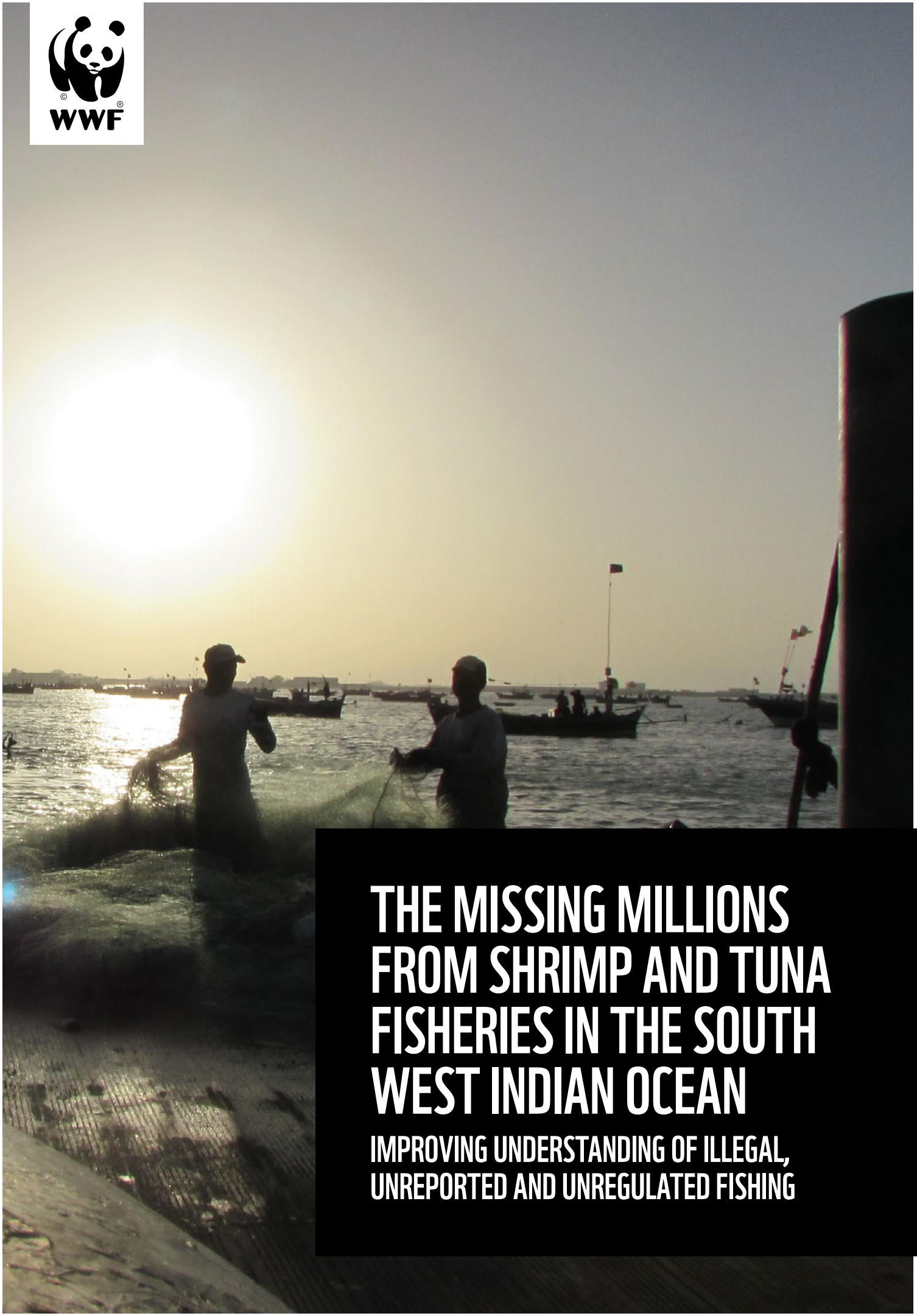

THE MISSING MILLIONS FROM SHRIMP AND TUNA FISHERIES IN THE SOUTH WEST INDIAN OCEAN

IMPROVING UNDERSTANDING OF ILLEGAL, UNREPORTED AND UNREGULATED FISHING

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EXECUTIVE SUMMARY

The impacts of illegal, unreported and unregulated (IUU) fishing activities pose risks to international food security and are responsible for financial losses in many low-income and least-developed countries, as IUU fishing exacerbates existing human development crises and counteracts endeavours to improve livelihoods.[1] Numerous efforts have been made to deter, eliminate and reduce IUU fishing at the local, national and international levels, such as having onboard vessel observers, increasing patrols of marine areas (for nations that have the capacity), vessel blacklists (which are cross-listed among diverse fisheries management organisations), increasing penalties for those caught making infringements, as well as campaigns for improving fisheries transparency and seafood traceability. At the global level, the conclusion of the United Nations (UN) Food and Agriculture Organization (FAO) Port State Measures Agreement (PSMA), and UN Sustainable Development Goals 14 and 16 have contributed positively to the fight against IUU fishing. However, the success of these efforts hinges on the ability of national governments, local authorities, and regional fisheries management organisations (RFMOs) to ensure adequate implementation of national laws and regional fisheries mechanisms.

Proper implementation of global commitments to combat IUU fishing require strong political will, excellent monitoring control and surveillance (MCS) infrastructure, regional cooperation, human resources and a host of other elements which are currently lacking, allowing 'business as usual' to continue. Globally, fish stocks are continuously harvested above sustainable levels, largely exacerbated by the presence of IUU fishing, to the detriment of coastal communities' livelihoods and food security.

The catches of distant water fishing nations (DWFNs) can further enable IUU fishing as the immense scale of their operations adds pressure on already overfished stocks, in turn creating a level of demand that, as a consequence, is often filled to some extent by IUU fishing.[2] DWFNs are fleets from countries that fish outside of their own territories. They can extend their range of action to faraway places, expand their efforts to achieve the desired quantity of catches, and typically target high-value species such as tunas and shrimps, including those in the Indian Ocean. DWFNs who are not effectively monitored due to the vastness of the ocean and poor MCS structures engage in IUU fishing and are responsible for lost economic opportunities in local coastal communities and in regional governments tied to the fisheries sector.

This study examines the potential extent and economic impacts of IUU fishing of shrimp/prawn and tuna species in the exclusive economic zones (EEZs) of five countries in the South West Indian Ocean (SWIO): Kenya, Madagascar, Mozambique, South Africa and Tanzania. It also assesses the potential impact of IUU fishing by DWFNs in the region as related to UN FAO Area 51.[3]

The research shows that as much as **US$142.8 million** of potential income is lost from the region every year as a result of a combination of potential IUU fishing activities linked to tuna and shrimp species. IUU fishing occurs at different scales across the region, with some nations facing potentially higher costs associated with increased levels of these activities, such as Mozambique and Madagascar.

By examining discrepancies between automatic identification system (AIS) vessel data, apparent *illegal* and *unregulated* fishing effort in the region for both tunas and shrimps over a six-year period (2016-2021) amounted to roughly **US$50 million per year** for both species in potential harvest value (based on average trade data value). In total, **nearly half (48.7%) of all tuna effort in the AIS dataset was identified as potentially *illegal* or *unregulated* activity**. The discrepancies in reported and reconstructed catches revealed that an average of **9,494 metric tonnes (mt)** of tuna and of shrimp combined were *unreported* annually (2015-2019) within the region to the potential resource value of approximately **US$92.3 million**. This quantity would be enough to meet the total seafood consumption needs of around 463,122 people, based on average global per capita fish and seafood consumption in 2019.[4]

Finally, substantial trade reporting discrepancies were identified within every SWIO country for shrimp and tuna products, revealing the potential for trade of illegitimate catches. These trade discrepancies can highlight potential pathways for seafood derived from IUU fishing to be exported from the region. Every country within the SWIO seascape had recorded export data that did not align with the import data of trade partners.

The presence of DWFNs in the EEZs of the focal countries, as revealed by the AIS data, varied based on target species. For tunas, the DWFNs responsible for the highest effort were the fishing entities of **Taiwan**, **Japan**, **Korea**, **China** and **Spain**. For shrimps, the main DWFNs were **China, Greece and Portugal**. Based on catch reporting, the scale of which does not identify whether catches occurred within or just outside of EEZs, 12 DWFNs reported catches of species managed under the Indian Ocean Tuna Commission (IOTC). Of those 12, **China**, **the United Kingdom**, **Malaysia**, **Portugal**, **Spain**, **Sri Lanka** and the fishing entity of **Taiwan** were the most prominent DWFNs seeking tuna species in the region. For shrimps, catch data by DWFN were not available, mostly due to the fact that no regional management body has the necessary mandate to manage shrimp fisheries both within and outside of EEZs. In most SWIO countries, fisheries authorities take minimal action to track shrimp catches, and even less to ensure that data is made publicly available.

US$142.8 million

IS LOST TO THE SWIO EVERY YEAR AS A RESULT OF POTENTIAL IUU FISHING OF TUNA AND SHRIMP SPECIES

While the trade data do not reveal from which States shrimp and tuna products originate, and thus which flag State vessels (including DWFNs) are responsible for the catches, they do point to key import and export markets for wild capture shrimp and tuna products where DWFNs are key actors in international trade. Trade analysis identified China, Portugal, Spain and France as the SWIO region's primary trade partners (i.e. market States) for both shrimp and tuna products. While these nations do not necessarily represent DWFNs, they could be an indication of DWFNs as some export transactions are recorded through transshipment at port. This is notable as addressing transshipment has been identified as a key issue to tackle IUU fishing.[5]

Based on these findings, several actions are urgently needed at the local, national and regional level to effectively curb these illicit fishing activities and restore fisheries profits to the SWIO.

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INTRODUCTION

Globally, IUU fishing is estimated to be worth between US$26 and US$50 billion annually, as catches are diverted away from legitimate systems.[6] The Indian Ocean is the second-most productive ocean for fisheries, supporting the second-largest tuna fishery in the world.[7] Unlike other oceans, Indian Ocean artisanal fisheries – relatively low-tech vessels ranging from non-mechanised pirogues that fish for subsistence to trawlers, long liners, gillnetters, or purse seiners that are under 24 metres in overall length – are responsible for a greater proportion (56%) of average annual tuna catches, and around 93% of the neritic and 37% of tropical tuna (yellowfin, skipjack, and bigeye) catches.[8] These small-scale fisheries support livelihoods, local economies and boost the food security of coastal and small-island developing States. It is noteworthy, however, that the IOTC provides a much wider margin for what it considers "artisanal fisheries" compared with other RFMOs, such as the International Commission for the Conservation of Atlantic Tunas (ICCAT), which defines this sector as vessels under 12 metres in length – IOTC recognises vessels as double this size as "artisanal" or "small-scale".

IUU fishing has been identified as a risk to the sustainability of fisheries for decades.[9] The impacts of continued IUU fishing activities have contributed to food insecurity and a loss of revenue for many low-income and least-developed countries as they exacerbate existing human development crises and counteract efforts to improve livelihoods.[10] IUU fishing also represents a serious human rights issue: aside from the theft of fishery resources from those dependent on them, there have been many documented cases of forced labour and human trafficking that coincide with the activity.[11] Therefore, it has been the consensus of many experts that drastically reducing the ability for IUU fishing activities to persist is a key component of poverty reduction and to stabilise food security in the world's most vulnerable nations.[12]

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Various strategies for identifying the presence, extent and impacts of IUU fishing have been presented at both international and regional levels, which can provide a baseline for the monitoring of potential IUU fishing activities in a region and be used in the evaluation of the effectiveness of mitigation efforts.[13] Each strategy is dependent on the context of the fishery and available data. In the SWIO, the use of AIS data, catch reconstructions (estimates of total catch, extrapolated from time series data and any additional data or reports on a given fishery to account for any *unreported* catches), and trade data analysis could provide insights into the extent of IUU fishing within the area.

There have been various efforts to curb the extent of global IUU fishing over the years through the use of onboard vessel observers, Port States Agreements, increased maritime patrols (for nations that have the capacity), vessel blacklists, increased penalties, and campaigns for improved fisheries transparency and seafood traceability. However, the success of these efforts hinge on the ability of fisheries management to ensure the adequate implementation of these measures. However, in the SWIO region, the pervasiveness of IUU fishing could indicate that countries may be falling short of their efforts to combat the activities.

In addition to the impacts of IUU fishing, the presence of DWFNs represents not only lost opportunities for SWIO fisheries to harness the value of local resources, but the demand for seafood in DWFNs can enable products sourced from IUU fishing to enter more lucrative markets, further incentivising these kinds of illicit activities.[14] The DWFNs authorised to fish in the SWIO bear a responsibility for the state of play in these waters, as their large-scale operations add pressure on already overfished stocks, which in turn create a level of demand that, as a consequence, is often filled to some extent by IUU fishing. The *unreported* component of IUU fishing by DWFNs is already well documented as reducing the potential income and food security of the nations whose waters they fish within, exacerbating sustainability concerns.[15]

To improve knowledge on IUU fishing and the presence of DWFNs in the SWIO in order to support nations in developing and implementing strategies and policies that address the issue, this project undertook a region-wide assessment to identify various impacts of IUU fishing and DWFN vessels. As illegal operators tend to follow profits, this study has focused on two high-value commercial species: tunas and shrimps.

Furthermore, catches by authorised vessels may be underreported, either through misidentification of species (whether accidental or deliberate) or the intentional misreporting of catch quantities incentivised through restrictive regulations such as total allowable catch (TAC) and total allowable effort (TAE).[16] The allocation of resources to DWFNs (e.g. fishing rights for foreign fleets) can reduce the potential income and food security of the nations they fish within, as DWFN catches are predominantly destined for export markets rather than for the local or regional communities that depend on seafood for nutrition. The addition of underreporting leads, therefore, to exacerbated sustainability concerns. Identifying key DWFNs and their potential IUU fishing impacts within a region could reveal policy strategies to help retain resources within a nation's EEZ.

The overarching aim of this research is to inform decision makers and civil society organisations on the potential social and economic impacts of IUU fishing by DWFNs in the SWIO region – specifically within Kenya, Madagascar, Mozambique, South Africa and Tanzania. Coherent, integrated, fair, and science-based approaches to managing the development of fisheries activities is essential to supporting a blue economy in the region that is sustainable,[17] especially in the face of escalating climate change and historic rates of overfishing which are compounded by illicit fishing activities. Decision makers must act swiftly, at both the regional and national levels, to dedicate the required capacity to combat IUU fishing.

METHODOLOGY TO IDENTIFY AND ASSESS ASSOCIATED IMPACTS OF IUU FISHING BY COASTAL STATES AND DWFNs IN THE SWIO

By nature, IUU fishing is not easy to apprehend. Most countries in the SWIO region are facing challenges in tackling these problems and the associated costs for governments, society and coastal community livelihoods in the region. In this context, it is important to quantitatively assess and analyse the economic and social impacts of IUU fishing in the region in order for decision makers to understand what actions are urgently needed and which measures are best equipped to affect change.

This study focuses on tuna and shrimp species, as these are of high value for the region, with industrial tuna and shrimp fisheries being the main sources of foreign income for fisheries. The geographic scope of this study includes the EEZs of South Africa, Madagascar, Mozambique, Kenya and Tanzania. The impacts of DWFNs active in UN FAO Area 51 are also examined, especially those from the EU and China, as they play a major role as key flag or market States.

To estimate such economic impacts, three key secondary data types were used, as well as qualitative information by consulting with key government, RFMOs and private experts. The potential extent of IUU fishing activity was measured through AIS data,[18] trade data[19] and reported catch data over the most recent five-year time period for which data were available. The time period varied between datasets, but ranged from between 2015 to 2021.[20] The same datasets were used to measure the impacts of DWFNs in the SWIO. These data were used and compared to explore the total harvest amounts of these fleets and the potential monetary average annual value of their catches.

AIS data can reveal apparent fishing effort by specific vessels within marine protected areas (MPAs), EEZs and even on the high seas, which can potentially identify fishing that is *illegal* or *unregulated* (or a combination of the two) depending on the national or regional regulations.[21] Trade data can highlight discrepancies between the reported fishery exports of a nation and the reported imports of their corresponding trade partners, which can be an indication of *unreported* (or misreported) catches, in addition to exposing inadequate trade documentation. These findings can indicate a need to either change how policies are enforced due to persisting discrepancies or to sanction the operators involved in IUU fishing, if confirmed. This study aims to answer two questions:

Question 1:

What is the estimated amount of tuna and shrimp caught via IUU fishing in the SWIO region and what are the potential economic impacts of those catches?

Using all available literature and data, as well as interviews with key stakeholders, an upper and lower estimate of catch volumes associated with IUU fishing of tuna and shrimp species were estimated, as well as the potential gross landed value of these catches. These catch and value estimates form the basis of this study's estimated economic losses to SWIO countries as a result of IUU fishing activities. Catch data can be compared with reconstructed catch estimates to calculate potential *unreported* catches.[22]

Question 2:

To what extent did DWFNs participate in potential IUU tuna and shrimp fishing in the SWIO region and what are the corresponding socio-economic impacts?

Using the same available datasets as described above, DWFN presence within the SWIO and any potential IUU fishing activity linked to these fleets for the same period was assessed. Discrepancies in trade reporting between DWFN fleets and the SWIO nations were identified to highlight possible market opportunities for seafood products derived from IUU fishing.

For both the trade and catch data, reporting discrepancies revealed potential *illegal* and *unregulated* fishing, as well as *unreported* catch quantities. These quantities were then multiplied by the potential export values revealed in the trade datasets to calculate the economic losses to the SWIO region. Catch reconstructions are estimates of total catches extrapolated from time series data and any additional data or reports on a given fishery to account for any *unreported* catches. Catch reconstruction analyses involved subtracting the reported catches within the region from total reconstructed catch for both shrimp and tuna fisheries to provide an indication of *unreported* catches for the species. The economic impacts of these potential IUU fishing activities were then assessed in terms of the quantities (mt) of fish associated with each activity and their corresponding export value to reveal potential costs of IUU fishing within the region.

Key DWFNs and their impacts were evaluated using the same datasets to explore the total potential harvest (mt) of these fleets and the potential monetary value (US$) of their catches.

WWF reflection

Assessing the impact of IUU fishing is incredibly challenging due to the illicit nature of this activity. The methods used to assess the impacts of IUU fishing in this report only scratch the surface of the story, providing estimates on the repercussions of IUU fishing in the SWIO region, as a lack of data makes it difficult to specify the type of activity and prominent data discrepancies hinder analyses. By consequence, the findings presented in this report should be verified by relevant authorities via further investigations to better understand the impacts of IUU fishing, together with other potential associated crimes on fishing boats that pose a risk to national security, e.g. drug trafficking.

Despite the challenges of analysing and quantifying the impacts of IUU fishing, this report confirms the presence of unauthorised fishing vessels operating in the region, mechanisms for supporting IUU fishing through transshipments to reefers at sea, poor coastal State monitoring, and discrepancies in trade data proving that illegally caught fish can be easily laundered along the supply chain. These findings point to the likelihood of high levels of IUU fishing activity in the region. Further, the findings underscore the need for DWFNs to be held accountable for their role in IUU fishing, as they catch the largest proportion of tuna in the SWIO region. The report also highlights the responsibility of key market States such as China and the EU Member States to ensure their borders are closed to illegal seafood exports and thus eliminate economic opportunities for illicit operations to persist.

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RESULTS

The analysis shows that as much as **US$142.8 million** is lost to the SWIO every year as a result of potential IUU fishing activities linked to tuna and shrimp species in the region (Table 1). Some nations suffered potentially higher losses due to IUU fishing, such as Tanzania which represents roughly **45.8%** of total losses in resource potential **(around US$65.4 million**). The greater losses to Tanzania are likely due to the higher export value of species from the area, as well as a high level of suspected *unreported* catch.

The total apparent IUU fishing effort of the five countries assessed based on AIS data amounted to roughly **699,388 hours** for both tuna and shrimp species over a 6-year period (2016-2021). This represents around **36%** of the total effort from vessels (out of 1,942,598.94 hours). Shrimp /prawn fisheries accounted for a substantially lower proportion of this fishing effort at around 1.2% (24,553.2 hours), likely due to the fact that fisheries occur close to the coast with less time spent at sea on average. It should be noted that the apparent hours of potential IUU fishing effort by shrimp fisheries are likely an underestimation, due to data limitations which restricted this analysis to examining activities that took place within MPAs.

The discrepancies in reported and reconstructed catches revealed that an average of **9,494 mt** of combined tuna and of shrimp were *unreported* annually (2015-2019) within the region to the potential resource value of approximately **US$92.3 million**. The mismatched reported import and export amounts between the SWIO countries and their trade partners amounted to roughly **4,570 mt** annually – composed predominantly of shrimp species (82.3%) - amounting to nearly **US$46.4 million** per year in potential resource value. Such discrepancies in catch and trade data are potential indicators of concealed IUU fishing activity in the region.

BETWEEN 2016-2021,
36%
OF APPARENT FISHING EFFORT WAS POTENTIALLY IUU FISHING

Table 1: Potential annual economic values (US$) associated with IUU fishing in the SWIO region

Country	Suspected illegal fishing (based on AIS data)	Suspected unregulated fishing (based on AIS data)	Suspected unreported fishing (based on catch data)	Suspected unreported fishing (based on trade data)*
Kenya	$10,963	$2,244,963	$1,609,617	$454,670
Madagascar	$402,787	$19,323,950	$15,880,000	$5,340,000
Mozambique	$413,981	$1,786,671	$ 9,670,000	$32,060,000
South Africa	$1,724,845	$12,868,044	$11,434,467	$6,500,000
Tanzania	$31,321	$11,707,929	$53,660,000	$2,035,225
Total	$2,583,899	$47,931,558	$92,254,084	$46,389,895

*NB: Trade discrepancy amounts may contain catch estimates from the other IUU fishing assessment methods used within this study. As a result, they are omitted from the total potential IUU fishing values shown here to avoid double counting.

TUNAS

Nearly ½

OF ALL TUNA FISHING EFFORT WAS POTENTIALLY ILLEGAL AND UNREGULATED FISHING

EACH YEAR, POTENTIAL IUU FISHING OF TUNAS WAS WORTH AROUND US$95.8 million

The Indian Ocean is the world's second largest tuna production area behind the Western Pacific Ocean. It accounted for nearly 20% of the world's commercial tuna catch (1.4 million tons) in 2016 and 16% of the world tuna industry's revenue in the same year earning US$ 6.5 billion (based on the total wholesale price of canned tuna), with catches increasing year over year.[23] The Indian Ocean tuna industries are among the main suppliers of the world's canned tuna, steak and sashimi markets.

Two types of fleets operate in the Indian Ocean: industrial distant water fishing fleets and coastal small-scale fleets, mostly of the artisanal type whose activities remain near coastlines. Unlike other marine regions, these artisanal fleets contribute significantly to the overall fishing effort, accounting for more than half (56%) of all catches.[24]

Overfishing of tunas is a persistent problem in the Indian Ocean: in the case of yellowfin tuna, 37% of the catch (in weight) was composed of juveniles (under 76 cm long) and 53.7% of individuals below the optimum length (125 cm) from 2015-2019.[25] IUU fishing aggravates pressures on overfished tuna species, putting both the future of fisheries and the health of the ocean food web at risk.

Within the SWIO countries evaluated, the potential economic impacts of IUU fishing activities for tunas amounted to on average roughly **US$95.8 million annually**. Kenya was the least impacted (**US$2.8 million**) due to a much lower revealed presence of IUU fishing activities. Tanzania, meanwhile, was the most impacted and by a significant margin (**US$37.1 million**), mostly driven by a large reported catch discrepancy.

While trade data for the region did not produce conclusive estimates of IUU fishing, they demonstrate significant gaps in reporting protocols that appear to contravene existing documentation requirements and could enable products derived from IUU fishing to enter end markets. These failures in reporting protocols suggest countries may not be living up to their seafood traceability mandates, such as the PSMA, and will require stricter monitoring.

Nearly half (**48.7%**) of all identified tuna effort in the AIS dataset was identified as potentially *illegal* and *unregulated* activity. This reflects a catch potential of nearly **8,862 mt** of tuna annually based on catch per unit effort (CPUE) calculations, mainly by drifting longline vessels. This amount of tuna has a potential resource value (based on average annual export values) of **US$48.5 million** representing substantial losses in potential local economic contributions to nations with food security issues and/or lower gross domestic product (GDP). It would also be enough to meet total tuna consumption needs of roughly 19.7 million people, based on average per capita global tuna consumption in 2007.[26]

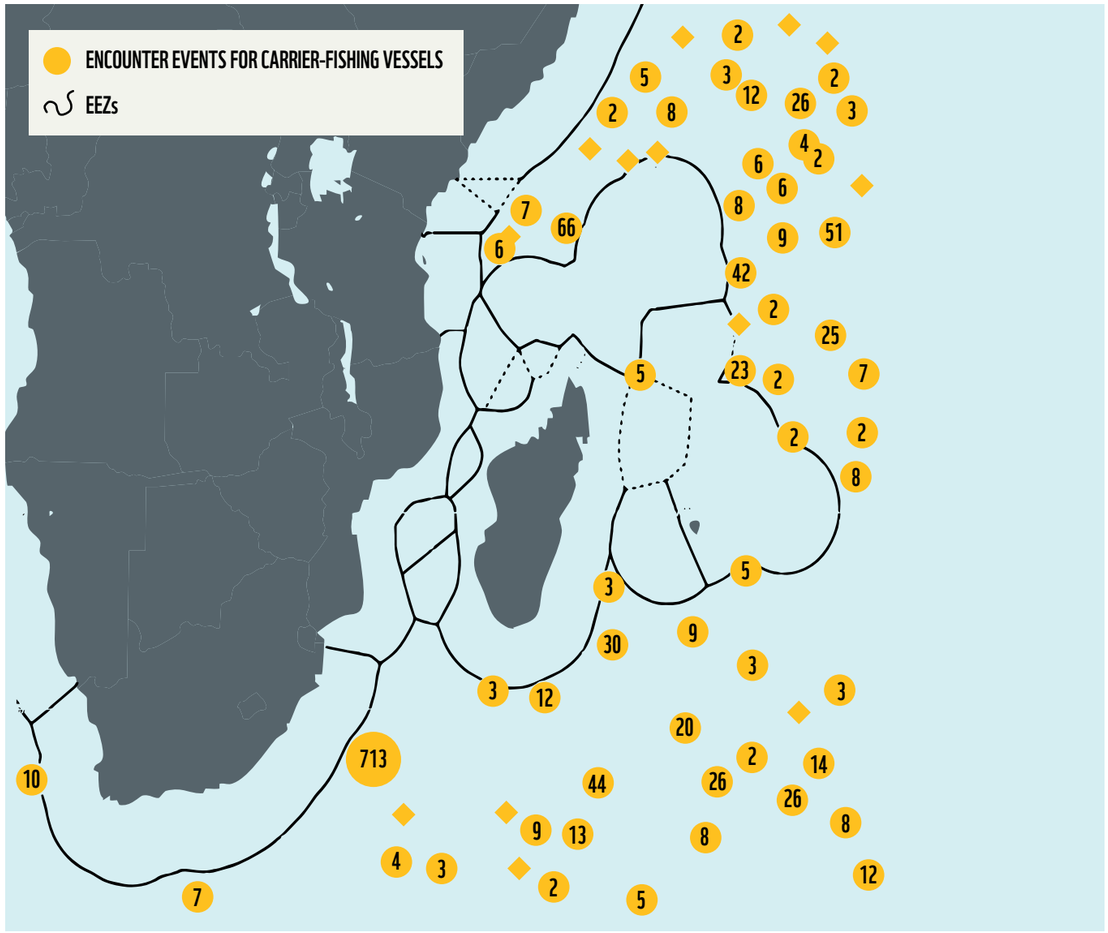
Specifically, the *illegal* activities of fishing within MPAs closed to fishing for tuna and by RFMO blacklisted vessels amounted to roughly **200 mt** per annum at an estimated value of **US$1.75 million,** and **74 mt** per annum at an estimated value of **US$276,147**, respectively. These amounts bring the total impacts of the *illegal* fishing component to roughly **US$2 million** per year across the SWIO between 2016 and 2021. The highest levels of *illegal* fishing effort were in South Africa by drifting longliners in MPAs and blacklisted vessel effort within the EEZ of Madagascar. There were no identifiable *illegal* fishing activities in Tanzania as this nation has no MPAs closed to fishing activities.

Unregulated fishing effort was apparent throughout all countries within the SWIO seascape. This activity, which is represented by vessels fishing without RFMO authorisation or effort by vessels of unknown flag States (also known as "ghost fleets"), had a total catch potential of roughly **8,081 mt** and **507 mt**, respectively. Unauthorised vessels also represent *illegal* fishing, however, in this report they are considered *unregulated* as they are not monitored in the same way as RFMO-listed vessels. These potential catches have an estimated average annual value of **US$44.64 million** (no RFMO authorisation) and **US$1.83 million** (unknown flag State vessels). Madagascar had the highest proportion of effort by both unknown flags and vessels without RFMO authorisation.

In addition to *illegal* and *unregulated* fishing effort, the AIS data revealed potential at-sea transshipments taking place, with a key hotspot for this being just outside the eastern South African EEZ where there were 713 incidents over the period of 2016-2021.

These potential transshipment encounters were almost exclusively between drifting longliner vessels – a gear type primarily used for large pelagic fish species such as tuna – and a carrier vessel (i.e. the vessel transporting cargo to a destination). While transshipment is not always illegal as it requires RFMO authorisation, the activity's nature enables vessels to offload catch in the high seas, avoiding scrutiny in landing ports

Figure 1: Locations and number of potential transshipment at sea between 2016-2021 based on automatic identification system (AIS) tracking



Data source: Global Fishing Watch (2022). Accessed on 11/9/2022

and thus creating an opportunity for misreporting catches and hampering transparency along the seafood value chain. Closer monitoring of these hotspots is needed to better assess the legality of at-sea transshipments.

Discrepancies between reported catches and catch reconstruction estimates revealed that an average of **6,486 mt** of tuna went *unreported* annually. These catches have a potential economic export value of roughly **US$47.9 million annually**. Madagascar and Tanzania had the highest proportion of average annual *unreported* catches (**2,681 mt** and **2,822 mt**, respectively), while Mozambique did not have data available to provide catch reconstruction at the time of analysis.

Trade data revealed discrepancies between exports reported by each country and the corresponding imports of their trade partners. In some instances, import records were significantly higher than exports, which has been shown to be a potential indicator of products sourced from IUU fishing entering end markets,[27] however there were a number of instances where recorded exports were significantly higher than recorded imports. While it may not be possible to conclude that these indicate IUU fishing activity, it clearly demonstrates gaps in reporting that could violate rules from the World Trade Organization and United Nations Convention on the Law of the Sea (UNCLOS), and violate guidelines of the PSMA which undermines seafood traceability, generally speaking, thereby enabling IUU fishing activities to occur.

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The role of DWFNs

The presence of DWFNs and their recorded levels of effort compared with domestic tuna fleets represents a substantial opportunity cost to the countries where this fishing effort occurs. The EEZs of Madagascar and Mozambique had the highest annual effort by DWFNs with 77,621 hours and 32,598 hours respectively, which accounts for roughly **92% of DWFN effort for tuna within the region**. Total DWFN effort results in an annual lost opportunity cost to local countries of roughly **US$415 million** annually. In terms of economic value, Madagascar and Tanzania faced the highest potential costs at US$350 million annually, roughly 84% of potential catch value. Though Tanzania had a relatively low amount of effort in hours, the primary gear type used was purse seine nets which have substantially higher CPUE.

DWFNs WERE RESPONSIBLE FOR ROUGHLY **78%** OF ALL TUNA CATCHES IN THE SWIO

While the Tanzania Mainland registry is limited to Tanzanian nationals, the Zanzibar registry is an open registry that also caters to vessels owned by foreign individuals and companies recognised to be operating under a flag of convenience.[28] This means that vessels in the Tanzanian registry are probably owned by a country other than the one they are flagged to in order to purposefully take advantage of lax controls, minimal regulations, and/or low or no taxes, which are key drivers of IUU fishing as the ultimate goal is profit. Regarding Madagascar, while it is an IOTC requirement (resolution 14/05) for Parties that issue licences to foreign flag vessels to operate within their EEZ to be reported, only EU vessels are reported in a transparent manner and made public via the Sustainable Fisheries Partnership Agreement between Madagascar and the EU. This means that other opaque DWFN activities in Madagascar are likely to occur.

From the AIS data, the DWFNs present in the EEZs of the focal countries were, in order of highest apparent effort, the fishing entities of **Taiwan**, **Japan**, **Korea**, **China** and **Spain**. The effort by these five flag States contributed to roughly **35.1%** of the total tuna fishing effort by all flag States who were active in the region. Based on catch data reporting, the scale of which does not identify whether catches occurred within EEZs or just outside, 12 flag States reported catches of IOTC species such as tunas. These data revealed that the fishing entities of **Taiwan**, **Portugal**, **Spain**, **China**, **Malaysia**, **United Kingdom** and **Sri Lanka** (listed in order of highest to lowest effort) were the prominent DWFNs seeking tuna species in the region. Their catches amounted to roughly **78%** of total catches in the SWIO over the five-year period. Trade analysis identified **China**, **France**, **Portugal** and **Spain** as the primary trade partners for the region for tunas. These represent key foreign markets for tuna, the demand from which creates high value for fisheries resources and can act as a driver for IUU fishing activities.

As previously stated, the presence of DWFNs can further enable IUU fishing activities, especially from those operating under flag States with lax regulations or enforcement, and when they have the ability to circumvent jurisdictional sanctions. Transshipment at sea by DWFNs remains a hard-to-trace issue, which also enables IUU fishing in the region. Taking all of these factors together, the potential economic losses in terms of contributions to a country's GDP can be significant, especially in view of what that money could contribute domestically (e.g. poverty alleviation, domestic fishery enhancement). To safeguard their resources and unlock the economic potential of fisheries, SWIO nations need to concentrate on enforcing robust policy tools to secure legal and sustainable fisheries, and thereby effectively disincentivise IUU fishing practices.

RECOMMENDATIONS

Actively combatting IUU fishing of tuna requires a multi-faceted approach that is largely applicable to all countries within the SWIO region. It mostly entails taking advantage of the existing agreements in place to monitor and manage fisheries resources, such as the IOTC Agreement of 1993 with its agreed conservation and management measures (CMMs) and the PSMA to which all SWIO countries within this study are a party to. The IOTC CMMs are wide-ranging, and include MCS and information requirements such as reporting and statistics.

Additionally, catch documentation schemes (CDS) have been effectively implemented in other RFMOs, but are not yet in place under the IOTC competencies. Classified as a trade measure, a CDS tracking system monitors products from the point of catch through transshipment routes to end markets, thereby preventing the entry of products linked to IUU fishing. While the Commission on the Conservation of Southern Bluefin Tuna (CCSBT) and ICCAT have implemented CDS, the IOTC and individual States should work towards establishing electronic CDS (e-CDS) to ensure traceability and transparency in trade of tuna products.

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While vessel monitoring and control remains the primary responsibility of the flag State in the high seas, the increased demand for MCS has led to the development of joint inspection programmes in some RFMOs to allow reciprocal boarding and inspections of vessels between Contracting Parties. The Indian Ocean Commission (IOC) has implemented initiatives in this sense, but these programmes should be expanded as they are cost effective and innovative: they push the boundaries of marine fisheries law by involving actors other than the flag State in inspections on the high seas. Controls should also extend across borders and national authorities through the creation of inter-agency task forces to effectively investigate and address fisheries crimes, as well as illegal trade and financial flows in the region.

Given the discrepancies found in the various data sources reviewed, numerous options to improve data capture are available and should be pursued. The implementation of CDS, for example, can tackle many of the discrepancies between trade partners and undocumented catches. However, this would require cooperation from all key trade partners to be effective. Leveraging smart technologies such as electronic monitoring for real-time tracking can also reduce user-end input errors and has shown some promise in other parts of the world.[29] However, the only way to ensure that data are being accurately recorded is through the auditing of recorded data by national authorities at every stage of resource monitoring.

In addition to issues in data reporting, there appears to be an absence of reporting by RFMO Contracting Parties to the Secretariat regarding non-compliant vessels. A duty of IOTC Contracting Parties is to report the tuna fishing activities of vessels in the IOTC management area that are not included in the Record of Authorised Vessels (RAV), as it is presumed these activities are IUU fishing.[30] As such, IOTC party members must take charge of their resources and adhere to their mandated responsibilities, by reporting these types of vessels.

There is a substantial amount of work to be done with regards to implementing CMMs and enforcing regulations in the assessed SWIO countries. States need to increase awareness of IUU fishing with local authorities, and empower them to effectively manage their fisheries and better enforce policies which have social, economic and environmental significance to coastal communities. Improved data collection at all levels of resource management would help inform national and regional measures to curtail IUU fishing, as well as leverage existing frameworks to prevent IUU fishing activities from persisting.

SHRIMPS AND PRAWNS

Globally, shrimp is one of the most traded species of seafood. In 2020, shrimps and prawns made up 16.4% of total global seafood exports, followed by tunas, with the majority entering high-income markets in North America, Europe and Japan.[31] While the majority of this demand is met by farmed shrimp, products from wild-capture fisheries such as those in the SWIO can come at a premium as more varied diets can improve flavour, as well as increase vitamins and minerals.[32] In response to continued overfishing of the main Penaeidae shrimp stocks in the SWIO, which are a key source of export revenue for the region, countries have introduced more stringent management measures.[33]

EACH YEAR, AROUND

US$47 million

WAS POTENTIALLY LOST TO IUU SHRIMP FISHING

The semi-industrial and industrial shrimp/prawn fisheries operating mainly in Mozambique and Madagascar, but also in Tanzania and Kenya, represent some of the main sources of foreign income tied to natural resources in those countries.[34] For shallow water trawl fisheries (less than 100 metres depth), all five countries mainly target just two species using similar gear, with high levels of bycatch observed.[35] For all SWIO nations except South Africa, catches are exported and are a valuable source of foreign currency. CPUE for Tanzanian fisheries show that catches have been in steady decline since the early 1990s with the trawl fishery needing to be fully closed in 2008 in order to allow stock recovery, while Mozambique's prawn catches have been in decline across all sectors (artisanal, semi-industrial and industrial) since the early 2000s. Conversely, the CPUE for deep-water trawl fisheries in Mozambique and South Africa remained stable or increased between 1990 and 2010, possibly due to increased fishing efficiency. It is noteworthy that fisheries management in the region has traditionally been at national level, with little integration across the region.[36]

Over ¼

OF ALL SHRIMP FISHING EFFORT WAS POTENTIALLY ILLEGAL AND UNREGULATED FISHING

In recent years, there has been increasing activity from artisanal and small-scale fishers.[37] This expansion has caused conflicts with the trawl sector, which are exacerbated by the trawlers' high levels of bycatch discarding, where some of those species form part of artisanal fisheries' targeted catches.[38] In addition to high bycatch, the declining status of shrimp/prawn stocks is of great concern, as these species are low in the food chain and directly impact the health of other species, including those of commercial importance such as tuna.

As shrimp and prawn species are found both in deep and shallow waters, the impacts of climate change have direct implications on their occurrence, distribution, seasonality and abundance in the region, and thus on fisheries productivity and across the food web. For example, a drought led to the closure of South Africa's Saint Lucia estuary in 2001 which saw prawn fishing effort along the Thukela Bank dramatically decline,[39] while variations in runoff have been observed to impact catches of shallow-water shrimp in Mozambique.[40] More generally, ocean acidification adversely impacts the development of some species' exoskeletons and transparency, affecting their ability to avoid predators.[41] Successfully addressing these types of impacts on crustacean habitats and populations is crucial to safeguard the livelihoods and ensure food security for those who depend on these fisheries.

The analysis found that potential economic losses stemming from IUU fishing for shrimp/prawn species amounted to roughly **US$47 million annually** throughout the SWIO seascape. Tanzania was the most heavily impacted by these activities, with approximately **US$25.7 million** in potential losses according (mostly) to catch reconstruction analyses.

While the AIS data were not a good identifier of *illegal* fishing effort for shrimps (including of fishing activities within MPAs when these are prohibited), the trade analysis and reconstructed catch analysis resulted in some substantial figures. It should be noted that most of the identifiable fishing effort in the data were from domestic fleets, revealing that the majority of IUU fishing for shrimp/prawn species in the SWIO stems from small-scale fishing in the region.[16]

Estimated fishing effort based on gear types associated with shrimp/prawns identified through AIS data amounted to roughly 92,850 hours per year, of which around **26.4%** (roughly 24,553 hours) involved potential *illegal* (**6,709 hours**) and *unregulated* (**17,845 hours**) fishing activity. The total *illegal* effort of fishing within MPAs was responsible for a potential annual catch of **52.55 mt** of shrimps, amounting to approximately **US$561,346** annually. Meanwhile, *unregulated* activities carried out by vessels of unknown flag States could amount to nearly **139.8 mt** each year, at an estimated annual average value of **US$1.47 million.** *Unregulated* fishing was primarily carried out in Kenya, where fishing activity was observed by vessels of unknown flags and roughly **19.5 mt** were potentially harvested annually at a value of **US$187,868**.

Discrepancies between reported catches and reconstructed catches revealed that an average **3,008 mt** of shrimp/prawn harvest went *unreported* annually (2015-2019) within the region. This amounts to roughly **US$45 million** in potential economic losses annually in the region. Catch reconstruction data revealed an enormous discrepancy for Tanzania where approximately **1,297 mt** were *unreported* annually with an approximate value of **US$27.93 million**. However, Mozambique and Madagascar also had a high level of discrepancy amounting to roughly **US$9.6 million** and **US$6 million**, respectively.

Between 2015-2020, approximately **22,117 mt** of shrimp/prawns were identified as misreported in the trade data, for an annual average of **3,686 mt**. The potential export value of the misreported quantities is as much as **US$38.2 million** annually. Mozambique represented the largest discrepancy observed in the data with 16,633 mt over the 2015-2020 period with the trade partner Portugal. However, the discrepancy indicated that exports from Mozambique are underreported relative to imports recorded by Portugal, which could suggest that these exports likely never passed through a Mozambique port as they were never recorded in an official way in Mozambique. Conversely, it could be the result of severely inaccurate recording, accidental or deliberate, by either trade partner. The trade discrepancy in Mozambique for shrimps equates to roughly **129% of the value** of their total reported exports. This is quite worrying as Mozambique has also failed to effectively comply with its national turtle excluder device (TED) regulations while exporting wild-caught shrimp to the EU; failure to use TEDs contributes to high rates of bycatch of endangered marine turtles.[42] The issues of trade data discrepancies are compounded by the lack of seafood traceability systems in importing market States, thus feeding markets for products derived from IUU fishing.[43]

The role of DWFNs

As shrimp and prawns are high-value species, various DWFNs were represented nearshore and in deep waters of SWIO EEZs. The AIS data for shrimp/prawn fishing within the EEZs of the focal countries revealed that **China, Greece, and Portugal** were the main DWFNs present in the SWIO, accounting for roughly 8% of total apparent shrimp fishing effort. Activities were focused primarily in Mozambique and Madagascar where an estimated **139 mt** and **209 mt** were potentially harvested annually. These amounts represent an opportunity cost for domestic fleets which should be addressed through policies that restrict DWFNs and enable local fishing capacity.

Trade analysis, meanwhile, identified **China**, **France**, **Portugal** and **Spain** as the primary trade partners for the region. However, trade patterns were not consistent over the period of analysis, with large trade volumes being recorded by a single trade partner in a single year or with substantially high trade amounts between partners in a single year or for just some years. This highlights some concerning discrepancies which could be concealing IUU fishing in the SWIO.

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RECOMMENDATIONS

While IUU fishing activity for shrimps and prawns in the SWIO region is largely driven by their high value, the amount of IUU fishing effort in the region is very difficult to quantify due to the lack of standardised catch reporting obligations within the seascape and the absence of a regional fisheries advisory body or RFMO to aggregate and monitor data around shrimp fisheries.

The South West Indian Ocean Fisheries Commission (SWIOFC) is a UN FAO Article VI body, responsible for promoting regional cooperation in how all living marine resources, including shrimp and prawn species, are managed within the EEZs of the SWIO States; all five SWIO countries within this study are members of the Commission. In addition, the South Indian Ocean Fisheries Agreement (SIOFA) was established to promote regional cooperation for managing deep water fish stocks and includes the management of crustaceans such as shrimps and prawns, but only in the high seas. Three countries (Kenya, Madagascar, and Mozambique) are signatories of the agreement, however, they have not yet ratified it. Further, none of the regional organisations have adopted measures nor expanded which species are covered under their mandates to effectively manage shrimp and prawn fisheries in the region. This is a significant strategic gap given the local, regional and international value of these resources.

To effectively address the onslaught of IUU fishing for shrimp and prawn species, the region's national governments and fisheries management bodies must adopt cross-cutting measures. For instance, increased MCS of shrimp /prawn fishing fleets is required in every country within this study and catch documentation should be standardised to account for catches not being landed in ports.

Additionally, while the PSMA will not do much to slow IUU fishing activities by small-scale and artisanal fishing fleets due to the sparsity of landing sites, large foreign industrial shrimp/prawn trawlers must land their catches in international ports. It is, therefore, crucial that PSMA measures are carried out as agreed by DWFNs to ensure the full traceability of shrimp and prawn harvests. In addition to port State responsibility, market States also have the responsibility to ensure imported products are derived from sustainable sources to not further drive IUU fishing practices.

The largest estimated potential economic impacts of IUU shrimp and prawn fishing stem from the trade and reconstructed catch analysis, suggesting that accurate monitoring of catches and reporting of trade quantities are critical to mitigate these illicit activities. Regular audits of log books and trade reports can provide continual insight into the scope of IUU fishing in the region and target the misreporting that enables IUU fishing to persist.

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Finally, to successfully address the impacts of climate change, the SWIO nations must plan, manage and effectively govern the use of their marine spaces and resources, both within their EEZs and via good cooperation across the region, applying inclusive methods and adopting an ecosystem-based approach. Forward-looking, precautionary, adaptive and integrated processes are essential to ensure the long-term health of these waters and sustainable shrimp/prawn fisheries, while considering human activities on land. Such processes must be participatory, accountable, transparent, equitable and inclusive, in order to be responsive to present and future human needs.

RECOMMENDATIONS

REGIONAL

- As the five countries under the scope of this study are considered developing nations, the urgent need for regional MCS systems should be revitalised, discussed and adopted in the SWIOFC, IOTC, Southern African Development Community (SADC), the New Partnership for Africa's Development (NEPAD) and the African Union (AU).
- A Weight of Evidence (WoE) approach should be adopted by all SWIO nations. This practice involves piecing together information about IUU fishing activities (evidence) from various sources to highlight the risk and consequences of the persistence of an activity to leverage existing legal frameworks and take action against IUU fishing.
- Based on the trade discrepancies revealed in this study, additional research should be undertaken by national representatives on trade reporting within the region to identify the drivers behind misreporting. In addition, regular auditing of data reporting systems should be carried out by governments to close any loopholes in documentation.
- Develop the subdivision of FAO fishing area codes to improve and distinguish reporting of catches between the EEZs and the high seas to improve fisheries management. This is a key data element that must also be considered in the development of an e-CDS.
- Given the cumulative impacts DWFN activities have on fish stocks and the marine ecosystem, both DWFN and coastal States should reinforce transparency (i.e. number of vessels, catches, bycatch) by establishing a regulatory framework that allows the systematic publication of any access agreements (private or public), as well as information on joint ventures and chartering arrangements in line with Article 238 of the 2019 UN General Assembly Resolution 74.18.
- SWIO coastal States should limit licences to DWFNs when stocks are overfished to help curb IUU fishing while, in parallel, streamline their local fishing fleets to improve the quality of seafood products (e.g. reducing bycatch, ensuring product quality and freshness) and limit waste along the value chain via skill and technology development. This will, in turn, support employment opportunities along the fisheries value chain and improve domestic food security.
- Improve transparency in the tuna industry by implementing a digital traceability system that tracks products from boat to plate through, for example, technology such as blockchain, RFID tags and QR codes.

- Create a fisheries data sharing platform for the transparency of catch, landing and trade data.
- Increase compliance to IUU fishing regulations for shrimp fisheries through increased MCS and enforcement.
- Improve local management systems and fisheries regulations via comprehensive management that includes MCS to better manage national fleets and foreign investment in SWIO fisheries.
- Urgently implement trade reporting standards for shrimp to reduce potential discrepancies.
- Encourage SWIO countries to commit to being part of the Fisheries Transparency Initiative (FiTI). This will require a collaborative approach that prioritises transparency, participation and science-based management.

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AFFILIATED NATIONS OF THE INDIAN OCEAN TUNA COMMISSION

- Adopt a Resolution for a new compliance mechanism to increase fisheries' accountability and support; ensuring transparency in the compliance assessment process will better identify why countries have difficulty fully implementing agreed measures.
- Improve MCS through common onboard electronic monitoring and data capture systems to ensure accurate catch data reporting for all vessels over 24 metres in length or those that fish in the high seas.
- Improve reporting of trade information and ensure cross-checking by the Secretariat and the Contracting Parties to avoid trade discrepancies which can allow catches from IUU fishing to reach destination markets.
- Link the future IOTC e-CDS to the IOTC's electronic Port State Measures (e-PSM) system, as well as other activities that monitor and verify vessel catches, to cross-check data for risk-based analysis and ensure that only legally-caught fish can reach markets.
- Adopt a new Recommendation to improve traceability through an e-CDS which prioritises all overfished species, and adopt the current proposed Strategy and timeline for an e-CDS to enter into force by the end of 2024. Ensuring a minimum level of compatibility of key data elements with other RFMOs should be ensured to facilitate information sharing, and better integration and monitoring of such systems worldwide.
- Review the IOTC definition of artisanal/ small-scale vessels to be better able to monitor the vessels that are more involved in supporting local livelihoods than commercial trade to improve catch transparency and, in turn, fish stock management.
  ICCAT's definition provides a strong example to follow: *a "small-scale coastal vessel" is a catching vessel with at least three of the five following characteristics: (a) length overall <12 m; (b) the vessel is fishing exclusively inside the territorial waters of the flag CPC (c) fishing trips have a duration of less than 24 hours (d) the maximum crew number is established at four persons, or (e) the vessel is fishing using techniques which are selective and have a reduced environmental impact.*
- Given recent progress with the Global Information Exchange System (GIES) for the PSMA, support the automated connection between the e-PSM application and the GIES to enable the information exchange that is critical for effective implementation of the PSMA.
- Upon request by interested stakeholders, provide access to party member fleet vessel monitoring systems (VMS) for high resolution and real-time monitoring to better identify IUU fishing activities.
- To address transshipment at sea by DWFNs, Contracting Parties must cooperate to strengthen Resolution 22/02 Establishing a Programme for Transhipment by Large-Scale Fishing Vessels to further improve MCS and reduce opportunities for IUU fishing. This should mandate the submission of transhipment reports from the large-scale tuna longline fishing vessels to the IOTC Secretariat within 24 hours of event completion.
- Adopt a resolution on reciprocal boarding and inspection schemes (also called "international joint inspection schemes") to promote compliance and facilitate enforcement in deterring IUU fishing. IOTC should follow the examples of ICCAT, the Western and Central Pacific Fisheries Commission (WCPFC), the Northwest Atlantic Fisheries Organization (NAFO), the North East Atlantic Fisheries Commission (NEAFC) and the General Fisheries Commission for the Mediterranean (GFCM) who all already have joint inspection programmes in place.
- Adopt a (partially) centralised VMS to monitor movements of all vessels of any size and type that are authorised to fish in areas beyond national waters or which are carrying out fishing-related activities. This must include fishing and associated support vessels, including but not limited to fish carriers and bunkering vessels, as these vessels are typically authorised to engage in fishing-related operations, such as transhipment. This can improve continuous port-to-port operation through secure communications systems that are type-approved and tamper-proof, as well as sealed, fully automatic and have adequate backup and recovery procedures to ensure reliability.

KENYA

- Improve trade reporting and conduct audits of trade figures to ensure there are no discrepancies originating from Kenya.
- Implement PSMA measures as recommended by the agreement to prevent catches from IUU fishing being landed in ports.
- Increase operational port capacity to incentivise port landings and reduce transshipment at sea.
- Report activity by vessels not listed in the RAV.
- Identify and sanction activities of vessels of unknown flag States to restrict activity by unregulated vessels.
- Increase MCS of foreign shrimp fishing fleets to ensure accurate catch reporting.

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MADAGASCAR

- Improve trade reporting and conduct audits of trade figures to ensure there are no discrepancies originating from Madagascar.
- Closely monitor MPAs for illegal fishing activity and appropriately sanction any illegal fishing that occurs.
- Implement PSMA measures as recommended by the Agreement to prevent catches from IUU fishing being landed in ports.
- Improve transparency in public and private agreements from foreign vessels and report any fishing activity made by vessels not listed in the RAV or who operate without an identified flag State.
- Support development and implementation of human resources (e.g. government authorities, law enforcement) to support enforcement of regulations against blacklisted vessels operating within the EEZ.
- Increase onboard vessel observation and audit log books to ensure proper reporting of catches and fishing effort.
- Increase operational port capacity to incentivise port landings and reduce transshipment at sea.
- Increase MCS of shrimp fishing fleets to ensure accurate catch reporting.
- Closely monitor the small-scale and artisanal shrimp fishing fleets to ensure that catches are being accurately reported.
- Closely monitor the two-mile area from the coast that is reserved for small-scale shrimp fisheries to ensure no illegal fishing activities take place and no incursion by industrial vessels, as these areas are key to support local livelihoods.
- Identify and sanction activities by vessels of unknown flag States to restrict activity by unregulated vessels.

MOZAMBIQUE

Implement PSMA measures as recommended by the Agreement to prevent catches from IUU fishing being landed in ports.

Improve availability of small–scale and artisanal fleets tuna catch data to RFMOs and independent researchers who can assist in data analyses to support policies.

Increase operational port capacity to incentivise port landings and reduce transshipment at sea.

Increase onboard vessel observation and audit log books to ensure proper reporting of catches and fishing effort.

Improve transparency in public and private agreements from foreign vessels and report any fishing activity made by vessels not listed in the RAV or who operate without an identified flag State.

Improve trade reporting and conduct audits of trade figures to ensure there are no discrepancies originating from Mozambique.

Closely monitor the small-scale and artisanal shrimp fishing fleets to ensure that catches are being accurately reported.

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SOUTH AFRICA

Improve trade reporting and conduct audits of trade figures to ensure there are no discrepancies originating from South Africa , especially for products that are landed and subsequently exported.

Enhance East Coast port operational capacity to discourage transshipment at sea.

Investigate the dubious movement and patterns of DWFNs coming into South Africa's EEZ for either illegal fishing or for any threats posed to national security.

Improve cross-border collaboration between port and flag States to better monitor South African vessels fishing within the EEZs of other SWIO countries.

TANZANIA

Improve transparency in vessel registry and report any fishing activity made by vessels not listed in the RAV or who operate without an identified flag State.

Improve trade reporting and conduct audits of trade figures to ensure there are no discrepancies originating from Tanzania.

Implement PSMA measures as recommended by the Agreement to prevent catches from IUU fishing being landed in ports.

Increase onboard vessel observation and audit log books to ensure proper reporting of catches and fishing effort.

Increase MCS of foreign shrimp fishing fleets, including onboard observer coverage, to account for the log book reporting discrepancy.

WAY FORWARD

IUU fishing in the SWIO is depriving the region of US$142.8 million in potential income every year. These potential economic losses not only impact the development and prosperity of nations in this region, but jeopardise the food security of populations already facing undernourishment and the livelihoods of many fishing communities who compete for the same resources. Urgent intervention is required.

The large extent of IUU fishing activities revealed in this analysis is deeply concerning. Fishing nations with interests in the region must urgently and seriously consider both Regional and National Plans of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (NPOA-IUU), following the UN-adopted International Plan of Action to prevent, deter and eliminate IUU fishing (IPOA-IUU) adopted in 2001. Any NPOA-IUU must formulate pertinent and achievable measures that are necessary to close gaps in the existing national framework for addressing IUU fishing.

All SWIO nations should keep a close eye on the activities of DWFNs in their waters for any links to IUU fishing. DWFNs should, at a minimum, be encouraged to land their catches in local ports; this will allow for vessel inspections, thus increasing transparency to dissuade illicit activities, as well as bring additional revenue via, for example, port fees.

As the losses from IUU fishing are shared across borders, regional cooperation is crucial. Kenya, Madagascar, Mozambique, South Africa and Tanzania are encouraged to adopt a much firmer stance against IUU fishing via strong measures, adopted both nationally and across the region. This will signal a turning point in the fight against IUU fishing and reclaim the missing millions in shrimp and tuna fisheries revenue from the SWIO.

The high costs involved in observer coverage and enforcement patrols that are necessary to achieve effective MCS of fishery resources currently barricade the fight against IUU fishing in less-developed countries, such as those featured in this study. National MCS strategies must be adapted to interventions that are affordable in the medium term, as this study has recommended, in tandem with onboard observer programmes to reduce unreported and misreported catches. Improved cooperation is also urgently needed between governments and nations at regional fora like the IOTC, SADC, IOC, NEPAD and the AU, and as part of the SIOFA, to co-manage regional resources and prevent IUU fishing activities by DWFNs.

Finally, it is important to note that the fight against IUU fishing is not meant to and should not create barriers for small-scale and artisanal fishing fleets that are reliant on fisheries resources to sustain livelihoods and provide nutritional sustenance to coastal communities. Instead, national intervention in cases of a lack of adherence to fisheries measures should support better cooperative management of local resources, data assimilation and rights-based allocations to resources.

There is an opportunity for the region to harness the values currently lost to IUU fishing, including those from DWFN activities. However, interrupting and altogether ameliorating the scourge of IUU fishing and DWFN presence in the SWIO will require collaboration at the global and regional level, as well as substantial effort by local governments to decide on appropriate measures for safeguarding resources. With fisheries resources documented as being in decline or altogether collapsed, and given the deep dependencies local populations have on these resources for nutrition and economic support, the time for taking action is now.

Coastal, flag, port and market States must now urgently:

Improve vessel monitoring and surveillance in the SWIO region to overcome data discrepancies and improve fisheries transparency.

Further investigate proven, assumed and potential impacts of IUU fishing and closely examine how some fishing activities may obscure other crimes that put the national security of SWIO countries at risk.

- Improve fisheries transparency to prevent illegally caught fish from entering the seafood supply chain via unfair means or unsustainable foreign fisheries access agreements; such initiatives include the implementation of e-CDS by SWIO governments to track Key Data Elements (KDEs) and Critical Tracking Events (CTEs).
- Require the use of low-cost MCS tools and alternate means of data collection to support small-scale/artisanal fisheries management in the SWIO.
- Prioritise support for regional collaboration on MCS to combat IUU fishing so that robust and effective efforts to deter such activities become fully operational.
- Implement electronic vessel data collection and tracking mechanisms to boost SWIO coastal States' capacities to effectively manage fishing activities within their waters and across the region.

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OUR MISSION IS TO STOP THE DEGRADATION OF THE PLANET'S NATURAL ENVIRONMENT AND TO BUILD A FUTURE IN WHICH PEOPLE LIVE IN HARMONY WITH NATURE.

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