

## OCCURRENCE OF BLUEFISH, *POMATOMUS SALTATOR* (LINNAEUS, 1766), AND BUTTERFISH, *STROMATEUS FIATOLA* (LINNAEUS, 1758), JUVENILES IN THE EASTERN CENTRAL ADRIATIC

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### ABSTRACT

The bluefish, *Pomatomus saltator*, and butterfly, *Stromateus fiatola*, juveniles were caught near Cape Čiovo (island of Čiovo, eastern central Adriatic) and near Stončica station (island of Vis, eastern central Adriatic) in September 1999, respectively. There are no previous records of the bluefish and butterfly juveniles in the eastern Adriatic, although several studies and investigations on fish juvenile stages were carried out between 1975 and 1998 in the eastern Adriatic. The main morphometric and meristic data are given.

**Key words:** *Pomatomus saltator*, *Stromateus fiatola*, juveniles, eastern Adriatic, first occurrence

## RITROVAMENTO DI STADI GIOVANILI DI PESCE SERRA, *POMATOMUS SALTATOR*, (LINNAEUS, 1766) E DI FIETO, *STROMATEUS FIATOLA* (LINNAEUS, 1758), NELL'ADRIATICO CENTRO-ORIENTALE

### SINTESI

Stadi giovanili di pesce serra, *Pomatomus saltator*, e di fieto, *Stromateus fiatola*, sono stati catturati nelle vicinanze di capo Čiovo (isola di Čiovo, Adriatico centro-orientale) e della stazione di Stončica (isola di Vis, Adriatico centro-orientale) a settembre del 1999. Sebbene tra il 1975 ed il 1998 siano stati condotti numerosi studi sugli stadi giovanili di pesci nell'Adriatico orientale, non risulta alcuna segnalazione precedente del ritrovamento di stadi giovanili di pesce serra e di fieto nell'Adriatico orientale. Nell'articolo vengono riportati i dati morfometrici e meristici.

**Parole chiave:** *Pomatomus saltator*, *Stromateus fiatola*, stadi giovanili, Adriatico orientale, primo ritrovamento

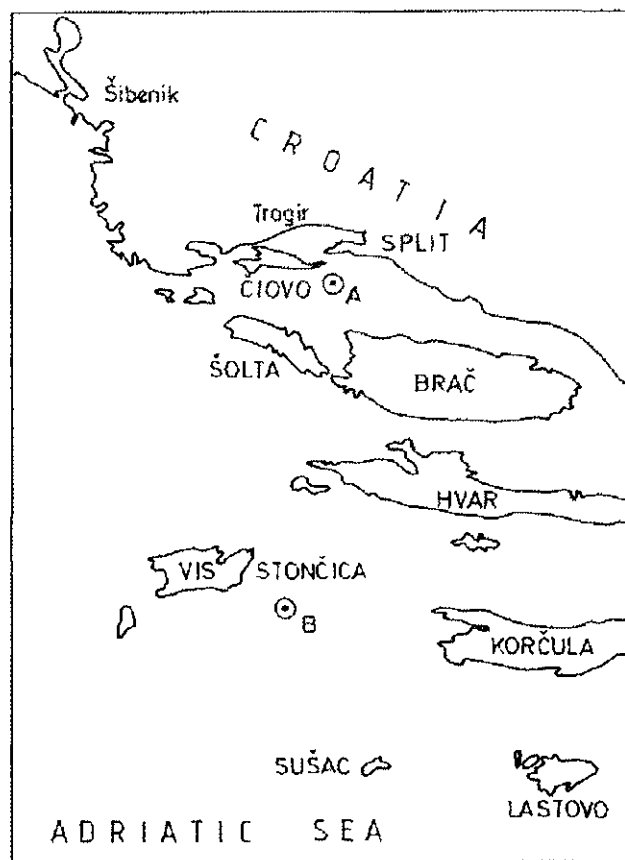
### INTRODUCTION

The bluefish, *Pomatomus saltator* (Linnaeus, 1766), is a pelagic species living in shoals (chiefly when young) along the continental shelf from 0 to 200 m. It is common in the eastern Atlantic from Portugal, Madeira, the Canaries, southward along African coasts to South Africa, also in the Mediterranean and the Black Sea (elsewhere, subcosmopolitan in tropical and subtropical seas) (Tortonese, 1986). This species is fairly rare in the Adriatic Sea (Jardas, 1996).

The butterfly, *Stromateus fiatola* Linnaeus, 1758,

occurs near the bottom over continental shelves from 12 to 50 m in depth. It occurs at the Atlantic coasts from the Bay of Biscay (rare) southward to Cape Town, and in the Mediterranean (not Adriatic) (Haedrich, 1986). Jardas (1996) reported about its presence in the Adriatic Sea (fairly rare).

There is no published information on biology and ecology of both species in the Adriatic. The aim of this paper is to provide first data on the occurrence of juveniles of the bluefish and butterfly in the eastern Adriatic and their morphometric and meristic characteristics.



**Fig. 1: Sites where juveniles of *Pomatomus saltator* and *Stromateus fiatola* were found (A - Cape Čiovo, island of Čiovo; B - Cape Stončica, island of Vis).**

**Sl. 1: Lokacije, na katerih so bile ujete mladice *Pomatomus saltator* in *Stromateus fiatola* (A - rt Čiovo, otok Čiovo; B - rt Stončica, otok Vis).**

#### MATERIAL AND METHODS

The bluefish juvenile was caught (29.09.1998) near Cape Čiovo (island of Čiovo, eastern central Adriatic) at the depth between 15 and 20 m on sandy-muddy bottom covered by *Posidonia oceanica* (Fig. 1). The butterfish juvenile was caught by bottom trammel set (23.09.1998) near Stončica station (island of Vis, eastern central Adriatic) at the depth of 20 m on rocky-sandy-muddy bottom (Fig. 1).

The specimens were identified according to Šoljan (1975). They are deposited in the Ichthyological Collection of the Institute of Oceanography and Fisheries in Split, Croatia.

The specimens were preserved in 4% buffered formaldehyde immediately after capture, subsequently measured to the nearest 0.01 mm, and weighed to the nearest 0.01 g. Reduction in length caused by preservation depends on initial lengths of the specimens and duration of storage. Meristic characteristics considered

were dorsal, anal, pectoral, ventral, caudal fins, and number of scales in the longitudinal line and denticles.

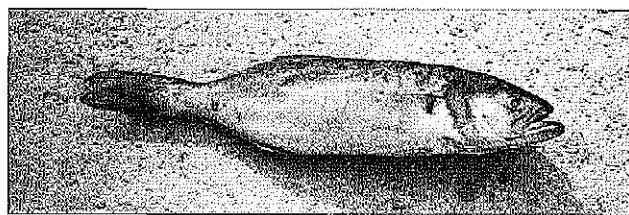
#### RESULTS AND DISCUSSION

Juveniles of the bluefish have elongate compressed body and large head (Fig. 2). Mouth terminal, lower jaw is slightly prominent. Pectoral fin is short, not reaching to origin of soft dorsal fin. Colour is silvery, greenish-grey on back and there is a longer black spot at the base of pectoral fin.

Juveniles of the butterfish have deep compressed body. Eyes and mouth small, dorsal fin single and long based, longer than the similar anal fin. Anterior rays longer than those, which follow, but fins not falcate. Pectoral fins broad and wing-like, but not prolonged, while pelvic fins are absent. Colour is generally bluish on the back, with dark vertical bars, and whitish on the sides and below, overall with a silver cast.

Studies on larval and juvenile stages of fish are of particular importance to population dynamics, especially to recruitment and biological models incorporating environmental parameters (Houde, 1986; Myers & Cadigan, 1993). The bluefish and butterfish are fairly rare species in the Adriatic Sea (Jardas, 1996; Pallaoro & Jardas, 1996). Graeffe (1888) reported about the presence of both species at Trieste fish market and their occurrence together with jellyfish *Rhizostoma pulmo* L. From that time only several specimens of the bluefish have been caught until now in the eastern Adriatic, the first one near Dubrovnik in June 1887, and the second near Split (without data on date of capture) registered by J. Kolombatović (Langhoffer, 1903). Further records were made near Vranjic (Split area) on June 16 in 1938, and in Tarska Cove - Novigrad (Istra peninsula) on December 6 in 1991.

The first record of the butterfish was made near Rijeka on July 16<sup>th</sup> in 1896 (Langhoffer, 1903). Other records were in the Neretva Channel on November 20 in 1944 (Onofri, 1997), in Trpanj area (Pelješac peninsula) on February 2 in 1996 (Pallaoro & Jardas, 1996), in Dubrovnik area (without data on date of capture) (Mušin, 1989) and in Vis Channel (without data on date of capture) (Onofri, 1983).



**Fig. 2: Juvenile specimen of the bluefish *Pomatomus saltator*.**

**Sl. 2: Mladica skakavke *Pomatomus saltator*.**

In table 1 the main morphometric and meristic data of both species are presented.

**Tab. 1. Morphometric (in mm) and meristic data of the bluefish and butterfish juveniles in the eastern Adriatic.**

**Tab. 1. Morfometrični (v mm) in meristični podatki o mladincih skakavke in fige v vzhodnem Jadranu.**

Species	<i>Pomatomus saltator</i>	<i>Stromateus fiatola</i>
Weight (W) (g)	250.3	44.30
<b>Morphometric characters (cm)</b>		
Total length (TL)	30.20	16.30
Standard length (SL)	25.60	12.62
Head length (C)	6.56	2.99
Predorsal length (LPD)	8.83	3.62
Preal anal length (LPA)	15.14	5.31
Prepectoral length (LPP)	7.23	3.24
Preventral length (LPV)	7.86	3.42
First dorsal fin length (LD1)	3.60	7.42
Second dorsal fin length (LD2)	6.98	-
Anal fin length (A)	6.40	5.01
Pectoral fin length (LP)	4.33	2.88
Ventral fin length (LV)	2.95	0.22
Caudal fin length (LC)	6.15	3.76
Maximal body height (Tmax)	6.59	6.45
Minimal body height (Tmin)	2.08	0.97
Eye diameter (O)	1.08	0.59
Interorbital length (Io)	1.71	1.29
Preorbital length (Po)	1.66	0.85
Postorbital length (Olo)	3.97	1.65
<b>Meristic characters</b>		
First dorsal fin (D1)	VII	VI / 44
Second dorsal fin (D2)	25	-
Anal fin (A)	III / 24	III / 34
Pectoral fins (P)	16	23
Ventral fins (V)	I / 5 + 5 / 1	3
Caudal fin (C)	III + 16 + III	IV + 16 + IV
Linea lateralis (LI)	102	-
Dentes sup.	15	-
Dentes inf.	18	-

There are no previous records of the bluefish and butterfish juveniles in the eastern Adriatic, although several studies and investigations on fish juvenile stages were carried out between 1975 and 1998 in the eastern Adriatic.

The meristic characteristics of the bluefish juveniles (Tab. 1) slightly differ from data by Tortonese (1986), i.e. D1 VII-VIII, D2 1+2-28, A II+23-27, while the characteristics of butterfish differ from data by Haedrich (1986), i.e. D 42-50, A 33-38, P 21-25.

These September records show that both species probably spawn in the middle Adriatic or even more to the south, especially when we take into consideration that the bluefish spawns in spring and summer (Tortonese, 1986). There are no data about reproduction of the butterfish in the Mediterranean, but this record could suggest that it is probably in the summer period, which is in agreement with the findings for Adriatic (Jardas, 1996). We suppose that both specimens are about one year old according to the spawning season. Spawning of the bluefish was limited to the warmest months, from July to September along the Catalan coast, when the surface temperature was about 25°C, suggesting an inshore spawning (Sabatés & Martin, 1993). Until quite recently, there were no reliable data on bluefish spawning in the Black Sea, but Gordina & Klimova (1996) showed that bluefish spawned throughout the Black Sea from June to September at temperatures from 20° to 26°C. Sabatés and Martin (1993) stated that the northern limit of the geographic distribution of bluefish in the Mediterranean is the Catalan coast, but the findings of bluefish specimens in the Tar Cove (Mirna estuary-northern Adriatic) could not support this statement. It should be emphasised that in 1998 the eastern Adriatic was characterised by some interesting records of thermophilic species more northerly, for example, species *Ruvettus pretiosus* (Bettoso & Dulčić, 1999) in the Gulf of Trieste. An unusual occurrence of such rarely found fish could be related to the changes in climate and/or oceanographical conditions (Quigley, 1985; Dulčić *et al.*, 1999). The penetration and occurrence of both species might be connected with some special climatological and oceanographical conditions and input of intermedian waters (50-100 m) in the central Adriatic, which influenced the increase in salinity and temperature. Pallaro (1988) also stated that the Adriatic incursions caused more rare species to appear in the central Adriatic region in the 1986-87 period. As quoted by Harmelin (1991), some species with southern affinities (*Seriola dumerili*, *Diplodus cervinus*, *Balistes carolinensis*, *Epinephelus alexandrinus*) are being found more commonly along the northwestern Mediterranean coasts. Juveniles of these species were observed at relatively high latitudes, such as Calvi and Barcelona. Changes in the physical properties of the water and natural fluctuations in space and time are perhaps responsible for the mentioned occurrences (Saldanha, 1992). The status of the bluefish and butterfish needs to be evaluated on a continuous basis because it is becoming increasingly apparent that uncommon species, and particularly those on the edge of their distribution, can be essential indicators of environmental change (Swabby & Potts, 1990).

POJAVLJANJE MLADIC SKAKAVKE *POMATOMUS SALTATOR* (LINNÉ, 1766) IN FIGE *STROMATEUS FIATOLA* (LINNÉ, 1766) V VZHODNEM SREDNJEM JADRANU

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## POVZETEK

Septembra 1999 so bile v bližini rta Čiovo (otok Čiovo, vzhodni srednji Jadran) ujete mladice skakavke *Pomatomus saltator*, v bližini postaje Stončice (otok Vis, vzhodni srednji Jadran) pa mladice fige *Stromateus fiatola*. Iz vzhodnega Jadrana doslej še ni bilo zapisov o pojavljanju mladice teh ribjih vrst, čeprav je bilo med letoma 1975 in 1998 v vzhodnem Jadranu opravljenih že več študij in raziskav o razvojnih stadijih mladice. Delo vsebuje tudi poglavitne morfološke in meristične podatke.

**Ključne besede:** *Pomatomus saltator*, *Stromateus fiatola*, mladice, vzhodni Jadran, prvo pojavljanje

## REFERENCES

- Bettoso, N. & J. Dulčić (1999): First record of the oilfish *Ruvettus pretiosus* (Pisces: Gempylidae) in northern Adriatic Sea. *J. Mar. Biol. Ass. U.K.*, 79, 1145-1146.
- Dulčić, J., B. Grbec & L. Lipej (1999): Information on the Adriatic ichthyofauna - effect of water warming. *Acta Adriat.*, 40(2), 33-44.
- Gordina, A. D. & T. N. Klimova (1996): On bluefish (*Pomatomus saltatrix* L.) spawning in the Black Sea. *Mar. Fres. Wat. Res.*, 47(2), 315-318.
- Graeffe, E. (1888): Übersicht der Seethierfauna des Golfes von Triest nebst Notizen über Vorkommen, Lebensweise, Erscheinungs- und Fortpflanzungszeit der einzelnen Arten. *Pisces (Fische)*, 1-26.
- Haedrich, R. L. (1986): Stromateidae. In: Whitehead, P.J.P., M.-L. Bauchot, J.-C. Hureau, J. Nielsen & E. Tortonese (eds.): *Fishes of the north-eastern Atlantic and the Mediterranean*. UNESCO, Paris, 565 pp.
- Harmelin, J. G. (1991): Statut du corb (*Sciaena umbra*) en Méditerranée. In: Boudouresque, C. F., M. Avon & V. Gravez (eds.): *Les Espèces Marines à Protéger en Méditerranée*. GIS Posidonie Publ. Marseille, France, 291-227.
- Houde, E. D. (1986): Potential for growth, duration of early life stages and regulation of recruitment in marine fish. *Int. Count. Explor. Sea ICES CM*, 1986/I, 28 pp.
- Jardas, I. (1996): Jadranska ihtiofauna. Školska knjiga, Zagreb, 533 pp.
- Langhoffer, A. (1903): Popis riba narodnog zoološkog muzeja u Zagrebu do konca godine 1900. *Glasnik hrvatskog naravoslovnog društva*, XV - prva polovina. Vlasništvo i naklada društva, Oton Kučera (ed.)
- Mušin, D. (1989): Ichthyological collection (Cyclostomata, Selachii, Osteichthyes) of the Natural History Museum of the Biological Institute, Dubrovnik. *Matice srpske za prirodne nauke*, 76, 137-168.
- Myers, R. A. & N. G. Cadigan (1993): Density dependent juvenile mortality in marine demersal fish. *Can. J. Fish. Aquat. Sci.*, 50, 1576-1590.
- Onofri, I. (1983): Riba (Pisces) prirodoslovnog muzeja u Splitu. *Matice srpske za prirodne nauke*, 64, 23-50.
- Onofri, I. (1997): On rare fish species in the Adriatic Sea. In: Finka, B., S. Jukić, S. Kaštela, M. Maras, I. Petricoli & T. Vodopija (eds.): *Zbornik radova znanstvenog skupa "Tisuću godina prvog spomena ribarstva u Hrvata"*. Razred za filološke znanosti HAZU, Zagreb, 531-541 (in Croat.)
- Pallaoro, A. (1988): O mogućnostima pojave nekih rijetkih vrsta riba na srednjeadrskom području u vezi sa jadranskom ingresijom 1986/87 godine. *Morsko ribarstvo*, 3, 82-87.
- Pallaoro, A. & I. Jardas (1996): Ichthyological collection of the Institute of Oceanography and Fisheries in Split (Croatia). *Nat. Croat.*, 3, 177-219.
- Quigley, D. T. G. (1985): Specimens of trigger fish *Balistes carolinensis* Cmelin, 1789 (*B. capricus* Cmelin) from Achill Island, Co. Mayo, and a review of the Irish records. *Ir. Nat. J.*, 21(11), 474-476.
- Sabatés, A. & P. Martin (1993): Spawning and distribution of bluefish *Pomatomus saltatrix* (L.) in the north-western Mediterranean. *J. Fish. Biol.*, 43: 109-118.
- Saldanha, L. (1992): Marine fishes, habitats and conservation. *Neth. J. Zool.*, 42(2-3), 190-199.
- Swabby, S. E. & G. W. Potts (1990): Rare British marine fishes - identification and conservation. *J. Fish. Biol.*, 37, 133-143.
- Šoljan, T. (1975): I pesci dell'Adriatico. *Officine grafiche di Verona*, 522 pp.
- Tortonese, E. (1986): Pomatomidae. In: Whitehead, P. J. P., M.-L. Bauchot, J.-C. Hureau, J. Nielsen & E. Tortonese (eds.): *Fishes of the north-eastern Atlantic and the Mediterranean*. UNESCO, Paris, 812-813.