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## **Additional records on the occurrence of alien fish species in the eastern Mediterranean Sea**

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### **Abstract**

*Recent records on the occurrence of the species *Etrumeus teres*, *Siganus rivulatus*, *Stephanolepis diaspros*, *Sphoeroides pachygaster*; *Lagocephalus sceleratus*, *Fistularia commersonii* and *Siganus luridus* are presented for the Aegean, Cretan and Libyan Seas and the new record of *Upeneus moluccensis* in the Cretan Sea is reported.*

**Keywords:** Alien species; Lessepsian immigrants; Mediterranean.

### **Introduction**

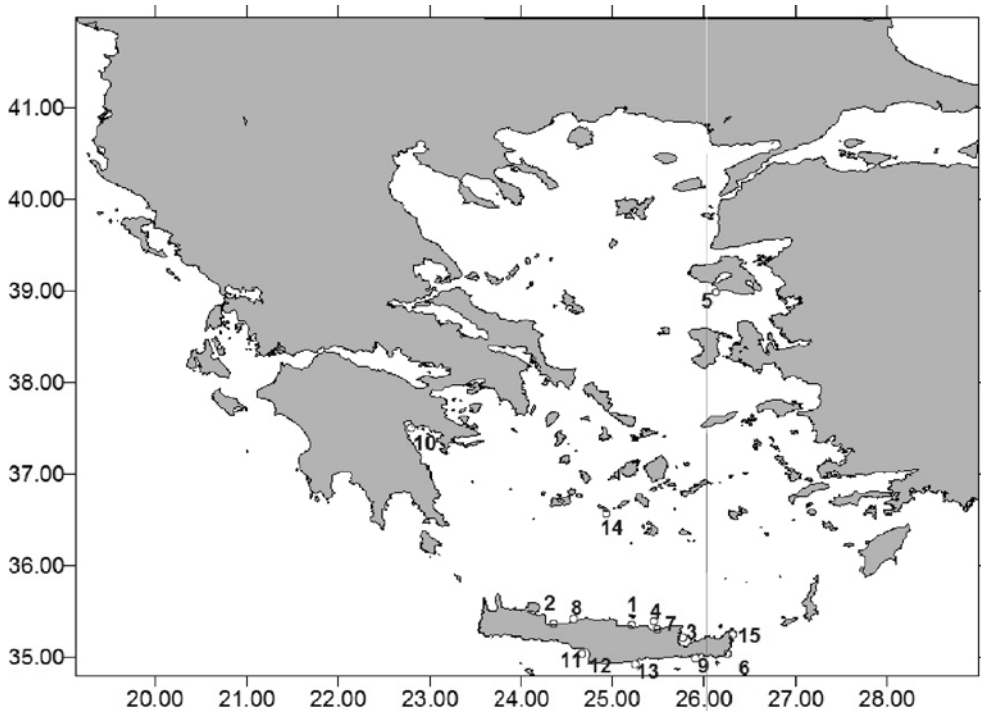
Alien species of Atlantic Ocean origin, as well as, since the opening of the Suez Canal in 1869, numerous species from the Indo-Pacific Ocean, have been introduced into the Mediterranean Sea (GOLANI *et al.*, 2002, 2006). The current work focuses on the occurrence of alien fish species in the Aegean, Cretan and Libyan seas. In the past several authors have reported the occurrence of exotic fish species in the Greek seas (KASPIRIS, 1976; KAVALLAKIS, 1968; PAPACONSTANTINOY, 1987; 1988; 1990; TSIMENIDES *et al.*, 1991; ZACHARIOU-MAMALINGA & CORSINI, 1994; CORSINI & ECONOMIDIS, 1999; CORSINI *et al.*, 2002; 2005; 2006; CORSINI FOKA *et al.*, 2004; GOLANI *et al.*, 2002; TINGILIS, *et al.* 2003; KARACHLÈ *et al.*, 2004; KALLIANIOTIS & LEKKAS, 2005; PANCUCI-PAPADOPOULOU *et al.*, 2005; SINIS, 2005; KASAPIDIS *et al.*, 2007a; 2007b).

The aim of the present work is to contribute to tracing the expansion and settlement of alien fish in Greek seas. New records of the occurrence of fish species which have invaded the Mediterranean through the Suez Canal or the Gibraltar Strait are presented, based on information derived either from the experimental bottom trawl surveys in the S. Aegean and Cretan Seas, carried out in the frames of the MEDITS program (BERTRAND *et al.*, 2002), or from specimens obtained from fishermen.

The first certified record of the occurrence of a Lessepsian immigrant fish new for the Cretan Sea is presented, while further data are provided regarding the expansion of other alien species in the study areas.

### **Materials and Methods**

The occurrence of specimens of immigrant species, at the sampling stations of the MEDITS surveys, conducted from 1996 to



**Fig. 1:** Spatial and temporal distribution of the sampled specimens of the species *Lagocephalus sceleratus*. (Numbers indicate the sample-record reported in Table 2).

2006 in the S. Aegean and Cretan seas has been recorded. Collected data includes: abundance in terms of number of individuals, biomass, date, geographical coordinates, depth and type of substrate. The depth-range covered by the MEDITS survey in the S. Aegean and Cretan seas, is from 20 to 800 m.

In addition, records of alien species obtained from commercial and sports fisheries and identified by HCMR scientists, are presented. Date, area, depth, gear and abundance are recorded.

**Results**

*MEDITS Survey 1996-2006:*

Specimens of 5 invasive species were caught and identified at the sampling stations of the MEDITS surveys. The specimens caught belonged to the immigrant species:

*Etrumeus teres*, *Upeneus moluccensis*, *Siganus rivulatus*, *Stephanolepis diaspros* and *Sphoeroides pachygaster*. The date, location and quantities of the catches are presented in Table 1. Four of the above species are Lessepsian immigrants (i.e. Red Sea origin), while *Sphoeroides pachygaster* is an alien species of Atlantic origin. For the golden-banded goatfish (*U. moluccensis*), this is the first certified record regarding its occurrence in the Cretan Sea.

*Records from commercial and sports fishery*

Forty specimens of the silverstripe Blaa-sop (*Lagocephalus sceleratus*) were caught by fishermen in different parts of the Aegean, Cretan and Libyan seas and identified by scientists from HCMR (Crete). Date, location of capture and quantity of the specimens are presented in Table 2. The spatio-temporal

distribution of the specimens is presented in Figure 1.

Two specimens of the species *Fistularia commersonii* were caught by fishermen in Ierapetra and Kalymnos and identified by scientists in February of 2007.

Important catches (up to 20kg/1000m of net) of *Siganus luridus* in the commercial coastal trammel-net fisheries operating in the Dodecanese islands complex have been recorded by scientific port observers since the early 1990s. Since 1995, the species has been also frequently observed in shallow waters with vegetation in the Cyclades and Crete (GOLANI *et al.*, 2006).

## Discussion

Although in the S. Aegean and Cretan seas, the MEDITS survey has been carried out annually, following the same sampling protocol since 1996, catches of alien species have appeared only in recent years. Specifically, two alien species were recorded in 2003 (*Siganus rivulatus*, *Sphoeroides pachygaster*), one in 2004 (*Siganus rivulatus*), three in 2005 (*Etrumeus teres*, *Sphoeroides pachygaster* and *Stephanolepis diaspros*) and three in 2006 (*Upeneus moluccensis*, *Sphoeroides pachygaster* and *Stephanolepis diaspros*).

Starting from the late 1960s (KAVALAKIS, 1968), *Siganus luridus* has been frequently observed in commercial catches of coastal fisheries operating around the Dodecanese islands (CORSINI & ECONOMIDIS, 1999; KALOGIROU *et al.*, 2007). This species however, has been never recorded in the catches of the MEDITS survey; a fact suggesting that it may inhabit depths shallower than those surveyed and/or non-trawlable substrates. The species is usually observed in a mixed type of substrate i.e. sandy bottoms with rocks or stones covered by algae.

Most of the species of Red Sea origin were found at depths of less than 68 m. This is to be expected, as the Suez Canal has a depth of around 10m and mainly coastal spe-

Table 1. Data on the occurrence of invasive species during the 1996-2006 MEDITS surveys in the S. Aegean and Cretan seas.

Record	Year	Area	Date	Latitude	Longitude	Depth (m)	Scientific name	Number of individuals	Weight (gr)	Bottom
1	2003	NE Kos	10/9	36,55.11	27,14.83	28-32	<i>Siganus rivulatus</i>	3	200	Vegetation
2	2003	SE Sikinos	26/8	36,38.09	25,09.51	101-105	<i>Sphoeroides pachygaster</i>	1	800	Rodophyceae/stones
3	2004	NE Kos	29/6	36,55.11	27,14.67	30-34	<i>Siganus rivulatus</i>	1	170	Vegetation
*4	2005	Malia	4/7	35,19.50	25,27.66	59-61	<i>Etrumeus teres</i>	403	2500	Vegetation
5	2005	S Serifos	14/6	37,05.95	24,24.70	155-157	<i>Sphoeroides pachygaster</i>	1	2100	Mud
6	2005	SE Sikinos	12/6	36,37.74	25,09.02	106-104	<i>Sphoeroides pachygaster</i>	2	2060	Rhodophyceae/stones
11	2005	Hania	9/6	35,32.67	23,53.11	25-26	<i>Stephanolepis diaspros</i>	1	35	Anthozoa
12	2006	SW Leros	4/7	37,10.22	26,39.77	177-166	<i>Sphoeroides pachygaster</i>	1	110	Mud/stones
13	2006	SW Astypalaia	11/7	36,29.76	26,18.11	137-143	<i>Sphoeroides pachygaster</i>	1	500	Rhodophyceae/stones
14	2006	NE Kos	6/7	36,55.10	27,14.74	29-31	<i>Stephanolepis diaspros</i>	4	400	Vegetation
15	2006	Kasteli	19/6	35,32.12	23,40.75	62-68	<i>Upeneus moluccensis</i>	1	2.5	Vegetation

\* Recorded by KASAPIDIS *et al.*, 2007b.

**Table 2. Reported and identified catches of *Lagocephalus sceleratus*.**

Record	Date	Area	Gear	Depth (m)	Number of individuals
1*	20/7/2005	Heraklion Bay	Spear gun	9	1
2*	20/12/2005	Georgiupolis Bay, Chania	Trammel net	30	1
3	7/12/2006	Elounda Bay	Beach-seine	8	1
4	11/2/2007	Hersonissos Bay	Trammel net	9	1
5	28/2/2007	Lesvos	Trammel net		1
6	1/3/2007	Atherinolakkos	Long-lines	20	4
7	2/3/2007	Xersonisos Bay	Trammel net	10	1
8	5/3/2007	Georgiupolis Bay, Chania	Trammel net	10	1
9	13/3/2007	Makrys gyalos, Ierapetra	Trammel net		1
10	13/3/2007	Tolo Argolidas	Trammel net	28	1
11	16/3/2007	Kokkinos Pyrgos	Trammel net	15	21
12	17/3/2007	Vathy-Lithino	Trammel net	33	1
13	27/3/2007	Keratokampos	Trammel net	20-25	3
14	22/4/2007	Folegandros	Trammel net		1
15	23/4/2007	Palaikastro Lasithiou	Trammel net		1

\* Recorded by KASAPIDIS *et al.*, 2007b.

cies invade the Mediterranean through the canal (GOLANI, 1998). The species *Stephanolepis diaspros* and *Siganus rivulatus* were found at depths of between 25-34m while *Etrumeus teres* and *Upeneus moluccensis* were found at depths of around 60m.

The species *Sphoeroides pachygaster*, of Atlantic origin, was caught at depths of between 100-180m, mostly at substrates consisting of stones covered by Rhodophyceae. This may indicate a specific habitat preference, though there are few available records.

Apart from the survey catches, three species were recorded from commercial and sports fisheries operating in shallow waters: *Siganus luridus*, *Fistularia commersonii* and *Lagocephalus sceleratus*. The latter was first recorded in northern Crete in 2005 (KASAPIDIS *et al.*, 2007a). Since then, several samples and reports regarding its occurrence have been provided by fishermen, indicating the rapid expansion of the species not only around Crete, but also in the southwest and northeast Aegean (Fig. 1). There is also a reported catch in the Korinthiakos Gulf, but

this has not yet been verified. When compared to the expansion pattern of other invasive species (KARACHLÈ *et al.*, 2004) and taking into account that *L. sceleratus* was recorded for the first time in the Mediterranean in 2003 (AKYOL *et al.*, 2005), it can be concluded that it is one of the faster expanding Lessepsian immigrants. Its rapid expansion northward (Lesvos island) and westward (east Peloponnese) may indicate a better ability to adapt to different environmental conditions. The species has been included among the 100 'worst invasive species' in the Mediterranean; it is a poisonous fish, dangerous for humans (STREFTARIS & ZENETOS, 2006). Its rapid expansion may also affect diversity and/or abundance of native species in the near future.

Our findings, together with past information on the existence and spread of alien species in the Aegean Sea (PAPACONSTANTINO, 1987; 1988; 1990, TSIMENIDES *et al.*, 1991; TINGILIS *et al.*, 2003; PANCUCCI-PAPADOPOULOU *et al.*, 2005; CORSINI *et al.*, 2006; KASAPIDIS *et al.*,

2007a; 2007b), indicate that the expansion of Lessepsian immigrants in the Cretan and S. Aegean seas has accelerated in recent years. It can be speculated that such a successful adaptation to the prevailing environmental conditions has been facilitated by general climatic changes.

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