

# Maritime Security in the Western Indian Ocean: Regional Governance Challenges and International Cooperation Surrounding Madagascar's EEZ

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## Abstract

Madagascar's Exclusive Economic Zone (EEZ), estimated at approximately 1.14 million km<sup>2</sup>, constitutes one of the most vast and strategic maritime spaces in the Western Indian Ocean. This maritime expanse represents a major asset for national economic development, owing to its potential in fisheries resources, marine biodiversity, and prospects related to the blue economy. However, this vast EEZ also exposes Madagascar to a multiplicity of transnational maritime threats—notably Illegal, Unreported, and Unregulated (IUU) fishing, maritime trafficking, transnational organized crime, risks of residual piracy, as well as growing environmental threats. In this context, maritime security cannot be viewed solely through the lens of national sovereignty, rather, it must be integrated into a framework of regional governance and international cooperation. This article analyzes the maritime security challenges surrounding Madagascar's EEZ through the prism of regional governance and international cooperation mechanisms within the Western Indian Ocean. It employs a qualitative approach based on documentary analysis, an examination of legal and institutional frameworks, and a comparative study of the experiences of other coastal and island states facing similar challenges. The findings highlight that, despite the existence of multiple regional and international frameworks, maritime governance remains fragmented and characterized by capacity asymmetries, institutional constraints, and a deficit in operational coordination. Nevertheless, international cooperation emerges as an essential strategic lever for information sharing, capacity building, and the harmonization of normative frameworks. The article concludes that strengthening maritime security around Madagascar's EEZ requires an integrated approach—combining national governance, regional cooperation, and international partnerships—to ensure the sustainable, secure, and sovereign management of the maritime domain.

**Keywords:** Maritime Security, EEZ, Madagascar, Maritime Governance, Regional Cooperation, Western Indian Ocean

## 1. Introduction

### 1.1. Maritime Security Amidst the Transformation of the International Order

Over the past few decades, maritime security has progressively established itself as a defining dimension of contemporary international security. Long confined to an essentially military approach—centered on the protection of shipping lanes and traditional naval defense—maritime security has undergone a profound transformation driven by globalization, the expansion of maritime jurisdictions, and the diversification of threats.

Maritime spaces are now recognized as complex strategic domains where economic, security, environmental, legal, and geopolitical stakes intersect. More than 80% of global trade by volume—and approximately 70% by value—transits via maritime routes [1]. This structural dependence of national and regional economies on maritime routes accords the sea a central role in the stability of the international system. Any significant disruption to Sea Lines of Communication (SLOCs) is liable to trigger major economic and political repercussions, as demonstrated by piracy-related crises in the Gulf of Aden, blockages of strategic canals, or geopolitical

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tensions affecting certain straits. In this context, maritime security is no longer limited to the prevention of inter-state conflicts at sea, rather, it encompasses a broader spectrum of so-called "non-traditional" threats.

These include Illegal, Unreported, and Unregulated (IUU) fishing, organized maritime crime, transnational trafficking, marine pollution, piracy, maritime terrorism, as well as risks associated with natural disasters and climate change. This evolution has led to the emergence of an expanded concept of maritime security, one that integrates dimensions of human security, economic security, and environmental security. Furthermore, the adoption and widespread acceptance of the United Nations Convention on the Law of the Sea (UNCLOS) have profoundly altered the legal geography of maritime spaces. The extension of Exclusive Economic Zones (EEZs) to 200 nautical miles has transferred increased responsibilities to coastal states regarding the management, surveillance, and protection of marine resources [2]. This development has transformed many states—particularly developing island and coastal states—into stewards of vast maritime spaces, often far exceeding the size of their land territories. This expansion of maritime jurisdictions has created a structural paradox: while states possess extensive sovereign rights over their EEZs, their material, human, and institutional capacities to effectively exercise these rights often remain limited. This disconnect between legal rights and operational capabilities constitutes one of the central challenges of contemporary maritime governance.

### **1.2. The Western Indian Ocean**

A Geostrategic Crossroads and Space of Vulnerabilities. The Western Indian Ocean (WIO) occupies a major strategic position within the global geopolitical architecture. Situated at the interface of Africa, the Middle East, South Asia, and East Asia, it serves as a vital crossroads for various flows, global commercial, energy, and logistical networks. The major maritime routes connecting Asia to Europe via the Suez Canal traverse this region, as do the energy routes linking the Persian Gulf to Asian and European markets. Strategic straits and passages—such as Bab el-Mandeb, the Mozambique Channel, and the approaches to the Cape of Good Hope—represent critical choke points, the security of which is essential for the stability of global trade. Any significant disruption to these corridors is liable to result in increased maritime transport costs, higher insurance premiums, and repercussions for global supply chains [3]. Alongside its economic importance, the Western Indian Ocean is characterized by an exceptional wealth of marine resources.

Fish stocks, coral ecosystems, mangroves, and breeding grounds constitute vital resources for the economies and societies of the littoral states. These resources support millions of jobs, particularly in the artisanal and industrial fishing sectors, coastal tourism, and related activities. However, this wealth is accompanied by structural vulnerabilities. The region is marked by significant disparities in terms of state capacity, political stability, and institutional governance [4]. Certain areas are characterized by

persistent state fragility, which limits the authorities' ability to exercise effective control over their maritime domains. These fragilities create opportunities for transnational criminal actors, who exploit gaps in surveillance and control mechanisms. The piracy crises off the coast of Somalia between 2008 and 2012 served as an emblematic illustration of these vulnerabilities. Although piracy has experienced a significant decline thanks to international naval operations and ship self-protection measures, the structural factors underlying the phenomenon—poverty, political instability, institutional weakness, and limited economic opportunities—remain largely present in certain parts of the region. In this context, the risk of a resurgence of violent forms of maritime crime cannot be entirely ruled out.

### **1.3. Madagascar: An Island State Facing Expanding Maritime Responsibilities**

Madagascar occupies a strategic geographical position at the heart of the Western Indian Ocean, particularly along the Mozambique Channel. As the world's fourth-largest island, the country possesses an Exclusive Economic Zone (EEZ) estimated at approximately 1.14 million km<sup>2</sup>, making it one of the states with the most extensive maritime jurisdictions in the region. This vast EEZ constitutes a major strategic asset for national economic development. It offers considerable potential in terms of fisheries resources, marine biodiversity, coastal tourism, as well as offshore energy resources. The concept of the "blue economy" is increasingly being incorporated into public policies and development strategies, highlighting the sea as a potential engine for inclusive and sustainable growth. However, this expansion of maritime responsibilities also presents a major challenge to national capabilities [5].

The surveillance and control of such a vast maritime space require substantial naval, aerial, and technological assets, as well as skilled human resources and effective institutional coordination. Like many states. As a developing island nation, Madagascar faces budgetary, technical, and organizational constraints that limit its capacity to maintain a permanent maritime presence throughout its entire Exclusive Economic Zone (EEZ). This disparity between the scope of legal responsibilities and actual operational capabilities creates zones of vulnerability that are susceptible to exploitation by illicit actors [6]. It also poses challenges regarding the State's credibility in exercising its maritime sovereignty, as well as in protecting national economic and environmental interests.

### **1.4. IUU Fishing: A Structural Challenge for Sovereignty and Sustainable Development**

Illegal, Unreported, and Unregulated (IUU) fishing constitutes one of the most significant threats facing Madagascar's EEZ. Globally, IUU fishing is responsible for economic losses estimated at between \$10 billion and \$23 billion annually, while simultaneously contributing to the overexploitation of fish stocks and the degradation of marine ecosystems. In the Western Indian Ocean, IUU fishing is facilitated by a combination of vast maritime spaces, limited surveillance capabilities, and the presence of foreign fleets equipped with advanced technologies. Incursions by

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foreign fishing vessels into the EEZs of African and island nations are regularly documented, resulting in substantial economic losses and compromising the sustainability of resources [7]. The experiences of other countries serve to illustrate the magnitude of this phenomenon. In Indonesia, for example, IUU fishing has been identified as a major threat to maritime sovereignty and economic development, prompting the government to adopt a strengthened enforcement policy combining stricter legislation, enhanced surveillance capabilities, and regional cooperation. Similarly, in the Seychelles—despite an EEZ covering approximately 1.3 million km<sup>2</sup>—authorities have invested in satellite surveillance systems and international partnerships to better monitor fishing activities. These examples underscore that IUU fishing constitutes not merely an economic problem, but also an issue of sovereignty, human security, and social stability. The overexploitation of fishery resources can undermine the livelihoods of coastal communities, fuel social tensions, and contribute to dynamics of criminality and instability.

### **1.5. Transnational Maritime Crime and Illicit Trafficking**

In addition to IUU fishing, Madagascar's EEZ and the surrounding maritime routes are exposed to various forms of transnational trafficking—notably in narcotics, weapons, contraband, and, in some instances, migrants. The Western Indian Ocean is increasingly being utilized as an alternative corridor for the transit of drugs—particularly heroin originating from South and Southeast Asia—destined for African and European markets. These criminal activities exploit gaps in maritime surveillance systems, the porosity of maritime borders, and the limited enforcement capabilities of coastal states [8]. They contribute to the rise of transnational criminal networks, corruption, and the erosion of the rule of law. Furthermore, they have direct implications for human security, fueling violence, instability, and the informal economy.

### **1.6. Environmental Threats, Maritime Security, and Climate Change**

Beyond traditional criminal and security threats, the environmental dimension has become a central element of contemporary maritime security. The oceans are no longer merely spaces for movement and economic exploitation, but also fragile ecosystems whose degradation can have direct consequences for human security, economic stability, and the resilience of coastal states. In the case of Madagascar, the exceptional richness of its marine ecosystems—coral reefs, mangroves, and seagrass beds—constitutes both a strategic asset and a source of vulnerability. These ecosystems play a crucial role in protecting coastlines from erosion, supporting the reproduction of fish species, and maintaining biodiversity [9]. Their degradation, due to pollution, overexploitation of resources, and climate change, weakens the ecological foundations of the maritime economy and increases risks for coastal populations. Climate change is a multiplier of threats to maritime security. Rising sea levels, the increased frequency and intensity of cyclones, ocean acidification, and coral bleaching directly affect port infrastructure, fishing activities, coastal tourism, and food security. These phenomena can also increase pressure on marine resources, intensify competition for access to fish stocks, and, in

some contexts, contribute to the emergence of social tensions and local conflicts. From this perspective, maritime security must be understood as a broad concept, fully integrating the environmental dimension. The protection of the marine environment thus becomes a constitutive element of maritime sovereignty and national security, and not a secondary or peripheral issue.

### **1.7. Regional Governance and Institutional Architecture in the Western Indian Ocean**

Maritime governance in the Western Indian Ocean is based on a complex institutional architecture involving a plurality of regional and international actors. This architecture reflects the transnational nature of maritime threats, as well as the growing recognition of the need for a cooperative approach. Among the key regional frameworks is the Djibouti Code of Conduct, amended in Jeddah, which aims to strengthen cooperation in combating piracy, armed robbery at sea, and illicit maritime activities. This framework encourages information sharing, operational coordination, and the building of national capacities. It has contributed to the establishment of regional information-sharing centers, fostering improved Maritime Domain Awareness (MDA) at the regional level [10]. The Indian Ocean Commission (IOC) also plays a significant role in promoting regional cooperation on maritime security. Through various programs and initiatives, the IOC aims to strengthen institutional capacities, promote the harmonization of public policies, and encourage coordination among member states [11]. These efforts demonstrate a regional commitment to building more integrated maritime governance even though their implementation still faces financial, technical, and political constraints. In addition to these regional frameworks, there are partnerships with international actors, including the European Union, the United Nations, and certain extra-regional maritime powers. These partnerships take the form of training programs, equipment provision, technical support, and participation in multinational naval operations. They contribute significantly to strengthening national capacities but also raise questions regarding dependency, national ownership of maritime security policies, and the long-term sustainability of the efforts undertaken.

### **1.8. In-depth international comparisons: lessons from other EEZs**

Comparative analysis helps to better understand the challenges and opportunities facing Madagascar in terms of maritime security. Several international cases offer relevant lessons.

- **Seychelles**

The Seychelles has an EEZ of approximately 1.3 million km<sup>2</sup>, comparable in size to that of Madagascar. Despite limited human and material resources, the country has developed a proactive maritime security strategy based on international partnerships, the use of satellite surveillance technologies, and active maritime diplomacy. Seychelles has also played a significant role in regional cooperation against piracy, which has enhanced its visibility and credibility as a regional maritime actor.

- **Mauritius**

Mauritius, with its extensive EEZ and continental shelf claims,

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has invested in Maritime Domain Awareness capabilities and strategic partnerships, notably with India and the European Union. The country has established inter-agency coordination mechanisms to improve the coherence of maritime policies and strengthen surveillance and control capacity.

- **Indonesia**

As an archipelagic state, Indonesia faces similar challenges in controlling vast maritime areas. The Indonesian government has adopted a strengthened policy against IUU fishing, combining stricter legislation, symbolic destruction of illegal fishing vessels, and regional cooperation. This approach illustrates the importance of strong political will, combined with appropriate legal and operational instruments.

- **Cape Verde and the Philippines**

Other island states, such as Cape Verde and the Philippines, have also developed maritime security strategies based on a combination of regional cooperation, international partnerships, and investments in surveillance capabilities. These experiences show that, even in resource-constrained contexts, coherent and integrated policies can significantly improve maritime governance. These comparisons highlight several key success factors: the integration of maritime policies into a coherent national strategy, inter-agency coordination, investment in Maritime Domain Awareness, and the strategic utilization of international partnerships.

### **1.9. Institutional Fragmentation, Capability Gaps, and Coordination Challenges**

Despite the progress achieved in terms of regional cooperation and international partnerships, maritime governance remains characterized by significant institutional fragmentation. At the national level, the multiplicity of actors involved in maritime security—naval forces, coast guards, port authorities, fisheries services, environmental agencies, and internal security forces—can lead to overlapping jurisdictions, institutional "gray areas," and coordination difficulties. This fragmentation is exacerbated by budgetary constraints and competing priorities, which limit States' capacity to invest consistently in maritime capabilities. In the case of Madagascar, these challenges manifest as incomplete coverage of the EEZ, increased reliance on external assistance, and difficulty in ensuring the sustainability of capacity-building programs. At the regional level, the coexistence of multiple cooperation frameworks can also generate issues regarding coherence and the duplication of efforts. While the plurality of initiatives attests to a growing interest in maritime security, it also underscores the need for improved coordination and the harmonization of strategies [12].

### **1.10. Research Problem, Hypotheses, and Scientific Objectives of the Article**

It is within this context—marked by the complexity of threats, the multiplicity of actors, and the fragmentation of governance—that the present article is situated. It aims to analyze the maritime security challenges surrounding Madagascar's EEZ through the prism of regional governance and international cooperation. The central research problem can be formulated as follows:

To what extent do existing regional and international mechanisms

effectively contribute to strengthening maritime security and ensuring the sustainable protection of Madagascar's maritime interests, and what are the structural limitations of these mechanisms? Based on this central issue, the article rests on several research hypotheses:

- Regional and international cooperation constitutes an indispensable lever for offsetting national capacity limitations.
- Institutional fragmentation and capacity asymmetries reduce the overall effectiveness of maritime governance mechanisms.
- An integrated approach—combining national governance, regional cooperation, and international partnerships—is necessary to ensure sustainable maritime security.
- The scientific objectives of the article are therefore threefold:
- To assess the relevance and effectiveness of existing regional and international frameworks,
- To identify institutional, capacity-related, and normative gaps,
- To propose avenues for improvement toward a maritime governance framework that is more coherent, sustainable, and tailored to the realities of a Small Island Developing State.

## **2. Methodology**

### **2.1. General Research Approach**

This study adopts a qualitative approach—supplemented by elements of comparative and institutional analysis—to thoroughly examine maritime security issues surrounding Madagascar's Exclusive Economic Zone (EEZ) within the broader context of regional governance and international cooperation. This methodological choice is justified by the multidimensional nature of maritime security, which encompasses legal, political, institutional, strategic, economic, and environmental dimensions. The qualitative approach enables the study to capture the complexity of interactions among actors, normative frameworks, and regional dynamics, while simultaneously taking into account the specific contexts in which maritime security policies are formulated and implemented. It is particularly well-suited for analyzing phenomena characterized by a high degree of interdependence across local, national, regional, and international levels [13]. The study is grounded in an applied research perspective, aiming not only to contribute to the academic literature on maritime security and regional governance but also to generate knowledge capable of informing public policymakers, maritime security practitioners, and international partners involved in the management of Madagascar's maritime domain.

### **2.2. Conceptual and Analytical Framework**

The analytical framework of this study is based on a combination of several theoretical approaches drawn from the fields of international relations, security studies, and maritime governance [14]. First, the concept of "expanded maritime security" is employed to move beyond a strictly military or naval conception of security. This approach integrates non-traditional security dimensions—such as IUU fishing, transnational crime, marine environmental protection, human security, and resilience to the effects of climate change. This perspective allows for a more accurate reflection of the contemporary reality of maritime threats in the Western Indian Ocean. Secondly, the concept of multi-level

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governance is employed to analyze the interactions among the various levels of decision-making and action—national, regional, and international. This approach highlights how maritime security policies are co-produced by a plurality of actors and institutions, and how dynamics of power, resources, and capabilities influence the effectiveness of governance. Thirdly, the literature on regional security cooperation provides a framework for assessing existing cooperation mechanisms—their objectives, their operational modalities, and their outcomes. This perspective enables an analysis of the extent to which regional cooperation contributes to mitigating capacity asymmetries and strengthening collective security [15]. Finally, the concept of Maritime Domain Awareness (MDA) is integrated as a central analytical tool to assess capabilities regarding surveillance, information sharing, and operational coordination. MDA is viewed both as a technical capability and as an institutional and political framework, reflecting the priorities and strategies of states and regional organizations.

### 2.3. Data Collection Strategy

Data collection relies primarily on document analysis and the review of secondary sources, supplemented by a comparative analysis of international experiences.

#### 2.3.1. Institutional and Legal Sources

The study draws upon a body of official documents produced by international, regional, and national organizations, including:

- Relevant international conventions and legal instruments, such as the United Nations Convention on the Law of the Sea (UNCLOS),
- Documents related to the Djibouti Code of Conduct (and its Jeddah Amendment),
- Reports and programs of the Indian Ocean Commission (IOC),
- Strategic documents and reports from the European Union, the United Nations, and other international partners,
- National legislative and regulatory texts pertaining to maritime security, fisheries, marine environmental protection, and EEZ management.

These sources facilitate the identification of normative frameworks, institutional responsibilities, and formal cooperation mechanisms.

#### 2.3.2. Academic Literature

A systematic review of academic literature was conducted, encompassing articles published in peer-reviewed journals, specialized monographs, and book chapters addressing:

- Maritime security in the Indian Ocean,
- Maritime governance and EEZ management,
- IUU fishing and maritime crime,
- Regional security cooperation,
- Maritime Domain Awareness and maritime surveillance technologies [16]. This literature review serves to situate the study within the existing academic field, identify theoretical and empirical debates, and draw upon recognized analytical frameworks.

### 2.3.3. Reports from Specialized Organizations

Reports produced by specialized organizations were also utilized—notably those from the International Maritime Organization (IMO), the FAO, the UNODC, Interpol, the World Bank, and non-governmental organizations specializing in maritime governance [17]. These reports provide empirical data, sectoral analyses, and public policy assessments that are useful for contextualizing the issues and supporting the analysis.

### 2.4. Data Analysis Method

The data analysis is based on a qualitative approach grounded in content analysis and thematic analysis.

The collected documents were examined to identify recurring themes, strategic priorities, cooperation mechanisms, and institutional gaps. The data were coded both inductively and deductively, allowing for both the testing of research hypotheses and the emergence of new analytical categories.

Particular attention was paid to how actors define maritime threats, conceptualize regional cooperation, and assess the effectiveness of existing mechanisms [18]. This approach serves to highlight divergences in perception, institutional tensions, and areas of convergence.

### 2.5. Comparative Approach

The study incorporates a comparative dimension by drawing on cases from other coastal and island states facing similar challenges regarding the management of vast EEZs and maritime security.

The cases of Seychelles, Mauritius, Indonesia, Cape Verde, and the Philippines were selected due to their relevance in terms of EEZ size, island or archipelagic context, and their experience in regional cooperation and combating maritime threats [19]. The objective of this comparative approach is not to establish statistical generalizations, but rather to identify best practices, institutional models, and strategies that may shed light on the case of Madagascar. This approach also facilitates a better understanding of the contextual factors that influence the effectiveness of maritime security policies.

### 2.6. Ethical Considerations and Methodological Limitations

The study relies exclusively on secondary sources and does not involve the collection of primary data involving human participants. Consequently, ethical risks related to confidentiality, consent, or personal data protection are limited. However, certain methodological limitations must be acknowledged. First, reliance on secondary sources may introduce biases related to the availability, quality, and priorities of the institutions producing the data. Second, the absence of interviews or fieldwork observations limits the ability to capture certain informal dynamics, operational practices, and local perceptions. Third, the comparative dimension—while useful—draws upon distinct national and regional contexts, thereby limiting the direct transferability of certain experiences [20]. These limitations have been taken into account in the interpretation of the results and underscore the need

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to complement this research with future studies incorporating primary data.

### 2.7. Justification of Validity and Reliability

The validity of the study is strengthened by the triangulation of sources, combining legal documents, institutional reports, and academic literature. This triangulation allows for the cross-referencing of perspectives and reduces the risk of over-reliance on a single category of sources [21]. Reliability is ensured through the transparency of the methodological approach, the systematization of document analysis, and the coherence between the conceptual framework, the research questions, and the analytical methods. The use of recognized theoretical frameworks also contributes to the analytical robustness of the study.

## 3. Results

### 3.1. Status of National Surveillance and Control Capabilities

An analysis of official documents and institutional reports reveals that Madagascar possesses a maritime security infrastructure that is limited relative to the vastness of its EEZ (approx. 1.14 million km<sup>2</sup>). Surveillance is primarily conducted by the National Navy, Maritime Security Forces, and the Gendarmerie, supplemented on an ad hoc basis by aerial patrols and coastal radar systems.

The results indicate that:

- **Incomplete EEZ Coverage:** Permanent patrol capacity covers only a fraction of the maritime domain, leaving vast areas vulnerable to IUU fishing and criminal activities. According to IOC reports (2022), less than 15% of the EEZ is regularly monitored.
- **Technological Limitations:** Existing satellite and radar surveillance systems are often obsolete and insufficient to detect incursions by fast vessels or illicit activities beyond the 50-nautical-mile coastal zone.
- **Human and Institutional Constraints:** The personnel trained in maritime surveillance are limited in number, and coordination among the various agencies (Navy, Gendarmerie, Port Authority, and Ministry of Fisheries) remains insufficient, resulting in operational redundancies or gaps. In comparison, island states such as the Seychelles and Mauritius possess more integrated MDA (Maritime Domain Awareness) systems, combining satellite surveillance, inter-agency coordination, and international partnerships (OECD, 2021). These models illustrate the importance of tailored technologies and organizational structures for securing vast EEZs.

### 3.2. Illegal, Unreported, and Unregulated (IUU) Fishing

Data indicate that IUU fishing constitutes the primary threat to the sustainability of Madagascar's EEZ. According to a FAO report (2022), estimated annual economic losses linked to IUU fishing in the region could reach USD 50 to 70 million, resulting from the plundering of fishery resources.

Specific findings include:

- **Most affected areas:** the Mozambique Channel and the zones surrounding Nosy Be and Sainte-Marie.
- **Identified foreign fleets:** primarily vessels originating from Southeast Asia and the Western Indian Ocean (India, Sri

Lanka, China).

- **Socio-economic impacts:** depletion of fish stocks available to local artisanal fishers, loss of income, and heightened food insecurity within coastal communities.
- **Comparisons with Indonesia and the Philippines** demonstrate that the adoption of policies combining severe sanctions, the symbolic destruction of vessels, and maritime domain awareness (MDA) monitoring has led to a significant reduction in IUU fishing. This underscores the potential for more coercive and better-coordinated policies in Madagascar.

### 3.3. Maritime Traffic and Transnational Crime

The findings indicate that the Western Indian Ocean—and particularly the waters surrounding Madagascar—is utilized as a corridor for various forms of transnational trafficking:

- **Narcotics:** Heroin and other drugs are trafficked in transit from South Asia toward Africa and Europe. Interceptions remain limited, and the porous nature of maritime routes facilitates the success of numerous trafficking operations.
- **Weapons and illicit goods:** Although less extensively documented than drug trafficking, the illicit trade in weapons and fraudulent fuels is sporadically reported by Interpol and UNODC reports.
- **Migrants:** Certain irregular vessels transit toward the Comoros and the Seychelles, contributing to humanitarian vulnerability and increasing the risk of maritime disasters.
- The collected data highlight that international coordination and information sharing remain insufficient, and that Madagascar remains dependent on technical and operational assistance from international partners to combat these trafficking activities [22]. By comparison, Mauritius and the Seychelles have implemented integrated maritime intelligence systems that enable them to anticipate and prevent such trafficking more effectively.

### 3.4. Regional Governance and International Cooperation: Implementation and Limitations

An assessment of regional cooperation mechanisms reveals several key findings:

- **Existence of normative frameworks:** The Djibouti Code of Conduct (amended in Jeddah) and initiatives by the IOC provide a legal and institutional basis for regional coordination.
- **Information sharing and MDA:** Regional centers facilitate enhanced maritime situational awareness, however, the flow of information to Malagasy national authorities remains, at times, delayed or incomplete.
- **Joint operations:** Multinational exercises and patrols have been conducted, but their frequency is constrained by costs, vessel availability, and the priorities of international partners.
- **Identified limitations include:** institutional fragmentation, a lack of procedural standardization, and reliance on external funding. The comparison with the Seychelles and Mauritius demonstrates that integrated mechanisms—featuring clear leadership and formalized coordination processes—yield significantly greater efficiency.

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### 3.5. Impact of Environmental and Climate Threats on Maritime Security

The findings also highlight the interplay between environmental degradation, climate change, and maritime security:

- Cyclones and rising sea levels impact port infrastructure and coastal navigation.
- The degradation of coral reefs and mangroves increases the vulnerability of artisanal fisheries.
- Marine pollution and the presence of plastic waste affect ecosystems, thereby limiting the resilience of coastal communities in the face of economic and social threats.
- These observations underscore the importance of integrating the environmental dimension into maritime security policies, in alignment with international approaches to "expanded maritime security."

### 3.6. Comparative Analysis: Lessons from Other EEZs

The comparative analysis yields several key lessons for Madagascar:

- Seychelles: Intensive utilization of Maritime Domain Awareness (MDA) capabilities and active regional cooperation, yielding tangible results in the reduction of IUU fishing and piracy.
- Mauritius: Implementation of integrated air and naval patrols, effective inter-agency coordination, and enduring partnerships with India and the European Union.
- Indonesia and the Philippines: Coercive strategies combined with maritime diplomacy, which have significantly reduced illegal incursions and bolstered sovereignty over their respective EEZs.

The findings suggest that Madagascar could benefit from adopting a combination of similar approaches, including the modernization of MDA capabilities, institutional integration, enhanced regional coordination, and investment in training and technology.

### 3.7. Summary of Key Findings

- The results of the study indicate that:
- National surveillance capabilities are limited and fragmented.
- IUU fishing and transnational illicit trafficking constitute the primary threats to maritime security and the maritime economy.
- Regional mechanisms exist but suffer from fragmentation, coordination gaps, and a reliance on external funding.
- Environmental and climate threats exacerbate vulnerabilities.
- Comparative experiences demonstrate that institutional integration, advanced MDA, and structured regional cooperation serve as key levers for strengthening maritime security. These findings constitute the empirical basis upon which the Discussion (the following section) will analyze the implications, challenges, and strategic recommendations.

## 4. Discussion

### 4.1. Reinterpretation of Results in Light of Theoretical Frameworks

Analysis of the results highlights a structural tension between

the extent of Madagascar's sovereign rights over its EEZ and its actual capacity to exercise those rights. This tension aligns with the analyses of Till (2013) and Bateman (2018), who emphasize that developing island states often find themselves in a paradoxical position: holders of vast maritime jurisdictions, yet limited in their capacity to ensure the surveillance, protection, and sustainability of resources. In this context, the expanded maritime security approach proves highly relevant, as it allows for the simultaneous consideration of economic, environmental, social, and security dimensions [23]. Maritime security is no longer merely a matter of naval defense, but rather a continuum of interdependent activities—ranging from the prevention of illegal fishing to the protection of marine ecosystems, as well as the fight against transnational crime.

### 4.2. National Governance: Limitations and Opportunities

The results reveal that Madagascar's national governance is fragmented, characterized by overlapping responsibilities and coordination gaps among the Navy, the Gendarmerie, port authorities, and the Ministry of Fisheries. This fragmentation limits operational effectiveness and creates areas of vulnerability that can be exploited by illicit actors.

However, the results also point to opportunities:

- Existence of national legal frameworks: Madagascar's legislation regarding fisheries, environmental protection, and maritime security provides a foundation for action, even if its enforcement remains partial.
- Growing political will: Recent initiatives in the realms of maritime diplomacy and international cooperation demonstrate a strategic commitment on the part of the State to strengthen its maritime sovereignty.
- The literature on multi-level governance (Kooiman, 2003, Österblom & Folke, 2013) indicates that inter-agency coordination is essential for translating legal frameworks into effective operational capabilities [24]. The experience of Mauritius and the Seychelles confirms that integrated institutional structures can significantly enhance maritime security, despite limited resources.

### 4.3. IUU Fishing and Food Security: A Dual Challenge

IUU fishing poses a direct threat to national economies and the sustainability of fishery resources. Analysis indicates that economic losses are substantial (USD 50–70 million per year), while the food security of coastal communities is compromised. This issue is exacerbated by a lack of surveillance and enforcement, as well as by the porous nature of maritime borders. International literature (Agnew et al., 2009, FAO, 2021) demonstrates that states possessing integrated Maritime Domain Awareness (MDA) systems, coordinated patrols, and international partnerships achieve tangible results in reducing IUU fishing [25].

Consequently, Madagascar could benefit from a strategy combining technology (MDA), human resources training, targeted sanctions, and international cooperation—a strategy inspired by the experiences of Indonesia and the Philippines. The involvement of local communities in surveillance and resource co-management can also enhance the effectiveness of these measures.

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#### 4.4. Transnational Crime and Residual Piracy

The region remains vulnerable to transnational crime, including the trafficking of drugs, weapons, and migrants. Although piracy has declined since 2012—thanks to multinational operations in the Gulf of Aden—the risk of resurgence persists, particularly in sparsely monitored areas of Madagascar’s Exclusive Economic Zone (EEZ). The findings indicate that regional and international cooperation is crucial: information sharing, joint exercises, and technical assistance bolster the capacity of island states to detect and neutralize these threats [26]. The experiences of Seychelles and Mauritius confirm that intelligence integration, inter-agency coordination, and active participation in multinational operations are effective in reducing incidents of piracy and maritime trafficking.

#### 4.5. Regional Governance and the Role of the IOC

An assessment of regional mechanisms reveals that the Indian Ocean Commission (IOC) plays a pivotal role in promoting maritime security. Its initiatives regarding training, capacity building, and coordination are perceived by Member States as positive levers.

However, the analyzed literature and data also point to certain limitations:

- Fragmentation of initiatives: the coexistence of multiple international programs with differing priorities.
- Dependence on external funding: the maintenance of capabilities and operations relies heavily on technical and financial support from international partners.
- Capacity asymmetries among Member States: disparities in resources, technology, and personnel create imbalances in the implementation of regional cooperation.
- These limitations suggest that the IOC could play a more active role in standardizing procedures, coordinating operations, and harmonizing national strategies.

#### 4.6. Integration of Maritime Domain Awareness (MDA)

MDA emerges as a key strategic tool for strengthening Madagascar’s maritime security. The findings indicate that:

- Currently, MDA coverage is partial and fragmented.
- Comparable nations (Seychelles, Mauritius, Indonesia) have demonstrated that integrated MDA enhances the detection of illicit activities, inter-agency coordination, and operational planning.
- The adoption of a national MDA framework—combined with regional cooperation—would enable Madagascar to reduce areas of vulnerability and optimize the use of limited resources. It is essential that MDA be designed as a multi-layered tool, integrating technical surveillance, maritime intelligence, and institutional coordination.

#### 4.7. Environmental Issues and Climate Change

The discussion of the findings also highlights that environmental and climate-related threats exacerbate maritime security vulnerabilities. Rising sea levels, cyclones, coral reef degradation, and marine pollution directly impact human security, port infrastructure, and economic activities. International literature

(UNEP, 2020, Hoegh-Guldberg et al., 2019) indicates that island states must integrate environmental security into their maritime security policies by adopting proactive approaches to ecosystem protection and climate resilience [27]. This integration is also essential for fulfilling international commitments regarding sustainable development and the protection of marine biodiversity [28].

#### 4.8. Comparative Lessons for Madagascar

The experiences of other island and archipelagic states offer several key lessons:

- Leadership and National Coordination: Mauritius and the Seychelles demonstrate that clear inter-agency structures and centralized leadership enhance the effectiveness of maritime security policies.
- Regional Integration: Active participation in regional and multinational initiatives boosts deterrence and prevention capabilities.
- Investment in MDA: An integrated maritime surveillance system significantly reduces illegal intrusions and illicit trafficking.
- Integrated Approach to Expanded Security: Combining economic, environmental, human, and maritime security enables the sustainable management of the EEZ.

For Madagascar, these lessons underscore the need for a coherent national strategy—aligned with regional cooperation and bolstered by sustainable international partnerships.

#### 4.9. Summary of Strategic Implications

The discussion highlights that:

- Madagascar’s maritime security relies on a multi-layered approach that integrates national capabilities, regional cooperation, and international support [29].
- Fragmented governance constitutes a major risk, but it can be mitigated through coordination, the standardization of procedures, and institutional consolidation.
- Maritime Domain Awareness (MDA) and international partnerships serve as key levers for bridging capability gaps and strengthening national sovereignty.
- Integrating environmental and climate-related dimensions is essential to ensure sustainable security and long-term resilience.

### 5. Strategic Recommendations

Based on the findings of this study, several recommendations can be formulated aimed at strengthening maritime security within Madagascar’s Exclusive Economic Zone (EEZ), while integrating institutional, technological, environmental, and diplomatic dimensions:

#### 5.1. Strengthening National Capacities

- Modernization of the maritime surveillance system: MDA technologies, radar, satellites, and AIS.
- Human resources development: training and increasing the number of qualified personnel.

- Inter-agency coordination: creation of a central body to harmonize the actions of various agencies.

### 5.2. Strengthening Regional Cooperation

- Active participation in regional initiatives (IOC, Djibouti Code of Conduct).
- Structured information sharing with regional and international partners.
- Harmonization of standards and procedures to ensure coherent regional action.

### 5.3. Combating IUU Fishing and Maritime Crime

- Strengthened sanctions policies against illegal vessels.
- Integration of local communities into surveillance and resource co-management efforts.
- Targeted international partnerships to enhance intelligence capabilities and combat transnational trafficking.

### 5.4. Integrating Environmental and Climate Dimensions

- Protection of marine ecosystems: establishment of protected areas and environmental monitoring.
- Climate resilience plan for port infrastructure and the continuity of economic activities.
- Awareness-raising and education for local stakeholders regarding sustainability and resilience.

### 5.5. Developing Maritime Diplomacy

- Proactive diplomacy to strengthen regional and international presence.
- Bilateral and multilateral partnerships for training, equipment, and operational support.
- Promotion of collective maritime security within the Western Indian Ocean [30].

### 5.6. Prospects for Future Research

- Primary field studies involving local stakeholders.
- Economic and social analyses of the impacts of IUU fishing and illicit trafficking.

Assessment of the effectiveness of MDA technologies and their impact on maritime governance

## 6. Conclusion

This study has provided an in-depth analysis of the maritime security challenges surrounding Madagascar's Exclusive Economic Zone (EEZ), examined through the lens of regional governance and international cooperation. The findings highlight a central paradox: while Madagascar holds sovereign rights over an extremely vast maritime domain, its national surveillance and control capabilities remain limited. This vulnerability exposes the country to a multitude of threats, ranging from illegal fishing and transnational trafficking to environmental and climate-related risks. The analysis demonstrates that regional cooperation—facilitated by the Djibouti Code of Conduct, the Indian Ocean Commission, and various international partnerships—serves as a strategic lever for offsetting these capability limitations. However, the

effectiveness of these mechanisms is undermined by institutional fragmentation, capability asymmetries among member states, and a reliance on external funding. Comparative experiences from the Seychelles, Mauritius, Indonesia, and the Philippines underscore the critical importance of integrated governance, clear national leadership, and the optimal utilization of Maritime Domain Awareness (MDA) to bolster maritime security. Finally, the study emphasizes the necessity of adopting a broadened approach to maritime security—one that fully integrates economic, social, environmental, and climate-related dimensions. The protection of fisheries resources, marine ecosystems, and port infrastructure is inextricably linked to the country's economic and social stability, as well as to its national sovereignty.

These findings suggest that Madagascar must pursue a coherent strategy combining:

- The strengthening of national capacities and technological modernization,
- Institutional integration and inter-agency coordination,
- Regional cooperation and sustainable international partnerships, and
- Environmental protection and climate resilience. This comprehensive approach constitutes a prerequisite for ensuring sustainable maritime security and the country's inclusive economic development.

**Summary:** These recommendations provide an integrated action plan for Madagascar, combining national capacity-building, regional cooperation, environmental sustainability, and maritime diplomacy, with a view to achieving sustainable maritime security and inclusive development.

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