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JURNAL SCIENTIA, Volume 12 No 4, 2023 ISSN 2302-0059

SUSTAINABLE FISHERY MANAGEMENT: LEARNING FROM THE INDIGENOUS COMMUNITY OF BIAK

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Keywords:
Community-based management, Common property resources, Indigenous communities, Ostrom Design Principles, Sustainability, Local management

The depletion of natural resources has occurred worldwide, especially in the field of fisheries. Various solutions to address this depletion involve the conservation or preservation of natural resources. The management carried out by indigenous communities is considered one of the important environmental governance approaches to protect ecosystems and natural resources. Understanding the fundamental principles of how local actors can collaborate successfully in environmental governance can provide valuable insights into how ecosystems and natural resources are managed by them and how the provision of related ecosystem services can be sustained. This research utilizes the design principles proposed by Ostrom to identify the resource management conducted by the Biak Indigenous Community in the Biak Numfor Regency through the Sasisen practices rooted in local knowledge. Sasisen practices are assessed as a contributing factor to natural resource preservation. The aim of this research is to analyze the existence of each principle and how they are applied. The analysis is based on data collected through interviews with various local actors. These principles help explain how indigenous communities can organize collective actions in the management of natural resources. There are Ostrom principles verified by these Sasisen practices, namely the principles of boundaries, rules, collective choice, monitoring, and graduated sanctions. As for the principles of recognition of rights and nested enterprises, conflicts persist between indigenous communities and government agencies, as well as between small-scale and large-scale fisheries sectors. This research also explains the behavior of indigenous communities in preserving their fisheries resources, which can be considered by the government.

1. INTRODUCTION

Fishery resources have become one of the food sources with continually increasing market demand [1]. This demand will impact the sustainability of fishery resources. Fisheries are also categorized as common-pool resources (CPRs) with open access. This condition tends to drive exploitative human behavior in harvesting fishery commodities. In such conditions, conservation becomes crucial for human survival. All living organisms benefit from the availability of fishery resources both now and in the future. Preserving fishery resources means not consuming them faster than they can be replenished [2]. Various approaches have been employed to protect and restore natural resources. Ostrom [3] explained that natural resources do not have to be public goods under state control to be preserved. In the literature, it is generally known that resource users, such as small-scale fishermen, can manage their resources under certain conditions [3-8]. McCay and Jones [9] added that besides the government, the regulation of natural resources can depend on communities (including individuals, social networks, civil organizations).

The concept of "The commons," as proposed by Ostrom and Ostrom [10], serves as a key to understanding under what conditions resource management regimes are expected to lead to more sustainable resource use [3]. The primary issue with common property regimes, of course, is related to the rational actions of individuals in a context where their outcomes depend on the actions of all other resource users. This is essentially a problem of collective action, and Ostrom understood that common ownership institutions or local communities in various parts of the world that have long practiced certain forms of management can be used as places to study how they deal with conditions that lead to

tragedies [11, 12]. Based on the analysis conducted by Ostrom [3], she proposed eight design principles that she associated with sustainable resource governance, measured by the sustainability of long-term resource systems. The most successful common ownership institutions tend to operate in accordance with the design principles (DP) set out by Ostrom. These principles have been widely used to evaluate and diagnose various forms of resource systems, including fisheries.

The Papua community has long practiced sustainable resource management in coastal and marine areas, one of which is the Sasisen practice carried out by the Biak Indigenous Community in the Biak Numfor Regency (Sujarta et al., 2021). This practice aims to protect core fishing areas in coastal and marine ecosystems. Indigenous communities are often described as environmental stewards who live "harmoniously" with their environment [13, 14]. Research conducted by Rumbino, Iskandar [15] suggests considering Sasisen practices in conservation areas. Through traditional practices maintained by local communities, they have demonstrated how not to overexploit resources [2]. Therefore, researchers are interested in identifying Sasisen practices for CPRs Fisheries management using Ostrom's design principles as a guide. Can these practices, in line with the management model used to protect and enhance or maintain the abundance of fishery commodities as CPRs in the Biak Numfor Regency.

2. METHODS

This research employs a qualitative approach to explore the actions of a community in order to gain complex and detailed insights and understanding of a particular issue [16]. This approach was chosen because it allows the researcher to study how the Biak Indigenous Community collectively acts to manage fisheries resources through Sasisen practices. Ostrom's design principles do not guide the data collection process but are used as an analytical tool for the purposes of this study. Data were obtained through interviews conducted with indigenous leaders, experts from non-governmental organizations, and fishermen who implement Sasisen practices. Respondent selection used the snowball technique. This technique, in its initial stages, has a small number of samples and will increase as the direction of the first sample develops [17].

3. RESULTS AND DISCUSSION

Ostrom developed eight principles based on observations of similar practices applied in several self-managed, self-regulated, and, most importantly, sustainable CPR regimes. The eight design principles are "(1) clearly defined boundaries," "(2) proportional equivalence between benefits and costs," "(3) collective choice arrangements," "(4) monitoring," "(5) graduated sanctions," "(6) conflict resolution mechanisms," "(7) minimal recognition of the right to organize," and "(8) nested enterprises." For each principle, important factors or conditions that can be found in successful CPR systems are explained [1, 2]. The researcher analyzes whether fisheries through Sasisen practices adhere to Ostrom's design principles, indicating whether the conditions for collective action are met.

Clear Boundaries on Access and Usage

A clear distinction between authorized and unauthorized users is crucial for collective action, and this is undoubtedly related to resource limitations [1, 3]. Ostrom [2] refers to this first principle as an initial step to prevent freeriding (in this case, individuals benefiting from CPRs without making efforts to protect or preserve them) and organizing collective actions. From a behavioral perspective, this principle seems to determine how contingency arrangements can prevent outsiders from accessing CPRs. Social and geographical boundaries establish prerequisites, meaning different consequences for different situations. For example, in restricted areas, if community members access CPRs, they may need approval from other users in the community and share the proceeds from their use. On the other hand, in the same area, if outsiders access CPRs, they may face objections from community users and fines imposed by authorities [4]. Lemos explains that the utilization of CPRs by external parties can alter the cost-benefit ratio of cooperative behavior among community members. If there are not enough incentives for everyone, community members may engage in different behaviors that may not

be conducive to preserving CPRs. Clear delineation and rules are necessary to limit how much each individual in the group can extract or sell to achieve desired benefits.

In the case of Sasisen, the delineation of catchment boundaries is based on customary village rights. Customary village rights typically differ from village administration and have a broader territorial scope (covering two village administrations). The delineation of customary rights covering coastal areas signifies the community's control over CPRs in that area. This delineation helps control who can access or benefit from these resources and also determines the authorities responsible for enforcing rules, sanctions, and penalties. The indigenous community also adds that the existence of village administration blurs the boundaries of their customary rights.

The establishment of these customary rights delineations is determined by the village's indigenous community. The village's customary institution consists of three pillars: traditional leaders, religion, and government. In the village environment, it is led by Mananwir Mnu, involving church leaders and the village head. This institution plays a role in ensuring the sustainability and implementation of the indigenous community's rights to the village's resources. This delineation also aims to differentiate between community members and outsiders, as well as serve as a reference for reporting violations.

As an illustrative example of village customary rights boundaries (mnu/moes) in the Padaido District, these rights are divided into four village customary rights areas. In each village customary rights area, they are further categorized into three zones: protection areas, limited use areas, and communal use areas. Protection areas are often referred to as sasisen areas, which are restricted zones for resource extraction. Limited use areas are areas occupied by local fishermen using floating nets. Communal use areas are open for fishing by the village community. Not all villages in the Biak Regency have successfully mapped their village customary rights. The success of this mapping is driven by collaboration between the indigenous community and NGOs. This mapping also serves as physical evidence that village customary rights boundaries can be delineated and can overcome the ambiguity associated with the term "as far as the eye can see" when discussing indigenous community customary rights [5, 6].

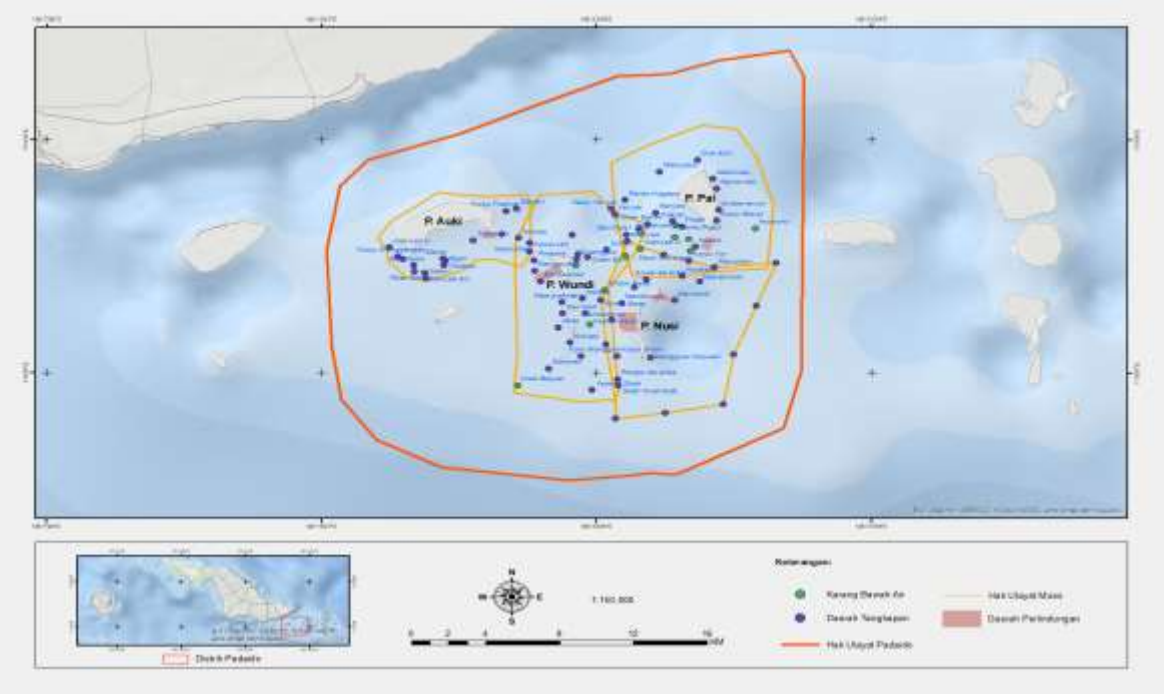

Figure 1: Customary Land Rights Map of Padaido District

Rules Regarding Local Resource Conditions

Ostrom [1] explains this principle as property rules that restrict the time, place, technology, and/or the number of resource units relative to local conditions and requirements that require labor, materials, and/or money. The goal is to ensure that owners who invest in the conservation of natural resources receive equivalent returns. Rules within this Sasisen practice are formulated and continuously reviewed, taking into consideration the fisheries conditions in collaborative evaluations between the three pillars and the indigenous community in the village. Thus, the rules created will always evolve in line with developments in society, nature itself, climate change, and other aspects.

The Sasisen practice includes the closure of protection areas for certain periods. This period is usually during the calm season when the closure occurs during the windy season and is opened during the coastal waters' low tide. This activity is typically carried out for 3 or 6 months or even 1 year, marked by buoys and wooden stakes in the protection area. The duration depends on the community's observations of the fishing conditions in the protection area. This action aims to enhance the threatened fisheries commodities and ease fishing for local fishermen, so they don't have to venture far out to get abundant results. During the closure of the protection area, all activities that disturb the tranquility of the coastal waters, such as fishing, swimming, and crossing the area, are prohibited. Usually, when the coastal area is closed, the community goes fishing together in shared fishing areas or seeks alternative sources of income.

In limited-use areas where nets are placed, it is expected that fishermen who want to fish or set nets will provide sufficient space between nets and fishing locations. There are no specific rules regarding the required distance in this area. In communal use areas, fishermen can freely engage in fishing activities, and this area is usually used by fishermen from outside the indigenous village community. For fishermen from outside the indigenous village community who wish to harvest resources in the customary village rights area, they need to obtain permission from Mananwir Mnu, which will then be coordinated with the indigenous community, especially the fishermen in that village.

The indigenous community has also established specific criteria for the capture of fishing gear and permissible species. here are also prohibitions on harvesting protected commodities, including Taripang, Lola, Anadara, Lobster, Bia Bulan, Kima, Humphead Wrasse, Dolphin, Dugong, Parrot Fish, Clownfish, Sea Turtles dan Inggin. The species protected may change depending on the abundance of the species and the agreement of the indigenous community. Despite the rules set by the community, violations can still occur from external fishermen, such as accessing resources in the customary village rights area, harvesting in the Sasisen area, or capturing species protected by the indigenous community. These violations occur because external fishermen feel free to capture due to having obtained a Fishing Business License (Ijin Usaha Perikanan, IUP) [7]. This shows a discrepancy between internal and external rules. The conflicts that arise as a result of this are negative consequences for fishermen and natural resources when externally imposed rules do not align with local practices and environmental conditions [8].

Regulation of Collective Choice

Ostrom proposed that most individuals affected by rules should be able to participate in modifying those rules. This principle is designed to allow the majority of resource users to participate in the decision-making process. It emphasizes the importance of local knowledge in the management of natural resources and is based on the fact that local users have direct and cost-effective access to information about their situation, thus giving them a comparative advantage in designing effective rules and strategies for their specific location, especially when local conditions change [3]. This principle describes the participation of indigenous communities in the decision-making process. The Biak Indigenous Community has customary rules, spiritual values, a dependence on their territory, solidarity, and reciprocal relationships between individuals and the environment. Conflict also serves as a reason for each individual to voluntarily participate in decision-making.

Demographically, the indigenous community in Biak Numfor is predominantly Christian, so the role of religious leaders greatly influences this participation process. Discussions take place in the church during Sunday worship, allowing every member of the indigenous community in the village to listen, discuss, voice demands, and formulate rules. There is also another scenario where the indigenous community members are represented by Mananwir Keret (clan leader). Mananwir collects information, engages in discussions, and negotiates on behalf of their clan. Subsequently, Mananwir Keret conveys the demands to the three pillars for joint discussion. These three pillars formulate policies or rules based on the previously conveyed demands and then inform Mananwir Keret to further relay the information to their clan members. This cycle repeats until consensus is reached and is communicated through village meetings at the church. The sustainability of participation depends on the internal strength of individuals and the traditional institutions or government of the three pillars at the village level. For example, some villages in the Biak Kota District no longer practice Sasisen due to demographic factors and cultural changes influenced by population migration.

Monitoring of Resource Availability and Utilization

This principle requires the presence of monitors, and these monitors are members of the community who are accountable to the community itself [3]. Monitoring, which actively verifies the condition of CPRs (Common Pool Resources) and the behavior of appropriators or owners, is the responsibility of the appropriators or owners themselves [1]. It explains that in long-term CPRs systems, monitoring and sanctions are carried out by members of the community or the local community rather than external institutions. In this context, those who wish to avoid opportunistic behavior are also committed to observing rule-breaking behavior. An important aspect of implementing control and enforcement procedures is assessing the costs and benefits of these procedures. "Individuals who catch rule violators gain status and prestige by being good community defenders, while violators lose status and reputation" [1].

In the customary village rights area, there are three levels of monitoring for the extraction of fisheries CPRs and handling violations. If the issue cannot be resolved at the first level, the complaint will be escalated to the next level. First, monitoring is carried out by every member of the community related to fishing activities and the condition of CPRs. Second, the Three Pillars are the figures who handle complaints from community members, especially the traditional leader, Mananwir Mnu. Third, relevant institutions such as Fisheries, Environment, and the police.

The common procedure when a violation occurs is that community members will admonish and advise the violator that their behavior has consequences for the environment and request the return of species caught in the protected area. If this is unsuccessful, the violation can be reported to Mananwir Mnu, who can reprimand and sanction the violator. If it still cannot be resolved, then it will be escalated to the third level.

Monitoring of the fisheries' condition is aimed at providing input information in determining the timing of closure and reopening of the protected area. When there is a decline in species or damage in coastal areas, the Sasisen closure activities can be implemented for that specific commodity or area. The decision to reopen an area or species that is under Sasisen also depends on monitoring the condition of the species and area, whether there are signs of significant recovery. This information is then conveyed to Mananwir Mnu regarding the condition, and it will be further discussed in village meetings.

Graduated Sanctions

This principle emphasizes the importance of additional sanctions for resource users who violate community rules. An effective enforcement system helps build trust within the institutional framework by ensuring that particularly challenging cases are penalized. It also helps maintain cohesion among local users while ensuring a balance between the seriousness of the violation and the sanctions [3]. A graduated sanctions system is based on the severity of the violation and the repetition of the offense. First, it is important to remind violators of the importance of following CPRs rules. This may be sufficient to prevent further violations. However, if the same party repeatedly violates the

rules, it may be necessary to escalate the applicable sanctions to deter future violations [1, 2]. From a behavioral perspective, the punishment system in self-regulating CPRs regimes, as described by Ostrom, establishes a gradual process of increasing the intensity or changing the type of punishment stimulus applied to prevent repeated behavior. It can increase the intensity of penalties, for example, ranging from small fines to larger ones. Reprimands, fines, or expulsions are various types of punishment stimuli that can vary in intensity.

Sanctions and fines are periodically applied to rule violators in the Sasisen system. It starts with a warning for the first violation, fines for subsequent violations, and the confiscation of fishing technology. Sanctions and fines are periodically applied to violators. It begins with the first warning, fines for the second violation, and confiscation accompanied by fines for the third violation. The amount of the fine is determined based on the violator's status and the type of violation.

Warnings are conducted in a familial manner, where Mananwir Mnu will meet with Mananwir Keret from the side of the violator for mediation, and then the sanctions will be imposed by Mananwir Keret. If the violator is an outsider to the village, then Mananwir Mnu will approach the leaders of the Three Pillars on the side of the violator. In addition to warning sanctions, there are also restorative sanctions, where sanctions involve activities that can restore or replenish the coastal resources, such as placing threatened species' seeds or coastal reforestation, such as coral reef and mangrove conservation. These sanctions will be carried out within a specified time frame based on the agreement of the indigenous village community.

Conflict Resolution Procedures

In this principle, it explains the importance of cheap and easily accessible conflict resolution mechanisms for the sustainability of CPRs institutional systems [9]. Lemos, Favacho [4] add that from the perspective of community behavior, it enables interactions to generate quick and low-cost mutual agreements. This is related to the position or rights of indigenous communities as owners of CPRs. Indigenous communities have the ability to regularly review, revise, or detail rules, as there is constant change in local conditions and livelihood strategies. The rules that are formed serve as contingency arrangements to promote community behavior in monitoring CPRs conditions and re-discussing with individuals in the community. The overall product of these discussions should be an agreement on how to manage CPRs.

Local issues in the Biak indigenous community are discussed through deliberation, with the three pillars serving as mediators and figures who gather aspirations to facilitate the management of CPRs. This results in rules that can align with the needs of these issues. For example, the prohibition of harvesting taripang in Nusi Island is based on the observations of local fishermen regarding the decline in this commodity and the recovery of high-value economic commodity resources. Buton traders often buy taripang from local fishermen. Therefore, the community decided to ban the harvest of this commodity at certain times to meet the demand from Buton traders.

Rules and sanctions also help maintain the behavior of the Biak indigenous community in monitoring CPRs conditions and discussing them. Conservation-related information is absorbed by them and implemented based on their understanding or values. If there are issues that require deeper discussion, village meetings are held, and external parties (NGOs and researchers) may be involved.

Recognition of Management Rights by External Authorities

Ostrom [1] notes that "the rights of appropriators to devise their own institutions are not challenged by external government bodies." Minimal recognition of the legitimacy of CPRs administration allows owners to enforce rules without external intervention. If external actors believe they have the right to impose different rules without consulting the local community, it may be difficult for the rights holders to respect their traditions [1-3]. If this principle is not respected, owners may challenge the rules in front of external actors. In this situation, different reasons in the case or different interpretations of the facts or precedents involved may conflict with the rules established by the community and threaten the maintenance of CPRs. Owners must be confident that no external agents will challenge the rules they have set.

The Biak Community has developed their own rules to regulate the extraction of fishery CPRs, and they have even created a village regulation that mainly concerns the management of natural resources. Certainly, the formulation of these rules was not done without the approval of the indigenous community in that village, although external parties such as NGOs in Biak Numfor provided assistance. The Sasisen practice is strongly supported by external parties because of its impact on coastal ecosystem conservation, especially by the government or the state. The government of Biak Numfor Regency promotes the Sasisen practice through the Biak Munara Wampasi Festival or Snap Mor and the Marine Protected Areas (MPAs) by the Indonesian Ministry of Marine Affairs and Fisheries (KKP). Although the state has recognized and supported the Sasisen practice, the management rights remain in the hands of the government or the state. In the view of the indigenous community, customary rights encompass the right to manage for the indigenous community, so they have the right to determine their livelihoods through the rules they create.

Ali, Aditya [10] explains that welfare should be considered as part of the freedom to act and behave in the management of various natural resources enjoyed by individuals without any pressure or interference from any party, including the government. Therefore, it is important for the government to recognize the management rights of CPRs to indigenous communities. The Biak Indigenous Community also explains that they are not sufficiently involved in decision-making by the government regarding fishery CPRs in their area, and the government has not provided legal recognition for village regulations created by the indigenous community, so the legality of these village regulations is still based on customary law. To ensure that fishery CPRs management aligns with this principle, the government must first analyze local knowledge and customary institutions and then develop them for the long-term sustainability of any scheme.

Nested Networks

In this principle, Ostrom [1] emphasizes that the success of governance systems is marked by the presence of various nested enterprises or networks. Cox, Arnold [3] add that activities such as appropriation, provision, monitoring, enforcement, conflict resolution, and governance are organized in multiple layers of nested enterprises. This principle is also related to the seventh principle as it pertains to cross-scale institutional factors that support the eighth principle.

In the practice of Sasisen, traditional institutional networks have collaborated with NGOs in the management of fisheries resources. However, this collaboration has not been sufficient in addressing conflicts between small-scale and large-scale fishing sectors. Therefore, the involvement of the government, which has the capacity to manage large-scale fisheries, is needed. The government, traditional institutions, and NGOs can collaborate to establish nested enterprises for making decisions on the governance of fisheries CPRs. In constructing the Biak Customary Institution on a larger scale, the government plays a role in the governance of the three tungkus, but based on interview results, there is currently no collaboration between the district-level government and the customary community. The customary community is only involved in the final stage, which is the policy socialization stage, and not in the policy formulation stage. The lack of recognition of the rights of the customary community over resource management diminishes their role in formulating rules related to their customary land. As a result, the current Sasisen rules are the outcome of collaboration between the customary community, the church, and NGOs.

4. CONCLUSIONS

This research compares the framework of indigenous community management of fisheries resources in the coastal areas of Biak Numfor Regency by examining the design principles identified as potentially important for the success of common ownership institutions. Although the design principles are analyzed separately, it's important to understand that these principles are interrelated. When there are changes in one design principle, it can alter the structure of relationships.Through the prac ce of Sasisen, we can see that Principle 1 (Clearly Defined Boundaries) participates in Principle 3 (Collective Choice) to influence actions in formulating Principle 6 (Conflict Resolution Procedures)

for the determination of Principles 2 (Rules), 4 (Monitoring), and 5 (Graduated Sanctions). Clear boundaries are essential in determining who can contribute and determining ownership of fisheries resources. These boundaries affect the collective actions of the indigenous community in securing their fisheries resources, thus encouraging the formulation of rules and sanctions in their utilization, as outlined in the village regulations. Because the involvement of the indigenous community in the village regulations encourages participation in monitoring. However, there are challenges or gaps in Principles 7 (Recognition of Rights) and 8 (Nested Enterprises). These challenges relate to the recognition of management rights and the involvement of the Biak indigenous community by the district and central governments, so that the Sasisen practice can be sustainable in conservation. Recognition of rights is the key to opening up access for the Biak indigenous community to participate in the management of natural resources and the sustainability of their local practices. If recognition of rights is obtained by the Biak indigenous community, it will facilitate the achievement of other principles proposed by Ostrom through the Sasisen practice. Identifying these alignments and gaps provides a starting point for institutional strengthening and capacity building in the management of Fisheries CPRs in Biak Numfor Regency.

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