SIOFA Sharks

Length Based Indicators for Centroscymnus coelolepis

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Introduction

In this analysis, we update the biological knowledge on *Centroscymnus coelolepis*, using data from catch data and biological sampling obtained from SIOFA and IEO

Based on these data we update the life history parameters such as the length-weight relationship ($W = aL^b$), length at maturity, and maximum size (L_{max}). The analysis also evaluates the current status using Length Based Indicators (LBIs).

Data

The datasets include length, mass and maturity-at-age; SIOFA data are in `SIOFA_DWS-2023-01-Data.xlsx`, and IEO data in `Sharks_biological.Rdata`, `Sharks_logbooks.Rdata`, and `maturity_data.xlsx`.

Life history parameters

By default the life history parameters are downloaded from 'FishBase'. However, these are sparse as they do not include information by gender.

Table 1 "Life History parameters from `FishBase` for Centroscymnus coelolepis".

Parameter	Description	Reference
Maturity (Lm)	101.8 cm (range 95 - 110 cm)	Ref. 122636
Max Length	121 cm TL male/unsexed	Ref. 122636
Common Length	92.0 cm TL male/unsexed	Ref. 247
Max Weight	10.1 kg	Ref. 122636

Table 2 Life history parameters and priors from `FishLife`.

trait	Value	Variance	Hat	CV
G	28.1372334	460.7792570	21.0689	0.7621
h	0.4006917	0.0480868	0.1525	0.5479
K	-2.3875709	0.6868437	0.0919	0.9980
Lm	4.3904107	0.6260039	80.6735	0.9320
ln_Fmsy	-3.2865789	4.8466601	NA	NA
ln_Fmsy_over_M	-1.2797840	3.5190248	NA	NA
ln_G	3.0477958	0.6235274	NA	NA
ln_margsd	-1.0174141	0.3239014	NA	NA
ln_MASPS	-2.2788016	6.1262137	NA	NA
ln_r	-3.7373649	3.4226241	NA	NA
ln_var	-3.2203285	2.8332176	NA	NA
logitbound_h	-1.8804194	4.9197776	NA	NA
Loo	4.8274004	0.7143187	124.8859	1.0224
M	-1.9905201	0.8289344	0.1366	1.1291
r	0.0726278	0.0169649	0.0238	1.8137
rho	0.6939458	0.1335680	NA	NA
Temperature	13.3508320	45.2934871	NA	NA
tm	2.5756209	0.7643163	13.1395	1.0700
tmax	3.3957434	0.7312075	29.8368	1.0352
Winfinity	9.1462597	6.8784363	NA	NA

Length Weight Relationship

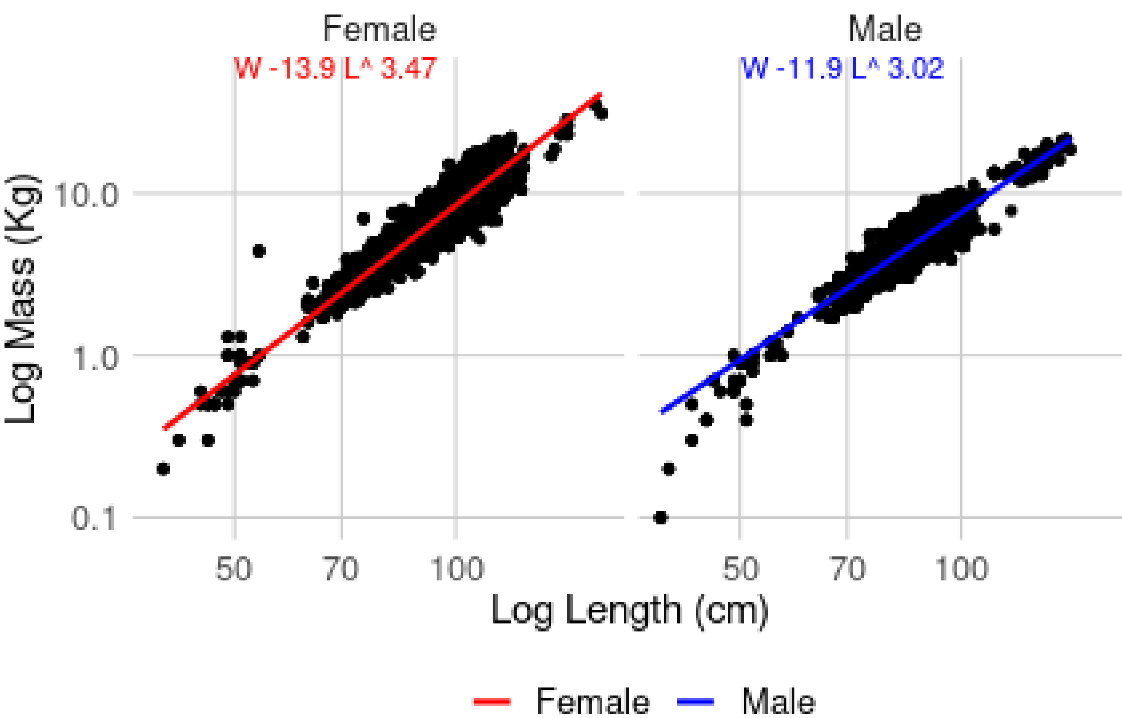


Figure 1 Length weight relationship ($W = aL^b$).

Maturity

Codes for maturity stages are **Females:** 1: immature; 2: maturing; 3: mature; 4: uterine developing; 5: differentiating; 6: expecting; 7: post-natal, spent; 8: Re-starting development; and **Males:** 1: immature; 2: developing; 3: mature; 4: active

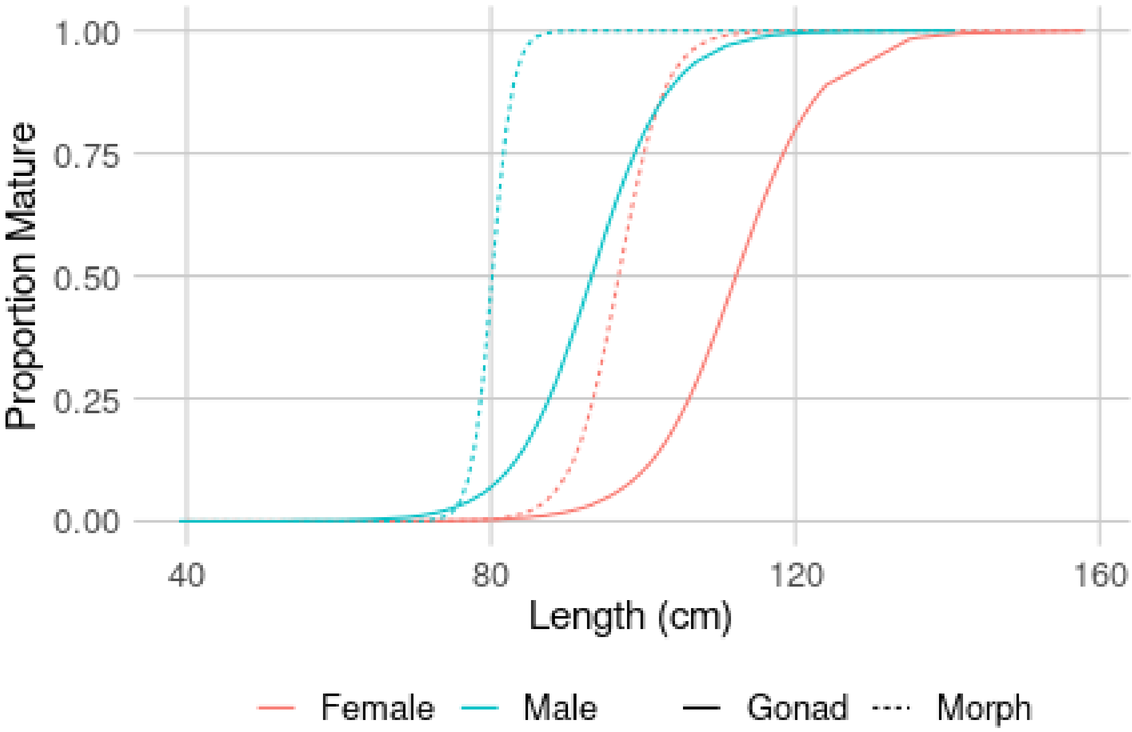
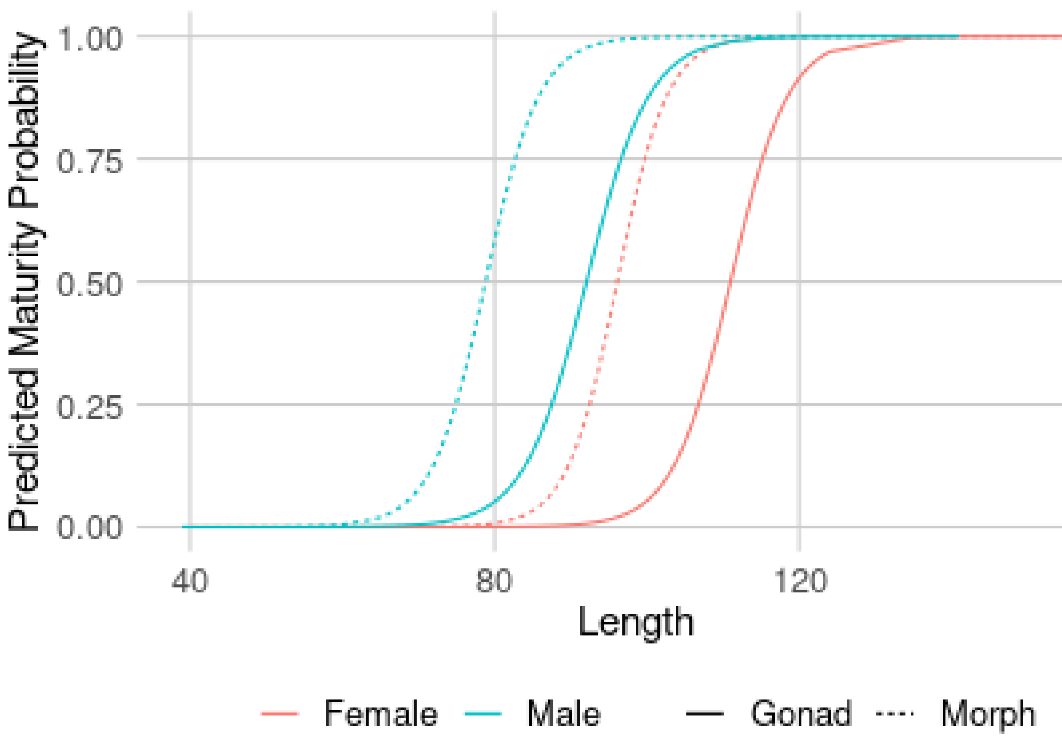


Figure 2 Maturity Ogives, provided by IEO.



Fit logistic regression model

Figure 3 Maturity Ogives, fitted using data provided by IEO.

Table 3 Life history parameters and priors from `FishLife`.

Gender	Type	l50
Female	Gonad	112
Female	Morph	97
Male	Gonad	93
Male	Morph	80

Table 4 Life history parameters and priors from `FishLife`.

Gender	Type	L50
Female	Gonad	111
Female	Morph	96
Male	Gonad	92
Male	Morph	79

Catch

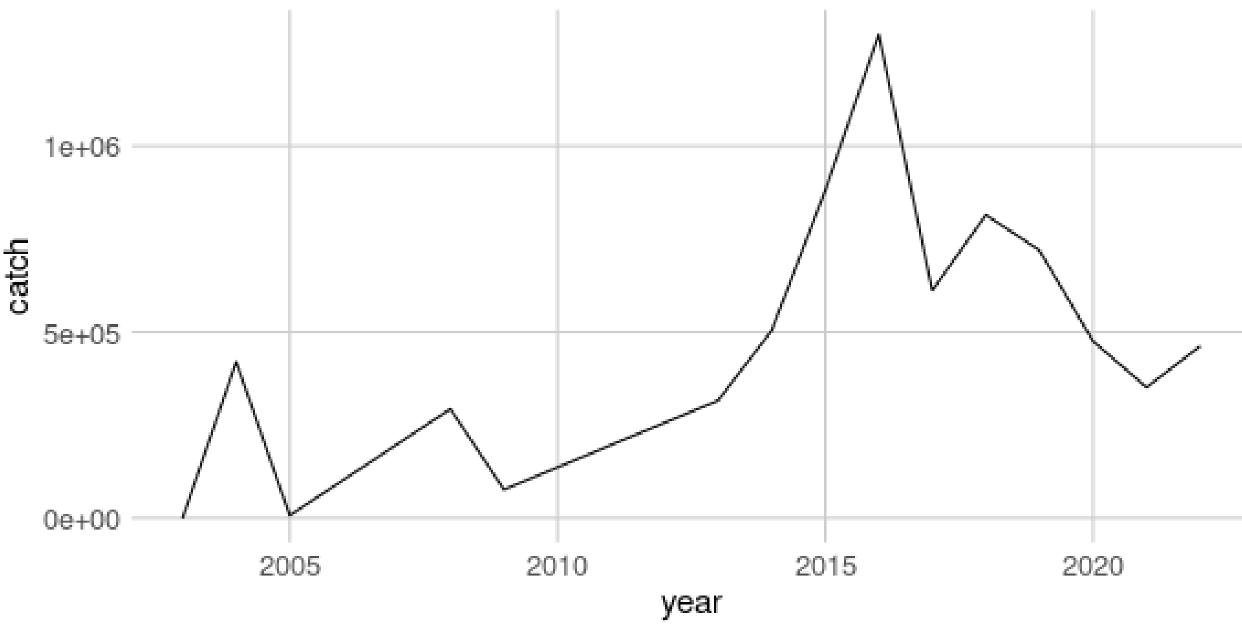


Figure 4 Time series of aggregated catch biomass.

Length Frequency Distributions

IEO

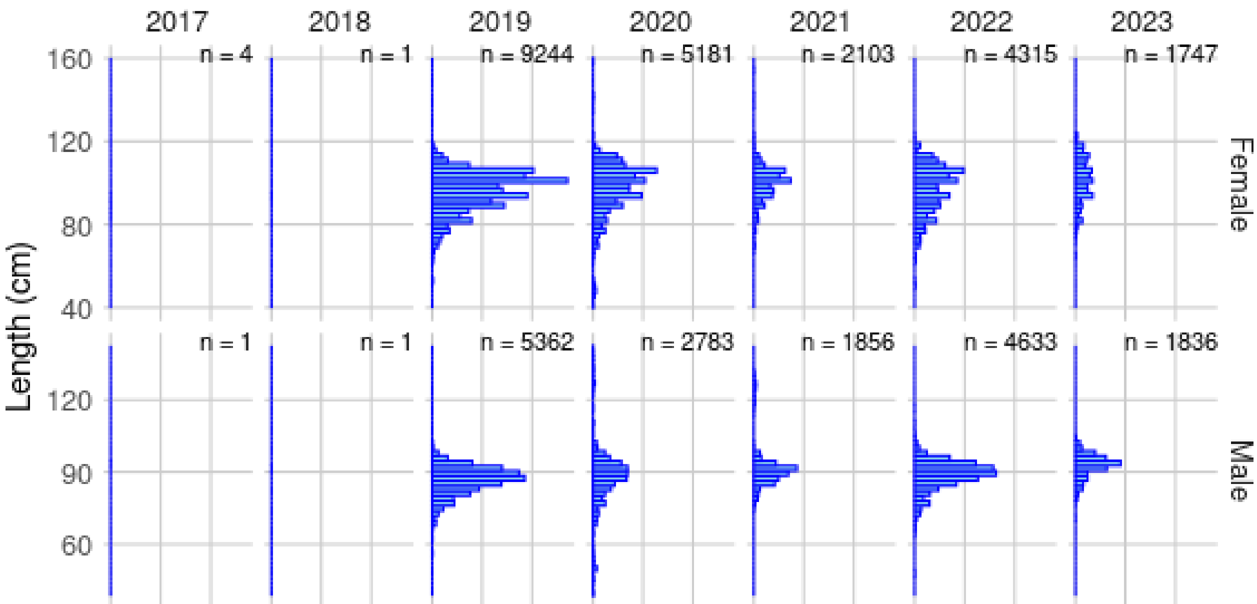


Figure 5 Length distributions by gender for IEO data.

SIOFA

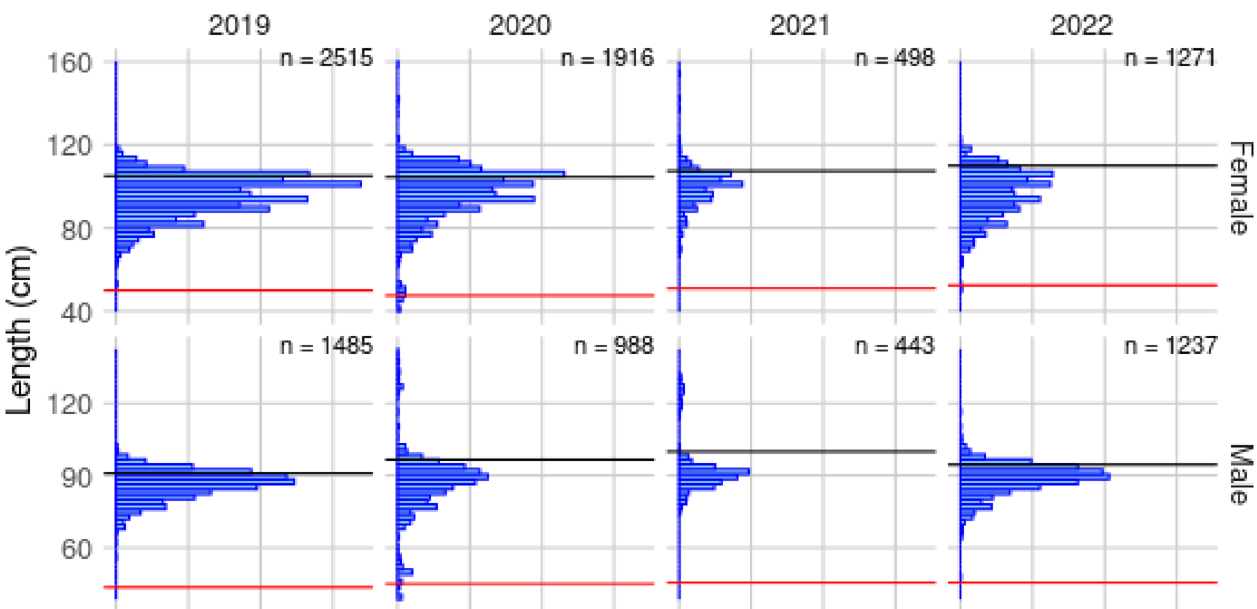


Figure 6 Length distributions by gender for SIOFA data.

Maximum size

The empirical relationship between L_∞ (asymptotic length, the maximum length towards which the individuals in a population converge as they become infinitely old) and L_{max} (the maximum observed length in a population) is important in data limited stocks for assessing fish growth and developing priors for population dynamics.

While both L_∞ and L_{max} provide insights into the growth potential of a species, they are distinct parameters. L_∞ is a theoretical parameter derived from growth models (e.g., the von Bertalanffy growth function), whereas L_{max} is an empirical observation from field data.

Several studies have attempted to establish empirical relationships between these two metrics to facilitate the estimation of one parameter from the other, especially in data-poor situations. However, it's important to note that any empirical relationship may be species-specific and influenced by environmental factors, fishing pressure, and the methodological approaches used in studies. A commonly cited rule of thumb is that L_{max} is often observed to be approximately 0.95 to 0.99 times L_∞, acknowledging that most individuals in a population do not reach or exceed the asymptotic length due to natural mortality, predation, or fishing pressure. This approximation allows researchers to estimate L_∞ from L_{max} when growth model parameters are unknown or cannot be directly calculated due to lack of data.

However, relying on a fixed ratio or empirical relationship without considering species-specific life history traits, ecological conditions, and the quality of the available data can lead to inaccuracies. Therefore, when such empirical relationships are used, they should be applied with caution and, if possible, validated against more comprehensive data sets or models specific to the species and region of interest.

Table 5 .

	Female	Male
2017	95	94
2018	95	92
2019	119	57
2020	158	141
2021	155	121
2022	121	64
2023	121	105

Table 6 .

	Female	Male
2019	119	101.0
2020	158	141.0
2021	155	130.5
2022	123	64.0