



**Ministry of Fisheries and Ocean Resources**  
Male', Republic of Maldives

**Contribution from the Maldives to the seventeenth round of Informal Consultations  
of States Parties to the United Nations Fish Stocks Agreement, serving as a further  
preparatory meeting for the resumed Review Conference on the Agreement  
(15 – 17 May 2024)**

*Sustainable fisheries management in the face of climate change*

Situated in the Indian Ocean, the Maldives archipelago comprises of 26 atolls spread across approximately 90,000 square kilometers. With an average elevation of just 1.5 meters above sea level, the Maldives is the world's lowest-lying country, making it particularly vulnerable to the impacts of climate change and rising sea levels. Despite its small land area, the Maldives holds rich biodiversity, hosting 3% of the world's coral reefs<sup>1</sup>. The unique geography of the country has shaped the cultural identity and economic activities of the Maldivian people, where the population almost entirely depends on coastal and marine resources and services obtained from them, with approximately 98% of national exports, 89% of the GDP, 62% of foreign exchange and 71% of national employment deriving from biodiversity<sup>2</sup>.

Although tourism is the dominant economic sector, fisheries activities serve as the primary source of livelihoods across the inhabited islands of the Maldives<sup>3</sup>. In 2015, the fisheries sector employed 11% of the country's labor force, and by 2021, it contributed approximately 6% to the country's annual GDP<sup>4</sup>. Maldives also has one of the highest fish consumption rates globally, with an annual per capita fish consumption of 181kg<sup>5</sup>. Furthermore, fish and fish products make up more than 90% of the total exports<sup>6</sup>, indicating the significant dependence on this resource.

The fisheries sector in the Maldives relies heavily on tuna, with skipjack tuna (*Katsuwonus pelamis*) and yellowfin tuna (*Thunnus albacares*) making up 98% of the total catch. Tuna fishing in the Maldives has been dated back to the ninth century CE<sup>7</sup>. Pole-and-line has remained as the primary gear for skipjack tuna fishing throughout the history of the country. This method targets surface-swimming tuna and is known to have a minimal impact on the ecosystem compared to other fishing gears around the

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<sup>1</sup> Tim Dalgleish et al., "Status of Coral Bleaching in the Maldives 2016," *Journal of Experimental Psychology: General* 136, no. 1 (2016): 23–42.

<sup>2</sup> Emerton, Baig, and Saleem, "Valuing Biodiversity. The Economic Case for Biodiversity Conservation in the Maldives."

<sup>3</sup> Thomas Hohne-Sparborth, M. Shiham Adam, and Adam Ziyad, "A Socio-Economic Assessment of the Tuna Fisheries in the Maldives" (London, 2015).

<sup>4</sup> Maldives Bureau of Statistics. 2022. "GDP Production." <https://statisticsmaldives.gov.mv/gdp-production/>.

<sup>5</sup> Thomas Hohne-Sparborth, M. Shiham Adam, and Adam Ziyad, "A Socio-Economic Assessment of the Tuna Fisheries in the Maldives" (London, 2015).

<sup>6</sup> Maldives Customs Service. "Total Exports 2022," 2023. <https://www.customs.gov.mv/Statistics>.

<sup>7</sup> Yadav, Shreya, Ameer Abdulla, Ned Bertz, and Alexander Mawyer. 2020. "King Tuna: Indian Ocean Trade, Offshore Fishing, and Coral Reef Resilience in the Maldives Archipelago." *ICES Journal of Marine Science* 77 (1): 398–407. <https://doi.org/10.1093/icesjms/fsz170>.

world<sup>8</sup>. Sustainability has always been at the core of Maldivian fisheries, playing a vital role since its inception. Yellowfin tuna handline fishery is a relatively recent development, emerging in the late 1990s and early 2000s. Net fishing and other forms of destructive gears are prohibited by law in the Maldives<sup>9</sup>.

The sustainable nature of the pelagic tuna fishery and the strong cultural values associated with tuna is believed to have supported the reef health of the country over the past thousand years<sup>10</sup>. However, climate change now threatens this tradition. The oceanographic changes in the Indian Ocean are known to have already started affecting its net primary productivity<sup>11</sup>. Numerous studies have suggested potential taxonomic shifts in response to warming climates, including the migration of tuna species towards cooler areas in the Indian Ocean<sup>12</sup>. Populations of skipjack and yellowfin tuna are also expected to show significant declines towards the end of the century<sup>13</sup>. This is anticipated to disrupt current fishing patterns, leading to significant socio-economic impacts in the region.

The effects are expected to be amplified for the Maldives mainly for three reasons. 1) Maldives tuna fishery depends on livebait, which is sourced from the reefs. Important livebait species include silver sprat (*Spratelloides gracilis*), blue sprat (*Spratelloides delicatulus*), anchovy (*Encrasicicholina heteroloba*), cardinalfish (Apogonidae), fusiliers (Caesionidae) and species of Chromis. With the onset of climate induced warming of the seas, coral reefs are subjected to increasing stresses. Coral bleaching in the Maldives has become more intense and frequent with potential losses in habitat complexity of reef fish<sup>14</sup>. Ocean acidification is expected to further stress the reefs, reducing recruitment success<sup>15</sup> and overall productivity of the ecosystem<sup>16</sup>, thus affecting catchability of livebait. 2) The pole and line gear is specifically designed to target surface swimming schools of tuna. Therefore, if the increase in sea surface temperature continues to drive tuna species to migrate towards deeper waters, it may become increasingly challenging to effectively utilise the pole-and-line gear for tuna fishing compared to other gears such as longline that are set at greater depths. 3) Since current observations and projections suggest the northern Indian Ocean<sup>17</sup>, particularly the Arabian Sea, might experience faster warming compared to the southeastern Indian Ocean, it is possible that migratory fish species, including tunas, will move southward. This shift is likely to result in a net loss of migratory fish within the Maldives as these species relocate from the equatorial region towards cooler southern waters. Given that Maldives

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<sup>8</sup> K Miller et al., “Interactions with Endangered, Threatened and Protected (ETP) Species in the Maldivian Pole-and-Line Tuna Fishery,” *IPNLF and MRC*, 2016, <https://ipnlf.org/wp-content/uploads/2021/02/ipnlf-tech-report-etp-species-interactions-with-pole-and-line-fisheries-in-the-maldiveslr.pdf>.

<sup>9</sup> Ministry of Fisheries, Marine Resources and Agriculture. 2019. Fisheries Act of the Maldives.

<sup>10</sup> Yadav, Shreya, Ameer Abdulla, Ned Bertz, and Alexander Mawyer. 2020. “King Tuna: Indian Ocean Trade, Offshore Fishing, and Coral Reef Resilience in the Maldives Archipelago.” *ICES Journal of Marine Science* 77 (1): 398–407. <https://doi.org/10.1093/icesjms/fsz170>.

<sup>11</sup> Padmini Dalpadado et al., “Warming of the Indian Ocean and Its Impact on Temporal and Spatial Dynamics of Primary Production,” *Progress in Oceanography* 198 (November 1, 2021), <https://doi.org/10.1016/j.pocean.2021.102688>.

<sup>12</sup> Alberto Monllor-Hurtado, Maria Grazia Pennino, and José Luis Sanchez-Lizaso, “Shift in Tuna Catches Due to Ocean Warming,” *PLoS ONE* 12, no. 6 (June 1, 2017), <https://doi.org/10.1371/journal.pone.0178196>.

<sup>13</sup> Dueri, Sibylle. 2017. “Impacts of Climate Change and Ocean Acidification on Indian Ocean Tunas.”

<sup>14</sup> Dagleish, Tim, J. Mark G. Williams, Ann-Marie J. Golden, Nicola Perkins, Lisa Feldman Barrett, Phillip J. Barnard, Cecilia Au Yeung, et al. 2016. “Status of Coral Bleaching in the Maldives 2016.” *Journal of Experimental Psychology: General* 136 (1): 23–42.

<sup>15</sup> Philip L. Munday et al., “Replenishment of Fish Populations Is Threatened by Ocean Acidification,” *Proceedings of the National Academy of Sciences of the United States of America* 107, no. 29 (2010): 12930–34, <https://doi.org/10.1073/pnas.1004519107>.

<sup>16</sup> K. R.N. Anthony et al., “Ocean Acidification Causes Bleaching and Productivity Loss in Coral Reef Builders,” *Proceedings of the National Academy of Sciences of the United States of America* 105, no. 45 (2008): 17442–46, <https://doi.org/10.1073/pnas.0804478105>.

<sup>17</sup> Sharma, Sahil, Kyung Ja Ha, Ryohei Yamaguchi, Keith B. Rodgers, Axel Timmermann, and Eui Seok Chung. 2023. “Future Indian Ocean Warming Patterns.” *Nature Communications* 14 (1). <https://doi.org/10.1038/s41467-023-37435-7>.

fishing vessels operate exclusively within the EEZ, any such migration of tuna species beyond the EEZ boundaries will greatly affect its catch. Even if accessing these areas were feasible, the operation would require substantially more fuel, resulting in higher costs and increased emissions associated with fishing operations.

The potential implications on the Maldives pole-and-line fishery will not only impact the local communities dependent on the fishery, but also the broader Indian Ocean region, as the information collected from its operations are crucial inputs for the IOTC stock assessment models. Maldives' contribution to skipjack tuna stock assessment in the Indian Ocean plays a key role in providing essential data for informed decision-making and sustainable management of skipjack tuna in the region.

The magnitude of impact of climate change on the Maldives fisheries is clearly seen from a recent study conducted by the University of British Columbia funded by the World Bank. The preliminary findings of this study show that exposure to climate impacts on fisheries across the region, measured by the change in maximum catch potential (MCP), is highest for the Maldives compared to its SIDS counterparts, with a significant loss of 75% by the end of the century under the most pessimistic climate scenario<sup>18</sup>. This is followed by steep projected declines in fisheries net revenue with average annual changes of -78% relative to 2020. Analyses also indicate that the northern region of the Maldives is subject to high projected local extinction of marine species by that time, posing significant risks to its fisheries and communities that depend on marine resources.

Recognising the urgency in taking actions and given the extremely limited understanding of climate science in the Indian Ocean compared to other regions, Maldives presented a proposal at the IOTC Commission in 2022, which aimed to advocate for the inclusion of climate change impacts within both scientific research and fisheries management decision-making processes. This heightened sense of urgency is also reflected in government policies, which prioritize advancing sustainability efforts and transitioning the fisheries sector towards carbon neutrality. Substantial investments are being allocated towards the development of energy-efficient vessels and the integration of renewable energy sources across harvesting and processing operations. The industry aims to achieve a minimum of 35% of power generation from renewable sources within the next five years. Central to these developmental strategies are sustainability principles and the preservation of oceanic health. Leveraging technological advancements, fishing operations in the Maldives are being tailored and refined to ensure the continuity of environmentally responsible fishing practices amidst the challenges posed by climate-induced changes.

### **Actions needed to further strengthen sustainable fisheries management in the face of climate change:**

1. Climate science in the Indian ocean is extremely limited, hence further research on anticipated tuna movements within the region in response to climate change is highly necessary.

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<sup>18</sup> Institute for the Oceans and Fisheries, "The Impact of Climate Change on Fisheries, Coastal Ecosystems and Coastal Communities in Maldives," unpublished.

Specifically, investigating potential shifts in tuna distribution patterns and identifying cooler areas that could serve as refuges for tunas amidst warming ocean temperatures would be useful for informing sustainable fisheries management practices and ensuring the resilience of the Indian Ocean tuna stocks in the face of climate-induced challenges.

2. The case of the Maldives pole-and-line fishery serves as an example of the need for continual evolution of best practices in response to the impacts of climate change. As climate change increasingly affects marine ecosystems, traditional fishing methods like pole-and-line fishing must adapt to ensure their sustainability and effectiveness. This adaptation involves not only adjusting fishing techniques but also implementing measures to mitigate and adapt to the changing environmental conditions while maintaining the sustainability and economic viability of fishing operations. This may include improving the vessel design to make the operations more fuel efficient and investment in cutting-edge technological innovations for fishing gear, fish finding, and data analytics. Integrated fisheries management efforts as such can also effectively contribute to achieving sustainable development goals, promoting food security, and conserving marine resources for future generations.
3. While the Maldives' one-by-one tuna fishing industry is internationally recognized as one of the cleanest fisheries worldwide, adoption of renewable energy solutions across both the harvesting and processing sectors will help solidify its position as the greenest fishery as well. Support mechanisms such as financial incentives, policy frameworks, technical assistance and collaborative partnerships are imperative to realize the ambitious goal of making the Maldives' fishery sector the epitome of environmental sustainability and resilience.