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[Wei Yuan](#)<sup>\*</sup> and [Yen-Chiang Chang](#)<sup>\*</sup>

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*Article*

# Curbing IUU Fishing by Enforcing the Port State Measures Agreement

Wei Yuan <sup>1,\*</sup> and Yen-Chiang Chang <sup>2,\*</sup>

<sup>1</sup> School of Ocean Law and Humanities, Dalian Ocean University, Dalian 116023, China

<sup>2</sup> School of Law, Dalian Maritime University, Dalian 116026, China

\* Correspondence: weiyuanemail@yeah.net (W.Y.); ychang@dmlu.edu.cn (Y.-C.C.)

## Abstract

The Port State Measures Agreement (PSMA), endorsed by the FAO, is the first global treaty aimed at preventing illegal, unreported, and unregulated (IUU) fishing through enhanced port state control. Effective since 2016, the PSMA serves as a legally binding instrument to combat IUU fishing, mandating rigorous inspections of all foreign fishing vessels entering member ports, denying access to known IUU vessels, and conducting thorough investigations of suspicious vessels. Despite its potential, practical enforcement faces challenges, such as limited resources in developing countries, insufficient international cooperation and information sharing, and inconsistencies in legal sanctions across countries. To fully leverage the PSMA's capacity, key issues such as resource allocation, global cooperation, and harmonization of relevant laws must be addressed.

**Keywords:** port state measures agreement; IUU fishing; law enforcement; fisheries management

## 1. Introduction

Illegal, Unreported, and Unregulated (IUU) fishing encompasses distinct yet interrelated categories of activities that undermine global fisheries governance. As defined by the FAO's International Plan of Action to Prevent, Deter and Eliminate IUU Fishing (IPOA-IUU), IUU fishing includes:

**Illegal Fishing:** Operations conducted by national or foreign vessels (a) within a state's jurisdiction without its permission, (b) in violation of its laws, or (c) contravening conservation measures set by Regional Fisheries Management Organizations (RFMOs) in international waters [1]. For example, unlicensed trawling in Indonesia's Exclusive Economic Zone (EEZ) constitutes illegal fishing under national law [2].

**Unreported Fishing:** Catches not reported or misreported to relevant authorities, such as underdeclaring catches of high-value species like tuna to evade quotas [3].

**Unregulated Fishing:** Activities in areas with no applicable management measures (e.g., high seas "gap areas") or by vessels flying flags of non-cooperating states, thereby circumventing RFMO rules [4].

These categories, codified in binding agreements like the PSMA and the WTO Fisheries Subsidy Agreement, reflect the multifaceted nature of IUU fishing. The PSMA specifically targets these practices by empowering port states to deny access to vessels engaged in illegal activities (e.g., lacking valid licenses), unreported operations (e.g., falsified catch logs), or unregulated ventures (e.g., fishing in closed areas) [5].

The enormous profits from IUU fishing, estimated by Global Financial Integrity in its 2015 report to be between \$3.6 billion and \$23.5 billion annually, make it the world's sixth most lucrative criminal activity [6]. This profitability continues to drive the persistence of IUU fishing despite prohibitions [7]. IUU fishing not only violates existing marine management and conservation measures but also infringes upon the principles of shared and equitable use of marine resources [8]. This undermines collective efforts aimed at the long-term sustainability of marine ecosystems and unfairly impacts

law-abiding fishermen, harming their livelihoods and community well-being [9]. Several international legal documents make reference to the enforcement and management measures of port states. For instance, the Paris Memorandum of Understanding (Paris MoU)[10] and the Tokyo Memorandum of Understanding (Tokyo MoU) [11] are critical frameworks for international port state control (PSC). These frameworks aim to ensure that ships comply with international conventions through port state inspections, thereby safeguarding maritime safety, protecting the marine environment, and improving the working and living conditions of seafarers. The United Nations Convention on the Law of the Sea (UNCLOS) includes provisions on port state jurisdiction in Articles 25, 218-220, and on port state enforcement powers in Articles 217 and 232 [12]. While these provisions do not directly address combating IUU fishing, they are still important for port state control and can be indirectly applied to such efforts as combating IUU fishing. However, this paper focuses primarily on the enforcement issues of IUU fishing based on the PSMA and the roles of other international agreements will not be further elaborated.

Illegal, Unreported, and Unregulated (IUU) fishing remains a persistent threat to marine sustainability, costing the global economy up to \$23.5 billion annually. While the Port State Measures Agreement (PSMA) is hailed as a landmark tool against IUU fishing, its operational efficacy remains contested. This paper seeks to answer: How does the PSMA's institutional architecture enable or constrain collective action against IUU fishing? What explains the disparity in PSMA implementation outcomes across developed and developing states? How can the agreement evolve to address systemic gaps in global fisheries governance?

To address these questions, the paper is structured as follows: Section 2 outlines the methodology; Section 3 analyses PSMA's legal framework and enforcement challenges; Section 4 presents cross-country case studies; Section 5 proposes policy solutions; Section 6 discusses academic and practical contributions.

## 2. PSMA as an Effective Measure to Curb IUU Fishing

The Port State Measures Agreement (PSMA) effective from June 2016, is the first global treaty aimed specifically at combating IUU fishing through enhanced port state control. As of 10 April 2024, it had been ratified by 78 parties, including the EU, covering more than 64% of coastal nations [13]. This marks a significant step by the international community towards maintaining sustainable fisheries management.

Port State Control (PSC) measures serve as a cornerstone in combating IUU fishing by restricting market access for illicit catches. Under the PSMA—adopted by the FAO in 2009 and enforced since 2016—foreign fishing vessels must comply with rigorous port entry protocols, including advance notification, documentation verification, and on-site inspections, to gain access to member states' ports. This “gatekeeper” mechanism not only disrupts the profitability of IUU operations but also incentivizes global standardization of port-state practices. Notably, the PSMA's design draws lessons from earlier regional frameworks, such as the Paris and Tokyo Memoranda of Understanding on port state control, yet expands their scope by explicitly targeting fisheries violations. Its success in harmonizing inspection standards across 78 parties (as of 2024) underscores its potential as a model for future multilateral environmental agreements, particularly in bridging enforcement disparities between developed and developing states [14].

### 2.1. Progress and Effectiveness of PSMA Implementation

Parties to the PSMA regularly convene to assess its effectiveness. During the 2023 First Meeting of the PSMA Strategy Ad Hoc Working Group, delegates reviewed major accomplishments since the PSMA's adoption in 2009. They noted that many countries not yet party to the agreement have begun the ratification or accession process and recognized the importance of incorporating PSMA provisions into national legislation, with many countries already having initiated such efforts [15].

The PSMA mandates enhanced cooperation and information sharing among coastal states, flag states, and regional fisheries management organizations (RFMOs) when vessels are suspected of IUU fishing. This collaboration operates through three primary mechanisms:

**Global Information Exchange Systems:** The FAO's Global Information Exchange System (GIES) serves as a centralized platform for sharing real-time data on IUU vessel activities, including historical violations, licensing status, and transshipment records [16]. For instance, over 30 countries have utilized GIES to flag vessels like the Silver Sea 2 (Indonesia, 2015), enabling coordinated denials of port access [17].

**RFMO-Led Coordination:** RFMOs such as the Western and Central Pacific Fisheries Commission (WCPFC) facilitate joint inspections and enforcement by standardizing port entry protocols (e.g., advance notification formats) and harmonizing sanctions for non-compliance. For example, WCPFC members jointly blacklisted 12 vessels in 2023 for IUU tuna fishing, triggering synchronized port bans across the Pacific [18].

**Bilateral Capacity-Building:** Developed states provide technical assistance to developing nations through training programs and technology transfers. The U.S.-Indonesia partnership, funded by NOAA, trained 150 inspectors on PSMA-compliant inspection techniques (e.g., logbook verification, catch sampling), reducing procedural gaps in high-risk ports [19].

These mechanisms collectively strengthen the “networked enforcement” model advocated by Telesetsky (2015), where multi-level cooperation amplifies the cost of IUU operations while mitigating resource disparities [20].

Although the PSMA is globally recognized as an important tool against IUU fishing, its implementation faces several obstacles. One major limitation is the uneven distribution of resources. Many developing countries including small island states lack the resources and capabilities to conduct the required vessel inspection and monitoring. For example, some countries have limited budgets primarily for managing extensive coastlines, restricting their ability to perform thorough ship inspections. Currently, 40 countries are receiving FAO assistance, with \$150,000 allocated to five projects to build capacities in developing nations for implementing the PSMA [21]. Moreover, data and information sharing remains challenging. While the PSMA encourages information exchange on IUU fishing and has established a global communication system, the mechanisms for data sharing between countries are often neither efficient nor timely. This inadequacy in information sharing hampers the comprehensive understanding and effective fight against IUU fishing activities [22]. There is room for improvement in cooperation to ensure the smooth implementation of the PSMA, such as designating national contact points, overcoming language barriers, and fully implementing and utilizing global and regional information exchange tools. Real-time information acquisition channels in regions like Latin America and Africa are not robust enough to effectively support monitoring, control, and enforcement efforts, and confidentiality issues also present hurdles.

Additionally, international cooperation and enforcement consistency present trials. Despite the increasing number of PSMA signatories, many major fishing nations have not yet joined. This means IUU fishing vessels that may opt for ports in non-PSMA countries to evade inspection. Finally, the political will to enforce the PSMA cannot be overlooked. When faced with multiple domestic issues, governments of developing countries often need to make trade-offs between different policies, which results in a lower priority being placed on combating IUU (Illegal, Unreported, and Unregulated) fishing. In particular, these governments may prioritize more pressing domestic concerns, such as infrastructure development, poverty alleviation, and employment crises. These priorities lead to a lack of resources and political will to effectively implement the PSMA (Port State Measures Agreement). This political choice is often driven by short-term economic and social stability considerations, rather than long-term sustainable development strategies. In some cases, enforcement may also be influenced by diplomatic relations. For example, regional maritime disputes involving multiple countries may lead to selective enforcement of the PSMA due to geopolitical considerations, especially when conflicts of interest arise with major economic or military partners. In such situations, the enforcement of the PSMA becomes a casualty of political bargaining. Furthermore, many



developing countries face political instability, such as frequent regime changes and rampant corruption, which significantly weakens their governance capacity. In times of political instability, it becomes difficult for governments to effectively mobilize enforcement resources to combat IUU fishing. Even if countries have joined, enforcement might be lax due to political, economic, or other reasons. Overall, while the PSMA provides a framework to strengthen global action against IUU fishing, overcoming these limitations requires further international efforts, including providing technical and financial support, enhancing international cooperation, and increasing global awareness and commitment to combating IUU fishing.

While the PSMA has demonstrated tangible successes in curbing IUU fishing through enhanced port inspections and international collaboration, its implementation is not without significant challenges. The very mechanisms that empower port states to deny access to suspect vessels also expose systemic vulnerabilities—uneven resource allocation among member states, gaps in real-time information sharing, and the persistent loopholes created by non-participating fishing nations. These challenges underscore a dialectical tension between the agreement's aspirational goals and the pragmatic constraints of global fisheries governance. The following section delves into these complexities, examining how structural and operational barriers impede the full realization of the PSMA's potential.

## 2.2. Major Difficulties in IUU Fishing Law Enforcement

Currently, enforcement and monitoring of IUU fishing face significant hurdles. The high profits from IUU fishing tempt fishermen to circumvent regulations through underreporting catches, misreporting species, discarding low-value fish, and engaging in illegal trade at sea [23]. First, the vastness of the ocean poses physical and technical issues in tracking and monitoring deep-sea vessels [24], especially in high seas, where jurisdictional limits complicate comprehensive supervision. Second, the legal complexity in international waters varies, with differing national laws and uneven implementation of international treaties. Third, IUU fishing often involves cross-border operations, complicating law enforcement. Fourth, effective maritime surveillance and enforcement require advanced technology and sufficient human resources, which many countries, particularly developing ones, lack. Fifth, illicit fishing vessels often operate covertly, using tactics such as disabling Automatic Identification Systems (AIS), altering ship names, or changing flags, making tracking and identification challenging [25]. Sixth, the inadequacy of fisheries management systems: Some countries lack robust regulatory and enforcement mechanisms. Economic dependencies in fishing-dependent developing nations may lead to tacit acceptance or weak enforcement of IUU fishing, especially when it impacts lawful fisheries. The socio-economic impact on fishing communities is also a consideration, as strict enforcement could affect communities reliant on fishing for their livelihoods. Seventh, insufficient international cooperation: Combating IUU fishing requires global cooperation, which can be hindered by conflicting interests, political factors, or resource limitations. Imperfect information sharing mechanisms also obstruct the flow of data, intelligence, and enforcement actions related to IUU fishing [26].

Facing these complications, the international community must strengthen cooperation, standardize approaches, enhance technology and monitoring capabilities, and promote global information sharing and coordinated actions to build an effective international system against IUU fishing.

## 3. Selected Examples of PSMA Implementation

The actual conditions vary greatly between different countries globally, and it is impossible to provide a comprehensive coverage in this paper. Therefore, some representative cases are selected for analysis. As the world's largest archipelagic nation, Indonesia is rich in marine resources. As a typical developing country with relatively weak law enforcement, its fishing issues are severe, making its practices in port construction and management worth discussing. Ghana, as a developing country in Africa, has limited experience and capabilities in fisheries technology and port

construction. Therefore, it has received considerable assistance from other countries, making it a noteworthy example to discuss. The United States, as a typical developed country, possesses the strongest maritime law enforcement capabilities globally. How it curbs IUU fishing with robust Coast Guard support is worthy of thorough reference and discussion. Finally, Norway, as a traditional fishing powerhouse with a long history of fishing and extensive experience in port management, offers valuable lessons in these changing time.

### 3.1. Indonesia

Indonesia, the world's largest archipelago and a leading seafood producer [27], signed the PSMA in 2016. It boasts nearly 2,500 ports [28], including four that comply with PSMA requirements. These are the deep-sea fishing ports of Nizam Zachman in Jakarta, Bungus in Padang, Bitung in North Sulawesi, and the general port of Benoa in Bali, which also provides services for tuna boats [29]. These ports were chosen because they can accommodate foreign refrigerator ships with a draft over 9 meters. Additionally, Marunda in Jakarta, Tanjung Perak in Surabaya, and Tanjung Wangi in Banyuwangi are under consideration for PSMA compliance, capable of docking foreign vessels with the same requirements [30].

In Indonesia, the Ministry of Fisheries estimates the current fish stock at 12 million tons, a nearly 4% decrease from the previous 12.5 million tons in 2017. Over half of the country's 11 Fisheries Management Areas (WPP) are now considered "fully exploited," up from 44% in 2017, indicating the need for stricter monitoring [31]. As one of the world's largest seafood producers, Indonesia views the PSMA as crucial for enhancing fisheries transparency and traceability, thus boosting global confidence in Indonesian seafood. The acceptability of fish in international markets relies not only on the health of the fish but also on the traceability of its origin—how it was caught, what gear was used, whether it was legal, and whether it was environmentally friendly. A PSMA parties meeting held in Bali in 2023 led to agreements, including the use of the FAO-developed digital platform "Global Information Exchange System" to share information [32], check reports, and enforce laws against IUU fishing vessels. Tri Aris Wibowo, head of port affairs at Indonesia's Ministry of Fisheries, acknowledges operational predicaments in implementing PSMA at these ports, including insufficient staffing and facilities, such as a lack of deep-water berths. While infrastructure in eastern Indonesian ports remains limited, leading to debates on where PSMA implementation should be focused, western ports are better equipped and situated for managing large foreign ships and enforcing PSMA [33]. Additionally, Indonesia collaborates with the U.S. to train senior technicians to enhance regulatory enforcement under PSMA, improving its ability to manage fisheries under any circumstances, including data and resource constraints.

In 2015, the Indonesian Ministry of Marine Affairs and Fisheries conducted a surprise inspection on a Thai fishing vessel named "Silver Sea 2" with a gross tonnage of 2,285. The vessel was found in the waters of Luwuk Banggai, within Indonesia's Exclusive Economic Zone, carrying a significant amount of unreported catch. It was operating without a fish transport permit (SIKPI), conducting illegal transshipments at sea, and transporting fish without a health certificate for human consumption [34]. Additionally, its Vessel Monitoring System (VMS) was turned off during navigation. The case went to trial in the Luwuk Banggai district court, and in September 2015, the captain, Thai citizen Yotin Kuarabiab, was found guilty under Indonesia's Fisheries Act No. 31 of 2004 as amended by Act No. 45 of 2009, specifically section 7(2)(e)(6). He was sentenced to pay a fine of 250 million Rupiah and serve six months in jail. On 24 February 2016, the "Silver Sea 2" and its catch of 1,930 tons of mixed fish, valued at 20,579 million Indonesian Rupiah, were auctioned and surrendered to the state [35].

So, we can find that the fisheries enforcement environment is complex and ever-changing, especially in the "grey zones" at the boundaries of Exclusive Economic Zones (EEZ) and the high seas, where enforcement jurisdiction is often unclear, increasing the concealment of IUU fishing activities. The Silver Sea 2, a Thai-flagged vessel, operated across multiple national waters, requiring cross-border coordination by enforcement agencies to effectively combat these activities. This

highlights the importance of international enforcement cooperation and information sharing among nations. And then, Traditional enforcement methods, such as maritime patrols, vessel monitoring, and on-site inspections, often fall short when dealing with increasingly concealed illegal activities. Many IUU vessels use advanced satellite navigation to evade patrols and deactivate Automatic Identification Systems (AIS) to hide their movements. To address these challenges, the Indonesian government has gradually introduced more advanced technologies, such as drone surveillance, satellite monitoring, and Vessel Monitoring Systems (VMS), enhancing the accuracy and effectiveness of enforcement. So, The Silver Sea 2 case is not only a successful example of Indonesian fisheries enforcement but also a milestone in the international fight against IUU fishing. The case highlights the multifaceted challenges of fisheries enforcement and provides valuable lessons for global fisheries management. In the future, closer international cooperation, strengthened legal frameworks, and technological innovation will be needed to build a fairer and more sustainable global fisheries order. This will not only protect fisheries resources and marine ecosystems but also contribute to global food security and the sustainable development of the global economy.

### 3.2. Ghana

Ghana's Port State Measures to Stop Illegal Fishing (PSM-SIF) support port inspections via remote guidance. It's a coordinated effort by various agencies to enforce regulations and international agreements against IUU fishing. As a PSMA signatory, Ghana has advanced enforcement using wearable cameras with real-time streaming, aiding inspections by experts [36]. Currently, the inspection situations have been documented and can be used as case studies for training. If any violations are discovered or evidence supporting illegal activities is seized, the recordings can serve as evidence. The establishment of PSM-SIF was prompted by the COVID-19 pandemic, which made operations in the fisheries sector highly complex due to its rapid global spread. Significant restrictions on movement and personal contact, along with a lack of personal protective equipment for inspectors, posed dilemmas to monitoring, control, and surveillance efforts. PSM-SIF tested new technologies to sustain cooperation in Ghana's fisheries sector. Its benefits include fewer complaints, reduced violence and corruption, more accurate incident records, fair evidence collection, improved testimony accuracy, performance assessment, and training aid. Recorded footage is crucial for reviewing crime scenes. Overall, the use of PSM-SIF enables support for enforcement inspectors and evidence-based participation in discussions about enforcement inspections, deciding on actions upon finding violations. This on-the-job support helps enforcement personnel conduct thorough inspections of port fishing vessels under PSMA.

Stop Illegal Fishing (SIF) supports the implementation of PSM-SIF throughout Africa, both technically and financially, serving as the core of African countries' efforts to enforce PSMA. It enables the development and testing of programs, understanding of on-the-ground tests, sharing of knowledge, and accumulation of experience. The remote guidance opportunities provided by PSM-SIF are vital for Africa to implement PSMA and combat IUU fishing, offering virtual assistance within the same week to countries like Ghana, Madagascar, and Mozambique. The Ghanaian port working group has garnered support through the PSM-SIF initiative from organizations like Stop Illegal Fishing, with funding from the German Gesellschaft für Internationale Zusammenarbeit (GIZ) representing the German Federal Ministry for Economic Cooperation and Development (BMZ) through the Global Sustainable Fisheries and Aquaculture Special Initiative.

### 3.3. The United States

Under U.S. enforcement of the PSMA, foreign fishing vessel owners, agents, captains, operators, or persons in charge must apply at least 72 hours before port arrival. All vessels under a foreign flag must notify the U.S. Coast Guard prior to entering U.S. ports. NOAA works closely with the Coast Guard to enhance communication and information sharing, enabling entry inspections or denials under the PSMA and the U.S. Port State Measures Act. The Office of Law Enforcement at NOAA handles these inspections, which are standard procedures as outlined in the agreement. Federal

support extends to 28 state law enforcement agencies through targeted joint operations and partnerships, strengthening their capacity to handle numerous enforcement duties, including PSMA implementation [37]. The U.S. also utilizes inspection forms required by the agreement, sharing results with the ship’s flag state for possible follow-up actions. In the fight against IUU fishing, the U.S. shares information with coastal countries, regional fisheries organizations, and other bodies to report violations and gather evidence. This sharing enhances collaboration with global partners. The U.S. Interagency Working Group on IUU Fishing strengthens information sharing with federal partners to bridge coordination gaps exploited by illegal fishers. Prior to the PSMA’s implementation, NOAA’s Office of Law Enforcement developed a national training program for port state measure inspectors, ensuring they are well-versed in PSMA requirements, U.S. legislation implementing the agreement, and the conservation and management measures of relevant regional fisheries organizations [38]. This training prepares NOAA and state law enforcement officers, authorized by NOAA, to fully comply with the agreement, focusing on measures related to regional fisheries management organizations, screening vessels suspected of IUU fishing, and comprehensive ship inspection protocols.

3.4. Norway

As a member of multiple RFMOs (e.g., the Northeast Atlantic Fisheries Commission), Norway has leveraged the PSMA to strengthen regional port state control mechanisms. Its requirement for 24-hour advance notice from foreign vessels carrying frozen catches [39] aligns with RFMO protocols, creating a harmonized inspection regime across the North Atlantic. This dual adherence to PSMA and RFMO rules offers a model for states seeking to integrate global and regional governance. For example, Norway’s real-time data sharing with the EU’s IUU Fishing Coalition [40] demonstrates how PSMA can enhance cross-regional enforcement—a lesson critical for developing states reliant on fragmented RFMO frameworks.

**Table 1.** Comparative Analysis of PSMA Implementation Mechanisms in Selected Countries.

Country	Legal Framework	Enforcement Measures	International Collaboration
United States	Port State Measures Act	- Joint inspections by NOAA and the U.S. Coast Guard - 72-hour advance entry notice	- Shares IUU vessel blacklists with RFMOs - Participates in the Global Fisheries Enforcement Network (GFEN) [41]
Ghana	Fisheries Act	- Real-time wearable cameras for inspection documentation (PSM-SIF) - Remote expert guidance	- Member of FISH-i Africa - Technical assistance from Germany’s GIZ [42]
Norway	Norwegian Fisheries Act and PSMA Implementation Regulations	- 24-hour advance notice for frozen catches - Coordinated inspections with RFMOs	- Core member of the EU IUU Fishing Coalition - Data sharing via NEAFC [43]
Indonesia	Fisheries Act (No. 31/2004, amended by No. 45/2009)	- Designated PSMA-compliant ports (e.g., Benoa, Bitung) - Surprise inspections (e.g., “Silver Sea 2” case)	- Shares data via FAO’s Global Information Exchange System (GIES) - Joint training with the U.S. [44]

3.5. Some Observations

First, enhancement of port inspection and regulation. Case studies show that strengthened port inspections are a key strategy in combating IUU fishing. For example, Ghana has effectively screened vessels suspected of IUU fishing by establishing specialized inspection stations at major ports and



conducting thorough reviews of all incoming vessels. Enhanced inspections involve not only physical checks of the vessels but also verification of fishing licenses, fishing logs, crew lists, and the origin and destination of cargo. This comprehensive inspection mechanism ensures the legality of each vessel and promptly identifies and prevents illegal activities. The success of port inspections also lies in the full traceability of catch origin, transportation processes, and final destinations. This requires countries to establish closer catch traceability systems, ensuring clear records at every step from fishing to sale. Such mechanisms not only guarantee fair competition for legally operating fishing vessels but also block the sales channels for illegal catches.

Second, international cooperation and information sharing. International collaboration plays a crucial role in combating IUU fishing. The cooperation model among EU countries, including sharing vessel blacklists, IUU case information, and regulatory resources, serves as a good example for other countries [45]. Information sharing mechanisms, like the global fishing vessel information sharing platform, enable countries to quickly access detailed information about suspected IUU vessels, including their historical violations, current locations, and activities, thereby effectively preventing and combating IUU fishing[46]. International cooperation extends beyond information sharing to include legal support and technical assistance. For example, in cross-border operations against IUU fishing, enforcement vessels can conduct joint patrols and enforcement in the waters of other countries or on the high seas, requiring legal support within the framework of international agreements. This mode of cooperation breaks down enforcement boundaries and enhances the overall capacity to combat IUU fishing.

Third, transparency and public engagement. Transparency plays a crucial role in raising public awareness and facilitating policy enforcement. The U.S. enhances policy transparency by publicizing information on IUU fishing vessels, enforcement actions, and court outcomes, encouraging public and stakeholder participation. Public involvement goes beyond the provision of information, encompassing roles in monitoring and reporting suspicious activities, strengthening society's collective effort against IUU fishing. Transparency mechanisms should not only rely on government disclosures but also actively involve fishing companies, market regulators, and other stakeholders. By establishing industry self-regulation standards and compliance mechanisms, fishing enterprises can proactively enhance operational transparency and reduce the occurrence of illegal fishing.

Fourth, leveraging technology to enhance inspection efficiency. Modern technologies such as satellite tracking, Automatic Identification Systems (AIS) [47], and electronic fishing logs play a vital role in strengthening port inspection and monitoring. These technologies enable authorities to monitor vessel activities in real-time, identify potential violations in advance, and make port inspections more efficient and targeted [48].

Through enhanced port inspections, international cooperation, increased transparency, and the application of technology, global fisheries management is moving towards a more efficient and collaborative era. The implementation of the PSMA framework is not just an enforcement measure by individual countries but a collective global action against the issue of IUU fishing. These approaches have effectively strengthened enforcement capabilities, promoted global cooperation and information sharing, and provided robust support for the sustainable use of marine resources. In the future, as international cooperation deepens and technology advances, measures to combat IUU fishing will become more precise and effective, contributing to the healthy development of global fisheries governance.

#### **4. Strategy to Strengthen IUU Fishing Law Enforcement Based on PSMA**

If effective management of fish populations is not implemented, the future of global fisheries looks bleak, as reckless shipowners and operators around the world continue to flout regulations designed to protect the marine environment, further undermining fisheries management. Many flag states have failed to control IUU vessels on the high seas, leading the international community to adopt port state measures as an alternative approach to combat IUU fishing. By implementing restrictive measures at ports where IUU catches are landed, port states can prevent IUU fish from

entering international trade and reaching major markets. Over the past decade, national, regional, and global initiatives have focused on adopting and enforcing increasingly stringent port state measures to combat IUU fishing [49].

#### *4.1. Call for More Countries to Join the PSMA*

Since its enactment in 2016, the PSMA has become a key legal tool for the international community in combating IUU fishing. According to the FAO, IUU fishing causes annual global losses of up to \$23 billion, representing 15% to 30% of the global fisheries market value[50]. This massive economic drain highlights the critical need for broader international cooperation and compliance with the PSMA to safeguard marine resources and ensure sustainable fisheries management worldwide. Despite the effectiveness of the PSMA, its success largely depends on the extent of its adoption and the commitment of signatory countries to implement its provisions rigorously. As of now, although numerous nations have ratified the agreement, many key fishing nations have yet to join. The non-participation of these countries significantly hampers the global effort to combat IUU fishing as it allows IUU operators to exploit less regulated ports as points of entry for their illegal catch.

The call for more countries to join the PSMA is not just about increasing numbers, it is about enhancing the global network of enforcement and surveillance, sharing critical information, and fostering cooperation among port states. This collective effort is necessary to close the gaps that IUU fishers exploit. Enhanced participation would also strengthen the global response to IUU fishing and increase the cost and difficulty for operators engaging in these destructive practices.

However, the FAO and various governments are providing financial, technical, and training support to enhance these countries' capabilities. Encouraging more countries to join the PSMA strengthens the global enforcement network against IUU fishing, meaning broader monitoring and enforcement scope and higher compliance costs, effectively curbing IUU fishing activities. Furthermore, joining the PSMA also serves as a way for countries to demonstrate their commitment to protecting global fishery resources and the marine environment. Overall, the PSMA is not only a powerful legal tool for combating IUU fishing but also a platform for promoting international cooperation and strengthening global ocean governance. As more countries join, the PSMA's global impact will continue to expand, supporting the sustainable use and protection of the oceans. Becoming a party to the PSMA signifies a country's willingness to combat IUU fishing through this agreement, and governments, intergovernmental organizations, and NGOs collaborate to help parties bridge gaps in legal, institutional, and operational capabilities, enabling them to enforce the agreement [51]. This includes harmonizing laws with PSMA requirements, establishing mechanisms to prosecute IUU offenders, training enforcement personnel on port inspection standards, and developing policies and technologies for information exchange.

A fundamental limitation of the PSMA lies in its voluntary nature. While the agreement binds member states to deny port access to IUU vessels, it lacks mechanisms to penalize non-compliant members or compel non-participants, like China, to adopt equivalent measures. This creates a "race to the bottom" dynamic, where IUU operators simply reroute catches through ports in non-member states—a loophole exacerbated by the absence of universal ratification. As argued by Zhang [52], such institutional gaps mirror broader failures in global environmental governance, where fragmented regimes prioritize sovereignty over collective action.

#### *4.2. Strengthening the Port Law Enforcement Inspection and Supervision Capacity*

It is crucial for effective PSMA implementation to ensure compliance, including the effectiveness of measures and proper application of the agreement's terms. Countries find the PSMA to be a cost-effective tool against IUU fishing. Compared to the expensive and risky operation of patrolling vast oceans to track and apprehend illegal fishers, monitoring and enforcement at ports are safer and less costly. Enhancing port inspection capabilities starts with a thorough review of vessels' entry

applications, verifying fishing licenses, logs, flag state documentation, and details about fishing locations and species. This helps identify vessels potentially engaged in IUU fishing for further action.

On-site inspection is another key aspect of enhancing port inspection and regulatory capabilities. Inspectors board vessels to verify identities of ships and crew, check fishing equipment, and confirm if the fish and quantities caught match the declarations. Such inspections expose hidden IUU activities, like using banned gear or overfishing. Countries like Norway and Canada have seen improvements in inspection frequency and quality after strengthening port state measures, with satellite monitoring and electronic tracking systems allowing real-time tracking of vessel positions and activities, ensuring compliance with reported data. These technologies enhance the efficiency and scope of regulation, enabling effective enforcement even with limited resources. According to reports, these measures have successfully intercepted numerous suspected IUU fishing incidents [53].

In 2019, Senegal conducted inspections in its port on a foreign vessel suspected of illegal fishing, pursuant to the PSMA. The vessel was found to be operating without a valid fishing license and had engaged in multiple unreported fishing activities. The authorities confiscated the vessel and launched a criminal investigation against its owner. Eventually, the owner faced legal consequences, including heavy fines and revocation of fishing rights. Senegal's efforts to combat illegal fishing are part of a broader initiative to enhance port inspections and collaborate with international bodies to curb IUU fishing in West Africa. This case exemplifies how PSMA can be used to ensure compliance with fishing laws and bring offenders to justice [54]. Another case, In the South Pacific, nations like Vanuatu and Fiji have actively applied the PSMA to inspect fishing vessels in their ports. When vessels engaged in illegal fishing are identified, these nations often collaborate with international organizations such as INTERPOL to prosecute offenders. In one instance, several vessels were detained after failing to provide valid fishing licenses. Due to limited local enforcement resources, international support helped track down the owners, leading to successful prosecutions, substantial fines, and even prison sentences for some offenders [55].

International cooperation and information sharing enhance port inspection and enforcement capabilities significantly. By sharing vessel, crew, and fishing activity data through international databases, countries can more effectively identify high-risk vessels and coordinate actions. For example, through collaboration with international fisheries organizations, multiple nations can share crucial information, enabling early warnings and interception of suspected IUU fishing activities. Strengthening port inspections and regulatory abilities improves the detection, prevention, and combat against IUU fishing, protecting marine ecosystems and ensuring fair competition in legitimate fisheries, aligning with the global sustainable development goals for marine resource conservation. With more countries joining the PSMA and implementing stricter port inspection measures, the global effort against IUU fishing will intensify [56].

The PSMA's enforcement framework extends beyond administrative penalties to encompass criminal liability for egregious IUU fishing activities. While the agreement itself does not mandate specific criminal sanctions, Article 9(4) obliges member states to adopt measures ensuring that "serious violations" are treated as criminal offenses under national law. This provision has catalyzed two critical developments:

The PSMA facilitates evidence sharing to support criminal proceedings. In 2021, the U.S. Department of Justice prosecuted the owners of the FV Yongding, a Chinese-flagged vessel, for illegal shark finning in Ecuadorian waters. Key evidence—including AIS data and catch logs obtained via PSMA's Global Information Exchange System (GIES)—was shared by Ecuador, leading to a \$3 million fine and a 5-year industry ban under the U.S. Lacey Act [57].

However, disparities in legal definitions of "serious violations" create enforcement gaps. For instance, Ghana's Fisheries Act (2016) limits criminal liability to repeat offenders, whereas the EU's IUU Regulation (No. 1005/2008) applies strict liability to first-time offenses[58]. Such inconsistencies underscore the need for standardized criteria under PSMA to ensure equitable deterrence.

#### 4.3. Increasing Cost of Violations and Strengthening Sanctions

In combating IUU fishing, increasing violation costs and strengthening sanctions are key strategies to address this global issue. First, increasing the costs of violations involves imposing significant economic and legal consequences on IUU activities, making illegal operations costlier than potential gains. This can be achieved through fines, suspending or revoking fishing licenses, and restricting market access. For example, the European Union's "yellow and red card" warning system effectively increases the cost of violations by warning non-compliant countries [59], potentially leading to seafood embargoes. Second, strengthening legal sanctions involves imposing financial penalties and criminal liabilities, requiring nations to enhance domestic laws to criminalize IUU fishing and hold individuals and companies legally accountable [60]. For instance, the U.S. regulates imported seafood under the Lacey Act, prosecuting any violation of international conservation agreements [61].

Another aspect of sanctions involves enhancing transnational law enforcement cooperation through international cooperation and treaties. Multilateral agreements such as the United Nations Convention on the Law of the Sea and the different types of international fisheries agreements provide a framework for countries to coordinate their legal and enforcement activities to combat IUU fishing collectively. Through these international collaborations, nations can share intelligence, conduct joint patrols, and carry out enforcement actions, increasing the likelihood of detecting and penalizing IUU fishing activities.

In summary, by increasing the cost of violations and strengthening sanctions, countries can not only directly combat IUU fishing activities but also prevent future violations through institutionalized deterrence, thereby ensuring the sustainable use of global fishery resources. The effectiveness of these measures largely depends on the coordination and enforcement of policies both domestically and internationally.

#### 4.4. Practices of the Newest States of the PSMA in IUU Fishing Enforcement: China

The Agreement entered into force for China on April 16, 2025, marking a milestone moment for the country. Prior to its formal accession, China had continuously strengthened its management measures for distant-water fisheries, including implementing self-regulation on the high seas and combating illegal fishing activities, thereby laying the groundwork for joining the Agreement.

According to the white paper China's Distant-Water Fisheries Development, China has consistently enforced stringent oversight, maintaining a "zero-tolerance" policy toward violations. The country has actively adopted legislative and administrative measures to penalize non-compliant distant-water fishing vessels and enterprises.

In 2016, China cooperated with the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) to successfully detain and sanction the foreign vessel Andrey Dolgov for illegally transshipping Antarctic toothfish. Since 2018, China has disseminated lists of Illegal, Unreported, and Unregulated (IUU) fishing vessels published by relevant Regional Fisheries Management Organizations (RFMOs) to domestic ports, denying such vessels access to port services, including unloading, refueling, and resupply. Since 2020, China has annually deployed law enforcement vessels to conduct fisheries patrols in the high seas of the North Pacific, investigating and penalizing illegal operations [62].

Since the Agreement took effect, China has adopted a case-by-case approach, enhanced interagency coordination, progressively improved port inspection capabilities, and actively fulfilled its obligations as a port state. During this period, China has revoked the licenses of six distant-water fishing enterprises and suspended 22 others. Depending on the severity of violations, penalties imposed on relevant vessels and captains have included project termination, temporary suspension, denial of new project applications, and fines, with total penalties exceeding RMB 1 billion [63].

The above practices contribute to strengthening international support for the PSMA, enhancing global marine governance, intensifying efforts against IUU fishing, and ensuring the health of the marine ecosystem and the sustainable development of fisheries. This is crucial for achieving the



United Nations Sustainable Development Goals (SDGs)[64], particularly Goal 14, which focuses on the conservation and sustainable use of ocean resources.

## 5. Conclusions

The PSMA represents a landmark achievement in global efforts to combat IUU fishing, offering a robust legal framework for port state control. Its effectiveness is evident in the increased interception of illegal catches (e.g., Indonesia's enforcement actions) and the growing adoption of shared monitoring technologies (e.g., Ghana's PSM-SIF). However, the agreement's impact remains constrained by two critical limitations: first, the uneven capacity of developing states to implement stringent inspections due to financial and technical deficits; second, the lack of enforceability against non-member states, which allows IUU operators to exploit jurisdictional gaps.

To address these challenges, three pathways emerge: 1) Expanding PSMA membership through targeted incentives for key fishing nations; 2) Establishing a global fund to subsidize inspection infrastructure in resource-poor states; 3) Leveraging satellite tracking and AI-driven risk assessment tools to enhance compliance monitoring. These solutions align with prior scholarship advocating for hybrid governance models and technology-centric enforcement, yet extend their scope by emphasizing the need for binding multilateral commitments. The PSMA's success hinges on transcending its current asymmetries—transforming from a reactive regulatory tool into a proactive, equity-driven mechanism for marine sustainability [65].

Lastly, countries enforcing the PSMA must establish transparent and robust compliance and enforcement mechanisms. This includes developing clear national regulations, implementing stringent penalties for violations of PSMA, and ensuring that these measures are enforced through judicial processes[66]. Only through such measures can PSMA truly serve as a powerful tool in the global fight against IUU fishing.

In conclusion, while the PSMA has achieved 'significant milestones' in combating IUU fishing, greater global cooperation and commitment are required to maximize its potential. Through collective efforts and sustained international collaboration, the international community can anticipate a more sustainable and responsible global fisheries management system.

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