Arctocyclopina pagonasta, a new genus and species of the family Cyclopinidae (Cyclopoida, Copepoda) from the annual sea ice in the Canadian Arctic

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A new genus and species of Cyclopoida is described; ***Arctocyclopina pagonasta*** is found inhabiting the arctic sea ice. Comparison is made with *Cyclopina gracilis* Claus, with which it may be confused.

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On trouvera ici la description d'***Arctocyclopina pagonasta***, n. gen., n. sp., découvert dans les glaces de l'océan Arctique. L'espèce est comparée à *Cyclopina gracilis* Claus avec laquelle il est facile de la confondre.

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Introduction

A new cyclopoid belonging to the family Cyclopinidae has been found associated with the annual sea ice in Frobisher Bay, Northwest Territories, Canada. The family Cyclopinidae has been divided by Kiefer (1927) into the subfamilies Pterinopsyllinae and Cyclopininae on the basis of the number of segments forming the second antenna.

The new genus herein described is placed within the subfamily Cyclopininae Kiefer of which there are 26 known genera. These are listed in Table 1.

TABLE 1. The genera of the subfamily Cyclopininae Kiefer

Cyclopina Claus, 1862	*Allocyclopina* Kiefer, 1954
Cyclopinella Sars, 1918	*Procyclopina* Herbst, 1955
Cyclopetta Sars, 1918	*Arenocyclopina* Krishnaswamy, 1957
Cyclopinodes Wilson, 1932	*Microcyclopina* Plesa, 1961
Cyclopinopsis Smirnov, 1935	*Parapseudocyclopinodes* Lindberg, 1961
Paracyclopina Smirnov, 1935	*Heterocyclopina* Plesa, 1968
Cyclopidina Steuer, 1940	*Afrocyclopina* Wells, 1967
Pseudocyclopina Lang, 1946	*Indocyclopina* Wells, 1967
Cyclopinoides Lindberg, 1953	*Paracyclopetta* Wells, 1967
Cyclopicina Lindberg, 1953	*Psammocyclopina* Wells, 1967
Metacyclopina Lindberg, 1953	*Cryptocyclopina* Monchenko, 1979
Neocyclopina Herbst, 1953*a*	*Cyclopuella* Por, 1979
Hemicyclopina Herbst, 1953*b*	*Cycloporella* Monchenko, 1981

Materials and methods

Holotypic female (whole, in alcohol), National Museum of Natural Sciences, Ottawa, No. NMC-C-1984-1540, 6 May 1980 (see Table 2); allotypic male (dissected, slide preparation), No. NMC-C-1984-1541, 3 February 1982; 11 paratypes (dissected, slide preparation, 6 females, 5 males), No. NMC-C-1984-1542 to 1547, 24 March 1981, 3–6 February 1982, 14–24 May 1982, 9 March 1984.

All drawings were made with the aid of a camera-lucida and specimens were measured with an eyepiece micrometer scale. Specimens are mounted in glycerin and Pro-texx®, a mounting medium.

Arctocyclopina gen. n.

Description

Antenna 1, 16-segmented. Antenna 2, 4-segmented; exopod represented by 2 setae. Endopod of mandibular palp 2-segmented; exopod 4-segmented. Endopod of maxilliped with 2 segments. P1–P4 with trimerous rami. Spine formula 4-4-3-3; setal formula 4-5-5-5. The second segment of the endopod P1 with one inner seta. P5 with 2 segments; basal segment with one external seta; distal segment with 4 setae in the female and 5-6 setae in the male.

Genotype: *Arctocyclopina pagonasta* sp. n.

Arctocyclopina pagonasta gen. n. et sp. n.

Female

Total length excluding furcal setae 700 μm (n = 51, mean = 700 μm, range = 630–850 μm). Body shape typically cyclopoid (Fig. 1, B). Head 200 μm in length, well demarcated from the first pedigerous segment. Maximum width 230 μm and total length to width ratio about 3:1. Ratio of the length of the anterior body to the urosome (which includes the fifth thoracic segment and excludes the furca) about 1.5:1. Genital segment longer than wide, with two small ventro-lateral proturberances each bearing 2 setulae of unequal length. Ovisacs oval in form and 220 μm in length, each containing about 15 eggs of about 40 μm in diameter.

Length of the furca greater than that of the anal segment; ratio about 1.6:1 (Fig. 2). Average furcal length to width ratio of 6 specimens 3.8:1. A single external seta, 40 μm in length, inserted at the proximal third of the furca. Length of the dorsal apical seta subequal to the length of the furca. Lengths of the external, external medial, internal medial, and internal apical setae 40, 160, 290, and 55 μm, respectively.

Antenna 1 composed of 16 segments (Fig. 1), reaching to the end of the head when reflected. Third segment longest with an indication of incomplete division.

Antenna 2 composed of 4 segments (Fig. 2). Exopod represented by 2 setae inserted at the external distal angle of the basal segment; another seta inserted at the internal distal angle.

Exopod of the mandibular palp composed of 4 segments. Endopod with 2 segments (Fig. 2); the proximal segments with

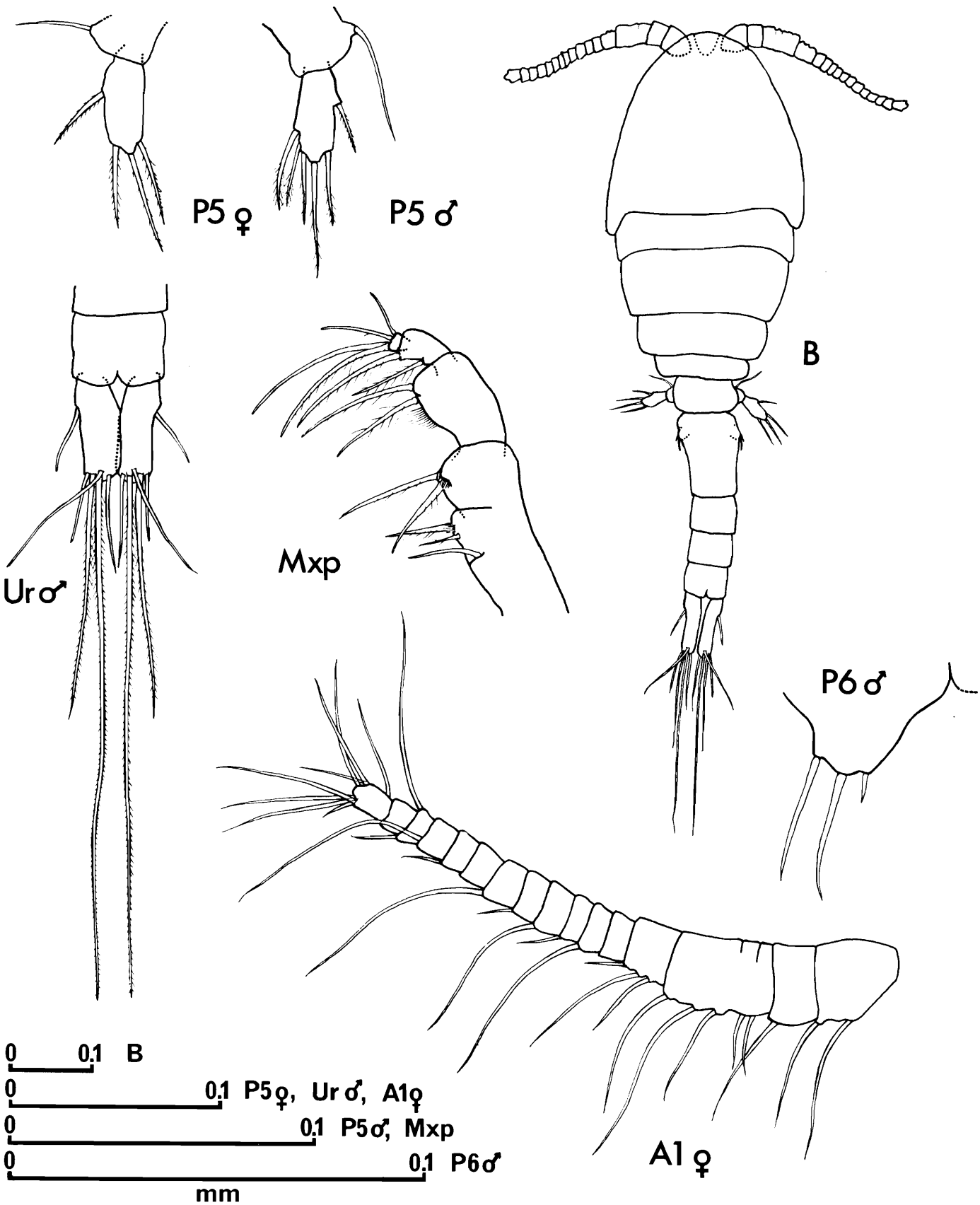

FIG. 1. *Arctocyclopina pagonasta* gen. n. sp. n., Frobisher Bay, N.W.T. B, mature female; A1, antenna 1; Mxp, maxilliped; P5, fifth leg; P6, sixth leg; Ur, furca and anal segment. All parts taken from mature females unless specified otherwise.

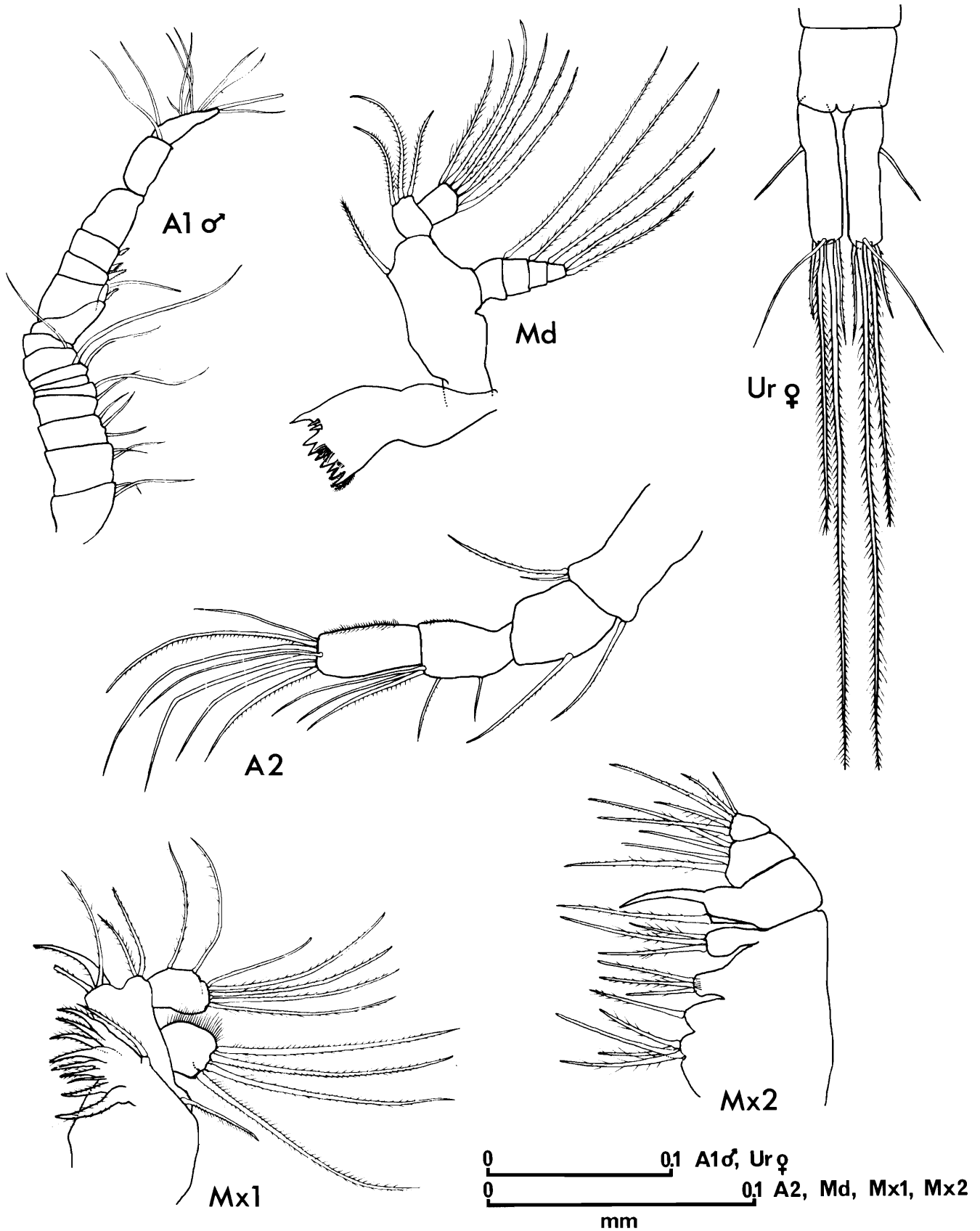

FIG. 2. *Arctocyclopina pagonasta* gen. n. sp. n., Frobisher Bay, N.W.T. A1, antenna 1; A2, antenna 2; Md, mandible; Mx1, maxilla 1; Mx2, maxilla 2; Ur, furca and anal segment. All parts taken from mature females unless specified otherwise.

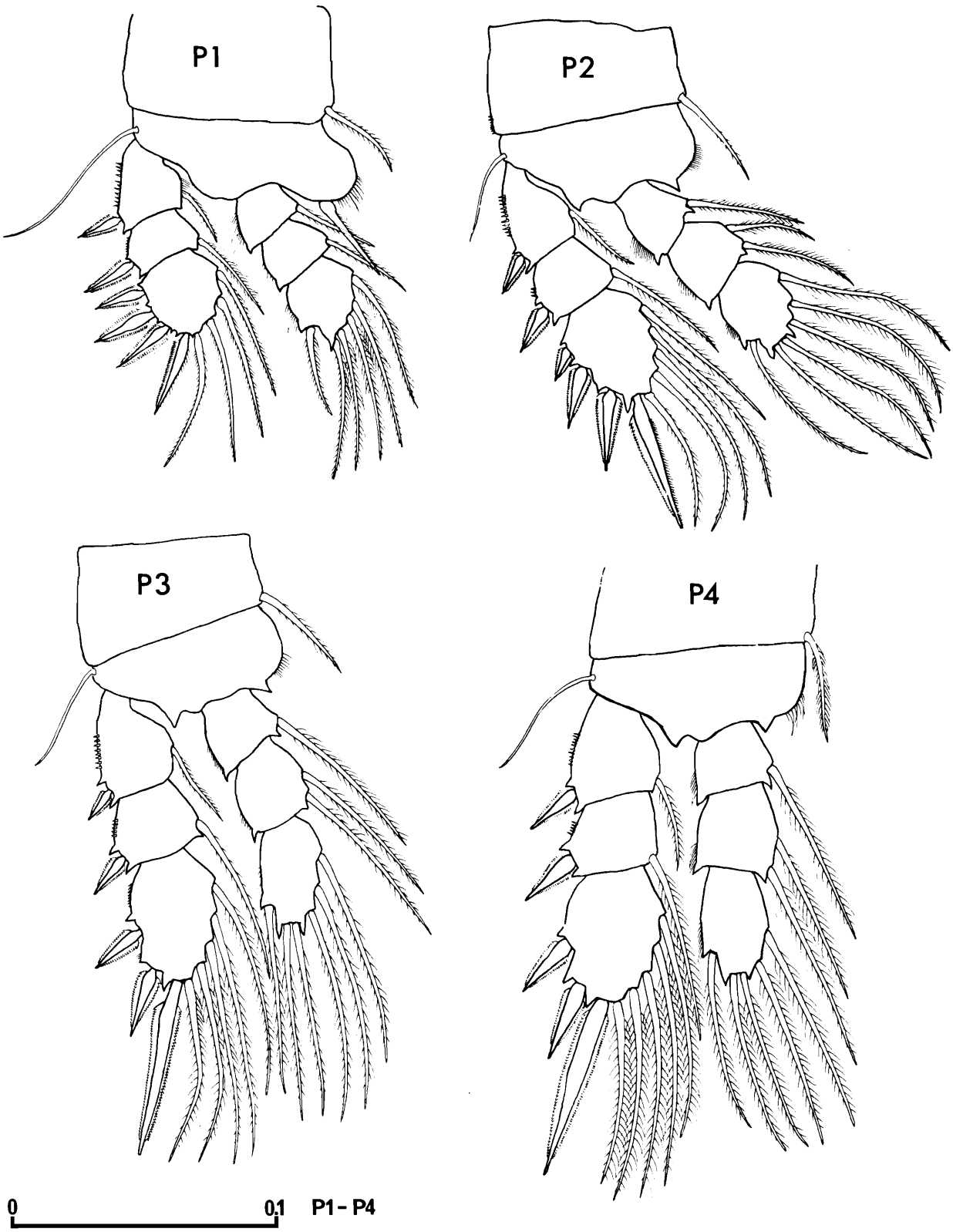

FIG. 3. *Arctocyclopina pagonasta* gen. n. sp. n., Frobisher Bay, N.W.T. P1–P4, first to fourth legs, respectively; from mature females.

TABLE 2. Dates and locations of samples taken in Frobisher Bay, N.W.T.

Collection date	Station No.	Depth	Location
6 May 1980	80-1	Bottom 3 cm of 162-cm ice cover	63°42.8′ N, 68°30.8′ W
24 March 1981	81-1	Bottom 3 cm of 142-cm ice cover	63°42.8′ N, 68°30.8′ W
3 February 1982	82-1	Bottom 3 cm of 80-cm ice cover	63°42.8′ N, 68°30.8′ W
6 February 1982	82-5	Bottom 3 cm of 92-cm ice cover	63°40.2′ N, 68°26.3′ W
14 May 1982	82-5	Bottom 3 cm of 144-cm ice cover	63°40.2′ N, 68°26.3′ W
24 May 1982	82-5	Between 3 and 20 cm of the bottom of 139-cm ice cover	63°40.2′ N, 68°26.3′ W
9 March 1984	84-41	Bottom 5 cm of 145 cm ice cover	63°42.1′ N, 68°28.8′ W

TABLE 3. Setae (Arabic numerals) and spines (Roman numerals) of P1–P4

	Exopod			Endopod		
	Segment 1	Segment 2	Segment 3	Segment 1	Segment 2	Segment 3
P1	1 + I	1 + I	4 + IV	1	1	6
P2	1 + I	1 + I	5 + IV	1	2	6
P3	1 + I	1 + I	5 + III	1	2	6
P4	1 + I	1 + I	5 + III	1	2	5

3 setae and the distal with 6.

Coxa and basis of the maxilla 1 confluent, bearing 4 setae and a pennate spine apically (Fig. 2). Exopod and endopod each one-segmented, with 4 and 7 setae, respectively.

Maxilla 2 composed of 4 segments (Fig. 2). Precoxa and coxa confluent. Basis with a claw and a seta. Endopod represented by 2 segments.

Maxilliped 4-segmented (Fig. 1). Coxa incompletely divided. Endopod represented by 2 segments.

Exopods and endopods of P1–P4 with 3 segments (Fig. 3). The configuration of spines and setae is shown in Table 3. All spines with a narrow serrulate hyaline flange.

P5 composed of 2 segments (Fig. 1), the proximal with an outer seta, the distal with 3 apical setae and one inserted externally just above the middle.

Male

Differs from the female in the following characters.

Total length excluding furcal setae 610 μm (n = 6, mean = 580 μm, range = 530–680 μm). Furca slightly shorter than that of the female (Fig. 1); average ratio of the furcal length to the length of the anal segment of 7 specimens 1.4:1; furcal length to width ratio 2.7:1.

Antenna 1 also apparently of 16 segments, with a geniculation between segments 14 and 15 (Fig. 2).

P5 with a total of 5 or 6 setae on the distal segment; in addition to the three distal setae as in the female, 1 and in some instances 2 internal setae appear (Fig. 1).

P6 represented by 3 setae of unequal length (Fig. 1).

Habitat

Arctocyclopina pagonasta was found in abundance inhabiting the annual sea ice of Frobisher Bay. Although 90% of the specimens were found in the lower 20 cm of the ice cover, some animals were found at levels 40–60 cm from the bottom of the ice and in the water under the ice. *Cyclopina gracilis* and *Cyclopina schneideri* were also present in lesser numbers in these collections.

Arctocyclopina pagonasta has also been found in samples taken from the undersurface of ice off the northern coast of Alaska (70°24′ N, 147°31.1′ W) by A. G. Carey, Jr., of Oregon State University, as well as in a sample taken at Cape Hatt, Eclipse Sound in the Canadian Arctic (70°24′ N, 79°50′ W) by Carolyn Rymes of McGill University.

Etymology

The generic name is chosen to indicate that the species was first encountered in the Arctic. The specific name refers to its close association with the sea ice (Greek pagos = ice; Greek nastes = inhabitant).

Discussion

The characters enumerated in the generic description of *Arctocyclopina* were established by Lindberg (1953, 1961) as a basis for the erection of new genera of Cyclopininae. The genus *Arctocyclopina* is distinguished by a particular combination of these characters not found in other genera. The affinities with more closely related genera of Cyclopininae are summarized in Table 4.

Arctocyclopina pagonasta can be easily confused with *Cyclopina gracilis* Claus which also inhabits sea ice. Even though the two species are similar in furcal length and in general body shape, *A. pagonasta* can be readily recognized by certain fundamental differences listed below.

In both males and females of *A. pagonasta*, all appendages on the distal segment of P5 are setal, one of which is inserted in the middle of the outer edge. In *C. gracilis*, two lanceolate spines are found at the corners of the distal segment and no seta appears on the outer edge. In the females of *A. pagonasta* the first antenna is 16-segmented with the 3rd segment being the longest. That of *C. gracilis* is 10-segmented of which the 6th is longest. Only three spines are present on the distal segment of the exopod P3 of *A. pagonasta* as opposed to four in *C. gracilis*. In *A. pagonasta* the head is distinctly separated from the first pedigerous segment. In *C. gracilis* it is confluent.

TABLE 4. Comparison of *Arctocyclopina* gen. n. with closely related genera

Genus	Antenna of 16 segments	Exopod of antenna 2 represented by 2 setae	Mandibular palp: Exopod of 4 segments	Mandibular palp: Endopod of 2 segments	Endopod of maxilliped 2 of 2 segments	Spine formula 4-4-3-3	Setal formula 4-5-5-5	P5: 2 segments (♂)	P5: 2 segments (♀)	P5: 2 segments (♀), last segment with 4 appendages
Arctocyclopina gen. n.	+	+	+	+	+	+	+	+	+	+
Afrocyclopina Wells, 1967	−	−	+	+	?	−	+	+	+	−
Cyclopina Claus, 1862	−	−	+	+	?	−	+	+	+	−
Cyclopinoides Lindberg, 1953	−	+	+	+	−	−	+	−	−	−
Cyclopinopsis Smirnov, 1935	−	−	−	+	−	−	+	+	+	+
Cycloporella Monchenko, 1981	+	+	+	+	−	−	+	?	+	−
Cyclopuella Por, 1979	−	−	+	+	−	−	+	+	+	−
Hemicyclopina Herbst, 1953	−	+	+	+	−	−	−	+	+	+
Paracyclopetta Wells, 1967	−	−	+	+	+	−	+	?	+	−
Paracyclopina Smirnov, 1935	+	+	+	+	+	−	+	−	−	−
Parapseudocyclopinodes Lindberg, 1961	−	+	+	+	−	−	−	−	+	+

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