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

Chassot Emmanuel1,2, Nathalie Bodin1,2,4, Constance Diaha3, Cindy Assan4, Aurélie Guillou1, Julien Lebranchu1,

06 January 2022

## Authors’ affiliations

1 Research Institute for Sustainable Development (IRD), Victoria, Mahé, Seychelles

2 Indian Ocean Tuna Commission (IOTC) (present affiliation)

3 Centre de Recherches Océanologiques (CRO), Abidjan, Côte d’Ivoire

4 Seychelles Fishing Authority (SFA), Victoria, Mahé, Seychelles

| Corresponding author: [Julien.Lebranchu@ird.fr](mailto:Julien.Lebranchu@ird.fr)

## Abstract

*This is the abstract*

**Keywords:** eastern Atlantic Ocean, length-weight relationships; tuna fisheries; Western Indian Ocean

# 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 overarching objective of the present study is 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 large morphometric data sets collected through different monitoring programs since the mid-1970s.

Bolger, T., and Connolly, P.L. 1989. The selection of suitable indices for the measurement and analysis of fish condition. Journal of Fish Biology **34**(2): 171–182. Available from <http://dx.doi.org/10.1111/j.1095-8649.1989.tb03300.x>.

Gerritsen, H.D., and McGrath, D. 2007. Significant differences in the length–weight relationships of neighbouring stocks can result in biased biomass estimates: Examples of haddock (*Melanogrammus aeglefinus*, L.) And whiting (*Merlangius merlangus*, L.). Fisheries Research **85**(1): 106–111. doi:[10.1016/j.fishres.2007.01.004](https://doi.org/10.1016/j.fishres.2007.01.004).

Minte-Vera, C.V., Aires-da-Silva, A., Satoh, K., and Maunder, M.N. 2016. Changes in longline size-frequency data and their effects on the stock assessment models for yellowfin and bigeye tunas. *In* Seventh meeting of the Scientific Advisory Committee of the Inter-American Tropical Tuna Commission, 09-13 May 2016, La Jolla, California, USA. IATTC, La Jolla, California (USA). p. 22.

Pianet, R., Pallarés, P., and Petit, C. 2000. New sampling and data processing strategy for estimating the composition of catches by species and sizes in the European purse seine tropical tuna fisheries. *In* IOTC Proceedings. pp. 104–139.

Ricker, W.E. 1975. Computation and interpretation of biological statistics of fish populations. Bulletin of the Fisheries Research Board of Canada **191**: 1–382.