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LENGTH–WEIGHT AND LENGTH–LENGTH RELATIONSHIPS, AND CONDITION FACTOR OF *AMBASSIS DUSSUMIERI* CUVIER, 1828, IN THE NORTHEASTERN MEDITERRANEAN, TÜRKIYE

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ABSTRACT

*This study provides the first data on the length–weight relationship (LWR), length–length relationship (LLR), and condition factor (*K*) of the Malabar glassy perchlet,* Ambassis dussumieri, *in the northeastern Mediterranean (Tuzla coast, Türkiye). A total of 132 specimens (68 males and 64 females) were examined. The specimens ranged from 4.5 to 8.9 cm in total length (TL), 3.7 to 7.7 cm in fork length (FL), 3.4 to 6.9 cm in standard length (SL) for both sexes. The calculated* b *values indicated positive allometric growth for the overall population (t-test,* $p < 0.05$*). The length–length relationships among the three length measurements (TL, FL, and SL) were highly correlated (*$r^2 > 0.970$*). The mean condition factor (*K*) was calculated as 0.812 ± 0.074 for both sexes, with no significant difference between females and males. These results will be useful for studies on the biology of non-indigenous fish species.*

Key words: The Malabar glassy perchlet, biological parameters, Levantine Sea, Türkiye

RELAZIONI LUNGHEZZA–PESO E LUNGHEZZA–LUNGHEZZA, E FATTORE DI CONDIZIONE DI *AMBASSIS DUSSUMIERI* CUVIER, 1828, NEL MEDITERRANEO NORD-ORIENTALE, TURCHIA

SINTESI

Lo studio fornisce i primi dati sulla relazione lunghezza–peso (LWR), sulla relazione lunghezza–lunghezza (LLR) e sul fattore di condizione (K) del pesce vetro di Dussumier, Ambassis dussumieri, *nel Mediterraneo nord-orientale (costa di Tuzla, Turchia). È stato esaminato un totale di 132 esemplari (68 maschi e 64 femmine). Gli esemplari presentavano una lunghezza totale (TL) compresa tra 4,5 e 8,9 cm, una lunghezza alla forcella (FL) tra 3,7 e 7,7 cm e una lunghezza standard (SL) tra 3,4 e 6,9 cm per entrambi i sessi. I valori di b calcolati hanno indicato una crescita allometrica positiva per l'intera popolazione (t-test,* $p < 0,05$*). Le relazioni lunghezza–lunghezza tra le tre misure di lunghezza (TL, FL e SL) hanno mostrato un'elevata correlazione (*$r^2 > 0,970$*). Il fattore di condizione medio (K) è stato calcolato pari a 0,812 ± 0,074 per entrambi i sessi, senza differenze significative tra femmine e maschi. Questi risultati saranno utili per studi sulla biologia delle specie ittiche non indigene.*

Parole chiave: pesce vetro di Dussumier, parametri biologici, Mare del Levante, Turchia

INTRODUCTION

The Malabar glassy perchlet, *Ambassis dussumieri* Cuvier, 1828, is widely distributed in the Mediterranean Sea (Stern *et al.*, 2022) and throughout the Indo-West Pacific, from Algoa Bay in South Africa to the Red Sea and Seychelles, and eastwards to India, Australasia, the Philippines, and China (Anderson & Heemstra, 2003).

Ambassis dussumieri inhabits marine, estuarine, and riverine environments (Froese & Pauly, 2026). In the Mediterranean, the species was first recorded in the eastern basin, on the Israeli coast, by Stern *et al.* (2022) and subsequently reported by Çevik & Ergüden (2026) from Turkish marine waters in the northeastern Mediterranean. The pathway by which it entered the Mediterranean Sea remains uncertain, although Stern *et al.* (2022) suggested that the species likely migrated from the Red Sea to the Israeli coast via the Suez Canal.

The length–weight relationship (LWR) is an important tool in fish biology, ecology, and fisheries assessment, providing valuable information for stock assessment studies (Moutopoulos & Stergiou, 2002; Gonzalez Acosta *et al.*, 2004), particularly for converting length observations into weight estimates and assessing biomass (Gonzalez Acosta *et al.*, 2004).

The length–length relationship (LLR) is useful for standardising length types when summarising data and is also effective for comparative growth studies (Froese, 2006; Moutopoulos & Stergiou, 2002; Bakhshalizadeh *et al.*, 2025). Understanding relationships among total length, fork length, and standard length allows for the estimation of species distribution, assessment of population condition, and morphological comparisons. All these data contribute to informed decision-making and effective conservation strategies (Froese, 2006).

The present study aimed to investigate the length–frequency distribution, length–weight relationship (LWR), length–length relationship (LLR), and Fulton's condition factor (*K*) of the non-indigenous fish species of Malabar glassy perchlet *Ambassis dussumieri* in the northeastern Mediterranean Sea, Türkiye.

MATERIAL AND METHODS

A total of 132 specimens of *A. dussumieri* were collected in October, November, and December 2025 from the Kara Göçer Drainage Canal, Tuzla coast (Karataş, Adana), using a cast net (Fig. 1). Sampling was conducted approximately 400–500 m upstream from the canal mouth at a depth of

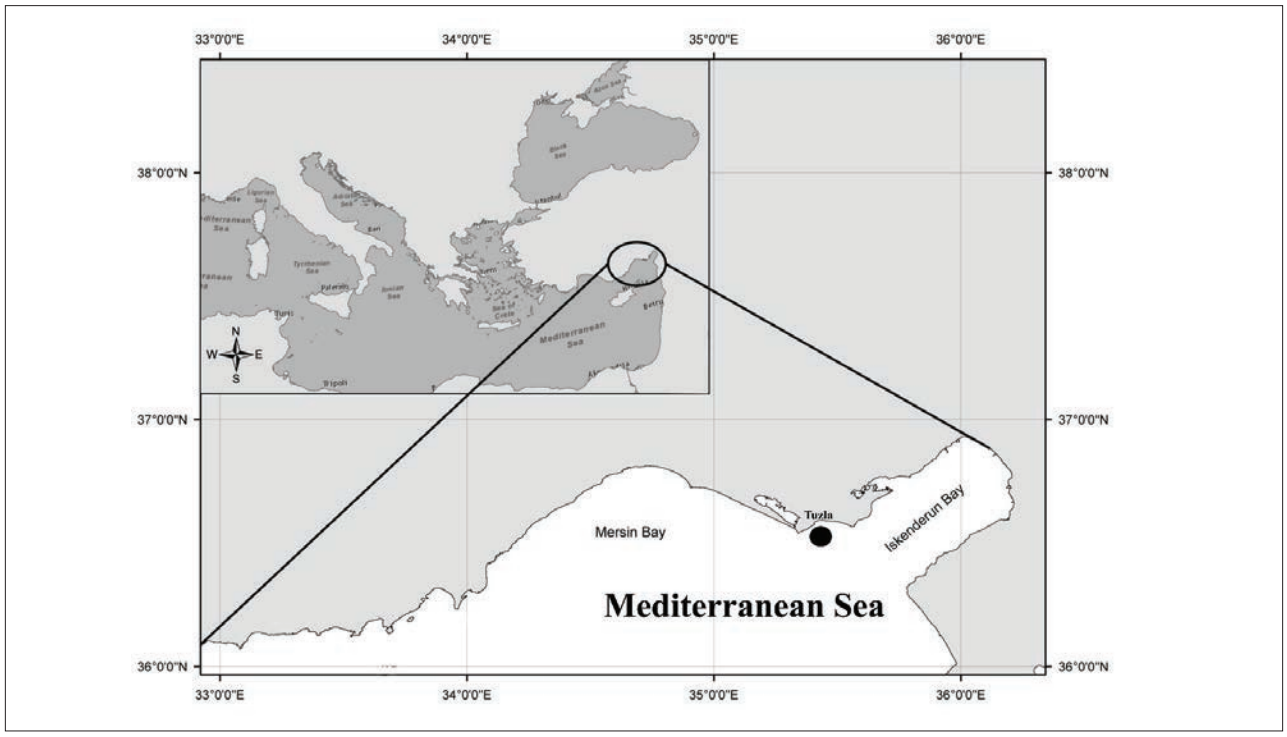

Fig. 1: Map showing the capture locality (•) of** Ambassis dussumieri **in the northeastern Mediterranean (Tuzla, Türkiye).
Sl. 1: Zemljevid obravnavanga območja z lokaliteto ulova primerkov vrste** Ambassis dussumieri **v severovzhodnem Sredozemlju (Tuzla, Turčija).

Tab. 1: Descriptive statistics and estimated parameters of the length–weight relationships of** Ambassis dussumieri **from the northeastern Mediterranean, Türkiye. a: = intercept, b: = slope, SE.: = Standard error, C.I: = Confidence interval, r2: = Coefficient of determination, GT: = Growth type.
Tab. 1: Opisna statistika in ocenjeni parametri dolžinsko-masnih odnosov za vrsto** Ambassis dussumieri **iz severovzhodnega Sredozemlja, Turčija. a: = začetni koeficient (odsek), b: = naklon, SE.: = standardna napaka, C.I: = interval zaupanja, r2: = koeficient determinacije, GT: = tip rasti.

Sample	No. of indivi-duals	Total Length, TL (cm)	Weight, W (g)	Parameters of the relationship					
Ambassis dussumieri		L_{min}-L_{max} (mean ±SD)	W_{min}-W_{max} (mean ±SD)	a	b	SE(b)	95% CI of b	r^2	GT
Female	64	4.50–8.60 (6.86±0.949)	0.75–6.51 (2.83±1.348)	0.0036	3.417	0.068	3.282–3.553	0.976	A+
Male	68	4.50–8.90 (6.93±1.127)	0.72–6.99 (2.99±1.467)	0.0058	3.175	0.058	3.060–3.292	0.978	A+
Combined	132	4.50–8.90 (6.90±1.040)	0.72–6.99 (2.90±1.382)	0.0050	3.253	0.044	3.167–3.340	0.976	A+

about 1.5 m. After collection, the specimens were transported in a small iced Styrofoam box to the Basic Sciences Laboratory at the Faculty of Fisheries Science, Çukurova University.

Species identification was carried out based on the diagnostic criteria provided by Maugé (1986) and Anderson and Heemstra (2003). For each fish specimen, total length (TL), fork length (FL), and standard length (SL) were measured to the nearest 0.1 cm, and total weight (TW) was recorded to the nearest 0.01 g.

The sex was determined by macroscopic observation of the gonads in all individuals. Specimens of the Malabar glassy perchlet were grouped into size classes, and percentage frequency and TL were used to construct the length–frequency distribution. The sex ratio (males:females) was calculated and significant deviations from the expected ratio (1:1) were tested using the χ^2 test (Zar, 1996).

The functional relationship between length and weight of the specimens was fitted to the equation $W = aL^b$, where W is total weight (g), L is length (cm), and a and b are parameters to be estimated, with b representing the coefficient of allometry (Ricker, 1975). The parameters a and b were estimated using the least-squares regression on log-transformed length and weight values (Le Cren, 1951), according to the linearized form $\log W = \log a + b \log L$ (Sokal & Rohlf, 1987).

The b value is useful in describing fish growth type and associated changes in body shape under specific environmental conditions. When $b = 3$, growth is isometric; values of $b < 3$ indicate negative allometric growth, whereas values of $b > 3$ indicate positive allometric growth (Ricker, 1975; Sparre & Venema, 1992; Avsar, 2016). Significant deviations of the estimated b value from the isometric value ($b = 3.0$) were tested using a t-test.

Fulton's condition factor was calculated from weight (g) and length (cm) and used to estimate changes in nutritional condition. The formula used was $K = 100 \times W / L^3$, where K is the condition factor, W is body weight, and L is total length (Le Cren, 1951; Pauly, 1980). Data were analysed using SPSS v22.0. All statistical tests were considered significant at the 0.05 level ($p < 0.05$).

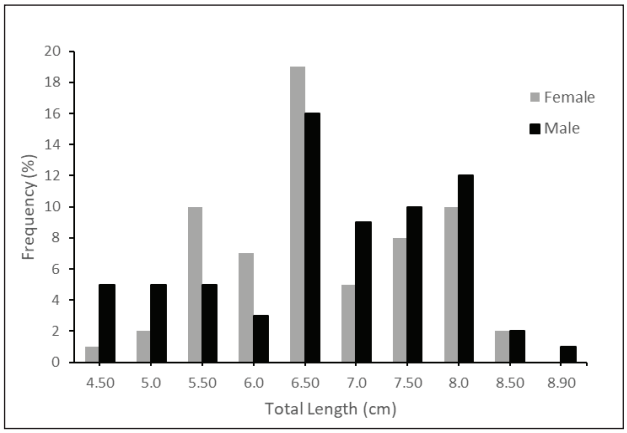

Fig. 2: Total length frequencies of female and male** Ambassis dussumieri **from the northeastern Mediterranean coast of Türkiye.
Sl. 2: Frekvenčna porazdelitev celotne dolžine samic in samcev vrste** Ambassis dussumieri **s severovzhodne sredozemske obale Turčije.

RESULTS AND DISCUSSION

A total of 132 specimens were examined. The specimens ranged from 4.5 to 8.9 cm in total length (TL), 3.7 to 7.7 cm in fork length (FL), 3.4 to 6.9 cm in standard length (SL), and 0.72 to 6.99 g in total weight (TW) for the two sexes combined (Tab. 1). The maximum total length recorded during the study period was 8.9 cm. In males, TL ranged from 4.5 to 8.9 cm, and TW from 0.72 to 6.99 g, while in females, TL ranged from 4.5 to 8.6 cm and TW from 0.75 to 6.51 g.

The results show that the studied population consisted of 51.52% males (n=68) and 48.48% females (n=64), with maximum length and weight values higher in males. The overall sex ratio was M:F = 1.06:1, indicating a slight male bias (χ^2 test; $p < 0.05$). There was no significant difference between females and males regarding mean length (t-test, t = 0.154, $p > 0.05$) and weight (t-test, t = 0.276, $p > 0.05$).

The length–frequency relationship indicated that the 6.5 cm class size had the highest frequency, followed by the 8.0 cm class in both females and males, the 7.5 cm class in males, and the 5.5 cm class in females (Fig. 2).

The LWR indicated a positive allometric growth for both sexes (t-test, $p < 0.05$); the coefficient of determination (r^2) was 0.9762 for females, 0.9784 for males, and 0.9769 for the two sexes combined, indicating a strong correlation between length and weight. The length–weight equations were $W = 0.0036xL^{3.4171}$ for females, $W = 0.0058xL^{3.1757}$ for males, and $W = 0.0050xL^{3.2534}$ for the combined sexes (Fig. 3). The calculated parameters and length characteristics of the length–weight relationships are given in Table 1.

The relationship between total length (cm) and total weight (g) for all samples is shown in Fig. 3. All regression models were highly significant ($p < 0.05$), with coefficients of determination (r^2) exceeding 0.970 for all sexes.

In the length–length relationship analysis, the present study found that the *b* value of the LLRs was greater than 1, indicating positive allometric growth for females, males, and the two sexes combined. The relationships among the three length measurements (TL–FL–SL) were highly correlated ($r^2 > 0.970$, $p < 0.001$). Conversions among length measurements (TL, FL, and SL) are given in Table 2.

Fulton's condition factor (*K*) for females, males, and combined sexes was 0.807±0.078, 0.820±0.072, and 0.812±0.074, respectively, showing no significant variation ($p > 0.05$).

The maximum length values for *A. dussumieri* recorded in the present study are higher than those reported in previous studies (Stern *et al.*, 2022; Afrand & Sourinejad, 2023; Çevik & Ergüden, 2026; Tab. 3). The enhanced growth and larger body size may be driven by nutrient-rich conditions associated with river inputs into the northeastern Mediterranean coastal waters of Türkiye, which likely boost primary production in the region.

Growth studies provide important scientific data for fisheries. The observed growth patterns showed positive allometry in the combined sample as well as the separate male and female samples, as the *b* value exceeded the isometric value ($b = 3.0$). The deviation

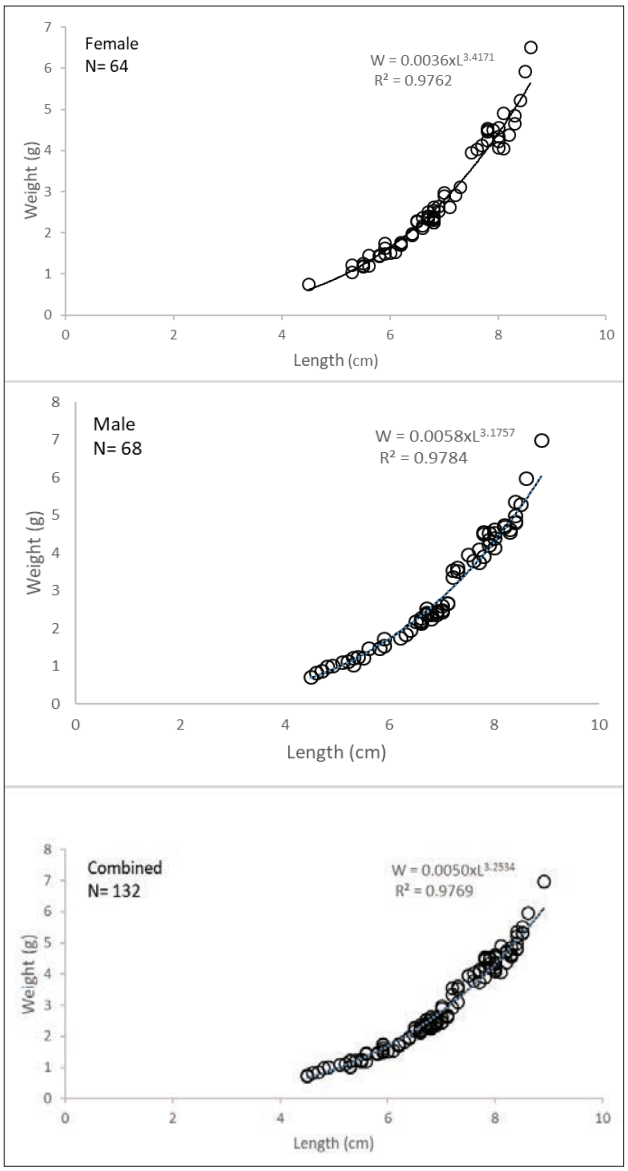

Fig. 3: Length–weight relationships for female, male, and combined of** Ambassis dussumieri **from the northeastern Mediterranean coast of Türkiye.
Sl. 3: Dolžinsko-masni odnosi za samice, samce in skupno populacijo vrste** Ambassis dussumieri **s severovzhodne sredozemske obale Turčije.

Tab. 2: Estimated parameters for the conversions between the length measurements (TL, FL, and SL in cm) of *Ambassis dussumieri* ***from the northeastern Mediterranean coast of Türkiye.***
Tab. 2: Ocenjeni parametri za pretvorbe med merami dolžine (TL, FL in SL v cm) pri primerkih vrste *Ambassis dussumieri* ***s severovzhodne sredozemske obale Turčije.***

Sample	No. of individuals	Equation	Constant a	Slope b	SE (b)	r^2
Female	64	TL = a + bSL	0.212	1.033	0.021	0.974
		SL = a + bFL	0.204	0.831	0.024	0.971
		FL = a + bTL	-0.379	1.106	0.016	0.971
Male	68	TL = a + bSL	0.215	1.023	0.018	0.980
		SL = a + bFL	0.141	0.866	0.015	0.982
		FL = a + bTL	-0.343	1.097	0.019	0.980
Combined	132	TL = a + bSL	0.236	1.013	0.014	0.977
		SL = a + bFL	0.149	0.862	0.024	0.971
		FL = a + bTL	-0.358	1.100	0.013	0.973

of the *b* value for the combined sexes (3.253) was statistically significant ($p < 0.05$).

Bagenal & Tesch (1978) stated that *b* values can vary primarily depending on sample size, length interval, study season, sea conditions, and environmental conditions at the sampling location. Our results are not fully comparable with previous records, since not all of them included LWR studies for this species. However, a comparison between the previously reported length–weight parameters and those obtained in our study is provided in Table 3.

Additional factors are known to influence the length–weight parameters in fish, including gonad maturity, stomach fullness, health, and preservation techniques (Bagenal & Tesch, 1978; Wootton, 1998). Our length and weight data were collected during autumn and winter, however, the season and other above-mentioned factors were not considered in the study.

Fulton's condition factor (*K*), an expression of the relative fatness of fish, which indicates the interaction between biotic and abiotic factors and general fish condition, was 0.812 for the sexes combined. This factor is suitable for comparing the condition of fish of the same species across seasons, locations, or sexes, and reflects ecological and physiological conditions, providing information on the fish's physiological state. This metric also relates to fish welfare in terms of reproduction and nutrition (Le Cren, 1951).

In our study, the condition value was less than 1 ($K < 1$), possibly reflecting food/prey scarcity, increased competition, or environmental factors, including water quality. Nevertheless, our findings indicate that the population of *A. dussumieri* primarily exhibited allometric growth (+), which suggests that the northeastern Mediterranean waters of Türkiye still provide, on average, a suitable feeding environment for this species.

Prior to this study, no information was available on the length–weight and length–length relationships or condition factor of *A. dussumieri* along the Mediterranean coasts, and no biological data on this species were available in the FishBase database. Therefore, this study provides the first comprehensive information on the species in Mediterranean waters.

Tab. 3: Geographic comparison of maximum length and length–weight relationship data for *Ambassis dussumieri.*
Tab. 3: Geografska primerjava največje dolžine in podatkov o dolžinsko-masnem odnosu za vrsto *Ambassis dussumieri***.**

Study	Locality	Country	Samples	No. of individuals	Length Type	L_{min}-L_{max} (cm)	W_{min}-W_{max} (g)
Stern *et al.* (2022)	Eastern Mediterranean Sea	Israel	Combined	6	TL	3.94–4.88	0.51–0.97
Afrand & Sourinejad (2023)	Persian Gulf, Khuran Strait	Iran	Combined	2	TL	4.98–5.20	-
Çevik & Ergüden (2026)	Northeastern Mediterranean Sea	Türkiye	Combined	4	TL	7.17–8.65	3.46–6.67
This study	Tuzla coast, northeastern Mediterranean Sea	Türkiye	Combined	132	TL	4.50–8.90	0.72–6.99

It also contributes to scientific knowledge of the Mediterranean Sea by documenting a newly recorded fish species and supporting the inclusion of its biological parameters in the FishBase database.

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DOLŽINSKO-MASNI ODNOS MED DOLŽINO IN KONDICIJSKIM FAKTORJEM PRI VRSTI *AMBASSIS DUSSUMIERI* CUVIER, 1828, V SEVEROVZHODNEM SREDOZEMSKEM MORJU, TURČIJA

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POVZETEK

Avtorja obravnavata prve podatke o dolžinsko-masnem odnosu (LWR), razmerju med dolžinami (LLR) in kondicijskem faktorju (K) za Malabarskega steklenega ostriža Ambassis dussumieri *v severovzhodnem Sredozemskem morju (obala Tuzle, Turčija). Pregledala sta skupaj 132 osebkov (68 samcev in 64 samic). Primerki obeh spolov so merili od 4,5 do 8,9 cm celotne dolžine (TL), od 3,7 do 7,7 cm viličaste dolžine (FL) in od 3,4 do 6,9 cm standardne dolžine (SL). Izračunane vrednosti b* so nakazovale pozitivno *alometrično rast za celotno populacijo (t-test, $p < 0,05$). Odnos med tremi merami dolžine (TL, FL in SL) je bil statistično zelo značilen ($r^2 > 0,970$). Povprečni koeficient kondicije (K) je bil 0,812 ± 0,074 za oba spola, brez pomembnih razlik med samicami in samci. Ti rezultati bodo uporabni za raziskave o biologiji tujerodnih vrst rib.*

Ključne besede: Malabarski stekleni ostrž, biološki parametri, Levantsko morje, Turčija

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