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Assessing local responses to illegal, unreported, and unregulated (IUU) fishing in Olutanga, Zamboanga Sibugay: A baseline study using the I-FIT tool

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ABSTRACT

Illegal, unreported, and unregulated (IUU) fishing poses threats to small-scale fisheries communities in the Philippines. This study assessed the local responses to IUU fishing in Olutanga, Zamboanga Sibugay using five standardized indicators of the Philippine IUU Fishing Index and Threat Assessment Tool (I-FIT), a diagnostic framework designed to guide evidence-based management rather than evaluate local government performance. A mixed-method approach was employed, integrating key informant interviews, focus group discussions, workshops, and secondary data review. Social Survey was also conducted across 14 coastal barangays from August 2024 to February 2025 to validate the data obtained from LGU. Findings indicate critical gaps across all response indicators (R1-R5): the enforcement team was partially operational (R1), no targeted information, education, and communication (IEC) activities was conducted (R2), fisheries compliance audits were absent (R3), IUU fishing data were collected informally and not analyzed to address IUU fishing (R4), and approved and official IUU fishing reduction plan was lacking (R5). The municipality's average IUU fishing response score was 3.4 (SD= 0.55), indicating high risk to IUU fishing. The following interventions are recommended to address the high risk to IUU fishing in Olutanga: strengthen enforcement operations and capacity; implement regular targeted IEC campaigns; comply with fisheries compliance audit annually; institutionalize systematic data collection; and develop a comprehensive IUU Fishing Reduction Plan. This study is the first endeavor to evaluate the local response to IUU fishing in Region 9 and aligns primarily with the United Nations Sustainable Development Goal 14.4 target which aims to end IUU fishing.

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INTRODUCTION

Marine ecosystems are vital sources of nutrients and contribute significantly to food security and economic stability (Ward *et al.*, 2022; Begum *et al.*, 2024; Alvarico *et al.*, 2021). However, rising global demand for marine resources has fueled unsustainable practices such as IUU fishing, which poses a grave threat to fish stocks and ecosystem health (Gebremedhin *et al.*, 2021). IUU fishing refers to illegal activities that violate national or international laws, unreported activities that go undocumented or are misrepresented, and unregulated operations often carried out by vessels without legal nationality or in areas lacking proper conservation measures (FAO, 2020a; Philippine Fisheries Code and RA 19654). According to the National Oceanic and Atmospheric Administration (NOAA), IUU fishing undermines sustainable fisheries management and threatens marine ecosystems, economic stability, and global food security (NOAA, 2021; Stefanus, 2021). The Food and Agriculture Organization (FAO) of the United Nations also emphasizes the urgency of combating IUU fishing through international cooperation and improved policy implementation (FAO, 2020a). Furthermore, FAO underscores in The State of World Fisheries and Aquaculture 2020: Sustainability in Action that addressing IUU fishing is essential to achieving sustainable fisheries and realizing Sustainable Development Goal 14.4 (FAO, 2020b). IUU fishing continues to impose severe environmental, economic, and social costs (Chapsos *et al.*, 2019), and is increasingly recognized as a threat to national security due to its impact on fish stocks and links to transboundary criminal activities (Okafor-Yarwood, 2020; FAO, 2020b; Saadon *et al.*, 2020). Key drivers of IUU fishing include financial gain, weak governance, limited enforcement capacity, and systemic corruption, all of which undermine ecological integrity and food security in vulnerable nations (Widjaja, Long, and Wirajuda, 2022; DA-BFAR, 2022; Stefanus, 2021).

Global estimates suggest IUU fishing causes between USD 26 billion and USD 50 billion in losses annually and removes 11 to 26 million metric tons of fish from the ocean each year (Widjaja *et al.*, 2020; Temple *et al.*, 2022; FAO, 2020b). The practice not only drives overfishing but also uses destructive techniques that harm marine habitats (U.S. Coast Guard, 2020; Orlowski, 2020), while socially destabilizing coastal communities and perpetuating illicit labor practices (U.S. Coast Guard, 2020). Addressing IUU fishing therefore demands improved governance, strong international cooperation, and enhanced enforcement mechanisms (NOAA, 2021; Stefanus, 2021). In the Philippines, a marine biodiversity hotspot with 7,641 islands, IUU fishing problem is acute (Mendoza, 2023; Madarcos *et al.*, 2021; SEA Circular, 2020). Though the country improved its IUU Fishing Index rank in 2021 from 27th to 20th out of 152 coastal nations, it still scored 2.55—higher than both the global and Asian averages (BWorld Online, 2022). With 4.3 million metric tons of fish produced in 2022, a 2.2% increase (DA-BFAR, 2024), the Philippines remains among the top ten countries most vulnerable to IUU fishing, with a vulnerability score of 3.92 (DA-BFAR, 2022; Widjaja *et al.*, 2020). Accurate IUU fishing quantification is critical to sustain fisheries, improve fishery productivity and assist law-abiding fishers (Coastal Resources Center, 2021; PSA, 2020).

The Philippines developed the IUU Fishing Index and Threat Assessment Tool (I-FIT) through DA-BFAR and USAID to identify and address regional IUU fishing risks (DA-BFAR, 2022). I-FIT was designed based on the Global IUU Fishing Index's prevalence-vulnerability-response framework. The Philippine IUU Fishing Assessment Report 2023 shows the following regional coverage: Region 1 (36%), Region 2 (52%), CAR (79%), Regions 3 (85%), NCR (63%), Region 4A (24%), Region 4B (65%), Region 5 (9%), Region 6 (87%), Region 7 (39%), Region 8 (27%), Region 9 (0%), Region 10 (38%), Region 11 (14%), Region 12 (60%), Region 13 (95%), and BARMM (6%) according to DA-BFAR (2024). Thus, this study aimed to fill the gaps for the zero assessment in Region 9 where IUU fishing has been rampant. Only recently that IUU fishing assessment in Region 9 has been documented. This covers only the prevalence of

IUU fishing in the Municipality of Alicia (Fernandez *et al.,* 2025) and vulnerability to IUU fishing in Municipality of Mabuhay (Ogoc *et al.,* 2025), both in Zamboanga Sibugay, Region 9. This study reports for the first time the response component of the I-FIT in one of the municipalities in Zamboanga Sibugay. This study assessed the response to the IUU fishing in Olutanga, Zamboanga Sibugay in Region 9 by determining what has been done by Olutanga Municipality to address IUU fishing using the I-FIT five standard indicators. This study is in line mainly with the United Nations Sustainable Development Goal 14.4 which aims to end illegal, unreported, and regulated fishing.

MATERIALS AND METHODS

Sampling area

This study was conducted in the municipality of Olutanga, Zamboanga Sibugay, an island municipality covering approximately 113.3 km² with a coastline of about 93.44 km. It is situated along the productive waters of Sibuguey Bay within the Sulu-Celebes Sea marine ecosystem.

The research specifically focused on all 14 coastal barangays of Olutanga that are directly affected by illegal, unreported, and unregulated (IUU) fishing (Fig. 1). These barangays were selected due to their proximity to fishing grounds and the documented prevalence of IUU fishing activities.

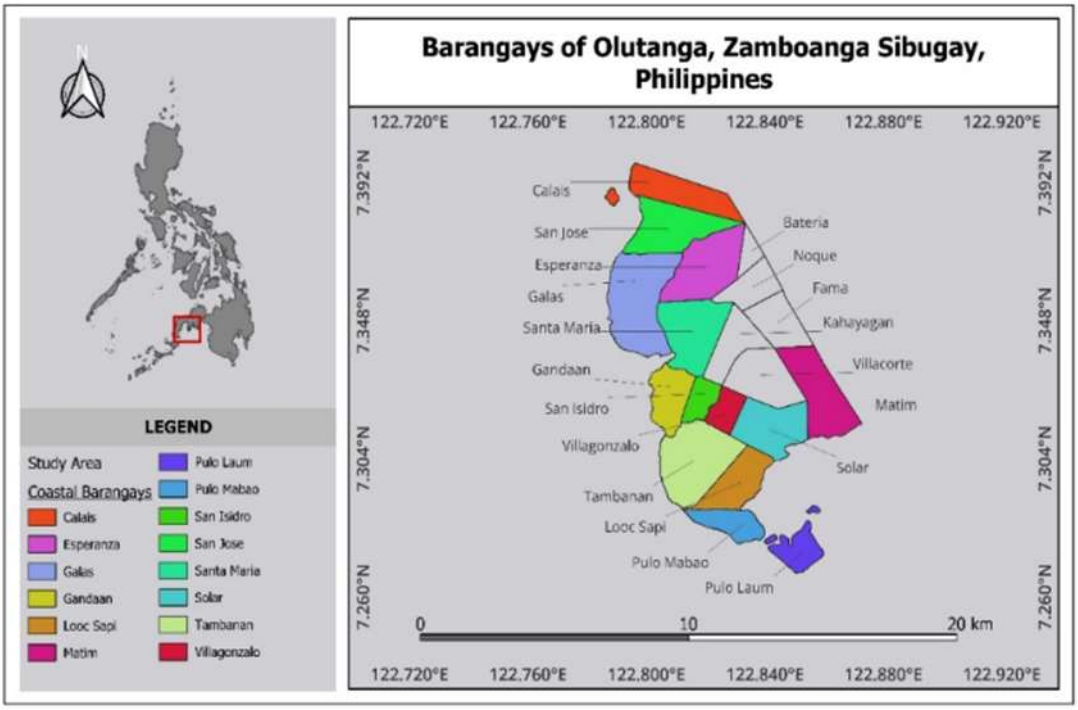

Fig. 1. Map showing the study area comprising 14 coastal Barangays of Olutanga Municipality, Zamboanga Sibugay, Philippines

Ethical considerations and field coordination

This study adhered to ethical standards for research involving human participants. Ethical clearance was obtained from the Mindanao State University – Iligan Institute of Technology (MSU-IIT) Ethics Review Board. Local government and community endorsements were secured to ensure transparency, field support, and safe access. Participants were informed of the study's objectives, assured of voluntary participation, and guaranteed confidentiality. All data collection activities were conducted with cultural sensitivity, particularly regarding discussions related to illegal fishing activities.

Research design

This study employed a mixed-methods design to assess local responses to IUU fishing in the municipality of Olutanga. The approach integrated

quantitative I-FIT assessments with qualitative insights from key informant interviews (KIIs), focus group discussions (FGDs), workshops, and secondary data review to provide a comprehensive evaluation of local governance and fisheries management practices. Additionally, a social survey was conducted to gather community perspectives on IEC programs aimed at addressing IUU fishing.

Population and sampling techniques

For the social survey, the sampling frame was limited to respondents engaged in fishing-related activities within the 14 coastal barangays of Olutanga, Zamboanga Sibugay. Random samples were drawn from each barangay, and the required sample size was calculated using Slovin's formula at a 95% confidence level and a 5% margin of error (Yulinda *et al.*, 2022), as shown below:

$$n = \frac{N}{1 + Ne^2}$$

Where,

n = sample size

N = population size

e = margin of error (0.05)

In this formula, N represents the total population of registered fisherfolk in each barangay, while n denotes the number of respondents selected for the survey. The calculated sample sizes were as follows: Pulo Laum (16), Calais (15), San Jose (14), Galas (26), Esperanza (2), Sta. Maria (19), Gandaan (22), San Isidro (7), Villagonzalo (2), Tambanan (36), Matim (14), Pulo Mabao (75), Looc Sapi (17), and Solar Poblacion (72). This resulted in a total sample size of 337 respondents across all barangays.

Field sampling and data collection based on I-FIT response indicators (R1-R5)

All data collection activities were guided by the I-FIT framework, the Philippine IUU Fishing Index and Threat Assessment Tool (I-FIT) developed by the Department of Agriculture–Bureau of Fisheries and Aquatic Resources (DA-BFAR) in 2022. The I-FIT is based on the global prevalence-vulnerability-response framework but for this study it only focused on the response component (R1-R5) to assess IUU fishing response risk in municipal waters.

Fieldwork was conducted from August 2024 to February 2025. Data were collected following the I-FIT framework developed by DA-BFAR in collaboration with the United States Agency for International Development (USAID) (DA-BFAR, 2022). The I-FIT was designed according to the Global IUU Fishing Index's prevalence-vulnerability-response framework. In this study, the focus was solely on the response component, assessed using five standardized indicators (R1–R5): (R1) presence of a fully operational enforcement team, (R2) implementation of targeted information, education, and communication (IEC) activities, (R3) LGU compliance with national fisheries laws, (R4) systematic data collection to guide IUU fishing reduction strategies, and (R5) presence and implementation of an IUU Fishing Reduction Plan.

Table 1. Data sources for IUU fishing response indicators

Response indicator	Data sources
R1. Fully operational enforcement team	KII/enforcement team
R2. Targeted and purposive information, education, and communication (IEC) to increase compliance	FGD/LGU and other stakeholders
R3. LGU compliance with national fisheries law	KII/ Municipal Agriculture Office
R4. Systematic data collection on IUU fishing used proactively to inform reduction strategies	KII/MAO and Enforcement team
R5. IUU fishing reduction plan	KII/MAO

Each response indicator (R1–R5) was scored based on the type of evidence specified by I-FIT, and data sources were obtained exclusively from local government units (i.e., Municipal Agriculture Office and enforcement team) as prescribed by I-FIT. However, social survey was conducted to further and solely validate the data from the LGUs. Thus, the computation of response scores for all indicators relied only on data sources as required by I-FIT tool (Table 1), excluding the social survey.

Questionnaire design

The social survey used a semi-structured questionnaire based on the I-FIT Tool.

It was composed of two sections: Part I determined the IEC programs conducted in the Municipality of Olutanga to address IUU fishing; Part II examined the demographic and socioeconomic profiles of respondents.

Data analysis

Measurement of response to IUU fishing using I-FIT indicators (R1–R5)

Scoring of responses to IUU fishing followed the standardized I-FIT response indicators. A four-point scale (1–4) was used, where 1 indicates low risk to IUU fishing (good response), 2 indicates moderate risk, 3 indicates high risk, and 4 indicates very high risk (poor response), as shown in Fig. 2. Table 2 illustrates how the scoring was applied. Each response indicator was assigned a score from 1 to 4, and the average of all five indicators (R1–R5) was calculated to determine the overall response score to IUU fishing.

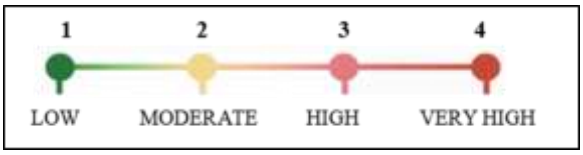

Fig. 2. IUU fishing response score

The scores reflect the actual level of response to IUU fishing based on the evidence collected for each indicator. It is important to note that the I-FIT framework emphasizes that the IUU Fishing Index score is not intended to measure LGU performance. Rather, it serves as a diagnostic tool to assess the status of IUU fishing within an LGU's jurisdiction and to determine whether ongoing reduction efforts are progressing toward their intended goals.

Table 2. Response scores to IUU fishing using I-FIT indicators (R1–R5)

Response indicators	Response scores			
	1 (Low)	2 (Moderate)	3 (High)	4 (Very high)
R1. Enforcement team fully operational.	Enforcement team evaluation form (Table 40) score of 10	ETEF score from 6 to 9	ETEF score from 1 to 5	No local/enforcement team organized, or not operational
R2. Targeted and purposive information, education, and communication to increase compliance.	Active engagement of fishers in IEC campaigns, dialogues/forums, and meetings	IEC campaigns on IUU fishing and compliance	IEC campaigns focusing mostly on knowledge of laws and regulations only.	No regular IEC campaigns on IUU fishing with the community.
R3. LGU compliance to national fisheries laws.	>75%	51% to 75%	26% to 50%	0% to 25% or no FCA score during the assessment period.
R4. Systematic data collection on IUU fishing used proactively to inform reduction strategies.	Systematic data collection e.g., recording, archiving, and analyses of info. from community observations and enforcement data.	Collection from law enforcement operations or community observations only.	Some data is collected but not analyzed or used in response planning.	No systematic data collection, archiving, or analysis of information.
R5. IUU Fishing Reduction Plan.	IUU fishing reduction plan approved and being implemented.	N/A	Enforcement plan/strategy only.	No plans

RESULTS AND DISCUSSION

Using the I-FIT framework, this study offers valuable insights on what was being done in 2024 to address IUU fishing in the Municipality of Olutanga. Results (R1-R2) show that the coastal water of Olutanga is under high risk to IUU fishing.

R1- Operational status of the enforcement team in Olutanga

The enforcement team in Olutanga scored 5 out of 10 based on the standard evaluation form (Table 3), corresponding to a response score of 3, which indicates a high risk to IUU fishing.

Table 3. Enforcement team evaluation form results

Question	Yes or No
Does the Municipality/City have an existing and operational local/composite enforcement team? (Must be both existing and operational. If not, then the answer is "No")	Yes
Does the enforcement team have an enforcement plan, that is targeted to specific types of illegal fishing? (e.g., dynamite, intrusion of commercial fishing vessel, use of active gear, etc.)	Yes
Does the enforcement team have a team leader, assistant team leader and two other personnel? (Must be complete, otherwise the answer is "No", if more, answer is "Yes")	No
Do all of the members of the Enforcement Team undergo basic training and/or retraining on coastal law enforcement? (All must have undergone training to get a "Yes" answer. Basic training must include: fish, gear, vessel, license and fisher identification, (b) boarding procedure, (c) basic navigation, (d) use of GPS, (e) recording, (f) investigation (g) affidavit writing (If any one of the trainings is lacking, the answer is "No". Trainings can be scattered)	No
Does the enforcement team have a land-based vehicle and a patrol boat? (Must be two, if only one the answer is "No")	Yes
Is there a specific allocation in the LGU budget that is dedicated particularly to coastal law enforcement? (If included in the budget of the MAO, must have a specific item in the budget, if there is no specific item then the answer must be "No")	Yes
Does the enforcement team conduct seaborne patrol operations, market-denial operations, fish landing inspections, port-side inspections and check-points? (Must be all, otherwise the answer is "No")	Yes
Are the assets (personnel, land-based and floating) enough to cover patrolling the entire municipal waters, all fish landing areas, docking areas, and market places?	No
Are criminal cases being filed against those that have been apprehended? (Administrative proceedings and fine impositions are not included)	No
Is the enforcement team fully capacitated on the enforcement loop (from surveillance to post-operations assessment, re-planning, and prosecution) and actively adjusting strategies based on data analysis? (Enforcement loop must be complete. If one or more is lacking the answer must be "No")	No
Total Points (number of "Yes")	5 points

Although the team is organized and equipped with an enforcement plan, vehicles and boats, a budget, and patrol activities, it lacks critical components such as full personnel, comprehensive training in coastal law enforcement, and adaptive enforcement strategies.

The high-risk rating indicates that Olutanga's enforcement system remains insufficient to effectively deter IUU fishing. Literature shows that fully operational, well-trained, and regularly patrolling enforcement teams significantly reduce IUU fishing incidents (Tahiluddin and Sarri, 2022). Specific gaps identified in the R1 evaluation-including incomplete staffing, limited training, insufficient patrol coverage, and the absence of formal criminal case filing-suggest that the team cannot sustain consistent enforcement or validate its operational performance. Consequently, the likelihood of persistent illegal fishing activities remains high.

R2- Implementation of targeted IEC to improve compliance in Olutanga

The assessment revealed that no targeted or purposive information, education, and communication (IEC) activities on IUU fishing were reported by the LGU or enforcement personnel during key informant interviews and FGDs. This finding was further confirmed by the survey results, in which 100% of respondents (n= 337) indicated no participation in any IEC events. Consequently, the response rating was 4, denoting a very high risk. This reflects a critical gap in community awareness and voluntary compliance.

The absence of IEC campaigns limits fishers' understanding of fisheries laws, the environmental consequences of IUU fishing, and the benefits of compliance, thereby reducing the effectiveness of enforcement measures. Evidence from Basagre (2021) demonstrates that IEC materials tailored to local fishing practices, combined with science-based education, can improve community understanding, encourage sustainable fishing practices, and support behavioral change.

R3- LGU Compliance with national fisheries laws in Olutanga

The assessment revealed that no Fisheries Compliance Audit (FCA) was available for Olutanga during the

assessment year, as confirmed by the Municipal Agriculture Office (MAO), resulting in a response score of 4, signifying a very high risk to IUU fishing. The absence of an FCA indicates a critical gap in the formal monitoring of LGU adherence to national fisheries laws, limiting accountability and oversight at the local level.

Evidence from Pinera *et al.* (2023) demonstrates that knowledge of and compliance with fisheries laws among coastal communities are closely linked, highlighting that systematic monitoring and reporting mechanisms, such as the FCA, are essential for ensuring proper enforcement and promoting adherence to legal provisions. Implementing routine compliance audits will strengthen accountability, enhance law enforcement effectiveness, and support the sustainable management of municipal waters.

Table 4. LGU responses during workshop-based KII on IUU data collection and use

Intervention area	LGU response	Remarks
Fisheries law enforcement	Yes (observations during patrols used informally)	No formal system; data not documented or compiled regularly
Information, education, and communication (IEC)	No dedicated IEC for IUU data awareness	IEC activities exist in general, but not specific to IUU data use
Community meetings/Forums (e.g., Assemblies)	Yes (IUU issues mentioned in barangay assemblies)	Informal discussions only; no tracking or follow-through
Policy/Ordinance development	Yes (ordinances in place)	Ordinances exist but not based on data or trend analysis
Data integration in registration/Licensing	Yes	Registration is active; not linked to IUU incident monitoring
Dedicated data collection system/Forms	No	No central logbooks, forms, or analytics framework used
Written reports/Documentation	No	No meeting minutes, reports, or documented IUU data available
Bantay dagat activation	Yes (in 5 barangays only)	Active in select areas; limited capacity and not data-driven

R4- Collection and use of IUU fishing data in Olutanga

The results revealed that Olutanga's LGU lacks a formal system for recording, analyzing, and using IUU fishing data to inform enforcement (Table 4), resulting in a response score of 3, reflecting a high risk to IUU fishing. Although some data are collected informally—such as observations during patrols, mentions of IUU issues in barangay assemblies, and active registration/licensing-these are neither documented systematically nor analyzed to guide interventions or policy adjustments. This gap limits the LGU's capacity to implement evidence-based responses and adopt effective strategies to reduce IUU fishing.

R5- Existence and implementation of an iuu fishing reduction plan in Olutanga

The assessment showed that the Municipality of Olutanga does not yet have a formally approved IUU Fishing Reduction Plan, resulting in a response score of 3, meaning high risk to IUU fishing. The municipality currently relies only on its enforcement plan/strategy. The MAO emphasized Olutanga's participation in the ATOM Alliance (Alicia, Talusan, Olutanga, Mabuhay), which coordinates joint initiatives including registration updates, a proposed MandE plan, Manual of Operations, integrated with the development alliance of TOMMBA: Talusan, Olutanga, Mabuhay, Malangas, Buug, and Alicia., financial planning for 2025, illegal fishing gear inventory, planned fishery law enforcement operations, and legal forms under the FLEMOP (Fisheries and Livelihood Enhancement and Management Operational Plan), all to be implemented in 2025 (Table 5). Inter-LGU meetings further support the development of a coordinated reduction plan. Based on these results, Olutanga should formalize a comprehensive IUU Fishing Reduction Plan, integrating ongoing ATOM Alliance initiatives, to be implemented in 2025 to effectively prevent, reduce, mitigate, and eliminate IUU fishing across all its coastal barangays.

Table 5. Planned IUU fishing reduction initiatives in Olutanga through the ATOM alliance

Initiative/Plan	Description	Implementation status
Registration updates	Updating fisher, vessel, and gear registries to reflect current information	Planned for 2025
Proposed M&E Plan	Monitoring and evaluation framework for IUU reduction activities across ATOM municipalities	Planned for 2025
Manual of operations	Standard operating procedures for coordinated enforcement and IUU reduction	Planned for 2025
TOMMBA integration	Coordination with Malangas and Buug municipalities under the development alliance for integrated coastal management	Planned for 2025
Financial planning	Budget allocation and financial plan for IUU reduction activities across ATOM municipalities	Planned for 2025
Illegal fishing gear inventory	Cataloging and assessing illegal fishing gear in municipal waters	Planned for 2025
Fishery law enforcement operations	Coordinated enforcement activities to address IUU fishing	Planned for 2025
Legal forms under FLEMOP	Preparation and adoption of standardized legal forms for enforcement and prosecution	Planned for 2025
Inter-LGU meetings	Regular meetings among ATOM municipalities to coordinate reduction strategies	Ongoing / Planned for 2025

Table 6. Summary of IUU fishing response scores in Olutanga municipality

Indicator	Response score
R1- Operational status of the enforcement team	3
R2- Implementation of targeted IEC to improve	4
R3- LGU Compliance with national fisheries laws	4
R4- Use of systematic IUU data collection to inform enforcement	3
R5- Existence and implementation of an IUU fishing reduction plan	3
Total	17/20
Average	3.4

Average IUU fishing response score using I-FIT

The summary of response score per indicator is presented in Table 6. The average IUU fishing response score for Olutanga is 3.4 (SD= 0.55), indicating high risk to IUU fishing. This response sore is higher than the national average of 2.76 reflecting significant gaps in the municipality's current efforts to address IUU fishing.

CONCLUSION

This study assessed the response to IUU fishing in the Municipality of Olutanga Zamboanga Sibugay using five standardized indicators of the Philippine IUU Fishing Index and Threat Assessment Tool I-FIT developed by DA-BFAR and USAID. Results showed an average IUU fishing response score of 3.4 SD 0.55 indicating a high risk to IUU fishing and higher than the national average of 2.76. All five response indicators R1 to R5 revealed critical gaps. R1 showed that although the enforcement team is operational it lacks sufficient personnel and assets to patrol the entire coastal area has limited training and capacity in coastal law enforcement and data analysis and does not file formal criminal cases against offenders. R2 revealed the absence of targeted IEC activities to improve compliance and awareness while R3 highlighted non compliance with national fisheries laws particularly the lack of a Fisheries Compliance Audit. R4 indicated the absence of systematic data collection and analysis to guide IUU fishing interventions and R5 showed that Olutanga lacks a formal IUU Fishing Reduction Plan despite existing enforcement strategies through the ATOM Alliance. Overall these findings indicate that current interventions to address IUU fishing in Olutanga remain weak and limited at the municipal level.

RECOMMENDATION(S)

The study recommends strengthening the operational capacity of the local enforcement team by completing personnel requirements, enhancing training in coastal law enforcement, institutionalizing

documentation and monitoring systems, ensuring full patrol coverage of municipal waters, adopting adaptive enforcement strategies, and strengthening legal follow-up measures, including the filing of criminal cases, to improve deterrence against IUU fishing. It further recommends that the LGU and enforcement team design and implement targeted and purposive information, education, and communication (IEC) campaigns through workshops, information materials, and regular community engagement activities, with proper documentation of participation and feedback to enhance community awareness and voluntary compliance. In addition, the study recommends prioritizing the timely completion and submission of the Fisheries Compliance Audit (FCA), maintaining proper documentation, and utilizing audit results to identify gaps and guide improvements in local fisheries governance. The establishment of a centralized and systematic IUU fishing data recording and analysis system is also recommended to support evidence-based enforcement, policy development, and adaptive management.

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