



A Local Wisdom-Based Marine Management Model To Improve Animal Protein Utilization And Children's Nutrition In East Flores District

Hendrikus Likusina Kaha¹ Stephanie Perdana Ayu Lawalu²

Universitas Katolik Widya Mandira

*) Corresponding Author
*kahahendrikus2@gmail.com

Received : February 27, 2026; Accepted : April 15, 2026

DOI 10.25299/jiap.2026.27425

Abstract

The study formulates a marine management model based on local wisdom to increase the use of animal protein and improve the nutritional status of children in East Flores Regency. Although this region has abundant marine resource potential, children's animal protein consumption remains low due to sub-optimal distribution of catches and limited nutritional education. A mixed methods approach with a sequential explanatory design was used, involving 120 fishing households as a sample. Multiple linear regression analysis showed that the distribution of catch for family consumption ($\beta = 0,421$; $p < 0,01$), frequency of fish consumption ($\beta = 0,365$; $p < 0,05$), and processed seafood diversification ($\beta = 0,287$; $p < 0,05$) had a significant effect on children's nutritional status. Qualitative findings emphasize the importance of integrating local wisdom, strengthening traditional institutions, and community-based nutrition education. The developed model integrates catch distribution management, nutrition education, and marine product diversification, thereby bridging the marine and health sectors. This research also provides theoretical contributions to the development of community-based coastal governance and practical contributions to local policies to improve child nutrition quality.

Key Words: marine management, local wisdom, animal protein, children's nutritional status

Introduction

East Flores Regency is an archipelago in East Nusa Tenggara Province with significant marine and fisheries resources. Its coastal geography makes the fisheries sector serve as a key to local livelihoods. Marine products such as fish and other aquatic biota are sources of high-quality animal protein, containing essential amino acids, omega-3 fatty acids, and other micronutrients, which are important for children's growth and development. The Food and Agriculture Organization (FAO, 2022) emphasized that regular fish consumption significantly contributes to food security and improvement of community nutritional quality, particularly in coastal areas and developing countries.

Animal protein plays a crucial role in supporting children's linear and cognitive growth, as well as increasing immune and body resistance. The World Health Organization (WHO, 2021) states that long-term lack of protein consumption and micronutrient intake can increase the risk of stunting and developmental disorders. Somehow, even though surrounded by rich natural resources, especially marine resources, the prevalence of child nutrition problems is still a sincere concern in many regions of Indonesia. This condition shows a paradoxical situation, where there is a gap between the availability of marine resources and the animal protein consumption at the household level. Conceptually, community-based natural resource management emphasizes the active participation of local communities in planning, utilization, and monitoring of resources in a sustainable manner (Ostrom, 1990). This approach is relevant for coastal areas with traditional value systems and norms in governing marine resources management. Local wisdom serves as a social mechanism for maintaining ecosystem balance while ensuring community livelihoods' sustainability. In the context of sustainable development, it is important to integrate ecological, social, and public health aspects, so that resource utilization is not just economically oriented but also has a direct impact on improving the community's quality of life.

Problems that arise in East Flores Regency are not solely related to seafood availability, but also to patterns of distribution, consumption preferences, limitations in processing, and the low integration between the marine sector and child nutrition improvement programs. Some catches are market-oriented to increase income, while household consumption has not been a top priority. Furthermore, seasonal fluctuations and limited storage facilities also impacted the continuity of animal protein for family access. Furthermore, seasonal fluctuations and limited storage facilities also impacted families' continued access to animal protein. Given these conditions, a marine management model is needed, a model that not only maintains resource sustainability but also systematically directs their use in supporting child nutrition improvement. This research offers a problem-solving plan by formulating a local wisdom-based marine management model. The proposed model integrates: (1) the strengthening of traditional institutions and fishing communities, (2) regulating catch distribution for family consumption, (3) education on local nutrition potential, and (4) developing suitable children's food from diversified sources of processed marine products. The model is expected to bridge the marine and health sectors in one integrated intervention framework.

This research's novelty lies in three main aspects, namely: (1) the integration of a local wisdom-based marine resource management with public health indicators; (2) the expansion of the community-based natural resource management concept, by including catch distribution for household consumption as one of the dimensions; (3) the development of a cross-sector policy model or an integrated coastal governance model that connects the marine

and health sectors. The objective of this research is to formulate a participatory and sustainable model of marine management based on local wisdom, to increase the utilization of animal protection to support improvement in children's nutritional status in East Flores Regency. Results are expected to provide theoretical contributions to develop an integrated coastal development model, as well as give practical contributions to local governments and stakeholders in designing policies based on local potential and oriented towards improving human resources quality from an early age.

This research tries to develop an integrated marine management model based on local wisdom to improve children's nutritional status. The proposed model involves five main actors, namely local customary institutions, fishermen's groups, the marine and fisheries agency, the health offices (community health centers and integrated health posts), and the village government. The decision-making process is carried out through a collaborative governance mechanism based on village deliberation that resulted in agreements regarding catch distribution patterns and household consumption. The model will be implemented later through village regulations or customary agreements, strengthening of social norms on catch distribution patterns, and community-based nutrition education.

This model also integrates economic incentives such as fish product diversification, market support, and storage technology to maintain a balance between fishers' consumption and income. Model outputs include increased animal protein consumption, improved child nutritional status, and strengthened local institutions.

Method

This study executes mixed approaches with a sequential explanatory design, namely gradual combinations of quantitative and qualitative methods to obtain a comprehensive understanding of local wisdom-based marine management and its relationship with the increasing of children's nutritional status and animal protein consumption. This approach was chosen because it can integrate the advantages of numerical and contextual data, thus thoroughly explaining social phenomena (Creswell & Plano Clark, 2018). The first stage involved quantitative data collection and analysis, followed by the second stage, which involved qualitative data collection, and lastly, the third stage involved data analysis to deepen and explain the statistical findings. This research was conducted in the coastal area of East Flores Regency, East Nusa Tenggara Province, considering the characteristics of fishing communities that are highly dependent on marine resources and still maintain local wisdom practices in their management.

The research was carried out in the coastal area of East Flores Regency, East Nusa Tenggara province, considering the characteristics of fishing communities that still apply local wisdom practices in managing marine resources. The data used consisted of primary and secondary data. Primary data included household animal protein consumption, frequency of children's fish consumption, anthropometric data (weight and height), catch distribution practices, and the customary marine management system. Secondary data were obtained from local government reports, statistical publications, marine and fisheries service reports, health service reports, and policy documents related to coastal management and nutrition improvement programs

The primary data source for the quantitative approach was fishing households with children aged between two and twelve years. The sample was selected using stratified random sampling based on the coastal village area and the level of fisheries sector dependence. The

sample size was determined with 95% confidence level and a 5% margin of error. For the qualitative approach, informants were selected using purposive sampling, including traditional leaders, fishing group leaders, village officials, integrated health post (Posyandu) cadres, and health workers. Informant selection was based on the principles of relevance and depth of information (Miles, Huberman, & Saldaña, 2014).

The study population was all fishermen’s households with children aged 2-12 years in the study area. The sample size was determined using the Slovin formula with a 95% confidence level and a 5% margin of error. Based on this calculation, a sample size of 120 fishing households was obtained. The sampling technique used was stratified random sampling, based on the distribution of coastal villages and their level of dependence on the fisheries sector. This approach was used to ensure the representation of the socioeconomic characteristics of the fishing community in the study.

Table 1. Population and Sample

Description	Formula and Numbers
Number of populations	171 households
Margin of error	5 %
Slovin Formula and calculation	$n = \frac{N}{1 + N(e^2)}$ $n = \frac{171}{1 + 171(0,05^2)}$
Result (number of sample)	$n = \frac{171}{1,4275} = 119,8 \approx 120$

Source: Authors (2026)

Quantitative data collection was conducted through a survey using a structured questionnaire. Animal protein consumption was measured using a food frequency questionnaire (FFQ) and a 24-hour recall to estimate children’s nutrient intake. Nutritional status was assessed through anthropometric measurements and analyzed based on the World Health Organization (WHO, 2006) child growth standards, using height-for-age (H/A) and weight-for-age (BW/A) indicators. This approach is commonly used in nutritional epidemiology studies to assess stunting and underweight conditions (WHO, 2006). To improve the clarity and consistency of the analysis, variables in this study are operationally defined as follows:

1. Animal protein consumption is defined as the total daily intake of protein from fish and other animal protein sources consumed by children.
 - a. The indicator of animal protein consumption is measured by the amount of protein intake, measured in grams per day
 - b. Measurement was executed by a 24-hour consumption recall and food frequency questionnaire (FFQ) on the ratio scale.
2. Distribution of catch for family consumption: Defined as the proportion of fishermen's catch allocated for household consumption compared to the total catch.

- a. Percentage of catch consumed by households
 - b. Measurement method by respondents estimated based on the average weekly catch distribution on the ratio scale
3. Frequency of fish consumption by children: Defined as the number of fish consumed by children in one week.
 - a. Number of fish consumed in times per week
 - b. The measurement method was with FFQ on the ratio scale
4. Child nutritional status: Defined as the child's growth condition as measured by the WHO child growth standards.
 - a. Height for Age (H/A)
 - b. Weight for Age (B/A)
 - c. Anthropometry Measurement of height and weight
 - d. Z-score analysis based on WHO Standards (2006)

Qualitative data collection was conducted through in-depth interviews, focus group discussions (FGDs), and participant observation. The interviews focused on exploring customary norms, fishing area regulation systems, seafood distribution mechanisms, and community perceptions regarding the importance of animal protein consumption for children. Focus group discussions were used to identify opportunities for integration between community-based marine management systems and nutritional intervention strategies. Participatory observation was conducted to understand social and economic practices in catch utilization. Quantitative data analysis was conducted both descriptively and inferentially. Descriptive analysis was used to describe respondent characteristics, animal protein consumption levels, and the distribution of children's nutritional status. Inferential analysis used Pearson correlation and multiple linear regression to examine the relationship between seafood management variables, animal protein consumption levels, and children's nutritional status. This analysis refers to social statistics principles commonly used in public health research (Sugiyono, 2019). Qualitative data analysis was conducted through the stages of data reduction, data presentation, and conclusion drawing, as outlined by Miles, Huberman, and Saldana (2014). Data from interviews and focus group discussions (FGDs) were transcribed, coded, and then grouped into key themes, such as customary institutions, catch distributions, family consumption patterns, and locally based nutrition improvement strategies. Data validity was maintained through triangulation of sources, methods, and time, to enhance the findings' credibility.

Results of both analyses were then integrated during the interpretation stage to formulate a conceptual model for marine management based on local wisdom that supports increased animal protein consumption and improved child nutritional status. This integration enabled the formulation of a model that is not only based on statistical evidence but also comprehensively considers the local social, cultural, and institutional context.

Results and Discussion

Results

Based on the research conducted in the coastal areas of East Flores Regency, results showed that the average animal protein consumption of children aged between 2 and 12 years was 32.6 grams per day. This figure is below the recommended daily protein intake for school-age children, which ranges from 40 to 50 grams per day, according to the national Recommended Daily Intake (Kementerian Kesehatan RI, 2019). A total of 58% of children in the study sample were recorded as consuming less than the recommended intake of animal protein. Based on anthropometric measurements referring to the World Health Organization's child growth standards (WHO, 2006), it was found that 29% of children were classified as stunted (Height/Age <-2 SD), 18% were underweight (BW/Age <-2 SD) and 7% were wasted (BW/Height <-2 SD), while 46% were in the normal nutritional status category.

Survey's results of fishing households showed that 72% of respondents prioritized selling their catch over household consumption. Sixty-four percent of respondents stated that there are no customary rules specifically regulating the allocation of catch for family nutrition, despite local provisions regarding fishing zones and prohibitions on the use of destructive fishing gear. Hypothesis testing results indicate a positive and significant relationship between animal protein consumption and children's nutritional status ($p < 0.05$). Furthermore, there is a significant relationship between community-based seafood distribution mechanisms and increased frequency of children's fish consumption ($p < 0.05$).

The result of this study is obtained by a multiple linear regression model, which is formulated as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 Z_1 + \beta_6 Z_2 + \epsilon$$

Description of regression formula:

- Y = Child's nutritional status (z-score Height/Age)
- X1 = Distribution of catch (%)
- X2 = Frequency of fish consumption (times/week)
- X3 = Diversification of processed seafood
- X4 = Household income
- Z1 = Mother's education
- Z2 = Child's age
- ϵ = error term

Table 2. Result of Regression Analysis of Marine Management, Animal Protein Consumption, and Children's Nutritious Status

Variabel	Coefficient (β)	Std. Error	t- count	Sig. (p)
Constant	-1,215	0,532	-2,284	0,024
Catch Distribution (X1)	0,421	0,118	3,567	0,001
Animal protein consumption (X2)	0,365	0,142	2,570	0,012

Diversification of processed seafood(X3)	0,287	0,121	2,372	0,019
Household income(X4)	0,208	0,098	2,122	0,036
Mother's Education (Z1)	0,190	0,087	2,183	0,031
Childs' age (Z2)	-0,145	0,072	-2,014	0,046

Source: Authors (2026)

Table 3. Goodness of Fit

Statistic	Value
R Square	0,62
Adjusted R Square	0,59
F-count	18,45
Sig. F	0,000

Source: Authors (2026)

Results showed that the regression model was simultaneously significant ($F = 18.45$; $p < 0.001$) with an Adjusted R^2 value of 0.59, meaning that 59% of the variation in children's nutritional status can be explained by the variables in the model. The distribution of catches for family consumption was the most influential variable ($\beta = 0.421$; $p < 0.01$), followed by the frequency of fish consumption ($\beta = 0.365$; $p < 0.05$). This finding indicates that the aspect of resource distribution governance has a more dominant role than purely economic factors. This also suggests that resource distribution governance plays a more dominant role than purely economic factors.

Along with quantitative findings from the regression, qualitative findings from interviews with the fishermen's group also indicate that communities still maintain local wisdom practices to maintain marine sustainability, such as seasonal fishing restrictions and community-based monitoring of catch distribution for market and household consumption. However, there has been no explicit integration between customary-based marine management systems and programs to increase animal protein consumption for children.

Discussion

The study's findings indicate a gap between the availability of marine resources and children's animal protein consumption levels. This condition aligns with the food security framework proposed by the Food and Agriculture Organization (FAO, 2022), which emphasizes that food security is determined not only by availability but also by access, utilization, and stability.

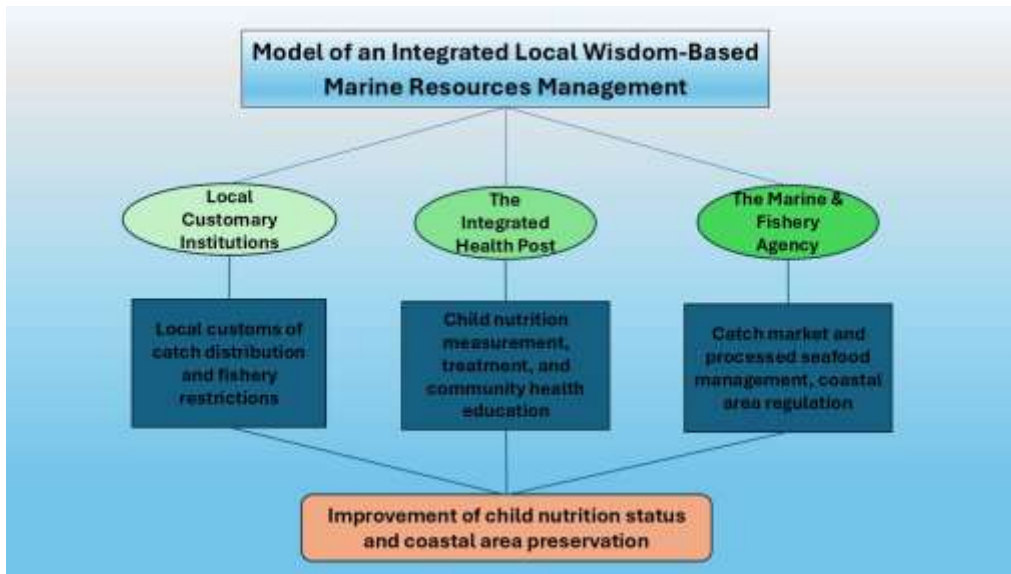
All the above findings of this study indicate that there is a gap between the availability of marine resources and the level of children's animal protein consumption. This condition aligns with the food security framework proposed by the Food and Agriculture Organization (FAO, 2022), which emphasizes that food security is determined not only by availability but also by access, utilization, and stability of food. In the context of East Flores, fish availability is relatively adequate, but household access and utilization are still sub-optimal due to a predominance of economic factors over family consumption. The significant relationship between animal protein consumption and children's nutritional status reinforces WHO findings (2021), which state that high-quality protein intake contributes to children's linear growth and cognitive development. Fish, as a source of animal protein, is rich in essential amino acids and omega-3 fatty acids, which play a role in tissue formation and nervous system development. Therefore, consistently increasing fish consumption has the potential to reduce the risk of stunting in coastal areas.

Findings regarding the importance of seafood distribution for family consumption indicate that local governance has a direct impact on children's nutritional quality. This extends Ostrom's theory of community-based natural resource management (Ostrom, 1990), which emphasizes the importance of local institutions in maintaining the sustainability of resources. This research adds a new dimension, namely the integration of nutritional indicators as part of successful coastal resources management. Conceptually, the results of this study modify the local wisdom-based marine management approach by including the component of utilizing catches to improve the nutritional quality of children. Previously, studies of sustainability tend to focus more on ecological and economic aspects; this research shows that the public health dimension is also an indicator that needs to be considered in the coastal management model.

Integrating the marine and health sectors is a relevant strategy in the context of sustainable development. This cross-sectoral approach aligns with the Sustainable Development Goals (SDGs) agenda, particularly the zero hunger goal (SDG 2) and underwater life preservations goal (SDG 14). Thus, the local wisdom-based marine management model resulting from this research is not only relevant at the local level but also contributes to a broader sustainable development framework.

Based on the findings, the authors are trying to propose an integrated collaborative governance of three agencies. The first actor is the local customary institutions, the second actor is the health officers of the community health post and the public health center, and the third actor is the Marine and Fishery Agency. The relationship between the three actors can be pictured as follows:

Figure 1. Integrated Model of Local Wisdom Based Marine-Management



Source: Authors (2026)

Conclusion

This study aims to formulate a marine and coastal management model based on local wisdom to increase the utilization of animal protein and support improvements in children's nutritional status in the East Flores Regency. Based on the results, it can be concluded that marine resources are abundant, but this does not guarantee the fulfilment of children's animal protein needs. The average consumption of animal protein among children remains below the recommended nutritional adequacy, and stunting prevalence is still found in some respondents. Hypothesis testing results indicate that the distribution of seafood for family consumption, the frequency of fish consumption, and the diversification of seafood processing are significantly associated with children's nutritional status improvement. Thus, local wisdom-based marine management, which has been oriented towards ecological sustainability, needs to be expanded to include the dimension of utilizing catches for family nutritional needs as part of the social sustainability indicator.

The formulated model of this study emphasizes integration between customary institutions, the regulation of catch distribution for household consumption, community-based nutrition education, and strengthening regional policies that support increasing children's consumption of animal protein. This model demonstrates that coastal resource management not only impacts the environmental and economic sustainability of fishing communities but also directly contributes to the development of human capital from an early age. Based on these findings, it is recommended that the East Flores Regency Government, through the Maritime Affairs and Fisheries Agency, develop regulations or programs that encourage the allocation of a portion of the catch for household consumption by fishermen, particularly for families with growing children. This policy aims to ensure that the potential

of marine resources is effectively utilized to improve the nutritional quality of local communities.

Local health departments and community health centers are advised to integrate education on fish and animal protein consumption into integrated health posts (Posyandu) programs and elementary schools, so that improved nutritional knowledge goes hand in hand with strengthened marine resource management. This step aims to raise parental awareness of the importance of animal protein consumption for children's growth. Traditional institutions and fishing groups are advised to consider adding local norms or agreements that prioritize the use of catches for family needs before marketing. This recommendation aims to strengthen the social function of local wisdom in supporting food security and improving child nutrition. For future researchers, it is recommended to develop an action-based intervention model (action research) to directly test the effectiveness of the model's implementation over a specific period. Further research could also expand the scope of the study area to obtain a comparative picture across coastal areas.

Acknowledgement

The author would like to express his gratitude to the government of East Flores Regency and all village officials at the research sites for their permission and support during the data collection process. Gratitude is also expressed to the traditional leaders, fishermen's groups, integrated health post cadres, and the respondents' families who actively participated in this research. This research was made possible with financial support from the Research and Community Service Institute of Widya Mandira Catholic University, Kupang. The authors also appreciated the contributions of all enumerators and field teams who assisted with the survey and data processing.

References

- Creswell, J. W. & Plano Clark, V. L. (2018). *Designing and Conducting Mixed Methods Research*. Thousand Oaks, CA, USA: Sage Publications.
- Food and Agriculture Organization (FAO). (2022). *The State of World Fisheries and Aquaculture 2022*. Rome, Italy: FAO.
- Kementerian Kesehatan RI. (2019). *Pedoman Konsumsi Protein Hewani untuk Anak*. Jakarta, Indonesia: Kementerian Kesehatan Republik Indonesia.
- Miles, M. B., Huberman, A. M., & Saldaña, J. (2014). *Qualitative Data Analysis: A Methods Sourcebook* (3rd ed.). Thousand Oaks, CA, USA: Sage Publications.
- Ostrom, E. (1990). *Governing the Commons: The Evolution of Institutions for Collective Action*. Cambridge, UK: Cambridge University Press.
- Sugiyono. (2019). *Metode Penelitian Kuantitatif, Kualitatif, dan R&D*. Bandung, Indonesia: Alfabeta.
- World Health Organization (WHO). (2006). *WHO Child Growth Standards: Methods and Development*. Geneva, Switzerland: WHO.
- World Health Organization (WHO). (2021). *Guideline: Protein Intake for Optimal Child Growth*. Geneva, Switzerland: