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1 Length–weight relationships of four fish species from Fatala estuary, Guinea, West Africa

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26 **Summary**

27 This study provides length-weight relationships (LWR) that had not yet been reported for
28 four fish species belonging to four different families: *Chrysichthys johnelsi* Daget, 1959,
29 *Cynoglossus senegalensis* (Kaup, 1858), *Citharichthys stampflii* (Steindachner, 1894) and
30 *Pseudotolithus typus*, Bleeker, 1863. Data were collected in the Fatala estuary, republic of
31 Guinea, each month between January 1993 and March 1994, using alternately a purse seine
32 net (length 250 m, height 20 m, 14 mm side mesh) and gillnets (side mesh sizes of 10, 12.5,
33 15, 15.5, 20, 22.5, 25, 30, 35 and 40 mm). For each fish specimen, fork or total length and
34 total weight were measured with precision to 0.1 cm and 0.1 g respectively. A wider size
35 range, compared to the size range available in FishBase, was obtained for *Pseudotolithus*
36 *typus*. The present study also provides a new maximum total length for *Citharichthys*
37 *stampflii*. The determination coefficient (r^2) between length and total body weight ranged
38 between 0.958 in *Citharichthys stampflii* and 0.989 in *Cynoglossus senegalensis*. The
39 allometric coefficient b varied from 2.9552 (*Chrysichthys johnelsi*) to 3.7288 (*Citharichthys*
40 *stampflii*). The value of LWRs for the four fish species should assist fisheries scientists and
41 managers to complement their further studies of population parameters to improve
42 management decisions in Fatala estuary and, more widely, in West Africa.

43
44 **Key words:** Length–weight relationships, fish species, Fatala estuary, Guinea

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47 **INTRODUCTION**

48 Fisheries management and research often require the use of biometric relationships to
49 transform field data into appropriate indices (Ecoutin & Albaret, 2003). Among them, length-
50 weight relationships (LWR) are useful for weight prediction and estimation of fish biomass
51 from length data collected by visual census as an indication for fish stock assessment
52 (Carlander, 1969; Froese, 2006). This is particularly relevant in data-poor species and stocks
53 where new studies are of great importance to improve species-specific estimates and increase
54 the reliability of on-line databases (Froese et al., 2014). Consequently, the present study
55 provides length-weight relationships for four fish species from the Fatala estuary to assist in
56 future conservation and management.

57 **MATERIALS AND METHODS**

58 The Fatala estuary is located in the republic of Guinea between 10.0° and 10.3° North and
59 between 14.0° and 14.25° West (Simier et al., 2019). It is subject to a humid tropical climate
60 of the sub-Guinean type characterized by an alternating dry season from November to May
61 and a rainy season culminating in July. Rainfall is very high (around 3500 mm.year⁻¹), and
62 the hydrological maximum occurs in August-September (Simier & Ecoutin, 2017). The
63 estuarine zone is limited 60 km upstream by a rocky sill where both the dynamic tide and the
64 salt tide stop. The sampling plan set 7 locations located in the estuary, respectively at 3, 10,
65 17, 24, 33, 39 and 46 km from the mouth, plus one at sea, in the extension of the mouth. Two
66 fishing methods were used alternately each month between 24/01/1993 and 22/03/1994 to
67 describe the variations in the fish population in a complementary way (Baran, 1995). The first
68 one was a purse seine (length 250 m, height 20 m, 14 mm side mesh); two fishing hauls were
69 made per location, one in the channel, the other as close to the bank as possible (minimum
70 water height 2 m) (Simier & Ecoutin, 2017). The second one, gillnets, was used for better
71 sampling of the riparian habitat. Sampling was carried out using batteries of gillnets set at
72 night, parallel to the bank. Each set consisted of ten nets mounted at 50%, with dimensions of
73 25 m x 2 m in fishing. The white knotted multifilament nets had mesh sizes of 10, 12.5, 15,
74 15.5, 20, 22.5, 25, 30, 35 and 40 mm respectively. Four sites were set, common to the purse
75 seine sampling, located respectively at 3, 17, 33 and 46 km from the mouth. For each site, 4
76 replicates were defined, corresponding to two successive nights of fishing on each bank of
77 the river (Simier & Ecoutin, 2017). A total of 212 purse seine fishing hauls were carried out
78 and 952 gillnets were set, corresponding to 96 batteries.

79 Fish were identified to the species level, measured to the nearest mm (fork length for fish
80 with a forked caudal fin, total length for species with a pointed caudal fin) (Baran, 1995), and
81 weighed to the nearest g. All data are available in PPEAO database (Simier et al., 2019).
82 Linear regressions of log(W) vs. log(L), where W is total weight in g, L is total or fork
83 length in cm, were calculated to obtain the length-weight relationship of the form $W = aL^b$
84 (Froese, 2006) where log(a) is the intercept and b is the slope of the regression. Length and
85 weight data were first plotted to identify outliers, the most extreme of which were finally
86 excluded from the analyses.

87 **RESULTS**

88 Sample size, length and weight ranges and parameters of the LWR equations with 95%

89 confidence limits and values of the determination coefficient (r^2) were computed for the four
90 species and reported in Table 1. Length-weight relationships for all species were highly
91 significant (Table 1; $P < 0.01$). All fish species had the allometric coefficient b in the LWR
92 equations between 2.9552 (*Chrysichthys johnelsi*) and 3.7288 (*Citharichthys stampflii*). The
93 coefficient of determination (r^2) between length and weight varied from 0.958 (*Citharichthys*
94 *stampflii*, $n=51$) to 0.989 (*Cynoglossus senegalensis*, $n=28$).

95 DISCUSSION

96 Length-weight data from purse seine sampling in the Fatala estuary had been included in a
97 global study on LWR of species from estuaries and lagoons in West Africa by Ecoutin &
98 Albaret (2003). The present work focused on historical data from the Fatala estuary with
99 much more individuals thanks to additional data from gillnets sampling. Due to their
100 importance, the study of historical data provides results that allow comparisons or modelling
101 of the biogeographical life cycle of fish species and fish stocks. The slope values (b) of
102 LWRs fell within the expected range of 2.5-3.5 as expected by Carlander (1969) and Froese
103 (2006) for all species except *Citharichthys stampflii*. A new maximum total length was
104 presented for *Citharichthys stampflii*. The size range of *Pseudotolithus typus* obtained in this
105 study was larger than that reported in FishBase. Therefore, our study provides a significant
106 baseline study on the LWRs of four fish species from Fatala estuary. These results are useful
107 for further studies or for other key parameters needed for fisheries management (Gonçalves et
108 al., 1997; Fromentin & Fonteneau, 2001; Moutopoulos & Stergiou, 2002; De La Cruz Agüero
109 et al., 2011; Saberi et al., 2017). The results presented here are reliable and can enrich length-
110 weight relationships and maximum lengths in FishBase (Froese & Pauly, 2021).

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117 fieldwork and in the laboratory, at that time.

118 **Data availability statement:** Data are available at <http://ppeao.ird.fr> or upon request to
119 ppeao@ird.fr

120 CONFLICT OF INTEREST

121 Authors declare that they do not have any conflict of interest.

122 REFERENCES.

- 123
124 Baran, E. (1995). *Dynamique spatio-temporelle des peuplements de poissons estuariens en*
125 *Guinée: Relations avec le milieu abiotique. Thèse de Doctorat en Océanologie*
126 *biologique, Université de Bretagne Occidentale, Brest.* ORSTOM, Paris: Thèses et
127 Documents Microfichés, Vol. 142. Retrieved from [http://horizon.documentation.ird.](http://horizon.documentation.ird.fr/exl-doc/pleins_textes/pleins_textes_6/TDM/42826.pdf)
128 [fr/exl-doc/pleins_textes/pleins_textes_6/TDM/42826.pdf](http://horizon.documentation.ird.fr/exl-doc/pleins_textes/pleins_textes_6/TDM/42826.pdf)
129 Carlander, K. D. (1969). *Handbook of freshwater fishery biology* (3rd ed., Vol. 1). Ames,
130 Iowa: Iowa State University Press.

- 131 De La Cruz Agüero, J., García Rodríguez, F. J., Cota Gómez, V. M., Chollet Villalpando, J.
132 G., & Vergara Solana, F. J. (2011). Length–weight relations of selected species of the
133 family Gerreidae (Actinopterygii: Perciformes) from the Mexican coast. *Acta*
134 *Ichthyologica Et Piscatoria*, 41(1), 67–69. <https://doi.org/10.3750/AIP2011.41.1.10>
- 135 Ecoutin, J.-M., & Albaret, J.-J. (2003). Relation longueur-poids pour 52 espèces de poissons
136 des estuaires et lagunes de l’Afrique de l’Ouest. *Cybium*, 27(1), 3–9.
- 137 Froese, R. (2006). Cube law, condition factor and weight–length relationships: History, meta-
138 analysis and recommendations. *Journal of Applied Ichthyology*, 22(4), 241–253.
139 <https://doi.org/10.1111/j.1439-0426.2006.00805.x>
- 140 Froese, R., & Pauly, D. (2021). FishBase. World Wide Web electronic publication. Retrieved
141 from <http://fishbase.org/> (accessed 09/2021).
- 142 Froese, R., Thorson, J. T., & Reyes, R. B. (2014). A Bayesian approach for estimating length-
143 weight relationships in fishes. *Journal of Applied Ichthyology*, 30(1), 78–85.
144 <https://doi.org/10.1111/jai.12299>
- 145 Fromentin, J.-M., & Fonteneau, A. (2001). Fishing effects and life history traits: A case study
146 comparing tropical versus temperate tunas. *Fisheries Research*, 53(2), 133–150.
147 [https://doi.org/10.1016/S0165-7836\(00\)00299-X](https://doi.org/10.1016/S0165-7836(00)00299-X)
- 148 Gonçalves, J. M. S., Bentes, L., Lino, P. G., Ribeiro, J., Canário, A. V. M., & Erzini, K.
149 (1997). Weight-length relationships for selected fish species of the small-scale demersal
150 fisheries of the south and south-west coast of Portugal. *Fisheries Research*, 30(3), 253–
151 256. [https://doi.org/10.1016/S0165-7836\(96\)00569-3](https://doi.org/10.1016/S0165-7836(96)00569-3)
- 152 Moutopoulos, D. K., & Stergiou, K. I. (2002). Length–weight and length–length relationships
153 of fish species from the Aegean Sea (Greece). *Journal of Applied Ichthyology*, 18(3),
154 200–203. <https://doi.org/10.1046/j.1439-0426.2002.00281.x>
- 155 Saberi, M., Paighambari, S. Y., Darvishi, M., & Farkhondeh Shilsar, G. (2017). Length–
156 weight relationships of six fish species from the Coastal Waters of Jask, Iran. *Journal of*
157 *Applied Ichthyology*, 33(6), 1226–1228. <https://doi.org/10.1111/jai.13326>
- 158 Simier, M., & Ecoutin, J.-M. (2017). *Base de Données PPEAO Pêches Scientifiques. Guinée*
159 *(Fatala et Dangara) 1993-1994* (p. 7). IRD. Retrieved from IRD website:
160 [http://vmppeao-
161 proto.ird.fr/work/documentation/metadata/files/Descriptif_Guinee_1993_1994_peches_experimentales.pdf](http://vmppeao-proto.ird.fr/work/documentation/metadata/files/Descriptif_Guinee_1993_1994_peches_experimentales.pdf)
- 162 Simier, M., Ecoutin, J.-M., & Tito de Morais, L. (2019). The PPEAO experimental fishing
163 dataset: Fish from West African estuaries, lagoons and reservoirs. *Biodiversity Data*
164 *Journal*, 7, e31374. <https://doi.org/10.3897/BDJ.7.e31374>
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167 Table 1. Synthesis of studies on length–weight relationship (LWR) of four fish species from the Fatala estuary in Guinea. Abbreviations: n, sample size; Max,
 168 maximum; Min, minimum; a and b, parameters of LWR; CL, confidence limits; r², coefficient of determination. Species: ^f, fork length; ^t, Total length. Lmax
 169 fishbase, maximum length in Fishbase.

Species	n	Length (cm)	Weight (g)	Relationship parameters			Lmax Fishbase
		Min-Max	Min-Max	a (95%CL)	b (95%CL)	r ²	
Claroteidae							
<i>Chrysichthys johnelsi</i> ^f Daget, 1959	67	7.5-33.4	4-430	0.013 (0.010-0.016)	2.9552 (2.8713-3.0392)	0.987	33
Cynoglossidae							
<i>Cynoglossus senegalensis</i> ^t (Kaup, 1858)	28	14.5-63.5	9-805	0.002 (0.001-0.003)	3.1322 (3.0009-3.2634)	0.989	66.5
Cyclopsettidae							
<i>Citharichthys stampflii</i> ^t (Steindachner, 1894)	51	5.8-19.0	1-73	0.001 (0.001-0.002)	3.7288 (3.5044-3.9533)	0.958	16
Sciaenidae							
<i>Pseudotolithus typus</i> ^t Bleeker, 1863	54	27.3-84.2	115-3500	0.005 (0.003-0.008)	3.0642 (2.9310-3.1974)	0.976	140

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