

THE ECHINODERM FAUNA OF TURKEY WITH NEW RECORDS FROM THE LEVANTINE COAST OF TURKEY

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ABSTRACT

The echinoderm fauna of Turkey consists of 80 species (two Crinoidea, 22 Asteroidea, 18 Ophiuroidea, 20 Echinoidea and 18 Holothuroidea). In this study, seven echinoderm species are reported for the first time from the Levantine coast of Turkey. These are, five ophiroid species; *Amphipholis squamata*, *Amphiura chiajei*, *Amphiura filiformis*, *Ophiopsila aranea*, and *Ophiothrix quinquemaculata* and two echinoid species; *Echinocyamus pusillus* and *Stylocidaris affinis*. Turkey is surrounded by four seas with different hydrographical characteristics and Turkish Straits System (Çanakkale Strait, Marmara Sea and İstanbul Strait) serve both as a biological corridor and barrier between the Aegean and Black Seas. The number of echinoderm species in the coasts of Turkey also varies due to the different biotic environments of these seas. There are 14 echinoderm species reported from the Black Sea, 19 species from the İstanbul Strait, 51 from the Marmara Sea, 71 from the Aegean Sea and 42 from the Levantine coasts of Turkey. Among these species, *Asterias rubens*, *Ophiactis savignyi*, *Diadema setosum*, and *Synaptula reciprocans* are alien species for the Turkish coasts.

Key words: *Echinodermata, new records, Levantine Sea, Turkey.*

INTRODUCTION

Özaydın *et al.* (1995) compiled the data on 71 echinoderm species distributed in the Turkish coasts of the Mediterranean Sea, Aegean Sea, Marmara Sea and Istanbul Strait and Öztürk (1998) reported 13 species (1 Asterozoa, 5 Ophiurozoa, 1 Echinozoa and 6 Holothurozoa) for the Turkish coast of the Black Sea by the literature review. Albayrak (1996) reported 4 new echinoderm records for the İstanbul Strait and among them *Asterias rubens* is an alien species, also reported from the Marmara Sea (Yüce & Sadler, 2000) and the Black Sea (Karhan *et al.*, 2007). Balkıs (1992) reported *Phyllophorus (Phyllophorus) urna* and *Brissus unicolor* from the Marmara Sea. Çınar *et al.* (2002) reported the alien echinoderm species, *Ophiactis savignyi* from the Aegean Sea. The alien holothurian species, *Synaptula reciprocans*, was reported from the Aegean Sea by Zaitsev & Öztürk (2001) and from the Levantine coast by Çınar *et al.* (2006). Yokeş & Galil (2006) and Gökoğlu *et al.* (2007) reported the alien long-spined sea urchin, *Diadema setosum* from the Levantine coast of Turkey.

MATERIAL AND METHODS

In this study, the samples are collected by SCUBA diving between 2003 and 2004 from the 1-6 stations from the depth of 10-40 m in the Gulf of Fethiye and by trawling on March, 2008, from the 7 station from the depth of 70 m in the Gulf of Antalya (Figure 1, Table1).



Fig 1: The map of the study area indicating sampling stations (Stations 1-6 are located in the Gulf of Fethiye; station 7, in the Gulf of Antalya)

RESULTS

In this study, seven new echinoderm species are reported from the Levantine coast of Turkey. These are, five ophiroid species; *Amphipholis squamata*, *Amphiura chiajei*, *Amphiura filiformis*, *Ophiopsila aranea*, and *Ophiothrix quinquemaculata* and two echinoid species; *Echinocyamus pusillus* and *Stylocidaris affinis*.

***Echinocyamus pusillus* (O.F.Müller, 1776)**

Two specimens from **St.1, 40m**; one specimen from **St.3, 40m**; two specimens from **St.4, 30m**; and one specimen from **St.4, 40m**.

***Stylocidaris affinis* (Philippi, 1845)**

One specimen from **St.4, 20m.**, and five specimens from **St.7, 70m**.

***Amphipholis squamata* (Delle Chiaje, 1828)**

One specimen from **St.3, 10 m**.

***Amphiura chiajei* Forbes, 1843**

Three specimens from **St.1, 40m**; and one specimen from **St.2, 10m**.

***Amphiura filiformis* (O.F.Müller, 1776)**

One specimen from **St.1, 40m**; and three specimens from **St.2, 10m**.

***Ophiopsila aranea* Forbes, 1843**

Five specimens from **St.2, 10m**; 28 specimens from **St.3, 10m**; two specimens from **St.3, 20m**; two specimens from **St.3, 30m**; one specimen from **St.3, 40m**; one specimen from **St.4, 10m**; four specimens from **St.4, 20m**; 15 specimens from **St.5, 10m**; and one specimen from **St.5, 20m**.

***Ophiothrix quinquemaculata* (D.Chiaje, 1828)**

One specimen from **St.2, 10m**; four specimens from **St.2, 40m**; one specimen from **St.5, 10m**; one specimen from **St.6, 10m**; and one specimen from **St.6, 30m**.

DISCUSSION

According to the present study and recent studies, the echinoderm fauna of Turkey consists of 80 species (2 Crinoidea, 22 Asteroidea, 18 Ophiuroidea, 20 Echinoidea and 18 Holothuroidea). Turkey is surrounded by four seas with different hydrographical characteristics and Turkish Straits System (Çanakkale Strait, Marmara Sea and İstanbul Strait) serve both as a biological corridor and barrier between the Aegean and Black Seas (Öztürk & Öztürk, 1996). The number of echinoderm species in the coasts of Turkey also varies due to the different biotic environments of these seas. There are **14** echinoderm species (2 Asteroidea, 6 Ophiuroidea, 1 Echinoidea and 5 Holothuroidea) reported from the Black Sea, **19** species (1 Crinoidea, 4 Asteroidea, 4 Ophiuroidea, 4 Echinoidea and 6 Holothuroidea) from the İstanbul Strait, **51** (2 Crinoidea, 16 Asteroidea, 11 Ophiuroidea, 13 Echinoidea and 9 Holothuroidea) from the Marmara Sea, **71** (2 Crinoidea, 21 Asteroidea, 14 Ophiuroidea, 19 Echinoidea and 15 Holothuroidea) from the Aegean Sea and **42** (1

Crinoidea, 12 Asteroidea, 12 Ophiuroidea, 11 Echinoidea and 6 Holothuroidea) from the Levantine coasts of Turkey (Table 2).

Salinity is an important range limiting factor for most aquatic species over other ecological factors (food supply, competition, behaviour, predators, etc.). In brackish seas, like Black Sea, salinity determines most of the species range limits and colonization potential. Black Sea is lacking the truly polymixohaline zone (salinity 18-30‰) because the salinity slightly exceeding 18‰ may be found only in the offshore central pelagic parts of the Black Sea and in the narrow pre-Bosphorus Strait (**Paavola *et al.*, 2005**). Most echinoderms cannot tolerate marked changes in salinity, temperature, and light intensity and tend to move away from areas where the salinity is below 15‰ (Binyon, 1966). The low numbers of echinoderm species, reported in the İstanbul Strait (19) and Black Sea (14) is probably related to the low salinity and high seasonal alterations in the hydrographical conditions due to the river inputs. The echinoderm species are increasingly becoming a subject of study in the Mediterranean Sea because of their ecological roles in the ecosystem and usage as indicator organisms for monitoring the alterations in the ecosystem. **Francour *et al.* (1994)** reported the increase in the abundance of thermophilic echinoderm species *Arbacia lixula*, *Centrostephanus longispinus* and *Ophidiaster ophidianus* in the western Mediterranean waters due to the increase of the water temperature in the basin. Rising seawater temperature may change the pool of species which could establish themselves in the Mediterranean, enable the warm stenothermal species (native and alien) to expand beyond their present distributions, and may impact on a suite of population characteristics (reproduction, survival) that determines inter-specific interactions, and, therefore, the dominance and prevalence patterns of both native and alien species, and provide the thermophilic aliens with a distinct advantage over the native biota (Galil, 2007).

The consequences of the climate change may still look like to be minor but the economic and ecological impacts are already very serious. Among the invasive alien species reported from Turkey; eleven species were reported to have impacts on fisheries and aquaculture, six species to have impacts on health and sanitation, and thirteen to have impacts on infrastructure and building (Özgür, 2008). According to Özgür (2008) a total of 297 alien species were reported from the Turkish coasts and among them there are four echinoderm species. While *Asterias rubens* is thought to be introduced by shipping, the other three species (*Ophiactis savignyi*, *Diadema setosum* and *Synaptula reciprocans*) are Erythrean alien echinoderms entered the Mediterranean Sea via the Suez Canal. *A. rubens* may have considerable negative economic importance as a voracious predator of the marketable

mussels *Mytilus edulis* and *M. galloprovincialis*, which are economically important as a food resource and ecologically important as a habitat for a number of species. Another impact of this species can be competition with native starfish, *Marthasterias glacialis* for food and space (**Karhan *et al.*, 2007**).

Çınar *et al.* (2002) reported that they found a low faunal diversity on the sponge samples where the invasive Lessepsian species, *Ophiactis savignyi* was present. *O. savignyi* was also reported to produce a dense population within the canals of *Spirastrella inconstans* in the Red Sea (Fishelson, 1962). *Synaptula reciprocans* is a frequently found holothuroid at shallow water on soft and hard substrates in the Aegean and Levantine coasts (**Çınar *et al.*, 2006**, Özgür & Öztürk, 2007).

The long and slender spines of *D. setosum* may inflict painful injuries on the unwary swimmers, divers and fishermen. The spines are brittle and hollow, with barbed tips that penetrate the skin and remain imbedded in the flesh, releasing venom from their tissue and lumen. The venom may cause redness, swelling, and acute pain, which subsides after a few

hours; however, spine fragments are difficult to remove, and healing may take several weeks (Yokeş & Galil, 2006).

The number of echinoderm species, reported in the Levantine coast is lower (42), compared to the Aegean Sea (71) and Marmara Sea (51). The reason for this is thought to be that there are higher numbers of studies on the echinoderm fauna of the Marmara and Aegean Seas compared to the Levantine coast of Turkey. The studies on the echinoderm fauna of the Marmara Sea dates back to Demir (1952) and Tortonese & Demir (1960). There are a high number of studies realized in the Aegean coast of Turkey (**Forbes, 1843; Geldiay & Kocataş, 1972; Ünsal, 1973; Kocataş, 1978; Okatan, 1985; Özaydın, 1991; Özaydın et al., 1995**). However, the studies on the echinoderm fauna in the Levantine coast of Turkey are very limited (**Forbes, 1845 and Özaydın et al., 1995**). The number of the echinoderm species is thought to be increase with further studies, realized in the Levantine coast of Turkey.

It is necessary to complete the knowledge on the fauna and flora on the Levantine coast because the region is extensively subjected to Lessepsian migration. The majority of aliens reported from the Turkish coasts were found in shallow benthic habitats. Thus, monitoring programmes on spatio-temporal structures of communities particularly in the hot spot areas for aliens such as harbours, shallow, brackish and polluted waters should be undertaken (**Çınar et al., 2005**). Long-term approaches are required to monitor the alien species in proportion to local and endemic species, to examine the competition between them and to

document the displacement and replacement events. Special interest and monitoring studies are needed in the Levantine basin and Suez Channel due to prediction of the probable impacts to the native fauna and flora components.

REFERENCES

- Albayrak, S., 1996, Echinoderm Fauna of the Bosphorus (Türkiye). *Oebalia*, vol. XXII, 25-32.
- Balkıs, H., 1992, Marmara Adası Littoralinin Makrobentosu Üzerine Bir Ön Araştırma. İ.Ü. Deniz Bilimleri ve Coğrafya Enstitüsü Bülteni, no:9, No:9, 309-327. [In Turkish]
- Binyon, J., 1966, Salinity tolerance and ionic regulation. In: Boolootian, R. A. (ed.) *Physiology of Echinodermata*. Wiley, New York, pp. 359-377.
- Çınar, M.E., Bilecenoğlu, M., Öztürk, B. & Can, A., 2006, New records of alien species on the Levantine coast of Turkey. *Aquatic Invasions*, 1(2), 84-90.
- Çınar, M.E., Bilecenoğlu, M., Öztürk, B., Katağan, T. & Aysel, V., 2005. Alien species on the coasts of Turkey. *Mediterranean Marine Science*, 6/2: 119-46.
- Çınar, M.E., Katağan, T., Ergen, Z. & Sezgin, M., 2002, Zoobenthos-inhabiting *Sarcotragus muscarum* (Porifera: Demospongiae) from the Aegean Sea. *Hydrobiologia*, 482, 107-117.
- Demir, M., 1952, *Boğazlar ve adalar sahillerinin omurgasız dip hayvanları*. İstanbul University, Faculty of Science, Hydrobiology Research Institute, no: 3, Osman Yalçın Matbaası, İstanbul. [In Turkish]
- Fishelson, L., 1962, *Spirastrella inconstans* Dendy (Porifera) as an ecological niche in the littoral zone of the Dahlak Archipelago (Eritrea). *Bull. Sea Fish. Stn. Israel*, 41: 17-25.

- Forbes, E., 1843, Report on Aegean invertebrates. *British Association for the Advancement of Science*, 13, 148-151.
- Forbes, E., 1845, On the radiata of the Eastern Mediterranean. Part I., Ophiuridae. *Trans. Linn. Soc. London*, 19, 143-153.
- Francour, P., Boudouresque, C.F., Harmelin, J.G., Harmelin-Vivien, M.L. & Quignard, J.P., 1994, Are the Mediterranean waters becoming warmer? Information from biological indicators. *Marine Pollution Bulletin*, 28 (9), 523-526.
- Galil, B.S., 2007, Alien decapods in the Mediterranean Sea - Which, When, Where, Why? *Rapports et procès-verbaux des réunions Commission Internationale pour l'exploration scientifique de la Mer Méditerranée*, 38, 9.
- Geldiay, R. & Kocataş, A., 1972, İzmir Körfezi'nin bentosu üzerine prelinimer bir araştırma. *Monography Series of Ege University, Faculty of Science*, 12, 1-34. [In Turkish]
- Gökoğlu, M., Balci, B.A., Çolak, H. & Banbul Acar, B.A., 2007, Akdeniz'de Uzun Dikenli Deniz Kestanesi'nin (*Diadema setosum*; Leske 1778) İkinci Kaydı. *SBT 2007, 11. Underwater Science and Technology Meeting*, İstanbul Turkey. [In Turkish]
- Karhan, S.Ü., Kalkan, E. & Yokeş, M.B., 2007, First record of the Atlantic starfish, *Asterias rubens* (Echinodermata: Asteroidea) from the Black Sea. *JMBA2 - Biodiversity Records, Published on-line*.
- Kocataş, A., 1978, İzmir Körfezi kayalık sahillerinin bentik formları üzerine kalitatif ve kantitatif araştırmalar. *Monography Series of Ege University, Faculty of Science*, 12, 1-93. [In Turkish]
- Okatan, T., 1985, Pınallı Ada (İzmir Körfezi) Echinodermata faunası üzerine araştırmalar. *Master Thesis*, Ege University, Faculty of Science, 60 pages. [In Turkish]
- Özaydın, O., 1991, Ege Denizi derin deniz Echinodermalarının ekolojisi ve sistematigi. *Master Thesis*, Dokuz Eylül University, Marine Science and Technology Institute. [In Turkish]
- Özaydın, O., Katağan, T. & Ünsal, S., 1995, The Echinoderms of the Turkish Seas. *Israel Journal of Zoology*, 41, 57-68.
- Özgür, E., 2008, Review on the Alien Species on the Coasts of Turkey, with Special Emphasis on the Recent Records. *2nd International Symposium on Underwater Research*, March 20-22, 2008, KKTC.
- Özgür, E. & Öztürk, B., 2007, Abundance of Zoobenthic Exotic Species on Rocky Reefs in the Southern Aegean Sea. *Rapports et procès-verbaux des réunions Commission Internationale pour l'exploration scientifique de la Mer Méditerranée*, 38, 565.
- Öztürk, B., 1998, Black Sea Biological Diversity Turkey. GEF Black Sea Environmental Programme, ISBN 92-1-129504-1, United Nations Publications Sales No. E.99.III.R.1, *Black Sea Environmental Series*, Vol. 9. 144 pp.
- Öztürk, B. & Öztürk, A.A. 1996, Biology of the Turkish Strait Systems in: Dynamics of Mediterranean Straits and Channels. Briand F. ad. *CIESM Science Series No. 2, Bulletin de l'Institut Océanographique, Monaco*, No. Special 17: 205-217.
- Paavola M., Olenin, S. & Leppakoski, E., 2005, Are invasive species most successful in habitats of low native species richness across European brackish water seas? *Estuarine, Coastal and Shelf Science*, 64, 738-750.
- Tortonese, E. & Demir, M., 1960, The Echinoderm Fauna of the Sea of Marmara and the Bosphorus. *Istanbul University, Hydrobiology Research Institute Publ.*, Seri B., Fas. 1-2, İstanbul.

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- Ünsal, S., 1973, Ege Denizi Türkiye karasularında yaşamakta olan derisidikenliler (Echinodermata) üzerine biyo-ekolojik arařtırmalar. *Doctorate Thesis*, Ege University, Faculty of Science, General Zoology Department. [In Turkish]
- Yokeř, M.B. & Galil, B.S., 2006, The first record of the needle-spined urchin *Diadema setosum* (Leske, 1778) (Echinodermata: Echinoidea: Diadematidae) from the Mediterranean Sea. *Aquatic Invasions*, 1(3), 188-90.
- Yüce, Ö. & Sadler, K.C., 2000, Determination of the reproduction periods of two dominant starfish in the Straits and the Sea of Marmara. In *Proceedings of SBT 2000 – 4th National Meeting of Underwater Science and Technology, Istanbul, 2–3 November 2000* (ed. S. Hamarat and V. Evrin), pp. 45–49. [In Turkish]
- Zaitsev, Y. & Öztürk, B., 2001, Exotic species in the Aegean, Marmara, Black, Azov and Caspian Seas. *Turkish Marine Research Foundation*, Istanbul, 267 pp.

Table (1) The study areas with station names and coordinates in the Levantine coast of Turkey.

St. No	Station name	Coordinates	Habitat
1	Kızılada Island	N 36° 38' 48" - E 29° 03' 46"	Rocky (40m)
2	Dalyan Reef	N 36° 36' 06" - E 29° 01' 19"	<i>Cystoseira</i> Facies (10m), Rocky (20-40m)
3	Cape of İblis	N 36° 32' 39" - E 29° 00' 24"	<i>Cystoseira</i> Facies (10-30m), Rocky (40m)
4	Karacaören Bay	N 36° 32' 20" - E 29° 03' 27"	<i>Cystoseira</i> Facies (10m), Rocky (20-40m)
5	Gemiler Island	N 36° 33' 22" - E 29° 04' 42"	<i>Cystoseira</i> Facies (10-20m), Rocky (30-40m)
6	Kabak Bay	N 36° 28' 05" - E 29° 06' 20"	Rocky (10-30m)
7	Gulf of Antalya	N 36° 46' 64" - E 30° 37' 15"	Gravelly Sands (70m)

The check list for the distribution of the echinoderm fauna is prepared by the literature review based on the studies realized in Turkey.

Table 2. The echinoderm fauna of the Levantine Sea (LS), Aegean Sea (AS), Marmara Sea (MS) İstanbul Strait (ISt.) and Black Sea (BS) of Turkey.

Crinoidea	LS	AS	MS	ISt.	BS
<i>Antedon mediterranea</i> (de Lamarck, 1816)	+	+	+	+	
<i>Leptometra phalangium</i> (J. Müller, 1841)		+	+		
TOTAL	1	2	2	1	-
Asteroidea	LS	AS	MS	ISt.	BS
<i>Anseropoda placenta</i> (Pennant, 1777)	+	+	+		
<i>Asterias rubens</i> Linnaeus, 1758			+	+	+
<i>Asterina gibbosa</i> (Pennant, 1777)	+	+	+	+	
<i>Asterina pancerii</i> (Gasco, 1870)	+	+	+		
<i>Astropecten aranciacus</i> (Linnaeus, 1758)	+	+	+		
<i>Astropecten bispinosus</i> (Otto, 1823)	+	+	+		
<i>Astropecten irregularis</i> (Pennant, 1777)	+	+	+	+	
<i>Astropecten jonstoni</i> (Delle Chiaje, 1827)		+	+		
<i>Astropecten platyacanthus</i> (Philippi, 1837)		+	+		
<i>Astropecten spinulosus</i> (Philippi, 1837)		+	+		
<i>Brisingella coronata</i> (G.O. Sars, 1871)		+			
<i>Chaetaster longipes</i> (Retzius, 1805)		+			
<i>Coscinasterias tenuispina</i> (de Lamarck, 1816)	+	+	+		
<i>Echinaster (Echinaster) sepositus</i> (Retzius, 1783)	+	+	+		
<i>Hazelia attenuata</i> Gray, 1840		+	+		
<i>Luidia ciliaris</i> (Philippi, 1837)		+	+		
<i>Luidia sarsi</i> Düben and Koren		+			
<i>Marthasterias glacialis</i> (Linnaeus, 1758)	+	+	+	+	+
<i>Odontaster mediterraneus</i> (Marenzeller, 1891)		+			
<i>Ophidiaster ophidianus</i> (de Lamarck, 1816)	+	+			
<i>Peltaster placenta</i> (J. Müller & Troschel, 1842)	+	+	+		
<i>Tethyaster subinermis</i> (Philippi, 1837)	+	+			
TOTAL	12	21	16	4	2
Ophiuroidea	L.S.	A.S.	M.S.	I.St.	B.S.
<i>Amphiura (Acrocnida) brachiata</i> (Montagu, 1804)	+				
<i>Amphipholis squamata</i> (Delle Chiaje, 1829)	+	+	+	+	+
<i>Amphiura chiajei</i> Forbes, 1843	+	+	+	+	+
<i>Amphiura filiformis</i> (O.F. Müller, 1776)	+	+	+		

<i>Amphiura stepanovi</i> D'yakonov, 1954					+
<i>Ophiacantha setosa</i> (Retzius, 1805)		+			
<i>Ophiactis savignyi</i> (J. Müller & Troschel, 1842)		+			
<i>Ophiactis virens</i> (M. Sars, 1857)	+				
<i>Ophioderma longicauda</i> (Retzius, 1805)			+	+	
<i>Ophiomyxa pentagona</i> (de Lamarck, 1816)	+	+	+		
<i>Ophiopsila annulosa</i> (M. Sars, 1859)			+		
<i>Ophiopsila aranea</i> Forbes, 1845	+	+	+		
<i>Ophiothrix fragilis</i> (Abildgaard, in O.F. Müller, 1789)	+	+	+	+	+
<i>Ophiothrix quinque maculata</i> (D.Chiaje, 1828)	+	+	+		
<i>Ophiura albida</i> Forbes, 1839	+	+	+		+
<i>Ophiura grubei</i> Heller, 1863			+	+	
<i>Ophiura ophiura</i> (Linnaeus, 1758)	+	+	+	+	+
<i>Pectinura vestita</i> Forbes, 1843	+				
TOTAL	12	14	11	4	6
Echinoidea	L.S.	A.S.	M.S.	I.St.	B.S.
<i>Arbacia lixula</i> (Linnaeus, 1758)	+	+			
<i>Brissopsis lyrifera</i> (Forbes, 1841)	+	+	+		
<i>Brissopsis atlantica</i> var. <i>Mediterranea</i> Mortensen, 1913			+		
<i>Brissus unicolor</i> (Leske, 1778)			+	+	
<i>Centrostephanus longispinus</i> (Philippi, 1845)	+	+	+		
<i>Cidaris cidaris</i> (Linnaeus, 1758)	+	+			
<i>Diadema setosum</i> (Leske 1778)	+				
<i>Echinocardium cordatum</i> (Pennant, 1777)	+	+			
<i>Echinocardium mediterraneum</i> (Forbes, 1844)			+	+	
<i>Echinocyamus pusillus</i> (O.F. Müller, 1776)	+	+	+	+	+
<i>Echinus acutus</i> de Lamarck, 1816			+	+	
<i>Echinus melo</i> Lamarck, 1816			+		
<i>Genocidaris maculata</i> A. Agassiz, 1869			+	+	
<i>Paracentrotus lividus</i> (de Lamarck, 1816)	+	+	+	+	
<i>Psammechinus microtuberculatus</i> (de Blainville, 1825) Heller, 1868	+	+	+	+	
<i>Schizaster canaliferus</i> (de Lamarck, 1816)			+	+	
<i>Spatangus inermis</i> Mortensen, 1913			+		
<i>Spatangus purpureus</i> (O.F. Müller, 1776)			+	+	
<i>Sphaerechinus granularis</i> (de Lamarck, 1816)	+	+	+		
<i>Stylocidaris affinis</i> (Philippi, 1845)	+	+	+		

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TOTAL	11	19	13	4	1
Holothuroidea	L.S.	A.S.	M.S.	I.St.	B.S.
<i>Holothuria (Holothuria) mammata</i> Grube, 1840		+			
<i>Holothuria (Holothuria) tubulosa</i> Gmelin, 1790	+	+	+	+	+
<i>Holothuria (Roweothuria) poli</i> Delle Chiaje, 1823		+			
<i>Holothuria (Thymiosycia) impatiens</i> (Forskål, 1775)		+			
<i>Labidoplax digitata</i> (Montagu, 1815)	+	+	+	+	+
<i>Leptopentacta elongata</i> (Düben & Koren, 1846)		+	+	+	
<i>Leptopentacta tergestina</i> (M. Sars, 1857)		+	+		
<i>Leptosynapta inhaerens</i> (O.F. Müller, 1776)		+	+	+	+
<i>Leptosynapta makrankyra</i> (Ludwig, 1898)	+				
<i>Mesothuria intestinalis</i> (Ascanius, 1805) Östergren, 1896		+			
<i>Panningia hyndmanni</i> (W. Thompson, 1840)					+
<i>Ocnus planci</i> (Brandt, 1835)		+	+	+	
<i>Ocnus koellikeri</i> (Semper, 1868)		+	+		
<i>Ocnus syracusanus</i> (Grube, 1840) Panning, 1949	+	+			
<i>Stereoderma kirchsbergi</i> (Heller, 1868)		+		+	+
<i>Parastichopus regalis</i> (Cuvier, 1817)	+	+	+		
<i>Phyllophorus (Phyllophorus) urna</i> Grube, 1840			+		
<i>Synaptula reciprocans</i> (Forskål, 1775)	+	+			
TOTAL	6	15	9	6	5