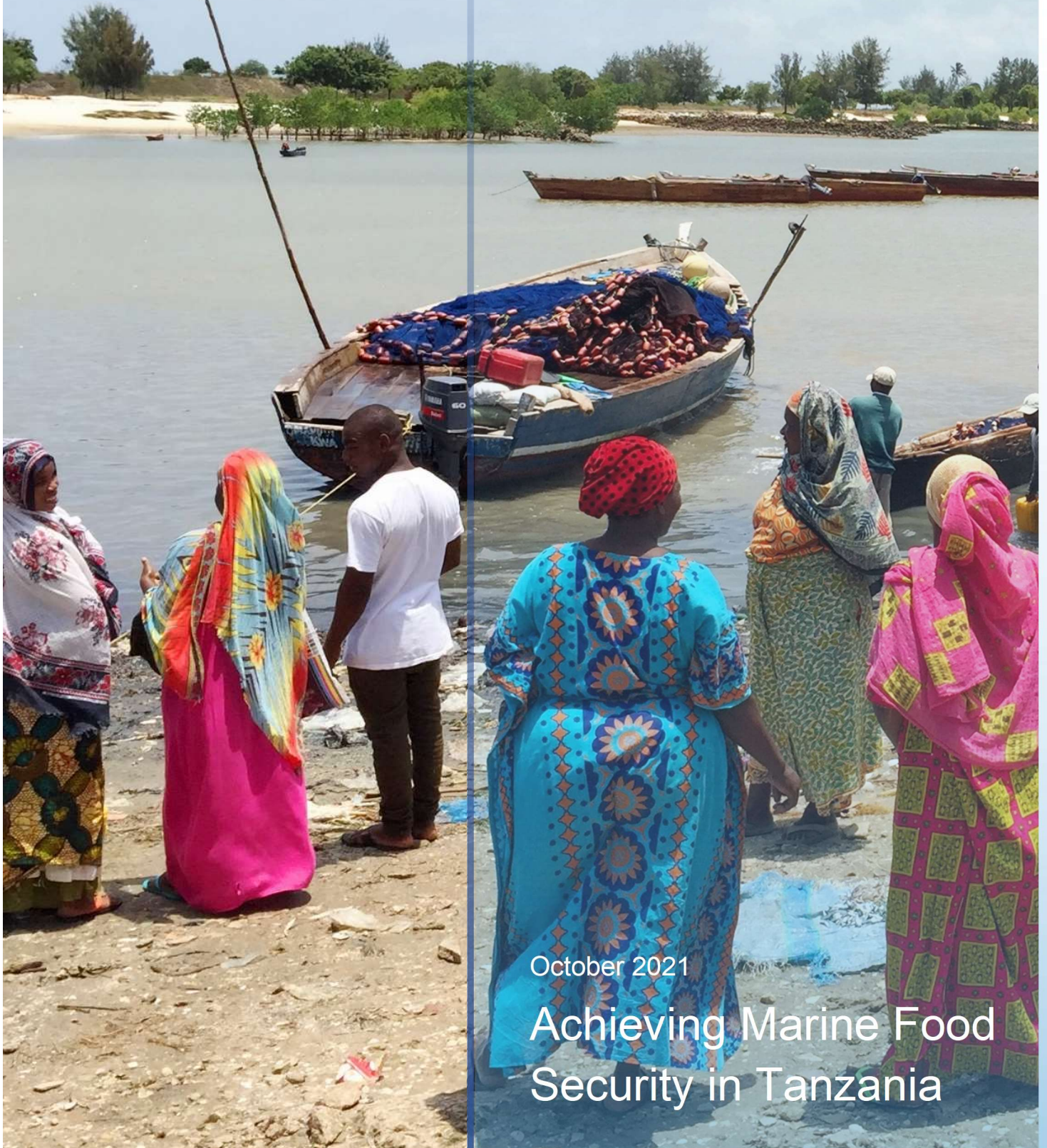# SOLSTICE

Achieving Marine Food Security in Tanzania

October 2021

Achieving Marine Food Security in Tanzania

Key Messages:

Tanzania's coastal marine resources face increased pressures from overexploitation, climate change, population growth and habitat destruction.

Improved management practices linked to sustainable Blue Economy initiatives are key to improved economic prosperity and food security amongst coastal communities.

Development of the Blue Economy must consider a unified long-term vision for Tanzania's marine resources that includes EEZ waters.

The coastal waters of Tanzania play a central role in the economy and livelihoods of local communities, yet its marine resources are under threat as a result of the pressures posed by a growing population, overexploitation, habitat destruction and the impacts of climate change. A decline in fishery yields will have a significant socioeconomic impact on these communities. In order to ensure the marine food security of the coastal population, it is crucial that these resources are better managed. Improved management, in turn, relies on the ability to predict fluctuations in fisheries yields. This underscores the importance of improved fisheries data collection, particularly in the face of the fact that artisanal fisheries are notoriously underreported.

Better management of Tanzania's limited marine resources – and thus development of a sustainable blue economy – is key to the country's economic prosperity. Adopting a long-term vision, with a shift in attention to offshore waters and the whole of the Exclusive Economic Zone (EEZ), is essential if the blue economy is to flourish. With the continuous degradation and overexploitation of the coastal waters (United Republic of Tanzania, 2015), such a shift could bolster food security by turning the focus to tuna and tuna-like species as an important source of income (in addition to small and medium pelagics). This will also require improved monitoring and reporting of fishing activities within the EEZ. To this end, Tanzania could benefit from a joint management plan between Zanzibar and Mainland Tanzania.

Background

An estimated one-third of the Western Indian Ocean (WIO) regional population, about 60 million people, lives within 100 km of a coastline.

The ocean and its resources provide both employment and primary sources of protein, and there is growing focus on the sustainable management of the WIO's natural resources (Painter et al., 2021).

Stretching from 4.5°S at the border with Kenya to 10.3°S at the border with Mozambique lies the approximately 1,400 km-long coast of Tanzania. These coastal waters are central to the economy and livelihood of local communities.

Tanzania comprises Mainland Tanzania and Tanzania Zanzibar (Zanzibar) (Mlimuka and Vrancken 2017). Mainland Tanzania has one major island, Mafia, while Zanzibar has two major islands, Unguja (also known as Zanzibar Island) and Pemba. Several smaller islands also lie off the coast of Tanzania Mainland and Zanzibar (Mlimuka and Vrancken 2017). Tanzania thus has four different coastal regions: Tanga (northern mainland) and the three islands – Pemba, Zanzibar and Mafia – located off the mainland.

The Tanzanian coastal area has a characteristically narrow continental shelf that is about 5.8 km wide. The Zanzibar and Mafia channels are an exception, with a maximum width of 62 km. The Zanzibar and Mafia islands are located on the Tanzanian continental shelf with channels less than 50 m deep separating them from the mainland. Pemba Island is located off the Tanzanian continental shelf and a channel approximately 800 m deep separates it from the mainland.

One of the most important socio-economic marine sectors is the fishing sector.[1] In this sector, inshore resources are over-exploited while deep sea resources are underutilised (United Republic of Tanzania, 2011).

Off the coast of Tanzania, artisanal and subsistence fisheries rely on small and medium pelagic fish species for employment and nutritional security (Kizenga et al., 2021). One-third of the total marine catch comes from these fish species, which include anchovy, shad, herring, mackerel and sardine (Jebri et al., 2020). With more than 2 million people employed in the fishing sector (Jebri et al., 2020), it is the main source of employment and income. Since entry into the small and medium pelagic fishery is both free and widespread, the management of these fish species is challenging (Kizenga et al 2021). Increased exploitation, unsustainable practices and noticeable environmental impacts also put the fishing sector under pressure. Those government bodies tasked with addressing the country's challenges are now focused on this issue.

In conservation planning, data on the spatial distribution of habitats and vulnerable species is crucial. In particular, it is necessary to know how marine ecosystems are connected in terms of depth and seafloor characteristics (Osuka et al., 2021). Historically, the region is under-sampled, with limited oceanographic observations, sparse biogeochemical measurements and some outdated key results. Few areas of the seafloor

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[1] Fisheries resources in Tanzania comprise marine, freshwater, riverine and wetland species. This science into policy review focuses on marine species only.

have been studied or mapped, which means there is little knowledge about the connections between shallow- and deep-water communities (**Figure 1**).

To make informed decisions, policymakers need to understand the physical and biogeochemical drivers of small pelagic fish's long-term abundance, especially in the face of climate change (Jebri et al., 2020). They also need to understand how the marine environment will respond to future changes and impacts of climate change, which should inform decision-making around adaptation measures and strategies.
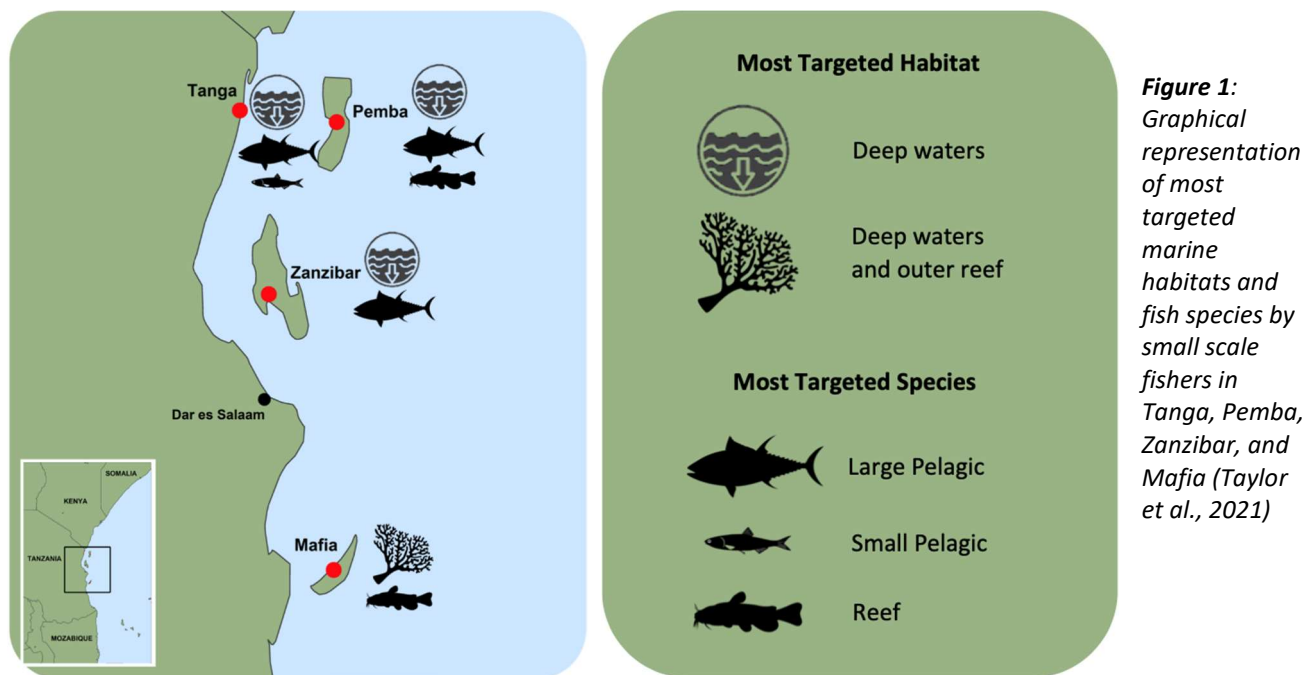

Figure 1: Graphical representation of most targeted marine habitats and fish species by small scale fishers in Tanga, Pemba, Zanzibar, and Mafia (Taylor et al., 2021)

Tanzania's Policy Landscape

The United Republic of Tanzania is 'one State which is a sovereign United Republic'.[2] This quasi-federal state comprises Mainland Tanzania and Tanzania Zanzibar, as well as territorial waters.[3]   There are two governments: the Union Government, which deals with all union matters listed in the first Schedule of the Constitution and matters concerning Mainland Tanzania, and the Revolutionary Government of Zanzibar, which deals with all non-union matters in Zanzibar. Both these governments have executive, judicial, legislative and supervisory powers (Mlimuka and Vrancken 2017).

According to the constitution, the exploitation of marine living resources does not fall within the purview of the Union. Mainland Tanzania and Tanzania Zanzibar thus have their own legal regimes in terms of the waters up to the outer limits of the territorial waters. At the same time there is a single regime for activities in the EEZ (Vrancken and Tsamenyi 2017). The ministers responsible for fisheries in Mainland Tanzania and Tanzania Zanzibar manage the respective marine fisheries.

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[2] Constitution of the United Republic of Tanzania 1977, Section 1.

[3] Ibid., Section 2 (1).

The Fisheries Act of 2003 governs marine living resources in the waters off Mainland Tanzania,[4] while the Fisheries Act of 2010 regulate the marine living resources in the waters surrounding Tanzania Zanzibar.

Marine living resources in the whole Tanzanian EEZ are governed by the Deep Sea Fisheries Management and Development Act of 2020, which repealed the Deep Sea Fishing Authority Act of 1998 as amended. This new Act applies to both Mainland Tanzania and Tanzania Zanzibar, and all relevant national policies shall be formulated and implemented in accordance with it.[5]

The Act gives the Deep Sea Fishing Authority (DSFA)[6] exclusive authority over the exploration, exploitation, conservation and management of fisheries in the EEZ. This shall be done by drawing up, implementing and overseeing policies and strategies aimed at conserving, managing, developing and ensuring the sustainable use of EEZ fishery resources. The DSFA is also responsible for the development, management and control of all fishing (and related) activities in the EEZ. This includes formulating appropriate standards for the management, development and protection of the fishery resources found in the EEZ.[7] In addition, it must draw up guidelines for the preparation of fisheries-specific management and development plans in the EEZ,[8] and collect and analyse relevant data.[9] Tanzania has recently developed the EEZ Fisheries Research Agenda 2018–2027 to further support the management of the EEZ.

Other strategies include the National Adaptation Programme of Action (2007) and the Agriculture Climate Resilience Plan 2014–2019 (ACRP),[10] developed by the Ministry of Agriculture Food Security and Cooperatives. National policy documents typically consider the fisheries and aquaculture sector, along with other sectors, as part of a general definition of agriculture (Breuil and Grima 2014). This means that Tanzania's agriculture sector extends to livestock and fisheries, in addition to crop agriculture. However, the ACRP – at the moment – focuses exclusively on crop agriculture, both for greater manageability and given that it is the first of its kind in the country. Fisheries also fall under a different ministry than crops and food security which would have meant that implementation would be problematic (United Republic of Tanzania 2014).

In Zanzibar, the Second Vice President's Office in the Revolutionary Government of Zanzibar is driving the Climate Change Adaptation Strategy, which is aimed at ensuring that Zanzibar is climate resilient and sustainable by 2030.

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[4] Which is being amended. See Stop Illegal Fishing (2019, 4 February). Tanzania Fisheries Act for amendment. Retrieved from https://stopillegalfishing.com/press-links/tanzania-fisheries-act-for-amendment/

[5] Deep Sea Fisheries Management and Development Act 2020, Art 2(1) – (2). The Act shall be construed as being in addition to and not in derogation of the Territorial Sea and Exclusive Economic Zone Act for fishing purposes in the Exclusive Economic Zone and other areas which the United Republic exercises jurisdiction rights or sovereign rights, and shall for all fishing intents and purposes complement that Act.

[6] Deep Sea Fisheries Management and Development Act 2020, Art. 5.

[7] Ibid., Art 6(a).

[8] Ibid., Art 6(b)(ii).

[9] Ibid., Art 6(b)(vi).

[10] Other climate change policies and strategies include the National Climate Change Communication Strategy, 2012–2017, National Climate Change Strategy (2012), Second National Communication, UNFCCC (2014) and Intended Nationally Determined Contributions (2015).

It is also important to consider the Tanzania Agriculture and Food Security Investment Plan (TAFSIP, 2011-2020). The TAFSIP is aimed at, among others, "contribut[ing] to … household income and food security" (United Republic of Tanzania 2011). To do this it outlines what investments are needed to achieve the Comprehensive Africa Agriculture Development Program (CAADP) target of 6% growth a year in agricultural GDP. It is implemented by the Agricultural Sector Development Strategy II (ASDS-2) (United Republic of Tanzania 2015).

ASDS-2 steers the implementation of sectoral policies from 2015–2025, and is meant to contribute to the Tanzania Development Vision (Vision 2025) by promoting inclusive and sustainable agricultural growth; reducing rural poverty; and improving food and nutrition security. One priority of ASDS-2 is using science and technology research to transform the agricultural sector (crops, livestock, fisheries) into a modern market that will ensure food security and reduce poverty. The overall goal of the TAFSIP and ASDS-2 is to help realise Vision 2025, which envisages raising Tanzanians' general standard of living by 2025.

Older strategies include the National Fisheries Sector Policy and Strategy Statement of 1997 (United Republic of Tanzania 1997). In a policy gap analysis, the ASDS-2 identified that this strategy statement recognizes that the fisheries sector, including fish farming, has the potential to be instrumental in ensuring food security, especially through the provision of high-quality protein and other nutrients. The sector can also provide more employment. The analysis then pointed to the relevant policy gaps, namely a lack of programmes to address declining stock and protect endangered aquatic species; and inadequate legal frameworks to combat illegal, unregulated and unreported fishing.

It proposed expanding the range of fisheries products by investing in infrastructure for deep sea fishing; improving fishing techniques to help artisanal fishers reduce post-harvest losses; and strengthening relevant regulatory frameworks (United Republic of Tanzania 2015).

While the United Republic of Tanzania has no blue economy strategy yet, the government has prioritized the blue economy in achieving its 2030 Development Agenda. The National Technical Committee on Blue Economy was established in 2019 to ensure inter-institutional consultations among national stakeholders and address national commitments to the blue economy and ocean governance. In October 2020 Zanzibar published its Blue Economy Policy (The Revolutionary Government of Zanzibar 2020).

Complex Interactions, Varying Responses

Large-scale monsoon winds control oceanic conditions and productivity in Tanzanian waters. The winds are seasonal along the East African coast – December to February sees the Northeast monsoon while May to September sees the Southeast (SE) monsoon. The months in-between, when the winds change direction, are seen as transition periods (Kizenga et al 2021), with March to April, or sometimes mid-May, bringing the "long rains" and October to November, or sometimes mid-December, bringing the "short rains". These two monsoons and two transitional periods define the four main seasons of the region.

The Tanzanian marine environment is an open ocean upwelling-driven system with the prevalent current along the Tanzanian coast, the East African Coastal Current (EACC; **Figure 2**), dominating the circulation pattern of coastal waters. The EACC is also influenced by the seasonal monsoon winds. The EACC affects heat distribution and nutrients along Tanzania's coast. However, its flows in the Zanzibar, Mafia and Pemba channels differ from one another. It has been suggested that these differences in flow and depth of the channels maintain

different biological regimes and are likely to cause different biological responses to the accelerating impacts of climate change. The Mafia and Zanzibar channels are also close to major rivers, which act as another source of nutrients for photosynthetic activity (Shaghude et al., manuscript in preparation).

These different biological responses, together with the impact of various forms of upwelling and other complexities such as the impacts of climate change and different adaptive capacity, necessitate varying responses to enable appropriate adaptation measures for ecosystems in Tanzanian waters.
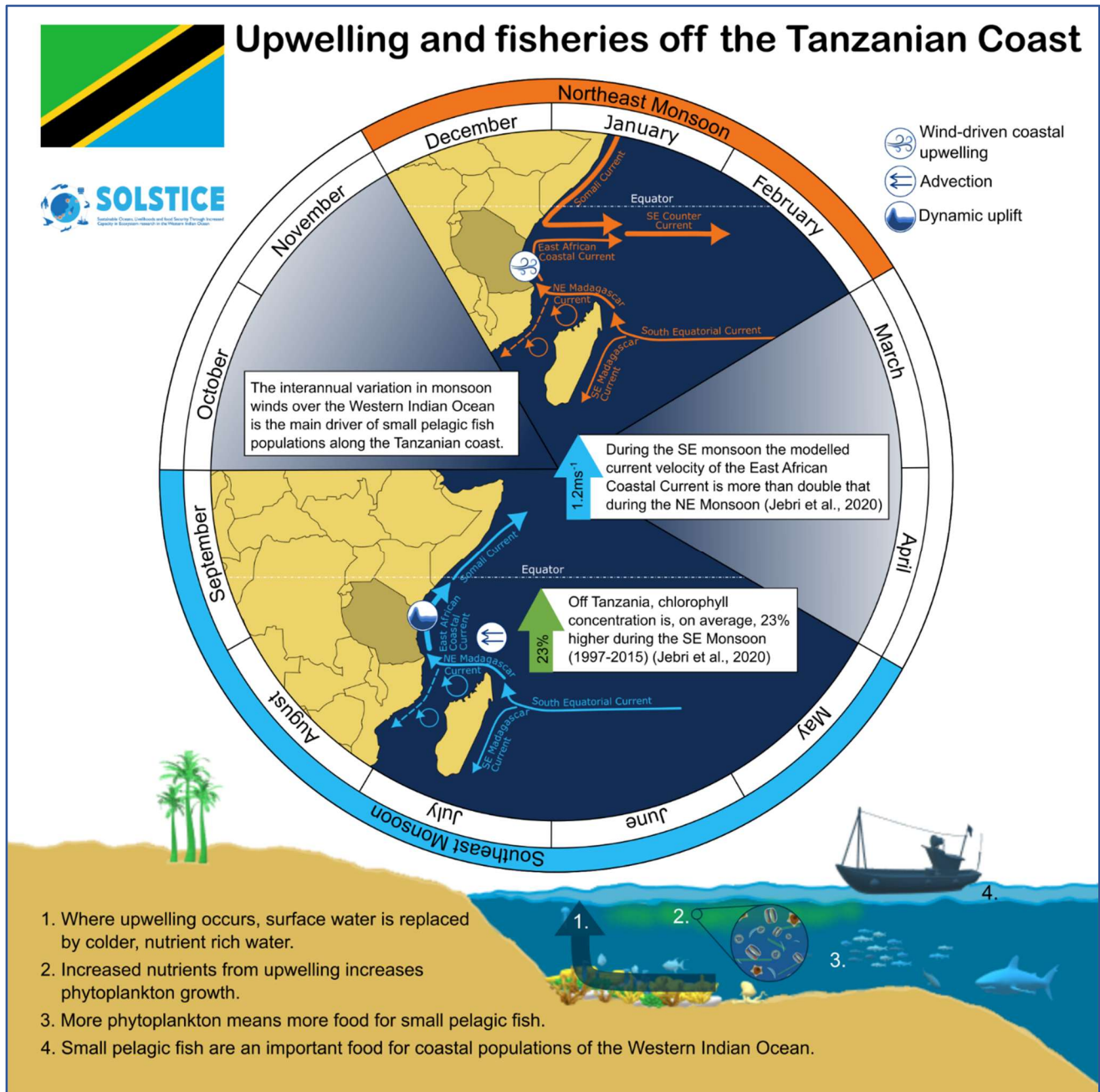

Figure 2: *The significance of seasonal upwelling for fisheries along the Tanzanian coast*

Phytoplankton Availability

The abundance of small pelagic fisheries depends upon the availability of phytoplankton. There is a significant positive relationship between one of the key biophysical parameters, Chlorophyll-a (Chl-a), a proxy for

phytoplankton biomass concentrations, and small pelagic fisheries in Tanzanian waters (Jebri et al., 2020; Kizenga et al., 2021). Understanding Chl-a variability and its drivers is of critical importance to marine fisheries management, in particular small pelagics. The biophysical processes likely to drive long-term variations in small pelagic catches are examined via satellite observations, ocean model outputs and in-situ measurements.

The strength of surface currents during the SE monsoon, which causes a 'dynamic uplift' upwelling and westward advection of nutrients into Tanzanian waters, is a key driver of phytoplankton blooms (Jebri et al., 2020). Owing to the interannual changes of monsoon winds the resultant variations in these mechanisms impact the Chl-a concentration.

However, despite its importance there is little in-situ measurement of the seasonal and spatiotemporal distribution and evolution of observed Chl-a and its link to environmental conditions along the Tanzanian channels, and even this is fragmented. The few studies that have been done have focussed on localized sites close to the mainland coast or the shallow waters near Unguja and Pemba islands (Sekadende et al., 2021).

Subtle underlying mechanisms cause variations in the timing of phytoplankton bloom in the Mafia, Zanzibar and Pemba channels. The Mafia Channel is predominantly affected by terrestrial impacts, the Pemba Channel sees oceanic influences, and the Zanzibar channel experiences both terrestrial and oceanic driving forces. This has important implications for fisheries management in Tanzania and, in particular, climate change adaptation options (Shaghude et al., manuscript in preparation).

Eight main rivers discharge into Tanzanian coastal waters. Terrigenous nutrient supply via riverine input may affect small pelagic fish productivity in the Mafia Channel by impacting marine primary productivity and enhancing phytoplankton and zooplankton abundance. Meanwhile in the Pemba Channel, which receives the outflow of the Pangani River, it remains unclear if terrigenous nutrient supply similarly affects productivity due to the greater oceanic influence (Sekadende et al., 2020).

Climate Change and Small Pelagics

The impacts of climate change, with diverse onsets, will affect small pelagic fisheries through various direct and indirect pathways. Tropical marine fisheries, like those in Tanzanian waters, are very susceptible to the effects of climate change. Small pelagics also have diverse habitats, behaviours and life history strategies, which implies that their response to the impacts of climate change will vary based on their species and geographical range. The likely climate change impacts include 'distributional shifts in response to changes in temperature, abundances, composition and phenology of phyto- and zooplankton, ocean deoxygenation and acidification' (Sekadende et al., 2020). Climate change also has an effect on ocean circulation and therefore indirectly impacts small pelagics, in that it affects retention and population connectivity and ocean upwelling – which has an impact on nutrient supply to the food chain. If the rising ocean temperature approaches small pelagics' thermal limits – with early life stages expected to be the most vulnerable to extreme temperatures – negative impacts will be seen in their growth, metabolism and reproduction. As such, environmental stress during early life stages may result in the decline of fish species as the climate heats up (Sekadende et al., 2020).

It is therefore crucial to gain a better understanding of the pressure that climate change puts on marine ecosystems, associated fisheries and the socio-economic systems that rely on them.

Only through sustained observation of the Tanzanian waters and through regional biogeochemical models will it be feasible to interpret existing variability and future trends in the region. Once this has been interrogated, it will be possible to put in place informed climate change adaptation measures (Jacobs et al., 2021).

Since different mechanisms drive seasonal variability in phytoplankton biomass, the Mafia and Pemba channel ecosystems may differ greatly in their response to climate change and may need discrete adaptation strategies (Sekadende et al., 2020).

Different Adaptive Capacity

All natural resource-based industries in Tanzania are facing the impacts of climate change, which is making food sources more scarce and unstable (Taylor et al., 2021). There is a complex relationship between species diversification, the wealth of fishers and their capacity to adapt. Adaptive capacity means the 'conditions that enable people to anticipate and respond to change, minimise the consequences, enable recovery, and take advantage of new opportunities' (Taylor et al., 2021). The most common habitat targeted in Tanzania's four coastal regions are deep waters, except in Mafia, where fishers operate in shallow waters.

It seems that within the fishing community fishing revenues are already diversified in two main ways: fishers can either target different species or species groups within a region or catch in different regions.

With greater access to different habitats comes a more diverse catch, which could increase adaptive capacity, ensure nutritional security and protect livelihoods. However, this would mean larger and more expensive boats and fishing gear, which is not necessarily possible for many fishers. Management strategies that focus on catch diversification in tropical fisheries should keep this in mind (Taylor et al., 2021).

In Pemba, Zanzibar and Mafia, wealthier fishers show the most adaptive capacity and their portfolio strategies are more diverse. In Tanga, on the other hand, wealthier fishers have the lowest level of adaptive capacity in the region because they opt for species specialisation. It has been observed that in all four coastal regions fishers in the lowest asset wealth quartile show little adaptive capacity, meaning that fisheries have few substitute livelihoods.

The Need for Region-Specific Features

While climate change is happening worldwide, it manifests in different ways regionally and is influenced by local factors (Jacobs et al., 2021). For instance, it has been discussed that in the Pemba, Zanzibar and Mafia channels satellite observations of Chl-a show seasonal variability in phytoplankton blooms, which is caused by different driving mechanisms. This means that the ecosystems of these channels will respond differently to climate change and that climate change strategies need to include region-specific features (Shaghude et al., manuscript in preparation).

Future oceanic changes will therefore drive management strategies in Pemba Channel and, to a certain extent, the Zanzibar Channel, while rainfall projections should be considered in the Mafia Channel waters. The impacts of enhanced ocean stratification, reduced nutrient supply and, subsequently, decline in primary production may leave the Pemba Channel ecosystems and fisheries particularly exposed.

The Pemba Channel may however, experience delayed exposure to rising sea surface temperature due to the influence of oceanic upwelling (Jebri et al., 2020; Painter et al., 2021). This may mean that the channel's

exposure to associated extreme events such as marine heatwaves may be delayed or diminished, which could offer reef fish a refuge in future (Shaghude et al., manuscript in preparation). The Mafia Channel, on the other hand, where riverine input is the main controlling mechanism of productivity, will most likely be more vulnerable to changes in large-scale rainfall patterns (Shaghude et al., manuscript in preparation).

Certain instances will call for the design of a collaborative management mechanism. The Pemba and Zanzibar channels each function as unified biomes, with common environmental mechanisms that impact both the mainland and island side of the channels (Shaghude et al., manuscript in preparation). Small pelagics can thus be regarded as a shared resources between the two governments. As a result, collaboration in the sustainable use of this resource, taking into account seasonal variability patterns, will be to both their benefit.

Yet, all of this must also consider the different adaptive capacities within the coastal regions of Tanzania.

Conclusions

Since one-third of the total marine catch off the coast of Tanzania comes from small and medium pelagic fish species, they are a crucial livelihood source for artisanal and subsistence fisheries. Sustainable management of this resource is thus paramount. However, since access to the small and medium pelagic fishery is both free and commonplace, it is difficult to manage these fish species. The sector is also facing increasing pressure from growing exploitation, unsustainable practices and serious environmental impacts. The government bodies in charge of tackling the country's challenges are now prioritizing this issue.

The nature of Tanzania's marine ecosystems – the multiple biological responses, coupled with different upwellings and other issues such as the effects of climate change and differing adaptive capacities – means that varying responses are needed to ensure appropriate adaptation measures are put in place. At the same time, in some cases a collaborative management mechanism is appropriate. One example discussed is the Pemba and Zanzibar channels, which act as unified biomes with shared environmental mechanisms that affect both the mainland and island sides of the channels. Here, small pelagics become a common shared resource. This means that collaborating in their sustainable exploitation, whilst also considering seasonal variability patterns, will benefit both governments.

Ensuring food security and livelihoods in Tanzania requires policy development at national level that is underpinned by growing and improved research and data collection. In particular it requires a blue economy strategy for the United Republic of Tanzania as well as a climate change adaptation strategy that includes the fishing sector,

The new Deep Sea Fisheries Management and Development Act of 2020 allows for a joint management plan between Zanzibar and Mainland Tanzania, which should be considered for the management of the deep-sea fisheries resources, a vital shift in attention to improve food security.

Key Findings:

- The Tanzanian artisanal and subsistence fisheries rely heavily on small and medium pelagic fish species for employment and nutritional security.
- In the face of significant population growth, overexploitation, habitat destruction and climate change, food security must be a top priority for the Tanzanian Government.

- One of the key components in achieving food security for a coastal population is the development of a sustainable blue economy.
- In the face of climate change, insight into the physical and biogeochemical drivers of small, medium and large pelagic fish's long-term abundance is crucial.
- An understanding of how the marine environment will respond to future changes and impacts of climate change should inform decision-making around adaptation measures and strategies.

Recommendations:

- Adopt a long-term vision for a blue economy, which includes a shift in attention to offshore waters and the whole of the EEZ.
- Focus on tuna and tuna-like species as an important source of income.
- Retain more value from the foreign fishing fleets operating in Tanzanian waters.
- Prepare for the accelerating negative impacts of climate change on marine ecosystems and fisheries.
- Recognise that ecosystems in Tanzanian waters are strongly reliant on various forms of upwelling.
- Invest in operational remote sensing and establish an 'upwelling watch' to document the responses of ecological and socioeconomic systems to anomalous events such as heatwaves and upwelling regimes, thereby improving fisheries data collection.
- Endeavours to analyse and predict food security crises must include fisheries.

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References

Breuil, C. & Grima, D. (2014). *Baseline Report Tanzania*. Ebene: SmartFish Programme of the Indian Ocean Commission, Fisheries Management FAO component, 10. Retrieved from http://www.fao.org/3/br800e/br800e.pdf

Constitution of the United Republic of Tanzania 1977. Retrieved from https://www.nao.go.tz/uploads/Constitution_of_the_United_Republic_of_Tanzania_en.pdf

Jebri, F., Z.L. Jacobs, D.E. Raitsos, M. Srokosz, S.C. Painter, S. Kelly, M.J. Roberts, L. Scott, S.F.W. Taylor, M. Palmer, H. Kizenga, Y. Shaghude, J. Wihsgott, E. Popova (2020) Interannual monsoon wind variability as a key driver of East African small pelagic fisheries. *Scientific Reports, 10*(1), https://doi.org/10.1038/s41598-020-70275-9

Jacobs, Z.L., A. Yool, F. Jebri, M. Srokosz, S. Van Gennip, S.J. Kelly, M. Roberts, W. Sauer, A.M. Queiros, K.E. Osuka, M. Samoilys, A.E. Becker, E. Popova (2021). Key climate change stressors of marine ecosystems along the path of the East African Coastal Current. *Ocean & Coastal Management*, 208, 105627, https://doi.org/10.1016/j.ocecoaman.2021.105627

Kizenga, H.J., F. Jebri, Y. Shagude, D.E. Raitsos, M. Srokosz, Z.L Jacobs, F. Nencioli, M. Shalli, M.S. Kyewalyanga, E. Popova (2021). Variability of the mackerel fish catch and remotely-sensed biophysical controls in the eastern Pemba channel. *Ocean & Coastal Management*, 207, 105593, https://doi.org/10.1016/j.ocecoaman.2021.105593

Mlimuka A., & P. Vrancken (2017). Tanzania, in P. H. G. Vrancken & M. Tsamenyi (Eds.), *The Law of the Sea: The African Union and its member states*. Cape Town: Juta.

Okafor-Yarwood, I., N.I. Kadagi, N.A.F. Miranda, J. Uku, I.O. Elegbede, I.J. Adewumi (2020). The blue economy–cultural livelihood– ecosystem conservation triangle: The African experience. *Frontiers in Marine Science*, 7, 586, https://doi.org/10.3389/fmars.2020.00586

Osuka, K. E., C. McClean, B.D. Stewart, T. Le Bas, J. Howe, C. Abernethy, S. Yahya, D. Obura, M. Samoilys (2021). Characteristics of shallow and mesophotic environments of the Pemba Channel, Tanzania: Implications for management and conservation. *Ocean & Coastal Management*, 200, 105463, https://doi.org/10.1016/j.ocecoaman.2020.105463

Painter, S.C., B. Sekadende, A. Michael, M. Noyon, S. Shayo, B. Godfrey, M. Mwadini, M. Kyewalyanga (2021). Evidence of localised upwelling in Pemba Channel (Tanzania) during the southeast monsoon. *Ocean & Coastal Management* 200, 105462, https://doi.org/10.1016/j.ocecoaman.2020.105462

Sekadende, B.C., A. Michael, S.C. Painter, M. Noyon, M.S. Kyewalyanga (2021). Spatial variation in the phytoplankton community of the Pemba Channel, Tanzania, during the south-east monsoon. *Ocean & Coastal Management* 212, 105799, https://doi.org/10.1016/j.ocecoaman.2021.105799

Sekadende, B., L. Scott, J. Anderson, S. Aswani, J. Francis, Z. Jacobs, F. Jebri, N. Jiddawi, A.T. Kamukuru, S. Kelly, H. Kizenga, B. Kuguru, M. Kyewalyanga, M. Noyon, N. Nyandwi, S.C. Painter, M. Palmer, D.E. Raitsos, M. Roberts, S.F. Sailley, M. Samoilys, W.H.H. Sauer, S. Shayo, Y. Shaghude, S.F.W Taylor, J. Wihsgott, E. Popova (2020). The small pelagic fishery of the Pemba Channel, Tanzania: What we know and what we need to know for management under climate change. *Ocean & Coastal Management,* 197, 105322, https://doi.org/10.1016/j.ocecoaman.2020.105322

Stop Illegal Fishing (2019, 4 February). Tanzania Fisheries Act for amendment. Retrieved from https://stopillegalfishing.com/press-links/tanzania-fisheries-act-for-amendment/

Taylor, S.F.W., S. Aswani, N. Jiddawi, J. Coupland, P.A.S. James, S. Kelly, H. Kizenga, M. Roberts, E. Popova (2021). The complex relationship between asset wealth, adaptation, and diversification in tropical fisheries. *Ocean & Coastal Management*, 212, 105808, https://doi.org/10.1016/j.ocecoaman.2021.105808

The Revolutionary Government of Zanzibar (2020). Zanzibar Blue Economy Policy. Retrieved from http://planningznz.go.tz/doc/new/BE%20Policy-2020.pdf

United Republic of Tanzania, Ministry of Natural Resources and Tourism (1997). National Fisheries Sector Policy and Strategy Statement. Retrieved from https://www.mifugouvuvi.go.tz/uploads/publications/en1595837829-NATIONAL%20FISHERIES%20SECTOR%20POLICY%20AND%20STRATEGY%20STATEMENT.pdf

United Republic of Tanzania (2011). Tanzania Agriculture and Food Security Investment Plan (TAFSIP) 2011-12 – 2020-21. Retrieved from http://www.fao.org/faolex/results/details/en/c/LEX-FAOC160649

United Republic of Tanzania, Ministry of Agriculture (2014). Tanzania Agriculture Climate Resilience Plan, 2014–2019. Retrieved from https://www.kilimo.go.tz/index.php/en/resources/view/tanzania-agriculture-climate-resilience-plan-20142019

United Republic of Tanzania (2015). Agricultural Sector Development Strategy - II 2015/2016 – 2024/2025. Retrieved from http://extwprlegs1.fao.org/docs/pdf/tan160643.pdf

United Republic of Tanzania (2018). Overview/milestones of blue economy in Tanzania towards implementation of SDG 14. Retrieved from https://saiia.org.za/wp-content/uploads/2018/04/Overview-Milestones-of-Blue-Economy-in-Tanzania-towards-implementation-of-SDG-14-by-Julius-Edward.pdf

Vrancken P. H. G., & Tsamenyi, M. (Eds.). (2017). The Law of the Sea: The African Union and its member states. Cape Town: Juta