

— SHORT COMMUNICATION —

First documented report on the Lessepsian migrant *Etrumeus teres* De Kay, 1842 (Pisces: Clupeidae) in the Greek Seas

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In this study, the presence of the Lessepsian migrant red-eye round herring (*Etrumeus teres*) is validated in the Greek Seas with the capture of large quantities by purse seiners during May 2004, in the Cyclades Islands. This species is recorded for the first time in the Southern Aegean Sea, although fishermen reported that it has been caught repeatedly during the last five years in the same area. Morphometric and meristic characteristics of the species are described and two biological parameters are estimated (*i.e.* the length-weight relationship and the reproductive maturity).

Keywords: *Etrumeus teres*, red-eye round herring, Aegean Sea, Lessepsian migrant, biological parameters.

INTRODUCTION

The main characteristics of the Aegean Sea are the complex contour of the coastline, the large number of islands and the intense sea bed relief. The presence of warm water masses in the South Aegean and the nutrient rich, cold water current in the North Aegean differentiate the oceanographic conditions along an axis from North to South, that creates the conditions for increased biodiversity which is observed in this region (Stergiou *et al.*, 1997).

An imaginary line from the southernmost point of Euboea to Chios Island separates the Aegean Sea to Northern and Southern part (Peres, 1967). The Southern part is characterized as an oligotrophic system, with lower salinity and narrower continental shelf when compared to the Northern part. In addition, the ichthyofauna found in the two sea regions is differentiated (Stergiou *et al.*, 1997). In the South Aegean, a number of species recorded can be characterized as subtropical, while during the last years the number of tropical fish species in this region has increased along with the sea surface temperature

(Papakonstantinou, 1987). The same author characterized the North Aegean as an area of cold-water fauna and the South Aegean as an area of warm-water fauna due to the presence of Lessepsian migrants.

Until 2002, in the Mediterranean Basin, 90 tropical fish species have been identified; 59 of them are Lessepsian migrants, 28 tropical species and 3 migrants of boreal origin. In the Aegean Sea, 16 Lessepsian fish migrants have been identified (Golani *et al.*, 2002).

This study refers to a new Lessepsian fish migrant in the Cyclades Islands, Southern Aegean Sea. The *Etrumeus teres* De Kay, 1842 case, the red-eye round herring, is different from other Lessepsian fish migrant cases, because it is found in large quantities and it is already fished by local fishermen.

MATERIALS AND METHODS

The documentation of the presence of *E. teres* in the Aegean Sea was based on a sub-sample of 30 individuals, part of a larger sample, which were caught in the Cyclades Islands in the sea area between Paros, Naxos and Ios islands in late May 2004 (Fig. 1). The fish were caught by the purse seiner “NIKO-

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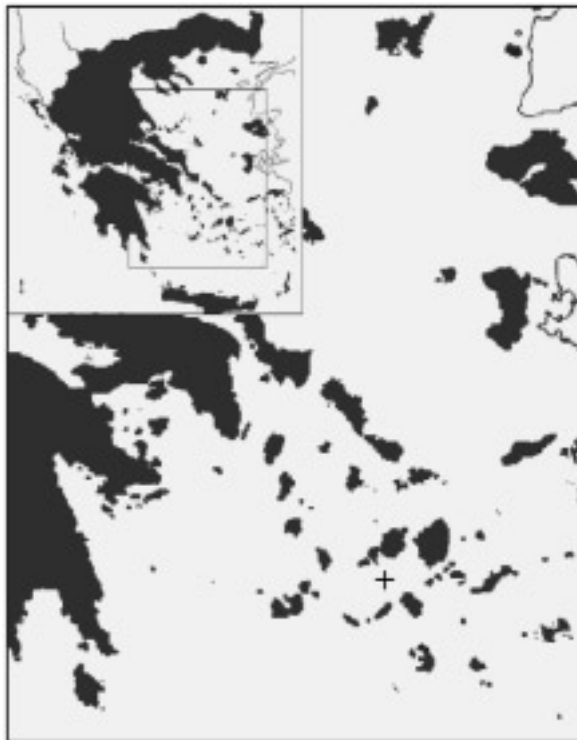


FIG. 1. Map of the Aegean Sea. The cross denotes the area where the sample of *Etrumeus teres* was collected.

LAOS A", in an area where the depth is 110 m, using a net with 14 mm mesh size. The total landed quantity of the species at that day was approximately 9,600 kg. The sub-sample specimens were placed in 10% formalin solution immediately after their capturing.

The species identification was done according to Whitehead (1985) and Golani *et al.* (2002). The morphometric and meristic characteristics (Table 1) were measured applying the methods used by Nielsen & Johnson (1983), and the length-weight relationship was calculated using the relationship $W = aL^b$ (Gulland, 1969). The growth parameters L_{∞} , t_0 and K used were from Yilmaz & Hoşsucu (2003).

The sexual maturity examination was based on a sample of 11 female gonads. The gonads were dehydrated, cleared in xylol and embedded in paraffin. Sections (5 μm) of the middle part of the gonads were cut and stained with hematoxylin-eosin (Clark, 1981). The histological classification of the ovaries was based on the developmental stage of the most mature oocytes (West, 1990).

Furthermore, a preliminary stomach content analysis was performed in 4 specimens.

TABLE 1. Meristic and morphometric characters of the *E. teres* from the Aegean Sea

Morphometric characters	Min	Max	Average	S.D.
Total length	197.00	233.00	222.30	8.42
Fork length	179.00	216.00	201.70	7.51
Standard length	168.00	201.00	187.70	6.86
Max height	30.00	38.00	34.60	2.26
Head height	20.92	27.55	23.70	1.41
Head length	37.48	44.00	41.10	1.63
Eye diameter	10.91	12.68	11.70	0.43
Pre-dorsal length	74.00	93.00	83.10	3.83
Length of dorsal fin base	21.80	29.40	25.30	1.46
Length of anal fin base	8.13	11.52	9.80	0.93
Length of pectoral fin	23.62	28.36	26.30	1.19
Length of pelvic fin	11.07	15.74	13.30	1.03
Height of dorsal fin	20.02	26.52	23.20	1.18
Weight	64.58	120.06	96.90	11.08
Meristic characters	Min	Max	Average	S.D.
Number of dorsal fin rays	14	18	16.10	1.13
Number of pelvic fin rays	8	11	9.40	0.81
Number of ventral fin rays	7	11	8.70	0.97
Number of anal fin rays	24	30	27.10	1.81
Number of pectoral fin rays	14	18	16.40	1.19

RESULTS AND DISCUSSION

The *E. teres* belongs to the order Clupeiformes and the family Clupeidae and its common English name is red-eye round herring. It is a pelagic species that lives in large schools, feeds on zooplankton (mainly copepods and euphausiids) and it is found in depths down to 150 meters (Froese & Pauly, 2005).

Its body is elongated and cylindrical in its anterior part (Fig. 2). Its abdomen is rounded and smooth without scales. The dorsal fin base is before the midpoint of the body. The head is big and the eyes are covered with an adipose eyelid. A single W-shaped pelvic scale is found at the base of the pelvic fins. Its colour is dark blue on the back with silvery flanks. It can reach a maximum length of 28 cm while the lengths from 15 to 25 cm are the most common.

Etrumeus teres is distributed from the Red Sea to Eastern Africa, from Japan to South Australia and in Western Atlantic from Bay of Fundy in Canada, to Mexico and Venezuela. In the Mediterranean it was recorded for the first time in Israel in 1963 (Whitehead, 1963), then in Egypt in 1994 (El Sayed, 1994), in the southern coasts of Turkey in 1997 (Basusta *et al.*, 1997) and finally in Cyprus in 2000 (Golani, 2000).

In the stomachs analysed, copepods, planktonic decapods and euphausiids were found, confirming that *E. teres* feeds on zooplankton.

Macroscopic examination of the gonads revealed that 5 out of 30 individuals examined were males while all fishes were mature. The ovaries contained a distinct group of oocytes in an advanced stage of vitellogenesis (oocytes with large diameters), in addition to groups of oocytes in early stages of vitellogenesis. Furthermore, all gonads that were analysed contained postovulatory follicles (POF) (Fig. 3) in different stages of deterioration, which implies that the specimens were running ripe, they had spawned shortly before their capture and the species spawns

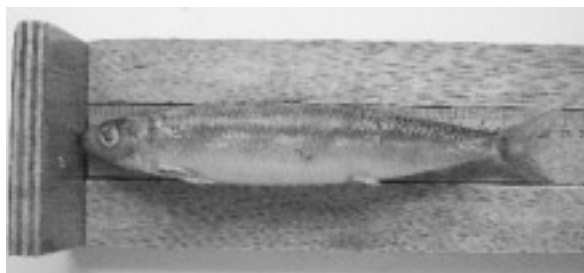


FIG. 2. *Etrumeus teres* De Kay, 1842 from the Aegean Sea.

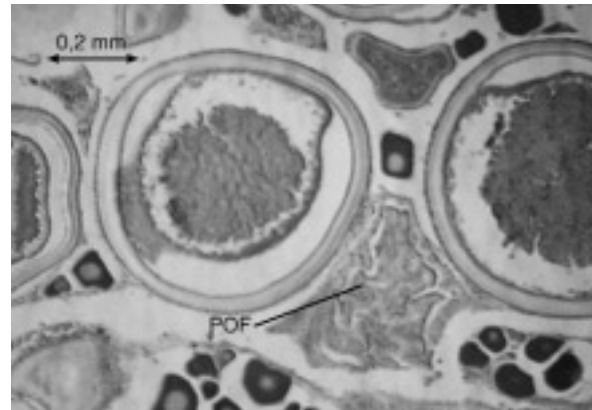


FIG. 3. Female gonad of *E. teres* from the Aegean Sea. The oocytes are at advanced stage of vitellogenesis: postovulatory follicles (POF) are shown with arrows.

gradually during the spawning period. Froese & Pauly (2005) reported that the spawning period of the species in Egypt extends from January to May; the fact that all specimens in May had already spawned, suggests that the spawning period in the Aegean Sea is probably similar to that of Southern Mediterranean.

The equation of the length-weight relationship of *E. teres* that was calculated from the sample was:

$$W = 0.0147 \times L^{2.8329}$$

The b value found in our study suggests that the growth pattern of *E. teres* is negatively allometric. However, this value is significantly different to the value ($b = 3.1683$) given by Yılmaz & Hoşsucu (2003). The difference could be due to the fact that the sub-sample contained a limited number of fish (30 specimens) of similar length.

When determining the age of the individuals of the sub-sample the following values of the parameters L_{∞} , t_0 and K were used: $L_{\infty} = 33.77$ cm, $K = 0.20$, $t_0 = -1.6313$. Table 2 presents the lengths at age of the *E. teres* sample; age group 2+ was represented by 3.3% of the sample, 76.6% was in 3+ and 20% was in 4+.

The red-eye round herring is a Lessepsian migrant in the Aegean Sea. Every year, 5 to 10 new fish species from the Red Sea are found in the Mediterranean Sea, which means that the fish migration from the Suez Channel is continuous and that the Eastern Mediterranean allows for additional links in the food web (Stergiou *et al.*, 1997; Golani, 1998). Furthermore, it is known that in the Eastern Mediterranean there are less species than the Red Sea (430 species in Eastern Mediterranean and over

TABLE 2. Mean length at age of *E. teres* from the Aegean Sea

Age	Number of specimens	Min Total Length (mm)	Max Total Length (mm)	Average Total Length (mm)	Standard Deviation of Total Length
2+	1	19.7	19.7	19.7	–
3+	23	20.5	22.8	22.1	0.65
4+	6	22.9	23.3	23.0	0.16

1000 in the Red Sea). The difference in biodiversity between the two Seas is at present counterbalanced by the migration of species, adapted in warm and saline waters, through the Suez Channel (Por, 1978; Madl, 1999).

The main abiotic parameters affecting the spreading of Lessepsian migrants are temperature and salinity (Golani, 1990). Furthermore, the prerequisites for a species to be established in a new area are (1) adjustment of its reproductive processes and (2) succeeding in spawning during the suitable period, for its offspring to have favourable conditions to survive (Madl, 1999). *Etrumeus teres* possibly takes advantage of the lower competition and reduced predation in Eastern Mediterranean compared to the Red Sea. It has already been established in the Greek seas and perhaps it makes seasonal migrations due to trophic needs. Although the species presence is documented for the first time in the Greek Seas, fishermen from the Cyclades Islands reported that in August 1999 juveniles of *E. teres* were caught mixed with specimens of the species *Sardinella aurita*. From July 2002 until today, large quantities of the *E. teres* are fished regularly in the Cyclades sea area, while lately large quantities are also reported from Crete.

In order to confirm the hypotheses discussed above, a more thorough examination of the reproductive biology, growth dynamics and trophic niche of *E. teres* in the Greek Seas must take place. This is vital in assessing the response of this new colonizer to its new environment and the possible interactions and impacts this could have on the local pelagic species, such as anchovy and sardine and with the Aegean Sea ecosystem.

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