Zoological Studies **51**(8): 1397-1410 (2012)

Zoological Studies

Ecological Checklist of the Marine and Brackish-Water Harpacticoid Copepod Fauna in Korean Waters

Sung Joon Song[1], Jinsoon Park[1], Bong-Oh Kwon[1], Jongseong Ryu[2], and Jong Seong Khim[1,*]

[1]*School of Earth and Environmental Sciences & Research Institute of Oceanography, Seoul National University, Seoul, Republic of Korea*

[2]*Department of Marine Biotechnology, Anyang University, Ganghwa-gun, Incheon, Republic of Korea*

(Accepted August 16, 2012)

Sung Joon Song, Jinsoon Park, Bong-Oh Kwon, Jongseong Ryu, and Jong Seong Khim (2012) Ecological checklist of the marine and brackish-water harpacticoid copepod fauna in Korean waters. *Zoological Studies* **51**(8): 1397-1410. The 1st comprehensive checklist of Korean marine harpacticoid copepods is provided here with the purpose of being more informative compared to other conventional checklists. The checklist includes data from both marine and brackish-water habitats, along with reports on the occurrence of a few common planktonic harpacticoids. The checklist comprises 88 taxa of species and subspecies belonging to 23 families and 58 genera, encompassing planktonic, free-living benthic, and invertebrate-associated benthic forms. Details of corresponding ecological data for the listed species are provided, including habitats, substratum, salinity range, lifestyle, and size range. The most speciose families are the Miraciidae and Thalestridae (11 species each), followed by the Harpacticidae and Porcellidiidae (8 species each), which were primarily collected from littoral algae. A historical review focusing on newly reported harpacticoid species from Korean marine and brackish-water habitats is presented as an indicator of scientific efforts in harpacticoid taxonomy in Korea. Eighty-eight Korean harpacticoids are categorized according to habitat type and life form, and their distributional characteristics are further discussed. Comparisons are also made with existing checklists from other regions across the world of comparable biogeographical coverage. Finally, the limitations, significance, and role of checklists are briefly discussed. http://zoolstud.sinica.edu.tw/Journals/51.8/1397.pdf

Key words: Copepoda, Harpacticoida, Biodiversity, Taxonomy, South Korea.

Faunal checklists are important taxonomic scientific documents requiring the compilation of extensive datasets. They offer the most recent and proper scientific names of the taxonomic group of interest, often accompanying guides for identification (e.g., species keys and/or photographic information) (Goh and Chou 1996, Bruno et al. 2005), taxonomic revisions (Wells 2007), and reports of new taxa (Lee 2010).

Meantime, such checklists may also serve as starting points for other scientific disciplines (Hendrickx 1995, Goh and Chou 1996, Majka and Sikes 2009). First, many checklists aim to contribute to knowledge about biodiversity (Bertini et al. 2004, Minton and Perez 2005, Majka and Sikes 2009, Alper et al. 2010, Ryu et al. 2012, Taheri et al. 2012) which has become an important global issue. Datasets of checklists are also used to obtain a deeper understanding of ecological issues, e.g., biogeography (Almeida and Coelho 2008) and speciation (Emerson 2005). Conservation biology is another discipline in which the acquisition and understanding of such databases might be essential (Graening et al. 2007). Furthermore, faunal checklists may be important and practical tools in other environmental sciences, for example, species lists must first be consulted for the development of experimental

*To whom correspondence and reprint requests should be addressed. Sung Joon Song and Jinsoon Park contributed equally to this work. Tel: 82-2-8806750. Fax: 82-2-8720311. E-mail:jskocean@snu.ac.kr

organisms from local fauna by ecotoxicologists, along with information about the ecological spectrum of target species (Römbke et al. 2010). Species lists may also be used as baseline data in the disciplines of environmental monitoring and environmental policy, in terms of understanding contemporary changes in local faunal compositions (Møller et al. 2010). Finally, access to comprehensive faunal checklists is an important component of environmental management to determine the appropriate strategy for species protection at local and regional scales (Majka and Sikes 2009).

However, to our understanding, the majority of faunal checklists might not meet the expectations of scientists from disciplines other than taxonomy. The reason for this is that information regarding species ecology (i.e., habitat, substratum, or salinity ranges) is often limited or even missing (Takeuchi 1999, Graening et al. 2007, Clark et al. 2008). Such omissions may be due to the highly specialized focus of faunal taxonomists. Hence, the inclusion of detailed ecological data in traditional faunal checklists may improve the quality of the classical content and extend the limited utility across a broad range of scientific disciplines.

The classification of harpacticoids in Korea exemplifies a group that requires the consolidation of taxonomic and ecological information. In Korea, studies on marine and brackish-water harpacticoids were pioneered by ecologists in the 1980s (Shim and Ro 1982, Kim and Huh 1983). However, taxonomic information in these initial efforts was limited. For example, systematic drawings and/or taxonomic comments were not provided for some marine plankton in those studies. Yeatman (1983) compiled the 1st taxonomic work of Korean harpacticoids, reporting the presence of *Tigriopus californicus* (Baker 1912). However, a later study (Song and Chang 1993) concluded this to be a misidentification of *T. japonicus* (Mori 1938), based on the original description and figures of the P4 exopod-3. Of note, Ho and Hong (1988) provided the 1st description of 2 new species from the southeastern coast of Korea (*Amenophia orientalis* and *Parathalestris infestus*), which cause pinhole disease on brown seaweed *Undaria finnatifida*.

Later, in the 1990s, several investigations of free-living benthic Korean harpacticoids in association with marine algae contributed towards improving taxonomic knowledge of this group (Song and Chang 1993 1995, Yoo and Lee 1993, Chang and Song 1995 1997a b, Kim and Kim 1997a, Song and Yun 1999, Song et al. 1999 2010). Of those studies, Kim and Kim (1997a) investigated the relationship between porcellid harpacticoid copepods and marine macroalgae (ecological aspects), with detailed descriptions of species belonging to the genus *Porcellidium* (taxonomic view). Invertebrate-associated harpacticoid copepods were also reported in the Korean fauna, including several indigenous species. For example, a number of species associations were recorded with isopod-infested wood, hermit crabs, and sea cucumbers (Kim 1991 1998, Kim and Kim 1996 1997b 1998). In 2000-2010, the interests of harpacticoid taxonomists further expanded into brackish-water environments, and a series of studies on brackish-water harpacticoids were carried out in estuaries and brackish lagoons (Lee and Chang 2003 2005 2007 2008a-c, Chang 2007 2008 2009). Still ongoing is the discovery of new species, as illustrated by recent studies of marine harpacticoids (Cho et al. 2010, Back and Lee 2011 2012, Kim et al. 2011a, Karanovic and Cho 2012).

Overall, earlier studies of Korean marine and brackish-water harpacticoids conveyed extensive taxonomic information. However, detailed ecological data were often provided implicitly or were even missing from the survey literature, possibly due to limited space, interest, or data availability. For instance, habitats of many species were described as ‘estuarine’ or ‘coastal’ (Song and Chang 1993, Lee and Chang 2007), which is too general for practical use. It should also be noted that the salinities of sampling sites are mostly not provided, even for brackish-water species (Chang 2007). This observation is particularly notable in terms of habitat and substratum, for which ambiguous and/or improper terms have occasionally been used, possibly due to the inattention of some taxonomists to the exact use of ecological/oceanographic terms or the mistranslation of Korean terms into English. For example, the terminology of ‘ditch’ and ‘swamp’, which are mainly used for freshwater areas, was applied to marine and brackish-water environments (Chang 2009).

While the provision of exact and extensive ecological data may be considered unnecessary in taxonomic studies, it can provide useful background information and hence be a practical tool for the fields of ecology, conservation biology, environmental sciences, and even fisheries management (Goh and Chou 1996, Almeida and Coelho 2008, Majka and Sikes 2009, Huang et al.

2012). Thus, in the present study, we performed a detailed literature review, incorporating both taxonomic and ecological aspects, to compile the 1st comprehensive faunal checklist of Korean marine and brackish-water harpacticoid copepods. In addition, the regional biogeographic distribution of Korean marine and brackish-water harpacticoids is presented. We also compared the biodiversity of the copepod fauna of South Korea with other regions around the world, particularly the Pacific Ocean (Japan and North America), the Caribbean Sea, and the British Isles.

MATERIALS AND METHODS

Data collection

Data from all of the 46 peer-reviewed publications on the taxonomy of Korean marine and brackish-water harpacticoid copepods were gathered and assimilated. Twenty-eight studies from the literature were included on free-living benthic harpacticoids (Ho and Hong 1988, Song and Chang 1993 1995, Yoo and Lee 1993, Chang and Song 1997a b, Kim and Kim 1997a, Song and Yun 1999, Song et al. 1999 2001 2003 2007a 2007b, Lee 2003, Nam and Lee 2005 2006 2012, Lee et al. 2007, Back and Lee 2010 2011 2012, Back et al. 2011, Cho et al. 2011, Kim et al. 2011a b, Park and Lee 2011, Karanovic and Cho 2012, Park et al. 2012) and 4 studies in the literature on invertebrate-associated harpacticoids (Kim and Kim 1996 1997b 1998, Kim 1998). In addition, 14 ecological surveys of planktonic harpacticoids from marine and brackish-water habitats were also included (Shim and Ro 1982, Kim and Huh 1983, Chang and Kim 1991, Lee and Chang 2003 2005 2007 2008a-c, Huys et al. 2005, and Chang 2007 2008 2009), along with a report of a new Korean planktonic harpacticoid (Cho et al. 2010).

Species are listed alphabetically in accordance with taxonomic hierarchy, which is followed by ecological information, including habitat, substratum, salinity, lifestyle, and size range (Table 1). Corresponding references are presented after this information. In particular, a number of ambiguous and/or implicit terms shown in the ecological data were refined and specified by 1) a thorough context-based examination of the published literature, 2) additional research on the corresponding species and localities from other sources (e.g., from the published literature, the Internet, etc.), and 3) personal communication with the original authors. It should be noted that the taxonomy and nomenclature of harpacticoid copepods in the present checklist (Table 1) followed the comprehensive work of Huys (2009) and others (Melville 1985, Huys 1990, Huys and Conroy-Dalton 2000, Willen 2000, Seifried 2003).

Data analysis

To improve our understanding of the regional distribution of Korean marine and brackish-water harpacticoid copepods, Korean coastal areas were divided into 8 regions (Fig. 1). These regions were modified from 10 administrative districts for coastal management, which were established by the Korean Ministry of Maritime Affairs and Fisheries, and are primarily based on geographic scales. Briefly, the East Sea (east coast) was divided into 2 regions (east-central and east-south); the Yellow Sea (west coast) was also divided into 2 regions (west-central and west-south); and finally the southern coast was divided into 4 regions (southwest, south-central, southeast, and Jeju Island) (Fig. 1). Subsequently, species localities in each district were investigated through a literature survey.

For comparative purposes with other reported checklists worldwide, the following manuscripts, books, and websites were referred to: Huys et al. (1996), Suarez-Morales et al. (2006), Wells (2007), a Japanese checklist (http://home.hiroshima-u.ac.jp/fishlab), and a Californian checklist (http://www.fish.washington.edu/people/cordell/species_list.htm).

RESULTS

Faunal characteristics

The list includes 88 marine and brackish-water harpacticoid copepods, belonging to 23 families and 58 genera. In terms of genera, the families Miraciidae and Thalestridae were found to be the most diverse groups (11 genera each), followed by the Harpacticidae (8), Porcellidiidae (8), Peltidiidae (6), Ameiridae (5), Laophontidae (5), Canthocamptidae (4), Tachidiidae (4), Cletodidae (3), Dactylopusiidae (3), and Pseudotachidiidae (3). There are 10 families represented by only 1 or 2 species. The most speciose genera were *Porcellidium* (7 species) and *Parathalestris* (7 species), followed by *Ameira* (3 species) and *Harpacticus* (3 species). The remaining genera comprised only 1 or 2 species.

It was possible to divide the species into 3 groups based on habitat, specifically, planktonic, free-living benthic, and invertebrate-associated benthic species (Fig. 2A). Out of the 88 species identified from previous records, 75 species (ca. 85%) were free-living benthic taxa, which had mainly been collected from macroalgae, sand, and pebbles. Seven species of harpacticoid were identified from a diverse number of marine invertebrates. Furthermore, the Korean fauna of marine and brackish-water harpacticoid copepods could also be divided into 4 groups based on salinity ranges (Fig. 2B). Of the 88 species, 69 were marine, 14 brackish-marine, and just 4 were freshwater-brackish species. Thus, it appears that the Korean harpacticoid copepod fauna is primarily represented by free-living benthic taxa, with research having been focused in marine and semi-marine environments.

Checklist details

The list of 88 Korean marine and brackish-water harpacticoid copepods is presented in alphabetical order (Table 1) along with the

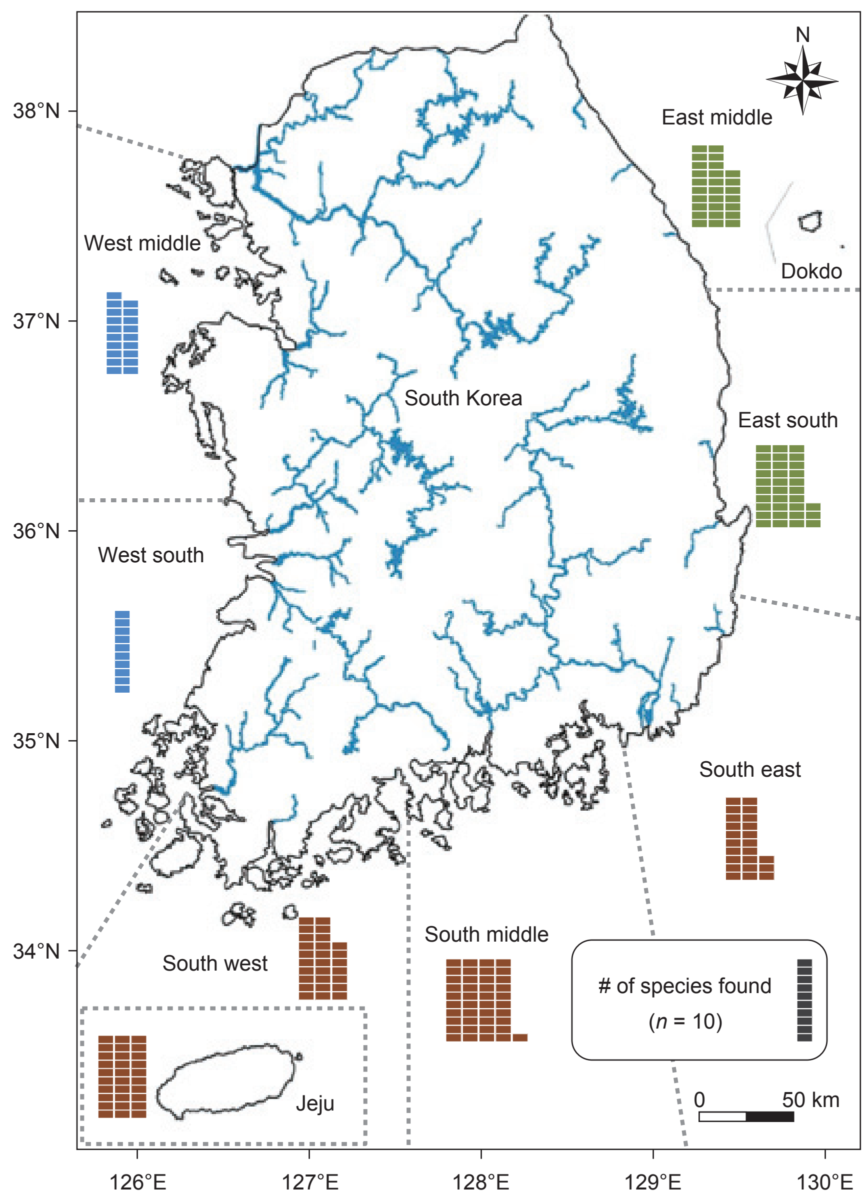

Fig. 1. Map of the study area in Korea and the total number of Korean harpacticoid copepods recorded in each region. The Korean coastal areas were categorized into 3 coastlines (west, south, and east) and further divided into 8 regions.

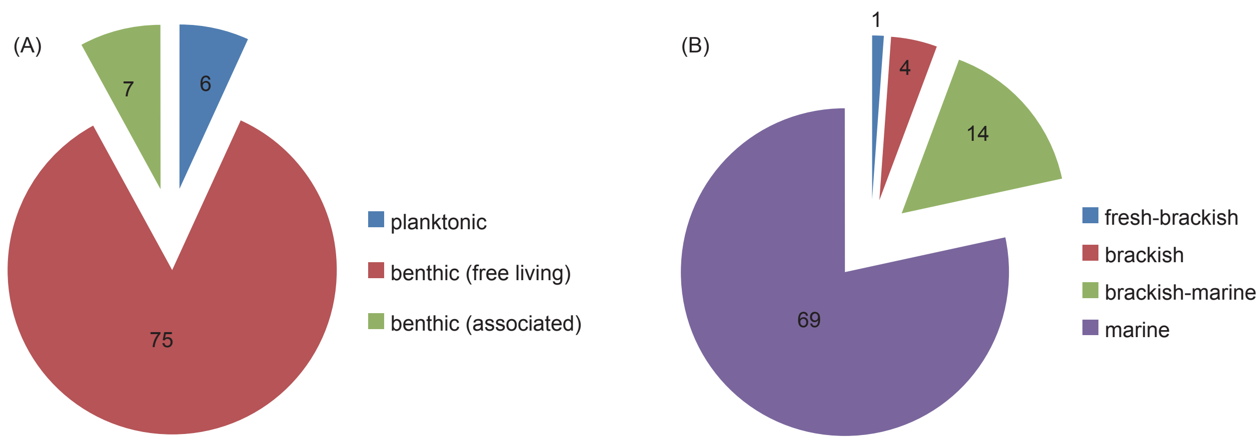

Fig. 2. Characteristics of Korean harpacticoid copepods in terms of (A) habitat categorized into 3 groups of planktonic, free-living benthic, and invertebrate-associated benthic forms and (B) salinity ranges categorized into 4 groups of freshwater-brackish, brackish, brackish-marine, and marine.

Table 1. Ecological checklist of Korean marine and brackish harpacticoid copepods, with detailed ecological data for each taxon

Family / Genus / Species	Body size (µm)	Ecological data: Occurrence (# of sites) west	south	east	Habitats (sampling areas)	Substratum (materials)	Salinity (category)	Life style (category)	References
Family Ameiridae Monard, 1927									
Genus *Ameira* Boeck, 1865									
Ameira parvula (Claus, 1886)	F: 500-600 M: 400-500		4	1	stream mouth, salt marsh, brackish lake	sand	brackish-marine	free-living benthic	Chang 2007
Ameira zahaae Karanovic and Cho, 2012	F: 448 M: 442	1			intertidal zone	mud	marine	free-living benthic	Karanovic and Cho 2012
Ameira kimchi Karanovic and Cho, 2012	F: 442-452 M: 430		1		littoral (33 m)	-	marine	free-living benthic	Karanovic and Cho 2012
Genus *Nitocra* Boeck, 1865									
Nitocra koreanus Chang, 2007	F: 720-830 M: 630	1	4	6	coastal well, estuary, lagoon, coastal marsh, [1]swamp	-	brackish-marine	free-living benthic	Chang 2007
Genus *Pseudameira* Sars, 1911									
Pseudameira mago Karanovic and Cho, 2012	F: 412-427		1		littoral (33 m)	-	marine	free-living benthic	Karanovic and Cho 2012
Family Canthocamptidae Brady, 1880									
Genus *Hetoropsyllus* T. Scott, 1984									
Heteropsyllus coreanus Nam and Lee, 2006	F: 362-459 M: 258-306	1	4		sublittoral (35-159 m)	mostly muddy sand	marine	free-living benthic	Nam and Lee 2006
Genus *Itunella* Brady, 1896									
Itunella arenaria Lee and Chang, 2008	F: 460 ± 30 M: 378 ± 20			3	estuary, coastal well, beach	sand dune	brackish	free-living benthic	Lee and Chang 2008a
Genus *Mesochra* Boeck, 1864									
Mesochra alaskana Wilson, 1958	F: 430-510 M: 390-460			3	stream mouth, [1]swamp	-	brackish	free-living benthic	Lee and Chang 2003
Mesochra bisetosa Lee and Chang, 2008	F: 740 ± 30 M: 680 ± 20	2			mouth of stream	muddy sand	brackish	free-living benthic	Lee and Chang 2008a
Family Canuellidae Lang, 1944									
Genus *Scottolana* Por, 1967									
Scottolana bulbifera (Chislenko, 1971)	F: 800 M: 810	1	1		subtidal	mud, sandy mud	marine	free-living benthic	Park and Lee 2011
Genus *Sunaristes* Hesse, 1867									
Sunaristes japonicus Ho, 1986	F: 2550 M: 2200			2	-	invertebrate	marine	invertebrate-associated	Kim 1998
Family Cletodidae T. Scott, 1904									
Genus *Kollerua* Gee, 1994									
Kollerua longum (Shen and Tai, 1979)	F: 444-447 M: 418-428		2		estuarine delta, reed marsh	-	brackish-marine	free-living benthic	Lee and Chang 2007
Genus *Limnocletodes* Borutsky, 1926									
Limnocletodes angustodes Shen and Tai, 1963	F: 510-530		2		estuary, salt marsh	-	brackish-marine	free-living benthic	Lee and Chang 2007
Limnocletodes behningi Borutzky, 1926	F: 429-475 M: 366-401	2	3	1	estuary, estuarine delta, salt marsh	-	brackish-marine	free-living benthic	Lee and Chang 2007
Family Dactylopusiidae Lang, 1936									
Genus *Dactylopusia* Norman, 1903									

Table 1. (Continued)

Family		Ecological data							References
Genus	Body size (μm)	Occurrence (# of sites)			Habitats (sampling areas)	Substratum (materials)	Salinity (category)	Life style (category)	
Species		west	south	east					
Dactylopusia falcifera Willey, 1935	F: 640 M: 610		1	3	littoral rocky shore	macroalgae on rock bottom	marine	free-living benthic	Song et al. 2001
Dactylopusia pauciarticulata Chang and Song, 1997	F: 560-620	1	4	5	sublittoral, rocky shore	macroalgae	marine	free-living benthic	Chang and Song 1997a
Genus *Paradactylopodia* Lang, 1944									
Paradactylopodia koreana Chang and Song, 1997	F: 560-620	1	3	6	sublittoral	macroalgae on sand/rock bottom	marine	free-living benthic	Chang and Song 1997a
Family Darcythompsoniidae Lang, 1936									
Genus *Leptocaris* T. Scott, 1899									
Leptocaris brevicornis (van Douwe, 1905)	F: 574-645 M: 530 ± 20		5		estuary, salt marsh	sandy mud	brackish-marine	free-living benthic	Lee and Chang 2008b
Leptocaris trisetosus pacificus Lee and Chang, 2008	F: 689-753 M: 640 ± 20		2		estuary, salt marsh	-	brackish-marine	free-living benthic	Lee and Chang 2008b
Family Ectinosomatidae Sars, 1903									
Genus *Microsetella* Brady and Robertson, 1873									
Microsetella norvegica (Boeck, 1865)	-	1	2		open ocean (surface layer, bottom layer)	-	marine	planktonic	Kim and Huh 1983; Shim and Ro 1982
Microsetella rosea (Dana, 1848)	-	1			open ocean (surface layer)	-	marine	planktonic	Kim and Huh 1983
Family Hamondiidae Huys, 1990									
Genus *Ambunguipes* Huys, 1990									
Ambunguipes rufocincta (Brady, 1880)	-		1	4	[2]intertidal/subtidal zone	macroalgae	marine	free-living benthic	Song et al. 1999
Family Harpacticidae Dana, 1846									
Genus *Harpacticella* Sars, 1908									
Harpacticella itoi Chang and Kim, 1991	F: 650 M: 530		4	2	estuary, river mouth, [3]spring on the beach	sand, pebble	fresh-brackish	free-living benthic	Chang and Kim 1991; Song and Chang 1993
Harpacticella oceanica Ito, 1977	F: 710		5	1	sand beach	sand	marine	free-living benthic	Song and Chang 1993; Song and Chang 1995
Genus *Harpacticus* Milne Edwards, 1840									
Harpacticus compsonyx Monard, 1926	-			1	[2]beach	[2]sand	marine	free-living benthic	Song and Chang 1993
Harpacticus nipponicus Ito, 1976	F: 680		6	1	[2]subtidal zone	[2]macroalgae on rock bottom	marine	free-living benthic	Song and Chang 1993; Song and Chang 1995
Harpacticus uniremis Kroyer, 1842	-	7	5	6	[2]tidal flat, [2]subtidal zone, water column	[2]macroalgae on rock bottom	marine	free-living benthic	Kim and Huh, 1983; Song and Chang, 1993
Genus *Tigriopus* Norman, 1868									
Tigriopus japonicus Mori, 1938	F: 1040-1160 M: 1030-1050	2	1	1	[2]rocky shore, [2]splash zone	[2]rock bottom	marine	free-living benthic	Song and Chang 1993; Yeatman 1983 as *T. californicus*
Genus *Zaus* Goodsir, 1845									
Zaus robustus Ito, 1974	F: 530 M: 490			3	[2]intertidal/subtidal zone	[2]macroalgae on rock bottom	marine	free-living benthic	Song and Chang 1993
Zaus unisetosus Ito, 1974	F: 540 M: 450		8	10	[2]intertidal/subtidal zone	[2]macroalgae on rock bottom	marine	free-living benthic	Song and Chang 1993; Song and Chang, 1995
Family Laophontidae T. Scott, 1905									
Genus *Apolethon* Wells, 1967									
Apolethon articulatus Lee and Chang, 2008	F: 503 ± 32 M: 462 ± 30		3	1	coastal marsh, reed marsh, estuary, lagoon	muddy sand	brackish-marine	free-living benthic	Lee and Chang 2008c
Genus *Microchelonia* Brady, 1918									
Microchelonia koreensis (Kim, 1991)	F: 502 M: 379	1	1	1	-	invertebrate	marine	invertebrate-associated	Kim 1991; Kim 1998
Genus *Onychocamptus* Daday, 1903									
Onychocamptus bengalensis (Sewell, 1934)	-		3		mudflat	mud	marine	free-living benthic	Lee and Chang 2005; Song and Chang 1995
Onychocamptus vitiospinulosa (Shen and Tai, 1963)	F: 535-546 M: 480		2		estuary, reed marsh	-	brackish-marine	free-living benthic	Lee and Chang 2005
Genus *Quinquelaophonte* Wells, Hicks and Coull, 1982									
Quinquelaophonte koreana Lee, 2003	F: 579 ± 800 M: 554-729	1			sandy beach	sand	marine	free-living benthic	Lee 2003
Family Louriniidae Monard, 1927									
Genus *Lourinia* Wilson, 1924									
Lourinia armata (Claus, 1866)	F: 750-950 M: 830-950		1	1	open ocean, coastal area	macroalgae	marine	free-living benthic	Yoo and Lee 1993
Family Miraciidae Dana, 1846									
Genus *Amonardia* Lang, 1944									
Amonardia coreana Song et al., 2007	F: 1043.6 M: 914.3		1		*Undaria* farm	macroalgae	marine	free-living benthic	Song et al. 2007a
Amonardia normani (Brady, 1872)	-		4		[2]mudflat	macroalgae	marine	free-living benthic	Song and Chang 1995
Genus *Amphiascoides* Nicholls, 1941									
Amphiascoides coreanus Lee et al., 2007	F: 429-536 M: 353-459		2		beach	presumably sand	marine	free-living benthic	Lee et al. 2007

Table 1. (Continued)

Family / Genus / Species	Body size (μm)	Occurrence (# of sites) west	south	east	Habitats (sampling areas)	Substratum (materials)	Salinity (category)	Life style (category)	References
Genus *Dactylopodamphiascopsis* Lang, 1944									
Dactylopodamphiascopsis latifolius (Sars, 1909)	-			5	[2]subtidal zone	macroalgae on rock bottom	marine	free-living benthic	Song et al. 1999
Genus *Diosaccus* Boeck, 1872									
Diosaccus ezoensis Ito, 1974	-		3	3	[2]subtidal zone	macroalgae on rock bottom	marine	free-living benthic	Song et al. 1999
Genus *Macrosetella* A. Scott, 1909									
Macrosetella glacilis (Dana, 1847)	-		2		open ocean (surface and bottom layer)	-	marine	free-living benthic	Shim and Ro 1982
Genus *Onychostenhelia* Ito, 1979									
Onychostenhelia bispinosa Huys and Mu, 2008	F: 723 M: 581	1	1		subtidal	mud	marine	free-living benthic	Kim et al. 2011b
Genus *Sarsamphiascus* Huys, 2009									
Sarsamphiascus kawamurai (Ueda and Nagai, 2005)	F: 630-720 M: 530			2	lagoon, coastal marsh, tidal pool	-	brackish-marine	free-living benthic	Chang 2009a
Genus *Schizopera* Sars, 1905									
Schizopera clandestina Klie, 1924	F: 580-670	1	7	3	lagoon, well at salt farm, salt marsh, estuary, estuarine marsh, [4]ditch	-	brackish-marine	free-living benthic	Chang 2009a
Schizopera neglecta Akatova, 1935	F: 620	1	7	2	reed marsh, lagoon, estuary, harbor, coastal [1]swamp and [4]ditch, cave	-	brackish-marine	free-living benthic	Chang 2009a
Genus *Sinamphiascus* Mu and Gee, 2000									
Sinamphiascus dominatus Mu and Gee, 2000	F: 370-540 M: 270-360	1	1		sublittoral (40-130 m)	sand, muddy sand	marine	free-living benthic	Nam and Lee 2012
Family Nannopodidae Brady, 1880									
Genus *Huntemannia* Poppe, 1884									
Huntemannia doheoni Song et al., 2007	F: 580-760 M: 640-1170	2	1		muddy sand flat	muddy sand	marine	free-living benthic	Song et al. 2007b
Family Orthopsyllidae Huys, 1990									
Genus *Orthopsyllus* Brady and Robertson, 1873									
Orthopsyllus cf. *linearis* (Claus, 1866)	-		1		intertidal, subtidal	macroalgae	marine	free-living benthic	Park et al. 2012
Family Paramesochridae Lang, 1944									
Genus *Apodopsyllus* Huys, 2009									
Apodopsyllus gwakjiensis Back and Lee, 2012	F: 550 M: 510		1		subtidal	sand	marine	free-living benthic	Back and Lee 2012
Apodopsyllus unisetosus Back and Lee, 2012	F: 655 M: 600		1		subtidal	sand	marine	free-living benthic	Back and Lee 2012
Genus *Paramesochra* Scott, 1892									
Paramesochra taeana Back and Lee, 2010	F: 331 M: 277	1			subtidal (33-35 m) zone	sandysediment	marine	free-living benthic	Back and Lee 2010
Genus *Remanea* Klie, 1929									
Remanea naksanensis Back et al., 2011	F: 553 M: 498			1	a brackish stream near a sandy beach	sand	brackish	free-living benthic	Back et al. 2011
Family Parastenheliidae Lang, 1936									
Genus *Parastenhelia* Thompson and A. Scott, 1903									
Parastenhelia pyriformis Song et al., 2003	F: 382-388 M: 332-354	1	1		subtidal zone	macroalgae on [2]sand bottom	marine	free-living benthic	Song et al. 2003
Family Peltidiidae Boeck, 1873									
Genus *Alteutha* Baird, 1845									
Alteutha depressa (Baird, 1837)	-		4		[2]subtidal zone	[2]macroalgae on rock bottom	marine	free-living benthic	Song and Chang 1995
Genus *Alteuthoides* Hicks, 1986									
Alteuthoides affinis Kim and Kim, 1998	F: 760-890 M: 580-650		1		sublittoral zone	invertebrate	marine	invertebrate-associated	Kim and Kim 1998
Genus *Clytemnestra* Dana, 1848									
Clytemnestra scutellata Dana, 1849	-		2		open ocean (surface and bottom layer)	-	marine	planktonic	Shim and Ro 1982
Genus *Goniopsyllus* Brady, 1883									
Goniopsyllus rostrata Brady, 1883	-		1		open ocean (surface and bottom layer)	-	marine	planktonic	Shim and Ro 1982
Goniopsyllus dokdoensis Cho et al., 2010	F: 820-915 M: 960			1	open ocean (~200 m)	-	marine	planktonic	Cho et al. 2010
Genus *Peltidium* Philippi, 1839									
Peltidium quinquesetosum Song and Yun, 1999	F: 1860 M: 1290		2	1	sublittoral zone	macroalgae on rock bottom	marine	free-living benthic	Song and Yun 1999
Family Porcellidiidae Boeck, 1865									
Genus *Kushia* Harris and Iwasaki, 1996									
Kushia gamoi Harris and Iwasaki, 1996	-		4	2	shallow sublittoral	macroalgae	marine	free-living benthic	Kim and Kim 1997a as *Porcellidium gamoi*
Genus *Porcellidium* Claus, 1860									
Porcellidium acutum Kim and Kim, 1997	F: 908 M: 742		1	1	shallow sublittoral	macroalgae	marine	free-living benthic	Kim and Kim 1997a
Porcellidium bipartitum Kim and Kim, 1997	F: 1710 M: 1050		1		shallow sublittoral	macroalgae	marine	free-living benthic	Kim and Kim 1997a

Table 1. (Continued)

Family / Genus / Species	Body size (μm)	Occurrence (# of sites) west	south	east	Habitats (sampling areas)	Substratum (materials)	Salinity (category)	Life style (category)	References
Porcellidium brevicaudatum Thompson and A. Scott, 1903	F: 680 ± 30 M: 500 ± 30		1		-	invertebrate	marine	invertebrate-associated	Kim and Kim 1996
Porcellidium brevicavum Kim and Kim, 1997	F: 735 M: 623		1		shallow sublittoral	macroalgae	marine	free-living benthic	Kim and Kim 1997a
Porcellidium ofunatense Harris and Iwasaki, 1996	-		3	2	shallow sublittoral	macroalgae	marine	free-living benthic	Kim and Kim 1997a
Porcellidium similis Kim and Kim, 1996	F: 760 M: 500 ± 30		2	3	-	invertebrate	marine	invertebrate-associated	Kim and Kim 1996
Porcellidium wandoensis Kim and Kim, 1997	F: 763 M: 616		2	1	shallow sublittoral	macroalgae	marine	free-living benthic	Kim and Kim 1997a
Family Pseudotachidiidae Lang, 1936									
Genus *Pseudonsiella* Hicks, 1988									
Pseudonsiella longicaudata Kim and Kim, 1997	F: 630 M: 570			1	-	invertebrate	marine	invertebrate-associated	Kim and Kim 1997b
Genus *Sentiropsis* Huys and Gee, 1996									
Sentiropsis coreana Kim et al., 2011	F: 550 M: 530			1	upper sublittoral (2-3 m)	sand	marine	free-living benthic	Kim et al. 2011a
Genus *Xylora* Hicks, 1988									
Xylora longiantennulata Kim and Kim, 1997	F: 750-820 M: 640-710			1	-	invertebrate	marine	invertebrate-associated	Kim and Kim 1997b
Family Rhizothricidae Por, 1986									
Genus *Rhizothrix* Sars, 1909									
Rhizothrix sejongi Nam and Lee, 2005	F: 513-701 M: 416-555		1		beach	sand	marine	free-living benthic	Nam and Lee 2005
Family Tachidiidae Boeck, 1865									
Genus *Euterpina* Norman, 1903									
Euterpina acutifrons Dana, 1847	F: 500-750 M: 500-560	1	1		open ocean (surface layer)	-	marine	planktonic	Kim and Huh 1983; Cho et al. 2011
Genus *Neotachidius* Shen and Tai, 1963									
Neotachidius coreanus Huys et al., 2005	F: 690 ± 40 M: 600 ± 40		1		river mouth, reed marsh	mud	brackish-marine	free-living benthic	Huys et al. 2005
Neotachidius parvus Huys et al., 2005	F: 500 ± 30 M: 450 ± 30	2	12		brackish lake, salt marsh, estuary, reed marsh, [1]swamp, [4]ditch	mud	brackish-marine	free-living benthic	Chang 2008; Huys et al. 2005; Song and Chang 1995 as *Tachidius triangularis*
Genus *Tachidius* Lilljeborg, 1853									
Tachidius discipes Giesbrecht, 1881	-		2	1	mudflat, Lagoon	mud	marine	free-living benthic	Chang 2008; Song and Chang 1995
Family Thalestridae Sars, 1905									
Genus *Amenophia* Boeck, 1865									
Amenophia orientalis Ho and Hong, 1988	-		1		-	macroalgae	marine	free-living benthic	Ho and Hong 1988
Genus *Eudactylopus* A Scott, 1909									
Eudactylopus andrewi Sewell, 1940	-		3	1	[2]sublittoral zone	[2]macroalgae on rock bottom	marine	free-living benthic	Chang and Song 1995
Eudactylopus spectabilis (Brian, 1923)	F: 1350 M: 1520		4	8	[2]sublittoral zone	[2]macroalgae on rock bottom	marine	free-living benthic	Chang and Song 1995
Genus *Parathalestris* Brady and Robertson, 1873									
Parathalestris areolata Ito, 1972	-	1	2	2	marina, [2]sublittoral zone	macroalgae	marine	free-living benthic	Chang and Song 1997b; Back and Lee 2011
Parathalestris bulbiseta Lang, 1965	-	1	3	8	[2]sublittoral zone	[2]macroalgae on rock bottom	marine	free-living benthic	Chang and Song 1997b
Parathalestris infestus Ho and Hong, 1988	-		3	1	beach, [2]subtidal zone	macroalgae	marine	free-living benthic	Chang and Song 1997b; Ho and Hong 1988; Back and Lee 2011
Parathalestris pacificus Chislenko, 1971	-		2	1	[2]subtidal zone	[2]macroalgae on rock bottom	marine	free-living benthic	Chang and Song 1997b
Parathalestris parviseta Chang and Song, 1997	F: 1180 M: 860-900		2		[2]subtidal zone	[2]macroalgae on rock bottom	marine	free-living benthic	Chang and Song 1997b
Parathalestris verrucosa Ito, 1970	-		2	1	[2]subtidal zone	[2]macroalgae on rock bottom	marine	free-living benthic	Chang and Song 1997b
Parathalestris jejuensis Song and Hwang, 2010	F: 1225-1423		1		[2]subtidal zone	[2]macroalgae on rock bottom	marine	free-living benthic	Song and Hwang 2010
Genus *Phyllothalestris* Sars, 1905									
Phyllothalestris sarsi Sewell, 1940	F: 1100 M: 760	1	3	1	littoral rocky shore	macroalgae	marine	free-living benthic	Song et al. 2001
Family Tisbidae Stebbing, 1910									
Genus *Scutellidium* Claus, 1866									
Scutellidium longicauda acheloides Ito, 1976	-		2		[2]subtidal zone	[2]macroalgae on rock bottom	marine	free-living benthic	Song and Chang 1995

[1]the term ‘swamp’ seemingly represents the ‘tidal pool’ of the intertidal zone. [2]data was not provided in the corresponding literatures yet available through personal communcation with authors. [3]the phrase ‘spring on the beach’ seemingly represents coastal groundwater seepage. [4]the term ‘ditch’ seemingly represents ‘small tidal channel’ of the intertidal zone.

preferred habitat, substratum, salinity range, lifestyle, size range, and corresponding literature.

DISCUSSION

Faunal studies in Korea

Since Ho and Hong (1988) 1st described 2 new species (*Amenophia orientalis* and *Parathalestris infestus*) of the family Thalestridae, 88 harpacticoid copepods have been recorded in Korean marine and brackish waters, with 40 species (> 45%) being new to science; 2 in the 1980s, 14 in the 1990s, 17 in the 2000s, and 7 in the 2010s (Table 2). It is remarkable that 9 endemic species were added to the Korean fauna as new to science in 1997. Of these, 4 species belong to the family Porcellidiidae (Kim and Kim 1997a), 2 to the Thalestridae (Chang and Song 1997b), and 2 to the Pseudotachidiidae (Kim and Kim 1997b). Of additional note, invertebrate-associated marine harpacticoid copepods were extensively studied in the 1990s (Kim 1991 1998, Kim and Kim 1996 1997b), which was discontinued following the 2000s. Since 2000, a broader range of habitats (i.e., macroalgae, sand, mud, pebbles, and deep sea) has been investigated, with many new harpacticoid copepods being described, due to the strengthening of ecologically oriented research during this time.

Faunal distribution in Korea

Thirty-eight of the 88 harpacticoid species (about 40%) obtained from previous records appeared to be limited to just one of 8 coastal regions, while 20 species were found in 2 different regions (Fig. 3A). Furthermore, no species concurrently occurred throughout all 8 regions, and only 1 species occurred across 7 regions. However, it is unlikely that the majority of Korean marine harpacticoids are truly restricted to just a few localities. Rather, this observation may be attributed to the limited ecological information provided by authors in the taxonomic literature. Because the majority of these publications are solely taxonomic, ecological and/or biogeographical information is very limited. It should also be noted that faunistic studies of benthic harpacticoids are relatively rare.

Large-scale distribution patterns indicated that 71 of the 88 harpacticoid species were from the southern coast, including Jeju I., followed by the East Sea (46 species) and Yellow Sea (26 species) (Fig. 3B). Furthermore, the number of sites surveyed, where new taxa were reported, was the greatest on the southern coast (64 sites on the southern coast), followed by the East Sea (32 sites on the east coast) and the Yellow Sea (15 sites on the west coast) (Table 2). These records indicate the paucity of taxonomic research effort on the west coast of Korea, which encompasses a relatively well-developed intertidal flat (2880 km^2) along the shoreline (Sato and Koh 2004). In terms of co-occurrence, 34 species co-occurred on the southern coast and East Sea, while 21 species co-occurred on the southern coast and Yellow Sea. Only 12 species spanned all 3 seas (*Dactylopusia pauciarticulata*, *Harpacticus uniremis*, *Limnocletodes behningi*, *Microchelonia koreensis*, *Nitocra koreanus*, *Paradactylopodia koreana*, *Parathalestris areolata*, *P. bulbiseta*, *Phyllothalestris sarsi*, *Schizopera clandestina*, *S. neglecta*, and *Tigriopus japonicus*).

Faunal comparisons with other regions

The Korean fauna of marine and brackish-water harpacticoids was further compared to corresponding faunal assemblages from other regions (Table 3). A broad range of checklists was selected with comparable geographic scales to that of the Korean Peninsula, including Pacific regions (Japan and California, USA), Caribbean Sea, and northwestern Europe. Of note, the work of Wells (2007) was used as a reference because it includes the polyarthran families Longipediidae and Canuellidae, and encompasses approximately 4300 species or subspecies of 589 genera belonging to 56 families from across the world, with the provision of systematic identification keys to the specific or generic level.

Within the Pacific region, 142 species belonging to 29 families are listed in the checklist for Japan (http://home.hiroshima-u.ac.jp/fishlab), and 182 species belonging to 28 families are listed for the Californian coast, USA (http://www.fish.washington.edu/people/cordell/species_list.htm). The number of species recorded in either region was about double that recorded in Korea. The checklist for the Caribbean Sea also had a similar number of listed species to those of Japan and California, with 178 species belonging to 33 families. In the Caribbean, the most speciose families were the Miraciidae and Laophontidae, with the insular Caribbean being nearly as diverse as the continental areas. Furthermore,

Table 2. List of Korean marine and brackish harpacticoid copepods (new to science only, 40 species), with regional occurrence across the three coasts in Korea (see Fig. 1)

Year		Species	Occurrence (# of sites in corresponding regions)								References
			west coast		south coast				east coast		
			middle	south	west	Jeju	middle	east	south	middle	
1980s	88	*Amenophia orientalis*			1						Ho and Hong 1988
		Parathalestris infestus			1		2				Ho and Hong 1988
1990s	91	*Harpacticella itoi*			1	1	2		1	1	Chang and Kim 1991
		Microchelonia koreensis		1				1		1	Kim 1991
	96	*Porcellidium similis*			1	1		1	2		Kim and Kim 1996
	97	*Dactylopusia pauciarticulata*	1			2	1	1	5		Chang and Song 1997b
		Paradactylopodia koreana		1		2		1	5	1	Chang and Song 1997b
		Parathalestris parviseta				1	1				Chang and Song 1997a
		Porcellidium acutum					1			1	Kim and Kim 1997a
		Porcellidium bipartitum					1				Kim and Kim 1997a
		Porcellidium brevicavum					1				Kim and Kim 1997a
		Porcellidium wandoensis			1		1		1		Kim and Kim 1997a
		Pseudonsiella longicaudata								1	Kim and Kim 1997b
		Xylora longiantennulata								1	Kim and Kim 1997b
	98	*Alteuthoides affinis*				1					Kim and Kim 1998
	99	*Peltidium quinquesetosum*					2		1		Song and Yun 1999
2000s	03	*Parastenhelia pyriformis*	1			1					Song et al. 2003
		Quinquelaophonte koreana	1								Lee 2003
	05	*Neotachidius coreanus*					1				Huys et al. 2005
		Neotachidius parvus	2		4	2	5	1			Huys et al. 2005
		Rhizothrix sejongi					1				Nam and Lee 2005
	06	*Heteropsyllus coreanus*		1	1	2	1				Nam and Lee 2006
	07	*Amonardia coreana*						1			Song et al. 2007a
		Amphiascoides coreanus					2				Lee et al. 2007
		Huntemannia doheoni	2				1				Song et al. 2007b
		Nitocra koreanus	1		1	2	1		3	3	Chang 2007
	08	*Apolethon articulatus*					1	2		1	Leeand Chang 2008c
		Itunella arenaria							3		Lee and Chang 2008a
		Leptocaris trisetosus pacificus					1	1			Lee and Chang 2008b
		Mesochra bisetosa	1	1							Lee and Chang 2008a
	10	*Goniopsyllus dokdoensis*								1	Cho et al. 2010
		Paramesochra taeana	1								Back and Lee 2010
		Parathalestris jejuensis				1					Song and Hwang 2010
2010s	11	*Remanea naksanensis*								1	Back et al. 2011
		Sentiropsis coreana				1					Kim et al. 2011a
	12	*Apodopsyllus gwakjiensis*				1					Back and Lee 2012
		Apodopsyllus unisetosus				1					Back and Lee 2012
		Ameira zahaae	1								Karanovic and Cho 2012
		Ameira kimchi					1				Karanovic and Cho 2012
		Pseudameira mago					1				Karanovic and Cho 2012
Sub-total											
1980s			0	0	2	0	2	0	0	0	
1990s			1	2	3	8	10	4	15	6	
2000s			9	2	6	8	14	5	6	5	
2010s			1	0	0	0	2	0	0	0	
Total			15		64				32		

approximately 800 species belonging to 53 families have been described for the British Isles, the land mass of which is of a similar size to the Korean Peninsula, with most harpacticoid families occurring in this region. In the British Isles, the number of harpacticoid families is notably high (comprising 53 families), even after taking into account the fact that the compiled data include species reported from adjacent waters of up to 200 m deep around the British Isles.

Considering the short historical period in the taxonomic study of Korean harpacticoid copepods, the current list is expected to grow rapidly, and many previously unreported taxa are likely to be discovered when previously unexplored environments undergo detailed surveys. The number of Korean harpacticoid copepods is expected to be much greater than that of current records (88 species), based on the known biodiversity of harpacticoid copepods from other regions of the world, particularly considering the numbers reported from Pacific regions (142 species in Japan and 182 species in California).

The role of checklists

An informative checklist was developed through a critical reanalysis of existing taxonomic reports on Korean marine and brackish-water harpacticoid copepods. However, the absence and/or ambiguity of information provided in the corresponding literature constrained, to a certain extent, the potential usefulness of the present checklist to scientists from this and other disciplines. Following completion of the review, we suggest that future studies should take into consideration the following parameters: 1) the inclusion of ecological information, if any, including habitat, substratum, salinity, lifestyle, and size range, in the form of reader-friendly search data; 2) the careful use of specific terms, instead of coastal area, estuary, or marsh, rather clarifying

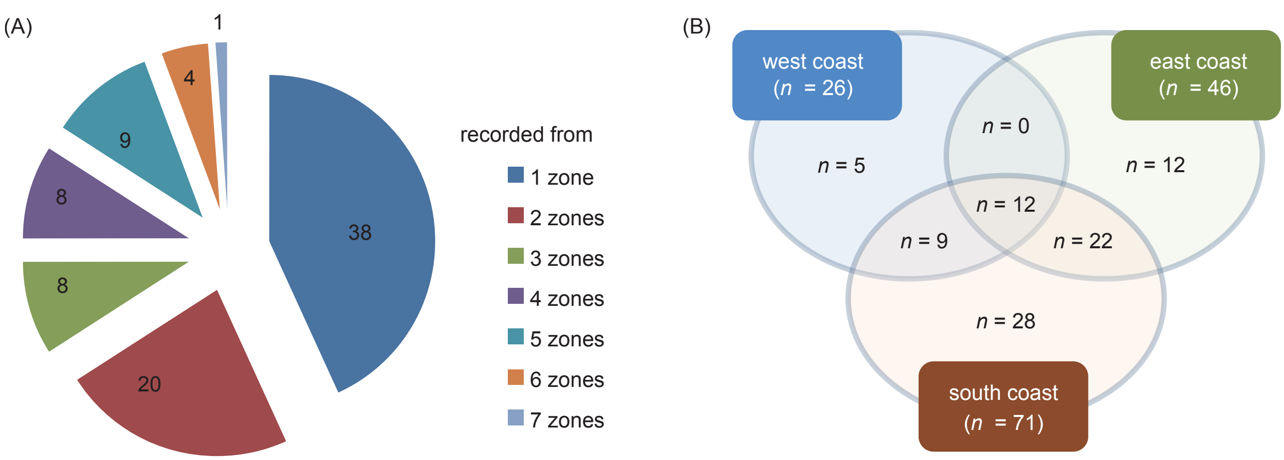

Fig. 3. Distributional characteristics of Korean harpacticoid copepods in terms of occurrence (A) across the 8 regions (= zones) and (B) across the 3 coasts (i.e., west, south, and east coasts) of Korea.

Table 3. Comparisons of Korean marine and brackish harpacticoid copepods with those reported from different regions of the world

Locality	Ratio of Species/Family	Reported number of			References
		Species	Genus	Family	
World	76.8	~4,300	589	56	Wells 2007
Northwestern Europe	15.1	~800	~190	53	Huys et al. 1996
California	6.5	182	101	28	http://www.fish.washington.edu/people/cordell/species_list.htm
Caribbean Sea	5.4	178	94	33	Suarez-Morales et al. 2006
Japan	4.9	142	76	29	http://home.hiroshima-u.ac.jp/fishlab
Korea	3.8	88	58	23	this study

upper intertidal or subtidal, mudflat or sandflat, low or high salinity, etc.; and finally 3) the proper use of relevant terms, by avoiding improper and/or arbitrary terms, such as swamp, ditch, tidal pool, and channel.

Acknowledgments: This work was supported by a National Research Foundation (NRF) grant funded by the Korean Government (MEST) (no. 2012-0001895). This work was also supported by the projects entitled "Development of Technology for CO_2 Marine Geological Storage" and "Oil Spill Environmental Impact Assessment and Environmental Restoration" funded by the Korean Ministry of Land, Transport, and Maritime Affairs given to Prof. J.S. Khim.

REFERENCES

Almeida AO, PA Coelho. 2008. Estuarine and marine brachyuran crabs (Crustacea: Decapoda) from Bahia, Brazil: checklist and zoogeographical considerations. Lat. Am. J. Aquat. Res. **36:** 183-222.

Alper A, S Karaytuğ, S Sak. 2010. Interstitial and phytal Harpacticoida (Crustacea: Copepoda) inhabiting the mediolittoral zone of the Datça-Bozburun Peninsulas (Muğla, Turkey). Süleyman Demirel Üniv. J. Sci. **5:** 16-28.

Back J, W Lee. 2010. A new species of the genus *Paramesochra* (Copepoda: Harpacticoida) from Korean waters. Proc. Biol. Soc. Wash. **123:** 47-61.

Back J, W Lee. 2011. Redescription of two species of *Parathalestris* (Copepoda, Harpacticoida, Thalestridae) in Korea. Bull. Natl. Inst. Biol. Res. **2:** 85-97.

Back J, W Lee. 2012. Two new species of *Apodopsyllus* (Copepoda, Harpacticoida) from Jeju Island, Korea. Zootaxa **3368:** 128-145.

Back J, W Lee, R Huys. 2011. A new species of *Remanea* Klie, 1929 (Copepoda: Harpacticoida: Paramesochridae) with a redescription of the type species. J. Nat. Hist. **45:** 2939-2964.

Baker CF. 1912. Notes on the Crustacea of Laguna Beach. Annu. Rep. Laguna Mar. Lab. **1:** 100-117.

Bertini G, A Fransozo, GAS Melo. 2004. Biodiversity of brachyuran crabs (Crustacea: Decapoda) from non-consolidated sublittoral bottom on the northern coast of São Paulo State, Brazil. Biodivers. Conserv. **13:** 2185-2207.

Bruno MC, JW Reid, SA Perry. 2005. A list and identification key for the freshwater free-living copepods of Florida (USA). J. Crust. Biol. **25:** 384-400.

Chang CY. 2007. Two harpacticoid species of genera *Nitokra* and *Ameira* (Harpacticoida: Ameiridae) from brackish waters in Korea. Integr. Biosci. **11:** 247-253.

Chang CY. 2008. Brackish-water copepods of the family Tachidiidae (Copepoda: Harpacticoida) from South Korea. Kor. J. Syst. Zool. **24:** 229-240.

Chang CY. 2009. Three miraciid copepods (Harpacticoida, Miraciidae) from South Korea. Kor. J. Syst. Zool. **25:** 215-225.

Chang CY, HS Kim. 1991. *Harpacticella itoi*, a new harpacticoid species from Korea (Copepoda: Harpacticoida: Harpacticidae). Kor. J. Sys. Zool. **7:** 73-80.

Chang CY, SJ Song. 1995. Marine harpacticoid copepods of genus *Eudactylopus* (Harpacticoida, Thalestridae) in Korea. Kor. J. Syst. Zool. **11:** 379-388.

Chang CY, SJ Song. 1997a. Two new thalestrid harpacticoids (Copepoda, Harpacticoida, Thalestridae) from Korea. Kor. J. Biol. Sci. **1:** 297-304.

Chang CY, SJ Song. 1997b. Marine harpacticoids of genus *Parathalestris* (Copepoda, Harpacticoida, Thalestridae) from Korea. Kor. J. Syst. Zool. **13:** 221-231.

Cho KH, WS Kim, W Lee. 2010. A new species of the genus *Goniopsyllus* Brady (Copepoda, Harpacticoida, Clytemnestridae) from Korean waters. Proc. Biol. Soc. Wash. **123:** 121-136.

Cho KH, DJ Lee, W Lee. 2011. Redescription of a planktonic copepod, *Euterpina acutifrons* (Harpacticoida; Euterpinidae) from Korea. Bull. Natl. Inst. Biol. Res. **2:** 76-84.

Clark PF, KLN Peter, HJMF Charles, AM Patsy, CD Peter, B Keiji. 2008. A checklist of Crustacea Decapoda collected from Conic Island cave and adjacent areas of Hong Kong. J. Nat. Hist. **42:** 913-926.

Emerson BC. 2005. Species diversity can drive speciation. Nature **434:** 1015-1017.

Goh NKC, LM Chou. 1996. An annotated checklist of the gorgonians (Anthozoa: Octocorallia) of Singapore, with a discussion of gorgonian diversity in the Indo-West Pacific. Raffles Bull. Zool. **44:** 435-459.

Graening GO, ME Slay, DB Fenolio, HW Robison. 2007. Annotated checklist of the Isopoda (subphylum Crustacea: class Malacostraca) of Arkansas and Oklahoma, with emphasis upon subterranean habitats. Proc. Okla. Acad. Sci. **87:** 1-14.

Hendrickx ME. 1995. Checklist of brachyuran crabs (Crustacea: Decapoda) from the eastern tropical Pacific. Bull. Inst. R. Sci. Nat. Belg. Biol. **65:** 125-150.

Ho JS, JS Hong. 1988. Harpacticoid copepods (Thalestridae) infesting the cultivated wakame (brown alga, *Undaria pinnatifida*) in Korea. J. Nat. Hist. **22:** 1623-1637.

Huang LL, ZQ Wu, JH Li. 2012. Fish fauna, biogeography and conservation of freshwater fish in Poyang Lake Basin, China. Environ. Biol. Fish. (in press)

Huys R. 1990. A new harpacticoid copepod family collected from Australian sponges and the status of the subfamily Rhynchothalestrinae Lang. Zool. J. Linn. Soc. **99:** 51-115.

Huys R. 2009. Unresolved cases of type fixation, synonymy and homonymy in harpacticoid copepod nomenclature (Crustacea: Copepoda). Zootaxa **2183:** 1-99.

Huys R, S Conroy-Dalton. 2000. Generic concepts in the Clytemnestridae (Copepoda, Harpacticoida), revision and revival. Bull. Nat. Hist. Mus. Lond. (Zool.) **66:** 1-48.

Huys R, JM Gee, CG Moore, R Hamond. 1996. Marine and brackish water harpacticoid copepods. Part 1. Keys and notes for identification of the species. *In* RSK Barnes, JH Crothers, eds. Synopses of the British fauna, new series 51. Shrewsbury, U.K.: Field Studies Council.

Huys R, S Ohtsuka, S Conroy-Dalton, Y Kikuchi. 2005. Description of two new species of *Neotachidius* Shen and Tai, 1963 (Copepoda, Harpacticoida, Tachidiidae) from Korean brackish waters and proposal of a new genus for *Tachidius* (*Tachidius*) *vicinospinalis* Shen and Tai, 1964.

Zool. J. Linn. Soc. **143:** 133-159.

Karanovic T, JL Cho. 2012. Three new ameirid harpacticoids from Korea and first record of *Proameira* simplex (Crustacea: Copepoda: Ameiridae). Zootaxa **3368:** 91-127.

Kim DY, HT Huh. 1983. Seasonal variations of copepods in Garolim Bay. Bull. Kor. Ocean Res. Devel. Inst. **5:** 29-35.

Kim IH. 1991. A new species of *Namakosiramia* Ho and Perkins, parasitic on holothurians from Korea (Copepoda: Harpacticoida). Bull. Plank. Soc. Jpn Spec. Vol., pp. 429-435.

Kim IH. 1998. Illustrated encyclopedia of fauna and flora of Korea. Vol. 38. Cirripedia, Symbiotic Copepoda, Pycnogonida. Seoul, Korea: Ministry of Education, 1038 pp.

Kim IH, HS Kim. 1997a. Harpacticoid copepods of the genus *Porcellidium* associated with marine macroalgae in the seas of Korea. Kor. J. Syst. Zool. **13:** 141-172.

Kim K, W Lee, R Huys. 2011a. A new species of *Sentiropsis* (Copepoda: Harpacticoida: Pseudotacidiidae) from the upper sublittoral zone off Hyeopjae beach, Jeju Island, Korea, and a key to genera of the subfamily Danielsseniinae. Proc. Biol. Soc. Wash. **124:** 179-197.

Kim K, E Park, W Lee. 2011b. First record of *Onychostenhelia bispinosa* (Copepoda: Harpacticoida: Miraciidae) from Korea. Bull. Natl. Inst. Biol. Res. **2:** 55-65.

Kim SH, W Kim. 1996. Two species of Porcellidiidae (Copepoda, Harpacticoida) associated with hermit crabs from Korea. Kor. J. Syst. Zool. **12:** 375-387.

Kim SH, W Kim. 1997b. Two new species of the subfamily Donsiellinae (Copepoda, Harpacticoida, Thalestridae) associated with the isopod from Korea. Kor. J. Biol. Sci. **1:** 1-13.

Kim SH, W Kim. 1998. *Alteuthoides affinis*, a new peltidiid copepod (Harpacticoida) associated with the sponge from Cheju Island, Korea. Kor. J. Biol. Sci. **2:** 203-208.

Lee YJ. 2010. Checklist of cicadas (Hemiptera: Cicadidae) of Luzon, Philippines, with six new species and revised keys to the species of *Oncotympana* Stal and *Psithyristria* Stal. Zootaxa **2621:** 1-26.

Lee JM, CY Chang. 2003. Taxonomy on freshwater canthocamptid harpacticoids from Korea III. Genera *Mesochra* and *Elaphoidella*. Kor. J. Syst. Zool. **19:** 203-216.

Lee JM, CY Chang. 2005. Harpacticoid copepods of genus *Onychocamptus* (Laophontidae) from Korea. Kor. J. Syst. Zool. **21:** 31-43.

Lee JM, CY Chang. 2007. Three cletoid copepods of the genera *Limnocletodes* and *Kollerua* (Harpacticoida, Cletodidae) from coastal marshes and estuaries in South Korea. Ocean Sci. J. **42:** 255-267.

Lee JM, CY Chang. 2008a. Two canthocamptid copepods of the genera *Itunella* and *Mesochra* (Harpacticoida, Canthocamptidae) from brackish waters in South Korea. J. Nat. Hist. **42:** 1729-1747.

Lee JM, CY Chang. 2008b. Copepods of the genus *Leptocaris* (Harpacticoida: Darcythompsoniidae) from salt marshes in South Korea. Kor. J. Syst. Zool. **24:** 89-98.

Lee JM, CY Chang. 2008c. A new species of the rarely known genus *Apolethon* (Copepoda, Harpacticoida, Laophontidae) from brackish waters of Korea. Anim. Cell. Syst. **12:** 249-259.

Lee W. 2003. A marine harpacticoid, *Quinquelaophonte koreana* sp. nov. from a sandy beach in Korea (Crustacea: Copepoda). Zool. Sci. **20:** 657-668.

Lee W, HY Soh, HL Suh. 2007. A new species of the genus *Amphiascoides* (Copepoda: Harpacticoida) from Korean waters. Proc. Biol. Soc. Wash. **120:** 279-292.

Majka CG, DS Sikes. 2009. Thomas L. Casey and Rohde Island's precinctive beetles: taxonomic lessons and the utility of distributional checklists. ZooKeys **22:** 267-283.

Melville RV. 1985. *Dactylopusia* Norman, 1903 (Crustacea, Copepoda): type species designated. Bull. Zool. Nomencl. **42:** 335-337.

Minton RL, KE Perez. 2005. A systematic checklist of the land snails of Louisiana. Tex. J. Sci. **57:** 153-164.

Møller PR, JG Nielsen, SW Knudsen, JY Poulsen, K Sünksen, OA Jørgensen. 2010. A checklist of the fish fauna of Greenland waters. Zootaxa **2378:** 1-84.

Mori T. 1938. *Tigriopus japonicus*, a new species of neritic Copepoda. Zool. Mag. (Tokyo) **50:** 294-295.

Nam EJ, W Lee. 2005. A new species of the genus *Rhizothrix* (Copepoda: Harpacticoida: Rhizothricidae) from Korean waters. Proc. Biol. Soc. Wash. **118:** 692-705.

Nam EJ, W Lee. 2006. Two new species of the genus *Heteropsyllus* (Crustacea, Copepoda, Harpacticoida) from Jeju Island, Korea and Devon, England. J. Nat. Hist. **40:** 1719-1745.

Nam EJ, W Lee. 2012. First record of the genus *Sinamphiascus* (Copepoda: Harpacticoida) from Korean waters. J. Species Res. **1:** 44-55.

Park EO, MS Han, W Lee. 2012. The first record of *Orthopsyllus* species (Copepoda: Harpacticoida: Orthopsyllidae) from Korean waters. J. Species Res. **1:** 56-67.

Park EO, W Lee. 2011. New record of *Scottolana bulbifera* (Copepoda: Harpacticoida: Canuellidae) from Korea. Bull. Natl. Inst. Biol. Res. **2:** 66-75.

Römbke J, K Barrett, WU Blanckenhorn, T Hargreaves, N Kadiri, S Knäbe et al. 2010. Results of an international ring test with the dung fly *Musca actumnalis* in support of a new OECD test guideline. Sci. Total. Environ. **408:** 4102-4106.

Ryu SH, KH Jang, EH Choi, SK Kim, SJ Song, HJ Cho et al. 2012. Biodiversity of marine invertebrates on rocky shores of Dokdo, Korea. Zool. Stud. **51:** 710-726.

Sato N, CH Koh. 2004. Biological richness of the Asian tidal flats and its crisis by human impacts. *In* SK Hong, JA Lee, BS Ihm, A Farina, YH Son, ES Kim, JC Choi, eds. Ecological issues in a changing world - status, response, and strategy. Dordrecht, the Netherlands: Kluwer Academic Publishers, pp. 135-155.

Seifried S. 2003. Phylogeny of Harpacticoida (Copepoda): Revision of "Maxillipedasphalea" and Exanechentera. Cuvillier Verlag, Göttingen.

Shim JH, I Ro. 1982. The composition and abundance distribution of zooplankton in the vicinity of Yeosu, Korea. Proc. Coll. Nat. Sci. Seoul Natl. Univ. **2:** 165-183.

Song SJ, CY Chang. 1993. Eight harpacticoid species of Harpacticidae (Copepoda, Harpacticoida) from Korea. Kor. J. Syst. Zool. **9:** 203-220.

Song SJ, CY Chang. 1995. Marine harpacticoid copepods of Chindo Island, Korea. Kor. J. Syst. Zool. **11:** 65-77.

Song SJ, W Kim, CY Chang. 2001. Redescription of two thalestrid copepods, *Phyllothalestris sarsi* Sewell, 1940 and *Dactylopusia falcifera* Willey, 1935 (Copepoda, Harpacticoida, Thalestridae) in Korea. Kor. J. Syst. Zool. **17:** 229-243.

Song SJ, W Kim, CY Chang. 2003. A new species of *Parastenhelia* (Copepoda: Harpacticoida: Parastenheliidae) from Korea. Zool. Sci. **20:** 221-228.

Song SJ, HS Rho, W Kim. 2007a. A new species of *Amonardia* (Copepoda: Harpacticoida: Miraciidae) from the cultivated brown alga, *Undaria pinnatifida*. Integr. Biosci. **11:** 69-77.

Song SJ, HS Rho, W Kim. 2007b. A new species of *Huntemannia* (Copepoda: Harpacticoida: Huntemanniidae) living on muddy sand flat from the Yellow Sea, Korea. Zootaxa **1616:** 37-48.

Song SJ, J Ryu, JS Khim, W Kim, SG Yun. 2010. Seasonal variability of community structure and breeding activity in marine phytal harpacticoid copepods on *Ulva pertusa* from Pohang, east coast of Korea. J. Sea Res. **63:** 1-10.

Song SJ, SG Yun. 1999. A new species of *Peltidium quinquesetosum* (Copepoda: Harparticoida: Peltidiidae) on the marine macroalgae in Korea. Kor. J. Syst. Zool. **15:** 67-74.

Song SJ, SG Yun, CY Chang. 1999. New records on three harpacticoid copepods associated with marine macroalgae in Korea. J. Fish. Sci. Technol. **2:** 189-198.

Suarez-Morales E, MD Troch, F Fiers. 2006. A checklist of the marine harpacticoida (Copepoda) of the Caribbean Sea. Zootaxa **1285:** 1-19.

Taheri M, MY Foshtomi, M Noranian, SS Mira. 2012. Spatial distribution and biodiversity of macrofauna in the south-east of the Caspian Sea, Gorgan Bay in relation to environmental conditions. Ocean Sci. J. **47:** 113-122.

Takeuchi I. 1999. Checklist and bibliography of the Caprellidea (Crustacea: Amphipoda) from Japanese waters. Otsuchi Mar. Sci. **24:** 5-17.

Wells JBJ. 2007. An annotated checklist and keys to the species of Copepoda harpacticoida (Crustacea). Zootaxa **1568:** 1-872.

Willen E. 2000. Phylogeny of the Thalestridimorpha Lang, 1944 (Crustacea, Copepoda). Cuvillier Verlag, Göttingen.

Yeatman HC. 1983. Copepods from microhabitats in Fiji, Western Samoa, and Tonga. Micronesica **19:** 57-90.

Yoo KI, WC Lee. 1993. A marine harpacticoid copepod, *Lourinia armata*, new to Korea. Kor. J. Syst. Zool. **9:** 115-121.