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Practice of Territorial Use Rights in Fisheries in Coastal Fishery Management in China: A Case Study of the Island Reefs Fishery Lease Policy from Shengsi County in Zhejiang Province

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Abstract: Coastal fisheries are vital for food supply, employment, and social stability. However, overfishing is a common problem, often attributed to open access. Territorial Use Rights in Fisheries (TURFs) have gained popularity as a tool to improve the sustainability of coastal fisheries, but research on TURFs in China is limited. This paper examines the island reef fishery lease policy implemented in Shengsi County, Zhejiang Province, within the Ma'an Islands National Marine Special Reserve. The policy leases the use of island reefs to a collective, aiming to address overfishing and resource degradation by establishing fishing area boundaries and limiting the number of users and usage time. Technically, it is an application of TURFs, and it represents a shift from traditional fishing licenses to collective compliance. This experience has disrupted the existing top–down fishery governance structure and signifies a transition to a rights-based fishery management system in China. Through a comprehensive investigation and analysis of the policy's implementation, this research identifies the factors contributing to its flaws. These include the inadequate provision of national and local government policies, insufficient support for policy implementation from fishery management authorities, and the limited involvement of fishermen's organizations. To enhance coastal fishery management, we propose that the Chinese government should build upon existing foundations by clarifying fishing rights through central and local laws and policies. Additionally, there is a need to strengthen data monitoring of coastal fisheries, conduct multidisciplinary research to improve the allocation mechanism of fishing rights, adopt diverse fishery management approaches to enhance supervision capabilities, establish a collaborative governance mechanism, and foster coordination and cooperation between grassroots fishermen's organizations and government departments.

Keywords: coastal fishery; rights-based fishery management; TURFs; co-management

Key Contribution: The following study provides a comprehensive review of the application of Territorial Use Rights for Fisheries (TURFs) in coastal fishery management in China, focusing on the case of the Island Reefs Fishery Lease Policy in Shengsi County, Zhejiang Province. Through a meticulous analysis of the policy's implementation, the study identifies the key factors contributing to its shortcomings, and valuable insights for the establishment of a rights-based fishery management system in China's coastal regions are presented. By assessing legal policies, fishery management tools, and social functions, the following study sheds light on the challenges faced by China's coastal fisheries management system, and effective strategies for improvement are proposed. The findings and policy recommendations shared in this study contribute to ongoing efforts toward enhancing coastal fishery management and ensuring the sustainable utilization of fishery resources in China.

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1. Introduction

Coastal fisheries play a crucial role in addressing global food security, providing nourishment, and contributing to national and regional economic development. These fisheries also contribute to the conservation of biodiversity, the preservation of ecological equilibrium, and the transmission of fishing cultural heritage [1,2]. The issue of unrestricted entry into coastal fisheries has long been a formidable challenge in the realm of global fishery governance. Allowing unimpeded access to these fishing grounds can give rise to an excessive number of fishermen and fishing areas, which in turn fosters direct competition for resources and conflicts among fishermen, thereby undermining the sustainability of fishery resources. Controlling access to fishing grounds or establishing designated fishing areas is a key approach to addressing this problem and ensuring regulated fishing access [3]. Currently, two primary approaches are being employed globally to address this issue. One such approach entails the creation of Territorial User Rights in Fisheries (TURFs) and Customary Marine Tenure, which pertain to the exclusive access rights possessed by groups or communities of fishermen within specific spatial confines. TURFs, as a system predicated on property rights, proffer unmistakable advantages over traditional fishery management systems by furnishing fishermen with potent incentives to embrace more sustainable resource management practices. TURFs empower fishermen with enhanced authority over resource access, exploitation levels, and trading prerogatives. Furthermore, TURFs effectively obviate the notion of "competitive fishing", a phenomenon that often engenders overexploitation. The inherent advantage of Territorial Use Rights in Fisheries (TURFs) lies in their ability to incentivize fishermen to embrace sustainable resource management practices, promoting a more responsible and accountable approach to fishing operations [3,4]. Another approach involves the implementation of limited entry licenses, where fishing rights are allocated through the issuance of licenses, consequently reducing the number of participants in the fishery. This approach is based on the concept of total allowable catch (TAC) for specific fish populations and allocates a proportionate share of the catch while incorporating the principles of maximum sustainable yield (MSY) introduced by Beverton and Holt (1957) and Schaefer (1957) [5]. In this paradigm, the establishment of fishing catch limits becomes the primary objective of fishery management.

As TURF management is considered an innovative solution to the problem of overexploitation, this management approach prevents competitive fishing among fishermen and avoids excessive exploitation of fishery resources. The key to the successful implementation of this system lies in specific fisheries, clear fishing areas, and dedicated fishery communities. This system has been successful in the management practices of coastal fisheries in Japan and Chile [6–8]. Particularly in Japan, a management system based on fishing rights has been implemented in the form of fishing area allocation to cooperative associations (Fishing Cooperative Associations, FCAs) [9]. This system not only prevents competitive fishing among fishermen but also protects coastal fisheries and fishermen from encroachment by other economic sectors through legal protection of property rights. FCAs are responsible for developing resource development and management plans for designated coastal areas, which are reviewed by the county government, and proposals are made to create community-based fishery management at the FCA level. The management system based on fishing rights is also considered a community-based co-management method. After years of implementation, this system has successfully established close interaction between FCAs and the government and promoted coordination organizations at all levels and of various sizes [9–12]. Certainly, TURFs also play a significant role in fishery management in other countries. Belize has extensive experience in different countries and regions worldwide. During the TURF pilot process, Belize focused on lobster and conch fishing in communities, eventually expanding the "restricted access" TURF system to the entire country in 2016. Despite being relatively new, the system has already shown improvements in catch reporting and compliance rates [5]. The Philippines, with its large national fishing fleet, relies on fishing as a vital source of income and food, particularly in remote coastal communities. When other approaches failed to ensure ecological, economic,

and social productivity and resilience, some communities in the Philippines adopted the TURF management method. The success of the TURF system in the Philippines heavily relies on the design, promotion, and implementation by local government officials [13,14]. In Mexico, high-value aquatic products such as lobsters and abalones are often caught in remote areas with limited scientific, management, and law enforcement capabilities. To safeguard the value of these crucial fisheries, Mexico authorized cooperatives to share joint management responsibilities in these remote areas [15].

Coastal fisheries in China are crucial for national economic and social development, representing one of the oldest and most traditional types of fishing in the country's history [16]. Traditional fishermen in coastal areas continue to depend on coastal fisheries as a means to support their families and contribute significantly to the economic and social development of coastal regions. These fisheries serve as vital sources of employment and livelihood for a large number of fishermen, thereby playing a crucial role in sustaining the local communities and fostering regional growth.

The management of coastal fisheries in China is complex due to regional resource variations, the use of multiple fishing gears, various catch types, and wide distribution. Since the 1970s [17], overexploitation and utilization of fishery resources have been observed in China's coastal fishing grounds. In response to the negative impacts of declining fishery resources, fishery authorities have progressively implemented input control and technical measures. While these policies and measures have had some success in mitigating resource decline, fundamentally reversing the downward trend of coastal fishery resources remains a significant challenge.

With the development of island tourism, the number of external fishing personnel far exceeds that of local fishermen, and competitive fishing has led to the near-extinction of shellfish resources in the Ma'an Islands National Marine Special Reserve. According to local fishermen, there has been a noticeable change in their fishing practices. In the past, they were able to collect shellfish conveniently above the high tide line. However, due to the current circumstances, they are now compelled to dive below the low tide line. The implementation of the island reef contracting project in Shengsi County aimed to protect the island reef resources and prevent unauthorized and destructive fishing activities by outsiders. The project, carried out in Shenshan Town (Shengshan is a town under Shengsi country jurisdiction), Bixia Island, Shengshan Island, and Gouqi Island, granted exclusive fishing rights to local fishermen through contracts signed between the government and contractors (Figure 1). The project was initially implemented in Shenshan Town and Gouqi Township simultaneously, with a cooperative management approach involving six villages. The management actions included patrolling and intercepting fishing activities at sea, as well as preventing the sale of shellfish and other seafood by women cadres on shore. However, due to a lack of administrative management and punishment criteria, conflicts arose among different parties. Insufficient funds and the busy schedules of village cadres also hindered the effectiveness of the management efforts. As a result, a civilian self-protection management model emerged, with over 30 local fishermen voluntarily engaging in offshore diving to protect the local ecology. Additionally, the contracting rights were granted to companies and fishermen's elites, each with their own characteristics. The companies had wider leasing rights over the use of island reefs, with specific regulations regarding catch species, size, and fishing timing, imposing penalties on violators. On the other hand, fishermen's elites had smaller management scopes and relied on self-discipline within their group [18,19]. While this initial exploration of rights-based fishery management in Chinese coastal fisheries was considered beneficial, the island reef contracting policy ultimately failed. This paper aims to analyze the suitability of fishery rights-based management in Chinese coastal fisheries, using the island reef policy in Shengsi County, Zhejiang Province, as a case study. It seeks to identify the reasons for the policy's failure and provide rational suggestions and support for the Chinese government in future fishery management endeavors.

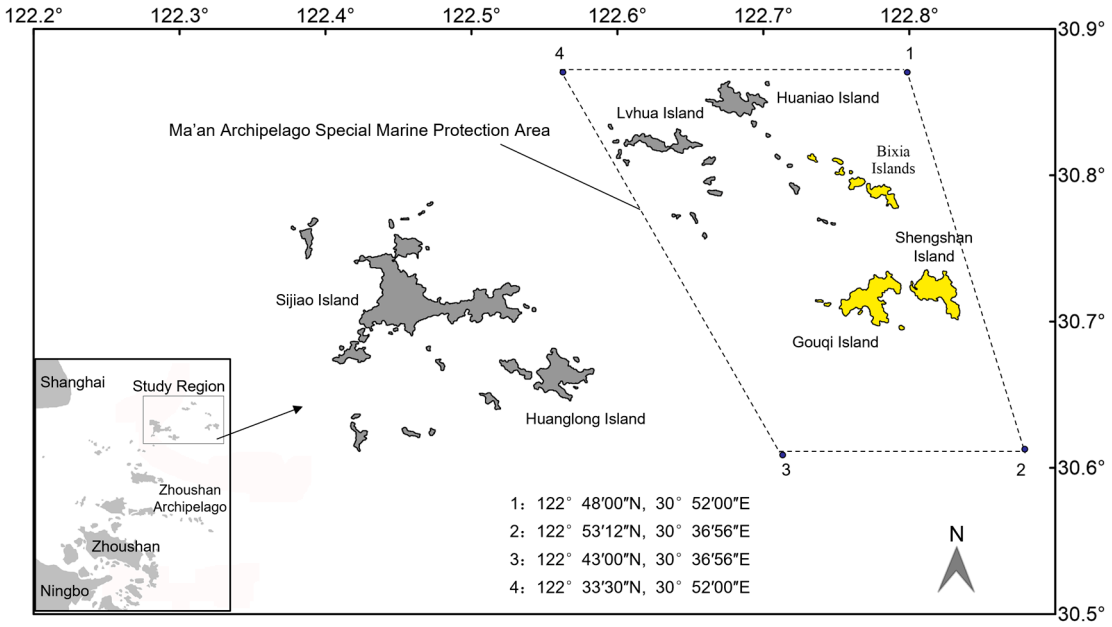

Figure 1. Geographical positioning of Shengsi and the Ma'an Islands National Marine Special Reserve (the yellow area is designated as the pilot area for the Island Reefs Fishery Lease Policy).

2. Study Area and Research Methods

2.1. Study Area

Shengsi County, situated in Zhoushan City, Zhejiang Province, is known for its vast expanse of uninhabited islands and abundant reef resources. Located at the mouth of the Yangtze River, the marine area is influenced by a combination of low-salinity coastal waters, the cold water mass of the Yellow Sea, and the high-salinity water system from the open sea. These distinct environmental factors create nutrient-rich water conditions, providing an ideal habitat for the migration, residence, and breeding of diverse shellfish and algae species.

The area surrounding the islands consists of extensive sand and gravel areas, as well as rocky reefs. The sand and gravel provide a suitable environment for sediment-loving shellfish, while the reefs support the growth of *Ostreidae, Balanus, Trochus niloticus, Oncomelania*, and other species. Within the crevices of the reefs, additional marine life, such as wild, thick-shelled mussels, can be found. The reefs are also home to yellow snails, and various types of seaweed, including *Poro-hyra tenera Kjellm* and *Hizikia fusifarme*, flourish around them. The overall reef area demonstrates stable biodiversity and food chains, forming a well-functioning reef ecosystem [19].

2.2. Methodology

2.2.1. Policy Document Analysis

We conducted a comprehensive analysis of policy documents to identify flaws in the management of the coastal fishery in Shengsi. Firstly, we examined all relevant policy and regulatory documents at the national, provincial, city, and county levels. These documents were sourced from official government websites. Secondly, we identified key sections in these documents that specifically addressed island reef policy. A total of eleven documents were found (refer to Table 1a,b) Utilizing our expertise and considering the leasing of island reefs in Shengsi, we then analyzed these eleven documents to identify key deficiencies in coastal management.

Table 1. (a) Summary of legislative documents relating to the current legal system and relevant sections that apply to coastal fisheries in Shengsi County. Adapted from: Minsi X., Zuli W., Yi T., HuiHui S., and Shu S. (2022) [20]. (b) Summary of policy documents relating to the current legal system and relevant sections that apply to coastal fishery management in Shengsi County. Adapted from: Minsi X., Zuli W., Yi T., HuiHui S., and Shu S. (2022).

(a)

Documents (the Latest Version)	Contents Relevant to Shengsi Coastal Fishery Management
Provisions on the Administration of Fishing Licenses (2019) [21]	Article 32. The fishery administrative department of the local people's government above the county level shall give priority to local professional fishermen and fishery enterprises when approving and issuing fishing licenses; Small-scale fishing vessels are exempt from the fishing log.
Regulations of Zhejiang Province on Fisheries Management (revised for the fourth time in 2020) [22]	Encourage small fishing vessels to install safety rescue information system terminal equipment. The people's governments at or above the county level shall support local fishery producers to establish non-commercial fishery mutual aid organizations.
Measures of Zhejiang Province on Fishing Licenses (revised in 2015) [23]	Fishing area and a time limit for small fishing vessels are stipulated: vessels with engine power less than 44.1 kW shall operate in fishing zones A and C except for purse seine. while vessels using a trawl, purse seine, net, gill net, cage pot, fishing tackle, miscellaneous fishing gear, trap, and rake shall operate in fishing zone A of this county during the non-closed fishing season.
Interim Measures for the Management of Shellfish Fishing in Zhoushan National Marine Special Reserve (2017) [24]	The license of shellfish algae in the conservation area shall be subject to the total control system. Local livelihood fishermen shall be given priority. The fishery administrative department of the county where the conservation area is located shall examine and approve the issuance of shellfish fishing licenses within the total limit and give priority to local traditional fishermen. Traditional fishermen should provide certificates from the towns or villages where the conservation is located.
Regulations on the Administration of the Zhoushan National Marine Special Reserve (2016) [25]	The total amount of control of fishing vessels and fishermen entering the protection zone. The government should give priority to local traditional fishermen entering and conducting fishing activities. The governments of the county where the protection zone is located shall guide the fishermen in their transition from fishing. Encourage fishermen to use eco-friendly fishing modes. Given priority fishing rights for local traditional fishermen to use shellfish resources.

(b)

Documents (the Latest Version)	Contents Relevant to Shengsi Coastal Fishery Management
Notice of the Ministry of Agriculture on Further Strengthening the Management of Domestic Fishing Vessels and Implementing the Total Management of Marine Fishery Resources (2017) [26]	The village or town government or the fishery's primary-level management organizations are responsible for small fishing vessels' management.
Implementation Plan for Transferring Fishermen from Marine Fisheries and the Fishing Industry (2016) [27]	Prioritize compression and reduction of the quantity of old and wooden fishing vessels.

Table 1. *Cont.*

(b)	
Documents (the Latest Version)	**Contents Relevant to Shengsi Coastal Fishery Management**
Management documents of small fishing vessels in villages and towns of Zhejiang Province (2012) [28]	Control and reduce the total number of small fishing vessels gradually. It is not allowable to build new small fishing vessels. Small fishing vessels implement the summer fishing moratorium policy, which lasts from May 1st to September 16th every year. Those who disobey the fishing moratorium system shall not be registered. Townships and their cooperatives should strengthen the safety management of small fishing vessels; villages and towns governments should build a supervision platform for small fishing vessel monitoring system.
Guidance of the Shengsi County People's Government on the Transformation of Livelihood Fisheries in Shengsi County (2015) [29]	Zone access condition: define the available area in Ocean Park and the fishing of Shengsi County in traditional operation mode as the catching area of the coastal fishery, and define the catching area range of each vessel. Gear access condition: keep the traditional and resource-friendly fishing gears in Shengsi County, such as the lift net, drift net, fishing basket, and pot. Number access condition: limit the number of people entering the fishing ground and strengthen the training of fishermen. limit the harvesting size, strictly abide by the national fishing gear catchable-size standard, and limit the ratio of caught juveniles. The total allowable catch: in accordance with the local resource conditions, develop the annual fishing capacity and guide the fishing activities.
The Three-Year Action Plan (2019–2021) for the construction of the Shengsi National Green Fisheries Experimental Base [30]	In the Ma'an Archipelago Marine Special Protection Area, pilot projects for the commercialization of fishing rights have been initiated in the fishing grounds along the Shengshan coast sea fishing areas and wolfberry aquaculture fishing areas. These projects aim to explore a model for separating the ownership, usufructuary rights, and operating rights of fisheries resources.

2.2.2. Semi-Structured Interview

The interviews took place from June 2023 to March 2024, involving 28 stakeholders who participated in a face-to-face interview, including six fisheries managers (coded as FM1-6) from the Bureau of Marine and Fisheries of Shengsi Country, four law enforcers (coded as LE1-4) from the law enforcement agency of Shengsi Country, three fish sellers (coded as FS1-3), three fish processors (coded as FP1-3), and seven fishermen (coded as F1-7), three members of the fishing cooperative (coded as FC1-3), and two fishery researchers (coded as FR1-2). The six fisheries managers recruited for the interviews were recommended and introduced by our contact at the Bureau of Marine and Fisheries of Shengsi Country and had served in the Shengsi Marine Fisheries Bureau for more than five years. Due to the early implementation of the policy of reef protection, the remaining 22 interviewees were recommended by and regarded as key informants of the Shengsi island reef by the fisheries managers interviewed (see Table 2 for the questions and their corresponding respondents).

2.2.3. Case Study

Case studies provide valuable insights into the specific implementation, strategies, and outcomes of policies. They enable detailed investigation and analysis, allowing for an assessment of the policy's impact and whether it has achieved its intended objectives. Case studies also facilitate the evaluation of the quality of policy implementation.

Table 2. Questions developed based on the findings of the document analysis for the semi-structured interviews and their corresponding respondents.

Findings of Document Analysis	Questions	Respondents
Island reefs have no legal definition	Q1. What do you think island reefs are? Q2. Do you think island reefs should be managed separately from other types of fisheries?	All interviewees All interviewees
There are no legal requirements for the collection and use of artisanal fishery related data in management	Q3. Is it necessary to fill out fishing logs for island and reef fisheries? This includes information such as fishing vessels, fishing methods, types of catches, and catch quantity?	FM1-6, LE1-4, and F1-7
Starting in 2019, non-coastal residents are prohibited from obtaining marine fisheries licenses. Starting in 2017, the protected area implements a permit total control system for shellfish and seaweed fishing licenses, with priority given to local livelihood fishermen.	Q4. Do local fishermen have priority access to fishing grounds? Q5. Are there restrictions in place to prevent outsiders from entering the fishing grounds? Q6. Is it permissible for non-coastal residents to obtain marine fishing licenses in Shengsi?	All interviewees All interviewees All interviewees
Starting in 2015, Shengsi has designated coastal fishing zones and implemented quota management.	Q7. Do you collect data on artisanal fisheries? Q8. Are there currently any quota management systems for resident species on islands and reefs? Are there any relevant policies? Is there an implementation plan for quota management?	FM1-6, LE1-4, and F1-7 FM1-6, LE1-4, and F1-7
Starting in 2019, fishermen wishing to obtain a marine fishing license must provide a reference letter to the fishing organization to which they belong.	Q9. What are the conditions for joining a fishery organization? Q10. Has individual fishing become more profitable after joining the fishery organization? Q11. Are there any specialized fishermen's organizations for coastal fisheries?	FM1-6 and F1-7 FC1-3 and F1-7 FC1-3 and F1-7
	Q12. In addition to fisheries agencies, what agencies are involved in the management of coastal fisheries in Shengsi? Q13. Are there collaborative mechanisms between fisheries agencies and the other agencies in Shengsi? If so, how effective is the collaboration?	FM1-6, F1-7, and FC1-3 FM1-6, F1-7, and FC1-3

3. Predicaments of Coastal Fisheries Management in Shengsi

3.1. Legal System

The analysis of the current legal system reveals several issues that contribute to the failure of the island reef policy. Firstly, there is a lack of a coastal fishery data statistics system, which hinders the collection of vital information on production processes and dynamic information about coastal fisheries. Existing policies and management practices do not require fishing logbooks for coastal small-scale fishing boats or artisanal operations, resulting in a lack of data on coastal small-scale fishery information and statistics at both national and local levels [20].

Secondly, the difficulty in supervision is identified as a major reason for the policy's inability to continue effectively. Law enforcement for the contracted reef areas is carried out by contractors, leading to challenges in regulating and preventing trespassing. While regular patrols are conducted to protect resources from outsiders, the cost and operational expenses involved are significant. Moreover, the lack of a legal basis and law enforcement authority hampers effective handling of trespassers. Lax law enforcement and leniency for familiar faces further undermine the policy's enforcement. The absence of legal policy

support from both central and local governments during the implementation process has resulted in a lack of legal basis and insufficient improvements over the past two decades.

Thirdly, the current policies fail to explicitly define fishing rights, leading to ongoing issues with illegal fishing. Despite the contracting method used by Shengsi County to clarify the users of island reefs, the policy does not address the fundamental problem of illegal fishing. Fishing rights are not allocated to those who catch fish on the reef, and there is no clear allocation or prioritization of rights for local traditional fishermen. Fishermen who lack funds or prestige may perceive their fishing rights as infringed upon by the contracted reef policy. The conflict between sea area use rights and fishing rights creates ambiguity regarding power subjectivity, as fishermen with sea area use certificates believe they inherently possess the right to use reef resources.

Furthermore, there is a lack of fishermen's organizations and operational mechanisms. Under the reef protection policy, contracting is based on the organization, which operates in the form of a company. Only when local fishermen join the organization can their fishing activities be considered compliant, and they are required to pay membership fees. The organization enforces unified management and distribution of fishing boats, production plans, and catches. This organization's function resembles the responsibility system for fishing vessel operations in China during the 1980s. The core principle is the separation of ownership and management rights for fishing vessels. Collective economic organizations own the fishing vessels, while contracted operators have the management rights to operate independently, assume responsibility for their own profits and losses, and pay contract fees according to regulations. To some extent, this organization has reduced competitive fishing, alleviated fishing pressure, and standardized fishermen's behavior. However, the expensive management of fishing boats and the supervision of contracted islands, reefs, and surrounding waters, coupled with the lack of financial and policy support, hinder the organization's operations' sustainability. Currently, there is no specific fishermen's organization established in the fishing industry along the Shengsi coast. Instead, decentralized management by individual households is practiced. When applying for a fishing license, the fishermen's village committee or neighborhood committee, which are general grassroots autonomous organizations, are utilized. Their members consist of residents from villages and towns, not specifically fishermen's organizations.

Addressing these legal system shortcomings is crucial for the successful implementation of the island reef policy. Improved data collection, strengthened supervision, an explicit definition of fishing rights, and the establishment of effective fishermen's organizations and operational mechanisms are necessary steps to address the existing challenges and ensure sustainable management of island and reef fisheries in the region.

3.2. Fishery Management System

The interview findings highlight the challenges associated with the fishery management system, specifically the predominant use of input control methods in China's coastal fisheries [31]. Input control primarily relies on limiting the number of vessels, net tools, and horsepower to control fishing effort. However, the diverse nature of coastal fishery operations, the mobility of operations, and the variety of catches make it difficult to effectively classify and manage different types of catches without clear and specific management systems. This lack of planning and control functions results in high oversight costs and delayed responses.

In the case of the contracted reef policy, the rotation of law enforcement responsibility within the contracted waters by the contracted company leads to operational difficulties due to the high costs involved. The top–down management approach faces complex law enforcement situations with insufficient law enforcement capabilities. The interviewees, depending on their roles, have differing views on the fairness of law enforcement. Contractors, for example, do not possess law enforcement authority and can only serve a supervisory role. When trespassers are detected, they can only notify government law enforcement, providing trespassers with an opportunity to escape. Moreover, law enforcement is often

delayed and does not align with government penalties. There is also leniency in law enforcement for acquaintances with shared interests.

The contracted reef policy aimed to shift from an administrative licensing system to a management system based on fishery rights. However, the underlying system has not evolved and is still relying on outdated methods. Input control alone is insufficient to meet the management needs of the contracted reef policy. Additionally, the law enforcement methods employed are limited. Even with the involvement of fishermen as a supplementary force to government law enforcement during the policy's implementation, the challenges, high costs, and limited effectiveness of law enforcement have not been fundamentally addressed. Competitive fishing and trespassing continue to persist.

The current management approach, which heavily relies on input control, incurs high government oversight costs and lacks timely responses. To address the issues identified, it is necessary to explore alternative and more effective management strategies that consider the unique characteristics of coastal fisheries in the region. This may involve implementing more comprehensive and specific management systems, improving law enforcement capabilities, and exploring innovative approaches to achieve sustainable and equitable fishery management.

3.3. Co-Management

The implementation of China's island reef policy aimed to enhance local fishermen's participation in governance and promote the development, utilization, and protection of fishery resources. However, the policy faced challenges in its implementation, primarily due to the absence of fishery cooperatives along the coastal areas.

The 'six-village co-governance' model adopted during the implementation of the contracted reef policy represents a form of villager autonomy. In this model, fishermen-initiated monitoring organizations lack the necessary authorization and financial support to fulfill their functions comprehensively. Their role is limited to assisting government law enforcement rather than actively participating in the allocation of fishing rights, collecting statistical data on production dynamics, or tracking sales volume and revenue.

The lack of fishery cooperatives and limited authority and financial support for monitoring organizations hinder the co-management aspect of the contracted reef policy. Co-management involves collaboration between government entities, local communities, and fishermen to jointly manage and govern fishery resources. In this case, the absence of an effective co-management structure prevents the full integration of local fishermen in decision-making processes and resource management.

To enhance the effectiveness of co-management, it is crucial to establish fishery cooperatives along the coastal area. These cooperatives would provide a platform for fishermen to actively participate in the allocation of fishing rights, collect and analyze statistical data on production dynamics, and track sales volume and revenue. Additionally, providing authorization and financial support to fishermen-initiated monitoring organizations would enable them to play a more significant role in resource management and support government law enforcement efforts.

By strengthening co-management structures and fostering collaboration among government entities, local communities, and fishermen, it is possible to improve the implementation of the contracted reef policy and achieve more sustainable and inclusive fishery resource management.

3.4. Summary

The failure of the contracted reef policy in Shengsi County, Zhejiang Province, can be attributed to three main factors, i.e., the policy system, management tools, and social functions (see Table 3).

Table 3. Obstacles to establishing a fisheries management system based on fishing rights in Shengsi.

Policy System	1. Lack the goals of management; 2. Lack of legal basis; 3. Lag and delayed response.
Management Tools	1. Lack of data; 2. Limited means; 3. High and inefficient enforcement costs.
Social Functions	1. Lack of fishermen's organization; 2. Lack of authorization.

In terms of fishery legal policy, the lack of legal recognition and policy support for the contracted reef policy at both the central and local government levels pose significant challenges. The absence of clear provisions regarding the management scope, such as fishing vessel length, operation methods, types of catch, and catch limits, makes enforcement difficult and hampers the determination of access objects and qualifications.

Regarding fishery management, coastal island reef fisheries have unique characteristics and require specific considerations. The concentrated operating range and reliance on traditional fishing tools and techniques differentiate them from medium- and large-scale fisheries. The limited resources and space on coastal islands result in scarce fishery resources and intense competition for fishing grounds. However, the management methods employed do not account for these distinctions and primarily rely on input control, similar to medium- and large-scale fisheries.

In terms of co-management, its role has been limited to supervision rather than effectively bridging the gap between the government, scientists, enterprises, and fishermen. The implementation of co-management has not facilitated meaningful collaboration and participation among these stakeholders.

To address these challenges and improve the management of island reef fisheries, it is crucial to establish legal recognition and policy support for the contracted reef policy. Tailored management approaches that consider the unique characteristics of coastal island reef fisheries should be developed, moving beyond reliance on input control. Additionally, effective co-management structures should be established to foster collaboration and engagement among government entities, scientists, enterprises, and fishermen.

By addressing these issues and implementing comprehensive and context-specific measures, it is possible to enhance the success and sustainability of island reef fishery management in Shengsi County and similar regions.

4. Improvement Rights-Based Management Fishery in China: Lessons from International Experience

4.1. Japan

Japan has established itself as a leading example in fishery management based on fishery rights. Recognizing the importance of protecting the rights of traditional fishermen, the Japanese government granted exclusive utilization rights over nearshore waters to traditional fishermen's associations as early as 1901. This move clarified the legal status of traditional fishermen and established a fishery rights system. Under the fishery rights system, fishery rights holders, fishing rights holders, and other fishery operators are divided [32]. Fishery rights holders refer to traditional fishermen who are granted rights over nearshore waters. The ownership of marine resources in Japan is vested in the state, with the rights and responsibilities directly granted to Fishery Cooperative Associations (FCAs) rather than individual fishermen.

FCAs are legal and administrative entities responsible for managing Japan's nearshore TURF system. They play a vital role by providing scientific advice and jointly undertaking regulatory tasks with local governments [33,34]. FCAs are responsible for managing a wide range of species and fishing gear types, involving sedentary species, benthic organisms, seaweed, plankton, and various types of fishing gear.

Japan emphasizes the involvement of stakeholders other than the government in fisheries management. FCAs, composed of fishermen from the area, act as the holders of fishery rights and serve as a bridge between the government and non-fishing fishermen [12,35]. The management model of Japan's coastal small-scale fishery combines top-down hierarchical management with decentralized, multi-stakeholder co-governance. The top-down approach involves interactions between national, county-level, and FCAs, while cooperative governance at the county level involves horizontal interactions among various stakeholders, including fishermen, scientists, and managers.

Overall, Japan's coastal small-scale fishery governance involves both vertical and horizontal interactions. Fishery associations play a central role, with the government providing legal and policy support to facilitate effective management based on fishery rights.

By studying the Japanese experience, China can learn valuable lessons in protecting the rights of traditional fishermen, establishing cooperative governance models, and promoting the sustainable development and protection of fisheries. Implementing a fishery rights-based management approach can enhance the involvement and empowerment of fishermen in decision-making processes and contribute to the long-term viability of China's coastal fishery resources.

4.2. Chile

Chile has also made significant advancements in coastal fishery management based on fishery rights, particularly in the utilization of benthic shellfish resources. The country has established a comprehensive fishery rights system to ensure the sustainable management of coastal resources.

To address conflicts between industrial fishermen in offshore waters and small-scale coastal individual fishermen, Chile passed the Chilean Fisheries and Aquaculture Law (CFAL) in 1991. This law designated a 5-nautical-mile coastal zone and allowed for the establishment of multilateral environmental agreements that were exclusively granted to fishermen's organizations [8,36]. The Management and Exploitation Areas for Benthic Resources (MEABR) were established in 1995. These management areas, also known as TURFs, were created to oversee the sustainable management of benthic resources, including algae, shellfish, sea squirts, sea urchins, clams, and more [7].

The TURFs system in Chile covers approximately 2500 miles of sea, providing exclusive rights to fishery associations upon request and application. By 2010, Chile had 726 TURFs with a total of 31,497 members. However, it is important to note that not all areas operate under the TURFs system [5,37].

The management of Chile's coastal fishery is based on a co-management system between the government and fishermen's associations. Long-term access rights management systems have been established to sustainably develop benthic resources. Cooperation between fishermen and scientists is encouraged through informal and voluntary total catch-sharing agreements among regional associations.

The application process for obtaining a TURF requires fishery organizations to submit a study that assesses the total catchable amount of fishery resources, provides detailed maps of the area, and profiles secondary species in the location. Once recommended by the fishery organization, the government grants the TURFs, and the organization manages them on behalf of its members. Internal rules, such as entry and exit regulations, fishing methods, income distribution, social funds, and welfare systems, are developed by the fishery organizations [5,38–43].

TURFs in Chile cannot be transferred between fishermen's associations, and fishery organizations are required to pay annual taxes. Failure to comply with tax requirements may result in the revocation of the MA's privileges. In the event of termination, the fishermen's organization cannot reapply for a TURF within three years [5].

Chile's co-management system, through the TURFs approach, has proven to be a successful model for sustainable fishery management. By granting exclusive rights to fishery associations and involving fishermen in decision-making processes, Chile has

effectively protected its benthic resources and promoted the long-term viability of its coastal fisheries. China can draw valuable insights from Chile's experience to improve its own coastal fishery management based on fishery rights.

4.3. Summary

Coastal fishery management in Japan and Chile shares common approaches and objectives for protecting the rights of traditional fishermen and promoting sustainable development. Both countries have implemented fishery rights systems, recognized and protected traditional fishery rights, and emphasized co-governance among multiple stakeholders. They also prioritize scientifically informed management measures to ensure the sustainable utilization of fishery resources.

1. TURFs can play a significant role in various contexts. Despite Japan and Chile having distinct socio-economic, cultural, and resource conditions, both countries face unique challenges in fishery resource management. TURF systems can be customized to fit the regional cultural economy and establish effective management frameworks. Irrespective of the circumstances, it is crucial to define management objectives and implement a comprehensive collaborative design process.

2. The design of TURF systems should involve clearly defined geographical and social boundaries. Fixed boundaries, both geographical and social, prevent resource allocation and migration issues in fishery resource management. Moreover, well-defined social boundaries foster mutual familiarity and trust between fishermen and managers within the region, thus enhancing decision-making, supervision, implementation, and overall performance.

3. While the transition to a TURFs management system entails devolving more monitoring responsibilities from national and provincial governments to local institutions and involving fishermen in the management process, higher-level government departments continue to play an integral role.

4. Determining access rights and approving new participants represents a significant and challenging task. Typically, fishermen from coastal communities can acquire fishing rights without the need for specific TURF delineation, and historical factors may result in a greater number of individuals operating in these areas. Consequently, it becomes crucial to establish conditions for fishermen from neighboring areas to access the TURF. Equally important is the consideration of how permits should be issued to new community members seeking fishing privileges on the designated TURF. Striking a balance is vital—avoiding a fleet that becomes too large while preserving fishing traditions and encouraging community involvement. Establishing and maintaining mechanisms for entry and exit represent key objectives in this regard.

5. The positive effect of co-governance in TURF In Japan, exclusive utilization rights over nearshore waters have been granted to local FCAs composed of traditional fishermen. The FCAs play a key role in fishery management, acting as a bridge between the government and non-fishing fishermen. The management approach involves cooperative governance and the incorporation of scientific advice.

Similarly, in Chile, the MEABR system has been established to manage coastal resources. Exclusive rights are granted to fishermen's organizations, ensuring the rational utilization and management of benthic fishery resources. Co-management between fishermen and scientists is emphasized, and measures such as restricted fishing quotas, authorized gear, and temporary bans are implemented to protect and sustainably manage the resources.

Both countries prioritize the scientific basis for their management decisions. In Japan, scientific advice is taken into account in determining management measures, such as fishing seasons. Chile also employs monitoring and assessment to ensure the sustainability of benthic resources.

In general, by recognizing and protecting traditional fishery rights, adopting fishery rights systems, promoting co-management, and prioritizing scientific management,

Japan and Chile have demonstrated successful approaches to coastal fishery management. These experiences can serve as valuable lessons for other countries seeking to enhance the protection of fishery resources and achieve sustainable development in coastal fisheries.

5. How to Improve Coastal Fishery Management in China

From the analysis above, it is evident that the island reef fishery lease policy system in Shengsi County serves as a prototype of the TURFs system, representing a significant step forward in establishing a rights-based coastal fisheries management system in China. However, there are still areas for improvement in both the system and its management. In 2023, China introduced a three-dimensional rights setting in maritime areas, a crucial measure to enhance the property rights system of maritime resources and expand the functions of maritime usage rights. In February 2024, Zhejiang Province released the first provincial-level technical specification for the three-dimensional delineation of maritime areas, marking a progressive transition in the development and utilization of marine fishery resources towards a refined, diversified, and three-dimensional management era. These developments present new opportunities to improve the fishing rights system. Therefore, we suggest the following improvements:

5.1. Implementing Precision Policies to Enhance Policy Adaptability

To effectively manage coastal fisheries in Shengsi County, it is necessary to consider the unique characteristics of coastal island reef fisheries. The following measures can be implemented:

Firstly, establish clear fishery management goals. Shengsi County can determine access standards for entering coastal island reef fisheries based on factors such as the type, size, operational range, and type of fishing vessels, as well as whether the operator is a resident of the coastal community.

Secondly, ensure localized rights to use resources. Consider the establishment of protected fisheries for small-scale fisheries, providing exclusive rights to fishermen who meet the access conditions. When planning for the functional use of nearshore waters, the government can designate specific areas for the exclusive use of coastal fisheries. For instance, the coastal island reef fishery in Shengsi County should only be accessible to local fishermen from that county, granting them exclusive rights to use the fishery. This targeted protection can significantly reduce conflicts and competition during fishing operations while promoting resource conservation.

Thirdly, design the system to attribute fishery resources within the area to property rights. This involves transforming resource rights into quota rights, separating ownership and usage rights, assigning ownership to cooperative collectives, and granting usage rights to fishermen within the cooperative. Quotas can be employed to quantify the utilization of property rights. The effectiveness of this approach relies on the system's integrity, systematic nature, and precise policy implementation in coastal fishery management.

By implementing these improvements, China can enhance its coastal fishery management practices, effectively protect fishery resources, and promote sustainable development in coastal fisheries.

5.2. Adopting Diverse Fishery Management Measures

China's current management regulations for coastal fisheries do not differentiate between medium-/large-scale and coastal small-scale fisheries. The predominant management measure is input control, which limits fishing effort by restricting the number and horsepower of fishing vessels. However, relying solely on input control measures is inadequate for a country like China, with its extensive coastline, numerous fishing vessels, and complex fishery structure. Traditional top–down management approaches have proven ineffective in governing small-scale fisheries, especially in developing countries. These approaches lack the ability to differentiate between different types of catches and require extensive planning and control functions, leading to high government regulatory costs and

delayed responses. To address these challenges, a combination of different fishery management measures should be considered. For example, implementing a quota management system alongside input and output control systems can create a comprehensive fishery management system that is more adaptable and effective.

5.3. Accelerating the Construction of Grassroots Fishermen's Organizations and Introducing Co-Governance Mechanisms

Fishermen are vital to the development of the fishery economy and play a crucial role in coastal fishery activities. Their active participation is key to achieving sustainable coastal fishery development. Establishing fishermen's organizations is fundamental to implementing a rights-based fishery management system. Evidence from Japan and Chile shows that fishermen's organizations with exclusive rights over fishery territories are important in achieving a co-management system. The island reef fishery lease policy in Shengsi County has shifted from using fishing licenses as the sole access condition to requiring collective membership for compliance with fishing activities. This has increased fishermen's sense of belonging and enthusiasm for participating in co-governance. However, incomplete policies have led to uncertainty regarding their legality and effectiveness. The lack of institutional guarantees means there are no solutions to problems encountered during fishing operations, and there are no subsidies or reward mechanisms to incentivize fishermen's participation. This limits the extent, degree, and methods through which basic fishermen can participate and hampers the role of basic fishermen's organizations in fishery governance.

Therefore, it is crucial to reshape fishery communities, develop fishermen's collectives, and promote the organization of fishermen. China's current fishery management primarily involves direct interactions between the government and a vast number of fishermen. However, faced with complex management affairs, the direct management efficiency of fishery authorities is low, and costs are high. Communication difficulties between government fishery management departments and fishermen further complicate matters. Strengthening coastal fishery communities can enhance fishermen's sense of belonging and cohesion by transferring certain government management functions to grassroots fishery organizations to assume regulatory roles. China is currently undergoing major reforms in marine fishery management, transitioning towards total resource management, quota fishing, fixed landing of fishery products, and traceability measures. If the existing management model is maintained, with some management functions not delegated to grassroots fishery organizations, or if fishery organization self-governance cannot replace some government regulatory functions, the reform of marine fishery management will face challenges. Moreover, the decentralized nature of small-scale fisheries makes it difficult to ensure safety supervision for inherently high-risk marine fishing activities. Therefore, establishing a co-governance mechanism involving the government, fishermen's organizations, fishermen, and scientists is essential.

5.4. Strengthening Data Collection and Monitoring

Coastal fisheries often face challenges in data collection and monitoring. Manual fisheries, which are not included in the statistical system, may yield different results when compared to sociological survey methods or mathematical statistics. Sociological surveys, primarily conducted through questionnaires, may indicate that hand-fishing is the main method, while mathematical statistics may suggest driftnet fishing as the predominant method. These discrepancies can be attributed to several factors, such as the selection of survey subjects and samples, potential subjective influences on survey questions, and the interactions between surveyors and respondents. Obtaining timely and accurate information about fishing vessels and catches is difficult due to the dynamic and temporary nature of fishing activities in coastal fisheries. This longstanding issue hampers the accurate assessment of contributions and existing problems in coastal fisheries. This further underscores the importance of establishing grassroots fishermen's organizations.

While it may be challenging to require coastal fishermen to fill out fishing logs, fishermen's organizations can play a role in collecting data by requiring fishermen to report catch quantity, operational areas, voyage times, and other relevant information at the end of each voyage. Fishermen's organizations can also conduct monthly, quarterly, and annual surveys on coastal fishing vessels, gear, personnel, fishery product sales, circulation, costs, and outputs. Establishing databases and maintaining dynamic records can facilitate the implementation of output control measures.

Due to the insufficient data available, we have not adequately considered the influence of economic, social, and other factors on TURF. According to the limited literature, artisanal fishing is the primary method employed in island reef fisheries. However, fishing boat registration data reveal that gill netting is the most common operational technique. The Provisions on the Administration of Fishing Licenses in China (2019) stipulate that artisanal fishing requires a fishing license. However, the statistical analysis of actual fishing activities does not include the artisanal fishing industry, resulting in a data gap.

We conducted a preliminary investigation into coastal fisheries in various locations across China, and we discovered that the island reef fishery in Shengsi holds significant research value regarding fishery characteristics and management policies. However, further exploration is required to ascertain the applicability of this system in other coastal areas of China.

6. Conclusions

During the "Fourteenth Five-Year Plan" period, China's management objectives for coastal fisheries shifted from strict control to optimizing fishing structures, indicating a move towards differentiated, refined, and scientific fishery management. The introduction of the three-dimensional rights setting in 2023 also presents new opportunities for establishing a coastal fishing rights system [44]. With China's vast coastline, large and complex fisheries, and regional differences in coastal fisheries, it is crucial to analyze and explore improvement measures based on a rights-based fishery management system.

Through the case study of Shengsi County's coastal island reef fisheries, we have identified areas for improvement and proposed suggestions to enhance the fishery management system in China's coastal areas. The issuance of the "Regulations on the Management of Fishery Licensing" in 2019 introduced new management measures for coastal fisheries, including the allocation of fishing grounds, indicators for small coastal fishing vessels and net gear, and the inclusion of manual fisheries under licensing management. However, challenges remain in regulating manual fisheries, as there are limited data available through government statistics.

As the revision of 'Fisheries Law of the People's Republic of China' is underway, we call on the central and local governments to consider adopting a rights-based fishery management approach as a supplement to input control. This would improve the precision of management objectives. In the process of implementing rights-based fishery management, it is essential to address the deficiencies in the management system of coastal fisheries in Shengsi County, such as the lack of clear definitions and management objectives in national and government legal documents, the absence of fishing log requirements for non-vessel fisheries, and the insufficient establishment of grassroots fishermen's organizations.

In conclusion, recognizing the crucial role of coastal fisheries in ensuring sustainable development and promoting the social and economic growth of coastal fishing communities, we urge the Chinese government to continue advancing the establishment of a coastal fishing rights system. This includes incorporating management standards for coastal fisheries into legal documents, setting management objectives based on the unique characteristics of coastal fisheries, strengthening data collection and multidisciplinary research, promoting scientifically informed fishery management, and fostering a collaborative governance framework involving fishing areas, fishing villages, scientists, and enterprises. We recommend that the Chinese government continue to explore the establishment of protected fishing grounds, such as turf, as a potential solution. When planning the utilization of

offshore waters in the future, the government could consider designating dedicated fishing grounds for coastal fisheries. These fishing grounds would be exclusively operated by fishermen from coastal communities within the county, granting them exclusive use rights. This approach would be particularly beneficial for regions like Shengsi County, which is geographically composed of islands and reefs and has a large concentration of traditional fishermen. The establishment of fishing grounds with exclusive use rights would not only help reduce conflicts and competition but also encourage fishermen to actively participate in the protection of fishery resources. By promoting resource sustainability, these measures would ultimately safeguard the long-term interests of all stakeholders.

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