Morphometrics and allometry in tuna from the tropical Atlantic and Indian Oceans

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## Abstract

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# Introduction

Morphometric data are widely used to derive conversion factors and relationships in order to (i) standardize different types of measurements collected on fish from various sources (e.g., fishermen, scientific observers at sea), (ii) estimate biomass from length observations since the collection of precise and accurate data on fish weight is generally difficult for logistical reasons, and (iii) derive condition factors aimed at measuring the energetic status of fish ([Ricker 1975](#ref-Ricker1975); [Bolger and Connolly 1989](#ref-Bolger1989)). Morphometric relationships are instrumental in the processing of fisheries data to estimate sampling and reporting rates, track changes in size-based indicators (e.g., average weight in the catch), and derive fishery-specific size distributions required for most stock assessment models. Biased or inappropriate morphometric relationships have been shown to affect knowledge on the size structure of the catch with potential impacts on stock assessments ([Gerritsen and McGrath 2007](#ref-Gerritsen2007); [Minte-Vera et al. 2016](#ref-MinteVera2016)). Furthermore, in some mixed fisheries, the species composition of the catch in weight may be estimated from the conversion of samples of fish size, with potential major impacts on the estimates of species-specific catches if length-weight relationships are biased.

Purse seine fishing has represented about 70% of the global tropical tuna catch over the last decade, with an estimate of more than 3.6 million metric tons in 2019. In the Indian and Atlantic Oceans, the purse seine catch of the principal market tunas, yellowfin tuna (*Thunnus albacares*), skipjack tuna (*Katsuwonus pelamis*) and bigeye tuna (*Thunnus obesus*), was close to 800,000 metric tons in recent years. Purse seiners also catch albacore tuna (*Thunnus alalunga*) to a lesser extent when they occur in mixed schools with tropical tunas. The species composition of most purse seine catch of the Indian and Atlantic is estimated from size samples of the catch performed during unloading operations that mainly take place in the ports of Abidjan (Côte d’Ivoire), Dakar (Senegal), and Victoria (Seychelles) ([Pianet et al. 2000](#ref-Pianet2000)). The collection of morphometric data on tuna has been implemented as early as the 1970s to derive the morphometric relationships required for the monitoring of purse seine fisheries occurring in the Atlantic and Indian Oceans (Guillou et al. *submitted*).

The present study aims to derive length-length and length-weight relationships for the principal market tropical tunas and albacore tuna caught with purse seine in the Atlantic and Indian oceans based on the morphometric data sets collected in the principal fishing ports where tuna is landed.

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