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The paramesochrid fauna of the Great Meteor Seamount (Northeast Atlantic) including the description of a new species of *Scottopsyllus* (*Intermedopsyllus*) Kunz (Copepoda: Harpacticoida: Paramesochridae)

Christoph Plum · Kai-Horst George

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Abstract Because of their potentially important role for the distribution of marine benthic organisms, seamounts have been the subject of focused interest on the part of marine biologists particularly during the past decade. One of the largest seamounts sampled so far is the Great Meteor Seamount (GMS), which is located in the North Atlantic. Although some of the most detailed investigations have been carried out on this particular seamount, it is still a little-known environment regarding benthic copepod diversity and ecology. Therefore, material from 14 stations collected in 1998 was investigated to address the following aspects: (1) species composition and diversity of the harpacticoid family Paramesochridae at the GMS; (2) faunistic comparison with other localities and *Intermedopsyllus*; and (3) revision of the worldwide distribution of known Paramesochridae. Of the 28 paramesochrid species determined from the GMS, 26 are new to science. The vast majority were found on the plateau; only two species were detected in the deep-sea stations. Other species found at the GMS are already known from East Atlantic deep-sea areas. In the frame of providing new taxonomical information for future research, *Scottopsyllus* (*Intermedopsyllus*) *antoniae* sp. nov. from the plateau of the GMS is described here. The new species can without any doubt be allocated to *Scottopsyllus* because of the 1-segmented endopods but 3-segmented exopods in P2–P3, the “paramecium”-like shape of P2–P3 endopods, and the 1-segmented exopods in the antenna and the mandible. The new species differs from its congeners mainly by retention of

setae on the antennule, the reduced size of furcal seta VI, the fact that the proximal maxillar endite bears only 1 seta, and the loss of the maxillar endopod.

Keywords Biodiversity · Taxonomy · Seamounts · Deep sea · Meiofauna · Distribution patterns · *Scottopsyllus* (*Intermedius*) *antoniae*

Introduction

Although it has been estimated that there may be as many as 100,000–200,000 seamounts spread throughout the world’s oceans (Wessel 2007), these undersea features are still little-known environments regarding their biodiversity and ecology. This is partly because of the complex conditions associated with seamounts, such as large depth ranges, cryptic topography, hard substrata, fast currents, and geographic isolation, which make them difficult to sample (Rogers 1994). However, at the same time, these specific conditions render seamounts unique habitats for deep-sea and shallow-water organisms (Rogers 1994; Richer de Forges et al. 2000).

The first scattered investigations on seamounts took place in the late nineteenth and early twentieth centuries (Brewin 2007), but only during recent decades have deep-water sampling gear and underwater vehicles allowed detailed sampling of the deep sea. Fundamental questions on species composition, diversity, community structure, and possible endemism at seamounts were first addressed by Hubbs (1959).

Because of their potentially important role for the distribution of marine benthic organisms (Hubbs 1959; Gad and Schminke 2004), there has been focused interest

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on seamounts by marine biologists during the past decade (e.g., Thistle 1998; Richer de Forges et al. 2000; George and Schminke 2002; Mohn and Beckmann 2002; Bartsch 2003; George 2004a, b; Mironov and Krylova 2006; Samadi et al. 2006). The most detailed investigations on biodiversity, composition and distribution of the seamount benthic macrofauna and meiofauna have been carried out in the North Atlantic, particularly at the Great Meteor Seamount (Emschermann 1971; Grasshoff 1972, 1973, 1977; Bartsch 1973a, b, 1983, 2001a, b, 2003, 2004, 2008; Hartmann-Schröder 1979; George and Schminke 2002; George 2004a, b, 2006; Gad 2004a, b, 2008; Gad and Schminke 2004; Piepenburg and Müller 2004; Mironov and Krylova 2006). The Great Meteor Seamount (GMS) is one of the largest seamounts in the North Atlantic, rising from a depth of 4,200 m up to 275 m below sea level (Ulrich 1971). It is located in the subtropical Northeast Atlantic, west of the Canary Islands and south of the Azores. The distance to the African coast is about 1,600 km. Due to its shape and the large summit plateau, the GMS resembles a giant table mountain and is therefore characterized as a guyot. The plateau is covered by coarse biogenic sediment composed of fragments of mollusc shells and corals (Gad and Schminke 2004). Estimates of the age of the GMS range from 10 m.y. (Wendt et al. 1976) to 35 m.y. (Hinze 1969) and more than 50 m.y. (Grevemeyer 1994) to 82–86 m.y. (Verhoef 1984).

The present study is the result of the expedition M42/3 with the German RV “Meteor” to the Great Meteor Seamount in 1998, as part of the interdisciplinary SEA-MEC (Seamount Ecology) project. A first detailed examination of the meiofauna material collected during M42/3 yielded a large number of Harpacticoida (Copepoda), including specimens of the family Paramesochridae Lang 1944 (George and Schminke 2002). They were one of the most abundant taxa found on the plateau of the GMS and presumably represent an important constituent of the harpacticoid fauna. To date, the Paramesochridae contain 125 species belonging to 13 genera and 4 subgenera (Bodin 1997; Boxshall and Halsey 2004; Wells 2007). Members of this family show a wide geographical distribution and are typically small, interstitial animals that inhabit intertidal and shallow-water sandy sediments. Only a few species have been recorded at depths greater than 300 m (Lang 1936; Drzycimski 1967; Becker 1972; Becker et al. 1979; Veit-Köhler 2004, 2005; Veit-Köhler and Drewes 2009; Vasconcelos et al. 2009). This leads to the essential question of how species of a typically interstitial taxon could settle on the Great Meteor Seamount, considering the large distance to the nearest coast and the assumption that fine-grained clayish bottoms in the deep sea may preclude dispersal of interstitial meiofauna adapted to coarse sand (Westheide 1991; Gad and Schminke 2004).

To increase our knowledge about harpacticoid species biodiversity, this study focuses on the Paramesochridae from the Great Meteor Seamount. The investigation includes: (1) a qualitative analysis of the species composition and diversity at the GMS, including distribution patterns on the seamount; (2) a faunistic comparison of the paramesochrid taxa of the GMS with associations from other localities; (3) a summarizing review of the geographical and bathymetric distribution of paramesochrid species; and (4) a description of *Scottopsyllus (Intermedopsyllus) antoniae* sp. nov. from GMS.

Material and methods

Qualitative samples were collected from the GMS during expedition M42/3 of the German RV “Meteor” in 1998 (Pfannkuche et al. 2000). The GMS covers a total area of 1,465 km² and rises from a depth of approximately 4,200 m to a minimum of 275 m below the water surface. Its summit is represented by a plateau with a maximum length of 54 km, a maximum width of 31 km, and a surface area of about 1,200 km² (Ulrich 1971; Hinze 1969). The volcanic bedrock of the plateau is covered with a 150- to 400-m-thick cap of biogenic carbonates constituting the seabed of the summit (Piepenburg and Müller 2004). During expedition M42/3, 26 stations were sampled (Table 1), of which 14 stations contained specimens of Paramesochridae (Table 2). Two of them were located in the deep sea at the northeastern slope, while the rest were located on the plateau (Table 1, Fig. 1). The material was collected with a multicorer (MUC, after Barnett et al. 1984), epibenthic sledge (EBS, after Brandt and Barthelnt 1995) and giant boxcorer (GKG, after Hessler and Jumars 1974; see George and Schminke 2002).

Sample treatment is described by George and Schminke (2002). For determination of the paramesochrid species, the specimens were transferred on slides using glycerine as embedding medium (Pfannkuche and Thiel 1988). Sorting was done in the laboratory at Senckenberg am Meer, Department DZMB (German Centre of Marine Biodiversity Research) in Wilhelmshaven, Germany.

Before dissection, the holotype of *Sc. (I.) antoniae* sp. nov. was drawn from the dorsal and lateral side. Detailed drawings of the lateral and ventral view of the abdomen were also made. Dissected parts of the holotype and the paratypes were placed in glycerin drops, mounted on several slides. All drawings were made of female holotype except the maxillule (Fig. 3 from paratype 1). The paratype parts were drawn without dissection. Drawings were made with the aid of a drawing tube on a Leica differential interference contrast microscope (DMR with UCA condenser, IC prism and doubler $\times 1.25$ and $\times 1.6$). All specimens were deposited in the collection of the Senckenberg

Table 1 Date, gear, geographical position, depth and numbers of sampled stations during the expedition M42/3 with the German RV "Meteor"

	Sampling date	Station	Gear	Geographic locality	Depth (m)
	01.09.1998	451	GKG	30°08.4'N, 28°34.8'W	455
	02.09.1998	452	GKG	29°42.9'N, 28°22.7'W	297
	02.09.1998	455	GKG	29°42.9'N, 28°22.7'W	297
	03.09.1998	456	GKG	29°48.2'N, 28°29.7'W	303
	04.09.1998	DS 459	MUC	29°45.7'N, 28°44.3'W	2,722
	06.09.1998	467	GKG	30°02.1'N, 28°32.6'W	292
	08.09.1998	DS 484	MUC	29°25.5'N, 28°33.9'W	4,015
	09.09.1998	489	GKG	29°57.0'N, 28°23.1'W	323
	09.09.1998	492	GKG	29°58.5'N, 28°29.7'W	294
	11.09.1998	DS 505	GKG	30°18.3'N, 28.03.3'W	4,005
	12.09.1998	DS 506	MUC	30°12.2'N, 28°14.2'W	3,009
	13.09.1998	511	GKG	30°07.2'N, 28°22.8'W	597
	13.09.1998	515	EBS	29°48.9'N, 28°29.0'W	302
	14.09.1998	516	GKG	29°49.3'N, 28°37.1'W	325
	14.09.1998	517	EBS	30°05.9'N, 28°32.2'W	312
	14.09.1998	518	EBS	30°02.0'N, 28°32.0'W	293
	14.09.1998	519	EBS	30°06.2'N, 28°24.5'W	416
	14.09.1998	520	EBS	30°06.0'N, 28°24.3'W	422
	14.09.1998	521	EBS	30°05.9'N, 28°23.2'W	511
	14.09.1998	522	EBS	30°05.6'N, 28°23.0'W	518
	17.09.1998	DS 548	MUC	29°52.8'N, 28°14.2'W	2,320
	18.09.1998	551	EBS	29°53.4'N, 28°19.5'W	476
	18.09.1998	552	EBS	29°53.9'N, 28°22.0'W	322
	19.09.1998	DS 558	MUC	30°32.1'N, 28°46.8'W	4,111
<i>MUC</i> Multicorer, <i>EBS</i>	20.09.1998	565	EBS	29°39.4'N, 28°22.9'W	403
epibenthic sledge, <i>GKG</i> giant boxcorer	20.09.1998	DS 566	MUC	29°32.7'N, 28°29.9'W	3,077

Forschungsinstitut und Naturmuseum Frankfurt am Main (SMF), Germany.

Abbreviations used in the text: A1 = antennula; A2 = antenna; aes = aesthetasc; benp = baseoendopod; Cphth = cephalothorax; enp = endopod; exp = exopod; enp-1 (2,3) = proximal (middle, distal) segment of endopod; exp-1 (2,3) = proximal (middle, distal) segment of exopod; FR = furcal ramus/rami; GF = genital field; GMS = Great Meteor Seamount; Md = mandibula; Mx1 = maxillula; Mx = maxilla; Mxp = maxilliped; P1–P6 = first to sixth swimming leg.

Results

Taxonomy

Harpacticoida Sars 1903

Paramesochridae Lang 1944

Subfam. Paramesochrinae Huys 1987

Scottopsyllus (*Intermedopsyllus*) Kunz 1962 sensu Kunz 1981

Scottopsyllus (*I.*) *antoniae* sp. nov.

Type material

Holotype: Female, dissected and mounted on 10 slides (Coll. No. SMF 33623). *Paratype* 1: non-dissected female, mounted on 1 slide (Coll. No. SMF 33624). *Paratype* 2: non-dissected male, mounted on 1 slide (Coll. No. SMF 33625). *Additional material*: 4 females and 6 males from station 516 (Coll. No. SMF 33626), 5 females and 3 males from station 451 (Coll. No. SMF 33627), 1 female and 2 males from station 455 (Coll. No. SMF 33628), all preserved in glycerine slides.

Type locality

Northeast Atlantic, Great Meteor Seamount, 29°49.3'N, 28°37.1'W, southwest plateau, station 516, 325 m depth (Fig. 1).

Etymology

The species name is given in dedication to the first author's grandmother, Antonie Behrends, and his newborn niece, Antonia Plum.

Table 2 Paramesochrid species collected from the Great Meteor Seamount in 1998

Stations															
No.	Species	467	492	451	455	505	506	515	516	517	518	521	551	552	565
1	<i>Apodopsyllus</i> spec.	2	1	-	5	-	-	-	4	-	-	-	1	-	1
2	<i>Diarthroedella</i> spec.	1	-	-	1	-	-	-	-	-	-	-	1	-	-
3	<i>Kliopsyllus schminkei</i>	-	-	-	-	1	1	-	-	-	-	-	-	-	-
4	<i>Kliopsyllus</i> spec. 1	8	7	7	2	-	-	1	1	-	10	5	109	10	3
5	<i>Kliopsyllus</i> spec. 2	1	-	-	-	-	-	1	2	-	-	1	-	-	1
6	<i>Kliopsyllus</i> spec. 3	20	9	1	14	-	-	-	9	-	-	-	1	-	-
7	<i>Kliopsyllus</i> spec. 5	5	2	-	-	-	-	-	-	-	-	-	-	-	-
8	<i>Kliopsyllus</i> spec. 6	-	-	7	-	-	-	-	6	-	-	-	1	-	-
9	<i>Kliopsyllus</i> spec. 7	-	-	2	-	-	-	-	-	-	-	-	7	1	-
10	<i>Kliopsyllus</i> spec. 8	-	-	-	-	-	-	-	-	-	-	-	-	1	-
11	<i>Kliopsyllus</i> spec. 9	-	-	-	-	1	-	-	-	-	-	-	1	-	-
12	<i>Kliopsyllus</i> spec. 10	-	1	-	1	-	-	-	-	-	-	-	4	-	-
13	<i>Leptopsyllus</i> spec. 1	1	-	-	-	-	-	-	11	-	1	-	-	-	-
14	<i>Leptopsyllus</i> spec. 2	1	1	11	5	-	-	-	46	-	4	-	10	1	-
15	<i>Paramesochra</i> spec. 1	5	3	2	7	-	-	2	10	-	1	-	3	-	-
16	<i>Paramesochra</i> spec. 2	2	-	7	2	-	-	1	6	1	-	-	3	-	1
17	<i>Paramesochra</i> spec. 3	-	-	2	-	-	-	-	-	-	-	-	24	-	1
18	<i>Paramesochra</i> spec. 4	-	-	-	-	-	-	-	-	-	-	7	2	1	2
19	<i>Paramesochra</i> spec. 5	-	-	2	-	-	-	-	2	-	-	-	-	-	-
20	<i>Paramesochra</i> spec. 6	1	7	6	12	-	-	3	10	-	6	-	5	4	-
21	<i>Paramesochra</i> spec. 7	-	-	5	-	-	-	-	-	-	-	3	-	5	-
22	<i>Paramesochra</i> spec. 8	-	-	-	-	-	-	-	-	-	-	-	2	-	-
23	<i>Paramesochra</i> spec. 9	-	-	2	-	-	-	-	5	-	-	-	-	-	-
24	<i>Paramesochra</i> spec. 10	-	-	-	-	-	-	-	-	-	-	1	-	-	-
25	<i>Paramesochra</i> sp. 11	-	-	1	-	-	-	-	-	-	-	-	-	-	-
26	<i>Scottopsyllus</i> (L.) intermedius	3	17	4	8	1	-	-	13	-	1	-	1	-	-
27	<i>Sc. (I) antoniae</i> sp.n.	-	-	8	3	-	-	-	15	-	-	-	-	-	-
28	Paramesochridae spec.	-	-	1	-	-	-	-	-	-	-	-	-	-	-
	<i>N</i> /station	50	48	68	60	3	1	8	140	1	23	17	175	23	9
	<i>S</i> /station	12	9	16	11	3	1	5	14	1	6	5	16	7	6
	<i>N/S</i> ratio	4.2	5.3	4.3	5.1	1.0	1.0	1.6	10.0	1.0	3.8	3.4	10.9	3.3	1.5

Description of the female

Body (Fig. 2a, b) elongate, cylindrical and slightly depressed dorsoventrally. Body length (including FR) 426 μm . Last abdominal segment and telson tapering posteriorly. Surface of the body covered with small rounded depressions resembling the surface of a golf ball (Fig. 6b). Rostrum nearly indiscernible. First pedigerous somite completely fused to dorsal cephalic shield forming the cphth. Cphth and thoracic somites bearing P2–P4 with sensilla laterally and dorsally. Last thoracic body somite (P5 bearing somite) without sensilla. First abdominal somite completely fused with last thoracic body somite, forming the genital double somite, with 6 sensilla and 2 pores dorsally, 1 sensillum and 3 pores on each lateral side. Following abdominal somite dorsally with 2 sensilla and 1

lateral pore. Penultimate body somite without sensilla, carrying a fine, well developed pseudoperculum. Telson short, tapering posteriorly. FR (Fig. 6a–c) short, about twice as long as wide, with 6 setae: I absent; II long, inserted dorsolaterally in proximal half; III slightly shorter than II, bipinnate in distal part, inserted subdistally; IV slightly longer than III, terminally; V longest seta, terminally; VI shortest seta, inserted terminally at inner side of ramus; VII longer than setae II and III, inserted dorsally on distal half of ramus, slightly displaced inwards. Length/width ratio: 2:1.

A1 (Fig. 3a) 8-segmented; armature formula: I–1, II–9, III–7, IV–3 + aes, V–1, VI–2, VII–3, VIII–6 + aes. Both aes basally fused with 1 seta. First two segments largest, following segments decreasing in size.

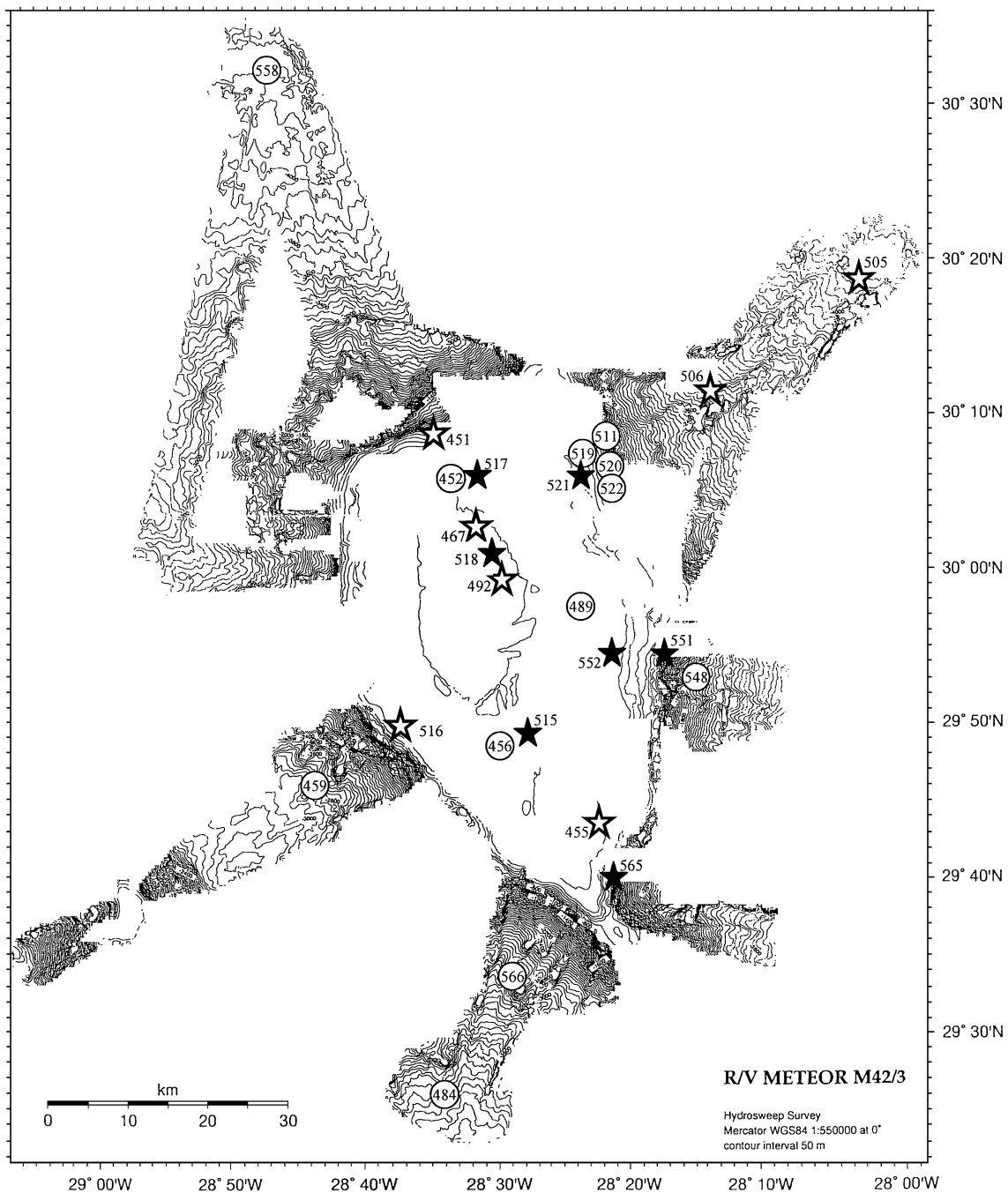


Fig. 1 Location of the stations sampled during RV “Meteor” cruise M 42/3 (1998) at the Great Meteor Seamount (Northeast Atlantic Ocean). Stars Stations where Paramesochridae have been found: black stars sampled with EBS; white stars sampled with MUC and GKS

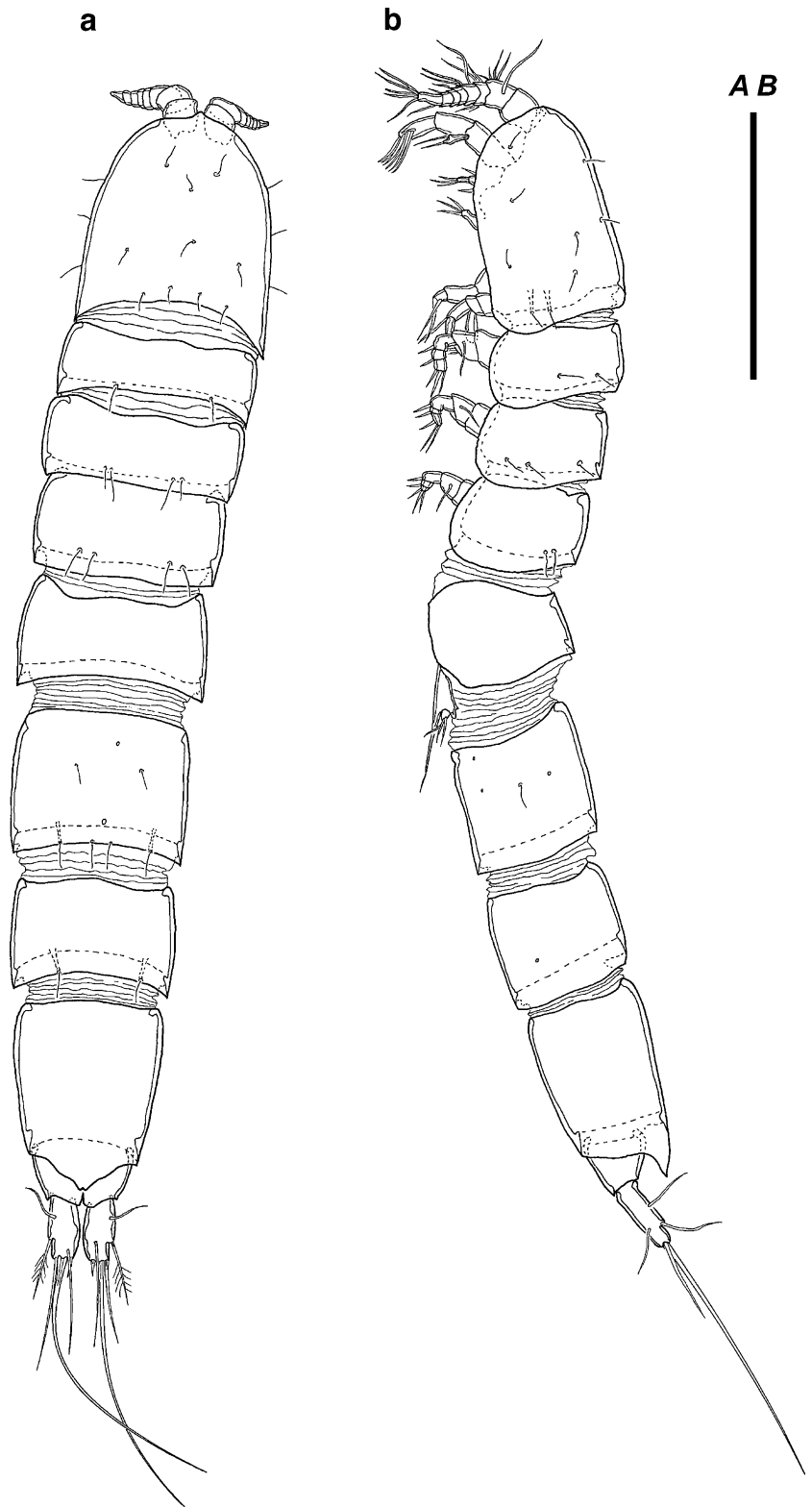
A2 (Fig. 3b) Basis short and strong. Enp 2-segmented; enp-1 with 1 bare and slender abexopodal seta; enp-2 with 2 bare setae laterally and a group of 6 strong geniculate setae apically. Exp 1-segmented with 1 bare lateral seta and 2 apical setae (1 seta broken).

Md (Fig. 4a) Cutting edge lost during dissection. Md palp biramous, with basis, enp and exp. Basis with 1 unipinnate seta. Enp 1-segmented with 1 lateral seta and 4 apical

setae; all setae bare. Exp fused to basis, very small and cone-shaped, with 2 apical bare setae, 1 of which short and thin.

Mxl (Fig. 4b) Arthrite of praecoxa with 6 strong, stout spines terminally and 1 strong seta at the distal inner corner. Coxal endite with 1 slender naked seta apically. Basis with 5 apical setae and 1 slender naked seta laterally, representing enp. Exp very small, 1-segmented, with 2 bare apical setae.

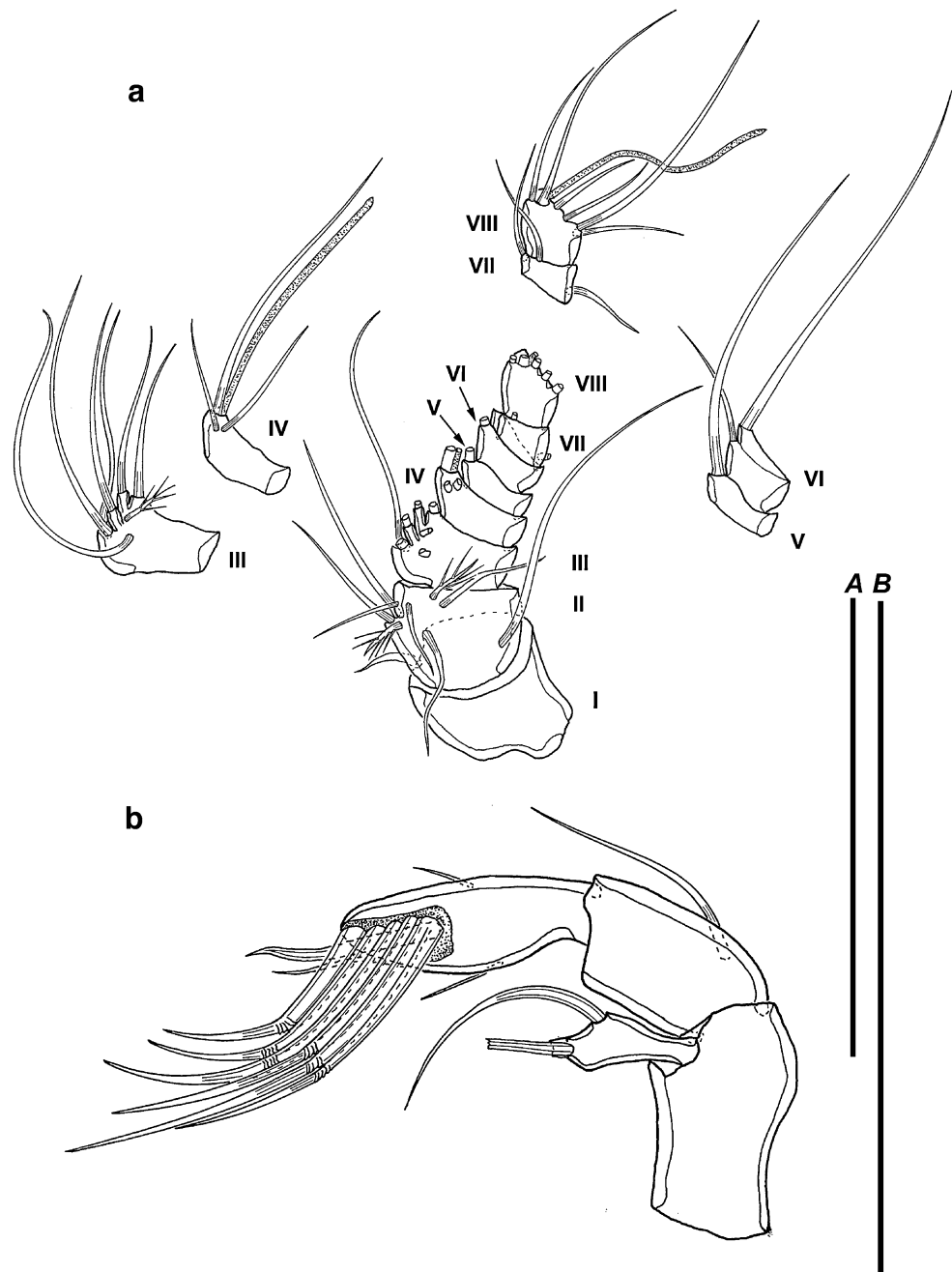
Fig. 2 *Scottopsyllus*
(*Intermedopsyllus*) *antoniae* sp.
nov., holotype female:
(a) habitus dorsal; (b) habitus
lateral. Scale bar: 100 μ m



Mx (Fig. 4c) Syncoxa with 2 endites, proximal endite bearing 1 seta; distal endite with 2 setae; allobasis drawn out to form 1 strong unipinnate claw bearing 2 additional setae, one of which unipinnate. Enp represented by 4 setae.

Mxp (Fig. 4d) subchelate, comprising syncoxa, basis and 1-segmented enp. Syncoxa short and bare, without any ornamentation. Basis slightly elongate and swollen, with short row of strong spinules. Enp 1-segmented, with claw-

Fig. 3 *Scottopsyllus* (*Intermedopsyllus*) *antoniae* sp. nov., holotype female: **a** antenull, **b** antenney. Scale bars: 50 μ m



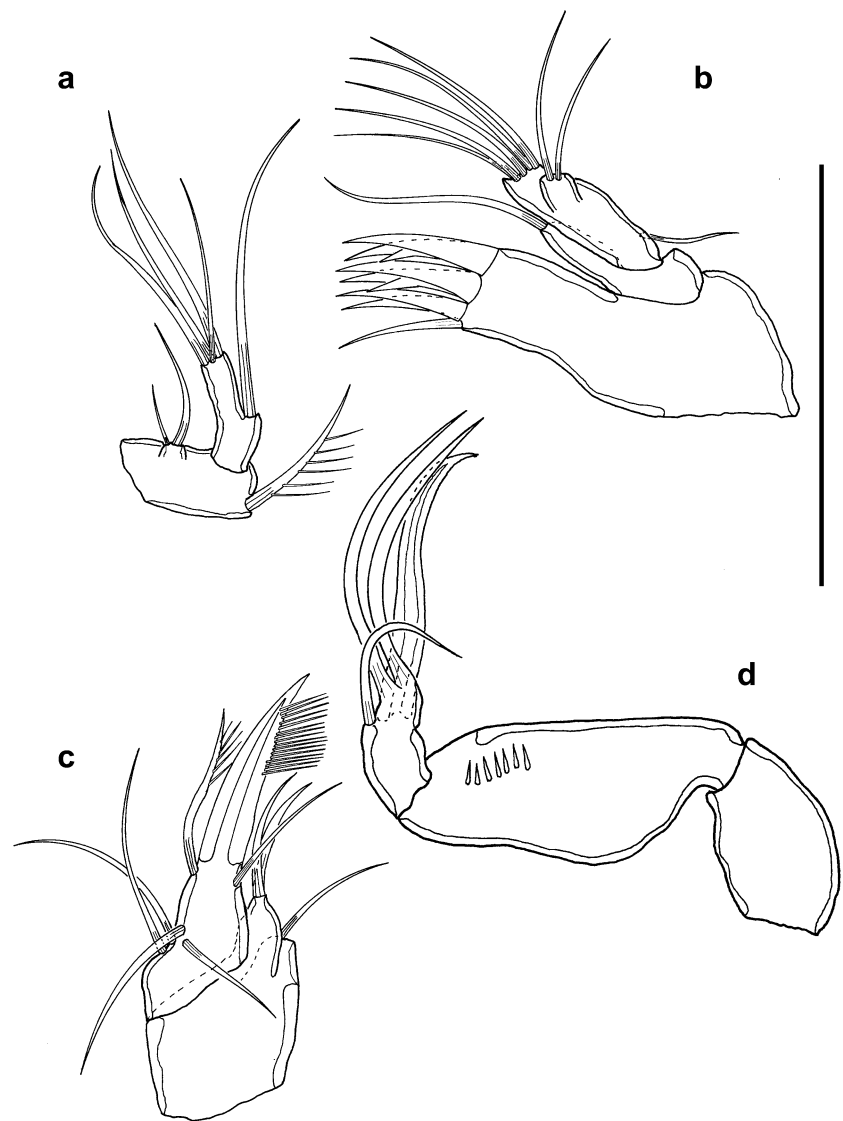
like seta accompanied by 1 small outer seta and 2 apical setae.

P1 (Fig. 5a, Table 3) Coxa without setae. Basis with 1 inner seta, outer seta absent. Enp and exp 2-segmented. Exp-1 almost twice as long as exp-2, with 1 outer seta; exp-2 with 2 outer and 2 apical setae; both segments with outer row of strong spinules. Enp-1 without seta, but with outer row of long spinules. Enp-2 with 1 long, apical seta and 1 shorter, outer seta, both setae bare and geniculate.

P2–P3 (Fig. 5b, c) Basis with 1 outer, bare seta. Enp 1-segmented, with long spinules along the margin and without seta. Exp 3-segmented, longer than enp, exp-2 shortest segment. Exp-1, exp-2 and exp-3 with stout outer spine and outer row of strong spinules; exp-3 with 2 apical setae, the inner of which unipinnate.

P4 (Fig. 5d) Basis without outer seta. Enp as in P2 and P3 but smaller. Exp longer than enp. Exp 2-segmented due to fusion of exp-1 and exp-2. Exp-1 with 2 strong outer spines and outer row of strong spinules, exp-2 with 1 strong outer

Fig. 4 *Scottopsyllus* (*Intermedopsyllus*) *antoniae* sp. nov.: **a** mandibular palp, **b** maxillule, **c** maxilla, **d** mandible. Scale bar: 25 μ m



spine and 1 apical, bare seta; apically with row of strong spinules.

P5 (Fig. 6d) benps fused to single, broad and large lamelliform plate. Outer basal seta on short setophore. Each endopodal part of P5 with 1 seta. Exps distinct, not fused, and very small, with 3 slender, bare setae apically.

GF and P6 (Fig. 6e) Gonopore not covered, almost triangular in ventral view. P6 represented by 2 medially fused plates, each bearing two minute spinules placed on small protrusions.

Male differs from female as follows

A1 (Fig. 7b) 6-segmented, chirocer. Segment II with 1 bipinnate seta, other setae bare; segment V rounded and

bulbous; segment VI sharpened. Armature formula: I-1, II-9, III-7 + aes, IV-1, V-10 + aes, VI-11.

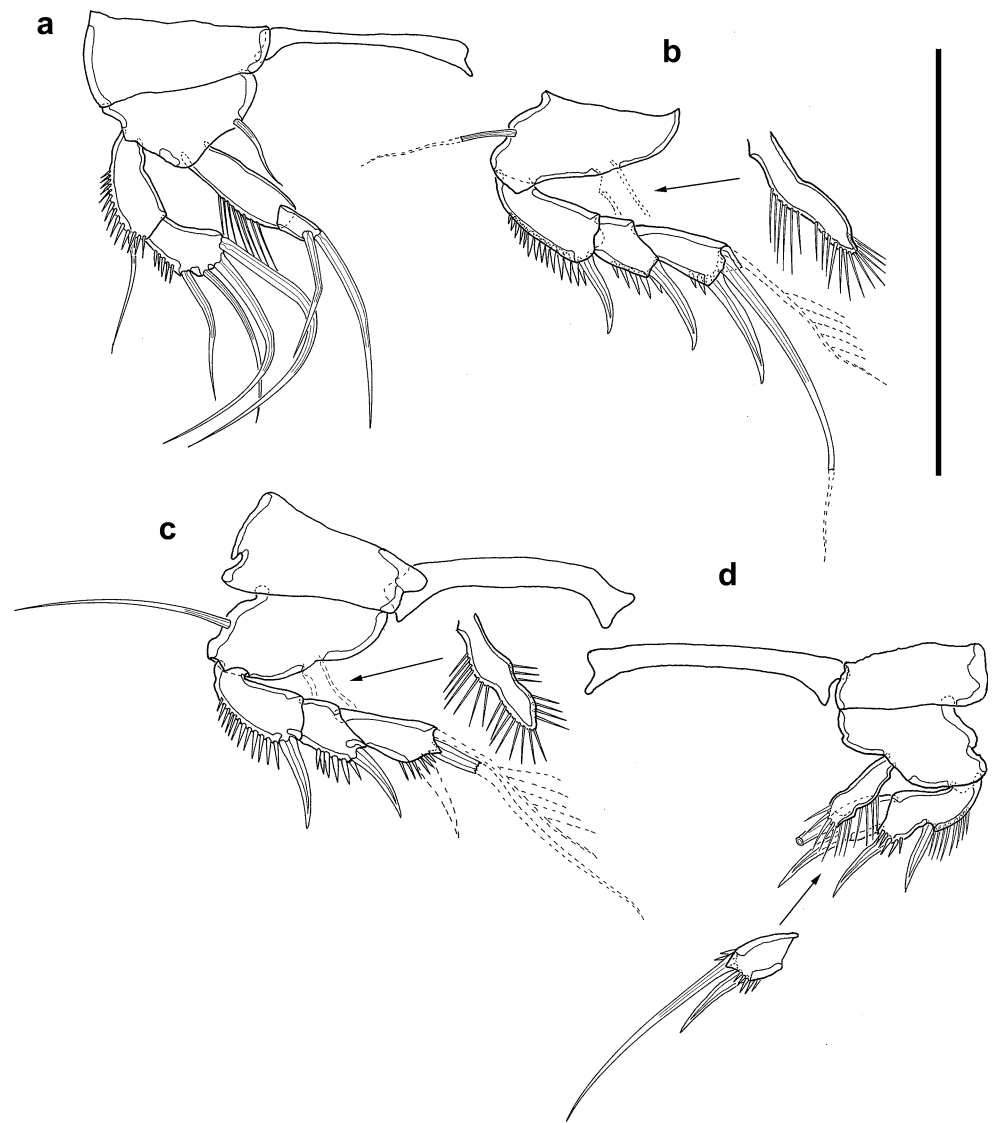
P5 (Fig. 7a) strongly resembling that of female, but without such a pronounced endopodal plate and without endopodal seta

P6 (Fig. 7a) Represented by medially fused plates furnished each with 1 outer and 2 inner bare setae.

Paramesochridae of the Great Meteor Seamount

Paramesochridae were one of the most abundant harpacticoid taxa at the GMS, making up 20.4% of total harpacticoid number of individuals (George and Schminke 2002). Of the 1,249 collected specimens, 623 individuals (49.9%) were copepodids, and 626 (50.1%) adults. More than half of the adults (626 specimens or 65.0%) were

Fig. 5 *Scottopsyllus* (*Intermedopsyllus*) *antoniae* sp. nov., holotype female: **a** swimming leg 1, **b** swimming leg 2, **c** swimming leg 3, **d** swimming leg 4. Scale bar: 50 μ m



found on the southern part of the plateau. The highest absolute individual number N was recorded at station 551 ($N=175$, i.e., 28.1%), followed by station 516 ($N=140$, 11.2%) and station 451 ($N=68$, 5.4%). Only one specimen was found at stations 506 and 517, respectively (Table 3). Median value Z for all stations: $Z_N=23$.

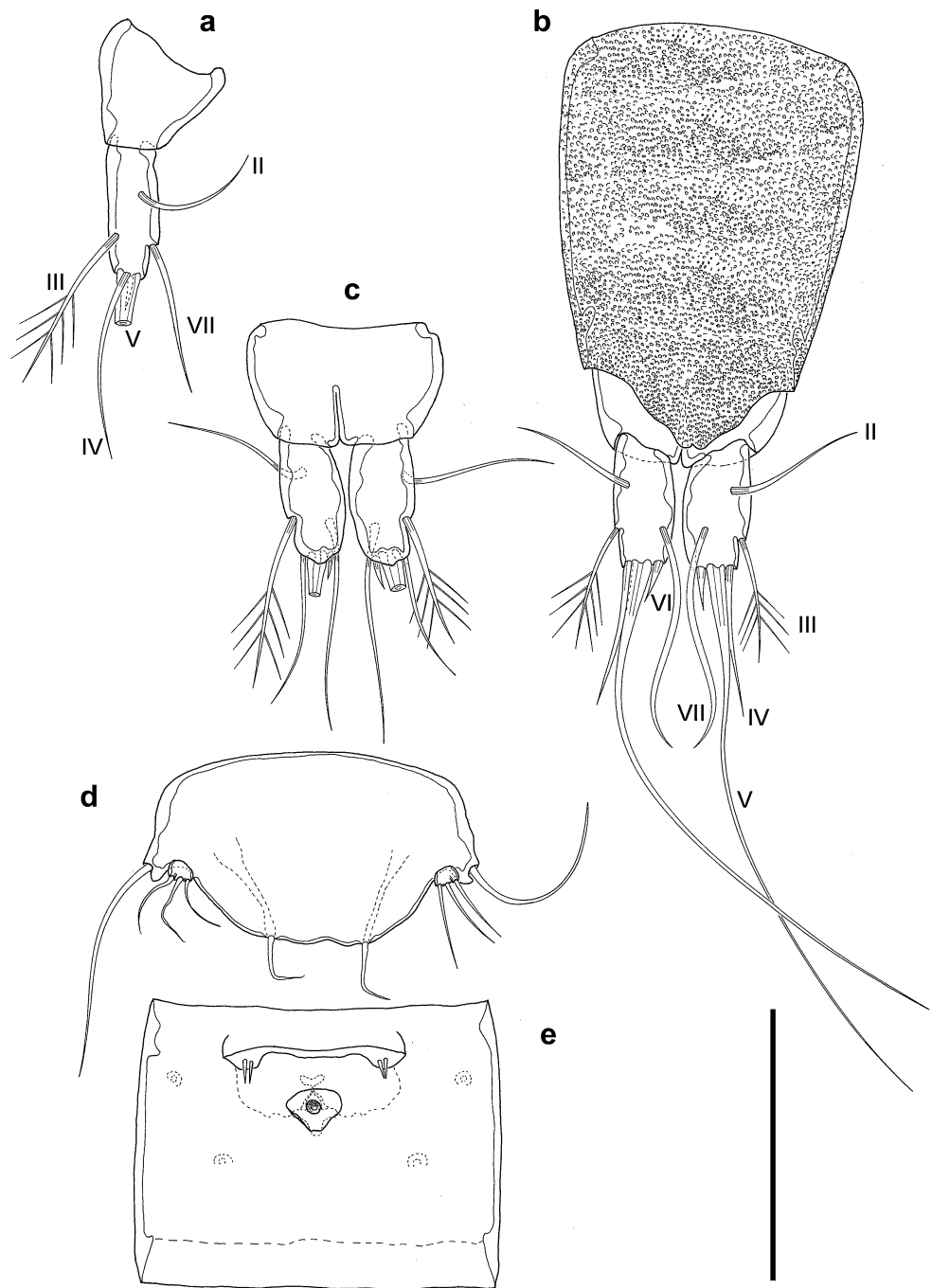
The obtained adults were assigned to six genera (*Apodopsyllus* Kunz 1962; *Diarthrodella* Klie 1949; *Kliop-*

Table 3 Setal formula of swimming legs of *Scottopsyllus* (*Intermedopsyllus*) *antoniae* sp. nov

Leg	Coxa	Basis	Exopod	Endopod
P1	0-0	0-1	I-0; I,I,2	0-0,I,I
P2	0-0	1-0	I-0; I-0; I,I + 1	0
P3	0-0	1-0	I-0; I-0; I,I + 1	0
P4	0-0	0-0	II-0; I,I	0

syllus Kunz 1962; *Leptopsyllus* T. Scott 1894; *Paramesochra* T. Scott 1892 and *Scottopsyllus* Kunz 1962) and 28 species (Table 2). The number of species within the stations ranges from $S=1$ (stations 506, 517) up to $S=16$ (stations 451, 551; Table 3) (i.e., the latter two stations contain 57.1% of the total number of paramesochrid species at the GMS). Stations 451 and 551 show the highest species richness (S). However, for a more objective impression, S should be standardized, and in our case, S can be related to the number of specimens, N , representing a simple measure of N/S (cf. Rose et al. 2005). The N/S ratio (Table 3) indicates how many individuals are needed to encounter a new species (cf. George 2004a). Not taking into account stations with <5 specimens (i.e., st. 505, 506, 517), the highest evenness is observed at station 565 ($N/S=1.5$), followed by st. 515 ($N/S=1.6$), st. 552 ($N/S=3.3$), and st. 521 ($N/S=3.4$). The above mentioned stations 451 and 551 show much higher N/S ratios (4.3 and 10.9, respectively).

Fig. 6 *Scottopsyllus* (*Intermedopsyllus*) *antoniae* sp. nov., holotype female: **a** furcal ramus, lateral, **b** furcal rami, telson and pseudoperculum, dorsal, **c** furcal rami, ventral, **d** P5, **e** GF with P6. Scale bar: 50 μ m

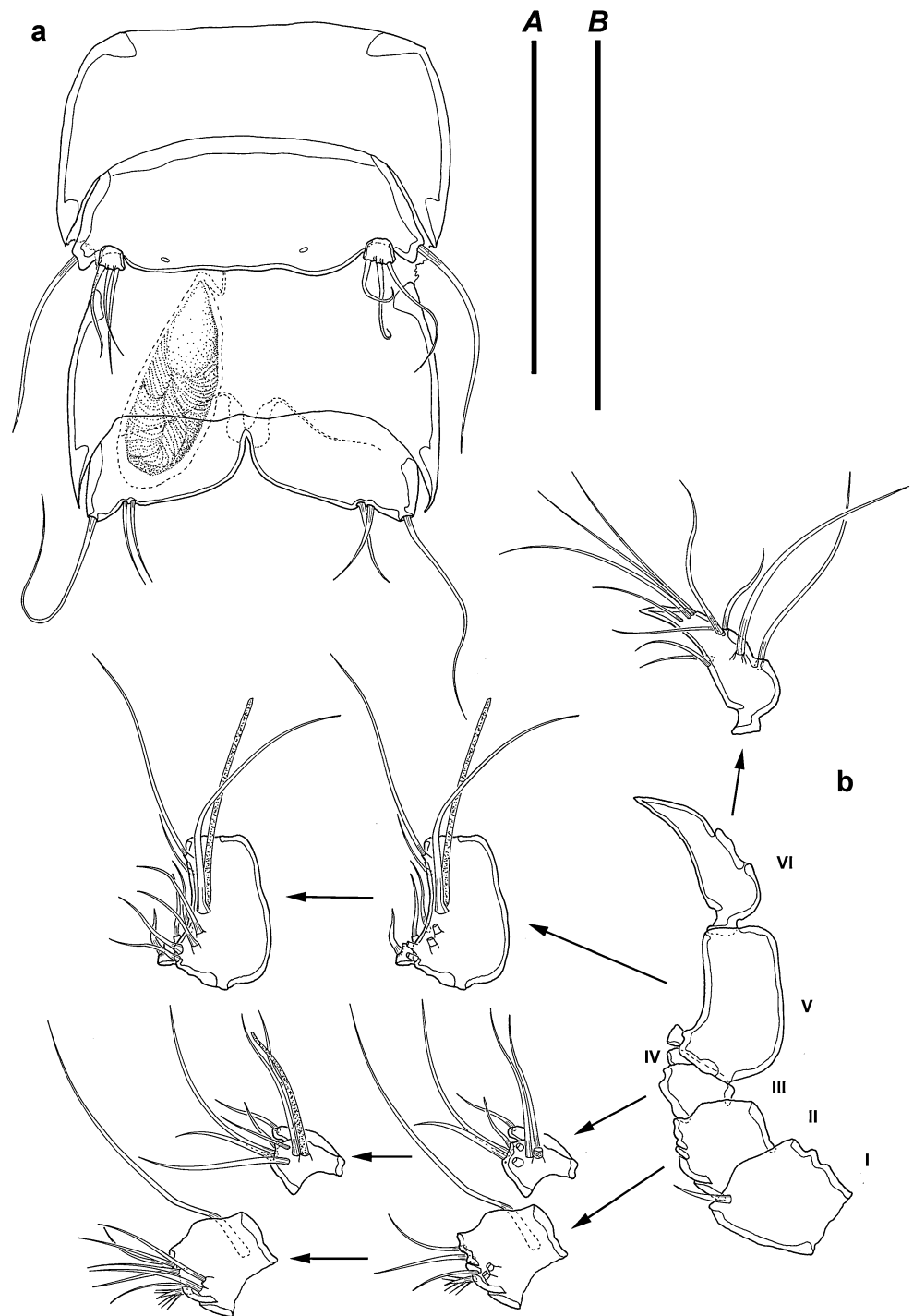


Paramesochra and *Kliopsyllus* were the most species-rich genera on the GMS plateau (Table 2) with 11 species for both genera, together comprising 78.6% of all paramesochrid species found. Two species have been recognized within *Leptopsyllus*, two within *Scottopsyllus*, one species within *Apodopsyllus* and one within *Diarthrodella*. Most of the paramesochrid species at the GMS ($S=26$, i.e., 92.9%) have not yet been reported from anywhere else. Only *Scottopsyllus* (*I.*) *intermedius* T. and A. Scott 1895 and *Kliopsyllus schminkei* Veit Köhler and Drewes 2009 were already known to science.

Bathymetric and geographical distribution of paramesochrid species from the GMS

Most of the 28 species ($S=25$ or 89.3%) were found exclusively on the plateau (292–511 m) of the GMS (Fig. 8), while only one species, *Kliopsyllus schminkei*, was confined to the adjacent deep sea. This species has hitherto been reported from three abyssal plains of the southeast Atlantic Ocean, namely the Guinea, the Angola and the Cape Basins (Veit Köhler and Drewes 2009; Gheerardyn and Veit-Köhler 2009). The records of *K.*

Fig. 7 *Scottopsyllus* (*Intermedopsyllus*) *antoniae* sp. nov., paratype male: **a** P5 and P6, **b** antennula, ventral view. Scale bar: 50 μ m



schmikei from the GMS are from a similar depth, namely from the deep-sea stations 505 (4005 m) and 506 (3009 m).

Kliopsyllus sp. 3 and *Kliopsyllus* sp. 10 have been found at Seine seamount (Büntzow, personal communication), which is also located in the Northeast Atlantic Ocean, approximately 750 nm north-east of the GMS. Another species, *Kliopsyllus* sp. 7, found between 322 and 476 m depth at the GMS, was also found in the Guinea Basin during the DIVA-2 expedition (2005) (Gheerardyn and Veit-Köhler 2009).

Scottopsyllus (*I.*) *intermedius* and *Kliopsyllus* sp. 10 were found in the deep sea as well as on top of the seamount (Fig. 8). *Sc.* (*I.*) *intermedius* actually occurs in coastal waters of the East Atlantic, the North Sea, the Black Sea and the White Sea (Kornev and Chertoprud 2008). Its geographical distribution in the East Atlantic ranges from the Firth of Forth (Scotland) in the north to the Lüderitz Bay of Namibia in the south. This species could be characterized as a typical interstitial species of shallow-

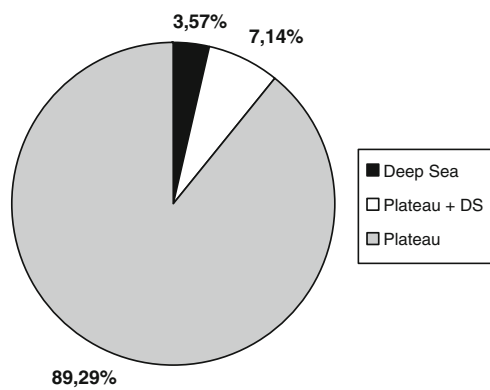


Fig. 8 Bathymetric distribution pattern (%) of paramesochrid species at the GMS (DS deep sea)

water habitats. Findings at the GMS were almost restricted to the shallow plateau, but one specimen was found at the deep-sea station 505 at 4,005 m depth. This is the first record of a *Scottopsyllus* species from the deep Atlantic Ocean.

The species *Scottopsyllus (I.) antoniae* sp. nov. described here is new to science, but was also recorded during the OASIS expedition (2003) (<http://www1.uni-hamburg.de/OASIS/>) on Sedlo Seamount (Büntzow, personal communication), approximately 630 nautical miles (nm) north of the GMS.

Review of the worldwide geographic and bathymetric distribution of Paramesochridae

Members of the harpacticoid family Paramesochridae have been reported from various parts of the world's oceans. They are typically small, interstitial animals that mostly inhabit sandy beaches as well as intertidal and shallow-water sandy sediments. Nevertheless, some species have also been recorded repeatedly in deep-sea sediments (e.g., Becker et al. 1979, Thistle 1982; Veit-Köhler 2004, 2005; Rose et al. 2005; Baguley et al. 2006) and were recently also discovered on the Seine and Sedlo seamounts in the Northeast Atlantic (Büntzow, personal communication) and on the Anaximenes seamount in the eastern Mediterranean Sea (George, personal observation).

Table 4 presents a list of all paramesochrid species described so far, with notes on their geographic and bathymetric distribution. Including the newly described species *Scottopsyllus (I.) antoniae* sp. nov., 126 paramesochrid species with 15 subspecies, belonging to 13 genera and 4 subgenera, have been described thus far.

The majority of Paramesochridae (35 species or 29%) have been found in the Atlantic Ocean, but there are also many records from the Pacific Ocean (26 species or 21%), the Indian Ocean (26 species, 21%), the Mediterranean Sea (8 species or 7%), and even from Antarctic waters (*Kliopsyllus andeep* Veit-Köhler 2004; *Scottopsyllus (Sc.)*

praecipuus Veit-Köhler 2000) or inland seas like the Black Sea and the Baltic Sea (e.g., *Kliopsyllus holsaticus* Klie 1929) (Fig. 9).

The bathymetric distribution of Paramesochridae ranges from the littoral down to abyssal depths (see Table 4 and Fig. 10). The vast majority of them occur in (sub-)littoral zones with records generally ranging from beaches down to coastal waters of 146 m depth [*Scottopsyllus (Wellsopsyllus) gigas* Wells 1965]. Only nine species have been recorded at depths deeper than 300 m, including *Scottopsyllus (I.) antoniae* sp. nov. (325 m), *Kliopsyllus minor* Vasconcelos et al. 2009. (492 m), *Leptopsyllus elongatus* Drzycimski 1967 (515 m), *Leptopsyllus (Paraleptopsyllus) articus* Lang 1936 (1,750 m), *Scottopsyllus (Wellsopsyllus) abyssalis* Becker et al. 1979 (2,000 m), *Leptopsyllus abyssalis* Becker 1972 (3,820 m), *Kliopsyllus andeep* Veit-Köhler 2004 (4,541 m), *Kliopsyllus diva* Veit-Köhler 2005 (5,389 m), and *Kliopsyllus schminkei* Veit-Köhler and Drewes 2009 (5,389 m). Figure 10 shows the bathymetric distribution patterns based on the available record data and indicates that 77% of all species have been found in shallow waters. Only 7% of the species have been recorded at depths below 200 m.

The most species-rich genera of the Paramesochridae are *Kliopsyllus* (38 species) and *Apodopsyllus* (25 species) followed by *Paramesochra* (14 species) and *Scottopsyllus* (13 species) (Table 4). As mentioned above, the genera *Kliopsyllus* and *Paramesochra* are found to be the most diverse paramesochrid taxa at the GMS. The majority of the described species of *Kliopsyllus* and *Paramesochra* have been reported from coastal waters, but recent studies extended the depth range of *Kliopsyllus* down to >4,000 m (Veit-Köhler 2004, 2005; Veit-Köhler and Drewes 2009). Geographically, most species are restricted to regional areas, but certain species can be considered as “cosmopolitans”. For example, *Kliopsyllus holsaticus* has been recorded from the Northeast Atlantic, the North Sea, the Baltic, and the Black Sea. The reports of *Kliopsyllus andeep* by Veit-Köhler 2004 have expanded the distribution range of *Kliopsyllus* to Antarctic waters. Species of *Paramesochra* show a similar broad distribution range with records from the North Sea and the Northeast Atlantic (*Paramesochra dubia* T. Scott 1892; *Paramesochra borealis* Geddes 1981), the Baltic Sea, Hawaii (*Paramesochra acutata hawaiiensis* Kunz 1981), the Mediterranean Sea (*Paramesochra brevifurca* Galhano 1970), the Indian Ocean (*Paramesochra denticulata* Rao and Ganapati 1969), Galapagos Islands (*Paramesochra helgolandica galapagoensis* Mielke 1984a, b), Panama (*Paramesochra kunzi* Mielke 1984a, b) and Perth in western Australia (*Paramesochra longicaudata* Nicholls 1945).

The genus *Scottopsyllus*, in turn, encompasses 13 species (and 1 subspecies), including the *Scottopsyllus (I.)*

Table 4 List of all paramesochrid species recorded so far, including data on geographic and bathymetric distribution. Information are taken from original descriptions and references provided by Bodin 1997 and Wells 2007

No.	Species and authorship	References	Location/Records	Depth/Habitat	Geogr. Region
I.	<i>Apodopsyllus</i> Kunz 1962				
1	<i>A. aberrans</i> Mielke 1984a, b	Mielke 1984a	Panama, Isla Naos, Isla Melones	Beach	Pacific Ocean
2	<i>A. adaptatus</i> Krishnaswamy 1957	Krishnaswamy 1957; Rao and Ganapati 1969	India, Lawsons Bay, Waltair, Madras	Beach, sand, detritus	Indian Ocean
3	<i>A. africanus</i> Kunz 1962	Kunz 1962	Lüderitz-Bay, Namibia, SW Africa,	Tidal, sand	Atlantic Ocean
	<i>A. africanus listensis</i> Mielke 1975	Mielke 1975	Germany, Sylt	Wadden, tidal	North Sea
4	<i>A. alexandrovillabosi</i> Gómez 2002	Gómez 2002	Mexico, Sinaloa	Lagune	Pacific Ocean
5	<i>A. arcuatus</i> Mielke 1984a, b	Mielke 1984b	Galapagos Islands, Santa Cruz	Beach	Pacific Ocean
6	<i>A. arenicolus</i> Chappuis 1954	Chappuis 1954; Kunz 1962; Bodin 1979	Spain; Algiria, La Calle, Philippeville; France, Ile de Re	Sandy beaches	“Cosmopolitan”
7	<i>A. bermudensis</i> Coull and Hogue 1978	Coull and Hogue 1978	Bermuda, Base of Castle Island	Subtidal sand flat 1-2 m	Atlantic Ocean
8	<i>A. biarticulatus</i> Cottarelli and Altamura 1986	Cottarelli and Altamura 1986	Philippines, Palawan Island	Coastal waters	Pacific Ocean
9	<i>A. camptus</i> Wells 1971	Wells 1971; Wells and Rao 1987	South India	?	Indian Ocean
10	<i>A. chilensis</i> Mielke 1987	Mielke 1987	Chile, Coquimbo	?	Pacific Ocean
11	<i>A. cubensis</i> Mielke 1988	Mielke 1988	Caribbean, Cuba, Playa Larga	Interstitial, beach	Atlantic Ocean
12	<i>A. depressus</i> Krishnaswamy 1957	Krishnaswamy 1957	Lawsons Bay, Waltair; India, Madras	Beach, sand, detritus	Indian Ocean
13	<i>A. littoralis</i> Nicholls 1939	Nicholls 1939; Wells 1961	Atlantic, Scotland	7–10 cm	Atlantic Ocean
14	<i>A. lynceorum</i> Cottarelli 1971	Cottarelli 1971	Mediterranean, Porto S. Stefano	Sandy beach	Mediterranean
15	<i>A. madrasensis</i> Krishnaswamy 1951	Krishnaswamy 1951; Wells and Rao 1987	Indian Ocean, Coast of Madras	9.15 m	Indian Ocean
16	<i>A. melitae</i> Kunz 1992	Kunz 1992	Mediterranean, Mljet Island	30 cm depth	Mediterranean
17	<i>A. perplexus</i> Wells 1963b	Wells 1963a, b	England	Litoral	Atlantic Ocean
18	<i>A. panamensis</i> Mielke 1984a, b	Mielke 1984a	Panama, Pacific coast, Isla Culebra	Beach	Pacific Ocean
19	<i>A. pseudocubensis</i> Gómez 2002	Gómez 2002	Mexico, Sinaloa	Lagune	Pacific Ocean
20	<i>A. reductus</i> Petkovski 1955	Petkovski 1955; Kunz 1962	Croatia, Split Zvan	Littoral	Mediterranean
21	<i>A. samubelgomezi</i> Gómez 2002	Gómez 2002	Mexico, Sinaloa	Lagune	Pacific Ocean
22	<i>A. schulzi</i> Noodt 1964	Noodt 1964	Red Sea	Corral sand	Indian Ocean
23	<i>A. spinipes</i> Nicholls 1939	Nicholls 1939	Atlantic, Scotland	Intertidal zone, 7–10 cm	Atlantic Ocean
24	<i>A. unguiformis</i> Coull and Hogue 1978	Coull and Hogue 1978	USA, Georgetown, South Carolina	Sand, 1 m depth	Atlantic Ocean
25	<i>A. vermiculiformis</i> Lang 1965	Lang 1965; Coull and Hogue 1978	USA, Monterey Bay, California, USA; Canada, Nanaimo, British Columbia	Intertidal pools, fine sand	Atlantic Ocean
II	<i>Biuncus</i> Huys 1996				
26	<i>B. ingens</i> Huys 1996	Huys 1996	Collected by Karaman-Chappuis methode, Elat, Israel	Low-water line, amphioxus sand	Mediterranean
III	<i>Caligopsyllus</i> Kunz 1975				
27	<i>C. primus</i> Kunz 1975	Kunz 1975; Huys 1988	South Africa, East London	Tidal pools of a reef, shell gravel	Indian Ocean
IV	<i>Diarthrodella</i> Klie 1949				
28	<i>D. chilensis</i> Mielke 1985a, b	Mielke 1985b	Niebla, Isla Maiquillahue, Quellon, Viña del Mar	Beach, sand	Pacific Ocean

Table 4 (continued)

No.	Species and authorship	References	Location/Records	Depth/Habitat	Geogr. Region
29	<i>D. convexa</i> Kunz 1983	Kunz 1983	Azores	Littoral	Atlantic Ocean
30	<i>D. galapagoensis</i> Mielke 1984a, b	Mielke 1984b	Galapagos, Fernandina, Cabo Gougls; James, Bahia James; Santa Cruz, Bahia; Academy; Barrington; Floreana; San Christobal;	Beach	Pacific Ocean
31	<i>D. lancifera</i> Kunz 1983	Kunz 1983	Azores	Littoral	Atlantic Ocean
32	<i>D. neotropica</i> Mielke 1984a, b	Mielke 1984b	Galapagos, Santa Cruz, Playa Borrero; Hood, Bahia Gardner	Beach, low water level; Groundwater level	Pacific Ocean
33	<i>D. orbiculata</i> Klie 1949	Klie 1949	Helgoland, North Sea	Littoral	North Sea
34	<i>D. parorbiculata</i> Wells 1963a, b	Wells 1963b	Northern Ireland	?	Atlantic Ocean
	<i>D. parorbiculata pacifica</i> Mielke 1984a, b	Mielke 1984b	Galapagos, Tower, Bahia Darwin; Santa Cruz, Bahia Academy	Beach	Pacific Ocean
35	<i>D. psammophila</i> Bocquet and Bozic 1955	Bocquet and Bozic 1955	France, Roscoff	Sand	Atlantic Ocean
36	<i>D. secunda</i> Kunz 1954	Kunz 1954; Mielke 1975	Germany, Island of Sylt	Beach, low water level	North Sea
	<i>D. secunda pacifica</i> Kunz 1981	Kunz 1981	Hawaii, Anaeho'omalulu Bay	Beach, sand, low water level	Pacific Ocean
V	<i>Kunzia</i> Wells 1967				
37	<i>K. bispinosa</i> Kunz 1974	Kunz 1974	Africa	Coastal interstitial	Indian Ocean
38	<i>K. epacra</i> Wells 1967	Wells 1967	Indian Ocean, Ilha dos Portuguesos, Mozambique	Beach, clean sand	Indian Ocean
39	<i>K. minutissima</i> Wells 1967	Wells 1967	Indian Ocean, Ilha dos Portuguesos, Mozambique	Beach, clean sand	Indian Ocean
VI	<i>Kliopsyllus</i> Kunz 1962				
40	<i>K. acutifurcatus</i> Mielke 1985a, b	Mielke 1985a, b	Chile, Mehui	Beach	Pacific Ocean
41	<i>K. andeep</i> Veit-Köhler 2004	Veit-Köhler 2004	Antarctica, Weddell Sea	Muddy sediment, 4,541 m	Antarctica
42	<i>K. arenicolus</i> Krishnaswamy 1957	Krishnaswamy 1957	India, Madras	?	Indian Ocean
43	<i>K. atlanticus</i> Kunz 1983	Kunz 1983	Azore Islands	Interstitial	Atlantic Ocean
44	<i>K. californicus</i> Kunz 1981	Kunz 1981	Pacific, San Fransisco, USA	Tidal pools of a reef	Pacific Ocean
45	<i>K. capensis</i> Krishnaswamy 1957	Krishnaswamy 1957; Rao Ganapati 1969	India, Cape Comorin; Waltair	Beach	Indian Ocean
46	<i>K. chilensis</i> Mielke 1985a, b	Mielke 1985a	Chile, Quellon, Viña del Mar, Reñaca	Coastal waters	Pacific Ocean
47	<i>K. coelebs</i> Monard 1935	Monard 1935; Pesta 1959; Kunz 1962; Wells 1963a, b; Marinov 1977	France, Roscoff; Las Palmas; Mauritania	Coarse sand, interstitial	Atlantic Ocean
48	<i>K. constrictus</i> Nicholls 1935	Nicholls 1935; Marinov 1971; Apostolov and Marinov 1988	Helgoland; north-east Atlantic; Scotland; Mediterranean Sea; Marmara Sea; Black Sea; White Sea	Littoral, coarse sand	North-Europe
	<i>K. constrictus egyptus</i> Mitwally and Montagna 2001	Mitwally and Montagna 2001	Egypt, Alexandria, diterranean	Sandy beach	Mediterranean
	<i>K. constrictus orotavae</i> Noodt 1958	Noodt 1958; Rao and Ganapati 1969	Israel, Nahariyya, Mediterranean; Azores, Atlantic; Waltair, India, Indian Ocean	Coarse sand	"Cosmopolitan"
	<i>K. constrictus pacificus</i> Mielke 1984a, b	Mielke 1984a, b, 1987	Pacific, Isla Flamenco, Isla Melones; Chile, Coquimbo, Iquique	Beach	Pacific Ocean

Table 4 (continued)

No.	Species and authorship	References	Location/Records	Depth/Habitat	Geogr. Region
49	<i>K. debilis</i> Kunz 1981	Kunz 1981	Hawaii, Coconut Island, Ohau	Fine sand, 20 cm	Pacific Ocean
50	<i>K. diva</i> Veit-Köhler 2005	Veit-Köhler 2005	East Atlantic, Angola Basin	Muddy sediment, 5,389 m	Atlantic Ocean
51	<i>K. enalius</i> Krishnaswamy 1957	Krishnaswamy 1957	India, Madras	?	Indian Ocean
52	<i>K. fircavariatus</i> Kunz 1974	Kunz 1974	East Africa; Tanzania; West Indies	Coral sand 3 m	Indian Ocean
53	<i>K. gracilis</i> Wilson 1932 (uncertain Bodin 1997)	Wilson 1932	?	?	?
54	<i>K. holsaticus</i> Klie 1929	Klie 1929; Scheibel 1972; Mielke 1975; Wells and Rao 1987; Apostolov and Marinov 1988; Kunz 1981	North-east Atlantic; Baltic Sea, Bay of Kiel; North Sea, Helgoland; Black Sea	Sand	“Cosmopolitan”
	<i>K. holsaticus varians</i> Kunz 1951	Kunz 1951	South West Africa	Sand	Atlantic Ocean
	<i>K. holsaticus longicaudatus</i> Galhano 1970	Galhano 1970	Portugal	Interstitial	Atlantic Ocean
	<i>K. holsaticus listensis</i> Mielke 1984a, b	Mielke 1984a, b	?	?	?
55	<i>K. idiotes</i> Wells 1967	Wells 1967	Africa, Mozambique	Coastal waters	Indian Ocean
56	<i>K. insularis</i> Kunz 1981	Kunz 1981	Hawaii, Coconut Island	Fine sand 20 cm	Pacific Ocean
57	<i>K. laurenticus</i> Nicholls, 1939 (uncertain Bodin 1997)	Nicholls 1939; Wells 1963a, b	Canada, St. Lawrence River; USA, Woods Hole	Sandy beach	Atlantic Ocean
58	<i>K. longifurcatus</i> Scheibel 1975	Scheibel 1975	Baltic Sea, Bay of Kiel	Sand flat	North Europe
59	<i>K. longisetosus</i> Krishnaswamy 1951	Krishnaswamy 1951, 1957	India, Madras	Coastal waters	Indian Ocean
60	<i>K. major</i> Nicholls 1939	Nicholls 1939	Canada, St. Lawrence River	Coarse sand 8 m	Atlantic Ocean
61	<i>K. masryi</i> Masry 1970	Masry 1970	Israel, Shiqmona, Nahariyya; Italy; France	Beach	Mediterranean
62	<i>K. miguelensis</i> Kunz 1983	Kunz 1983	Azores	Interstitial	Atlantic Ocean
63	<i>K. minutus</i> Krishnaswamy 1957	Krishnaswamy 1957	India	Coastal waters	Indian Ocean
64	<i>K. minor</i> Vasconcelos et al. 2009	Vasconcelos et al. 2009	Northeastern Brazil	492 m	Atlantic Ocean
65	<i>K. panamensis</i> Mielke 1984a, b	Mielke 1984a, b	Panama, Isla Melones	?	Pacific Ocean
66	<i>K. paraholsaticus</i> Mielke 1975	Mielke 1975	?	Sand, wadden	North Sea
67	<i>K. perhardiensis</i> Wells 1963a, b	Wells 1963b	Atlantic; France, Roscoff; Ireland; England	Beach, brackish waters	Atlantic Ocean
68	<i>K. ponticus</i> Serban 1959	Serban 1959, 1968	Black Sea	Beach	North-Europe
69	<i>K. psammobionta</i> Noodt 1964	Noodt 1964	Cosmopolitan	Coastal waters	“cosmopolitan”
70	<i>K. psammophilus</i> Noodt 1964	Noodt 1964	Red Sea	?	Indian Ocean
71	<i>K. pseudogracilis</i> Krishnaswamy 1951	Krishnaswamy 1951; Rao and Ganapati 1969	India, Waltair Sand	Coastal waters	Indian Ocean
72	<i>K. pygmaeus</i> Nicholls 1939b	Nicholls 1939b	Scotland, Balloch Bay, Firth of Clyde; Canada, St Lawrence	Sand, low water	Atlantic Ocean
73	<i>K. regulexstans</i> Mielke 1984a, b	Mielke 1984a, b	Galapagos Islands; Atlantic, Caribbean, Isla Mosquito	Coastal waters	“Cosmopolitan”
74	<i>K. schminkei</i> Veit-Köhler and Drewes 2009	Veit-Köhler and Drewes 2009	South-east Atlantic, Angola Basin	5,389 m	Atlantic Ocean
75	<i>K. similis</i> Mielke 1984a, b	Mielke 1984a, b	Galapagos Islands; Atlantic, Caribbean, Isla Mosquito	Beach	“Cosmopolitan”

Table 4 (continued)

No.	Species and authorship	References	Location/Records	Depth/Habitat	Geogr. Region
76	<i>K. spiniger</i> Wells et al. 1975	Wells et al. 1975; Mielke 1984b	Indian Ocean, North Andaman, India; Galapagos Islands	10–30 cm	“Cosmopolitan”
	<i>K. spiniger ornatus</i> Kunz 1981	Kunz 1981	Hawaii, Maui	Coastal groundwater	Pacific Ocean
77	<i>K. unguiseta</i> Mielke 1984a, b	Mielke 1984a, b	Galapagos Islands, Santa Cruz	Beach	Pacific Ocean
78	<i>K. wilsoni</i> Krishnaswamy 1957	Krishnaswamy 1957; Rao and Ganapati 1969	India, Waltair	Sand	Indian Ocean
79	<i>Kliopsyllus</i> sp. (sp. i.) Apostolov 1973b	Apostolov 1973b	Black Sea	?	Black Sea
VII	<i>Leptopsyllus</i> T. Scott 1894				
80	<i>L. abyssalis</i> Becker et al. 1979	Becker et al. 1979	Iberian Basin	3,820 m	Atlantic Ocean
81	<i>L. celticus</i> Bodin and Jackson 1987	Bodin and Jackson 1987	Ireland, An Poll Brean beach, Mweenish Island; France, Kersaint beach, Brittany	Intertidal sand	Atlantic Ocean
82	<i>L. dubatyi</i> Soyer 1975	Soyer 1975	Kerguelen	Mesopsammon	Antarctica
83	<i>L. elongatus</i> Drzycimski 1967	Drzycimski 1967	Norway, Korsfjorden	Mud, 515 m	Atlantic Ocean
84	<i>L. harveyi</i> Wells 1963a, b	Wells 1963a, b, 1967	Indian Ocean, Ilha dos Portuguesos	Beach, clean sand	Indian Ocean
85	<i>L. paratypicus</i> Nicholls 1939	Nicholls 1939	Scotland, Balloch Bay, Firth of Clyde	Sand	Atlantic Ocean
86	<i>L. platyspinosus</i> Mielke 1984a, b	Mielke 1984a, b	Galapagos Islands	Beach	Pacific Ocean
87	<i>L. punctatus</i> Mielke 1984a, b	Mielke 1984a, b	Galapagos, Marchena, Southwest beach, Santa Cruz, Playa Borrero, Bahia Academy, Bartholome Nord, Cop. Floreana, Punta Cormorant	Beach	Pacific Ocean
88	<i>L. reductus</i> Lang 1948	Lang 1948; Por 1964	Sweden, Gullmarfjord	70–80 m, mud	North Europe
89	<i>L. typicus</i> Lang 1948	Lang 1948	Scotland, Queensferry, Firth of Forth	?	Atlantic Ocean
90	<i>Leptopsyllus</i> (<i>Paraleptopsyllus</i>) <i>L. (Par.) articus</i> Lang 1936	Lang 1936; Lang 1948	Spitzbergen	Clay 1,750 m	Atlantic Ocean
VIII	<i>Meiopsyllus</i> Cottarelli and Forniz 1994				
91	<i>M. marinae</i> Cottarelli and Forniz 1994	Cottarelli and Forniz 1994	Sardinia, Asinara island, Cala Arena	Seashore	Mediterranean
IX	<i>Paramesochra</i> T. Scott 1892				
92	<i>P. acutata</i> Klie 1935	Klie 1935; Lang 1948; Mielke 1975	Germany, Baltic Sea, Courland Spit, Bay of Kiel	Coastal groundwater	North Europe
	<i>P. acutata hawaiiensis</i> Kunz 1981	Kunz 1981	Hawaii, Kauai island, Maui Island, Beach	Beach, tidal pool	Pacific Ocean
93	<i>P. australis</i> Mielke 1994	Mielke 1994	Chile	?	Pacific Ocean
94	<i>P. borealis</i> Geddes 1981	Geddes 1981	Norway, Tromsø	Intertidal sand	Atlantic Ocean
95	<i>P. brevifurca</i> Galhano 1970	Galhano 1970	Atlantic, Portugal	Interstitial sand	Atlantic Ocean
	<i>P. brevifurca mediterranea</i> Huys 1987	Huys 1987; Cottarelli 1971	Mediterranean, Italy, Sardinia	Interstitial sand	Mediterranean
96	<i>P. denticulata</i> Rao and Ganapati 1969	Rao and Ganapati 1969	India, Waltair, Palm Beach	Medium sand, half-tide level	Indian Ocean
97	<i>P. dubia</i> T. Scott 1892	T. Scott 1892; Lang 1948	Norway, Korshavn; Germany, Helgoland;	12–43 m; mud, sand	North Europe

Table 4 (continued)

No.	Species and authorship	References	Location/Records	Depth/Habitat	Geogr. Region
			Scotland, Firth of Forth, St. Monas; England, Cornwell, St. Mary's Sound of Scilly Island, Liverpool Bay, Port Erin; Ireland, Killary Harbour; France, Roscoff		
98	<i>P. helgolandica</i> Kunz 1936	Kunz 1936; Marinov 1971; Apostolov 1972, 1973b; Apostolov and Marinov 1988	North Sea, Helgoland; Black Sea, White Sea	Amphioxus sand and gravel	North Europe
	<i>P. helgolandica galapagoensis</i> Mielke 1984a, b	Mielke 1984b	Galapagos, Santa Cruz, Playa Borrero	Sand	Pacific Ocean
99	<i>P. kunzi</i> Mielke 1984a, b	Mielke 1984a	Panama, Pacific, Isla Naos, Isla Melones; Isla Flamenco	Sand	Pacific Ocean
100	<i>P. longicaudata</i> Nicholls, 1945	Nicholls, 1945; Noodt 1964	Australia, Perth, Cottesloe Beach; Red Sea	Sand, corral sand	"Cosmopolitan"
101	<i>P. marisalbi</i> Kornev and Chertoprud 2008	Kornev and Chertoprud 2008	Russia, White Sea	12 m depth, sandy ground	North Europe
102	<i>P. mielkei</i> Huys 1987	Huys 1987	North Sea, Southern Bay, Dutch coast	Medium sand, 12 m	North Sea
103	<i>P. ornata</i> Krishnaswamy 1957	Krishnaswamy 1957	India	Brackish interstitial	Indian Ocean
104	<i>P. pterocaudata</i> Kunz 1936	Kunz 1936	North Sea, Helgoland	Amphioxus sand	North Sea
105	<i>P. similis</i> Kunz 1936	Kunz 1936; Apostolov and Marinov 1988	Helgoland, Great Britain, Black-Sea	Amphioxus sand	"Cosmopolitan"
106	<i>P. unaspina</i> Mielke 1984a, b	Mielke 1984a, b	Galapagos, Isabely, Caleta	Interstitial	Pacific Ocean
X	<i>Remanea</i> Klie 1929				
107	<i>R. arenicola</i> Klie 1929	Klie 1929; Nicholls 1945; Bozic 1955; Mielke 1975; Arlt 1983	Scotland, Fintry Bay, Isle of Cumbrae, Firth of Clyde; Germany, Bay of Kiel, Island Sylt France, Roscoff; Australia	Coarse sand, low-water mark	"Cosmopolitan"
108	<i>R. plumosa</i> Pennak 1942	Pennak 1942	USA, Woods Hole	?	Pacific Ocean
XI	<i>Rossopsyllus</i> Soyer 1975				
109	<i>R. kerguelensis</i> Soyer 1975	Soyer 1975	Kerguelen	Littoral	Antarctica
	<i>R. kerguelensis quellonensis</i> Mielke 1985a, b	Mielke 1985a, b	Chile, Quellón	Beach	Pacific Ocean
110	<i>R. obscurus</i> Cottarelli and Baldari 1987	Cottarelli and Baldari 1987	Macquarie Island	Interstitial	Pacific Ocean
XII	<i>Scottopsyllus</i>				
111	<i>S. (Sc.) depressus</i> Kornev and Chertoprud 2008	Kornev and Chertoprud 2008	Russia, White Sea	10 m depth, sandy ground	North Europe
112	<i>S. (Sc.) herdmani</i> Thompson and A. Scott 1900	Thompson and A. Scott 1900; Marinov 1971; Apostolov 1972; Mielke 1975; Letova 1982; Apostolov and Marinov 1988	U.K., Isle of Man, Port Erin; Scotland, Clyde; Bay of Kiel, Baltic Sea; White Sea; Black Sea	Beach, sand	"Cosmopolitan"
113	<i>S. (Sc.) langi</i> Mielke 1984a, b	Mielke 1984a, b	Galapagos, Tower, Bahia Darwin, Santa Cruz, Puerto Nunez, Bahia Academy	Sand	Pacific Ocean
	<i>S. (Sc.) langi continentalis</i> Kunz 1992	Kunz 1992	Croatia, Mediterranean Sea, Korcula Island Lumbarda south beach	Fine sand, sea level	Mediterranean

Table 4 (continued)

No.	Species and authorship	References	Location/Records	Depth/Habitat	Geogr. Region
114	<i>S. (Sc.) minor</i> T. and A. Scott 1895	T. and A. Scott 1895; Mielke 1975; Apostolov and Marinov 1988	Scotland, Firth of Forth, Musselburgh; Canada, St. Lawrence, Trois Pistoles; Germany, North Sea, Island of Sylt; Bulgaria, Black Sea, Mitschurin	Near shore, Pools near low water, coarse sand, supratidal, breakwater, Sandwatt Coast	"Cosmopolitan"
115	<i>S. (Sc.) pararobertsoni</i> Lang 1965	Lang 1965	California, Monterey Bay off Hopkins	Tidal pool, shell sand	Pacific Ocean
116	<i>S. (Sc.) praecipuus</i> Veit-Köhler 2000	Veit-Köhler 2000	Antarctica, South Shetland Islands, King George Island, Potter Cove	Muddy sediments, 20–30 m depth	Antarctica
117	<i>S. (Sc.) robertsoni</i> T. and A. Scott 1895	T. and A. Scott 1895; Apostolov 1972; Apostolov and Marinov 1988	Scotland, Firth of Forth, Musselburgh; Bulgaria, Black Sea, Nessebar	Shore near pools near low water, Clean sand, 10 m	North Europe
118	<i>S. (I.) antoniae</i> sp.nov Plum and George, this paper	Plum and George, this paper	Northeast Atlantic, Great Meteor seamount	Coarse sand, 325 m depth	Atlantic Ocean
119	<i>S. (I.) intermedius</i> T. and A. Scott 1895	T. and A. Scott 1895; Kunz 1962; Mielke 1975; Apostolov and Marinov 1988	Scotland, Firth of Forth, U.K., Isle of Man, Port Erin; Germany, North Sea, Island of Sylt; Africa, Namibia, Lüderitz-Bay; Bulgaria, Black Sea, Warná; Northeast Atlantic, Great Meteor seamount	Pools near low water, sand; sandwatt, supratidal groundwater; amphioxus sand	"Cosmopolitan"
120	<i>S. (I.) minutus</i> Nicholls 1939	Nicholls 1939	Scotland, Firth of Forth	Muddy sand	Atlantic Ocean
121	<i>S. (I.) smirnovi</i> Kunz 1992	Kunz 1992	Croatia, Mediterranean Sea, Mijet island	Shell-sand	Mediterranean
122	<i>S. (W.) abyssalis</i> Becker et al. 1979	Becker et al. 1979	Peru Trench, "Anton Bruun"	2,000 m depth	Pacific Ocean
123	<i>S. (W.) gigas</i> Wells 1965	Wells 1965	Scotland, Fladen	Mud, 146 m depth	Atlantic Ocean
124	<i>S. (W.) runtzi</i> Soyer 1975	Soyer 1975	Kerguelen, Port Kirk, Anse du Tranchant, Baie Charrier	Littoral sands near estuaries	Indian Ocean
XIII	<i>Tisbisoma</i> Bozic 1964				
125	<i>T. spinisetum</i> Bozic 1964	Bozic 1964	Reunion Island	?	Indian Ocean
126	<i>T. triarticulatum</i> Wells 1967	Wells 1967; Wells and Rao 1987	Mozambique, Ponta Torres	Clean sand	Indian Ocean

antoniae sp. nov. (cf. Veit-Köhler 2000) described here. Most species were found in coastal waters of northern Europe, but there are also records from King George island [*Sc. (Sc.) praecipuus* Veit-Köhler 2000], the Lüderitz Bay, Namibia [*Sc. (I.) intermedius*], the Peru Trench [*Sc. (W.) abyssalis*], the Galapagos Islands [*Sc. (Sc.) langi* Mielke 1984a, b] and recently the Great Meteor Seamount [*Sc. (I.) antoniae* sp. nov., this study].

Discussion

Taxonomy

Scottopsyllus (Intermedopsyllus) antoniae sp. nov. is attributed to the genus *Scottopsyllus* Kunz 1962 mainly because of

the 1-segmented, "paramecium"-shaped endopods of P2 and P3. Besides these conspicuous features, the 1-segmented exp of the antenna, the 1-segmented exp of the mandible and the 3-segmented exopods of P2 and P3 characterize the new species as a member of *Scottopsyllus*.

In 1962, Kunz established the genera *Scottopsyllus* and *Intermedopsyllus* as part of a revision of the Paramesochridae (Kunz 1962). Later on, he relegated these genera to subgeneric status, placing them together with another new subgenus *Sc. (Wellsopsyllus)* in the genus *Scottopsyllus* (Kunz 1981). The three subgenera can be distinguished mainly by the segmentation of the endopods and exopods of P4. *Sc. (Wellsopsyllus)* exhibits a 3-segmented exp and a 1-segmented enp in P4, while in *Sc. (Scottopsyllus)* the P4 exp is 3-segmented and the enp 2-segmented. *Sc. (Intermedopsyllus)*,

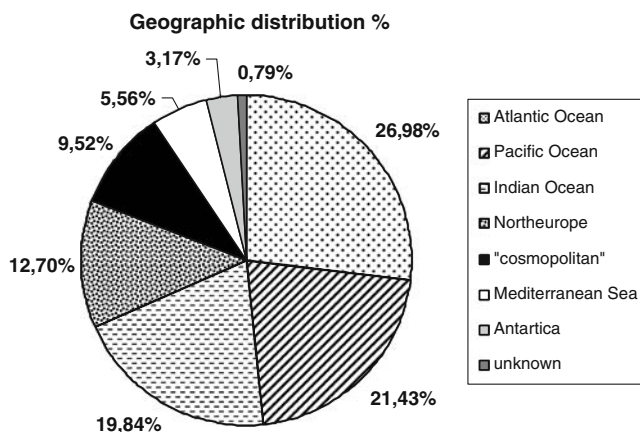


Fig. 9 Global geographic distribution of paramesochrid species

in turn, has a 2-segmented exp in P4 due to a fusion of the 2 proximal segments (and a 1-segmented enp). The new species *Scottopsyllus (Intermedopsyllus) antoniae* sp. nov. is placed in the subgenus *Sc. (Intermedopsyllus)*, as it has this derived character in the exp of P4.

Within *Sc. (Intermedopsyllus)*, the new species can be distinguished from its congeners by virtue of the following characteristics:

Female A1

Sc. (I.) antoniae sp. nov. bears 1 seta on segment 1, 9 setae on segment 2 and 7 setae on segment 3. According to the original descriptions, the three other species of *Sc. (Intermedopsyllus)* lack a seta on the first segment and bear less setae in the following two segments [4 setae at both segments 2 and 3 in *Sc. (I.) intermedius*, 5 and 6 setae, respectively in *Sc. (I.) minutus* Nicholls 1939, 4 and 5 setae, respectively in *Sc. (I.) smirnovi* Kunz 1992].

Mandibular palp

Sc. (I.) antoniae shows a 1-segmented enp with 5 setae and a 1-segmented, small exp with 2 setae. In contrast, the palpus of *Sc. (I.) intermedius* possesses a 2-segmented enp with 8 setae in total and an exp with 4 setae, whereas that of *Sc. (I.) smirnovi* has a 1-segmented enp with 3 setae, while the exp is lacking. Furthermore, the basis lacks the terminal setae in *Sc. (I.) smirnovi*. The md palpus of *Sc. (I.) minutus* was not described by Nicholls (1939).

Maxilla

The mx of *Sc. (I.) antoniae* resembles that of *Sc. (I.) minutus*. Both species have 2 endites on the syncoxa but can be distinguished by the number of setae. The proximal endite in

Sc. (I.) antoniae sp. nov. exhibits only 1 seta, while that of *Sc. (I.) minutus* bears 2 setae. *Sc. (I.) intermedius* (after Kunz 1992) possess 3 endites on the syncoxa, while in *Sc. (I.) smirnovi* the two proximal of the three endites are each represented by a single seta. Furthermore, in *Sc. (I.) antoniae* sp. nov. the maxillar enp is absent and represented by 4 setae, while it is present but fused to the allobasis in *Sc. (I.) minutus* and *Sc. (I.) intermedius*. In *Sc. (I.) smirnovi* the enp seems to be separated and assembled with 3 setae. Additionally, *Sc. (I.) antoniae* sp. nov. and *Sc. (I.) intermedius* share the well developed claw of the allobasis, but in the latter the claw is not accompanied by additional setae.

P2 and P3 exp

The most outstanding feature of *Sc. (I.) antoniae* sp. nov. is the third seta on the terminal segment of P2 and P3 exp. This seta has never been described in any other species of the genus *Scottopsyllus (Intermedopsyllus)*.

Furca

Sc. (I.) antoniae sp. nov. lacks furcal seta I, retaining only six furcal setae. Also, *Sc. (I.) minutus* and *Sc. (I.) smirnovi* lost furcal seta I. However, these species additionally lost seta IV, which is well developed in *Sc. (I.) antoniae* sp. nov.. The only species retaining all seven furcal setae is *Sc. (I.) intermedius*.

Ecological remarks

Paramesochridae of the Great Meteor Seamount - distribution and endemism

Due to sedimentological and topographical conditions, the plateau of GMS has been sampled quite pragmatically, using gear that was able to provide sampling material in these circumstances (cf. Martínez Arbizu and Schminke

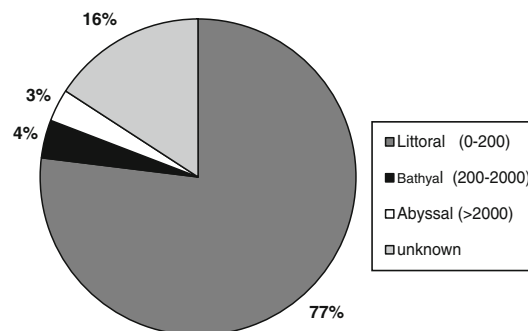


Fig. 10 Global bathymetric distribution pattern (%) of paramesochrid species

2000; George and Schminke 2002). Consequently, the sampling was not standardized, and quantitative analysis is therefore impossible. However, regarding the distribution of Paramesochridae at GMS, no homogeneous distribution pattern can be detected. As shown in Table 2, even stations of the same plateau area may differ remarkably with respect to their number of individuals. For instance, eastern stations 551 and 552 were both sampled with the epibenthic sledge (EBS, cf. Table 1). However, station 552 yielded $N=23$, whereas neighboring station 551 provided $N=175$ (Table 2). Interestingly, samples taken with the box corer (BC) produced almost the same number of specimens (stations 451, 455, 467, 492, cf. Table 2), ranging between 48 and 68 specimens, with the exception of stations 505 (deep sea: $N=3$) and station 516 (western plateau: $N=140$), and a mean value of $Z=55$ individuals. This might be an indication for a non-patchy distribution, although a real quantitative sampling is needed to address that question. In contrast, the EBS demonstrates a large variation in specimen numbers, from 1 to 175, with a mean value of $Z=17$ individuals. Evidently, this is due to the specific gear characteristics, as it is designed to catch bigger animals than Paramesochridae (Brandt and Barthelnt 1995).

The high degree of scientifically new species at GMS (>90%) was not surprising, as in many other recently extensive investigated marine environments most of the sampled harpacticoid species are considered to be new to science (e.g., George and Schminke 2002; George 2004a, b, 2005; Rose et al. 2005; Baguley et al. 2006; Gheerardyn and Veit-Köhler 2009). Contrary to Emschermann (1971), who suggested that the deep sea might act as a kind of

“faunal reservoir” for the GMS and that its faunal assemblages may mainly consist of deep-sea “resistant” species, George and Schminke (2002) came to the conclusion that the GMS plateau represents an isolated area with only occasional bathymetric and geographic exchange. They base their assumption on the large number of new species found on GMS plateau. Mironov and Krylova (2006) also mention a high degree of endemism (91%) on the GMS for meiofauna organisms. As shown by the results presented here, this hypothesis is supported with respect to Paramesochridae. Nevertheless, many isolated islands and seamounts show a lower endemism than less isolated islands and seamounts (Mironov and Krylova 2006). A differentiation has yet to be made between the taxa or major groups under study, a fact that is often not taken into account in such a comparison. Although a high number of new species does not necessarily mean a high degree of endemism, it certainly may be an indication for a significant to high isolation of the corresponding habitat. With respect to the GMS and to Harpacticoida, it means that the very high percentage of unknown species on the plateau supports the hypothesis of the seamount’s role as a “trapping stone” (Hubbs 1959) for at least that taxon. Quite opposite to that hypothesis, studies on other meiobenthic taxa and on megabenthic and macrobenthic groups from GMS suggest that most species are widespread elements of the North Atlantic fauna, indicating that the GMS area is not isolated. Bartsch (2003) criticizes the hypothesis of George and Schminke (2002), stating that marine mites (Halacarida), as well as several other macrobenthic and megabenthic taxa (including fish) certainly do present a

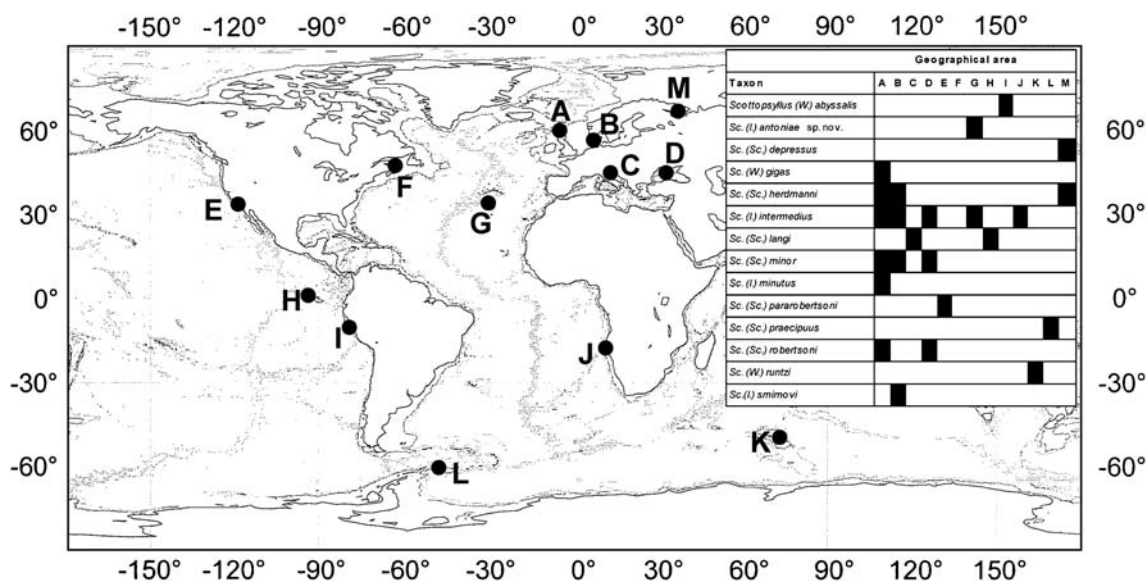


Fig. 11 Geographic distribution patterns of the genus *Scottopsyllus*. Capital letters (A–L) indicate geographic areas where the known species were recorded. The small table assigns the species to the corresponding area(s). For detailed information cf. Table 4

widespread distribution, even though found solely on GMS so far. However, Bartsch's (2003) argumentation is inconsistent in our opinion. Especially with regard to the meiobenthic Halacarida, she turns from species to genus level, which is meaningless in connection with endemic species. The paramesochrid genera from GMS are widespread in the world's oceans (Table 4, Fig. 9), but it is a species that provides valuable information on endemism. Bartsch (2003, p. 114 and Table 1) shows that 17 of the 24 halacarid species (>70%) were new to science and exclusively found at GMS. When Bartsch (2003, p. 113) states that "Certainly more species will be found in future investigations", it is not less speculative than the contrary assumption of the species possibly being endemic ones.

Regarding macrofauna and megafauna, a direct comparison with meiobenthic data, as realized by several authors, is questionable. Percentages of endemism for macrobenthic and megabenthic species on the GMS (Piepenburg and Müller 2004) conform with values from studies of different seamounts (e.g., Rogers 1994; Richer de Forges et al. 2000; Gillet and Dauvin 2003; Ávila and Malaquias 2003) that presented much lower exclusive macrobenthic and megabenthic species than reported by George and Schminke (2002) for meiobenthic Harpacticoida. However, this is not surprising as the lifecycle of macrobenthic and megabenthic organisms includes life stages living in the water column, which is an important prerequisite for wide geographic dispersal. Nevertheless, results obtained by investigations on megafauna and macrofauna must not be extended to meiofauna, which does not meet the mentioned prerequisite. The antithesis presented by Bartsch (2003), and apparently supported by results obtained for macrofauna and megafauna, shows impressively that seamounts do not correspond to generalizing assumptions that attempt to assign single functions to them. A seamount should not be regarded as solely a staging post supporting geographical dispersal of benthic organisms, or only an isolated object retaining "trapped" organisms. The same seamount may play several roles at the same time, depending, among other things, on the taxon referred to. This assessment is not as trivial as one might believe, as demonstrated impressively by McClain (2007) in his criticism of seamount research.

In a study on the typical deep-sea family Argestidae on the GMS, George (2004a) presumed that the relatively high percentage of closely related species on the plateau was due to radiation in that area rather than a successive colonization from other localities. Contrary to the Argestidae, Paramesochridae are considered to be shallow-water rather than deep-sea organisms. In this context, it is remarkable that the paramesochrid community at GMS seems to be dominated by species of the taxa *Kliopsyllus* and *Paramesochra*. Species of these genera are typically found in coastal waters. Thus, the assumption by George (2004a, b) of an elevation of the

argestid fauna over millions of years together with the growing seamount itself appears unlikely for Paramesochridae. This is supported, for example, by *Scottopsyllus (Intermedopsyllus) antoniae* sp. nov., which was also sampled on the summits of Sedlo and Seine seamounts. The same applies to *Sc. (I.) intermedius*, which has only been recorded in intertidal habitats so far (Table 4). Consequently, one might conclude that most of the Paramesochridae at GMS possibly originate from geographically adjacent regions rather than from the surrounding deep sea. It is plausible that "Scenario I: geographical immigration" as described by George (2004a, b, p. 262) applies to the Paramesochridae of the GMS, i.e., most Paramesochridae originate from shallow-water localities and reach the GMS by overcoming the vast deep-sea areas. However, we still have no information or even plausible ideas to explain how meiobenthic organisms surmount both the depth and deep-sea sediments, both of which are considered to be significant barriers for certain interstitial meiofauna species (Gerlach 1977; Westheide 1991; Gad and Schminke 2004). A bathymetrical migration obviously does occur, as demonstrated by the presence of *Scottopsyllus (I.) intermedius* and *Kliopsyllus* sp. 10 on both the plateau and in the deep sea (cf. George and Schminke 2002 and George 2004a, b for other examples). Their presence in the deep sea may point to a much higher range of depth and sediment tolerance than presumed so far (but supporting Emschermann's 1971 hypothesis of deep-sea "resistant" species), and this may also be true for other Paramesochridae found exclusively on the plateau thus far.

Bathymetrical and geographical distribution of the genus Scottopsyllus

The reports of most paramesochrid species from only shallow waters so far may be the result of scientific history rather than real geographical distribution. Especially along European shorelines, many samples have been taken from littoral zones since the end of the nineteenth century. Consequently, species distribution ranges are concentrated in European waters and also in other regions, mainly confined to littoral zones. During the last decades, new paramesochrid taxa have increasingly been reported in different oceans and depths around the world, indicating a worldwide geographical and a broad bathymetrical distribution for this family. *Scottopsyllus* may serve as an example to illustrate paramesochrid distribution patterns. Figure 11 shows the geographical distribution of all known *Scottopsyllus* species (according to Veit-Köhler 2000) and includes the *Sc. (I.) antoniae* sp. nov. described here. None of the *Scottopsyllus* species reported in the Atlantic has been found at depths greater than 400 m. Gheerardyn and Veit-Köhler (2009) found two new species of the genus

Scottopsyllus at depths between 2,274 m and 5,194 m, but they were restricted to the Scotia Sea (Antarctica). *Scottopsyllus* (*W.*) *abyssalis* was found at 2,000 m depth, but has only been reported in the Peru Trench (Pacific Ocean). In this context, it is remarkable that the finding of *Scottopsyllus* (*I.*) *intermedius* at a GMS deep-sea station is the first record of *Scottopsyllus* in the Atlantic deep sea. This species occurs in shallow waters from the Firth of Forth (Scotland) to Lüderitz Bay in Namibia, but has never been recorded in the East Atlantic deep sea before.

The study by Gheerardyn and Veit-Köhler (2009) already indicated that ranges of certain species might span thousands of kilometres across the East Atlantic (or also the northern European seas in the present study). The large distribution ranges of certain paramesochrid species found at the GMS are comparable to the distribution patterns of deep-sea Paramesochridae in the Southeast Atlantic and Antarctic abyssal plains (Gheerardyn and Veit-Köhler 2009). These findings support what Giere (1993) called the “meiofauna paradoxon”: small-sized marine animals (even from shallow-water areas), lacking planktonic life stages and strictly bound to marine sediments, show a widespread, often cosmopolitan distribution even at species level. Our findings provide further evidence that there are no real barriers that might hinder the dispersal of copepods in the Atlantic (Gheerardyn and Veit-Köhler 2009). Vermeij (2004) mentioned that the deep sea in itself is not an obstruction to dispersal for seamount organisms. He pointed out that, even for shallow-water organisms, deep-sea basins and sediments offer at most a porous barrier. Several factors, such as suspension and rafting with floating material (Gerlach 1977), plate tectonics and continental drift (Rao 1972; Sterrer 1973; Westheide 1977), or long generation times (Gheerardyn and Veit-Köhler 2009) are proposed in relevant literature as explanations for the large dispersal ranges of meiofauna organisms. Connections via currents between seamounts may also increase the dispersal potential. Regarding the GMS and following Emschermann (1971), a drift of meiofauna organisms and their larvae across large distances is unlikely due to the discontinuous peripheral currents of the Canary Current. To date, such hypotheses are still speculative and seem to be inadequate to explain distribution patterns of small benthic organisms because most of these hypotheses seek an explanation for dispersal near the ocean’s surface.

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