Oceanological and Hydrobiological Studies
International Journal of Oceanography and Hydrobiology

Volume 43, Issue 1

ISSN 1730-413X
eISSN 1897-3191

(106–113)
2014

VERSITA

DOI: 10.2478/s13545-014-0122-2
Short communication

Received: *August 01, 2013*
Accepted: *December 16, 2013*

The first report on Amphipoda from Marian Cove, King George Island, Antarctic

Jee-Hoon Kim[1,3], Anna Jażdżewska[2], Han-Gu Choi[3], Won Kim[1,*]

[1]*School of Biological Sciences, Seoul National University, Seoul 151-747, Korea*
[2]*Laboratory of Polar Biology and Oceanobiology, University of Łódź, ul. Banacha 12/16, 90-237, Łódź, Poland*
[3]*Korea Polar Research Institute, Incheon 406-840, Korea*

Key words: Crustacea, amphipods, shallow sublittoral, West Antarctic

Abstract

This is a first account on amphipods from Marian Cove in Maxwell Bay, near the *King Sejong* Station, King George Island, the Antarctic. We have conducted a survey in 14 localities in the shallow sublittoral zone. A total of 22 amphipod species belonging to 12 families were identified. Six of these species were new for the whole Maxwell Bay. Our findings increase the amphipod fauna of Maxwell Bay from 55 to 61 species. The dominant species in the shallow sublittoral zone of Marian Cove were: *Cheirimedon femoratus* and *Gondogeneia antarctica*, followed by *Bovallia gigantea*, *Orchomenella* cf. *ultima*, *Paradexamine fissicauda*, *Prostebbingia brevicornis*, *Pariphimedia integricauda*, and *Jassa wandeli.*

* Corresponding author: *wonkim@snu.ac.kr*

INTRODUCTION

The region of the Antarctic Peninsula is one of the most rapidly warming regions on Earth (Turner et al. 2005, Steig et al. 2009, Rückamp et al. 2011). King George Island is the largest of the South Shetland Islands, and is situated close to the tip of the Antarctic Peninsula. There are eleven scientific stations situated on this island (eight permanent ones, belonging to Argentina, Brazil, Chile, China, Korea, Poland, Russia, Uruguay, and three seasonal ones operated by Ecuador, Peru and USA). The *King Sejong* Station was established on the coastline of Marian Cove by the Republic of Korea on February 17, 1988, and is used to conduct environmental studies in the surrounding area. The current research area, Marian Cove, is a 136 m deep inlet within Maxwell Bay. Presently, there are several studies of invertebrates conducted in this area and in the Southern Ocean in general (e.g. Barnes et al. 2006, Rhem et al. 2006, San Vincente et al. 2009). In the West Antarctic region, studies of invertebrates were conducted mainly in South Shetlands, South Orkneys and Palmer archipelagos (Thurston 1974, Lowry 1975, Siciński et al. 2011). Studies of the amphipod fauna are actively pursued, because amphipods represent one of the dominant marine invertebrate groups in the sublittoral zone of the Southern Ocean (Jażdżewski et al. 1991, Cattaneo-Vietti et al. 2000, Huang et al. 2007, Pabis et al. 2011, Siciński et al. 2011).

Several amphipod faunal studies have been conducted in Maxwell Bay (Rauschert 1989, 1990, 1991, 1994, 1997; Ren and Huang 1991; Rauschert and Andres 1993, 1994), but there are no published reports concerning Marian Cove. Therefore, in this paper we present the first systematic account on amphipods from the above-mentioned inlet. Our findings provide the groundwork for further

monitoring of invertebrate fauna in the waters close to the *King Sejong* Station that can be influenced by climate changes observed in the whole West Antarctic area.

MATERIALS AND METHODS

Sixteen samples were collected from the shallow sublittoral zone at a depth of 0–30 m by SCUBA diving, hand-netting, boat-netting, light-trapping, and bait-trapping (Fig. 1, Table 1). All specimens were fixed in 99.9% ethanol and preserved in 95.0% ethanol. The individuals were dissected in lactic acid and observed microscopically. Photographs were taken with a digital camera (D7000, Nikon) and processed with the Helicon Focus software (Model Helicon Focus; Helicon Soft Ltd., Kharkov, Ukraine). The geographic provinces are distinguished according to De Broyer et al. (2007) where extensive citation and synonym lists for each species can be found.

RESULTS AND DISCUSSION

The results of faunistic investigations are presented in Table 2.

Prostebbingia brevicornis was briefly described by Chevreux (1906a), however, its thorough description with detailed drawings was published later the same year (Chevreux 1906b). Both descriptions were based only on female specimens. Thurston (1974) reported this species from Signy Island under the name *Pontogeneiella brevicornis*. On the basis of more than 9000 specimens of both sexes, the aforementioned author stated that the eyes are larger than presented

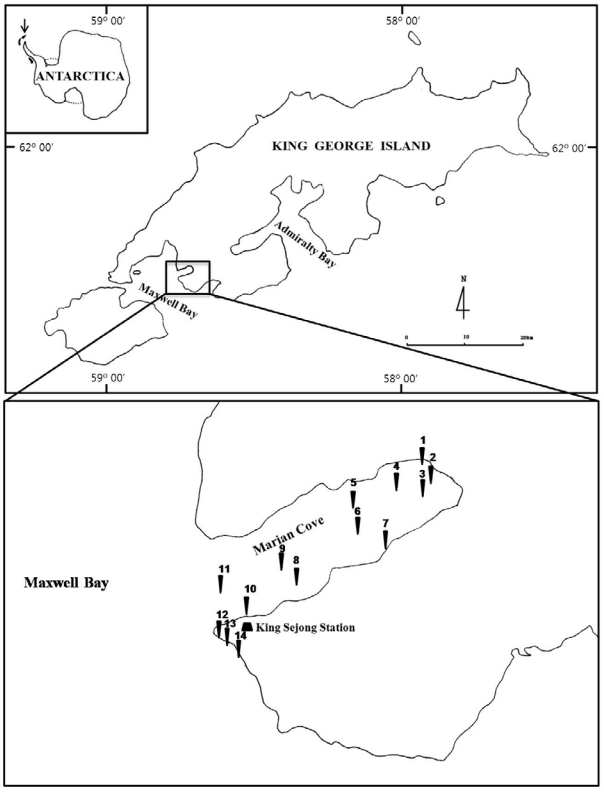

Fig. 1. Sampling sites in Marian Cove

Table 1

Samples used for the present study

Sample code	Coordinates	Date	Depth	Sampling method
1	62°12'06.48"S 58°44'03.14"W	20-Jan-12	20-30 m	SCUBA diving
2	62°12'13.80"S, 58°43'56.59"W	19-Feb-12	2 m	boat netting
3	62°12'19.81"S, 58°44'4.15"W	08-Feb-12	2 m	boat netting
4	62°12'16.37"S, 58°44'32.68"W	28-Jan-12	2 m	boat netting
5	62°12'26.28"S, 58°45'18.50"W	28-Jan-12	2 m	boat netting
6	62°12'37.99"S, 58°45'12.48"W	06-Feb-12	2 m	boat netting
7	62°12'48.45"S, 58°44'42.36"W	18-Jan-12	~0.5 m	hand net
8	62°13'01.90"S 58°46'08.51"W	19-Jan-12	10 m	SCUBA diving
9	62°12'55.51"S, 58°46'36.87"W	19-Feb-12	2 m	boat netting
10a	62°13'19.60"S, 58°47'13.81"W	30-Jan-12	10 m	SCUBA diving
10b	62°13'19.60"S, 58°47'13.81"W	26-Jan-12	1.5 m	light trap
10c	62°13'19.60"S, 58°47'13.81"W	19-Jan-12	1m	baited trap
11	62°13'6.64"S, 58°47'41.53"W	28-Jan-12	2 m	boat netting
12	62°13'28.90"S, 58°47'41.18"W	21-Jan-12	~0.5 m	hand net
13	62°13'32.38"S, 58°47'33.69"W	19-Jan-12	~0.5 m	hand net
14	62°13'45.10"S 58°47'15.84"W	22-Jan-12	~0.2 m	hand net

Table 2

The list of species found in Marian Cove with depth and geographic distribution. Geographic codes: E, East (or High) Antarctic province; W, West (or Maritime) Antarctic province; G, South Georgia district (within the West/Maritime Antarctic province); S, sub-Antarctic Islands province; T, Tristan da Cunha district (within the sub-Antarctic Islands province); M, Magellan province. Geographic codes and literature data taken from De Broyer et al. 2007

Family	Species	Individual count	Sample code	Depth range in present study	Depth range (literature data)	Geographic distribution
AMPELISCIDAE Costa, 1857	*Gitanopsis squamosa* (Thomson, 1880)	1♂	1	20 m	0–88 m	W+G+S+M+T
COLOMASTIGIDAE Stebbing, 1899	*Colomastix fissilingua* Schellenberg, 1926	1♂	8	10 m	0–494 m	E+W+G+S+M
DEXAMINIDAE Leach, 1814	*Paradexamine fissicauda* Chevreux, 1906 (Fig. 5A)	5♀♀ 1♂	1	20–30 m	1–129 m	W+G
EPIMERIIDAE Boeck, 1871	*Epimeria monodon* Stephensen, 1947	1♂	9	5 m	0–254 m	E+W
PONTOGENEIIDAE Stebbing, 1906	*Bovallia gigantea* Pfeffer, 1888 (Fig. 5B)	4♂♂ 8♀♀	1,8	10–30 m	0–91m	W+G
	Djerboa furcipes Chevreux, 1906	2♂♂ 4♀♀	1	20–30 m	0–156 m	W+G+S
	Eurymera monticulosa Pfeffer, 1888	1♂	13	0.5 m	0–40 m	W+G
	Gondogeneia antarctica (Chevreux, 1906) (Fig. 5C)	210	2,3,4,5,6,11,12,14	0–1.5 m	0–150 m	W+G+M
	Prostebbingia brevicornis (Chevreux, 1906) (Figs.2,3,4,5D)	2♂♂3♀♀	13	0.5 m	0–310 m	W+G+S
	Prostebbingia longicornis (Chevreux, 1906)	1♂	10a	10 m	4–310 m	W+G
MELITIDAE Bousfield, 1973	*Paraceradocus gibber* Andres, 1984	1♂	10a	10 m	160–793 m	E+W
IPHIMEDIIDAE Boeck, 1871	*Pariphimedia integricauda* Chevreux, 1906 (Fig. 5E)	6♀♀ 2♂♂	1	20–30 m	0–145 m	W
	Stegopanoploea joubini (Chevreux, 1912)	1♂	8	10 m	45–549 m	E+W
LEUCOTHOIDAE Dana, 1852	*Leucothoe* cf. *spinicarpa* (Abildgaard, 1789)	1♂	8	10 m	1–972 m	
LYSIANASSIDAE Dana, 1849	*Cheirimedon femoratus* (Pfeffer, 1888) (Fig. 5F)	412 2000+ (in sample 10c)	2,3,7,10b,10c,12,13	0.5–1.5m	0–310 m	E+W+G+S
	Orchomenella cf. *ultima* (Fig. 5G)	8♂♂ 11♀♀	10b,12	0.5 m	0–30 m	
STENOTHOIDAE Boeck, 1871	*Metopoides sarsi* (Pfeffer, 1888)	1♂1♀	8	10 m	0–30 m	W+G+S
	Scaphodactylus foliodactylus (Rauschert, 1990)	1♂	8	10 m	20–30 m	W
	Prothaumatelson nasutum (Chevreux, 1912)	1♂	1	20 m	0–40 m	W+G
	Thaumatelson cf. *herdmani* Walker,1906	2♂♂ 4♀♀	1	20–30 m	3–385 m	E+W+G+S+M
EOPHLIANTIDAE Sheard, 1936	*Wandelia crassipes* Chevreux, 1906	2♂♂ 3♀♀	1	20–30 m	1–126 m	W+T
ISCHYROCERIDAE Stebbing, 1899	*Jassa wandeli* Chevreux, 1906 (Fig. 5H)	3♂♂ 5♀♀	1	20–30 m	0–20 m	W

by Chevreux (1906a, b), particularly in male specimens, but he has not made a drawing of the species. Therefore we are presenting some morphological details of the male *P. brevicornis* (Figs. 2–4). The differences between the present male specimen and the description given by Cherveux are as follows: maxilla 1 – article 2 of the palp is more slender in the present specimen (Fig. 2c); maxilla 2 – the outer plate is more slender in the present specimen (Fig. 2d); maxilliped – the 2nd article of the palp is broader in the presently studied individual (Fig. 3c). Also carpi and propodi of gnathopods 1 and 2 are proportionally slightly longer in our individuals (Fig. 3d, e).

In the case of *Leucothoe* cf. *spinicarpa*, we are aware that the revision of the family Leucothoidae is actually carried on (Krapp-Schickel and De Broyer, 2014) and that *Leucothoe spinicarpa* is a complex of several species. Additionally, three species have been found in Admiralty Bay (Krapp-Schickel and De Broyer, 2014), so we are treating our identification as provisional until the results of the revision are published.

The present *Orchomenella* cf. *ultima* specimens are most similar to *Orchomenella ultima* (Bellan-Santini, 1972). However, several morphological differences between the two species were observed. The present species can be distinguished from *Orchomenella ultima* by the following features: (1) antennae are longer than those of *Orchomenella ultima*; (2) article 1 of antenna 1 is more slender; (3) the flagellum of antenna 1 is 12-articulated, whereas it is 9-articulated with the first article produced in *Orchomenella ultima*; (4) article 1 of the accessory flagellum is shorter than that of *Orchomenella ultima*; and (5) the propodus of gnathopod 1 is broader than that of *Orchomenella ultima*. Additionally, *Orchomenella ultima* has so far

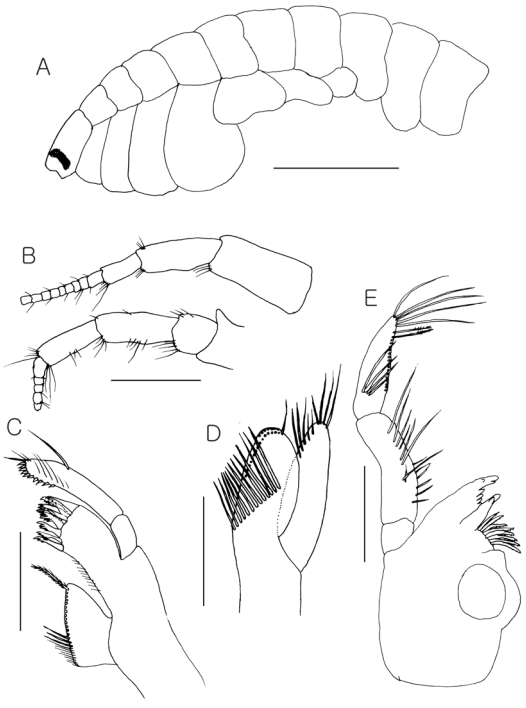

Fig. 2. *Prostebbingia brevicornis* (Chevreux, 1906). Male. A, body; B, antennae; C, maxilla 1; D, maxilla 2; E, molar. Scale bars = 5 mm (A), 1 mm (B), 0.5 mm (C–E)

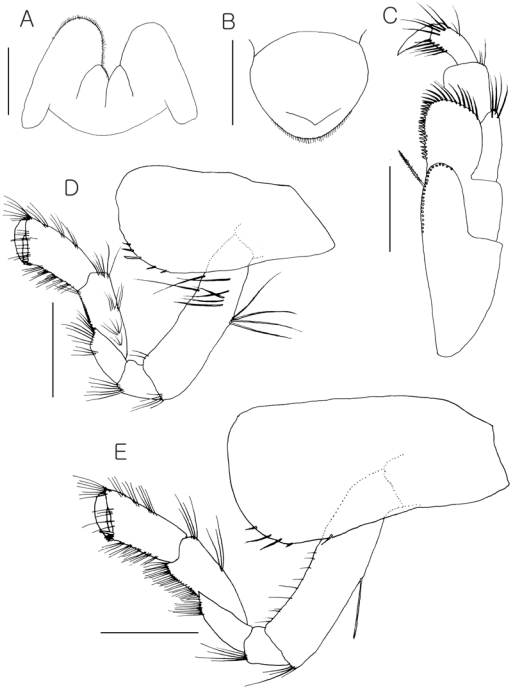

Fig. 3. *Prostebbingia brevicornis* (Chevreux, 1906). Male. A, labium; B, labrum; C, maxilliped; D, gnathopod 1; E, gnathopod 2. Scale bars = 0.5 mm (A–C), 1 mm (D, E)

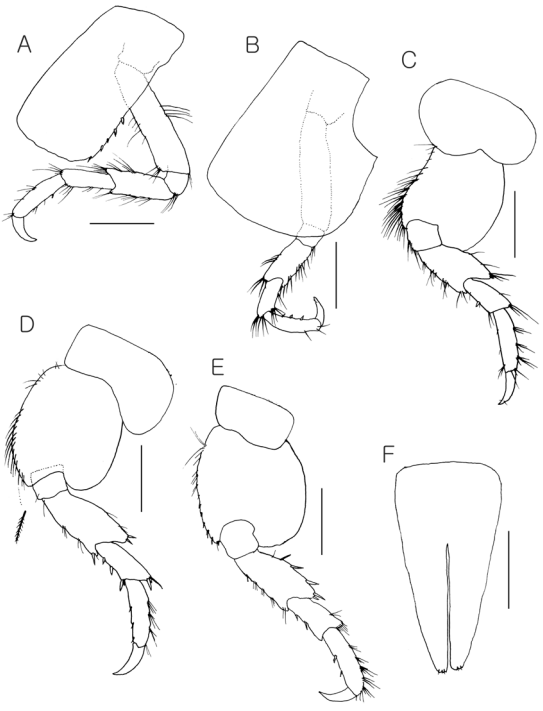

Fig. 4. *Prostebbingia brevicornis* (Chevreux, 1906). Male. A, pereopod 3; B, pereopod 4; C, pereopod 5; D, pereopod 6; E, pereopod 7; F, telson. Scale bars = 1 mm (A–E), 0.5 mm (F)

Table 3

Amphipods of the shallow sublittoral zone (up to 30 m depth) of Marian Cove

species	A	a	b
Gitanopsis squamosa (Thomson, 1880)		+	*
Colomastix fissilingua Schellenberg, 1926		+	*
Paradexamine fissicauda Chevreux, 1906		++	**
Epimeria monodon Stephensen, 1947		+	*
Bovallia gigantea Pfeffer, 1888		++	***
Djerboa furcipes Chevreux, 1906		+	*
Eurymera monticulosa Pfeffer, 1888		++	*
Gondogeneia antarctica (Chevreux, 1906)		+++	****
Prostebbingia brevicornis (Chevreux, 1906)		++	**
Prostebbingia longicornis (Chevreux, 1906)		+	*
Paraceradocus gibber Andres, 1984		+	*
Pariphimedia integricauda Chevreux, 1906		+	**
Stegopanoploea joubini (Chevreux, 1912)	O	+	*
Leucothoe cf. *spinicarpa* (Abildgaard,1789)	O	+	*
Cheirimedon femoratus (Pfeffer, 1888)		+++	****
Orchomenella cf. *ultima*	O	++	***
Metopoides sarsi (Pfeffer, 1888)	O	+	*
Scaphodactylus foliodactylus (Rauschert, 1990)		+	*
Prothaumatelson nasutum (Chevreux, 1912)	O	+	*
Thaumatelson cf.*herdmani* Walker,1906		+	**
Wandelia crassipes Chevreux, 1906		+	**
Jassa wandeli Chevreux, 1906	O	+	**
	22 sp.		

A: Species new for Maxwell Bay

a: Frequency in the amphipod sample: + <15%; ++15%-25%; +++ >25%

b: Percentage in the whole material: * <1%; ** 1-5%; *** 5-10%; ****>10%

Fig. 5. Major amphipod species in Marian Cove. A – *Paradexamine fissicauda* Chevreux, 1906, B – *Bovallia gigantea* Pfeffer, 1888, C – *Gondogeneia antarctica* (Chevreux, 1906), D – *Prostebbingia brevicornis* (Chevreux, 1906), E – *Pariphimedia integricuada* Chevreux, 1906, F – *Cheirimedon femoratus* (Pfeffer, 1888), G – *Orchomenella* cf. *ultima*, H – *Jassa wandeli* Chevreux, 1906

Table 4

Amphipods of the shallow sublittoral zone (depth 0 to 30 m) of Maxwell Bay and Admiralty Bay (Rauschert 1989, 1990, 1991, 1994, 1997, Rauschert & Andres 1993, 1994, Ren and Huang 1991, Jażdżewski et al. 1991, 2001, Siciński et al. 2012 and present data combined). Asterisk (*): amphipods in the shallow sublittoral zone of Marian Cove (present data)

Amphipod species found in the shallow sublittoral zone		
only in Maxwell Bay	in Maxwell and Admiralty bays	only in Admiralty Bay
Ampelisca bouvieri	**Bovallia gigantea*	*Atyloella magellanica*
Atyloella quadridens	**Cheirimedon femoratus*	*Cardenio paurodactylus*
Atylopsis fragilis	**Djerboa furcipes*	*Gondogeneia subantarctica*
**Colomastix fissilingua*	**Eurymera monticulosa*	*Heterophoxus trichosus*
**Epimeria monodon*	**Gitanopsis squamosa*	*Heterophoxus videns*
Eusirus antarcticus	**Gondogeneia antarctica* = *Gondogeneia* sp. (juv.)	*Hippomedon kergueleni*
Eusirus perdentatus	**Jassa wandeli*	*Jassa ingens*
Gitanopsilis amissio	*Liouvillea oculata*	*Monoculodes scabriculosus*
Gitanopsis simplex	*Methalimedon nordenskjoeldi*	*Oediceroides lahillei*
Gondogeneia bidentata	*Oradarea edentata*	*Oediceroides macrodactyla*
Gondogeneia redfearni	*Orchomenella* cf. *ultima*	*Oradarea bidentata*
Gondogeneia spinicoxa	**Paradexamine fissicauda*	*Oradarea* cf. *ocellata*
**Leucothoe* cf. *spinicarpa*	*Paramoera hurleyi*	*Orchomenella rotundifrons*
Metaleptamphopus pectinatus	**Pariphimedia integricauda*	*Orchomenella* sp. (juv.)
**Metopoides sarsi*	**Prostebbingia brevicornis*	*Paramoera edouardi*
**Paraceradocus gibber*	*Prostebbingia gracilis*	*Parhalimedon turqueti*
Paramoera fissicauda	**Prothaumatelson nasutum*	*Parharpinia rotundifrons*
**Prostebbingia longicornis*	*Schraderia dubia*	*Phoxocephalopsis deceptionis*
**Scaphodactylus foliodactylus*	*Schraderia gracilis*	*Probolisca ovata*
Scaphodactylus simus	**Wandelia crassipes*	*Urothoe* sp.
Schraderia acuticauda		
Schraderia barnardi		
**Stegopanoploea joubini*		
**Thaumatelson* cf. *herdmani*		
24 sp.	20 sp.	20 sp.
44 sp.		
	40 sp.	

been found only in East Antarctic (Bellan-Santini 1972).

The present *Thaumatelson* cf. *herdmani* specimens differ from the description of Chilton (1912). Antennae and propodus of gnathopod 1 are longer than those described by this author. Therefore, the present specimens are tentatively identified as *Thaumatelson* cf. *herdmani*. It is possible, however, that they belong to other species or to a new species.

Two species, *Stegopanoploea joubini* and *Paraceradocus gibber*, were caught at a depth of 10 m. These records slightly extend their depth distribution as both species have so far been collected deeper than 45 m and 160 m, respectively.

Taxonomic studies of amphipods in the Southern Ocean have frequently been conducted. The entire amphipod fauna of the Southern Ocean comprises 723 gammaridean species, 92 corophiidean species, and 69 hyperiidean species. Among the 884 Southern Ocean species, 536 species occur only in the Antarctic region (De Broyer et al. 2007).

In the present study, we collected amphipods at a depth ranging from 0 to 30 m. Marian Cove is located in Maxwell Bay where the amphipod fauna has been extensively studied. These studies have resulted in 55 amphipod species found in Maxwell Bay (Rauschert 1989, 1990, 1991, 1994, 1997; Ren and Huang 1991; Rauschert and Andres 1993, 1994). In the present study, we identified 22 amphipod species belonging to 12 families, including six species new for the whole Maxwell Bay (Table 3). Four of them were recorded only from Fildes Strait characterized by strong tidal currents (Rauschert 1991), and one species (*Orchomenella* cf. *ultima*) is possibly new to science. So now 61 amphipod species are recorded from Maxwell Bay, including 44 species found in the shallow sublittoral zone, at a depth of 0–30 m.

The amphipod fauna of Admiralty Bay, that is the other embayment of King George Island, has been thoroughly studied for more than 30 years (Arnaud et al. 1986; Jażdżewski et al. 1991, 2001, Jażdżewska 2011) and the results of these studies give the opportunity to compare the two areas. The general comparison of amphipod species composition between the two bays was done by Jażdżewska (2011): a total of 177 amphipod species have been found in Admiralty Bay – a relatively large number

compared with other similar studies, and 101 species in Maxwell Bay and Fildes Strait combined. However, this comparison took into account the amphipod fauna from the whole depth range of the two bays. This proportion changes into 40 species in Admiralty Bay and 44 in Maxwell Bay when only species from the shallow sublittoral (0-30 m) are included (Rauschert 1991, Jażdżewski et al. 1991, 2001, Siciński et al. 2012, present study). Only 20 of these species are common to both bays at this depth range (Table 4). However, one has to take into account the fact that out of the remaining 24 species found in the shallow sublittoral zone of Marian Cove, 14 species were also recorded in Admiralty Bay, but at greater depths.

We have also collected one large sample from a baited trap. The whole material consists of only one species *Cheirimedon femoratus* − a shallow water species known from its scavenging habits (Bregazzi 1973, Presler 1986, Jażdżewski and Konopacka 1999, Jażdżewska 2009, Núñez-Pons et al. 2012). However, the results of Smale et al. (2007) suggest that the species feeds mainly on carrion in the winter season.

Our present findings are the first account on the amphipod fauna in Marian Cove and provide the groundwork for monitoring the invertebrate fauna in this basin.

ACKNOWLEDGEMENTS

We are very thankful to Sanghui Lee and Hye-Won Moon for collecting some samples. This work was supported by the Basic Research Program of KOPRI (PE12030), the National Institute of Biological Resources (NIBR) of the Ministry of Environment, KOREA (1834-302), and the Marine Biotechnology Programme funded by the Ministry of Land, Transport and Maritime affairs of the Korean Government.

REFERENCES

Arnaud P.M., Jażdżewski K., Presler P. & Siciński J. (1986). Preliminary survey of benthic invertebrates collected by Polish Antarctic Expeditions in Admiralty Bay (King George Island, South Shetland Islands, Antarctica). *Polish Polar Research*. 7(1-2), 7–24.

Barnes D.K.A., Linse K., Waller C., Morely S., Enderlein P., Fraser K.P.P. & Brown M. (2006). Shallow benthic fauna communities of South Georgia Island. *Polar Biology*. 29, 223–228.

Bellan-Santini D. (1972). Amphipodes provenant des contenus stomacaux de trois espèces de poisons Nototheniidae récoltés en Terre Adélie (Antarctique). *Tethys*. 4(3), 683-702.

Bregazzi P.K. (1972). Locomotor activity rhythms in *Tryphosella kergueleni* (Miers) and *Cheirimedon femoratus* (Pfeffer) (Crustacea, Amphipoda). *British Antarctic Survey Bulletin*. 33-34, 17–32.

Cattaneo-Vietti R., Chiantore M., Gambi M.C., Albertelli G., Cormaci M. & Di Geronimo I. (2000). Spatial and vertical distribution of benthic littoral communities in Terra Nova Bay. In: Faranda F.M., Ianora A. (Eds). Ross Sea Ecology, Berlin Heidelberg, Springer-Verlag, 503–514.

Chevreux E. (1906a). Diagnoses d'amphipodes nouveaux provenant de l'expedition antarctique du «Francais». IV. Atylidae. *Bulletin de la Societe Zoologique de France*. 31, 82-86, figs.1-3.

Chevreux E. (1906b). Crustaces amphipodes. In: JOUBIN L. (Ed.). Expedition Antarctique Francaise (1903-1905) commandee par le Dr Jean Charcot. *Sciences naturelles: documents scientifi ques. Crustaces. Masson et Cie, Paris*. 100, 56 figs.

Chilton C. (1912). The Amphipoda of the Scottish National Antarctic Expedition. *Transactions of the Royal Society of Edinburgh*. 48(3), 455-520, pls.1-2.

De Broyer C., Lowry J.K., Jażdżewski K. & Robert H. (2007). Catalogue of the Gammaridean and Corophiidean Amphipoda (Crustacea) of the Southern Ocean with distribution and ecological data. *Bulletin de l'Institute royal des Sciences naturelles de Belgique*. Biologie 77, suppl. 1, 1–325.

Huang Y.M., Amsler M.O., McClintock J.B., Amsler C.D., & Baker B.J. (2007). Patterns of gammaridean amphipod abundance and species composition associated with dominant sublittoral macroalgae from the western Antarctic Peninsula. *Polar Biology*. 30(11), 1417-1430.

Jażdżewska A. (2009). Antarctic necrophagous lysianassoids from stranded fur seal carcass. *Polish Polar Research*. 30(1), 29–36.

Jażdżewska A. (2011). Soft bottom sublittoral amphipod fauna of Admiralty Bay, King George Island, Antarctic. *Oceanological and Hydrobiological Studies*. 40(1), 1-10.

Jażdżewski K. De Broyer C., Pudlarz M. & Zieliński D. (2001). Seasonal fluctuations of vagile bentos in the uppermost sublitoral of a maritime Antarctic fjord. *Polar Biology*. 24, 910–917.

Jażdżewski K. & Konopacka A. (1999). Necrophagous lysianassoid Amphipoda in the diet of Antarctic tern at King George Island, Antarctica. *Antarctic Science*. 11, 316–321.

Jażdżewski K., Teodorczyk W., Siciński J. & Kontek B. (1991). Amphipod crustaceans as an important component of zoobenthos of the shallow Antarctic sublittoral. *Hydrobiologia*. 223, 105–107.

Krapp-Schickel T. & De Broyer C. (2014). Revision of Leucothoe (Amphipoda, Crustacea) in the Southern Ocean: a cosmopolitanism concept is vanishing. *European Journal of Taxonomy*. in press.

Lowry J.K. (1975). Soft bottom macrobenthic community of Arthur Harbor, Antarctica. In: Pawson DL. (Ed). *Biology of Antarctic Seas V, Antarctic research series*. 23(1), 1–19.

Núñez-Pons L., Rodríguez-Arias M., Gómez-Garreta A., Ribera-Siguán A. & Avila C. (2012). Feeding deterrency in Antarctic marine organisms: bioassays with the omnivore amphipod *Cheirimedon femoratus*. *Marine Ecology Progress Series*. 462, 163-174.

Pabis K., Sicinski J. & Krymarys M. (2011). Distribution patterns in the biomass of macrozoobenthic communities in Admiralty Bay (King George Island, South Shetlands, Antarctic). *Polar Biology*. 34(4), 489-500.

Presler P. (1986). Necrophagous invertebrates of the Admiralty

Bay of King George Island (South Shetland Islands, Antarctica). *Polish Polar Research*. 7(1-2), 25–61.

Rauschert M. (1989). *Atylopsis fragilis* n. sp. (Crustacea, Amphipoda, Gammaridea, Eusiridae) aus dem Sublitoral von King George (Sud-Shetland-Inseln). *Mitteilungen aus dem Zoologischen Museum in Berlin*. 65(1), 127-138.

Rauschert M. (1990). Neue Stenothoidae (Crustacea, Amphipoda, Gammaridea) aus dem Sublitoral von King George (Sud-Shetland-Inseln). *Mitteilungen aus dem Zoologischen Museum in Berlin*. 66(1), 3-39.

Rauschert M. (1991). Ergebnisse der faunistischen Arbeiten im Benthal von King George Island (Sudshetlandinseln, Antarktis). *Berichte zur Polarforschung*. 76, 1-75.

Rauschert M. (1994). *Gitanopsilis* (Crustacea, Amphipoda, Gammaridea), eine neue Amphilochiden-Gattung aus dem Sublitoral der Konig-Georg-Insel (Sudshetlandinseln). *Mitteilungen aus dem Zoologischen Museum in Berlin*. 70(1), 133-156.

Rauschert M. (1997). *Stomacontion bulbus* sp. n. (Crustacea, Amphipoda, Gammaridea, Lysianassidae) aus der Maxwell Bay von King George Island (Sudshetlandinseln). *Mitteilungen aus dem Zoologischen Museum in Berlin*. 73(1), 17-25.

Rauschert M. & Andres H.G. (1993). *Scaphodactylus*, eine neue Stenothoiden-Gattung aus dem Sublitoral der Sud-Shetland-Inseln (Crustacea: Amphipoda: Gammaridae). *Mitteilungen aus dem Zoologischen Museum in Berlin*. 69(2), 347-358.

Rauschert M. & Andres H.G. (1994). *Scaphodactylus simus* (Crustacea: Amphipoda: Gammaridea), ein weiterer Vertreter der Stenothoiden aus dem Sublitoral der Konig-Georg-Insel (Sud-Shetland-Inseln). *Mitteilungen aus dem Zoologischen Museum in Berlin*. 70(2), 321-330.

Ren X. & Huang L. (1991). Studies on Gammaridea and Caprellidea (Crustacea: Amphipoda) from the northwest waters off the Antarctic Peninsula. *Studia Marina Sinica*. 32, 185-323.

Rhem P., Thatje S., Arntz W.E., Brandt A. & Heilmayer O. (2006). Distribution and composition of macrozoobenthic communities along a Victoria Land Transect (Ross Sea, Antarctica). *Polar Biology*. 29: 782–790.

Rückamp M., Braun M., Suckro S. & Blindow N. (2011). Observed glacial changes on the King George Island ice cap, Antarctica, in the last decade. *Global and Planetary Change*. 79(1), 99-109.

San Vincente C., Munilla T., Corbera J., Sorbe J.C. & Ramos A. (2009). Suprabenthic fauna from the Bellingshausen Sea and western Antarctic Peninsula: spatial distribution and community structure. *Scientia Marina*. 73(2), 357–368.

Siciński J., Jażdżewski K., De Broyer C., Presler P., Ligowski R., Nonato E.F. (2011). Admiralty Bay Benthos Diversity—A census of a complex polar ecosystem. *Deep Sea Research Part II: Topical Studies in Oceanography*. 58(1), 30-48.

Siciński J., Pabis K., Jażdżewski K., Konopacka A. & Błażewicz-Paszkowycz M. (2012). Macrozoobenthos of two Antarctic glacial coves: a comparison with non-disturbed areas. *Polar Biology*. 35(3), 355–367.

Smale D.A., Barnes D.K.A., Fraser K.P.P., Mann P.J. & Brown M.P. 2007. Scavenging in Antarctica: Intense variation between sites and seasons in shallow benthic necrophagy. *Journal of Experimental Marine Biology and Ecology*. 349, 405–417.

Steig E.J., Schneider D.P., Rutherford S.D., Mann M.E., Comiso J.C. & Shindell D.T. (2009). Warming of the Antarctic ice-sheet surface since the 1957 International Geophysical Year. *Nature*. 457, 459–462.

Thurston M.H. (1974). The Crustacea Amphipoda of Signy Island, South Orkney Islands. *British Antarctic Survey Scientific Reports*. 71, 1-133.

Turner J., Colwell S.R., Marshall G.J. & Lachlan-Cope T.A. (2005). Antarctic climate change during the last 50 years. *International Journal of Climatology*. 25, 279–294.