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FREQUENCY DISTRIBUTION OF LENGTHS OF TWO TERAPONID FISHES (FAMILY TERAPONIDAE) FROM KARACHI COAST, PAKISTAN

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ABSTRACT

This study describes the frequency distribution of lengths of two Teraponid species i.e., *Terapon jarbua* and *T. puta* from Karachi coast, Pakistan. The results show the presence of all size classes of two Teraponid species (*T. jarbua* and *T. puta*) during different months of the research period (January 2013 to December 2014). It supports that environmental conditions near Karachi coast are suitable for these two Teraponid species in all stages of their life cycle.

Key-words: Frequency distribution of lengths, Teraponid species, stock assessment, fisheries, biology, Pakistan.

INTRODUCTION

Studies on frequency distributions of lengths of fishes are useful in several fisheries' assessment models (Haddon, 2001; Ranjan *et al.* 2005). Therefore, several scientists have been used frequency distribution of length of different fishes for their stock assessments and to study the population dynamics from various areas such as, Balik *et al.* (2006); Ghosh *et al.* (2009); Sawusdee (2010); Tomsic *et al.* (2010); Ghosh *et al.* (2013); Ghosh *et al.* (2014); Ortiz *et al.* (2014) and Sen *et al.* (2014). According to Steele and Lopez-Fernandez (2014) distribution of lengths of fishes has a significant association with their life history, ecology and distribution of species and it may be affected by diet, feeding and morphology of fishes. The presence of large sized fishes in an area shows that environmental conditions for adult fishes are more favorable which gives a better spawning ground for fishes while, absence of large sized fishes represents that habitat conditions are not favorable for healthy growth of adult fishes because of natural disorders or man-made disorders and these adults migrates to other suitable grounds (Ranjan *et al.*, 2005). Also the food and feeding is most significant parameter which affects the distribution of length of a fish because the availability of food and variations in available food cause a difference in accessibility of nutrients hence, produce a competition of food in an area which altogether effects on the length distribution of fishes (Mathialagan *et al.*, 2014). Salinity is the most important factor which effects the distribution (Cardona, 2006) because juvenile fishes mostly desired low salinity areas, therefore, small sized or juvenile fishes are abundant in estuaries or creek areas, where salinity level is relatively low (Akinrotimi *et al*., 2010). The absence of small-sized fishes in commercial landings may be attributed to the size selectivity by fishermen during commercial catches (Masood *et al.*, 2015).

MATERIALS AND METHODS

A total of 676 specimens of *Terapon jarbua* (325 male and 351 female) and 622 specimens of *T. puta* (213 male and 409 female) were collected from commercial landing site at Karachi fish harbour during January 2013 to December 2014. Frequency distributions of lengths were used to examine season patterns in the distribution and abundance of both sexes of Teraponid fishes near Karachi. Data was stacked in seven length classes. The following equation was used to calculate the length intervals of the length classes (Larson and Farber, 2000).

$$Length\ intervals = \frac{Maximum\ data\ value - Minimum\ data\ value}{Number\ of\ Classes}$$

RESULTS AND DISCUSSION

The result of frequency distributions of fish lengths in present investigation showed the variations in the distribution and abundance of individuals of both Teraponid species (*Terapon jarbua* and *T. puta*) in their different length classes. The results indicated the presence of all length classes in commercial catches of Karachi Fish Harbour all the year. During August to November, the individuals *T. jarbua* were observed higher in small-size classes (Table 1a,b). The presence of individuals of *T. puta* in small-size classes were observed during the months of February, May, September, and December (Table 2a,b) showing recruitment period for these species.

Table 1a. Frequency distribution of lengths (%) of *Terapon jarbua* during January 2013 to December 2013. All lengths are measured in millimeters (mm)

Size classes	Month	Combined sexes	Male	Female	Month	Combined sexes	Male	Female
151-175		16.67	25.00	0.00		0.00	0.00	0.00
176-200		27.78	25.00	33.33		0.00	0.00	0.00
201-225	Jan-13	27.78	16.67	50.00	Jul-13	0.00	0.00	0.00
226-250		16.67	25.00	0.00		29.41	83.33	0.00
251-275		11.11	8.33	16.67		17.65	16.67	18.18
276-300		0.00	0.00	0.00		52.94	0.00	81.82
301-325		0.00	0.00	0.00		0.00	0.00	0.00
151-175		0.00	0.00	0.00		27.27	0.00	50.00
176-200		15.38	20.00	12.50		63.64	100.00	33.33
201-225	Feb-13	23.08	20.00	25.00	Aug-13	9.09	0.00	16.67
226-250		50.00	50.00	50.00		0.00	0.00	0.00
251-275		11.54	10.00	12.50		0.00	0.00	0.00
276-300		0.00	0.00	0.00		0.00	0.00	0.00
301-325		0.00	0.00	0.00		0.00	0.00	0.00
151-175		0.00	0.00	0.00		0.00	0.00	0.00
176-200		0.00	0.00	0.00		54.17	53.85	54.55
201-225	Mar-13	36.84	44.44	30.00	Sep-13	45.83	46.15	45.45
226-250		39.47	44.44	35.00		0.00	0.00	0.00
251-275		10.53	11.11	10.00		0.00	0.00	0.00
276-300		13.16	0.00	25.00		0.00	0.00	0.00
301-325		0.00	0.00	0.00		0.00	0.00	0.00
151-175		0.00	0.00	0.00		4.76	0.00	12.50
176-200		4.55	11.11	0.00		28.57	23.08	37.50
201-225	Apr-13	45.45	22.22	61.54	Oct-13	61.90	76.92	37.50
226-250		27.27	55.56	7.69		4.76	0.00	12.50
251-275		22.73	11.11	30.77		0.00	0.00	0.00
276-300		0.00	0.00	0.00		0.00	0.00	0.00
301-325		0.00	0.00	0.00		0.00	0.00	0.00
151-175		0.00	0.00	0.00		7.14	15.38	0.00
176-200		0.00	0.00	0.00		17.86	0.00	33.33
201-225	May-13	36.84	44.44	30.00	Nov-13	42.86	46.15	40.00
226-250		42.11	44.44	40.00		32.14	38.46	26.67
251-275		5.26	11.11	0.00		0.00	0.00	0.00
276-300		15.79	0.00	30.00		0.00	0.00	0.00
301-325		0.00	0.00	0.00		0.00	0.00	0.00
151-175		0.00	0.00	0.00		0.00	0.00	0.00
176-200		13.33	20.00	10.00		9.09	20.00	0.00
201-225	Jun-13	13.33	0.00	20.00	Dec-13	81.82	60.00	100.00
226-250		26.67	20.00	30.00		9.09	20.00	0.00
251-275		46.67	60.00	40.00		0.00	0.00	0.00
276-300		0.00	0.00	0.00		0.00	0.00	0.00
301-325		0.00	0.00	0.00		0.00	0.00	0.00

Table 1b. Frequency distribution of lengths (%) of *Terapon jarbua* during January 2014 to December 2014. All lengths are measured in millimeters (mm)

Size classes	Month	Combined sexes	Male	Female	Month	Combined sexes	Male	Female
151-175		9.09	12.00	5.26		0.00	0.00	0.00
176-200		31.82	40.00	21.05		0.00	0.00	0.00
201-225		36.36	28.00	47.37		0.00	0.00	0.00
226-250	Jan-14	15.91	16.00	15.79	Jul-14	31.58	66.67	0.00
251-275		4.55	4.00	5.26		26.32	33.33	20.00
276-300		2.27	0.00	5.26		42.11	0.00	80.00
301-325		0.00	0.00	0.00		0.00	0.00	0.00
151-175		0.00	0.00	0.00		13.43	12.12	14.71
176-200		6.90	16.67	0.00		62.69	63.64	61.76
201-225		20.69	16.67	23.53		23.88	24.24	23.53
226-250	Feb-14	58.62	58.33	58.82	Aug-14	0.00	0.00	0.00
251-275		10.34	8.33	11.76		0.00	0.00	0.00
276-300		3.45	0.00	5.88		0.00	0.00	0.00
301-325		0.00	0.00	0.00		0.00	0.00	0.00
151-175		0.00	0.00	0.00		21.43	34.62	0.00
176-200		0.00	0.00	0.00		57.14	50.00	68.75
201-225		45.16	42.86	47.06		21.43	15.38	31.25
226-250	Mar-14	25.81	57.14	0.00	Sep-14	0.00	0.00	0.00
251-275		9.68	0.00	17.65		0.00	0.00	0.00
276-300		19.35	0.00	35.29		0.00	0.00	0.00
301-325		0.00	0.00	0.00		0.00	0.00	0.00
151-175		0.00	0.00	0.00		21.88	7.14	33.33
176-200		13.51	11.11	15.79		9.38	14.29	5.56
201-225		24.32	22.22	26.32		53.13	78.57	33.33
226-250	Apr-14	40.54	55.56	26.32	Oct-14	12.50	0.00	22.22
251-275		21.62	11.11	31.58		0.00	0.00	0.00
276-300		0.00	0.00	0.00		0.00	0.00	0.00
301-325		0.00	0.00	0.00		3.13	0.00	5.56
151-175		0.00	0.00	0.00		11.29	24.14	0.00
176-200		0.00	0.00	0.00		9.68	0.00	18.18
201-225		14.29	28.57	7.14		29.03	27.59	30.30
226-250	May-14	9.52	14.29	7.14	Nov-14	50.00	48.28	51.52
251-275		66.67	57.14	71.43		0.00	0.00	0.00
276-300		9.52	0.00	14.29		0.00	0.00	0.00
301-325		0.00	0.00	0.00		0.00	0.00	0.00
151-175		0.00	0.00	0.00		0.00	0.00	0.00
176-200		11.76	0.00	22.22		20.00	41.67	0.00
201-225		23.53	25.00	22.22		64.00	41.67	84.62
226-250	Jun-14	5.88	12.50	0.00	Dec-14	8.00	16.67	0.00
251-275		41.18	25.00	55.56		8.00	0.00	15.38
276-300		17.65	37.50	0.00		0.00	0.00	0.00
301-325		0.00	0.00	0.00		0.00	0.00	0.00

Table 2a. Frequency distribution of lengths (%) of *Terapon puta* during January 2013 to December 2013. All lengths are measured in millimeters (mm)

Size classes	Month	Combined sexes	Male	Female	Month	Combined sexes	Male	Female
100-109		0.00	0.00	0.00		0.00	0.00	0.00
110-119		15.00	15.38	14.29		63.64	50.00	66.67
120-129	Jan-13	85.00	84.62	85.71	Jul-13	18.18	50.00	11.11
130-139		0.00	0.00	0.00		18.18	0.00	22.22
140-149		0.00	0.00	0.00		0.00	0.00	0.00
150-159		0.00	0.00	0.00		0.00	0.00	0.00
160-169		0.00	0.00	0.00		0.00	0.00	0.00
100-109		3.23	0.00	4.76		0.00	0.00	0.00
110-119		0.00	0.00	0.00		0.00	0.00	0.00
120-129	Feb-13	6.45	0.00	9.52	Aug-13	0.00	0.00	0.00
130-139		61.29	100.00	42.86		100.00	100.00	100.00
140-149		22.58	0.00	33.33		0.00	0.00	0.00
150-159		6.45	0.00	9.52		0.00	0.00	0.00
160-169		0.00	0.00	0.00		0.00	0.00	0.00
100-109		0.00	0.00	0.00		20.00	0.00	29.41
110-119		5.13	6.25	4.35		56.00	75.00	47.06
120-129	Mar-13	46.15	68.75	30.43	Sep-13	24.00	25.00	23.53
130-139		25.64	6.25	39.13		0.00	0.00	0.00
140-149		20.51	18.75	21.74		0.00	0.00	0.00
150-159		2.56	0.00	4.35		0.00	0.00	0.00
160-169		0.00	0.00	0.00		0.00	0.00	0.00
100-109		0.00	0.00	0.00		0.00	0.00	0.00
110-119		20.69	83.33	4.35		0.00	0.00	0.00
120-129	Apr-13	41.38	16.67	47.83	Oct-13	19.05	50.00	11.76
130-139		27.59	0.00	34.78		4.76	25.00	0.00
140-149		10.34	0.00	13.04		28.57	0.00	35.29
150-159		0.00	0.00	0.00		38.10	25.00	41.18
160-169		0.00	0.00	0.00		9.52	0.00	11.76
100-109		25.00	50.00	0.00		0.00	0.00	0.00
110-119		31.25	0.00	62.50		54.55	100.00	46.43
120-129	May-13	31.25	50.00	12.50	Nov-13	36.36	0.00	42.86
130-139		12.50	0.00	25.00		9.09	0.00	10.71
140-149		0.00	0.00	0.00		0.00	0.00	0.00
150-159		0.00	0.00	0.00		0.00	0.00	0.00
160-169		0.00	0.00	0.00		0.00	0.00	0.00
100-109		0.00	0.00	0.00		11.11	10.00	11.76
110-119		12.50	0.00	50.00		40.74	30.00	47.06
120-129	Jun-13	87.50	100.00	50.00	Dec-13	40.74	40.00	41.18
130-139		0.00	0.00	0.00		7.41	20.00	0.00
140-149		0.00	0.00	0.00		0.00	0.00	0.00
150-159		0.00	0.00	0.00		0.00	0.00	0.00
160-169		0.00	0.00	0.00		0.00	0.00	0.00

Table 2b. Frequency distribution of lengths (%) of *Terapon puta* during January 2014 to December 2014. All lengths are measured in millimeters (mm)

Size classes	Month	Combined sexes	Male	Female	Month	Combined sexes	Male	Female
100-109		0.00	0.00	0.00		0.00	0.00	0.00
110-119		22.22	18.18	28.57		56.25	50.00	58.33
120-129	Jan-14	77.78	81.82	71.43	Jul-14	25.00	25.00	25.00
130-139		0.00	0.00	0.00		18.75	25.00	16.67
140-149		0.00	0.00	0.00		0.00	0.00	0.00
150-159		0.00	0.00	0.00		0.00	0.00	0.00
160-169		0.00	0.00	0.00		0.00	0.00	0.00
100-109		0.00	0.00	0.00		0.00	0.00	0.00
110-119		0.00	0.00	0.00		0.00	0.00	0.00
120-129	Feb-14	13.33	23.53	7.14	Aug-14	0.00	0.00	0.00
130-139		53.33	41.18	60.71		100.00	100.00	100.00
140-149		26.67	35.29	21.43		0.00	0.00	0.00
150-159		6.67	0.00	10.71		0.00	0.00	0.00
160-169		0.00	0.00	0.00		0.00	0.00	0.00
100-109		0.00	0.00	0.00		21.05	0.00	33.33
110-119		3.39	10.53	0.00		57.89	85.71	41.67
120-129	Mar-14	40.68	63.16	30.00	Sep-14	21.05	14.29	25.00
130-139		44.07	21.05	55.00		0.00	0.00	0.00
140-149		10.17	5.26	12.50		0.00	0.00	0.00
150-159		1.69	0.00	2.50		0.00	0.00	0.00
160-169		0.00	0.00	0.00		0.00	0.00	0.00
100-109		0.00	0.00	0.00		0.00	0.00	0.00
110-119		0.00	0.00	0.00		0.00	50.00	0.00
120-129	Apr-14	58.06	100.00	51.85	Oct-14	14.29	16.67	4.55
130-139		32.26	0.00	37.04		3.57	0.00	0.00
140-149		9.68	0.00	11.11		35.71	33.33	45.45
150-159		0.00	0.00	0.00		42.86	0.00	45.45
160-169		0.00	0.00	0.00		3.57	0.00	4.55
100-109		21.74	50.00	0.00		0.00	0.00	0.00
110-119		34.78	0.00	61.54		55.10	100.00	35.29
120-129	May-14	34.78	50.00	23.08	Nov-14	36.73	0.00	52.94
130-139		8.70	0.00	15.38		8.16	0.00	11.76
140-149		0.00	0.00	0.00		0.00	0.00	0.00
150-159		0.00	0.00	0.00		0.00	0.00	0.00
160-169		0.00	0.00	0.00		0.00	0.00	0.00
100-109		0.00	0.00	0.00		4.00	0.00	9.09
110-119		10.00	0.00	12.50		36.00	21.43	54.55
120-129	Jun-14	90.00	100.00	87.50	Dec-14	52.00	64.29	36.36
130-139		0.00	0.00	0.00		8.00	14.29	0.00
140-149		0.00	0.00	0.00		0.00	0.00	0.00
150-159		0.00	0.00	0.00		0.00	0.00	0.00
160-169		0.00	0.00	0.00		0.00	0.00	0.00

The studies on length distribution give an insight into life-history and the recruitment season of fish. The environmental conditions of Pakistani waters have been shown to be of good quality for Teraponid species (Masood *et al.,* 2015). This is supported by the results of the present study where the presence of specimens in all size classes indicates that all life-history stages were found in the area. Frequency distribution of lengths is a significant association of life history, ecology, and distribution of species and it may be affected by diet, feeding habits and morphology of fishes (Steele and Lopez-Fernandez, 2014). The presence of large-sized fishes in the studied samples shows the suitability of environmental conditions in favor of adult fishes and gives a better spawning ground for Teraponid fishes (Ranjan *et al.,* 2005). The food and feeding habits are the most significant parameter which affects the distribution of length of a fish. The availability of food and variations in the available food cause a difference in the accessibility of nutrients, hence, produce competition of food in an area which altogether effects on the length distribution of fishes (Mathialagan *et al.,* 2014). Juvenile fish mostly desired low salinity areas, therefore, small-sized or juvenile fishes are abundant in estuaries or creek areas, where salinity level is relatively low. Therefore, salinity could be considered as a major factor affecting the length distribution of fishes (Cardona, 2006; Akinrotimi *et al*., 2010). The abundance of adult fishes in high salinity, the abundance of medium-sized fishes in brackish waters, and the abundance of juveniles in low salinity areas have been studied by Karna *et al*. (2011) supporting the effect of salinity on length-frequency distribution of Teraponid species.

Froese and Pauly (2015) have reported a size range of 9.6-26.8cm for *Terapon jarbua* and 10.2-11.2cm for *T. puta* from different areas of the world. Harrison (2001) reported standard length range of *T. jarbua* as 10-148mm from South Africa. Kulbicki *et al.* (2005) from New Caledonian lagoon have been examined size range of *T. jarbua* from 2-28.5cm. Karna and Panda (2012) investigated fork length ranging between 59-123mm for *T. jarbua* and 93-122mm for *T. puta.* Nyanti *et al.* (2012) have reported the total length of *T. jarbua* as 14.90cm from station 1, 12.30cm from station 2, 8.25cm from station 3 and 9.20cm from station 4 of Lutong River, Malaysia. Isa *et al.* (2012) have observed the length-frequency distribution of *T. jarbua* as 5.7-11.4cm from Kedah. Lavergne *et al.* (2013) from Wider Gulf of Aden have been studied the length distribution for *T. jarbua* as 4.7-27.99cm in standard length. Manoharan *et al*. (2013) from India had recorded the size range of *T. jarbua* as 12.5-37.5cm for males and 12.1cm-36.9cm for females. These differences in length distribution may be spatial or temporal or may be due to the habitat condition, stock size, health, and characteristics of other populations, which may also vary in different habitats and seasons (Ranjan *et al.*, 2005).

During the study period, the presences of combined, male, and female sexes of both Teraponid species (*T. jarbua* and *T. puta*) in all length classes signify the occurrence of immature to fully-grown specimens. That is an indication of good environmental conditions for the comfortable living of Teraponid species in Pakistani waters (Masood *et al.,* 2015). Siyal and Amir (2012) observed the length-frequency distribution of *Pampus argenteus* from Pakistan. They found that the fishes were dominant in midsize classes while few in lowest and highest size classes. Mathialagan *et al.* (2014) observed the same results of length-frequency distribution for male, female, and combined sexes of *Cirrhinus reba* from India. Patimar (2008) observed the dominance of males of *Liza saliens* in small size groups while, females were numerous in large size groups. Lawson and Olagundoye (2011) have observed length distribution of specimens of *Polydactylus quadrifilis* from Ologe lagoon. They reported the abundance of sub-adults (181-280mm) in the samples. Based on length-frequency distribution, Jadhav and Rathod (2014) have been examined first recruitment in the stock of *Lepturacanthus savala* during April and second recruitment during July and August from India. Ezenwaji and Ezenwaji (2009) have been observed only one peak in length-frequency distribution of *Citharinus citharus* and *Alestes baremoze* from Nigeria. While, Valdez-Pineda *et al.* (2014) have been examined the distribution in *Sphoeroides annulatus* from Mexico and found that majority of fishes were fall in midsize range. Furthermore, Ghosh *et al.* (2014) have reported the exploitation of juvenile *Trichiurus lepturus* from northern Arabian Sea and northern Bay of Bengal based on their size frequency distribution.

CONCLUSION

The results of frequency distributions of lengths indicated the presence of specimens in all length classes. It may be concluded that all life-history stages were found in the area the environment near Karachi coast is suitable for the two Teraponid species (*Terapon jarbua* and *T. puta*).

REFERENCES

Akinrotimi, O.A., O.M.G. Abu, D.O. Bekibele and B. Udeme-Naa (2010). Occurrence and distribution of grey mullets *Liza falacippinis* and *Liza grandisquamis* from Buguma Creek, Niger Delta, Nigeria. *Research Journal of Biological Science,* 2 (1): 1-5.

Balik, I., H. Cubuk, R. Ozkok and R. Uysal (2006). Some characteristics and size of carp (*Cyprinus carpio* L., 1758) population in the lake Karamık (Afyonkarahisar/Turkey). *Turkish Journal of Fisheries and Aquatic Sciences,* 6: 117-122.

Cardona, L. (2006). Habitat selection by grey mullets (Osteichthyes: Mugilidae) in Mediterranean estuaries: the role of salinity. *Scientia Marina,* 70: 443-455.

Ezenwaji, N.E. and H.M.G. Ezenwaji (2009). Length-weight relationships and condition factor of *Citharinus citharus* and *Alestes baremoze* from Anambra River Basin, Nigeria. *Animal Research International,* 6 (3): 1107-1109.

Froese, R. and D. Pauly (2015). *FishBase*. World Wide Web electronic publication. www.fishbase.org, version (04/2015).

Ghosh, S., G. Mohanraj, P.K. Asokan, H.K. Dhokia, M.S. Zala and H.M. Bhint (2009). Fishery and stock estimates of the silver pomfret, *Pampus argenteus* (Euphrasen), landed by gill netters at Veraval. *Indian Journal of Fisheries,* 56 (3): 177-182.

Ghosh, S., M.V.H. Rao, P. Rohit, K. Rammohan and G. Maheshwarudu (2014). Reproductive biology, trophodynamics and stock structure of ribbonfish *Trichiurus lepturus* from northern Arabian Sea and northern Bay of Bengal. *Indian Journal of Geo-Marine Sciences,* 43 (5): 755-771.

Ghosh, S., M.V.H. Rao, S. Sumithrudu, P. Rohit and G. Maheswarudu (2013). Reproductive biology and population characteristics of *Sardinella gibbosa* and *Sardinella fimbriata* from North West Bay of Bengal. *Indian Journal of Geo-Marine Sciences,* 42 (6): 758-769.

Haddon, M. (2001). Modelling and quantitative methods in fisheries. Edt Chapman & Hall/CRC.

Harrison, T.D. (2001). Length-weight relationships of fishes from South African estuaries,

Isa, M.M., M.N.A. Basri, M-Z.M. Zawawi, K. Yahya, S-A.M. Nor (2012). Length-weight relationships of some important estuarine fish species from Merbok Estuary, Kedah. *Journal of Natural Sciences Research,* 2 (2): 8-17.

Jadhav, S.R.K. and J.L. Rathod (2014). Length frequency, length-weight and relative condition factor of ribbonfish, *Lepturacanthus savala* (Cuvier, 1829) from Karwar Waters, Karnataka State. *IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT),* 8 (5 Ver. I): 25-31.

Karna, S.K. and S. Panda (2012). Length-weight relationship (LWR) of 20 fish species in Chilika Lagoon, Odisha (India). *Asian Journal of Experimental Biological Sciences,* 3 (1): 243-246.

Karna, S.K., S. Panda and B.C. Guru (2011). Length-weight relationship (Lwr) and seasonal distribution of *Valamugil Speigleri* (Valancienues) through size frequency variation and landing assessment in Chilika Lagoon, India. *Asian Journal of Experimental Biological Sciences,* 2 (4): 654-662.

Kulbicki, M., N. Guillemot and M. Amand (2005). A general approach to length-weight relationships for New Caledonian lagoon fishes. *Cybium,* 29 (3): 235-252.

Larson, R. and B. Farber (2000). *Elementary statistics: Picturing the world*. Prentice Hall. 4th edition. 663pp.

Lavergne, E., U. Zajonz and L. Sellin (2013). Length-weight relationship and seasonal effects of the summer monsoon on condition factor of *Terapon jarbua* (Forsskål, 1775) from the wider Gulf of Aden including Socotra Island. *Journal of Applied Ichthyology,* 29: 274-277.

Lawson, E.O. and A.U. Olagundoye (2011). Growth Patterns, diet composition and sex ratios in giant African threadfin, *Polydactylus quadrifilis* from Ologe Lagoon, Lagos, Nigeria. *International Journal of Agriculture & Biology,* 13 (4): 559-564.

Manoharan, J., A. Gopalakrishnan, D. Varadharajan, C. Udayakumar and S. Priyadharsini (2013). Length-weight relationship of crescent perch *Terapon Jarbua* (Forsskal) from Parangipettai Coast, South East Coast of India. *Journal of Aquaculture Research & Development,* 4 (3): 1-3.

Masood, Z., R. Yasmeen, Mussaratul-Ain, Hameed-Ur-Rehman, A. Ullah, Naveed-Ullah, S. Navid, S. Zaman, Sidra-Tul-Muntaha and L. Manzoor (2015). Size frequency distribution patterns of the four mugilid species of the family Mugilidae (order Mugiliformes) collected from the Karachi Fish Harbour, Pakistan. *Biological Forum–An International Journal,* **7** (1): 459-469.

Mathialagan, R., R. Sivakumar, N. Rajasekaran and S. Chandrasekar (2014). Length-frequency distribution and length-weight relationship of reba carp *Cirrhinus reba* (Hamilton, 1822 Cypriniformes: Cyprinidae) from Lower Anicut, Tamil Nadu, India. *International Journal of Fisheries and Aquatic Studies,* 2 (2): 115-125.

Nyanti, L., T.Y. Ling and G. Jongkar (2012). Fish and crustacean communities and fish length-weight relationship of Lutong River, Miri, Sarawak, Malaysia. *World Journal of Fish and Marine Sciences,* 4 (1): 102-110.

Ortiz, M., A.J. Rubio and J.L. Gallego (2014). Review and preliminary analyses of farm harvested size frequency samples of eastern bluefin tuna (*Thunnus thynnus*). *Collective Volume of Scientific Papers ICCAT,* 70 (2): 338-356.

Patimar, R. (2008). Some biological aspects of the sharpnose mullet *Liza saliens* (Risso, 1810) in Gorgan Bay-Miankaleh wildlife refuge (the Southeast Caspian Sea). *Turkish Journal of Fisheries and Aquatic Sciences,* 8: 225-232.

Ranjan, J.B., W. Herwig, S. Subodh and S. Michael (2005). Study of the length frequency distribution of sucker head, *Garra gotyla gotyla* (Gray, 1830) in different rivers and seasons in Nepal and its applications. *Kathmandu University Journal of Science, Engineering and Technology,* I (1): 1-14.

Sawusdee, A. (2010). Population dynamics of the spotted scat *Scatophagus argus* (Linnaeus, 1766) in Pak Panang Bay, Nakhon Si Thammarat, Thailand. *Walailak Journal of Science & Technology,* 7 (1): 23-31.

Sen, S., G.R. Dash, K.K. Mohammad, K.R. Sreenath, S.K. Mojjada, M.K. Fofandi, M.S. Zala, and S. Kumari (2014). Stock assessment of Japanese thread fin bream, *Nemipterus japonicas* (Bloch, 1791) from veraval water. *Indian Journal of Geo-Marine Sciences,* 43 (4): 519-527.

Siyal, F.K. and S.A. Amir (2012). Length-weight Relationship and Relative Condition Factor (Kn) of Silver Pomfret, *Pampus argenteus* in Pakistani Waters. *Journal of the Fisheries Society of Taiwan,* 39 (2): 83-90.

Steele, S.E. and H. Lopez-Fernandez (2014). Body size diversity and frequency distributions of Neotropical cichlid fishes (Cichliformes: Cichlidae: Cichlinae). *PLoS ONE,* 9 (9): 1-11.

Tomsic, S., A. Conides, I. Dupcic-Radic and B. Glamuzina (2010). Growth, size class frequency and reproduction of purple sea urchin, *Paracentrotus lividus* (Lamarck, 1816) in Bistrina Bay (Adriatic Sea, Croatia). *Acta Adriatica,* 51 (1): 67-77.

Valdez-Pineda, M.C., R.E. Moran-Angulo, D. Voltolina and S. Castillo-Vargasmachuca, (2014). Population structure and reproductive aspects of puffer fish *Sphoeroides annulatus* (Jenyns, 1842) (Osteichthyes: Tetraodontidae), landed in Teacapan, Sinaloa, Mexico. *Latin American Journal of Aquatic Research,* 42 (1): 121-126.

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