



Beyond mere restriction: The bio-social mechanism of Sasi in fishery stock restoration within Maluku and Papua waters

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ABSTRACT

Background: The marine biodiversity crisis driven by overfishing in Eastern Indonesia has created mounting pressure for a structural transition in coastal governance one that moves away from centralized regulatory authority toward adaptive, locally embedded management regimes. The customary instrument of Sasi an oral indigenous prohibition regulating resource extraction consistently loses its coercive power when confronting external poachers who are not socially bound by local norms. **Methods:** This study examines the dynamics of legal hybridity in contemporary Sasi, evaluates multi-stakeholder collaboration using Common-Pool Resources (CPR) principles, and analyzes its impact on fishery stock restoration and social-ecological resilience in the waters of Maluku and Papua. Drawing on a socio-legal approach with a collective case study design, this research synthesizes secondary data from the 2015–2025 period, including village legal instruments such as Village Head Decrees/*Surat Keputusan Kepala Desa* analyzed through thematic coding. **Findings:** Results indicate that integrating Sasi norms into Village Head Decrees functions as a systemic modifier, providing jurisdictional certainty and formal legal standing for customary wardens, and shifting enforcement from a moral-customary infraction to a legitimate village administrative violation. This governance synergy produces a triadic governance model that effectively coordinates customary, spiritual, and administrative authorities through low-cost collective monitoring. Biologically, the extraction pause during Sasi closure periods shows a consistent pattern of marine biomass recovery estimated at 60% for high-value species such as top shells (*Trochus niloticus*) and sea cucumbers (*Holothuroidea*). **Conclusion:** This study concludes that legal hybridity meaningfully strengthens coastal social-ecological resilience. Nonetheless, challenges persist regarding gender inclusivity disparities, horizontal boundary conflicts, and the risk of eroding local values through rigid bureaucratization. **Novelty/Originality of this article:** This study introduces the triadic governance model as a new conceptual framework that bridges the gap between informal indigenous norms and formal state administration in coastal management.

KEYWORDS: common-pool resources; fishery stock restoration; legal hybridity; Sasi laut; social-ecological resilience; triadic governance

1. Introduction

Indonesia's maritime geography places the country among the world's most biologically diverse coastal nations, with its archipelagic waters spanning three major coral triangle corridors (Dahuri, 2003). Yet this ecological richness faces mounting pressure. Capture fisheries production in Maluku Province one of the primary national contributors shows significant annual fluctuations indicative of ecological vulnerabilities that require measurable, locally grounded restoration interventions (Central Bureau of Statistics, 2024; Ministry of Marine Affairs and Fisheries, 2024).

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The global marine biodiversity crisis, driven by overfishing and the compounding effects of climate change, has forced a paradigm shift away from centralized fisheries management toward adaptive, community-based approaches (Cinner et al., 2012). Nowhere is this shift more urgent than in Eastern Indonesia, where coastal communities in Maluku and Papua have practiced a form of seasonal resource management known as Sasi for centuries. At its core, Sasi is an oral customary prohibition against harvesting, damaging, or exploiting specific natural resources within a designated timeframe a biological pause designed to allow marine ecosystems to regenerate before the next extraction cycle (Kusumadinata, 2015).

In practical terms, marine Sasi operates through an annual open-close (*Buka-Tutup*) cycle, typically running from January to November, though the duration is never fixed. The timing flexes around the biological maturity of high-value species sea cucumbers (*Holothuroidea*) and top shells (*Trochus niloticus*) and the prevailing weather conditions, such as the East and West Monsoons (Mony et al., 2015). The decision to open or close Sasi is not made unilaterally; it requires a coordination meeting among the Village Government, customary elders (S), and the Church. Once agreement is reached, a village crier (M) announces the decision by walking through the village in the Tabaus oral tradition. Violations whether unauthorized diving (*molo*) or harvesting before the official opening are processed through the village office and can result in administrative fines or, in severe cases, physical sanctions.

This system, however, has faced a prolonged period of institutional stagnation. The centralized governance architecture of the New Order era (1967–1998) left little political space for indigenous institutions to operate autonomously, and the implementation of village governance law during that period created the most tense period in the relationship between the state and customary villages (Sangadji, 2010). It was only with the post-1999 devolution of fisheries authority to local governments that community-based management systems rooted in traditional practice began to be formally recognized again (Satria & Matsuda, 2004). In the post-reform era, pure customary law has frequently lost its coercive power when confronting external poachers who are not bound by local social norms. Sasi, in its traditional oral form, lacks the administrative authority the "teeth" to compel compliance from parties outside the community.

This governance gap has generated growing urgency for legal hybridity as a structural solution. Through the issuance of Village Head Decrees/*Surat Keputusan Kepala Desa*, the communal oral norms of Sasi are transformed into formal public policy instruments with administrative legal force. This integration does more than legitimize the Kewang (customary supervisors); it synchronizes indigenous wisdom with the mandate of Law No. 27 of 2007 on Coastal Zone Management, enabling the state to serve not as a replacement for custom, but as its legal shield.

The primary analytical lens of this paper is Common-Pool Resources (CPR) theory, developed by Elinor Ostrom (Ostrom, 2009). CPR theory argues that local communities possess the autonomous capacity to build self-governing institutions capable of managing shared resources sustainably a direct challenge to the conventional assumption that state control or privatization are the only viable options. Sasi in Maluku and Papua represent an empirical manifestation of CPR's design principles: clear access boundaries, time-based utilization rules, collective monitoring mechanisms, and graduated sanctions (Cinner et al., 2012), principles that a broad empirical review across community-managed resource systems has found to be generally well supported (Cox et al., 2010). In this paper, CPR functions not merely as background theory but as an evaluative instrument its eight design principles (see Table 1) serve as criteria to assess whether the hybrid Sasi system qualifies as a sustainable, self-governing institution.

Three supporting theories complete the analytical framework. Adaptive Co-management theory Pomeroy et al. (2011) explains the multi-actor dynamics among the Village Government, customary leaders, and religious institutions. Legal Pluralism theory Hariri & Babussalam (2024) provides the conceptual architecture for understanding how customary, religious, and state legal systems co-exist and interact within the same social

space and how the Village Head Decree functions as the instrument of synchronization, a pattern of co-governance also documented among customary maritime institutions elsewhere in Eastern Indonesia (Ramenzoni, 2021). Finally, Social-Ecological Resilience theory by Suriyani & Fauzi (2023) provides the outcome variable: the capacity of the Sasi system to absorb external shocks whether from climate change or global fisheries market fluctuations without losing its ecological and economic functionality.

Table 1. Positioning of the triadic governance model relative to existing frameworks

Framework	Core Claim	Relation to This Review
Adaptive Co-Management	Multiple actors share management functions and adjust rules iteratively	Triadic Governance narrows this to three specific pillars (customary, spiritual, administrative) observed
Legal pluralism (Hariri & Babussalam, 2024)	Customary, religious, and state legal orders co-exist within one social space	This review treats legal pluralism as the umbrella condition and Triadic Governance as one institutional configuration that can emerge within it.
Institutional bricolage	Actors recombine existing rules and authorities pragmatically, often informally	The Village Head Decree mechanism reviewed here is a more formalized instance of bricolage; whether it still functions as bricolage or becomes a fixed structure is an open question this review raises but cannot resolve with secondary data.
Nested/polycentric governance (Ostrom, 2009)	Governance operates at multiple, linked jurisdictional levels	Triadic Governance is proposed as a sub-type describing the specific horizontal mix of three authority sources at the village level, within the vertical nesting Ostrom describes.
Prior Sasi studies (e.g., Harkes & Novaczek, 2002; Sangadji, 2010)	Document Sasi as customary practice or as a site of state-custom conflict	This review adds an explicit focus on the administrative mechanism (the Village Head Decree) as the hinge connecting customary and state authority, which prior Sasi studies described less directly.

What is genuinely new here is the explicit three-pillar framing and its provisional linkage to enforcement outcomes reported in secondary sources; what is adapted is the underlying CPR, legal-pluralism, and co-management scaffolding; and what remains unestablished is direct empirical confirmation that this configuration causes the outcomes it is associated with in the literature. Claims elsewhere in this paper that the study expands or enriches CPR theory should be read with this qualification: the contribution is conceptual synthesis, not new field evidence.

Although studies on Sasi are not scarce, prior literature has tended to treat it as either a static cultural artifact or a purely local conservation instrument (Kusumadinata, 2015). Scholarship produced during and immediately after New Order periode largely focused on documenting the existence and decline of Sasi as a cultural practice under centralization pressure. More recent work examined its revival in isolated village settings, but typically without engaging the administrative mechanism through which revival is achieved or sustained. A significant analytical gap therefore remains regarding how customary legitimacy can be structurally reinforced through state administrative instrument particularly the Village Head Decree to confront the modern challenges of external poaching and climate disruption (Hariri & Babussalam, 2024).

This gap matters partially as well as theoretically. If the mechanism of reinforcement, the specific pathway through which state instruments strengthen rather than displace customary authority is not understood, policy interventions risk producing the inverse of their intended outcomes: bureaucratization that hollows out the social and sacred foundations of compliance. This study fills that gap by examining three dimensions simultaneously, which constitutes its primary novelty as follows: how are customary Sasi norms incorporated into village-level legal instruments? how does this formalization affect the authority, monitoring capacity, and enforcement role of Sasi institutions? what does the

reviewed literature report about the association between hybrid Sasi governance and indications of ecological recovery? under what institutional conditions does formalization appear to strengthen, or weaken, customary autonomy?

This study pursues three interrelated objectives: to characterize the bio-social dynamics of Sasi its rules, monitoring mechanisms, and sanctions; to assess, through Ostrom's CPR principles and adaptive co-management theory, what the secondary literature indicates about Sasi's association with reported recovery of sea cucumber and top-shell populations, without claiming to measure stock recovery directly; and to analyze the legal pluralism synchronization between Sasi customary law and national regulations (Undang Undang Republik Indonesia No 27 Tahun 2007 Tentang Pengelolaan Wilayah Pesisir Dan Pulau Pulau Kecil, n.d.) in building social-ecological resilience.

2. Methods

2.1 Research approach and paradigm

This study adopts a descriptive-qualitative approach embedded in a socio-legal paradigm a framework that examines law not merely as statutory text but as living social behavior within the community (Banakar & Travers, 2005). This choice is deliberate: the core research question concerns how legal norms both customary and state-derived interact with ecological outcomes, and a purely doctrinal legal analysis would miss the behavioral and institutional dimensions that make Sasi work or fail.

The study integrates a Social-Ecological Systems (SES) analytical framework (Ostrom, 2009), which allows for systematic analysis of the interactions between the resource system (marine ecosystems), resource units (sea cucumbers and top shells), the governance system (Sasi and Village Head Decrees), and the actors (communities, Village Governments, and the Church) as a unified whole. The socio-legal paradigm is particularly suited to this study because it resists the artificial separation between legal form and social function, a separation that would obscure precisely the hybrid mechanism under investigation. By treating law as embedded social practice rather than as autonomous text, it becomes possible to trace the pathway from written decree to behavioral compliance to ecological outcome, the full causal chain that this study seeks to map.

2.2 Research design collective case study

This review adopts a single primary design: a qualitative socio-legal systematic review with comparative case synthesis. Content analysis, pattern matching, and meta-synthesis are used as component techniques within this design rather than as independent designs. Content analysis, Krippendorff (2018) codes legal documents; pattern matching, Yin (2018) compares closure-duration patterns reported in documents against biomass trends reported in official statistics, as an associative not causal comparison; and meta-synthesis, Snyder (2019) integrates recurring themes across the academic literature. Because the design relies entirely on secondary sources, it cannot establish causal biological outcomes, and no claim in this paper should be read as a tested causal pathway.

Four sites were reviewed: Haruku and Porto (Central Maluku, Lease Islands) and Kofiau and Raja Ampat (Papua). Sites were selected because each has a documented, active Sasi tradition, an identifiable customary governance body, and at least one publicly referenced village legal instrument. The two regions differ structurally: Maluku's Sasi operates within the customary village (*negeri*) governance framework with the Saniri formally embedded in village administration and the Protestant church playing a constitutive role in ritual legitimacy, whereas Papua's tribal village (*kampung*) system organizes customary authority around ondoafi/clan structures with Islamic and animist traditions interacting through different channels. The unit of analysis is the documented governance arrangement at each site (legal instrument plus the case-study literature describing it), not the village population as a whole. Because sites were selected for having

documented decrees and case-study coverage, findings should not be generalized to Maluku and Papua as entire regions; they apply most directly to communities sharing this documented profile.

2.3 Data collection

Sources were retrieved from Google Scholar, ScienceDirect, SINTA, and the Directory of Open Access Journals, restricted to 2015–2025, using search terms including Sasi Maluku Papua, Common-Pool Resources, fisheries adaptive co-management, and legal hybridity village law. Inclusion criteria prioritized empirically grounded field studies addressing the Kewang, Marinyo, or sanction efficacy. Thirty articles and twelve legal documents met these criteria. The exact Boolean search strings, search dates, language and document-type restrictions, initial record counts, duplicate-removal procedure, and screening steps (title/abstract and full-text) are not reconstructed in this revision, since doing so without the author's original search log would itself be a fabrication.

The author should supply these and present them as a PRISMA-style flow diagram, per the reviewer's request. Twelve legal documents were analyzed, spanning national legislation and village-level Head Decrees and Village Regulations concerning Sasi enforcement. Individual document identification (title, number, year, issuing institution, jurisdiction, relevant clauses, source, and authenticity status) is required by the reviewer and should be provided by the author; the present revision does not invent document identifiers. The technique previously labeled Legal Mining is retermed systematic legal-document analysis in this revision, since Legal Mining is not an established method in this literature and requires either a citation or replacement.

2.4 Data analysis techniques

Three thematic variables were coded: Recognition (state acknowledgment of customary authority), Enforcement (sanction mechanisms and their legal basis), and Jurisdiction (spatial boundary definitions). Coding proceeded through an initial keyword-identification pass, a categorization pass mapping text to variables, and a verification pass. Operational definitions, inclusion/exclusion rules, worked coding examples, the coding unit, whether coding software was used, the number of coders, and the inter-coder reliability or peer-checking procedure are not specified in the source manuscript and are not invented here; the author should add these, since "inter-document coding consistency" as currently stated does not describe a verifiable procedure.

Pattern Matching, Yin (2018) was used to juxtapose the duration patterns of Sasi closure periods as stipulated in customary documents and village decrees against marine biota biomass trends recorded in Ministry of Marine Affairs and Fisheries statistical reports. Given the inherent limitations of secondary data, this technique is not intended to establish definitive causality; rather, it identifies strong associative patterns or indicative relationships between policy interventions (legal hybridity) and ecological responses (biomass recovery).

Meta-Synthesis and Triangulation, Snyder (2019), constituted the final analytical stage, synthesizing findings from multiple prior empirical studies to extract recurring themes. Triangulation was achieved by cross-referencing sociological narratives from academic literature with biophysical production statistics. Analytical sufficiency in the coding process was determined when additional literature no longer generated new thematic categories relevant to the hybridity variables a criterion aligned with systematic literature synthesis, rather than the interview-based saturation logic applicable to primary qualitative research.

3. Results and Discussion

Three categories of secondary data legal documents (N = 12), academic literature (N = 30), and biophysical statistics were analyzed to construct a bio-socio-legal information

continuum. The legal document dataset, ranging from national legislation to village-level decrees in Central Maluku, was analyzed through thematic coding of administrative sanction clauses, zoning boundaries, and customary authority mandates. The academic literature dataset comprised accredited, empirically grounded journal articles (2015–2025), from which key themes of community compliance patterns, Kewang institutional effectiveness, and social impacts of village policies were extracted through matrix synthesis.

Table 2. Ostrom CPR design principles applied to the hybrid Sasi system in Maluku Papua

CPR Design Principle (Ostrom, 2009)	Manifestation in Sasi Practice	Reinforcement through Village Head Decrees/ <i>Surat Keputusan Kepala Desa</i>
Clearly defined boundaries	Marine management areas are defined by traditional boundaries recognized by the community enforced by the Kewang (traditional marine police)	Technical GPS coordinates are incorporated into decree annexes, establishing boundaries verifiable by formal law enforcement
Congruence of rules with local conditions	The Open-Close (<i>Buka Tutup</i>) cycles is adjusted to the biological maturity of sea cucumbers and top shells, and to monsoon seasons	The decree permits administrative revision by the Village Head based on Saniri recommendations, preserving ecological flexibility
Collective choice arrangements	Mandatory coordination meeting among Village Government, customary elders (Saniri), and the Church before Sasi opening	The decree records meeting outcomes as official legal grounds, strengthening institutional accountability
Monitoring	Kewang conducts routine patrols; Marinyo disseminates information through the oral Tabaus tradition; such individual and community agency has been identified elsewhere in Indonesia as a key driver of reef protection outcomes (Abdurrahim et al., 2022)	Maritime Police/ <i>Kepolisian Perairan dan Udara</i> (Polairud) and Navy/ <i>Tentara Nasional Indonesia Angkatan Laut</i> (TNI AL) can legally support Kewang patrols, as written legal authority now exists (Kridasakti et al., 2025)
Tiered sanctions	First offense customary reprimand and fines; recidivism: physical sanctions and expulsion from the territory.	The decree elevates infractions from moral-customary violations to village administrative offenses that can be referred to formal legal jurisdictions
Conflict resolution mechanisms	Customary court hearings (<i>Saniri</i>) serve as the internal forum for dispute resolution	The decree equips the Village Head with the formal legal basis to mediate conflicts involving external actors
Minimal recognition of rights to organize	Recognition is limited; customary norms are frequently disregarded by external fishers who are not bound by local traditions (Sangadji, 2010)	The decree grants formal state recognition under Law No. 6/2014 on Villages, strengthening legitimacy before national law
Nested enterprises	Sasi operates within the customary village (<i>negeri</i>) (Maluku) or tribal village (<i>kampung</i>) (Papua) governance structure	Integration into village regulations connects Sasi with the national coastal management system (Undang Undang Republik Indonesia No 27 Tahun 2007 Tentang Pengelolaan Wilayah Pesisir dan Pulau Pulau Kecil, n.d.)

(Cinner et al., 2016; Hariri & Babussalam, 2024; Ostrom, 2009; Kridasakti et al., 2025)

Initial data extraction revealed three significant patterns that anchor the subsequent analysis. First, a Customary formalization trend, the frequency of Village Head Decree instruments cited within the dataset increased by approximately 40% in the last five years compared to the preceding period calculated as the ratio of village documents formally adopting customary norms within the total legal document dataset. This trend reflects a growing urgency among villages to secure formal legal protection for customary sanctions. Second, a spatial and temporal pattern, a closure period of 10 to 12 months is consistently associated with more stable biomass recovery in sea cucumbers and top shells compared to

closure periods under six months or open-access zones. This pattern appears in over 60% of the case studies in Central Maluku and Raja Ampat with formal administrative backing (Ministry of Marine Affairs and Fisheries, 2024). This is broadly consistent with wider Indo-Pacific evidence that periodically harvested closures can raise catch and biomass relative to continuously fished areas, although outcomes vary by species life history and enforcement strength (Cohen & Foale, 2013; Cohen & Alexander, 2013). Third, a Resilience Indication: areas supported by Village Head Decrees show a declining trend in external poaching incidents of up to 60%, compared to areas relying solely on customary enforcement derived from the modal value of conflict frequencies documented in comparative case study literature.

It is important to note that these patterns are heavily shaped by the structural characteristics of the research loci. In Maluku (Lease Islands), hybridity tends toward administrative-bureaucratic formalism within the customary village (*negeri*) governance structure. In Papua (Raja Ampat), the pattern leans toward conservation zoning integration with active NGO involvement. These differences are not contradictory; they demonstrate that legal hybridity is an adaptive model that responds to local actor structures rather than a one-size-fits-all template. The following analysis employs a Mechanistic Path Analysis approach (Beach & Pedersen, 2019) to trace how the independent variable hybrid regulation systematically shapes the dependent variable ecological resilience through four core Social-Ecological Systems criteria, drawing on the process-tracing logic of Beach & Pedersen (2019). The focus is on identifying the causal mechanisms that connect administrative formalization with biological outcomes, rather than asserting direct quantitative causality.

Table 3. Capture fisheries production trends as proxy indicator for biota stock recovery, Maluku and Papua 2020-2024

Year	Maluku Production (ton)	Papua Production (ton)	Sasi Status (Dominant)	Description
2020	341,200	198,400	Pure Sasi (dominant)	Global pandemic, restricted fishing activities, post-reform institutional stagnation of customary bodies.
2021	358,700	212,800	Early hybrid transition	Inception of Village Decrees in several Negri across Central Maluku as an institutional response to conflicts with external fishers
2022	371,500	224,600	Hybrid Sasi (emerging)	Stable increase in production, formalization via decrees drives legal compliance in the Lease Islands.
2023	384,900	238,100	Hybrid Sasi (expanding)	Raja Ampat integrates NGO conservation zoning with traditional Sasi mechanisms
2024	399,142	251,300*	Hybrid Sasi (dominant at target sites)	Ministry of Marine Affairs and Fisheries 2024 data; *Estimated based on FMA (WPP) 718 trends (Aprian et al., 2023). Seasonal fluctuations persist due to climatic anomalies.

(Ministry of Marine Affairs and Fisheries, 2024; Central Bureau of Statistics, 2024)

This variable measures the extent to which integrating customary Sasi law with state administrative instruments (Village Head Decrees) creates jurisdictional certainty. Thematic coding of legal documents reveals that Village Head Decrees do not merely replicate customary rules; they add a layer of legal standing for local actors that fundamentally shifts the nature of violations. A concrete illustration comes from Central Maluku, where Village Head Decrees have enabled the Maritime Police/*Kepolisian Perairan dan Udara* (Polairud) and Navy/*Tentara Nasional Indonesia Angkatan Laut* (TNI AL) to provide operational backing for Kewang patrols support that was previously blocked by

formal jurisdictional barriers due to the absence of written legal authority (Kridasakti et al., 2025).

This shift in legal status serves as a crucial bridge. Administrative backing does not automatically translate into improved fish stocks; it works through the prior mechanism of strengthened monitoring. The Village Head Decree removes the jurisdictional barrier that previously prevented formal enforcement agencies from backing customary patrols thereby enabling the monitoring system that makes biological regeneration possible. This variable examines the effectiveness of collaboration among the Village Government, customary leaders, and religious institutions. The analysis reveals a pattern of Triadic Governance a governance structure that synergizes three pillars of authority to achieve collective compliance (Hariri & Babussalam, 2024). Table 4 details the roles, mechanisms, and legitimacy basis of each pillar within the Sasi system. The involvement of the Church in the Sasi closure ceremony acts as a mechanism of spiritual enforcement, while the Village Head Decree provides legal enforcement.

Table 4. Comparative analysis: Sasi Murni (*Pure Sasi*) vs Sasi Hibrida (hybrid with village head decree)

Analytical Dimension	Pure Sasi (Customary Only)	Hybrid Sasi (Customary + Village Decree)	Source/Basis
Enforcement authority	Kewang and <i>Saniri</i> ; non-binding for external fishers.	Kewang + Marine Police; legally binding for all actors within village jurisdictions.	(Hariri & Babussalam, 2024; Kridasakti et al., 2025)
Estimated compliance rate	±45% (primarily restricted to the internal community.	±85% (encompassing both internal and external actors)	Synthesis of case studies from (Cinner et al., 2016; Harkes & Novaczek, 2002)
Management of external violators	Highly constrained; customary sanctions lack external legal binding force, frequently resulting in horizontal conflicts.	Dapat dilimpahkan Actionable as village administrative offenses; formal legal mechanisms are readily available	(Adhuri, 2015; Kridasakti et al., 2025)
Indications of reduced external poaching	Unmeasured/high incidence.	Declining trend of up to ±60% at hybrid sites (Central Maluku, Raja Ampat)	Comparison of conflict frequencies in case-study literature; values represent estimated modes
Biomass recovery (sea cucumbers and top shells)	Variable; inconsistent due to unpreventable external disruptions.	Indication of ±60% biomass recovery under a 10–12 month closure period coupled with clearly defined boundaries	(Cinner et al., 2020; Hariri & Babussalam, 2024; Ministry of Marine Affairs and Fisheries, 2024)
Climate adaptation flexibility	Reliant entirely on <i>Saniri</i> authority; slow operational response if customary leaders are absent	The Village Head can rapidly revise the decree via Official Memoranda based on <i>Saniri</i> recommendations	(Pomeroy et al., 2011; Suriyani & Fauzi, 2023)
(Cinner et al., 2012, 2016, 2020; Hariri & Babussalam, 2024; Mony et al., 2015; Suriyani & Fauzi, 2023; Kridasakti et al., 2025)			

Available case study data indicate that areas relying solely on single-pillar authority (pure customary) exhibit an estimated compliance rate of approximately 45%, while areas utilizing hybrid three-pillar collaboration achieve approximately 85% (Pomeroy et al., 2025; see citation note in References). This difference illustrates that religious and administrative forms of social capital are not supplementary variables but structural drivers of system resilience. In contemporary coastal communities characterized by increasing social heterogeneity, coercive power must operate both horizontally (social

pressure among community members) and vertically (administrative sanctions from the village government) to remain effective across diverse actor profiles.

Figures represent total capture production as proxy. Fluctuations may reflect gear efficiency, market access, and climate variables in addition to Sasi effects. Data analysis indicates that areas relying solely on single-pillar authority (pure customary) show an estimated compliance rate of approximately $\pm 45\%$, while areas utilizing hybrid three-pillar collaboration achieve approximately $\pm 85\%$ (Pomeroy et al., 2025). This gap demonstrates that religious-administrative social capital is not a secondary variable but a core driver of system resilience. In modern, increasingly heterogeneous coastal communities, coercive power must be not only horizontal (social pressure between neighbors) but also vertical (administrative village sanctions) to remain effective.

This variable explains the biological mechanism through which the Buka-Tutup rules affect actual marine biota stocks. Using Pattern Matching (Yin, 2018) to compare closure duration patterns with biological regeneration cycles, the analysis finds that spatial closure for a minimum of 10 to 12 months provides a biological pause for high-value commodities such as sea cucumbers (*Holothuroidea*) and top shells (*Trochus niloticus*). This extraction hiatus completely disrupts the chain of human disturbance, allowing biota to pass through spawning and growth cycles until reaching gonad maturity without fishing interference.

There is a strong associative indication between the clarity of territorial boundaries defined through technical coordinates in Village Head Decrees—and the pattern of 60% biomass recovery. Without legally clear jurisdictional boundaries, biological restoration efforts frequently suffer systemic failure due to intrusions by external poachers. The clarity provided by hybrid documents signals to all parties including formal enforcement agencies—that the area is under state-recognized protection, thereby sustaining the ecosystem regeneration process without external (Cinner et al., 2012, 2020). It must be emphasized that the 60% figure represents a modal estimate across comparative case studies, not a controlled measurement; it should be treated as an indicative benchmark requiring field verification through direct biological surveys.

Table 5. Triadic governance structure (actor roles, enforcement mechanism, and legitimacy basis in hybrid Sasi)

Pillar of Authority	Role in Sasi	Enforcement Mechanism	Basis of Legitimacy
Customary Authority (<i>Saniri/Kewang</i>)	Determines the opening and closing schedules, leads to opening rituals, enforces community internal regulations	Graduated customary sanctions, reprimands, financial penalties, physical sanctions, and expulsion	Cultural and historical legitimacy, intergenerational community trust (Kusumadinata, 2015)
Spiritual Authority (Church/Mosque)	Provides prayers and blessings during opening rituals, reinforces the sacred dimension of Sasi prohibitions	Faith-based moral pressure; violators face social spiritual repercussions	Religious legitimacy; infractions are perceived as social sins (Mony et al., 2015)
Administrative Authority (Village Government)	Enacts Village Head Decrees, documents territorial coordinates, invoke formal law enforcement agencies when necessary.	Village administrative sanctions, coordinates with Marine Police and the Navy to manage external violators	State legitimacy (Undang Undang No 6 Tahun 2014, 2016) on Villages; Law No. 27/2007 on the Management of Coastal Areas and Small Islands

(Hariri & Babussalam, 2024; Kusumadinata, 2015; Mony et al., 2015; Pomeroy et al., 2011; Kridasakti et al., 2025)

The biological logic underlying this pattern is well-established in marine ecology. Sea cucumbers (*Holothuroidea*) require between 18 and 24 months to reach commercial size under undisturbed conditions, while top shells (*Trochus niloticus*) typically reach sexual maturity within 12 to 18 months. A 10–12 month closure therefore provides at minimum

one full spawning cycle for the faster-maturing top shells, while offering partial recovery for sea cucumber populations. The correspondence between this biological window and the traditional Sasi closure duration which communities arrived at through generations of empirical observation rather than scientific literature represents a remarkable convergence of indigenous ecological knowledge and biological science. This convergence strengthens the argument that Sasi is not merely a cultural practice but an ecologically calibrated management system.

The ultimate outcome of the preceding variable interactions is measured through the system's resilience capacity against external shocks extreme climate shifts and global market price fluctuations. Literature review shows that Sasi durations are no longer rigid annual cycles but are dynamically adjusted to marine biophysical conditions, including West and East Monsoon cycles. This adaptive flexibility is precisely what legal hybridity enables: the Village Head, in coordination with the Saniri (Customary Council), can issue a directive memo or revise the Decree rapidly to extend or shorten the Sasi period based on direct field observation an administrative agility that rigid state law does not possess.

This adaptive capacity ensures that human resource extraction remains within the environmental carrying capacity, allowing economic functions to continue without sacrificing long-term ecological functions (Suriyani & Fauzi, 2023). The hybrid system thus addresses a fundamental tension in resource governance: the need for legal certainty on one side and ecological adaptability on the other. Where state law provides certainty and enforceability, customary knowledge provides the ecological intelligence that informs when and how rules should flex.

The findings of this study position legal hybridity as an analytical enrichment not a refutation of the existing coastal governance literature. Classical studies, such as Sangadji (2010), predominantly portrayed the state as a centralized, antagonistic entity threatening customary legal autonomy. The present study provides a reinterpretation calibrated to the current era of village autonomy: within the context of legal hybridity, the state through its smallest unit, the village government acts as a catalyst and a legal shield, enabling indigenous wisdom to remain relevant and enforceable in the face of modern challenges and external market pressures.

This interpretation also enriches the biophysical dimension of the literature. While Cinner et al. (2012) established that community management frequently outperforms formal Marine Protected Areas in terms of ecological outcomes, the present study provides analytical depth by answering how this occurs administratively. The Village Head Decree provides formal law enforcement officials with the legal confidence to back customary patrols an operational bridge not examined in detail by Harkes & Novaczek (2002), whose analysis remained focused on the traditional institutional resilience of Sasi without engaging the administrative reinforcement dimension.

This study also refines the social capital dynamics identified by (Mony et al., 2015). While Mony identified shifts in livelihood strategies within the Sasi system, the present analysis sharpens that contribution through the Triadic Governance framework. Contemporary Sasi effectiveness depends not on a single authority but on the synergy of spiritual (Church/Mosque), customary (Kewang), and administrative (Village Head) authority. This pattern represents an enrichment of Adaptive Co-management theory (Pomeroy et al., 2011) in a hybrid system, coercive power is no longer solely horizontal but also vertical, answering the challenge of increasingly heterogeneous coastal communities that do not automatically defer to traditional moral sanctions.

These findings do more than juxtapose theories they demonstrate how legal hybridity functions as a systemic modifier of the resource governance literature. Where classical CPR theory (Ostrom, 2009) emphasized community autonomy as sufficient, the present findings suggest that pure autonomy is often vulnerable to external market pressures in the modern era. The analysis expands the scope of Legal Pluralism theory by showing that administrative synchronization through the Village Head Decree serves as a protective safeguard unifying living law (custom) and state law. Hybridity, in this reading, is no longer about jurisdictional competition the concern raised by (Sangadji, 2010) but about

institutional co-evolution. CPR theory thus transforms into an Integrated CPR model, in which boundary clarity is no longer purely physical-traditional but becomes an administrative-legal entity reinforcing overall system resilience, consistent with evidence from other community-based fisheries that the ecological payoff of Ostrom-type design principles depends on how well they are institutionally operationalized rather than on their formal presence alone (Arantes et al., 2021).

The practical significance of this theoretical shift should not be understated. An Integrated CPR model implies that policymakers should treat village administrative capacity not only ecological conditions as a variable affecting fishery outcomes. Communities with weak or captured village governance may experience the inverse of what this study documents: formalization that undermines rather than reinforces customary authority. The conditions under which legal hybridity strengthens versus erodes indigenous institutions therefore represent an important frontier for future research.

A second theoretical implication concerns the epistemological status of indigenous ecological knowledge within formal governance frameworks. The traditional Sasi closure calendar developed through generations of community observation has proven to be closely aligned with the biological windows needed for marine species recovery. This convergence between indigenous temporal knowledge and scientific ecological understanding suggests that customary systems should not be treated merely as governance instruments to be formalized, but as repositories of place-specific ecological intelligence. Incorporating this intelligence formally into the decree-revision process, for example, by requiring Saniri ecological assessment as a precondition for decree modification would strengthen both the epistemic legitimacy of the hybrid system and its long-term biological effectiveness.

The analysis highlights three primary sustainability risks. First, bureaucratization risks: the homogenization of customary rules into bureaucratic language may erode the sacred and philosophical values of Sasi the very foundation of internal compliance. If Sasi is perceived as mere administrative procedure, its moral binding power may weaken over time; comparable Indonesian marine protected areas have shown that formal legal designation of a zone does not by itself guarantee compliance or biological recovery once community ownership of the rule weakens (Campbell et al., 2012). This concern is most acute where village governance lacks transparency or where decision-making is dominated by village officials without meaningful customary council (s) involvement (Suriyani & Fauzi, 2023). Second, gender inclusivity gaps: women fishers and their ecological knowledge are systematically underrepresented in Sasi governance structures, limiting both institutional legitimacy and adaptive capacity. Women in coastal Maluku and Papua communities often possess detailed knowledge of seasonal species behavior and intertidal zones knowledge that is directly relevant to optimizing closure timing yet are routinely excluded from the coordination meetings (Saniri sessions) where those timing decisions are made. This exclusion represents a governance deficit with direct ecological consequences, echoing findings from other Indo-Pacific customary fisheries that women's limited voice in closure decisions can itself undermine compliance and the conservation benefits those closures are meant to achieve (Rohe et al., 2018). Third, boundary conflicts: the formalization of spatial boundaries through technical coordinates in Village Head Decrees, while strengthening enforcement capacity, can also create new horizontal conflicts between neighboring villages over overlapping customary territories. In contexts where traditional boundaries were understood through oral agreement and relational trust, converting them into GPS coordinates introduces a legibility that can be contested in ways that informal boundaries were not.

Several methodological limitations must be acknowledged. This analysis relies entirely on secondary data synthesis. Consequently, the 60% biomass recovery estimate and the $\pm 85\%$ compliance rate should be understood as indicative patterns rather than verified causal measurements; they represent the modal values drawn from comparative case study literature and require field verification through intensive process tracing (Beach & Pedersen, 2019). The use of fisheries production figures as proxy indicators for biota stocks is also subject to confounding factors gear efficiency, market dynamics, and climate

anomalies which cannot be fully controlled in a desk study. Additionally, the focus on Maluku and Papua, while providing deep contextual understanding, limits generalizability to villages with different sociocultural characters and leadership integrity profiles. A further limitation concerns citation reliability. At least two references in this study Pomeroy et al. (2011) and the journal attribution for Kridasakti et al. (2025) require independent bibliographic verification before formal publication, as their DOI records contain inconsistencies that could not be resolved through secondary source analysis. Readers are advised to verify these citations against primary journal databases prior to citation.

3.1 Discussion

What makes the Sasi case analytically distinctive is that it does not fit neatly into the standard dichotomy of state versus community governance. It is neither a pure co-management model where state and community share authority over a defined space nor a purely devolved system where the state withdraws and leaves community institutions to self-organize. Instead, it represents a form of institutional layering: the administrative layer of the state is added on top of the customary layer without replacing it, functioning as a legal amplifier for rules that were already embedded in community practice. This architectural insight may have broad relevance beyond the Indonesian context. Wherever indigenous or customary institutions possess deep ecological knowledge and community legitimacy but lack the formal authority to exclude external actors, the layering of minimal administrative instruments decrees, ordinances, permits may offer a path to effective enforcement without the cultural costs of wholesale institutional replacement.

For regional and village governments, formalization of Sasi through village regulations should be pursued with explicit prerequisites institutional capacity of village governance, administrative integrity of village officials, and transparent accountability mechanisms for the management of sanction funds. This hybrid model cannot be replicated uniformly across all areas; it must be calibrated to the degree of legitimacy of the local customary council (Saniri) and the specific sociocultural characteristics of each community. The Village Head Decree must function strictly as an administrative shield against external actors, without intervening in the sacred substance and ritual practices that constitute the internal driving force of Sasi compliance. For National Policymakers: The hybrid Sasi model should be considered as a reference framework for inclusive coastal zone management policy. Law No. 27 of 2007 already mandates the integration of local wisdom into national coastal management; the operationalization of this mandate through standardized-yet-flexible village regulation guidelines would allow for formal legal recognition without enforcing cultural uniformity.

For future researchers given the secondary data limitations of this study, future research should conduct comparative longitudinal field studies combining underwater biological surveys (to measure biota biomass directly) with in-depth community interviews (to assess social compliance and institutional health). Studies should specifically evaluate whether state administrative intervention over the long term strengthens local institutions or risks generating dependency and value erosion a critical unresolved question that desk-study analysis alone cannot answer. Particular attention should be directed to gender inclusion in Sasi governance and the comparative institutional health of Sasi systems across different levels of village government integrity. Future work should also develop methods for measuring the quality not merely the presence of legal hybridity: the degree to which village decrees genuinely reflect customary deliberation, rather than serving as administrative covers for unilateral village executive decisions. This distinction will determine whether legal hybridity produces the institutional co-evolution documented in this study, or merely a new form of state enclosure of indigenous commons.

4. Conclusions

This study concludes that coastal resilience in Eastern Indonesia can no longer rest on a single governance authority, whether state or customary community in isolation. Legal hybridity manifested through the integration of Sasi norms into Village Head Decrees acts as a systemic modifier that fills the jurisdictional gap between formal law and the living law of the community. This analysis strengthens the proposition on adaptive Legal Pluralism developed by Kridasakti and the team, in which the synchronization of village regulations serves as a key instrument for reinforcing legal legitimacy at the community level.

The Triadic Governance pattern synergizing customary, spiritual, and administrative authorities confirms that community compliance in coastal resource management is multidimensional and cannot be reduced to any single mechanism. This hybrid coercive power, both horizontal and vertical, is particularly crucial in the contemporary era where coastal populations are increasingly heterogeneous and not uniformly bound by traditional moral sanctions. The extraction pause supported by jurisdictional boundary clarity provides space for biota to complete spawning cycles, with indications of up to 60% biomass recovery for high-value species when Sasi closures are maintained for 10 to 12 months with formal administrative backing.

These findings carry both theoretical and practical weight. Theoretically, they reinterpret the state's role in customary resource governance from obstacle as characterized by Sangadji research to catalyst and enrich both CPR and Legal Pluralism frameworks with an administrative dimension that existing literature has not fully addressed. Practically, they suggest that the formalization of custom through village instruments is not a form of bureaucratization that kills tradition, but a structural necessity to maintain bio-social resilience in the face of external pressures.

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Author Contribution

The author was solely responsible for the conceptualization, methodology, data collection, data analysis, interpretation of results, drafting of the manuscript, critical revision of the content, and approval of the final version of the manuscript.

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During the preparation of this work, the author used Turnitin and Grammarly to assist in refining the grammatical structure, enhancing academic vocabulary, and improving the clarity of the narrative flow. After using this tool, the author reviewed and edited the content as needed and took full responsibility for the content of the publication.

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