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1 Length–weight relationships of 5 fish species from the Sine Saloum estuary, Senegal, West
2 Africa

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27 **Summary**

28 Length-weight relationships ($W=aL^b$) were estimated for 5 fish species, the pearl stingray
29 *Fontitrygon margaritella* (Compagno & Roberts, 1984), the West African spadefish
30 *Chaetodipterus lippei* (Steindachner, 1895), the East Atlantic African spadefish *Ephippus*
31 *goreensis* (Cuvier, 1831), the law croaker *Pseudotolithus senegallus* (Cuvier, 1830) and the
32 Guinean sole *Dagetichthys cadenati* (Chabanaud, 1948). Fishes were collected during several
33 scientific fishing surveys using purse seine (length 250 m, height 20 m, 14 mm mesh size)
34 and beach seine (180 m length, 9 m height and 25 mm mesh net) conducted from April 1990
35 to October 2012 in the Sine Saloum estuary, Senegal. They were weighed to the nearest g and
36 measured to the nearest mm (disc width for *Fontitrygon margaritella* and total length for the
37 4 other species). The values of parameter b in the LWR equations varied from 3.048
38 (*Chaetodipterus lippei*) to 3.274 (*Dagetichthys cadenati*) and the coefficient of determination
39 (r^2) varied between 0.969 (*Fontitrygon margaritella*) and 0.998 (*Chaetodipterus lippei*). In
40 addition, new maximum lengths are proposed for *Fontitrygon margaritella*, *Chaetodipterus*
41 *lippei* and *Dagetichthys cadenati*.

42

43 **Key words:** Length–weight relationships, fish species, Sine Saloum, estuary, Senegal

44 **Running Head:** Fish Length–weight relationships in Senegal

45 INTRODUCTION

46 Length–weight relationships (LWR) contribute together with the monitoring of several other
47 essential parameters (e.g. sex ratio, age of first maturity, fecundity, recruitment, natural and
48 fishing mortality, growth patterns, estimation of biomass, population dynamics) to the
49 required stock assessment for proper population management (Le Cren, 1951; Hampton,
50 2000; Fromentin & Fonteneau, 2001; Froese, 2006). They help to describe a specific
51 population, to compare fish species populations or fish life histories between seasons, years,
52 zones and regions, provided all investigators use the same standardized sampling
53 methodology (De La Cruz Agüero et al., 2011; Gonçalves et al., 1997; Moutopoulos &
54 Stergiou, 2002). In this study, we assessed length-weight relationships for 5 fish species from
55 the Sine Saloum estuary. This work complements those of Ecoutin and Albaret (2003) and
56 Ndiaye et al. (2015) on LWR of fish species in the Saloum estuary.

57 MATERIALS AND METHODS

58 The Sine Saloum estuary is located 100 km south of Dakar, in Senegal, between 13°55' and
59 14°10' North and 16°03' and 16°50' West. The Sine Saloum is an inverse estuary
60 characterized by an increase in salinity from downstream to upstream in all seasons.
61 Mangrove forests cover almost the entire southern portion of the system and progressively
62 diminish in the North (Diouf, 1996; Simier et al., 2004). Data were collected during two
63 research programs covering the whole Sine Saloum estuary in 1990-1993 and then in 2002-
64 2003 (Diouf, 1996; Ecoutin et al., 2010) and the biological monitoring of the Bamboung
65 MPA and its surroundings from 2003 to 2012 (Ecoutin et al., 2014; Sadio et al., 2015). All
66 the sampling was carried out over the three main hydro-climatic seasons of the region (Simier
67 et al., 2004). 166 fishing hauls were made using a purse seine (length 250 m, height 20 m, 14
68 mm mesh size; see Simier et al., 2004) and 11 using a beach seine (180 m length, 9 m height
69 and 25 mm mesh net; see Diouf, 1996). Fish were measured to the nearest mm (disc width for
70 *Fontitrygon margaritella* and total length for the 4 other species) and weighed to the nearest
71 g. All data are available in PPEAO database (Simier, Ecoutin, & Tito de Morais, 2019).
72 Linear regressions of $\log(W)$ vs. $\log(L)$, where W is total weight in g and L is total length
73 or disc width in cm, were calculated to obtain the length-weight relationship of the form $W =$
74 aL^b , where a and b are regression parameters (Froese, 2006).

75 RESULTS

76 Five fish species belonging to 4 families were considered in this study. Sample size, length
77 and weight ranges, parameters of the LWR equations with 95% confidence limits and values
78 of the determination coefficient (r^2) were computed for the 5 fish species (Table 1). All
79 regressions of LWRs were statistically significant ($p < 0.001$).

80 DISCUSSION

81 All the fishes in this study were collected over a long period of time, during several scientific
82 surveys of the fish assemblages in the Sine Saloum estuary. The sampling protocols were
83 designed to cover the entire hydroclimatic cycle and to explore various habitats, thus
84 providing a spatial and temporal overview of estuarine fish assemblages. The five species

85 presented here are not however among the most frequent in these assemblages. Except
86 *Fontitrygon margaritella* and *Pseudotolithus senegallus* which are an “estuarine species from
87 marine origin” and a “marine-estuarine species” respectively, the 3 others are “marine
88 species, occasionally or accidentally found in estuaries” (Albaret, 1999). Thus, for *Ephippus*
89 *goreensis* the sample size is limited and the maximum length is only 20.8 cm (for a known
90 maximum size of 30 cm) and for *Pseudotolithus senegallus* the maximum length is 101 cm
91 (for a known maximum length of 230 cm). Consequently, the parameters estimated here,
92 especially for these two species, should be considered as tentative. Despite these limitations,
93 the coefficients of determination (r^2) were very high for the five species, indicating a good
94 predictive power. All species had b value comprised between 2.5 and 3.5 as expected (Froese,
95 2006). Regression results suggest that the data from this study and the results presented here
96 are reliable and can enriched length-weight relationships in FishBase (Froese & Pauly, 2020)
97 for the Senegal.

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103 research vessel and its captain François Sanseo, without whom these results could not have
104 been obtained.

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

107 CONFLICT OF INTEREST

108 The authors declare no conflict of interest.

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174 Table 1. Descriptive statistics and estimated parameters of length-weight relationships ($W = aL^b$) for five species from the Sine Saloum estuary, Senegal,
 175 captured from 1990 to 2012. n, sample size; Max, maximum; Min, minimum; a and b, parameters of LWR; CL, confidence limits; r^2 , coefficient of
 176 determination. Length = Total Length except for *Fontitrygon margaritella* (Disc Width). *, indicates that the LWR includes a new not yet reported maximum
 177 total length.

Family	Species	n	Length (cm)	Weight (g)	Relationship parameters		
			Min – Max	Min – Max	a (95%CL)	b (95%CL)	r^2
Dasyatidae	<i>Fontitrygon margaritella</i> (Compagno & Roberts, 1984)*	139	10.7 – 47.0	54 – 5175	0.025 (0.018 – 0.033)	3.177 (3.081 – 3.274)	0.969
Ephippidae	<i>Chaetodipterus lippei</i> Steindachner, 1895*	73	4.4 – 32.3	3 – 1114	0.029 (0.027 – 0.033)	3.048 (3.013 – 3.082)	0.998
	<i>Ephippus goreensis</i> Cuvier, 1831	15	5.5 – 20.8	5 – 316	0.024 (0.017 – 0.032)	3.141 (3.014 – 3.269)	0.995
Sciaenidae	<i>Pseudotolithus senegallus</i> (Cuvier, 1830)	118	11.1 – 101.0	9 – 8250	0.006 (0.005 – 0.006)	3.079 (3.047 – 3.112)	0.997
Soleidae	<i>Dagetichthys cadenati</i> (Chabanaud, 1948)*	20	8.3 – 38.0	3 – 457	0.003 (0.002 – 0.005)	3.274 (3.054 – 3.494)	0.982

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