

# **Fish species size distributions in a changing climate**

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## Abstract

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## 1 Background

Body size is a key trait in determining how organisms interact with their environment, this is particularly true for marine organisms, where body size is a strong predictor of trophic position<sup>1</sup>, growth rate, and predation mortality<sup>2</sup>. Giometto et al.<sup>3</sup>, using the spherical diameter of unicellular protists, identified that the mean body size of a species, was sufficient to describe the entire body size distribution. The authors conjectured that this may hold for multicellular organisms. Here, we test this conjecture using 15 million+ individuals from 1064 fish species.

## 2 Results & discussion

We found that the variance parameter of the lognormal distribution was constant across the fitted mean parameter of the lognormal distribution (Figure ?? A), further we found a consistent relationship between the standard deviation and the mean of the normal distribution fitted to observed body size (Figure ?? B). This is to say the mean size of the species is sufficient to describe the overall body size distribution. For both data sources, continuous and binned, we found the patterns between the mean and variance parameters of the lognormal distribution held, with  $\text{sdlog} = 0.39 \pm 0.007$  (Reef Life Survey, binned data) and  $0.3 \pm 0.03$  (Cryptobenthic fish, continuous). For normal distribution, we found a consistent relationship

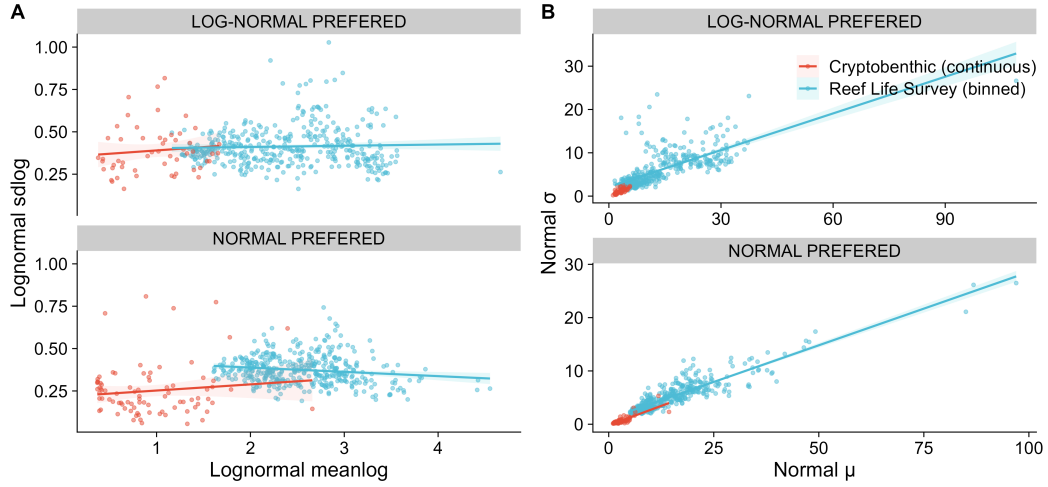


Figure 1: Mean size is sufficient to describe overall body size distribution.

## 3 Methods

### 3.1 Body size data sources

Fish body size data were obtained through two sources: Reef Life Survey (RLS; 15M+ individuals, binned body size)<sup>4</sup>, and Cryptobenthic reef fish (CBF; 8K+ individuals, continuous body size)<sup>5</sup>.

RLS surveys involve an underwater visual census method along 50m transect line, with a diver searching 5m either side of the transect line, the body size of the fish is estimated to the nearest body size bin (2.5, 5, 7.5, 10, 15, 20, 25, 30, ..., 400cm).