



## Full length article

# Biometric characteristics of *Trachinus araneus* Cuveir, 1829, *Trachinus draco* Linnaeus, 1758 and *Trachinus radiatus* Cuveir, 1829 (Pisces; Trachinidae) from the Egyptian Mediterranean waters

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## ABSTRACT

The biometric characteristics of *Trachinus araneus*, *Trachinus draco* and *Trachinus radiatus* from the Egyptian Mediterranean waters at the West of Alexandria City, were studied. In total, 105, 96 and 55 specimens of these three Fish species were sampled, respectively, by the use of bottom trawls operated in the sectors of El-Dabaa and Sidi Abd El Rahman. The morphological characteristic and related index ratio were determined. The results showed that *T. araneus* total length varied from 10.9 to 30.0 cm TL with mean length of  $19.87 \pm 5.43$  cm TL and a number of horizontal dots appear to be distributed along the lateral line, *T. draco* total length was 11.8 to 27.6 cm TL with a mean length of  $17.85 \pm 4.23$  cm TL, and specimens of this Fish species showed yellow vertical oblique lines on the body. On the other hand, *T. radiatus* is characterized by a total length of 10.6 to 35.0 cm TL with a mean length  $18.04 \pm 4.87$  cm TL, and by circular brown dots spread on the whole body and head. Furthermore, these three Fish species have poisonous spines, one on each operculum, and both spines on the internal border of the dorsal part of each eye orbit. The morphometric regression of each morphometric character showed close agreement between the observed and calculated values.

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## Introduction

Trachinidae are Teleostei fishes of the Perciform Order, which are able to cause painful pricks due to their poisonous spines (IUCN, 2019). They are benthic marine fish species living on sandy or muddy bottoms, particularly on the continental shelf in deeper waters of about 200 m depth, but commonly observed between 20 and 50 m (Azizi et al., 2017; Fischer et al., 1987; Froese & Pauly, 2019; Roux, 1990; Tortonese, 1986).

According to Bentivegna and Fiorito (1983) and Neloson et al. (2016) Trachinidae family is subdivided in two Genera, notably: *Trachinus* and *Echiichthys* that includes nine species. In the present study, genus *Trachinus* is represented by three Fish species. These are *Trachinus araneus*- Cuvier, 1829 (spotted weever), *Trachinus draco*- Linnaeus, 1758 (greater weever), and *Trachinus radiatus*-Cuvier, 1829 (starry weever). Concerning Genus *Echiichthys*, it contains one Fish species, notably *Echiichthys vipra* which was not found in the collected samples in the present study. The three spe-

cies of Genus *Trachinus* are noncommercial fishes which are present in the catches of bottom trawls in the Egyptian Mediterranean waters. Their local name is Ballamah.

It is very important to study the biometry of any Fish species including the morphometric characters and meristic measurements as this helps in Fish identification (Barlow, 1961; Ezzat et al., 1979; Sartimbul et al., 2018; Simon et al., 2010; Uiblein & Heemstra, 2010, 2011; Wadie et al., 1987; Zubia et al., 2015). These parameters are affected by different environmental factors such as temperature, salinity and food availability (Howard, 1954; Lindsey, 1954; Muchlisin et al., 2013; Vladykov, 1934).

Very little is known about the morphometric characters of family Trachinidae. Bentivegna and Fiorito (1983) reported the morphometric characters of four Trachinidae species obtained from Naples and Adriatic Sea. This, in addition to Torcu (2004), who gave some morphometric parameters on *T. draco* in the Marmara Sea. Moreover, Hamed and Chakroun-Marzouk (2016) gave an account on the morphometric characters of four Trachinidae species obtained from the Tunisian Gulf.

According to, Neloson et al. (2016) Family Trachinidae is distributed in the estuaries of the Atlantic, Indian, and Pacific oceans. As mentioned before, this species has no commercial value, but it has significant importance in the food chain and the

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ecosystem balance. The purpose of this study is to highlights the morphometric characteristics of these considered three Fish species.

## Materials and methods

From August 2018 to August 2019, a total of 1051 Trachinidae Fish species samples were obtained monthly by use of bottom trawl operated in the area between El Dabaa at 30° 59' N, 2° 91' E – 29° 08' N, 5° 27' E and Sidi Abd El-Rahman at 31° 08' N, 6° 87' E – 28° 23' N, 2° 12' E, at the West of Alexandria City, Egypt (Fig. 1).

In the laboratory, 256 subsamples of the 1051 caught specimens were identified according to the morphological criteria described in the identification key of Tortonese (1986), Fischer et al. (1987) and Smith (2016). One hundred and five specimens of *Trachinus araneus*, 96 of *Trachinus draco* and 55 of *Trachinus radiatus* were examined.

Seventeen morphometric parameters (Fig. 2) were measured for each specimen to the nearest centimeter (0.01 cm) as follows: total length (TL), standard length (S.L.), pre first dorsal (Pr. DI), post first dorsal (Po. DI), pre second dorsal (Pr. D2), post second dorsal (Po. D2), pre pectoral (Pr. P), pectoral length (P.), pre ventral (Pr. V), pre anal (Pr. A), post anal (Po. A), body depth (B.D.), head length (H.L.), inter orbit (I.O.), eye diameter (E.D.), Maxillary Length (Max. L.), Mandible Length (Man. L.).

The morphometric index to each character was given as percentage to the standard length. ED, IO, Max., and Man. were related to head length by using the following formula, (Table 1).

$$\text{Index range} = (\text{morphometric measurement} / \text{standard length or head length}) \times 100.$$

The linear regression equations were used to obtain the relation between the total length (TL) and each morphometric characters with the exception of eye diameter, inter-orbital, maxillary and mandible which are related to head length (HL) as given in the following equation:

$$Y = a + bx$$

where Y is the variable morphometric character, x is the independent character (total length or head length), a, and b are the constants whose values can be determined by the least square method.

Meristic characters including the number of spines and rays were recorded. Statistical analyses including mean, standard deviation, and correlation coefficient were carried out according to Snedecor and Cochran (1982).

## Results

### Morphological character of *Trachinus* species from the Egyptian Mediterranean waters

#### Spotted weever *Trachinus araneus*- Cuvier, 1829

The body is elongated and slightly compressed (Fig. 3), with total length varying from 10.9 to 30.0 cm TL with mean length of  $19.87 \pm 5.43$  cm TL. First dorsal fin (DI) has 6–7 spines and the first five dorsal spines are covered with black membrane. Second dorsal (D2) has 26–29 rays; pectoral fin (P) has 15 rays; ventral fin (V) has 1 spine and 5 rays and anal fin has (A) 2 spines and 29–31 rays. The color of the body is yellowish brown. The pectoral fin and anal fins are colorless. The edge of the dorsal fin rays is black. The caudal fin is slightly concave with broad blackish edge. *T. araneus* has poisonous spines, one on each operculum, and two spines on the internal border of the dorsal part of each eye orbit. The body has about 13 brown patches along the lateral line and small brown dots distributed above and below it. No space is present between the first dorsal spines and the second dorsal rays. The body depth represents 17.0% of S.L., mandible size 41.6% of H.L., and maxilla size 39.0% of H.L. The margin edge of the head declines downward sharply, and the mouth is directed to open upward in the head.

#### Greater weever *Trachinus draco*- Linnaeus, 1758

The total length is 11.8 to 27.6 cm TL with a mean length of  $17.85 \pm 4.23$  cm TL. The first dorsal fin (D1) has 5–7 spines and second dorsal (D2) has 29–32 rays, while the pectoral fin (P) is characterized by 15 rays. The ventral fin (V) has 1 spine and 5 rays, and anal fin has (A) 2 spines and 27–34 rays (Fig. 4).

The body is elongated and the first 4 dorsal spines are covered with a black membrane. The edge of the second dorsal rays is black.



Fig. 1. Map showing the sampling area (El Dabaa and Sidi Abd El-Rahman) from West of Alexandria City in the Egyptian Mediterranean waters.

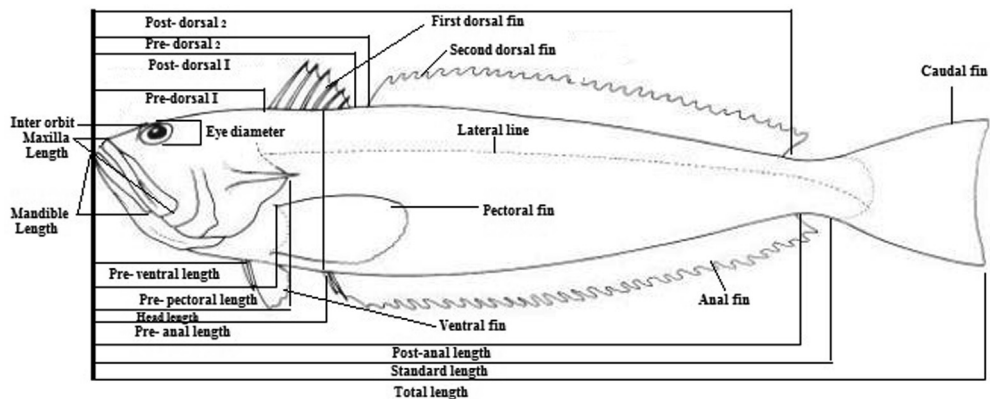


Fig. 2. Morphometric measurements in *T. araneus*, *T. draco* and *T. radiatus*.

**Table 1**  
Index ranges and means values of different morphometric characters of *T. araneus*, *T. draco* and *T. radiatus* sampled from Egyptian Mediterranean waters.

Morphometric characters	<i>T. araneus</i> (No. = 105)		<i>T. draco</i> (No. = 96)		<i>T. radiatus</i> (No. = 55)	
	Index range	Mean $\pm$ s. d.	Index range	Mean $\pm$ s. d.	Index range	Mean $\pm$ s. d.
S. L.	9.9–30.1	17.1 $\pm$ 1.32	10.5–27.1	15.8 $\pm$ 1.32	8.7–28.9	14.74 $\pm$ 1.32
Pr. D1/S. L.	12.2–34.5	20.9 $\pm$ 1.42	12.8–31.9	20.1 $\pm$ 1.30	16.8–48.5	27.5 $\pm$ 1.54
Po. D1/S. L.	19.4–52.3	30.4 $\pm$ 2.06	20.1–49.8	29.8 $\pm$ 1.41	23.6–70.7	38.5 $\pm$ 1.63
Pr. D2/S. L.	19.4–52.3	30.5 $\pm$ 2.06	20.1–49.8	29.8 $\pm$ 1.34	24.2–70.7	38.6 $\pm$ 1.83
Po. D2/S. L.	48.6–147.9	80.7 $\pm$ 2.01	52–135.1	80.6 $\pm$ 2.14	53.9–179	91.3 $\pm$ 1.41
Pr. P./S. L.	15.7–41.9	25.0 $\pm$ 1.27	16.8–39	24.9 $\pm$ 2.59	21–60	34.0 $\pm$ 1.39
P./S. L.	9.9–22.4	14.1 $\pm$ 1.23	9.4–20.9	14.0 $\pm$ 2.85	13.3–50.5	21.0 $\pm$ 1.66
Pr. V./S. L.	13.2–32.2	20.0 $\pm$ 1.52	13.8–34.9	20.1 $\pm$ 1.65	16.8–46.4	26.3 $\pm$ 1.26
Pr. A./S. L.	18.8–50.7	30.2 $\pm$ 1.47	21.1–49.8	29.9 $\pm$ 2.67	22.2–69.3	38.6 $\pm$ 1.53
Po. A./S. L.	51.4–149.3	83.8 $\pm$ 1.61	54.2–144.8	83.8 $\pm$ 1.64	55.2–186	95.0 $\pm$ 1.46
B. D./S. L.	11.6–25.9	16.8 $\pm$ 1.12	12.2–27	16.6 $\pm$ 2.12	12.8–48.5	24.4 $\pm$ 1.14
H. L./S. L.	12–40.7	23.9 $\pm$ 1.51	17.7–39.2	24.3 $\pm$ 1.53	19.9–59.2	32.3 $\pm$ 1.53
E. D./H. L.	12.2–28.9	18.5 $\pm$ 1.28	15.9–29.3	13.7 $\pm$ 1.19	12.2–30.8	13.3 $\pm$ 1.34
IO./H. L.	4.1–12.4	6.9 $\pm$ 1.164	4.1–12.2	5.4 $\pm$ 1.41	1.8–12.4	2.5 $\pm$ 0.91
Max./H. L.	25.2–58.9	38.9 $\pm$ 1.85	29.8–65.9	35.4 $\pm$ 3.29	26–74.6	30.3 $\pm$ 1.44
Man./H. L.	27.2–61.7	41.6 $\pm$ 3.02	32.7–68.3	38.0 $\pm$ 2.25	29.8–73.2	29.83 $\pm$ 4.13
Meristic Characters	DI: VII ; D <sub>2</sub> :26–29; P: 15; A: II, 29–31; V: 1, 5		DI:V–VII; D <sub>2</sub> :29–32; P: 15; A: II, 27–34; V: I, 5		DI:VI–VII; D <sub>2</sub> :24–29; P: 15; A: II, 25–29; V: I, 5	

s. d. = standard division.

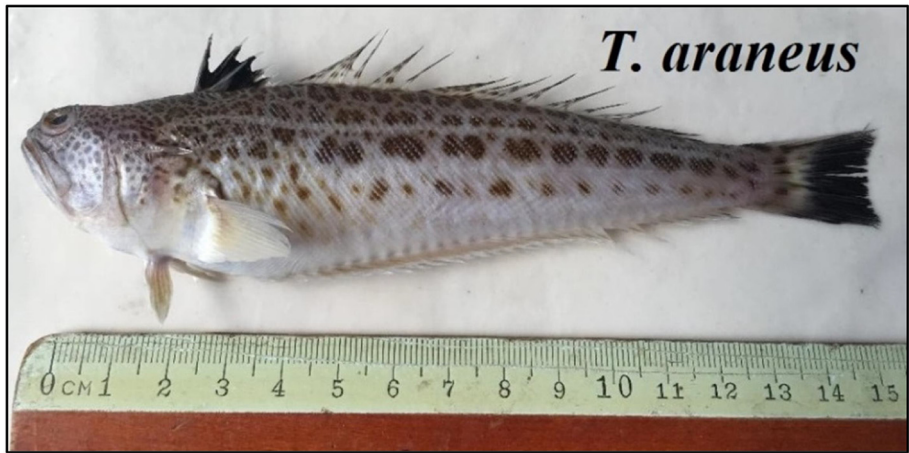


Fig. 3. External feature of *T. araneus* collected from the West of Alexandria in the Egyptian Mediterranean waters.

The caudal fin is slightly concave with black edge. The pectoral and anal fins are colorless. The body is characterized by oblique yellow vertical strikes and a large black spot above the pectoral fin. The eyes are on the upper edge of the head. *T. draco* has poisonous spines, one on each operculum, and two spines on the internal border of the dorsal part of each eye orbit. The head is without brown

spots and with metallic operculum but with irregular yellow lines. The second dorsal fin base (Po. D2 - Pr. D2) is about 81.0% S.L.; the base of anal fin (Po. A. and Pr. A.) is about 51.0% S.L.; the body depth (B. D.) is about 16.6% S. L.; the inter orbit distance (I. O.) represents about 5.4% H. L. The mandible size is slightly larger than the max-





Fig. 4. External feature of *T. draco* collected from the West of Alexandria in the Egyptian Mediterranean waters.

illa size which is about 38.0% of H. L. and 35.0% of H. L., respectively. Consequently, *T. draco* mouth is opened directed upward.

#### Starry weever *Trachinus radiatus*- Cuvier, 1829

*T. radiatus* is characterized by total length of 10.6 to 35.0 cm TL with a mean length  $18.04 \pm 4.87$  cm TL. The body is elongated (Fig. 5A, B). The first dorsal fin (D1) has 6–7 spines and the second dorsal (D2) has 24–29 rays; the pectoral fin (P) has 15 rays; the ventral fin (V) has one spine followed by 5 rays and the anal fin has (A) 2 spines and 25–29 rays. The first four dorsal spines are covered by a black membrane. The edge of the second dorsal rays is black.

Body coloration is yellowish and characterized by the presence of circular brown dots distributed from the beginning of the head till the caudal fin. There is no black spot above the pectoral fin.

The roof of head has oriented rays in fan like structure behind each eye (rough bony crests). *T. radiatus* has poisonous spines, one on each operculum, and two spines on the internal border of the dorsal part of each eye orbit. The ventral and anal fins are colorless. The caudal fin has straight edge with black color.

#### Morphometric indices

The index ranges for the three species *T. araneus*, *T. draco* and *T. radiatus* given in Table 1 shows the main differences between them through the following items:

- a. The eye diameter in *T. draco* and *T. radiatus* is about 13.3 and 13.7% H. L. respectively and is smaller than in *T. araneus* (18.5% H. L.);

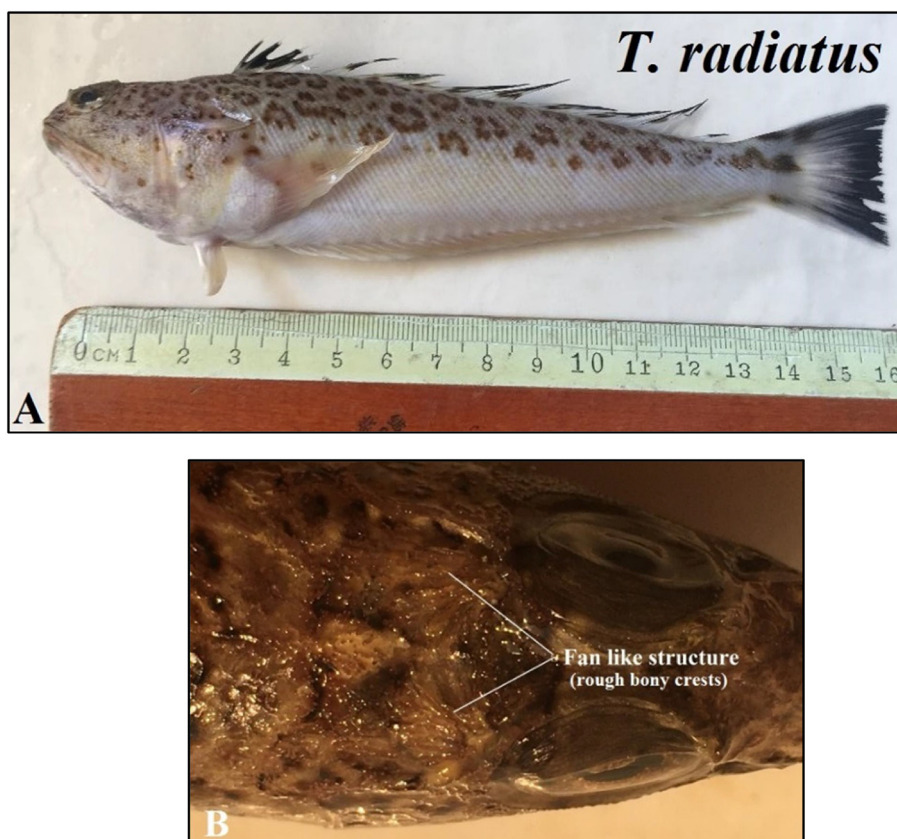


Fig. 5. External feature (A) and (B) fan like structure (rough bony crests) of *T. radiatus* collected from the West of Alexandria in the Egyptian Mediterranean waters.

- The inter-orbit (I. O.) in *T. radiatus* (2.5% H. L.) is much smaller than *T. araneus* and *T. draco* (6.9 and 5.4% of H. L. respectively);
- The body depth in *T. araneus* and *T. draco* has nearly the same proportion (about 7.0% S. L.), while it is large in *T. radiatus* (about 24.4% S. L.);
- The mandible (Man.) size in *T. araneus* (41.6% H. L.) and in *T. draco* (38.0% H. L.) are larger than that of *T. radiatus* (29.8% of H. L.);
- The mandible and maxilla in *T. radiatus* have the same size (29.8% H. L.) and the mouth opening is terminal. The base of the first dorsal fin spines is nearly the same for the three fish species (10.0–11.0% S. L.);
- The anal fin base (i.e. Po. A. – Pr. A.), has nearly the same proportion (54.5% S. L.) in *T. araneus* and *T. draco*, whereas for *T. radiatus* it is about (56.0% S. L.).
- The pectoral fin length in *T. araneus* and *T. draco* represents 14.0% S. L., whereas it is about 21.0% S. L. for *T. radiatus*.

### Morphometric regressions

The regression constants a and b and the correlation coefficient  $r^2$  for each morphometric character in *T. araneus*, *T. draco* and *T. radiatus* are given in Table 2. Table 3 shows the mean observed, and mean calculated for each morphometric character for *T. araneus* (Fig. 6A and B), *T. draco* (Fig. 7A and B) and *T. radiatus* (Fig. 8A and B). It is clear, that the observed and calculated values are similar to each other.

### Discussion

The most common *Trachinus* species in the Egyptian Mediterranean waters at the West of Alexandria City in El- Dabaa and Sidi Abdel- Rahman are the spotted weaver (*Trachinus araneus*- Cuvier, 1829), the greater weaver, (*Trachinus draco*- Linnaeus, 1758), and the starry weaver (*Trachinus radiatus*- Cuvier, 1829).

The first considered Fish species *Trachinus araneus* is characterized by a total length (TL) ranging from 10.9 to 30.10 cm with mean length  $19.87 \pm 5.43$  cm, the previously recorded maximum total length of this weaver was 50.0 cm (Fischer et al., 1987) in Mediterranean and Black Sea.; whereas it is 45.0 cm (Smith, 2016) in the Eastern Central Atlantic, and 50.0 cm (Hamed &

Chakroun-Marzouk, 2016) in the Tunisian waters. In this study, *Trachinus draco* specimens have total length (TL) ranging from 11.7 to 27.6 cm with mean length: 17.97 cm; whereas its maximum length was 50.0 cm, 23.0 cm, 32.0 cm, 39.6 cm, 26.5 cm, 38.3 cm, 39.0 cm, 20.0 cm, 36.6 cm, 35.0 cm, 25.0 cm, 45.0 cm according to Fischer et al., 1987 in Mediterranean and Black Sea; Abdallah, 2002 in the Egyptian coast of Mediterranean; Moutopoulos & Stergiou, 2002 in the Aegean Sea; Santos et al., 2002 in the Algarve coast of Atlantic (Southern Portugal); Morey et al., 2003 in the Western Mediterranean Coast; Bagge, 2004 in the water of the Kattegat (Denmark); Mendes et al., 2004 in the Portuguese west coast; Sangun et al., 2007 in the Turkish Northeastern Mediterranean; Kinacgil et al., 2008 in the Aegean Sea; Ak, 2009; Ak & Genç, 2013 in the Black Sea; Smith, 2016 in the Eastern Central Atlantic, respectively. In the present work, the *Trachinus radiatus* total length (TL) ranged from 10.6 to 34.7 cm with mean length 18.02 cm. The maximum total length was 50.0 cm, 45.0 cm, 47.0 cm, 40.4 cm as given by Fischer et al., 1987 in Mediterranean and Black Sea; Moutopoulos & Stergiou, 2002 in the Aegean Sea; Morey et al., 2003 in the Western Mediterranean Coast; Smith, 2016 in the Eastern Central Atlantic, respectively.

The three *Trachinus* species are characterized by clear variations in the external features. *T. araneus* has spotted brown dots along its lateral line, while *T. draco* has oblique lines spreading vertically on its body and has black spot above the pectoral fin. As for *T. radiatus*, this Fish species has brown circular dots spreading on its body. Moreover, the three species have poisonous spines, one on each operculum, and two spines on the internal border of the dorsal part of each eye orbit, according to Bentivegna and Fiorito (1983) and Hamed and Chakroun-Marzouk (2016) which is in close agreement with the present study. In addition, the morphometric ratios with standard length declared the separation of each species from each other as the eye diameter Inter-orbit, body depth, pectoral fin length in *T. radiatus* are larger than in both *T. araneus* and *T. draco*. Both mandible and maxilla have the same size in *T. araneus* and *T. draco* showing the mouth to open terminally whereas the mandible size is larger than maxilla in *T. radiatus* whose mouth opening is directed upwards.

There is no variation in morphometric and meristic characters between *Trachinus* species from different parts of the Mediter-

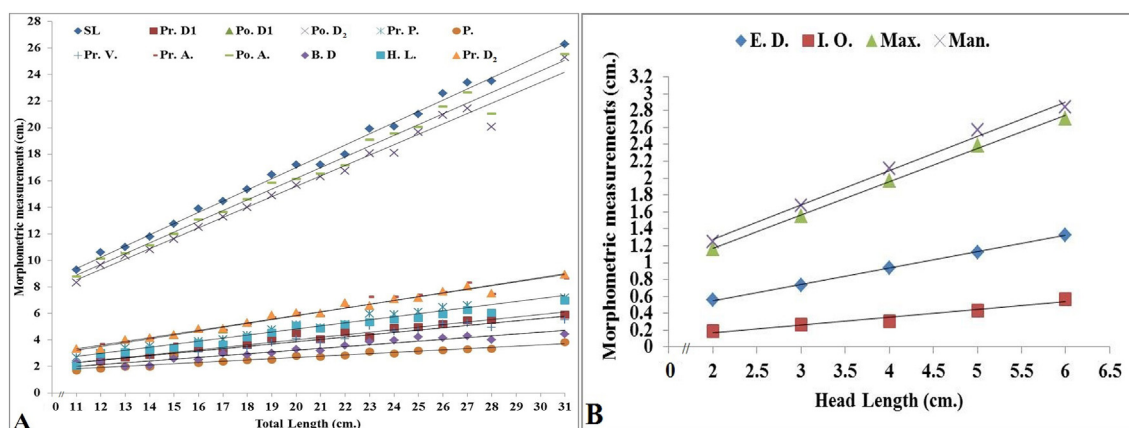
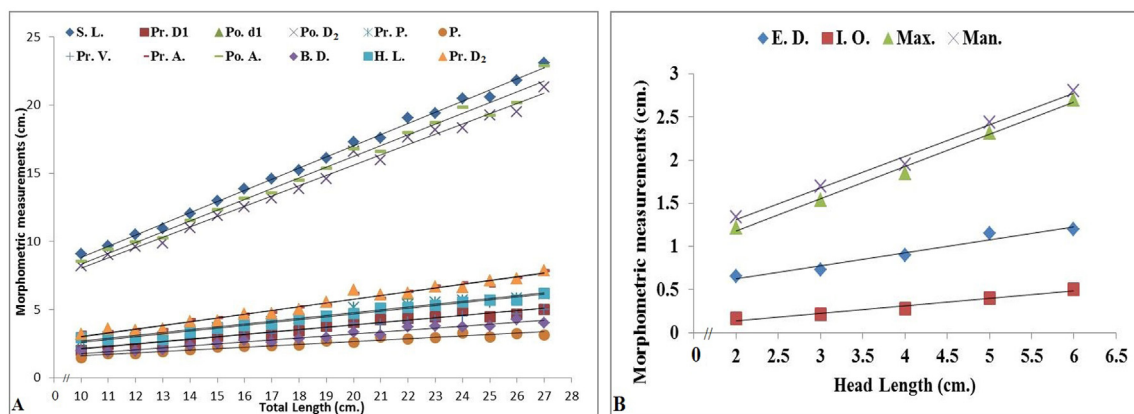
**Table 2**

Regression constants a & b and correlation coefficient  $r^2$  for different morphometric characters of *T. araneus*, *T. draco* and *T. radiatus* collected from the Egyptian Mediterranean waters.

Regression	<i>T. araneus</i>			<i>T. draco</i>			<i>T. radiatus</i>		
	Regression Constant (a)	Regression Coefficient (b)	Correlation Coefficient ( $r^2$ )	Regression Constant (a)	Regression Coefficient (b)	Correlation Coefficient ( $r^2$ )	Regression Constant (a)	Regression Coefficient (b)	Correlation Coefficient ( $r^2$ )
S.L./T. L.	0.13	0.84	1	0.67	0.82	1	-0.08	0.82	1
Pr. D1/T. L.	0.17	0.19	0.97	0.35	0.18	0.96	0.64	0.19	0.98
Po. D1/T. L.	0.24	0.28	0.98	0.26	0.28	0.98	0.52	0.28	0.98
Pr. D2/T. L.	0.24	0.28	0.98	0.26	0.28	0.98	0.6	0.28	0.99
Po. D2/T. L.	-0.07	0.78	0.98	0.53	0.75	0.99	-0.15	0.76	1
Pr. P./T. L.	0.23	0.23	0.95	0.6	0.21	0.98	0.49	0.25	0.99
P./T. L.	0.83	0.09	0.88	0.62	0.1	0.95	0.27	0.16	0.68
Pr. V/T. L.	0.36	0.18	0.94	0.4	0.17	0.95	0.5	0.19	1
Pr. A/T. L.	0.08	0.29	0.96	0.36	0.27	0.98	0.49	0.29	0.98
Po. A/T. L.	0.03	0.81	0.99	0.47	0.79	0.99	-0.57	0.81	1
B. D./T. L.	0.54	0.13	0.93	0.35	0.14	0.97	-0.07	0.2	0.97
H. L./T. L.	0.1	0.23	0.97	0.51	0.21	0.98	0.59	0.23	0.99
E. D./H. L.	0.164	0.193	0.999	0.318	0.152	0.961	0.29	0.15	0.983
I. O./H. L.	-0.014	0.092	0.958	-0.028	0.085	0.968	-0.113	0.084	0.96
Max./H. L.	0.38	0.394	0.998	0.43	0.374	0.994	0.433	0.397	0.991
Man./H. L.	0.462	0.407	0.994	0.366	0.582	0.991	0.657	0.351	0.957

**Table 3**Observed and calculated values of different morphometric characters for *T. araneus*, *T. draco* and *T. radiatus* collected from the Egyptian Mediterranean waters.

Morphometric characters	<i>T. araneus</i>			<i>T. draco</i>			<i>T. radiatus</i>		
	Obs. Mean $\pm$ s. d.	Cal. Mean $\pm$ s. d.	t-test	Obs. Mean $\pm$ s. d.	Cal. Mean $\pm$ s. d.	t-test	Obs. Mean $\pm$ s. d.	Cal. Mean $\pm$ s. d.	t-test
SL	17.1 $\pm$ 4.9	17.1 $\pm$ 4.9	0.13	15.8 $\pm$ 4.37	15.8 $\pm$ 4.36	0.00	16.36 $\pm$ 5.79	16.36 $\pm$ 5.79	-0.71
Pr. D1	4.0 $\pm$ 1.1	4.0 $\pm$ 1.1	0.07	3.6 $\pm$ 0.96	3.6 $\pm$ 0.94	0.01	4.37 $\pm$ 1.33	4.37 $\pm$ 1.32	-1.61
Po. D1	5.9 $\pm$ 1.7	5.9 $\pm$ 1.6	-0.11	5.4 $\pm$ 1.48	5.4 $\pm$ 1.47	0.01	6.18 $\pm$ 2.01	6.18 $\pm$ 1.99	0.96
Pr. D2	5.9 $\pm$ 1.7	5.9 $\pm$ 1.6	0.1	5.4 $\pm$ 1.48	5.4 $\pm$ 1.47	0.01	6.21 $\pm$ 1.99	6.21 $\pm$ 1.98	0.96
Po. D2	15.1 $\pm$ 4.1	15.7 $\pm$ 4.6	0.04	14.5 $\pm$ 4.04	14.5 $\pm$ 4.0	0.09	14.98 $\pm$ 5.33	14.98 $\pm$ 5.32	-1.09
Pr. P.	4.9 $\pm$ 1.4	4.9 $\pm$ 1.3	0.00	4.5 $\pm$ 1.13	4.5 $\pm$ 1.12	0.00	5.48 $\pm$ 1.76	5.48 $\pm$ 1.76	-0.41
P.	2.7 $\pm$ 0.6	2.7 $\pm$ 0.5	0.11	2.5 $\pm$ 0.56	2.5 $\pm$ 0.54	-0.01	3.47 $\pm$ 1.37	3.46 $\pm$ 1.13	-0.01
Pr. V.	3.9 $\pm$ 1.1	3.9 $\pm$ 1.0	-0.19	3.6 $\pm$ 0.95	3.6 $\pm$ 0.93	0.02	4.24 $\pm$ 1.32	4.24 $\pm$ 1.31	-2.80
Pr. A.	5.9 $\pm$ 1.7	5.9 $\pm$ 1.7	3.17	5.4 $\pm$ 1.46	5.4 $\pm$ 1.44	-0.02	6.21 $\pm$ 2.03	6.21 $\pm$ 2.02	-1.22
Po. A.	16.3 $\pm$ 4.7	16.3 $\pm$ 4.7	-0.04	15.1 $\pm$ 4.23	15.1 $\pm$ 4.21	0.00	15.66 $\pm$ 5.76	15.64 $\pm$ 5.71	0.62
B. D.	3.3 $\pm$ 1.61	3.2 $\pm$ 0.8	0.2	3.0 $\pm$ 0.78	3.0 $\pm$ 0.76	-0.01	3.97 $\pm$ 1.45	3.5 $\pm$ 1.41	0.64
H. L.	4.6 $\pm$ 0.8	4.6 $\pm$ 1.3	0.3	4.4 $\pm$ 1.12	4.4 $\pm$ 1.11	0.00	5.19 $\pm$ 1.63	5.19 $\pm$ 1.61	-0.06
E. D.	0.94 $\pm$ 0.31	0.94 $\pm$ 0.31	0.00	0.93 $\pm$ 0.25	0.93 $\pm$ 0.24	0.00	1.04 $\pm$ 0.33	1.04 $\pm$ 0.32	-0.09
I. O.	0.35 $\pm$ 0.15	0.32 $\pm$ 0.15	0.00	0.31 $\pm$ 0.14	0.31 $\pm$ 0.13	0.00	0.31 $\pm$ 0.19	0.31 $\pm$ 0.18	-0.20
Max.	1.96 $\pm$ 0.62	1.96 $\pm$ 0.62	0.00	1.93 $\pm$ 0.59	1.93 $\pm$ 0.59	0.00	2.42 $\pm$ 0.86	2.42 $\pm$ 0.86	0.00
Man.	2.09 $\pm$ 0.65	2.09 $\pm$ 0.64	0.00	2.05 $\pm$ 0.58	2.05 $\pm$ 0.58	0.00	2.41 $\pm$ 0.78	2.41 $\pm$ 0.76	0.00

**Fig. 6.** Relation between the measured morphometric Parameters with Total Length (A) and Head Length (B) for *T. araneus* collected from the Egyptian Mediterranean water.**Fig. 7.** Relation between the measured morphometric Parameters with Total Length (A) and Head Length (B) for *T. draco* collected from the Egyptian Mediterranean water.

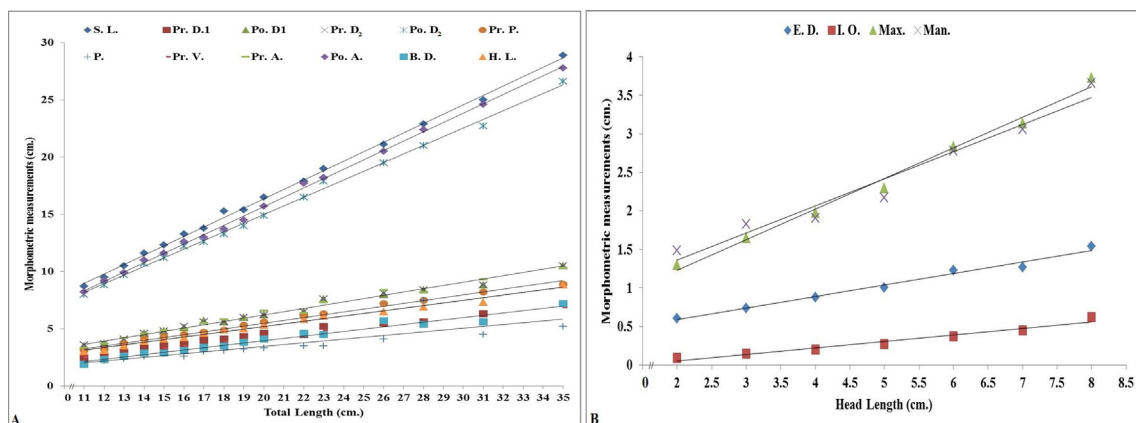


Fig. 8. Relation between the measured morphometric Parameters with Total Length (A) and Head Length (B) for *T. radiatus* collected from the Egyptian Mediterranean water.

Table 4

Variation in the morphometric characters in various geographical locations in the Mediterranean Sea as compared with the other studies areas.

Authors and Location	Bentivegna and Fiorito (1983) (Italy & Adriatic Sea)		Torcu (2004) (MARMARA Sea)		(Hamed & Chakroun-Marzouk, 2016) (Gulf of Tunisia Mediterranean Sea)		Present work			
	Species		Species		Species		Species		Species	
Morphometric characters	<i>T. araneus</i>	<i>T. draco</i>	<i>T. radiatus</i>	<i>T. draco</i>	<i>T. araneus</i>	<i>T. draco</i>	<i>T. radiatus</i>	<i>T. araneus</i>	<i>T. draco</i>	<i>T. radiatus</i>
Orbit edge	with 2 spines	with 2 spines	with 2 spines	–	with 2 spines	with 2 spines	with 2 spines	with 2 spines	with 2 spines	with 2 spines
First dorsal Spines (D <sub>1</sub> )	VII	V–VII	VII	VI	VI–VII	V–VII	VI	VI–VII	V–VII	VI–VII
Second dorsal rays (D <sub>2</sub> )	26–29	29–32	24–27	29	26–29	29–32	24–27	26–29	29–32	24–29
Ventral fin spines	–	–	–	I	–	–	–	I	I	I
Ventral fin rays	–	–	–	5	–	–	–	5	5	5
Anal fin spines	II	II	II	–	II	II	II	II	II	II
Anal fin rays	29–31	28–34	26–29	–	29–31	29–34	26–29	29–31	27–34	25–29
Max. Length	40 cm	40 cm	42 cm	–	50 cm	45 cm	50 cm	30 cm	28 cm	35 cm
Caudal fin	Slightly Concave	Slightly Concave	Straight	–	Broad with black dark spots	–	–	Slightly Concave	Slightly Concave	Straight
Dorsal fin color	Partly black	Partly black	Partly black	–	Yellowish gray	Yellowish	gray or brown	Partly black	Partly black	Partly black
Body characterized by	Variable spots	oblique spots	annular spots	–	brownish or blackish patches	oblique brown, blue, yellow lines	circular brown dots	Variable spots	oblique yellow vertical strikes	circular brown dots
Head characterized by	black dots	brown spots	black dots	–	–	greenish brown back with dark spots	small dots or short dark lines	black brown patches	brown spots	black dots
Body color	Yellowish	greenish	yellowish	–	Yellowish gray	greenish	yellowish brown	Yellowish brown	greenish	yellowish

anean Sea (Italy, Adriatic, Marmara Sea, Tunisia and present study) (Table 4).

## Conclusion

We can conclude that Trachinidae Fish species could be differentiated by their external features and ratio indices. Further, studies should be carried out to know more about the fishery of family Trachinidae in the Egyptian Mediterranean waters, as it plays a vital role in the ecosystem management.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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