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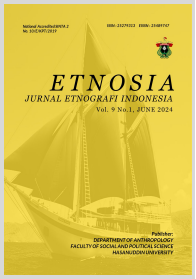

The Role of Indigenous Communities in Turtle Breeding Activities, Skouw Yambe Village, Papua

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ABSTRACT

This study uniquely examines the role of indigenous communities in turtle conservation in Skouw Yambe Village, Jayapura City, Papua, by employing a descriptive qualitative approach. Unlike previous research, this study provides an in-depth analysis of local community conservation practices specifically focused on four turtle species: green turtle (*Chelonia Mydas*), hawksbill turtle (*Eretmochelys Imbricata*), loggerhead turtle (*Caretta Caretta*), and leatherback turtle (*Dermochelys Coriacea*). Unlike previous research that predominantly offered superficial, descriptive accounts of conservation activities, this study delves deep into the complex socio-ecological mechanisms that underpin community-driven environmental preservation.

By applying qualitative approach, this study utilizes an integrated methodology of in-depth interviews and participatory observation. A total of nine informants were purposefully selected for this study, representing diverse perspectives within the indigenous community of Skouw Yambe Village.

The study reveals a systematic traditional knowledge system for species identification and conservation practices, demonstrating how indigenous communities in Skouw Yambe Village effectively use intergenerational ecological knowledge to protect and manage local turtle populations The conservation process encompasses three critical stages: egg collection, incubation, and hatchling release, occurring between January and May each year. It demonstrates that turtle conservation in this location transcends mere species preservation, representing a manifestation of cultural values and environmental ethics. The community-based conservation model harmoniously synthesizes traditional ecological wisdom with modern conservation methodologies. The approach aims to prevent species extinction, protect coastal habitats, strengthen social

cohesion, and empower local communities. The conservation initiative is supported by three fundamental components: high community awareness and participation, synergistic collaboration with government and non-governmental agencies, and conducive natural habitat conditions. Despite challenges such as plastic pollution and coastal erosion, the Skouw Yambe indigenous community has developed an adaptive conservation strategy. The study concludes by emphasizing the urgent need to recognize and support indigenous communities as ecosystem guardians, highlighting the potential of this community-based conservation model as a comprehensive reference for similar programs, while acknowledging the unique socio-ecological characteristics of each region.

1. Introduction

The Anthropology, as a comprehensive discipline, examines human existence and all dimensions of life. The anthropological paradigm views culture as a series of adaptive strategies developed by society in its interactions with the environment and resources (Meinarno et al., 2024; Poerwanto, 2010). In this context, there are three fundamental dimensions that are mutually integrated in the structure of society: the socio-economic dimension which includes material organization and physical survival; the socio-political dimension which includes collective decision-making mechanisms; and the socio-cultural dimension which summarizes value systems and aspirations (Hariram, 2023).

The dynamic interaction between the three dimensions cannot be separated from the ecological context that surrounds it. The socio-ecological (ecosocial) approach emphasizes the complexity of the reciprocal relationship between humans and their natural environment. This paradigm integrates ecological aspects (ecosystems and environment) with social aspects (society, culture, and economy) in understanding and managing various environmental problems (De Jonge et al., 2012).

Empirical studies have been conducted by several researchers demonstrating the significance of the role of local communities in the preservation of coastal and marine resources through their traditional wisdom (Berkes et al., 1994; Furqan et al., 2021; Inglis, 1993; Syarif et al., 2023; Yuliana et al., 2023). This is in line with the spirit of Law Number 32 of 2009 concerning Environmental Protection and Management which recognizes and values local wisdom in the context of environmental conservation.

In a specific context, the indigenous community of Skouw Yambe Village demonstrated an ecosystem conservation model through a turtle breeding initiative. This practice represents a manifestation of a cultural system that reflects concern and moral responsibility for the environment. As argued by Atikawati et al. (2019), environmental ethics not only balances rights and obligations, but also limits human behavior to remain within the limits of environmental resilience.

The urgency of environmental conservation is increasingly relevant considering the UN report on World Environment Day 2021 which indicates that environmental damage has affected 3.2 billion people (40% of the global population), with annual losses reaching 10% of the global economy. Keraf (2010) and Wiryono (2013) emphasized that environmental problems are fundamentally a matter of human morality and behavior. Therefore, a holistic and systemic approach is needed in environmental conservation efforts that integrate social, economic, and ecological aspects in a sustainable manner.

Papua, with its 12 regencies and one city with coastal areas, offers a natural laboratory for studying human-environment interactions. Skouw Yambe Village in Muaratami District, Jayapura City, is a significant turtle conservation area, with nesting activities taking place from January to May each year. Its strategic location facing the Pacific Ocean and connected to the Tami River estuary and Humbolt Bay creates ideal conditions for conservation. Although numerous studies have explored the role of local communities in coastal and marine resource conservation, there remain significant limitations in comprehensively understanding the specific mechanisms by which traditional knowledge concretely contributes to sea turtle ecosystem preservation at the community level. Particularly in the Papua region, in-depth research about turtle conservation practices by the indigenous community of Skouw Yambe remains extremely limited. Most previous studies have focused more on general descriptions of conservation practices, but have not fully uncovered an internal dynamics of community decision-making mechanisms in turtle conservation initiatives, the cultural factors influencing motivation and sustainability of conservation practices, specific interactions between traditional ecological knowledge and modern conservation strategies, and the challenges and adaptations of the Skouw Yambe community in maintaining conservation practices amid environmental changes and economic pressures. Therefore, this research aims to fill these knowledge gaps by conducting an in-depth analysis of the indigenous community's role in turtle conservation activities in Skouw Yambe Village, which can provide theoretical and practical contributions to understanding community-based conservation dynamics.

While numerous studies have explored community-based conservation, this research distinguishes itself through a comprehensive and nuanced examination of indigenous turtle conservation practices in the relatively unexplored context of Skouw Yambe Village, Papua. Unlike previous research that predominantly offered superficial, descriptive accounts of conservation activities, this study delves deep into the complex socio-ecological mechanisms that underpin community-driven environmental preservation. By meticulously unpacking the intricate decision-making processes, cultural motivations, and adaptive strategies of the indigenous community, the research transcends traditional academic narratives. It provides a holistic understanding of how traditional ecological knowledge interacts with contemporary conservation approaches, revealing the dynamic and sophisticated ways local communities navigate environmental challenges. The study's unique contribution lies not just in documenting conservation practices, but in illuminating the profound cultural and moral dimensions that drive sustainable environmental stewardship. Set

against the backdrop of increasing global environmental degradation and the critical role of indigenous knowledge in conservation, this research offers both theoretical insights and practical frameworks for understanding community-based environmental management, with specific relevance to marine turtle conservation in the Papua region.

2. Method

This study adopts a qualitative descriptive approach that aims to explore and elaborate social phenomena systematically and comprehensively. The qualitative paradigm was chosen because of its ability to produce in-depth understanding of events, behaviors, and social conditions in the form of holistic narratives.

This research was conducted in Skouw Yambe Village, located in Muaratami District, Jayapura City, Papua, Indonesia. The study specifically focuses on this village due to its strategic location facing the Pacific Ocean, with proximity to the Tami River estuary and Humbolt Bay. This area is particularly significant for marine turtle conservation, with documented nesting activities occurring annually from January to May 2024.

Informant selection was carried out using purposive sampling techniques, with specific criteria that prioritize individuals who have direct involvement, substantial local ecological knowledge, and in-depth understanding of the role of indigenous communities in turtle conservation activities in Skouw Yambe Village.

A total of 9 informants were participated in this study, representing diverse perspectives within the indigenous community of Skouw Yambe Village. The sample was strategically composed to capture comprehensive insights into turtle conservation activities. Informants in this study are the head of the Skouw Yambe Turtle Conservation Group and indigenous community leaders, active member of the conservation group responsible for night patrols, indigenous elder who maintain traditional knowledge about turtles, local youth involved in conservation activities since 2018, member of the conservation group who focus on handling eggs, conservation officer who is responsible for the breeding pond, facilitator who facilitates between conservation groups and government institutions, indigenous community member who has knowledge of traditional rituals related to turtles, and indigenous youth who is active in conservation education for visitors.

Data collection was carried out through in-depth interviews and observation. Adopting the conceptualization of Irianto and Bungin (2001:108), interviews were conducted as a constructive dialogical process between researchers (interviewers) and informants to explore the dimensions of activity, organization, motivation, and subjective experiences of participants. Interviews were conducted using structured interview guidelines and audio documentation to explore the dimensions of conservation activities (including traditional practices and patrol routines), community organizational structure in managing turtle conservation, cultural and spiritual motivations driving conservation efforts, and personal experiences of community members in maintaining the sustainability of turtle populations. Furthermore, observation was carried out to observe

behavioral patterns and interactions of the Skouw Yambe Village community in turtle conservation activities, social dynamics around the conservation location, and the ecological conditions of the habitat of the conserved species.

Data analysis followed Miles and Huberman's (2014) interactive model through three concurrent stages. In the data reduction stage, interview transcripts were coded to identify key themes related to turtle conservation practices, focusing on traditional conservation methods, community organization patterns, and cultural values. During data presentation, the coded information was organized into thematic matrices that mapped out the relationships between community activities, traditional knowledge systems, and conservation outcomes. For example, ritual practices associated with turtle nesting seasons were analyzed alongside their practical conservation implications. The conclusion drawing process involved synthesizing these relationships to understand how traditional ecological knowledge specifically contributes to successful turtle conservation in Skouw Yambe Village. This included analyzing patterns in community patrol schedules, traditional restrictions on turtle harvesting, and intergenerational knowledge transfer about turtle habitats.

This research adhered to strict ethical guidelines to protect the rights and interests of the indigenous community of Skouw Yambe Village. Prior to data collection, formal research permits were obtained from both local government authorities and traditional leadership structures. Following the principle of Free, Prior and Informed Consent (FPIC), we conducted preliminary meetings with community leaders to explain the research objectives, methods, and potential implications. Written informed consent was obtained from all participants, with clear explanations provided in both Indonesian and local language to ensure full understanding.

Given the sensitive nature of traditional ecological knowledge, we established protocols to protect indigenous intellectual property rights. Participants retained the right to withdraw information they considered culturally restricted or sacred. All interviews were conducted with cultural sensitivity, respecting local customs and traditional protocols around knowledge sharing. All names are pseudonyms. Special consideration was given to the handling of information about turtle nesting sites and conservation practices to prevent potential misuse that could harm the turtle population. Data storage followed strict confidentiality measures, with access limited to the research team. Research findings were validated through member checking, allowing participants to review and verify their contributions before finalization.

3. Result and Discussion

- **Conservation Context of Sea Turtles in Skouw Yambe**

All turtle species inhabiting Indonesian waters have obtained legal protection status through the 1999 Government Regulation concerning the preservation of protected plants and animal species, as referenced by the Directorate of Conservation and National Parks (Akbar et al., 2020; Sianturrahman & Tjahjono, 2024; Wicaksono et al., 2018). In a biological context, female turtles demonstrate specific reproductive behavior by migrating to optimal nesting locations,

including the coastal waters of Skouw located in eastern Indonesia. At the nesting location, turtles select sites for nest construction that function as a medium for protecting eggs from predators and extreme thermal fluctuations. Reproductive capacity per nest varies between 50 and 200 eggs, with variations depending on the specific characteristics of the species. The eggs have a spherical morphology with an elastic surface texture. The turtle reproductive cycle represents the complexity of biological processes that include a series of stages, starting from copulation activities in pelagic habitats, oviposition in the littoral zone, to the release of hatchlings into the marina environment. Although this species has an adaptive and resilient reproductive mechanism, its existence still faces a multiplicity of factors that have the potential to threaten the sustainability of the population, emphasizing the urgency of implementing conservation and habitat protection efforts.

In historical perspective, turtle nesting activities in Skouw Yambe have been ongoing continuously for an extensive temporal period. However, the systematic initiation of the conservation program was only realized in 2014, initiated by the collective awareness of the local indigenous community. Mr. Johny Tobby, a community leader who also acts as a conservation officer, articulated that:

Since 2014 until now, this turtle breeding activity is still running. In the past, we only made simple things. Initially, we made ponds independently and collected hatchlings. There were 900 hatchlings collected. And only then did the media come to cover it, such as Cepos (Cenderawasih Pos) and RRI. Finally, this place began to be known, all the people of Jayapura City came, even from India, Australia, Korea, they came to interview you on the beach here.

Conservation initiatives implemented by Johny Tobby and its collaborators have received positive resonance from multiple stakeholders, both from government and non-government institutions. Contributing government entities include the Jayapura City Marine and Fisheries Service, the Tourism Service, and PLN. This institutional support is manifested in various forms of intervention, including the transfer of knowledge on hatchling nutrition management, development of conservation gallery infrastructure, allocation of operational subsidies for conservation communities, and facilitation of exposure of conservation programs initiated by the Skouw Yambe (*tetangwe*) indigenous community to external stakeholders.

The Skouw Yambe conservation site is a habitat for four species of turtles: the green turtle (*Chelonia Mydas*), the loggerhead turtle (*Caretta Caretta*), the hawksbill turtle (*Eretmochelys Imbricata*), and the leatherback turtle (Dermochelys Coriacea). Indigenous communities have developed a traditional knowledge system in species identification through egg characteristics, as indicated by Mr. Thomas Nathan below:

> We can distinguish the types of turtles from the size of their eggs. The smallest is the flatback turtle, while the leatherback turtle's eggs are larger, the same size as a tennis ball. Since January we've been walking every night. When she lays eggs, she's not disturbed. So, the mucus comes out, then

another egg, then another mucus, then an egg. Later, after she's laid the eggs, she'll cover the sand with her back wings until it's neat.

The interview with Mr. Thomas Nathan reveals a nuanced understanding of sea turtle nesting behaviors, rooted in intimate ecological observations. Local community members distinguish turtle species through careful examination of egg sizes, noting the distinct characteristics of different species; from the diminutive eggs of flatback turtles to the tennis ball-sized eggs of leatherback turtles. Since January, dedicated community members have conducted nightly beach patrols, demonstrating a respectful and systematic approach to conservation. Their observations detail the intricate nesting process with remarkable precision: they describe how a female turtle methodically releases mucus and deposits eggs, creating a rhythmic pattern of biological progression. Once the egg-laying is complete, the turtle employs her rear flippers; referred to as back wings to meticulously cover and smooth the nest, ensuring the sand is carefully arranged to protect her future offspring.

Since January 2024, community members have conducted systematic nightly beach patrols, demonstrating a respectful conservation approach. The community described the nesting process with remarkable precision:

- Methodical mucus release and egg deposition by female turtles
- Use of rear flippers to cover and smooth the nest
- Careful sand arrangement to protect future offspring

Conservation group roles include identification of nest location, hatching monitoring process, and egg protection from environmental threats. This community-based approach integrates traditional knowledge with modern conservation practices, where each member contributes significantly to marine ecosystem preservation. The study highlights the critical role of indigenous communities in understanding and protecting marine biodiversity, showcasing how traditional ecological knowledge can effectively support conservation efforts.

- **The Role of Indigenous Communities in Turtle Conservation**

In anthropological studies, conservation represents the manifestation of community values and behavior in maintaining the sustainability of the ecosystem. Indigenous communities, with a legacy of traditional knowledge and wisdom formed over centuries, have a deep understanding of harmony with nature. The spiritual dimension in the relationship between the community and turtles is an integral element in conservation practices, where traditional leaders act as guardians of traditional ecological knowledge and facilitators of the transmission of local wisdom between generations. Concern for turtle conservation in the Skouw Yambe indigenous community is more driven by cultural values that have been passed down from previous generations to maintain harmony between humans and nature. In the context of the Yambe community, indigenous knowledge is currently facing systematic challenges from environmental management regimes that do not fully support the aspirations of indigenous communities (Kothari, 2013). Behind that, most indigenous communities in the Amazon region, Canada, and Australia

emphasize customary law as a strong path to support turtle conservation which in practice is clustered based on turtle nesting and migration areas and limitations for consumption patterns. Even in certain areas such as Maranhao Brazil, there is evidence of regulation in traditional conservation strategies (Medeiros et al., 2023).

Based on interviews with local conservation officer and community leader in Skouw Yambe Village, we found that the community's approach to turtle conservation extends beyond ecological preservation to a deeply rooted cultural practice. Mr. Johny Tobby**,** a key informant and community leader, shared insights into their conservation philosophy, as follows:

> Our connection with turtles is not just about protection but about maintaining the balance between our community and the natural environment. Each generation passes down knowledge about these creatures, treating them as more than just a species, but as part of our cultural heritage.

The community's conservation efforts are characterized by spiritual connection (traditional leaders act as knowledge guardians, intergenerational transmission of ecological wisdom, and rituals and practices that reinforce human-nature harmony). Furthermore, practical conservation strategies that represented by nightly beach patrols (January-May), systematic egg collection and relocation, and community-based monitoring of nesting sites. Unlike theoretical discussions found in literature, the Skouw Yambe community demonstrates a living, adaptive approach to turtle conservation that integrates cultural values with practical ecological preservation.

In addition, in the legal framework and implementation of conservation in Indonesia, turtle protection in Indonesia is regulated in several legal instruments PP Number 7 of 1999 concerning the Preservation of Plant and Animal Species, Permen LHK Number 106 of 2018, Law Number 5 of 1990 concerning Conservation of Biological Natural Resources, Circular Letter Number 526 of 2015 concerning Turtle Protection. However, the meeting point between the modern conservation regime and customary knowledge still does not have a strong framework. In this context, the Skouw Yambe Turtle Conservation Group (KKP) implements a systematic customary-based conservation program, as expressed by Mr. Daniel Piter**:** "Every night we walk along the beach... to look for turtle eggs and move them to a safe place. Mother turtles dig holes in the sand with their paddle-like back legs to lay their eggs."

This highlights the community's proactive approach to sea turtle conservation through nightly beach patrols. Local conservation efforts involve systematically walking along the coastline to locate turtle nests, with a primary goal of relocating eggs to safer areas. The description provides insight into the nesting behavior of mother turtles, who use their distinctive paddle-like back legs to excavate carefully chosen nesting sites in the sand.

- **Breeding Protocols and Conservation Practices**

It can be elaborated that the turtle breeding process in the area implements three systematic, integrated stages. The first stage begins with egg collection which includes a series of structured activities, including identification and securing of turtle nest locations, egg extraction using special standardized techniques, and a controlled transportation process to the breeding facility. The second stage focuses on the egg incubation process which lasts for 45 to 60 days, during which intensive monitoring of environmental parameters as well as temperature and humidity management is carried out to optimize the hatching success rate. Furthermore, the third stage concentrates on the management and release of hatchlings, which is initiated with a 15-day maintenance period, followed by a comprehensive evaluation of release readiness, and ends with a strategic release carried out at night.

In the coastal village of Skouw Yambe, sea turtle conservation unfolds through a carefully orchestrated three-stage breeding process that blends scientific rigor with traditional wisdom. The journey begins with egg collection, where dedicated community patrol teams, drawing upon generations of knowledge, meticulously identify and secure turtle nesting sites. Conservation officer (Mr. Kris Sopater) emphasizes the critical nature of this initial phase, explaining, "Our egg collection process is crucial. We use specialized techniques to ensure minimal disruption to the nesting site and maximum survival probability." Once collected, the eggs enter a precisely controlled incubation period lasting 45 to 60 days, during which conservation officers maintain vigilant oversight of environmental conditions. The facility's temperature and humidity levels are monitored with exacting precision, not only to ensure optimal hatching rates but also to influence the gender distribution of the hatchlings through temperature-based sex determination. The final stage involves a meticulous 15-day hatchling management period, where each young turtle is carefully evaluated for release readiness. The community's profound understanding of predator behavior influences their strategic decision to conduct releases under the cover of darkness, maximizing the hatchlings' chances of survival as they make their crucial journey to the sea. This sophisticated breeding protocol exemplifies how the Skouw Yambe community has masterfully woven together modern conservation science with their deep-rooted cultural understanding of marine ecosystems. In a broader perspective, the ecological and socio-cultural dimensions of this conservation practice show interesting complexity.

The Skouw Yambe community's sea turtle conservation program represents a sophisticated interweaving of ecological science, cultural heritage, and community engagement. Their comprehensive approach to species preservation encompasses four distinct turtle species, supported by meticulously designed breeding protocols and careful management of environmental parameters to optimize hatchling survival rates. What makes their conservation model particularly remarkable is its deep roots in traditional ecological knowledge, where ancient wisdom about nesting sites and marine ecosystems passes seamlessly from generation to generation. This cultural foundation creates a profound spiritual connection between the community and the marine

environment they protect. The community has masterfully integrated indigenous ecological knowledge with modern scientific techniques, creating a dynamic conservation framework that adapts to environmental challenges while preserving cultural identity. Every community member plays a vital role in this conservation effort, from elderly knowledge keepers who share generations of ecological wisdom to young monitors who blend traditional observation methods with contemporary tracking techniques. Their adaptive strategies demonstrate remarkable flexibility in responding to environmental changes and anthropogenic threats, striking a delicate balance between time-honored practices and innovative scientific approaches.

The conservation practices carried out by the Skouw Yambe community represent a harmonious synthesis between the natural resource management system and local cultural values. The Skouw Yambe community's sea turtle conservation program stands as a testament to their holistic approach to environmental stewardship. At its core, their initiative weaves together three vital objectives that create a robust framework for protecting these ancient marine creatures. The community's dedication to ecological protection manifests in their meticulous efforts to safeguard turtle eggs from predators and human interference, while their carefully designed protocols maximize hatchling survival rates in the critical first days of life. Beyond immediate species preservation, the Skouw Yambe people have masterfully integrated conservation practices into their social fabric, fostering a deep environmental consciousness among community members while ensuring traditional ecological knowledge flows seamlessly from elders to youth. This cultural transmission creates a new generation of local conservation leaders who understand both ancestral wisdom and modern scientific principles. Their commitment to environmental sustainability extends beyond turtle protection, encompassing comprehensive coastal ecosystem management that maintains the delicate balance between human needs and ecological preservation. Through this multifaceted approach, the Skouw Yambe community has created a conservation model that not only ensures the survival of sea turtles but also strengthens their cultural heritage while preserving the intricate web of marine life that supports these magnificent creatures. This conservation initiative has multiple objectives that are integrated into three fundamental aspects.

First, ecological protection that emphasizes preventing egg damage, increasing the survival rate of hatchlings, and preserving natural habitats. *Second*, socio-cultural strengthening, which is realized through increasing communal awareness, intergenerational transmission of traditional knowledge, and building the capacity of local communities. *Third*, environmental sustainability which includes sustainable resource management, coastal ecosystem preservation, and long-term ecological balance.

This conservation practice provides empirical evidence of how traditional ecological wisdom can be effectively synergized with modern conservation methodologies to achieve sustainable environmental conservation goals. Along the pristine coastline of Papua, the Skouw Yambe community exemplifies a remarkable fusion of ancestral wisdom and contemporary conservation science

in their sea turtle protection efforts. Local elders, drawing upon generations of knowledge passed down through oral traditions, work seamlessly alongside marine biologists to safeguard these ancient marine creatures. Their traditional understanding of nesting sites, enriched by a deep spiritual connection to the ocean, perfectly complements modern scientific protocols. Community members conduct nightly beach patrols, their keen eyes trained by centuries of observation, while simultaneously employing systematic monitoring techniques. In their custom-built hatchery, they maintain precise temperature controls for the 45–60-day incubation period, integrating traditional timing knowledge with scientific measurements.

This harmonious approach has yielded impressive results: four turtle species now thrive under their protection, with eight breeding ponds actively maintained. The community's holistic method extends to their innovative release strategy, where hatchlings undergo a carefully monitored 15-day preparation period before being released under the cover of darkness. Despite mounting challenges from plastic pollution and coastal erosion, the Skouw Yambe's unique blend of traditional ecological knowledge and modern conservation techniques continues to ensure the survival of these magnificent creatures, creating a model of environmental stewardship that bridges past and present. This integration not only strengthens the technical basis of conservation but also enriches the socio-cultural dimensions in environmental conservation efforts.

- **Ecological Challenges and Conservation Adaptation**

The turtle conservation program in Skouw Yambe has faced various ecological challenges identified through systematic observations during January-March 2024. Conservation facilities which currently include eight breeding ponds, and one hatching unit have succeeded in increasing the number of hatchlings released from 2,780 (2019) to 4,215 (2024). However, previous studies conducted by Duarte et al. (2019), Duncan et al. (2021), and Mazaris et al. (2023) have shown that challenges to turtle conservation include challenges from fishing, climate change, and plastic pollution. A similar situation was also found in this study. The sustainability of this program is threatened by five main challenges that require continuous adaptation from indigenous communities. The challenges include plastic pollution, beach erosion and loss of nesting habitat, temperature changes and their impact on turtle sex determination, increased predation, and conflict with fishing activities.

Plastic Pollution

Surveys conducted on three beach segments (each 500 meters long) in February 2024 revealed an alarming accumulation of plastic waste. Based on an interview with Mr. Pae, on 12 February 2024, the conservation team has noted a dramatic increase in litter volume in the main nesting area. In the latest patrol, they collected 87 kg of plastic waste from the area, a significant increase compared to 43 kg for the same area in the same period in 2022. The team's documentation also shows 14 cases of female turtles who were forced to return to the sea without laying eggs after encountering obstacles in the form of piles of plastic waste.

Analysis of the conservation team's diary revealed that the composition of waste was dominated by single-use plastic (62%), followed by fishing equipment such as nets and ropes (23%), and various other plastic materials (15%). The observations documented in an interview on 13 February 2024 showed a significant increase in plastic waste density. Through 10x10 meter observation plots established at three main turtle nesting locations, data from January 2022 to February 2024 shows an increase in plastic waste density from an average of 1.8 items/m² to 4.3 items/m². Conditions in some areas are very worrying with layers of rubbish reaching a depth of 15 cm, creating a physical barrier that makes nest excavation by turtles almost impossible. In response to this challenge, the conservation group has developed a structured beach cleaning system with a rotating schedule involving 25 community members divided into five operational teams. An interview with Mr. Kris Sopater on February 13, 2024, revealed the data-driven approach to the cleanup effort. Based on monitoring data since 2021, the conservation team has identified three "hot spots" of waste accumulation that correlate with seasonal ocean current patterns. The strategy now focuses on concentrating 70% of the cleanup effort in these crucial locations, with intensification of activities especially in the two-week period before the peak nesting season as predicted by the "Mberu" indigenous calendar.

Beach Erosion and Loss of Nesting Habitat

The results of coastline measurements carried out at 20 fixed points along the Skouw Yambe coast between 2020-2024 show an alarming erosion pattern. An interview with EM on 14 February 2024 revealed that monitoring data shows an average shoreline retreat of 4.2 meters in the last four years, with the worst erosion level reaching 6.7 meters in the main nesting zone in the north. Documentation of nesting locations revealed the fact that of the 34 nesting locations identified in 2020, 11 of them have now completely disappeared due to ongoing erosion.

The physical condition of the beach is also experiencing serious degradation, as revealed in mapping and measuring the slope of the beach carried out in January 2024. Observation results show the formation of sand cliffs (scarps) with heights varying between 0.8-1.5 meters along the 2.3 kilometers coastline. These formations create significant physical barriers, making it difficult for turtles to reach optimal nesting zones and potentially reducing reproductive success.

In an interview on February 15, 2024, with Mr. Johny Tobby, he outlined the traditional adaptation strategies that have been developed to overcome the erosion problem. Since 2021, the community has implemented the "Kambui" technique - a traditional beach stabilization method that uses a combination of woven bamboo fences and coconut planting in a specific pattern passed down from generation to generation. Evaluation results at 12 test sites show the effectiveness of this approach, with a reduction in erosion rates of 63% compared to untreated control sites. As a complement to traditional techniques, conservation groups have also initiated comprehensive coastal vegetation restoration programs. Based on an interview with (Mr. Dani Rayhan) on February 15, 2024, this program was implemented based on an analysis of coastline changes. The community has planted 1,750 local beach trees, mainly

Casuarina equisetifolia (sea cypress) and Pandanus tectorius (beach pandanus) along 1.4 kilometers of coastline identified as most vulnerable. Two years of monitoring data showed that areas with restored vegetation experienced 58% lower erosion rates than control areas without intervention, demonstrating the effectiveness of this approach in coastal stabilization.

Temperature Changes and Their Impact on Turtle Sex Determination

Systematic temperature measurements taken at 27 natural nests and 35 nests in captive facilities during the 2022-2024 hatching season revealed a significant warming trend. An interview with Mr. Dani Rayhan on 13 February 2024 revealed that the average sand temperature at nest depth (50 cm) during the critical phase of sex determination (second week of incubation) had increased from 29.2°C in 2018 to 31.4°C in 2024. This condition is very worrying considering that temperatures above 30°C tend to produce female hatchlings, resulting in a dramatic shift in the population sex ratio.

During the 2023-2024 nesting season, 76% of days had an average temperature above the 29.5°C threshold that is the pivot point for sex determination, showing a significant increase compared to only 42% in the same period in 2018-2019. This phenomenon has the potential to create long-term population imbalances if not addressed.

An interview with Mr. Dani Rayhan on 15 February 2024 revealed innovative technical adaptations developed by conservation groups to address this problem. Based on analysis of multi-year temperature data, they have designed a layered breeding system with precisely controlled temperature gradients. This approach integrates modern technology in the form of digital sensors with the traditional "Wamboko" shading technique which uses palm leaves woven according to a certain pattern. Eggs are strategically positioned in this layered system to maintain gender balance in the resulting cohort of hatchlings. The effectiveness of this approach is documented in hatching records showing that with the implementation of temperature control systems, conservation groups have succeeded in achieving a male:female ratio of approximately 1:1.7 for hatchlings released by 2024. This achievement contrasts with the estimated ratio of 1:8.5 for natural hatchings in the same period, indicating success in mitigating the impacts of warming.

Increased Predation

Intensive monitoring of 96 sea turtle nests during the 2023-2024 nesting season revealed alarming levels of predation. Through a combination of methodologies that included direct observation, installation of surveillance cameras, and track analysis, the conservation team identified a spectrum of predators that threaten the survival of sea turtle eggs. An interview with Emili Lusia on 14 February 2024 revealed that monitoring data showed 31% of unprotected nests experienced predation, a significant increase from 17% in 2019. Predator identification analysis showed that water lizards were the main threat (responsible for 52% of predation cases), followed by wild dogs (27%), crabs (13%), and various species of shorebirds (8%).

The spatial distribution of predation events also shows a clear pattern. Mr. Kris Sopater explained that through comprehensive predation intensity mapping, the conservation team found a strong correlation between proximity to human settlements and predation levels. Nests within an 800-meter radius of residential areas experienced 3.2 times higher levels of predation than more isolated nests. In addition, vegetation characteristics also have a significant influence, with areas having less than 30% vegetation cover showing higher vulnerability to predation.

In the face of these challenges, conservation groups have developed nest protection systems based on empirical evidence**.** Mr. Daniel Pieter in an interview on February 16, 2024, explained that based on analysis of predation data collected from 2018-2023, they have implemented a two-tier protection strategy. For areas identified as high risk, they use "Kwofi nest protection" – an adaptation of a traditional design modified with the use of bamboo and wire mesh. Field tests show that this innovation has been effective in reducing predation by up to 82% compared to unprotected nests.

Conflict With Fishing Activities

A comprehensive survey of fishing activities in Skouw Yambe waters conducted in January-February 2024 revealed complex interactions between turtle conservation and the livelihoods of coastal communities (Kalor et al., 2018). The study involved in-depth interviews with 36 local fishermen and detailed mapping of 22 fishing locations. An interview with Mr. Daniel Piter on 16 February 2024 revealed the identification of 9 main conflict areas where fishing activities overlap with turtle migration routes. Analysis of bycatch reports since 2020 shows that an average of 17 turtles per year are entangled in fishing gear, with large mesh gill nets being the riskiest gear for turtles.

Data collected from local fishermen revealed spatial and temporal patterns of turtle-fishery interactions. Around 84% of turtle catch cases occur in shallow waters with a depth of less than 10 meters and within 2 kilometers of the coast. Temporal patterns show increased interactions during the turtle migration period towards nesting areas, especially between November and January.

An interview with Mr. Johny Tobby on February 12, 2024, revealed collaborative initiatives developed to address these conflicts of interest. Based on conflict mapping and analysis of by-catch data, the community formed a "Fisherman and Conservation Forum" in 2022 which will become a dialogue platform between fishermen and the conservation team. The forum has successfully developed a season-based zoning system that prohibits fishing activities in key migration corridors during the peak spawning season. Apart from that, this forum also facilitates the introduction and adoption of turtle-friendly fishing gear modifications, such as nets with adjusted eye sizes and the installation of turtle excluder devices.

An impact evaluation of this initiative carried out in February 2024 showed positive results, with a 58% reduction in turtle catch cases compared to the same period in 2022. The adoption rate of fishing gear modifications also showed encouraging progress, with 22 out of 36 fishers (61%) now having adopted the recommended fishing gear modifications. This shows the success of a

collaborative approach that integrates conservation needs and livelihood sustainability.

The turtle conservation program in Skouw Yambe, Papua, has demonstrated significant effectiveness in efforts to preserve endangered species, with a particular focus on leatherback turtles (Dermochelys coriacea) and green turtles (Chelonia mydas). The successful implementation of this program is supported by three fundamental, interconnected components. First, the level of awareness and participation of local communities as reflected through active involvement in habitat monitoring, implementation of conservation practices based on local wisdom, and sustainable intergenerational knowledge transfer. Second, support for synergistic collaboration with government agencies, active involvement of Non-Governmental Organizations, and integration of community empowerment programs. Third, conducive natural habitat conditions, characterized by the suitability of geographical characteristics, the availability of adequate nesting sites, and the existence of optimal supporting ecosystems. This phenomenon illustrates the complexity of the interaction between ecosystems and anthropogenic activities, confirming the implications of ecosystems on human cultural behavior (Nyadzi et al., 2021).

The breeding protocol includes a 15–20-day incubation period prior to release of the hatchlings, with special consideration of swimming ability. Temperature management is critical, given its role in determining the sex of the turtles – lower temperatures produce males, while higher temperatures produce females. This community-based conservation approach represents a synthesis of traditional knowledge and modern conservation principles, emphasizing the vital role of indigenous communities as stewards of ecosystems (Newcomb, 2016; Nez Henderson et al., 2022).

4. Conclusion

This research explores the dynamics of sea turtle conservation in Skouw Yambe Village, Papua, revealing the complex mechanisms of interaction between traditional ecological knowledge and modern conservation practices. Through an in-depth investigation of indigenous community practices, the study identifies that turtle conservation in this region is a sophisticated manifestation of an ecological adaptation system deeply integrated with the socio-cultural dimensions of the local community. Analysis unveils that the Skouw Yambe community has developed a conservation protocol spanning three critical stages: egg collection, a 45–60-day incubation period, and hatchling release management. This approach extends beyond the technical aspects of species preservation, representing a holistic paradigm that views conservation as a culturally profound practice, where every community member—from traditional leaders to young generations—plays an integral role in maintaining ecosystem balance.

Five primary ecological challenges were identified—plastic pollution, coastal erosion, temperature changes, increased predation, and conflicts with fishing activities—which the community has addressed through innovative adaptive strategies. Techniques such as the "Kambui" beach stabilization method, layered incubation systems, and the Fishermen and Conservation Forum demonstrate

their capacity to integrate traditional knowledge with contemporary scientific approaches, resulting in effective and sustainable conservation interventions.

This research is expected to contribute to the development of future benefits that can be obtained by indigenous communities, including efforts to ensure the long-term sustainability of the role played by indigenous communities. The concept of community-based conservation can serve as an important framework related to indigenous peoples' livelihoods and is aligned with sustainable environmental goals. The significance of this research transcends the documentation of local conservation practices. The study provides empirical evidence of the fundamental role of indigenous communities as ecosystem guardians, underlining the importance of traditional ecological knowledge in responding to global environmental challenges. The success of the sea turtle conservation program in Skouw Yambe emphasizes the urgency of a holistic approach that synergistically combines local wisdom, community participation, and modern conservation principles.

The proposed academic research recommendations emerge from the critical need to expand and deepen understanding of community-based marine conservation strategies. A primary focus is the development of comprehensive comparative studies that transcend local boundaries, exploring the nuanced variations of indigenous ecological wisdom across different coastal communities in Indonesia. By conducting systematic cross-location research, scholars can illuminate the diverse approaches to sea turtle conservation, revealing the rich tapestry of traditional knowledge systems that have evolved in response to specific ecological contexts.

Equally crucial is the implementation of long-term longitudinal research designs that extend over a decade or more. Such sustained investigations would provide unprecedented insights into the long-term impacts of community-based conservation practices, tracking the intricate mechanisms of community adaptation to ecological transformations. These studies would not merely document static preservation efforts but would dynamically capture the evolutionary trajectory of indigenous conservation strategies in the face of environmental challenges.

Conflicts of Interest

The authors declare that there is no conflict of interest.

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