ISSN: 2458-8989

Natural and Engineering Sciences

Supplement, 2017, 2(3): 41-47

-REVIEW ARTICLE-

Long journey of *Lagocephalus sceleratus* (Gmelin, 1789) throughout the Mediterranean Sea

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Abstract

Lagocephalus sceleratus is widely distributed in the tropical Indo-West Pacific Ocean as well as the Red Sea, and more recently in the eastern basin of the Mediterranean Sea. *L. sceleratus* in the Mediterranean has been first recorded from Gökova Bay, southern Aegean Sea in 2003. Since then, this fish invaded rapidly whole Levantine basin, especially western and southern Anatolian coasts, Israel and Lebanon, Greek Islands in the Aegean Sea, especially Crete and Rhodes, Egypt and Libya. The northernmost records of *L. sceleratus* were given from the Adriatic Sea in both 2012 and 2013. Lately, the fish reached to Algeria and Spain in 2014. Along the Mediterranean, we have just gathered a total of 53 recording locations for *L. sceleratus* and this compilation work presents the update of the spreading of this invasive species throughout the Mediterranean Sea. Considering the recent locations where *L. sceleratus* has been recorded, we advise the regional fisheries management authorities that the problem of *L. sceleratus* is not only problem of the eastern Mediterranean anymore but also all Mediterranean marine ecosystem. Recent developments show that it is time to work on a guideline to monitor its impacts and mitigate the negative effects of this species in the Mediterranean.

Keywords:

Silver-cheeked toadfish, *Lagocephalus sceleratus*, records, distribution, Mediterranean Sea.

Article history:

Received 2 November 2017, Accepted 10 November 2017, Available online 19 December 2017

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Introduction

Silver-cheeked toadfish, *Lagocephalus sceleratus* (Gmelin, 1788) is a demersal, solitary fish found usually at depths of 10-50 m but was recorded also at 100 m (Golani et al., 2006). *L. sceleratus* is one of the largest members of Tetraodontidae family, reaching 110 cm SL and 7 kg weight (Froese & Pauly, 2017).

L. sceleratus is widely distributed in the tropical Indo-West Pacific Ocean as well as the Red Sea, and more recently in the eastern basin of the Mediterranean Sea (Kara et al., 2015). First confirmed record of *L. sceleratus* (Figure 1) in the Mediterranean Sea has been given by Akyol et al. (2005) from Gökova Bay on 17 February 2003. Previously, Mouneimne (1977) recorded it as misidentification of the similar pufferfish *L. suezensis* (see, Golani, 1996). This compilation work presents the update of the spreading of this invasive species throughout the Mediterranean Sea.

Figure 1. *Lagocephalus sceleratus*, recorded first in 2003 in the Mediterranean Sea

Successive Records in the Mediterranean

Since the first record of *L. sceleratus* in 2003, this fish invaded rapidly whole Levantine basin, especially western and southern Anatolian coasts, Israel and Lebanon, Greek Islands in the Aegean Sea, especially Crete and Rhodes, Egypt and Libya. The northernmost records of *L. sceleratus* were given from the Adriatic Sea in both 2012 and 2013. Recently, the fish reached to Algeria and Spain in 2014. Table 1 and Figure 2 show the distribution of *L. sceleratus* throughout the Mediterranean Sea.

Table 1. Chronology of documented records of *Lagocephalus sceleratus* in the Mediterranean

Map Ref.	Location	Coordinates Lat. N - Lon. E	Depth (m)	Record Date	Number collected	Size TL, mm	References
1	Gökova Bay, Turkey	37°09'-28°16'	15	17.2.2003	1	459	Akyol et al. (2005)
2	Gökova Bay, Turkey	37°02'-28°19'	-	?.8.2003	1	-	Filiz & Er (2004)
3	Kemer, Antalya, Turkey	36°82'-30°64'	0	18.9.2004	1	389	Bilecenoğlu et al. (2006)
4	Jaffa, Israel	-	-	9.11.2004	1	101	Golani & Levy (2005)
5	Haifa Bay, Israel	32°84'-35°00'		24.2.2005	1	618	Golani & Levy (2005)
6	Bodrum, Turkey	-	-	10.3.2005	2	-	Bilecenoğlu et al. (2006)
7	Adrasan, Antalya, Turkey	-	3	14.5.2005	2	200	Bilecenoğlu et al. (2006)
8	Heraklion Bay, Crete, Greece	35°20'-25°15'	-	?.7.2005	1	348	Kasapidis et al. (2007)
9	Rhodes, Greece	36°31'-28°27'	5-20	21.9.2005	1	376	Corsini et al. (2006)
10	Kaş, Antalya, Turkey	-	-	3.10.2005	1	-	Bilecenoğlu et al. (2006)

11	Georgioupoli Bay, Greece	35°21'-24°21'	0	20.12.2005	1	>300	Kasapidis et al. (2007)
12	Hekim Island,Izmir, Turkey	38°26'-26°45'	0-12	21.4.2006	1	498	Bilecenoğlu et al. (2006)
13	S Beirut, Lebanon	33°81'-35°42'	-	2005-2006	-	-	Carpentieri et al. (2009)
14	Cyprus	35°49'-33°74'	-	2006	-	-	Katsanevakis et al. (2009)
15	Elounda Bay, Greece	35°20'-25°72'	8	7.12.2006	1	-	Peristeraki et al. (2006)
16	Hersonissos Bay, Greece	35°31'-25°45'	9	11.2.2007	1	-	Peristeraki et al. (2006)
17	Lesvos, Greece	38°99'-26°15'	-	28.2.2007	1	-	Peristeraki et al. (2006)
18	Atherinolakos, Greece	35°00'-26°21'	0	1.3.2007	4	-	Peristeraki et al. (2006)
19	Hersonissos Bay, Greece	35°30'-25°44'	0	2.3.2007	1	-	Peristeraki et al. (2006)
20	Chania, Greece	35°38'-24°52'	0	5.3.2007	1	-	Peristeraki et al. (2006)
21	Makry Gialos, Greece	35°00'-25°87'	-	13.3.2007	1	-	Peristeraki et al. (2006)
22	Tolo Argolidas, Greece	37°53'-22°77'	8	13.3.2007	1	-	Peristeraki et al. (2006)
23	Kokkinos Pyrgos, Greece	35°07'-24°64'	5	16.3.2007	21	-	Peristeraki et al. (2006)
24	Vathy-Lithino, Greece	34°89'-24°77'	3	17.3.2007	1	-	Peristeraki et al. (2006)
25	Keratokampos, Greece	34°92'-25°24'	0-25	27.3.2007	3		Peristeraki et al. (2006)
26	Folegandros, Greece	36°57'-24°94'	-	22.4.2007	1	-	Peristeraki et al. (2006)
27	Palaikastro, Chania, Greece	35°24'-26°29'	-	23.4.2007	1	-	Peristeraki et al. (2006)
28	Asos, Çanakkale, Turkey	-	0	?.7.2008	1	-	Türker Çakır et al. (2009)
29	Alexandria, Egypt	-	0	2008	-	-	Halim & Rizkalla (2011)
30	N Aegean Sea, Greece	40°49'-22°79'		?.10.2008	1	-	Minos et al. (2010)
31	Sea of Marmara, Turkey	40°24'-26°40'		?.10.2008	1	95	Irmak & Altınağaç (2015)
32	Rhodes, Greece	-	-35	2008-2009	290	53-631	Kalogirou (2013)
33	Iskenderun Bay, Turkey	36°19'-36°56'	0	?.2.2009	4	388-611	Torcu-Koç et al. (2011)
34	N Aegean Sea, Greece	40°23'-23°81'	-	?.3.2009	1	-	Minos et al. (2010)
35	N Aegean Sea, Greece	40°12'-23°20'	-	?.12.2009	1	-	Minos et al. (2010)
36	Antalya Bay, Turkey	-	-	2008-2010	656	125-650	Aydın (2011)
37	Ain Al Ghazala, Libya	32°09'-23°15'	5-25	?.9.2010	5	279	Milazzo et al. (2012)
38	Mersin Bay, Turkey	-	2	10.11.2010	2	75-84	Yağlıoğlu et al. (2011)
39	Iskenderun Bay, Turkey	-	3	29.11.2010	2	65-75	Yağlıoğlu et al. (2011)
40	Gulf of Gabes, Tunisia	33°50'-11°52'	-	8.12.2010	1	600	Jribi & Bradai (2012)
41	Tunisian coasts	-	-	2010-2013	12	520-640	Ben Souissi et al. (2014)
42	Iskenderun Bay, Turkey	-	-50	2011-2012	77	89-784	Başusta et al. (2013)
43	Jakljan Island, Croatia	-	-	17.10.2012	1	663	Sulic-Sprem et al. (2014)
44	Tribunj, Croatia	42°38'-17°50'	-	17.3.2013	1	492	Dulcic et al. (2014)
45	Lempedusa Island, Italy	-	0	7.10.2013	1	410	Azzurro et al. (2014)
46	El Kala, Algeria	-	-	14.12.2013	1	-	Kara et al. (2015)
47	Annaba, Algeria	-	0-60	11.1.2014	2	320-480	Kara et al. (2015)
48	Syracuse, Italy	36°55'-15°10'	5-20	16.1.2014	1	650	Tiralongo & Tibullo (2014)
49	Alicante, Spain	39.067°-03.166°	50	31.7.2014	1	580	Izguerdo-Munoz & Izguerdo-Gomez (2014)
50	Gnejna, Malta	35°55'-14°20'	5	?.8.2014	1	568	Deidun et al. (2015)
51	Off Pernera, Cyprus	35.039°-34.037°	0	12.9.2014	1	259	Iglesias & Frotté (2015)
52	Off Pernera, Cyprus	35.039°-34.037°	0	16.9.2014	1	575	Iglesias & Frotté (2015)
53	Saros Bay, Turkey	40.368°-26.321°	-	2014	1	556	Tunçer & Önal (2014)

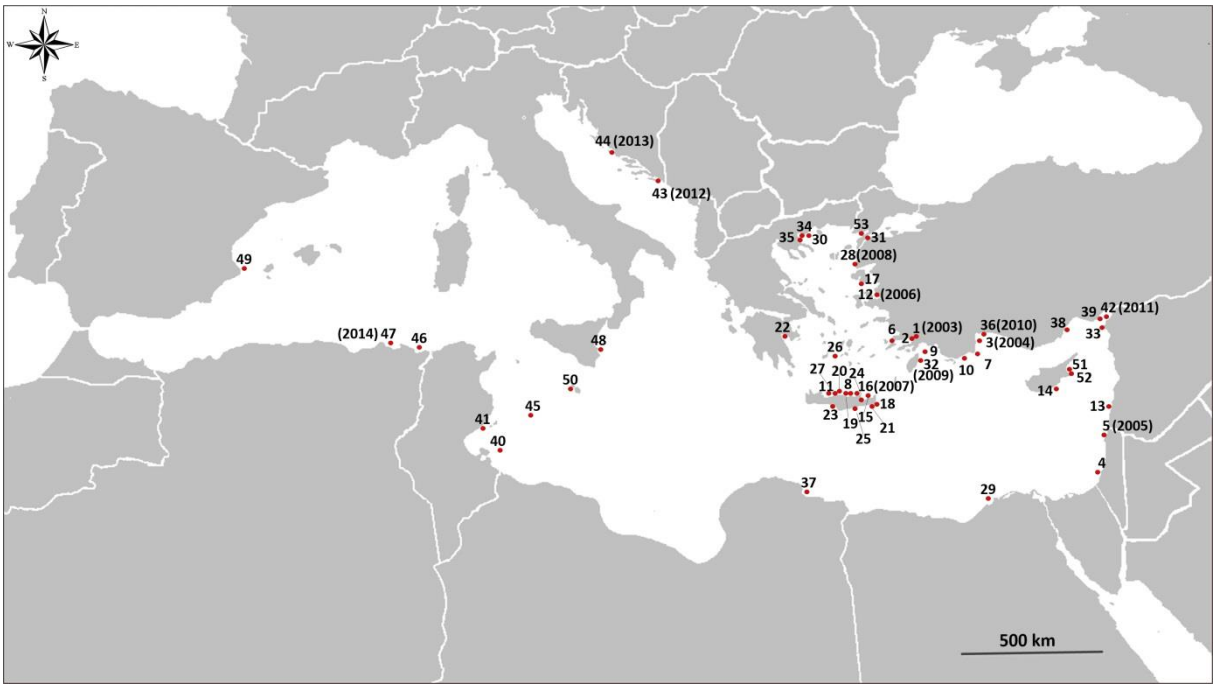

Figure 2. Range expansion of *Lagocephalus sceleratus* in the Mediterranean Sea (the years in parenthesis show the starting point of each year)

Where will it stop?

Since from the entrance to Mediterranean Sea, *L. sceleratus* as a rapid invader has been reached to Ibiza Strait (Spain) after 11 years (since 2003, *see,* Akyol et al., 2005). Apparently, the fish won't stop and continue towards to the Gibraltar. We will wait and see. Already, FishBase signs that this fish is likely to occurring along the Portugal, northern Spain and France, Morocco and western African coasts, even the Caribbean Sea and Brazilian and Argentina coasts as suitable habitats (Froese & Pauly, 2017).

Conclusion

L. sceleratus has been included in the black list as an one of the worst 18 invader fish species by the IUCN (Otero et al. 2013), and it is likely to out of the Mediterranean Sea; on the other words, it might be spreaded towards to Atlantic. In this wide area, it can be interested in for human consumption. Whereas, it is venomous to eat owing to contains lethal tetrodotoxin (TTX). Namely, it is a very dangerous fish to human health. For these reasons, this fish should be hunted and its population should be decreased under control. Another issue pertaining to this species is negative economic impacts on fishers owing to the fact that its damages to passive fishing gears and fish entangled in these fishing gears. Some studies (Ünal et al. 2015; Ünal & Göncüoğlu-Bodur, 2017) which have been focused on socioeconomic impacts of this species propose bounty system to encourage its fishing as well as to mitigate its impact on fishers. On the other hand, considering the recent locations where *L. sceleratus* has been recorded, we advise the regional fisheries management authorities that the problem of *L. sceleratus* is not only problem of the eastern Mediterranean anymore but also all Mediterranean marine ecosystem. Recent developments show

that it is time to work on a guideline to monitor its impacts and mitigate the negative effects of this species in the Mediterranean Sea.

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