Marine Biodiversity Records

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First record of the oceanic puffer *Lagocephalus lagocephalus* (Linnaeus, 1758) from the Syrian marine waters (eastern Mediterranean)

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Abstract

Background: The puffer fish species (Tetraodontidae) inhabit tropical and subtropical coastal waters around the world, and some species exist in many parts of the Mediterranean Sea. In the Syrian marine waters (eastern Mediterranean), five species are known to exist but *Lagocephalus lagocephalus* (Linnaeus, 1758) was not recorded there before.

Method: Samples were collected from a depth of 300 m off Banyas coast, Syria, using bottom longline, the morphometric measurements and meristic measurements were recorded.

Results: One specimen of the oceanic puffer *Lagocephalus lagocephalus* (Linnaeus, 1758) was caught from the marine water of Syria.

Conclusion: This is the first record of *Lagocephalus lagocephalus* (Linnaeus, 1758) in the Syrian marine waters.

Keywords: Oceanic puffer, *Lagocephalus lagocephalus*, Mediterranean, Syrian coast

Background

The puffer fishes (Tetraodontidae) comprise 200 species belonging to 29 genera (Froese and Pauly 2019) that inhabit tropical and subtropical coastal waters around the world (Bilecenoglu and Fernández-Álvarez 2013; Teker et al. 2018). There are 11 species known from the Mediterranean and Black Seas (Bearez et al. 2017; Ali 2018). Tetraodontidae has the second most poisonous creature to human on the planet after the Golden Poison Frog. The poisonous nature of this puffer fish is largely due to the tetrodotoxin (TTX) and paralytic saxitoxin contents of their internal organs (liver, ovary, intestine, skin…etc.). Tetrodotoxin is a potent neurotoxin that blocks the voltage-gated sodium channels on the surface of nerve membranes: It is 100 times more potent than cyanide, and one puffer fish may be enough to kill 30 adults (Santhanam 2018; Tamele et al. 2019). In the marine waters of Syria, five Tetraodontid species [*Lagocephalus sceleratus* (Gmelin, 1789), *Lagocephalus spadiceus* (Richardson, 1845), *Lagocephalus suezensis* (Clark & Gohar, 1953), *Sphoeroides pachygaster* (Müller & Troschel, 1848) and *Torquigener flavimaculosus* (Hardy & Randall, 1983)] had been previously recorded (Rahman et al. 2014; Galiya et al. 2015; Ali 2018). The oceanic puffer *Lagocephalus lagocephalus* (Linnaeus, 1758) is a native tetraodontid species that can be found in many Mediterranean coasts (Froese and Pauly 2019), but had not been recorded before in the marine waters of Syria (Ali 2018). Hence, the present study reports that the oceanic puffer *L. lagocephalus* (Linnaeus, 1758) had been recorded in the Syrian marine waters.

Methods

Samples were collected from a depth of 300 m off Banyas coast, Syria (N: 35°14′35.11", E: 35°55'12.56") (Fig. 1), using bottom longline. The fish was identified according to Carpenter and De Angelis (2016), and the morphometric measurements (length to the nearest

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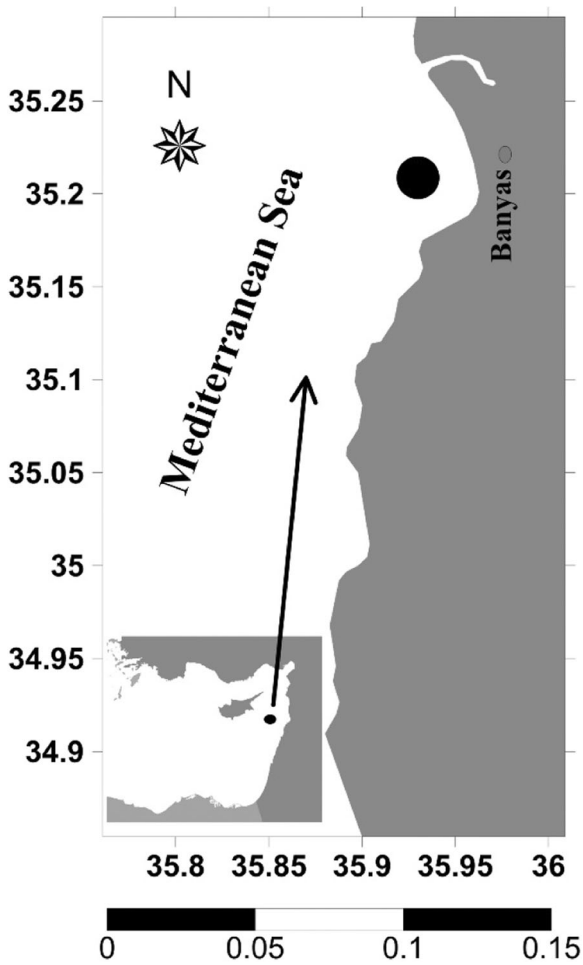

Fig. 1 A map showing the collection site of *L. lagocephalus* specimen

mm., weight to the nearest gr.) and some meristic measurements were recorded. The fish was then photographed, carefully dissected for sex, maturity and reproduction determinations, preserved in 7% formaldehyde, and placed at the biology laboratory of High Institute of Marine Research -HIMR (Tishreen University - Lattakia, Syria) as a reference sample (unnumbered yet).

Results

One specimen of the oceanic puffer *Lagocephalus lagocephalus* (Linnaeus, 1758) was caught on 20-12-2018 from the marine water of Syria (Fig. 2a). It was a live mature male (testis length was 137 mm, gonadosomatic index value was 4.02; Fig. 2b) at spawning stage; the milt was ready for release after slight pressure on the belly. The specimen has the following properties (Fig. 2a): the head was blunt with heavy jaws forming a beak of two, upper and lower, teeth. The dorsal and anal fins were slightly falcate to back, the pelvic fin was absent, the skin had no scales but the ventral side had tiny spinules. The dorsal side of the body was dark green and the belly was white with 18 dark spots. The dorsal, anal, pectoral and caudal fins were dark. The morphometric measurements are shown in Table 1; They were very close to those recoded by Erguden et al. (2017) and Teker et al. (2018) (Table 1) in the Turkish marine water. The diagnostic characters were: Dorsal fin rays (D), 13; Pectoral fin rays (D), 14; Anal fin rays (A), 11; Caudal fin rays (C), II + 15. All the above mentioned features were in full agreement with those of *L. lagocephalus* species (Smith and Heemstra 1986; Teker et al. 2018). After catching this specimen, two Syrian professional fishermen confirmed that this species had appeared in their catch, on 2017 and 2014; with 3 and 1 individuals respectively.

Discussion

The oceanic puffer *L. lagocephalus* exists in tropical and subtropical seas, and spreads from north-west to north-

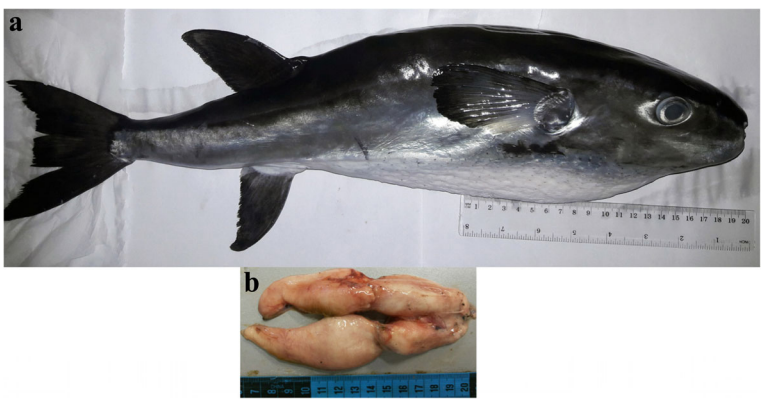

Fig. 2 a- a male *L. lagocephalus* specimen caught on 20-12-2018, **b**-Testis of the specimen

Table 1 Morphometric measurements of *L. lagocephalus* captured from the marine water of Syria and those recorded by Erguden et al. (2017) and Teker et al. (2018)

Factors	Morphometric Measurements (mm. or g.)		
	Syrian water	Turkish waters	
	Present Study	according to Erguden et al. (2017)	according to Teker et al. (2018)
Total length (TL)	537	605	605
Stander length	436	NR	500
Head length	71 (16.28% SL)	111 (20.72%TL)	NR
Eye diameter	21 (4.81% SL)	23	25 (5%SL)
Caudal fin length	89 (20.41%SL)	NR	NR
Pectoral fin length	92	NR	NR
The dorsal fin height	73	NR	NR
The anal fin height	71	NR	NR
Testis length	137 (31.42% SL)	NR	NR
Testis width	38	NR	NR
Total weight	1565	2800	2490
Testis weight	63 (4.02% GSI)	NR	NR

NR not recorded

east of the Mediterranean (Papaconstantinou 1988; Dulčić and Pallaoro 2006; Bañón et al. 2010; Bilecenoglu and Fernández-Álvarez 2013; Farrag et al. 2016; Erguden et al. 2017; Teker et al. 2018); It has never been recorded before in the marine waters of Syria (Galiya et al. 2015; Ali 2018). By recording this species, Tetraodontidae would be represented by six species in the checklist of the Syrian marine fish species; four out of these belong to the genus *Lagocephalus*. The oceanic puffer *L.lagocephalus* is so far represented by a single confirmed specimen, and thus, its establishment in the area has still to be proven. The advanced testis maturity of this specimen gives a preliminary indication that this species breeds in the area. The survival of this species in the Syrian waters and the recent sea water warming (Vallerga et al. 2003, Aldo Drago et al. 2004, RAC 2009, Ben Haj et al., 2009, Ibrahim et al. 2010, Alshawy et al., 2016, Alshawy et al. 2019) may assist this species to expand its original range and establish itself there. Compared to the other puffer fish species in the Syrian marine water, *L.lagocephalus* has the highest level of toxicity, especially in the edible parts, where ~ 300 g of flesh are enough to kill a human, (Saoudi et al. 2008; Saoudi et al. 2011; Rahman 2015). Thus, its establishment in the area may have serious consequences on people consuming the flesh, especially that the local people are not always aware of puffer fishes toxicity. In addition, food and space competitions with the other fish species may have a serious consequences on the native fish communities (Aydın 2011). Similarly, puffer fish destroy the traditional habitats of native fish, which reduces fish stocks, and destroy fishing nets and lines which reduce fish catch (Eastmed 2010).

Conclusion

This study reveals that the oceanic puffer *Lagocephalus lagocephalus* (Linnaeus, 1758) exists in the Syrian marine waters, where it is recorded for the first time. This species may expand its original range and establish itself in the area, which may lead to serious poisonous effect to human health and to serious ecological consequences to other fish populations.

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References

Drago A, Aarup T, Abdelbaki A, Abuissa A, Awad H, Mb A, Beken C, Besiktepe S, Af B, Brundrit G, Capari M, Carlier A, Cermelj B, Casazza G, Fs C, Cohen Y, Christos T, Dahlin H, Dalla Costa M, Drakopoulos P, Nc F, J Font GF, Gertman I, Harzallah A, Herrouin G, Ibrahim A, Kabbara N. MEDGOOS-building a strong regional partnership for operational oceanography in the Mediterranean. Rapports et proces verbaux des réunions-commission internationale pour l'exploration scientifique de la mer. Méditerranée. 2004;37:158.

Ali MF. An updated checklist of the marine fishes from Syria with emphasis on alien species. Mediterr Mar Sci. 2018;19:388–93.

Alshawy F, Ibrahim A, Hussein C, Lahlah M. First record of the Broadbanded cardinalfish *Ostorhinchus fasciatus* white, (1790) from the Syrian marine waters (eastern Mediterranean). International Journal of Agriculture & Environmental Science. 2019;6:14–6.

Alshawy F, Lahlah M, Hussein C. First record of the Berber ponyfish *Leiognathus berbis* Valenciennes, 1835 (Osteichthyes: Leiognathidae) from Syrian marine waters (eastern Mediterranean). Marine Biodiversity Records. 2016;9:4.

Aydın M. Growth, reproduction and diet of pufferfish (Lagocephalus sceleratus Gmelin, 1789) from Turkey's Mediterranean Sea coast. Turk J Fish Aquat Sci. 2011;11:569–76.

Bañón R, Villegas-Rios D, Serrano A, Mucientes G, Arronte JC. Marine fishes from Galicia (NW Spain): an updated checklist. ZOOTAXA. 2010;1:27.

Bearez P, Pruvost P, Feunteun E, Iglesias S, Francour P, Causse R, De Mazieres J, Tercerie S, Bailly N. Checklist of the marine fishes from metropolitan France. Cybium. 2017;41:351–71.

Ben Haj S, Cebrian D, Limam A, Grimes S, Halim Y, Bitar G, Bazairi H, Ibrahim A, Romdhane M. SPA (2009) sub-regional report on vulnerability and impacts of climate change on marine and coastal biological diversity in the Mediterranean, Arab countries. In: Ben Haj S, Cebrian D, Limam A, Grimes S, Halim Y, Bitar G, Bazairi H, Ibrahim A, Romdhane M, editors. RAC, UNEP-map; 2009.

Bilecenoglu M, Fernández-Álvarez FÁ. New Mediterranean marine biodiversity records (December, 2013). Mediterr Mar Sci. 2013;14:18.

Carpenter KE, De Angelis N. The living marine resources of the eastern Central Atlantic volume 4 bony fishes part 2(Perciformes to Tetradontiformes) and sea turtles. Rome: FAO; 2016.

Dulčić J, Pallaoro A. First record of the oceanic puffer (*Lagocephalus lagocephalus lagocephalus* Linnaeus, 1758), for the Adriatic Sea. J Appl Ichthyol. 2006;22:94–5.

Eastmed. F. Report of the sub-regional technical meeting on the Lessepsian migration and its impact on eastern Mediterranean fishery. Food and agriculture organisation of the United Nations (FAO). FAO EastMed technical documents 04, Nicosia, Cyprus. In: 132 pp; 2010.

Erguden D, Gurlek M, Turan C. First occurrence of the oceanic puffer, Lagocephalus lagocephalus (Linnaeus, 1758) in Iskenderun Bay, North-Eastern Mediterranean, Turkey. J Appl Ichthyol. 2017;33:801–3.

Farrag M, El-Haweet AA, Moustafa MA. Occurrence of puffer fishes (Tetraodontidae) in the eastern Mediterranean, Egyptian coast-filling in the gap. BioInvasions Record. 2016;5:47–54.

Froese, R. & Pauly, D. Fishbase www. fishbase. in. 2019 www.fishbase.in. 11 Jan 2019.

Galiya M, Ali AK, Rahman WA. Contribution to the study of the qualitative composition and biology of puffer fishes (Tetraodontidae) in the marine water of Lattakia. Tishreen University journal for research and scientific. Studies. 2015;37:283–301.

Ibrahim A, Lahlah M, Kassab M, Ghanem W, Ogaily S. *Signatus javus*, a new record from the Syrian waters, with reference to growth and feeding of two Lessepsian fish. Rapport de la Commission international de la. Mer Méditerranée. 2010;39:544.

Papaconstantinou C, Fauna Graeciae IV. Pisces. Check-list of marine fishes of Greece. Athens, Greece: National Centre for marine research. Athens: Hellenic Zoological Society; 1988.

Rahman WA, Galiya M, Ali AK. First record of the blunthead puffer *Sphoeroides pachygaster* (Osteichthyes: Tetraodontidae) in Syrian marine waters (eastern Mediterranean). Marine Biodiversity Records. 2014;7.

Rahman WMA. Study on the concentrations of a toxic substance in puffer fishes (Tetraodontidae) from the marine water of Lattakia. In: Master degree, Tishreen University.117 pp (in Arabic and abstract in English); 2015.

Santhanam R. *Biology And Ecology Of Toxic Pufferfish*, USA. In: Taylor & Francis group; 2018.

Saoudi M, Abdelmouleh A, Jamoussi K, Kammoun A, El Feki A. Hematological toxicity associated with tissue extract from poisonous fish Lagocephalus lagocephalus—influence on erythrocyte function in wistar rats. J Food Sci. 2008;73:H155–9.

Saoudi M, Messarah M, Boumendjel A, Abdelmouleh A, Kammoun W, Jamoussi K, Feki A. Extracted tetrodotoxin from puffer fish *Lagocephalus lagocephalus* induced hepatotoxicity and nephrotoxicity to Wistar rats. Afr J Biotechnol. 2011;10:8140–5.

Smith MM, Heemstra PC. Smiths' sea fishes. Berlin: Springer Science & Business Media; 1986.

Tamele I, Silva M, Vasconcelos V. The incidence of Tetrodotoxin and its analogs in the Indian Ocean and the Red Sea. Marine drugs. 2019;17:28.

Teker S, GÖkoğlu M, Korun J. Antalya Körfezi'nde Nadir Bir Balon Balığı Türü; Mavi Balon Balığı *Lagocephalus lagocephalus* (Linnaeus, 1758). Süleyman Demirel Üniversitesi Eğirdir Su Ürünleri Fakültesi Dergisi. 2018;14:215–9.

Vallerga S, Drago A, Aarup T, Abdelbaki A, Abuissa A, Awad H, Awad M, Beken C, Besiktepe S, Boargob A, Brundrit G, Capari M, C A, Cermelj B, Casazza G, Civili F, Cohen Y, Tziavos C, D H, Costa MD, Drakopoulos P, F N, Font J, F G, Gertman I, G G, Harzallah A, Herrouin G, Ibrahim A, Kabbara N, Kljajic Z, Kouyoumjian H, Legrand J, Lopez-Jurado J, Magni P, Mahmoud Al-Sheikh A, Maillard C, Malacic V, Manzella GMR, Marchand P, Morovic M, Pissierssens P, Pinardi N, Nittis K, Rosen D, Summerhayes C, Ribotti A, Reed G, Selenica A, Salihoglu I, Sammari C, Sauzade D, Silvestri C, Snoussi M, Sorgente R, Umgiesser G, Vargas M, Vucijak B, Woods J, Zavatarelli M, Zodiatis G. MAMA—towards a new paradigm for ocean monitoring in the Mediterranean, *Elsevier oceanography series*. Athens: Elsevier; 2003.

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