5-Year Review of the Tanzanian Distinct Population Segment (DPS) of African Coelacanth (*Latimeria chalumnae*)

June 2025

National Marine Fisheries Service
Office of Protected Resources,
Silver Spring, Maryland

National Marine Fisheries Service
5-Year Review of the

Threatened Tanzanian Distinct Population Segment (DPS) of African Coelacanth

Recommendation Resulting from the 5-Year Review:

- [ ] Downlist to Threatened
- [ ] Uplist to Endangered
- [ ] Delist
- [x] No change is needed

Review Conducted By:

Heather Austin, Office of Protected Resources, Heather.Austin@noaa.gov

HEADQUARTERS APPROVAL:

[x] Concur   [ ] Do Not Concur

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Tanzanian Distinct Population Segment (DPS) of African Coelacanth
(*Latimeria chalumnae*)

The National Marine Fisheries Service (NMFS) of the National Oceanic and Atmospheric Administration (NOAA) conducted this review as required by the Endangered Species Act of 1973, as amended (ESA, 16 U.S.C. 1533 *et seq.*).

1 GENERAL INFORMATION

1.1 Reviewers

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1.2 Introduction

Section 4(c)(2) of the ESA requires us to review the status of listed species at least once every 5 years (16 U.S.C. 1533(c)(2)) to determine whether the species should be

- removed from the list (i.e., delisted),
- reclassified from an endangered species to a threatened species (i.e., downlisted), or
- reclassified from a threatened species to an endangered species (i.e., uplisted).

Section 4(b)(1)(A) of the ESA requires us to base the determination solely on the best scientific and commercial data available and after taking into account efforts to protect the species (16 U.S.C. 1533(b)(1)(A)). Any recommendation to delist or reclassify the species would require a rulemaking.

Throughout this review, we use terms as defined or described by the ESA (16 U.S.C. 1532) including:

- The term “species” includes any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature.
- The term “endangered species” means any species which is in danger of extinction throughout all or a significant portion of its range.

- The term “threatened species” means any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

1.3 Methods

As required under 50 CFR 424.21, we announced initiation of the 5-year review in the Federal Register (FR) and solicited relevant information (89 FR 72379; September 5, 2024). We specifically requested information that has become available since we listed the DPS in 2016. We did not receive any relevant information during the 60-day comment period.

We used scientific publication search tools to identify relevant information available since the completion of the 2014 status review. The NOAA Library performed and documented a systematic search across major bibliographic resources, including organizational websites and literature repositories. The library provided an extensive digital library of the full-text literature. We reviewed and evaluated this literature and other available data (cited herein) in conducting this status review.

1.4 ESA Section 4 History

Section 4 of the ESA authorizes us to promulgate regulations to list threatened and endangered species (16 U.S.C. 1533 *et seq.*), which are listed at 50 CFR 17.11. For this species, we have completed the following actions under section 4 of the ESA.

1.4.1 Initiation of this 5-Year Review

FR notice: 89 FR 72379
Date published: September 5, 2024

1.4.2 Listing History

Original Listing
FR notice: 81 FR 17398
Date listed: March 29, 2016
Entity listed: Tanzanian Distinct Population Segment of African Coelacanth
Status: Threatened

1.4.3 Review History

- Whittaker K (2014). Endangered Species Act status review report for the coelacanth *Latimeria chalumnae.* Report to National Marine Fisheries Service, Office of Protected Resources. October 2014. National Marine Fisheries Service, Silver Spring, Maryland, USA.

- Conclusion: the Tanzanian DPS of African coelacanth has a moderate risk of extinction.

2 DESCRIPTION OF LISTED ENTITY

2.1 Species Description

The African coelacanth, *Latimeria chalumnae*, belongs to class Sarcopterygii, an ancient lineage of bony, lobe-finned fish, which includes coelacanths, lungfish, and very early tetrapods. The species was believed to have gone extinct over 65 million years ago but was rediscovered off the coast of South Africa in 1938 (Whittaker 2014). The Tanzanian distinct population segment (DPS) is a small, isolated population that diverged from the other three populations (Comoros, Madagascar, and South Africa) approximately 200,000 years ago (Whittaker 2014; Cooke et al. 2021).

2.2 DPS Analysis

The 1996 Policy Regarding the Recognition of Distinct Vertebrate Population Segments Under the ESA ("DPS Policy," 61 FR 4722; February 7, 1996) provides principles to guide the listing, delisting, and reclassification of DPSs. Under the DPS Policy, we consider:

1. Discreteness of the population segment in relation to the remainder of the species to which it belongs;
2. The significance of the population segment to the species to which it belongs; and;
3. The population segment's conservation status in relation to the Act's standards for listing (i.e., is the population segment, when treated as if it were a species, endangered or threatened).

The Tanzanian population is likely small, with no connectivity to other populations, and is one of only four established populations of the African coelacanth, all considered to be small and isolated (Whittaker 2014; Cooke et al. 2021). The other three established populations have been confirmed by survey efforts, inhabiting deep-water caves off the coast of the Comoros, Madagascar, and South Africa, with Cooke et al. (2021) recently providing the first confirmed and comprehensive account of a population of Madagascan coelacanths. The authors note that the recently confirmed Madagascan population is distributed along 1,000 km of the southern and western coasts of the island, and is a resident and regionally important coelacanth population, possibly ancestral to the Comoros population (Cooke et al. 2021). However, due to lack of tissue samples from Madagascan specimens, genetic information is currently lacking for the

Madagascan population, and no new genetic studies have been conducted (Cooke et al. 2021). Although these data on the Madagascan coelacanths have become available since the 2014 status review, the available data still support a finding that the Tanzanian population qualifies as a DPS pursuant to the DPS Policy – i.e., the Tanzanian population is discrete from other populations of coelacanths and is significant to the taxon as a whole.

3 BIOLOGY, LIFE HISTORY, AND RANGE

The Tanzanian DPS of African coelacanth inhabits deep-water coastal habitats along the Tanzanian coast (**Figure 1**). It is found predominantly at 70 – 140 m depths within rocky terraces comprised of sedimentary limestone, where it uses submarine cavities and shelves for shelter (Whittaker 2014; Cooke et al. 2021; Queiros et al. 2024). However, some coelacanths (n = 19) have also been reported at depths of 40 – 60 m in the outer reefs near the village of Tanga, Tanzania (Whittaker 2014; Pulfrich 2018; Cooke et al. 2021). This suggests that the Tanzanian DPS of African coelacanth may prefer shallower depths than other populations exhibit (i.e., the Comoran population is found at 180 – 230 m depths, the South African population is found at 100 – 130 m, and the Madagascan population is found at 60 – 500 m) (Whittaker 2014; Pulfrich 2018; Cooke et al. 2021). The DPS demonstrates strong site fidelity, typically migrating 3-4 km per night, with a maximum distance of 35 km from their home caves (Fricke et al. 2011; Pulfrich 2018). Their site fidelity and small home-range size may be related to traditional use and understanding of the cave topography and surroundings (Fricke et al. 1994; Decamps et al. 2017; Pulfrich 2018). Coelacanths typically occur singly or in groups, congregating in caves and under overhangs during the day, with as many as 14 fish reported crowded together in a single cave (Pulfrich 2018; Sakau et al. 2021). Researchers observed that an individual might frequent several caves within its home range (Pulfrich 2018). The use of caves allows them to rest and conserve energy in a deep-water, low-prey environment (Pulfrich 2018; Sakau et al. 2021).

Coelacanths are extremely slow nocturnal drift-hunters, feeding opportunistically on benthic, epibenthic, and mesopelagic fish and mollusks found in their deep-water coastal habitats (Pulfrich 2018). Evidence from the prey found in coelacanth stomachs indicate that they predominantly feed on fish, eels, skates, shark, squid, octopi, and cuttlefish (Pulfrich 2018; Mesaki 2024). Their low-energy drift feeding behavior likely helps to conserve their energy and oxygen (Whittaker 2014; Pulfrich 2018). At night, coelacanths descend 50 to 100 m below their daytime habitat, reaching depths of approximately 200 to 300 m to consume their prey (Pulfrich 2018). This diurnal movement is largely dependent on prey availability (Whittaker 2014; Cooke et al. 2021;

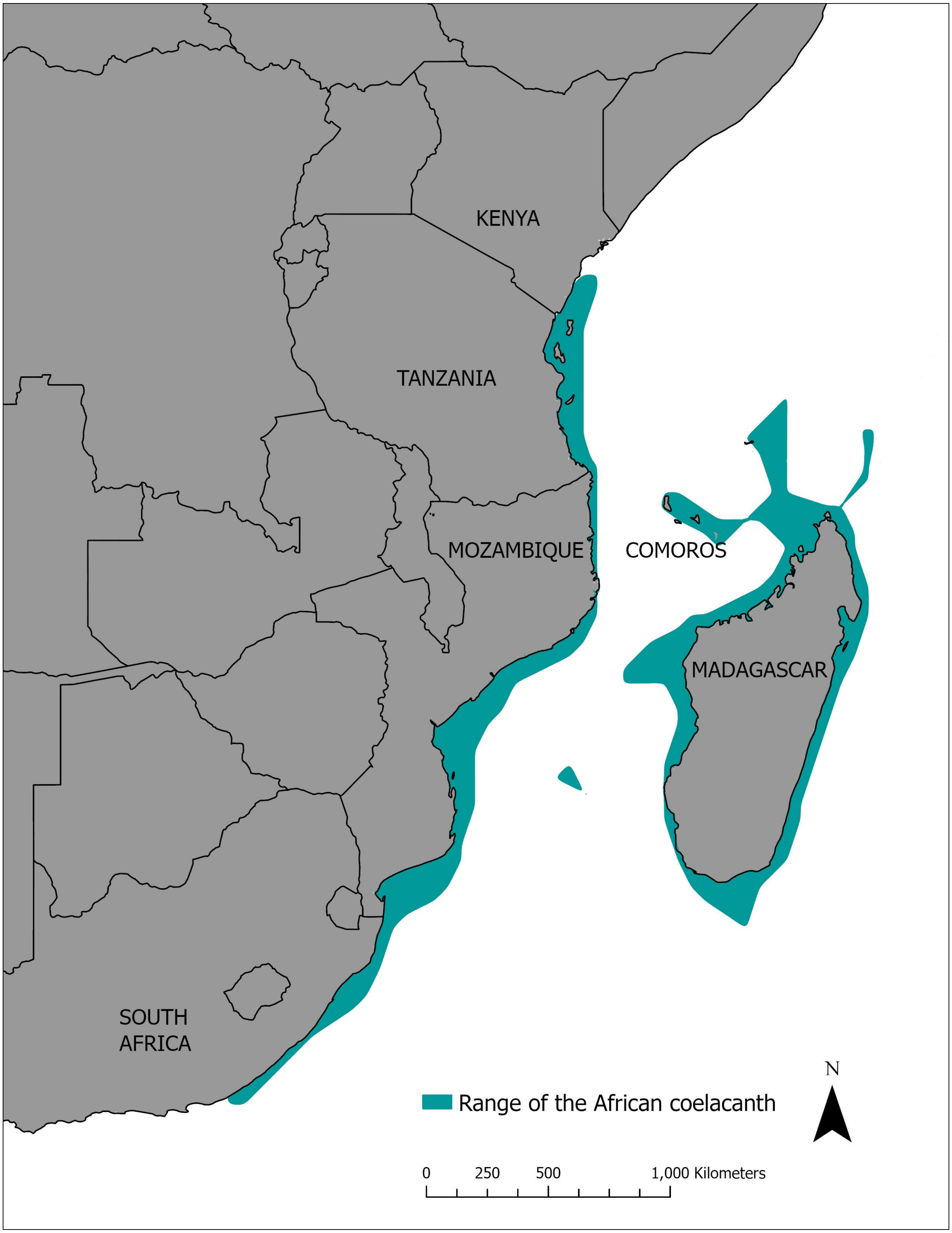

FIGURE 1. MAP PROVIDING APPROXIMATE REPRESENTATION OF THE AFRICAN COELACANTH'S RANGE OFF THE EAST COAST OF AFRICA (GREEN SHADED AREAS). THE TANZANIAN DPS IS FOUND IN DEEP-WATER COASTAL HABITATS ALONG THE TANZANIAN COAST, PREDOMINANTLY AT 70 – 140 M DEPTHS.

Sakaue et al. 2021). Coelacanths have also been observed performing maneuvers that may help it maximize benthic prey capture (Lauridsen et al. 2022). It performs headstand maneuvers lasting for minutes as it drifts across the substrate, with its head facing downwards, placing the narrowly focused electrosensitive rostral organ in close proximity to the seabed (Lauridsen et al. 2022). Even when the coelacanth restraightens the caudal fin during the headstand, the anterior position of the center of gravity to center of buoyancy will ensure that it can drift in this abnormal posture with minimal need for movements of balance adjustments, which potentially increases its ability to sneak up on prey (Lauridsen et al. 2022).

4 DEMOGRAPHIC FACTORS

The demographic factors of abundance, productivity, spatial distribution, and diversity can be reliable indicators of a species' persistence and reflect the manifestation of past threats (McElhany 2000). Information on these demographic factors, however, is limited for this DPS.

4.1 Abundance

No estimates of abundance were available for the Tanzanian DPS of African coelacanth at the time of the last status review, and no estimates of abundance are currently available. We attribute the lack of data to small population size (as concluded in the status review) and remote habitat. Sampling and survey conditions require deep technical scuba or submersibles to reach and document the Tanzanian DPS of African coelacanth in its natural habitat (Whittaker 2014; Edeye 2022).

4.2 Productivity and Population Trends

For the Tanzanian DPS of African coelacanth, no new information on population trends has become available since the previous status review. However, Mahe et al. (2021) evaluated 27 specimens sampled across 80 years using polarized light microscopy and provided new estimates of growth parameters as follows:

- Lifespan: ~100 years
- Age at maturity:
  - 58 – 66 years (female)
  - 40 – 69 years (male)
- Length at maturity:
  - 160 – 179 cm (female)
  - 120 – 129 cm (male)
- Gestation: ~5 years

- Length at birth: 30.8 – 35.8 cm

The data demonstrate that the coelacanth's lifespan is approximately 100 years, and has among the lowest growth rates of marine fishes for its size (Mahe et al. 2021; **Figure 2**). Typical of fish with slow life histories and slow growth, they exhibit low oxygen-extraction capacity, slow metabolism, ovoviviparity, and low fecundity (Mahe et al. 2021). Ovoviviparity means that embryos develop inside eggs that hatch within the female's body (Dulvy and Reynolds 1997; Iwata et al. 2019; Mahe et al. 2021).

The delayed maturity of the coelacanth relative to its longevity also implies a shorter relative reproductive lifespan than teleost fishes. This results in very different benefits and demographic consequences of extreme longevity (Mahe et al. 2021). In teleost fishes, long-lived species have an extended reproductive lifespan and thus ''sample'' multiple reproductive events. In a variable environment resulting in fluctuating recruitment, this allows taking advantage of occasional favorable environmental conditions to produce strong year classes literally ''stored'' in the adult population until conditions for strong recruitment return, a type of bet-hedging strategy also called "storage effect" (Warner et al. 1985; Mahe et al. 2021). In contrast, the coelacanth demography is likely to rely on a continuous influx of weak recruitment insured by very high survival rates of a few offspring per individual whatever the environmental conditions (Mahe et al. 2021).

The coelacanth is characterized by slow life history and relatively low fecundity, very late age at first sexual maturity, and exceptionally long gestation time and is therefore extremely vulnerable to perturbations of a natural or anthropogenic nature due to their very low replacement rate (Cheung et al. 2005; Mahe et al. 2021). The data from Mahe et al. (2021) indicate that the species lifespan is approximately 100 years. This number is greater than the foreseeable future timeframe in the final rule to list the DPS, which estimated a lifespan of 40 or more years based on data available at the time (81 FR 17398, March 29, 2016). However, for purposes of this 5-year review, we are not applying a different foreseeable future timeframe, because we do not have sufficient data on threats beyond 40 years.

4.3 Spatial Distribution

The Tanzanian DPS of African coelacanth has a narrow distribution along the Tanzanian coast (Whittaker 2014; Fraser et al. 2020; Cooke et al. 2021). There is currently little information in the scientific literature on the current spatial distribution and actual occurrences of this DPS, which is largely based on bycatch data. Since 2003, researchers observed 40 out of the 70 coelacanth specimens via bycatch off the coast of Zanzibar and Tanga, Tanzania (Fraser et al. 2020; Cooke et al. 2021). Additionally,

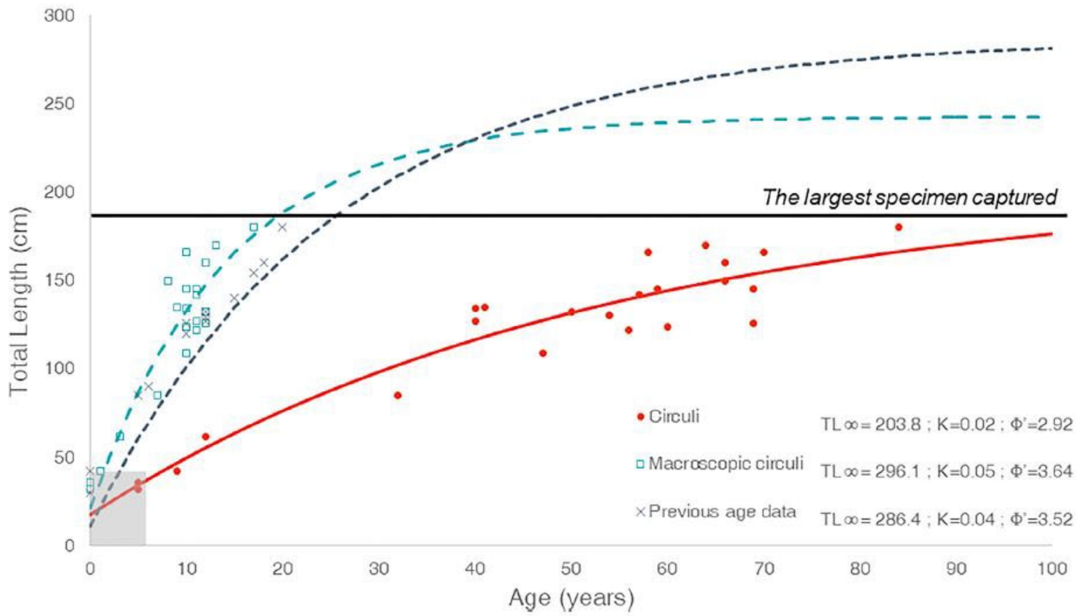

FIGURE 2. BODY GROWTH PATTERN OF THE AFRICAN COELACANTH ACCORDING TO DIFFERENT SCALE INTERPRETATIONS (MAHE ET AL. 2021).

Observed length-at-age data for different scale interpretations for age are shown (red solid circles, circuli aging; blue open squares, macro-circuli aging; dark blue crosses, previous age interpretation Froese and Palomares 2000) together with the corresponding fitted von Bertalanffy growth models (dashed light blue curve, macro-circuli; continuous red curve, circuli; dashed dark blue curve, previous age interpretation). TL and K are the asymptotic total length (cm) and the rate coefficient, i.e., the rate at which the asymptotic length is reached (per year), respectively, estimated from the von Bertalanffy growth models and 0 = logðKÞ + 2 log TLN ð is the growth performance index (cm,year^{-1}) that allows overall growth performance comparison across populations or species. The gray area represents embryos *in utero*. The black horizontal line indicates the size of the largest specimen ever captured.

juveniles (<100cm) are largely absent from survey and bycatch data and size classes between 40 and 100 cm are also absent from shallower water, suggesting that juveniles inhabit deeper water compared to older individuals, and further suggesting that earlier life stages may exhibit differences in spatial distribution (Fricke et al. 2011; Whittaker 2014).

4.4 Diversity

Genomic analysis of individuals from the Tanzanian DPS reveal that divergence and diversity within the population are very low (Nikaido et al. 2013; Mahe et al. 2021; Cavin et al. 2022). Low levels of diversity coupled with the long generation time and slow evolutionary rate of the Tanzanian DPS reflect a low adaptive and evolutionary potential, making the Tanzanian DPS particularly vulnerable to environmental change and episodic events. Additionally, due to the Tanzanian DPS' low diversity, this population may be at an increased risk of random genetic drift and could experience the fixing of recessive detrimental genes that could further contribute to the DPS' extinction risk (Whittaker 2014; Cavin et al. 2022).

5 ESA SECTION 4(A)(1) FACTORS OR THREATS

Section 4(a)(1) of the ESA requires us to determine whether any species is an endangered species or a threatened species because of any of the following factors (16 U.S.C. 1533(a)(1)):

(A) the present or threatened destruction, modification, or curtailment of its habitat or range;

(B) overutilization for commercial, recreational, scientific, or educational purposes;

(C) disease or predation;

(D) the inadequacy of existing regulatory mechanisms; or

(E) other natural or manmade factors affecting its continued existence.

We identified the following other natural or manmade factors affecting the species continued existence:

- Fisheries Bycatch

In the sections below, we review the impact of these 4(a)(1) factors or threats on the species. Since regulatory mechanisms aim to reduce other threats, we address this factor last.

5.1 Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Present and threatened habitat destruction are threats to the Tanzanian DPS of African coelacanth. Habitat threats include deep-water port construction, nearshore dynamite fishing, and changing environmental conditions.

5.1.1 Deep-Water Port Construction

The Tanzanian Port Authority (TPA) proposes to build a new multi-million dollar deep-sea port in Mwambani Bay, 8 km south of the original Tanga Port (Whittaker 2014; Mesaki 2024). Development of this port would include submarine blasting, channel dredging, and destruction of known coelacanth habitat near Yambe and Karange islands – the site of several Tanzanian coelacanth catches (Hamlin 2014; Whittaker 2014; Mesaki 2024). Additionally, this new port is scheduled to be built in the middle of the

Tanga Coelacanth Marine Park (TACMP), a protected marine reserve that was gazetted in 2009 and spans roughly 552km^2 (85km^2 of which are terrestrial and 467 km^2 are marine; Whittaker 2014; EACOP 2022). As its name suggests, this park provides essential habitat to the Tanzanian DPS of African coelacanth (TPA 2015; EACOP 2022; Mesaki 2024). Submarine blasting and channel dredging would destroy the submarine caves that coelacanths require for shelter, energy preservation, and protection against predation. This project is likely to occur within the foreseeable future which is estimated as 40 or more years (81 FR 17398, March 29, 2016).

In preparation for the deep-sea port, the TPA has initiated construction on a bonded warehouse for trucks, container storage, and residential buildings (TPA 2015). This construction has polluted the coastal habitat off Tanga, Tanzania and caused an influx of sediment into the coastal waters of the TACMP (Mesaki 2024). Increased pollution and sedimentation likely reduce the availability of the species' prey. Sedimentation damages the habitat of animals that the coelacanth regularly eats (see **Section 3.0**), and pollution can accumulate in the tissues of these prey, making them unsafe or less palatable for the coelacanth (Sakaue et al. 2021; Mustafa et al. 2024). Additionally, pollution and sedimentation can result in altered prey distribution, by changing the physical and chemical environment, making certain areas less suitable for coelacanth prey species (Mustafa et al. 2024). Such an influx of sediment and pollution is likely to increase in the future, as construction progresses.

In summary, construction has resulted in the present modification of the DPS' habitat through pollution, leading to loss of prey, and thus productivity. Proposed construction of the deep-sea port threatens to destroy the DPS' deep-water habitat. The greatest concern is habitat destruction in the TACMP, one of the few locations that this DPS is known to inhabit. The loss of this essential habitat would reduce the distribution of this DPS. Thus, deep-water port construction poses present and threatened destruction and modification of the DPS' habitat. These threats are likely to increase in the foreseeable future, as construction progresses.

5.1.2 Dynamite Fishing

Historically, dynamite fishing in the Pangani district within the Tanga region of Tanzania demolished a large fraction of the region's coral reefs and resulted in dramatic reductions in fish abundance (Robertson et al. 2018). Such reductions may limit prey availability for the coelacanth indirectly, by destroying its prey's nursery habitat (Cooke et al. 2021). While once widespread (Whittaker 2014; Braulik 2020; NEMC 2024), government enforcement has resulted in a substantial drop in dynamite fishing during the period of 2016 – 2018 (Braulik et al. 2020). Since mid-2018, dynamite fishing levels in Tanzania have been at their lowest in decades (Braulik et al. 2020; see **Figure 3**). These low levels are likely to persist into the foreseeable future.

Despite improvement, Braulik et al. (2020) detected 54 blasts during 695 acoustic recording days between June 2018 and May 2019, estimating a total of 108 blasts during that time (Braulik et al. 2020). Braulik et al. (2020) defined an acoustic recording day as 12 hours of daylight since blasting was never recorded at night. The largest number of blasts detected was in the outer reefs of the Tanga Coelacanth Marine Park, where 80 blasts, representing 74% of the total were estimated (Braulik et al. 2020). Additionally, Braulik et al. (2020) noted that although government enforcement has reduced dynamite fishing levels off the coast of Tanzania since mid-2018, fishers continue to engage in dynamite fishing at lower levels off the coast of the Tanga Region. Moreover, more than half (53.5%, n=29) of all dynamite fishing blasts detected occurred during spring low tides (Braulik et al. 2020). During these extreme spring low tides, fishers are able to access deeper fish habitats (Braulik et al. 2020), including those that are important to the DPS.

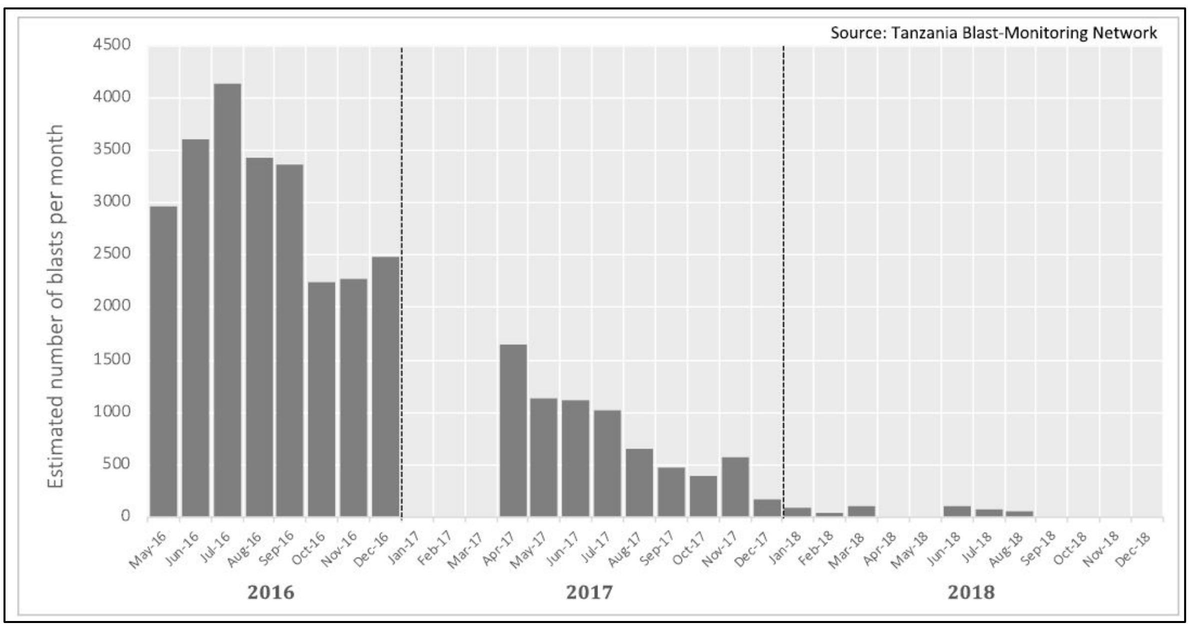

FIGURE 3. TREND IN ESTIMATED TOTAL MONTHLY BLASTS AT 24 HOTSPOT LOCATIONS ALONG THE TANZANIAN MAINLAND COAST BASED ON SYSTEMATIC SAMPLING FROM MAY 1, 2016 TO DECEMBER 31, 2018 (BRAULIK ET AL. 2020; TBMN, HTTPS://TZ-BLAST-MONITORING.NET/BLAST).

5.1.3 Changing Environmental Conditions

Changing environmental conditions threaten to modify the habitat of the DPS. For instance, researchers have reported significant warming trends in air temperatures and coastal waters over the past few decades, with recorded increases per decade consistent with global trends (NEMC 2024). Regarding precipitation, annual and seasonal decadal trends show a decline in maximum rainfall for coastal areas, particularly Tanga and Dar es Salaam, during the long rainy season in March – May (NEMC 2024). Model reconstructions of long-term sea level trends from a record of over 50 years show a general rising trend in Tanzania ranging from 0.4-2.0 mm/year (NEMC 2024). A study on inter-annual variations of ocean temperature spanning the period of 1980 – 2007 by Manyilizu et al. (2014) suggest that Tanzanian coastal waters were dominated by sea surface temperature variability at a periodicity of approximately 5 years. The strongest inter-annual variations occurred offshore at two periodicities of 2.7 and 5 years. Manyilizu et al. (2014) further suggest that the variability of the area links El Niño-Southern Oscillation and Indian Ocean Dipole oscillations to changes in the thermocline and surface heat fluxes.

Increasing temperatures extend into deep-water habitat (100+ meters) and are likely to continue increasing in the foreseeable future. Bathyal depths are likely to experience increasing temperatures over the next century, and projections indicate that even abyssal (3,000 – 6,000 meters) ocean temperatures could increase by 1°C over the next 84 years (Sweetman et al. 2017). For Tanzanian coelacanths, the water temperature at coelacanth catch depths is around 20°C, which corresponds to estimates of thermal requirements based on the temperature-dependent oxygen saturation of their blood, with an optimum at 15°C and an upper threshold at 22 - 23°C (Whittaker 2014).

Researchers note that the Tanzanian coelacanth population may prefer shallower depths than other coelacanth populations (see **Section 3.0**). Because of the Tanzanian coelacanth's possible preference for shallower-depth habitats, this DPS could be more subject to warming trends in sea surface temperature and variability in thermoclines off the Tanzanian coast. It is unlikely that the demographic parameters of the Tanzanian coelacanth (i.e. small and isolated population, low diversity, long generation time, and delayed maturity) would allow this population to adapt quickly to changing ocean conditions such that it would be physiologically better able to withstand metabolic stress of a warming ocean. However, the Tanzanian coelacanth may be able to move to suitable habitat outside of its current range, thus adapting its range to avoid the warming deep-water conditions (Cooke et al. 2021; Mahe et al. 2021; Mesaki 2024). If the need for cooler waters displaces the Tanzanian coelacanth, but complex cave shelters do not exist elsewhere, local extirpation or range restriction could happen. Rising sea surface temperatures and altered ocean currents may also shift the distribution and abundance of prey species, potentially leading to food shortages for the Tanzanian DPS (Pulfrich 2018; Mesaki 2024). However, the extent of these potential impacts on the coelacanth remain uncertain, and data are lacking on how changing environmental conditions directly affect the Tanzanian coelacanth population. Thus, impacts from and responses to changing environmental conditions are highly uncertain for this DPS throughout all of its range.

5.1.4 Summary (Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range)

Based on the best available information, we conclude that the present and threatened habitat destruction and modification continue to be a moderate threat to this DPS in the foreseeable future. Construction related to the deep-water port construction has increased pollution and sediment influx. Submarine blasting and channel dredging are likely to destroy the coelacanth's habitat within the TACMP. While government enforcement has reduced dynamite fishing levels off the coast Tanzania since mid-2018, fishers continue to engage in dynamite fishing at lower levels off the coast of the Tanga Region, destroying the DPS' shallower habitat. Changing environmental conditions could potentially modify the habitat of this DPS and any such impacts would be expected to increase in the future. The Tanzanian coast has experienced significant warming trends in air temperatures and coastal waters over the past few decades that also extend into the coelacanth's deep-water habitat (100+ meters). Additionally, rising sea surface temperatures and altered ocean currents may shift the distribution and abundance of prey species, potentially leading to food shortages for the Tanzanian DPS. These changing environmental conditions are likely to increase in the foreseeable future. In sum, habitat loss and degradation via deep-sea port construction continues to be a moderate threat to this DPS.

5.2 Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

5.2.1 Commercial Overutilization: Human Use and Consumption

The coelacanth is not desirable commercially, as a traditional food source, or for artisanal handicrafts. The coelacanth's flesh is rancid and contains large amounts of urea, which coelacanths store in their tissues like elasmobranchs, as well as oils, wax esters, and other compounds that are difficult to digest (Cooke et al. 2021). The coelacanth's local name '*gombessa'* means 'taboo' or 'strictly forbidden' in Swahili; derived from the coelacanth's oily flesh, and is suspected to be used locally as a medicinal laxative, but not desirable as food (Stobbs 1989; Whittaker 2014). No one has ever developed targeted methods of fishing for the coelacanth, and local cultures do not value the coelacanth commercially or for subsistence purposes (Fricke 1998; Cooke et al. 2021). Cooke et al. (2021) noted that people occasionally eat coelacanth flesh in Tanzania, but it is usually avoided as a food source by fishers and locals (Whittaker

2014; Cooke et al. 2021). Thus, the use of coelacanths for human use and consumption is likely not a current threat to this DPS.

5.3 Disease or Predation

The previous status review indicated that researchers have not observed any direct evidence of predation and identified disease and predation as a very low threat to this DPS (Whittaker 2014). No new information on disease has become available since the previous status review.

Recently, a study by Sherman et al. (2021) noted that bite marks found on coelacanths suggest that sharks are the coelacanth's main predator. Additionally, a study by Sakaue et al. (2021) detected a new behavioral response in South African coelacanths when a sand tiger shark (*Carcharias taurus*) entered their cave. An analysis of time-lapse video footage showed that the first dorsal fin angle of the coelacanth correlated with the presence-or-absence of a large shark that frequently passed through the cave (Sakaue et al. 2021; **Figure 4**). When no shark was present, the coelacanth's dorsal fin was folded 3/4 of the time, but when the shark entered the cave, its dorsal fin was unfolded >95% of the time, while no such reactions were observed with other fish entering the cave (Sakaue et al. 2021; **Figure 4**). This observation suggests that the dorsal fin's behavior is an evolutionary adaptation to shark predation (Sakaue et al. 2021; **Figure 4**). While predation of coelacanths by sharks may be occurring, there is no evidence that this is posing a threat to the DPS.

5.4 Fisheries Bycatch

The status review identified bycatch in the shark gillnet fishery as the greatest threat to this DPS (Whittaker 2014). New information that has become available since the previous status review describes an increasing trend in coelacanth bycatch in the shark gillnet fishery off the coast of Tanzania, indicating that fisheries bycatch continues to be the greatest threat to this DPS (Cooke et al. 2021; Mesaki 2024), throughout all of its range in deep-waters off the coast of Tanzania.

Historically, fisheries bycatch has been the most significant threat to the coelacanth (Cooke et al. 2021). Since its discovery in 1938, all known coelacanth catches are the result of bycatch. The Tanzanian DPS of African coelacanth in particular is subject to bycatch in the Tanzanian shark gillnet fishery, which has continued to expand off the coast of Tanzania throughout all of its range (Cooke et al. 2021; Oliver et al. 2024). Additionally, Oliver et al. (2024) notes that increasing catches of coelacanths in shark gillnets in Tanzania and Madagascar are prompting calls for increased protection for these coelacanth populations.

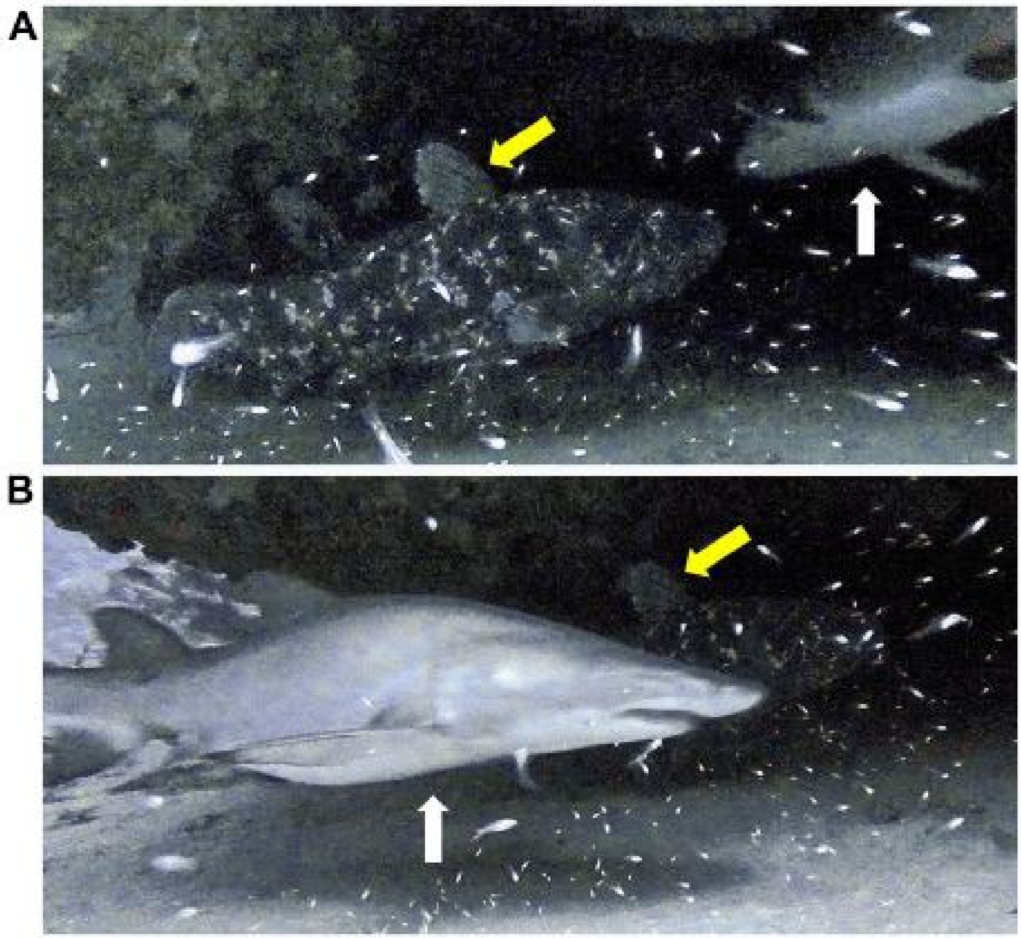

Figure 4. Photographs of the coelacanth in the cave with its first dorsal fin unfolded (yellow arrow) when a shark (white arrow) was present and likely visible to the coelacanth (A, B) (Sakau et al. 2021).

For more than a century, artisanal fishers have targeted sharks for shark fin and oil in the Western Indian Ocean (Cooke et al. 2021). Schaeffer (2004) reports that shark fin exports started as early as 1919 and that 6.6 tons of shark fins had exported from Zanzibar, Tanzania by 1923. Shark fishing intensified significantly with the rapid growth of the Chinese economy in the 1980s, and the resulting demand for shark fins continues today (Cooke et al. 2021). The advent of deep-sea gillnets, or *jarifa*, for catching sharks, driven by the demand for shark fins and oil from China in the mid-to late 1980s, resulted in an increase of coelacanth captures in Tanzania throughout all of its range, and other countries in the Western Indian Ocean (i.e. Madagascar and the Comoros) (Cooke et al. 2021). The *jarifa* gillnets used to catch sharks are a relatively new and more deadly innovation as they are large and set in deep-water, generally between 100 m and 300 m, within the preferred habitat range of coelacanths, and, unlike trawl nets, can be deployed in the rugged, rocky environments which coelacanths prefer (Cooke et al. 2021). There are two kinds of *jarifa* gillnets: those with large meshes (15 cm or 24 cm stretched mesh), which are often baited with small fish, and those with smaller meshes (10 cm; called 'ZZ nets'), which are not baited (Cooke et al. 2021). Large-mesh *jarifa* gillnets are used in Tanzania throughout all of its range, with fishers using the 15-cm stretched-mesh nets (Benno 2006; Whittaker 2014; Cooke et al. 2021). Large-mesh *jarifa* gillnets continue to be the biggest threat to the survival of coelacanths in Tanzania throughout all of its range and Madagascar (Cooke et al. 2021). Additionally, these nets are difficult to detect by fish as they are static and do not produce a pressure wave like active gear, such as a trawl net (Cooke et al. 2021). Furthermore, coelacanths hunt at night and have poor eyesight, and their main sensory organ, electroreception, may not be triggered by the thin strands of a gillnet (Cooke et al. 2021). In fact, coelacanths may be attracted to the nets, if they are baited with small fish (Cooke et al. 2021). Coelacanths may also be susceptible to capture in the snagging meshes of a *jarifa* gillnet, since they have large mouths with sharp teeth, large opercula, eight spines on the first dorsal fin, and paired lobed fins (Cooke et al. 2021).

Over 70 specimens of the Tanzanian DPS of African coelacanth have been reported (largely via bycatch) between 2003 and 2015 off the coast of Tanzania throughout all of its range (Cooke et al. 2021). Cooke et al. (2021) report that fishers have caught a significant number of coelacanths in *jarifa* gillnets off Tanga, Tanzania, where they caught 19 in 6 months in 2004/2005, including 6 in one night. Additionally, 35 (87.5%) of the 40 coelacanths captured off the coast of Tanzanian between 2003 and 2015 and for which the capture method is known were caught using 15-cm *jarifa* gillnets (except for two caught on handlines, two moribund specimens found floating on the water's surface, and one caught in a ring net; Benno et al. 2006; Nulens and Herbin 2011; Cooke et al. 2021). Of these 40 coelacanths, sex was determined for 26 fish; 10 of which were male and 16 (61.5%) were female, and half of the 16 female individuals caught were carrying eggs or unborn pups (Benno et al. 2006; Nulens and Herbin 2011; Cooke et al. 2021). In July 2009, an 86.5-kg, 176-cm female coelacanth was caught in a gillnet off Unguja Island, Zanzibar, Tanzania (Cooke et al. 2021). This female was carrying 23 fully developed juveniles (Cooke et al. 2021). It is important to note that over 90% of all captured coelacanths larger than 50 kg have been female (Bruton et al. 1991; Nulens and Herbin 2011; Cooke et al. 2021), and that these larger female coelacanths may be more susceptible than the smaller male coelacanths to capture by large-mesh gillnets set for sharks. The continued capture of pregnant female coelacanths within populations of the Western Indian Ocean, including the Tanzanian population is a serious concern as Fricke et al. (1994) have estimated that they produce only 140 young during their entire life.

In Tanzania, authorities prohibited fishing in the TACMP, which extends along 100 km of coastline from the Pangani River estuary to Mafuriko village north of Tanga City (Cooke et al. 2021). However, *jarifa* gillnets continue to be used in this marine reserve, which results in mortality of coelacanths and other marine life (Cooke et al. 2021).

In summary, bycatch in the shark gillnet fishery is the greatest threat to the coelacanth, contributing to mortality and reduced abundance. Given that a large proportion of bycaught coelacanths are mature females, bycatch is also likely contributing to reduced productivity of the DPS. Research suggests that the coelacanth population is unlikely to withstand high levels of exploitation (Cooke et al. 2021). The Tanzanian DPS of African coelacanth exhibits characteristics of a species that is vulnerable to extinction such as, occupying a relatively high trophic level, having low dispersal rates and limited spatial distribution, producing few offspring, having a low genetic diversity, and a long lifespan. Overall, the coelacanth's life history characteristics increase its vulnerability to the threat of bycatch and impede its resilience and recovery within the foreseeable future, which we estimate to be 40 or more years. Thus, fisheries bycatch continues to be the greatest threat to this DPS, and this threat appears to be increasing throughout all of its range since the previous review.

5.5 Inadequacy of Existing Regulatory Mechanisms

Since the 2014 status review, the Tanzanian government enacted the "Deep Sea Fisheries Management and Development Act" on June 19, 2020 (United Republic of Tanzania 2020). This act repeals the Deep Sea Fishing Authority Act (DSFA) of 1988 and its 2017 amendments, and it aims to improve the administration of the DSFA and enhance fisheries conservation throughout Tanzania (Gates et al. 2021). This new law, which Tanzania is also applying in Zanzibar, aims to introduce fisheries research in the Exclusive Economic Zone (EEZ), implement regional conservation and management measures, control fishing efforts, and prohibit the use of certain fishing gear, such as large-scale driftnets (United Republic of Tanzania 2020; Gates et al. 2021). While the Act doesn't explicitly mention gillnets, the regulations implementing the Act, specifically the Deep Sea Fisheries Management and Development Regulations of 2021, define "large-scale driftnets" as gillnets or other nets exceeding 2.5 kilometers in length used for enmeshing, entrapping, or entangling fish (Deep Sea Fisheries Management and Development Regulations 2021) and prohibit their use in the Tanzanian EEZ and within areas managed under a Regional Fisheries Management Organization (RFMO), such as the Indian Ocean Tuna Commission (IOTC) (Deep Sea Fisheries Management and Development Regulations 2021). Coelacanths are increasingly bycaught in gillnets (i.e. *jarifa* nets) throughout the DPS' range, despite this prohibition. We conclude that monitoring and enforcement of existing regulations within Tanzanian waters may be inadequate to ameliorate the threat of bycatch to the coelacanth.

Since the previous status review (Whittaker 2014), dynamite and *jarifa* net fishing continue in TACMP, despite the Tanzanian government restricting fishing activities within the park's boundaries (MPRU 2011; Braulik et al. 2020; Cooke et al. 2021; Mesaki 2024; NEMC 2024). Braulik et al. (2020) reports that in the Tanga region of Tanzania, dynamite fishing continues in TACMP, albeit at lower levels than in years prior to 2017, and the area of highest prevalence occurs within and offshore from the outer reefs of the TACMP. Cooke et al. (2021) reports that *jarifa* gillnets continue to be used in the TACMP, which has resulted in coelacanth mortality, despite the government's restriction of *jarifa* gillnets within the park. Additionally, Mesaki et al. (2024) indicates that TACMP management may not adequately prevent coelacanth bycatch within the park's boundaries. This indicates a lack of implementation and enforcement of existing regulations within the TACMP, and a need to strengthen law enforcement capacity within the park (Kuboja 2013; Chevallier 2019; Mesaki et al. 2024). This is concerning, given the importance of this area to the DPS.

In summary, while the Tanzanian government has established new regulations to prohibit the use of gillnets within the Tanzanian EEZ and within areas of the IOTC RFMO, coelacanths continue to be bycaught in gillnets via the shark gillnet fishery (Cooke et al. 2021). Additionally, even though the Tanzanian government has regulations in place to restrict fishing activities, including use of *jarifa* nets within the TACMP, they are not adequately enforced and thus do not reduce the main threat of bycatch faced by this DPS. Based on this information, and given the lack of monitoring and enforcement of existing regulations (especially within TACMP, which has resulted in coelacanth mortality), we conclude that regulatory mechanisms are inadequate and pose a moderate threat to this DPS.

6 RECOVERY PLAN

Section 4(f)(1) of the ESA requires us to develop and implement recovery plans for listed species, unless such a plan will not promote the conservation of the species (16 U.S.C. 1533(f)(1). For the Tanzanian DPS of African coelacanth, we did not develop a recovery plan because this DPS occurs entirely in foreign waters, and the United States does not contribute to the threats of this DPS. Therefore, as we concluded on July 25, 2019, an ESA recovery plan is not likely to promote the conservation of this DPS.

7 EFFORTS TO PROTECT THE SPECIES

Section 4(b)(1)(A) of the ESA requires us to make our determinations based solely on the best scientific and commercial data available and after taking into account efforts, if any, being made by any State or foreign nation, or any political subdivision of a State or foreign nation, to protect such species, whether by predator control, protection of habitat and food supply, or other conservation practices, within any area under its jurisdiction, or on the high seas to protect the species (16 U.S.C. 1533(b)(1)(A).

Since the 2014 status review, the following protective efforts have been implemented or are being developed and may promote the conservation of the Tanzanian DPS.

Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)
In 2000, the African coelacanth was formally listed on CITES Appendix I, which provides the highest level of protection under CITES (CITES Appendices). CITES is an international convention that aims to ensure that international trade in animals and plants does not threaten their survival. CITES affords varying degrees of protection to over 40,000 species, which are classified into three appendices: Appendix I includes species threatened with extinction, and trade in specimens of these species is permitted only in exceptional circumstances; Appendix II includes species not necessarily threatened with extinction, but trade must be controlled to ensure utilization is compatible with their survival; and Appendix III contains species that are protected in at least one country that has asked other CITES Parties for assistance in controlling the trade in specimens of that species (CITES Appendices). As a CITES-Appendix I species, the African coelacanth may not be traded for commercial gain (Cooke et al. 2021). There continues to be no evidence of illegal trade of the Tanzanian DPS of African coelacanth (Cooke et al. 2021; Mesaki 2024).

The Kenya-Tanzania Marine Trans-Boundary Conservation Area (TBCA)
Kenya and Tanzania proposed a coastal and marine Trans-Boundary Conservation Area (TBCA) between their two countries as part of the Indian Ocean Commission (IOC) Biodiversity Programme supported by the European Union (EU). This initiative is in response to a decision by the 8th Conference of the Parties of the Nairobi Convention (June 2015) which requested contracting parties and partners to support a cross-border management system of the transboundary marine protected area between Kenya and Tanzania (Parks et al. 2015). The proposed site extends from the northern boundary of the Diani-Chale Marine National Reserve in Kenya to the southern boundary of Mkinga District in Tanzania (Parks et al. 2015). The area of interest harbors highly significant marine and coastal biodiversity. The aims of the proposed TBCA include strengthening the capacity for restoring ecosystem health, as well as piloting ecosystem-oriented approaches into spatial planning, water management, fisheries and protected area management in Kenya and Tanzania (Parks et al. 2015). This regional conservation initiative is likely to help conserve and protect coelacanth habitat along the Tanzanian

coast. Additionally, this regional initiative is likely to be implemented since it was accepted as a commitment under Sustainable Development Goal 14 with further support during the 9th Conference of the Parties of the Nairobi Convention (August 2018).

Tanzanian Marine Protected Areas (MPAs) and Marine Reserves
Within the past decade, the Tanzanian government has established additional Marine Protected Areas (MPAs) as a conservation tool to protect marine biodiversity and ensure sustainable fishing practices within Tanzanian waters (Machumu 2021). The main objective of MPAs in Tanzania is to safeguard and sustainably manage the fabric and integrity of marine resources in partnership with both local and global communities (Machumu 2021). MPAs in Tanzania are currently being promoted to mitigate over-fishing and other anthropogenic impacts on marine resources (Machumu and Yakupitiyage 2013; Machumu 2021). Other important functions of the MPAs in Tanzania include protection of biodiversity and ecosystem functions; controlling over-exploitation of resources and activities in sensitive habitats; and facilitating responsible utilization of coastal and marine resources (Machumu 2021). Protection of biodiversity and ecosystem functions within each MPA is critical to conserving the coelacanth and its habitat. Currently, there are 18 formal MPAs, comprising 3 Marine Parks (**Figure 5**) and 15 Marine Reserves (Machumu 2021). Many of the Marine Reserves are small, with ten being less than 10 km² in area (Machumu 2021). The total area covered by formal MPAs is 2,142.57 km², representing about 1 percent of the country's EEZ (Machumu 2021). There are also a number of mangrove forest reserves extending along the five coastal regions of Tanzania: Tanga, Pwani, Dar es Salaam, Lindi and Mtwara (Machumu 2021). The three marine parks are the Mafia Island Marine Park (MIMP) in Mafia Island, the Mnazi Bay Ruvuma Estuary Marine Park (MBREMP) in the Mtwara District, and perhaps most importantly the TACMP in Tanga, Tanzania (Machumu 2021; NEMC 2024). In addition to these formal MPAs, the Tanzanian government also has rapidly established and developed Locally Managed Marine Areas (LMMAs), also known locally as Collaborative Fisheries Management Areas (CFMAs) or Collaborative Management Areas (CMAs) (**Figure 6**), which provide some levels of protection to endemic species (like the coelacanth), while supporting fisheries dependent livelihoods of coastal communities (NEMC 2024).

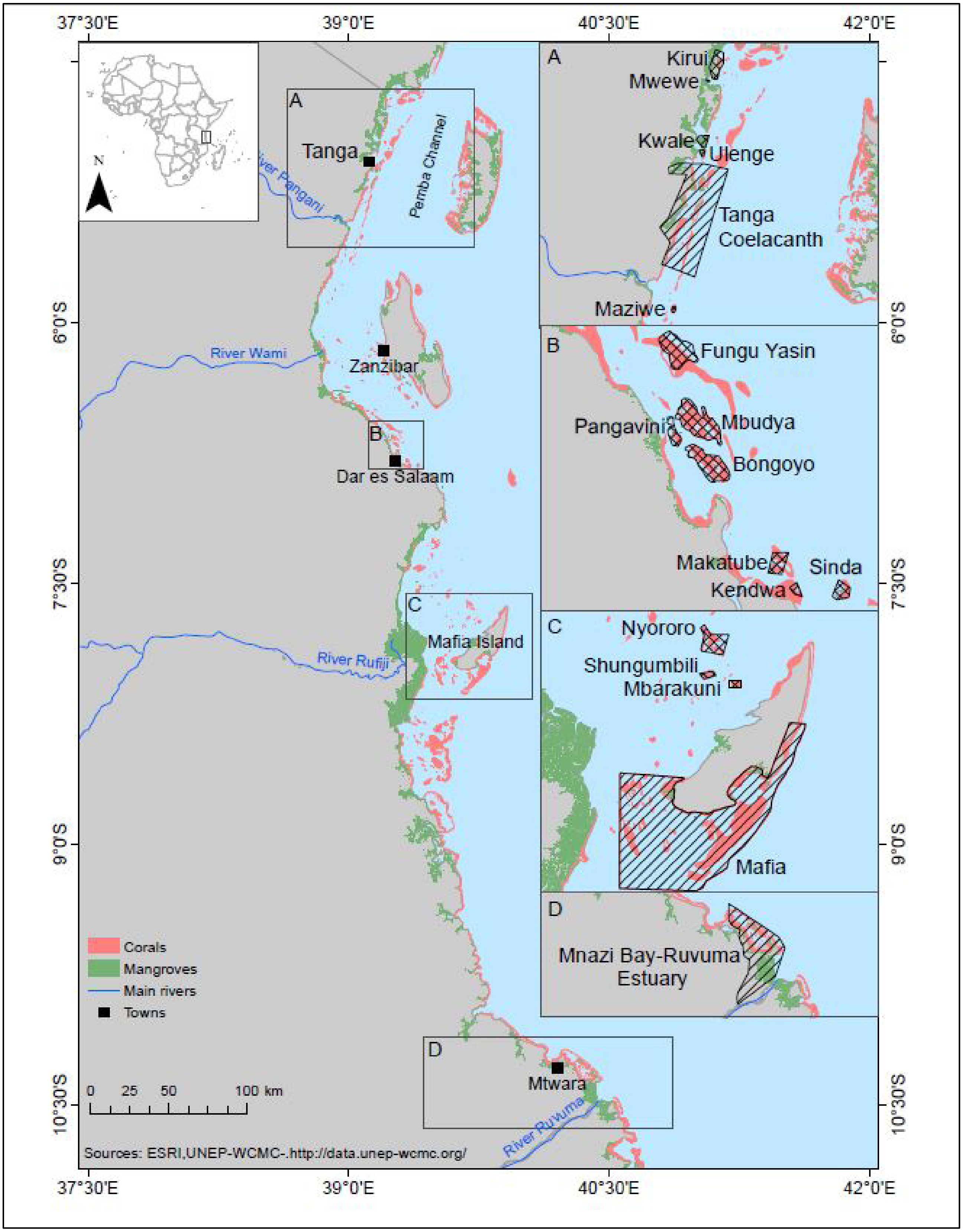

FIGURE 5. MAP OF THE COASTAL AREA OF MAINLAND TANZANIA SHOWING THE LOCATION AND DISTRIBUTION OF MARINE PROTECTED AREAS (MPAS)

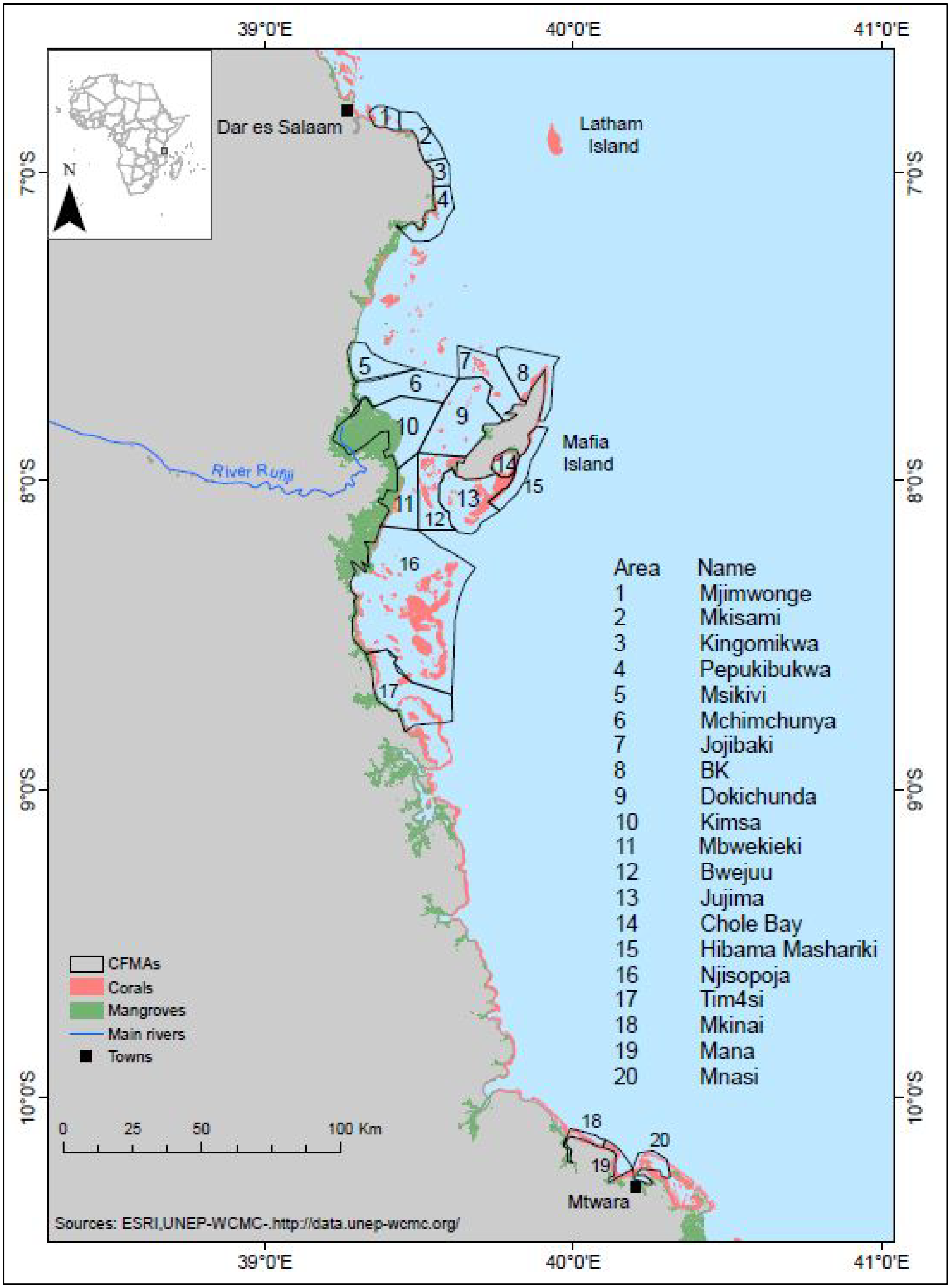

Figure 6. Map of the Coastal Area of Mainland Tanzania Showing the Location and Distribution of Designated Collaborative Fisheries Management Areas (CFMAs)

8 SYNTHESIS

In 2016, NMFS listed the Tanzanian DPS of African coelacanth (*Latimeria chalumnae*) as a threatened species under the ESA (81 FR 17398, March 29, 2016). The status review found that fisheries bycatch was the greatest threat to the Tanzanian DPS, which would be exposed to deep-water port construction in its habitat within the foreseeable future. At that time, we were able to make projections into the foreseeable future (of 40 or more years) in assessing the threats of overutilization and habitat destruction, and their interaction with the life history of the coelacanth (81 FR 17398, March 29, 2016). While new data demonstrate that the coelacanth's lifespan is approximately 100 years, we do not have sufficient data on the threats beyond 40 years.

The Tanzanian DPS occupies a narrow coastal range along the Tanzanian coast, primarily inhabiting deep-water rocky terraces composed of sedimentary limestone at depths between 70 –140 meters (Whittaker 2014; Cooke et al. 2021). Observations and bycatch records indicate a spatially limited distribution with no known connectivity to other established coelacanth populations (e.g., Comoros, Madagascar, and South Africa) (Whittaker 2014; Queiros et al. 2024). Information is very limited on actual occurrences of this DPS, and the information that is available is largely based on bycatch data throughout all of its range.

Abundance of this DPS is likely low, and no new quantitative estimates have become available since the previous status review (Whittaker 2014; Cooke et al. 2021). Continued challenges in monitoring deep-water habitats preclude robust abundance estimates and trend analyses (Whittaker 2014; Edeye 2022). Productivity is low, consistent with newly available life history data that confirm extreme longevity (~100 years), delayed maturity (40–69 years), and an extended gestation period (~5 years) (Mahe et al. 2021). These findings, derived from scale analysis using polarized light microscopy (Mahe et al. 2021), corroborate earlier hypotheses of slow reproductive output likely impeding rapid recovery and resiliency from mortality events. Genomic analyses confirm limited adaptive potential and high susceptibility to environmental or demographic stochasticity (Mahe et al. 2021; Cavin 2022).

The greatest threat to the Tanzanian DPS of African coelacanth continues to be bycatch in the shark gillnet fishery which occurs throughout its range in deep-waters off the coast of Tanzania (Cooke et al. 2021). Bycatch contributes to coelacanth mortality within this DPS, and in particular for reproductive females and juveniles (Cooke et al. 2021). New data suggest there is an increasing trend in bycatch of the Tanzanian coelacanth in the shark gillnet fishery throughout its range (Cooke et al. 2021). Large-mesh gillnets (i.e. *jarifa*) remain in use even within protected areas, including the TACMP, where regulations exist but enforcement remains inadequate (Cooke et al. 2021). As a consequence of the species' demographic traits, including maturation rate and low productivity, these mortalities likely have an impact on the DPS. While regulatory improvements have occurred, most notably Tanzania's 2020 Deep Sea Fisheries Management and Development Act and its implementing regulations of 2021, which prohibit large-scale driftnets, implementation and enforcement remain insufficient throughout its range. Additionally, the marine protected area designed to protect the species does not adequately do so due to lack of enforcement of fishing prohibitions within its boundaries. Thus, regulatory mechanisms are inadequate to mitigate current threats (Cooke et al. 2021) and pose a moderate threat to the DPS.

Habitat loss and degradation via deep-sea port construction also poses a threat to this DPS. Construction has modified the habitat through pollution. The planned construction of the Mwambani deep-water port poses a significant risk in the foreseeable future by targeting known coelacanth habitat for development, including submarine blasting and dredging (Whittaker 2014; TPA 2015; Mesaki 2024). While still in the early phases, this project poses a moderate threat to the DPS.

In summary, the best scientific and commercial data available since the previous status review demonstrate that the Tanzanian DPS of African coelacanth continues to be at risk due to fisheries bycatch, habitat loss and modification, and inadequate regulatory mechanisms. The species' low diversity, restricted spatial distribution, long generation time, delayed maturity, and small population size makes it highly vulnerable to threats of bycatch and habitat loss and degradation. While some regulatory improvements and protective efforts have occurred and additional MPAs have been established, they do not adequately reduce the threats. There is insufficient information available to determine that the DPS is an endangered species in a significant portion of its range. The best data available indicate that fisheries bycatch occurs somewhat uniformly and has a moderate impact on the DPS throughout its small range. Since the previous status review, fisheries bycatch has increased, providing evidence of the threat, but also demonstrating continued, consistent presence of the species throughout its range. Thus, bycatch mortality coupled with the species low productivity poses a moderate threat to the DPS. While the deep-water port construction would occur in a portion of the DPS' range (TACMP), construction is still in the early phases, thus this threat is likely to occur in the foreseeable future. Therefore, we conclude that the DPS is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range (i.e., it meets the definition of a threatened species). While the aforementioned threats have increased since the previous status review, we are unable to determine whether threats to the DPS have changed enough to recommend uplisting at this time.

9 RESULTS

Based on the best available scientific and commercial data, we provide the following recommendations.

9.1 Recommended Classification

_____**Downlist to Threatened**
_____**Uplist to Endangered**
_____**Delist** *(Indicate reason for delisting per 50 CFR 424.11):*

_____*Extinction*
_____*Recovery*
_____*Original data for classification in error*

___X__**No change is needed**

9.2 Brief Rationale

Increasing moderate magnitude threats continue to threaten the Tanzanian DPS of African coelacanth (**Table 1**).

TABLE 1. SUMMARY OF 4(A)(1) FACTORS (THREATS)

The magnitude of the threat is categorized as high (red), moderate (orange), low (yellow), or unknown (no shading). The trend of the threat since previous status review (2014) is categorized as increasing (upwards arrow), stable (lateral arrows), decreasing (downwards arrow), or unknown (question mark). The demographic factor impacted by the threat is listed, if known.

Threat	Magnitude of Threat	Trend of Threat	Impact to DPS
Habitat Loss and Degradation	Moderate	↑ Increasing	Abundance, spatial distribution, population trends
Overutilization	Not a threat	N/A	None
Disease/Predation	Low	? Unknown	Unknown
Fisheries Bycatch	Moderate	↑ Increasing	Abundance, spatial distribution, population trends

Threat	Magnitude of Threat	Trend of Threat	Impact to DPS
Regulatory Inadequacy	Moderate	↔ Stable	Abundance, spatial distribution, population trends

10 RECOMMENDED FUTURE ACTIONS

We recommend the following future actions to protect and conserve the Tanzanian DPS of African coelacanth. Completion of these recommendations is not required, and the results of subsequent reviews are not dependent on the completion of these recommendations.

- Fund and conduct research into the current distribution, abundance, habitat preferences, depth range, and diel activity patterns of this DPS – information needed for their successful management.

- Accurately quantify incidental catch and mortality rates of this DPS. Fishers rarely record incidentally caught coelacanth specimens accurately or in detail. Therefore, onboard observers, or video recordings of catches, may be required in order to collect accurate data.

- Log information on incidentally caught coelacanths in Tanzania and include catch information in an official inventory that is currently available (i.e. the CCC Coelacanth Inventory) and make it available to the international community via publications.

- Launch an awareness campaign among artisanal fishers to encourage them to share information on coelacanth catches with authorities.

- Increase monitoring and enforcement of existing regulatory mechanisms aimed to protect this DPS.

- Increase monitoring and enforcement of the use of *jarifa* nets within Tanzanian waters, and especially within Tanzania's marine protected areas (i.e. TACMP).

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