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New data on the Asteroidea of Admiralty Bay, King George Island, South Shetland Islands

ABSTRACT: In the material of nearly 2000 individuals of Asteroidea collected in Admiralty Bay, the largest bay of the South Shetlands, 36 species were determined, enriching the list of hitherto known asteroid species of this basin by 17 taxa. One of them, *Peribolaster macleani*, is recorded for the first time in Western Antarctic. The most frequent and abundant asteroids of Admiralty Bay were *Odontaster validus*, *Psilaster charcoti*, *Bathybiaster loripes obesus* and *Diplasterias brucei*. The bathymetric and geographic distribution of all species are discussed.

Key words: Antarctic, South Shetland Islands, Asteroidea, zoogeography.

Introduction

The number of species of recent Asteroidea is estimated at some 1500 taxa (Rupert and Barnes 1994). According to A.M.Clark (1962) and Fell and Dawsey (1969) some 200 species of Antarctic and Subantarctic asteroids are known. Asteroidea inhabit all oceanic depths from upper sublittoral to the abyssal and all kinds of the substrate, usually avoiding unstable littoral habitats. In general asteroids are eurytopic animals but some exhibit distinct preferences, like Antarctic species *Bathybiaster loripes obesus* or *Psilaster charcoti* that live mainly on the muddy bottom. Asteroidea are mostly predators with an opportunistic diet; they are well known for their tendency to necrophagy and coprophagy. Because of their ubiquity, wide diet spectrum and sometimes comparatively high abundance Asteroidea constitute an important element of the Antarctic sublittoral zoobenthos.

Asteroids were collected in the Antarctic by early expeditions and some collections were amply elaborated (Koehler 1912, 1920, Fisher 1940, A.M.Clark 1962). In an important paper Dearborn (1977) discussed the ecology of Antarctic Asteroidea, whereas asteroids of particular Antarctic regions were treated by H.E.S. Clark (1963, Ross Sea), Arnaud (1964, Adelie Land region), Bernasconi (1970, Antarctic Peninsula region) and Voss (1988, Weddell Sea).

For twenty years Admiralty Bay of King George Island (South Shetlands) the home of the Polish Antarctic Station *Arctowski*, has been the subject of detailed investigations. Hundreds of samples collected there allowed the establishment of a preliminary faunal list (Arnaud *et al.* 1986) and general estimation of the abundance and biomass of zoobenthos (Jażdżewski *et al.* 1986). Some groups were elaborated in detail, like Polychaeta (Siciński 1986, 1993, Siciński and Janowska 1993), Amphipoda (Jażdżewski *et al.* 1991, 1992, Jażdżewski 1993, Jażdżewski, Węsławski and De Broyer 1995), Cumacea (Błażewicz and Jażdżewski 1995) or Ophiuroidea (Presler 1993).

Materials collected by the Polar Biology and Oceanobiology Laboratory team, University of Łódź, during several expeditions to the *Arctowski* Station include an ample collection of Asteroidea. The hitherto available data on this animal group in Admiralty Bay were rather scarce. They were to be found in the papers by Koehler (1912), Fisher (1940), Arnaud *et al.* (1986), Presler (1986) and Wägele and Brito (1990). The present paper brings new information on Asteroidea of this basin.

Investigated area

The South Shetland Islands archipelago lies west of the Antarctic Peninsula between Drake Passage and the Bransfield Strait. Its largest island is King George Island with a surface of some 1300 km^2. Admiralty Bay, in turn, is the largest bay of this island, and of the whole archipelago. It is a deep fiord widely open to the south into the Bransfield Strait, whereas its northern part is trifurcated into three inlets: Ezcurra, MacKellar and Martel. The deepest part of Admiralty Bay exceeds 500 m.

Some general information on bottom substrates of the Bay are given by Jażdżewski and Siciński (1993) and Rakusa-Suszczewski, Battke and Cisak (1993). Phytobenthos of Admiralty Bay was elaborated by Zieliński (1990). Temperature and salinity are rather stable throughout the Bay, especially at the sea floor, where the salinity ranges from 33,8 to 34,3‰ and temperature from -0,4 to 0,9°C (Szafrański and Lipski 1982). Detailed information on hydrography and hydrology of this basin can be found in the papers by Presler (1980), Pruszak (1980), Rakusa-Suszczewski (1980, 1992, 1993, 1995), Samp (1980), Szafrański and Lipski (1982), Tokarczyk (1986), Lipski (1987) Marsz and Rakusa-Suszczewski (1987) and Sarukhanyan and Tokarczyk (1988).

Material

Samples of zoobenthos were collected between March 1977 and January 1989 by the scientists of the Laboratory of Polar Biology and Oceanobiology, University of Łódź, who took part in numerous Polish Antarctic Expeditions. Sampling

stations were distributed throughout the whole of Admiralty Bay, including the central basin and distal inlets, in all depths and in various sediments. Altogether 244 qualitative samples were gathered, using the fishery trawl, beam trawl, dredge and hand net. Asteroids were present in 168 samples, that is in 69% of samples. In all 1974 individuals of Asteroidea were found; 1815 specimens (92% of the collection) were determined to the species rank; 159 individuals were juveniles with insufficiently developed key features and they remained indetermined.

Results and discussion

First data on Asteroidea from Admiralty Bay were due to Koehler (1912). In the materials collected by the 2nd French Antarctic Expedition under J. Charcot this author has found 8 species (*Bathybiaster loripes obesus, Cuenotaster involutus, Henricia parva, Lophaster gaini, Lysasterias perrieri, Notasterias bongraini, Odontaster validus* and *Psilaster charcoti*). Grieg (1929), who worked out a small echinoderm collection collected at the whaling station operating in Admiralty Bay, has noted two species only, enlarging the list to 9 taxa. Fisher (1940) has elaborated materials gathered in 1925–1936 by British expeditions of *Discovery*, *Discovery II* and *William Scoresby*, but the number of species from Admiralty Bay was not increased by his study. Presler (1986) noted in Admiralty Bay 13 species of Asteroidea, of that number 8 species hitherto had not been found in this area. In the paper by Arnaud *et al.* (1986) two further asteroid species were added. Finally Wägele and Britto (1990) mentioned 3 asteroid species from Admiralty Bay – all previously recorded there. So altogether 19 species of Asteroidea were hitherto given from Admiralty Bay.

In present materials 36 asteroid species were determined. They represented 3 ordines and 10 families. This way the list of species of this group inhabiting Admiralty Bay has been enlarged by 17 taxa, marked here by an asterisk.

PHANEROZONIDA Sladen, 1889

Astropectinidae Gray, 1840

1. *Bathybiaster loripes obesus* Sladen, 1889
2. *Leptychaster flexuosus* (Koehler, 1920) *
3. *Macroptychaster accrescens* (Koehler, 1920) *
4. *Psilaster charcoti* (Koehler 1906)

Odontasteridae Verrill, 1889

5. *Acodontaster capitatus* (Koehler, 1912) *
6. *Acodontaster conspicuus* (Koehler, 1920) *
7. *Acodontaster hodgsoni* (Bell, 1908) *
8. *Odontaster meridionalis* (Smith, 1876) *
9. *Odontaster validus* Koehler, 1906

Goniasteridae Forbes, 1841

10. *Chitonaster johannae* (Koehler, 1908) *

SPINULOSIDA Perrier, 1894

Ganeriidae Perrier, 1894

11. *Cycethra verrucosa mawsoni* A.M. Clark, 1962 *
12. *Perknaster antarcticus* (Koehler, 1906)
13. *Perknaster aurorae* (Koehler, 1920) *
14. *Perknaster charcoti* (Koehler, 1912)
15. *Perknaster sladeni* (Perrier, 1891) *

Solasteridae Perrier, 1884

16. *Cuenotaster involutus* (Koehler, 1912)
17. *Lophaster gaini* Koehler, 1912
18. *Paralophaster antarcticus* Koehler, 1912 *
19. *Paralophaster lorioli* (Koehler, 1908) *

Asterinidae Gray, 1840

20. *Kampylaster incurvatus* Koehler, 1920 *

Korethrasteridae Dan. et Koren, 1884

21. *Peribolaster macleani* Koehler, 1920 *
22. *Remaster gourdoni* Koehler, 1912

Poraniidae Perrier, 1894

23. *Porania antarctica glabra* Sladen, 1889

Echinasteridae Verrill, 1867

24. *Henricia parva* (Koehler, 1912)

FORCIPULATIDA

Asteriidae Gray, 1840 emend. Fisher, 1928

25. *Cryptasterias turqueti* (Koehler, 1906)
26. *Diplasterias brucei* (Koehler, 1908)
27. *Granaster nutrix* (Studer, 1885)
28. *Labidiaster annulatus* Sladen, 1889
29. *Lysasterias belgicae* (Ludwig, 1903) *
30. *Lysasterias digitata* A.M. Clark, 1962
31. *Lysasterias hemiora* Fisher, 1940
32. *Lysasterias heteractis* Fisher, 1940 *
33. *Lysasterias perrieri* (Studer, 1885)
34. *Neosmilaster georgianus* (Studer, 1885)
35. *Notasterias bongraini* (Koehler, 1912)
36. *Notasterias stolophora* Fisher, 1940 *

Out of the species new for Admiralty Bay 10 were formerly noted in the South Shetlands area, namely *Acodontaster conspicuus, A. hodgsoni, Cycetra verrucosa mawsoni, Kampylaster incurvatus, Lysasterias belgicae, L. heteractis, Odontaster meridionalis, Paralophaster antarcticus, P. lorioli* and *Perknaster aurorae* (Fisher 1940, Madsen 1955, Bernasconi 1956, 1962, 1970).

The remaining 7 species were recorded from more remote areas. The nearest sites of *Acodontaster capitatus, Macroptychaster accrescens* and *Perknaster sladeni* were located near the Antarctic Peninsula (Bernasconi 1970), *Chitonaster johannae* occurs in South Orkneys area (Koehler 1908), *Notaster stolophora* near Joinville Island (Fisher 1940), *Leptychaster flexuosus* was found in the western Weddell Sea whereas *Peribolaster macleani* was noted in southern and eastern Weddell Sea (Voss 1988).

The species richness of Asteroidea of Admiralty Bay is remarkable taking into account its comparatively small area. In far larger regions of the Ross Sea H.E.S.Clark (1963) found 37 species of that group, whereas Voss (1988) has noted 50 species for the Weddell Sea. Bernasconi (1970) for the region of the tip of Antarctic Peninsula and adjoing islands has given a list of 32 species.

The most frequent and abundant asteroid species in Admiralty Bay was *Odontaster validus* (F = 40%, D = 32%). Very frequent species were *Psilaster charcoti, Bathybiaster loripes obesus, Diplasterias brucei, Cuenotaster involutus, Odontaster meridionalis* and *Porania antarctica glabra*. Very rare were *Acodontaster capitatus, Lysasterias belgicae, Paralophaster lorioli* and *Leptychaster flexuosus*; these species were recorded only once or twice. Abundant species, along with *O. validus*, were *Psilaster charcoti, Bathybiaster loripes obesus, Diplasterias brucei, Odontaster meridionalis* and *Notasterias bongraini*. As many as 17 species were represented in the collection by one to several individuals (Tab. 1).

Bathybiaster loripes obesus, Diplasterias brucei, Labidiaster annulatus, Odontaster validus, Porania antarctica glabra and *Psilaster charcoti* occurred in all depths sampled; these species can be recognized as eurybathic ones. Nine species: *Acodontaster conspicuus, A. hodgsoni, Cryptasterias turqueti, Granaster nutrix, Lysasterias belgicae, L. hemiora, L. heteractis, Neosmilaster georgianus* and *Perknaster charcoti* were found in depths not exceeding 70 m, thus revealing their preferences to shallow sublittoral; however most of them (except of *Cryptasterias turqueti*) in other Antarctic regions were recorded also at greater depths. Many asteroid species were noted in deepest parts of Admiralty Bay (Tab. 2); out of them *Leptychaster flexuosus* and *Paralophaster lorioli* were noted only below 380 m. Our present data for *Chitonaster johannae, Henricia parva, Kampylaster incurvatus, Lysasterias digitata, L. heteractis, Notasterias bongraini, N. stolophora, Paralophaster antarcticus, P. lorioli, Perknaster antarcticus, P. sladeni* enlarge their hitherto known bathymetric range (Tab. 2).

Table 1

Characteristics of the investigated material. N – number of specimens, NS – number of samples with particular species, F – frequency in % of species presence in all 244 samples, D – dominance in the whole material (in %).

Species	N	NS	F	D
Acodontaster capitatus	1	1	0.41	0.05
Acodontaster conspicuus	5	3	1.23	0.25
Acodontaster hodgsoni	4	4	1.64	0.20
Bathybiaster loripes obesus	156	45	18.44	7.90
Chitonaster johannae	5	3	1.23	0.25
Cryptasterias turqueti	7	3	1.23	0.35
Cuenotaster involutus	58	35	14.34	2.94
Cycethra verrucosa mawsoni	20	9	3.69	1.01
Diplasterias brucei	117	45	18.44	5.93
Granaster nutrix	3	3	1.23	0.15
Henricia parva	34	18	7.38	1.72
Kampylaster incurvatus	38	11	4.59	1.93
Labidiaster annulatus	38	25	10.25	1.93
Leptychaster flexuosus	6	2	0.82	0.30
Lophaster gaini	6	5	2.05	0.30
Lysasterias belgicae	1	1	0.41	0.05
Lysasterias digitata	34	15	6.15	1.72
Lysasterias hemiora	14	7	2.87	0.71
Lysasterias heteractis	4	4	1.64	0.20
Lysasterias perrieri	17	8	3.28	0.86
Macroptychaster accrescens	6	4	1.64	0.30
Neosmilaster georgianus	47	18	7.38	2.38
Notasterias bongraini	95	12	4.92	4.81
Notasterias stolophora	8	7	2.87	0.41
Odontaster meridionalis	95	34	13.93	4.81
Odontaster validus	637	98	40.16	32.27
Paralophaster antarcticus	8	5	2.05	0.41
Paralophaster lorioli	6	1	0.41	0.30
Peribolaster macleani	8	4	1.64	0.41
Perknaster antarcticus	12	10	4.10	0.61
Perknaster aurorae	7	3	1.23	0.35
Perknaster charcoti	7	4	1.64	0.35
Perknaster sladeni	21	13	5.33	1.06
Porania antarctica glabra	71	31	12.70	3.60
Psilaster charcoti	204	54	22.13	10.33
Remaster gourdoni	15	11	4.59	0.76
Asteroidea juv.	159	39	15.98	8.05
Σ	1974	(244)		100

Zoogeographic analysis of Admiralty Bay asteroids (Tab. 2) was based on the biogeographic division by Hedgpeth (1969), slightly modified by De Broyer and Jażdżewski (1993) as well as on the detailed data by Smith (1876), Studer (1885), Sladen (1889), Bell (1902, 1908, 1917), Ludwig (1903), Koehler (1905, 1906, 1908, 1911, 1912, 1917, 1920, 1923), Döderlein (1928), Fisher (1940),

Table 2

Bathymetric and zoogeographical ranges of Asteroidea of Admiralty Bay. E – East Antarctic Sub-region, W – West Antarctic Sub-region, S – Subantarctic Islands Sub-region, M – Magellanic Sub-region. Bathymetric ranges in meters.

Species	Bathymetric range in Admiralty Bay	Bathymetric range outside Admiralty Bay	Zoogeographical range
Acodontaster capitatus	200-270	30-787	E+W
Acodontaster conspicuus	30-70	0-695	E+W+M
Acodontaster hodgsoni	15-60	3-540	E+W
Bathybiaster loripes obesus	10-535	0-1266	E+W+M+S
Chitonaster johannae	200-320	293-3246	E+W
Cryptasterias turqueti	30-40	0-45	W
Cuenotaster involutus	10-320	0-794	E+W
Cycethra verrucosa mawsoni	50-300	0-780	E+W
Diplasterias brucei	0-535	0-752	E+W
Granaster nutrix	10-40	0-250	W
Henricia parva	30-250	163-780	E+W
Kampylaster incurvatus	50-400	93-750	E+W
Labidiaster annulatus	15-535	0-554	E+W+S
Leptychaster flexuosus	420-500	201-695	E+W
Lophaster gaini	200-535	110-732	E+W
Lysasterias belgicae	65	0-560	E+W
Lysasterias digitata	25-240	163-450	E+W
Lysasterias hemiora	10-40	0-150	W
Lysasterias heteractis	10	342	W
Lysasterias perrieri	0-300	0-793	E+W
Macroptychaster accrescens	60-535	0-780	E+W
Neosmilaster georgianus	8-40	0-335	W
Notasterias bongraini	25-535	60-830	E+W
Notasterias stolophora	22-200	247-780	E+W
Odontaster meridionalis	0-470	0-695	E+W+S
Odontaster validus	0-500	0-914	E+W+S
Paralophaster antarcticus	10-300	88-750	E+W
Paralophaster lorioli	380-400	750-5500	E+W
Peribolaster macleani	200	10-787	E+W
Perknaster antarcticus	30-500	0-457	E+W
Perknaster aurorae	55-200	18-634	E+W
Perknaster charcoti	30-70	0-235	W
Perknaster sladeni	30-240	40-500	E+W+M
Porania antarctica glabra	15-535	0-3200	E+W+M+S
Psilaster charcoti	10-535	0-3900	E+W+M
Remaster gourdoni	60-300	10-540	E+W+M

Madsen (1955, 1956), Bernasconi (1956, 1962, 1964a,b, 1967, 1970), A.M.Clark (1962), H.E.S.Clark (1963), Arnaud (1964), Fell and Dawsey (1969), Cherbonnier and Guille (1975), Voss (1988), Wägele and Brito (1990), Branch *et al.* (1993).

Five groups of species can be distinguished:

1. Asteroids of the widest distribution range in the Antarctic (E+W+S+M). Altogether this group constitutes 2 species – 5,6% of all species of Admiralty Bay.

2. Narrow circumantarctic asteroids (E+W), 21 species – 58,3%.

3. Wide circumantarctic asteroids (E+W+S), 3 species – 8,3%.

4. Circumantarctic species occurring in the Magellanic area (E+W+M), 4 species – 11,1%.

5. Asteroids endemic to the West Antarctic or "Scotia" area (W), 6 species – 16,7%.

High number of circumantarctic species reflects the high faunistic similarity of the whole Antarctic shelf.

The presence of several species endemic of the Scotia subregion (*Cryptasterias turqueti, Granaster nutrix, Lysasterias hemiora, L. heteractis, Neosmilaster georgianus, Perknaster charcoti*) is, however, worth noticing; this indicates a biogeographical peculiarity of that subregion.

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Streszczenie

Pierwsze informacje o rozgwiazdach zasiedlających dno Zatoki Admiralicji pochodzą z 1912 roku. Zatoka ta jest największą spośród zatok wcinających się w ląd Wyspy Króla Jerzego i jednocześnie największą w Archipelagu Szetlandów Południowych. Jej głębokość przekracza nieco 500 m. W okresie od 1977 do 1988 pracownicy Zakładu Biologii Polarnej i Oceanobiologii UŁ zebrali z dna Zatoki Admiralicji 244 jakościowe próby bentosowe, w których znajdowały się 1974 osobniki rozgwiazd. Ustalono, że należą one do 36 gatunków. Dotychczasowa lista gatunków *Asteroidea* zasiedlających dno badanego akwenu powiększona została o dalszych 17. Jeden spośród nich (*Peribolaster macleani*) nie były dotąd podawany z rejonu Antarktyki Zachodniej. W obrębie badanych szkarlupni gatunkiem zdecydowanie dominującym pod względem częstości występowania w próbach i ogólnej ilości złowionych osobników był *Odontaster validus*. Kolejne miejsca w tym względzie zajmowały *Psilaster charcoti*, *Bathybiaster loripes obesus* i *Diplasterias brucei* (Tab. 1). Stwierdzono, że 6 gatunków rozgwiazd cechuje eurybatyczność, 9 preferuje wody płytkie, zaś 21 zasiedla głównie głębokie części zatoki. Porównano zasięgi batymetryczne rozgwiazd żyjących w Zatoce Admiralicji z ich zasięgami w innych rejonach Antarktyki. W przypadku 11 gatunków dostarczono na ten temat nowych informacji (Tab. 2). Przeprowadzono analizę zoogeograficznego rozmieszczenia rozgwiazd występujących w Zatoce Admiralicji (Tab. 2) i na jej podstawie potwierdzono odmienność faunistyczną subregionu Scotia w stosunku do innych subregionów sub- i antarktycznych.