

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

Md. Ashekur Rahman and Jun Ohtomi

Department of Fisheries, University of Rajshahi, Rajshahi-6205, Bangladesh (MAR);  
Faculty of Fisheries, Kagoshima University, 4-50-20 Shimoarata,  
Kagoshima 890-0056, Japan (JO)  
email: ashiqru17@gmail.com

**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). Kerdagari *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<sup>-1</sup> in

Pakistan (Ali *et al.*, 2014), 0.53 year<sup>-1</sup> 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 0.0035 to 0.0270 (Table 1 & Fig. 1) with a mean of 0.0149 (mean  $\pm$  SD = 0.0149  $\pm$  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 <i>et al.</i> (1994)	0.0176
Southern coast, India	C	0.03900	2.664	Abdurahiman <i>et al.</i> (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 <i>et al.</i> (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 <i>et al.</i> (2003)	0.0125
Gulf of Aden, Yemen	U	0.02500	2.870	Edwards <i>et al.</i> (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 <i>et al.</i> (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 <i>et al.</i> (2012)	0.0181
Mangalore, India	M	0.0203	2.83	Rajेशha <i>et al.</i> (2011)	0.0117
	F	0.0036	2.988		0.0035
	C	0.0183	2.989		0.0176
Pakistan	C	0.032	2.778	Ali <i>et al.</i> (2014)	0.0160
North Persian Gulf	M	0.0183	2.992	Kerdgari <i>et al.</i> (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 <i>et al.</i> (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

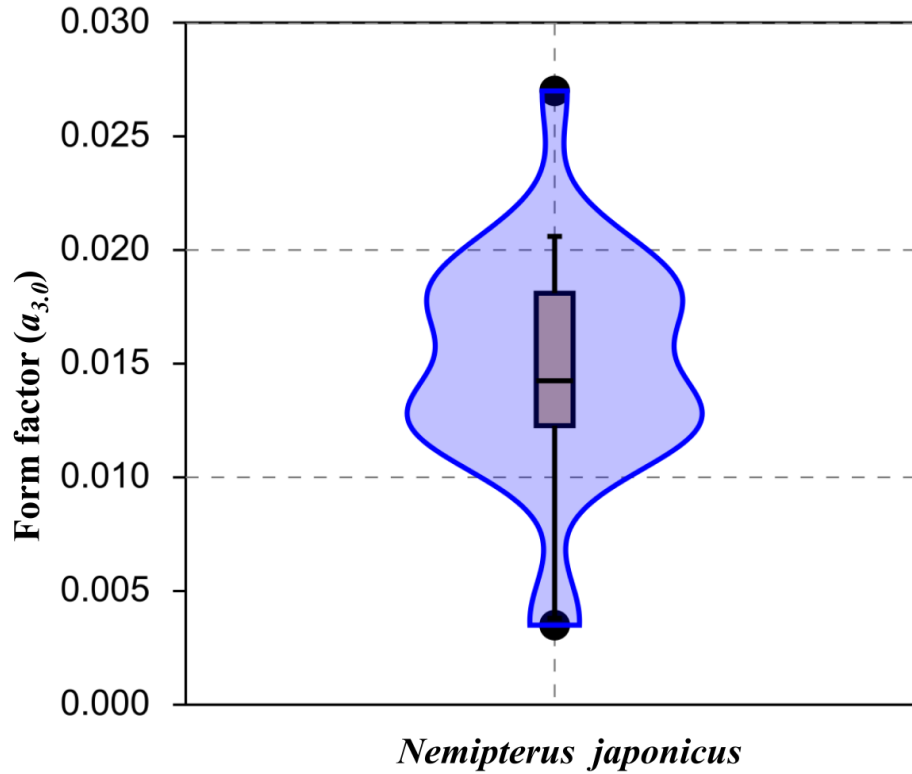


Fig. 1. Violin and box plot of estimated form factor ( $a_{3,0}$ ) of *Nemipterus japonicus*.

#### REFERENCES

- Abdurahiman, K.P., T. Harishnayak, P.U. Zacharia and K.S. Mohamed, 2004. Length-weight relationship of commercially important marine fishes and shellfishes of the southern coast of Karnataka, India. *Naga WorldFish Center Q.* 27(1&2): 9-14.
- Afshari, M., T. Valinassab, J. Seifabadi and E. Kamaly, 2013. Age determination and feeding habits of *Nemipterus japonicus* (Bloch, 1791) in the Northern Oman Sea. *Iran. J. Fish. Sci.* 12(2): 248-264. <http://jifro.ir/article-1-987-en.html>
- Ahmad, A.T.B., M.M. Isa, M.S. Ismail and S. Yusof, 2003. Status of demersal fishery resources of Malaysia. p. 83-135. In: G. Silvestre, L. Garces, I. Stobutzki, M. Ahmed, R.A. Valmonte-Santos, C. Luna, L. Lachica-Aliño, P. Munro, V. Christensen and D. Pauly (eds.) Assessment, management and future directions for coastal fisheries in Asian countries. WorldFish Center Conference Proceedings 67.
- Al Sakaff, H. and M. Esseen, 1999. Length-weight relationship of fishes from Yemen waters (Gulf of Aden and Red Sea). *Naga ICLARM Q.* 22(1): 41-42.

- Ali, K.M., L. Qun, M.K. Hussain, C.M. Saleem and Z. Kui, 2014. Population dynamics of Japanese threadfin bream *Nemipterus japonicus* from Pakistani waters. *Acta Oceanol. Sin.* 33(10): 1-9. <https://doi.org/10.1007/s13131-014-0000-0>
- Amine A.M., 2012. Biology and assessment of the thread fin bream *Nemipterus japonicus* in Gulf of Suez, Egypt. *Egypt. J. Aquat. Biol. Fish.* 16(2): 47-57. <https://dx.doi.org/10.21608/ejabf.2012.2124>
- Chakraborty, S.K., 1995. Growth, mortality and yield per recruit of threadfin bream *Nemipterus japonicus* (Bloch) off Bombay. *Indian J. Geo-Mar. Sci.* 24: 107-109.
- Desouky, M.G., 2017. Population dynamics of *Nemipterus japonicus* (Bloch, 1791) in Suez Gulf, Egypt. pp. 260-276. In: 1<sup>st</sup> International Conference Cairo, Egypt, 20-22 November 2017.
- Edwards, R.R.C., A. Bakhader and S. Shaher, 1985. Growth, mortality, age composition and fishery yields of fish from the Gulf of Aden. *J. Fish Biol.* 27(1): 13-21. <https://doi.org/10.1111/j.1095-8649.1985.tb04005.x>
- Froese, R. and D. Pauly, 2021. Fishbase. World Wide Web electronic publication, version. (02/2021). <http://www.fishbase.org>
- Froese, R., 2006. Cube law, condition factor and weight length relationship: history meta-analysis and recommendations. *J. Appl. Ichthyol.* 22: 241-253. <https://doi.org/10.1111/j.1439-0426.2006.00805.x>
- Hanafi, N. A. D. S., M. A. RAZAK M and A. Adil Y, 2010. Fishery, growth and mortality of the threadfin bream, *Nemipterus japonicus* (Bloch, 1791) (Pisces: Nemipteridae) from the southern Sudanese waters, Red Sea. *Basrah J. Agric. Sci.* 23:187-199.
- Hossain, M.Y., M.A. Hossen, D. Khatun, F. Nower, M.F. Parvin, O. Rahman and M.A. Hossain, 2017. Growth, condition, maturity and mortality of the Gangetic leaf fish *Nandus nandus* (Hamilton, 1822) in the Ganges River (Northwestern Bangladesh). *Jordan J. Biol. Sci.* 10(1): 57-62.
- Islam, M.A., M.Y. Hossain, M.A. Rahman, O. Rahman, M.S. Sarmin, D. Khatun, A. Nima, Z. Mawa, M.A. Rahman, S. Tanjin and M.F. Parvin, 2021. Some biological aspects of Asian stinging catfish, *Heteropneustes fossilis* (Bloch, 1794) (Teleostei: Siluriformes) in a wetland ecosystem. *Iran. J. Ichthyol.* 8(1): 52-61. <http://dx.doi.org/10.22034/ijj.v8i1.336>
- Joshi, K.K., 2010. Population dynamics of *Nemipterus japonicus* (Bloch) in the trawling grounds off Cochin. *Indian J. Fish.* 57(1): 7-12. <http://eprints.cmfri.org.in/id/eprint/2342>
- Karpouzi, V.S., and K.I. Stergiou, 2003. The relationships between mouth size and shape and body length for 18 species of marine fishes and their trophic implications. *J. Fish boil.* 62(6): 1353-1365. <https://doi.org/10.1046/j.1095-8649.2003.00118.x>
- Kerdgari, M., T. Valinassab, S. Jamili, M.R. Fatemi, and F. Kaymaram, 2009. Reproductive biology of the Japanese threadfin bream, *Nemipterus japonicus* in the Northern Persian Gulf. *J. Fish. Aquat. Sci.* 4(3): 143-149.
- Lee, C.K.C., 1975. The exploitation of *Nemipterus japonicus* (Bloch) by Hongkong vessels in 1972-73. p. 48-52. In: B. Morton (ed.) Symposium Papers of the Pacific Science Association Special Symposium on Marine Science, 7-16 December 1973, Hongkong, PSA, Hongkong.

- Manojkumar, P.P., 2007. Fishery of threadfin breams with some aspects on the biology and stock assessment of *Nemipterus mesoprion* (Bleeker, 1853) off Malabar coast. *Indian J. Fish.* 54(2): 149-154. <http://eprints.cmfri.org.in/id/eprint/5857>
- Mathews, C.P. and M. Samuel, 1991. Growth, mortality and length-weight parameters for some Kuwaiti fish and shrimp.
- Murty, V.S., T. Apparao, M. Srinath, E. Vivekanandan, K.V.S. Nair, S.K. Chakraborty, S.G. Raje and P.U. Zachariah, 1992. Stock assessment of threadfin breams (*Nemipterus* spp.) of India. *Indian J. Fish.* 39(1,2): 9-41. <http://eprints.cmfri.org.in/id/eprint/258>
- Mustafa, M.G., 1999. Population dynamics of penaeid shrimps and demersal finfishes from trawl fishery in the Bay of Bengal and implication for the management. PhD thesis, University of Dhaka, Bangladesh. 223 p.
- Nikolsky, G.V., 1963. The Ecology of Fishes. Academic Press London, London, 352 pp.
- Pauly, D. and S. Aung, 1984. Population dynamics of some fishes of Burma based on length-frequency data. Bur/77/003/. FAO Field Doc. No. 7.22 p. FAO, Rome.
- Psomadakis, P.N., H.B. Osmany and M. Moazzam, 2015. Field identification guide to the living marine resources of Pakistan. Food and Agriculture Organization of the United Nations, Marine Fisheries Department, Ministry of Ports & Shipping, Government of Pakistan, Rome, Italy.
- Raeisi, H., S.Y. Paighambari, R. Davoodi, M. Bibak, S.A. Hoseini and M.J. habni, 2012. Length-weights relationships and relative weights of some demersal fish species from the Persian Gulf, Iran. *Afr. J. Agric. Res.* 7(5): 741-746. <https://doi.org/10.5897/AJAR11.1315>
- Rahman, M.A., M.Y. Hossain, M.R. Hasan, Z. Mawa, S. Tanjin, B.K. Sarker and M.A. Islam, 2021. Length weight relationships and form factor of 8 marine fishes from the Bay of Bengal. *Thalassas* (In press).
- Rajesh, D.P., S. Benakappa, H.N. Anjanayappa, S.M. Shivaprakash and D.P. Prakash, 2011. Length-weight relationship and relative condition factor of *Nemipterus japonicus* (Bloch) from Mangalore waters. *Environ. Ecol.* 29(4A): 2169-2171.
- Russell, B.C., 1990. FAO Species Catalogue. Vol. 12. Nemipterid fishes of the world. (Threadfin breams, whiptail breams, monocle breams, dwarf monocle breams, and coral breams). Family Nemipteridae. An annotated and illustrated catalogue of nemipterid species known to date. FAO Fish. Synop. 125(12): 149p. Rome: FAO. <http://www.fao.org/docrep/009/t0416e/t0416e00.htm>
- Sabbir W., M.Y Hossain, Z. Mawa, M.R. Hasan, M.A. Rahman, M.A. Islam, S. Tanjin, M.A. Rahman, B.K. Sarker and M.N Khan, 2020. New maximum size record, length-weight relationships and form factor of Hooghly Croaker *Panna heterolepis* Trewavas, 1977 from the Bay of Bengal (Bangladesh). *Lakes & Reserv.* 25: 346-349. <https://doi.org/10.1111/lre.12333>
- Samuel, M., 1986. Spawning of *Nemipterus japonicus* (Bassi) in Kuwait's waters and growth differences by sex. *Annu. Res. Rep. Kuwait Inst. Sci. Res.* 5-17 pp.
- Sen, S., G.R. Dash, M.K. Koya, K.R. Sreenath, S.K. Mojjada, M.K. Fofandi, M.S. Zala and S. Kumari, 2014. Stock assessment of Japanese threadfin bream, *Nemipterus japonicus* (Bloch, 1791) from Veraval water. *Indian J. Geo-Mar. Sci.* 43(4): 519-527.

- Vivekanandan, E. and D.B. James, 1986. Population dynamics of *Nemipterus japonicus* (Bloch) in the trawling grounds off Madras. *Indian J. Fish.* 33(2): 145-154. <http://eprints.cmfri.org.in/id/eprint/378>
- Wang, X.-H., Y.S. Qiu, G.P. Zhu, F.Y. Du, D.R. Sun and S.L. Huang, 2011. Length-weight relationships of 69 fishes in the Beibu Gulf, northern South China sea. *J. Appl. Ichthyol.* 27: 959-961. <https://doi.org/10.1111/j.1439-0426.2010.01624.x>
- Xu, G., W. Zheng and G. Huang (eds.), 1994. Atlas of the fishes and their biology in Daya Bay. Anhui Scientific and Technical Publishers, P.R.O.C. 311 p.