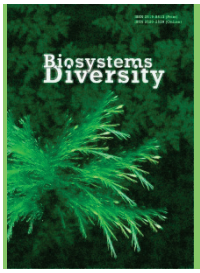

Biosystems Diversity

ISSN 2519-8513 (Print)
ISSN 2520-2529 (Online)
Biosyst. Divers.,
2024, 32(2), 278–284
doi: 10.15421/012430

First records of echinoderm species in the checklist of the Algerian coast (Mediterranean Sea), found off Paloma Island

N. Kaïdi *, S. Grimes*, Z. Bammoune*, M. Benabdi**

*National School of Marine Sciences and Coastal Planning, Algiers, Algeria
**University of Oran 1 Ahmed Ben Bella, Oran, Algeria

Article info

Received 02.05.2024
Received in revised form 05.06.2024
Accepted 19.06.2024

Marine Resources Conservation and Valorization Laboratory, Environment-Marine Biodiversity Interaction Research Team, National School of Marine Sciences and Coastal Planning, Algiers, Algeria. Tel.: +213-558-43-23-41. E-mail: nawal.kaidi@ensssmal.edu.dz, samirgrimes@yahoo.fr

Environmental Surveillance Network Laboratory, University of Oran 1 Ahmed Ben Bella, Oran, Algeria. E-mail: benabdi@gmail.com

Kaïdi, N., Grimes, S., Bammoune, Z., & Benabdi, M. (2024). First records of echinoderm species in the checklist of the Algerian coast (Mediterranean Sea), found off Paloma Island. Biosystems Diversity, 32(2), 278–284. doi:10.15421/012430

The study of echinoderms in the Mediterranean region has generated considerable interest and has led to significant advancements in systematic research. Numerous species have been identified, with 35% of them belonging to the Holothuroidea class. This paper provides pertinent information on the echinoderm fauna of the Algerian coast, specifically focusing on the sampling conducted at Plane Island in western Algeria. Additionally, it includes an updated account of previously recorded species. The recent research findings consist of a total of 288 specimens: 284 ophiuroids and 4 echinoids. The research provides a comprehensive list of all the species identified. Additional species have been discovered at Paloma (Plane) Island. Several of these species have not previously been recorded on the Algerian coastline, such as the pencil urchin *Stylocidaris affinis*. A map of its distribution has been created to monitor its establishment in the Mediterranean. Our findings show that *S. affinis* is more abundant in shallow waters ranging from 50 to 150 m. A total of 70 species were documented along the Algerian coast, with the majority belonging to the classes Holothuroidea and Ophiuroidea. The class Crinoidea, however, only counts three species: *Antedon bifida moroccana*, *A. mediterranea*, and *Leptometra celtica*. The majority of species (65.2%) have a distribution that spans the region of the Atlantic Ocean and the Mediterranean Sea. Approximately 33% of species are potentially exclusive to the Mediterranean region, and only one species (1%) is found worldwide. Three echinoderms are now indexed as endangered or threatened in Barcelona's Appendix II. Moreover, to provide a comprehensive understanding, this study compares the fauna of the Algerian coast with that of adjacent seas.

Keywords: Plane Island; Algerian basin; endangered species; indigenous species; pencil urchin.

Introduction

The phylum Echinodermata consists of marine invertebrates, with around 7,000 extant and 13,000 fossil species found in the world's oceans. The phylum consists of five extant classes: Crinoidea, Asteroidea, Ophiuroidea, Echinoidea, and Holothuroidea (Pawson, 2007). So far, approximately 154 different species of echinoderms have been documented in the Mediterranean region, with a particularly high number of species found in the Aegean Sea, totaling 107 species. Echinoderms undergo evolutionary changes as they transition from the shallow intertidal zone to the abyssal zone, playing a significant role in the ecological dynamics of marine ecosystems (Coll et al., 2010).

Scientific research on Echinodermata in Algeria's marine biodiversity is notably lacking. Koehler (1921) and Dieuzeide (1933, 1935) documented the initial discovery of echinoderms from the Algerian coast, which is home to a limited number of previously published records of these organisms. Other authors have focused on specific economically significant classes, such as the Holothuroidea (Mezali et al., 2006; Bakalem, 2008; Mezali, 2011) and other authors (Mansouri et al., 2018; Mezali et al., 2020; Khodja et al., 2021) on the Echinoidea (Soualili, 2008; Dermeche, 2010; Belkhedim, 2014; Boukhelf et al., 2019; Elakkermi et al., 2020). Subsequent research on echinoderms was conducted in the coastal areas of Algiers (Mezali et al., 2003; Soualili, 2008) and the western coast of Algeria (Mezali et al., 2024), specifically in the bays of Oran (Belkhedim, 2009; Tamacha et al., 2019) and Mostaganem (Belbachir et al., 2014; Benzait et al., 2020). In addition, Bakalem (2008) and Grimes (2010) conducted inventories to study the presence of echinoderms in fine sandy bottoms and harbors along the Algerian coasts. The researchers also considered the ecological condition of the area being investigated. To enhance understanding of this phylum, this study presents novel insights into the echinoderms of Paloma Island. It includes updated information on previously documented echinoderm species and concludes with a comparison of the fauna found along the Algerian coast and in nearby seas.

Materials and methods

The study uses sampled data obtained from the hard substrates of the West Algerian Plane Island, commonly referred to as Paloma, during scuba diving expeditions. Plane Island is situated 25 km in the north-west direction of the wilaya of Oran (Fig. 1). It spans an area of 300 m in length and 100 m in width and is distinguished by a firm underlying surface. The uninhabited island features a diminutive, shallow pier for small watercraft and an operational, vacant lighthouse. The sampling was conducted manually in June 2018 using a compressed-air suction device (Table 1).

Specimens were collected at depths ranging from 0 to 50 m (Fig. 2). The collection device comprises a PVC pipe with a flexible hose at one end and a sampling tube at the other. It allows for the attachment of 1 mm mesh nets, where the sample is collected. This study employed a device to efficiently gather the complete biological layer after carefully removing it from a specific bedrock surface. The gathered specimens were preserved in a solution of 5% formalin and kept in glass containers for identification purposes in the laboratory. Subsequently, the species were primarily identified by referencing (Koehler, 1921; Tortonese, 1965; Perrier, 1971) the descriptive documents (Fisher, 1987; Riedl, 2005).

The taxa were organized based on their present classification in the global database WoRMS (World Register of Marine Species. www.marinespecies.org) of the World Register of Marine Species. The remaining Echinoderm records discussed in this article are sourced from various outlets, including the National Marine Biodiversity Data Base (BANBIOM) located at the National School of Marine Sciences and Coastal Planning

(ENSSMAL). The literature review thoroughly examines the biodiversity and distribution of echinoderms along the Algerian coast. Table 2 displays the initial records of species, providing information on the types of substrates, depth ranges, and geographic distribution of each species.

Table 1
Locations and biotope of samples collected on Paloma island

Station	N	Depth, m	Geographical coordinates		Biotope
Paloma	1	15.4	35.770625°N	-0.901071°W	wall coralligenous
Paloma	2	28.0	35.771783°N	-0.898633°W	wall coralligenous
Paloma	3	33.0	35.770168°N	-0.902223°W	wall coralligenous
Paloma	4	37.8	35.774350°N	-0.906483°W	wall coralligenous
Paloma	5	35.3	35.776783°N	-0.925933°W	wall coralligenous
Mdina djdida	6	49.0	35.771580°N	-0.917213°W	wall coralligenous
Paloma	7	37.5	35.779320°N	-0.906944°W	wall coralligenous
Paloma	8	33.4	35.779420°N	-0.905278°W	wall coralligenous
Paloma	9	41.1	35.779500°N	-0,928000°W	wall coralligenous

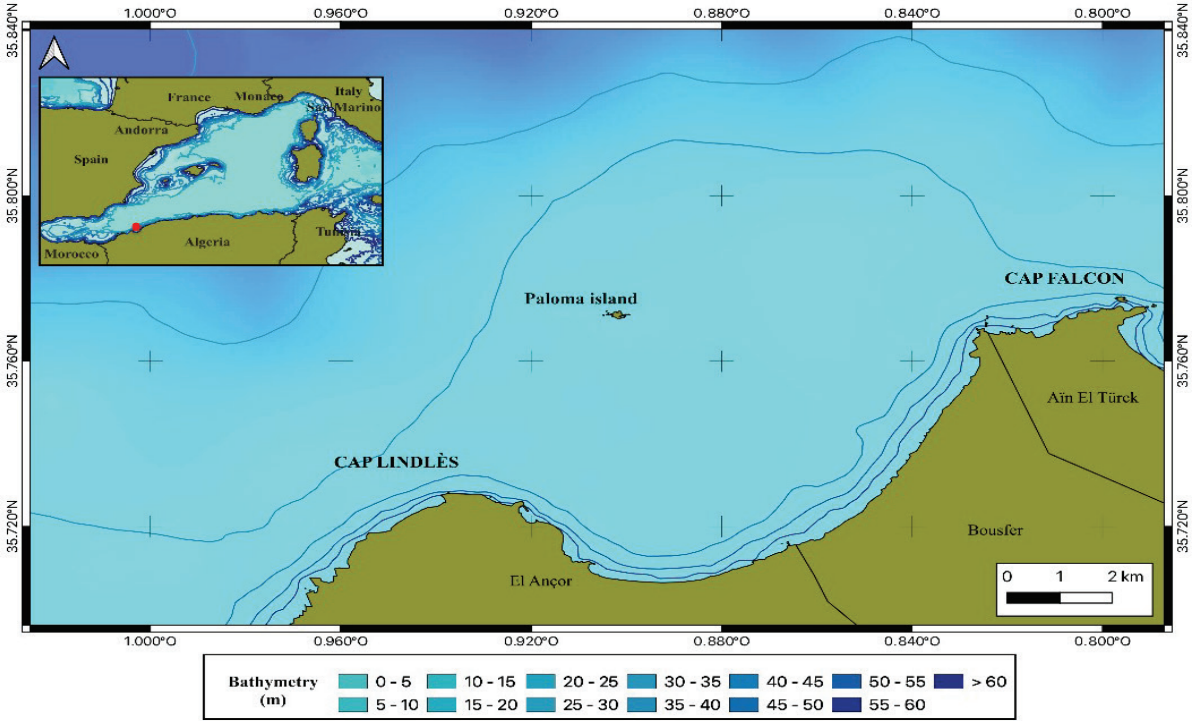

Fig. 1. Geographical location of Paloma island

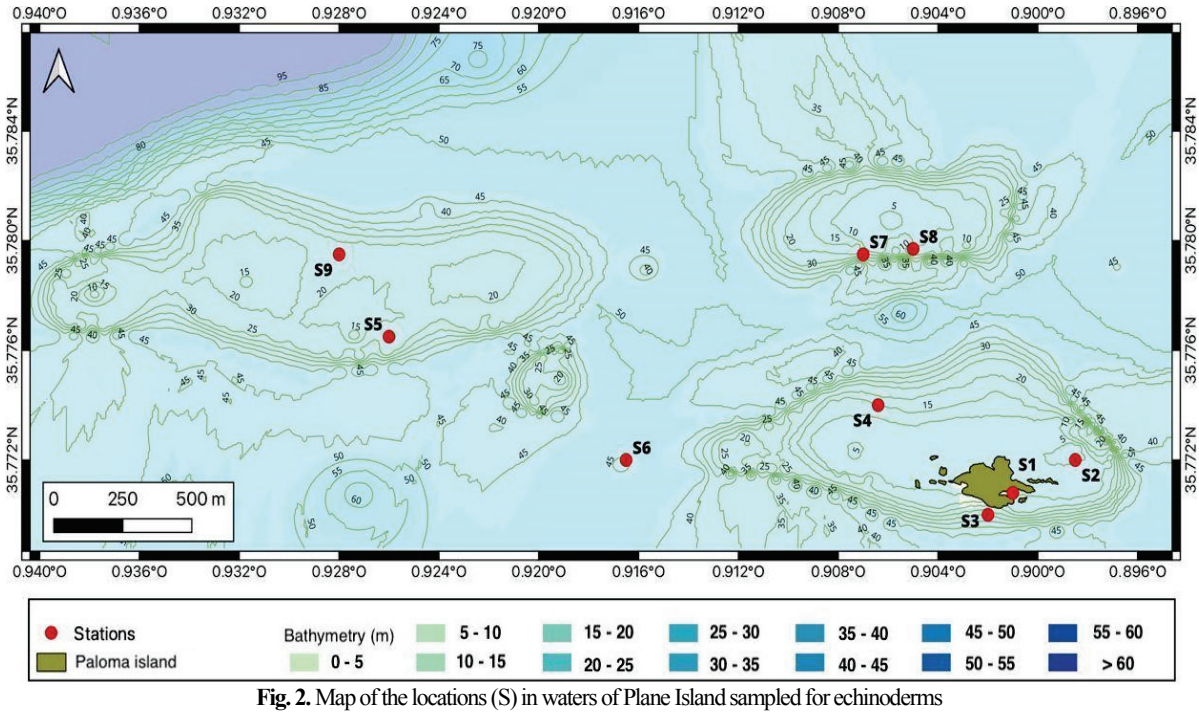

Fig. 2. Map of the locations (S) in waters of Plane Island sampled for echinoderms

Results

We sampled 14 of the 70 species (Table 2). One of them was the first recorded on the Algerian coast. A total of 288 specimens, including around 284 ophiuroids and 5 echinoids, were collected. The reason for this abundance can be attributed to the fact that ophiuroids are seldom harvested directly by humans, although certain species of *Ophioderma* are commercially traded as marine aquarium species.

Table 2
Checklist of echinoderm species of Algerian coast

Species	Class	Depth, m	Habitat	Dist.
Acrocnida brachiata (Montagu, 1804)	Ophiuroidea	0–50	S	At/M
**Amphipholis squamata* (Delle Chiaje, 828)	Ophiuroidea	1–100	R	At/M
Amphiura cherbonnieri Guille, 1972	Ophiuroidea	0–450	S	At/M
**Amphiura chiajei* Forbes, 1843	Ophiuroidea	18–70	R	At/M
**Amphiura filiformis* (O.F. Müller, 1776)	Ophiuroidea	46–98	R	At/M
Amphiura lacazei Guille, 1976	Ophiuroidea	0–61	S	At/M
Amphiura mediterranea Lyman, 1882	Ophiuroidea	61–91	V/PM	M
Anseropoda lobiancoi (Ludwig, 1897)	Asteroidea	30–60	V/PM	At/M
Antedon bifida moroccana (A. H. Clark, 914)	Crinoidea	0–120	R	At/M
Antedon mediterranea (Lamarck, 1816)	Crinoidea	0–100	V/PM	Me
Arbacia lixula (Linnaeus, 1758)	Echinoidea	2–100	R	At/M
Asterina gibbosa (Pennant, 1777)	Asteroidea	1–100	R	At/M
Astropecten aranciacus (Linnaeus, 1758)	Asteroidea	5–50	S/PM	At/M
Astropecten bispinosus Otto, 1823)	Asteroidea	10–50	S/PM	At/M
Astropecten irregularis (Pennant, 1777)	Asteroidea	1–250	S/R	At/M
Astropecten jonstoni (Delle Chiaje, 1827)	Asteroidea	3–4	S	Me
Astropecten spinulosus (Philippi, 1837)	Asteroidea	3–40	S/PM	M
Brissopsis lyrifera (Forbes, 1841)	Echinoidea	0–266	S	At/M
Brissus unicolor (Leske, 1778)	Echinoidea	0–50	R	At/M
**Centrostephanus longispinus* (Philippi,1845)	Echinoidea	11–220	S/R	At/M
Chaetaster longipes (Bruzelius, 1805)	Asteroidea	30–100	S	At/M
Cidaris cidaris (Linnaeus, 1758)	Echinoidea	11–600	R	At/M
Coscinasterias tenuispina (Lamarck, 1816)	Asteroidea	1–100	S	At/M
Cryptopelta brevispina (Ludwig, 1879)	Ophiuroidea	20	S	M
Echinaster (Echinaster) sepositus (Retzius, 1783)	Asteroidea	1–200	S	At/M
Echinocardium mediterraneum (Forbes, 1844)	Echinoidea	0–3	S	At/M
Echinocyamus pusillus (O. F. Müller, 1776)	Echinoidea	39–61	S	M
Echinus melo Lamarck, 1816	Echinoidea	11–150	S	M
Genocidaris maculata A. Agassiz, 1869	Echinoidea	11–50	S/PM	M
Gracilechinus acutus Lamarck, 1816	Echinoidea	0–120	S	At/M
Hacelia attenuata Gray, 1840	Asteroidea	1–310	S	At/M
Hemiocnus syracusanus (Grube, 1840)	Holothuroidea	0–100	S	M
Holothuria (Holothuria) helleri von Marenzeller, 1877	Holothuroidea	20	S	M
Holothuria (Holothuria) mammata Grube, 1840	Holothuroidea	0–200	S	M
Holothuria (Holothuria) stellati Delle Chiaje, 1824	Holothuroidea	0–10	S	M
Holothuria (Holothuria) tubulosa Gmelin, 1791	Holothuroidea	3–8	S/PM	M
Holothuria (Panningothuria) forskali Delle Chiaje, 1823	Holothuroidea	3	S/PM	At/M
Holothuria (Platyperona) sanctori Delle Chiaje, 1823	Holothuroidea	3	R	At/M
Holothuria (Roweothuria) arguinensis Koehler and Vaney, 1906	Holothuroidea	4–5	S/R	At/M
Holothuria (Roweothuria) poli Delle Chiaje, 1824	Holothuroidea	0–10	S/R	At/M
Holothuria (Thymiosycia) impatiens (Forskål, 1775)	Holothuroidea	0–5	S/R	Cs
Leptometra celtica (M'Andrew and Barrett, 1857)	Crinoidea	50	R	At/M
Marthasterias glacialis (Linnaeus, 1758)	Asteroidea	1–225	R	At/M
Neocucumis marionii (von Marenzeller, 1877)	Holothuroidea	25	S	Me
Odontaster mediterraneus (von Marenzeller, 1893)	Asteroidea	11–320	S	M
Oestergrenia digitata (Montagu, 1815)	Holothuroidea	0–400	S/PM	M
**Ophiacantha setosa* (Bruzelius, 1805)	Ophiuroidea	40–50	R	At/M
Ophiactis virens (M. Sars, 1859)	Ophiuroidea	0–50	S	At/M
**Ophidiaster ophidianus* (Lamarck, 1816)	Asteroidea	5–30	S	At/M
Ophiocomina nigra (Abildgaard in O. F. Müller, 1789)	Ophiuroidea	27	SG	At/M
**Ophioderma longicauda* (Bruzelius, 1805)	Ophiuroidea	5–8	R	At/M
Ophiomyxa pentagona (Lamarck, 1816)	Ophiuroidea	100	R	At/M
**Ophiopsila aranea* Forbes, 1843	Ophiuroidea	30–50	S	At/M
**Ophiothrix fragilis* (Abildgaard in O. F. Müller, 1789)	Ophiuroidea	0–200	R	At/M
**Ophiothrix quinquemaculata* (Delle Chiaje, 1828)	Ophiuroidea	11–200	R	Me
**Ophiura albida* Forbes, 1839	Ophiuroidea	61–91	S	At/M
**Ophiura ophiura* (Linnaeus, 1758)	Ophiuroidea	0–320	R	At/M
**Paracentrotus lividus* (Lamarck, 1816)	Echinoidea	1–250	R/PM	At/M
Paraleptopentacta elongata (Düben and Koren, 1846)	Holothuroidea	28	GS	M
Paraleptopentacta tergestina (M. Sars, 1857) Panning, 1949	Holothuroidea	32	GS	M
Parastichopus regalis (Cuvier, 1817)	Holothuroidea	0–53	R/PM	At/M
Phyllophorus (Phyllophorus) urna Grube, 1840	Holothuroidea	0–100	S	M
Psammechinus microtuberculatus (Blainville, 1825)	Echinoidea	50–70	S	At/M
Pseudocnus koellikeri (Semper, 1868)	Holothuroidea	50–70	S	M
**Sphaerechinus granularis* (Lamarck, 1816)	Echinoidea	0–100	R	At/M
Stereoderma kirchsbergii (Heller, 1868) Panning, 1949	Holothuroidea	0–100	R/PM	M
**Stylocidaris affinis* (Philippi, 1845)	Echinoidea	0–1025	R	At/M
Tethyaster subinermis (Philippi, 1837)	Asteroidea	11–250	R/PM	At/M
Thyone fusus (O. F. Müller, 1776)	Holothuroidea	11–50	S	At/M
Thyone inermis Heller, 1868	Holothuroidea	11–50	S	M

Notes: At – Atlantic Ocean; Cs – cosmopolitan; M – Mediterranean Sea; Me – Mediterranean endemics; PM – Posidonia meadow; R – rocky bottom; S – sandy bottom; V – Vase; G – Gravel; GS – Gray sand; [*]: Plane Island.

We disclose the nonexistence of the subsequent categories: Crinoids, Asteroids, and Holothuroids. The absence of the latter is attributed to the presence of hard substrate in Plane Island. Out of the 70 species recorded along the Algerian coast, the largest number can be found in the Holothuroidea and Ophiuroidea classes, with 20 and 18 species, respectively. Asteroidea follows this with 15 species, and Echinoidea with 14 species. The Crinoidea class is the least populous, consisting of only three species: *Antedon bifida moroccana*, *A. mediterranea*, and *Leptometra celtica*.

Out of the identified echinoderms, 36 species were discovered on soft substrata, 19 species were observed on hard substrata, and 7 species were found on both soft and hard substrata. However, only three species were detected on muddy substrate and coarse sand.

The echinoderms on the Algerian coast are geographically distributed across three sectors. A total of 48 species, belonging to 32 genera are found in the western sector. The central sector is home to 29 species distributed across 20 genera. In the eastern sector, there are 43 species belonging to 37 genera.

The prospected sites can be differentiated based on the predominant species found along the Algerian coast, namely *Amphipholis squamata*, *Amphiura chiajei*, *A. filiformis*, *Ophiura albida*, and *O. ophiura*. These species are primarily found on substrates consisting of fine sandy-muddy bottoms, gravel, and shell-debris bottoms. Table 2 shows that four of the studied species are endemic to the Mediterranean. One was cosmopolitan, with approximately twenty Mediterranean distributions (all other species had Atlanto-Mediterranean distributions).

New records. Stylocidaris affinis (Philippi, 1845). References: Koehler (1921); FAO (1987). Class Echinoidea. Subclass Cidaroidea. Order Cidaroida. Family Cidaridae. Genus *Stylocidaris*. Records: Plane Island. Diameter: 3.1 cm. Depth: 41 m. Station: number 9. Identified by N. Kaïdi and Z. Bammoune (Fig. 3).

Fig. 3. *Stylocidaris affinis* (Philippi, 1845): specimen of st. 9

Description. The animal's coloration is striking, displaying a vivid red hue and brownish radiolae adorned with alternating lighter and darker bands. The primary spines of *Stylocidaris affinis* are elongated and primarily located in the interambulacral regions. Their length is not greater than the diameter of the test, and they exhibit relatively coarse longitudinal striations, which are approximately 3.1 cm (Fig. 3). The dermal skeleton diameter and primary spine length of *S. affinis* specimens were nearly identical, whereas the primary spines of *Cidaris cidaris* specimens were longer than the dermal skeleton diameter (Koehler, 1921; Mastrototaro, 2021). Their appearance is distinctly marked by parallel lines, exhibiting dense particles organized in lengthwise patterns.

Distribution of the species. Stefanini (1914) reported *S. affinis* for the first time in the Mediterranean, using a single sample collected by the "Washington" at a depth of 400 m in the Tyrrhenian Sea. Tortonese (1946, 1947), Pérès & Picard (1958), Lubet & Azzouz (1969) and Rodriguez et al. (1920) documented it in a variety of locations throughout the Aegean Sea. This species, which lives in both the Mediterranean and the Atlantic, is classified as an Atlanto-Mediterranean species. It has also been reported in several Mediterranean regions (Koukouras et al., 2007; Terribile & Schembriwas (2013). *Stylocidaris affinis* is typically found in shallower depths than *C. cidaris*, which has a wider range of depths. Nonetheless, different authors offer varying depth ranges. Koehler (1921) reported ranges of 30–150 m. Tortonese (1965) reports bathymetric ranges of 30–1000 m for *S. affinis* and 50–2000 m for *C. cidaris* (Fig. 5). In comparison, Koukouras et al. (2007) stated ranges of 5–180 m, Mifsud et al. (2009) at 159 m on the Maltese seabed, and in the offshore waters of the Gulf of Gabes, *S. affinis* dominated on sand bottom with other species of echinoderms at 78–110 m (El Lakhrach et al., 2012).

Terribile & Schembri was (2013) identified *S. affinis* at depths of 50–550 m around the Maltese islands. Our findings show that *S. affinis* is more abundant in shallow waters ranging from 50 to 150 m (Fig. 6), with the exception of the Maltese islands (Leonard et al., 2020). Leonard et al. (2020) reported the species at a maximum depth of 1025 m on the Maltese seabed, but their results indicate that it is more abundant in shallower waters.

Discussion

This study provides a thorough review of all citations and distribution information of echinoderms along the Algerian coast. The literature review showed that for some species, only very limited biological/ecological data were available. The findings of this study indicate that the recorded species of echinoderms account for 1% of the global echinological fauna's diversity and approximately 45% of the Mediterranean's (Coll et al., 2010). This paper provides new information about the urchin *S. affinis*, including geographic and bathymetric distributions. The spatial distribution of echinoderms in the Mediterranean Sea reveals a distinct difference between the eastern and western basins. Echinoderms are predominantly distributed in the western Mediterranean, where there are 144 species compared to 91 species in the central Mediterranean (Koukouras et al., 2007). Table 3 shows that the Tyrrhenian Sea and the Aegean Sea have similar distributions of 100 species and 107 echinoderms, whereas the Levantine basin has 73 species.

Table 3
Comparison of the Algerian coast's echinoderms with other Mediterranean sites

Sites	Autors	Number of species	%
Worldwide	Coll et al. (2010)	7000	100
Mediterranean	Coll et al. (2010)	154	2.20
Western Mediterranean (including Tyrrhenian Sea. Alboran and Southwest Mediterranean)	Coll et al. (2010)	144	2.06
Adriatic Sea	Despalatović et al. (2017)	108	1.54
Aegean Sea	Coll et al. (2010)	107	1.53
France (including Algeria coast)	Koehler (1921)	106	1.51
Tyrrhenian Sea	Rinelli (1998)	100	1.43
Central Med. (including Ionan Sea)	Coll et al. (2010)	98	1.40
Turkey	Öztoprak et al. (2014)	91	1.30
Levantine basin	Coll et al. (2010)	73	1.04
Plane Island waters	Present study	70	1.00
Maltese islands	Leonard et al. (2020)	25	0.36
Spain (Southern Mediterranean coast)	Rodriguez (2020)	48	0.69
Northern Tunisia	Chammem et al. (2019)	45	0.64
Greece	Kaspiris et Tortonese (1982)	38	0.54
Alboran Sea (bathyal zone)	Sibuet (1974)	18	0.26

The echinological fauna of the Alboran Sea exhibits an Atlantic profile, consisting of a total of 18 species. Nevertheless, the presence of the Gibraltar Strait is expected to hinder the colonization of certain species that are typically found in the Alboran Sea. This is due to the fact that the hydrological and sedimentary conditions in the Alboran Sea closely resemble those of the Atlantic. The presence of a strong Atlantic influence in the western basin could be responsible for the reduction of this influence as we move toward the eastern Mediterranean region. The relatively shallow Gibraltar Strait may serve as an additional impediment to the movement of Atlantic echinoderms. Research conducted on sea urchins has demonstrated that their rates of growth are strongly influenced by temperature

(Le Gall, 2020). Species that have a strong reliance on temperature for their reproductive and developmental processes tend to speed up their seasonal cycle. For example, the planktonic stages of echinoderms can accelerate their cycle by almost 40 days (Gros, 2011). Thus, the impact of climate change on the abundance of echinoderm larvae has been proven (Edwards et al., 2004). According to Harmelin (2010), certain species, like the starfish *Ophidiaster ophidianus*, could serve as reliable indicators of global warming. Other factors threaten echinoderms. Furthermore, echinoderms in deep Mediterranean environments are extremely vulnerable to the destructive effects of bottom trawling, with no ability to escape or withstand them (Fiorentino, 2004).

The biogeography of echinoderms on the Algerian coast reveals that all species found there are either native to the Mediterranean or have originated from the Atlantic. The majority of species (65.2%) have a distribution that spans the region of the Atlantic Ocean and the Mediterranean Sea. Approximately 33% of species are potentially exclusive to the Mediterranean region, and only one species (1%) is found worldwide. Moreover, the data obtained from the Mediterranean region indicated that the taxonomic groups with the highest proportion of endemic species were echinoderms, accounting for 24% of the total (Boudouresque et al., 2004; Coll et al., 2010). Three echinoderms found along the Algerian coast are currently classified as endangered or threatened in Appendix II of the Barcelona Convention for the Protection of the Marine Environment and the Coast of the Mediterranean (1995). Chammem (2019) also documented the presence of these three species in Tunisia.

Remarkable species distribution. Three notable echinoderms, specifically *Centrostephanus longispinus*, *Ophidiaster ophidianus*, and *Paracentrotus lividus*, were observed along the coast of Algeria (Kaïdi, 2012).

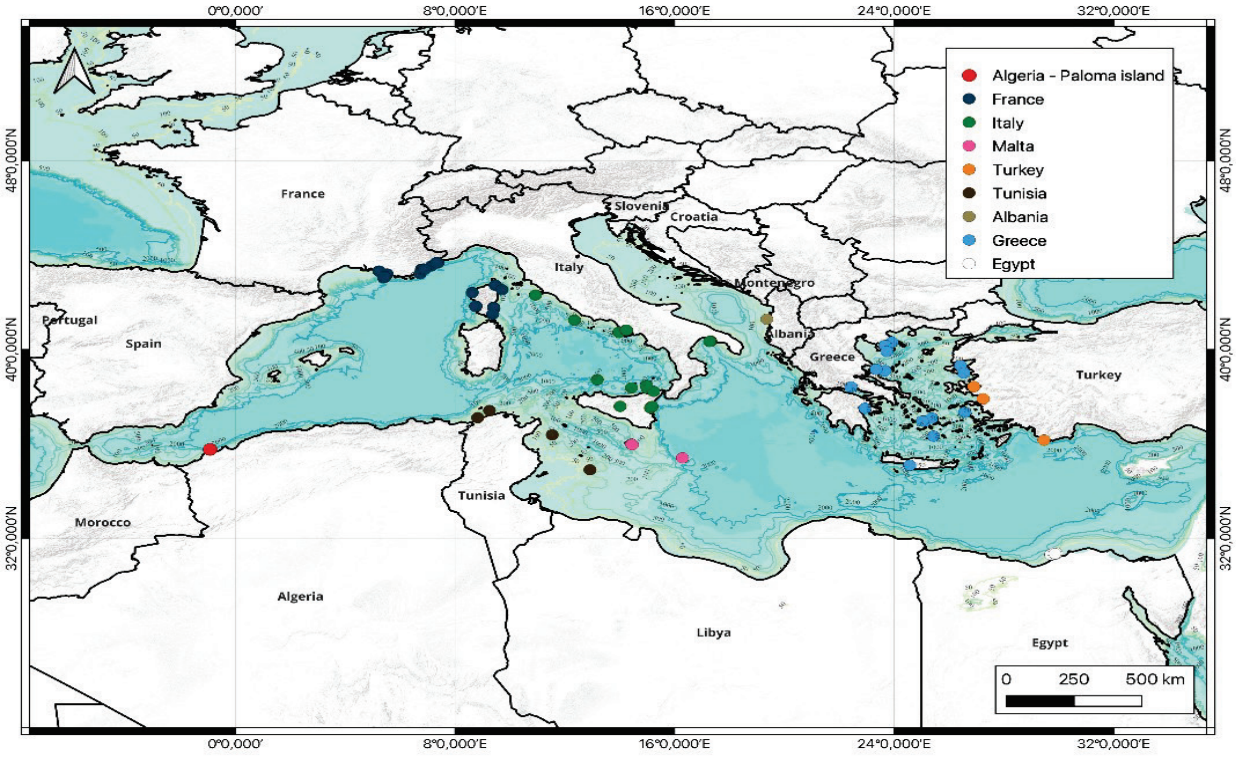

Fig. 4. Distribution of *S. affinis* in known geographical areas of the Mediterranean region

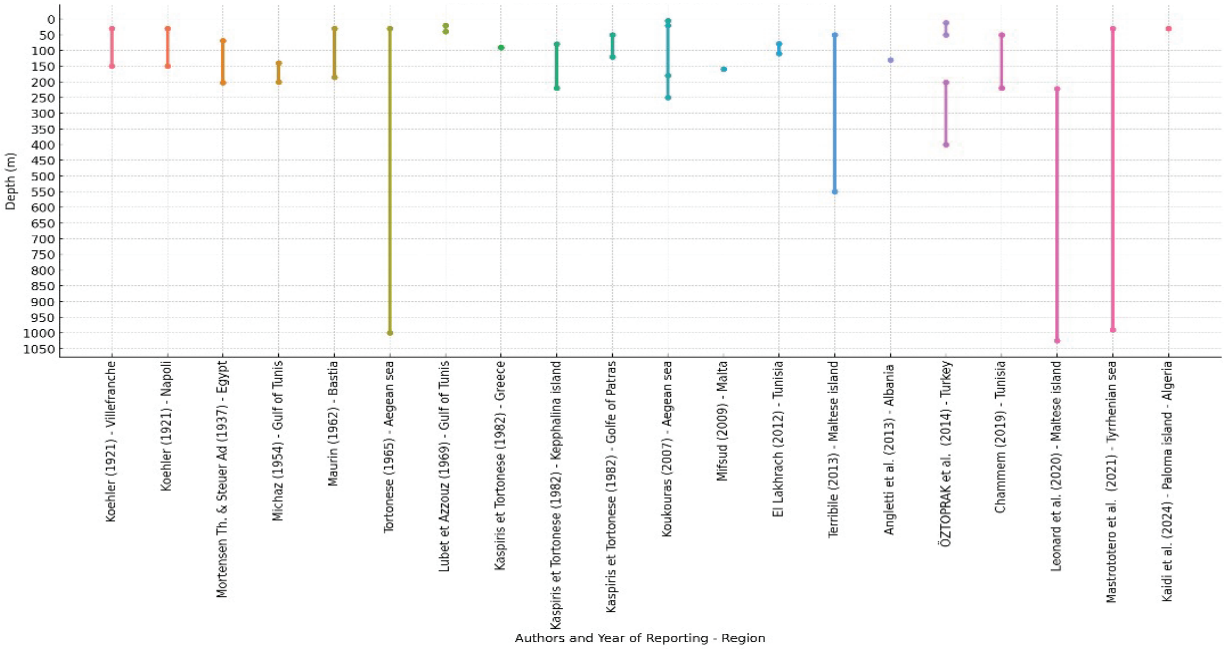

Fig. 5. Depth range of reports of *S. affinis* in geographical areas of the Mediterranean region

Centrostephanus longispinus (Philippi, 1845). The diadem sea urchin, specifically listed in Annex II of the Bern Convention, was documented in Algeria by Dieuzeide in 1933. In addition, Boumedienne & Djillali (2014) noted that the occurrence of Oran diminished over time. This species is found along the western Algerian coast (Grimes et al., 2004) and on Plane Island (current study).

Paracentrotus lividus (Lamarck, 1816). This species is widely distributed along the Algerian coast. The species has been documented in Annaba (Derbal & Kara, 2005), Mostaganem (Benzait, 2015), Plane Island (Hussein & Talet, 2019), and the current study. *Paracentrotus lividus*, a species of sea urchin, can be found in various habitats such as rocky bottoms, *Posidonia* or seagrass meadows, and sometimes on sandy or coralligenous bottoms. It is most commonly found at a depth of 30 m, although it can also be found as deep as 80 m (Pnue/Pam-Car/Asp. (2016). Algérie: Rachgoun Island. Mapping key Mediterranean marine habitats and initiating monitoring networks. Par Ramos Esplá, A. et al. (Ed.). CAR/ASP – Projet MedKeyHabitats. Tunis). *Paracentrotus lividus* has been documented in the Algiers and Mostaganem regions, as reported by Soualili (2008), Belkhedim (2009), Dermeche (2010), and Boukhelf (2019). The species was observed in the north-west region of Plane Island (S9) at a depth of approximately 35 m in the current study.

Ophidiaster ophidianus (Lamarck, 1816). The purple starfish is a large starfish that can range in size from 15 to 40 cm. It thrives in waters that are neither too cold nor too hot (Koehler, 1921). Koehler was the initial observer of this species on the Algerian coast, at depths ranging from 5 to 30 m. Other scientists have documented the species in different locations, including the Habibas Islands (Grimes et al., 2010; Harmelin, 2010) and Oran (Boumedienne & Djillali, 2014). The primary peril is associated with divers gathering the species for decorative intentions.

Plane Island serves as a focal point for these three species, providing a sanctuary for these iconic creatures due to the inaccessibility of the islets to fishermen and tourists, owing to their distance from the main island. No endemic echinoderm species have been found along the Algerian coast, as stated by Grimes et al. (2018).

Conclusion

Up to 2024, a comprehensive assessment of echinoderms was conducted, resulting in the identification and documentation of approximately 70 species across five distinct classes. The classes Ophiuroidea and Holothuroidea are the most prevalent, with Asteroidea, Holothuroidea, and Crinoidea following closely behind. The literature review indicates that the majority of records primarily focus on the West coast in comparison to the East. Undoubtedly, the West Algerian coast has traditionally undergone more extensive sampling. This study resulted in the establishment of a comprehensive list of echinoderm species found along the Algerian coast, which accounts for approximately 45% of all known echinoderm species in the Mediterranean region. The historical review provides valuable insights into the fields of systematics and species management. Additionally, it offers valuable understanding regarding the comprehensiveness and deficiencies in knowledge pertaining to the echinoderm fauna in Algeria. However, further field research is needed along the Algerian coast, exploring different depths and habitats. Emphasis should be placed on exploring the unexplored depths of the Algerian coast to collect new data.

The authors would like to thank Mrs. Gabriela Kouahla for her help in revising the English language of the manuscript.

This research did not receive any specific grants from public, commercial or non-profit funding agencies. The authors declare that they have no known competing financial interests or personal relationships that might appear to influence the work reported in this paper.

References

Angeletti, L., Canese, S., Cardone, F., Castellan, G., Foglini, F., & Taviani, M. (2020). A brachiopod biotope associated with rocky bottoms at the shelf break in the central Mediterranean Sea: Geobiological traits and conservation aspects. Aquatic Conservation: Marine and Freshwater Ecosystems, 30(2), 402–411.

Bakalem, A. (2008). Contribution to the study of benthic communities on the Algerian continental shelf. PhD thesis. USTHB.

Belbachir, N., Mezali, K., & Soualili, D. L. (2014). Selective feeding behaviour in some aspidochirotid holothurians (Echinodermata: Holothuroidea) at Stidia, Mostaganem Province, Algeria. SPC Bêche-de-mer Information Bulletin, 34, 34–37.

Belkhedim, L. (2009). Contribution to the study of the biology of the regular sea urchin *Paracentrotus lividus* (Lmck, 1816) at the Oran harbour and Ain Franin. Magister's thesis. Oran University.

Belkhedim, L., Dermeche, S., Chahrour, F., & Boutiba, Z. (2014). Physiological indices and reproduction in the sea urchin *Paracentrotus lividus* (Lamarck, 1816) Echinodermata Echinoidae in the west coast of Algeria. International Journal of Research and Reviews in Applied Sciences, 18(2), 173.

Benzait, H. (2015). Contribution to the evaluation of echinoderm biodiversity in the Mostaganem coastal region. Doctoral dissertation. University of Mostaganem-Abdelhamid Ibn Badis, Algeria.

Benzait, H., Khodja, I., Soualili, D. L., & Mezali, K. (2020). Note on *Parastichopus regalis* (Cuvier, 1817) from the Sidi-Medjdoub area of Mostaganem, Algeria. SPC Bêche-de-Mer Information Bulletin, 40, 43–45.

Boudouresque, C. F. (2004). Marine biodiversity in the Mediterranean: Status of species, populations and communities. Travaux scientifiques du Parc national de Port-Cros, 20, 97–146.

Boukhelf, K., Dermeche, S., Chahrour, F., & Bouderbela, M. (2019). Comparative study of the metallic contamination assessment of a *Paracentrotus lividus* (Imck, 1816) macrobenthic community in Algerian west coast. Global Journal of Fisheries Science, 1(2), 15–25.

Boumediene, H., & Djillali, B. (2014). First observations of the macrozoobenthos biodiversity of Oran coastal area, Algeria. Journal of Biodiversity and Environmental Sciences, 5(1), 625–637.

Chammem, H., Souissi, J. B., & Pérez-Ruzafa, A. (2019). Checklist with first records for the echinoderms of Northern Tunisia (Central Mediterranean Sea). Scientia marina, 83, 277–288.

Coll, M., Piroddi, C., Steenbeek, J., Kaschner, K., Ben Rais Lasram, F., Aguzzi, J., ... & Voultsiadou, E. (2010). The biodiversity of the Mediterranean Sea: Estimates, patterns, and threats. PloS One, 5(8), e11842.

Dermeche, S. (2010). Physiological indices, heavy metals and bioassays in the common sea urchin *Paracentrotus lividus* (Lmck, 1816) from the Oranese coast. PhD thesis. University of Oran.

Despalatović, M., Cvitković, I., & Žuljević, A. (2017). Checklist of the echinoderm fauna of the Adriatic Sea. Zootaxa, 4353(1), 101–116.

Dieuzeide, R. (1933, 1935). The regular echinoids of the Bay of Castiglione. Bull. St. Aquic. Pêche Castiglione, 2, 75–81.

Edwards, M., & Richardson, A. J. (2004). Impact of climate change on marine pelagic phenology and trophic mismatch. Nature, 430(7002), 881–884.

El Lakhrach, H., Hattour, A., Jarboui, O., Elhasni, K., & Ramos-Esplá, A. (2012). Spatial distribution and abundance of the megabenthic fauna community in Gabes gulf (Tunisia, Eastern Mediterranean Sea). Mediterranean Marine Science, 13(1), 12–29.

Elakkermi, M., & Soualili, D. L. (2020). Temporal and spatial variability in the feeding behavior of the black sea urchin *Arbacia lixula* (Echinodermata: Echinoidea) from the north-western Algerian coast. South Asian Journal of Experimental Biology, 10(6), 480–490.

Fiorentino, F., Garofalo, G., Gristina, M., Gancitano, S., & Norrito, G. (2004). Some relevant information on the spatial distribution of demersal resources, benthic biocoenoses and fishing pressure in the Strait of Sicily. Report of the MedSudMed Expert Consultation on Spatial Distribution of Demersal Resources in the Straits of Sicily and the Influence of Environmental Factors and Fishery Characteristics. MedSudMed Technical Documents, 2, 50–66.

Fischer, W. (1987). FAO species identification sheets for fisheries purposes. Rev. 1. Mediterranean and Black Sea. Fishing Area 37. Vertebrates. Vol. 2.

Gautier-Michaz, M. (1958). Scientific results of Calypso's campaigns. VII. Studies on the Siculo-Tunisian sill. 5. Echinoderms. Annales Institut Océanographique, Monaco, 34, 145–155.

Grimes, S. (2010). Benthic communities on the soft substrates of the Algerian coast: Taxonomy, structure and ecological status. PhD thesis. University of Oran.

Grimes, S., Benabdi, M., Babali, N., Refes, W., Boudjellal-Kaidi, N., & Seridi, H. (2018). Biodiversity changes along the Algerian coast (Southwest Mediterranean basin): From 1834 to 2017: A first assessment of introduced species. Mediterranean Marine Science, 19(1), 156–179.

Grimes, S., Boutiba, Z., Bakalem, A., Bouderbala, M., Boudjellal, B., Boumaza, S., Boutiba, M., Guedioura, A., Hafferssas, A., Hemida, F., Kaïdi, N., & Kerzabi, F. (2004). Algerian marine and coastal biodiversity. Project Sonatrach/LRSE. Sonatrach.

Gros, P. (2011). Chapitre 5. Ecosystèmes marins [Chapter 5. Marine ecosystems]. In: Connaissance des impacts du changement climatique sur la biodiversité en France métropolitaine – synthèse de la bibliographie [Knowledge of the impacts of climate change on biodiversity in mainland France]. MEDDTL.

Harmelin, J. G., & Ruitton, S. (2010). The thermophilic Asteroidea *Ophidiaster ophidianus* on the NW Mediterranean coasts: Evidence of frequency increase. Scientific Reports of the Port-Cros National Park, 24, 127–137.

Hussein, K. B., & Bensahla Talet, L. (2019). A preliminary inventory of biodiversity and benthic habitats of "Plane" Island (Paloma) in Oran Bay, North Western Algeria (Western Mediterranean). Journal of the Black Sea / Mediterranean Environment, 25(1), 49–72.

Kaidi-Boudjellal, N. (2012). Influence of a wetland on the characteristics of a benthic ecosystem on the Algerian coast: Lake Réghaia (Eastern Algeria). Magister thesis. University Djillali Liabes.

Kaspiris, P., & Tortonese, E. (1982). Echinoderms from the Western Seas of Greece. Thalassographica, 5, 27–32.

Khodja, I., Mezali, K., & Thandar, A. S. (2021). Multiple records and polymorphism of *Parastichopus regalis* (Cuvier, 1817) (Echinodermata: Holothuroidea: Stichopodidae) along the Algerian coast. Zootaxa, 5032(4), 549–562.

Koehler, R. (1921). Fauna of France. 1. Echinoderms. Paris. Faculty of Science Bookshop.

Koukouras, A., Sinis, A. I., Bobori, D., Kazantzidis, S., & Kitsos, M. S. (2007). The echinoderm (Deuterostomia) fauna of the Aegean Sea, and comparison with those of the neighbouring seas. Journal of Biological Research, 7, 67–92.

Le Gall, P., Bucaille, D., & Grassin, J. B. (2020). Influence de la température sur la croissance de deux oursins comestibles, *Paracentrotus lividus* et *Psammechinus miliaris*. In: Jangoux, M. (Ed.). Echinoderm research. CRC Press, London. Pp. 183–188.

Leonard, C., Evans, J., Knittweis, L., Aguilar, R., Alvarez, H., Borg, J. A., Garcia, S., & Schembri, P. J. (2020). Diversity, distribution, and habitat associations of deep-water echinoderms in the Central Mediterranean. Marine Biodiversity, 50(5), 69.

Mansouri, T., & Mezali, K. (2018). Taxonomic status and phylogenetic relationship of some Algerian shallow-water sea cucumber species (Holothuroidea: Echinodermata) deduced from mitochondrial DNA sequences. Bioinformatics and Data Analysis Workshop. 12–13 March 2018. Tangier, Morocco.

Mastrototaro, F., Montesanto, F., Tursi, A., Aguilar, R., & Chimienti, G. (2021). Biometry supporting species identification from underwater images in two Mediterranean sea urchins. In: 2021 International Workshop on Metrology for the Sea. Learning to Measure Sea Health Parameters (MetroSea). Pp. 91–94.

Mezali, K. (2011). Some insights on the phylogeny of Algerian shallow-water sea cucumber species (Aspidochirotida). S.P.C. Bêche-de-mer Information Bulletin, 31, 45–47.

Mezali, K., Chekaba, B., Zupo, V., & Asslah, B. (2003). Feeding behavior of five aspidochirotid holothurians species (Holothuroidea: Echinodermata) of the Sidi-Fredj peninsula – Algeria. Bulletin of the French Zoological Society, 128, 49–62.

Mezali, K., Thandar, A., & Khodja, I. (2020). Paraleptopentacta, a new Mediterranean and north-west Atlantic sea cucumber genus, with the first record of *P. tergestina* n. comb. (Echinodermata: Dendrochirotida: Cucumariidae) from the north-western Algerian coast. Zootaxa, 4860(2), 3.

Mezali, K., Zerroual, H., Lebouazda, Z., & Khodja, I. (2024). On the presence of *Ocnus planci* Brandt, 1935 (Echinodermata: Dendrochirotida: Cucumariidae) in the Mostaganem region (Western Algerian coast). Zootaxa, 5403(4), 479–487.

Mezali, K., Zupo, V., & Francour, P. (2006). Population dynamics of *Holothuria* (*Holothuria*) *tubulosa* and *Holothuria* (*Roweothuria*) *poli* of an Algerian *Posidonia oceanica* meadow. Biologia Marina Mediterranea, 13, 158–161.

Mifsud, C., Taviani, M., & Stohr, S. (2009). Remarks on Echinodermata from the South Central Mediterranean Sea based upon collections made during the MARCOS cruise (10 to 20th April, 2007). Mediterranean Marine Science, 10(2), 63–72.

Öztoprak, B., Doğan, A., & Dağli, E. (2014). Checklist of Echinodermata from the coasts of Turkey. Turkish Journal of Zoology, 38, 892–900.

Pawson, N. (2007). Phylum Echinodermata. Progress in Invertebrate Taxonomy. Zootaxa, 1668, 1–766.

Pérès, J. M., & Picard, J. (1958). Research on benthic communities in the North-Eastern Mediterranean. Annals of the Oceanographic Institute, 34, 213–281.

Perrier, R. (1971). The fauna of France illustrated. 1A (Coelenterates, Sponges, Echinoderms, Protozoa). France.

Riedl, R. (2005). Fauna e flora del mediterraneo. Ed. Franco Muzzio.

Rinelli, P. (1998). A synthesis of the Echinoderm fauna of the Tyrrhenian Sea. Rapports et procès-verbaux des réunions Commission internationale pour l'exploration scientifique de la Mer Méditerranée, 35, 484.

Rodriguez, J. (2020). Echinoderms (except Holothuroidea) of the Southern Mediterranean coast of Spain. In: Jangoux, M. (Ed.). Echinoderms: Present and past. CRC Press, London. Pp. 127–131.

Sibuet, M. (1974). Echinoderms of the Alboran Sea. Bulletin of the National Museum of Natural History, 3(231), 25–34.

Soualili, D. L. (2008). Natural sea urchin populations: A tool for assessing the state of health in the Algiers region. Doctorat Dissertation. USTHB University.

Tamacha Slimane, F., Soualili, D. L., & Mezali, K. (2019). Reproductive biology of *Holothuria* (*Roweothuria*) *poli* (Holothuroidea: Echinodermata) from Oran Bay, Algeria. SPC Beche-de-mer Information Bulletin, 39, 47–53.

Terribile, K., & Schembri, P. J. (2013). Depth distribution of *Cidaris cidaris* (Linnaeus, 1758) and *Stylocidaris affinis* (Philippi, 1845) (Echinodermata, Echinoidea) around the Maltese Islands. Rapports et Procès-Verbaux des Réunions Commission Internationale Pour L'exploration Scientifique de la Mer Méditerranée, 40, 697.

Tortonese, E. (1946). Echinoderms from the Eastern Mediterranean (Island of Rhodes). The Annali and Magazine of Natural History, 13, 716–719.

Tortonese, E. (1947). Note inforno alla fauna e flora marine dell'isola di Rodi (Mara Egeo). Bolletino di Pesca, Piscicolturae Idrobiologia (Note e Memorie Scientifiche), 2, 13–20.

Tortonese, E. (1965). Echinodermata. In: Fauna d'Italia. Vol. 6. Pp. 1–419.