

## Updated distribution of the holothuroid *Synaptula reciprocans* (Forskål, 1775) in the Mediterranean: does it follow shallow-water circulation patterns?

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### Abstract

The Indo-Pacific holothurian, *Synaptula reciprocans*, entered the Mediterranean Sea through the Suez Canal and has spread along the Levantine coast. The present study reports the finding of flourishing populations off the Dodecanese and Cyclades islands, southeastern Aegean Sea. The species occurs on shallow rocky and sandy bottoms. Further research is needed to monitor its possible spread northwards and westwards and the ecological implications of its establishment.

**Key words:** *Synaptula reciprocans*, Aegean Sea, Eastern Mediterranean, alien, invasion, circulation patterns

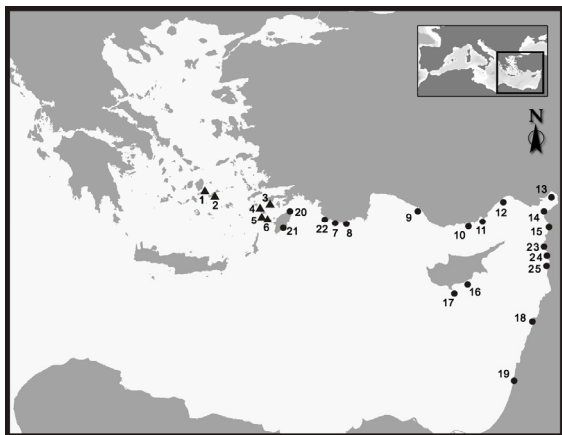
558 metazoan species have been reported as alien to the Mediterranean Sea (Galil 2008), of which only five, *Asterina burtoni* (Gray, 1840), *Ophiactis parva* Mortensen 1926, *O. savignyi* (Müller and Troschel, 1842), *Diadema setosum* (Leske, 1778) and *Synaptula reciprocans* (Forskål, 1775), belong to the Echinodermata (Galil 2006; Yokes and Galil 2006).

*Synaptula reciprocans* (Figure 1) is distributed throughout the tropical Indo-Pacific, and it is common in the Red Sea (Clark and Rowe 1971). Its earliest records in the Mediterranean Sea were from the coasts of Cyprus and Israel (Cherbonnier 1986; Galil 2007). It was later reported from Lebanon, Syria and Turkey (Zibrowius and Bitar 2003; Bitar et al. 2003 Cinar et al. 2006; Galil 2006), and more recently from Rhodes and Megisti islands, Greece (Pancucci et al. 2005; Koukouras et al. 2007). In September 2005 and 2008, extensive populations have been sighted during a survey of the Dodecanese and the Cyclades, South Aegean Sea. Specimens were recorded off the coast of Symi, Tilos, Chalki, Alimia, Amorgos and

Antikeros islands (Figure 2). *S. reciprocans* was found on sandy bottoms with gravel and pebbles, as well as on gently sloping rocky shores mostly covered with the alga *Caulerpa racemosa* (Forsskål) J. Agardh 1873. The population density ranged from 0.1 to 0.6 individuals/m<sup>2</sup>, with the highest values recorded at the depth of 4-8 m.



**Figure 1.** *Synaptula reciprocans*, Tilos Island, Dodecanese, South Aegean Sea (photo by C. Antoniadou, 27 September 2005)



**Figure 2.** Up to day distribution of the species *Synaptula reciprocans* in the eastern Mediterranean (▲ present study, ● literature data)

*Synaptula reciprocans* has probably entered the Mediterranean Sea through the Suez Canal (Cherbonnier 1986) and spread northward along the Levantine coast and the southeastern Aegean Sea. The path of invasion seems to follow water circulation patterns and specifically the counter-clockwise circulation of Atlantic water masses in the eastern Mediterranean basin (Theocharis et al. 1999; Galil 2006; Hamad et al. 2006). The species occupies the shallow sublittoral zone, on rocky and sandy bottoms, where well established populations have been reported (Cinar et al. 2006; present data). It feeds upon diatoms, other micro-organisms and organic coated particles (Clark 1907; Cherbonnier 1986). There is no information on the impact of *S. reciprocans* on the native fauna and further study is required to assess the viability and evolution of the established populations, by gathering data on the population density and reproduction of this Lessepsian invasive alien species, as well as to determine potential competitors and predators. Such efforts should be carried out collaboratively, in order to assess the ecological implications of the establishment of alien species into the Mediterranean (Galil 2008).

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Distribution pattern of *Synaptula reciprocans* in Mediterranean

**Annex 1**

Records of *Synaptula reciprocans* in the Eastern Mediterranean

Location	Coordinates		Location in Figure 2	Date of record	Habitat	Depth	Population density	Reference
	Latitude, N	Longitude, E						
Antikeros	36°47'56"	25°44'81"	1	2008	coarse sand with gravel rocks	2-6 m	0.10 ind./m <sup>2</sup>	present study
Amorgos	36°47'56" 36°48'18"	25°44'81" 25°44'98"	2	2008	surrounded with sand and gravel rocks	2-4 m	0.12 ind./m <sup>2</sup>	present study
Tilos	36°26'74" 36°25'71" 36°23'29"	27°23'39" 27°23'71" 27°25'73"	3	2005	surrounded with sand and gravel rocks	2-8 m	0.28 ind./m <sup>2</sup>	present study
Chalki	36°13'01"	27°38'77"	4	2005	coarse sand with gravel rocks	2-8 m	0.42 ind./m <sup>2</sup>	present study
Alimia	36°21'91"	27°27'68"	5	2005	surrounded with sand and gravel rocks	4-8 m	0.45 ind./m <sup>2</sup>	present study
Symi	36°31'13" 36°33'30" 36°37'13" 36°38'10"	27°51'83" 27°52'82" 27°52'25" 27°48'98"	6	2005, 2008	surrounded with sand and gravel	2-6 m	0.60 ind./m <sup>2</sup>	present study
Rhodes	36°20'40" 36°06'30"	28°12'50" 28°04'50"	20-21	2004, 2007	no data	0-4 m	no data	Pancucci et al. 2005; Koukouras et al. 2007
Megisti	36°07'59"	29°35'27"	22	2007	no data	0-4 m	no data	Koukouras et al. 2007
Cyprus	34°39'56" 34°43'29"	33°02'07" 33°20'14"	16-17	1986, 2004, 2007	no data	0-4 m	no data	Cherbonnier 1986; Koukouras et al. 2007
Turkey	36°19'30" 36°08'17" 36°42'15" 36°00'36" 36°54'22" 36°11'26" 36°32'13" 36°08'51" 36°18'51"	35°47'00" 33°32'53" 34°28'00" 35°58'34" 35°58'05" 29°50'51" 31°59'54" 29°41'41" 33°51'47"	7-15	1986, 2001-2005	soft and hard substratum	0-7 m	no data	Cinar et al. 2006; Galil 2006
Lebanon	no data on the exact location in which the species has been found		18	2000	no data	no data	no data	Zibrowius and Bitar 2003
Syria	35°55'18" 35°51'04" 35°31'63"	35°53'86" 35°48'08" 35°45'64"	23-25	2003	soft and hard substratum	-9 m	no data	Bitar et al. 2003
Israel	no data on the exact location in which the species has been found		19	1971	no data	no data	no data	Cherbonnier 1986; Galil 2007