

Reproductive Biology and Lipid Content of Albacore Tuna (*Thunnus alalunga*) in the Western Indian Ocean

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Abstract : Scientific advice on the status of fish stocks relies on indicators that are based on strong assumptions on biological parameters such as condition, maturity and fecundity. Currently, information on the biology of albacore tuna, *Thunnus alalunga*, in the Indian Ocean is scarce. Consequently, many parameters used in stock assessment models for Indian Ocean albacore originate largely from other studied stocks or species of tuna. Inclusion of incorrect biological data in stock assessment models would lead to inappropriate estimates of stock status used by fisheries manager's to establish future catch allowances. The reproductive biology of albacore tuna in the western Indian Ocean was examined through analysis of the sex ratio, spawning season, length-at-maturity (L50), spawning frequency, fecundity and fish condition. In addition, the total lipid content (TL) and lipid class composition in the gonads, liver and muscle tissues of female albacore during the reproductive cycle was investigated. A total of 923 female and 867 male albacore were sampled from 2013 to 2015. A bias in sex-ratio was found in favour of females with fork length (LF) <100 cm. Using histological analyses and gonadosomatic index, spawning was found to occur between 10°S and 30°S, mainly to the east of Madagascar from October to January. Large females contributed more to reproduction through their longer spawning period compared to small individuals. The L50 (mean \pm standard error) of female albacore was estimated at 85.3 \pm 0.7 cm LF at the vitellogenic 3 oocyte stage maturity threshold. Albacore spawn on average every 2.2 days within the spawning region and spawning months from November to January. Batch fecundity varied between 0.26 and 2.09 million eggs and the relative batch fecundity (mean \pm standard deviation) was estimated at 53.4 \pm 23.2 oocytes g⁻¹ of somatic-gutted weight. Depending on the maturity stage, TL in ovaries ranged from 7.5 to 577.8 mg g⁻¹ of wet weight (ww) with different proportions of phospholipids (PL), wax esters (WE), triacylglycerol (TAG) and sterol (ST). The highest TL were observed in immature (mostly TAG and PL) and spawning capable ovaries (mostly PL, WE and TAG). Liver TL varied from 21.1 to 294.8 mg g⁻¹ (ww) and acted as an energy (mainly TAG and PL) storage prior to reproduction when the lowest TL was observed. Muscle TL varied from 2.0 to 71.7 g⁻¹ (ww) in mature females without a clear pattern between maturity stages, although higher values of up to 117.3 g⁻¹ (ww) was found in immature females. TL results suggest that albacore could be viewed predominantly as a capital breeder relying mostly on lipids stored before the onset of reproduction and with little additional energy derived from feeding. This study is the first one to provide new information on the reproductive development and classification of albacore in the western Indian Ocean. The reproductive parameters will reduce uncertainty in current stock assessment models which will eventually promote sustainability of the fishery.

Keywords : condition, size-at-maturity, spawning behaviour, temperate tuna, total lipid content

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