Pakistan Journal of Marine Sciences, Vol. 30(1), 13-19, 2021.

FORM FACTOR OF JAPANESE THREADFIN BREAM, *NEMIPTERUS JAPONICUS* (BLOCH, 1791)

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ABSTRACT: Japanese threadfin bream, *Nemipterus japonicus* is a large-scale commercial fish found in the Pacific and Indian Ocean. Form factor ($a_{3.0}$) is used widely for comparison of the fish body shape between geographic locations. The present study was aimed to estimate the form factor of *N. Japonicus* from available literature based on empirical model. Assessed $a_{3.0}$ ranged from 0.0035 to 0.0270. The median (0.0143) and 95% confidence limit (0.0130-0.0168) indicated that *N. Japonicas* poses the typical torpedo body shape 'fusiform'. Findings on the form factor of *N. japonicus* will be effective for perceiving further body shape alteration between geographic distributions.

KEYWORDS: Body shape; Form factor; Japanese threadfin bream; Morphological feature; *Nemipterus japonicus*

INTRODUCTION

The Japanese threadfin bream, *Nemipterus japonicas* (Bloch 1791) is marine demersal fish inhabited in the pacific and Indian ocean (4°N - 11°S, 31°E - 133°E). This tropical non-migratory fish species is native in 44 countries including Bangladesh, Pakistan, India, Japan Iraq, Jordan, Yemen, Egypt etc. A Red Sea immigrant into the Mediterranean reported from Haifa Bay (Froese and Pauly, 2021). It is very common in coastal waters, where it can be observed in schools on mud or sand bottoms with a depth of 5-80 meters. Smaller individuals inhabit shallower waters of less than 27 meters depth, while larger individuals occur in waters deeper than 45 meters. Tiny fishes, crustaceans, mollusks (primarily cephalopods), polychaetes, and echinoderms are the primary food sources (Russell, 1990). It is a large scale commercial trawl fish throughout its range and marketed mainly fresh or frozen but also in steamed, dry-smoked, dried-salted, fermented or made into fish balls and fish meal (Russell, 1990). This relatively short-lived and fast-growing species has a maximum total length of 38.2 cm (Lee, 1975) with a common length of 25 cm (Psomadakis, 2015). Females predominate at small sizes and males at larger sizes, due to faster growth rate in males (Lee, 1975). Sexual maturity of this species is 19.4cm for male and 19.1 for female in the Persian Gulf (Kerdagari *et al*., 2009), 18 cm in India (Sen *et al*., 2014), 14 cm in Kuwait (Samuel, 1986), 11.4 cm for female and 12.5 cm for male in Gulf of Suez (Amine 2012). Kerdgari *et al*., (2009) reported its spawning season in April-May and September in the Persian Gulf, March-June and September in Gulf of Suez (Amine 2012). Afshari *et al.*, (2013) also stated longevity of at least 5 years in the northern Gulf of Oman and Sen *et al*., (2014) also did same from the Indian waters. Natural mortality has been estimated as 0.74 $year^{-1}$ in

Pakistan (Ali *et al*., 2014), 0.53 year^{-1} in Egypt (Amine, 2012) and 1.2, 1.3 or 1.52 in India (Manojkumar, 2007; Joshi, 2010; Sen *et al.*, 2014).

Body shape and other morphological traits are the main characteristics that are still used to identify fishes to date. Hence, understanding the classification of fishes requires a basic overview of their basic shapes. Body shapes acts as an essential role in fish swim, prey and avoids predators and affects the methods of fish caught by different fishing gears and determines the size ranges of these fishing gears (Karpouzi and Stergiou, 2003). Diverse body shapes are found in fishes. Torpedo shape is the typical shape of fish termed as fusiform. Common basic shape categories of fish include: laterally flattened, ventrally flattened, torpediform or fusiform, arrow-like, eel-like, ribbon-like and spheroid-shaped (Nikolsky, 1963).

According to Froese (2006) ''the form factor can be used to determine whether the body shape of a given population or species is significantly different from others''. Form factor ($a_{3.0}$) is used widely for comparison of the fish body shape between geographic locations (Sabbir *et al*., 2020; Islam *et al*., 2021). Several studies on biology, food and feeding habits, population dynamics have been done earlier except form factor for *N. japonicus*. Thus the study was aimed to estimate the form factor of *N. japonicus* from water body worldwide.

MATERIAL AND METHODS

Form factor of *N. japonicus* was estimated by the equation of Froese (2006): $a_{3.0}=10^{log\ a-s(b-3)}$ where, *a* and *b* are the regression parameters of length weight relationships and *S* is the mean regression of log *a vs. b* = –1.358. Length weight relationships data (*a* and *b*) was collected from the available literature through Fish Base and other peer-review journals. All statistical analyses were performed through Microsoft Office Excel program considering a 5% significance level ($p< 0.05$).

RESULTS AND DISCUSSION

Estimated form factor ($a_{3.0}$) for *N. Japonicas* ranged from 0.0035to 0.0270 (Table 1 & Fig. 1) with a mean of 0.0149 (mean±SD = 0.0149±0.0049). The median and mode of $a_{3.0}$ was 0.0143 and 0.0176, respectively. According to Froese (2006), the median and 95% confidence limit (0.0130-0.0168) of them indicated that, *N. Japonicas* poses the typical body shape 'fusiform'.

Estimated form factor and their comparisons are snapshot pictures of which is useful for fisheries management (Hossain *et al*., 2017). Literature on form factors is not available for this species. The assessed form factor of *N. japonicas* was more or less similar except from the Gulf of Aden & Red Sea, Yemen; Beibu Gulf, China and Off Bombay, India. This may happen due to earlier sampling bias for assessing the regression parameters (*a* and *b*). Differences on $a_{3.0}$ values may be attributed to plumpness, gonadal development stage or geographical areas etc. (Rahman *et al*., 2021). Froese (2006) stated ''the latter appears low and would increase if we had considered standard length instead of total length, i.e. excluding the length of the caudal fin from calculating the cube of length''. Findings on the form factor of *N. japonicus* will be effective for recognition of

Table 1. Estimated form factor ($a_{3.0}$) of Japanese threadfin bream, *Nemipterus japonicus* (Bloch, 1791) from available literature worldwide.

Water body/Country	Sex	*a*	*b*	References	$a_{3.0}$
Daya Bay, China	U	0.09096	2.475	Xu *et al*. (1994)	0.0176
Southern coast, India	C	0.03900	2.664	Abdurahiman *et al*. (2004)	0.0136
Gulf of Aden & Red Sea, Yemen	F	0.05900	2.664	Al Sakaf and Esseen (1999)	0.0206
	M	0.05800	2.666		0.0204
Kakinada & Visakhapatnam, India	U	0.02870	2.702	Murty *et al*. (1992)	0.0113
Cochin & Mangalore, India	U	0.02340	2.849		0.0146
Bombay &Veraval, India	U	0.00571	3.284		0.0139
Peninsular west coast, Malaysia	U	0.02900	2.730	Ahmad *et al*. (2003)	0.0125
Gulf of Aden, Yemen	U	0.02500	2.870	Edwards *et al*. (1985)	0.0166
Gulf of Suez, Egypt	C	0.01500	2.901	Desouky (2017)	0.0110
Off Bombay, India	U	0.00474	2.930	Chakraborty (1995)	0.0038
Beibu Gulf, China	U	0.03290	2.940	Wang *et al*. (2011)	0.0270
Madras, India	U	0.01360	2.966	Vivekanandan and James (1986)	0.0122
Hong Kong	M	0.01760	3.025	Lee (1975)	0.0190
	F	0.01470	3.094		0.0197
Bay of Bengal, Bangladesh	U	0.01070	3.057	Mustafa (1999)	0.0128
Myanmar	U	0.01050	3.060	Pauly and Aung (1984)	0.0127
Persian Gulf, Iran	C	0.0517	2.664	Raeisi *et al*. (2012)	0.0181
Mangalore, India	M	0.0203	2.83	Rajesha *et al*. (2011)	0.0117
	F	0.0036	2.988		0.0035
	C	0.0183	2.989		0.0176
Pakistan	C	0.032	2.778	Ali *et al*. (2014)	0.0160
North Persian Gulf	M	0.0183	2.992	Kerdgari *et al*. (2009)	0.0178
	F	0.0178	3.007		0.0182
	C	0.0181	3.000		0.0181
Red Sea	C	0.021	2.850	Hanafi *et al*. (2010)	0.0131
Gulf of Suez, Egypt	C	0.0256	2.733	Amine (2012)	0.0111
Kuwait	C	0.0245	2.790	Mathews and Samuel (1991)	0.0127

a and *b*, parameters of the LWRs equation; U, unsexed; C, combine sex; M, male; F, female

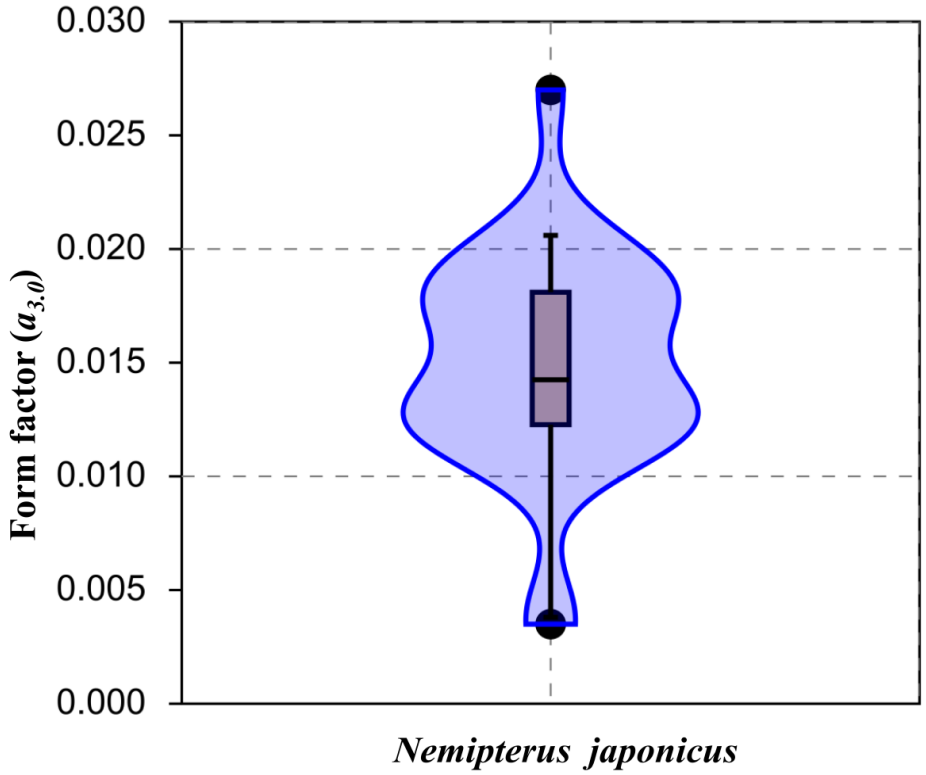

Fig. 1. Violin and box plot of estimated form factor ($a_{3.0}$) of *Nemipterus japonicus*.

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