n}{N} \times 100$$

Details:

- n : The total score achieved by the respondent;
 N : The maximum score that respondents can achieve.

The LEK classification follows Arikunto (2010), who classifies an individual's level of knowledge into three categories based on the percentage of correct answers obtained from the assessment tool or questionnaire. The classification of LEK levels comprises low (<60%), moderate (60%–75%) and high (>75%).

2. Nominal logistic regression test

The demographic factors and fishery characteristics influencing variations in community Local Ecological Knowledge (LEK) were determined using a multinomial logistic regression modeling approach. The independent variables included age, education level, income level, and fishing gear type. Testing was conducted at a 5% significance level ($\alpha = 0.05$). The significance of the independent variables on LEK was determined from the Likelihood Ratio Test if the p -value was less than 0.05. The multinomial logistic regression model used was expressed as follows:

$$\ln \left(\frac{P(Y = j)}{P(Y = J)} \right) = \alpha_{0j} + \beta_{1j}X_1 + \dots$$

Details:

- | | |
|---|------------------------------------|
| P : The probability that a respondent has LEK; | α_{0j} : LEK constant j ; |
| Y : Local ecological knowledge; | J : High LEK level (reference); |
| j : Low/moderate LEK level; | X_1 : Independent variable. |
| B_{1j} : Regression coefficients for each independent variable; | |

3. RESULT AND DISCUSSION

3.1 Demographic profile and its influence on LEK

The demographic characteristics of the respondents across the three islands are summarized in Figure 2. The study involved a total of 63 participants, with a representation of males 89% and females 11%. In terms of age distribution, most respondents fell within the productive age range of 21 to 40 years, with the 31–40 age group being the most frequent for both genders (Fig. 2D). Geographically, the respondents were distributed across three islands, with the highest participation from Salemo Island ($n = 30$), followed by Sagara ($n = 24$) and Sabangko ($n = 9$) (Fig. 2B). The higher concentration of respondents from Salemo Island is attributed to its role as the administrative center of the village, possessing the highest population density among the three islands. The monthly income distribution of the respondents is predominantly concentrated in the lower brackets, with the majority earning less than 2 million IDR per month (Fig. 2C). This indicates that a significant portion of the community is classified as low economic level, which then identified as a proxy for their reliance on marine resources for subsistence, shaping local communities tend to possess more extensive and profound LEK (Cullen et al., 2007).

As a small-island community, most local communities across the three islands worked as small-scale capture fishers, while the rest were involved in the aquaculture sector, particularly pond culture and floating net cages. The local communities on these three islands heavily relied on marine resources, including seagrass meadows, which served as reliable and accessible grounds for fishing and gleaning activities. The main catch for fishers was blue swimming crab, making Mattiro Bombang Village one of the largest producers of blue swimming crab in South Sulawesi. These livelihood characteristics, along with the demographic profile, likely influenced the level of Local Ecological Knowledge (LEK) and the community's perception of the surrounding seagrass ecosystems.

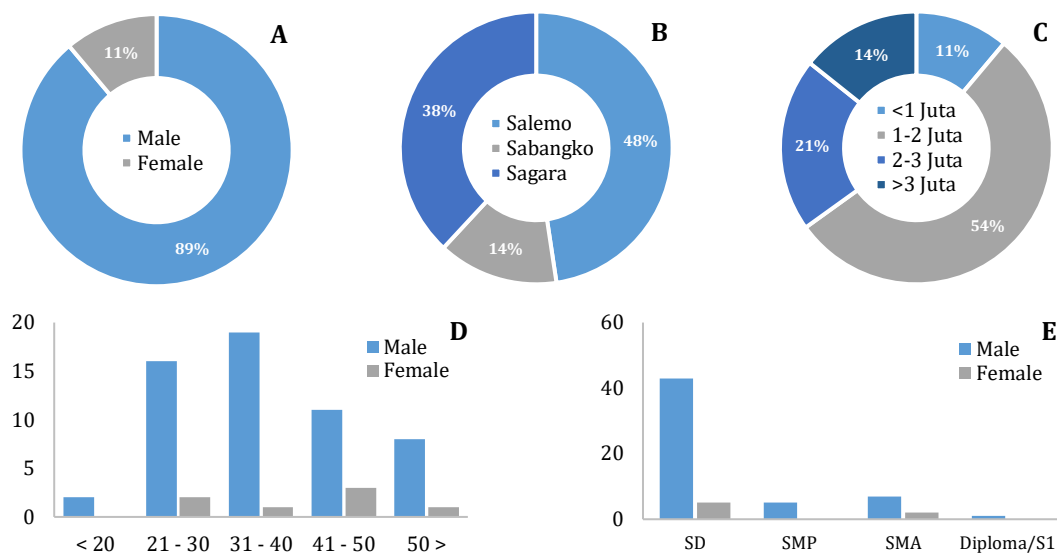


Figure 2. Demographic profile of respondents in three islands consisting of A) Gender, B) Responden distribution, C) Monthly income, D) Age, and E) Education level

The distribution of respondents' Local Ecological Knowledge (LEK) levels (Figure 3) showed that the low LEK category dominated with a proportion of 43% (range of 31% – 56%), followed by moderate LEK at 29% (range of 63% – 75%) and high LEK at 28% (range of 81% – 100%). This composition indicated that most of the community did not yet have a good understanding and knowledge of seagrass ecosystems, their benefits, and their degradation factors. Nevertheless, the combined proportion of moderate and high LEK remained relatively large, which suggested that their daily interactions were able to provide ecological knowledge. Therefore, capacity building, information dissemination, and environmental literacy enhancement were still needed to strengthen the community's ecological understanding more evenly.

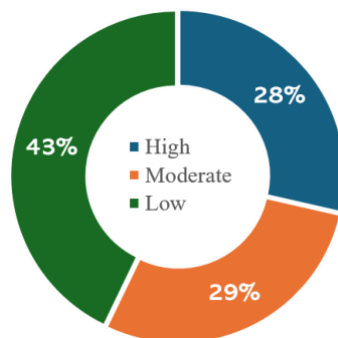


Figure 3. Percentage of respondents' level of local ecological knowledge (LEK)

To examine the effect of demographic characteristics on the variation in Local Ecological Knowledge (LEK), a nominal logistic regression analysis was conducted. Based on the summary of the logistic regression results in Table 1, the overall model fit was significant, and the combination of demographic variables and fishing gear types jointly explained the variation in the community's LEK levels. The Nagelkerke Pseudo R-Square value also indicated that approximately 55.2% of the variation in LEK levels could be explained by the variables tested in the model. Furthermore, the Likelihood Ratio Test revealed two variables that significantly influenced LEK levels: fishing gear type and income level. Meanwhile, age showed a marginally significant effect, and education level did not significantly affect LEK variations.

The strong influence of fishing gear type suggests that local knowledge was primarily shaped by how frequently community members interacted with seagrass ecosystems. Fishers operating gear directly inside seagrass beds, such as crab nets, fishing spear (*massulo*'), and gleaners, were more likely to gain higher LEK because they could directly observe target species behavior, catch dynamics, and habitat changes. In contrast,

those fishing mainly outside seagrass areas (using fish nets and crab pot traps) showed a weaker connection to this habitat. This highlights that LEK grows with higher resource dependency and regular engagement with daily utilized seagrass beds. Beyond fishing gear, income level also significantly affected LEK, indicating that socio-economic status influences ecological awareness. Specifically, this study found that respondents in the lowest income group (< IDR 1 million) were more likely to have Low to Moderate LEK. These findings may be related to the psychological influences described in the following discussion.

Table 1. Results summary of the nominal logistic regression on factors influencing LEK

Parameter	Value	Interpretation
<i>Model Fitting Information</i>	$\chi^2 = 42.237$; $p = 0.006^*$	The regression model is significant and can explain the variation in LEK levels.
<i>Goodness of Fit</i>		
Pearson	$p = 0.881$	A suitable model for the variable interpretation stage
Deviance	$p = 0.857$	
<i>Pseudo R - Nagelkerke</i>	0.552	The model explains 55.2 per cent of the variation in LEK levels.
<i>Likelihood Ratio Test</i>		
Income	$p = 0.007^*$	Has a significant effect on the LEK level.
Fishing gear	$p = 0.004^*$	Has a significant effect on the LEK level.
Age	$p = 0.067$	Not significant at $\alpha = 5\%$ but shows a trend towards a significant effect.
Education	$p = 0.156$	Has no significant effect on the LEK level.

*Significant $p < 0.05$, $\alpha > 0.05$

Furthermore, a significant proportion of the community has a primary school level education (SD), which is particularly prevalent among male fishers (Fig. 2E), while respondents with higher education levels (SMA and Diploma/S1) remained low, suggesting that local ecological knowledge in these islands is primarily transmitted through inherited knowledge and practical experience. This demographic profile was in line with statistical findings that education level does not significantly influence seagrass LEK. This indicated that LEK was acquired through practical experience (daily interaction) and intergenerational knowledge transmission. This aligns with the findings of Idrus et al. (2025) on Barrang Lompo Island, which showed that children, particularly those who dropped out of school due to economic hardship, tended to gain LEK through practical fishing experience with their parents. This phenomenon was also reflected in the field, where residents possessed basic knowledge regarding target species habitats, gleaning activities, and the operation of simple fishing gear (handlines and nets) since childhood.

Although education was not statistically significant in this study, previous studies have suggested that formal education may enhance ecological reasoning and environmental awareness. Findings from Launio et al. (2010) demonstrated that higher levels of education increased the likelihood of individuals holding positive views and awareness regarding the importance of marine resource conservation. Furthermore, education significantly influences how individuals evaluate environmental conditions and health. This was illustrated by Losciale et al. (2022), who found that respondents with higher academic degrees were better able to identify seagrass status and degradation, as well as showing high awareness of climate change as a direct threat to marine habitats.

Although age did not show a statistically significant effect at the 95% confidence level, the significance value close to the threshold ($p = 0.067$) indicated a trend where older individuals were more likely to possess high LEK. This tendency can be explained by the long-term accumulation of experience gained through direct interaction with seagrass ecosystems and fisheries over many years. Consequently, elders often hold vital environmental insights, particularly regarding seasonal cycles, historical environmental changes, and productive fishing grounds (Amores et al., 2026; Amores & Aguilar, 2026). Nevertheless, the analysis suggests that age as a proxy for experience may not fully explain variations in LEK without the influence of other contributing factors.

Overall, the logistic regression results indicated that community LEK was more strongly influenced by factors directly related to seagrass utilization and socioeconomic conditions rather than demographic characteristics alone. This finding further reinforces the definition of LEK as an accumulated body of ecological knowledge developed through continuous interaction, traditional practices, and everyday experiences of coastal communities with their environment over extended periods (Echevarría et al., 2026; Fauzi et al., 2026; Lako et al., 2023). Furthermore, the specific characteristics of LEK on each island are presented in the following subsection.

3.2 Communities' LEK on seagrass

LEK on the importance of seagrass ecosystem and awareness of conservation

Analysis of community perceptions across the three islands reveals significant variations in ecological understanding and conservation stewardship. This data is illustrated in Figure 4. In Sagara and Sabangko Islands, a robust consensus exists concerning the role of seagrass as a primary fishing ground and commercial habitat, with agreement levels ranging from 78% to 96%. Conversely, Salemo Island exhibited divergent views. Respondents expressed disagreement across four key metrics, most notably regarding ecosystem protection responsibility which garnered only 30% approval.

This perceptual disparity on Salemo Island is intrinsically linked to the heterogeneity of fishing gear and fishing ground. Groups employing gillnets and crab pot traps operate predominantly outside seagrass meadows. This spatial decoupling creates a disconnection between livelihoods and seagrass ecosystem services, fostering negative perceptions or indifference toward the importance of seagrass and its preservation. This asymmetry underscores that LEK is heavily mediated by direct resource dependency (Cullen et al., 2007; Cullen-unsworth et al., 2018). Fishers without direct seagrass utilization tend to exhibit lower conservation awareness than those whose livelihoods are intrinsically tied to seagrass-based fishing grounds.

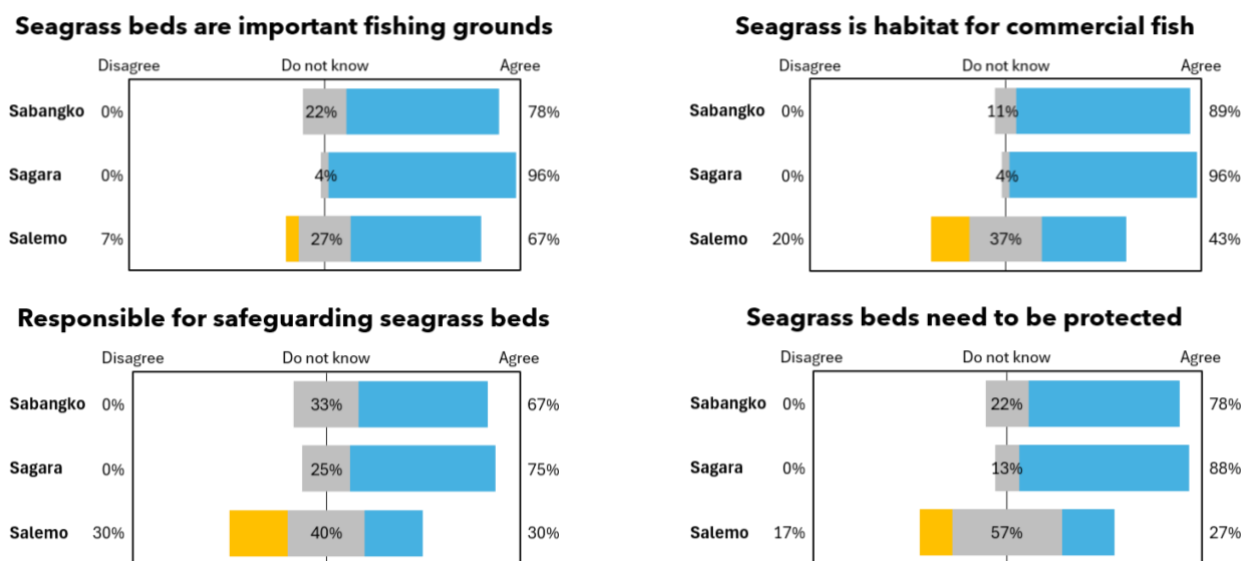


Figure 4. Community LEK concerning seagrass ecosystem functions in fisheries context and public awareness regarding the necessity of seagrass preservation

Local people know seagrass as Pama. Semi structured interviews were employed to elicit specific LEK concerning the role of seagrass as a habitat for commercially important species. All respondents demonstrated an awareness that various commonly caught species such as blue swimming crabs, blood cockles, dog conchs, sea cucumbers, rabbitfish, and emperors inhabit seagrass meadows. Furthermore, the respondents exhibited detailed knowledge of the behavior of seagrass-associated species particularly the blue swimming crab which serves as a primary target for local fishers. One of the informants mentioned: “during the day the crabs bury themselves in the substrate near the seagrass and only emerge at night, which is why we deploy crab pot traps or engage in spearfishing during the evening”. Additionally, some respondents were aware of the feeding habits of rabbitfish, as mentioned “these fish consume seagrass leaves or fine hairs (the epiphytic algae) attached to

the pama leaves”. They acknowledged that this knowledge was acquired through daily observations and passed down from their parents.

LEK on anthropogenic threats on seagrass and its impact

Data regarding the perception of anthropogenic impacts on seagrass ecosystems reveals a pattern of local knowledge that varies across islands. The results indicate that the level of understanding regarding direct impacts is significantly higher than that of indirect impacts (Fig. 5). In Sabangko and Sagara Islands, respondents demonstrated a strong awareness that seagrass degradation reduces fisheries catch (78% – 96%) and that destructive fishing practices damage the habitat (78% – 83%). Conversely, Salemo Island showed a notable percentage of disagreement (40%) regarding the statement that seagrass damage leads to catch declines. This lower ecological sensitivity on Salemo Island remains linked to the previously described livelihood profiles of the respondents, leading to being less aware of the causal link between seagrass degradation and fisheries productivity.

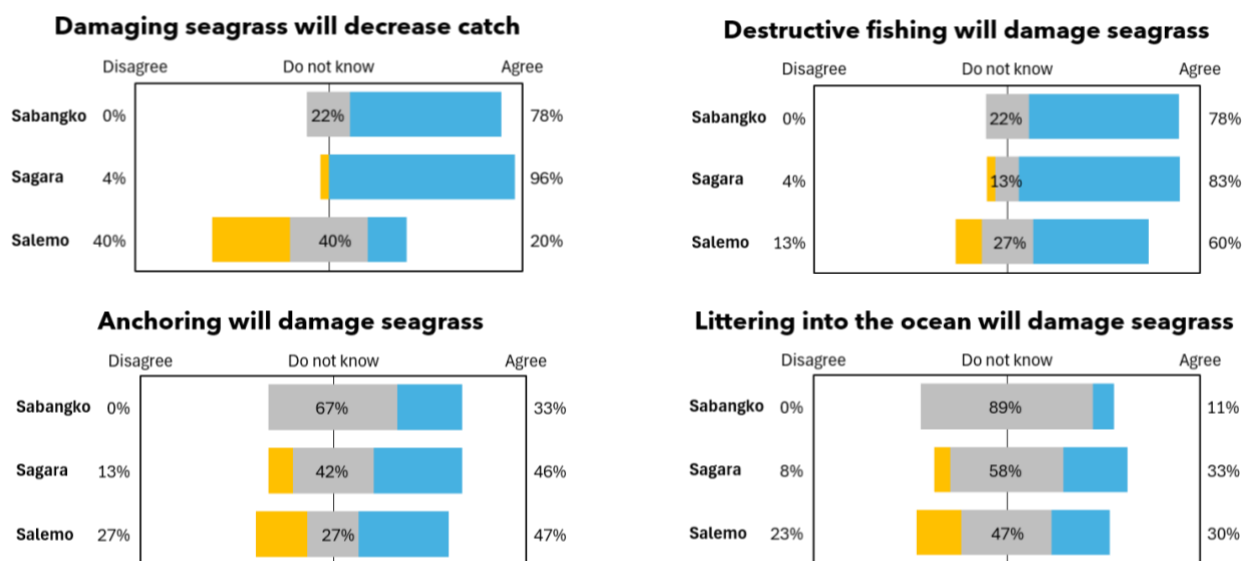


Figure 5. Community LEK concerning impact of anthropogenic factors on seagrass ecosystem

Furthermore, these findings indicate a blind spot in community knowledge across all three islands regarding the impacts of waste pollution and anchoring activities. This is reflected in the dominance of “do not know” responses which reached 89% in Sabangko for the waste issue. In fact, trash is one of the major problems at the study site, polluting the coastline and shallow waters. The impact of marine debris, especially plastic, can hinder seagrass growth and even reduce its biomass and coverage (Douglas et al., 2024; Zhang et al., 2023). Such a trend suggests that non extractive anthropogenic threats are not yet perceived as serious risks to the sustainability of seagrass ecosystem functions.

From our perspectives, the community ignorance in site study regarding several anthropogenic threats may be rooted in several factors. First, motivated reasoning and cognitive dissonance play a significant role where individuals who are highly dependent on resources for food and income often experience mental conflict when acknowledging that their activities damage the environment. To mitigate this conflict, they develop beliefs that such activities are harmless so that their perceptions align with their economic necessities (Jones et al. 2022). Second, persistent economic pressure and poverty force communities to prioritize short-term survival over long term conservation. This phenomenon is illustrated by the negative feedback loop in Fig. 6.

Despite possessing ecological awareness, economic vulnerability prevents them from adopting sustainable practices or participating in restoration efforts that require significant costs (Amores et al., 2026; Amores & Aguilar, 2026). Third, a lack of scientific literacy and effective communication hinders understanding because scientific concepts often fail to reach or are not understood by local communities in coastal areas and on islands (Quevedo et al., 2020).

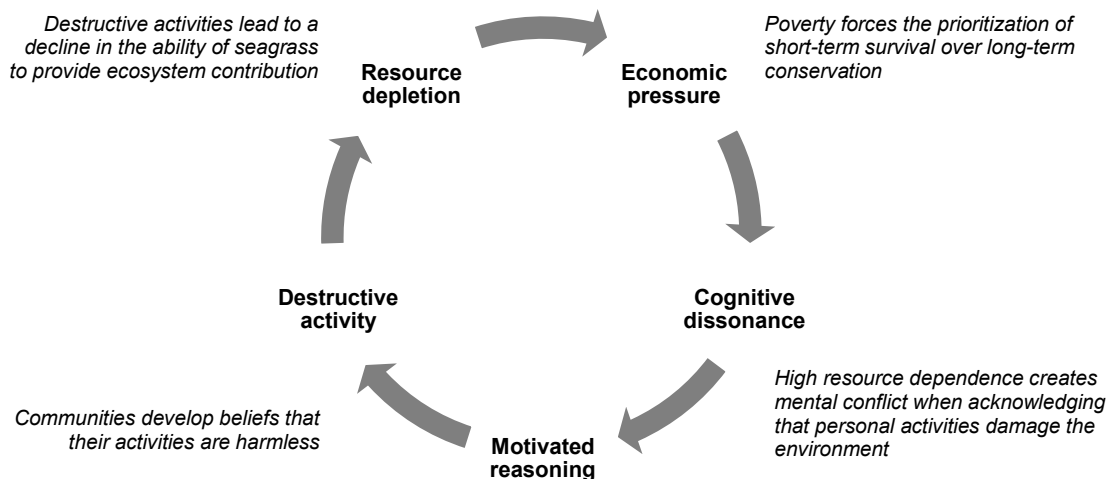
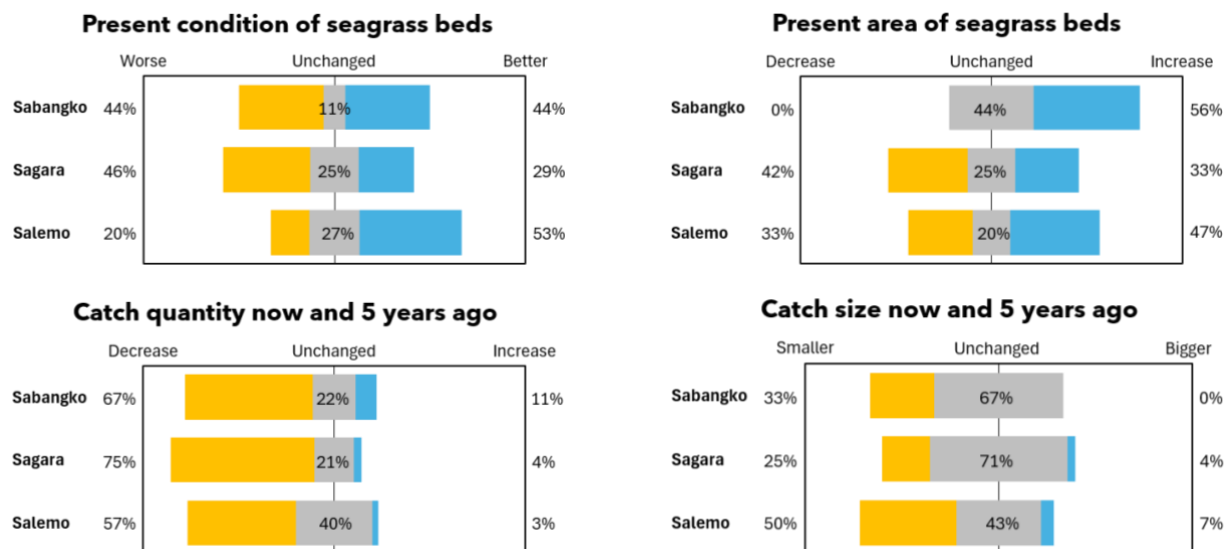


Figure 6. Negative feedback-loop caused by an incorrect LEK

LEK on dynamic of seagrass, catch, and revenue

The LEK analysis reveals a lack of linearity between seagrass biophysical status and the actual catch and revenue trends on the three islands. Visual data indicates that most respondents in Sabangko (56%) and Salemo (47%) perceive an expansion in seagrass area. Yet, this optimism is contradicted by a sharp decrease in catch volume reaching 75% in Sagara and 67% in Sabangko. In Salemo, the reduction in catch (57%) and income (67%) persists despite 53% of respondents viewing the ecosystem as being in a better state.

This marked disconnect between perceived habitat stability and the declining quantity and size of fish suggests that fishing pressure remains intense regardless of habitat quality. This pattern likely points toward overfishing as one of external factors. The findings also emphasize that the fisheries crisis is a collective experience despite differences in fishing gear or locations. Since seagrass associated species account for 54% to 57% of the catch for both gillnet and crab pot fishers, seagrass degradation impacts the broader fish stocks. This ensures that even fishers who operate beyond the seagrass are not immune to the consequences of habitat disturbance.



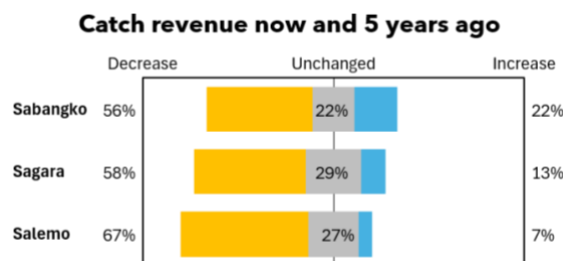


Figure 7. Community LEK concerning dynamics of seagrass ecosystem changes, catch, and income.

3.3 Implications of Management and Conservation

Since LEK represents the accumulated body of ecological knowledge developed through long-term interaction between local communities and the natural environment, it plays a crucial role in the success of conservation and resource management efforts. This study showed that LEK was strongly influenced by the degree of dependence on seagrass and livelihood profiles. Therefore, there are three crucial issues that need to be addressed. First, lack of local awareness of seagrass compared to other ecosystems (coral reefs or mangroves) may lead local communities to underestimate the seagrass as an unpopular ecosystem. Thus, efforts are needed to raise awareness about the importance of a holistic view of the seascape, rather than focusing on only one ecosystem. Second, efforts are needed to correct misconceptions and misunderstandings (cognitive bias) about seagrass use, which may lead local communities to underestimate the impacts of their unsustainable practices due to high economic reliance (Jones et al. 2022). Third, inadequate scientific literacy and communication hinder the public understanding of science, resulting in a failure to engage local communities. Thus, expanding and disseminating scientific knowledge to local communities is needed through LEK to raise their awareness of the anthropogenic factors threatening seagrass beds or other important issues (e.g. microplastic, marine debris, blue carbon).

In addition, there are several examples of LEK integration into environmental planning, management and monitoring (e.g. Cullen-unsworth et al., 2018; Echevarría et al., 2026; Lako et al., 2023). This highlights the important role of LEK as community insights in conservation and management efforts. In the absence of community insights in decision-making process, undermines social legitimacy, reduces regulatory compliance, and reinforces a persistent divergence, which frequently results in governance failure and adverse impacts on coastal livelihoods (Jones et al. 2022; Amores et al. 2026; Amores and Aguilar 2026).

Therefore, the systematic integration of Local Ecological Knowledge (LEK) into seagrass conservation frameworks is increasingly recognized as a vital pathway for fostering adaptive co-management. For such integration to be effective, management strategies must move beyond tokenistic consultation and prioritize the social-ecological coupling inherent in coastal communities. To do so, several crucial points must be considered. First, LEK must be recognized as an epistemologically valid source of knowledge rather than being dismissed as merely complementary or anecdotal evidence (Fauzi et al., 2026). Second, knowledge co-production is required by combining LEK and Conventional Scientific Knowledge (CSK) to generate adaptive indicators that serve as a robust framework for monitoring seagrass ecosystem dynamics (Jones et al. 2022). Third, it is equally vital to establish shared decision making where local communities are regarded as equal partners or co-researchers who are actively involved from the planning phase through to implementation and evaluation (Echevarría et al., 2026; Fauzi et al., 2026). This must be accompanied by the redistribution of authority and rights in seagrass use and management to ensure that LEK is not eroded but rather continues to evolve and remain sustainable.

4. CONCLUSION

Local Ecological Knowledge (LEK) regarding seagrass ecosystems is predominantly low (43%). LEK levels are significantly influenced by fishing gear type and income, where intensive interaction through gear operating directly within seagrass beds enhances ecological understanding. However, significant "blind spots" exist regarding non-fishing threats such as plastic waste and anchoring. Economic pressures and cognitive biases lead communities to underestimate the impacts of destructive practices. While seagrass conditions are often perceived as stable or improving, declining fish catches suggest external pressures like overfishing. Strengthening environmental literacy through a holistic seascape approach is essential to synchronize scientific understanding with local knowledge for successful conservation.

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