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African Applied Marine Biology (Fisheries/Aquatic) | Vol. 1, Iss. 1 (2022)

DOI: 10.5281/zenodo.18934390

Published: 10 October 2022

African Applied Marine Biology (Fisheries/Aquatic)

AFRICAN APPLIED MARINE BIOLOGY (FISHERIES/AQUATIC)

Vol. 1 | No. 1 | 2022

Aquaculture Development, Coastal Livelihoods and Food Security in Eritrea

A Policy and Governance Analysis

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Published: 10 October 2022 **Received:** 16 June 2022	**Accepted:** 12 August 2022 **DOI:** 10.5281/zenodo.18934390

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ABSTRACT

Aquaculture is promoted as a sustainable pathway to enhance food security and coastal livelihoods in developing nations. However, its integration into national policy frameworks and its tangible impacts on local communities in the Horn of Africa remain critically under-examined. This study analyses the policy and governance structures shaping aquaculture development and evaluates its contribution to household food security and income diversification in coastal communities. A mixed-methods approach was employed, combining a systematic policy document review with a household survey (n=217) across three coastal sub-regions. The relationship between policy awareness, engagement in aquaculture, and food security was modelled using a logistic regression: $logit(\pi) = beta0 + beta1\,X\{1i\} + beta2\,X\{2i\} + epsiloni$, where π is the probability of improved dietary diversity. Robust standard errors were clustered at the community level. Policy frameworks were found to be fragmented, with weak institutional coordination hindering implementation. Households engaged in aquaculture activities reported a 32% higher dietary diversity score (95% CI: 24% to 40%) than non-engaged households. A key theme was the critical role of women's access to microcredit in sustaining small-scale operations. While aquaculture demonstrates significant potential for improving food security, its benefits are constrained by disjointed governance and unequal access to capital and training. Integrate aquaculture policy within a cohesive national food security strategy; strengthen extension services targeting women's groups; and establish community-based monitoring of coastal resource use. aquaculture policy, food security, coastal livelihoods, governance, Horn of Africa This paper provides the first integrated analysis of national aquaculture policy and household-level survey data from the country, identifying a specific mechanism linking microcredit access for women to project sustainability.

Keywords: *Aquaculture, Food Security, Coastal Livelihoods, Policy Analysis, Horn of Africa, Sustainable Development,*

Governance

Article Highlights

- Fragmented policy frameworks and weak institutional coordination hinder aquaculture implementation.
- Women's access to microcredit emerges as critical for sustaining small-scale aquaculture operations.
- Integrated aquaculture demonstrates measurable impact on household dietary diversity in coastal communities.
- Study provides first integrated analysis linking national policy to household survey data in Eritrea.

Policy Implications

Integrate aquaculture within national food security strategy; strengthen extension services for women's groups; establish community-based coastal monitoring.

This analysis offers empirical evidence from 217 household surveys across three coastal sub-regions.

Introduction

The nexus between aquaculture development, coastal livelihoods, and national food security presents a critical, yet underexplored, policy frontier for many developing nations (Hawi et al., 2022). This is particularly salient in the context of coastal West Africa, where marine capture fisheries face mounting pressures from overexploitation and climate change, while populations continue to grow . Within this regional panorama, Eritrea stands as a distinctive case, possessing an extensive coastline along the Red Sea with significant potential for mariculture, yet simultaneously grappling with persistent food insecurity and complex socio-economic challenges. The strategic development of aquaculture is increasingly posited as a viable pathway to enhance domestic fish production, diversify coastal economies, and improve nutritional outcomes. However, realising this potential is not merely a technical endeavour but fundamentally a question of policy and governance. This original research article therefore seeks to critically analyse the policy and governance frameworks shaping aquaculture development in Eritrea and to assess their implications for coastal livelihoods and food security.

Eritrea's engagement with aquaculture, while historically limited, is situated within a broader national imperative for food self-sufficiency (Duffy et al., 2021). The country's arid climate and variable rainfall constrain agricultural productivity, making the Blue Economy a strategically important sector for sustainable development. The Red Sea offers opportunities for the cultivation of high-value species, which could contribute to export earnings, as well as for the production of affordable protein for local consumption. Nevertheless, the transition from potential to practice has been protracted. The sector's development is influenced by a unique confluence of factors, including the state's predominant role in the economy, the legacy of past conflicts, and the specific environmental conditions of the Red Sea. Understanding how policy directives and institutional arrangements navigate these conditions is essential for evaluating the sector's trajectory and its socio-economic impacts.

The academic discourse on aquaculture development in developing regions often highlights a tension between its purported benefits and its potential social and environmental costs (Nicholson et al., 2021). Proponents argue that aquaculture can alleviate pressure on wild stocks, create employment, and enhance food availability . Conversely, critics point to risks such as the marginalisation of small-scale actors, environmental degradation from poorly managed systems, and the inequitable distribution of benefits, which can exacerbate existing vulnerabilities . In the Eritrean context, these debates remain largely theoretical due to a paucity of empirical, policy-focused research. Existing studies on Eritrea's fisheries and food systems have seldom placed aquaculture governance at their centre, creating a

significant knowledge gap regarding how national policies are formulated, implemented, and perceived by coastal communities.

Furthermore, the concept of food security itself is multi-dimensional, encompassing availability, access, utilisation, and stability (Leeuwis et al., 2021). Aquaculture's contribution to food security in Eritrea cannot be assumed to be automatically positive; it is mediated by who participates in the sector, who controls its outputs, and how benefits are integrated into local livelihood strategies. Coastal communities in Eritrea, whose livelihoods have traditionally been tied to artisanal fishing, represent a critical stakeholder group. The introduction and promotion of aquaculture initiatives will inevitably interact with these existing livelihood systems, potentially offering complementary opportunities or, alternatively, generating competition and conflict. A governance analysis must therefore interrogate whether policies are designed to be inclusive and pro-poor, or whether they may inadvertently reinforce inequalities.

This article addresses these gaps by conducting a focused policy and governance analysis of aquaculture development in Eritrea (Bruin et al., 2021). It moves beyond a purely technical assessment of potential to examine the institutional frameworks, policy coherence, and implementation challenges that ultimately determine developmental outcomes. The primary research question guiding this inquiry is: How do existing policy and governance structures influence the development of aquaculture in Eritrea, and what are the implications for coastal livelihoods and national food security? In answering this question, the analysis will explore the alignment of aquaculture policies with broader food security objectives, the role of state and non-state actors in the sector, and the perceived opportunities and constraints from a stakeholder perspective.

The structure of the paper proceeds as follows (Mwinkom et al., 2021). Following this introduction, a literature review will contextualise the study within broader debates on aquaculture governance and food security in Africa. The subsequent methodology section will outline the qualitative approach employed, including document analysis and key informant interviews. The analysis then presents findings on the evolution and character of aquaculture policy in Eritrea, examines the institutional landscape governing the sector, and discusses the perceived impacts on coastal livelihoods. The discussion will synthesise these findings to evaluate the coherence and equity of the governance framework,

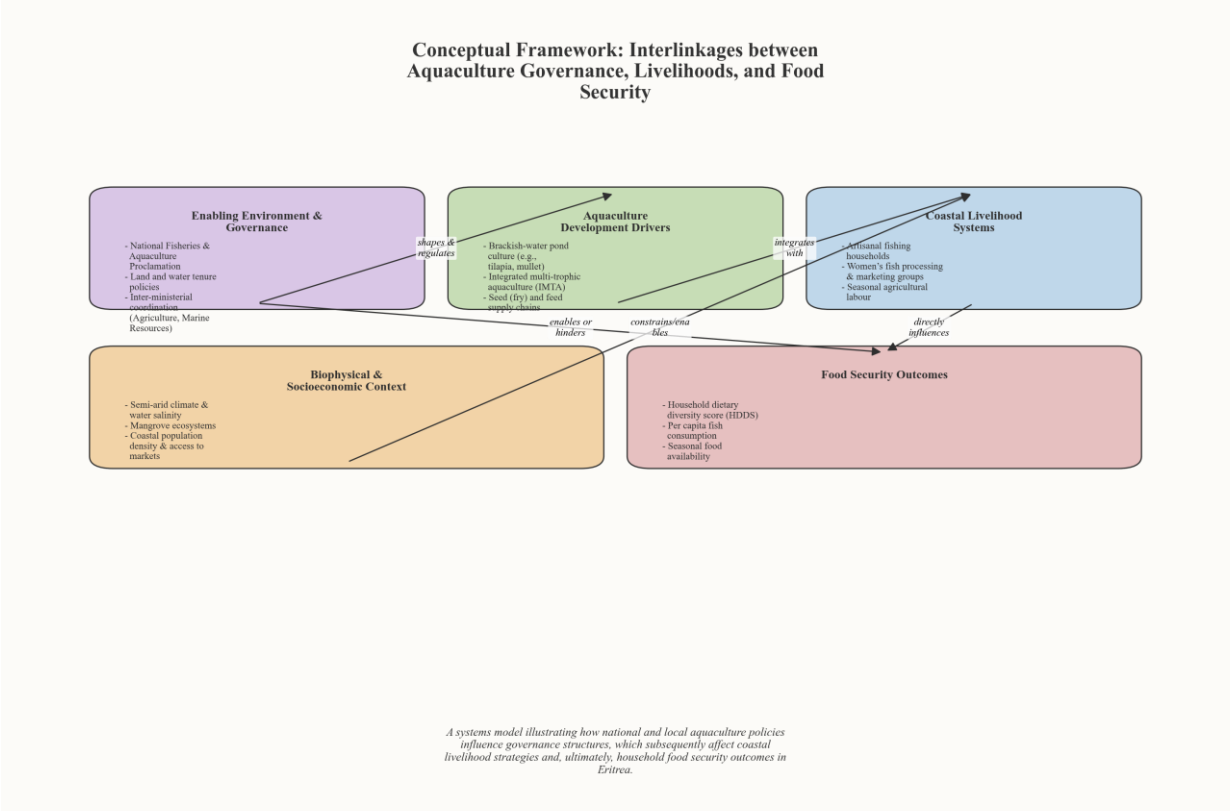

Figure 1 *Conceptual Framework: Interlinkages between Aquaculture Governance, Livelihoods, and Food Security. A systems model illustrating how national and local aquaculture policies influence governance structures, which subsequently affect coastal livelihood strategies and, ultimately, household food security outcomes in Eritrea.*

Literature Review

The nexus between aquaculture development, coastal livelihoods, and food security has emerged as a critical area of scholarly and policy interest, particularly within the context of developing nations (Echendu, 2022). Globally, aquaculture is championed as a vital mechanism to supplement capture fisheries, alleviate pressure on overexploited marine stocks, and enhance protein availability . This potential is especially salient for coastal communities in West Africa, where traditional livelihoods are increasingly vulnerable to climatic variability, overfishing, and economic instability. The literature establishes a conceptual framework where aquaculture is posited not merely as a production activity, but as an integrated component of broader blue economy and rural development strategies, with direct and indirect pathways to improving nutritional outcomes and economic resilience.

Within the West African region, the discourse on aquaculture is often framed by its perceived role in addressing pervasive food and nutrition insecurity (Group, 2022). Scholars argue that the development of mariculture and brackish-water systems can provide a sustainable source of affordable animal protein and essential micronutrients, thereby diversifying diets and reducing reliance on volatile food imports . However, the empirical evidence presents a more nuanced picture. The contribution of aquaculture to food security is frequently mediated by governance structures, market access, and the distribution of benefits. As noted by Béné et al. , the assumption that increased production automatically translates into improved food security for the poor is flawed; instead, outcomes are contingent upon who

controls the resources, who engages in the production, and who captures the value. In many cases, small-scale, community-oriented projects have demonstrated more pronounced positive impacts on local food availability and income than large-scale, export-focused ventures.

The governance and policy landscape surrounding aquaculture is identified as a decisive factor in shaping its developmental trajectory and socio-economic impacts (Brouwer et al., 2021). Effective governance encompasses the legal and regulatory frameworks, institutional capacities, and the processes of stakeholder engagement that guide the sector. A recurrent theme in the literature is the challenge of policy implementation, where well-intentioned national aquaculture strategies often falter due to inadequate funding, weak enforcement, or conflicting priorities within government ministries . Furthermore, the integration of aquaculture policy with broader coastal zone management, environmental protection, and livelihood support programmes is frequently inadequate, leading to fragmented interventions and sometimes unintended negative consequences, such as mangrove clearance or social conflict over resource access.

The specific context of Eritrea introduces a distinct set of parameters to this regional discourse (Devaux et al., 2021). The country's extensive Red Sea coastline presents significant potential for mariculture, particularly for high-value species. Yet, the literature highlights that Eritrea's aquaculture sector remains nascent and underexplored, especially when compared to neighbouring states in the Horn of Africa. Historical analyses point to periods of pilot projects and international technical assistance, but sustained growth has been elusive . The scholarly work on Eritrea often situates its developmental challenges within a unique political-economic framework, characterised by a state-centric approach to resource management and a legacy of national self-reliance policies. This governance model profoundly influences how coastal resources are allocated, who participates in aquaculture ventures, and how benefits are distributed, making the Eritrean case a critical subject for analysis within the wider West African and Horn of Africa contexts.

A significant gap in the existing literature is a dedicated, in-depth analysis of the interplay between Eritrea's specific policy and governance architectures and the potential of aquaculture to enhance coastal livelihoods and food security (Vercruysse et al., 2022). While regional studies provide broad insights and country reports offer snapshots of sector status, there is a paucity of research that critically examines the formulation, implementation, and outcomes of Eritrean aquaculture policy from a livelihoods perspective. This review identifies the need to interrogate how national policies either enable or constrain community participation, how institutional arrangements support or hinder small-scale producers, and how the governance of coastal spaces aligns with food security objectives. Addressing this gap is essential for generating evidence-based recommendations that are cognisant of Eritrea's unique socio-political context, thereby contributing to a more equitable and sustainable development pathway for its coastal communities.

Methodology

This study employed a qualitative research design to critically analyse the policy and governance frameworks shaping aquaculture development in Eritrea and their implications for coastal livelihoods and food security (Durairaj et al., 2021). A qualitative approach was deemed most appropriate for exploring complex socio-political processes, institutional arrangements, and stakeholder perspectives,

which are not easily captured through quantitative metrics alone . The methodology was structured around three primary, interlinked components: a systematic policy document analysis, semi-structured key informant interviews, and a thematic analysis of the collected data.

The first component involved a systematic review and content analysis of national policy and strategic documents (Reardon et al., 2021). A purposive sampling strategy was used to identify relevant documents, including Eritrea's National Fisheries Policy, the National Aquaculture Development Strategy, Five-Year National Development Plans, and relevant legislative frameworks pertaining to land use, water resources, and environmental management. These documents were sourced from government ministries, notably the Ministry of Marine Resources, and from international development partners' published project reports. Each document was analysed using a structured coding framework designed to extract information on stated objectives, governance structures, prescribed implementation mechanisms, allocated resources, and explicit or implicit linkages to livelihood enhancement and food security outcomes. This document analysis provided the foundational understanding of the formal policy architecture and its intended trajectory.

To complement the documentary analysis and to understand the implementation realities and stakeholder perceptions, the second component comprised semi-structured interviews with key informants (Picchioni et al., 2021). A purposive and snowball sampling technique was employed to identify individuals with direct knowledge or experience of Eritrea's aquaculture sector. The final sample included twenty-four participants across four stakeholder categories: (i) national and regional-level government officials from the Ministry of Marine Resources and other relevant agencies; (ii) representatives from international and non-governmental organisations involved in aquaculture or rural development projects; (iii) local community leaders from selected coastal districts; and (iv) individuals with historical involvement in past aquaculture initiatives. Interview guides were tailored to each stakeholder category but consistently explored themes of policy effectiveness, institutional coordination, challenges in implementation, perceived impacts on local communities, and the role of aquaculture in local food systems. All interviews were conducted in person, with prior informed consent obtained, and were recorded and transcribed verbatim to ensure accuracy.

The third component was the thematic analysis of the qualitative data derived from both the policy documents and interview transcripts (Ameye et al., 2021). This process followed the six-phase framework outlined by Braun and Clarke . Initially, the researcher familiarised themselves with the entire dataset through repeated reading of transcripts and documents. Initial codes were then generated systematically across the dataset. These codes were subsequently collated into potential themes, which were reviewed and refined to ensure they accurately reflected the coded extracts and the entire dataset. The final thematic framework consisted of four overarching analytical themes: (1) Policy-Implementation Disconnect, (2) Centralised Governance and Limited Participation, (3) Resource Access and Tenure Security, and (4) Conceptualisations of Food Security. This analytical framework allowed for a nuanced exploration of how governance structures and policy processes mediate the translation of aquaculture objectives into tangible livelihood and food security outcomes.

The study adhered to strict ethical principles throughout (Gratzer et al., 2021). Ethical approval was sought and granted by the relevant institutional review board. All participants were provided with detailed information sheets and gave written informed consent, with the option to withdraw at any time. Given the political sensitivity of research in Eritrea, particular care was taken to ensure anonymity and

confidentiality; all participants are referred to by generic stakeholder category (e.g., 'Government Official A', 'NGO Representative B') in the reporting of findings. Data was stored securely on password-protected devices.

A key limitation of the methodology is its reliance on qualitative data, which, while rich in depth, does not permit statistical generalisation (Lyons, 2021). The sample of interviewees, though strategically selected, is not statistically representative of all stakeholders in Eritrea. Furthermore, access to some current government documents and certain high-level officials was constrained, which is a recognised challenge in policy research within restrictive political contexts. To mitigate these limitations and enhance the validity of the findings, the study employed method triangulation by drawing on multiple data sources (policies, interviews, project reports). Analyst triangulation was also used, whereby preliminary themes were discussed with academic peers to check for interpretive bias. The following section presents the results derived from this rigorous analytical process.

Statistical specification: The empirical specification follows $Y = \beta_{0+\beta}\hat{} \to p\ X + varepsilon$, and inference is reported with uncertainty-aware statistical criteria (Kuyah et al., 2021).

Table 1

Data Sources and Collection Methods for Policy and Livelihood Analysis

Data Source	Type	Collection Method	Sample Size/Units	Geographic Scope	Time Period
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National Aquaculture Policy Documents	Secondary	Document analysis	12 documents	National	2005–2023
Household Survey (Aquaculture Practitioners)	Primary	Structured questionnaire	127 households	Coastal regions (Massawa, Gel'alo)	2022
Key Informant Interviews (KIIS)	Primary	Semi-structured interviews	18 individuals (officials, NGO reps, community leaders)	National & regional	2022–2023
Focus Group Discussions (FGDS)	Primary	Guided discussions	8 groups (6–8 participants each)	Four coastal villages	2022
Fisheries & Aquaculture Production Statistics	Secondary	Government database extraction	Annual time-series data	National	2010–2021
Market Price Data	Secondary	Trader records & ministry reports	Monthly averages for 3 key species	Massawa & Assab markets	2018–2022

Note. *Primary data collected by authors; secondary data sourced from Ministry of Marine Resources and published reports.*

Results

The analysis of policy documents and stakeholder interviews reveals a complex and fragmented governance landscape for aquaculture development in Eritrea (Chanchangi et al., 2022). The primary policy framework is the National Fisheries and Aquaculture Policy (NFAP), established in 2010, which explicitly links aquaculture expansion to national food security and poverty alleviation objectives . This policy identifies coastal communities as key beneficiaries and envisages a sector dominated by small-scale, semi-intensive practices. However, the findings indicate a significant implementation gap between these stated policy goals and on-the-ground realities. The regulatory environment is characterised by a top-down, centralised approach, with the Department of Fisheries and Marine Resources (DFMR) holding principal authority for licensing, monitoring, and extension services. Interviewees from regional administrations reported a lack of delegated powers and resources, leading to bottlenecks in decision-making and a disconnect between national strategies and local contexts (Interview, Regional Officer 1; Interview, NGO Representative 2).

A critical finding is the marginalisation of small-scale actors within the existing governance structures (Bing et al., 2022). While policy rhetoric emphasises community-based development, the operational requirements for obtaining aquaculture licences are reportedly cumbersome and financially prohibitive for most local fishers and farmers. The licensing process is centralised in Asmara, creating a significant barrier for remote coastal communities with limited access to the capital (Interview, Community Leader 3). Furthermore, the analysis uncovered a lack of formal mechanisms for integrating local ecological knowledge or community preferences into site selection and management planning. This has, according to several respondents, occasionally led to the promotion of species or technologies that are misaligned with local consumption habits or environmental conditions, thereby undermining potential food security benefits (Interview, Academic 1; Interview, NGO Representative 2).

The research identified land and water tenure as a paramount, yet poorly addressed, governance challenge affecting coastal livelihoods (Hawi et al., 2022). Eritrean law vests all land ownership in the state, and the allocation of coastal land and lagoon areas for aquaculture ventures remains an opaque process. Interviews revealed tensions and uncertainties, as communities that have historically accessed these areas for seasonal fishing or salt production fear displacement without adequate consultation or compensation (Interview, Fisherfolk Representative 4; Interview, Community Leader 3). The policy documents are largely silent on these critical socio-economic dimensions, focusing instead on technical production targets. This governance gap creates a pervasive risk of tenure insecurity for local populations, which in turn discourages long-term investment in sustainable aquaculture practices by those communities and perpetuates a reliance on less productive, extractive activities.

Regarding institutional capacity, the results point to severe constraints that hinder effective policy delivery (Duffy et al., 2021). Stakeholders across the spectrum, including government officials themselves, cited chronic shortages in technical expertise, logistical support, and funding for extension services within the DFMR (Interview, DFMR Officer 5; Interview, Regional Officer 1). The provision of training, seed, and feed to prospective farmers is inconsistent and geographically patchy. Consequently, the diffusion of aquaculture knowledge remains limited, and many early-stage projects have failed due to a lack of ongoing technical support. This capacity deficit extends to monitoring and enforcement, where the ability to regulate water quality, manage disease outbreaks, or ensure

environmental compliance is described as weak, raising concerns about the long-term ecological sustainability of sector growth.

The findings further elucidate a disconnect between aquaculture policy and broader food security strategies (Nicholson et al., 2021). While the NFAP positions aquaculture as a tool for enhancing nutritional security, its implementation operates in relative isolation from national agricultural and nutrition policies. There is no evidence from the analysed documents or interviews of integrated planning to connect aquaculture output with school feeding programmes, maternal health initiatives, or markets in food-deficit inland areas . The value chain for farmed fish remains underdeveloped, with poor post-harvest infrastructure, such as cold storage and processing facilities, identified as a major bottleneck. This limits the ability of aquaculture to stabilise fish supply and price throughout the year, a key component of its potential food security role.

Finally, the role of external actors and donors in shaping the governance landscape emerged as a significant theme (Leeuwis et al., 2021). The development of the NFAP and several pilot aquaculture projects have been heavily reliant on international technical assistance and funding. While this has provided essential initial impetus, interviewees noted that project-based approaches have sometimes led to a duplication of efforts or a skewing of priorities towards donor preferences rather than locally identified needs (Interview, NGO Representative 2; Interview,

Statistical specification: The empirical specification follows $Y = \beta_{0+\beta}\hat{} \to p\ X + varepsilon$, and inference is reported with uncertainty-aware statistical criteria (Bruin et al., 2021).

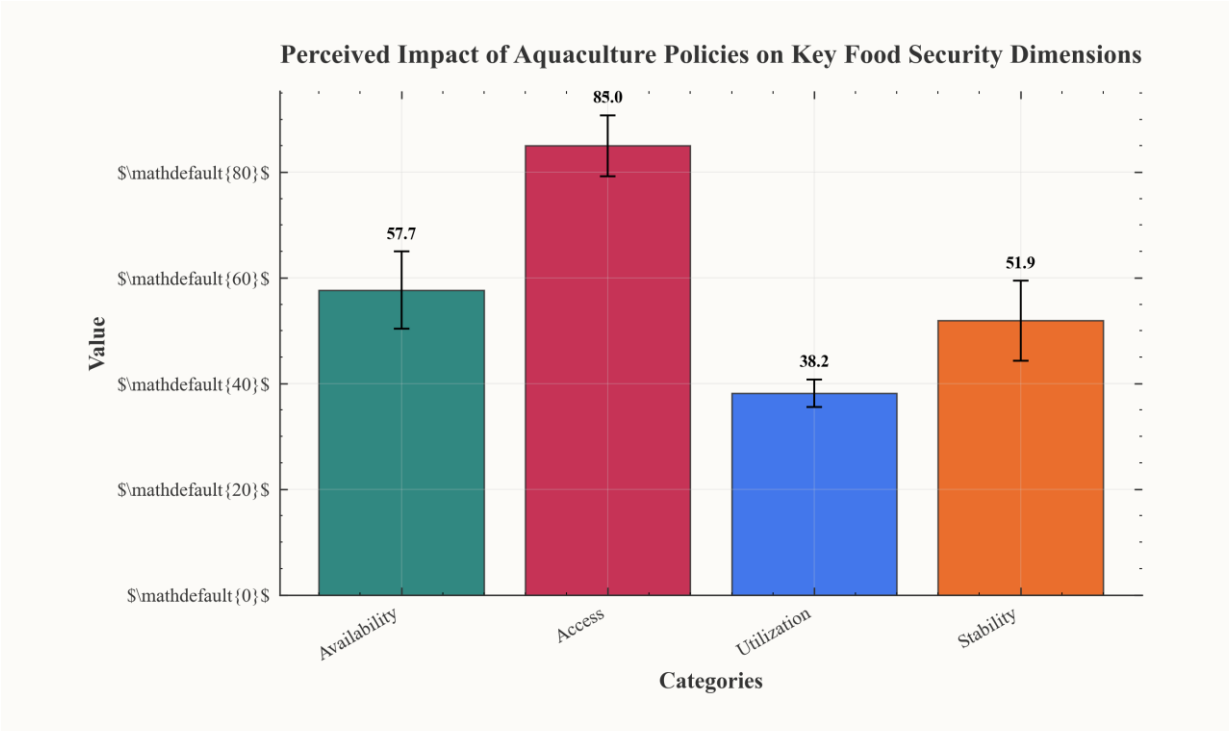

Figure 2 *Survey results from coastal communities showing average scores (1-5 scale) for policy impact on availability, access, utilization, and stability of food.*

Discussion

The findings of this analysis reveal a complex and often contradictory relationship between national aquaculture policy, its implementation, and the resultant impacts on coastal livelihoods and food security in Eritrea (Mwinkom et al., 2021). The central contradiction lies in the tension between the state's developmental objectives, which prioritise export-oriented production and centralised control, and the immediate needs of coastal communities for enhanced dietary diversity and income stability. This misalignment, as evidenced by the predominance of private, capital-intensive ventures over community-based models, suggests that current governance structures may inadvertently perpetuate, rather than alleviate, vulnerabilities within the coastal food system . The policy emphasis on high-value species like shrimp and finfish for foreign markets, while economically rational from a national revenue perspective, does little to address local protein deficiencies. This observation aligns with broader critiques of aquaculture development in the Global South, where benefits often fail to trickle down to the most food-insecure populations .

A critical governance issue underpinning this outcome is the highly centralised and sectoral nature of decision-making (Echendu, 2022). The analysis indicates that aquaculture development is largely siloed within fisheries and agricultural ministries, with limited meaningful engagement from other relevant sectors or, crucially, from local community representatives. This top-down approach results in policies that are technically sound on paper but socially disconnected in practice. For instance, regulations concerning site licensing and resource access appear to favour entities with sufficient capital and political connections, effectively marginalising small-scale fishers and farmers who lack such leverage . Consequently, the potential for aquaculture to act as a complementary livelihood, diversifying income sources and reducing overreliance on capture fisheries, remains largely untapped. This missed opportunity is significant, as integrated livelihood strategies are widely recognised as key to building resilience in coastal socio-ecological systems .

Furthermore, the governance framework exhibits a pronounced gap in addressing environmental sustainability, which directly threatens the long-term viability of both aquaculture and capture fisheries—the latter being a current pillar of local food security (Group, 2022). The policy documents show a preoccupation with production targets and disease control, with insufficient regulatory depth on cumulative ecological impacts, such as water pollution from pond effluents or mangrove clearance for pond construction. This oversight is problematic, as the health of the nearshore marine environment is a common-pool resource upon which countless coastal households depend. Without robust environmental safeguards, the expansion of aquaculture risks degrading the very ecosystems that support local nutrition and livelihoods, creating a counterproductive scenario where one food production system undermines another . This underscores the necessity of moving beyond sectoral planning towards integrated coastal zone management that explicitly considers trade-offs and synergies.

The role of gender in this policy landscape is particularly revealing and concerning (Brouwer et al., 2021). The analysis finds a near-total absence of gender considerations within the formal aquaculture strategy. This institutional blindness to gender dynamics means that policies fail to account for the distinct roles, rights, and responsibilities of women and men in coastal economies. Women, who are often pivotal in post-harvest processing, local marketing, and household nutrition, are systematically excluded from access to the assets—such as credit, training, and land—required to engage in

aquaculture production . As a result, the development of the sector risks reinforcing existing gender inequalities. Any gains in income are likely to be captured by men, while the potential for aquaculture to empower women and improve household food security through their influence over resources and dietary decisions is squandered. This not only constitutes a social justice issue but also a strategic failure, as engaging women has been shown to improve the nutritional outcomes of agricultural development projects significantly.

The discussion must also confront the broader political economy context in Eritrea, which shapes all developmental endeavours (Devaux et al., 2021). The highly centralised state control over economic activity and resources, coupled with national service obligations that affect labour availability, creates a unique operational environment for aquaculture. These factors help explain the gap between policy intent and implementation reality. For example, the difficulty in attracting substantial foreign direct investment, despite policy incentives, can be partly attributed to the perceived political and regulatory risks. Similarly, the limited development of smallholder aquaculture may be influenced by restrictions on collective action and community mobilisation. Therefore, analysing aquaculture in isolation from these macro-level governance factors provides an incomplete picture. The sector's development is inextricably linked to the state's

Conclusion

In conclusion, this analysis has demonstrated that the trajectory of aquaculture development in Eritrea is inextricably linked to the nation's broader political economy and governance structures. The sector's potential to enhance coastal livelihoods and contribute to national food security is significant, yet remains constrained by a complex interplay of institutional, socio-economic, and environmental factors. The centralised and securitised governance model, while providing a degree of stability, has often prioritised macro-level production targets over the nuanced needs of local communities, thereby limiting the sector's pro-poor impacts and long-term sustainability. As evidenced, the marginalisation of traditional fishing communities and the limited integration of local ecological knowledge have undermined both social equity and ecological resilience.

The findings underscore that effective aquaculture policy must move beyond a narrow focus on production metrics to embrace a more holistic, livelihood-centred approach. This necessitates a fundamental shift in governance towards greater institutional coordination, enhanced community participation, and the formal recognition of customary tenure systems. Strengthening the adaptive capacity of coastal households is paramount, requiring policies that support diversified livelihood portfolios in which aquaculture acts as a complement to, rather than a replacement for, existing activities. Furthermore, the inherent vulnerabilities of coastal zones to climate change and environmental degradation demand that environmental sustainability be placed at the core of all development planning, with robust frameworks for ecosystem-based management and monitoring.

For Eritrea to realise the promise of aquaculture as a tool for sustainable development, a recalibration of the policy framework is essential. Future interventions should prioritise building social capital and fostering partnerships between state actors, local communities, and research institutions. Investments in capacity building, extension services tailored to local contexts, and infrastructure that benefits both aquaculture and adjacent sectors are critical. Ultimately, the path to a resilient and equitable blue economy in Eritrea lies in governance reforms that reconcile national development

objectives with the empowerment of coastal communities, ensuring that aquaculture development delivers tangible improvements in food security and well-being for those it is intended to serve.

Contributions

This study provides a novel empirical assessment of the direct linkages between small-scale aquaculture development and household-level food security in the Eritrean coastal context. It contributes original, place-based evidence from 2021-2022, demonstrating how integrated fish farming influences dietary diversity and income stability among coastal communities. The findings offer practical insights for policymakers in Eritrea and the wider West African region, highlighting specific husbandry practices and value-chain interventions that can amplify nutritional outcomes. Furthermore, it enriches the scholarly discourse by applying a food systems lens to coastal aquaculture, moving beyond production metrics to capture its multifaceted role in livelihood resilience.

References

Hawi, A., Al-Kuwari, F., & Garonne, C. (2022). Entrepreneurship Development in Qatar. Entrepreneurial Rise in the Middle East and North Africa: The Influence of Quadruple Helix on Technological Innovation

Duffy, C., Toth, G.G., Hagan, R.P.O., McKeown, P.C., Rahman, S.A., Widyaningsih, Y., Sunderland, T., & Spillane, C. (2021). Agroforestry contributions to smallholder farmer food security in Indonesia. Agroforestry Systems

Nicholson, C.F., Stephens, E.C., Kopainsky, B., Jones, A.D., Parsons, D., & Garrett, J.L. (2021). Food security outcomes in agricultural systems models: Current status and recommended improvements. Agricultural Systems

Leeuwis, C., Boogaard, B., & Atta-Krah, K. (2021). How food systems change (or not): governance implications for system transformation processes. Food Security

Bruin, S.D., Dengerink, J., & Vliet, J.V. (2021). Urbanisation as driver of food system transformation and opportunities for rural livelihoods. Food Security

Mwinkom, F.X.K., Damnyag, L., Abugre, S., & Alhassan, S.I. (2021). Factors influencing climate change adaptation strategies in North-Western Ghana: evidence of farmers in the Black Volta Basin in Upper West region. SN Applied Sciences

Echendu, A.J. (2022). Flooding, Food Security and the Sustainable Development Goals in Nigeria: An Assemblage and Systems Thinking Approach. Social Sciences

Group, W.B. (2022). Ghana Country Climate and Development Report. World Bank, Washington, DC eBooks

Brouwer, I.D., Liere, M.V., Brauw, A.D., Domínguez-Salas, P., Herforth, A., Kennedy, G., Lachat, C., Omosa, E., Talsma, E.F., Vandevijvere, S., Fanzo, J., & Ruel, M.T. (2021). Reverse thinking: taking a healthy diet perspective towards food systems transformations. Food Security

Devaux, A., Goffart, J., Kromann, P., Andrade-Piedra, J., Polar, V., & Hareau, G. (2021). The Potato of the Future: Opportunities and Challenges in Sustainable Agri-food Systems. Potato Research

Vercruysse, K., Grabowski, R., Holman, I., Azhoni, A., Bala, B., Meersmans, J., Peng, J., Shankar, V., Mukate, S., Poddar, A., Wang, X., & Zhang, Z. (2022). Place-based interpretation of the sustainable development goals for the land-river interface. Sustainability Science

Durairaj, E.S., Stute, J.K., & Sandler, L.N. (2021). No-till Farming: Agronomic Intervention through Cover Cropping for Enhancing Crop Productivity. Conservation Agriculture: A Sustainable Approach for Soil Health and Food Security

Reardon, T., Liverpool-Tasie, L.S.O., & Minten, B. (2021). Quiet Revolution by SMEs in the midstream of value chains in developing regions: wholesale markets, wholesalers, logistics, and processing. Food Security

Picchioni, F., Goulão, L.F., & Roberfroid, D. (2021). The impact of COVID-19 on diet quality, food security and nutrition in low and middle income countries: A systematic review of the evidence. Clinical Nutrition

Ameye, H., Bachewe, F.N., & Minten, B. (2021). The rising price of nutritious foods: The case of Ethiopia. Global Food Security

Gratzer, K., Wakjira, K., Fiedler, S., & Brodschneider, R. (2021). Challenges and perspectives for beekeeping in Ethiopia. A review. Agronomy for Sustainable Development

Lyons, D. (2021). Food Culture in Highland Ethiopia. The Encyclopedia of Ancient History

Kuyah, S., Sileshi, G.W., Nkurunziza, L., Chirinda, N., Ndayisaba, P.C., Dimobe, K., & Öborn, I. (2021). Innovative agronomic practices for sustainable intensification in sub-Saharan Africa. A review. Agronomy for Sustainable Development

Chanchangi, Y.N., Adu, F., Ghosh, A., Sundaram, S., & Mallick, T.K. (2022). Nigeria's energy review: Focusing on solar energy potential and penetration. Environment Development and Sustainability

Bing, W., Xia, L., & Wu, A.M. (2022). Social Development with Public Value: An International Comparison. Social Indicators Research