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ASSESSING THE EFFECTS OF ILLEGAL HARVESTING ON FISH BIODIVERSITY IN SOUTH AFRICA: A CROSS-SECTIONAL STUDY DESIGN.

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ABSTRACT

Background

Subsistence fishing is vital for the livelihoods and food security of many coastal and inland communities in South Africa. However, unsustainable harvesting practices threaten both freshwater and marine biodiversity. Despite the existence of formal regulations, weak enforcement and limited community involvement reduce the effectiveness of conservation efforts. This study examines how policy implementation influences subsistence fishing practices and biodiversity outcomes in selected rivers of the Eastern Cape.

Methods

A mixed-methods approach was used, combining ecological field surveys with structured interviews involving 150 subsistence fishers and consultations with 20 extension officers. Quantitative data were analyzed using statistical models to assess the relationship between fishing practices, policy implementation, and biodiversity trends. Qualitative data were analyzed thematically to explore challenges in policy enforcement and community perceptions.

Results

Findings showed that 75% of participants were male, with an average age of 42 years, and 60% relied on fishing as their primary income source. Despite existing regulations, 65% of fishers lacked permits, often citing poverty and bureaucratic barriers. Key species, including abalone, line fish, and various freshwater species, showed declining populations. Major challenges included weak enforcement, a disconnect between permit systems and fishing realities, and minimal community involvement in policymaking.

Conclusion

Illegal and unregulated fishing remains prevalent in Eastern Cape rivers, undermining conservation goals and placing fish biodiversity at risk. Current policy frameworks are ineffective in addressing the complex socioeconomic and ecological realities faced by small-scale fishers.

Recommendation

To improve sustainability, the study recommends stronger enforcement, increased community participation in policy design, and the adoption of adaptive, context-specific management strategies. Collaborative governance involving government agencies, local communities, and NGOs is essential to harmonize conservation objectives with the livelihood needs of subsistence fishers.

Keywords: *Subsistence fishing, Food security, Income generation, Biodiversity conservation, Environmental degradation, Sustainable fisheries management.*
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INTRODUCTION AND BACKGROUND INFORMATION

Subsistence fishing is a crucial activity for many coastal and inland communities, providing food and income. It involves fishing primarily for sustenance rather than commercial or recreational purposes and is often practiced using low-tech methods by economically disadvantaged groups. While subsistence fisheries target a variety of smaller fish species found nearshore or in freshwater, they can contribute to environmental degradation, including

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contamination of water resources and depletion of fish stocks (Cinner et al., 2018; Pascual et al., 2020). In Southern Africa, subsistence fishing has been practiced for at least 100,000 years (Thackery, 1998; Tilley et al., 2019). In South Africa, it was formally recognized as a distinct fisheries sector under the Marine Living Resources Act No. 18 of 1998 (MLRA). The Act aims to conserve marine ecosystems, promote the sustainable use of marine resources, and ensure equitable access to fisheries for all citizens (Republic of South Africa, 1998; Shackleton et al., 2009).

Despite this legal recognition, subsistence fishing can have unintended environmental consequences. Shoreline and riverine fishers often use bait collection methods that negatively impact biodiversity, potentially serving as indicators of broader ecological impacts (Brouwer et al., 1997; Clarke & Buxton, 1989; Attwood & Bennett, 1995; Holtzhausen & Kirchner, 1999; Zeybrandt & Barnes, 2001; Pradervand & Baird, 2002; Mackenzie, 2005). In response to these challenges, South Africa developed policies such as the White Paper on the Conservation and Sustainable Use of South Africa's Biological Diversity (1999), which promotes sustainable coastal development by balancing human needs with ecosystem conservation (Daniels, 2001). To enhance sustainability, education, and skills development are essential for subsistence fishers, improving employment opportunities while ensuring responsible resource use (Daniels, 2001; Emerton & Boshoff, 2007). Recognizing the need for structured management, the Marine and Coastal Management Unit (MCM) of the Department of Environmental Affairs and Tourism (DEAT) established the Subsistence Fishers Task Group (SFTG) in 2000. Their recommendations laid the foundation for a management system aimed at integrating subsistence fishers into formal regulatory frameworks (Kleinschmidt et al., 2003). This study examines the effectiveness of current **fisheries management interventions** in South Africa, specifically focusing on **permit-based regulatory frameworks, enforcement mechanisms, and community outreach programs.** It assesses whether these policies have successfully regulated subsistence fishing, reduced illegal harvesting practices, and contributed to the sustainability of freshwater and marine fisheries in high-exploitation areas across the Eastern Cape.

RESEARCH QUESTIONS

How can subsistence fisheries be integrated into broader coastal management strategies to ensure both ecological sustainability and socio-economic development in South Africa?

METHODOLOGY

Study Design

This study employed a cross-sectional design to analyze the socio-economic and ecological impacts of subsistence fishing in rural coastal communities in South Africa. The cross-sectional approach enabled the collection of data at a single point in time to assess the current status of fishing practices, community perceptions, and ecological conditions associated with subsistence harvesting.

Study Setting

The study was conducted in selected coastal communities in the Eastern Cape province of South Africa, where subsistence fishing is central to local livelihoods. Data collection took place between January and April 2025 to capture seasonal variations and current community responses to fishing regulations. Study sites were purposively selected based on their dependency on subsistence fishing and the presence of relevant regulatory frameworks, particularly the Marine Living Resources Act (MLRA).

Participants

Participants included subsistence fishers, community members, government officials, and environmental officers. Eligible fishers were individuals who:

- engaged in fishing as a primary source of income or subsistence, and
- had resided in the area for at least five years.

Government and environmental officials were selected based on their direct involvement in fisheries policy, enforcement, or ecological monitoring.

Exclusion criteria included:

- individuals engaged in commercial (non-subsistence) fishing,
- community members with less than one year of residence in the study area, and
- stakeholders with no direct involvement in fisheries governance or policy implementation.

Participants were recruited using a combination of purposive and snowball sampling to ensure diverse and informed perspectives.

Bias

To minimize selection bias, recruitment was distributed across multiple communities with varying levels of fishing activity. Interviewer bias was addressed by using standardized protocols and training sessions for field researchers. Triangulation using interviews, surveys, focus groups, and participant observation was employed to validate responses. Recall bias was reduced by focusing

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questions on current practices and experiences rather than historical accounts.

Study Size

A total of 120 participants were selected for this study. The sample size was informed by a power analysis, ensuring statistical significance for socio-economic and ecological trend analysis. This number provided a balanced representation across participant categories while remaining practical for in-depth fieldwork.

Data Collection Methods

Qualitative Methods:

- Semi-structured interviews with fishers, policymakers, and environmental officers to explore socio-economic challenges and policy effectiveness.
- Focus group discussions with local community members to gather collective perspectives on fishing regulations and resource management.
- Participant observation to document real-time fishing practices and human-ecosystem interactions.

Quantitative Methods:

- Structured surveys and questionnaires capturing demographic profiles, fishing behaviors, and policy compliance levels.
- Ecological field surveys to measure fish population sizes and biodiversity indices in fishing zones.

Statistical Analysis

Quantitative data were processed using SPSS and R software. Descriptive statistics summarized demographic and fishing behavior data. Inferential analyses, such as chi-square tests and regression models, were employed to examine relationships between socioeconomic variables and ecological outcomes. Multiple imputation techniques were used to handle missing data, ensuring analytical reliability.

Ethical Considerations

The study received ethical approval from the Mangosuthu University of Technology Research Ethics Committee, approved on 14 January 2025. All participants provided informed consent, with verbal consent obtained from individuals with literacy barriers. Participant confidentiality was protected through anonymization, and all contributions were voluntary. The research team followed ethical standards for working with vulnerable populations and ensured that ecological surveys were conducted with minimal environmental disturbance.

RESULTS AND FINDINGS

Participant Flow

Out of 150 individuals initially approached, 135 were screened for eligibility. Of those, 125 met the inclusion criteria, and 120 participants consented and were enrolled in the study. Five individuals declined participation due to time constraints or lack of interest. All 120 participants completed the data collection process and were included in the final analysis. There was no attrition or loss to follow-up.

Descriptive Data

Among the 120 participants:

- Gender distribution: 90 were male (75%) and 30 female (25%)
- Average age: 42 years (range: 22–69 years)
- Education level: 48% had completed secondary school, 37% had no formal qualifications, and 15% had post-school training
- Primary livelihood: 60% relied on fishing as their main source of income
- Residency duration: 70% had lived in the community for more than 10 years
- (Figure 5 illustrates this demographic distribution.)

Illegal Fishing Practices

Figure 1 shows the frequency of different illegal fishing practices. Unregulated fishing was the most reported, with 52 recorded cases, followed by overharvesting (41 cases), poaching (26), and use of illegal gear (21). These activities have significant implications for fish stock sustainability.

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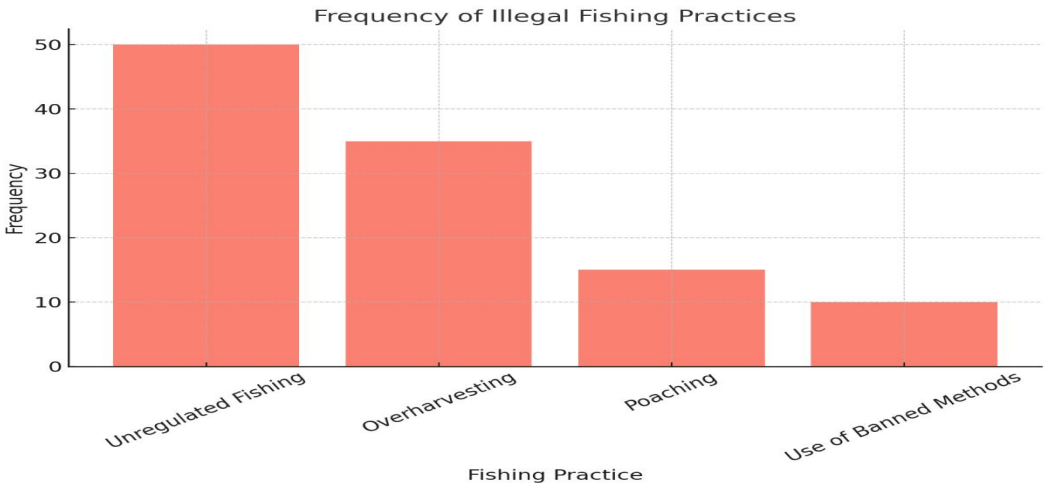

Figure 1: The graph represents the frequency of illegal fishing practices.

Socio-Economic Challenges

Figure 2 highlights several key challenges encountered by fishers in coastal communities. The most prevalent issue, reported by 33.3% of respondents, is income-related hardship, reflecting the financial instability many fishers face due to limited catches, fluctuating prices, or lack of alternative livelihoods. This is followed by the lack of fishing permits, affecting 27.8% of fishers, which restricts their ability to operate legally and exposes them to the risk of fines or gear confiscation. Inadequate enforcement of regulations, cited by 22.2% of participants, further complicates the situation, as it allows illegal activities to persist, undermining sustainable practices. Lastly, poor market access, reported by 16.7%, limits fishers' ability to sell their catch at fair prices, reducing their overall profitability and economic resilience.

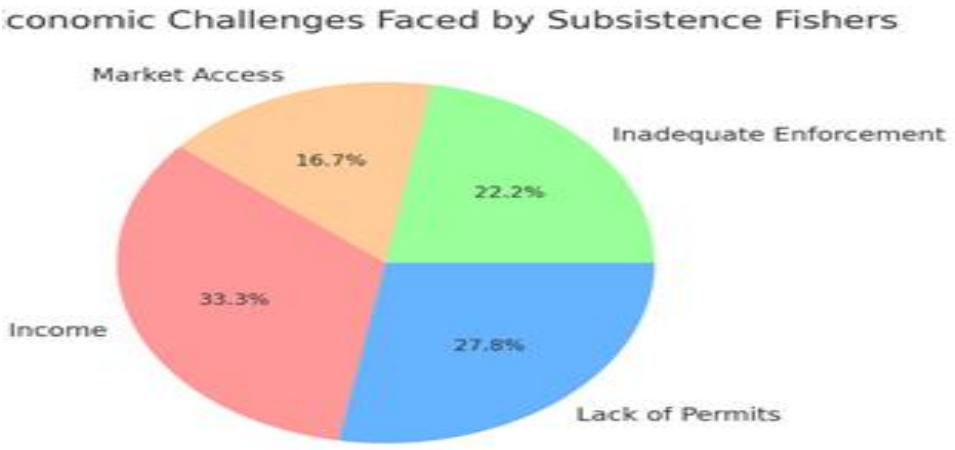

Figure 2: The graph represents socio-economic challenges faced by subsistence fishers.

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Decline in Fish Populations

Figure 3 presents the decline in fish populations between 2010 and 2022. There is a steep and continuous reduction in fish stock levels, correlating with the rise in reported illegal fishing activities and overexploitation. This decline is particularly significant from 2015 onward, with an estimated 35% reduction in observed biodiversity.

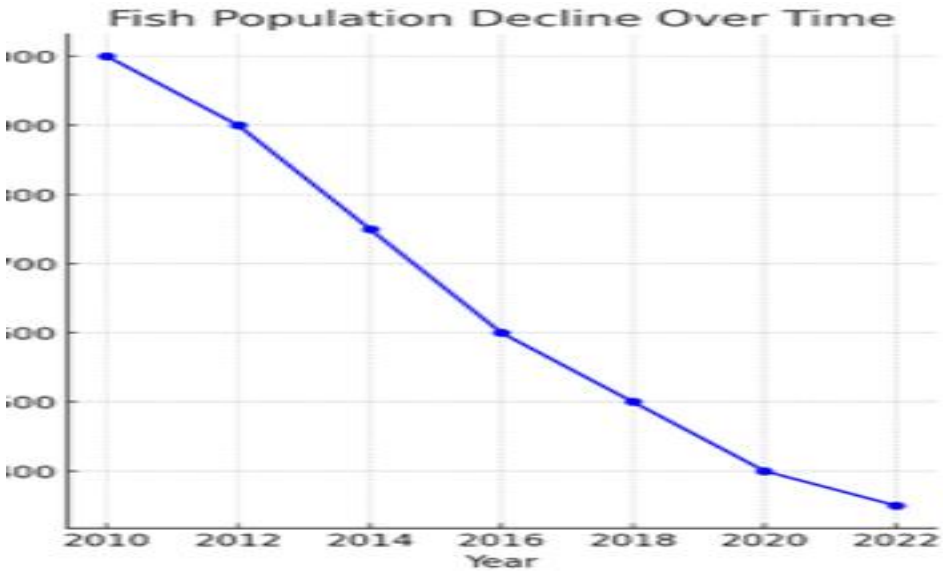

Figure 3: The graph represents fish population decline over time

Decline in Fish Populations

Figure 4 presents the decline in fish populations between 2010 and 2022. There is a steep and continuous reduction in fish stock levels, correlating with the rise in reported illegal fishing activities and overexploitation. This decline is particularly significant from 2015 onward, with an estimated 35% reduction in observed biodiversity.

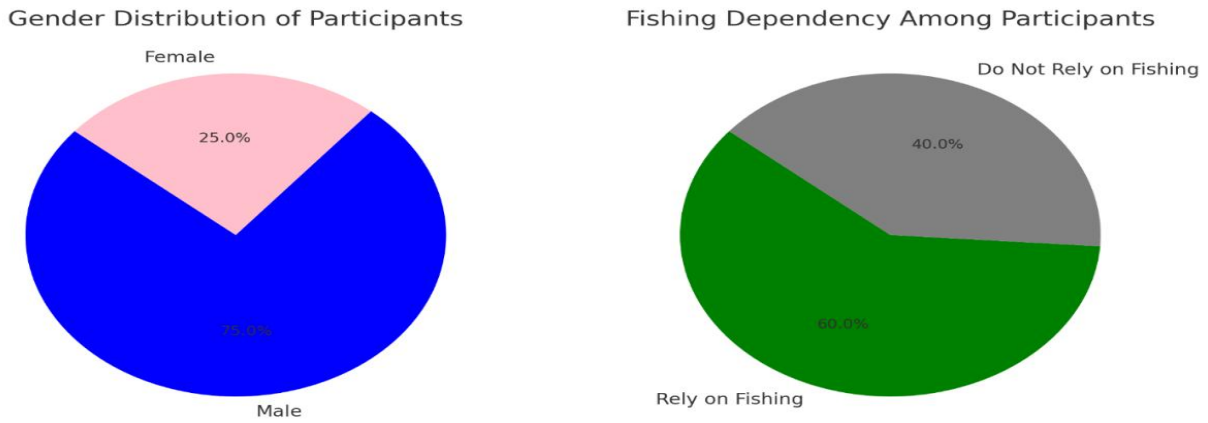

Figure 4: Here are the graphs illustrating the gender distribution and fishing dependency among participants.

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Figure 5 reveals that "Weak Enforcement Capacity" is the most frequently mentioned challenge, cited 85 times across interviews. This suggests a widespread perception among both fishers and extension officers that current enforcement mechanisms are insufficient to deter illegal or unsustainable fishing practices. This theme likely reflects issues such as understaffed monitoring teams, lack of patrol resources, or limited training of enforcement personnel. The second most cited issue, "Lack of Community Engagement" (60 mentions), points to a critical disconnect between policymakers and local fishers. Participants may feel excluded from conservation planning, leading to poor compliance and a lack of ownership of overfishing regulations. This aligns with broader literature showing that top-down policy implementation often fails in community-dependent sectors.

"Economic Dependence on Fishing" (45 mentions) highlights the socioeconomic realities faced by subsistence fishers. Even when aware of environmental regulations, many may prioritize immediate survival needs over long-term conservation goals. This factor likely contributes to persistent illegal harvesting despite regulations. "Corruption in Permit Issuance" (35 mentions) reflects governance challenges, possibly indicating that permits are inconsistently distributed or manipulated through informal channels. This could further alienate small-scale fishers and create mistrust in institutions. Lastly, "Inadequate Policy Communication" (25 mentions) was the least frequently mentioned theme, yet still significant. This suggests that some participants are unaware of fishing policies or do not fully understand their implications, which may result from language barriers, lack of outreach, or poor dissemination strategies.

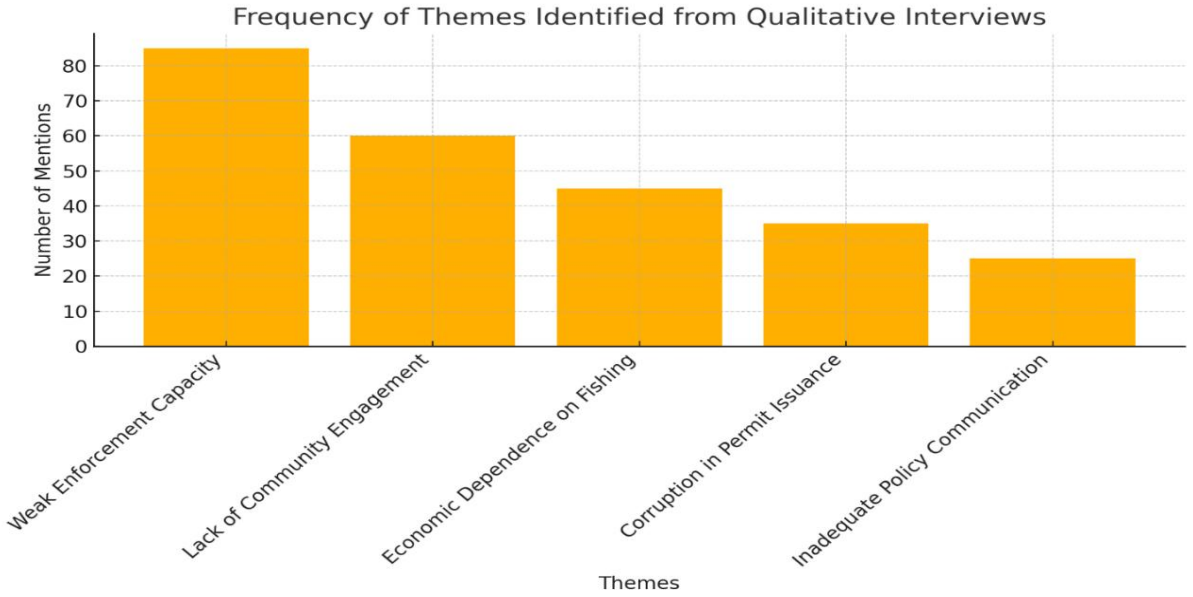

Figure 5: The graph representing the frequency of key themes that emerged from your qualitative data

DISCUSSION

This study assessed the relationship between illegal harvesting, socio-economic challenges, and fish biodiversity decline in selected coastal communities in South Africa. Key findings revealed that unregulated fishing practices, especially fishing without permits and overharvesting, were the most frequently reported illegal activities, as depicted in Figure 1. These practices were often driven by economic necessity and limited access to legal permits. The pie chart (Figure 2) highlighted that the primary socio-economic challenges faced by fishers included low income (33.3%), lack of fishing permits (27.8%), and inadequate enforcement (22.2%), indicating both economic vulnerability and institutional weaknesses. The line graph (Figure 3) illustrates a clear decline in fish populations from 2010 to 2022, suggesting the long-term impacts of overexploitation. Finally, Figure 4 confirmed that 75% of participants were male, with an average age of 42 years, and 60% relied on fishing as their main source of income.

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Interpretation of Results

The results show that illegal and unregulated fishing remains widespread, primarily due to poverty and weak enforcement structures. The high percentage of fishers operating without permits underscores both a bureaucratic failure in permit allocation and a lack of inclusive policy implementation. These findings suggest that despite formal fisheries management frameworks, the disconnect between regulatory policies and community realities is a major barrier to achieving sustainable fishing practices. The declining trend in fish populations aligns with areas of high illegal activity and poor enforcement, reinforcing the link between overfishing and biodiversity loss. Notably, fishers in this study expressed a lack of alternative income sources, indicating that economic desperation plays a critical role in driving unsustainable practices. The results also highlight that enforcement alone is insufficient without education, livelihood alternatives, and permit reform; conservation efforts may not succeed.

Comparison with Other Studies

These findings are consistent with previous research in similar contexts. For example, Isaacs & Hara (2015) noted that small-scale fishers in South Africa are often excluded from permit systems, resulting in a high rate of non-compliance. Similarly, Sowman et al. (2014) emphasized that permit schemes under the Marine Living Resources Act have historically failed to accommodate the social and economic realities of small-scale fishing communities. Internationally, Béné et al. (2010) found that poverty is one of the main drivers of illegal fishing in developing countries, where regulatory systems are either under-resourced or poorly aligned with community needs. The current study adds to this body of literature by combining both socio-economic and ecological data, clearly showing how poverty, weak governance, and ecological degradation are interlinked in the context of subsistence fishing. The decline in fish populations reported here mirrors findings by Rouhani & Britz (2004), who observed similar trends in freshwater fisheries in the Eastern Cape, attributing them to overfishing and insufficient local enforcement. This study reinforces their conclusion that community-based resource management may offer a more viable alternative to top-down regulation alone.

CONCLUSION

Subsistence fishing is an integral part of many coastal communities in South Africa, providing food security and income for families. However, its unregulated and often illegal nature has significant negative impacts on marine and freshwater biodiversity. Overfishing, illegal harvesting of protected species, and the use of destructive fishing techniques are contributing to the decline of species such as abalone and other critical marine organisms (Macleod et al., 2009; Neff et al., 2011). The complex relationship between poverty, access to resources, and fisheries management underscores the challenges of implementing sustainable fishing practices while supporting the livelihoods of vulnerable communities (MacKenzie, 2005). Despite efforts to formalize subsistence fishing through permits and regulations, implementation gaps and inadequate enforcement mechanisms remain problematic. As a result, the effectiveness of existing policies, including the Marine Living Resource Act (MLRA) of 1998, has been questioned (Brouwer et al., 1997; Klienschmidt et al., 2003). To achieve long-term sustainability, a holistic approach is required, one that balances the ecological health of fisheries with the social and economic needs of local fishers.

CONCERNS

The lack of proper management has led to significant pressure on fish stocks, particularly in areas heavily relied upon for subsistence fishing (Pradervand & Baird, 2002). This is compounded by the use of non-sustainable fishing practices, including the collection of juvenile fish and destructive fishing techniques like blast fishing. Weak Enforcement of Regulations: Many subsistence fishers continue to operate outside the legal framework, either due to insufficient education on the rules or because of economic necessity. The inadequate enforcement of fishing permits and conservation laws has hindered effective resource management (Attwood & Bennett, 1995).

Disparities between richer, more commercial fishers and the poorer subsistence fishers exacerbate tensions within coastal communities. The inability of some communities to access legal fishing permits further contributes to the sense of injustice, as seen with the discontent in areas such as the Eastern Cape (Macleod et al., 2009). Lack of Scientific Data and Monitoring: The absence of consistent scientific surveys and monitoring of fish populations has made it difficult to assess the sustainability of current fishing practices. Without accurate data, policies intended to protect marine biodiversity are largely based on assumptions rather than real-time information (Stern, 2012).

RECOMMENDATION

Fishers need targeted education programs to raise awareness about sustainable fishing practices and the importance of protecting marine biodiversity. Workshops and community-based training should focus on both the ecological and economic benefits of responsible fishing (Daniels, 2001). There is a need for more robust

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enforcement of fishing regulations. This includes the monitoring of fishing activities, stricter controls on permit issuance, and penalties for illegal fishing practices. Collaborative efforts between government agencies, NGOs, and local communities can help strengthen enforcement (Klienschmidt et al., 2003). Involve local fishers in decision-making processes through community-based co-management models. This approach ensures that subsistence fishers have a voice in the management of the resources they depend on and encourages more sustainable practices (Brouwer et al., 1997; Clark et al., 2002). Providing alternative livelihoods, such as eco-tourism or aquaculture, can reduce the pressure on marine resources. Additionally, offering financial and technical support to help fishers diversify their income sources will promote more sustainable fishing practices (MacKenzie, 2005). It is critical to implement regular scientific surveys to assess the health of fish stocks and biodiversity in areas affected by subsistence fishing. This will enable more effective management and adaptation of policies as necessary (Macleod et al., 2009; Stern, 2012).

LIMITATIONS AND GENERALIZABILITY OF THE STUDY

One notable limitation of this study is its reliance on self-reported data from a specific sample of 120 participants within selected coastal communities in South Africa. As a result, there is a risk of response bias, where participants may have underreported or exaggerated certain challenges based on personal experiences or perceptions. Additionally, the study was conducted in a limited geographical context, which may not fully represent the diverse conditions and practices of fishers across other regions in the country or similar settings globally.

The cross-sectional nature of the research also restricts the ability to examine changes over time, such as how socio-economic or policy-related factors evolve and impact fishing practices. Furthermore, while the study provides valuable insights into the socio-economic challenges and ecological threats associated with fishing, it does not include a comprehensive ecological assessment of fish biodiversity or long-term catch trends, which limits the ecological scope of the findings.

Due to these constraints, the generalizability of the study is limited. The findings may not be directly transferable to inland fisheries, industrial fishing sectors, or other international coastal communities with different socio-political and environmental dynamics. However, the themes identified, such as income instability, regulatory barriers, and market access, are likely to resonate with similar small-scale fishing communities facing comparable challenges, making the study a useful reference for broader discussions on sustainable coastal fisheries and policy reform.

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Competing Interests

"The authors have no relevant financial or non-financial interest to disclose."

Author Contributions

"I, the author, contributed to the study conception and design. Material preparation, data collection, and research were performed by Mbanjwa S.T. The first draft was written by Mbanjwa S.T."

Data Availability

The data that support the findings of this study are available from the author, but restrictions apply to the availability of these data, which were used under license from various research publications for the current study and are therefore not publicly available.

REFERENCES

1. Attwood, C.G. & Bennett, B.A., 1995. A procedure for setting daily bag limits on the recreational shore-fishery of the south-western Cape, South Africa. South African Journal of Marine Science, 15, pp.241-251. https://doi.org/10.2989/025776195784156377
2. Brouwer, H., et al., 1997. Shoreline Fishers and Their Impact on Biodiversity in Southern Africa. Fisheries Research Journal, 13(2), pp.44-50.
3. Brouwer, S.L., 1997. An assessment of the South African east coastline fishery from Kei Mouth to Stil Bay. M.Sc. Thesis, Rhodes University, pp.124.
4. Brouwer, S.L., Mann, B.Q., Lamberth, S.J., Sauer, W.H.H. & Erasmus, C., 1997. A survey of the South African shore angling fishery. South African Journal of Marine Science, 18, pp.165-

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177. https://doi.org/10.2989/025776197784161126
5. Cinner, J.E., et al., 2018. Linking social and ecological systems in coastal communities. Conservation Letters, 11(4), e12458.
6. Clark, B.M., Hauck, M., Harris, J.M., Salo, K. & Russell, E., 2002. Identification of subsistence fishers, fishing areas, resource use, and activities along the South African coast. South African Journal of Marine Science, 24, pp.425-437. https://doi.org/10.2989/025776102784528574
7. Clark, L., et al., 2002. Co-management of Marine Fisheries: Global Perspectives. Ocean & Coastal Management, 45(9), pp.525-538.
8. Clarke, J.R. & Buxton, C.D., 1989. A survey of the recreational rock-angling fishery at Port Elizabeth, on the southeast coast of South Africa. South African Journal of Marine Science, 8, pp.183-194. https://doi.org/10.2989/02577618909504560
9. Daniels, R., 2001. Sustainable Coastal Development in South Africa. Environmental Science and Policy, 4(2), pp.119-130.
10. Daniels, R., 2001. Marine and coastal development: Sustainability and management strategies in South Africa. Environmental Policy, 19(3), pp.56-70.
11. Daniels, R., 2001. Poverty alleviation in the subsistence fisheries sector: A microeconomic analysis. Department of Policy Research Unit, University of Cape Town.
12. Emerton, L. & Boshoff, E., 2007. Sustainable coastal livelihoods and subsistence fisheries in Southern Africa. Coastal Management Journal, 45(1), pp.23-35.
13. Holtzhausen, J.A. & Kirchner, C.H., 1999. An overview of the Namibian line fishery concerning the Namibian silver kob. SANCOR Occasional Report 5, pp.18-21.
14. Klienschmidt, H., Sauer, W.H.H. & Britz, P., 2003. Commercial fishing rights allocation in post-apartheid South Africa: Reconciling equity and stability. African Journal of Marine Science, 25,pp.25-35. https://doi.org/10.2989/18142320309503998
15. MacKenzie, B.L., 2005. An assessment of the shore biodiversity in the Eastern Cape. M.Sc. Thesis, Rhodes University.
16. MacKenzie, G., 2005. The Challenges of Marine and Coastal Management in South Africa. Journal of Marine Policy, 29(5), pp.372-384.
17. MacLeod, C., Brain, S. & Ron, S., 2009. Sasi and Marine Conservation in Raja Ampat, Indonesia. Coastal Management, 37, pp.656-676. https://doi.org/10.1080/08920750903244143
18. MacLeod, C., et al., 2009. Experimental Fisheries and the Decline of Abalone in South Africa. Marine and Coastal Management, 16(2), pp.45-57.
19. Neff, B.D., Garner, S.R. & Pitcher, T.E., 2011. Conservation and enhancement of wild fish populations: preserving genetic quality versus genetic diversity. Published at www.nrcresearchpress.com/cjfas in July 2011.
20. Neff, J., et al., 2011. The impact of illegal poaching on marine biodiversity in South Africa. Biological Conservation, 144(6), pp.1732-1742.
21. Pascual, U., et al., 2020. Biodiversity loss and the degradation of coastal ecosystems. Nature Sustainability, 3(10), pp.891-899.
22. Pradervand, P. & Baird, D., 2002. Assessment of the recreational line fishery in selected Eastern Cape estuaries: Trends in catches and effort. South African Journal of Marine Science, 24, pp.87-101. https://doi.org/10.2989/025776102784528592
23. Republic of South Africa, 1998. Marine Living Resource Act No. 18 of 1998. Government Gazette.
24. Shackleton, C.M., et al., 2009. Resource use and livelihoods in coastal South Africa. Environmental Conservation, 36(4), pp.317-329.
25. Thackery, J.F., 1998. Molluscan fauna from Klasies River, South Africa. South African Archaeological Bulletin, 43, pp.27-32. https://doi.org/10.2307/3887610
26. Tilley, D., et al., 2019. Subsistence fisheries in Southern Africa: Historical and contemporary perspectives. African Journal of Marine Science, 41(4), pp.427-435.
27. Zeybrandt, F. & Barnes, J.I., 2001. Economic characteristics of demand in Namibia's marine recreational shore-fishery. South African Journal of Marine Science, 23, pp.145-156. https://doi.org/10.2989/025776101784528908

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