

Impacts of Antandroy Migration on Water Resources, Fisheries, and Aquatic Biodiversity

Rejo Fienena Félicité¹, Andrianantenaina Tsiory Eric²

Université de Toliara, Madagascar. rejo_felicite@yahoo.fr⁽¹⁾

Université de Toliara, Madagascar. tsiorieric@gmail.com⁽²⁾

Abstract

Internal migration has become an important adaptation strategy to climate variability in southern Madagascar, yet its implications for natural resources remain insufficiently understood. This study investigated the impacts of Antandroy migration on water resources, fisheries, and aquatic biodiversity in the districts of Toliara I and Toliara II, Atsimo-Andrefana Region. A mixed-methods approach was employed, combining quantitative and qualitative data collected from 150 respondents through structured questionnaires, semi-structured interviews, field observations, and documentary review. Quantitative data were analyzed using descriptive statistics, while qualitative information was examined through thematic analysis. The findings reveal that migration is primarily driven by recurrent drought, food insecurity, and limited livelihood opportunities in the Androy Region. Sustained migration has increased domestic water demand, intensified fishing activities, and contributed to greater pressure on aquatic ecosystems, leading to declining water availability, reduced fishery resources, and deteriorating aquatic biodiversity. However, these environmental changes result from the combined effects of migration, climate variability, population growth, and inadequate natural resource governance rather than migration alone. This study provides an integrated understanding of the relationships between migration and aquatic resource management in southwestern Madagascar and highlights the need for coordinated policies promoting sustainable water management, responsible fisheries, biodiversity conservation, climate adaptation, and migration-sensitive development planning.

Keywords: *migration; resources; fisheries; biodiversity; Atandroy.*

Introduction

Human mobility has become one of the defining characteristics of environmental and socio-economic change worldwide. In many developing countries, internal migration is increasingly driven by the combined effects of climate variability, environmental degradation, livelihood insecurity, and demographic pressures. Rather than representing solely a demographic phenomenon, migration reshapes patterns of natural resource use and influences the sustainability of ecosystems in destination areas (Black et al., 2011; Adger et al., 2014). As populations relocate in search of better living conditions, increasing demands for water, food, and other natural resources may intensify environmental pressures, particularly in ecologically fragile regions.

Climate-induced migration has attracted growing scholarly attention during the past decade. The Intergovernmental Panel on Climate Change (IPCC, 2022) recognizes migration as one of the principal adaptation strategies adopted by vulnerable populations facing prolonged droughts, declining agricultural productivity, and food insecurity. While migration may improve household resilience, rapid population growth in receiving communities often increases competition for limited natural resources, including freshwater, fisheries, and coastal ecosystems (Black et al., 2011). Consequently, understanding the interactions between migration and environmental sustainability has become an important research priority within both migration studies and environmental management.

Madagascar represents one of the country's most vulnerable to climate change in Sub-Saharan Africa. The southern part of the country, particularly the Androy Region, experiences recurrent droughts, locally known as *kere*, which have severely affected agricultural production, livestock rearing, and household food security (FAO, 2021; WFP, 2022). These prolonged environmental stresses have accelerated internal migration toward comparatively resource-rich regions, especially Atsimo-Andrefana, where access to coastal fisheries, groundwater resources, and economic opportunities is relatively greater (Cooke et al., 2012; IOM, 2022; Eric et al., 2025). The districts of Toliara I and Toliara II have consequently become important destination areas for migrants, particularly members of the Antandroy community.

Although migration contributes to livelihood diversification and local economic development, it may also generate unintended environmental consequences. Population growth increases domestic water consumption, expands fishing activities, and intensifies the exploitation of aquatic ecosystems. Coastal environments, including mangrove forests, estuaries, and marine habitats, are particularly vulnerable to excessive resource extraction and weak governance (Cinner et al., 2012; IPBES, 2019). Furthermore, increasing fishing pressure and habitat degradation threaten biodiversity and undermine the ecological services upon which local communities depend (Millennium Ecosystem Assessment, 2005).

Previous studies have examined either migration dynamics in southern Madagascar (Muttenter, 2010; IOM, 2022; Emynorane et al., 2025) or the ecological challenges affecting marine and coastal resources (Cooke et al., 2012; Cinner et al., 2012; Emynorane et al., 2026). Other research has investigated the relationship between climate change and migration at the global scale (Black et al., 2011; Adger et al., 2014). However, limited empirical evidence exists regarding how the migration of Antandroy populations simultaneously affects water resources, fisheries, and aquatic biodiversity within receiving communities in southwestern Madagascar. Most existing studies address these issues separately, leaving an important knowledge gap concerning the interconnected effects of migration on aquatic socio-ecological systems.

Addressing this gap is particularly important because sustainable management of aquatic resources requires an integrated understanding of both ecological and human dimensions. Examining migration alongside water availability, fisheries, and biodiversity can provide evidence to support local planning, natural resource governance, and climate adaptation policies in Madagascar.

Therefore, this study investigates the impacts of Antandroy migration on water resources, fisheries, and aquatic biodiversity in the districts of Toliara I and Toliara II, Atsimo-Andrefana Region. Specifically, the study aims to (1) characterize the principal migration flows into the study area, (2) assess their effects on water resources, (3) evaluate their influence on fishing activities, and (4) examine their implications for aquatic biodiversity. The study hypothesizes that increasing migration intensifies pressure on water resources and fisheries, thereby contributing to the progressive degradation of aquatic ecosystems where resource governance remains inadequate.

This study contributes to the growing literature on climate-induced migration and environmental sustainability by providing empirical evidence from southwestern Madagascar. Its findings are expected to support policymakers, local authorities, and environmental managers in designing integrated strategies that balance human mobility, livelihood improvement, and the long-term conservation of aquatic ecosystems.

Methodology

This study employed a mixed-methods research design integrating quantitative and qualitative approaches to examine the impacts of Antandroy migration on water resources, fisheries, and aquatic biodiversity in the districts of Toliara I and Toliara II, Atsimo-Andrefana Region, Madagascar. A descriptive, exploratory, and analytical design was

adopted to characterize migration patterns and assess their environmental implications. The study area was purposively selected because it constitutes one of the principal destinations for migrants from the drought-prone Androy Region. The target population comprised migrant and indigenous households, fishers, water-resource users, local authorities, and technical officers involved in natural resource management. A total of 150 respondents participated in the study. Household respondents were selected through simple random sampling, while key informants were identified using purposive sampling based on their knowledge and responsibilities regarding migration, fisheries, water management, and environmental conservation (Cochran, 1977; Patton, 2015).

Primary data were collected using structured questionnaires, semi-structured interviews, direct field observations, and documentary review. The questionnaires gathered information on migration characteristics, water use, fishing activities, and perceptions of environmental change, whereas interviews with local authorities, technical agencies, and fisheries associations provided qualitative insights into resource governance and adaptation strategies. Field observations were conducted to assess water sources, fishing sites, mangrove ecosystems, and visible forms of environmental degradation. Secondary information was obtained from institutional reports and published literature related to migration, water resources, fisheries, and biodiversity. Quantitative data were analyzed using descriptive statistics, including frequencies and percentages, with Microsoft Excel and IBM SPSS Statistics. Qualitative data were analyzed through thematic content analysis following Braun and Clarke (2006). Finally, methodological triangulation was employed to integrate evidence from questionnaires, interviews, observations, and documentary sources, thereby enhancing the credibility and validity of the findings (Creswell & Creswell, 2018; Denzin, 1978; Miles et al., 2020).

Results and Discussion

Migration Characteristics of Antandroy Migrants

The survey findings indicate that the majority of migrants residing in the districts of Toliara I and Toliara II originated from the Androy Region, particularly the districts of Ambovombe (37.3%), Tsihombe (22.7%), and Beloha (18.7%) (Figure 1). Smaller proportions migrated from Bekily (13.3%) and Antanimora Sud (8.0%). This distribution demonstrates that migration is concentrated among populations living in the areas most severely affected by recurrent droughts, declining agricultural productivity, and chronic food insecurity. These findings are consistent with reports by the Food and Agriculture Organization (FAO, 2021) and the International Organization for Migration (IOM, 2022), which identify the Androy Region as one of Madagascar's most climate-vulnerable areas, where environmental degradation has become a major driver of internal displacement.

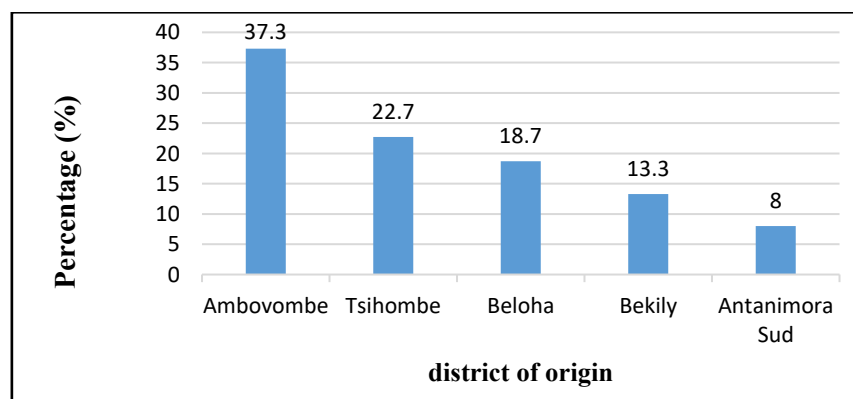


Figure 1: Districts of origin of the migrants surveyed

The principal motivations for migration further reinforce the close relationship between environmental stress and livelihood insecurity (Table 1). Employment and income generation represented the leading reason for migration (38.7%), followed by prolonged drought in the migrants' places of origin (28.0%). Other motivations included the search for agricultural land (12.7%), fishing opportunities (10.0%), family reunification (6.6%), and commercial activities (4.0%). These findings suggest that migration decisions are rarely driven by a single factor; instead, they reflect the interaction between climatic shocks and socio-economic constraints. Black et al. (2011) argue that environmental change generally acts as an indirect driver of migration by reducing livelihood opportunities rather than forcing immediate displacement. Likewise, Adger et al. (2014) emphasize that migration frequently represents an adaptive response to increasing environmental risks, allowing households to diversify income sources and improve their resilience.

Table 1. Main reasons for migration

Patterns	Effective	Percentage (%)
Job or income search	58	38.7
Drought in the Region of Origin	42	28.0
Search for agricultural land	19	12.7
Fishing activities	15	10.0
Family reunification	10	6.6
Trade and other activities	6	4.0
Total	150	100

Source: Field survey, 2026.

The duration of migrants' residence in the receiving communities also indicates that migration has become a long-term demographic process rather than a temporary coping strategy. Approximately 37.3% of respondents had lived in the study area for five to ten years, while 32.0% had settled within the previous five years and 30.7% had resided there for more than a decade (Figure 2). The relatively balanced distribution across these categories suggests that migration into Atsimo-Andrefana has occurred continuously over time. Long-term settlement is likely to strengthen migrants' integration into local economic activities, particularly fisheries and small-scale commerce, while simultaneously increasing demand for freshwater, land, and other natural resources.

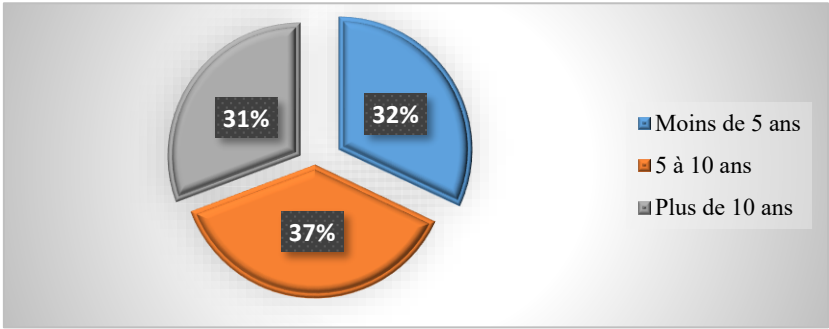


Figure 2. Length of residence in host communities

The migration characteristics identified in this study reveal an important socio-ecological dynamic in southwestern Madagascar. Previous studies have largely focused on documenting the climatic and economic factors driving migration from southern Madagascar (Muttенzer, 2010; IOM, 2022). In contrast, the present study extends this body of

knowledge by demonstrating that the persistence of migration flows is closely associated with increasing pressures on natural resources in destination communities.

Effects of Migration on Water Resources

The survey results indicate that domestic consumption constitutes the primary use of water in the study area, accounting for 54.0% of all reported water uses (Table 2). Agricultural and horticultural activities represented 17.3%, followed by fishing activities (13.3%), livestock production (10.7%), and commerce and small-scale enterprises (4.7%). The predominance of domestic water use reflects the increasing demand generated by population growth in migrant-receiving communities. At the same time, productive sectors such as agriculture and fisheries further intensify pressure on available water resources, particularly in coastal localities where economic activities depend heavily on reliable water supplies. These findings support previous observations by UN-Water (2021), which emphasize that demographic growth and expanding livelihoods significantly increase water demand in water-scarce regions. Similarly, the Food and Agriculture Organization (FAO, 2022) reported that climate variability and increasing human activities have amplified competition for freshwater resources in arid and semi-arid environments.

Table 2. Main uses of water according to the surveyed localities

Main uses	Mahav atsy	Amboh itsabo	Anke traky	Ankiam be-Bas	Belal anda	St Augustin	Soalara South	Anak ao	Total	Percent age (%)
Domestic consumption	10	9	9	8	12	10	11	12	81	54.0
Agriculture and market gardening	3	4	4	3	3	3	3	3	26	17.3
Livestock farming	2	2	2	2	2	2	2	2	16	10.7
Fishing activities	1	1	1	1	4	4	4	4	20	13.3
Trade and crafts	2	2	2	2	1	1	0	0	7	4.7
Total	18	18	18	16	22	20	20	21	150	100

Source: Field survey, 2026.

Respondents also perceived a substantial decline in water availability over the past decade (Table 3). Overall, 41% reported a strong decrease in water availability, while 36% observed a moderate decline. Only 17% considered water availability to have remained stable, and a small proportion (6%) perceived an improvement, mainly due to recent investments in boreholes and water distribution systems. These perceptions suggest that the combined effects of population growth, recurrent drought, and inadequate water infrastructure have reduced access to freshwater in both Toliara I and Toliara II. During field observations, respondents frequently reported longer waiting times at communal water points and declining groundwater levels, indicating increasing pressure on existing water sources.

Table 3. Perception of changes in water availability

Perception	Toliara I (%)	Toliara II (%)	Together (%)
sharp decrease	43	39	41
Moderate decrease	34	37	36
Stable	18	17	17
Improvement	5	7	6

Source: Field survey, 2026.

The observed reduction in water availability cannot be attributed solely to migration. Rather, migration appears to interact with climatic variability and institutional limitations to exacerbate existing water scarcity. The IPCC (2022) recognizes that climate change is intensifying drought frequency and reducing freshwater availability in many vulnerable regions, while UN-Water (2021) highlights the importance of strengthening water governance to ensure equitable resource allocation under increasing demand. In the study area, the continuous arrival of migrants increases domestic and productive water requirements, thereby accelerating competition for limited resources where infrastructure development has not kept pace with population growth.

The findings contribute new evidence to the growing body of literature on migration and environmental sustainability by demonstrating that migration influences not only the quantity of water consumed but also local perceptions of water security in receiving communities. While previous studies have primarily examined the climatic drivers of migration in southern Madagascar (FAO, 2021; IOM, 2022), this research illustrates how sustained migration flows may indirectly intensify pressure on freshwater systems in destination areas. These results underscore the importance of integrating migration dynamics into water resource planning and climate adaptation strategies to promote sustainable development in southwestern Madagascar.

Effects of Migration on Fisheries

The expansion of migration into the districts of Toliara I and Toliara II has been accompanied by noticeable changes in local fishing activities. Survey results indicate that 70.0% of respondents perceived an increase in fishing activities over recent years, including 32.0% who reported a substantial increase and 38.0% who observed a moderate increase (Table 4). In contrast, only 18.0% believed that fishing activities had remained stable, while 12.0% reported a decline. These findings suggest that migration has contributed to a growing dependence on fisheries as an accessible source of income and food security, particularly for households with limited access to agricultural land or formal employment. The expansion of fishing activities reflects the adaptive livelihood strategies adopted by migrants seeking economic opportunities in coastal communities.

Table 4. Perception of the evolution of fishing activities

Observed evolution	Effective	Percentage (%)
Sharp increase	48	32.0
Moderate increase	57	38.0
Stable	27	18.0
Decrease	18	12.0
Total	150	100

Source: Field survey, 2026.

The increase in fishing effort has generated multiple pressures on fishery resources (Table 5). Respondents identified the growing number of fishers as the most significant challenge (30.0%), followed by overexploitation of fish stocks (26.0%), the use of illegal or non-regulated fishing gear (18.0%), degradation of coastal habitats (14.0%), and pollution and other environmental factors (12.0%). These findings illustrate that the environmental consequences of migration extend beyond increased resource use to include changes in harvesting intensity and fishing practices. Similar patterns have been reported by Cinner et al. (2012), who demonstrated that increasing dependence on coastal fisheries often

accelerates resource depletion when management systems are unable to regulate fishing effort effectively. Likewise, the Food and Agriculture Organization (FAO, 2022) emphasizes that uncontrolled growth in fishing pressure remains one of the principal drivers of declining fish stocks in many developing coastal regions.

Table 5. Main pressures on fisheries resources

Pressures identified	Effective	Percentage (%)
Increase in the number of fishermen	45	30.0
Overexploitation of resources	39	26.0
Use of non-compliant equipment	27	18.0
Degradation of coastal habitats	21	14.0
Pollution and other factors	18	12.0
Total	150	100

Source: Field survey, 2026.

Perceptions of fishery resource availability further support these observations. Nearly three-quarters of respondents (74.0%) believed that fishery resources had declined during recent years, including 40.7% who reported a substantial decline and 33.3% who perceived a moderate decrease (Table 6). Only 17.3% considered fish stocks to be stable, while 8.7% observed some improvement, mainly in localities where community-based fisheries management and conservation initiatives had been implemented. Field observations also revealed that many fishers now travel greater distances and spend more time at sea to obtain catches comparable to those achieved in previous years, suggesting reduced resource availability and increasing fishing effort.

Table 6. Perception of the evolution of fisheries resources

Perception	Effective	Percentage (%)
sharp decrease	61	40.7
Moderate decrease	50	33.3
Stable	26	17.3
Improvement	13	8.7
Total	150	100

Source: Field survey, 2026.

The findings indicate that migration alone is not responsible for the decline in fishery resources. Instead, migration interacts with broader environmental and governance challenges, including climate variability, habitat degradation, and weak fisheries management. The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES, 2019) identifies overexploitation as one of the leading global drivers of biodiversity loss, while Cooke et al. (2012) highlighted the vulnerability of Madagascar's coastal fisheries to increasing human pressure. The present study reinforces these conclusions by demonstrating that sustained migration into coastal areas intensifies fishing activities and contributes to cumulative pressures on marine resources where regulatory capacity remains limited.

Unlike previous studies that primarily focused on ecological degradation or migration as separate phenomena, this research provides empirical evidence linking migration dynamics with changes in fishing intensity and perceived declines in fishery resources within receiving communities. These findings highlight the importance of

integrating migration considerations into fisheries governance, strengthening community-based resource management, promoting sustainable fishing practices, and expanding alternative livelihood opportunities to reduce long-term pressure on coastal ecosystems.

Effects of Migration on Aquatic Biodiversity

The findings indicate that migration has intensified multiple pressures on aquatic biodiversity in the districts of Toliara I and Toliara II. Respondents identified increased fishing activities as the most significant threat, representing 30.0% of reported pressures (Table 7). Other major factors included mangrove destruction (20.7%), water pollution (18.0%), expansion of human settlements (16.0%), and climate variability (15.3%). These results suggest that the environmental impacts of migration extend beyond increased resource consumption to include broader ecological changes affecting coastal and freshwater ecosystems. The growing demand for land, water, and fisheries associated with population expansion contributes to habitat degradation, particularly in mangrove ecosystems that play a critical role in maintaining biodiversity and supporting fish nursery habitats.

Table 7. Main pressures on aquatic biodiversity

Pressures identified	Effective	Percentage (%)
Intensification of fishing activities	45	30.0
Destruction of mangroves	31	20.7
Water pollution	27	18.0
Growth of human settlements	24	16.0
Climate variability	23	15.3
Total	150	100

Source: Field survey, 2026.

The prominence of mangrove degradation observed in this study is particularly significant because these ecosystems provide essential ecological services, including shoreline protection, carbon sequestration, nutrient cycling, and habitat for numerous aquatic species. As migrant populations become permanently established in coastal communities, the expansion of settlements and livelihood activities may accelerate the conversion of mangrove areas for housing, fuelwood, and small-scale economic activities. Similar concerns have been reported by Harris (2011), who emphasized the increasing vulnerability of Madagascar's coastal ecosystems to human-induced environmental change. Likewise, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES, 2019) identifies habitat destruction and overexploitation as among the leading global drivers of biodiversity loss.

Respondents' perceptions further revealed a widespread decline in aquatic biodiversity. Approximately 71.4% reported that aquatic biodiversity had decreased over recent years, whereas 20.0% considered biodiversity to have remained relatively stable and only 8.6% observed improvements (Figure 3). The reported decline was commonly associated with reduced abundance of aquatic species, degradation of mangrove habitats, and increasing exploitation of coastal resources. Although some communities acknowledged localized improvements resulting from mangrove restoration initiatives and community-based resource management, these positive developments appeared insufficient to offset the broader environmental pressures observed across the study area.

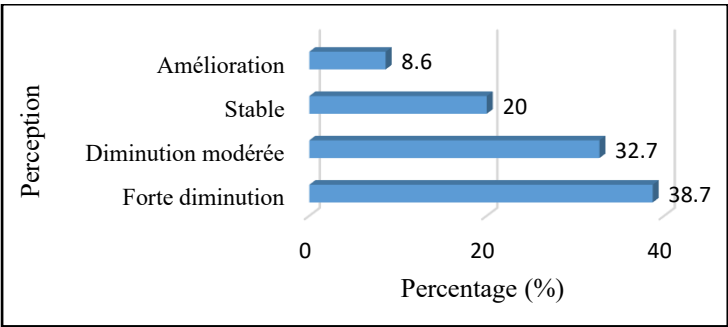


Figure 2: Perception of changes in aquatic biodiversity

The results suggest that biodiversity decline arises from the combined influence of migration, climate change, and resource governance rather than migration alone. The Millennium Ecosystem Assessment (2005) emphasizes that ecosystem degradation typically results from multiple interacting drivers operating simultaneously, while IPBES (2019) highlights the cumulative impacts of habitat loss, pollution, climate change, and unsustainable resource exploitation. The present study supports this integrated perspective by demonstrating that migration amplifies existing environmental pressures through increasing demand for aquatic resources and coastal land. Where governance mechanisms and conservation measures remain insufficient, these pressures may accelerate biodiversity loss and reduce the resilience of aquatic ecosystems.

This study contributes to the literature by providing empirical evidence linking internal migration with changes in aquatic biodiversity within receiving communities in southwestern Madagascar. Previous studies have generally examined migration, fisheries, or biodiversity independently. In contrast, the present research demonstrates that these processes are closely interconnected and should be considered within an integrated socio-ecological framework. These findings highlight the need for coordinated policies that combine sustainable migration planning, strengthened environmental governance, mangrove conservation, and community-based natural resource management to ensure the long-term resilience of aquatic ecosystems in the Atsimo-Andrefana Region.

Synthesis of Findings

The findings collectively demonstrate that migration from the Androy Region to the districts of Toliara I and Toliara II is primarily driven by the combined effects of recurrent drought, declining agricultural productivity, and livelihood insecurity. Rather than representing a temporary response to environmental stress, migration has become a sustained demographic process that reshapes patterns of natural resource use in receiving communities. As migrants settle and integrate into local economies, the demand for freshwater, fisheries, and other ecosystem services increases, creating additional pressure on already limited natural resources.

The study further reveals that the environmental consequences of migration extend beyond increased resource consumption. Greater dependence on fishing activities, combined with expanding settlements and growing water demand, contributes to the degradation of aquatic ecosystems through intensified fishing pressure, mangrove loss, declining water availability, and reduced aquatic biodiversity. However, these impacts should not be interpreted as being caused by migration alone. Instead, they result from the interaction between migration, climate variability, population growth, and limitations in natural resource governance. This finding supports the broader socio-ecological perspective advanced by the IPCC (2022) and IPBES (2019), which recognizes that environmental change is typically driven by multiple interconnected factors rather than a single determinant.

An important contribution of this study is its integrated analysis of migration, water resources, fisheries, and aquatic biodiversity within a single analytical framework. While

previous research in Madagascar has generally examined these issues separately, the present study demonstrates their close interdependence in the Atsimo-Andrefana Region. The results highlight the need for coordinated policies that combine climate adaptation, sustainable water management, responsible fisheries governance, biodiversity conservation, and migration-sensitive development planning. Such an integrated approach is essential to strengthening both ecosystem resilience and the livelihoods of host communities under increasing environmental and demographic pressures.

Conclusion

This study examined the impacts of Antandroy migration on water resources, fisheries, and aquatic biodiversity in the districts of Toliara I and Toliara II, Atsimo-Andrefana Region, Madagascar. The findings demonstrate that migration, primarily driven by recurrent drought, food insecurity, and limited livelihood opportunities in the Androy Region, has become a significant factor influencing natural resource use in receiving communities. Increased migration has intensified domestic water demand, expanded fishing activities, and contributed to growing pressure on aquatic ecosystems, resulting in declining water availability, reduced fishery resources, and deteriorating aquatic biodiversity. However, these environmental changes are not attributable to migration alone but arise from the interaction of climate variability, population growth, and inadequate natural resource governance. By integrating migration, water resources, fisheries, and biodiversity within a single analytical framework, this study contributes new empirical evidence to the understanding of socio-ecological dynamics in southwestern Madagascar. The findings underscore the need for integrated policies that promote sustainable water and fisheries management, biodiversity conservation, climate adaptation, and migration-sensitive development planning to enhance both ecosystem resilience and community livelihoods.

Reference

- Adger, W. N., Pulhin, J. M., Barnett, J., Dabelko, G. D., Hovelsrud, G. K., Levy, M., Oswald Spring, Ú., & Vogel, C. H. (2014). *Human security*. In C. B. Field et al. (Eds.), *Climate Change 2014: Impacts, Adaptation, and Vulnerability*. Cambridge University Press.
- Black, R., Bennett, S. R. G., Thomas, S. M., & Beddington, J. R. (2011). Migration as adaptation. *Nature*, 478(7370), 447–449.
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101.
- Cinner, J. E., McClanahan, T. R., Graham, N. A. J., Daw, T. M., Maina, J., Stead, S. M., Wamukota, A., Brown, K., & Bodin, Ö. (2012). Vulnerability of coastal communities to key impacts of climate change on coral reef fisheries. *Global Environmental Change*, 22(1), 12–20.
- Cochran, W. G. (1977). *Sampling techniques* (3rd ed.). John Wiley & Sons.
- Cooke, A., Randriamihajarijaona, P., & Ranaivoson, E. (2012). *Coastal and marine resource management in Madagascar*.
- Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). SAGE Publications.
- Denzin, N. K. (1978). *The research act: A theoretical introduction to sociological methods* (2nd ed.). McGraw-Hill.
- Emynorane, R. H., Urbain, M. J., Giovanni, R., Ratna, H. E., & Léa, S. (2026). Community Involvement and Its Impact on School Success in Madagascar. *Jurnal PAJAR: Pendidikan dan Pengajaran*, 10(1), 119–127.
- Emynorane, R. H., Arrive, J. T., Bien-Aimé, W. D., & Augustin, R. S. (2025). Decentralization and its Impact on Governance and Political Accountability in Madagascar. *Journal of Administration, Governance, and Political Issues*, 2(1), 97–108.
- Eric, R. R., Emynorane, R. H., Arrive, J. T., & Bien-Aimé, W. D. (2025). Measuring

- Government Performance through Governance Indicators: Case Study of Developing Countries. *Journal of Governance and Public Administration*, 2(3), 542–550.
- Food and Agriculture Organization. (2021). *Madagascar: Grand Sud drought response plan 2021*.
- Food and Agriculture Organization. (2022). *The State of World Fisheries and Aquaculture 2022: Towards blue transformation*. FAO.
- Harris, A. (2011). Out of sight but no longer out of mind: A climate of change for marine conservation in Madagascar. *Madagascar Conservation & Development*, 6(1), 7–14.
- Intergovernmental Panel on Climate Change. (2022). *Climate Change 2022: Impacts, Adaptation and Vulnerability*.
- Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. (2019). *Global assessment report on biodiversity and ecosystem services*. IPBES Secretariat.
- International Organization for Migration. (2022). *World Migration Report 2022*.
- Miles, M. B., Huberman, A. M., & Saldaña, J. (2020). *Qualitative data analysis: A methods sourcebook* (4th ed.). SAGE Publications.
- Millennium Ecosystem Assessment. (2005). *Ecosystems and human well-being: Synthesis*.
- Muttenzer, F. (2010). *Migration et dynamiques sociales dans le sud de Madagascar*.
- Patton, M. Q. (2015). *Qualitative research & evaluation methods* (4th ed.). SAGE Publications
- UN-Water. (2021). *The United Nations World Water Development Report 2021: Valuing Water*. UNESCO.