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Short communication:

Length-frequency distribution, length-weight relationship and condition factor of two grey mullets from Lagos Lagoon, Nigeria

Olufemi Olukolajo Soyinka[1*], Mutiu Oyekunle Sifau[2], Olugbenga Olanrewaju Olude[1] and Osawe Ashanabhode[1]

[1]*Department of Marine Sciences, University of Lagos, Akoka, Lagos, Nigeria*
[2]*Department of Cell Biology and Genetics, University of Lagos, Akoka, Lagos, Nigeria*

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ABSTRACT

There is a growing interest in examining of economically important fish species with excellent mariculture potentials in lagoons of coastal states. Members of the family Mugilidae, which are permanent residents in Lagos Lagoon form a mainstay of fish protein source and are potential candidates for such investigations. Length-frequency distribution, length-weight relationship, condition factor and molecular characteristics of two grey mullets, *Mugil cephalus* and *Liza falcipinnis* were investigated in Lagos Lagoon. A total of 52 samples (26 specimens of each species) of the fish were collected from the Lagos Lagoon. The standard length ranged from 10.0 – 19.2 cm and 12.0 – 18.2 cm for *M. cephalus* and *L. falcipinnis* respectively, with corresponding weights of 13.90 – 105.00 g and 36.00-129.00 g respectively. It is concluded that the growth pattern of the species showed negative allometric, b = 0.32 and 0.65 respectively. The condition factors were 1.81 and 2.16 respectively and this means both species were in good condition.

Introduction

Mugilidae are ray-finned fish, also known as mullets or grey mullets. They live in both tropical and temperate coastal and brackish waters around the world (Yulianto *et al*., 2020a; 2020b). The Mugilidae family, which consists of 26 genera, it has a total of 72 described species (Nelson, 2006; Eschmeyer and Fricke, 2011; Fishbase.org), the majority of which are classified in the genera *Mugil* and *Liza* (Batubara *et al*., 2021). These species are common in the landings of fisher folks who fish in the Lagos Lagoon, Nigeria. The local coastal communities refer to the two genera with the same local name, "Atoko". However, there are phenotypic differences of biological concerns between the two genera. While *M. cephalus* has adipose tissue around the eyes and extending to the operculum, the tissue remains around the eye region alone in *L. falcipinnis*. This is an important feature for distinguishing the species during field investigation.

From the works on the culture trial of *M. cephalus* (Soyinka, 2010; Soyinka and Lawal-Are, 2013), the species showed good aquaculture potential that be employed in the brackish water culture in the lagoons of south-west Nigeria. Efforts at adding to knowledge on the biology of this species and other mullet species populations in the same environment is ideal. The information of the bioecology of fish especially length-weight relations and condition factor are crucial for fisheries management (Muchlisin *et al*., 2015; Batubara *et al*., 2019; Bulanin *et al*., 2017, Machrizal *et al*, 2019). Presently, study on the length-weight relationships of the *M. cephalus* has been reported by Yulianto *et al*. (2020a) from Aceh waters, Indonesia. However, to date, no information of the biology data especially length-weight

* Corresponding author.
Email address: osoyinka@unilag.edu.ng

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relationships and condition factor of *M. cephalus* and *L. falcipinnis* from Lagos Lagoon, Nigeria.

Therefore, the objective of the current study was to have a comparative study of aspects of the biology (age, growth pattern and condition factors) of two grey mullets, *Mugil cephalus* and *Liza falcipinnis* from Lagos Lagoon.

Materials and Methods

Description of the research area

The Lagos Lagoon (Figure 1) is located between latitudes 60° 15' and 60° 40' E and longitudes 30° 20' and 30° 40' E. With an area of 208 km^2, it is the largest of the West African sub-lagoon region's systems. It is the largest of South-western Nigeria's nine coastal lagoons (the others are Yewa, Badagry, Iyagbe, Ologe, Kuramo, Epe, Lekki, and Mahin Lagoons). The lagoon has supported small-scale fisheries for decades, and indications of significant drop have begun to emerge. The salinity of the lagoon varies seasonally, with high brackish water situations present during the dry season (December – May) and freshwater situations present during the rainy season (June – November) (Ugwumba, 1984). It receives freshwater from Lekki Lagoon via Epe Lagoon in the northeast and discharges to the north-west via Majidun, Agboyi, and Ogudu creeks, as well as the Ogun River. The Lagos Lagoon, Nigeria's largest estuary, is estimated to be more than 50 km long and 13 km wide. It is separated from the Atlantic Ocean by 2 – 5 km wide sand spit with swampy margins on the Lagoon side (Okusipe, 2004).

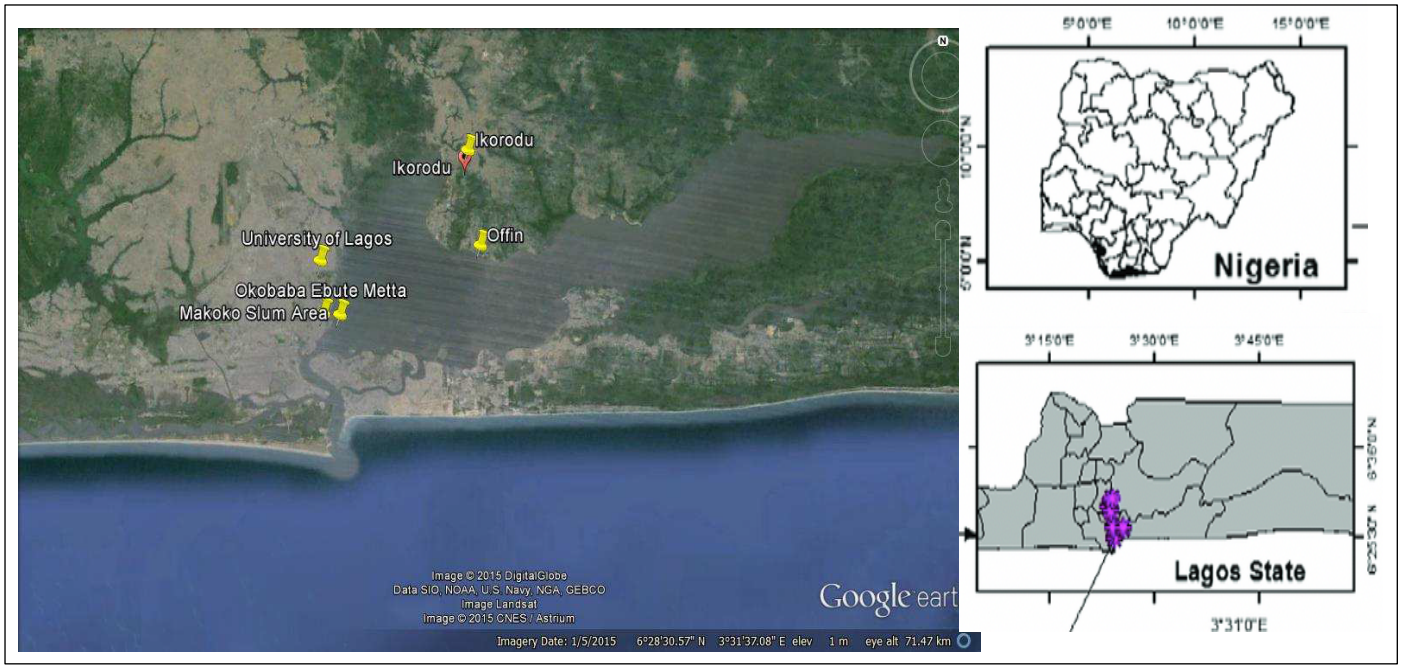

Figure 1. Map illustrating the Lagos Lagoon showed sampling locations (in yellow pins)
Source: Soyinka and Ojo (2015)

Field studies

Collection of fish specimen

A total of 52 specimens (26 each) of *M. cephalus* and *L. falcipinnis* used for this study were obtained from the Lagos Lagoon system. *M. cephalus* were identified with their flathead and transparent soft adipose tissue around the eye area and which extended to the operculum, while *L. falcipinnis* specimens had the adipose tissue only around the eye area. The specimens were procured alive from the catches of local fishermen as fishes were removed from the local fish pen or aggregating device known as "Acadja". The blood of each specimen used was extracted using a syringe and needle from the gill vessels under the right operculum; the blood samples were kept in an EDTA bottle. The blood samples and specimens were placed in ice chest containing ice flakes on the field. The fish samples were later placed in deep freezer (temperature –20°C) in the Marine Research Laboratory, University of Lagos, while the blood samples were preserved in a refrigerator for 24 hours and light was stable throughout prior to further analysis.

Laboratory procedures

Fish samples were removed from the deep freezer and thawed in the open air in the laboratory and the body wiped dry before analysis.

Length and weight measurement

Morphometric measurements recorded for each fish were standard length (SL) head length and total body length (TL) to the nearest 0.1cm and total weight to the nearest 0.01g using weighing balance (MODEL-CS 2000).

Age and growth pattern analysis

Length-frequency distribution: The percentage frequency was plotted against the size range of the standard length.

Length–weight relationship (LWR): This is used to determine the growth of the fish using the standard length (cm) and the total body weight (g) measurement. The linear regression equation expressing the relationship between the length and weight parameters is represented as follows:

$$W=aL^b$$

Where W= weight in grams (g), L= length (cm), a= regression constant, b= regression coefficient

According to Froese (2006), the value of b is between 2 and 4. When there is an equal proportion of growth in length and weight b is usually 3 which means that the fish is growing symmetrically and this is isometric growth. Values other than 3 are allometric growth, if b is less than 3 it shows that the fish has a negative allometric growth pattern means the length is growing faster than the weight and the fish looks slim, but if it were greater than 3 it is shown a positive allometric growth pattern meaning that body weight grows faster than the length the fish looks plump (Muchlisin *et al.*, 2015).

Condition factor (k)

This was calculated using the Fulton's equation for the fish:

$$K = \frac{100W}{L^b} \quad OR \quad \frac{100W}{L^3}$$

Where K = condition factor, L = standard length (cm), W = weight (g), b = regression coefficient (Le Cren, 1951). This factor was used to reflect the state of well-being of the fish (Muchlisin *et al.*, 2010).

Results

Age and growth pattern

Length frequency distribution: The standard length examined ranged from 10.0 – 19.2 cm and 12.0 – 18.2 cm for *M. cephalus* and *L. falcipinnis* respectively as illustrated in Figures 2a and Figure 2b. The graphs reflected two age groups in each species sampled population.

Length-weight relationship: The standard length ranged from 10.0 – 19.2 cm and 12.0 – 18.2 cm for *M. cephalus* and *L. falcipinnis* respectively, with corresponding weights of 13.90 – 105.00 g and 36.00-129.00 g respectively. The Log length - Log weight relationship reflected a linear equation, as indicated below, and the graphs are presented in Figures 3a and Figure 3b.

$$\text{Log } W = 0.6206 + 0.3183 \text{ Log SL}$$
$$(n = 26, r^2 = 0.9679) \quad \ldots\ldots. (M.\ cephalus)$$

$$\text{Log } W = 0.3556 + 0.6515 \text{ Log SL}$$
$$(n = 26, r^2 = 0.5705) \quad \ldots\ldots.. (L.\ falcipinnis)$$

Condition factor

The k-values obtained are shown in Table 1. The condition factors in both species were above 1.0 and this implied that the fish were in good condition.

Table 1. Condition factor of *M. cephalus* and *L. falcipinnis* from Lagos Lagoon

Species	Average length (cm)	Average weight (g)	Condition factor (k)
M. cephalus	14.68	57.26	1.81
L. falcipinnis	14.87	70.88	2.16

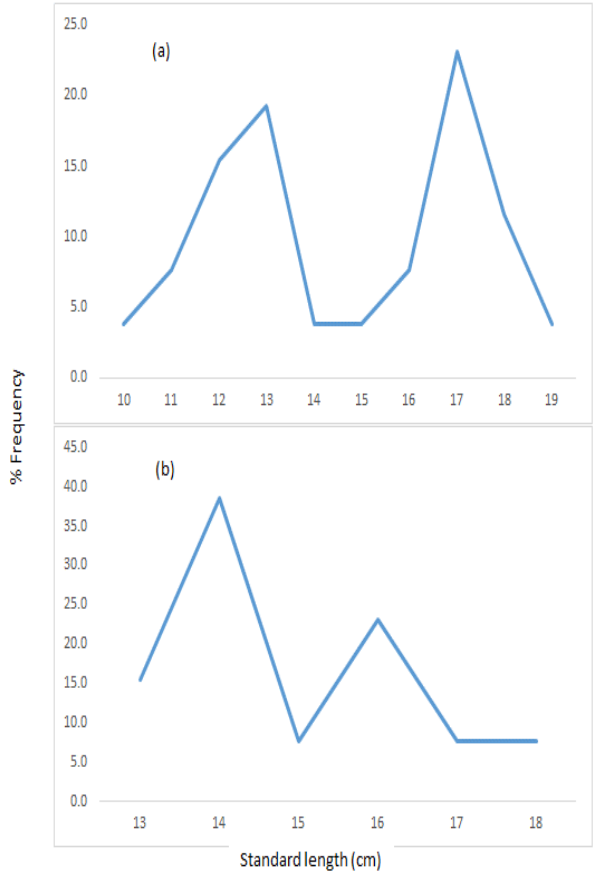

Figure 2. (a) Length-frequency distribution of *M. cephalus* (b) *L. falcipinnis* from Lagos Lagoon

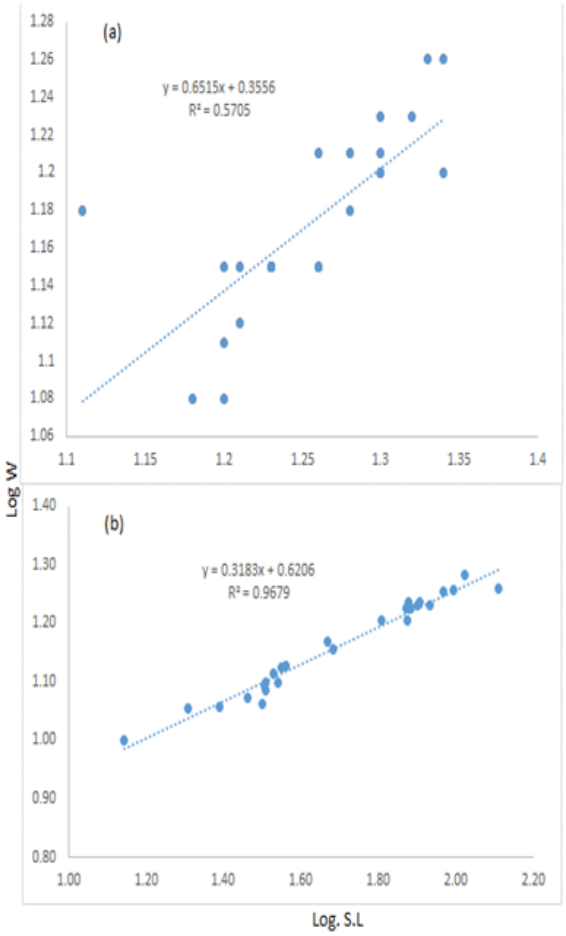

Figure 3. (a) Log Length and Log-Weight relationship of *L. falcipinnis* (b) *M. cephalus* from Lagos Lagoon

Discussion

The previous studies reported many morphological and allozyme studies including that of noted an absence in taxonomic variation among species based on their morphometric and meristic characters (Al-Hassan, 1985; Fakunmoju *et al.,* 2014). Morphometric characters in the present study were similar to (a) past studies in terms of taxonomic classification of mullets from the Lagos Lagoon. Morphometric characters are phylogenetically informative to distinguish between species of fish (Antovic and Simonovic, 2006). Besides, Batubara *et al.* (2021) have been employed the osteological characters to distinguish mullets from Aceh waters.

From the regression equation obtained in the present study it is obvious that the value of "b" is less than 3, showing the negative allometric pattern of growth. Tesch (1968) pointed out that the exponent (b) in the length-weight relationship is usually called isometric if it is 3; but could be greater or less than 3, and referred to as positive or negative allometric growth pattern. Soyinka (2010) however reported a positive allometric growth in *M. cephalus* from the Lagos Lagoon. It has been established that the *b* value can change for the same species due to changes in fullness of stomach, maturity, spawning and other physiological changes over seasons or even days (Jisr *et al.,* 2018; Muchlisin *et al.*, 2010). A *b* value of 0.823 was reported by Jisr *et al.* (2018) for *Diplodus sargus* in the Mediterranean Sea, and this corroborated the value obtained in the present study. However, the value of the LWR is not strongly correlated in *L. falcipinnis* unlike in *M. cephalus* with strong correlation.

The K-factor was used to assess the health of individual or group of fish. Fishes with condition factor value above 0.56 is considered to be in good condition (Ujjania *et al.,* 2012), although in most cases, a K-factor above 1 are regarded as being in good condition, while those less than 1 are taken as being in bad condition. In this study the condition factor (K) using the average standard length and body weight, ranging from 1.81 and 2.16, and thus the species were in good condition. In the works of Lizama and Ambrosio (2002), and Anene (2005), they observed that higher condition factor was recorded for lower lengths of fish which were also observed in this study. According to Gupta *et al.* (2011), the difference in condition factor could be due to the availability of food organisms at a particular time, state of maturity and age of fish, in some species sex of the fish (Ndome and Muabe, 2009), as well as the difference of gonad development (Muchlisin *et al.*, 2010). The present data could not clarify which factors among those described could have led to these observations. Soyinka (2010) reported a condition factor range of 1.39 – 2.30 for grey mullet, *M. cephalus* which is similar to that in this present study, from the same lagoon.

The differences in LWR and K-factor of all species in this study could be due to the factors listed earlier or a combination of factors which require further investigation.

Conclusions

Mullet species in Lagos Lagoon are part of the major fisheries resources in the coastal communities, occurring all year round in the lagoon. Different cohorts exist in the lagoon as noticed in number of age groups from size distribution studies.

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References

Al-Hassan, L.A.J. 1985 Phospho-glucose isomerase and Phospho-glucose Mutase isozymes in some freshwater fishes from Basrah, Iraq. Biochemical Systematics and Ecology, 13 (3): 357-364.

Anene, A. 2005. Condition factor of four cichlid species of a man-made in Imo state, South Eastern Nigeria. Turkish Journal of Fisheries and Aquatic Sciences, 5: 43 – 47.

Antovic, I., P., Simonovic. 2006. Phenetic relationships of six species of mullets (Mugilidae) from the south Adriatic, as inferred from the study of the visceral and dermal skeleton. Russian Journal of Marine Biology, 32: 250-254. doi:10.1134/S1063074006040080.

Batubara, A.S. Z. A. Muchlisin, D. Efizon, R. Elvyra, M. Irham. 2019. Length-weight relationships and condition factors of the naleh fish, *Barbonymus gonionotus* (Pisces, Cyprinidae) harvested from Nagan Raya Waters, Indonesia. Vestnik Zoologii, 53(1): 75–82.

Batubara, A.S., D. Yulianto, I. Dewiyanti, M.N. Siti-Azizah, D. Efizon, N. Fadli, Z.A. Muchlisin. 2021. Skeletal structure as taxonomic tool for identification of mullet species (Teleostei: Mugilidae) from Aceh waters, Indonesia. Journal of Applied Ichthyology, 37(5): 697-705.

Bennet, G. W. 1970. Management of lakes and ponds 2nd ed. Robert E. Krieger Publishing Company, Inc., Malabar, Florida.

Bulanin, B., M. Masrizal, Z.A. Muchlisin. 2017. Length-weight relationships and condition factors of the whitespotted grouper *Epinephelus coeruleopunctatus* Bloch, 1790 in the coastal waters of Padang City, Indonesia. Aceh Journal of Animal Science, 2(1): 23-27.

Eschmeyer, W.N., R. Fricke. 2011. Catalog of fishes. http://research.calacademy.org/research/ichthyology/ catalog/fishcatmain.asp.

Fakunmoju, F. A, S.L. Akintola, B. Ijimakinde. 2014. Comparative analysis of the morphometric and meristic character of Lutjanidae from Lekki and Badagry lagoons in Lagos State, Nigeria. IOSR Journal of Agriculture and Veterinary Science, 7(1): 81-88.

Froese, R. 2006. Cube law, condition factor, and weight–length relationships: history, meta-analysis, and recommendations. Journal of Applied Ichthyology, 22, 241–253. doi:10.1111/j.1439-0426.2006.00805.x

Gupta, B.K., U.K. Sarkar, S.K. Bhardwaj, A. Pal. 2011. Condition factor, length-weight and length-weight relationships of an endangered fish, *Ompokpabda* (Hamilton 1822) (Silurifomes: Siluridae) from the River Gomti, a tributary of the River Ganga, India. Journal of Applied Ichthyology 27: 962 964.

Le Cren, E. D., 1951. The length-weight relationship and seasonal cycle in gonad weight and condition in the perch (*Perca fluviatilis*). Journal of Animal Ecology 20:201- 219.

Lizama, M. D., A.M. Ambrosio. 2002. Condition factor in nine species of fish of the Characidae family in the upper Paraná River floodplain, Brazil. Brazilian Journal of Biology 62 (1):113-124.

Machrizal, R. K. Khaitul, J. Nasution, R.H. Dimenta, A. Harapah. 2019. Distribution and length-weight relationships of Hilsa shad *Tenualosa ilisha* in the Bilah River, Labuhanbatu Regency, North Sumatera Province, Indonesia. Aceh Journal of Animal Science 4(1): 42-49.

Muchlisin, Z.A., M. Musman, M.N. Siti-Azizah. 2010. Length-weight relationships and condition factors of two threatened fishes, *Rasbora tawarensis* and *Poropuntius tawarensis*, endemic to Lake Laut Tawar, Aceh Province, Indonesia. Journal of Applied Ichthyology, 26: 949-953.

Muchlisin, Z. A. A.S. Batubara, M. N. Siti-Azizah, M. Adlim, A. Hendri, N. Fadli, A. A. Muhammadar, S. Sugianto. 2015. Feeding habit and length weight relationship of keureling fish, *Tor tambra* Valenciennes, 1842 (Cyprinidae) from the western region of Aceh Province, Indonesia. Biodiversitas, 16(1): 89-94.

Muchlisin, Z.A., V. Fransiska, A.A. Muhammadar, M. Fauzi, A.S. Batubara. 2017. Length-weight relationships and condition factors of the three dominant species of marine fishes caught by traditional beach trawl in Ulelhee Bay, Banda Aceh City, Indonesia. Croatian Journal of Fisheries, 75: 142-154.

Ndome C. B., T. Muabe. 2009. The feeding behavior and condition index of *Heterobranchus bidorsalis* in southeastern Nigeria. Journal Sustainable Tropical Agriculture Research 29:18.

Nelson, J.S. 2006. Fishes of the World, 4th Edition. John Wiley and Sons, Inc. Hoboken, New Jersey, USA, 601 pp.

Soyinka, O. O. 2017. Reproductive studies of striped mullet (*Mugil cephalus)* from the high brackish tropical lagoon. Livestock Research for Rural Development, 29(8):

Soyinka, O.O. 2010. The Bio-ecology and culture potentials of the grey mullet, *Mugil cephalus* (Linnaeus) from the Lagos Lagoon, Nigeria. Ph.D. Thesis, University of Lagos, 223pp.

Soyinka O.O., O.O. Ojo. 2015. Growth pattern, condition factor and heavy metal concentration in blackchin tilapia, *Sarotherodon melanotheron* from Lagos Lagoon. Journal of Aquatic Sciences, 30(1B): 119 – 128.

Tesch, F.W., 1968. Age and growth. In: Methods for the assessment of fish production in freshwater (ed. W.R. Ricker), pp. 98-130. IBP Hand Book. No. 3.

Ugwumba, O.A. 1984. The biology of the ten pounder, *Elops lacerta* (Val.) in the freshwater, estuarine and marine environments. Ph. D Thesis, University of Lagos, p. 297.

Ujjania, N.C., M.P.S. Kohli, L.L. Sharma. 2012. Length-weight relationship and condition factors of Indian major carps (*C. catla, L. rohita* and *C. mrigala*) in Mahi Bajaj Sagar, India. Research Journal of Biology, 2(1): 4460 – 4464.

Yulianto, D., I. Indra, A.S. Batubara, N. Fadli, F. M. Nur, S. Rizal, M.N. Siti-Azizah, Z.A. Muchlisin. 2020. Morphometrics and genetics variations of mullets (Pisces: Mugilidae) from Aceh waters, Indonesia. Biodiversitas, 21(8): 3422-3430.

Yulianto, D., I. Indra, A.S. Batubara, D. Efizon, F.M. Nur, S Rizal, R, Elvyra, Z.A. Muchlisin. 2020. Length–weight relationships and condition factors of mullets *Liza macrolepis* and *Moolgarda engeli* (Pisces: Mugilidae) harvested from Lambada Lhok waters in Aceh Besar, Indonesia. F1000Research, 9: 259.