

Deployment of law enforcement officers from the Bureau of Fisheries and Aquatic Resources: Basis for improvement of enforcement mechanism

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Abstract

This study aims to assess the deployment of law enforcement officers from the Bureau of Fisheries and Aquatic Resources (BFAR), and the results serve as a basis for improving enforcement mechanisms. It specifically focuses on evaluating the enforcement mechanisms, personnel deployment, floating assets, training, and the overall capability of BFAR officers in CALABARZON. Additionally, the study examines the relationship between these operational factors and key regulatory aspects, including the prevalence of illegal, unreported, and unregulated (IUU) fishing, case filings, fishing activity levels, marine ecosystem health, and economic losses. A descriptive research design utilizing correlational analysis was employed to evaluate the various components of BFAR's enforcement operations. Data were collected through quantitative surveys administered to 18 fishery law enforcers and 47 local government unit (LGU) officials involved in fishery law enforcement within the CALABARZON Region. The survey responses provided valuable insights into the operational challenges and strengths of BFAR's enforcement strategy. The findings reveal that the training and capabilities of enforcement officers are rated *highly*, suggesting that these areas are well-established. However, concerns were raised regarding inadequate personnel and floating assets, which limit the overall enforcement capacity. The study found *strong positive correlations* between enforcement mechanisms, the number of enforcers, and floating assets with reduced IUU fishing, increased case filings, and improved marine ecosystem health. Training was also found to correlate significantly with case filings and economic losses, while perceived capability did not significantly correlate with regulatory outcomes. In conclusion, the study emphasizes that while certain aspects of BFAR's enforcement operations are effective, significant improvements are needed in increasing personnel and resources, particularly floating assets. The lack of sufficient resources constrains the agency's ability to enforce fisheries regulations effectively. The study highlights the importance of strengthening inter-agency collaboration to enhance the overall enforcement mechanism. Based on these findings, the study recommends increasing the number of deployed personnel, upgrading floating assets, and further enhancing inter-agency collaboration to improve enforcement outcomes. Additionally, periodic evaluations and updates to the training programs are suggested to ensure that enforcement officers remain prepared to adapt to the evolving challenges in fisheries management.

Keywords: Fisheries Law Enforcement; illegal; unreported and unregulated fishing; CALABARZON; BFAR

1. Introduction

Marine aquatic food systems are highly diverse and provide numerous environmental, economic, and social benefits, increasingly recognized worldwide for their role in supporting nutrition and ecosystem health (Tigchelaar et al., 2022). These systems contribute to sustainable diets and biodiversity, positioning them as vital solutions for enhancing global food security, improving nutrition, and preserving the environment (HLPE, 2020).

The Philippines' rich marine resources support millions of Filipinos, especially in coastal communities, by providing vital ecological services such as food security, livelihoods, and income (Cabral &

Geronimo, 2018). However, these resources face increasing threats from illegal, unreported, and unregulated (IUU) fishing, which has become a significant concern over the decades (Temple et al., 2022).

IUU fishing impacts all fishing industry sectors, harming critical marine habitats and depleting key fish stocks (Lariosa, 2024). Climate change and a growing population, driving higher fish demand, further amplify these effects (Valmonte-Santos et al., 2016).

The Philippine government has prioritized combating IUU fishing, implementing measures under Republic Act No. 10654, which amends the Philippine Fisheries Code of 1998. This act strengthens efforts to prevent, deter, and eliminate illegal fishing through new conservation and management measures, the reconstitution of fisheries institutions at national and local levels, and stricter penalties for violators (Republic Act No. 10654, 2015).

National government agencies responsible for protecting the environment, fisheries, and aquatic resources are actively working to combat IUU fishing, with local government units contributing efforts within their jurisdictions. As part of this collective effort, the Bureau of Fisheries and Aquatic Resources (BFAR) under the Department of Agriculture has established an enforcement body and deployed officers to address IUU fishing threats.

1.1. Background of the Study

The Bureau of Fisheries and Aquatic Resources (BFAR) is responsible for ensuring food security by developing and implementing comprehensive strategies aimed at the growth and sustainability of the fisheries industry. These strategies include the creation of a National Fisheries Industry Development Plan and a Comprehensive Fishery Research and Development Program. Coordination among local government units (LGUs), fisheries organizations, and cooperatives is prioritized to enhance fishery production and establish market development programs in fishing communities.

BFAR is also responsible for issuing licenses for commercial fishing vessels, monitoring fishing agreements between Filipinos and foreign entities, and ensuring compliance with international treaties regarding fishing in international waters. It collaborates with other government agencies to effectively oversee fishing activities, enforce conservation measures, and manage fishery resources, particularly for migratory and straddling fish stocks.

The Bureau focuses on improving global competitiveness by advising LGUs on proper sanitation in fish markets and implementing inspection systems to ensure the quality and safety of fishery products for both domestic consumption and export. Efforts are also directed towards the development of value-added fishery products. Extensive support services in fisheries production, processing, and marketing are provided, along with technical assistance to improve fish quality and enhance the technical capabilities of LGUs in fishery resource management.

In line with the Republic Act 8550 of 1998 or the Philippines Fisheries Code, BFAR is also charged with maintaining a Comprehensive Fishery Information System and ensuring that laws and regulations related to fishery conservation and resource management are enforced. It also plays a role in conflict resolution regarding resource use and allocation, and it supports community development efforts by enabling women and vulnerable groups to participate in fisheries-related economic activities. Its mandate encompasses a wide range of responsibilities, all aimed at promoting the sustainable development, conservation, and utilization of the nation's fisheries and aquatic resources.

A critical component of BFAR's mandate is the enforcement of fisheries law and regulations, mainly the conduct of monitoring, control, and surveillance (MCS) activities to combat illegal, unreported, and unregulated fishing (IUUF). These efforts are vital to preserving the sustainability of fishery resources and ensuring compliance with national laws and international agreements. BFAR collaborates with various government agencies to establish a specialized corps overseeing fishing activities within Philippine territorial waters and beyond. The agency monitors fishing agreements between Filipino citizens and foreign entities, ensuring that such activities adhere to global standards and do not compromise Philippine interests.

Surveillance efforts include modern technologies such as vessel monitoring systems, satellite tracking, and seaborne patrol to detect and deter illegal fishing practices, while enforcement measures are

applied to uphold fishery conservation laws and protect aquatic resources from exploitation. Through these monitoring, control, and surveillance initiatives, BFAR seeks to eliminate IUU fishing, safeguard marine biodiversity, and promote the long-term sustainability of the fisheries sector.

The BFAR Region 4A is the Regional Office of BFAR, primarily responsible for jurisdictions in CALABARZON. It includes the provinces of Cavite, Laguna, Batangas, Rizal, and Quezon. This region features various known fishing grounds such as Tayabas Bay, Lamon Bay, and Ragay Gulf, located in Quezon Province, as well as Batangas Bay and Balayan Bay in Batangas, and parts of Manila Bay in Cavite, where BFAR 4A conducts its seaborne and land-based patrols and monitoring activities. The Regional Office also collaborates with the Laguna Lake Development Authority to enforce fishery laws in Laguna Lake and works with the Department of Environment and Natural Resources in Taal Lake.

In the CALABARZON region, recent results of the assessment of major fish stocks from the best available data of the BFAR 4-A show ups and downs of catch level in a decreasing trend. The pattern may be attributed to various factors, including IUU fishing, which is one of the main contributors. Uncertainties occur about whether the enforcement effort of the BFAR 4A is sufficient to combat IUU fishing in CALABARZON. Currently, no study was conducted to evaluate the effectiveness of BFAR 4A in combating IUU fishing in the major fishing grounds using their current assets.

Therefore, the researcher should determine the cost-effectiveness of the BFAR 4A enforcer officer deployment and identify challenges and opportunities in the current fisheries situation.

1.2. Theoretical Framework

This study is anchored on the Resource-Based, Dynamic Capabilities, and Institutional Theories. These frameworks collectively support evaluating the cost-effectiveness and operational efficiency of the Bureau of Fisheries and Aquatic Resources (BFAR) Region 4A's enforcement officer deployment in CALABARZON's major fishing grounds.

The Resource-Based Theory, initially proposed by Wernerfelt (1984) and expanded by Barney (1991), asserts that an organization's internal resources, if valuable, rare, inimitable, and non-substitutable, are key to achieving and sustaining competitive advantage. In this study, BFAR's enforcement mechanisms, the number of enforcers deployed, available floating assets, quality of training, and the overall capability of its officers are conceptualized as strategic resources. These variables represent the core operational strengths that determine the agency's ability to implement effective fisheries management and combat illegal, unreported, and unregulated (IUU) fishing activities.

The enforcement mechanisms refer to the strategies and tools used by BFAR, including surveillance systems, legal frameworks, patrol strategies, and communication technologies, to ensure the protection of marine resources. These mechanisms are essential for reducing IUU fishing activities, as they enable timely detection and intervention. The number of enforcers deployed reflects the staffing levels and indicates the agency's capacity to cover extensive marine areas, ensuring that enforcement operations are adequately resourced. The availability and readiness of floating assets, such as vessels and boats, is another critical resource, ensuring that officers have the mobility to patrol large and often remote marine territories.

Training plays an essential role in equipping enforcement officers with the skills and knowledge necessary to handle emerging challenges in fisheries management. Well-designed training programs ensure that officers remain adaptable to evolving IUU fishing techniques, legal frameworks, and environmental concerns. Finally, the capability of officers is a measure of their experience, skills, and adaptability, which directly influence how well enforcement strategies are executed. A capable workforce ensures that BFAR's strategies are effectively implemented and that officers can respond swiftly and competently to any challenges that arise in the enforcement process. Efficient deployment and optimal utilization of these resources are critical to enhancing enforcement outcomes and ensuring sustainable fisheries.

Complementing the Resource-Based Theory in fisheries management, the Dynamic Capabilities Theory, introduced by Teece, Pisano, and Shuen (1997), underscores the importance of an organization's ability to adapt, integrate, and reconfigure internal and external competencies to address changing environments. In the context of fisheries management, dynamic capabilities are reflected in how BFAR

adjusts its enforcement strategies in response to evolving patterns of IUU fishing, emerging threats to marine ecosystem health, and the changing dynamics of fishing activities.

This adaptability is crucial for responding to shifts in illegal fishing tactics and emerging threats, ensuring that enforcement strategies remain practical and relevant. The agency's responsiveness to these changes is reflected in its ability to adapt enforcement strategies quickly and reallocate resources, such as additional officers or enhanced patrol routes, to areas of higher risk. Furthermore, the agency's flexibility to update training programs ensures that officers are continually prepared for new challenges, making the organization more agile and better equipped to handle changing enforcement needs.

The readiness and proper allocation of floating assets further demonstrate the agency's ability to maintain operational flexibility, allowing BFAR to adjust patrol coverage as needed. These dynamic capabilities enhance enforcement effectiveness by ensuring that the agency remains proactive and flexible, continually improving its response to IUU fishing and maintaining sustainable fisheries management. The capacity for adaptation is critical in reducing economic losses tied to the depletion of marine resources and ecosystem degradation.

The Institutional Theory, articulated by Meyer and Rowan (1977) and DiMaggio and Powell (1983), emphasizes the role of external norms, rules, and expectations in shaping organizational behavior. In this study, external pressures such as national fisheries regulations, international conservation agreements, and societal expectations regarding protecting marine ecosystems inform and shape BFAR's enforcement practices.

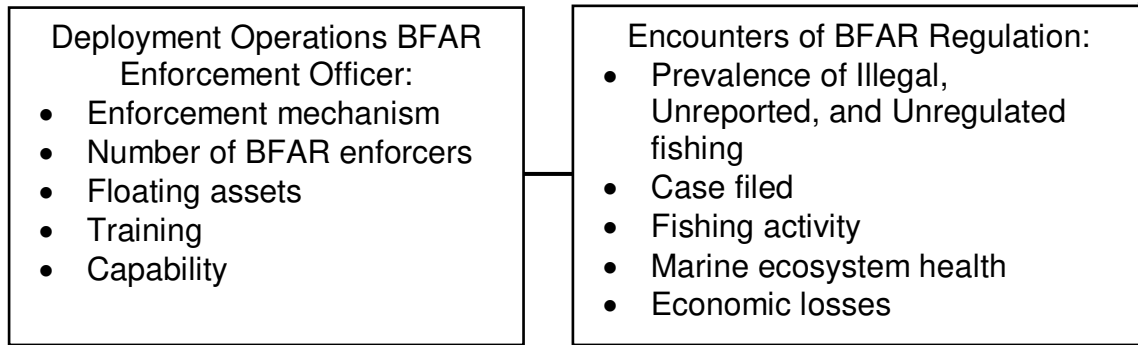
The outcomes of these external pressures are reflected in variables such as the prevalence of IUU fishing, cases filed, fishing activity levels, marine ecosystem health, and economic losses. The prevalence of IUU fishing serves as a direct measure of the success or failure of enforcement efforts. It reflects how effectively the enforcement mechanisms, staffing levels, and resources are being utilized to reduce illegal fishing. Cases filed represent the legal outcomes of enforcement actions and show how well the agency can detect, prosecute, and enforce penalties against violators. This is indicative of how well BFAR is upholding legal standards and the effectiveness of its enforcement procedures. The fishing activity levels represent both legal and illegal fishing operations.

A decrease in illegal activities would suggest that BFAR's enforcement mechanisms are effective, contributing to a more regulated fishing environment. Marine ecosystem health reflects the broader environmental impact of effective enforcement. Healthier ecosystems are indicative of successful enforcement in protecting marine biodiversity, ensuring the sustainability of fish stocks and marine resources. Lastly, economic losses directly result from declining fish stocks and ecosystem degradation caused by IUU fishing. By reducing these losses, effective enforcement protects marine ecosystems and supports local fishing communities' economic well-being.

Thus, the dependent variables, such as prevalence of IUU fishing, cases filed, fishing activity levels, marine ecosystem health, and economic losses, reflect the outcomes of BFAR's enforcement strategies and their effectiveness in addressing illegal activities. The independent variables, including enforcement mechanisms, number of enforcers, floating assets, training, and officer capability, represent the internal resources that BFAR deploys to influence these outcomes.

1.3. Conceptual Framework

The purpose of this study is to evaluate the cost-effectiveness of the current deployment of enforcement officers in the DA-BFAR Region 4-A within a major fishing ground of CALABARZON, and to ascertain the associated challenges and opportunities. In this regard, the researcher developed the conceptual framework illustrated in Figure 1.

INDEPENDENT VARIABLE**DEPENDENT VARIABLE**

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Figure 1. The Research Paradigm of the Study

The framework explains the relationship between BFAR's enforcement operations and their impact on achieving effective fisheries management. It highlights how operational factors, such as the deployment of officers and the challenges they face in regulating illegal activities, significantly shape the overall enforcement efforts. These inputs are crucial as they determine the capacity and effectiveness of enforcement, influencing how well marine resources are protected and how effectively illegal activities are reduced.

The findings of these studies confirm the effectiveness of the BFAR's inputs in terms of officer deployment after analyzing all the data and information gathered. Successful enforcement directly contributes to improved fisheries management by ensuring that marine ecosystems are protected and that illegal activities are minimized.

1.4. Statement of the Problem

This study aimed to evaluate the cost-effectiveness of the Bureau of Fisheries and Aquatic Resources' deployment of enforcer officers.

Specifically, the researcher sought to answer the following questions:

1. What is the level of assessment of the respondents on the BFAR Enforcement Officer in Deployment Operations in terms of:
 - 1.1. Enforcement mechanism
 - 1.2. Number of enforcers
 - 1.3. Floating assets
 - 1.4. Training and
 - 1.5. Capability
2. What is the extent of assessment of the respondents' encounter BFAR Regulation in terms of:
 - 2.1. Prevalence of IUU fishing
 - 2.2. Case filed
 - 2.3. Fishing activity
 - 2.4. Marine ecosystem health, and
 - 2.5. Economic losses
3. Is there a significant relationship between the respondents' assessment of the BFAR enforcement officer deployment operation and the Encounters BFAR regulation?

1.5. Hypothesis of the Study

There is no significant relationship between the respondents' assessments of the BFAR enforcement officer deployment operation and encounters with BFAR regulation.

1.6. Significance of the Study

This research aims to evaluate the cost-effectiveness of deploying the Enforcer's Office of BFAR. The findings of the study could make significant contributions to the following sectors:

Researcher

The study will help the researcher gain valuable insights into the cost-effectiveness and efficiency of BFAR's enforcement strategies in CALABARZON. It will enhance the researcher's understanding of resource deployment, operational challenges, and their impact on combating IUU fishing. The findings will also support the researcher in formulating policy recommendations and strengthening expertise in fisheries management and sustainable enforcement practices.

Department of Agriculture, Bureau of Fisheries and Aquatic Resources

The study helps BFAR assess whether resources are being efficiently allocated and utilized. This information is vital for optimizing patrols, training, and equipment investments to ensure the best use of government resources. It will enable BFAR to refine its monitoring, control, and surveillance (MCS) strategies, ensuring that enforcement efforts yield the maximum protection of marine resources and the long-term sustainability of fish stocks. Moreover, the study provides valuable data that can guide BFAR in making informed policy decisions and enhancing collaboration with local government units (LGUs) and other stakeholders.

Local Government Unit

The result of the study will provide LGUs with valuable insights into the effectiveness of current fisheries enforcement efforts, helping them to better understand how their collaboration with BFAR contributes to protecting marine resources and sustaining fish stocks. This information can guide LGUs in aligning their local fisheries policies with national strategies, improving the allocation of resources for monitoring and enforcement activities, and ensuring that local efforts effectively address IUU fishing. The findings can help LGUs identify opportunities to strengthen their capabilities in fisheries management, including capacity-building initiatives for local enforcement teams, investments in monitoring technologies, and coordination with fisherfolk communities.

Other Law Enforcement Agencies

The study can help other agencies, such as the Philippine National Police Maritime Group, the Philippine Coast Guard, the Department of Environment and Natural Resources, and local enforcement units, better understand their role in supporting fisheries management. The results will enable these agencies to assess their own contributions to enforcement efforts, identify gaps in coordination, and enhance their operational strategies to strengthen monitoring, control, and surveillance (MCS) activities. Furthermore, the study highlights the importance of inter-agency collaboration in addressing the complex and wide-ranging challenges posed by IUU fishing. It can serve as a basis for improving communication, information sharing, and joint operations between agencies.

Non-Government Organization

NGOs can use the findings to better understand the strengths and weaknesses of existing efforts by the Bureau of Fisheries and Aquatic Resources (BFAR) and other agencies. This information is crucial for NGOs to identify areas where they can provide targeted support, such as capacity-building initiatives, community engagement programs, and policy advocacy to strengthen fisheries law enforcement. The study offers NGOs a deeper understanding of the ecological, economic, and social impacts of IUU fishing, enabling them to design more effective interventions that complement government efforts.

Future researchers

They could use the results of this study as a springboard for further research on law enforcement and environmental protection.

1.7. Scope and Limitation of the Study

This study focused on Region CALABARZON, explicitly examining the major fishing grounds of Tayabas Bay, Ragay Gulf, Balayan Bay, Batangas Bay, and Lamon Bay. The primary objective was to

evaluate the cost-effectiveness of the enforcement operations conducted by the Bureau of Fisheries and Aquatic Resources (BFAR) Region 4A in combating illegal, unreported, and unregulated (IUU) fishing. The research addressed BFAR's efforts related to the deployment of enforcement officers, seaborne patrols, planning, and budgeting, while also focusing on specific illegal fishing activities, including dynamite fishing, fishing without permits, the use of banned fishing gear, and unauthorized fishing practices such as the intrusion of commercial fishing vessels into municipal waters.

The target respondents for this study included two main groups. The first group consisted of 18 law enforcement officers from BFAR who were involved in seaborne operations, along with planning officers, section chiefs, and division chiefs. These respondents provided insights into the operational efforts, enforcement strategies, and challenges faced by BFAR in managing and controlling IUU fishing activities within the region.

The second group included 47 local government unit (LGU) officials and personnel, including representatives from municipal and provincial government offices engaged in fisheries management, monitoring, and enforcement. Their input helped assess the coordination between BFAR and the LGUs in addressing IUU fishing, as well as the impact of BFAR's enforcement actions on local communities and economies.

The study was limited to data gathered from these respondents and available information from both BFAR and the LGUs within CALABARZON. The scope did not include land-based operations, nor did it extend to other regions or assess broader national or international policies beyond their relevance to this region. The findings were specific to the enforcement challenges and opportunities in the identified fishing grounds within CALABARZON.

1.8. Definition of Terms

For clarity and a better understanding of the study, the following terms are defined in conceptual and operational use as follows:

Commercial Fishing. Taking fishery species by passive or active gear for trade, business, or profit beyond subsistence or sports fishing.

Enforcement operations. Systematic activities carried out by BFAR enforcer officers ensure compliance with fisheries laws and regulations. These operations involve monitoring and regulating fishing activities to prevent illegal, unreported, and unregulated (IUU) fishing practices.

Fishing Gear. It refers to any instrument or device and its accessories for taking fish and other fishery species.

Fishing vessel. Any boat, ship, or other watercraft equipped to be used for taking of fishery species or aiding or assisting one (1) or more vessels in the performance of any activity relating to fishing, including, but not limited to, preservation, supply, storage, refrigeration, transportation and/or processing.

Illegal fishing. It refers to fishing activities that are carried out in violation of national or international laws. This includes operations by national or foreign vessels in waters under the jurisdiction of a State without its permission or in contravention of its laws and regulations. It also involves vessels flying the flag of states that are parties to a regional fisheries management organization but act against the conservation and management measures established by that organization, or are in breach of relevant international laws. Additionally, illegal fishing includes any activity that violates national laws or international obligations, including commitments made by cooperating States to a regional fisheries management body.

Municipal fishing. It refers to fishing within municipal waters using fishing vessels of three (3) gross tons or less, or fishing not requiring the use of fishing vessels.

Municipal waters. It refers to bodies of water that include not only streams, lakes, inland bodies of water, and tidal waters within the municipality which are not included within the protected areas as defined under Republic Act No. 7586 (The NIPAS Law), public forest, timber lands, forest reserves or fishery reserves, but also marine waters included between two (2) lines drawn perpendicular to the general coastline from points where the boundary lines of the municipality touch the sea at low tide and a third line parallel with the general coastline including offshore islands and fifteen (15) kilometers from such coastline. Where

two (2) municipalities are so situated on opposite shores that there is less than thirty (30) kilometers of marine waters between them, the third line shall be equally distant from the opposite shore of the respective municipalities.

Unregulated fishing. It involves fishing by vessels without nationality or those flying the flag of a State not party to a regional fisheries management organization, in a manner that is inconsistent with conservation and management measures. It also includes fishing in areas or for fish stocks for which there are no applicable conservation or management measures, and where such activities are conducted in a manner inconsistent with State responsibilities under international law.

Unreported fishing. It pertains to fishing activities that have not been reported or have been misreported to the relevant national authority or regional fisheries management organization, in violation of applicable reporting procedures.

1.9. Review of Related Studies and Literature

This chapter presents reviews of literature and studies by foreign and local authors that are deemed relevant to the current investigation. The literature, studies, and articles address the history and legal basis for combating IUU fishing, as well as BFAR monitoring, control, and surveillance operations. The information provided by this review guided the researcher toward a deeper understanding of the study.

1.9.1. Related Literature

Food security plays a crucial role in improving the socioeconomic status of any country, serving as a key strategy to combat malnutrition. However, many underdeveloped countries continue to face challenges in this area. Addressing human nutrition deficiencies highlights the importance of incorporating animal protein into regular diets. Fisheries play a vital role in tackling this issue by providing a substantial portion of the animal protein consumed globally. Aquatic animals are highly nutritious and represent one of the most affordable protein sources, offering essential vitamins, proteins, micronutrients, and minerals, which particularly benefit low-income populations (Pradeepkiran, 2019).

The fisheries sector has grown into a major food production industry, providing nutrition and livelihoods to around 820 million people worldwide. Fishing has been practiced for centuries, and with the rapid growth of the human population, the demand for fish has risen, intensifying capture fisheries (Ritika et al., 2022). In many parts of the world, especially in low-income countries, fisheries are a primary source of employment and income, supporting fishers and those involved in the processing, trade, and distribution of fish products (Steenbergen, 2019).

Global capture fisheries have consistently produced 86–94 million tons annually since the late 1980s, reaching 92.3 million tons in 2022, valued at USD 159 billion. Marine fisheries accounted for 79.7 million tons (43% of global production). However, sustainable marine stocks declined to 62.3% in 2021, necessitating urgent management reforms. Global consumption of aquatic foods rose to 165 million tons in 2022, with per capita intake growing from 9.1 kg in 1961 to 20.7 kg. Estimates that the global production of fish and seafood in 2022 was valued at USD 159 billion (FAO, 2024). This contribution extends beyond direct production to include seafood exports, a significant revenue source for many countries. Moreover, fisheries support related sectors such as tourism and transportation, thereby playing a pivotal role in the broader economy of coastal regions (Akbari, 2023).

Fisheries are profoundly culturally important in many coastal communities. Fishing traditions are deeply embedded in the social fabric of these societies, contributing not only to food security but also to cultural identity and community cohesion. Fisheries often serve as a central aspect of community life, shaping social interactions and local governance structures (Bennett et al., 2019). The importance of fish for local culture is reflected in traditional fishing methods, seasonal festivals, and community-based resource management systems (Martino, 2023).

The Philippines, being an archipelagic country, is fortunate to be endowed with rich fisheries resources (Tahiluddin & Terzi, 2021). Fishing is among the oldest methods of living, wherein people living in

coastal areas depend on the abundance of aquatic resources. Until today, millions of people rely on marine fisheries for food and livelihood (Lariosa et al., 2024).

In 2021, the Philippines' fisheries production totaled 4.25 million metric tons (MT), valued at PHP 302.44 billion. This represented a 3.46% decline in volume from the 4.40 million MT produced in 2020, though the production value rose by 10.59% from the previous year. The largest contribution came from aquaculture, producing 2.25 million MT (52.88%), followed by municipal capture fisheries with 1.13 million MT (26.64%), and commercial capture fisheries at 0.87 million MT (20.48%). Municipal capture fisheries increased by 2.69%, while aquaculture and commercial fisheries saw declines of 3.30% and 10.78%, respectively (BFAR, 2023).

Fisheries activities in the Philippines involve both men and women, highlighting the essential role of gender in the sector. For instance, in Taal Lake, Luzon, women comprise 46% of fisherfolk, with men representing 54%. These roles include fishers, processors, helpers, fish cage or pond owners, managers, and caretakers (Mutia et. al., 2020).

The fisheries sector in the Philippines provides employment to over 1.9 million individuals directly involved in capture fisheries and aquaculture, with millions more in related industries such as fish processing, marketing, and boat building. Coastal areas, where small-scale fishing dominates, are particularly reliant on these activities for income (Arthur et. Al. 2022). It is especially critical in low-income communities, where fish and other seafood are often the most affordable and accessible sources of high-quality protein and essential micronutrients (MRAG Asia Pacific, 2022).

Despite its importance, the sector faces numerous challenges, including declining fish stocks due to overfishing, habitat degradation, and illegal, unreported, and unregulated (IUU) fishing. Destructive fishing practices, such as blast fishing and cyanide fishing, continue to damage critical habitats like coral reefs, mangroves, and seagrass beds, further reducing fishery productivity. These environmental issues are compounded by socio-economic challenges, as fisherfolk remain among the poorest sectors in the country, often earning below the poverty threshold due to limited access to resources, low market prices for their catch, and inadequate government support (Tahiluddin & Sarri, 2022).

The prevalence of illegal, unreported, and unregulated (IUU) fishing remains one of the greatest threats to marine ecosystems because it undermines national and regional fisheries conservation and management efforts. It also jeopardizes livelihoods, exacerbates poverty, and increases food insecurity (FAO, 2024).

Illegal, unreported, and unregulated (IUU) fishing includes many unauthorized fishing activities that threaten fish stocks, marine ecosystems, and global seafood supply. Found across all types of fisheries from national waters to the high seas. IUU Fishing defines three main types within IUU fishing: Illegal fishing refers to unauthorized fishing in a state's waters, violating national or international laws, or disregarding regional fisheries management rules. Unreported fishing involves activities not disclosed to the relevant authorities, breaching national or regional reporting procedures. Lastly, unregulated fishing occurs in unmanaged areas, often by vessels without nationality or by those disregarding conservation measures, which ignores international obligations for sustainable resource management (Widjaja, et al. 2020).

Illegal, unreported, and unregulated (IUU) fishing is a widespread issue that hinders the goal of sustainable fisheries. It undermines legitimate fishing, threatens food security, harms livelihoods, supports international crime, and can involve other criminal activities like human trafficking, while distorting fair competition within the fishing industry (WWF, 2019).

IUU fishing includes highly destructive methods like blast and poison fishing, which harm ecosystems and target fish indiscriminately. Blast fishing involves setting off underwater explosives, killing fish with shock waves that rupture their swim bladders. Though only some fish float to the surface for collection, most sink, making it inefficient and leading to severe coral reef damage. Poison fishing, often using chemicals like sodium cyanide, indiscriminately stuns or kills fish, impacting coral reefs and lagoon habitats. Both practices disrupt ecosystem balance, impair coral growth, and can lead to species decline, despite laws aimed at curbing these activities (Carneiro et al., 2021).

Further, the sustainability of fisheries in the Philippines faces significant challenges, including overcapacity in vessels and fishers, the use of active gears in inshore waters, the intrusion of large-scale

fishing into municipal waters, and marine pollution from overdevelopment. These factors have contributed to declining capture fisheries production across various municipalities and provinces, as well as a reduction in total commercial and municipal fish yields over the past decade (Fabinyi, 2024).

Fishing activities in the Philippines face considerable challenges due to the prevalence of illegal, unreported, and unregulated (IUU) fishing, significantly impacting legal and illegal fishing operations. In many coastal areas, fishing activities are increasingly affected by the intrusion of large-scale commercial fishing vessels into municipal waters, overfishing, and destructive methods such as blast fishing and cyanide fishing (Kessler, 2024).

The fishing activity is mainly affected by the increasing demand for fish, population growth, increasing number of fishers, poor economic and social conditions, ineffective flag state and monitoring, control, and surveillance systems, and the lack of maritime boundary in the area, which contributed to the prevalence of IUU fishing (Widjaja et al., 2022).

Small-scale fisheries, which provide employment to approximately 1.6 million fishers, are the most prevalent type in the Philippines. Additionally, fishing households in the country experience a high poverty incidence rate of 34%, which is double the national average reported in 2015. Small-scale fishers, who represent 85% of the overall fishing population, are considered the most impoverished, highly dependent on fisheries for their livelihood (Macusi et al., 2021).

IUU fishing persists due to several underlying factors. Economic hardships drive many fishers to engage in illegal practices as they struggle to meet their daily needs, with limited access to alternative livelihoods further exacerbating the problem. Insufficient enforcement of fisheries regulations by relevant authorities also contributes to the widespread prevalence of illicit fishing activities, as weak monitoring and control mechanisms allow violations to go unchecked. In many cases, fishers resort to illegal fishing methods to cope with declining fish stocks and the pressures of overfishing, highlighting the urgent need for stronger enforcement measures and sustainable livelihood opportunities (Lariosa, 2024).

To combat IUU fishing, the Philippines has taken several significant steps to strengthen its fisheries management and address threats to food security and coastal livelihoods. In 2017, Republic Act 10654, known as "An Act to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated (IUU) Fishing," was enacted to amend the Philippine Fisheries Code of 1998, enhancing the policy framework. The country also launched the Integrated Marine Environment Monitoring System (IMEMS) Project, which is ongoing and includes the upgrade of the Vessel Monitoring System. Additionally, the Philippines ratified key FAO agreements: the Port State Measures Agreement and the 1993 FAO Agreement on Compliance with International Conservation and Management Measures, both of which entered into force in 2018. Furthermore, the Philippines has actively participated in WTO negotiations to curb subsidies that contribute to overcapacity, overfishing, and IUU fishing, while advocating for the needs of developing nations (FAO, 2021).

The Bureau of Fisheries and Aquatic Resources (BFAR) is the primary government agency responsible for managing, conserving, and regulating the country's aquatic resources. As part of the Department of Agriculture (DA), BFAR leads efforts to combat illegal, unreported, and unregulated fishing in the Philippines. The agency's responsibilities include enforcing rules for the conservation and management of fish stocks, deploying fisheries observers on commercial vessels, and overseeing a monitoring system for municipal fishing vessels. Additionally, BFAR is authorized to impose sanctions for violations, handle administrative cases, and initiate criminal prosecutions for offenses related to fisheries law enforcement (BFAR, 2023).

The Philippine Fisheries Development Authority (PFDA) is a government-owned corporation under the Department of Agriculture, established by Executive Order No. 772 (1982) to support the fishing sector's growth. It provides post-harvest facilities, including fish ports, markets, and services that enhance fish handling, distribution, and quality (Philippines, 1982).

The PFDA operates three key programs: **Regional Fish Ports (RFPP)** for large-scale operations with facilities like breakwaters, quays, and refrigeration; **Municipal Fish Ports (MFPP)** to address small-scale fishers' needs; and the **Ice Plants and Cold Storage Programme (IPCSP)** for preservation services. The PFDA also aids in combating Illegal, Unreported, and Unregulated (IUU) fishing by sharing port-based

intelligence with BFAR and raising awareness among stakeholders about the risks of engaging with illegal fishing activities (Jaal, 2022).

The Philippine Coast Guard (PCG), established under Republic Act No. 9993, operates as an armed and uniformed service under the Department of Transportation (Philippines, 2009b). In coordination with BFAR, the PCG enforces maritime and fishing laws, combats illegal fishing, and addresses violations like coral harvesting and unlawful marine activities within Philippine waters. A Memorandum of Agreement (MOA) with BFAR ensures PCG personnel support anti-illegal fishing patrols, enhancing the management, conservation, and protection of fisheries and marine resources (MOA PCG-BFAR, 2019).

The Local Government Units (LGUs) in the Philippines play a crucial role in combating Illegal, Unreported, and Unregulated (IUU) fishing as mandated by the Local Government Code of 1991 (*Republic Act No. 7160*) and the Fisheries Code of 1998 (*Republic Act No. 8550*), as amended by *Republic Act No. 10654*. LGUs are empowered to enforce fishery laws within their municipal waters, manage aquatic resources, and implement programs to promote sustainable fisheries. The LGUs are responsible for issuing permits and licenses for municipal fishing operations, creating local ordinances to regulate fishing activities, and forming Bantay Dagat (Sea Watch) teams to monitor and prevent IUU fishing. Their collaboration with national agencies, such as BFAR and the Philippine Coast Guard, further strengthens enforcement mechanisms and capacity-building efforts (Jabar et al., 2022).

A report by the Bureau of Fisheries and Aquatic Resources (BFAR) reveals the significant threats posed by illegal, unreported, and unregulated (IUU) fishing, particularly through the use of illegal fishing gears, to fisheries management and marine ecosystems in the Philippines. The assessment recorded 59 different illegal fishing practices and gears used by municipal and commercial fishers to increase their catch.

Intrusion into municipal waters (24%) was identified as the most common violation among commercial fishers, while fishing without a permit, in violation of local ordinances, was the leading violation in municipal fishing. Other notable violations included the use of Danish seines (21.9%), compressors (20.8%), explosives (18.6%), trawls (16.1%), fine mesh nets (13.3%), noxious or poisonous substances (11.9%), electricity (6.5%), and encroachment on marine protected areas (6.5%). These illegal practices continue to pose a major challenge to sustainable fisheries management and the protection of marine resources (DA-BFAR, 2024).

A study conducted in September 2020 with the University of the Philippines and Rare Philippines estimated that illegal fishing in the Philippines could account for 516,000-766,000 metric tons (MT) annually, worth Php 41.8-62.6 billion. Unreported fishing from commercial vessels is estimated at 274,000-422,000 MT per year, though these numbers carry high uncertainty. The definition of unregulated fishing aligns with international standards and can be measured by assessing fish stocks and management plan compliance. Additionally, the study found that 30-47% of municipal fishing vessels (MFVs) remain unregistered, along with 20-33% of commercial fishing vessels (CFVs), highlighting significant compliance issues that affect the estimation of IUU fishing's impact (BFAR, 2021).

Between 2020 and 2021, the Department of Agriculture-Bureau of Fisheries and Aquatic Resources (DA-BFAR), in collaboration with USAID and other stakeholders, facilitated 54 IUU fishing assessment workshops, involving 777 participants from 160 municipalities across nine Fisheries Management Areas (FMAs) in the Philippines. These workshops utilized the Philippine IUU Fishing Index and Threat Assessment Tool (I-FIT) to evaluate IUU fishing risks in municipal waters. The assessments focused on the prevalence, vulnerability, and response to IUU fishing at the local government unit (LGU) level.

The results showed a moderate risk of IUU fishing, with average I-FIT scores of 2.58 for the national index, 2.51 for prevalence, 2.53 for vulnerability, and 2.76 for response. In about half of the LGUs, strong enforcement efforts reduced IUU fishing, with many areas identifying vulnerability factors such as abundant fishing grounds and inadequate enforcement resources. The findings also indicated a correlation between the prevalence of IUU fishing and the vulnerability of the LGUs, suggesting that areas with rich fishing resources are more prone to illegal activities. DA-BFAR's data from 2016 to 2019 revealed that about 50% of poaching cases involved vessels with unknown flag states, contributing to illegal and unregulated fishing activities (BFAR, 2021).

Illegal fishing has significant direct and indirect impacts on marine life, affecting benthic ecosystems' diversity, structure, and productivity. These effects are particularly pronounced and long-lasting in areas with minimal natural disturbances. Exploiting an already vulnerable system can drastically alter the composition and balance of fish communities (Almubarak, 2020). As such, blast fishing remains one of the most destructive illegal fishing that still a threat in marine ecosystem such as coral reefs (Hampton-Smith, 2021).

Department of Agriculture's Bureau of Fisheries and Aquatic Resources (DA-BFAR) typically uses input and effort-based metrics, such as the number of patrols, apprehensions, and fines collected. However, there is also a need for outcome indicators to effectively track progress in reducing IUU fishing. Despite evidence of declining fish stocks, particularly in nearshore waters crucial for small-scale fishers, the direct quantification of IUU fishing remains a challenge. To address this, DA-BFAR and USAID have partnered to implement a two-pronged approach: first, by conducting a consensus-based IUU Fishing Quantification Workshop, and second, by developing an IUU Fishing Index and Threat Assessment Tool.

The complexities surrounding IUU fishing make it difficult to gather accurate data. BFAR describes IUU fishing as inherently secretive, leading to challenges in tracking illegal activities. Biologists and researchers from non-government organizations emphasize the hurdles in monitoring IUU fishing due to its elusive nature and insufficient data (Bello, 2021). The most recent estimates indicate that illegal fishing in the Philippines yields between 516,000 to 716,000 metric tons annually, which translates to a value of approximately P41.8 billion to P62.5 billion. Commercial fishing also sees a considerable amount of unreported catches, estimated between 274,000 to 422,000 metric tons each year; however, these figures carry a high degree of uncertainty, and the assessment for unregulated fishing remains ongoing (Coastal Resources Center, 2021).

IUU fishing is always tricky to measure because it is complex, covert, and data poor. In the Philippines, characterizing IUU fishing is even more complex because available data is concentrated on the number of anti-illegal fishing activities, as well as the volume and value of apprehended illegal catch. Monitoring reports are not standardized, unevenly done nationwide, and paper-based (Geronemo et al., 2021).

As the government's response, Monitoring, Control, and Surveillance (MCS) operations have resulted in the apprehension of various illegal fishing activities by BFAR Region 4-A in the CALABARZON region. As stipulated under Section 86 of the Philippine Fisheries Code, the most frequently recorded violations include unauthorized fishing and the use of active fishing gear within municipal waters, bays, and other fishery management areas, as outlined in Section 95.

Most of these offenses have been committed by the commercial fishing sector (DA-BFAR 4A, 2023). Records from BFAR 4A indicate that the number of administrative cases filed was 68 in 2020, 66 in 2021, 123 in 2022, 86 in 2023, and 64 in 2024. The annual fines collected amounted to approximately 8 million pesos in 2020 and 2021, around 3 million pesos in 2022 and 2023, and 1.4 million pesos in 2024 (DA-BFAR 4A, 2024).

Currently, BFAR Region 4A has 18 law enforcement officers, including both rank-and-file and contract-of-service personnel, who are directly engaged in fisheries law enforcement across the major fishing grounds of CALABARZON. The Enforcement and Regional Monitoring, Control, and Surveillance Operation Center (ERMCSOC) of BFAR 4A operates through four strategically located stations: The Main Center in Los Baños, Laguna; the Padre Burgos MCS Station covering the Southwest Seaboard; the Perez, Quezon MCS Station; and the Naic, Cavite MCS Station overseeing Manila Bay. Each MCS station is equipped with at least one 24-footer patrol boat capable of operating within municipal waters and extending beyond the 15-kilometer municipal water boundary into major fishing grounds. Furthermore, all team leaders assigned to the MCS stations have undergone specialized training in combating illegal, unreported, and unregulated (IUU) fishing, including the completion of a Basic Fishery Law Enforcement Course to enhance their capabilities in enforcing fisheries regulations (DA-BFAR 4A, 2024).

Related Studies

The Resource-Based View (RBV) theory, introduced by Barney (1991), provides a powerful lens for understanding the strategic management of firm by emphasizing the role of internal resources in achieving competitive advantages and operational success.

The Resource-Based View (RBV) Theory has been widely applied to explore how organizations,

including fisheries management authorities, optimize internal resources to address external challenges. Several studies highlight the relevance of RBV in strengthening fisheries management, focusing on resource allocation, capacity-building, and the development of innovative strategies to achieve sustainable outcomes (Vigfússon, 2025).

The application of RBV in sustainable fisheries management emphasizes the role of local institutional capacity, stakeholder collaboration, and technical expertise as key resources for sustainable fisheries governance. Their findings suggest that the success of fisheries management initiatives is often contingent on the ability to effectively leverage human capital and institutional knowledge, both of which align with the RBV's emphasis on resource heterogeneity and immobility (Bertheussen, 2021).

Collaborative fisheries co-management in Southeast Asia, analyzed through the Resource-Based View (RBV) framework, highlights the synergy between local knowledge, institutional partnerships, and enforcement mechanisms. The study by Rianawati et al. (2024) demonstrates that leveraging locally embedded resources and shared expertise enhances compliance and ecological outcomes. This approach underscores the importance of integrating localized knowledge with institutional support to foster effective and sustainable fisheries management.

RBV emphasizes that organizations achieve competitive advantages by leveraging resources that are valuable, rare, inimitable, and non-substitutable (Barney, 1991). For BFAR, such resources include its enforcement mechanisms, skilled personnel, floating assets, and advanced monitoring technologies. These resources, when strategically deployed, enable the agency to create an enforcement framework that deters illegal fishing practices while ensuring sustainable management of marine resources. The theory highlights the importance of resource heterogeneity and immobility, both of which are evident in BFAR's context-specific strategies and reliance on embedded institutional knowledge (DA-BFAR, 2019).

One key application of the Resource-Based View (RBV) in government efforts lies in leveraging human capital resources, mainly through trained enforcement officers. Governments have invested significantly in capacity-building programs to enhance their personnel's technical and operational competencies. These officers play a pivotal role in surveillance, investigations, and the filing of cases against violators, highlighting the central role of human capital in driving organizational performance. Well-trained enforcement personnel are crucial for ensuring the effective implementation of policies and achieving strategic objectives in fisheries management and beyond (Bose and Shekar, 2021).

Further, the Dynamic Capability Theory, as proposed by Teece, Pisano, and Shuen (1997), emphasizes an organization's ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments. In the context of this study, the theory aligns with BFAR's law enforcement operations, particularly in addressing the challenges posed by illegal, unreported, and unregulated (IUU) fishing in CALABARZON.

The theory suggests that BFAR's capacity to adapt its enforcement mechanisms, improve resource allocation, and enhance its training programs reflects its dynamic capabilities in responding to evolving fisheries management needs. The ongoing evaluation of its law enforcement personnel, the optimization of floating assets, and the refinement of enforcement strategies illustrate how BFAR builds and reconfigures its resources to enhance the effectiveness of its operations.

Furthermore, Institutional Theory, as developed by DiMaggio and Powell (1983), focuses on how organizations conform to institutional pressures and the role of formal structures, norms, and practices in shaping organizational behavior. In the context of this study, Institutional Theory provides a lens through which to examine the deployment of law enforcement officers by the Bureau of Fisheries and Aquatic Resources (BFAR) and its regulatory encounters in CALABARZON. According to this theory, BFAR's enforcement practices are influenced by both external pressures such as government regulations, local community expectations, and international conservation standards, and internal institutional norms that guide decision-making, resource allocation, and operational procedures.

The study explores how these institutional forces shape BFAR's law enforcement strategies, including the deployment of personnel and the management of floating assets. Institutional Theory also helps explain the role of legal frameworks and regulatory compliance in shaping BFAR's enforcement approach, highlighting how institutional norms and legitimacy impact the agency's ability to enforce laws effectively.

Understanding these institutional dynamics is crucial for improving BFAR's regulatory initiatives and ensuring that its enforcement actions are aligned with both local and broader governance structures, ultimately contributing to sustainable fisheries management in the region.

Co-management between communities and government creates a collaborative framework that addresses the limitations of both community-based and top-down management systems. While community-based management often lacks the capacity, technical expertise, or legal authority to enforce rules effectively, top-down government approaches struggle with low legitimacy and trust among resource users, which can hinder compliance. This partnership strengthens fisheries management by combining the government's legal framework, resources, and technical know-how with the communities' localized knowledge and cultural ties to the resource (Sitorus et al., 2023).

Central to its success is the role of law enforcement officers, who act as a bridge between government regulations and community practices. Their presence enhances monitoring, surveillance, and deterrence of illegal activities like illegal, unreported, and unregulated (IUU) fishing, legitimizing the management system and demonstrating the government's commitment to protecting shared resources (Castillo, et al., 2024).

The law mandates the establishment of a monitoring, control, and surveillance (MCS) system by the Department in coordination with local government units (LGUs), Fisheries and Aquatic Resources Management Councils (FARMCs), the private sector, and other agencies to ensure the sustainable utilization and conservation of fisheries and aquatic resources exclusively for Filipino citizens. This system applies to all Philippine-flagged fishing vessels, regardless of fishing area or catch destination. FARMCs operate at various levels, municipal, integrated, regional, and national, as mechanisms for coordination, consultation, and collaboration.

The Bureau of Fisheries and Aquatic Resources (BFAR) is tasked with interagency coordination for fishery law enforcement, implementing the Fisheries Law Enforcement Manual of Operations (FLEMOP), and providing law enforcement training to LGUs to enhance municipal water enforcement. Evidence shows a positive correlation between the number of enforcement personnel, floating assets, and the number of apprehensions and cases filed, indicating that increasing these resources can significantly bolster law enforcement efforts (DA-BFAR, NPOA, 2019, Kuemlangan et al., 2023).

Addressing illegal, unreported, and unregulated (IUU) practices in artisanal fishing requires coordinated efforts among stakeholders in the fishing sector, employing diverse strategies and actions. Central to this effort is creating multi-stakeholder platforms that unite government institutions like BFAR, the private sector, civil society, fisherfolk, and community members, particularly women, to establish a robust legal framework for sustainable fisheries management. For marine fisheries, the interconnected nature of the marine environment necessitates trans-regional dialogue and agreements to ensure effective and cohesive management across boundaries (Tump, 2024).

Capacity-building and training in fisheries governance are crucial for effective fisheries management, with both Bantay Dagat (BD) and local government unit (LGU) staff prioritized for development (Cabo Bujan & Arquiza, 2021). A study on the Marine Protected Area Network (MPAN) in Batangas Province identified key areas needing improvement, particularly in financing, enforcement, and monitoring and evaluation (M&E). Low competencies in biological and biophysical monitoring were attributed to a lack of specialized personnel, such as divers, with expertise in marine conservation.

Stakeholders expressed satisfaction with MPA managers' and BD personnel's planning and communication skills. However, they were only moderately satisfied with their abilities in financing, enforcement, and M&E. Significant differences were noted among MPA managers based on age. The number of training sessions attended, particularly in knowledge of enforcement, financing, and M&E. Additionally, the competencies of MPA managers and BD varied significantly by type, particularly in planning and financing. Age was also a factor for BD personnel, as older members struggled with physically demanding tasks like biophysical and biological monitoring, highlighting the need for targeted, age-sensitive capacity-building initiatives (Esmas and Panganiban, 2021).

The DA-BFAR crafted the Fisheries Administrative Order No. 266 Series of 2020, promulgating the Rules and Regulations on the Implementation of Vessel Monitoring Measures (VMM) and Electronic

Reporting System (ERS) for Commercial Philippine Flagged Fishing Vessels, Amending Fisheries Administrative Order No. 260 Series of 2018 (DA-BFAR, 2020). The FAO aims to enhance the government's capacity to monitor fishing operations and enforce fisheries laws in Philippine waters by implementing the Vessel Monitoring Measures (VMM).

The VMM requires using a Vessel Monitoring System (VMS) to track and monitor the position, course, and speed of fishing vessels in real time. This system plays a crucial role in the effective management of fisheries and fishing effort, as well as ensuring traceability within the supply chain. A key component of the system is the Automatic Location Communicator (ALC), a tracking device installed on fishing vessels that provides continuous location data and includes a distress alert button. In cases of accidents or emergencies, the distress alert feature allows authorities to respond swiftly, thereby enhancing the safety and security of fishers at sea. By implementing FAO No. 266, the government strengthens its capacity to combat illegal, unreported, and unregulated fishing (IUUF), promote sustainable fishing practices, and protect the livelihoods of coastal communities (FAO, 2020).

The Department of Agriculture-Bureau of Fisheries and Aquatic Resources (DA-BFAR) has taken significant steps in combating Illegal, Unreported, and Unregulated Fishing (IUUF) through the implementation of the Integrated Fisheries Intelligence Tool (I-FIT). The I-FIT assessment has provided valuable insights that allow for more targeted and strategic responses to address immediate and harmful threats. To strengthen enforcement efforts, DA-BFAR plans to expand the use of I-FIT at the Fisheries Management Area (FMA) level and support LGUs in regularly utilizing the tool to improve compliance, monitor risks, and implement targeted interventions. (USAID-FishRight, 2021).

DA-BFAR remains committed to providing national support to LGUs that face challenges in managing IUUF independently by identifying proactive measures to promote voluntary compliance and discourage high-risk fishing practices. Furthermore, best practices from LGUs with effective enforcement strategies will be replicated nationwide to enhance overall compliance efforts, as nearly half of the assessed LGUs have demonstrated progress in reducing IUUF.

2. Methodology

This chapter addresses the methods and procedures used in the study. It includes the research design, study respondents, research procedure, research instrument, and statistical treatment of the data.

2.1. Research Design

This study employed a descriptive research design with correlational analysis. The researcher conducted descriptive research to evaluate the cost-benefit analysis. Descriptive research utilizes quantitative surveys to collect data, which is then examined objectively using statistical methods to achieve adequate and accurate interpretations and findings.

2.2. Respondents of the Study

The researcher coordinated with the fishery law enforcement officers, or fishing regulatory officers, of the Bureau of Fisheries and Aquatic Resources Region 4A, who are directly involved in seaborne operations. Additionally, the Planning Officer and Chief of the Law Enforcement Division, who are responsible for planning and budgeting for these operations, were included as respondents in the study.

Using a purposive sampling technique, the study involved eighteen (18) Fishing Regulatory Officers and contract-of-service fishery law enforcers, one (1) Planning Officer, two (2) Section Chiefs, and one (1) Division Chief. Additionally, an extra forty-seven (47) local government unit (LGU) officials engaged in fishery law enforcement were included as respondents. These individuals were asked to complete a researcher-made survey questionnaire to gather the necessary data for the study.

2.3. Research Procedure

The research procedure of this study began with reviewing several published and unpublished resources regarding the researcher's stated problem. The researcher requested public documents from the Bureau of Fisheries and Aquatic Resources and sought permission to utilize all the relevant data and information from the agency. An invitation letter was sent to the respondents to encourage participation in answering the survey questionnaire. Secrecy, confidentiality, and neutrality were respected. All information and previous research used in this study are properly cited.

2.4. Research Instrument

The researcher utilized a self-constructed structured survey questionnaire to gather data needed for the present study. Items included in the survey questionnaire were based on the researcher's readings, personal experiences, observations, and expertise. The structured survey questionnaire is designed to collect quantitative data on the deployment and effectiveness of BFAR enforcement efforts in CALABARZON's fishing grounds.

The questionnaire consists of three sections. The first section gathers demographic information on respondents, such as their role, years of experience, and involvement in enforcement activities. The second section includes quantitative questions using Likert-scale items to assess factors like the adequacy of resources and the effectiveness of enforcement in reducing IUU fishing activities. Respondents rate these aspects to provide measurable data on operational strengths and challenges. The final section consists of open-ended questions that allow respondents to elaborate on specific enforcement challenges, opportunities for improvement, and any insights they may have on resource allocation or effectiveness.

2.5. Statistical Treatment of Data

The data collected for this study was systematically organized, presented in tabular form, and analyzed using appropriate statistical techniques tailored to each research objective. These methods provided a comprehensive understanding of the cost-effectiveness and operational impact of the Bureau of Fisheries and Aquatic Resources (BFAR) enforcement strategies in addressing illegal, unreported, and unregulated (IUU) fishing activities.

Descriptive statistics were employed to evaluate respondents' assessment of BFAR's enforcement officer deployment operations, specifically mean and standard deviation. The mean summarized the average level of respondents' evaluations on operational elements such as enforcement mechanisms, the number of enforcers, floating assets, training programs, and overall capability. The standard deviation was measured to indicate the variation in responses, indicating the extent to which respondents agree or disagree on these key factors, and highlighting areas where there may be significant divergence in opinion.

The same descriptive statistics (mean and standard deviation) were applied to assess respondents' perceptions of BFAR's regulatory actions. This will help evaluate indicators such as the prevalence of IUU fishing, the number of cases filed, fishing activity, the health of the marine ecosystem, and economic losses. These measures provided insight into how respondents perceive the effectiveness of BFAR's regulatory interventions and their impact on the fishing industry and the environment.

To explore the relationships between respondents' assessments of enforcement operations and their regulatory experiences, correlation analyses were conducted. Pearson's correlation coefficient was used for data that met the assumptions of normality and parametric testing, while Spearman's rank correlation was applied if the data were non-parametric. These methods assessed the strength and direction of relationships between variables such as the effectiveness of enforcement mechanisms and the prevalence of IUU fishing, or the number of enforcers and the level of fishing activity.

3. Results and Discussion

This chapter presents various results and discusses the findings derived from the data collected in this study. All specific questions in Chapter 1 regarding the statement of the problem were answered in this chapter and supported by tables. It details the data collected about the significant relationship between the respondents' assessment of BFAR Enforcement Officer in Deployment Operations and their assessment of BFAR Regulation Encounters. In particular, the study aimed to address the following:

3.1. Level of assessment of the respondents on BFAR Enforcement Officer in Deployment Operations

In this study, the respondents' assessment level on BFAR Enforcement Officer in Deployment Operations refers to the Enforcement mechanism, the Number of enforcers, floating assets, Training, and Capability. These variables were selected to evaluate how well the BFAR enforcement officers are equipped and prepared to address the challenges in regulating illegal fishing and ensuring sustainable fisheries management. The respondents provided their assessments based on their firsthand experiences and observations, which reflect the effectiveness of BFAR's operations in the region. By examining these key factors, the study aims to provide a comprehensive understanding of the strengths and areas for improvement in the deployment of BFAR enforcement officers. The following tables show the statement, mean, standard deviation, remarks, and verbal interpretation from the perspectives of respondents.

Table 1 Level of assessment of the respondents on BFAR Enforcement Officer in Deployment Operations in terms of Enforcement mechanism.

Indicator	M	SD	Interpretation
1. The enforcement strategies used by BFAR are well-designed to address illegal fishing in CALABARZON.	3.08	0.79	High
2. Policies and guidelines for enforcement operations are straightforward and practical for officers.	3.35	0.64	Very High
3. Using technology, such as GPS tracking, enhances the efficiency of enforcement mechanisms.	3.71	0.46	Very High
4. The enforcement protocols of BFAR are consistently followed during operations.	3.17	0.75	High
5. BFAR's partnerships with local communities enhance the effectiveness of enforcement strategies.	3.33	0.69	Very High
Overall Mean	3.33		Very High

Note. The mean was interpreted using the following 4.0-3.26 Very High, 3.25-2.51 High, 2.50-1.76 Low, 1.75-1.00 Very Low.

Table 1 shows the respondents' levels of assessment of the BFAR Enforcement Officer in Deployment Operations. It also displays the statements, mean, standard deviation, and remarks.

The use of technology, such as GPS tracking, enhances the efficiency of enforcement mechanisms. The mean ($M = 3.71$) suggests a very high level of assessment of the respondents on BFAR Enforcement Officer in Deployment Operations in terms of Enforcement mechanism and supported with standard deviation ($SD = 0.46$). Also, policies and guidelines for enforcement operations are clear and practical for officers. While the mean is lower ($M = 3.08$) with standard deviation ($SD = 0.79$), it still indicates the enforcement strategies used by BFAR are well-designed to address illegal fishing in CALABARZON.

The level of assessment of the respondents on BFAR Enforcement Officer in Deployment Operations in terms of Enforcement mechanism attained an overall mean score of 3.33 and was verbally interpreted as very high among the respondents.

In summary, Respondents assessed BFAR's enforcement mechanism as well-structured and effective in addressing illegal fishing in CALABARZON. Clear policies and practical guidelines support enforcement efforts, ensuring efficient implementation of regulatory measures. This supported the study of Kuemlengan et al., 2023 that effective enforcement mechanisms rely on both administrative and criminal processes, as many national fisheries legislations adopt a dual enforcement approach to deter illegal fishing. The use of technology, such as GPS, enhances enforcement efficiency by enabling real-time monitoring and improving officer deployment. Increased transparency in vessel activity strengthens fisheries management by reducing illegal fishing and overfishing while improving regulatory compliance (Orofino et al., 2023).

These findings align with research emphasizing the role of advanced monitoring technologies and well-defined enforcement policies in strengthening fisheries governance and compliance mechanisms.

Table 2 Level of assessment of the respondents on BFAR Enforcement Officer in Deployment Operations in terms of Number of enforcers.

Indicator	M	SD	Interpretation
1. The number of deployed enforcement officers is sufficient to manage illegal fishing activities.	2.31	0.85	Low
2. BFAR enforcers are assigned strategically to areas with high risks of illegal activities.	2.67	0.61	High
3. The recruitment process ensures that only well-qualified personnel become enforcement officers.	3.31	0.62	Very High
4. There are enough enforcement officers to conduct both land-based and seaborne patrols effectively.	2.38	0.84	High
5. BFAR has a system to assess and adjust manpower allocation based on enforcement needs.	2.69	0.83	High
Overall Mean	2.67		High

Note. The mean was interpreted using the following 4.0-3.26 Very High, 3.25-2.51 High, 2.50-1.76 Low, 1.75-1.00 Very Low

Table 2 presents a detailed assessment of the respondents' evaluation of the Bureau of Fisheries and Aquatic Resources (BFAR) Enforcement Officers in terms of their deployment operations. The table includes several components such as the specific assessment statements, the computed mean scores, standard deviations, and corresponding remarks that reflect the general perception of the respondents.

According to the data, respondents perceived the current number of deployed enforcement officers as insufficient to effectively manage and address illegal fishing activities in various maritime zones, as indicated by a mean score of 2.31 and a standard deviation of 0.85. This concern is echoed in their perception of the capability of the enforcement force to simultaneously conduct both land-based and seaborne patrols, which received a mean score of 2.38 with a standard deviation of 0.84.

Despite the concerns regarding quantity, respondents expressed moderate agreement with the idea that BFAR enforcers are strategically deployed to high-risk or critical areas, which received a mean score of 2.67 and a standard deviation of 0.61. This implies that while the number may be lacking, there is a degree of efficiency in the manner in which personnel are assigned. Furthermore, there is recognition of the agency's efforts to continuously monitor and evaluate its manpower distribution system, as seen in the assessment of BFAR's capacity to assess and adjust its deployment strategy, which garnered a mean score of 2.69 with a standard deviation of 0.83.

Among all the indicators, the highest rating was attributed to the recruitment process, which achieved a mean of 3.31 and a relatively low standard deviation of 0.62. This suggests a strong level of confidence among respondents in the agency's selection process for enforcement officers, highlighting that while there may be issues with deployment numbers, the quality of personnel being hired is viewed positively.

The respondents' evaluation of the BFAR Enforcement Officers in terms of deployment operations and the number of enforcers resulted in an overall mean of 2.67, which is verbally interpreted as "high." This indicates that the deployment strategy is generally perceived as effective. However, the feedback also emphasizes the potential for improvement, particularly in increasing the number of deployed personnel to strengthen operational effectiveness and better combat illegal fishing activities (Jabar et al., 2022).

Table 3 shows the level of assessment of the respondents on BFAR Enforcement Officer in Deployment Operations in terms of floating assets. It presents the statements, mean, standard deviation, and remarks.

The availability of floating assets for enforcement operations was rated low, with respondents disagreeing that BFAR provides enough patrol boats ($M = 2.21$, $SD = 0.71$) and allocates sufficient resources for expansion and upgrades ($M = 2.46$, $SD = 0.74$). The condition and maintenance of these assets were also rated unfavorably ($M = 2.42$, $SD = 0.71$), indicating concerns over operational readiness. However, respondents agreed that patrol vessels are equipped with modern technology ($M = 2.73$, $SD = 0.79$) and that floating assets are deployed efficiently to maximize coverage ($M = 2.52$, $SD = 0.77$).

The level of assessment of the respondents on BFAR Enforcement Officer in Deployment Operations in terms of floating assets attained an overall mean score of 2.47, verbally interpreted as low. In summary, findings imply that while asset deployment is generally efficient, the quantity, maintenance, and expansion of floating assets remain inadequate, potentially limiting the overall effectiveness of enforcement operations. Insufficient numbers of patrol vessels reduce the capacity of enforcement officers to monitor broad coastal and offshore areas, thereby creating gaps that may be exploited by illegal, unreported, and unregulated (IUU) fishing activities.

Addressing these deficiencies through increased investment, better asset management, and strategic fleet development would significantly enhance enforcement capabilities. Suppose floating assets are made sufficient in number and properly maintained. In that case, they can serve as a force multiplier, improving surveillance coverage and deterrence against violations, ultimately leading to more effective and sustainable fisheries enforcement (Orofino et al., 2023; Kuemlangan et al., 2023).

Table 3 Level of assessment of the respondents on BFAR Enforcement Officer in Deployment Operations in terms of Floating assets.

Indicator	M	SD	Interpretation
1 BFAR provides enough floating assets (e.g., patrol boats) to support enforcement operations.	2.21	0.71	Low
2 Floating assets are in good condition and regularly maintained to ensure operational readiness.	2.42	0.71	Low
3 BFAR's patrol vessels are equipped with modern technology for effective surveillance.	2.73	0.79	High
4 Floating assets are deployed efficiently to maximize coverage of fishing grounds.	2.52	0.77	High
5 Additional resources are allocated to expand and upgrade floating asset capabilities.	2.46	0.74	Low
Overall Mean	2.47		Low

Note. The mean was interpreted using the following 4.0-3.26 Very High, 3.25-2.51 High, 2.50-1.76 Low, 1.75-1.00 Very Low

Table 4 shows the level of assessment of the respondents on BFAR Enforcement Officer in Deployment Operations. It also displays the statements, mean, standard deviation, and remarks.

The respondents generally agreed that BFAR provides adequate and regular training for enforcement officers to update their skills and knowledge, as indicated by a mean of 3.15 with a standard deviation of 0.55. This suggests a positive view on the availability of learning opportunities. Furthermore, there was even stronger agreement ($M = 3.31$, $SD = 0.47$) that the training programs effectively address the specific challenges encountered during seaborne operations and enforcement tasks. Respondents also concurred that training sessions incorporate crucial legal aspects and essential case-building techniques for prosecution ($M = 3.25$, $SD = 0.44$) and specialized instruction for managing high-risk illegal fishing encounters ($M = 3.21$, $SD = 0.50$). While still indicating agreement, the statement regarding training on non-confrontational conflict resolution with violators received the lowest mean ($M = 3.13$, $SD = 0.53$) among the aspects of training assessed. **The respondents' assessment level on BFAR Enforcement Officer in Deployment Operations in terms of Training attained an overall mean score of 3.21 and a standard deviation of 0.5, which was verbally interpreted as high among the respondents.**

Table 4 Level of assessment of the respondents on BFAR Enforcement Officer in Deployment Operations in terms of Training.

Indicator	M	SD	Interpretation
1. BFAR provides adequate and regular training for enforcement officers to update their skills and knowledge.	3.15	0.55	High
2. Training programs address challenges specific to seaborne operations and enforcement tasks.	3.31	0.47	Very High
3. Training sessions include legal aspects and case-building techniques for prosecution.	3.25	0.44	High
4. Specialized training is provided for handling high-risk illegal fishing encounters.	3.21	0.50	High
5. Officers receive training on non-confrontational conflict resolutions with violators.	3.13	0.53	High
Overall Mean	3.21		High

Note. The mean was interpreted using the following 4.0-3.26 Very High, 3.25-2.51 High, 2.50-1.76 Low, 1.75-1.00 Very Low

In summary, respondents assessed BFAR's training for enforcement officers in deployment operations as generally effective and relevant. The training programs are perceived to address the specific challenges of their work, including seaborne operations, legal aspects, handling high-risk encounters, and conflict to the officers' preparedness and effectiveness in their roles.

These findings highlight the importance of comprehensive and targeted training programs in equipping fisheries enforcement officers with the necessary skills and knowledge to combat illegal fishing activities effectively. Continuous investment in and refinement of these training programs can further enhance the capabilities of BFAR Enforcement Officers (Bose and Shekar, 2021).

Table 5 Level of assessment of the respondents on BFAR Enforcement Officer in Deployment Operations in terms of Capability.

Indicator	M	SD	Interpretation
1. Enforcement officers can address complex challenges, such as handling conflicts with violators.	3.23	0.52	High
2. Coordination and communication between teams enhance the overall effectiveness of enforcement operations.	3.35	0.64	Very High
3. Enforcement officers are skilled in using technology such as GPS and drones for surveillance.	3.06	0.48	High
4. BFAR has established emergency response protocols for high-risk enforcement operations.	3.04	0.68	High
5. BFAR provides the necessary support to ensure the physical and mental well-being of enforcement officers.	3.08	0.77	High
Overall Mean	3.23		High

Note. The mean was interpreted using the following: 4.0-3.26 Very High, 3.25-2.51 High, 2.50-1.76 Low, 1.75-1.00 Very Low.

Table 5 shows the respondents' level of assessment of the BFAR Enforcement Officer in Deployment Operations in terms of Capability. It also displays the statements, mean, standard deviation, and remarks.

The respondents generally agreed that BFAR Enforcement Officers are capable of tackling complex challenges, including managing conflicts during operations ($M = 3.23$, $SD = 0.52$). The respondents indicated strong agreement that effective coordination and communication among the teams significantly boosted the overall success of enforcement activities ($M = 3.35$, $SD = 0.64$). While there was also agreement that officers possess skills in utilizing technologies like GPS and drones for surveillance ($M = 3.06$, $SD = 0.48$), opinions on this were somewhat more concentrated among the respondents. Similarly, the respondents agreed that emergency response protocols are in place for high-risk situations ($M = 3.04$, $SD = 0.68$) and that efforts are made to support the physical and mental well-being of the officers ($M = 3.08$, $SD = 0.77$), although there was more diversity in the assessments from the respondents regarding these particular areas. **The level of assessment of the respondents on BFAR Enforcement Officer in Deployment Operations in terms of Capability attained an overall mean score of 3.23 and was verbally interpreted as high among the respondents.**

In summary, the respondents' assessment indicates a general agreement regarding the capability of BFAR Enforcement Officers in deployment operations. Coordination and communication are perceived as

critical strengths. While technology utilization, emergency protocols, and officer well-being support are acknowledged, a broader variance in responses suggests potential areas for enhancement to further optimize officer capabilities (Bose & Shekar, 2021).

3.2. Extent of assessment of the respondents Encounters BFAR Regulation

In this study, the extent of assessment of the respondents on BFAR Regulation Encounters refers to Prevalence of IUU fishing, Case filed, Fishing activity, Marine ecosystem health, and Economic losses. The following tables show the statement, mean, standard deviation, remarks and verbal interpretation from the perspectives of respondents.

Table 6 Extent of assessment of the respondents on BFAR Regulation Encounters in terms of Prevalence of IUU fishing

Indicator	M	SD	Interpretation
1. IUU fishing is a persistent issue in CALABARZON fishing grounds.	3.75	0.44	Very High
2. BFAR's enforcement efforts have reduced the frequency of illegal fishing activities.	2.96	0.87	High
3. The impact of stricter penalties on reducing IUU fishing has been evident.	3.13	0.64	High
4. The presence of BFAR enforcers has increased voluntary compliance with regulations.	3.00	0.68	High
5. The presence of BFAR enforcers serves as a deterrent against illegal fishing.	3.08	0.61	High
Overall Mean	3.18		High

Note. The mean was interpreted using the following 4.0-3.26 Very High, 3.25-2.51 High, 2.50-1.76 Low, 1.75-1.00 Very Low

Table 6 shows the extent of assessment of the respondents on BFAR Regulation Encounters. Also displays the statements, mean, standard deviation, and remarks.

The IUU fishing is a persistent issue in CALABARZON fishing grounds. The mean ($M = 3.75$) suggests a very great extent of assessment of the respondents on BFAR Regulation Encounters in terms of Prevalence of IUU fishing and supported with standard deviation ($SD = 0.44$). Also, *impact of stricter penalties on reducing IUU fishing has been evident.* While the mean is lower ($M = 2.96$) with standard deviation ($SD = 0.87$), it still indicates the BFAR's enforcement efforts have reduced the frequency of illegal fishing activities.

The level of assessment of the respondents on BFAR Regulation Encounters in terms of Prevalence of IUU fishing attained an overall mean score of 3.18 and was verbally interpreted as *very high* among the respondents.

In summary, BFAR's enforcement efforts in CALABARZON have been assessed as addressing IUU

fishing to a significant extent, with respondents recognizing its continued prevalence. Despite existing measures, IUU fishing remains a persistent issue, threatening marine biodiversity and the socio-economic stability of coastal communities (Lariosa, 2024). While stricter penalties have contributed to reducing illegal fishing activities, enforcement challenges persist due to economic hardships, limited alternative livelihoods, and insufficient enforcement resources (Lariosa, 2024; Jabar et al., 2022).

The findings highlight the necessity for a comprehensive approach that integrates stricter regulatory measures, enhanced enforcement capacity, and socio-economic support to effectively mitigate illicit fishing in the region.

Table 7 Extent of assessment of the respondents on BFAR Regulation Encounters in terms of Case filed.

Indicator	M	SD	Interpretation
1. The process of filing cases against violators is efficient and ensures timely action.	3.04	0.77	High
2. Many filed cases lead to penalties and successful prosecutions.	2.96	0.65	High
3. The process of gathering evidence against illegal fishers is well-organized.	3.10	0.42	High
4. BFAR ensures transparency and fairness in the handling of cases filed against violators.	3.23	0.59	High
5. The penalties imposed on illegal fishers are proportionate to the severity of their violations.	3.13	0.67	High
Overall Mean	3.09		High

Note. The mean was interpreted using the following 4.0-3.26 Very High, 3.25-2.51 High, 2.50-1.76 Low, 1.75-1.00 Very Low

Table 7 shows the extent of assessment of the respondents on BFAR Regulation Encounters in terms of Case filed. It also displays the statements, mean, standard deviation, and remarks.

The process of filing cases against violators is perceived by the respondents as generally efficient and conducive to timely action ($M = 3.04$, $SD = 0.77$). Regarding the outcome of these filings, the respondents agreed that a notable number of filed cases result in penalties and successful prosecutions ($M = 2.96$, $SD = 0.65$). The respondents also indicated agreement that the process of gathering evidence against illegal fishers is well-organized ($M = 3.10$, $SD = 0.42$). Furthermore, the respondents agreed that BFAR ensures transparency and fairness in the handling of cases filed against violators ($M = 3.23$, $SD = 0.59$). Finally, the respondents agreed that the penalties imposed on illegal fishers are proportionate to the severity of violations ($M = 3.13$, $SD = 0.67$). The extent of assessment of the respondents on BFAR Regulation Encounters in terms of Case filed attained an overall mean score of 3.09 and was verbally interpreted as a high among the respondents.

In summary, the respondents generally agreed with the statements related to the case filing process for BFAR regulation encounters, indicating a moderate level of satisfaction with how regulatory violations are addressed. While the evidence-gathering procedures and the transparency and fairness of case handling were

viewed positively, suggesting confidence in the integrity of the enforcement process, there was slightly less strong agreement regarding the efficiency and timeliness of the case filing process. Respondents were uncertain about whether filed cases consistently lead to successful penalties, pointing to possible gaps in follow-through or legal resolution. Additionally, the perception that penalties imposed are proportionate to the violations committed showed some variability in responses, indicating differing views on the consistency and appropriateness of sanctions.

These findings highlight areas where improvements in procedural clarity, communication, and enforcement outcomes may strengthen the overall credibility and effectiveness of BFAR's legal and regulatory processes.

Table 8 Extent of assessment of the respondents on BFAR Regulation Encounters in terms of Fishing activity.

Indicator	M	SD	Interpretation
1. Most fishing activities in BFAR-monitored areas comply with established regulations.	2.92	0.71	High
2. Violations, such as the use of illegal fishing gear, continue despite enforcement efforts.	3.40	0.49	Very High
3. Small-scale fishers comply more with regulations compared to commercial fishers.	3.44	0.58	Very High
4. Enforcement operations have led to an increase in legal and sustainable fishing practices.	2.90	0.59	High
5. The use of illegal fishing gear has decreased due to enforcement efforts.	3.04	0.50	High
Overall Mean	3.14		High

Note. The mean was interpreted using the following: 4.0-3.26 Very High, 3.25-2.51 High, 2.50-1.76 Low, 1.75-1.00 Very Low.

Table 8 shows the extent of assessment of the respondents on BFAR Regulation Encounters in terms of Fishing activity. It also displays the statements, mean, standard deviation, and remarks.

The compliance of fishing activities, the respondents generally agreed that most fishing activities in BFAR-monitored areas comply with established regulations ($M = 2.92$, $SD = 0.71$). However, the respondents strongly agreed that violations like using illegal fishing gear continue despite enforcement efforts ($M = 3.40$, $SD = 0.49$). Furthermore, the respondents strongly agreed that small-scale fishers comply more with regulations than commercial fishers ($M = 3.44$, $SD = 0.58$). On the impact of enforcement, the respondents agreed that enforcement operations have increased legal and sustainable fishing practices ($M = 2.90$, $SD = 0.59$). Finally, the respondents agreed that the use of illegal fishing gear has decreased due to enforcement efforts ($M = 3.04$, $SD = 0.50$). The extent of assessment of the respondents on BFAR Regulation Encounters in terms of Fishing activity attained an overall mean score of 3.14 and a standard deviation of 0.62 and was verbally interpreted as a high among the respondents.

The respondents generally agreed that most fishing activities in BFAR-monitored areas comply with existing regulations, reflecting a positive perception of regulatory adherence. However, the persistence of

illegal gear use despite ongoing enforcement efforts suggests the presence of deeper, underlying drivers such as economic pressure, insufficient deterrents, and enforcement limitations (Lariosa, 2024; Widjaja et al., 2022). Notably, small-scale fishers are perceived as more compliant with fisheries laws compared to their commercial counterparts, possibly due to closer community ties, greater visibility, or more frequent interaction with enforcement personnel (BFAR, 2021). Respondents also acknowledged that enforcement initiatives have contributed to an increase in legal fishing practices and a reduction in the use of banned or destructive fishing gear. Nonetheless, these gains may be fragile if enforcement intensity is not sustained or if socio-economic incentives for illegal practices are not adequately addressed.

Table 9 Extent of assessment of the respondents on BFAR Regulation Encounters in terms of Marine ecosystem health.

Indicator	M	SD	Interpretation
1. BFAR's enforcement operations contribute significantly to protecting marine habitats in CALABARZON.	3.21	0.50	High
2. Monitoring tools effectively measure the health of marine ecosystems under BFAR's jurisdiction.	3.21	0.58	High
3. There is a noticeable improvement in fish population due to enforcement efforts.	2.83	0.63	High
4. Sustainable fishing practices have contributed to habitat recovery in protected areas.	3.38	0.57	Very High
5. The water quality in fishing areas has improved due to BFAR's enforcement operations.	2.98	0.70	High
Overall Mean	3.12		High

Note. The mean was interpreted using the following: 4.0-3.26 Very High, 3.25-2.51 High, 2.50-1.76 Low, 1.75-1.00 Very Low.

Table 9 shows the extent of assessment on BFAR Regulation Encounters in terms of Marine ecosystem health, displaying statements, mean, standard deviation, and remarks.

There was general agreement that BFAR's enforcement operations significantly contribute to protecting marine habitats in CALABARZON ($M = 3.21$, $SD = 0.50$). Agreement also existed regarding the effectiveness of monitoring tools in measuring the health of marine ecosystems under BFAR's jurisdiction ($M = 3.21$, $SD = 0.58$). While still in agreement, there were fewer convictions concerning a noticeable improvement in fish population due to enforcement efforts ($M = 2.83$, $SD = 0.63$). Strong agreement was evident that sustainable fishing practices have contributed to habitat recovery in protected areas ($M = 3.38$, $SD = 0.57$). Finally, agreement was noted on the improvement of water quality in fishing areas due to BFAR's enforcement operations ($M = 2.98$, $SD = 0.70$).

The extent of assessment on BFAR Regulation Encounters in terms of Marine ecosystem health attained an overall mean score of 3.12, which was verbally interpreted as a high.

In brief, assessments indicate general agreement that BFAR's enforcement helps protect marine habitats and that monitoring tools are effective. Strong agreement exists on sustainable fishing aiding habitat recovery. While agreement is present, there's less certainty about improved fish populations and water quality directly due to enforcement to reduce IUU fishing (BFAR, 2021; BFAR, 2024; Geronimo et al., 2021).

Table 10 *Extent of assessment of the respondents on BFAR Regulation Encounters in terms of Economic losses.*

	Indicator	M	SD	Interpretation
1.	Enforcement operations have minimized economic losses caused by illegal fishing.	2.94	0.70	High
2.	BFAR's enforcement efforts positively impact the livelihoods of small-scale fisherfolk in CALABARZON.	2.98	0.64	High
3.	The cost of illegal fishing to the economy outweighs the cost of enforcement operations.	3.00	0.51	High
4.	Stricter enforcement has increased fisherfolk confidence in legal fishing activities.	3.23	0.56	High
Overall Mean		3.04		High

Note. The mean was interpreted using the following: 4.0-3.26 Very High, 3.25-2.51 High, 2.50-1.76 Low, 1.75-1.00 Very Low.

Table 10 presents the assessment of BFAR Regulation Encounters regarding Economic losses, including individual statements, their means, standard deviations, and remarks.

Assessments indicated a consensus that enforcement operations have played a role in minimizing economic losses resulting from illegal fishing ($M = 2.94$, $SD = 0.70$). Similarly, there was agreement on the positive influence of BFAR's enforcement efforts on the livelihoods of small-scale fisherfolk within CALABARZON ($M = 2.98$, $SD = 0.64$). The respondents also concurred that the economic damage caused by illegal fishing surpasses the expenses associated with enforcement activities ($M = 3.00$, $SD = 0.51$). Furthermore, the highest level of agreement was observed in the perception that stricter enforcement has bolstered fisherfolk confidence in engaging in legal fishing practices ($M = 3.23$, $SD = 0.56$).

The overall assessment of BFAR Regulation Encounters in terms of economic losses reached an overall mean of 3.04, indicating a high level of impact based on the verbal interpretation. This suggests that regulatory enforcement measures, while essential for sustainable fisheries management, may impose significant financial burdens on affected fishers and industry stakeholders. The perceived economic losses could stem from penalties, temporary fishing bans, confiscation of illegal gear, or reduced catch due to stricter compliance requirements. Understanding the extent of these impacts is crucial for balancing enforcement effectiveness with the economic sustainability of fishing communities.

3.3. Test of Relationship between the Assessment of the Respondents on Deployment Operation of BFAR Enforcement Officer and Regulation Encounters

To test the significant relationship between the assessment of the respondents on BFAR Enforcement Officer in Deployment Operations and the assessment of the respondents on BFAR Regulation Encounters in terms of Prevalence of IUU fishing, Case filed, Fishing activity, Marine ecosystem health, and Economic losses they were treated statistically using Real Statistics Data Analysis Tools using the Pearson product moment correlation coefficient.

Table 11 Test of Relationship between the Assessment of the Respondents on Deployment Operation of BFAR Enforcement Officer and Regulation Encounters

Assessment of the respondents on BFAR Enforcement Officer in Deployment Operations		Assessment of the respondents Encounters BFAR Regulation				
		Prevalence of IUU fishing	Case filed	Fishing activity	Marine ecosystem health	Economic losses
Enforcement mechanism	Pearson	0.6257	0.8177	0.3429	0.3638	0.2992
	Correlation	0.0153	<.0001	0.0030	0.0085	0.0008
	Significance (2-Tailed)					
	N	48	48	48	48	48
Number of enforcers	Pearson	0.3755	0.7742	0.0844	0.2400	0.0688
	Correlation	<.0001	<.0001	<.0001	<.0001	0.0028
	Significance (2-Tailed)					
	N	48	48	48	48	48
Floating assets	Pearson	0.6789	0.7663	0.4087	0.6383	0.5361
	Correlation	<.0001	<.0001	<.0001	<.0001	<.0001
	Significance (2-Tailed)					
	N	48	48	48	48	48
Training	Pearson	0.5655	0.7798	0.4973	0.5341	0.3956
	Correlation	0.6805	0.0132	0.1747	0.1695	0.0233
	Significance (2-Tailed)					
	N	48	48	48	48	48
Capability	Pearson	0.6077	0.7130	0.5911	0.7179	0.5222
	Correlation	0.6332	0.2470	0.7678	0.5221	0.0942
	Significance (2-Tailed)					
	N	48	48	48	48	48
	Analysis	Not Sig	Not Sig	Not Sig	Not Sig	Not Sig

Note. The correlation coefficient value(r) was interpreted using the following 0.00-0.19 Very Weakly Positive, 0.20-0.39 Weakly Positive, 0.40-0.59 Moderately Positive, 0.60-0.79 Strongly Positive, and 0.80-1.00 Perfectly Positive.

A significant relationship was found between the respondents' assessment of BFAR Enforcement Officer deployment and their evaluation of BFAR regulation encounters. The core components of the enforcement mechanism, including the number of enforcers and the availability of floating assets, were positively associated with several regulatory outcomes. These outcomes include the reduction of illegal, unreported, and unregulated (IUU) fishing, an increase in case filings, more effective regulation of fishing activities, improved marine ecosystem health, and reduced economic losses. The findings highlight that enforcement operations supported by adequate resources and strategic deployment contribute substantially to the success of regulatory efforts. Additionally, the provision of training showed a statistically significant connection with improved efficiency in case filing and a reduction in economic losses. This suggests that training plays a crucial role in enhancing procedural effectiveness and mitigating the financial burden on stakeholders. However, training did not demonstrate a significant relationship with other indicators of enforcement success, which implies that its impact may be limited to administrative or process-related aspects. On the other hand, the perceived capability of enforcement officers showed no significant correlation with the evaluated outcomes. This indicates that subjective perceptions of competence do not necessarily align with measurable improvements in enforcement results. These findings underscore the need to strengthen enforcement structures, increase personnel capacity, and improve logistical resources to ensure better regulatory performance and effective control over IUU fishing activities (Orofino et al., 2023; Jabar et al., 2022).

4. Summary, Conclusion, and Recommendations

This chapter gives an overview of the conclusions drawn after presenting, evaluating, and interpreting the study's data, along with suggestions for further research.

4.1. Summary

This study assessed the deployment of law enforcement officers of BFAR as a basis for improving enforcement mechanisms. It examined the relationship between personnel deployment, enforcement strategies, floating assets, training, and the overall capability of enforcement officers. Additionally, the study assessed the relationship between regulatory encounters and factors such as illegal, unreported, and unregulated (IUU) fishing, case filings, fishing activities, marine ecosystem health, and economic losses. The goal was to provide insights into enhancing enforcement measures and strengthening regulatory activities to support sustainable fishing practices and marine conservation in the region.

The study aimed to answer several key questions. First, it sought to understand how respondents assess BFAR's Deployment of Law Enforcement Officers in CALABARZON, specifically focusing on enforcement mechanisms, number of law enforcement officers, floating assets, training, and capability. Second, it investigated the extent of regulatory encounters in terms of the prevalence of IUU fishing, case filings, fishing activity compliance, marine ecosystem health, and economic losses. Lastly, the study examined the relationship between BFAR's Deployment of Law Enforcement Officers and regulatory encounters in combating IUU fishing.

A descriptive research design with correlational analysis was employed in the study. Quantitative data were gathered using surveys distributed to 18 fishery law enforcers and 47 local government unit (LGU) officials involved in fishery law enforcement in CALABARZON. Respondents were asked to assess the effectiveness of BFAR's law enforcement mechanisms, personnel, floating assets, training programs, and overall capability. Additionally, respondents were asked to evaluate the extent of regulatory encounters related to IUU fishing, case filings, fishing activity compliance, marine ecosystem health, and economic losses. Statistical analysis was conducted to explore the relationships between the assessment of law enforcement operations and regulatory encounters.

The findings revealed that the level of assessment of respondents on BFAR Deployment of Law Enforcement Officers in CALABARZON varied across five key areas. Regarding enforcement mechanisms,

the assessment was rated very high, suggesting that BFAR's law enforcement strategies effectively addressed illegal fishing. Using advanced technology and clear policies helped enhance operational efficiency and strengthen collaboration with local communities. Regarding the number of law enforcement officers, the assessment was rated high, acknowledging the effectiveness of BFAR's recruitment process. However, respondents pointed out insufficient personnel limited the capacity to conduct land-based and seaborne patrols in major fishing grounds. The assessment of floating assets was rated low, reflecting concerns about inadequate and poorly maintained patrol boats.

Despite the availability of modern surveillance technology, respondents highlighted the need for additional resources to improve enforcement coverage and operational readiness. Regarding training, respondents acknowledged that BFAR provided comprehensive programs focused on seaborne operations, legal case-building, and specialized enforcement tasks, ensuring that officers were well-prepared for law enforcement duties and emerging challenges. Finally, the capability assessment was rated high, with respondents recognizing the effectiveness of coordination, technological proficiency, and emergency response protocols, which enhanced the ability of law enforcement officers to manage complex operational challenges.

The level of assessment of respondents on BFAR Deployment of Law Enforcement Officers, based on the indicators of Enforcement mechanism, Number of law enforcement officers, Floating assets, Training, and Capability, arrived at a grand mean score of 2.98 and a standard deviation of 0.69, which was verbally interpreted as high among the respondents. This finding indicated that respondents assessed BFAR's law enforcement operations as generally effective overall. However, concerns emerged regarding the number of law enforcement officers and the availability of floating assets.

The limited deployment of personnel restricted the capacity to manage illegal fishing and conduct both land-based and seaborne patrols, emphasizing the need for increased manpower. Similarly, the shortage of patrol boats and maintenance issues negatively impacted law enforcement efficiency, leading to the low rating for floating assets. Despite these challenges, the high ratings for training and capability indicated that the existing personnel were well-equipped and skilled. The findings suggest that strengthening inter-agency collaboration and improving resource allocation could enhance the overall effectiveness of law enforcement operations.

The extent of assessment of respondents on BFAR Regulation Encounters, particularly in terms of the Prevalence of IUU fishing, Case filed, Fishing activity, Marine ecosystem health, and Economic losses, arrived at a grand mean score of 3.12 and a standard deviation of 0.65, which was verbally interpreted as great extent among the respondents. This means that respondents recognized BFAR's regulatory efforts in combating IUU fishing, streamlining the case filing process, ensuring compliance with fishing regulations, preserving marine ecosystem health, and mitigating economic losses caused by illegal fishing. While law enforcement measures had contributed to reducing illegal practices and promoting sustainable fishing, challenges persisted, particularly in the prevalence of IUU fishing. The findings emphasized the need for BFAR to further strengthen law enforcement capacity and improve monitoring strategies to sustain the long-term effectiveness of its regulatory initiatives in CALABARZON.

4.2. Conclusion

Based on the data collected, the researcher concluded that BFAR's enforcement mechanisms are considered very effective, with advanced technology and clear policies enhancing surveillance and operational efficiency. However, continuous adaptation of these strategies is necessary to address evolving illegal fishing tactics.

Despite a well-structured recruitment process, the shortage of enforcement officers remains a critical challenge, limiting the frequency and reach of patrols, especially in large fishing grounds. This issue was rated high as it directly impacts the efficiency and effectiveness of enforcement operations. Additionally, the insufficient availability and poor condition of floating assets were rated low, hindering the ability of enforcement officers to carry out their duties, particularly in remote areas where illegal activities often occur.

The training programs offered by BFAR have equipped enforcement officers with vital skills in seaborne operations, legal case-building, and specialized enforcement tasks. These efforts received a high

rating, but ongoing training and exposure to emerging enforcement strategies are necessary to keep pace with increasingly sophisticated illegal fishing methods.

The capability of BFAR's enforcement officers was rated high, demonstrating their ability to coordinate operations, utilize technology, and respond effectively to emergencies. Nevertheless, long-term sustainable enforcement efforts require strategic resource allocation, logistical support, and strong institutional backing.

The study also examined regulatory encounters related to IUU fishing, case filings, fishing activity, marine ecosystem health, and economic losses. Despite ongoing enforcement efforts, the prevalence of IUU fishing remains a persistent issue in CALABARZON, rated very high by respondents. While penalties and monitoring initiatives have reduced some illegal activities, economic hardships and limited enforcement resources continue to contribute to violations.

The case-filing process was assessed very high, regarded as efficient and transparent, ensuring successful prosecution and reinforcing public confidence in the legal system. Fishing activities in monitored areas generally comply with regulations, with small-scale fishers showing greater adherence than commercial operators. However, the use of illegal fishing gear remains a concern, particularly in high-risk areas, where compliance is rated high.

BFAR's enforcement operations have contributed positively to marine ecosystem health, with improvements observed in habitat recovery and fish populations, which are rated very high. Furthermore, economic losses from illegal fishing have been mitigated to a great extent, protecting the livelihoods of small-scale fishers and fostering confidence in legal fishing practices.

Overall, the study highlighted that while significant progress has been made in addressing IUU fishing and supporting sustainable fishing practices, ongoing challenges related to manpower, floating assets, and evolving illegal activities underscore the need for continuous improvement in law enforcement strategies and resource allocation.

Concerning the hypothesis, the study found a significant relationship between the deployment of law enforcement officers and the effectiveness of enforcement mechanisms, regulatory encounters, and the mitigation of IUU fishing. The findings support the hypothesis that increased deployment and improved resources, such as personnel and floating assets, positively impact the success of enforcement operations and the reduction of illegal fishing activities in CALABARZON. However, the study also indicates that despite the significant role of enforcement, the challenges of limited resources and the persistence of IUU fishing suggest that further improvements in deployment strategies and resources are necessary to enhance long-term effectiveness.

Based on the study results, this section presents the suggested intervention for improving the enforcement mechanism.

It is recommended that the number of enforcement personnel and patrol boats be increased to enhance the Bureau of Fisheries and Aquatic Resources (BFAR) Enforcement Officer Deployment Operations in CALABARZON. This would improve patrol coverage and operational readiness, ensuring more comprehensive monitoring of fishing activities. Expanding the personnel will enable better distribution of resources across large fishing grounds, while acquiring and maintaining additional patrol boats will enhance the ability to respond effectively to illegal fishing incidents.

In addition to manpower and assets, expanding training programs in areas such as seaborne operations, legal case-building, and specialized enforcement tasks is crucial to better prepare officers for emerging challenges. Strengthening coordination with local government units (LGUs) and collaborating with other enforcement agencies can also improve operational efficiency. Furthermore, adopting advanced technology and improving emergency response capabilities will contribute to more effective enforcement. Further research should focus on determining the optimal right-sizing of personnel and patrol boats for each area, ensuring that resources are allocated efficiently according to the size of the area, frequency of violations, and specific operational needs.

In terms of improving BFAR Regulation Encounters, it is recommended that the widespread issue of Illegal, Unreported, and Unregulated (IUU) fishing be addressed, with particular attention to the illegal activities of commercial fishing vessels and small-scale fishers. Stricter enforcement of fishing regulations is

crucial, particularly against commercial vessels violating municipal fishing zones and small-scale fishers using illegal gear. Strengthening enforcement operations requires enhancing surveillance capabilities, including the use of advanced technologies like drones and satellite monitoring to detect illegal activities more effectively.

Additionally, improving the training and capabilities of enforcement officers in legal procedures and enforcement tactics will better equip them to manage IUU fishing more efficiently. Another key recommendation is to focus on inter-agency collaboration and community engagement, as these partnerships will improve information sharing and increase the collective capacity to combat IUU fishing. Moreover, a more focused approach on the socio-economic drivers of illegal fishing, such as poverty and lack of alternative livelihoods, will help in the long-term reduction of IUU activities. Policy initiatives that promote alternative livelihoods and provide incentives for legal fishing practices should also be considered as part of a broader strategy to reduce illegal fishing.

Table 12*Action Plan for Improvement of BFAR Enforcement Mechanism*

Action	Objective	Strategies	Timeline	Responsible Parties	Resources Needed	Success Indicators
1. Maximize the Efficiency of Existing Resources	Improve patrol coverage with limited assets and personnel	<ul style="list-style-type: none"> • Share patrol boats with other agencies or private entities. • Implement routine maintenance for existing floating assets. • Cross-train existing personnel for multi-role tasks. • Engage community volunteers or NGOs for surveillance. 	Immediate (within 3 months)	BFAR, Local Agencies, NGOs, Community Leaders	<ul style="list-style-type: none"> • Existing boats and personnel. • Volunteer networks. 	<ul style="list-style-type: none"> • Increased patrol coverage with existing assets. • Increased community participation in surveillance.
2. Foster Partnerships and Collaboration	Enhance resource availability through collaborations	<ul style="list-style-type: none"> • Partner with other government agencies • Explore private sector collaboration for asset donations or leasing. • Engage international NGOs and donors for technical support and funding. 	3-6 months	BFAR, Local Government Units (LGUs), NGOs, Private Sector, International Partners	<ul style="list-style-type: none"> • Partnership agreements. • Volunteer labor or donations. 	<ul style="list-style-type: none"> • Number of formal partnerships • Secured assets or resources through partnerships.

3. Leverage Technology for Cost-Effective Monitoring	Improve monitoring and surveillance with technology	<ul style="list-style-type: none"> • Increase use of satellite monitoring and drones for large area coverage. • Expand Vessel Monitoring System (VMS) usage. • Implement mobile apps for community-based reporting. 	3-12 months	BFAR, Technology Providers, Local Communities	<ul style="list-style-type: none"> • Satellite monitoring tech. VMS. • App development. 	<ul style="list-style-type: none"> • Improved surveillance coverage. • Increased reports of IUU fishing through mobile apps.
4. Procurement of Floating Assets	Expand enforcement capacity by procuring additional assets	<ul style="list-style-type: none"> • Develop a phased procurement plan for new patrol boats. • Pursue grants or low-interest loans for asset procurement. • Explore the leasing option for additional vessels. 	6-12 months	BFAR, National Government, Private Sector	<ul style="list-style-type: none"> • Budget for procurement. • Loan agreements. • Grant proposals. 	<ul style="list-style-type: none"> • Secured additional floating assets. • Increased patrol reach with new assets.
5. Recruitment and Deployment of Additional Personnel	Increase manpower for improved patrol coverage	<ul style="list-style-type: none"> • Advocate for increased budget allocation to hire additional officers. • Recruit temporary or contract personnel for peak periods. • Build a case for additional manpower by presenting data on IUU fishing impacts. 	6-12 months	BFAR, National Government, Local Authorities	<ul style="list-style-type: none"> • Recruitment resources. • Training programs. 	<ul style="list-style-type: none"> • Increased number of enforcement officers. • Improved patrol capacity due to increased personnel.
6. Targeted Enforcement	Focus enforcement	<ul style="list-style-type: none"> • Use data to identify high- 	3-6 months	BFAR, Local	<ul style="list-style-type: none"> • IUU fishing data. 	<ul style="list-style-type: none"> • Increased enforcement

in Hotspot Areas	efforts on high-risk areas to maximize impact	risk areas and prioritize patrols. • Shift to risk-based enforcement targeting the most harmful violations.		Authorities	• Mapping tools.	in hotspot areas. • Reduction in IUU fishing violations in identified hotspots.
7. Capacity Building Without Major Expenses	Enhance enforcement capacity through low-cost training	<ul style="list-style-type: none"> • Organize in-house training sessions with local experts. • Use free or low-cost online resources for training on fisheries enforcement. • Develop volunteer and internship programs with universities. 	6-12 months	BFAR, Local Universities, Training Providers	<ul style="list-style-type: none"> • Training materials. • Volunteer programs. 	<ul style="list-style-type: none"> • Number of personnel trained. • Improved enforcement skills among officers.
8. Advocate for Legislative and Policy Support	Seek long-term support for enforcement initiatives	<ul style="list-style-type: none"> • Lobby for increased funding and resource allocation for BFAR. • Advocate for policies that incentivize private sector involvement in fisheries enforcement. 	6-12 months	BFAR, Policymakers, Private Sector, NGOs	<ul style="list-style-type: none"> • Policy documents. • Advocacy campaigns. 	<ul style="list-style-type: none"> • Successful advocacy leading to increased funding or policy changes.

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