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RESEARCH

# Some Notes on Morphometry and Population Biology of Shi Drum *Umbrina cirrosa* Juveniles in the Marmara Sea, Türkiye

**İsmail Burak Daban**[1] · **Yusuf Şen**[2]

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## Abstract

In this study, we revealed ontogenetic development, length–weight relationship, otolith size relationships, otolith shape analyses, spatial distribution of mean abundance and feeding of Shi drum, *Umbrina cirrosa* juveniles in the Marmara Sea, Türkiye. The individuals ranged in total length (TL) between 49.44 mm and 128.46 mm, with a mean of 98.43 ± 5.43 mm; and the specimens were distributed in weight from 1.15 g to 21.51 g, with a mean of 9.63 ± 1.23 g. The total length–weight relationship was calculated as $W = 0.000008xTL^{3.0163}$ and an isometric growth was detected. *U. cirrosa* had relatively large sagittal otoliths, and the otolith size – fish size relationships were detected as linear. The otolith shape analyses showed that the juvenile sagitta shape indices are relatively the same as the adults. Stomach content of juvenile Shi drum contained mostly Amphipoda. The biological data on the early life stages of Shi drum is scarce, and the outputs of the presented data reveal first detailed results.

**Keywords** Otolith · Beach seine nets · Length–weight relationship · Stomach content · Catch per unit effort · *Umbrina cirrosa*

## Introduction

Shi drum, *Umbrina cirrosa* is a member of Sciaenidae family and it is well-known around all Mediterranean and Black Sea, also distributed from southern Morocco to Biscay Bay in the Eastern Atlantic (Chao and Trewavas 1990). The family Sciaenidae had a three species (*Argyrosomus regius*, *Sciaena umbra*, and *Umbrina cirrosa*) in Türkiye waters and Shi drum is distributed all Türkiye Seas (Bilecenoğlu et al. 2014). It has mainly shallower distribution and mostly found over rocky and sandy bottoms (Chao and Trewavas 1990). Although the fisheries worth stated as minor commercial interest, it has relatively high economical value in the fish market in Türkiye. It has mostly caught with spear fishing, in small quantities with trammel nets and rarely seen in the catch composition of the demersal trawls when towed in the banned shallower areas. The landing reports showed that Shi drum caught as 27.6 tonnes in 2022 in Türkiye waters (Tüik 2022). But it should not be forgotten that the un-reported catch data probably higher due to the fish caught by spear fishing sold the restaurants as underhanded. The generation time was reported as 9.5 years, current population trend was identified as decreasing due to the sharp declines of main nations landing this species (Italy and Türkiye) and according to these declines, it is assessed as Vulnerable under criteria A2b on the basis of an inferred population decline of at least 30% within the last three generations (Bizsel et al. 2020).

Captivity studies related reproduction, sperm mobility, culture feeding, photoperiod, ontogeny, genetic etc. constitutes the majority of the studies related Shi drum in the literature (Mylonas et al. 2009; Akpınar et al. 2012; Ayala et al. 2015; Karacaoğlan et al. 2023). Shi drum identified as high potential for aquaculture due to its proper biological specifications for production. The scientific knowledge on population biology of wild stocks is scarce. The feeding type is mainly carnivorous (Chakroun and Ktari 1981), mostly feeds on bentic crustaceans and has relatively high trophic level as 3.41 (Froglia and Gramitto 1998). Individual based maximum length, weight and age records (Cengiz and Paruğ 2020; Aydın and Sözer 2020; Aydın 2021; Tamoikin et al. 2023), and length–weight relationships (Koutrakis

✉ İsmail Burak Daban
burakdaban@gmail.com

[1] Department of Fisheries and Fish Processing, Faculty of Marine Science and Technology, University of Çanakkale Onsekiz Mart, Çanakkale, Türkiye

[2] Department of Marine Biology, Faculty of Marine Science and Technology, University of Çanakkale Onsekiz Mart, Çanakkale, Türkiye

and Tsikliras 2003; Dulčić and Glamuzina 2006; Bolognini et al. 2013; Başusta et al. 2019; Aydın and Sözer 2020), and spawning period (Chao 1986) were studied.

Information on the early life stages of Shi drum is absent both in Türkiye waters and in other seas. This study aimed to reveal detailed information on i. morphological development of fish and otolith ii. temporal and spatial distribution and abundance iii. feeding Shi drum in the juvenile phase in the Marmara Sea, Türkiye.

## Materials and Methods

The *Umbrina cirrosa* juveniles were collected with beach seine sampling from the equally spaced 12 stations located around Marmara Sea (Fig. 1). The seine net hauls were carried out with 2 replications from each station between December 2021 and March 2022. The length of the wings, the height of the wings and the length, width and height of the bag of the beach seine were donated as 30 m, 1.8 m and $2 \times 2 \times 2$ m, respectively. The 4 mm nominal bar length was used in the bag net, whereas 6.5 mm nominal bar length was used in the wing net. The beach seine hauls were conducted on seagrass beds and/or sandy habitats. Specimens were kept in ice-pack and transported laboratory, immediately. Then, individuals were measured to the nearest 1 mm total length (TL) and weighed to the nearest 0.01 g total weight (W).

All sampled individuals (23 speciemen) were used to reveal length–weight relationship, otolith size-fish size relationship and otolith shape analyses. To reveal detailed information for morphological development and feeding of Shi drum juveniles, six individuals were selected according to varied length groups.

The traditional morphometric characteristics were measured according to Hubbs and Bailey (1940). Olympus SZX-7 stereo microscobe and QCapture Pro 7 imaging software was used measurements and imaging of sagitta. Linear regression analysis ($y = bx + a$; where a is the intercept and b is the slope of the linear regression) was used to determine the relationship between each morphometric character (TL-OL; TL-OW; OL-OW; TW-OW) and the coefficient of determination ($r^2$) were calculated. The F-test was used to determine the significance of the linear regressions. The relationship between the length (TL) and weight (W) of fishes was calculated by fitting an exponential curve, $W = aTL^b$ (Le Cren 1951). The parameters a and b of TL-W relationships were estimated by least-squares method on log-transformed data. In this equation W is weight (g), TL is length (mm), a is the intercept and b is the slope of the linear regression. The b value for each species was tested by t-test (Pauly 1984) at the 0.05 significance level to verify the significant difference from the isometric growth ($b = 3$). *U. cirrosa* sagittal otolith shape indices were calculated using the following formulas (Tuset et al. 2003; Ponton 2006):

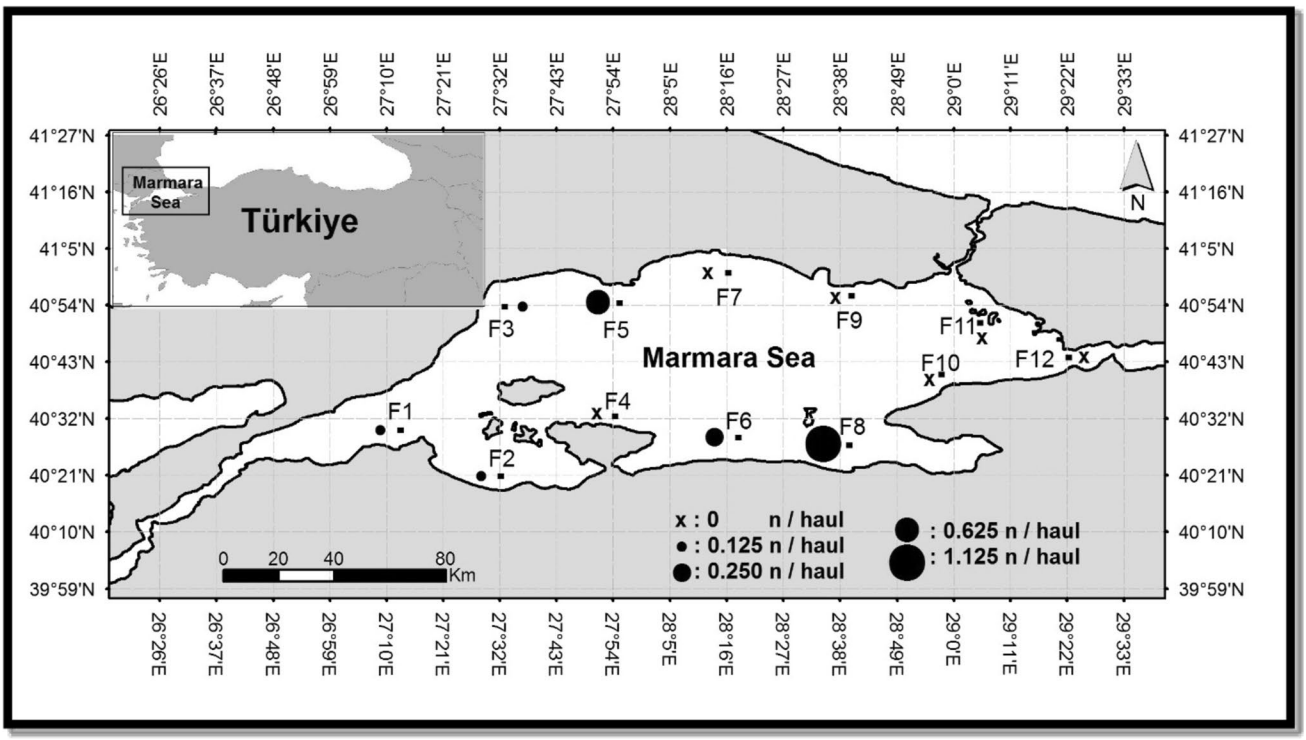


**Fig. 1** Spatial variation of mean abundance of the juvenile Shi drum, *U. cirrosa* in the Marmara Sea, Türkiye

Form factor (FF): 4π x Otolith Area x Otolith Perimeter$^{-2}$
Roundness (RD): 4 × Otolith Area x (π x Otolith Length$^2$)$^{-1}$
Aspect ratio (AR): Otolith Length x Otolith Width$^{-1}$
Circularity (C): Otolith Perimeter$^2$ x Otolith Area$^{-1}$
Rectangularity (R): Otolith Area x (Otolith Length x Otolith Width)$^{-1}$
Ellipticity (E): (Otolith Length—Otolith Width) x (Otolith Length + Otolith Width)$^{-1}$

The catch per unit effort (CPUE) calculated with the unit of individual number per haul (n/haul) according to the division of the total individual number by the total haul number. The total haul number detected with multiplication of replication number (2x) and the total survey number (4 months) for each station.

The total individual number of two hauls was counted in each location. Then, the mean number of the total individual number of two repetitions for each location at each month calculated. The mean abundance of each location was given with CPUE with the unit of fish number per haul.

Stomachs were removed and the contents of the stomach were sorted and identified to the taxonomic group. According to volume of fullness of prey in the stomach, the stomach fullness is determined as 5-stage such as empty (0%), 25%, 50%, 75% and 100%. Due to the low individual and stomach number, the stomach content calculations could not apply.

**Table 1** Morphometric characteristics of Shi drum *U. cirrosa* juveniles in the Marmara Sea, Türkiye

| | **Individuals with numbers given at** Fig. 2 **respectively** | | | | | |
|---|---|---|---|---|---|---|
| | **1st** | **2nd** | **3rd** | **4th** | **5th** | **6th** |
| **Total weight (g)** | 1.45 | 1.96 | 3.05 | 6.6871 | 8.88 | 9.38 |
| **Total length (mm)** | 55.87 | 63.28 | 72.52 | 95.48 | 102.1 | 107.5 |
| **Standard length (mm)** | 44.81 | 48.5 | 58.22 | 75.07 | 85.25 | 86.5 |
| **Head length (mm)** | 13.79 (24.7%) | 15.74 | 18.3 | 23.32 | 24.75 | 25.72 (23.9%) |
| **Pre-orbital length (mm)** | 3.84 (6.9%) | 4.77 | 5.82 | 7.94 | 7.68 | 8.1 (7.5%) |
| **Eye diameter (mm)** | 3.11 (5.6%) | 4.1 | 4.39 | 5.05 | 5.84 | 6.35 (5.9%) |
| **Post-orbital length (mm)** | 7.26 | 7.43 | 8.6 | 12.25 | 11.82 | 11.37 |
| **Interorbital length (mm)** | 3.08 (5.5%) | 3.13 | 4.03 | 5.08 | 5.54 | 5.87 (5.5%) |
| **1st dorsal fin base (mm)** | 6.35 | 7.21 | 8.83 | 11.13 | 12.88 | 13.66 |
| **2nd dorsal fin base (mm)** | 16.98 | 20.31 | 23.15 | 27.41 | 33.2 | 34.76 |
| **Interdorsal space (mm)** | 0.32 (0.6%) | 0.42 | 0.48 | 0.5 | 0.65 | 0.65 (0.6%) |
| **Depth of the 2nd dorsal fin (mm)** | 3.87 | 4.82 | 6.05 | 8.43 | 9.38 | 11.1 |
| **Length of caudal peduncle (mm)** | 5.18 (9.3%) | 6.05 | 6.15 | 7.3 | 7.73 | 8.59 (8%) |
| **Depth of body (mm)** | 12.34 (22.1%) | 12.68 | 15.09 | 21.03 | 23.45 | 23.81 (22.1%) |
| **Length of pectorel fin (mm)** | 7.81 | 8.47 | 10.16 | 14.96 | 15.6 | 16.38 |
| **Anal fin base (mm)** | 5.11 | 5.25 | 6.77 | 7.91 | 8.66 | 8.23 |
| **Snout length (mm)** | 1.02 (1.8%) | 1.2 | 1.34 | 1.6 | 2.03 | 2.42 (2.3%) |
| **Prepectoral length (mm)** | 13.02 (23.3%) | 14.49 | 19.36 | 21.79 | 23.54 | 26.92 (25%) |
| **Predorsal length (mm)** | 15.24 (27.3%) | 18.37 | 19.29 | 25.73 | 28.3 | 30.56 (28.4%) |
| **Preanal length (mm)** | 28.52 (51.1%) | 30.85 | 36.55 | 49.29 | 52.19 | 56.74 (52.8%) |
| **Prepelvik length (mm)** | 14.87 (26.6%) | 18.02 | 22.69 | 28.35 | 27.88 | 33.01 (30.7%) |
| **Body periphery (mm)** | 27 | 36 | 42 | 53 | 58 | 58 |
| **Dorsal fin ray** | D1: IX D2:1 + 23 | D1: IX D2:1 + 23 | D1: IX D2:1 + 23 | D1: IX D2:1 + 23 | D1: IX D2:1 + 23 | D1: IX D2:1 + 23 |
| **Anal fin ray** | II + 8 | II + 8 | II + 8 | II + 8 | II + 8 | II + 8 |
| **Barbel width (mm)** | 0.4 | 0.51 | 0.64 | 0.43 | 0.53 | 0.44 |
| **Barbel length (mm)** | 0.96 | 0.97 | 1.05 | 0.84 | 1.56 | 1.23 |

## Results

### Abundance

A total of 23 *U. cirrosa* individuals was sampled with beach seine nets from the Marmara Sea. Between all fish individuals collected, the frequency of occurrence of *U. cirrosa* was founded as a 0.34%, and the mean CPUE was calculated as a 0.24 per haul. In terms of monthly occurrence, 73.9% of the individuals were collected in December, 17.4% of abundance caught in January and 8.7% of abundance were detected in March. By means of spatial variation, *U. cirrosa* found 6 of 12 stations located in the Marmara Sea. Between them, O8 (Ayazma beach) and O5 (Marmaraereğlisi, Nato Port) were the most abundant areas with a 1.125 n/haul and 0.625 n/haul mean CPUE (Fig. 1).

### Morphometry

In terms of body morphometry, the measurements of all body parts increased with the increase of the total length. Hovewer, some measurements decreased proportionately against body growth, such as head length and caudal pedincule and some of them increased as preorbital length, snout length, prepectoral length, predordal length, preanal length, prepelvic length and eye diameter. With increasing of length, the body elongated and the anus position slightly shifted backward. Although the head shortened, the snout elongated. No linear relationship was detected between fish length and barb length or width. The barb was observed in all sizes examined. The body showed as compressed slightly in lateral and elongated in all sizes examined, determined as 22.1% of the TL proportionally, and not the ratio detected similar from the smallest individual to the largest one (Table 1 and Fig. 2).

### Length, Weight and Width Relationships of Fish and Otoliths

The individuals ranged in total length between 49.44 mm and 128.46 mm, with a mean of $98.43 \pm 5.43$ mm; and the specimens were distributed in weight from 1.15 g to 21.51 g, with a mean of $9.63 \pm 1.23$ g. The length–weight relationship was calculated as $W = 0.000008 \times TL^{3.0163}$ (Fig. 3). The difference of the estimated b value from 3 was not statistically significant ($P > 0.05$) and the result showed an isometric growth of *U. cirrosa*.

It was seen that the *U. cirrosa* had relatively large sagittal otoliths (Fig. 4). The right sagittal otoliths ranged between 1.7200 mm and 3.3820 mm, with a mean of $2.6777 \pm 0.1168$ mm in length. The right and left sagittal otoliths did not differ statistically in length, width, perimeter and area (Table 2). A relatively strong linear

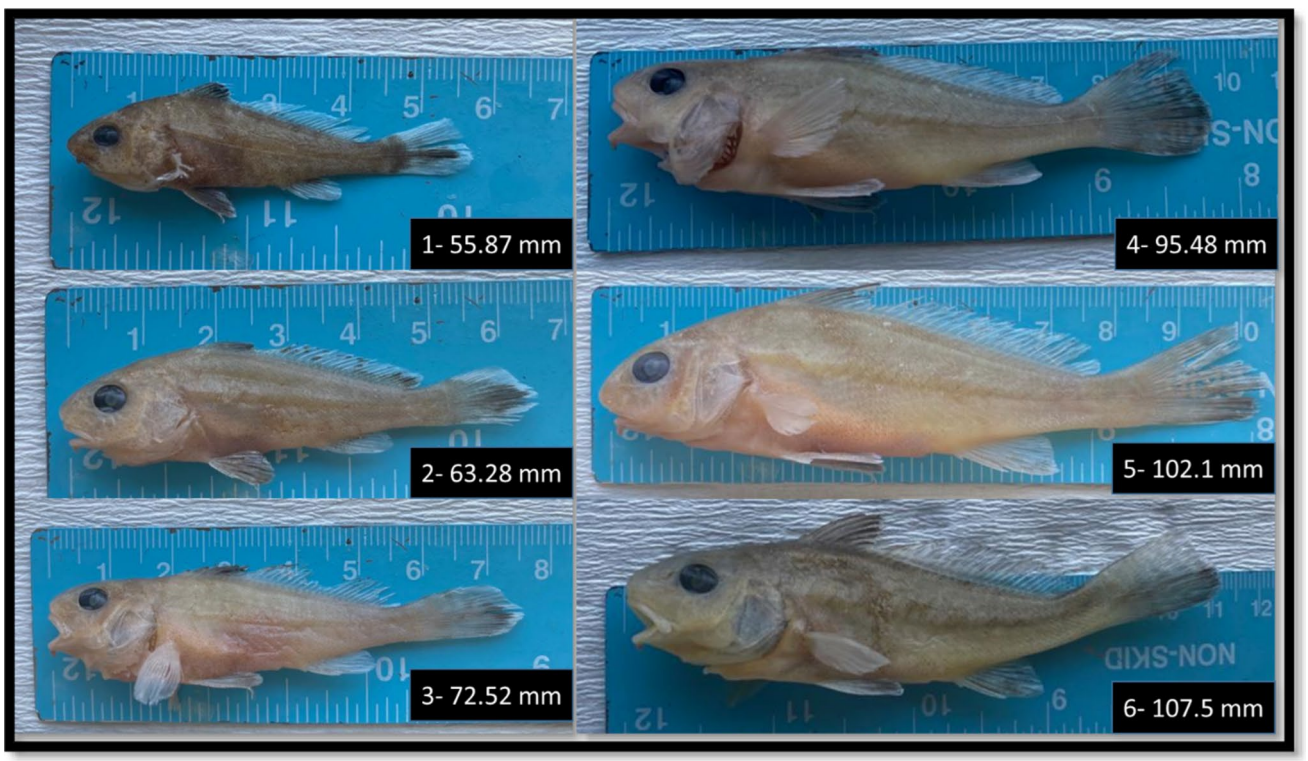


**Fig. 2** Morphological development of Shi drum, *U. cirrosa* juveniles in the Marmara Sea, Türkiye

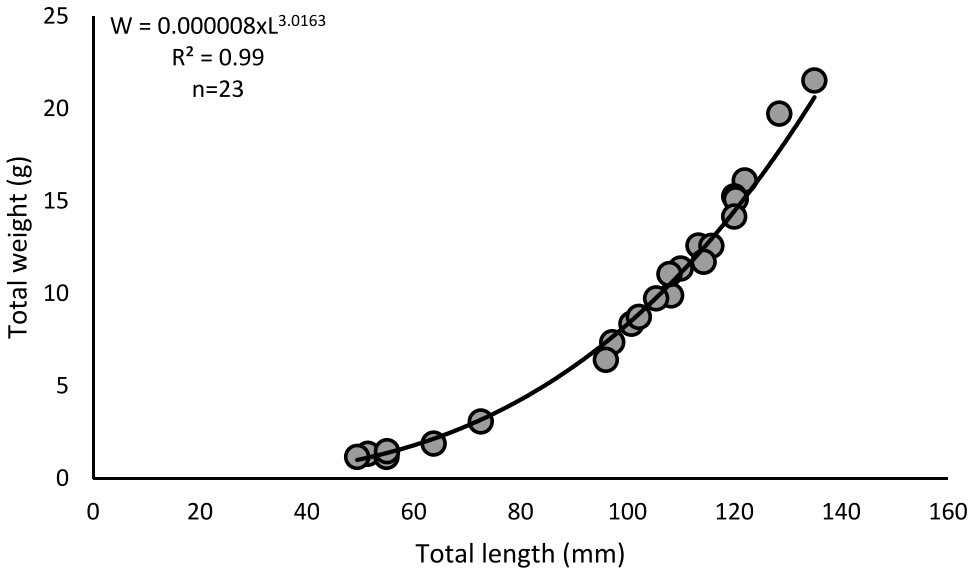


**Fig. 3** Length–weight relationship of Shi drum *U. cirrosa* juveniles in the Marmara Sea

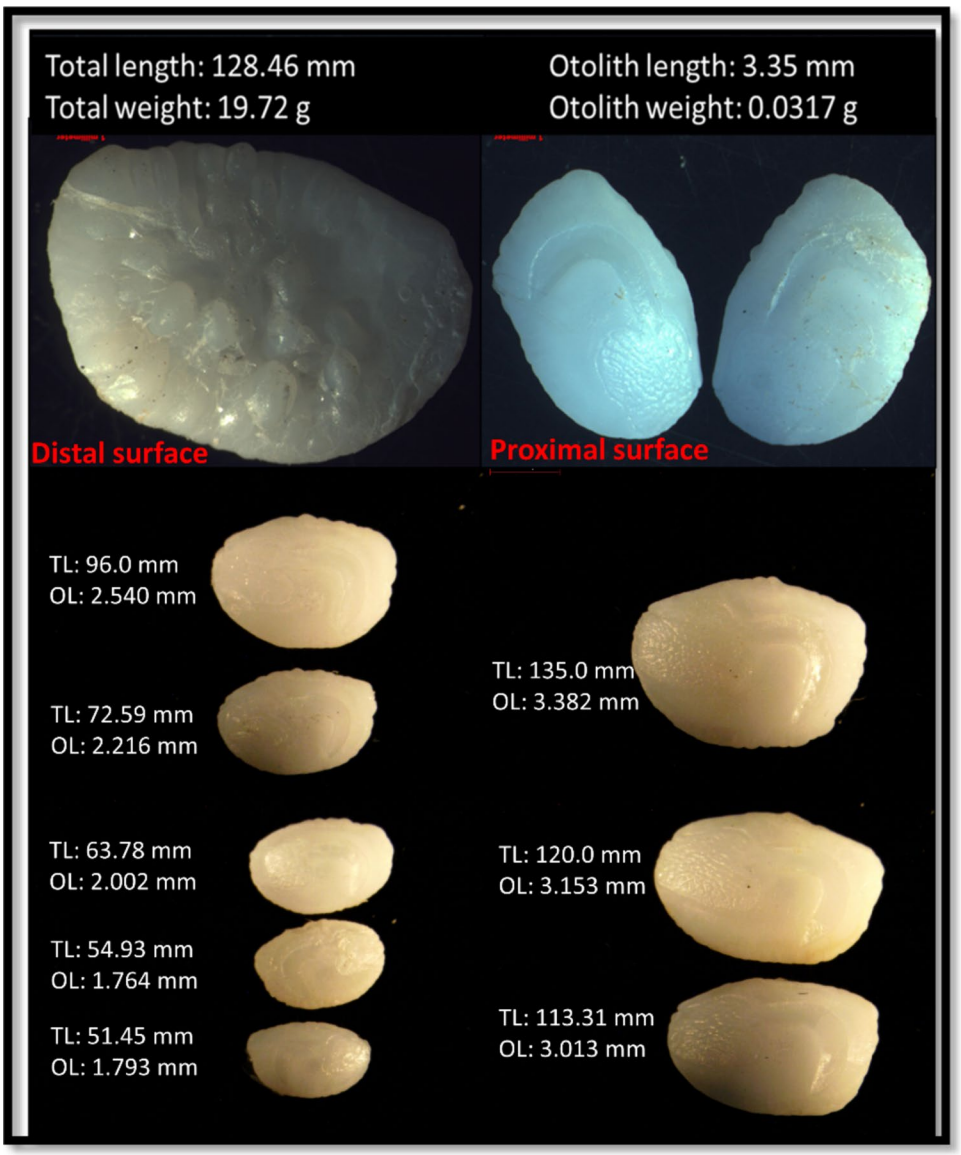


**Fig. 4** Otolith shape and morphometry of Shi drum *U. cirrosa* juveniles

**Table 2** Paired t-test results for left and right sagittal otoliths measurements of Shi drum *U. cirrosa* juveniles in the Marmara Sea

| Otolith Measurements | | Mean | Standard Error | Minimum | Maximum | Significance | |
|---|---|---|---|---|---|---|---|
| Otolith Length (mm) | Left | 2.6510 | 0.1131 | 1.6500 | 3.4020 | P > 0.05 | 0.5369 |
| | Right | 2.6777 | 0.1168 | 1.7200 | 3.3820 | | |
| Otolith width (mm) | Left | 1.8841 | 0.0868 | 1.0810 | 2.4480 | P > 0.05 | 0.3299 |
| | Right | 1.8693 | 0.0844 | 1.0880 | 2.4360 | | |
| Otolith Perimeter (mm) | Left | 7.7915 | 0.3681 | 4.8550 | 9.9370 | P > 0.05 | 0.1929 |
| | Right | 7.6912 | 0.3484 | 4.8550 | 10.1070 | | |
| Otolith Area ($mm^2$) | Left | 4.1500 | 0.3202 | 1.4580 | 6.5490 | P > 0.05 | 0.1094 |
| | Right | 4.1458 | 0.3454 | 1.5040 | 6.5440 | | |

relationships were found between otolith weight – total weight (OW = 0.015 × TW + 0.006) (Fig. 5), between otolith length and total length (OL = 0.0202 × TL + 0.7396) (Fig. 6), between otolith weight and total length (OW = 0.0003 × TL – 0.0132) (Fig. 7) and between otolith weight and otolith length (OW = 0.0168 × OL – 0.0252) (Fig. 8). This result clearly showed that the growth of sagittal otoliths showed similarities against somatic growth of the *U. cirrosa.*

## Otolith Shape

The otolith shape is oval, sulcus acusticus position can be described as a Pseudo-ostial type, the ostial region of the sulcus acusticus seems to be lateral, and the cauda is a curled type. The anterior region looks round, whereas the posterior part seems as oblique in the upper side and round in the lower side.

The calculated 6 otolith shape indices values can be seen in Table 3. According to otolith shape analyses, only one of 6 indices showed statistically significant differences between left and right sagitta, which the roundness of left one is higher than right sagitta (p:0.0487).

## Food Items in the Stomach Content

The maximum mouth length (MML) and width (MMW) values increased with the increasing of the TL. In addition, the ratio of MML/TL was increased from 6.8 to 7.7 from the smallest sized individual to the largest one. Similarly, the MMW/TL ratio was increased to 4.4 from 5 with the increase of the TL.

Within the six individuals examined, the mean stomach fulness was detected as 62.5%. One of the 6 indiviuals had an empty stomach, three of six individuals had 100% full stomachs. A total of 19 food items belonging to 5 major food item groups were detected. Amphipoda was observed as the most preferred prey item, which was consumed by all individuals. Polychaeta, Mysidae, Copepoda, and Processidae sp. were the other food items detected from the *U. cirrosa* stomach content (Table 4 and Fig. 9).

## Discussion

The scientific knowledge on the population biology of the wild stocks of Shi drum, *U. cirrosa* is mostly restricted to some length–weight relationship studies (LWRs). The b

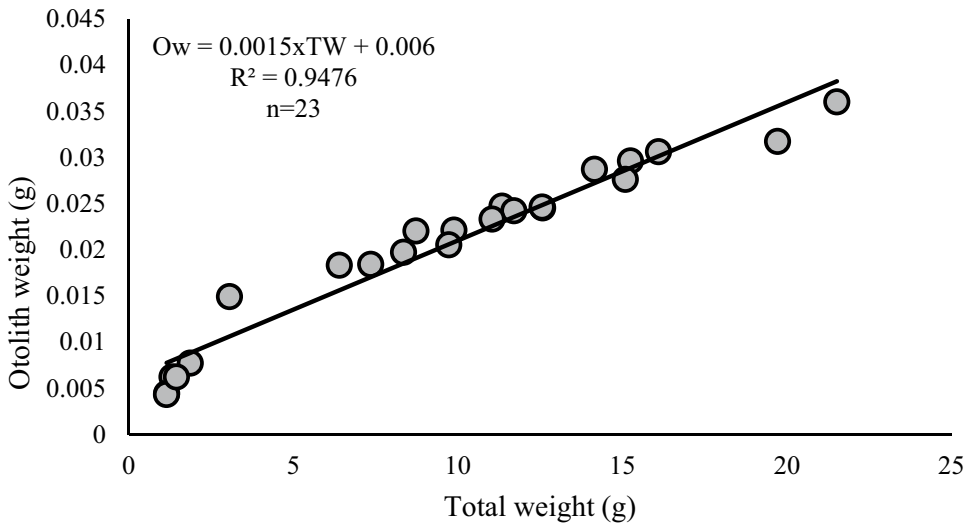


**Fig. 5** Total weight-otolith weight relationship of Shi drum *U. cirrosa* juveniles in the Marmara Sea

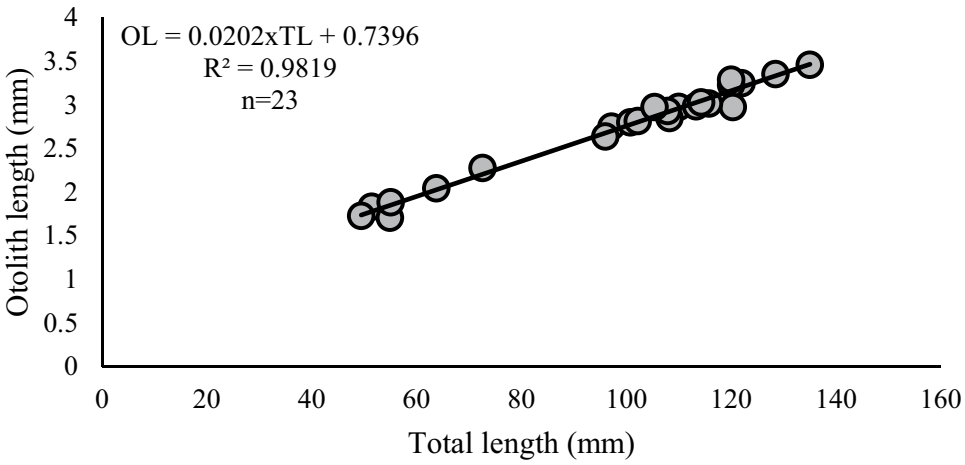


**Fig. 6** Total length-otolith length relationship of Shi drum *U. cirrosa* juveniles in the Marmara Sea

value of adult *U. cirrosa* was calculated as 3.011 around Egypt by Mehanna and Farouk (2021), 3.060 around Adriatic estuarine systems by Dulčić and Glamuzina (2006), 3.291 in the Northeastern Aegean Sea by Işmen et al. (2007), 3.054 in the South-eastern Black Sea by Aydın and Sözer (2020) and 3.42 in the Turkish coasts of the Levant Sea by Başusta et al. (2019). All these records reveal isometric or positive allometric growth type for adult *U. cirrosa* and this finding supports the rapid growth expressions of captivity studies. The LWRs data for a given species should not be consist of different life phases such as larvae, juveniles and adults and it is recommended that particular length–weight relationship (LWR) calculations for juveniles and adults should be realised (Fulton 1904; Froese 2006) due to the growth differences between these life phases. The LWRs data on *U. cirrosa* juveniles scarce, and our study may serve the first results. The b value was calculated at 3.016 and the growth type was determined as isometric. Koutrakis and Tsikliras (2003) estimated the LWRs of *U. cirrosa* individuals, ranged between 65 and 247 mm in length and can be thought partially juvenile. In that study, b value was found as 2.985 in the Porto Lagos lagoon, North Aegean Sea. Thus, it can be said that the growth type is isometric in juvenile phase and mostly positive allometric in the adult phase.

Otolith sizes should be used to estimate fish size when the strong linear relationship occurs (Bostancı et al. 2015). In this study, relatively high correlation coefficients showed a strong linear relationship between TL-OL, TW-OW, and TL-OW. Thus, predicted equations obtained from these relationships should be used for estimation of *U. cirrosa* size. In addition, these equations should be useful for stomach content analyses, when this species is consumed as a prey by other fish and so digested that it cannot be identified. The ontogenetic variation of Cod (*Gadus morhua*) otoliths studies by Hüssy (2008), and stated that otolith size and shape varies according to ontogeny. The adult otolith shape of *U. cirrosa* was investigated by Çiçek

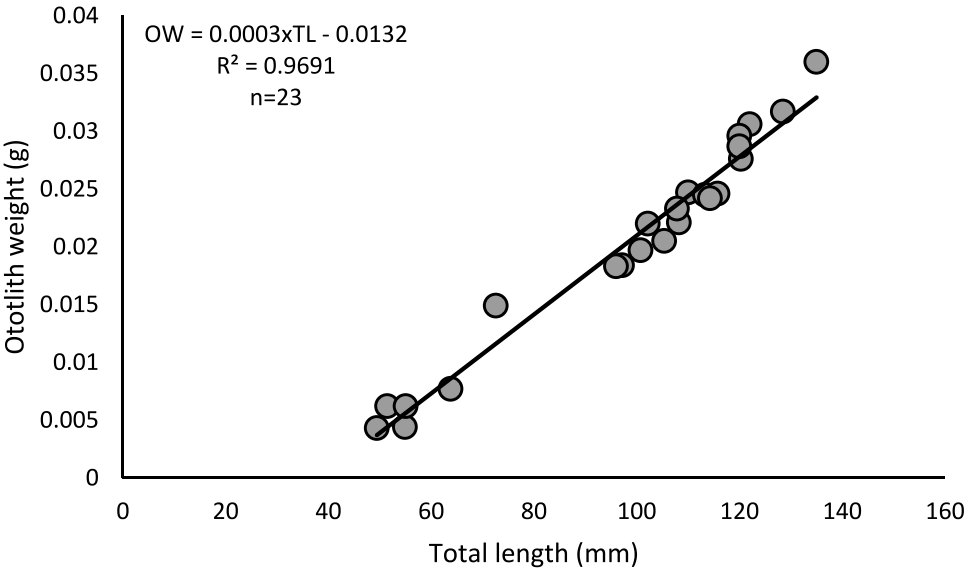


**Fig. 7** Total length-otolith weight relationship of Shi drum *U. cirrosa* juveniles in the Marmara Sea

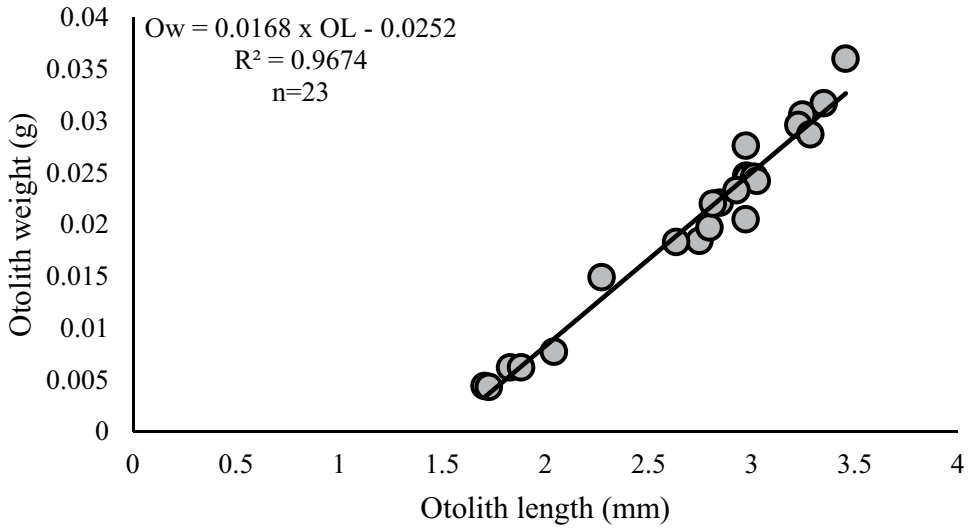


**Fig. 8** Otolith length-otolith weight relationship of Shi drum *U. cirrosa* juveniles in the Marmara Sea

et al. (2021) in the İskenderun Bay, Northeastern Mediterranean Sea. In that study, the FF, RD, AR, C, R and E of the adult *U. cirrosa* were calculated as 0.854, 0.713, 1.329, 14.709, 0.744 and 0.141, respectively. Whereas in our study, the FF, RD, AR, C, R and E of juvenile *U. cirrosa* were found as 0.817, 0.719, 1.414, 15.393, 0.799 and 0.171, respectively. Contrary to Hüssy's (2008) hypothesis, the otolith shape indices of *U. cirrosa* didn't differ for juvenile and adult *U. cirrosa*, even though obtained from relatively varied waters. Thus it was understood that the otolith shape characteristics varied as regards species specific and otolith shape of some species may remain similar independent from ontogenetic development. On the other hand, Tuset et al. (2008) calculated the C and R of adult *U. cirrosa* in the Western Mediterranean as a 15.8—17.0 and 0.1—0.2, respectively. These findings are mostly different from both our's and Çiçek et al. (2021)'s results. It can be stated that the broad geographical differences may be a major component of otolith shape development. Hence, this finding supports the knowledge of otolith shape analyses one of the most valuable tools to differentiating between fisheries stocks.

Using habitat selection of *U. cirrosa* in the early life stages, Koutrakis and Tsikliras (2003) and Sobrino et al. (2005) stated that it prefers to enter estuarine areas in the juvenile phase. In this study, the highest mean CPUE in the Marmara Sea was detected in the F8 (Ayazma Beach) station, where spatially close to Karacabey floodplain area. In addition, Fabi et al. (2002) indicated that Shi drum could be attracted by underwater constructions such as gas platform and mostly found around man-made artificial reefs. Interestingly, the F5 (Marmaraereğlisi Nato Port area), was the other abundant area of Shi drum in this study, embodies lots of gas platforms. Thus, our abundance results supported the previous findings related to the distribution of Shi drum.

Due to the thick structure of sagitta, daily ages could not be determined by sanding and polishing. The detailed sectioning procedure may be useful for daily age determination.

**Table 3** Estimated otolith shape indices and statistical comparison of these indices between left and right sagittal otoliths of *U. cirrosa* juveniles in the Marmara Sea

| Otolith Shape Indices | | Mean | Standard Error | Minimum | Maximum | Significance | |
|---|---|---|---|---|---|---|---|
| Form Factor | Left | 0.8172 | 0.0068 | 0.7565 | 0.8605 | $P > 0.05$ | 0.7527 |
| | Right | 0.8196 | 0.0166 | 0.7141 | 1.1095 | | |
| Roundness | Left | 0.7195 | 0.0081 | 0.6560 | 0.8142 | $p < 0.05$ | 0.0487 |
| | Right | 0.7007 | 0.0101 | 0.6171 | 0.7891 | | |
| Aspect ratio | Left | 1.4147 | 0.0135 | 1.3038 | 1.5475 | $P > 0.05$ | 0.3727 |
| | Right | 1.4375 | 0.0183 | 1.2286 | 1.6213 | | |
| Ellipticity | Left | 0.1712 | 0.0046 | 0.1319 | 0.2149 | $P > 0.05$ | 0.4117 |
| | Right | 0.1785 | 0.0062 | 0.1026 | 0.2370 | | |
| Circularity | Left | 15.393 | 0.130 | 14.595 | 16.602 | $P > 0.05$ | 0.9704 |
| | Right | 15.437 | 0.267 | 11.321 | 17.588 | | |
| Rectangularity | Left | 0.7990 | 0.0041 | 0.7560 | 0.8463 | $P > 0.05$ | 0.3219 |
| | Right | 0.7889 | 0.0096 | 0.6246 | 0.8455 | | |

**Table 4** Stomach content and food items of Shi drum *U. cirrosa* juveniles in the Marmara Sea

| | Individuals | | | | | |
|---|---|---|---|---|---|---|
| | **1st** | **2nd** | **3rd** | **4th** | **5th** | **6th** |
| **Total weight (g)** | 1.45 | 1.96 | 3.05 | 6.6871 | 8.88 | 9.38 |
| **Total length (mm)** | 55.87 | 63.28 | 72.52 | 95.48 | 102.1 | 107.5 |
| **Standard length (mm)** | 44.81 | 48.5 | 58.22 | 75.07 | 85.25 | 86.5 |
| **Max. mouth length (mm)** | 3.77 | 4.26 | 4.96 | 6.34 | 7.35 | 8.25 |
| **Max. mouth width (mm)** | 2.47 | 3.37 | 3.68 | 5.15 | 5.25 | 5.35 |
| **Stomach fulness** | 50% | 25% | 100% | 100% | 100% | Empty |
| **Food items** | 2 Amphipoda | 1 Amphipoda | 4 Amphipoda<br>1 Polychaeta | 4 Amphipoda<br>1 Polichaeta<br>1 Mysidae<br>2 Copepoda | 1 Mysidae<br>1 Amphipoda<br>1 Processidae sp. | None |

However, the spawning period occurred between March and August in the Mediterranean and the Black Sea (Chao 1986; Chakroun-Marzouk and Ktari 1985). The majority of specimens in our study obtained in December and estimated that these individuals may be approximately 5–7 months old. However, more detailed studies related to daily age increment should be conducted in order to provide more accurate and precise information.

Froglia and Gramitto (1998) revealed the feeding habits of adult *U. cirrosa* specimens (mean length: 330 mm TL) and stated that the most preferred food item was benthic Crustacea, especially Decapoda (*Liocarcinus* spp., *Upogebia* spp.). Also, shrimps, prawns, and polychaetes were found in the stomach of *U. cirrosa* (Chakroun and Ktari 1981). Also, Tamoikin et al. (2023) were detected the fragments of mollusk, polychaete and crab from the stomach of single species, which was 784 mm TL male individual obtained in the Black Sea Coast of Crimea. According to our findings, the feeding shows an alteration against ontogenetic development due to the major food item detected as Amphipodas.

Consequently, there is almost no published scientific information regarding the physico-chemical, nutritional and behavioral characteristics required by wild stocks of this species in their early life stages. The ability to produce a species with higher efficiency under culture conditions can only be achieved in proportion to the knowledge of the requirements of its natural environment. Thus, increasing this and similar studies may be beneficial both to a better understanding of its biology and to improving culture conditions. In addition, the occurrence of the juvenile specimens in the Sea of Marmara is a hopeful development for the sustainability of this species in the Mediterranean, whose stocks defined as vulnerable.

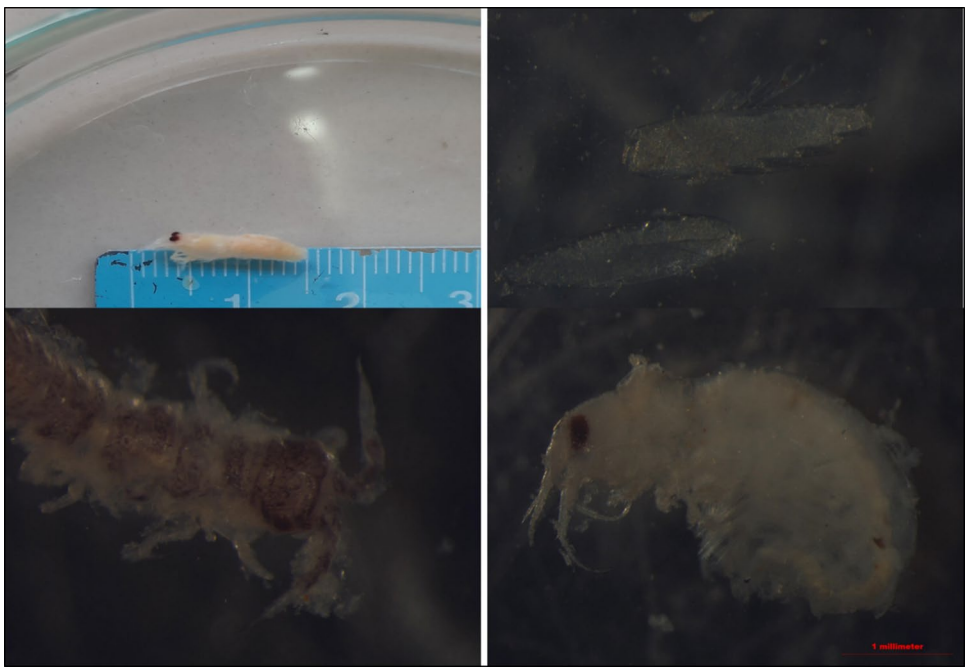

**Fig. 9** Food items in the stomach content of Shi drum *U. cirrosa* juveniles in the Marmara Sea

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**Data Availability** The data that support the findings of this study are available from the corresponding author, upon reasonable request.

## Declarations

**Ethical Approval and Consent to Participate** Not applicable.

**Consent for Publication** All authors have approved the manuscript and agree with its submission and publication to Thalassas: An International Journal of Marine Sciences.

**Competing Interests** The authors declare no competing interests.

**Human and Animal Ethics** Not applicable. There is no ethical issue concerning this article.

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