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The Relationships of Otolith Dimensions (Length-Breadth) with Weight and Total Length of Greater Forkbeard (*Phycis blennoides* (Brünnich, 1768)) Captured from northeastern Mediterranean Sea

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Abstract

The greater forkbeard, *Phycis blennoides* is captured by commercial trawler, has minor commercial value in Türkiye. This study is the first knowledge on otolith biometry-fish size relationships of *Phycis blennoides* living in the northeastern Mediterranean Sea. A total of 202 the greater forkbeard individuals were caught by commercial bottom trawl at a depth of 200 to 400 m in the northeastern Mediterranean. Minimum-maximum total length and weight of obtained fish specimens were found as 16.9-38.7 cm and 31.06-415.0 g for females and 16.3-38.3 cm and 27.14-504.08 g for males respectively. The difference of the total length and weight between the females and males of *P. blennoides* was statistically insignificant (P>0.05). The determination coefficient value showed that there were a moderate relationships between total length-right and left otolith lengths, total length-right and left otolith breadths.

Keywords:

Greater forkbeard, Phycis blennoides, otolith biometry, Iskenderun Bay

Article history:

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Introduction

The greater forkbeard (*Phycis blennoides*) is a demersal fish species found along the continental shelf and the slope, on the bottoms from 60 to 800 m depth (Farjallah et al., 2006). Phycis blennoides is captured in small numbers by bottom trawl and they have minor commercial value in Türkiye. The Greater forkbeard is distribute in the Mediterranean, Adriatic Sea, Aegean and

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Black Seas throughout the Atlantic Ocean from Iceland to Maruitiana and in the Faroe Islands, Madeira and the Azores (Golani et al., 2006). The shape and size of otoliths used to determine the age of fish also provide information about the size of fish in palaeontological samples (Bostanci et al., 2012; Başusta et al., 2013). Knowledge on the relationship between otolith biometry and total fish length is useful as fish size can be estimated from otolith morphometry measured from otoliths come across in predator stomachs and feeding ecology of fishes (Echeverria, 1987; Karachle et al., 2015). This knowledge is important for fish population management plans, prey–predator relationship studies and paleobiological research. By using the relationship between otolith biometry and total fish length, it is possible to determine fish length from otolith size or vice versa. Although various length-weight relationships of *P. blennoides* have been reported from the Aegean Sea and northeastern Mediterranean Sea, there is no detailed otolith biometry study on the greater forkbeard from the northeastern Mediterranean Sea (Filiz & Bilge, 2004; Stergiou & Moutopoulos, 2001; Girgin & Başusta, 2021).

This research provides preliminary information on the otolith biometry-total fish size relationships of *P. blennoides* inhabiting off the Iskenderun Bay.

Materials and Methods

Phycis blennoides specimens were caught by bottom trawl at a depth of 200 to 400 m in the northeastern Mediterranean Sea (36° 13’ 242” N-35° 31’ 328” E, 36° 12’ 927” N- 35° 14’ 566” E). Trawling duration was 3 hours with 2.5 knots speed. *Phycis blennoides* specimens were transferred to the fish biology laboratory of Faculty of Fisheries, Firat University. *P. blennoides* individuals were measured for total length to the nearest 0.1 cm, weight (W) was weighted to the nearest 0.1 g in the laboratory. The sexes were determined by macroscopic observation of the gonads and then both right and left sagittal otoliths were removed from each fish and soaked in 10% KOH solution for approximately 5 minutes and stored dry in a small ziplock bag for further applications. Right and left otolith weights (OW), otolith lengths (OL), otolith breadths (OB) were taken from each specimen to the nearest 0.001 mm and 0.0001g respectively and otoliths were examined under a binocular stereomicroscope (Leica S8APO) combined to a computer (Figure 1). Differences between females and males were tested by using One-way ANOVA.

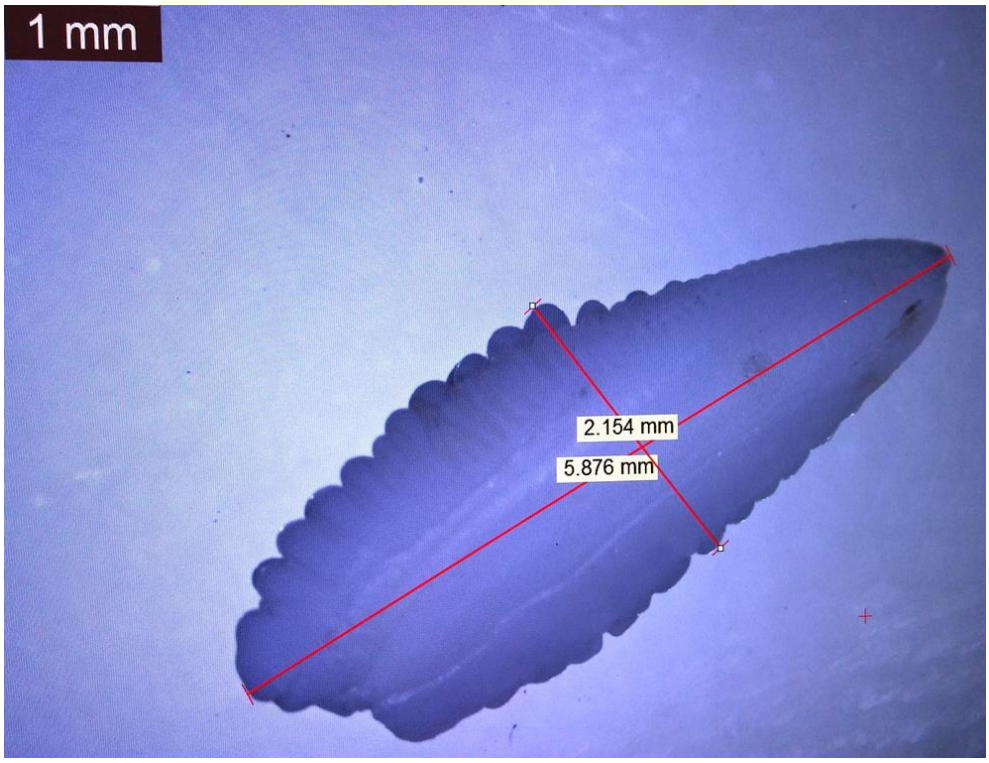

Figure 1. Otolith length and width measurements of the greater forkbeard.

The relationships of otolith biometry-total fish length were examined by using the following formula:

$$y = a + bx$$

where: x: total fish length, y: otolith length or otolith breadth, a: intercept value, b: coefficient value. Regression analyses were done by using Excel software for determining the relationships between total fish length and otolith length, breadth and weight (Dehghani et al., 2016).

Results and Discussion

A total of 202 greater forkbeard specimens (159 male and 43 female) were obtained. Minimum-maximum total length and mass of collected fish specimens were determined as 16.9-38.7 cm and 31.06-415.0 g for females and 16.3-38.3 cm and 27.14-504.08 g for males respectively. According to statistical analyses, there was no significant differences between values of male and female ($P > 0.05$; Student's t-test).

The distributions between the otolith weight, length and breadth of the *P. blennoides* population according to gender was given in Figure 2, Figure 3 and Figure 4. Accordingly, it was determined that the right and left otolith weights of female individuals were between 0.011 (g) and 0.012 (g), while the right and left otolith weights of male individuals were between 0.010 (g) and

0.011 (g). Likewise, the right and left otolith lengths of female individuals are between 11.0 - 11.5 (mm), the right otolith length of male individuals is 10.5 - 11.0 (mm), and the right and left otolith breadths of female individuals are 2.2- 4.3 (mm) in female individuals while the otolith breadths of male individuals are between 2.1 - 4.2 (mm). It is seen that the otolith weights, lengths and widths of female individuals are higher than those of male individuals.

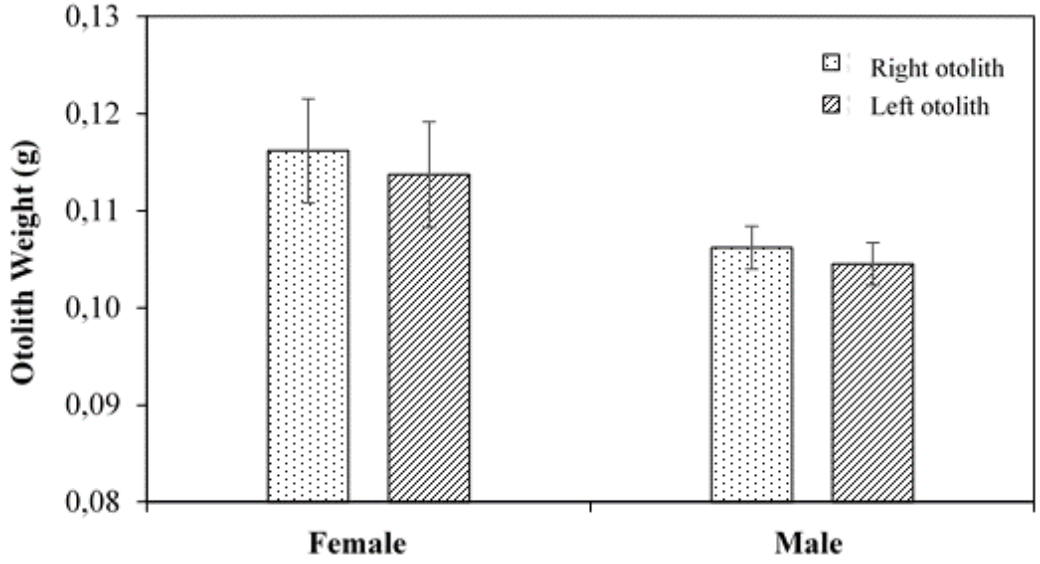

Figure 2. Right and left otolith weights according to sex in *Phycis blennoides.*

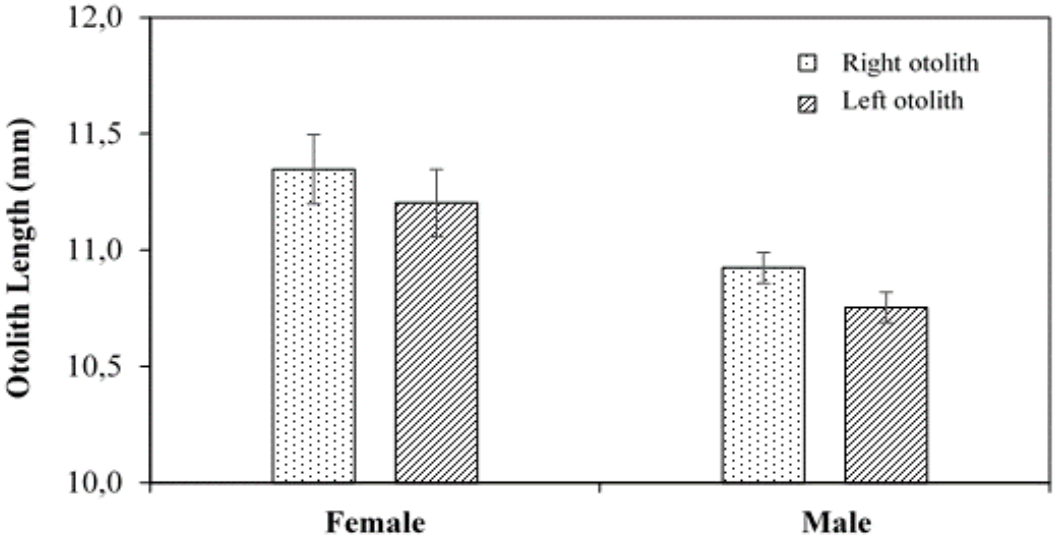

Figure 3. Right and left otolith lenghts according to sex in *Phycis blennoides.*

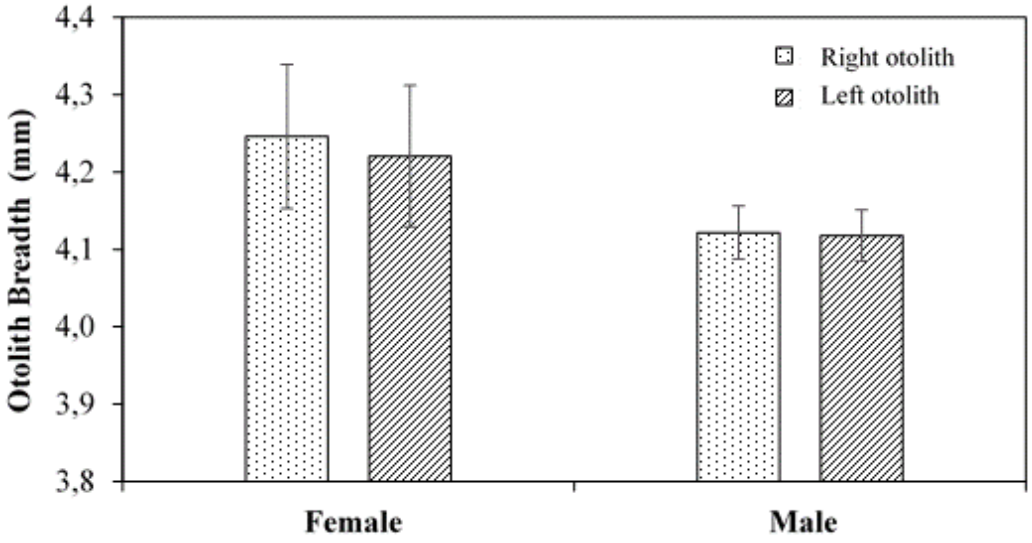

Figure 4. Right and left otolith breadths according to sex in *Phycis blennoides.*

In present study, the relationships of total length of fish with right otolith length and left otolith weight are shown in Figure 6. Both relationships were linear with equations; y=0.0037x+0.0124 (R^2=0.217) and y=0.0036x+0.135 (R^2=0.203), respectively.

According to the coefficient value of determination (R^2), both relationships show that positive and weak level. The relationships of total fish length with right otolith length and left otolith length are shown in Figure 7. Both relationships were linear with equations: y=0.16x+6.8582 (R^2=0.4214) and y=0.1587x+6.7271(R^2=0.4241), respectively. To the coefficient of determination (R^2), it can be said that both relationships are positive and moderate level.

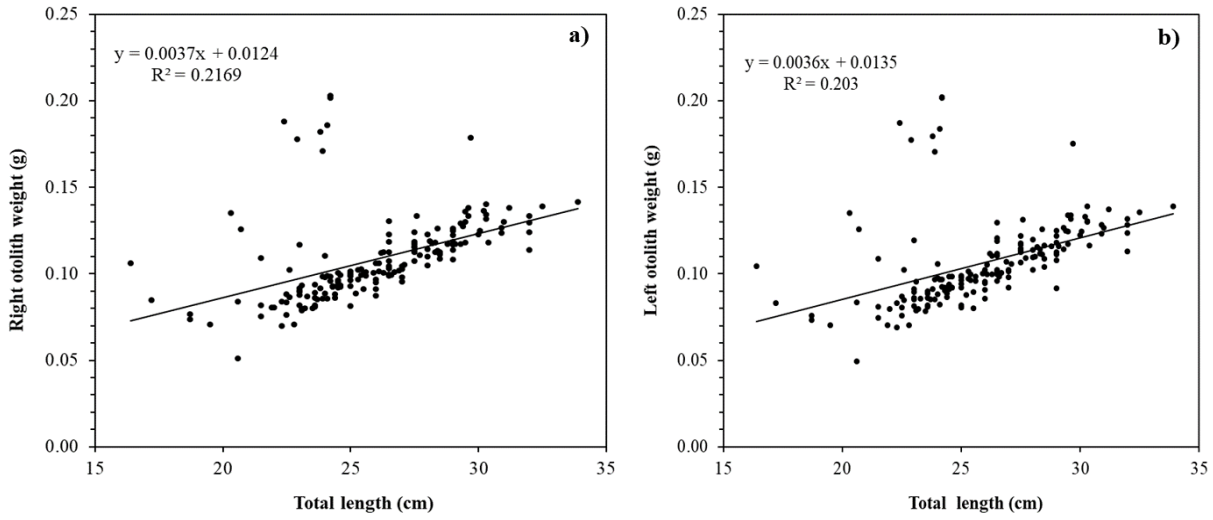

Figure 5. Relationships between total length-otolith weights of *Phycis blennoides* (a: Right otolith, b: Left otolith weights).

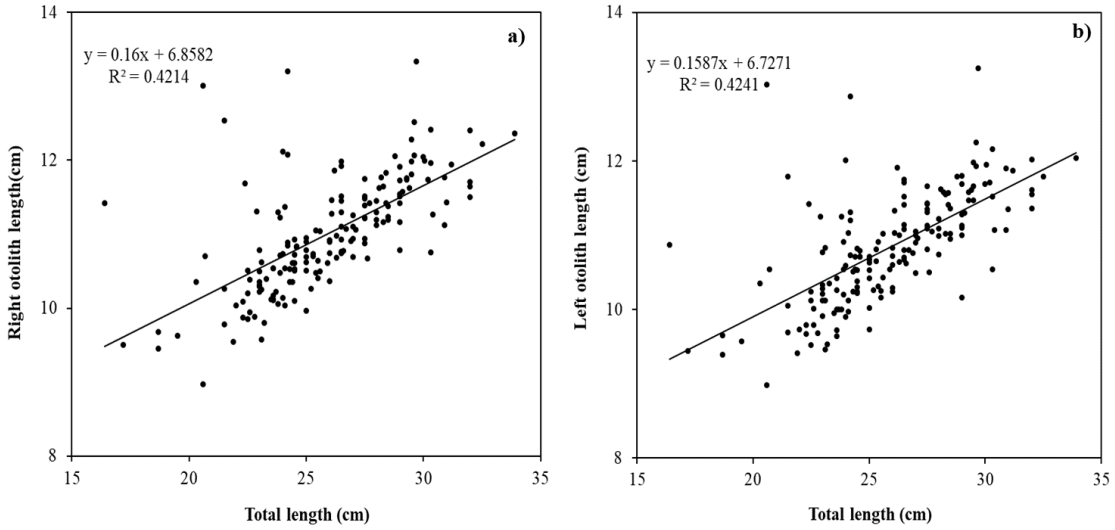

Figure 6. Relationships between total length-otolith lengths of *Phycis blennoides* (a: right otolith lengths, b: left otolith lengths).

The relationships of total fish length with right otolith breadth and left otolith breadth are shown in Figure 7. Both relationships were linear with equations: y=0.0735x+2.2407 (R^2=0.3349) and y=0.0656x+2.4393 (R^2=0.2827), respectively. According to the coefficient of determination (R^2), It is seen that both relationships are positive and weak.

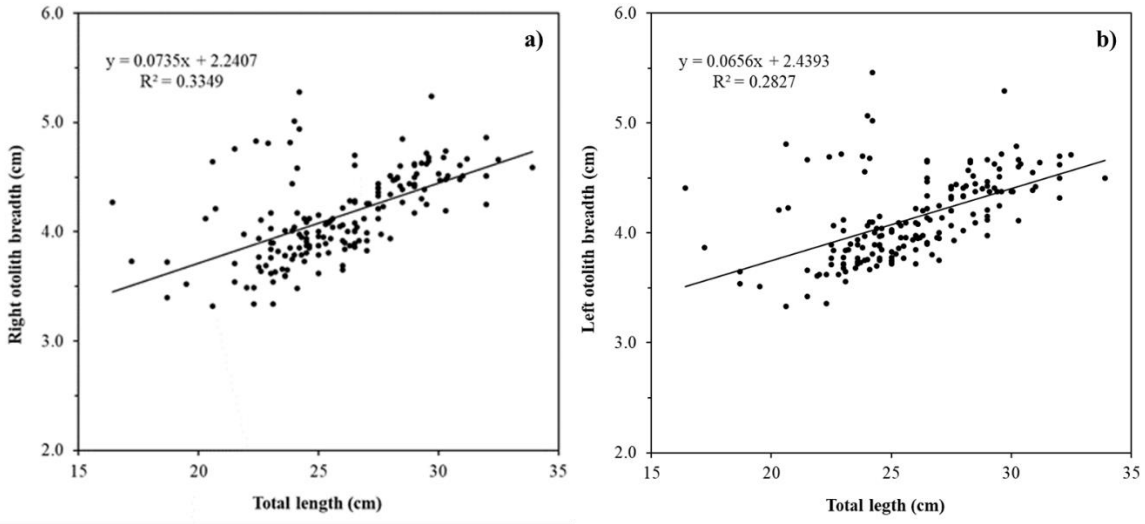

Figure 7. Relationships between total length-otolith breadth of *Phycis blennoides* (a: right otolith breadth, b: left otolith breadth).

There was no significant difference in right otolith and left otolith values ($P > 0.05$). Therefore, in future studies on this species, only the right or left otolith can be used instead of both sagittal otolith. Otolith biometry studies shows that otoliths can be used in stomach content research

and fish size in archaeological samples. Brander (1974) suggest that otolith mass has a linear relationship with the age of the fish. According to Harkönen (1986), there is a high correlation between total fish length and otolith length, and this is generally seen as a linear relationship. This study provides first information on the otolith biometry of the greater forkbeard in the northeastern Mediterranean Sea.

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Conflict of Interest

The authors declare that they have no competing interests.

Author Contributions

N.B. and H.G performed all the experiments and drafted the main manuscript text. All authors reviewed and approved the final version of the manuscript.

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