

ESTIMATION OF CONDITION FACTOR OF BENGAL TONGUE SOLE (*CYNOGLOSSUS CYNOGLOSSUS*) IN THE BAY OF BENGAL, BANGLADESH

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ABSTRACT: The Bay of Bengal is rich with its biological diversity, which plays an important role in the country's economic and social development. This study describes the condition factor of *Cynoglossus cynoglossus* in the Bay of Bengal, Bangladesh. Samples were collected from the Bay of Bengal during January to December 2020. Body weight (BW) of fishes were taken by an electric balance with 0.01 g precision, and total length (TL) was measured using a measuring board to the nearest 0.1 cm accuracy. The Fulton's condition factor was estimated by the equation: $K_F = 100 \times (BW/TL^3)$. Total length and body weight ranged from 10.0-38.7 cm (mean \pm SD = 24.24 ± 6.30) and 9.1-280.6 g (98.44 ± 57.79), respectively. The value of Fulton's condition factor was observed as 0.6469 (SD = 0.1148), indicating unstable physiological condition of fish in Bay of Bengal. The outcomes of this study will be helpful for sustainable management of *C. cynoglossus* in the Bay of Bengal and use as baseline information for further studies.

KEYWORDS: Bay of Bengal, Bengal tongue sole, *C. cynoglossus*, Fulton's condition factor

INTRODUCTION

The Bay of Bengal is enrich with marine resources and contains diversified fish species (Islam, 2003). There are over 740 marine fish species in the Bay of Bengal (Habib and Islam, 2020; Rahman *et al.*, 2021). A wide number of commercially valuable fishes with high export values have long been exploited (Islam, 2003). *Cynoglossus cynoglossus* generally familiar as Bengal tongue sole belonging to the family Cynoglossidae under Pleuronectiformes. It is found in brackish water and muddy or sandy bottoms along the coasts of Bangladesh, India, and Burma, as well as the coasts of the Philippines (Froese and Pauly, 2021). This species is commonly used as a food fish in Bangladesh, available in both fresh and dried forms. It is categorized as least concern in worldwide water bodies (IUCN, 2021).

Condition factor indicates physiological status of fish populations (Hasan *et al.*, 2020; Parvin *et al.*, 2021). This factor is derived from the relation between a fish's weight

and length, with the aim of identifying that individual's "condition" (Nash *et al.*, 2006; Bolarinwa, 2018).

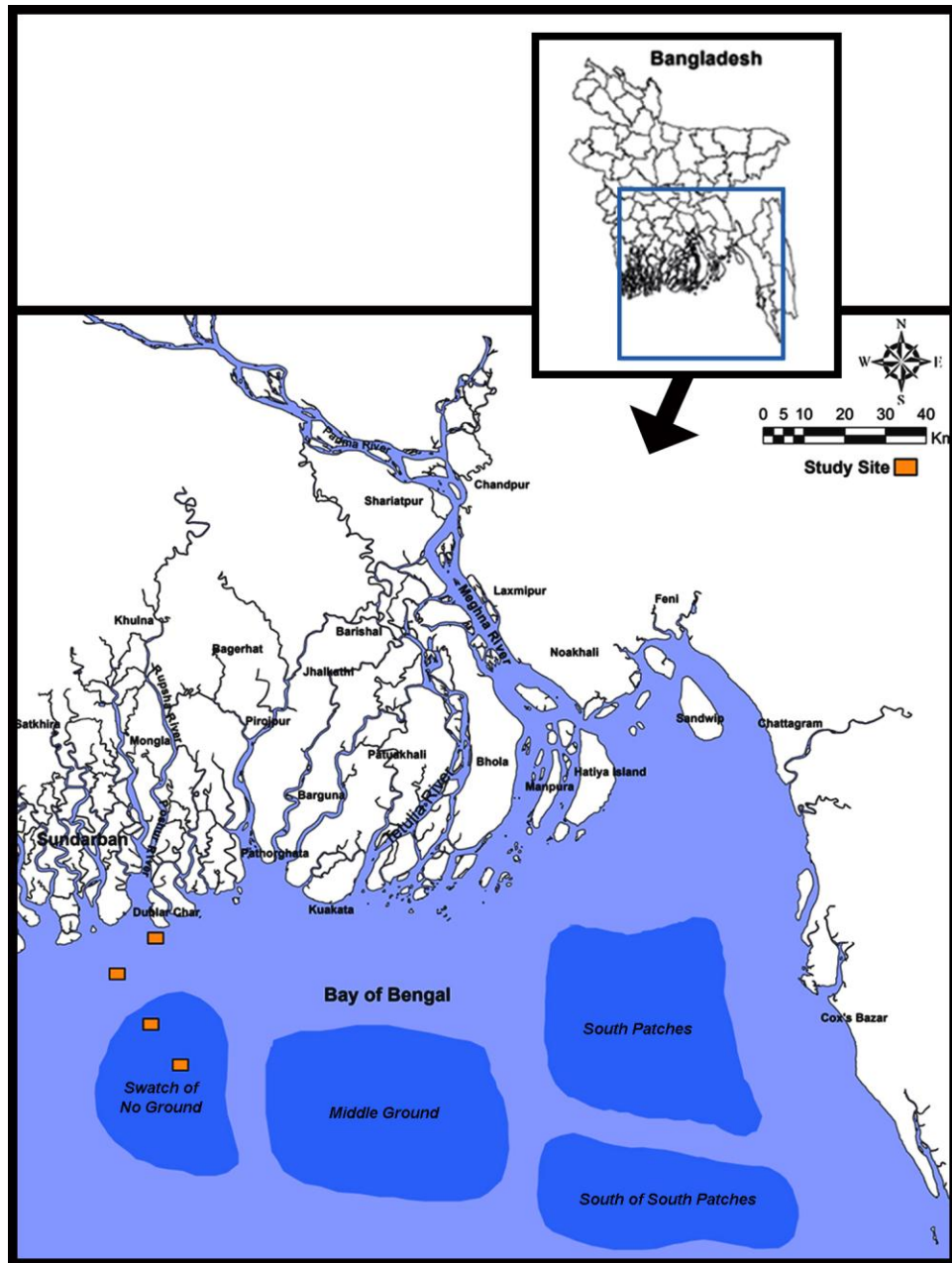


Fig. 1. The study sites in the Bay of Bengal, Bangladesh (Rectangle shapes indicate the sampling sites).

Some studies have been done on this species such as sexual maturity from Bay of Bengal (Mawa *et al.*, 2021), feeding, metabolism, and growth from Indian water bodies (Edwards, 1971), length-weight relationship and condition factor from Nigerian waters (Bolarinwa, 2018). This study was stated the first report on condition factor of *C. cynoglossus* from the Bay of Bengal, Bangladesh.

MATERIALS AND METHODS

Total 127 individuals were occasionally collected from commercial fisher's catch through different traditional fishing gears including seine bag nets (mesh size: 4.0 cm) and gill net (mesh size: 3.0 cm) using boats from January to December, 2020 from the Bay of Bengal (22.6678°N, 89.5326°E), Bangladesh (Fig. 1). The samples were kept in a 10% buffered formalin solution. Body weight (BW) of fishes were taken by an electric balance with 0.01 g precision, and total length (TL) was measured using a measuring board to the nearest 0.1 cm accuracy. The Fulton condition factor was estimated using the following equation: $K_F = 100 \times (W/L^3)$ (Fulton, 1904). All statistical analyses were conducted using Microsoft Office Excel software at a significance level of 5% ($p > 0.05$).

RESULTS AND DISCUSSION

Results: In this study, the recorded TL and BW of *C. cynoglossus* were ranged from 10.00-38.70 cm and 9.06-280.60 g, respectively. The descriptive statistics for morphometric measurements of *C. cynoglossus* are demonstrated in Table 1. The mean value of Fulton condition factor was calculated as 0.6469 with 95% confidence limit (0.6268 – 0.6671) shown in Fig. 2. Table 2 demonstrated the estimated Fulton's condition factors in different length classes of this species with 95% confidence limit.

Table 1. Morphometric measurements of *Cynoglossus cynoglossus* from the Bay of Bengal, Bangladesh.

Measurement	Min	Max	Mean ± SD
Total length (cm)	10.00	38.70	24.24 ± 6.30
Body weight (g)	9.06	280.60	98.44 ± 57.79

Min, minimum; Max, maximum; SD, standard deviation

Discussion: The Bay of Bengal is one of the world's least studied regions, although having significant potential for stock enhancement. A wide number of commercially valuable fishes with high export values have long been exploited (Islam, 2003). However, this study stated the condition of *C. cynoglossus* in the Bay of Bengal, Bangladesh. In this study we observed the maximum size of *C. cynoglossus* was 38.7 cm which is near to 38.5 cm from Bay of Bengal (Mawa *et al.*, 2021) and higher than 20.0 cm from Western Central Pacific (Munroe, 2001). Maximum length is very essential for comparison of morphology between fish populations from different areas, life history and sexual

maturity of fish (Rahman *et al.*, 2019), and it also help to estimate the growth parameters *i.e.*, asymptotic length, growth coefficient etc.

Table 2. Descriptive statistics on Fulton's condition factor of *Cynoglossus cynoglossus* from the Bay of Bengal, Bangladesh.

Total length	Fulton condition factor			
	Min	Max	Mean \pm SD	95 % CL
10.99	0.896	0.906	0.901 \pm 0.007	0.839- 0.962
11.99	0.812	0.913	0.870 \pm 0.052	0.7419 - 0.998
12.99	0.709	1.032	0.908 \pm 0.173	0.477 - 1.338
13.99	0.815	0.885	0.850 \pm 0.050	0.400 - 1.300
14.99	0.703	0.905	0.804 \pm 0.143	-0.479 - 2.087
15.99	0.761	0.767	0.764 \pm 0.004	0.726 - 0.801
16.99	0.703	0.801	0.761 \pm 0.052	0.633 - 0.889
17.99	0.581	0.711	0.651 \pm 0.065	0.488 - 0.813
18.99	0.710	0.859	0.791 \pm 0.066	0.721 - 0.861
19.99	0.668	0.771	0.727 \pm 0.046	0.678 - 0.775
20.99	0.715	0.798	0.757 \pm 0.034	0.721 - 0.792
21.99	0.583	0.693	0.630 \pm 0.056	0.540 - 0.720
22.99	0.631	0.683	0.665 \pm 0.0183	0.650 - 0.681
23.99	0.590	0.671	0.620 \pm 0.031	0.581 - 0.659
24.99	0.581	0.710	0.635 \pm 0.034	0.617 - 0.653
25.99	0.550	0.605	0.577 \pm 0.019	0.557 - 0.599
26.99	0.536	0.617	0.579 \pm 0.02	0.552 - 0.606
27.99	0.525	0.6119	0.567 \pm 0.030	0.544 - 0.590
28.99	0.555	0.643	0.591 \pm 0.028	0.571 - 0.611
29.99	0.544	0.634	0.589 \pm 0.063	0.015 - 1.163
30.99	0.527	0.577	0.546 \pm 0.018	0.524 - 0.569
31.99	0.509	0.058	0.530 \pm 0.023	0.472 - 0.590
32.99	0.515	0.528	0.521 \pm 0.009	0.439 - 0.606
33.99	0.489	0.533	0.512 \pm 0.022	0.457 - 0.567
34.99	0.479	0.564	0.494 \pm 0.034	0.357 - 0.599
35.99	0.478	0.516	0.497 \pm 0.026	0.256 - 0.738
36.99	0.479	0.509	0.494 \pm 0.015	0.458 - 0.532
37.99	0.521	0.751	0.635 \pm 0.019	0.541 - 0.720
38.99	0.472	0.484	0.478 \pm 0.008	0.406 - 0.551
Overall	0.472	1.033	0.646 \pm 0.114	0.627 - 0.667

Min, minimum; Max, maximum; SD, standard deviation; CL, confidence limit

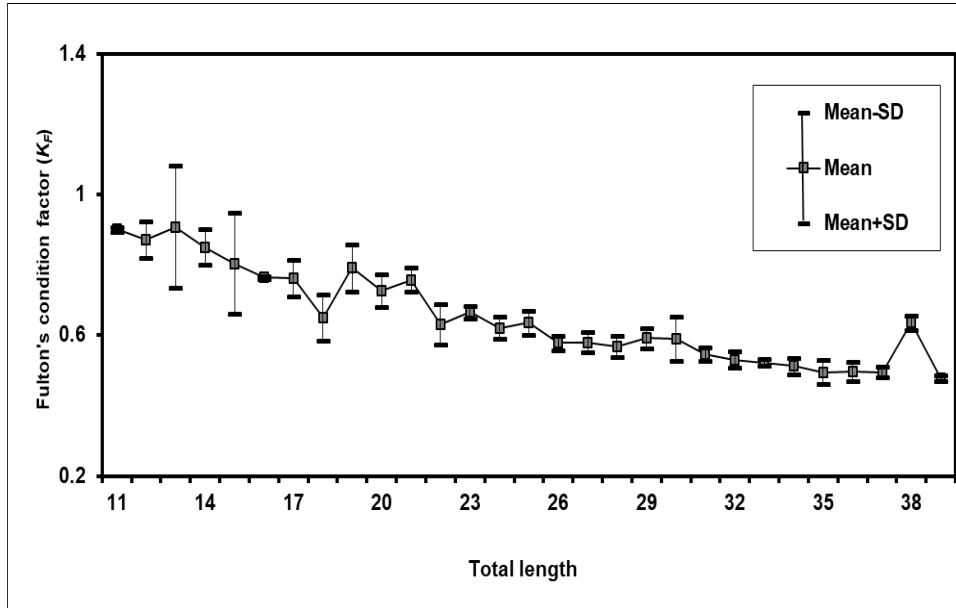


Fig. 2. Fulton's condition factor of *Cynoglossus cynoglossus* from the Bay of Bengal, Bangladesh.

Good physiological condition of any organism indicates suitable habitat such as available food, good environmental parameters etc. The Fulton's condition factor (K_F) indicates the physiological condition of fish. The value of Fulton's condition factors (K_F) is 1 or closest 1 indicating suitable environment and good physiology for fish stock (Hossain *et al.*, 2021). In our study, the estimated value of K_F was 0.6469 which is lower than 1 and indicates unstable physiological condition in their habitat. We also estimated the value of K_F in different lengths of *C. cynoglossus* and observed that with the increasing of size the value of K_F was gradually plummeted. The highest value of K_F (1.0328) when the size was 12.99 cm whereas the lowest value of K_F was 0.4841 when the size was 38.99 cm. The values of K_F vary due to some factors such as availability of food, spawning period, foraging behavior of individuals and stored or reserved energy (Sabbir *et al.*, 2020). To the best of author knowledge, we have not found any previous literature to compare our study. Due to various reasons such as climate change, over exploitation, pollution, biodiversity of fish are declining. To overcome the risk of extinction of fish species, we need to know about the condition of every species. This study will provide essential information for the sustainable management and conservation of this fish species in the Bay of Bengal.

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