

OCCURRENCE OF FINGERLINGS OF GREY TRIGGERFISH, *BALISTES CAROLINENSIS* GMELIN, 1789 (PISCES: BALISTIDAE), IN THE EASTERN ADRIATIC

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ABSTRACT

Three fingerlings of *Balistes carolinensis* Gmelin, 1789, found under a floating wreckage near the coast of the islet Gubavac (vicinity of the settlement Lumbarda, Korčula island), in September 1994, provided the first occurrence of the grey triggerfish fingerlings in the eastern Adriatic. This occurrence shows that this species spawns in the south-eastern Adriatic. The main morphometric and meristic data are given. The status of the grey triggerfish needs to be evaluated on a continuous basis as it is becoming increasingly apparent that uncommon species, and particularly those on the edge of their distribution, can be essential indicators of environmental change.

Key words: *Balistes carolinensis*, fingerlings, Eastern Adriatic, first occurrence

INTRODUCTION

The grey triggerfish, *Balistes carolinensis* Gmelin, 1789, occurs on reefs and in open waters in tropical and subtropical seas, chiefly over rocky bottoms at 10-100 m. It is common in the Mediterranean Sea and on both sides of the Atlantic (from the North Sea to Angola and from Nova Scotia to Argentina) but rare in the Black Sea (Tortonese, 1986). This species also occurs in the Adriatic Sea, especially in its southern part (Jardas, 1983, 1996; Pallaoro, 1988), and in warmer years it may be found in the northern Adriatic (Pallaoro, 1988).

There is no published information on biology and ecology of the grey triggerfish in the eastern Adriatic. The aim of this paper is to provide first data on the occurrence of fingerlings of grey triggerfish in the eastern Adriatic and their morphometric and meristic characteristics.

MATERIAL AND METHODS

Three fingerlings were found under a floating wreckage near the coast of the islet of Gubavac in the vicinity of the settlement Lumbarda (Korčula island) in the southeastern Adriatic in September 1994 (Fig. 1).

The specimens were identified according to Šoljan (1975) and Tortonese (1986). They are deposited in the Ichthyological Collection of the Institute of Oceanography and Fisheries in Split.

Specimens were preserved in 4% buffered formalin immediately after capture, subsequently measured to the nearest 0.1 mm (Fig. 2) and weighed to the nearest 0.01 g. Reduction in length caused by preservation depends on the initial lengths of the specimens and duration of storage. Preservation in formalin causes an average 5% loss in total length of larvae and fingerlings (Mc Gurk, 1984). Meristic characteristics considered were dorsal, anal, pectoral, caudal fin rays and number of scales in the longitudinal line.

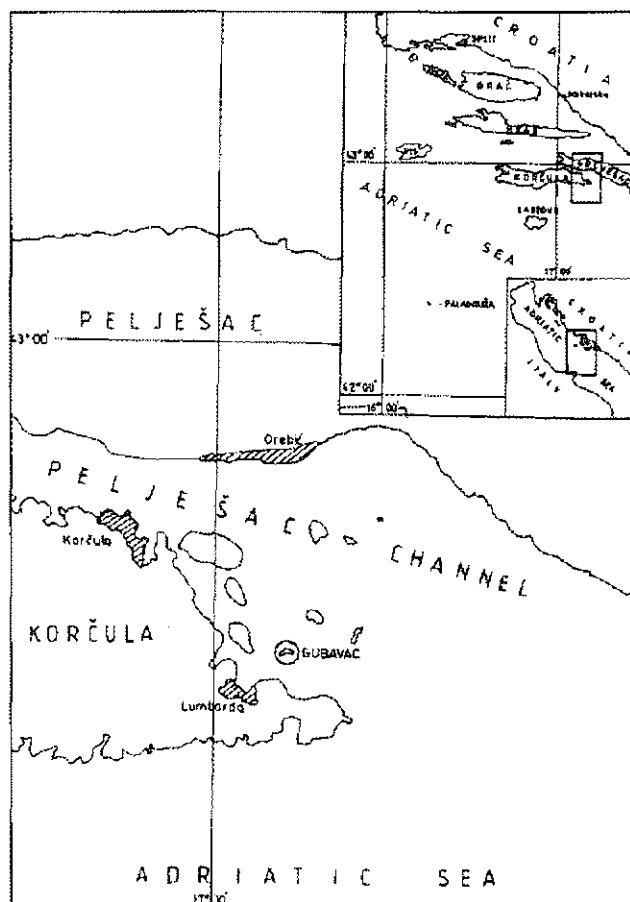


Fig. 1: Site where fingerlings of *Balistes carolinensis* were found (islet Gubavac).

Sl. 1: Lokaliteta mladice balestre *Balistes carolinensis* (ob otočku Gubavac).

RESULTS AND DISCUSSION

The grey triggerfish is relatively common in the south-eastern Adriatic and belongs to amphiatlantic bio-geographical elements (Tortonese, 1964, 1970; Jardaš, 1983, 1996). It is considered very rare in the northern areas, and only occurs in some years in the central Adriatic in the regions of Split and Zadar. The last occurrence was recorded in 1986/87 when several adult specimens were caught near the island of Ugljan and in Kornati Archipelago. Specimens occurred around the island of Lošinj in the northern Adriatic (Pallaoro, 1988); in 1969 and again in 1978, specimens were reported from the extreme north of the Adriatic in the Gulf of Venice (Boldrin & Rallo, 1980). Specimens were also recorded in Slovenian coastal waters (Piran Bay) and one is kept in the Piran Aquaria (Lipej, pers. comm.)

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). There are no previous records of the grey triggerfish fingerlings in the eastern Adriatic although several studies and investigations on fish juvenile stages were carried out between 1975 and 1995 in the eastern Adriatic.

Fingerlings of the grey triggerfish has short and deep body. Eyes are near dorsal edge. Mouth are small and jaws short and strong with two rows of few incisor-like teeth (Randall, 1968; Tortonese, 1986). Specimens have two dorsal fins; the anterior fin is equipped with three spines (Tortonese, 1986). Pelvic fins are replaced by short spine at end of long and movable pelvic bone. Gill openings are very small. There were no blue stripes below the eye (a pair of blue side stripes below the eye is characteristics of *Balistes vetula* L., 1758). It is indicative that all specimens were found under a floating wreckage, which is in agreement with the findings of Tortonese (1986). All specimens are without elongated caudal rays, which are characteristics of adult species (Bini, 1968; Tortonese, 1986).

In Table 1 the main morphometric and meristic data of the three specimens are presented.

Specimens	1	2	3
Total length	40.0	46.9	48.6
Standard length	33.1	38.9	40.8
Predorsal length	10.0	12.5	13.3
Preanal length	23.1	25.5	27.3
Preventral length	21.1	22.3	22.5
First dorsal fin, length	7.6	8.4	9.0
Second dorsal fin, length	11.4	12.2	13.0
Anal fin, length	6.2	6.7	7.0
Pectoral fin, length	6.6	6.9	6.9
Body depth (max)	18.2	19.1	21.3
Body depth (min)	4.4	4.5	4.8
Head length	13.8	14.9	15.7
Ocular diameter	3.4	3.9	4.3
Preorbital length	7.5	8.0	8.2
Postorbital length	3.3	3.8	3.9
First dorsal fin rays (D ₁)	III	III	III
Second dorsal fin rays (D ₂)	27	27	27
Anal fin rays (A)	25	25	26
Pectoral fin rays (P)	14	14	14
Caudal fin rays (C)	11	11	11
Scales	54	54	55

Tab. 1: Morphometric and meristic data (in mm) of the grey triggerfish fingerlings in the south-eastern Adriatic (islet Gubavac).

Tab. 1: Morfometrični in meristični podatki (v mm) mladice balestre v jugovzodnem Jadranu (otoček Gubavac).

The meristic characteristics of fingerlings (Table 1) closely correspond with data by Bini (1968), i.e. D_1 III, D_2 27-28, A 25-27, P 14, C 10-12, but differ from data by Tortonese (1986) i.e. D III+2, 22-25, A 2-3, 22-23.

Even several adult stages were caught and since there are no previous records of larval and fingerling stages, the following question was raised: "Does the grey triggerfish spawn in the eastern Adriatic?" This September record shows that this species probably spawns in the southeastern Adriatic or even more the south, especially when we take into consideration that the grey triggerfish spawns in summer in the Mediterranean (Tortonese, 1986). We suppose that this specimens are about 3 or 4 months old according to the spawning time. Ofori-Danson (1990) defined the breeding season of the grey triggerfish as October to December (warmer

months) in the Ghanalan coastal waters (Africa). The same author noted that the spawning of this species was characterized by relatively short preceding period of average minimum sea-surface temperature of 22.6°C. First time spawners were 13.3-15.7 cm in fork length (mean length $L=14.4$ cm, about 50.0-70.5 g in weight and one year of age) (Ofori-Danson, 1989, 1990). Wheeler (*pers. comm.*, after Quigley *et al.*, 1993), based on unsubstantiated reports on the occurrence of very small "young" triggerfish in Irish waters, speculated that the species may be "breeding quite close to Irish coasts (perhaps in Biscay)". It should be emphasized that in 1994 the eastern Adriatic was characterized by frequent records of larvae and juveniles, for example, larva of a mesopelagic species *Trachipterus trachipterus* (Dulčić, 1996) and juvenile of *Trachinotus ovatus* (Dulčić, *et al.*, 1997).

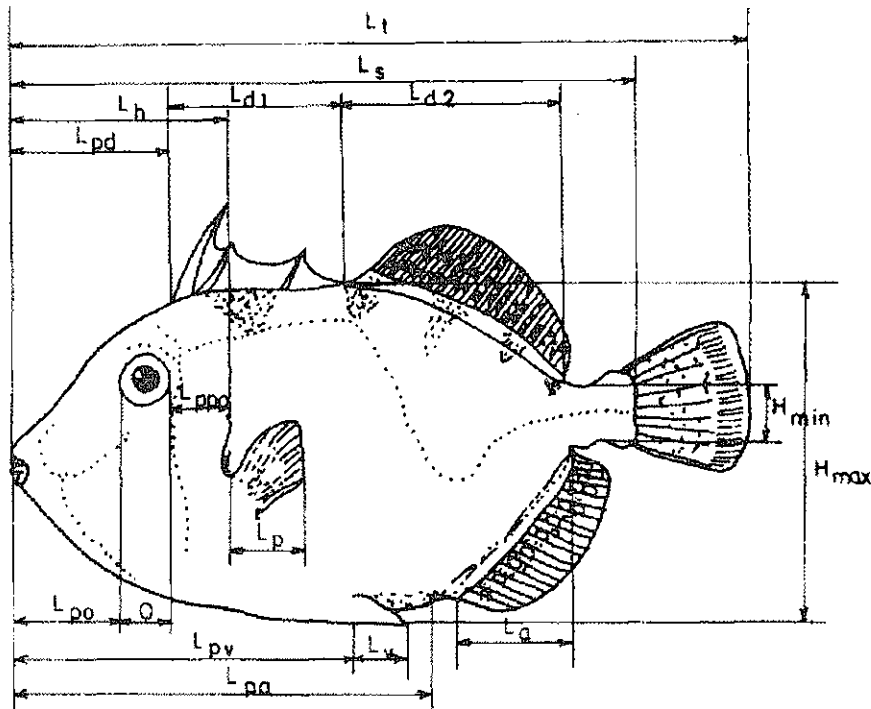


Fig. 2: Body measurements of *Balistes carolinensis* fingerlings. L_t - total length; L_s - standard length; L_{pd} - predorsal length; L_{pv} - preventral length; L_h - head length; O - eye diameter, L_{po} - preorbital length; L_{ppo} - postorbital length; L_{d1} - first dorsal fin length; L_{d2} - second dorsal fin length; L_p - pectoral fin length; L_v - ventral fin length; L_a - anal fin length; L_{pa} - preanal length; H_{min} - minimal body depth; H_{max} - maximal body depth at dorsal fin.

Sl. 2: Mere mladice balestre *Balistes carolinensis*: L_t - skupna dolžina; L_s - standardna dolžina; L_{pd} - predhrbna dolžina; L_{pv} - predtrebušna dolžina; L_h - dolžina glave; O - premer očesa, L_{po} - predorbitalna dolžina; L_{ppo} - postorbitalna dolžina; L_{d1} - dolžina prve hrbtne plavuti; L_{d2} - dolžina druge hrbtne plavuti; L_p - dolžina prsne plavuti; L_v - dolžina trebušne plavuti; L_a - dolžina analne plavuti; L_{pa} - predanalna dolžina; H_{min} - najmanjša višina; H_{max} - največja višina pri hrbtni plavuti.

Quigley *et al.* (1993) noted, from the biogeographical review, that *B. carolinensis* has been extending its range and abundance on both sides of the North and South Atlantic during recent decades, especially for Irish waters. During the 1960's and 1970's the triggerfish increase in frequency and range in British waters (Wheeler *et al.*, 1975; Dobson, 1984). During the 1970's they occurred in numbers in the North Sea (Blacker, 1981) and penetrated even into the Thames estuary (Andrews & Wheeler, 1985). During the same period, it was recorded from the coasts of Denmark (Neilsen, *pers. comm.* from Quigley *et al.*, 1993), The Netherlands (de Groot, 1973), and Belgium (De Clerk, 1975). Wheeler (1978) considered that the triggerfish appeared to make regular annual migrations into northern European waters, where its relative abundance varied from year to year. During the 1980's and early 1990's triggerfish numbers appeared to increase further. In 1983, two specimens were recorded from the Dutch coast (de Groot, 1986), while in 1984 several specimens were recorded from as far north as Scotland (Dobson, 1984). Large numbers of triggerfish were also captured by anglers off the southwest coast of England in 1984 and 1989 (Cooling, 1989). During 1991, triggerfish appear to have occurred more frequently than usual in UK waters, particularly in the west and northwest of Scotland (Gill, 1991). Wheeler (*pers. comm.* from Quigley *et al.*, 1993) remarked that "the triggerfish had become so common in English waters that it is probably the most striking change in the fauna of this century". In 1976, the triggerfish was regarded as rare north of the Gulf of Gascony in southwest France (Harambillet *et al.*, 1976). However, during the 1960's, 1970's and 1980's, the species was recorded with increasing frequency as far north as northwest France (Quéro *et al.*, 1986; Delmas *et al.*, 1986). The greater geographical range and general abundance of triggerfish may be related to the changes in climate and/or oceanographical conditions (Quigley, 1985). Global temperatures, for example, have risen by about 0.5°C in this century (Sweeney, 1989). Some changes in oceanographical conditions were noted for the central Adriatic (Marasović *et al.*, 1996). The penetration of the grey triggerfish in the central and

northern Adriatic and, according to our data, probably for its spawning in the southeastern Adriatic might be connected with some special climatological and oceanographical conditions in 1994 and input of intermediate waters (50-100 m) in the central Adriatic which influenced the increase in salinity and temperature (Marasović *et al.*, 1996). Pallaoro (1988) also stated that the Adriatic ingressions caused more rare species (*Centracanthus cirrus*, *Aulopus filamentosus*, *Pseudocharanx dentex*, *Synodus saurus*, *Centrolophus niger*) to appear in the central Adriatic region in 1986-87 period. An unusual abundance of such rarely found fish species compared to the non-ingression periods gives indication of their interdependence. The moving of some southern Adriatic thermophile (*Balistes carolinensis*) and bathiphile (*Lepidopus caudatus*) species to a greater extent towards the North has been ascertained in 1986/87, which is a possible result of the effect of the ingression waters (Pallaoro, 1988). As quoted by Harmelin (1991), some species with southern affinities like *Seriola dumerili*, *Diplodus cervinus*, *Balistes carolinensis*, *Epinephelus alexandrinus* and *Epinephelus marginatus* 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 (Spain). Changes in the physical properties of the water and natural fluctuations in space and time are perhaps responsible for the mentioned occurrences (Saldanha, 1992). Sazonov and Galaktionova (1987) found that the quasi-synchronous increase in abundance of *Sardina pilchardus*, *Macroramphosus scolopax* and *Balistes carolinensis* in different climatic zones of the Central east Atlantic can more likely be attributed to global weather processes rather than to fishery impact since the exploitation rate of these species is quite different.

The status of the grey triggerfish 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 (Swaby & Potts, 1990).

POJAVLJANJE MLADIC BALESTRE *BALISTES CAROLINENSIS* GMELIN, 1789 (PISCES: BALISTIDAE) V VZHODNEM JADRANSKEM MORJU

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POVZETEK

Balestra *Balistes carolinensis* Gmelin, 1789 naseljuje grebene odprtih voda tropskih in subtropskih morij, predvsem kamnito dno v globinah med 10 in 100 metri. Pogosta je v Sredozemskem morju in na obeh straneh Atlantika (od Severnega morja do Angole in od Nove Škotske do Argentine); v Črnem morju je redka (Tortonese, 1986). Živi tudi v Jadranskem morju, predvsem v njegovem južnem delu (Jardas, 1983, 1996; Pallaoro, 1988); v toplejših letih jo utegnemo opaziti tudi v severnem Jadranu (Pallaoro, 1988). Tri balestrine mladice, odkrite septembra 1994 pod ladijskimi razbitinami ob obrežju otočka Gubavac (v bližini naselja Lumbarda na Korčuli), so prvi podatek o pojavljanju mladice te vrste v vzhodnem Jadranu. To odkritje potrjuje, da se balestra drsti v jugovzhodnem Jadranu; v članku so nanizani glavni morfometrični in meristični podatki, zbrani o tej vrsti. Sicer pa avtorji članka ugotavljajo, da je treba položaj balestre v Jadranu oceniti na osnovi trajnejšega raziskovanja, saj postaja vse bolj očitno, da so tako nenavadne vrste - in posebno vrste z roba svoje razširjenosti - pomemben kazalec sprememb v morskem okolju.

Ključne besede: *Balistes carolinensis*, mladice, vzhodni Jadran, prvo pojavljanje

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