



First Record of White Sardine *Escualosa thoracata* (Valenciennes, 1847) (Clupeiformes: Clupeidae) from the Oman Sea

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Abstract: White sardine *Escualosa thoracata* (Valenciennes, 1847) was recorded for the first time from the Iranian coast of the Oman Sea. The identification was confirmed based on external morphometric and meristic characters, which were concordant with previously reported data. Genetic distances (based on 655 bp of COI Sequence) between identified and previously reported sequence were 0.8 % (*p*-distance). This record is a new addition to the ichthyofauna of the Oman Sea based on five specimens collected from Chabahar Bay.

Key words: COI, Chabahar bay, DNA barcoding

Introduction

The family Clupeidae contains 66 valid genera and 222 species (NELSON et al. 2016), including two species of the genus *Escualosa* Whitley, 1940. Members of this genus are small-sized, with standard length (SL) < 10 cm; they are strongly laterally compressed, with bright silver stripe along the flank and keeled belly. The white sardine *Escualosa thoracata* (Valenciennes, 1847) has a wide geographical range throughout the Indo-Pacific and northern Indian Ocean in pelagic-neritic waters of Australia, China, India, Pakistan, Philippines, Papua New Guinea and Thailand (WHITEHEAD 1985, FROESE & PAULY 2020). The western limit of distribution for this species was considered Karachi coasts in Pakistan and there is no previous record from coasts of the Oman Sea in Iran. The present study confirms *E. thoracata* for the first time in the Chabahar Bay and Iranian coast of the Oman Sea by morphological and molecular evidences.

Materials and Methods

Five specimens of the white sardine, with total length (TL) of 7.9-10.5 cm, were collected by a cast net from the Chabahar Bay (25°18'N, 60°37'E), Oman Sea, in summer 2019 (Figs. 1 and 2). The collected specimens were photographed. Two specimens were fin-clipped for molecular analysis. All specimens were catalogued in the Tarbiat Modares University Aquatic Animal Collection (TAC1225F). Nine morphometric measurements were taken using a calliper (0.02 mm accuracy) and eight meristic characters were studied using a stereomicroscope. Morphological data were compared with the available reported data on *E. thoracata* (WHITEHEAD 1985, RANDALL 1995, PSOMADAKIS et al. 2019). Genomic DNA was extracted using the phenol/chloroform method and the cytochrome C oxidase I (COI) gene was amplified and sequenced (WARD et al. 2005, ALAVI-YEGANEH & BAHMANI 2018). The obtained sequences were identical and were submitted to

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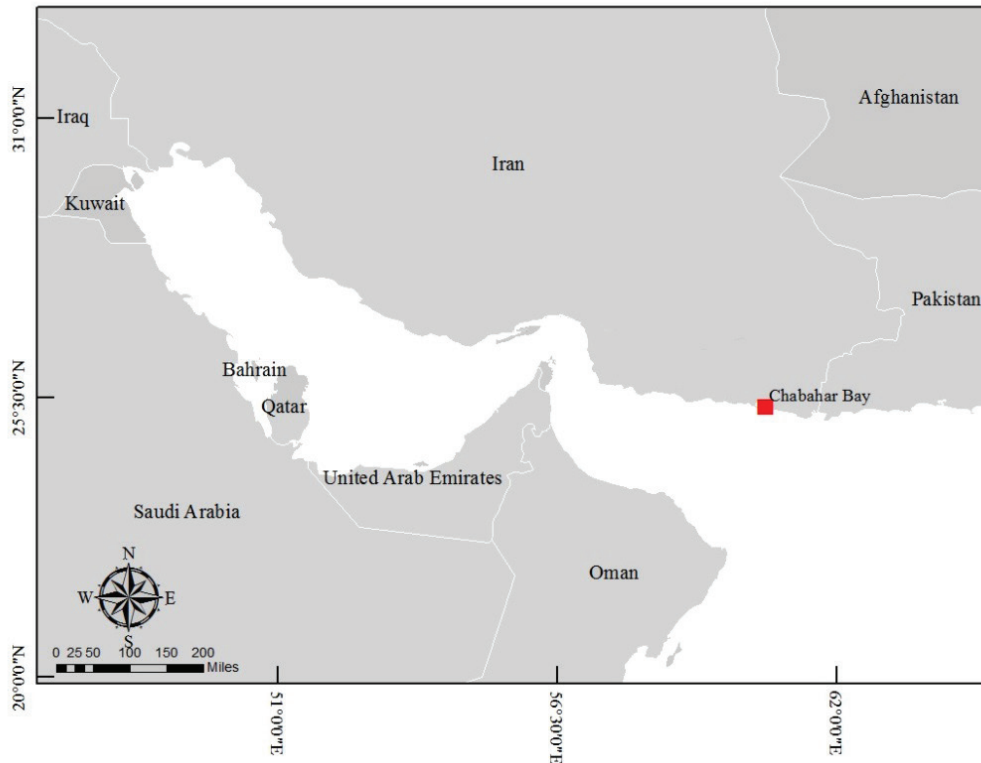


Fig. 1. Collection site of *Escualosa thoracata* (TL = 7.9-10.5 cm) from the Chabahar Bay, northern Oman Sea, summer 2019.



Fig. 2. White sardine *Escualosa thoracata* from the Chabahar Bay; Northern Oman Sea. TL = 10.5 cm.

the GenBank (Accession Numbers MW425682 and MW711782). The genetic distance between the identified COI haplotype of *E. thoracata* from the Oman Sea and other previous identified haplotypes from Bangladesh and Thailand were calculated using MEGA6 (TAMURA et al. 2013). The phylogenetic relationships of the identified haplotypes from white sardine with some other sardine species in the Oman Sea were analysed with Bayesian Inference (BI), MrBayes Ver. 3.1.2 (HUELSENBECK & RONQUIST 2001).

Results

Morphometric and meristic characters of the five collected specimens from the bay of Chabahar are presented in Table 1. All the measurements and meristic characters were concordant with the previously reported data for *E. thoracata* (WHITEHEAD 1985, RANDALL 1995). The white sardine is distinguished from the only other congeneric species, *E. elongata*, by its deeper body (27-37% SL vs. less than 25% SL in *E. elongata*), caudal peduncle width (10.7-13.2%

Table 1. Morphometric and meristic data for five specimens of *Escualosa thoracata* in comparison with previous records.

Parameters	Present study	Previous data (WHITEHEAD 1985, RANDALL 1995, PSOMADAKIS et al. 2019)
Total length (TL)	7.9-10.5 cm	-
Standard length (SL)	81.1±2.7% TL	84.6 % TL
Head length (HL)	18.8±1.1% TL	15.4 % TL
Pre dorsal fin length	37.8±1.1% TL	38.7 % TL
Pre pectoral fin length	18.2±0.5% TL	15.8 % TL
Pre anal fin length	59.7±3.6% TL	60.8 % TL
Pre orbital length	30.6±2.9% HL	30.0 % HL
Post orbital length	43.5±2.7% HL	-
Eye diameter	34.6±1.9% HL	35.6 % HL
Dorsal fin spine	0	0
Dorsal fin ray	13-14	13-21
Pectoral fin spine	0	0
Pectoral fin ray	12-13	12-14
Pelvic fin spine	0	0
Pelvic fin ray	7-8	6-8
Anal fin spine	0	0
Anal fin ray	14-18	14-19
Body depth	31.3±0.8 % SL	<i>E. elongata</i> (less than 25% SL) <i>E. thoracata</i> (27 to 37% SL)
Caudal peduncle width	11.9±1.2% SL	<i>E. elongata</i> (8 to 10.5% SL) <i>E. thoracata</i> (10.7 to 13.2% SL)

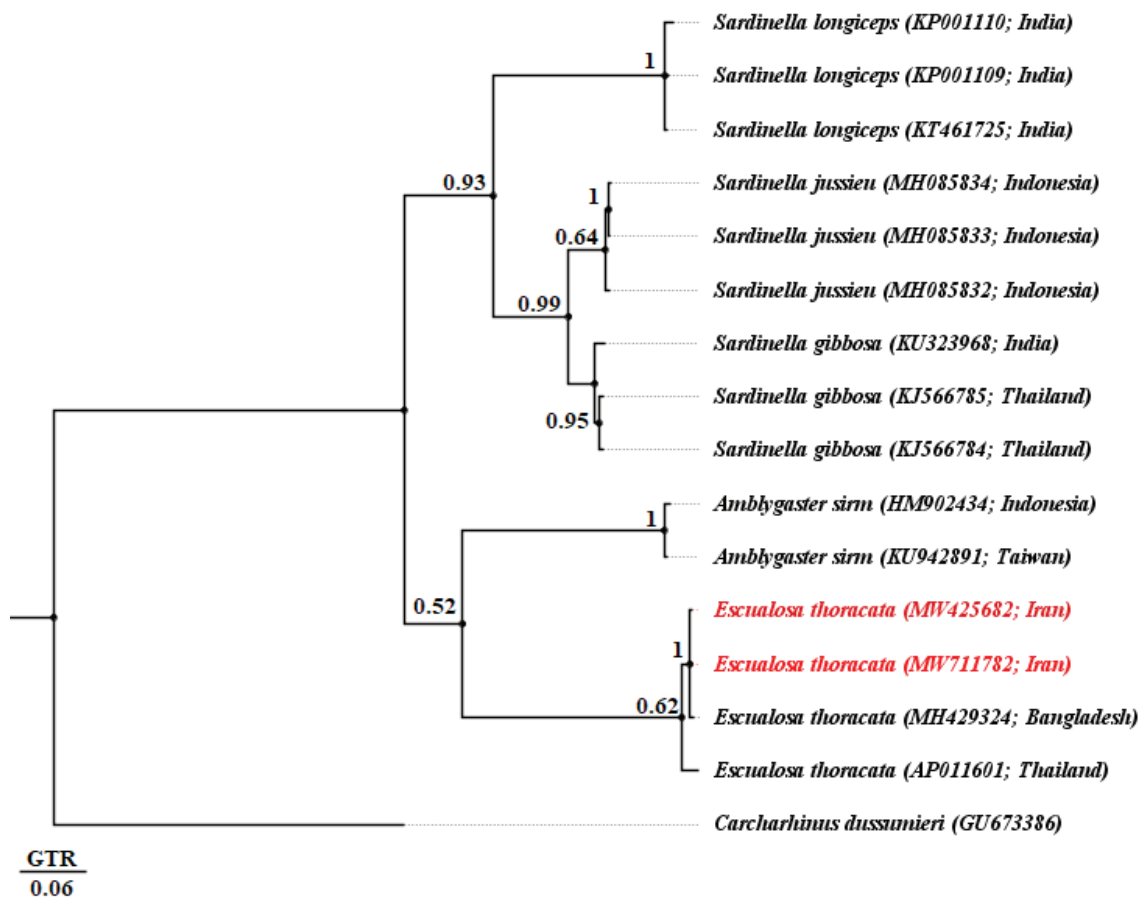


Fig. 3. Bayesian inference estimate of phylogenetic relationships of the collected specimens of *Escualosa thoracata* from the Oman Sea (COI; 655 bp; MW711782 & MW425682 in red colour) with some other sardine species from this area. Nodes are labelled with posterior probability values.

SL vs. 8-10.5% SL in *E. elongata*) and broader silver stripe (equal to eye diameter vs. half eye diameter for *E. elongata*).

Fragments of COI (655 bp) were sequenced from samples of *E. thoracata*. Genetic distances between identified sequence and previous reported sequence from Bangladesh (MH429324) and Thailand (AP011601) were 0.8 % (*p*-distance), while genetic distance among other congener sardine species in the area (*Sardinella* spp.; Oman Sea) was in the range of 14 to 20 % (*p*-distance). In the constructed phylogenetic tree, all sequences of *E. thoracata* formed a monophyletic clade, which was in sister position with haplotypes of the spotted sardinella (*Amblygater sirm*) (Fig. 3). All surveyed morphological and molecular characters confirmed identification of the collected specimens as *E. thoracata*.

Discussion

Regarding the available data from the Iranian Coast of the Oman Sea (WHITEHEAD 1985, RANDALL 1995, FROESE & PAULY 2020), the present study is the first report of the *E. thoracata* along the Iranian coast of the Oman Sea. It is confirmed by meristic and morphometric characters as well as by molecular data (COI gene sequence). The present study suggests that the distribution range of the white sardine has expanded to the north part of the Oman Sea as the western limit of its distribution. The lack of previous records of white sardine in this region is possibly due to lack of comprehensive studies. The other possible reason could be related to climate change effect on the expansion of the distribution range of the species. Climate change has already been proven to be the reason for the expansion of the distribution range of *Gazza minuta* and *Deveximentum ruconius* into the Oman Sea (JAWAD & AL-MAMRY 2013, ALAVI-YEGANEH & DEYRESTANI 2016, KHAJAVI & ALAVI-YEGANEH 2020). This study adds a new fish species to the fish fauna of the Oman Sea.

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