



Fecundity of Chub Mackerel (*Scomber japonicus* Houttuyn, 1782) in the Aegean Sea

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(With 2 figures)

Abstract

This study was carried out in April - June 2014 to determine absolute fecundity (F) of the chub mackerel (*Scomber japonicus* Houttuyn, 1782) in Saros Bay (Aegean Sea, Turkey). The relations between the absolute fecundity and total length, total weight and age of the chub mackerel females were estimated as $F=0.0318TL^{4.81}$, $F=1573.9TW-42858$ and $F=109607A-136129$, respectively. This study aims to contribute to the reproductive biology of *S. japonicus* by reporting the first findings about the absolute fecundity of the species for the Aegean Sea.

Keywords: *Scomber japonicus*, fecundity, Saros Bay, Aegean Sea.

Fecundidade da cavala (*Scomber japonicus* Houttuyn, 1782) no Mar Egeu

Resumo

Este estudo foi realizado em abril-junho de 2014 para determinar a fecundidade absoluta (F) da cavala (*Scomber japonicus* Houttuyn, 1782) na Baía de Saros (Mar Egeu, Turquia). As relações entre a fecundidade absoluta e comprimento total, peso total e a idade da cavala fêmeas foram estimados como $F=0.0318TL^{4.81}$, $F=1573.9TW-42858$ e $F=109607A-136129$, respectivamente. Este estudo visa contribuir para a biologia reprodutiva de *S. japonicus*, apresentando as primeiras conclusões sobre a fecundidade absoluta das espécies para o Mar Egeu.

Palavras-chave: *Scomber japonicus*, fecundidade, Baía de Saros, Mar Egeu.

1. Introduction

Fecundity studies are of great importance in total population assessments, productivity and population dynamics studies, and the determination of the specific properties of the populations, subpopulations, and/or fish stocks (De Martini and Sikkel, 2006).

The chub mackerel (*Scomber japonicus* Houttuyn, 1782) is a cosmopolitan middle-sized pelagic species inhabiting warm and temperate coastal waters of the Atlantic, Indian, and Pacific oceans and adjacent seas. It is found in the continental slope from the surface to the depth of 300 m and reaches its deepest levels during the day (Collette and Nauen, 1983). By virtue of its commercial importance worldwide, many studies has been conducted regarding growth and reproduction (Tchetchach et al., 2010; Cikeš Keč and Zorica, 2012; Cerna and Plaza, 2014), weight-length relationships (Petrakis and Stergiou, 1995; Moutopoulos and Stergiou, 2002; Karakulak et al., 2006), fishery (Cengiz et al., 2013a), feeding habit (Castro, 1993) and hermaphroditism (Özekinci et al., 2009), as a summary.

The objectives of the present study were: (1) to contribute to the reproductive biology of *S. japonicus* by reporting the first findings about the absolute fecundity of

the species for the Aegean Sea and (2) to compare these results with those of the previous studies.

2. Material and Methods

Saros Bay, which is situated in the Northeastern Aegean Sea, is connected to the North Aegean with a depth of approximately 600 m to the west. The shelf extends at a water depth of 90-120 m. The length of the bay is about 61 km and the width at the opening to the Aegean Sea is about 36 km (Eronat and Sayin, 2014). Cengiz (2012) reported that the spawning period of the chub mackerel occurred between April and August with a peak in June in the Saros Bay. Therefore, 35 fully mature females *S. japonicus* were sampled with handline during the spawning season in 2014 (Figure 1).

The specimens were measured to the nearest 1 mm (total length, TL), weighed to the nearest 0.01 g (total weight). Following removal, the sagittal otoliths were first soaked in 5% HCL and 3% NaOH solutions, respectively, and washed in distilled water and subsequently dried. The sagittal otoliths, placed in watch glass filled with the water, were read using a stereoscopic zoom microscope

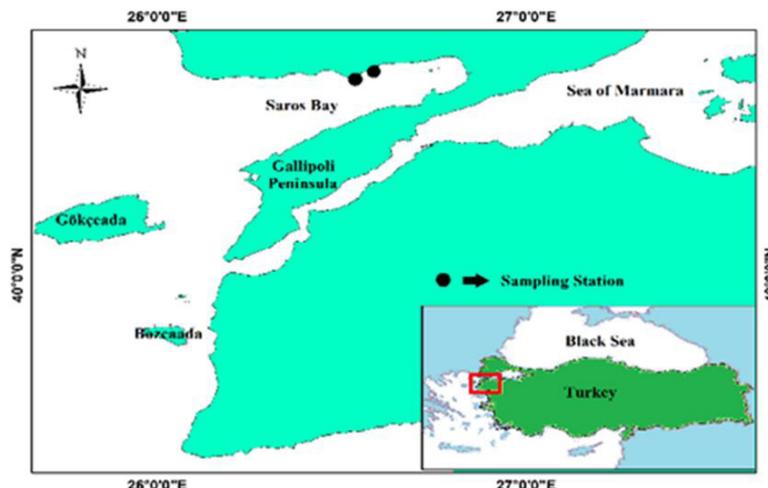


Figure 1. Saros Bay and sampling station.

under reflected light against a black background. Opaque and transparent zones were counted; one opaque zone plus one transparent zone was assumed to be one year (Cengiz et al., 2013b). Gravimetric method was used for fecundity estimates (Bagenal and Braum, 1978). In order to calculate fecundity, the ovaries of mature females (prior to the reproductive period) were weighed the nearest 0.0001 g (total weight), three sub-samples were taken from the front, mid- and rear sections of each ovary, weighed and then immersed separately in Gilson’s fluid. These ovaries were frequently shaken to ensure the separation of oocytes from ovarian tissues. All oocytes were counted directly under stereoscopic zoom microscope. The total number of eggs in each ovary sub-sample was then estimated by using the equation provided by Yeldan and Avşar (2000): $F_1 = (W_g \times N) \times W_s^{-1}$, where F_1 is the total number of eggs in ovary sub-sample 1, W_g is the gonad weight, N is the number of eggs in the sub-sample, and W_s is sub-sample weight. Later, by taking the mean number of three sub-sample fecundities (F_1 , F_2 , and F_3), the absolute fecundity (F) for each female fish was estimated as: $F = (F_1 + F_2 + F_3)^{-3}$. Hereby, the relations between absolute fecundity (F) and total length (TL), absolute fecundity (F) and total weight (TW), as well as absolute fecundity (F) and age (A) were estimated as $F = aTL^b$, $F = a + bTW$ and $F = a + bA$, respectively, where a and b are the parameters of the equation (Avsar, 2005).

3. Results and Discussion

The absolute fecundity (F) was estimated for 35 ripe females (age 2 to 4) caught in April-June 2014. A maximum value of 350622 eggs was recorded in 4 year-olds fish weighing 260.22 g (29.2 cm TL) and a minimum value of 77989 eggs for 2 year-olds fish weighing 69.36 g (20.7 cm TL). The mean value \pm standard error of absolute fecundity was 177035 ± 14645 . The relations between the absolute fecundity and total length, total weight and age of the chub mackerel females were estimated as $F = 0.0318TL^{4.81}$, $F = 1573.9TW - 42858$ and $F = 109607A - 136129$, respectively (Figure 2).

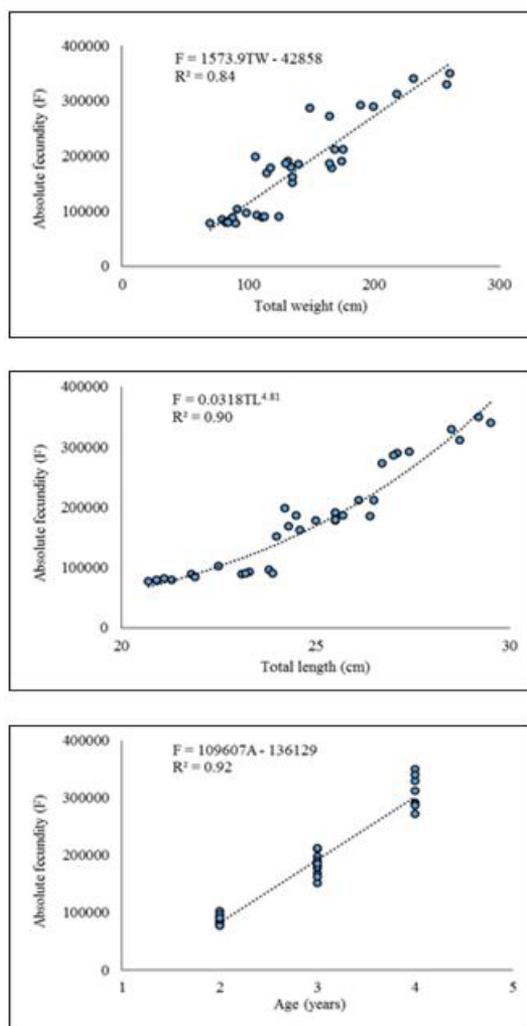


Figure 2. The relations between the absolute fecundity and total length, total weight and age of the chub mackerel females, *Scomber japonicus*, from Saros Bay.

Table 1. The fecundity values of *Scomber japonicus* in different areas.

Author (s)	Area	F	BF	RF	Fish Length
Dickerson et al. (1992)*	California	-	68.400 (23.280-120.537)	168 (53.1-315)	30.0-34.0
Yamada et al. (1998)*	Izu Islands, Japan	-	89.200 (18.900-157.600)	158	32.9-39.3
Techetach et al. (2010)*	Larache, Morocco	285.704 (77.621-465.712)	-	-	20.5-31.4
Cikeš Keč and Zorica (2012)*	Eastern Adriatic Sea	181.277 (99.166-394.120)	-	-	21.2-34.6
This study	Saros Bay, Aegean Sea	177.035 (77.989-350.622)	-	-	20.7-29.2

*from Techetach et al. (2019); F, absolute fecundity; BF, batch fecundity; RF, relative fecundity.

Table 1 presents the fecundity values of *Scomber japonicus* in different areas.

Within a given species, fecundity may vary as a result of different adaptations to environmental habitats (Witthames et al., 1995). Even within a stock, fecundity is known to vary annually, undergo long-term changes (Rijnsdorp, 1991). However, the fecundity-size relations has been used principally as a rapid means of predicting the fecundity of fish (Dulčić et al., 1998). Consequently, the results of this study will increase the life history data available for *S. japonicus* by providing the scientific support required so as to identify the current stock state and will help conservation and management of the species.

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