



## **Meristic and morphometric characteristics of *Torquigener flavimaculosus* (Hardy et Randall, 1983) from Tobruk coast Mediterranean Sea - Eastern Libyan**

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### **Abstract:**

In this study, 161 *Torquigener flavimaculosus*, from the Tetraodontidae of different sizes were examined to understand their body measurements and countable features. The study was conducted along the Tobruk coast in eastern Libya from January to December 2022. The fish measured between 6.5 to 15.4 cm in length for 70 males and 7.5 to 17.4 cm for 91 females. Their weights ranged from 7.59 to 87.72 grams for males and 11.40 to 124.02 grams for females. The growth pattern showed negative allometry, meaning the fish grew more in length than in weight, with values of 2.739 for males and 2.854 for females. Features like the overall amount of rakers on the gill, rays number in dorsal, pectoral, and caudal fins were counted. The results showed no differences in these features between males and females of *Torquigener flavimaculosus* from the Tobruk coast in the Mediterranean Sea, eastern Libya.



**Keywords:** *Torquigener flavimaculosus*, Morphometry, Meristic characters, Tobruk coast Mediterranean Sea - Eastern Libyan

### **Introduction:**

In fish, identification can be done using two main factors: morphometric and meristic traits. Morphometric methods usually involve measuring certain parts of the fish's body to understand its growth rate. On the other hand, meristic methods involve counting specific features on the fish to figure out its species and group. Additionally, morphometric studies are important for understanding how a species grows and its growth rate, which is crucial for managing and using the species' population wisely. Fish groups can be distinguished by traits derived from environmental influences, genetics. Two physical characteristics that are frequently used to distinguish between various groups of fish that are captured for purpose are morphometrics and meristics (Murta, 2000). According to numerous studies, these characteristics are crucial for differentiating between fish species, sexes, and races (Costa et al., 2003). Using these characteristics, we examined the differences between ♂ and ♀ of the target species, which is located in Tobruk coast. Morphometrics includes characteristics like overall length, head length, eye size, or the proportions between these factors.

Meristic: These are characteristics that are measurable, such scales, gill rakers, fin rays, and similar structures.

### **Materials and Methods:**

#### **Morphometrics:**

In the current study, 91 females (7.5–17.4 cm) and 70 males (6.5–15.4 cm) of *T. flavimaculosus* were picked at random from the Mediterranean, shore of Tobruk, Eastern Libya, between January and December 2022. This subgroup of gonads was used to test the hypothesis that there is no sexual dimorphism in the morphometric and meristic properties of *T. flavimaculosus*. Sex was determined by



macroscopically examining the gonads. Twelve morphometric measures were made on each fish's left side, to the nearest millimeter, with a divide and an accurate measurement tablet (Figure 1).





**Figure 1. Different photo of *T. flavimaculosus* during laboratory measurements from Tobruk coast, Mediterranean Sea, eastern Libya**

**The morphometric measurements included:**

- 1- Length Total (TL)
1. 2. Length Standard (SL)
2. Body Depth (BD)
3. Length of Head (HL)
4. Diameter of the Eye (ED)
5. Postorbital Length (POSL)
6. Length of Pectoral Fin (PFL)
7. Length of Dorsal Fin (DFL)
8. Length of Anal Fin (AFL)
- 10-Caudal Peduncle Depth (CPD)
- 11- Post Dorsal Length (PDL)
- 12- Total Weight (TW).

**The Meristics measurements included:**

*T. flavimaculosus* meristic measurements of 70 ♂ and 91 ♀ were taken into consideration. Meristic counts were noted as follows:

- 1- DFR - Dorsal Fin Rays
- 2- PFR - Pectoral Fin Rays



- 3- CFR - Caudal Fin Rays
- 4- The overall count of gill rakers (TNGR)

Using the formula  $W = a * L^b$ , where W is the total weight in grams (g), L is the total length in centimeters, an is the equation's intercept, and b is its slope, Le Cren (1951) established the length-weight relationship.

## Discussion and Results

### Relationship between length and weight:

Figures 2 and 3 present the findings of the study, which used 161 fish samples (70 males and 91 females) to examine the link between length and weight. The male fish weighed between 7.59 and 87.72 grams and ranged in length from 6.5 to 15.4 cm. The female fish weighed between 11.40 and 124.02 grams and T.L. from 7.5 to 17.4 centimeters. For both boys (2.739) and females (2.854), the relationship's "b" value was below 3, suggesting a predisposition toward negative allometric growth. A t-test was used to compare the total length and weight data for ♂ and ♀, and the findings showed a significant difference at  $p < 0.01$ .

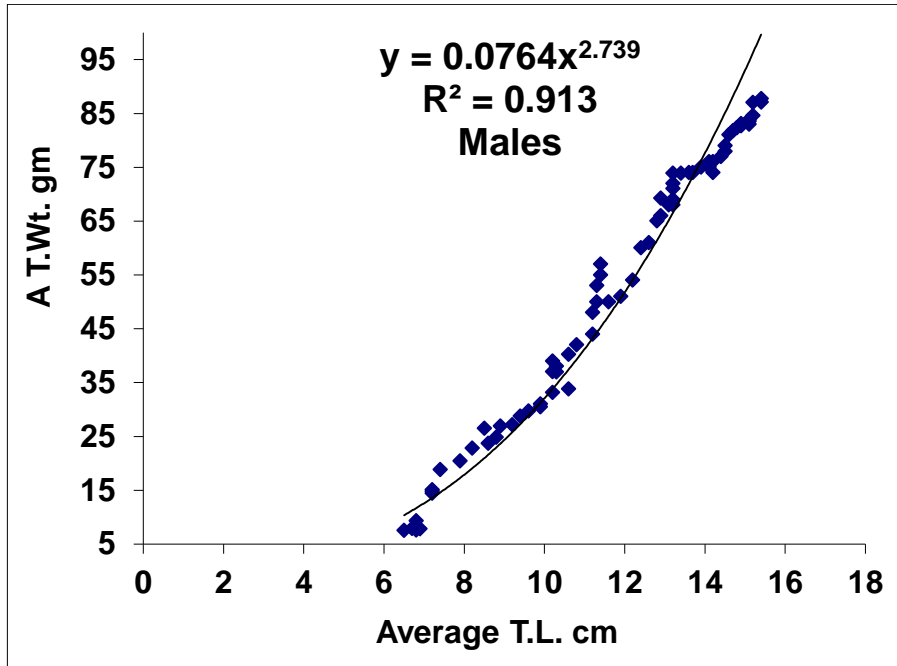
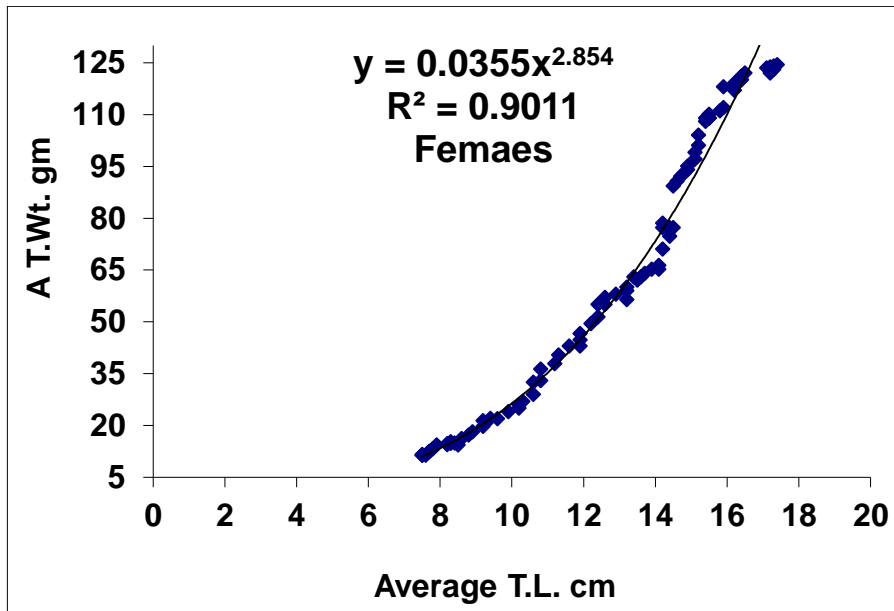


Figure (2). Relationship between 70 male *Torquigener flavimaculosus* from the Tobruk coast's average total weight (grams) and length (cm) between January and December 2022.



**Figure (3). Relationship between 91 female *Torquigener flavimaculosus* from the Tobruk coast's average total weight (grams) and length (cm) between January and December 2022.**

Although it can range from 2.5 to 3.5, The value of the factor  $(b)$  is usually near three (Froese, 2006). For *T. flavimaculosus*\*, this study confirms negative allometry in the length-weight relationship, with  $(b = 2.739)$  for ♂ and  $(b = 2.854)$  for ♀. Erguden et al. (2015) likewise found negative growth  $(b = 2.970)$  in their study in Iskenderun Bay. The Mugla coast also showed negative allometric growth  $(b = 2.836)$ , according to Bilge et al. (2017). However, Ulman et al. (2023) reported  $(b = 3.047)$ , and Ayas et al. (2019) noted positive allometric growth  $(b = 3.326)$  in Mersin Bay. Sample size, fishing techniques, season, fishing pressure, and breeding seasons are some of the variables that may be responsible for these

minor variations (Petrakis and Stergiou, 1995). Furthermore, regional or environmental changes may have an impact on these variations.

**Meristic characters:**

Meristic figures were displayed in Table 1.

Table 1. lists the meristic and morphometric traits of *Torquigener flavimaculosus* that were gathered from the Tobruk coast between January and December of 2022.

Character	Presently reported study Males	Presently reported study Females
Number of specimens	70	91
Total length [TL cm]	6.5 -15.4	7.5 - 17.4
Total weight (TWT gm)	7.59 - 87.72	11.40 - 124.02
Standard length [SL cm]	5.1 – 14.2	6.2 – 16.3
Body Depth [BD cm]	4.18	4.19
Head Length [HL cm]	3.06	3.08
Eye Diameter [ED cm]	0.81	0.81
Postorbital Length [POSL cm]	1.31	1.31
Pectoral Fin Length [PFL cm]	1.32	1.32
Dorsal Fin Depth [DFD cm]	0.47	0.47
Dorsal Fin Length [DFL cm]	1.46	1.46
Anal Fin Length [AFL cm]	1.17	1.17
Caudal Peduncle Depth [CPD cm]	2.48	2.48
Post Dorsal Length [PDL cm]	6.12	6.12
Dorsal Fin Rays Count [DFRC]	9	9



<b>Pectoral Fin Rays Count [PFRC]</b>	<b>15</b>	<b>18</b>
<b>Count of Caudal Fin Rays [CFRC]</b>	<b>7</b>	<b>8</b>
<b>The overall count of gill rakers (TNGR)</b>	<b>66</b>	<b>69</b>

The findings demonstrated that male and female *Torquigener flavimaculosus* do not differ physically. The proportions of the fish in our study did not differ significantly from those of fish from other Mediterranean regions when we evaluated their body sizes and countable traits (Golani, 1987 and Ulman et al., 2023). Because body measures and countable traits can demonstrate changes brought on by the environment, they remain dependable methods for identifying fish species, particularly in the field (Fryer and Iles, 1972). Furthermore, fish populations have been identified and their habitats have been understood thanks to these measurements and characteristics (Ihsen et al., 1981). The body measures and measurable characteristics of *Torquigener flavimaculosus*, which is located along the Tobruk shore in the Mediterranean Sea in Eastern Libya, were the main focus of this study. Fish populations vary in shape and appearance due to a variety of environmental conditions. These variables include water depth, velocity, oxygen content, radiation, temperature, and salt content (Lindsey 1988 and Turan 2000). When comparing groups of the same fish species, these differences—known as phenotypic variants—can include variances in body sizes and countable features (Jayasankar et al. 2004). These characteristics have been widely used to distinguish between various fish groups that are captured for fishing (Murta 2000). Disparities in gender, sources of food, prey of predator-interactions, physical circumstances, and environmental factors all contribute to these variances in body shape and characteristics among fish of the same species (Dasgupta 1991).



**In conclusion,** For both males (2.739) and females (2.854), the exponent "b" in the length-weight relationship was below 3, suggesting a predisposition toward negative allometric growth. Additionally, 12 body measurements and 4 meristic (count-based) measurements revealed no significant differences between males and females of *Torquigener flavimaculosus*. When comparing these measurements with other individuals from the Mediterranean, no noticeable differences in their proportions were observed.

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#### الملخص العربي

في الدراسة الحالية تم تجميع حوالي 161 عينة من اسماك أبو نفاخ الصفراء من عائلة الارنب شملت العديد من الاطوال لدراسة الصفات المورفومترية والميرستية في سحل طبرق شرق ليبيا على البحر المتوسط خلال الفتره من يناير الى ديسمبر 2022 وكان الطول الكلي لعدد 70 ذكر يتراوح بين 6.5-15.4cm وكان الطول الكلي لعدد 91 انثى يتراوح بين 7.5 – 17.4cm وكانت الاوزان بين 7.59-87.72 gm للذكور وبين 11.40-124.02 gm للإناث وكانت العلاقة بين الاطوال والاوزان سالبه حيث كانت قيمة معامل النمو  $b = 2.739$  للذكور وكانت قيمة  $b = 2.854$  للإناث تم حساب الصفات المرستية مثل أشعة الزعنفة الظهرية، وأشعة الزعنفة الصدرية، وأشعة الزعنفة الذيلية، والعدد الإجمالي للخياشيم الخيشومية. أظهرت النتائج عدم وجود ازدواج الشكل الجنسي في *Torquigener flavimaculosus* في ساحل طبرق، البحر المتوسط، شرق ليبيا.