ISSN: 0001-5113 AADRAY	ACTA ADRIAT., 44 (1): 21-26	UDC:598.112:591.134(262.3) Short comunication

Occurrence of juvenile Atlantic Lizardfish, *Synodus saurus* (Linnaeus, 1758) (Pisces: Synodontidae) in the southeastern Adriatic Sea

Pero TUTMAN, Nikša GLAVIĆ, Valter KOŽUL, Boško SKARAMUCA and Branko GLAMUZINA

Institute of Oceanography and Fisheries, Split, Laboratory for Ecology and Mariculture, Dubrovnik, P.O.BOX 83, 20000 Dubrovnik, Croatia

Six juvenile Atlantic lizardfish, Synodus saurus *(Linnaeus, 1758; Pisces: Synodontidae), a rare species in the Adriatic Sea, were caught in three shallow bays (Gornji Molunat Bay, Gornje Čelo Bay, and Lopud Bay) in the southeastern Croatian Adriatic. These specimens are the first record of juveniles of this species in the shallow waters of the southeastern Adriatic. This paper reports on their morphological and meristic features. This occurrence of juveniles is circumstantial evidence of the expansion of this species into this part of the Adriatic.*

Key words: occurrence, juvenile, *Synodus saurus*, morphometrics, meristics, southeastern Adriatic

INTRODUCTION

The Atlantic lizardfish, *Synodus saurus* (Linnaeus, 1758; Pisces: Synodontidae), is a common fish in the eastern and western Atlantic. It is also found in the Mediterranean area, with the exception of the Black Sea (SULAK, 1984; BAUCHOT, 1987). The Atlantic lizardfish is found on sandy and rocky substrates at depths ranging 4-400 m. The highest densities have been observed in the upper 50 m, mainly between 20 and 30 m depth (FISCHER *et al.*, 1987). While adult Atlantic lizardfish are usually solitary, their early life stage behavior is poorly known and no biological data on Atlantic lizardfish in the eastern Mediterranean is available (GOLANI, 1993).

The Atlantic lizardfish is the only member of the family Synodontidae in the Croatian part of the eastern Adriatic Sea and is considered a rare member of the Adriatic marine fauna (MOROVIĆ, 1972; JARDAS, 1996). It is occasionally caught in the Adriatic Sea (PALLAORO, 1988), but only adults and mainly from deeper waters (JARDAS, 1983). There are five reports of Atlantic lizardfish from the period 1986-1987: in December 1986 near Bol - Island of Brač, in August 1987 at the Island of Lastovo, in September 1987 along the western coast of the Island of Brač (two specimens) and in October 1987 at the Kornati archipelago in the eastern middle Adriatic (PALLAORO, 1988). Larger quantities were found during the summers of 1993 and 1994 (DULČIĆ *et al.*, 1999) and at the end of autumn and beginning of winter of 1994 in the northwestern part of Pelješac Channel (ONOFRI, 1997). In the northern Adriatic Sea, Atlantic lizardfish were recorded for the first

time in 1998 (DULČIĆ, *et al.*, 1999; DULČIĆ & GRBEC, 2000).

Published information on the biology and ecology of this species in the eastern Adriatic and elsewhere is relatively scarce. This paper reports the occurrence, biometric and meristic characteristics of Atlantic lizardfish juveniles in the eastern Adriatic.

MATERIALS AND METHODS

Three bays were sampled in this study (Fig. 1): Gornji Molunat Bay, about 30 km southeast of Dubrovnik; and two bays on the Elafiti Islands, just off the Dubrovnik shore (Gornje Čelo Bay on Koločep Island, and Lopud Bay on Lopud Island).

The sampling areas of Gornji Molunat Bay and Gornje Čelo Bay have clean sandy bottoms, while the sampling area of Lopud Bay has sandy and sandy/muddy sections, parts of which are overgrown by *Posidonia oceanica* and *Cymodocea nodosa*.

Samples were collected during the morning hours with a beach seine (25 m long, 5 m high in the center, with a central collection bag). The mesh was 8 mm at the seine's wings and 4 mm in the center. The net was dragged from the mouth of the bay, at a depth not exceeding 4 m, toward the shore. Specimens were preserved in a 4% formaldehyde solution and identified according to the taxonomic key provided by JARDAS (1996).

In the laboratory, total length and standard length were measured to an accuracy of 0.1 mm, and total weight was recorded. Recorded meristic characteristics included fin rays in the dorsal (*D*), anal (*A*), pectoral (*P*) and caudal (*C*) fins.

Formaldehyde preservation causes shrinkage, the amount of which depends on the initial length of the specimen and the duration of the storage. Following McGURK (1984), it was assumed that the length of each specimen decreased by approximately 5% due to the formaldehyde storage.

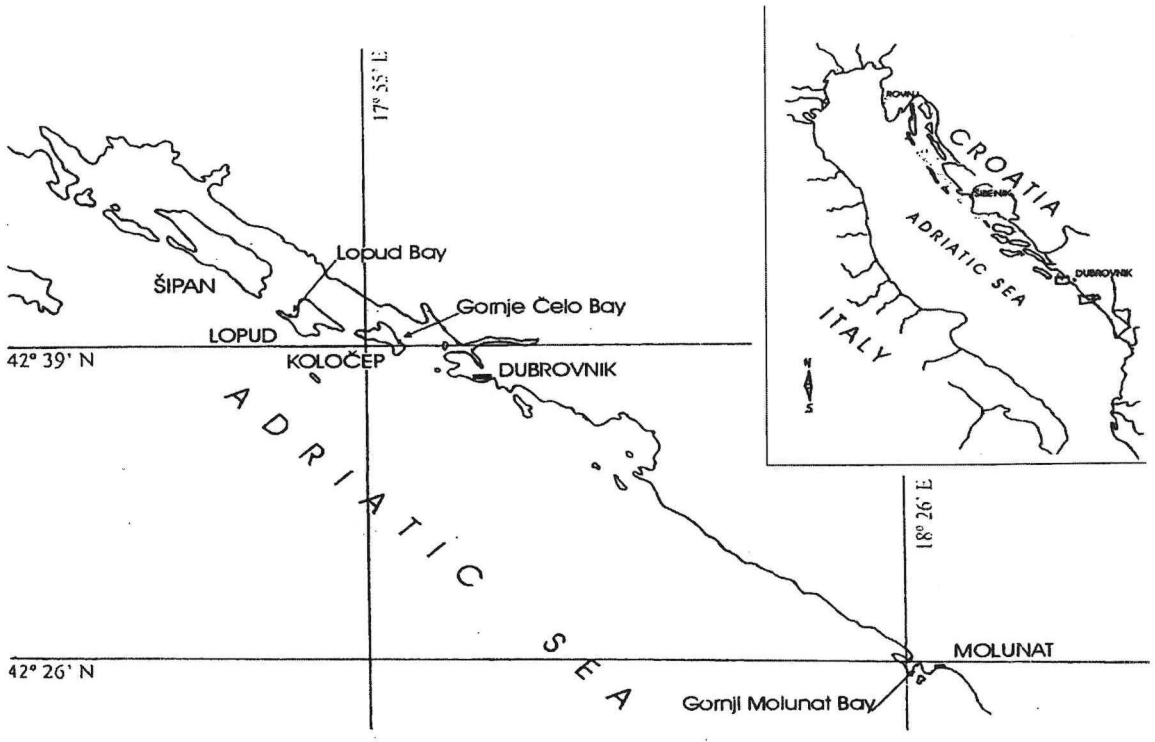

Fig. 1. Synodus saurus *juveniles finding sites*

RESULTS AND DISCUSSION

Five juveniles were captured in October (one each in Gornji Molunat and Lopud, and three in Gornje Čelo), and one in Lopud in December, 2001. Table 1 shows the measurements and meristic counts of the studied specimens.

The total length of the captured juveniles varied from 44 to 104 mm, the standard length from 39 to 93 mm and the body weight from 0.7 to 6.1 g. The dorsal (*D*) fin had 11-12 rays, the anal (*A*) fin 12, the pectoral (*P*) fin 12, the ventral (*V*) fin 8 and the caudal (*C*) fin 22 rays. The meristic characteristics closely corresponded with data of JARDAS (1996) and SULAK (1984) *i. e. D* 11-13, *A* 9-12, but differed from data of TORTONESE (1970), *i. e. A* 9-11.

Though a number of adult Atlantic lizardfish have been caught in the eastern Adriatic, there are no earlier records of juveniles in this area, despite several recent investigations (DULČIĆ *et al.*, 1997a; DULČIĆ *et al.*, 1998; TUTMAN *et al.*, 2000; TUTMAN *et al.*, 2001; MATIĆ *et al.*, 2001).

Earlier investigators considered this species a rare member of the Adriatic ichthyofauna (MOROVIĆ, 1972; JARDAS, 1983, 1996). PALLAORO (1988) and ONOFRI (1997) speculated that this species occurs in greater abundance in particular pluriannual intervals. Such occurrences could be associated with particular climatic and oceanographic conditions or the flow of Mediterranean waters into the Adriatic Sea, which increases salinity and temperature (ZORE-

Table 1. Morphometric (in mm) and meristic data of Atlantic Lizardfish juveniles caught in southeastern Adriatic Sea

	Specimens					
	I	II	III	IV	V	VI
Total length	44	65	70	72	94	104
Standard length	39	58	62	63	85	93
Fork length	5	7	8	9	9	11
Pre-dorsal length	18	21	26	26	33	42
Pre-anal length	29	32	37	38	45	75
Pre-pectoral length	10	14	18	18	26	32
Dorsal fin length	4	6	8	9	11	17
Anal fin length	4	6	8	9	11	17
Pectoral fin length	2	3	4	5	7	7
Ventral fin length	2	3	4	4	7	7
Caudal fin length	4	5	5	6	7	8
Body depth (max)	5	7	10	12	14	16
Body depth (min)	4	5	7	7	9	11
Head length	8	12	18	18	22	29
Ocular diameter (horizontal)	3	3	4	4	5	6
Interorbital width	2	3	3	3	4	5
Preorbital length	3	4	5	6	8	8
Dorsal fin rays	11	12	12	12	12	12
Anal fin rays	12	12	12	12	12	12
Pectoral fin rays	12	12	12	12	12	12
Ventral fin rays	8	8	8	8	8	8
Caudal fin rays	22	22	22	22	22	22
Body weight (g)	0.7	2.1	2.9	3.0	5.1	6.1

ARMANDA, 1972; ORLIĆ *et al.*, 1992; MARASOVIĆ *et al.*, 1995; GRBEC *et al.*, 1998) and in which this species seems to occur more frequently. Several authors noted changes in ichthyofauna that may have been the result climatic and oceanographic influences elsewhere (MEARNS, 1988; STEPHENS *et al.*, 1988; CUSHING, 1990; FRANCOUR *et al.*, 1994) and in the Adriatic Sea (DULČIĆ *et al.*, 1999; DULČIĆ & GRBEC, 2000). Many fish species may move toward higher latitudes as the sea becomes warmer. PALLAORO (1988) stated that occasional incursions of Mediterranean water masses are responsible for bringing rare species (*Aulopus filamentosus, Centracanthus cirrus, Centrolophus niger, Pseudocaranx dentex, Synodus saurus*) to the middle Adriatic. In the 1990s, records of several rare species in the southern and central Adriatic were reported (DULČIĆ, 1996; DULČIĆ *et al.*, 1997b; DULČIĆ *et al.*, 1997c; DULČIĆ, 1998; DULČIĆ, 1999; GLAMUZINA *et al.*, 2000; KOŽUL *et al.*, 2001), with a simultaneous northward migration of thermophilic species more typical of the southern Adriatic (DULČIĆ & LIPEJ, 1997; GLAMUZINA & SKARAMUCA, 1999). In the future, we may find a confamilial species, *Saurida undosquamis*, a Red Sea migrant, last recorded in Albania (RAKAJ, 1995). The periods during which such rarely-collected fish species appear and their abundance indicate their relationship to the ingression of Mediterranean waters.

Recently, Atlantic lizardfish have been caught in the southeastern Adriatic more and more frequently, suggesting an increase in the population density of this fish. This has been confirmed by the findings of relatively large numbers of specimens in the area near Dubrovnik. The status of these thermophilic species needs to be evaluated on a continuous basis as it is increasingly apparent that the presence of uncommon species can be valuable indicators of environmental changes (SWABBY & POTTS, 1990).

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Received: 20 April 2002
Accepted: 21 February 2003

Pojava mlađi guštera *Synodus saurus* (Linnaeus, 1758) (Pisces: Synodontidae) u jugoistočnom Jadranu

Pero TUTMAN, Nikša GLAVIĆ, Valter KOŽUL, Boško SKARAMUCA & Branko GLAMUZINA

Institut za oceanografiju i ribarstvo, Split, Laboratorij za ekologiju i marikulturu, Dubrovnik P.P. 83, 20000 Dubrovnik, Hrvatska

SAŽETAK

Šest primjeraka mlađi guštera *Synodus saurus* (Linnaeus, 1758), rijetke termofilne vrste u Jadranskom moru, ulovljeno je u plitkim vodama uvala Gornji Molunat, Gornje Čelo i Lopud, u jugoistočnom Jadranu. Ulovljene jedinke predstavljaju prve dokumentirane nalaze mlađi ove vrste u plitkim vodama tog dijela Jadrana. U radu su iznesene tjelesne i merističke značajke ovih jedinki. Povećana brojnost nalaza mlađi ove rijetke vrste ukazuje na povećavanje brojnosti populacije, a može biti i značajan pokazatelj promjena u morskom okolišu.

Ključne riječi: učestalost, mlađ, *Synodus saurus*, morfometrika, merističke značajke, jugoistočni Jadran