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POPULATION STUDY OF *TRACHURUS MEDITERRANEUS* FOCUSED ON REPRODUCTIVE BIOLOGY IN EDREMIT BAY, NORTHERN AEGEAN SEA

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ABSTRACT

This study provides insights into the reproductive traits of 754 individuals of Trachurus mediterraneus *collected in Edremit Bay between September 2008 and August 2009. The overall sex ratio differed significantly from the expected 1:1 ratio. Length at first sexual maturity (L_{50}) in females was 18.6 cm. Macroscopic examination of gonads and gonadosomatic index analyses indicated that the spawning period extended from March to August, with peak activity in April. Fulton's condition factor and the gonadosomatic index values showed inverse variation throughout the study period. Total fecundity ranged from 2,738 to 48,315 oocytes and showed strong positive correlations with total length and total weight. These findings provide essential information on the reproductive biology of this economically important species and may contribute to the sustainable management of its populations in the Aegean Sea.*

Key words: *Trachurus mediterraneus*, spawning, fecundity, Edremit Bay

STUDIO SULLA POPOLAZIONE DI *TRACHURUS MEDITERRANEUS,* CON PARTICOLARE ATTENZIONE ALLA BIOLOGIA RIPRODUTTIVA, NELLA BAIA DI EDREMIT, MAR EGEO SETTENTRIONALE

SINTESI

Lo studio fornisce approfondimenti sulle caratteristiche riproduttive di 754 individui di Trachurus mediterraneus *catturati nella baia di Edremit tra settembre 2008 e agosto 2009. Il rapporto complessivo tra i sessi differiva significativamente dal rapporto atteso di 1:1. La lunghezza alla prima maturità sessuale (L50) nelle femmine era di 18,6 cm. L'esame macroscopico delle gonadi e le analisi dell'indice gonadosomatico indicano che il periodo di deposizione si* **è** *esteso da marzo ad agosto, con un picco in aprile. Il fattore di condizione di Fulton e i valori dell'indice gonadosomatico hanno mostrato una variazione inversa durante l'intero periodo di studio. La fecondità totale variava da 2.738 a 48.315 ovociti e mostrava forti correlazioni positive con la lunghezza totale e il peso totale. I risultati forniscono informazioni essenziali sulla biologia riproduttiva della specie e contribuiscono alla gestione sostenibile delle sue popolazioni nell'Egeo.*

Parole chiave: *Trachurus mediterraneus,* deposizione, fecondità, Baia di Edremit

INTRODUCTION

Biological characteristics related to reproduction such as sex ratio, size at first sexual maturity, spawning period, fecundity, and condition factor are key parameters for the effective management of fishery resources (Komolafe & Arawomo, 2007). Understanding the size at which individuals first reach sexual maturity and the timing of the spawning season is critical for determining appropriate minimum catch sizes and for implementing fishing restrictions or seasonal bans (Dinh, 2018). Among these traits, fecundity holds particular significance in fish biology, as it may provide insight into fluctuations in population biomass (Das *et al*., 1989). Reproductive studies in fishery science have traditionally focused on female specimens, largely because reproductive output is more strongly constrained by egg production than by sperm availability (Helfman *et al*., 1997).

The Mediterranean horse mackerel (*Trachurus mediterraneus*) is a carnivorous species distributed across the Mediterranean and Black Seas, as well as the eastern Atlantic coastline from the English Channel to the waters off Morocco (Smith-Vaniz, 1987). This marine and brackish pelagic species, typically occurring at depths ranging from 20 to 200 meters, is known to form schools and exhibit oceanodromous migratory behaviour (Riede, 2004). Numerous studies have addressed its biological characteristics in different regions, including Egypt (El-Gharabawy & Abdel-Aziz, 1988), Tunisia (Ben Salem & Ktari, 1992), Türkiye (Bayhan & Mater, 2000; Şahin *et al*., 2009; Demirel & Yüksek, 2013), Bulgaria (Yankova *et al*., 2009, 2010), and the Adriatic Sea (Jardas *et al*., 2004; Šantić *et al*., 2006, 2011).

Edremit Bay, Türkiye, is a convergence zone influenced by regional circulation and interaction of Mediterranean and Black Sea-derived water masses, making it an important nursery area for both pelagic and demersal species (Toğulga, 1997). Although *T. mediterraneus* is among the economically important species in the region, no detailed studies have been conducted in Turkish waters, with the exception of Demirel & Yüksek (2013). Therefore, this study represents the first comprehensive investigation of reproductive parameters such as sex ratio, spawning season, size at first maturity, and fecundity, in Edremit Bay, northern Aegean Sea.

MATERIAL AND METHODS

A total of 754 specimens of Mediterranean horse mackerel were obtained from commercial catches between September 2008 and August 2009 in Edremit Bay (26°57′–26°34′E, 39°17′–39°34′N). From each monthly catch, a random subsample of 49 to 72 individuals (average: 62) was selected to ensure unbiased representation and consistent temporal coverage throughout the study period. During the study period, water temperature, pH, and salinity were measured monthly using a Hach HQ40d multiparameter device. Species identification was based on diagnostic morphological traits, including eye diameter, length of the accessory lateral line, and height of lateral line scales (Bini, 1968; Fischer *et al*., 1987) (Fig. 1). Since the specimens were obtained from commercial fisheries without any experimental manipulation, ethical approval was not required.

Total fish length (TL) was measured to the nearest 0.1 cm, from the anterior tip of the longest jaw to the posterior end of the caudal fin, using a digital calliper. Total weight (TW) was recorded to the nearest 0.01 g using an electronic balance. Sex was determined in all individuals by macroscopic examination of the gonads and classified based on the maturity scale defined by Holden & Raitt (1974).

Sex ratio was calculated as the ratio of females to males, monthly. Differences between the observed and expected proportions of females and males were tested using the chi-square (χ^2) formula:

$\chi^2 = \sum (O\text{-}E)^2/E$,

where:

χ^2 = Chi-square statistic

O = observed values

E = expected values

The null hypothesis (H_0), stating that there is no difference between the proportions of females and males, was tested at a significance level of $p < 0.05$ (Zar, 1996).

The gonadosomatic index (GSI) was calculated according to the equation:

$GSI = (GW/SW) \times 100$

where GW is gonad weight and SW is somatic weight (gonad free-weight) of the specimens, both recorded in grams (Avşar, 2016).

Fulton's condition factor (CF) was calculated separately for each sex as:

$CF = (TW/ TL^3) \times 100$, where TW is total weight (g) and TL is total length (cm) (Sparre & Venema, 1992).

The spawning period was determined based on the occurrence of gonads in mature stages (III and IV) and analyses of monthly variation in maturity-stage proportions and GSI values. In addition, the monthly percentages of each maturity stage were calculated.

Length at 50% maturity (L_{50}) was estimated by fitting maturity ogives using a log-logistic (Gompertz-type) model. The proportion of mature individuals (stages III–V) relative to immature ones (stages I–II) was calculated within 1-cm TL intervals, separately for each sex during the reproductive period. L_{50} was estimated based on the double-log function described by Ilkyaz *et al.* (1998). The equations applied were:

$r(TL) = \exp[-\exp(-(a + bTL))]$

$L_{50} = [-\ln(-\ln(0.5)) - a] / b$

where r(TL) is the proportion of mature individuals at a given TL, L_{50} is the estimated length at which 50% of individuals are mature, and *a* and *b* are the intercept and slope of the function, respectively. Although logistic regression is commonly used for maturity estimation, this

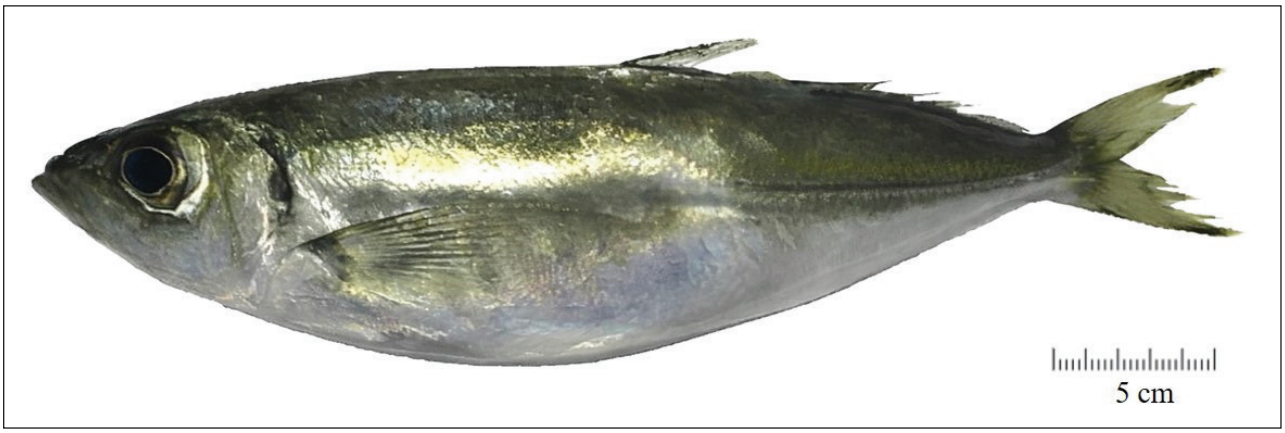


Fig. 1: General appearance of** T. mediterraneus **(Photo: Gülçin Ulunehir Aydın).
Sl. 1: Splošni videz vrste** T. mediterraneus **(Foto: Gülçin Ulunehir Aydın).

approach was chosen due to its robust fit to the observed data and its frequent use in regional studies.

Total fecundity, defined as the total number of mature oocytes ready for spawning within a single reproductive cycle, was estimated for 169 mature female specimens using the gravimetric method (Bagenal & Tesch, 1978; Bithy *et al.*, 2012). To account for potential variability within the ovary, oocytes were randomly sampled from three regions of the ovarian lobes: anterior, middle, and posterior. Each subsample was carefully dissected, and oocytes were separated individually using fine needles under a stereomicroscope to ensure accurate counting. The number of oocytes in each subsample was counted, and fecundity for each subsample was subsequently calculated using the following formula (Karlou-Riga & Economidis, 1997):

$F_s = (n \times GW) / w$

where:

F_s = fecundity of subsample

n = number of oocytes in subsample

GW = gonad weight

w = weight of subsample

Total fecundity (F) for each fish was calculated by averaging fecundity estimates obtained from the three subsamples, as expressed by:

$F = (F_1 + F_2 + F_3) / 3$

where F_1, F_2, and F_3 represent fecundity estimates from the anterior, middle, and posterior ovarian regions, respectively. This approach ensures a representative estimate of total fecundity, reflecting the reproductive potential of individual females during the spawning season.

Regression analysis was used to evaluate the relationships between total fecundity (F) and both total length (TL) and total weight (TW) in female fish. A linear regression model was applied to describe the relationship between fecundity and total weight, while a power function model ($F = a \times TL^b$) was used for the fecundity–length relationship. Model performance was evaluated using the coefficient of determination (R^2) to assess the strength of the relationships between variables. Among several tested models (including linear, logarithmic, exponential, and power functions), the selected models were those providing the best fit based on R^2 values and visual inspection of residuals. All statistical analyses were conducted using Jamovi 1.6.23, Microsoft Excel 2013, and PAST 4.03.

RESULTS

The present study focused on the reproductive biology of Mediterranean horse mackerel from Edremit Bay. Length–frequency distributions for females, males, and the combined sample are presented in Figure 2. Female total lengths ranged from 11.15 to 34.9 cm, male total lengths from 11.19 to 34.9 cm, and overall total lengths from 11.15 to 34.9 cm. No statistically significant differences were observed between females and males with respect to mean total length and mean total weight (*t*-test, $p > 0.05$).

A total of 754 specimens, including 323 males and 431 females, were collected during the study period. The overall sex ratio deviated significantly from the expected 1:1 proportion (F:M = 1.33:1; $\chi^2 = 15.46$; $p < 0.05$). Monthly variation of sex ratio is shown in Figure 3. Females generally predominated throughout the study period, except in September, when males were more abundant. Statistically significant deviations from the expected 1:1 sex ratio were observed only in March (F:M = 2.44:1; $\chi 2 = 9.62$; $p < 0.05$), October (F:M = 2.13:1; $\chi 2 = 9.72$; $p < 0.05$) and November (F:M = 1.62:1; $\chi 2 = 4.26$; $p < 0.05$).

The monthly variation in maturity stages is presented in Figure 4. While stages III, IV, and early stage V, as well as the sex of each specimen, were readily determined, identification of stages I, II, and late stage V proved more

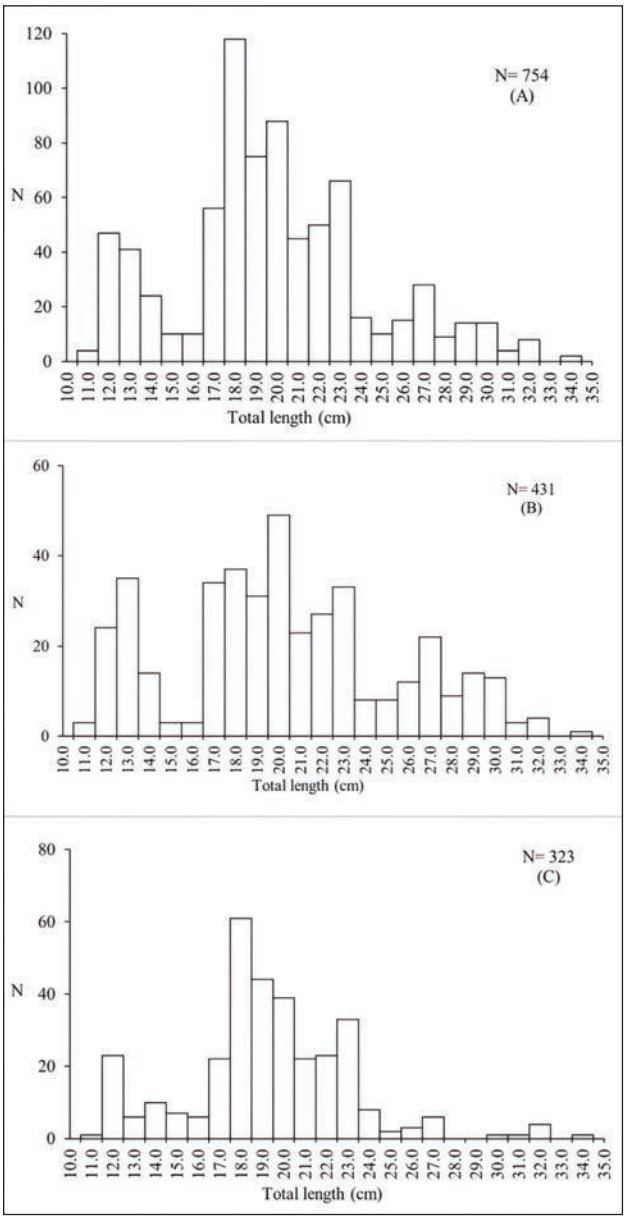


Fig. 2: Total length–frequency distribution of all individuals (A), females (B), and males (C) for *T. mediterraneus* ***in Edremit Bay.***
Sl. 2: Velikostna porazdelitev vseh osebkov (A), samic (B) in samcev vrste *T. mediterraneus* ***v Edremitskem zalivu.***

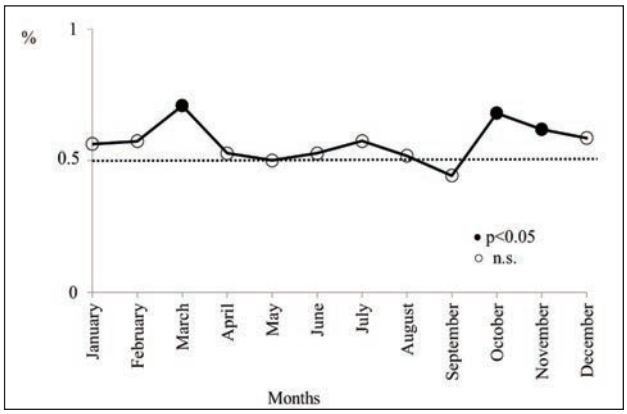


Fig. 3: Monthly sex ratio of T. mediterraneus (• statistically significant deviation from the 1:1 ratio, ∘ not significant) in Edremit Bay.
Sl. 3: Mesečno razmerje med spoloma pri vrsti T. mediterraneus (• statistično značilno odstopanje od razmerja 1:1, ∘ ni značilno) v Edremitskem zalivu.

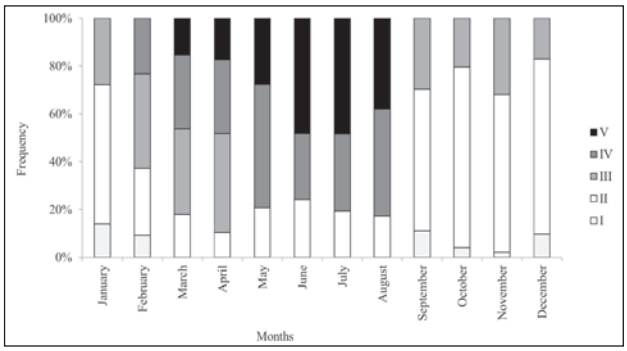


Fig. 4: Monthly percentage distribution of maturity stages of female *T. mediterraneus* ***in Edremit Bay.***
Sl. 4: Mesečna porazdelitev razvojnih stopenj pri samicah vrste *T. mediterraneus* ***v Edremitskem zalivu (v odstotkih).***

difficult. In these stages, the gonads were very small, and the distinction between male and female gonads could not be reliably determined.

The size at which 50% of the female *T. mediterraneus* population reached sexual maturity (L_{50}) was calculated as 18.6 cm using on a Gompertz-type model (Fig. 5).

The gonadosomatic index (GSI) revealed that the reproductive season extended from March to August, peaking in April (Fig. 6). The highest mean female GSI value (%) was recorded in April (4.112%), the lowest in August (0.375%). Differences in monthly GSI values were statistically significant (d.f.: 11,742; F = 103.835; $p < 0.001$; one-way ANOVA). During the same period, sea surface temperature exhibited a seasonal increase, from 14.0 °C in winter to 22.5 °C in summer. Dissolved oxygen concentrations were highest in winter and early spring (11.5–12.6 mg L^{-1}) and decreased during summer (7.1–7.5 mg L^{-1}). Salinity remained relatively stable throughout the study period, varying within a narrow range of 36.0 to 39.0‰ (Fig. 6).

As shown in Figure 7, the highest and lowest average monthly CF values for females were found in July (1.203) and March (0.883), respectively. Similarly, the highest and lowest average monthly CF values for males were observed in August (1.309) and April (0.818),

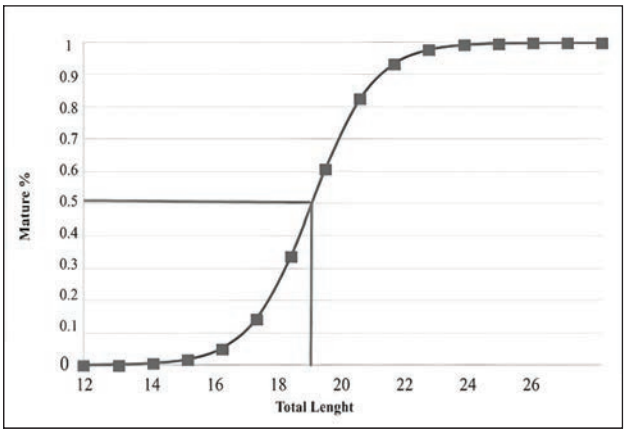


Fig. 5: Length at first sexual maturity of female T. mediterraneus in Edremit Bay.
Sl. 5: Dolžina ob prvi spolni zrelosti pri samicah vrste T. mediterraneus v Edremitskem zalivu.

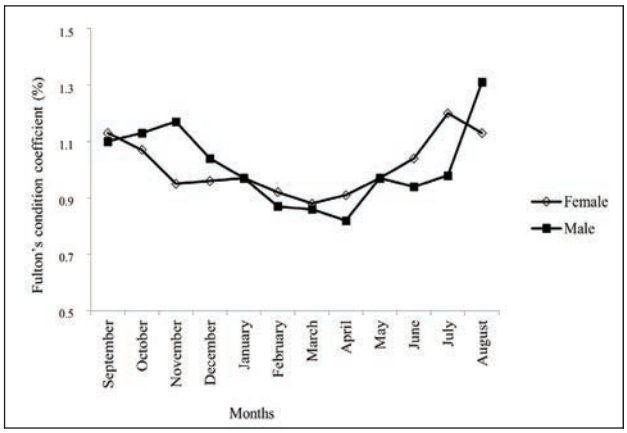
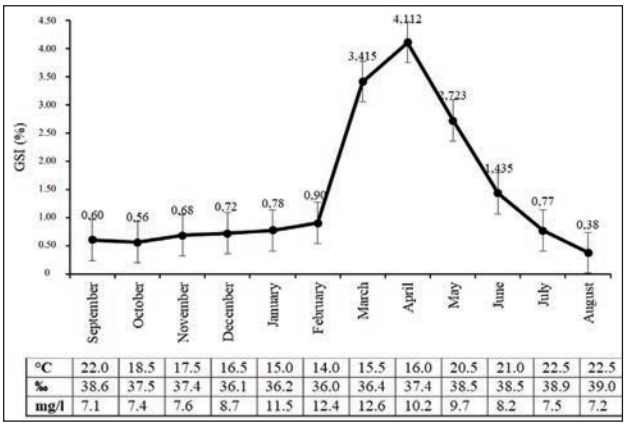


Fig. 7: Monthly variation in Fulton's condition factor of female and male** T. mediterraneus **in Edremit Bay.
Sl. 7: Mesečna dinamika Fultonovega indeksa kondicije pri samicah in samcih vrste** T. mediterraneus **v Edremitskem zalivu.



°C	22.0	18.5	17.5	16.5	15.0	14.0	15.5	16.0	20.5	21.0	22.5	22.5
‰	38.6	37.5	37.4	36.1	36.2	36.0	36.4	37.4	38.5	38.5	38.9	39.0
mg/l	7.1	7.4	7.6	8.7	11.5	12.4	12.6	10.2	9.7	8.2	7.5	7.2

Fig. 6: Monthly variation in gonadosomatic index of female** T. mediterraneus **in Edremit Bay, along with monthly mean sea surface temperature, salinity, and levels of dissolved oxygen.
Sl. 6: Mesečno spreminjanje gonadosomatskega indeksa pri samicah vrste** T. mediterraneus **v Edremitskem zalivu, skupaj s povprečno mesečno površinsko temperaturo morja, slanostjo in nivoji raztopljenega kisika.

respectively. Differences between monthly CF values were statistically significant (d.f.: 11,742; F: 7.956; $p < 0.001$; one-way ANOVA).

Total fecundity of T. mediterraneus ranged from 2,738 eggs (TL = 12.1 cm, TW = 22.29 g) to 48,315 eggs (TL = 32.9 cm, TW = 245.78 g). The results indicated a significant positive relationship between total fecundity and both total length and total weight in mature females (Fig. 8). The relationships were described by the following equations: $F = 151.05 \times TW + 4919.8$ ($R^2 = 0.9796$); $F = 6.005 \times TL^{2}.63$ ($R^2 = 0.9255$). These findings indicate a strong size-dependent increase in fecundity.

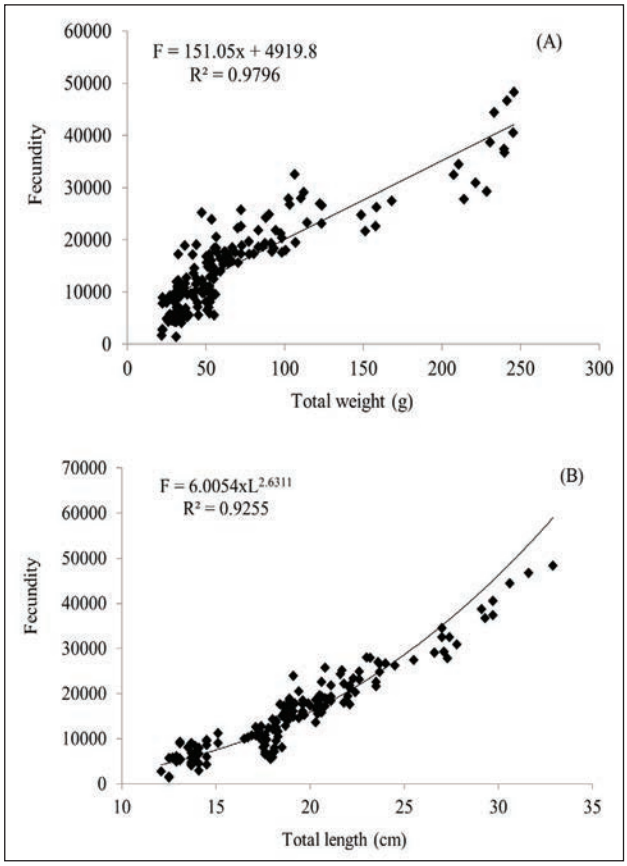


Fig. 8: Relationships between total fecundity and total weight (A) and total length (B) in female T. mediterraneus in Edremit Bay.
Sl. 8: Razmerje med celotno plodnostjo in celokupno maso (A) ter totalno dolžino (B) pri samicah vrste T. mediterraneus v Edremitskem zalivu.

DISCUSSION

This study provides the first comprehensive data on the reproductive biology of *T. mediterraneus* in Edremit Bay, establishing fundamental biological parameters for population assessment and management. A total of 754 specimens of were examined. Length–frequency distributions are presented in Figure 1, with TL ranging from 11.5 to 34.9 cm in females, 11.9 to 34.9 cm in males, and 11.5 to 34.9 cm for all individuals combined. As shown in Table 1, the size range observed in the present study generally differs from those reported for several other regions. However, comparable size distributions have been documented in the Adriatic Sea (Viette *et al*., 1997; Jardas *et al*., 2004; Šantić *et al*., 2006, 2011; Pešić *et al*., 2012). These variations in size may be attributed to environmental factors such as temperature, organic matter availability, feeding regime, capture time, stomach fullness, disease status, and parasitic burden (Ahamed *et al*., 2018).

The sex ratio (F:M) in the present study was skewed in favour of females (1.33:1) throughout the study period, except in September (Fig. 2). Although the sex ratio in most fish species is typically close to 1:1, it may vary among species and populations of the same species, and fluctuate temporally within a population (Nikolsky, 1980). As indicated in Table 1, the predominance of females observed in the present study is consistent with findings from previous studies on T. mediterraneus populations, including those from the Adriatic and Black Seas (Jardas *et al*., 2004; Šantić *et al*., 2006, 2011; Pešić *et al*., 2012; Yankova *et al*., 2009; Demirel & Yüksek, 2013). This female dominance has been attributed to factors such as longer lifespan in females, earlier and more readily identifiable ovarian development compared to testes, and sex-specific migratory behaviour (Khemiri & Gaamour, 2009).

Mature females (stages III–V) were observed throughout the year, suggesting a prolonged spawning period for Trachurus mediterraneus in Edremit Bay (Fig. 3). This reproductive strategy enhances annual egg production (Burt *et al*., 1988) while also reducing susceptibility to fishing pressure (Lowerre-Barbieri *et al*., 1998). Given these advantages, accurate estimation of size at first sexual maturity (L_{50}) is essential for effective stock management. In the present study, L_{50} for female T. mediterraneus in Edremit Bay was estimated at 18.6 cm TL (Fig. 4). This value, while higher than recent estimates reported for the western Mediterranean (13.8–17.7 cm TL; Rodríguez-Castañeda *et al*., 2022), falls within the broader range documented for Mediterranean populations (15.7–22.5 cm TL; Ragonese *et al*., 2002; Samia *et al*., 2002), indicating marked intraspecific variability (Table 2). Notably, the L_{50} estimated for Edremit Bay is substantially higher than values reported from the Sea of Marmara (12.2–12.5 cm TL; Demirel & Yüksek, 2013), a semi-enclosed basin characterised by restricted water exchange and distinct hydrographic conditions that may promote earlier sexual maturation at smaller body sizes. In contrast, the more open and stable environmental conditions in Edremit Bay, including higher winter temperatures and elevated levels of dissolved oxygen, likely support sustained somatic growth and delayed maturation, resulting in sexual maturity at larger body sizes.

Judging from gonadosomatic index (GSI) values and maturity stage analyses (Figs. 3 and 5), spawning of Trachurus mediterraneus in Edremit Bay occurs between March and August, with a pronounced peak in April. This spawning period is generally consistent with those reported from several other Mediterranean regions, whereas studies conducted in the Black Sea and the Marmara–Black Sea transition zone indicate a shorter and temporally shifted reproductive season (*e.g.*, Demirel & Yüksek, 2013; Tab. 3). These differences suggest that the onset, duration, and termination of the reproductive period in *T. mediterraneus* may vary geographically in response to local environmental conditions. As noted by Nikolsky (1980), reproductive timing in fish populations is influenced by multiple environmental factors, including hydrological regime, temperature, and food availability. In this context, the earlier onset and longer duration of the spawning period observed in Edremit Bay likely reflect favourable environmental conditions in the northern Aegean Sea. In particular, relatively high levels of dissolved oxygen recorded between January and April coincide with the pre-spawning and early spawning phases, suggesting enhanced physiological readiness for reproduction. Together with the progressive increase in seawater surface temperature, these conditions are likely to improve feeding efficiency and energy allocation toward gonadal development, thereby promoting earlier onset and prolonged reproductive activity, as reflected in elevated GSI values.

The calculated monthly condition factor (CF) values for the Mediterranean horse mackerel are presented in Figure 6. CF is an index reflecting the combined effects of biotic and abiotic factors on the physiological condition of fish. It is generally correlated with monthly variations in gonadosomatic index (GSI) (Avşar, 2016). As shown in Figures 5 and 6, CF increased from April onwards, peaking in July and August, which indicates an inverse relationship with GSI. Lower CF values coincided with higher GSI values, suggesting that CF may reflect reproductive activity in T. mediterraneus in Edremit Bay.

In this study, total fecundity was found ranging from 2,738 to 48,315 eggs in fish with total lengths between 12.1 and 32.9 cm and total weights between 22.29 and 245.78 g. These results differ from those of previous studies that estimated batch fecundity (*i.e.*, the number of eggs released per spawning event). Pora (1979) reported batch fecundity values ranging from 2,369 to 46,200 eggs in fish with fork lengths of 11.8 to 19.5 cm from the Black Sea. Similarly, Demirel & Yüksek (2013) reported batch fecundity values between 1,058 and 28,116 eggs

Tab. 1: Total length, total weight, and sex ratios of** Trachurus mediterraneus **in the present and previous studies.
Tab. 1: Totalna dolžina, celokupna masa in razmerja med spoloma pri vrsti** Trachurus mediterraneus **v pričujoči in predhodnih raziskavah.

Reference	N	TL (cm)	TW (g)	(F:M)	Locality
Viette *et al.* (1997)	482	9.8-38.3	-	-	Adriatic Sea
Merella *et al.* (1997)	232	3.9-24.4	-	-	Balear Islands
Karlou-Riga (2000)	1325	5.6-39.3	-	1.00:1	Aegean Sea
Moutopoulos & Stergiou (2002)	191	17.3-34.1	-	-	Aegean Sea
Koutrakis & Tsikliras (2003)	21	11.7-25.7			Aegean Sea
Jardas *et al.* (2004)	237	11.7-36.8	-	1.04:1	Adriatic Sea
Šantić *et al.* (2006)	1245	14.8-39.1	20.6-485.1	1.05:1	Adriatic Sea
Karakulak *et al.* (2006)	31	14.2-26.6	-	-	Aegean Sea
Sangun *et al.* (2007)	373	7.0-19.1	2.46-60.59	-	Mediterranean
Cherif *et al.* (2007)	182	8.8-30.0	-	-	Tunisia
Bostancı (2009)	791	-	4.10-466.9	-	Marmara Sea
Yankova *et al.* (2009)				1.36:1	Black Sea
Šantić *et al.* (2011)	1411	9.2-37.9	7.9-466.0	1.10:1	Adriatic Sea
Atılgan *et al.* (2012)	439	7.7-31.0	3.97-47.46	-	Black Sea
Pešić *et al.* (2012)	730	8.9-31.3	-	1.59:1	Adriatic Sea
Kasapoğlu & Düzgüneş (2013)	624	6.2-19.5	1.71-64.30	-	Black Sea
Demirel & Yüksek (2013)	1224	13.5-19.4	-	1.22:1	Marmara-Black Sea
This study	754	11.5-34.9	22.29- 300.5	1.33:1	Northern Aegean Sea

for specimens measuring 13.5–19.4 cm in total length. In a separate study, Karlou-Riga (1995) reported batch fecundity values between 17,977 and 155,747 eggs for fish with ovary-free weights ranging from 93 to 366 g. The relatively higher fecundity values observed in the present study may be attributed to the broader size range of sampled individuals and the estimation of total fecundity rather than batch fecundity. Variation in fecundity among populations may be influenced by environmental factors such as temperature, sunlight, and weather conditions, with temperature likely representing the primary selective driver (Jonsson & Jonsson, 1999; Bithy *et al.,* 2012).

Regression analyses showed that the relationship between total fecundity and total weight was best described by a linear model, while a power function model was the best fit for the relationship between total fecundity and total length (Fig. 7). The fecundity–weight relationship exhibited a higher coefficient of determination (R^2 = 0.9796) compared to the fecundity–length relationship (R^2 = 0.9255), indicating a stronger association between fecundity and body mass. These findings are consistent with the biological principle that reproductive potential is more closely related to somatic energy reserves than to linear size. This pattern has also been observed in other teleost species. For instance, Fasya (2022) reported that in Betta species, the relationship between fecundity and total weight (R^2 = 0.9319) was significantly stronger than the relationship with total length (R^2 = 0.1664). Overall, these findings support the idea that body weight is as a more reliable predictor of fecundity, likely because it better reflects the energetic resources available for oocyte production.

CONCLUSIONS

This study provides the first comprehensive data on the reproductive biology of Trachurus mediterraneus in Edremit Bay, revealing key biological parameters for population assessment and management. The markedly female-biased sex ratio, early onset of sexual maturity at 18.6 cm TL, and extended spawning period from March to August—with a peak in April—highlight the species' reproductive capacity and ecological adaptation

Tab. 2: Reported L_{50} values for** Trachurus mediterraneus **from various localities in the present and previous studies.
Tab. 2: Poročane vrednosti L_{50} za vrsto** Trachurus mediterraneus **z različnih lokalitet v pričujoči in predhodnih raziskavah.

Reference	Locality	L_{50} (cm)
Fischer *et al*. (1987)	Mediterranean Sea	23
Karlou-Riga (1995)	Saronikos Gulf	20
Viette *et al*. (1997)	Adriatic Sea	16
Ragonose *et al*. (2002)	Central Mediterranean Sea	17.1-22.5
Samia *et al*. (2002)	Tunisian	15.7
Demirel & Yüksek (2013)	Marmara-Black Sea	12.2-12.5
Rodríguez-Castañeda *et al*. (2022)	Spanish Mediterranean	13.8-17.7
This study	Northern Aegean Sea	18.6

Tab. 3: Spawning seasons (by months) of** Trachurus mediterraneus **at various localities in the present and previous studies.
Tab. 3: Obdobja drstenja (po mesecih) za vrsto** Trachurus mediterraneus **na različnih lokalitetah v pričujoči in predhodnih raziskavah.

Reference	Locality	Months											
		J	F	M	A	M	J	J	A	S	O	N	D
Slastenenko (1956)	Marmara Sea				■	■	■	■	■				
Demir (1961)	Black Sea					■	■	■	■				
Fischer *et al*. (1987)	Mediterranean Sea						■	■	■				
Karlou-Riga (1995)	Saronikos Gulf				■	■	■	■	■	■			
Ünlüata *et al*. (1996)	Black Sea					■	■	■	■				
Viette *et al*. (1997)	Adriatic Sea					■	■	■	■	■	■		
Nannini *et al*. (1997)	Tyrrhenian Sea				■	■	■	■	■	■	■		
Karlou-Riga (2000)	Aegean Sea				■	■	■	■	■	■			
Ragonose *et al*. (2002)	Mediterranean Sea						■	■	■				
Samia *et al*. (2002)	Tunisian						■	■	■	■	■		
Šantić *et al*. (2006)	Adriatic Sea					■	■	■	■				
Şahin *et al*. (2009)	Black Sea							■	■	■			
Demirel & Yüksek (2013)	Marmara-Black Sea					■	■	■	■	■			
Melendez *et al*. (2017)	Alboran Sea					■	■	■	■				
Rodríguez-Castañeda *et al*. (2022)	Spanish Mediterranean					■	■	■	■				
This study	Northern Aegean Sea			■	■	■	■	■	■				

in the region. The inverse relationship between the gonadosomatic index and condition factor further confirms a distinctly seasonal reproductive cycle. Additionally, the strong correlations between batch fecundity and both total length and total weight indicate that body size is a reliable predictor of reproductive output.

These findings provide essential baseline information that can contribute to improved stock assessment models and the development of sustainable fisheries management strategies. Future research should aim to expand sampling across seasons and geographic regions to refine knowledge of reproductive traits and support more precise fisheries management.

RAZMNOŽEVALNA BIOLOGIJA SREDOZEMSKEGA ŠURA (*TRACHURUS MEDITERRANEUS*) V SKLOPU POPULACIJSKE RAZISKAVE V EDREMITSKEM ZALIVU (SEVERNO EGEJSKO MORJE)

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POZVETEK

*Pričujoča raziskava prinaša vpogled v razmnoževalne značilnosti sredozemskega šura (*Trachurus mediterraneus*) na podlagi analize 754 osebkov, zbranih v Edremitskem zalivu med septembrom 2008 in avgustom 2009. Skupno razmerje med spoloma je odstopalo od pričakovanega razmerja 1:1. Samice so spolno dozorele (L_{50}), ko so dosegle 18,6 cm v dolžino. Pregled gonad in analize gonadosomatskega indeksa so pokazali, da je drstenje potekalo od marca do avgusta, z viškom v aprilu. Fultonov kondicijski faktor je bil obratno sorazmeren gonadosomatskemu indeksu med obdobjem raziskave. Plodnost je bila med 2.738 in 48.315 oocitami in je kazala izrazito pozitivno korelacijo s totalno dolžino in celokupno maso. Te ugotovitve prinašajo ključne informacije o razmnoževalni biologiji te gospodarsko pomembne vrste in lahko prispevajo k trajnostnemu upravljanju njenih populacij v Egejskem morju.*

Ključne besede: *Trachurus mediterraneus*, drstenje, plodnost, Edremitski zalivu

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