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The presence of Tetraodontidae species in the Central Mediterranean: an update from the southern Adriatic Sea

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This paper presents the first record of the Lessepsian migrant fish Lagocephalus sceleratus *(silver-cheeked toadfish) on the Italian side of the south Adriatic Sea. In addition, four specimens of* Sphoeroides pachygaster *(blunthead puffer) were analysed. Meristic and morphometric data of the silver-cheeked toadfish and blunthead puffer are in accordance with data from the Mediterranean. The specimen of silver-cheeked toadfish was a female with gonad in resting stage and the specimens of blunthead puffer were adults (male and female) with gonads in maturing, mature/spawner and post-spawning stage. The stomach contents of the specimen of silver-cheeked toadfish were composed by* Mollusca Opistobranchia *and* Crustacea Brachyura*. Stomach contents analysis of* S. pachygaster *confirmed that Mollusca are the preferred prey for this species. However, the presence of Crustacea (shrimps, crabs) and fish in the stomachs indicates that the blunthead puffer has a broad and variable diet in the south Adriatic Sea. The present study suggests the presence of an established population of blunthead puffer on the continental shelf of the southeast Adriatic Sea.*

Key words: *Lagocephalus sceleratus*, *Sphoeroides pachygaster,* morphometry, meristic counts, sexual maturity of the gonads, stomach contents

INDRODUCTION

The impact of non-native fish populations on native species determines several effects such as competition for habitats, predation, hybridization and the transfer of parasites and diseases (ARTHUR *et al.*, 2010; CANONICO *et al.*, 2005; CAREY & WAHL, 2010).

The human interference on geographical barriers, combined with climate change and increased seawater temperatures are deeply changing the geographical distributions of plant and animal species, thus increasing the poleward spread and success of these species in new environments. Fish community changes are mainly evident in the Mediterranean basin

(AZZURRO *et al.*, 2011; BIANCHI, 2007; GALIL *et al.*, 2007), considered one of the main hotspots of marine bioinvasion on the planet (QUIGNARD & TOMASINI, 2000). This is partly due to many fish species reached the Mediterranean Sea after the opening of the Suez Canal in 1865, while other newcomers arrived through the Gibraltar Strait. Continuous arrival of new species has been confirmed, although in less quantity, in the Adriatic Sea (DRAGIČEVIĆ & DULČIĆ, 2010; DULČIĆ & DRAGIČEVIĆ, 2011).

Among the new fish arrivals in the Mediterranean, one of the most emblematic is the case of species belonging to the Tetraodontidae family, which includes 19 genera and approximately 130 species (MATSUURA, 2001; NELSON, 2006). Puffers are marine fish distributed in tropical and subtropical areas of the Atlantic, Indian and Pacific Ocean, and six species have been reported in the eastern Mediterranean (GOLANI *et al.*, 2006).

The species of Tetraodontidae family have been recorded in the central-northern Adriatic Sea include the *Lagocephalus sceleratus* (Gmelin, 1789), *Sphoeroides pachygaster* (Müller & Troschel, 1848) and *Lagocephalus lagocephalus* (Linnaeus, 1758). *L. lagocephaelus* was reported for the first time at Molunat in 2004 (Dulčić & Pallaoro, 2006), while *L. sceleratus* was reported in 2012 close to Dubrovnik (ŠPREM *et al.* 2014) (Table 1). This species is a Lessepsian migrant with a potential risk to human health, as it contains the most harmful paralytic toxin known (i.e. the tetrodotoxin (TTX)) that may be a source of food poisoning. For this reason, *L. sceleratus* received considerable public attention and the European legislation (854/2004/EC) prohibits its marketing. Nevertheless, few cases of human poisoning after the ingestion of the fish have been reported for the Mediterranean (BENTUR *et al.*, 2008). This Lessepsian migrant species has been considered among the 100 invasive species in the Mediterranean Sea for its rapid expansion (STREFTARIS & ZENETOS, 2006). Indeed, after the first record in the Aegean Turkish coast in Gökova Bay (AKYOL *et al.*, 2005; FELIZ & ER, 2004), *L. sceleratus* had a rapid expansion in few years throughout the eastern basin, reaching the northernmost parts of the Aegean Sea and toward south-west until the southern coast of Tunisia (JRIBI & BRADAI, 2012; KALOGIROU, 2013).

The first record of *Sphoeroides pachygaster* off the western coast of south Adriatic Sea (Mola di Bari) is dated back in 1992 (BELLO, 1993) (Table 1). In the following years, many others captures of this species were recorded in the whole Adriatic Sea basin (DULČIĆ, 2002; GRUBAČ, 2008; JARDAS & PALLAORO, 1996; JOKSIMOVIĆ & MANDIĆ, 2008; LIPEJ *et al.*, 2013) (Table 1).

Because species of the Tetraodontidae family have an extremely invasive character and a potential risk to human health, monitoring these "alien species" populations is extremely important for assessing their impact on ecosystems and fisheries (NADER *et al.*, 2012).

Table 1. Records of S. pachygaster *and* L. sceleratus *in the Adriatic Sea*

		Years	Site	Country	Authors
Lagocephalus sceleratus	East side	2012	Dubrovnik	Croatia	ŠPREM et al. 2014
	West side	2014	Trani	Italy	Present study
Sphoeroides pachygaster	East side	1992	Sušac Island	Croatia	JARDAS & PALLAORO, 1996
		1992	Glavat Island		
		1992	Blitvenica		
		1998	Kamenjak (Pula)	Croatia	DULČIĆ, 2002
		2008	Šibenik	Croatia	GRUBAČ, 2008
		2008	Budva	Montenegro	JOKSIMOVIĆ & MANDIĆ, 2008
		2012	Piran	Slovenia	LIPEJ et al, 2013
		2012	Dures	Albania	Present study
		2014	Bar-Budva	Montenegro	
		2015	Bar	Montenegro	
	West side	1992	Mola di Bari	Italy	BELLO, 1993

The objective of this work was thus to add new records of species belonging to the Tetraodontidae family in the south Adriatic sea, reporting for the first time the capture of *Lagocephalus sceleratus* along the Italian coast of Adriatic Sea.

MATERIALS AND METHODS

The samples of *Lagocephalus sceleratus* (Silver-cheeked toadfish) and *Sphoeroides pachygaster* (blunthead puffer) were taken from commercial landings and discard monitoring (Data Collection Framework - DCF; EU Reg. 199/2008) coasts and from the MEDITS international trawl survey (AA.VV., 2016) (Fig. 1; Table 3). The specimen of Silver-cheeked toadfish was captured along the Italian coast of south Adriatic Sea, off Trani at 40 m depth (Fig. 1). The analyzed specimens of *S. pachygaster* were captured off the coast of Albania and Montenegro (Fig. 1; Table 3) at a depth range between 75 and 125 m.

The specimen of *L. sceleratus* was caught by commercial trawler in the 2014 along the Italian coast of south Adriatic Sea (Fig. 1). Among the 4 *S. pachygaster* specimens, two were caught during the MEDITS survey (2012 - Albanian coast; 2014 - Montenegrin coast) and the others two were caught by a commercial trawler (2014 – Montenegrin coast) and a longline vessel targeting European Hake (2015 – Montenegrin coast) (Fig. 1).

In total, 5 specimens (1 *L. sceleratus* and 4 *S. pachygaster*) were analysed. Morphology and color analysis, as well as morphometric measurements (nearest 1 mm) and meristic counts were carried out (Fig. 2), following the previous descriptions of species belonging to the Tetraodontidae family (GOLANI, *et al.* 2002; PSOMADAKIS *et al.,* 2006; RAGONESE *et al.,* 1997; TORTONESE, 1986).

Table 2. Maturity scale used in the present study (from MEDITS Handbook, AA.VV., 2016)

STAGE CODE	DESCRIPTION
1	VIRGIN
2A	VIRGIN DEVELOPING
2B	RECOVERING
2C	MATURING
3	MATURE/SPAWNER
4A	SPENT
4B	RESTING

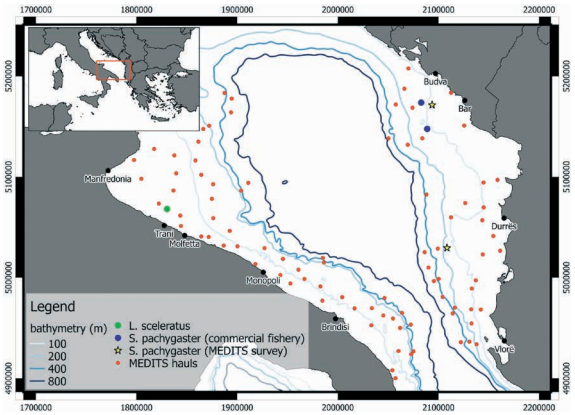

Fig. 1. Study area: red points represent the hauls of the MEDITS trawl survey, yellow star the sites of capture of S. pachygaster *during the MEDITS survey, the blue points the sites of capture of* S. pachygaster *during the commercial fishing activity, the green point the site of capture of* L. sceleratus

The following morphometric measurements and meristic counts were taken (Fig. 2): Total length (TL), Standard length (SL), Preanal length (PL), Head length (HL), Snout length (SnL), Opercular length (OL), Head height (HH); Body height (BH); Anal height (AH); Caudal peduncle height (CH), Opercular height (OH), Interorbital space (IS), Head width (HW), Body width (BW), Anal width (AW), Caudal peduncle width (CW), Eye horizontal diameter (EH), Eye vertical diameter (EV), Total weight, Liver weight, Gonad weight, Gutted weight, Number of dorsal fin rays, Number of anal fin rays, Number of pectoral fin rays, Number of caudal fin rays.

Sex and sexual maturity were determined macroscopically based on the MEDITS maturity scale (AA.VV., 2016) (Table 2).Gonad weights (GW) were recorded to the nearest 0.1 g.

Stomachs and its contents were carefully removed. Identification of prey items was generally limited to the higher taxonomic level, since the beak-like jaws of puffer fish crush food items to the extent that prey could rarely be identified

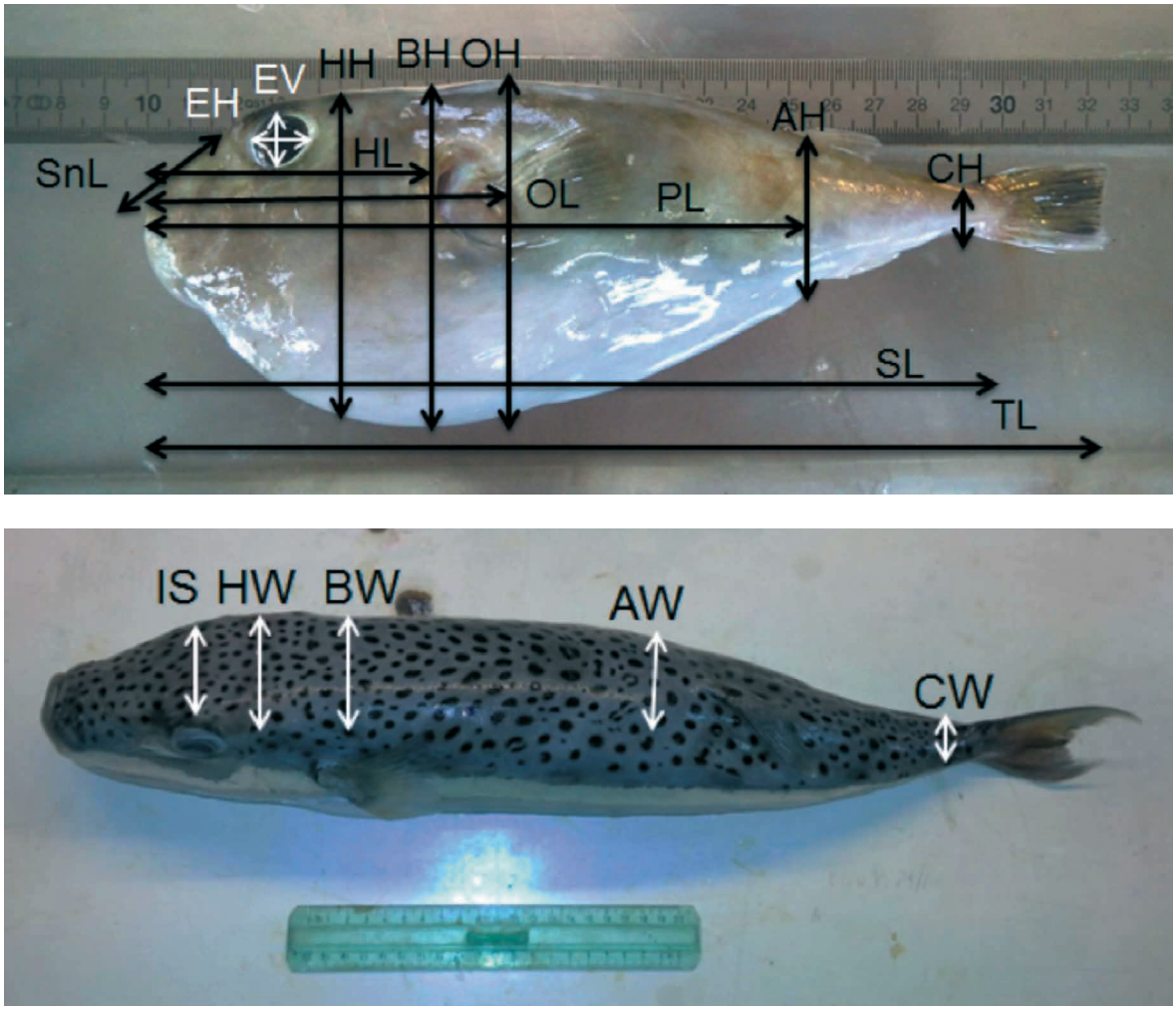

Fig. 2. Schematic representation of the morphometric measurements. Lateral view up (S. pachygaster) *and dorsal view down* (L. sceleratus)

to the species level. Dietary estimations were limited to number (N), percent number (%N), occurrence (O) and percent occurrence (%O) for each prey. Quantitative measurements of prey biomass were not possible given the stage of advanced digestion.

RESULTS

All measurements, meristic counts, sex, and gonad maturity are presented in Table 3 for *L. sceleratus* and *S. pachygaster.*

Lagocephalus sceleratus

The single specimen of *L. sceleratus* (Fig. 4) has a total length of 587 mm. Body elongated and cylindrical, compressed laterally and ventrally. The livery is characterized by a laterally wide silver bands extended from the mouth to the caudal fin and by a dorsal area grey-brownish with black spots regularly distributed. Typically for the Tetraodontidae species, the mouth has four large teeth (two in each jaw) forming a beak.

Fig. 3. Lagocephalus sceleratus *caught off the Puglia coasts*

Table 3. Morphometric, meristic, sex and maturity of S. pachygaster *and* L. sceleratus

Sphoeroides pachygaster					*Lagocephalus sceleratus*	
Specimens	1	2	3	4	**Specimens**	1
Origin	MEDITS	MEDITS	Landing	Landing	**Origin**	Landing
Date	21/07/2012	26/08/2014	20/08/2014	21/11/2015	**Date**	27/10/2014
Depth (m)	125	75	110	98	**Depth (m)**	50
Morphometric parameter (mm)					**Morphometric parameter (mm)**	
Total length (TL)	200	295	355	340	Total length (TL)	587
Standard length (SL)	175	258	313	287	Standard length (SL)	503
Preanal length (PL)	138	195	236	221	Preanal length (PL)	332
Head length (HL)	62	101.7	123.7	119.2	Head length (HL)	137
Snout length (SnL)	20	41.3	55.2	42.7	Snout length (SnL)	76
Opercular length (OL)	63.8	83.9	112.7	111.3	Opercular length (OL)	153
Head height (HH)	34.9	49.5	58.93	53.7	Head height (HH)	93.3
Body height (BH)	73.5	112.3	140.8	124.4	Body height (BH)	104.5
Anal height (AH)	28.3	48.4	57.2	49.4	Anal height (AH)	84.5
Caudal peduncle height (CH)	10	13.5	17.6	15.9	Caudal peducle height (CH)	15.6
Opercular height (OH)	26.6	33.9	46.2	49.3	Opercular height (OH)	75
Interorbital space (IS)	22.1	36.9	38.9	40.2	Interorbital space (IS)	67.3
Head width (HW)	32.3	44.7	61.6	56.2	Head width (HW)	78.4
Body width (BW)	35.4	55.2	67.5	64.6	Body width (BW)	80.5
Anal width (AW)	27	40.2	49.7	47.6	Anal width (AW)	85.6
Caudal peduncle width (CW)	8.2	11.6	15.2	12.8	Caudal peduncle width (CW)	20.6
Eye horizontal diameter (EH)	14.7	16.5	28	23.8	Eye horizontal diameter (EH)	22.2
Eye vertical diameter (EV)	9.2	12.1	16	15.6	Eye vertical diameter (EV)	18.7
Weight (g)					**Weight (g)**	
Total weight	200.8	759.8	1540.8	947	Total weight	2547.75
Liver weight	----	----	115.4	----	Liver weight	195.9
Gonad weight	3.7	5.7	151.2	13.6	Gonad weight	35.42
Gutted weight	171.5	528.5	1109.8	753.1	Gutted weight	2222.21
Meristic counts (N)					**Meristic counts (N)**	
Dorsal fin rays	8	8	8	8	Dorsal fin rays	12
Anal fin rays	7	7	7	7	Anal fin rays	9
Pectoral fin rays	14	14	14	14	Pectoral fin rays	17
Caudal fin rays	9	9	9	9	Caudal fin rays	18
Sex	Female	Female	Female	Male	Sex	Female
Maturity stage	2c	2c	3	4a	Maturity stage	4b

This specimen is a female with the gonad in the resting stage (4b)

Stomach content of the only specimens of *L. sceleratus* was composed by 6 preys: 4 Mollusca Opistobranchia and 2 Crustacea Brachyura (Table 4).

Sphoeroides pachygaster

The specimen of *S. pachygaster* (Fig. 5) was identified by its typical stout and inflatable body with rounded snout, big head and skin without scales. Mouth with four large teeth (two in each jaw) forming a beak. Eyes were rather large and oval in shape. A small dorsal fin is placed above the anal fin of similar size and shape. Pelvic fin is absent. Body is devoid of any scales, prickles or spines (as typical for other species of this genus). Dorsal surface and the flanks are greyish to olive green with many pale dots. Ventral side is whitish.

The belly was white and rough. A silver blotch was present in front of the eye. Pectoral fin base black, dorsal and anal fins short and posterior in position, and caudal fin lunate.

Table 4. Stomach contents of S. pachygaster *and* L. sceleratus*: Overall number (N), percent number (%N), occurrence (O) and percent occurrence (%O)*

	Sphoeroides pachygaster				*Lagocephalus sceleratus*			
Prey category	**N**	**%N**	**O**	**%O**	**N**	**%N**	**O**	**%O**
Total prey	12		3		6		1	
Total prey identified to genus	10	83			6	100		
Total prey identified to species	2	17						
Mollusca	**8**	**67**	**3**	**75**	**4**	**67**	**1**	**100**
Gasteropoda	5	42	2	50				
Dentaliidae	1	8	1	25				
Opistobranchia	3	25	1	25	4	67	1	100
Crustacea	**3**	**25**	**2**	**50**	**2**	**33**	**1**	**100**
Natantia	1	8	1	25				
Brachiyura	2	17	1	25	2	33	1	100
Macropipus tuberculatus	1	8	1	25				
Macropodia longirostris	1	8	1	25				
Teleostei	**1**	**8**	**1**	**25**				
Unidentified fish	1	8	1	25				
Somach no Empty	**3**				**1**			
Somach Empty	**1**							

The *S. pachygaster* analyzed are 3 female and 1 male. All specimens are adults, the female showed the gonad maturity in maturing (2c) or mature/spawner (3) stage, while the male in the resting stage.

Out of the 4 specimens of *S. pachygaster* analyzed only one presented empty stomach. A total of 12 preys were recognized and 67% were Mollusca, 25% Crustacea and 8% Teleost (Table 4). In terms of occurrence, Mollusca represented a large part of the diet followed by Crustacea and Teleost. Even though the largest part of Mollusca was represented by gastropods, only a fraction was identified to a lower level of classification (i. e. *Dentaliidae* family). Among Crustacea, *Macropipus tuberculatus* (Roux, 1830) and *Macropodia longirostris* (Fabricius, 1775) were the only species identified. Fish did not contribute greatly to the diet, and none could be identified to species level.

DISCUSSION

Changes are occuring in the Mediterranean marine biodiversity over the last decades (Bianchi, 2007) and the arrival of Tetraodontidae species is part of this modification (AZZURRO *et al.*, 2011; GALIL *et al.*, 2007).

L. sceleratus was firstly detected in the Mediterranean waters as misidentified specimens of *L. suezensis* from Lebanon (MOUNEIMNE, 1977), and only after many years other records were reported in the eastern Mediterranean (AKYOL *et al.*, 2005; FELIZ & ER, 2004), from Gokova Bay (southern Aegean Sea, Turkey). After this last record the Silver-cheeked toadfish was suddenly reported in the whole Aegean sea (BILECENOGLU *et al.*, 2006; KASAPIDIS *et al.*, 2007; PERISTERAKI *et al.*, 2006; TÜRKER-ÇAKIR *et al.*, 2009) including Crete (KASAPIDIS *et al.*, 2007) and Rhodes Islands (CORSINI *et al.*, 2006; KALOGIROU, 2013) and southeastwards along the Turkish coasts (BILECENOGLU *et al.*, 2006; YAGLIOGLU *et al.*, 2011), off Jaffa (GOLANI & LEVY, 2005), Lebanon costs (CARPENTIERI *et al.*, 2009) and Cyprus (KATSANEVAKIS *et al.*, 2009; ROUSOU *et al.*, 2014). Recently, this species has displayed a rapid spread out along north Africa coasts, west to the Suez Canal (Egyptian waters) (EL-HAWEET *et al.,* 2011), in Libyan (MILAZZO *et al.,* 2012) and Tunisian waters (ENAJJAR *et al.*, 2015; JRIBI & BRADAI, 2012) as well as westward and northward,

Fig. 4. Sphoeroides pachygaster caught during the MED-ITS trawl survey

reaching the Ionian sea (ZENETOS *et al.*, 2013) and Malta (DEIDUN *et al.*, 2015). In the central Mediterranean area, *L. sceleratus* was recorded in the south Sicily (AZZURRO *et al.*, 2014; TIRALONGO & TIBULLO, 2014). The first record of this species in the Adriatic Sea was in October 2012, when an individual was caught in Jakljan Island (Dubrovnik) (ŠPREM *et al.*, 2014).

The occurrence of *L. sceleratus* reported in the present study represents the first record of this species in the west Adriatic Sea. The capture depth is in accordance with a more coastal distribution of *L. sceleratus* than *S. pachygaster*. The specimen was an adult female (ROUSOU *et al.*, 2014) with gonads in resting maturity stage. In addition, the stomach content was in accordance with a diet reported for this species in Mediterranean basin based on Mollusca and Crustacea (KALOGIROU, 2013; ROUSOU *et al.*, 2014).

The presence of tetrodotoxin in this fish (liver, gonads, gastrointestinal tract, skin and muscle) has a social impact, being TTX one of the strongest marine paralytic toxins known today (SABRAH *et al.,* 2006). The social implication of the rapid spread of *L. sceleratus* regards not only the public health, but also the local fishery sector as the Silver-cheeked toadfish feeds on commercial species caught in nets, leading to significant loss of incomes and damage to fishing gears (CARPENTIERI *et al.*, 2009; NADER *et al.*, 2012).

The rapid expansion of *L. sceleratus* indicates that the species is well adapted to the new environment. Indeed the Silver-cheeked toadfish became in few years and in some areas (i.e. Rhodes and Cyprus) the dominant fish species in *Posidonia oceanica* habitats and on sandy bottoms (KALOGIROU *et al.*, 2010; 2012).

S. pachygaster was firstly recorded in 1979 around the Balearic Islands (OLIVER, 1981). Since then, the blunthead puffer has spread through the western Mediterranean and in the Strait of Sicily (RAGONESE *et al.*, 1992; 1997), where the presence of a stable population was recorded between Malta and southern Sicily (RAGONESE *et al.*, 1997; RAGONESE & MORARA, 2012). In the same period, the presence of *S. pachygaster* was also reported in the western Ionian Sea (TURSI *et al.*, 1992) where a steady population with spawning females was identified (MAIORANO *et al.*, 2010). In the eastern part of the Mediterranean the first record of *S. pachygaster* was reported around the Israel coasts (GOLANI, 1996), but after the species was caught in Greece (ZACHARIOU-MAMALLINGA & CORSINI, 1994) and more recently in Turkey (ERYILMAZ *et al.*, 2003) and Cyprus (KATSANEVAKIS *et al.*, 2009). This species was identified for the first time in the south-west of the Adriatic Sea at the beginning of the 1990 (BELLO, 1993) and after few years the blunthead puffer was recorded also in all the Adriatic (DULČIĆ, 2002; JARDAS & PALLAORO 1996; JOKSIMOVIĆ & MANDIĆ, 2008; LIPEJ *et al.,* 2013) up to the Istrian peninsula, which represents the northernmost site where of *S. pachygaster* has been reported in the Mediterranean basin.

The spread pattern of the blunthead puffer into the Mediterranean Sea seems to support an eastward and northward propagation from the Atlantic Ocean via Gibraltar Strait, as analyzed by LIPEJ *et al.* (2013). In the South Adriatic, after the first record reported by Bello (1993) no other catches of the species were reported in the West side (Table 1). Also the data reported in the present work are related to east side of the south Adriatic Sea (Montenegrin and Albania coasts). This evidence could be linked to the ecological preferences of this species (PERISTERAKI *et al.*, 2006) and/or to the different fishing pressure between the west and east sides of Adriatic coasts, being higher the trawl fishing pressure occurring along the Italian side (BITETTO *et al.*, 2014). Indeed blunthead puffer seems to be very vulnerable to the capture by trawl with a 100%

of discard mortality (RAGONESE & MORARA, 2012).

S. pachygaster was caught in Mediterranean basin mostly at depths between 80 and 180 m on sandy – muddy substrate (FARRAG *et al.*, 2016; HEMIDA *et al.*, 2009; JARDAS & PALLAORO 1996; JOKSIMOVIĆ & MANDIĆ, 2008; LIGAS *et al.*, 2006; TURSI *et al.*, 1992). Only in north Adriatic Sea this species was caught at shallower depths (20 m) (LIPEJ *et al.*, 2013). For the specimens caught during the MEDITS survey it was possible to associate the benthic fauna occurring in the same haul to the presence of *S. pachygaster*. In all the cases, the species was found on coastal detritic bottom biocenosis characterized by the typical presence of *Stichopus regalis* (Cuvier, 1817), *Alcyonium palmatum* Pallas, 1766, *Diazona violacea* Savigny, 1816 and the Crustacea *Macropipus tuberculatus* (Roux, 1830) and *Macropodia longirostris* (Fabricius, 1775) (also recognized in one of the analyzed stomachs).

Meristic and morphometric data of the blunthead puffer and silver-cheeked toadfish specimens analysed were in agreement with previous published data on the Mediterranean Sea (DULČIĆ, 2002; HEMIDA *et al.*, 2009;; KASAPIDIS *ET AL* 2007; LIPEJ *et al.*, 2013; NADER *et al.*, 2012; RAGONESE *et al.*, 1997).

All caught specimens were adult with a gonad maturity in accordance with a reproduction season extended from the spring to the autumn (ENAJJAR *et al.*, 2015). The occurrence of specimens both in maturation and/or mature would testify the presence of a stable population with active reproductive individuals.

Some authors report that the diet of *S. pachygaster* in Mediterranean Sea is based mainly on squid, cuttlefish and octopus, including small bony fish and/or crustacean (PSOMADAKIS *et al.,* 2006). In contrast with these findings, ENAJJAR *et al.* (2015) found a population of blunthead puffer in the Gulf of Gabès with a diet mostly based on fish (*Mullus barbatus* Linnaeus, 1758, *Mullus surmuletus* Linnaeus, 1758, *Trachurus trachurus* (Linnaeus, 1758), *Conger conger* (Linnaeus, 1758), *Engraulis encrasicolus* (Linnaeus, 1758), *Boops boops* (Linnaeus, 1758)). Though the results, reported in the present work, are limited to 3 specimens, they are in accordance with a diet mostly based on Mollusca. Nevertheless blunthead puffer should be considered as a generalist carnivore with a broad and variable diet composed of Mollusca (nudibranchs), Crustacea (shrimps, crabs) and fish, indicating an adaptive feeding behavior (PSOMADAKIS *et al.* 2006).

The potential effects of the spread out of Tetraodontidae in the Mediterranean Sea are hard to predict, but it is crucial to continue collecting biological data on these invasive species to better understand future potential ecological responses. There is no doubt that the biodiversity profile is changing in the Mediterranean Sea but it is hardto establish and it is under constant evaluation, to what extent warm-water species will affect the trophic web and the functioning of marine ecosystems (BIANCHI, 2007; REISE *et al.*, 2006; KALOGIROU *et al.*, 2010; 2012). Certainly, this field constitutes an important future challenge even for stakeholders and fisheries managers in the Mediterranean Sea.

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Nazočnost vrsta iz porodice četverozupki (Tetraodontidae) u središnjem Sredozemlju: novi podaci iz južnog Jadrana

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SAŽETAK

U radu je predstavljen prvi nalaz lesepsijske migratorne vrste *Lagocephalus sceleratus* (srebrenopruga napuhača) na talijanskoj strani južnog Jadrana. Uz to, analizirana su i četiri primjerka vrste *Sphoeroides pachygaster* (napuhača). Meristički i morfometrijski podaci dobiveni analizom primjeraka ovih dviju vrsta su u suglasnosti sa postojećim podacima iz Sredozemlja. Analizirana jedinka srebrenopruge napuhače bila je ženka, s gonadama u stadiju mirovanja, dok su jedinke napuhače bile u stadiju sazrijevanja, zrelom stadiju i izmrještenom stadiju. Sadržaj želudaca srebrenopruge napuhače sastojao se od ostataka skupina Mollusca, Ophistobranchia i Crustacea Brachyura. Sadržaj želudaca jedinki vrste *Sphoeroides pachygaster* potvrdio je da ova vrsta u prehrani preferira mekušce (Mollusca) kao plijen. Ipak, nazočnost ostataka rakova i kozica (Crustacea) u njihovim želucima ukazuje na raznoliku prehranu ove vrste u južnom Jadranu. Ovo istraživanje ukazuje na postojanje formirane populacije vrste *Sphoeroides pachygaster* na kontinentalnom šelfu jugoistočne obale Jadranskog mora.

Ključne riječi: *Lagocephalus sceleratus*, *Sphoeroides pachygaster*, morfometrija, meristika, spolna zrelost gonada, sadržaj želuca