Indian Ocean Tuna Commission
Commission des Thons de l'Océan Indien
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# POPULATION PARAMETERS: BULLET TUNA (*AUXIS ROCHEI*)

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Bullet tuna (*Auxis thazard*) is a highly migratory pelagic species occurring in neritic zones of the Atlantic (including the Mediterranean Sea), Indian and (western) Pacific oceans (Figure 1). Bullet tuna is an abundant and small schooling species that constitutes an important element of pelagic food webs as prey for larger tuna species and billfishes (Froese & Pauly 2016). Bullet tuna was traditionally caught by gillnets and lines, with smaller amounts (c. 6% in 2013) taken as bycatch in purse seine fisheries (Geehan & Pierre 2015). However, catches by other gear, including offshore longline gear, have increased markedly in recent years, and now exceed those taken by gillnets and lines. The vast majority (>90%) of catches in recent years are accounted for by fisheries in Sri Lanka, Indonesia and India (Geehan & Pierre 2015).

Growth studies are limited for bullet tuna in the Indian Ocean. Those that do exist are confined to India and use length-based methods for estimating age and growth parameters (Table 1). Information on growth is also available for Atlantic and Mediterranean populations and is provided for comparison. Estimates of growth parameters vary among studies with k values ranging from 0.32 (Grudtsev 1992) to 1.1 (Gopakumar & Ajithkumar 2003), though the species is generally considered to exhibit fast growth. Growth curves from a number of Mediterranean studies that describe very slow growth trajectories are not reproduced here due to concerns over parameter estimation (see Jasmine et al. 2013). A comparison of the growth model parameters and growth curves derived from included studies are provided in Table 1 and Figure 2. Estimates of mortality and length-weight relationship parameters are provided in Table 2.

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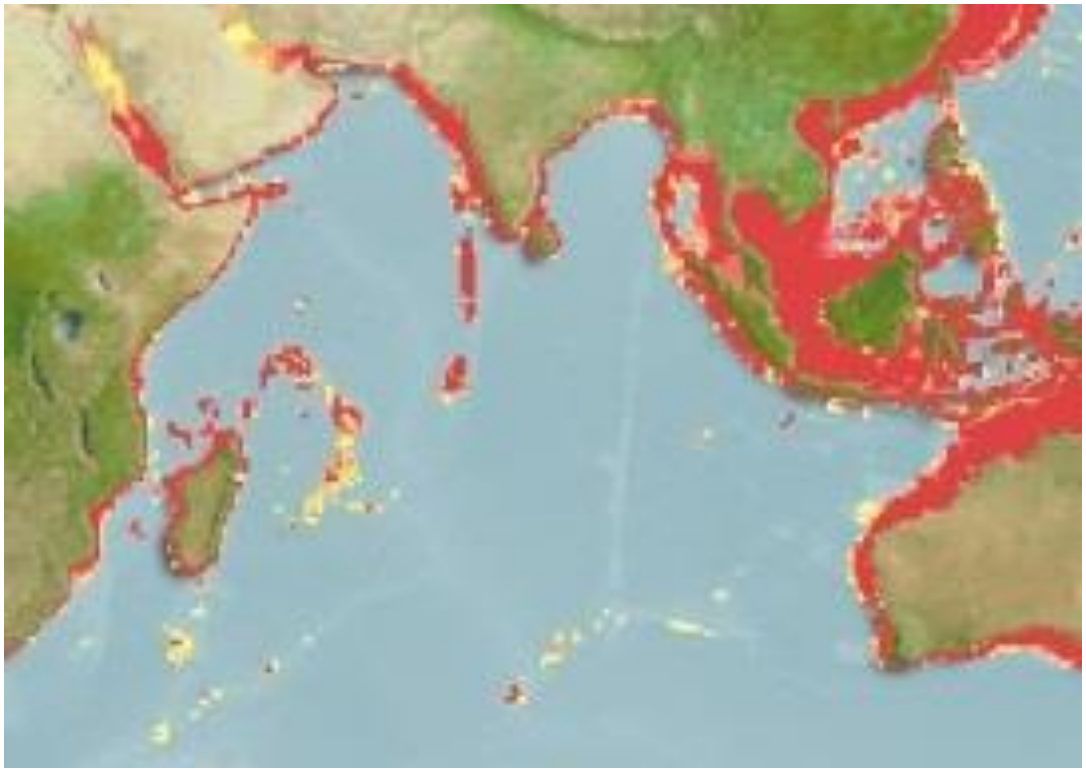

**Figure 1. Distribution of *Auxis rochei* in the Indian Ocean**[2]

[2] Reviewed distribution map for *Auxis rochei* (bullet tuna), with modelled year 2100 native range map based on IPCC A2 emissions scenario. www.aquamaps.org, version of Aug. 2015. Web Accessed 12 Apr 2016.

**Table 1. Estimated growth parameters for bullet tuna (*Auxis rochei*) with details of the type of analysis from which they have been determined and the region. LF: length frequency studies; ELEFAN: Electronic Length Frequency Analysis; FL: fork length; TL: total length.**

| Region | | | Von Bertalanffy growth parameters | | | Length at age (cm) | | | | n | Ageing method | Analysis type | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $L_{m50}$ (cm) | $L_{max}$ (cm) | $L_\infty$ (cm) | K (year$^{-1}$) | $t_0$ (years) | Yr 1 | Yr 2 | Yr 3 | Yr 4 | | | | |
| Turkey | 26.5 | 50 | 47.0 (TL)<br>45.1 (FL) [3] | 0.34 | -0.43 | | | | | | | | Fishbase |
| India | 23.6 | 40 | 42.3 (FL) | 0.61 | -0.03 | 18.6 | 29.3 | 35.2 | 38.4 | | LF | ELEFAN | (Jasmine et al. 2013) |
| India (south Kerala) | 23.5 | 31 | 34.0 (FL) | 1.10 | | 22.8 | 30.3 | | | | LF | ELEFAN | (Gopakumar & Ajithkumar 2003) |
| Mediterranean (west) | | 46 | 44.0 (FL) | 0.70 | -0.14 | 24.2 | 34.2 | 39.1 | 41.6 | 206 | Fin rays | Annual increments | (Valeiras et al. 2008) |
| Atlantic (east) | | | 41.5 (FL) | 0.32 | -0.83 | 18.4 | 24.7 | 29.3 | 32.7 | | | | (Grudtsev 1992) |
| Spain | 38.0 | | | | | | | | | | | | (Rodriguez-Roda 1983) |
| Mediterranean (Spain) | 35.0 | | | | | | | | | | | | (Macias et al. 2005) |

[3] Based on TL-FL conversion parameters in FishBase.org.

**Table 2. Mortality parameters and length-weight relationships**

| Region | Mortality estimates | | Lifespan (y) | Length-weight relationship | | | Reference |
|---|---|---|---|---|---|---|---|
| | M (year$^{-1}$) | Z (year$^{-1}$) | | a | b | Units | |
| Turkey | 0.6 | | 8.4 | 0.0076 | 3.25 | TL(cm) - g | Fishbase |
| India | 1.2 | 5.9 | 4.9 | 0.0076 | 3.24 | FL(cm) - g | (Jasmine et al. 2013) |
| India (south Kerala) | 1.9 | 4.8 | | 0.0031 | 3.47 | FL(cm) - g | (Gopakumar & Ajithkumar 2003) |
| Mediterranean | | | | 0.00001 | 3.13 | FL(cm) - g | (Rodriguez-Roda 1966) [4] |
| Mediterranean (Turkey) | | | | 0.054 | 2.69 | FL(cm) - kg | (Kahraman et al. 2011) |
| Mediterranean (west) | | | | 0.0022 | 3.56 | FL(cm) - g | (De la Serna et al. 2005) |
| Mediterranean (Turkey) | | | | 0.0076 | 3.24 | FL(cm) - g | (Bok & Oray 2001) |
| Mediterranean (Ligurian) | | | | 0.0014 | 3.68 | FL(cm) - g | (Palandri et al. 2008) |
| Japan | | | | 0.0016 | 3.66 | FL(cm) - g | (Yasui 1975) [3] |

[4] Cited in Uchida 1981.

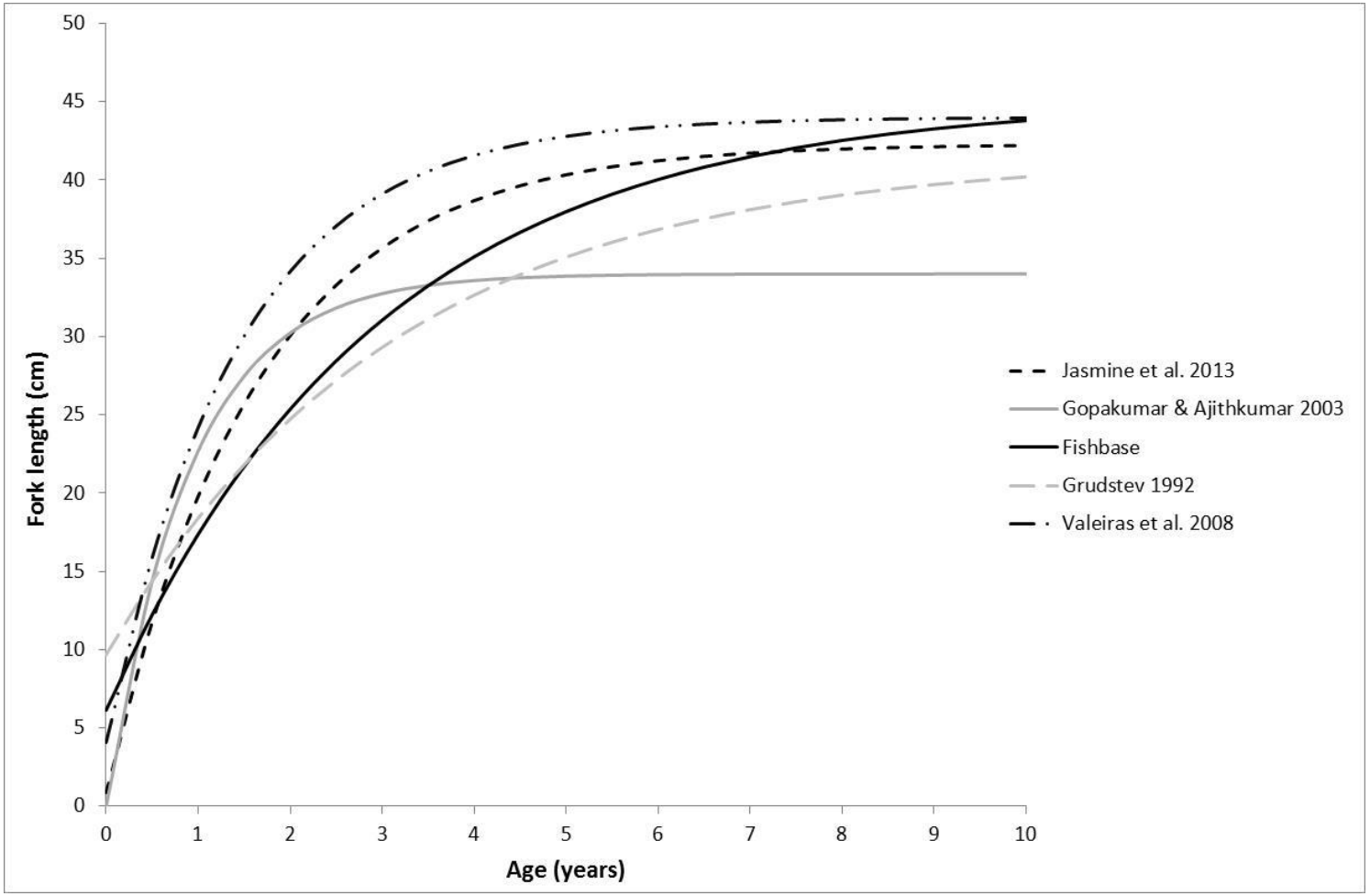


**Figure 2. Length-at-age curves derived from ageing studies of bullet tuna (*Auxis rochei*) from different regions of the Indian Ocean.**

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