

## Mobulid Ray Fishery Characteristics and Trends in East Java to Inform Management Decisions

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**Abstract :** Muncar, East Java, is one of the largest artisanal fisheries in Indonesia. Sharks and rays are caught as both target and bycatch, for local meat consumption and with some derived products exported. Of the seven mobulid ray species occurring in Indonesia, five have been recorded as retained bycatch at Muncar fishing port: the spinetail devil ray (*Mobula mobular*), the bentfin devil ray (*Mobula thurstoni*), the sicklefin devil ray (*Mobula tarapacana*), the oceanic manta ray (*Mobula birostris*) and the reef manta ray (*Mobula alfredi*). Both manta ray species are listed as Vulnerable by the International Union for the Conservation of Nature and are protected in Indonesia despite still being captured as bycatch, while all the three devil ray species mentioned here are listed as Endangered and do not currently benefit from any protection in Indonesian waters. Mobulid landings in East Java are caused primarily by small-scale drift gillnets but they also occasionally occur on longlines and in purse-seines operating off the coast of East Java and occasionally in fishing grounds located as far as the Makassar and Sumba Straits. Landing trends from 2015-2019 (non-continuous surveys) revealed that the highest abundance of mobulid rays at Muncar fishing port occurs during the upwelling season from June-October. During El-Nino or above-average temperature years, this may extend until November (such as in 2015 and 2019). The strong seasonal upwelling along the East Java coast is linked to higher zooplankton abundance (inferred from chlorophyll-a sea-surface concentrations), on which mobulids forage, along with teleost fishes constituting the primary target of gillnet fisheries in the Bali Strait. Mobulid ray landings in Muncar were dominated by *Mobula mobular*, followed by *M. thurstoni*, *M. tarapacana*, *M. birostris* and *M. alfredi*, however, the catch varied across years and seasons. A majority of immature individuals were recorded in *M. mobular* and *M. thurstoni*, and slight decreases in landings, despite no known changes in fishing effort, were observed across the upwelling seasons of 2015-2018 for *M. mobular*. While all mobulids are listed on Appendix II of the Convention on International Trade in Endangered Species, which regulates international trade in gill plates sought after in the Chinese Medicine Trade, local and national-level management measures are required to sustain mobulid populations. The findings presented here provide important baseline data, from which potential management approaches can be identified.

**Keywords :** devil ray, mobulid, manta ray, Indonesia

**Conference Title :** ICCB 2020 : International Conference on Conservation Biology

**Conference Location :** Singapore, Singapore

**Conference Dates :** November 19-20, 2020