Illustrated Keys to Free-Living Invertebrates
of Eurasian Arctic Seas and Adjacent Deep Waters
B.I. Sirenko, Series Editor

Volume 1
Rotifera, Pycnogonida, Cirripedia, Leptostraca, Mysidacea, Hyperiidea, Caprellidea,
Euphausiacea, Natantia, Anomura, and Brachyura
S.V. Vassilenko and V.V. Petryashov, Volume I Editors

Volume 1 Authors:
G.A. Kolbasov—Cirripedia
L.A. Kutikova—Rotifera
V.V. Petryashov—Anomura, Euphausiacea, Leptostraca, Mysidacea
V.I. Sokolov—Natantia
E.P. Turpaeva—Pycnogonida
S.V. Vassilenko—Brachyura, Caprellidea
M.E. Vinogradov and T.N. Semenova—Hyperiidea

AK-SG-09-02
$30

Published by
Alaska Sea Grant College Program
University of Alaska Fairbanks
Fairbanks, Alaska, USA

In cooperation with
Zoological Institute
Russian Academy of Sciences
Moscow, Russia

CIP
doi:10.4027/ikflieasadw.2009
ISBN 978-156612-137-8

Citation: Vassilenko, S.V., and V.V. Petryashov (eds.) 2009. Illustrated Keys to Free-Living Invertebrates of Eurasian Arctic Seas and Adjacent Deep Waters, Vol. 1. Rotifera, Pycnogonida, Cirripedia, Leptostraca, Mysidacea, Hyperiidea, Caprellidea, Euphausiacea, Natantia, Anomura, and Brachyura. Alaska Sea Grant, University of Alaska Fairbanks.

Credits

This book is published by the Alaska Sea Grant College Program, supported by the U.S. Department of Commerce, NOAA National Sea Grant Office, grant NA06OAR4170013, project A/161-01, and by the University of Alaska Fairbanks with state funds. Funding for the publication was provided by xx grant no. xx. The University of Alaska is an affirmative action/equal opportunity employer and educational institution.

Sea Grant is a unique partnership with public and private sectors combining research, education, and technology transfer for public service. This national network of universities meets changing environmental and economic needs of people in our coastal, ocean, and Great Lakes regions.

Cover photos of x,x, and x by Russ Hopcroft. Book and cover design by Jen Gundersen.

Alaska Sea Grant College Program
University of Alaska Fairbanks
P.O. Box 755040
Fairbanks, Alaska 99775-5040
Toll free (888) 789-0090
(907) 474-6707 Fax (907) 474-6285
alaskaseagrant.org

Table of Contents

Preface

This English translation is the first contribution in a series of volumes entitled *Illustrated Keys to Free-Living Invertebrates of Eurasian Arctic Seas and Adjacent Deep Waters*. This unprecedented effort will provide the international science community with a comprehensive set of tools for marine species identification that are essential to an understanding of arctic and global biodiversity. The outstanding taxonomic expertise dedicated to these volumes is based on Russia's long history of arctic invertebrate taxonomy, as well as persistent exploration of the arctic seas and their fauna over the past century. Hundreds, if not thousands, of type specimens of arctic fauna are archived in the collections of the Zoological Institute in St. Petersburg and other major collections in museums and institutes around Russia.

Climate change, species invasions, fisheries effects, oil and gas exploration, tourism, and other major facets of the human footprint in the ocean are altering marine communities. To understand such change, biodiversity studies, from simple species inventories to functional linkages between diversity and ecosystems, have regained the prominence they deserve in the global scientific community. Within this context, the International Census of Marine Life (CoML) was launched in 2000, with its arctic component, the Arctic Ocean Diversity project (ArcOD), beginning in 2004. CoML is a global network of researchers in more than 80 nations engaged in a 10-year scientific initiative to assess and explain the diversity, distribution, and abundance of life in the oceans addressing the questions "What lived the oceans in the past, what lives in the oceans now, and what will live in the oceans in the future." Within this framework, ArcOD seeks to inventory biodiversity in the arctic sea ice, water column, and seafloor—from the shallow shelves to the deep basins—using a three-level approach: compilation of existing data, taxonomic identification of existing samples, and new collections focusing on taxonomic and regional gaps.

To address biodiversity and other biological research questions in the Arctic, reliable and comprehensive identification keys are essential. ArcOD's Dr. Boris Sirenko has taken on the challenging and unparalleled task to coordinate the compilation of arctic invertebrate identification keys on a near pan-arctic scale. The ArcOD steering group identified this project as a major undertaking and legacy for ArcOD with the goal of facilitating, improving, and standardizing arctic taxonomy and species identification. This first volume of keys has been translated from Russian into English, to make it available to a global audience.

We are excited to facilitate the widespread distribution of this milestone in arctic diversity assessment. We thank the authors for their tireless efforts of putting the individual chapters together, Dr. Victor Petryashov (Zoological Institute) for his efforts in editing Volume I, Dr. Boris Sirenko (Zoological Institute) for the grand oversight, Dr. Kenneth Coyle (University of Alaska Fairbanks) for the flawless translation, Sue Keller (Alaska Sea Grant) for the dedicated editing of the English version, and Alaska Sea Grant director Dr. Brian Allee for making publication possible.

—Bodil Bluhm, Rolf Gradinger, and Russ Hopcroft, Arctic Ocean Diversity Census of Marine Life project.
The ArcOD project office is located at the University of Alaska Fairbanks, Fairbanks, Alaska, USA.

Introduction

Despite severe climate, the marginal seas of the Arctic Ocean sustain a fairly diverse fauna consisting of about 5000 species of free-living invertebrates. In recent years, the Arctic has attracted increasing attention. The scale of commercial development of useful minerals has been growing, not only along the shore but also on the shelf. Measures are required to minimize the anthropogenic impacts on the living resources and to preserve the unique arctic fauna. This is possible only with accurate information on the species diversity and quantitative distribution of all of the fauna of the arctic seas, and keys are a necessary component of this information.

Until now, specialists studying the faunistic composition of arctic seas have relied on the book *Keys to the Fauna and Flora of the Northern Seas of the USSR*, edited by N.S. Gaevskaya. This source was indispensable and highly recommended in its time, but it is now 50 years old and very outdated. It contains only about 30% of the currently known species in the northern seas of Russia. In addition, many of the species names in the book are no longer valid. For the above reasons, a new key is being generated consisting of a series of separately published volumes. The original hope was to place all 5000 species into eight volumes, arranged according to the systematic affinities of the various groups, but this proved impractical. It was therefore decided to publish the volumes separately in the order that they are completed, but more or less maintaining the arrangement of each group according to its systematics.

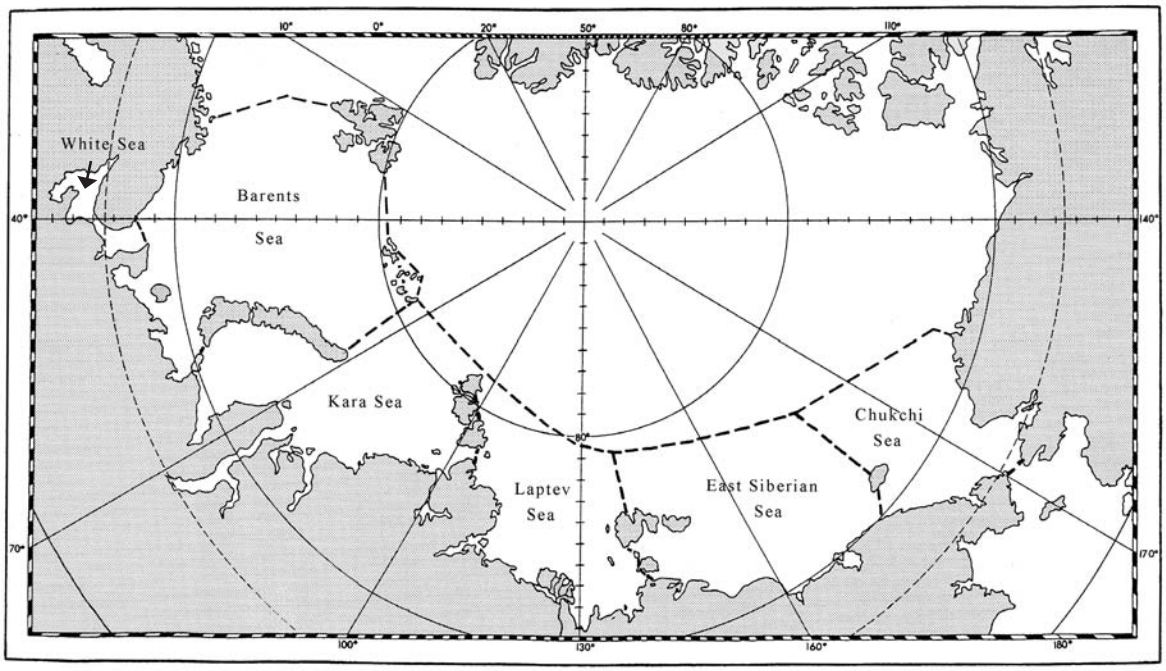
The new keys reflect our current understanding of each invertebrate group. About 60 of the most experienced taxonomists of various institutions in Russia and the Ukraine have worked on this project. The institutions include Zoological Institute of the Russian Academy of Sciences (RAS), the Institute of Oceanography (RAS), Institute of the Biology of the Seas of the Far East (RAS), St. Petersburg State University, Moscow State University, the All Russia Scientific Institute of Fisheries and Oceanography, Kharkovsk State University, and the Institute of the Biology of the Southern Seas (Ukrainian National Academy of Sciences).

The first step in putting together the series of keys was done in 2001, with the publication of a list of the free-living invertebrate species of the Eurasian arctic seas and the adjacent deep areas of the Arctic (*List of the Species of Free Living Invertebrates of the Eurasian Arctic Seas and Adjacent Deep Waters*), where more that 4800 species were listed. After processing new material collected in recent years in the Laptev and Chukchi seas, the list was expanded to about 5000 species.

The keys include not only the free-living invertebrate species inhabiting the Barents, White, Kara, Laptev, East Siberian, and Chukchi seas within their geographic boundaries (see map) but also species inhabiting the adjacent deep regions of the central arctic basin.

Each key is organized in a single format: (1) a short description of the group, including an explanation of the terms used in the keys; (2) individual keys for each taxonomic group from class to species; (3) a brief summary of two or three of the more important synonymies, the species' zoogeographic grouping, its typical distribution across its range, its horizontal and vertical distribution within the area covered by the key, a brief summary of its ecology; (4) a list of the important literature sources for the group; and (5) figures.

Most taxonomists use parenthetical keys (E. Mayr, 1969, Principles of systematic zoology, McGraw-Hill, New York, 428 pp.). This format is also used in our illustrated keys. This key has the advantage that the thesis and antithesis occur next to or near one another, which facilitates comparison. With this format, it is easy to move both forward and backward following the numbers, which indicate the route moving through the various selections.



Map showing locations of Eurasian seas and their borders, as referenced in this volume.

In recognition of the interest of our international colleagues in these keys, we plan to publish the keys in two editions—a Russian edition and an English edition.

The keys include accurate and inclusive species lists, which may differ from those published in 2001.

Each key names zoogeographical groupings where the species are found, referring to a section in the book with maps showing distribution in the world's oceans.

Volume I includes a small group of crustaceans, the rotifers and sea spiders. The following individuals took part in the preparation of this publication: L.A. Kutikova, Zoological Institute RAS, St. Petersburg (Rotifera); E.P. Turpaeva, P.P. Shirshov Institute of Oceanology RAS, Moscow (Pycnogonida); V.V. Petryashov, Zoological Institute RAS, St. Petersburg (Leptostraca, Euphausiacea, Anomura, Mysidacea); V.I. Sokolov, All Russian Scientific Institute of Fisheries and Oceanography, Moscow (Natantia); S.V. Vassilenko, Zoological Institute RAS, St. Petersburg (Caprellidea); G.A. Kolbasov, Moscow State University, Moscow (Cirripedia); and M.E. Vinogradov and T.N. Semenova, P.P. Shirshov Institute of Oceanology RAS, Moscow (Hyperiidea).

Phylum Rotifera

L.A. Kutikova, D.Sc., Main Scientist
Zoological Institute St. Petersburg, St. Petersburg, Russia

Rotifers are predominantly freshwater or brackish, and rarely marine. They are found in aquatic habitats, in plankton, littoral, and interstitial, and also terrestrial habitats including soil. About 2000 species are known from aquatic habitats of polar, temperate, and tropical latitudes. They feed on bacteria, detritus, small algae, and small invertebrates. A few species are parasitic.

Rotifers are bilaterally symmetrical, microscopic pseudocoelomates. Some are several tens of microns to hundreds of microns in size, rarely 2-3 mm. They live singly or in colonies, but are as a rule free moving. Sexual dimorphism is strongly expressed in most species. Males are dwarfed, very reduced, rarely seen, and not known in all species. Descriptions, taxonomy, and classification of rotifers are based on females.

Rotifers are surprisingly variable morphologically. In most species, the body is divided into a head (more rarely there is a neck), a body, and foot section. The foot is often absent in planktonic forms (Pl. I).

Two specific organs characterize the rotifers: the corona on the head and the mastax in the pharynx. Classification of the group is based on these key characters. Rotifers move using the more or less developed corona, and they grind their food in coordination with the corona and jaws. Depending on habit, the corona has several structures and is located terminally on the head in swimming and sedentary species and ventrally in species that crawl. In swimming rotifers the corona is composed of two concentric ciliated bands called the trochus and the cingulum. The head of several species of rotifers (*Synchaeta*) has lateral earlike ciliated appendages, called auricles. The cilia of the corona can be reduced in parasitic forms. Seven structural types are recognized in the organization of the mastax, which consists of a muscular sac and a series of hard jaw parts comprising the trophi. Trophi include the lamellate pair of rami fused by distal ends in the fulcrum. A pair of plates called the unci are supported proximally by the upper ends of the rami and connected distally to the club-shaped manubria. All parts of the trophi are attached by ligaments.

The body, divided by a fold or neck, is covered by a more or less developed lorica in many species; the lorica sometimes has sculpturing in the form of facets, ribs, spines, or dots. Most of the organs are located in the body cavity, including the digestive system (the mouth, mastax, esophagus, stomach, digestive gland, intestine, cloaca, and anus); the excretory system (terminal cells of the protonephridium, a pair of protonephridial canals emptying into a urinary bladder); and the reproductive system (in females the ovaries, yolk gland, oviduct, and cloaca). The muscle and nervous systems are well differentiated. The presence of eyespots and dorsal and lateral organs (cirri) often serve for vision and species determination. The foot, if present, has a pedal gland and often ends in one or two toes.

Rotifers have a very fast reproductive rate and can generate dense populations, sometimes even changing the color of seawater. Heterogenesis is often characteristic of rotifers, alternating sexual and parthenogenetic reproduction which can produce males and mictic females. Only one order, the fairly large Bdelloida, is obligate parthenogenetic. In sexual reproduction, the females produce mictic eggs, which can produce mictic males and females. After fertilization, resting eggs develop into mictic females, and after a resting period they give rise to amictic females. These females reproduce parthenogenetically, quickly increasing the population.

Rotifers are a component of the zooplankton in all possible aquatic habitats and play an important role in the food chain. Many species of rotifers are the indicators of specific environments. Marine rotifers predominantly inhabit coastal waters of the world's oceans. They are also found on drift ice in polar regions. The system of pores and canals, especially on the bottom of the ice, is rich in algae and bacteria, which serve as the food for rotifers (Friedrich and De Smet 2000).

Identification of the species of rotifers with thin loricas requires examination of the structure of the mastax. The individual parts are made distinguishable by using Javel water, a 10% solution of KOH saturated with chlorine, or more rarely a strong soda solution.

Key to orders and families of the class Eurotatoria (phylum Rotifera)

1(4) Mastax malleate (Pl. I, Figs. 5-6) (Brachionidae) or malleate-like (Proalidae). Uncus plates with several teeth. Manubria with three clearly expressed chambers. Rami with well developed chambers, narrowing anteriorly. Fulcrum short or long. . . . . **order Transversiramida, families Brachionidae and Proalidae.**

2(3) Body with hard integument (lorica). Mastax malleate . . . . . **family Brachionidae**

3(2) Body with more or less soft integument. Mastax malleate-like . . . . . **family Proalidae**

Body elongate, spindle-like. Foot long or short with two toes. Mastax very small with elements of malleate and virgate (long manubria) forms (see illustrations p. 12). Body elongate, spindle-shaped, thin. Foot very long, about ¼ of the total length with two telescoping-retracting articles. Pedal glands very long, extending into body. Toes lanceolate. Rami asymmetrical, broadly triangular, short, with one or two blunt teeth on the inner edge. Fulcrum short. Unci with four to five club-like teeth. Manubria long, thin, and bent at ends. . . . . **genus *Proales*, *P. reinhardti* (Ehrenberg, 1834) (Pl. III, Figs. 1-6; Pl. VII).**

Synonymy: *Furcularia reinhardti* Ehrenberg, 1834.
Length 200-380 μm, toes 20-28 μm, mastax 30-45 μm, rami 9-12 μm, fulcrum 6 μm, unci 12-14 μm, manubria 24-25 μm.
Length of males 150-155 μm (De Smet 1996).
Panoceanic. Barents and Laptev seas.

4(1) Mastax virgate or forcipate (see illustrations p. 10)

5(6) Mastax virgate. Unci plate-like. Fulcrum and manubria long, Muscular hypopharyngeal cord well developed. Some trophi are asymmetrical (*Trichocerca*) . . . . . **order Saeptiramida, families Synchaetidae and Trichocercidae**

6(5). Mastax forcipate. Unci club-shaped with one developed tooth. Rami large, chelate-shaped, with or without teeth on the inner edges. Fulcrum often laminate. A small intramalleal plate is commonly present between the unci and manubrium . . . . . **order Antrorsiramida, family Dicranophoridae**

Key to genera and species of the family Brachionidae (order Transversiramida)

1(2) Body lorica wide or like elongate oval. Anterior dorsal edge of lorica with six pairs of ventrally bent spines, with largest spines in middle. Posterior and lateral edges more or less rounded, always lacking spines. Surface of lorica with sculpturing. A medial, longitudinal keel runs from the anterior frontal facet, transecting three transverse ribs. Posterior edge with three lateral facets. Alveoli sculpturing more or less expressed . . . . . **genus *Keratella*, *K. cruciformis* (Thompson, 1892) (Pl. II, Figs. 1- 3)**

Synonymy: *Anuraea cruciformis* Thompson, 1892.
Atlantic widespread boreal Arctic.

Typical form (length of lorica 128-203 m, width 83-155 m, ratio of length to width of lorica 1.4) found in brackish water with 23-30 ppt salinity. Found in the plankton of the White, Barents, and Laptev seas.

K. cruciformis wirketissi Kutikova, 1970 (length of lorica 164-174 μm, width 94-102 μm; ratio of length to width of lorica about 1.8) found in the coastal waters of the southeastern Laptev Sea.

K. cruciformis eichwaldi (Levander, 1894) (length of lorica 138-168 μm, width 83-105 μm; ratio of length to width 1.5), known from the White Sea and estuarine arctic waters, as with the typical form.

2(1) Lorica of body elongate. Anterior dorsal edge of lorica with four to six nearly triangular spines. Posterior and lateral edges of lorica round, sometimes with spines. Surface of lorica with longitudinal cutting, furrows, or alveoli-like sculpturing . . . . . **genus *Notholca***

Key to the genus *Notholca*

1(2) Lateral edges of lorica lacking spines. Anterior edge of lorica with four spines. Dorsal plate of lorica with small, undulating, longitudinal furrows, transitioning toward anterior and posterior edges to alveoli. Posterior edge of lorica narrow, with two fork-like spines . . . . . ***N. japonica* (Marukawa) (Pl. II, Figs. 4-6)**

Synonymies: *Pseudonotholca japonica* Marukawa,1928.
Notholca quadrispinata Myers, 1936.
Lorica length 176-235 μm, width 55-91 μm, length of anterior dorsal spines: middle 22-30 μm, lateral 18-24 μm.
Widespread boreal Arctic. In plankton of the White, Barents, and Laptev seas.

2(1) Lateral edges of lorica with spines. Anterior edge of lorica with six spines. Dorsal plate of lorica with even longitudinal cutting. Posterior edge of lorica round, lacking spines . . . . ***N. bipalium* (Mueller, 1786) (Pl. II, Fig.7)**

Synonymies: *Brachionus bipalium* Mueller, 1786; *Anuraea biremis* Ehrenberg, 1832.
Length of lorica 191-250 μm, width of lorica 100-200 μm.
Panoceanic. In White Sea plankton.

Key to families, genera, and species of the order Saeptiramida

1(2) Body elongate, often spindle-shaped, covered with a fairly rigid integument. More or less developed folds and two sharp spines present on head. Foot short with one long (about ⅓ the body length), spine-like toe . . . . **family Trichocercidae, genus *Trichocerca*, *T. marina* (Daday, 1890) (Pl. II, Figs. 8-13).**

Synonymies: *Diurella marina* Daday, 1890; *Rattulus marinus* Beauchamp, 1904.
Body length 139-200 μm, toe length 46-51 μm.
Panoceanic. White, Barents, and Kara seas.

2(1) Body conical, ranging from bell-shaped to cylindrical or even sac or balloon shaped. Head with lateral appendages (auricles) used for swimming. Foot more or less short with one or two small toes. Mastax large, cone-shaped with strong musculature . . . . . **family Synchaetidae, genus *Synchaeta***

Key to species of the genus *Synchaeta*

1(2) Foot rudimentary, poorly developed with one toe. Body sac or balloon shaped, very transparent, with soft integument. Head short with small auricles. Lateral antennae on ventral side at level of foot. Unci with five large teeth. . . . . ***S. monopus* (Plate, 1889) (Pl. III, Figs. 7-9)**

Synonymy: *Parasynchaeta monopus* Plate, 1889.
Total length 209-257 μm, width 127-164 μm.
Panoceanic. Planktonic in Barents Sea.

2(1) Foot not rudimentary, easily retracted into body.

3(4) Pair of long neck processes beneath corona. Body spindle-like with long, almost conical foot and two sphenoid toes. Lateral antenna tube-shaped, distended at end with delicate cilia. Unci with six well-developed teeth (the last two teeth are separated from the four others by a deep concavity) and large hook-like process with small projection on outer edge) . . . . . ***S. bacillifera* Smirnov, 1932. (Pl. III, Figs. 10-16)**

Total length 250-500 μm.
Arctic circumpolar. In Barents Sea to northeast of Spitsbergen, in surface waters of northern Kara Sea, in drift ice over depths of 200 m.

4(3) Pair of neck processes beneath corona absent.

5(8) Foot with different sized toes; one toe shorter and harder to distinguish.

6(7) Foot two to three articulate, fairly long, clearly distinguishable from body. Toes asymmetrical, pointed on the ends: left conical, claw-like; right short, pressed against left toe. Lateral unpaired antennae on the posterior side of body shaped like small corolla of cilia. Plate of unci with five to eight blunt teeth; deep concavity present between frontal hook-like tooth and plate teeth. Digestive glands large, cylindrical or round. Small spine on bend of frontal tooth. Epipharynx shaped like two hard spines connected by plate. Pedal glands asymmetrical: left larger, more or less tube shaped . . . . . ***S. tamara* Smirnov, 1932 (Pl. IV, Figs. 1-6)**

Total length 200-270 μm, foot 45-70 μm, toes: left 11-17 μm, right 5-6 μm. Length of trophi 94 μm. Length of male 85 μm, toes 6-7 μm (Friedrich and De Smet 2000).

Arctic circumpolar. In the Barents and Kara seas. In the plankton and drift ice over depths to 3000 m.

7(6) Foot one-articulate, well distinguished from body, with one short, blunt toe and a shorter toe lying right against the larger toe (or lacking short toe in *S. cecilia fusipes* Buchholz, 1952). Lateral antennae on ends of body near base of foot. Plates of unci with six teeth and frontal hook. Auricles small. Intestine short, thin-walled. Pedal glands asymmetrical. Eyespots red, usually separated . . . . . ***S. cecilia* Rousselet, 1902 (Pl. V, Figs. 1-6)**

Total length 123-188 μm, foot 20.5 μm, toe 4 μm. Length of males 78 μm.
Panoceanic. Barents Sea. In drift ice; euryhaline.

8(5) Foot with more or less developed, similar-sized toes.

9(12) Head distinguishable from body by wide ring of muscle.

10(11) Body almost cylindrical with dense, rough integument. Head about ⅓ total body length. Foot fairly long, wrinkled, noticeably narrower than body. Pedal glands large, round or spindle shaped, narrowing in toes to cone-shaped duct. Unci well developed, slightly asymmetrical; six to eight teeth on each uncus (first two to three teeth separated by deep concavity, remaining separated by vallate structure) and hook-like appendage with process, also with two transparent lamellae between the appendage and first tooth and one plate near last tooth. Epipharynx present. Toes short, conical. Lateral antennae in lower part of body. Corona fairly distended with short auricles . . . . . ***S. hyperborea* Smirnov, 1932 (Pl. IV, Figs. 7-11)**

Females: total length 300-315 μm, head length 93-120 μm, foot 53-83 μm, toes 9-16 μm, trophi 56-96 μm. Males: total length 77-80 μm, toes 6 μm.
Arctic circumpolar. In plankton of Barents Sea (near Franz Joseph Land), Kara and Laptev seas, in the Arctic Ocean near Severnaya Zemlya. In drift ice of the Barents and Laptev seas over depths in excess of 3000 m.

11(10) Body elongate, conical, with dense yellowish integument. Head about ⅓ to ⅔ total length. Foot relatively short, about ⅒ total length. Pedal glands shaped like retort. Five teeth on each uncus, separated by vallate structure, hook-like appendage present with a small hook at base and transparent rectangular appendage near the last tooth. Epipharynx present. Toes short, conical. Lateral antennae in lower part of body near base of foot. Corona distended with short auricles . . . . . ***S. glacialis* Smirnov, 1932 (Pl. IV, Figs. 12-17)**

Total length 220-240 μm, length of head 96 μm, toes 10-14 μm, trophi 62-65 μm.
Arctic circumpolar. In plankton of Barents Sea (near Franz Joseph Land) and Kara Sea. In drift ice of the Barents and Laptev seas over depths of 220 to 3000 m.

12(9) Head not distinguishable from body by broad ring of muscles.

13(14) Tubular apical antennae on head. Body almost cylindrical or conical. Body clearly distinguishable from long, narrow, somewhat abbreviated foot. Pedal gland runs the length of entire foot. Toes short, pointed, with diverging ends. Each uncus with one large and four to five small teeth. Lateral antennae short, at about ⅔ body length. . . . . ***S. vorax* Rousselet, 1902 (Pl. V, Figs. 7-11)**

Females: total length 190-450 μm, toes 8-10 μm. Males: total length 146-149 μm.
Panoceanic. In plankton of Barents Sea.

14(13) No tubular apical antennae on head. Body bell-shaped or conical. Body often separated from foot by ring-shaped thickening of integument. Unci asymmetrical with five to six teeth and a frontal tooth. Pedal glands small, round, in terminal part of foot. Toes short, blunt. Corona convex with frontal prominence and two tufts of sensory setae. Auricles large, pendulous, with powerful cilia. Eyespots separated. Trophi massive . . . . . ***S. baltica* Ehrenberg, 1834 (Pl. V, Figs. 12-14)**

Total length 200-523 μm.
Panoceanic. In plankton of White and Barents seas.

Key to genera and species of the family Dicranophoridae (order Antrorsiramida)

1(2) Body worm-like, pear-shaped, widening posteriorly and rounded, covered with foreign particles. Head and neck about ½ total length. Foot short, displaced to the ventral side. Toes long, narrow, pointed at ends. Rami without teeth. Integument smooth, without folds. Proboscis large . . . . . **genus *Paradicranophorus*, *P. verae* Bogoslovsky, 1958 (Pl. VI, Figs. 1-3)**

Total length about 400 μm, toes about 56 μm.
Found only in sand in the marine littoral White Sea.

2(1) Body spindle-like, narrowing posteriorly, transparent. Head about ⅕ total length. Foot two articulate, narrowing at end. Toes about ⅒ total length, massive, slightly bent ventrally. Rami more or less round, wide at base and with bent tooth at end. Inner edge of each ramus with large tooth. Two preuncus teeth present. Unci with ventral and larger dorsal process. Intramallei round with pointed process. Manubria triangular, slightly bent and widened at ends. Pedal glands large, extending into body . . . . . .**genus *Encentrum*, *E. graingeri* Chengalath, 1985 (Pl. VI, Figs. 4-7)**

Length 170-225 μm, toes 16-24 μm, trophi 30-40 μm.
Arctic Eurasia. In drift ice of the Barents Sea (near Spitsbergen) and the Laptev Sea.

Literature

Bjorklund, B.C.1972. Taxonomical and ecological studies of species of *Notholca* (Rotatoria) found in sea- and brackish water, with description of a new species. Sarsia 51:25-66.

Bogoslovsky, A.S. 1958. Two new species of rotifers, *Paradicranophorus verae*, sp.n. and *Lecane chankensis*, sp.n. Zool. J. 37(4):622-624.

Chengalath, R. 1985. The Rotifera of the Canadian arctic sea ice, with description of a new species. Can. J. Zool. 63:2212-2218.

De Smet, W.H. 1996. The Proalidae (Monogononta). In: H.J.F. Dumont (ed.), Guides in the identification of the microinvertebrates of the continental waters of the world. Vol. 4. SPB Academic Publishing, Amsterdam. 102 pp.

Friedrich, C., and W.H. De Smet. 2000. The rotifer fauna of arctic sea ice from the Barents Sea, Laptev Sea and Greenland Sea. Hydrobiologia 432:73-89.

Harring, H.K., and F.J. Myers. 1924. The rotifer fauna of Wisconsin. II. A revision of the notommatid rotifers, exclusive of the Dicranophoridae. Trans. Wisconsin Acad. Sci., Arts and Letters 21:415-549.

Hollowday, E.D. 2002. Family Synchaetidae Hudson & Gosse, 1886. In: H.J.F. Dumont, T. Nogrady, and H. Segers (eds.), Rotifera Vol 6, Asplanchnidae, Gastropodidae, Lindiidae, Microcodidae, Synchaetidae, Trochosphaeridae and *Filinia*. Guides to the identification of the microinvertebrates of the continental waters of the world, no. 18. Backhuys Publishers, Leiden, The Netherlands, pp. 87-211.

Koste, W. 1978. Rotatoria. Die Raedertiere Mitteleuropas. I. (Rotatoria. Rotifers of central Europe. Vol. I. Borntraeger Brothers, Berlin, Stuttgart.

Kutikova, L.A. 1962. Rotifers (Rotatoria) of the Luzhsk region of the Leningrad district. Tr. Zool. Inst. AN SSSR. (Proceedings of the Zoological Institute, Academy of Sciences of the USSR) 31:453-462.

Kutikova, L.A. 1970. Rotifer fauna of the USSR. Keys to the fauna of the USSR, No. 104. Leningrad. 744 pp.

Kutikova, L.A. 1974. Class of rotifers. Rotatoria. Atlas of invertebrates of the Aral Sea. Izd-vo Pishchebaya promyshlennost (Publication of the food industry), Moscow, pp. 56-98.

Kutikova, L.A. 1976. Marine rotifers. Field key of the plankton. Zoological Institute of the Academy of Sciences of the USSR, Leningrad. I-III, 40 pp.

Levander, K.M. 1894. Materialien zur Kenntniss der Wasserfauna in der Umgebung von Helsingfors mit besonderer Berucksichtigung der Meeresfauna. II. Rotatorien (Information on the knowledge of the aquatic fauna near Helsingfors with particular focus on the marine fauna. II. Rotifera. Acta Soc. fauna et flora Fennica 12(3):1-70.

Markevich, G.I. 1993. Presnobodnye bespozvonochnye: biologiya, sistematika, evolyitsiya. (Evolution of rotifers and their taxonomic position in the Metazoa. Freshwater invertebrates: Biology, systematics and evolution). Tr. IBVV, No. 68(71):3-52.

Remane, A. 1929-33. Rotatorien. Dr. H.G. Bronn's Klassen und Ordnungen d. Tierreichs. Leipzig. (Rotifera. Dr. H.G. Bronn's classes and orders of the animal kingdom.) Vol. IV, Section II, Book 1, edn. 1-4, pp. 1-576)

Remane, A. 1949. Die psammobionten Rotatorien der Nord- und Ostsee. (The psammobiont rotifers of the North and Baltic seas.) Kieler Marine Science 6:59-67.

Rousselet, F. 1902. The genus *Synchaeta*. A monographic study with descriptions of five new species. J. Royal Microscop. Soc., pp. 269-290, 393-411.

Smirnov, N.S. 1932. Rotatoria, collection by an expedition to Franz Josef Land in summer, 1929. Tr. Arktichesk. Inst. (Proceedings of the Arctic Institute) Vol. 2, pp. 36-52.

Smirnov, N.S. 1933. Rotifers collected by the *G. Sedov* in 1930 and the Lomonosov expedition in 1931. Tr. Arktichesk. Inst. (Proceedings of the Arctic Institute). Vol. 8, pp. 79-91.

Wulfert, K. 1969. Raedertiere. Die neue Brehm-Buchreihe. (Rotifers. The new Brehm Series.) S. Ziemsen Verlag Wittenberg, Lutherstadt. 112 pp.

Yashnov, V.A. 1948. Class Rotatoria. Keys to the fauna and flora of the northern seas of the USSR. Moscow, pp. 91-93.

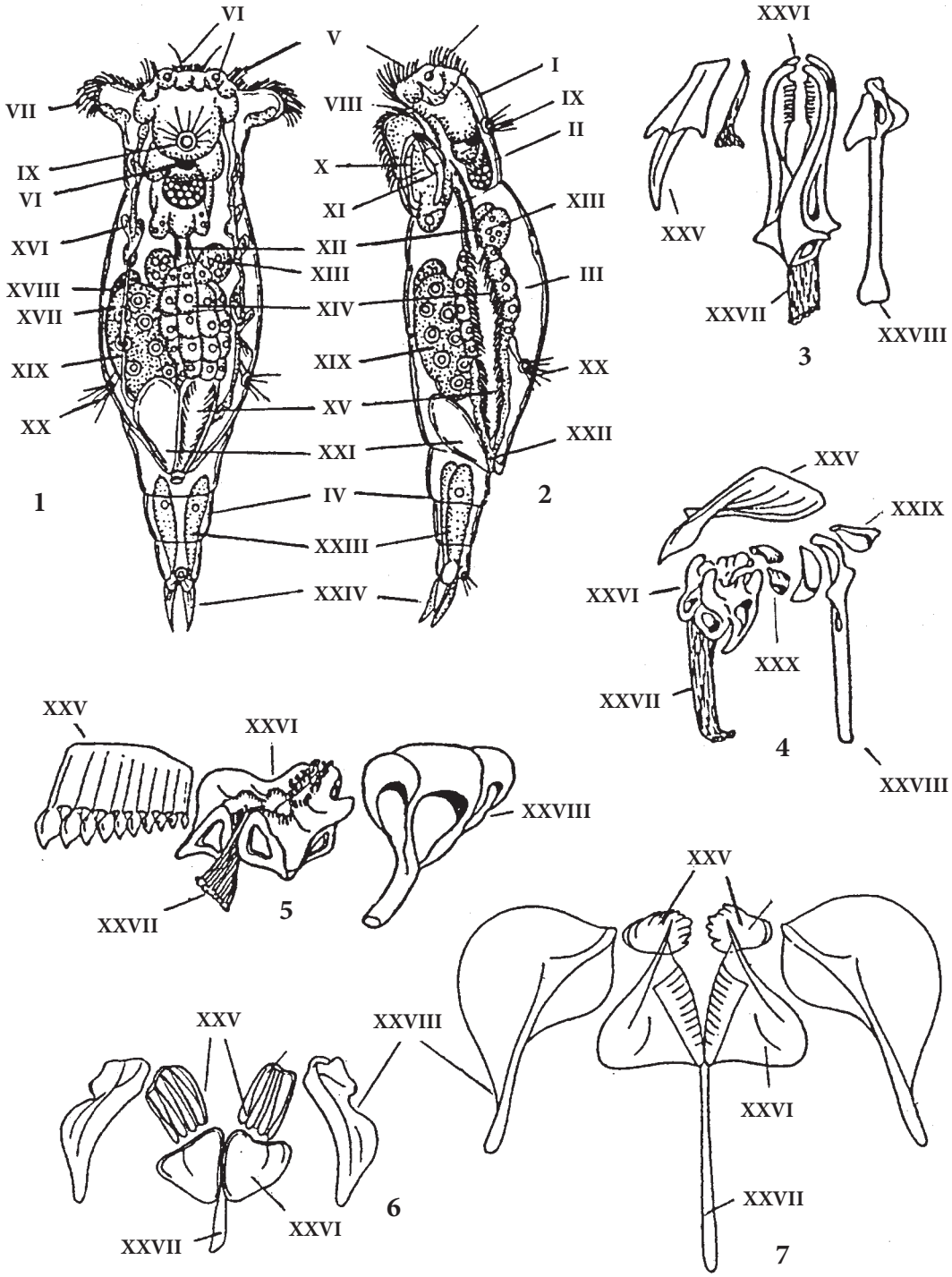


Plate I

Figs. 1-2 General structure of rotifers of the class Monogononta: I: head. II: neck. III: body. IV: foot. V: corona. VI: sensory cilia. VII: auricles. VIII: mouth. IX: dorsal antennae. X: mastax. XI: jaw apparatus (trophi). XII: esophagus. XIII: digestive gland. XIV: stomach. XV: intestine. XVI, XIX: protonephridia. XVII: yolk gland. XVIII: ovary. XX: lateral antenna. XXI: urinary bladder. XXII: anus. XXIII: pedal glands. XXIV: toes. XXV: uncus. XXVI: rami. XXVII: fulcrum. XXVIII: manubria. XXIX: intramalleus. XXX: epipharynx.

Fig. 3 Forcipate type trophi, dorsal and lateral views.

Figs. 5,6 Malleate type trophi, frontal and dorsal views.

Figs. 4,7 Virgate type trophi. (1-2 from Wulfert 1969, 3-5 from Markevich 1993, 6-7 from Kutikova 1976).

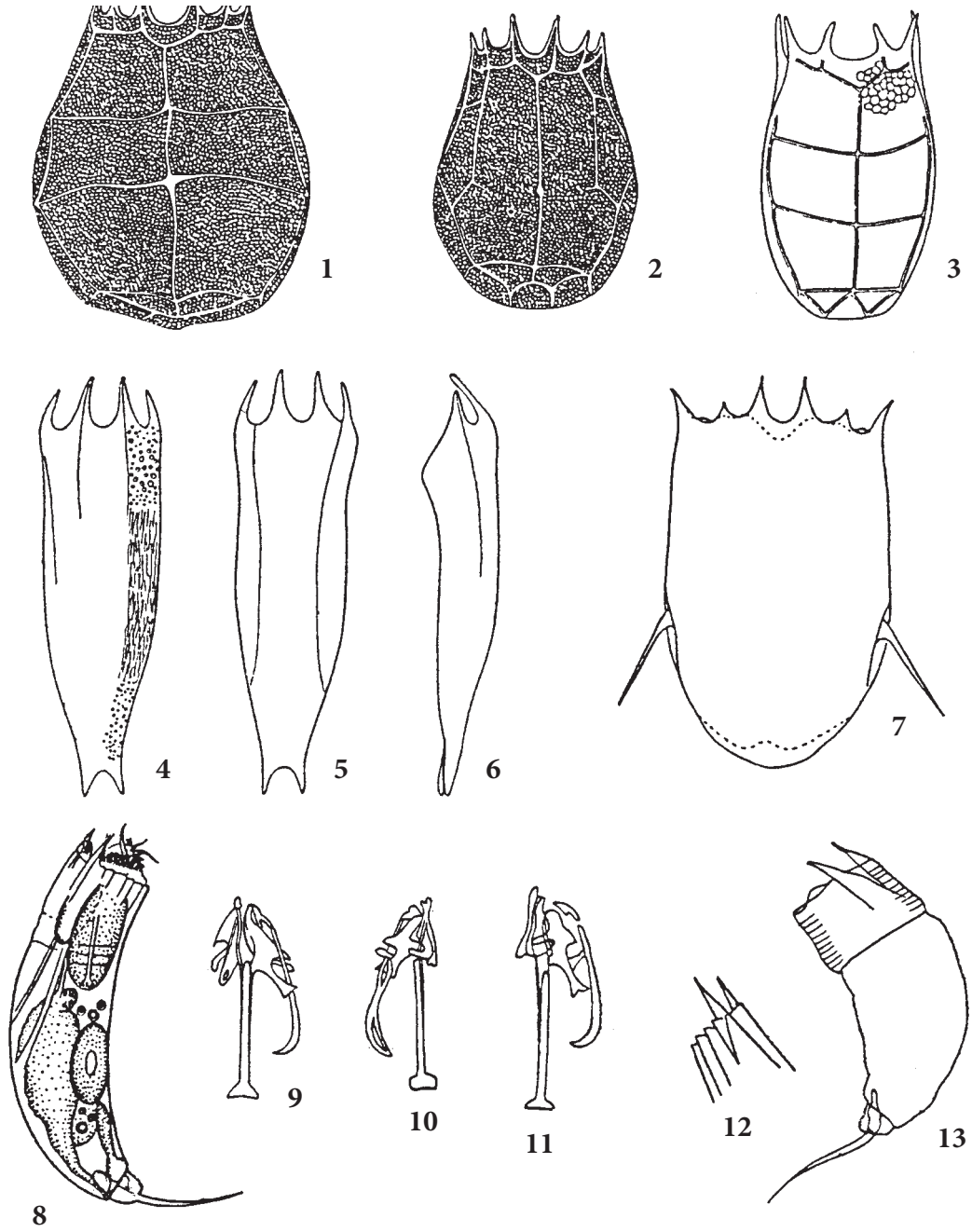


Plate II

Fig. 1 *Keratella cruciformis*, lorica, dorsal view.
Fig. 2 *Keratella cruciformis eichwaldi*, lorica, dorsal view.
Fig. 3 *Keratella cruciformis wirketissi*, lorica, dorsal view.
Figs. 4-6 *Notholca japonica*: 4: lorica, dorsal view. 5: lorica, ventral view. 6: lorica, lateral view.
Fig. 7 *Notholca bipalium*, lorica, dorsal view.
Figs. 8-13 *Trichocerca marina*: 8-13: whole animal, lateral view. 9-11: trophi. 9: dorsal view. 10-11: lateral view. 12: anterior edge of lorica. (1-2 from Levander 1894, 3-6 from Kutikova 1970, 7 from Bjorklund 1972, 8 and 12 from Remane 1949, 9-11 from Zelinka from Remane 1929, 13 from Smirnov 1933).

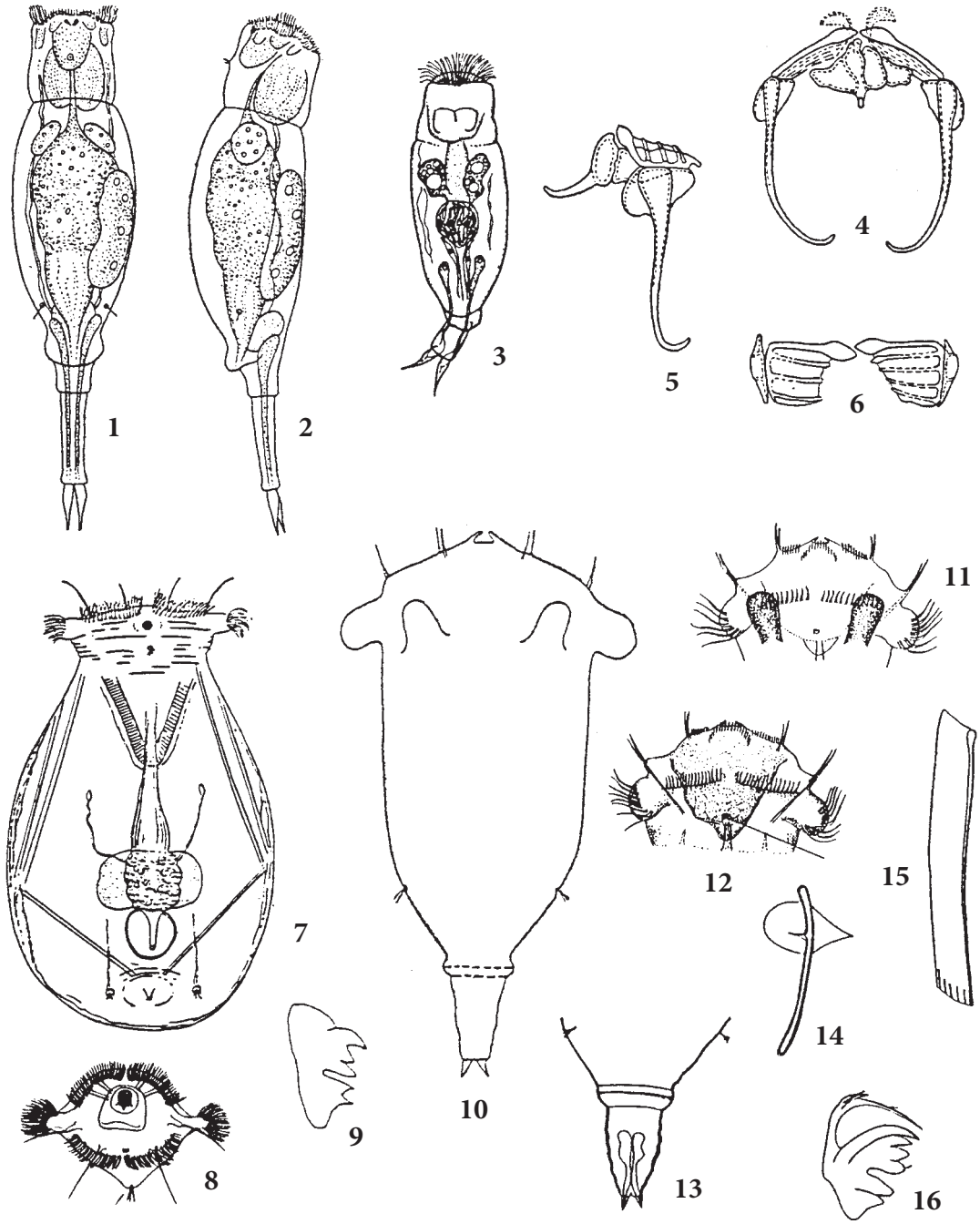


Plate III

Figs.1-6 *Proales reinhardti*: 1: whole animal, dorsal view. 2: lateral view. 3: male. 4-6: trophi. 4: dorsal view, 5: lateral view. 6: unci.

Figs. 7-9 *Synchaeta monopus*: 7: whole animal, dorsal view. 8: head, frontal view. 9: uncus.

Figs. 10-16 *Synchaeta bacillifera*: 10: whole animal, dorsal view. 11-12: head, dorsal and ventral views. 13: foot. 14: manubria. 15: fulcrum.16: uncus. (1-6 from Harring and Myers 1924, 7-8 from Rousselet 1902, 9 from Koste 1978, 10-16 from Smirnov 1933).

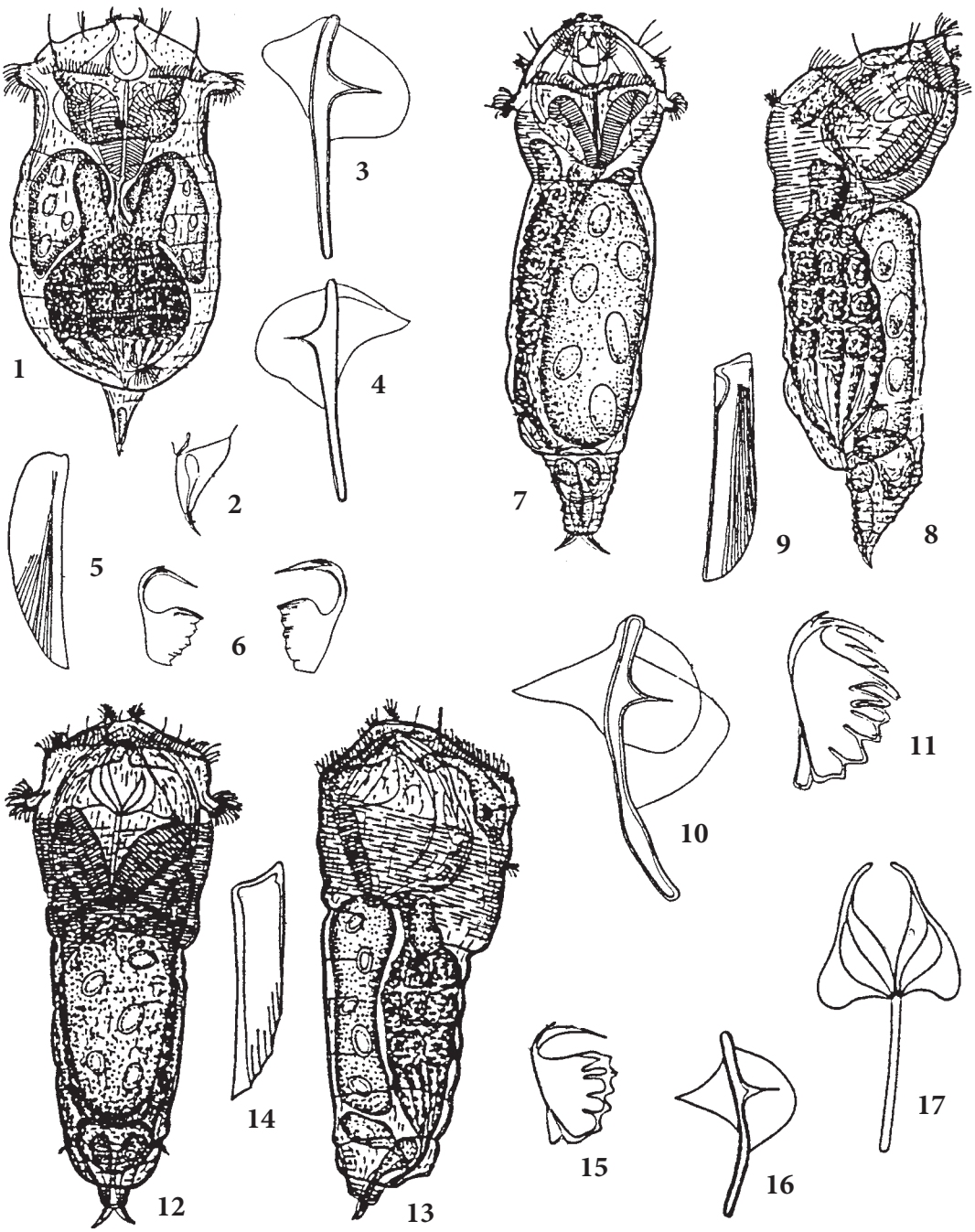


Plate IV

Figs. 1-6 *Synchaeta tamara*: 1: whole animal, dorsal view. 2: foot. 3-4: manubria. 5: fulcrum. 6: unci.
Figs. 7-11 *Synchaeta hyperborea*: 7-8: whole animal, ventral and lateral views. 9: fulcrum. 10: manubria. 11: uncus.
Figs. 12-17 *Synchaeta glacialis*: 12-13: whole animal, ventral and lateral views. 14: fulcrum. 15: uncus. 16: manubria. 17: rami and fulcrum. (1-17 from Smirnov 1932).

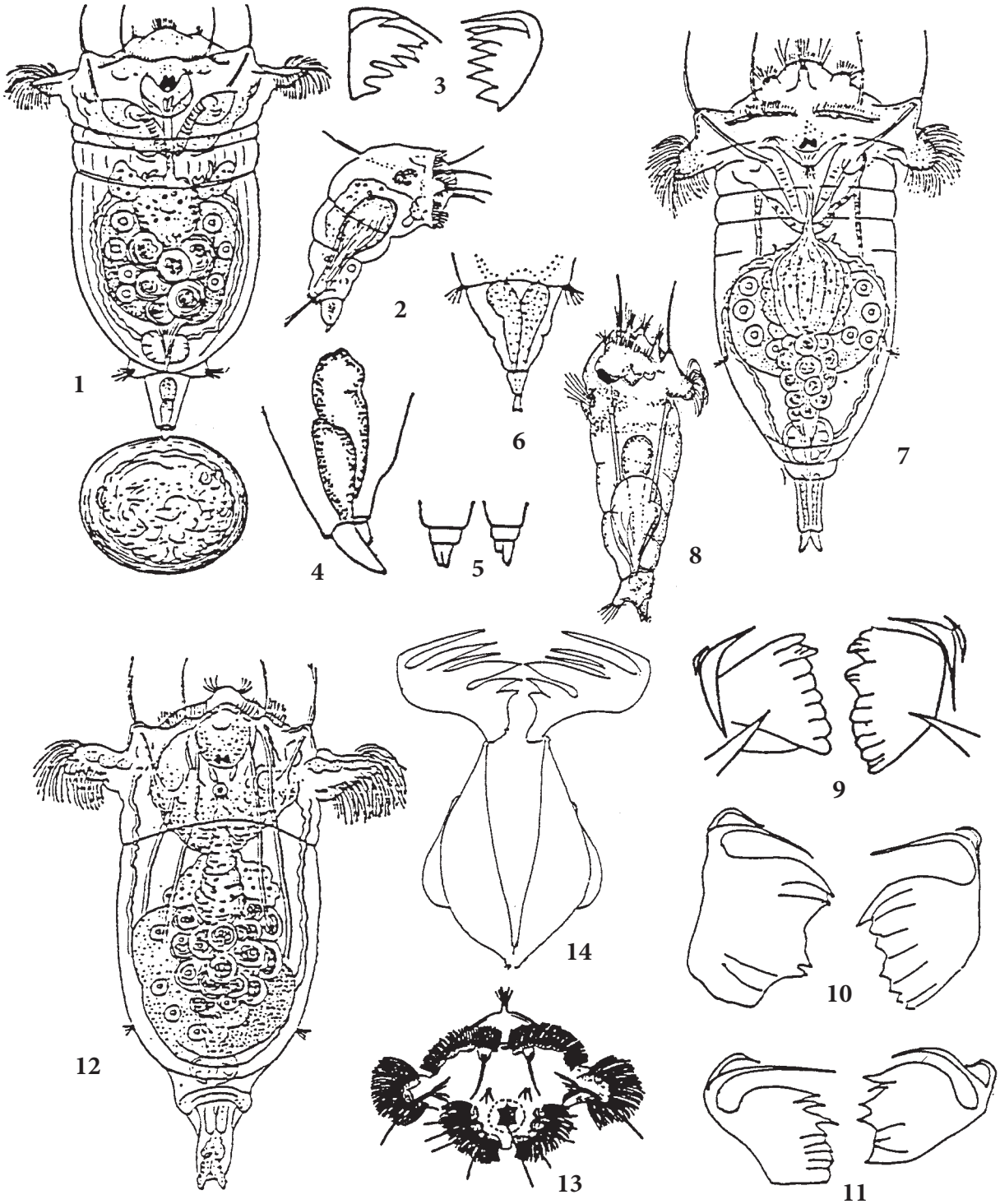


Plate V

Figs. 1-6 *Synchaeta cecilia*: 1: whole animal, female with attached egg, dorsal. 2: male, lateral. 3: unci. 4: foot, lateral view. 5: toes. 6: foot.
Figs. 7-11 *Synchaeta vorax*: 7: whole animal, dorsal view. 8: male, lateral view. 9-11: unci.
Figs. 12-14 *Synchaeta baltica*: 12: whole animal, dorsal view. 13: corona, frontal view. 14: unci and rami (1, 12, 13 from Rousselet 1902; 2 from Remane 1929; 3, 5, 6 from Kutikova 1962; 4 from Koste 1981; 7 from Rousselet 1902; 8-11 from Kutikova 1974; 14 from Hollowday 2002).

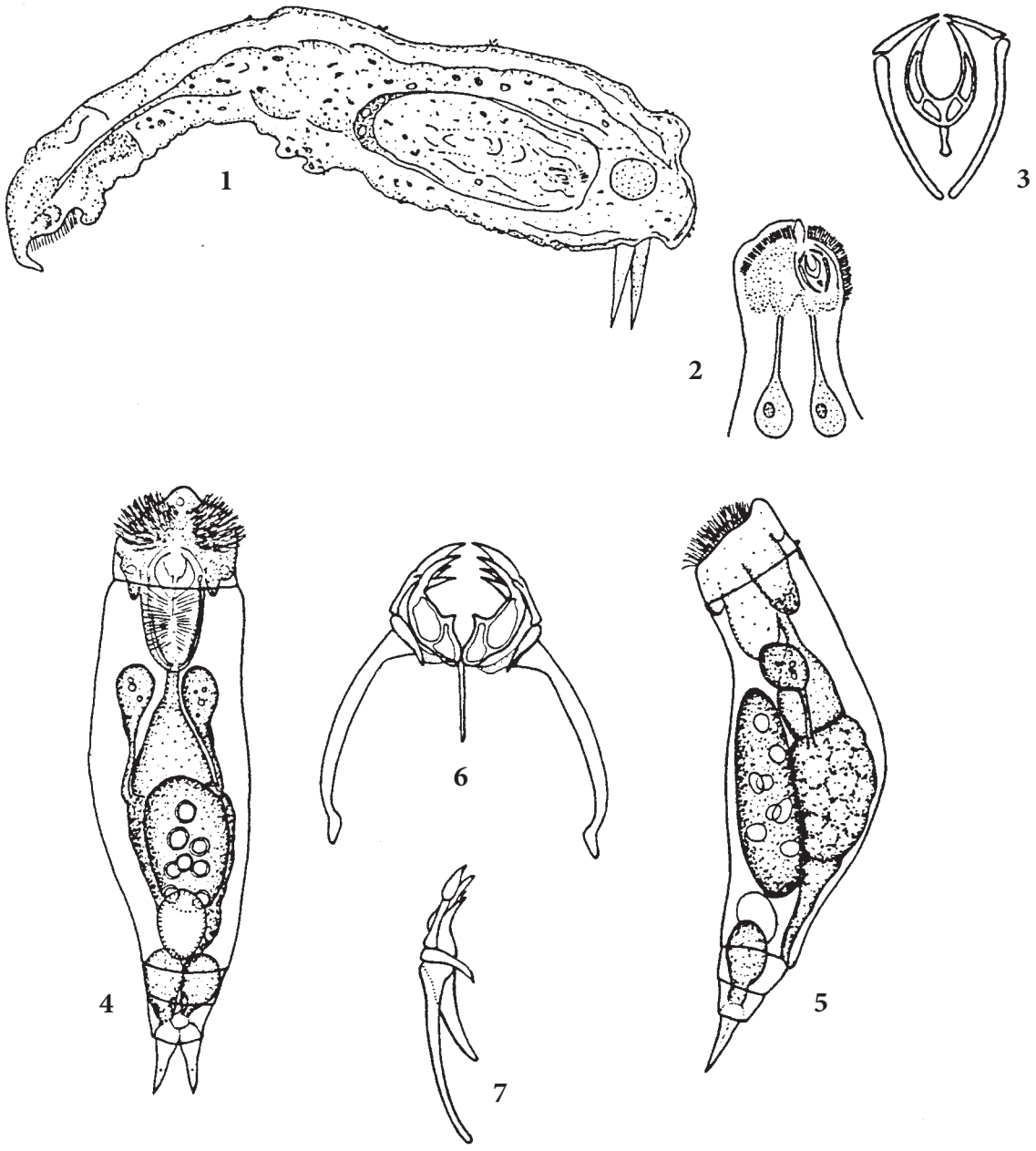


Plate VI

Figs. 1-3 *Paradicranophorus verae*: 1: whole animal, lateral view. 2: head. 3: trophi.
Figs. 4-7 *Encentrum graingeri*: 4-5: whole animal, ventral and lateral views. 6-7: trophi, dorsal and lateral views. (1-3 from Bogoslovsky 1958, 4-7 from Chengalath 1985).

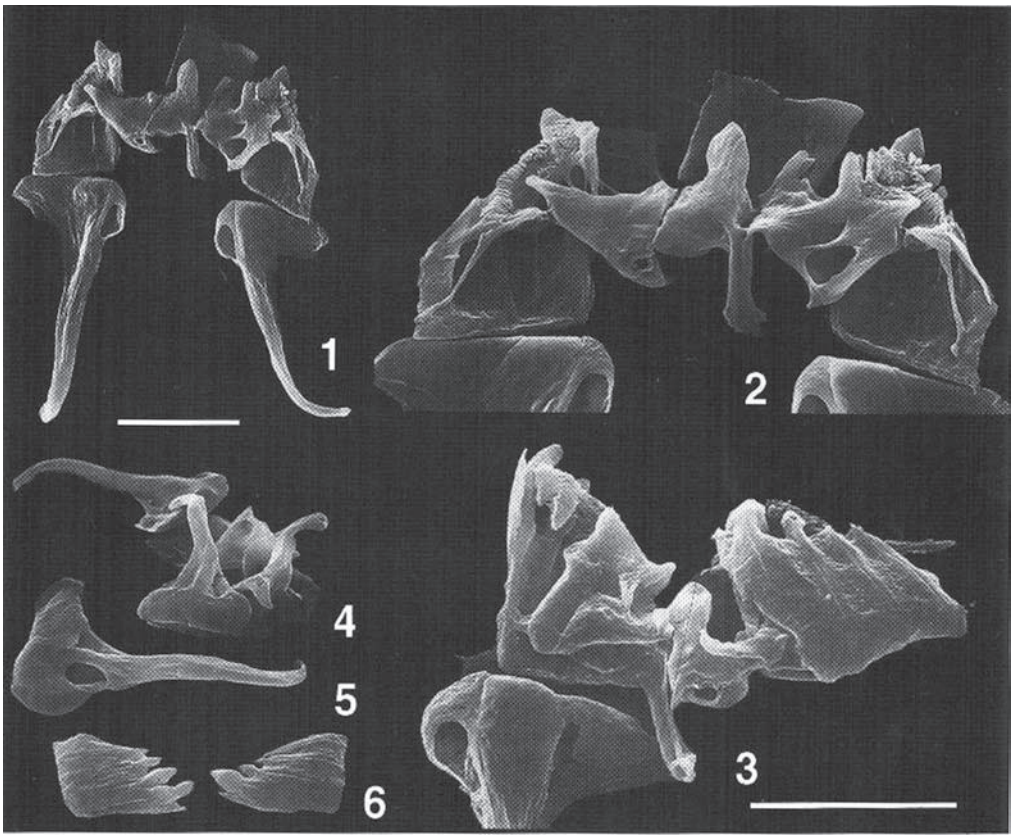


Plate VII. *Proales reinhardti*, trophi (SEM photographs). De Smet 1996.

Fig. 1 Dorsal view.
Fig. 2 Dorsal view, detail.
Fig. 3 Ventral view, detail.
Fig. 4 Lateral view.
Fig. 5 Right manubrium.
Fig. 6 Unci.

(1,2: Eastern Scheldt, Colijnsplaat, The Netherlands. 3-6: arctic sea ice, Laptev Sea, C. Friedrich.)

Class Pycnogonida (Order Pantopoda)

E.P. Turpaeva, D.Sc., Lead Scientist
Institute of Oceanology, Russian Academy of Sciences, Moscow

Pycnogonids are exclusively marine carnivores. Adult stages are free living or occasionally ectoparasitic. Appendages I, II, and III may by reduced, at least in adults. The presence or absence of these appendages is the main distinguishing character for different families.

Arctic pycnogonids usually consist of a four-segmented body, a proboscis, an abdomen, and seven pairs of appendages (Pl. I). The length of a pycnogonid has been described from the front of the cephalon segment to the caudal edge of the last body segment (Just 1972). The body segments of some species are divided; in others they are fused. Each segment has a pair of lateral processes for attachment of the walking legs. The first or head segment usually has a small process for attachment of appendages I, II, and III, and also a longitudinal proboscis with a triangular mouth opening at the end. Eye tubercles with four eyes are present on the dorsal surface of the head: one pair on the anterior and one pair on the posterior side. A small longitudinal abdomen with a terminal anus is present on the fourth segment between the lateral processes.

Pycnogonid appendages consist of articulations. Appendage I (chelifore) in northern pycnogonids consists of two articles: a straight, cylindrical first article and a second article that is rudimentary or with a widened proximal half and a chela with two dactyls, one moveable and one stationary. These appendages serve to grasp and retain prey. Appendage II (the pedipalp) has a tactile function; the number of articles varies from one to ten. Appendage III (oviger) is an egg-carrying leg; in males it serves to carry the eggs and in both sexes it is used to clean the carapace. The number of articles varies from five to ten; the seventh to tenth articles have flat serrate spines with denticulate edges.

The next four pairs of appendages are walking legs. They consist of eight articles in all species; the articles are named or numbered 1 through 8. The first three articles are coxal; they are often short, and the gonadal openings occur on the second article. The next three articles are long: the fourth article is the femur, the fifth and sixth articles are the tibiae, called tibia 1 and 2 respectively. The seventh (tarsal) and eighth articles, usually short, form the foot. The seventh article, the tarsus, can be straight or cup-shaped depending on the species. The eighth article, the propodus, is straight or slightly bent and has the main claw (sometimes called a dactyl) and a pair of accessory claws, which can be reduced. Basal spines are present on the ventral side of the propodus (the bottom of the foot), and some species have a short process with large spines on the proximal end of the ventral side of the propodus.

Key to the families, genera, and species of Pycnogonida Brunnich, 1764 (order Pantopoda Gerstaeker, 1863)

1(8) Appendage I present.

2(5) Appendage II present.

3(4) Appendage II with six-ten articles, appendage I shorter than proboscis; dactyls on the chela absent in adults, but present and small in subadults and juveniles . . . . . **Ammotheidae Dorn, 1881 (p. 18)**

4(3) Appendage II five-articulate, appendage I two-articulate, longer than proboscis, second article with dactyls having long or short teeth . . . . . **Nymphonidae Wilson, 1878 (p. 20)**

5(2) Appendage II absent or rudimentary.

6(7) Appendage III ten-articulate in both sexes . . . . . **Callipallenidae Hilton, 1942 (p. 25)**

7(6) Appendage III five to nine articulate only in males . . . . . **Phoxichilidiidae Sars, 1891 (p. 26)**

8(1) Appendage I absent.

9(10) Appendage II nine-articulate, appendage III ten-articulate. . . . . **Colossendeidae Hoek, 1881, *Colossendeis* Jarzynsky, 1870 (p. 26)**

10(9) Appendage II absent, appendage III nine-articulate only in males . . . . . **Pycnogonidae Wilson, 1878, *Pycnogonum* Brunnich, 1764, *P. littorale* (Strom, 1762-1766) (Pl. II, Figs. 1-5)**

Length 15 mm.
Widespread boreal Arctic. White Sea, Barents Sea.
Depth 5-350 m. On rocky, stony sediments.

Key to genera and species of the family Ammotheidae

1(4) Body elongate, segmented.

2(3) Proboscis consists of two parts: a cylindrical part and a moveable oval part articulated to the cylindrical part; eye tubercles are high and narrow, eyes pigmented; appendage I 3-articulate, accessory claws absent ***Eurycyde* Schiodte, 1857, *E. hispida* (Krøyer, 1845) (Pl. III, Figs. 1-7)**

Length 2.5 mm.
Atlantic high boreal Arctic. Norwegian, Barents, White, and Kara seas.
From sublittoral to 400 m depth. On hard bottoms, in bryozoan and hydroid communities.

3(2) Proboscis spindle-shaped, bent at proximal end; eye tubercles low, eyes absent; appendage I 2-articulate; accessory claws rudimentary or absent . . . . . ***Ascorhynchus* Sars, 1877, *A. abyssi* Sars, 1877 (Pl. III, Figs. 8-12)**

Length 5 mm.
Atlantic high boreal Arctic. Barents and Laptev seas, Arctic Ocean.
Depth 196-4000 m. Silty sediments.

4(1) Body disc-shaped, body segments usually fused (eye tubercles of varying shape; eyes usually pigmented; appendage I two-articulate, accessory claws present) . . . . . ***Achelia* Hodge, 1864**

Key to the genus *Achelia*

1(2) Eighth article of walking legs long and narrow, without large basal spines on the ventral side the of the eighth article of the foot, serrate setae absent from appendage III (males lack a special tubercle for the gonadal pore on legs III and IV) . . . . . ***A. borealis* (Schimkewitsch, 1895) (Pl. IV, Figs. 1-4)**

Length 5 mm.
Widespread boreal Arctic circumpolar. White, Barents, Laptev, Kara, and Chukchi seas.
Depth 3-638 m. On hard sediments and rock.

2(1) Eighth article of walking legs with large spines on proximal part of ventral side of the foot. Serrate spines present on distal article of appendage III.

3(4) Corners on the frontal part of the head rounded and without tubercles and spines (a single small conical tubercle lacking spines on dorsal side of lateral processes at distal end; eye tubercle low, conical; second and fourth articles of appendage II equal in length; tall tubercle on dorsal side of first articles of legs . . . . . ***A. alaskensis*** **Cole, 1904 (Pl. VI, Figs. 1-5)**

Length 3 mm.
Pacific widespread boreal. Chukchi Sea.
Depth 0-180 m. Hard bottoms.

4(3) Two conical tubercles present on corners ocular area on frontal part of head.

5(8) Tubercles on frontal part of head blunt.

6(7) Tubercles on frontal part of head lacking spines on top; dorsal side of lateral processes with pointed spine on anterior distal corner, blunt tubercles without spine on posterior distal corner. Eye tubercles tall, cylindrical (second article of appendage II shorter than fourth article; eighth article of walking legs bent, main claw larger than half of eighth article, accessory claws very small) . . . . . .***A. levis*** **Hodge, 1864 (Pl. V, Figs. 7-12)**

Length 1.5 mm.
Atlantic subtropical-boreal. White Sea.
Depth 30-55 m. On hard sediments.

7(6) Tubercles on frontal part of head bluntly conical with small spine on top; two tubercles of uneven shape on distal end of lateral processes, divided or with lateral projections, posterior tubercles larger than anterior. Eye tubercles tall, cylindrical, with rounded or conical tips (walking legs with several low tubercles, eighth article large, bent, with three large spines on proximal end of bottom of foot; main claw half the length of eighth article; accessory claws equal or somewhat longer than half main claw) . . . . . ***A. uschakovi*** **(Losina-Losinsky, 1933) (Pl. VI, Figs. 6-10)**

Synonymy: *Achelia litke* (Losina-Losinsky, 1933).
Length 1.2-1.6 mm.
Western Pacific widespread boreal. Chukchi Sea.
Depth 8-10 m. Sandy sediments.

8(5) Tubercles on frontal part of head sharply conical with spine on the end.

9(12) Tubercles on lateral corners of frontal part of head with single tips; eye tubercles low, bluntly conical (walking legs with spines and hairs).

10(11) Tubercles on lateral processes, on distal and on lateral sides of the first coxal articles with single tips; second article of appendage II longer than fourth article. . . . . ***A. echinata*** **Hodge, 1864 (Pl. V, Figs. 1-6)**

Length 2 mm.
Amphiboreal. White and Barents seas.
Sublittoral. On hard bottoms.

11(10) Tubercles on lateral processes and distal edges of the first two articles of the legs varying in shape with one to three conical tips with a spine in males, or several lateral spines in females. Second article of appendage II shorter than fourth article (a row of small tubercles with long setae present on side of first articles of legs (Chukchi Sea) or long thin tubercles with teeth (Kuril Islands) . . . . . ***A. salebrosa*** **Losina-Losinsky, 1961 (Pl. VII, Figs. 1-6)**

Length 4.5 mm.
Western Pacific widespread boreal. Chukchi Sea.
Sublittoral. On sand, rocks, algae.

12(9) Tubercles on lateral corners of frontal part of head high with divided tips, lateral processes with two small conical tubercles. Eye tubercles tall, cylindrical (several pointed conical tubercles on first article of legs, of which largest are in middle of article; proboscis short; eighth article of leg strong, bent). . . . . ***A. lavrentii*** **(Losina-Losinsky, 1933) (Pl. VII, Figs. 7-10)**

Length 2-2.25 mm.
Western Pacific widespread boreal. Chukchi Sea.
Depth 8-10 m. On sand.

Key to genera and species of the family Nymphonidae

1(2) Eye tubercles high, eyes present, dactyls of chela slightly bent with teeth on the inner edge; serrated spines with denticulate plates, claw of appendage III with teeth; bottom of foot of eighth article of walking legs with basal spines. . . . . ***Nymphon*** **Fabricius, 1794**

2(1) Eye tubercles low, eyes absent; dactyls of chela bent to semicircular shape with smooth inner edge; serrated spines with smooth edges; claw of appendage III lacking teeth on inner edge; bottom of foot of eighth article of legs lacking basal spines, only row of short setae present . . . .***Boreonymphon*** **Sars, 1888, *B. robustum* (Bell, 1855) (Pl. II, Figs. 6-11)**

Length 22 mm.
Widespread boreal Arctic. Barents, Kara, and Laptev seas.
Depth 14-1600 m. On silty sediments.

Key to the genus *Nymphon*

1(4) Body large, lateral processes almost touching each other (body and appendages usually covered with long setae, articles of walking legs robust).

2(3) Dactyls of chela thin, long, very bent; articles of appendage II long, cylindrical. . . . . .***N. spinosum hirtipes*** **Bell, 1855 (Pl. VIII, Figs. 1-6)**

Length 8-11.5 mm.
Widespread boreal Arctic. Barents, Kara, and Laptev seas.
Depth 3-1506 m. On silty sediments.

3(2) Dactyls of chela short, slightly bent; articles of appendage II robust, short. . . . . ***N. hirtum*** **Fabricius, 1794 (Pl. VIII, Figs. 7-11)**

Length 6 mm.
Atlantic widespread boreal. Barents Sea.
Depth 22-1844 m. On sand, rock.

4(1) Body elongate, bare or nearly bare; lateral processes separated by a substantial space.

5(6) Appendage I and walking legs covered with long setae; proximal part of second articles of appendage I asymmetrical, widening distally; dactyls of chela very bent (eye tubercle cylindrical with two high lateral tubercles on the top; accessory claws rudimentary). . . . . ***N. macronyx*** **Sars, 1877 (Pl. IX, Figs. 1-7)**

Length 6.5 mm.
Atlantic widespread boreal Arctic. Barents, Kara, Laptev, and Chukchi seas.
Depth 28-1321 m. On silty and sandy silt sediments.

6(5) Appendage I and walking legs covered with short hairs and longer setae sparsely present or sometimes absent; proximal part of second article of appendage I cylindrical, elongate; dactyls of chela slightly bent.

7(22) Serrate spines on appendage III with one or two pairs of large basal teeth and small denticles along the edge of the plate.

8(21) Serrate spines on appendage III with one pair of basal teeth; bottom of foot on eighth article of walking legs with large spines (eye tubercles conical or with flattened top).

9(14) Second article of appendage II shorter than third article (proboscis somewhat shorter than the ocular segment; eye tubercles with pointed tips lacking lateral tubercles).

10(13) Large spines on the bottom of foot of eighth article of walking legs strongly developed, distributed primarily on proximal half of article, main claw massive, half the length of the eighth article, accessory claws half the length of the main claw.

11(12) Second article of appendage II almost half the length of the third article; seventh article of all walking legs somewhat longer or shorter (in juveniles) than eighth article; neck short . . . . . .***N. grossipes*** **(Fabricius, 1780) (Pl. X, Figs. 1-7)**

Length 6 mm.
High boreal Arctic. White, Barents, Kara, Laptev, East Siberian, and Chukchi seas.
Depth 4-1466 m. On silty sand, rock, and shells.

12(11) Second article of appendage II somewhat shorter than third; seventh article of walking legs substantially longer than eighth; neck elongate, cylindrical . . . . . ***N. mixtum*** **Krøyer, 1845 (Pl. X, Figs. 8-13)**

Length 9.5 mm.
Atlantic widespread boreal Arctic. White, Barents, and Kara seas.
Depth 8-834 m. On sand, silty sand, rock, and shell.

13(10) Large spines on bottom of foot of eighth article of walking legs weakly developed (in males they are larger than in females), distributed at proximal end of foot, usually not more than five spines present; main claw thin, slightly bent, almost as long as eighth article (sometimes longer); accessory claws rudimentary. . . . . ***N. sluiteri*** **Hoek, 1882 (Pl. IX, Figs. 8-14)**

Length 7 mm.
Atlantic high boreal Arctic. Barents, Kara, Laptev, and Chukchi seas.
Depth 12-1444 m. On silty sediments.

14(9) Second article of appendage II equal to or longer than third article.

15(16) Up to 10 large spines present on bottom of foot of eighth article (proboscis substantially shorter than head segment; eye tubercles with pointed or flat tips). . . . . ***N. brevirostre*** **Hodge, 1863 (Pl. IV, Figs. 5-11)**

Quite variable species; there are eight subspecies.
Length 2.5-7.5 mm.
Widespread boreal Arctic. White, Barents, Kara, Laptev, East Siberian, and Chukchi seas.
Sublittoral. On silty sand, rock, and benthic vegetation.

16(15) Row of small thin spines present on the bottom of foot of eighth article of leg, among which there may be several larger ones near the center of the foot.

17(18) Fourth and fifth articles of appendage II nearly equal in length; neck thin and long, more than half the length of the ocular segment; large spines on bottom of foot of eighth segment of legs barely distinguishable, accessory claws very small. .***N. longitarse*** **Krøyer, 1845 (Pl. XI, Figs. 1-5)**

Length 5-8 mm.
Atlantic high boreal Arctic. Barents, Kara, and Laptev seas.
Sublittoral. On sandy sediments.

18(17) Fourth article of appendage II substantially shorter than fifth; neck shorter than half the length of the ocular segment; accessory claws longer than in *N. longitarse* Krøyer, their length can reach to ⅓ the length of the main claw.

19(20) Large spine on bottom of eighth article of legs absent or present (most often in females) with one or two spines but not on all legs; eye tubercles with flattened top . .***N. longitarse brevicollis*** **Losina-Losinsky, 1929 (Pl. XI, Figs. 6-11)**

Length 5 mm.
High boreal Arctic. Kara, Laptev, East Siberian, and Chukchi seas.
Sublittoral. On silty sediments.

20(19) Large spines on bottom of foot of eighth article of legs is clearly distinguishable in the center of the foot; eye tubercles with two small conical mounds . . . . . ***N. microrhynchum*** **Sars 1888 (Pl. XII, Figs. 1-6)**

Length 5 mm.
High boreal Arctic. Barents, Kara, and Laptev seas.
Sublittoral. On silt and silt with rocks.

21(8) Serrated spines on appendage III with two pairs of different basal teeth; bottom of foot of eighth article of legs lacking large spines. . . . . ***N. micronyx*** **Sars, 1888 (Pl. XII, Figs. 7-12)**

Length 3 mm.
High boreal Arctic. White, Barents, Kara, and Laptev seas.
Upper sublittoral. On rocks, gravel, and sand.

22(7) Serrated spines on appendage III lacking large basal teeth, spines have either small, saw-like teeth or relatively large lateral teeth along the entire length of spine.

23(30) Large spines on bottom of foot of eighth article of walking legs well developed; dactyls of the chela not longer than proximal part of second article of appendage I; length of fourth article of appendage II not greater than 2-2.5 times its width.

24(25) Dactyls of chela very short, lacking teeth, only small bumps present on inner edge. Large spines well developed on proximal and middle part of bottom of foot on eighth article of legs; accessory claws 3-3.5 times shorter than main claw . . . . . ***N. schimkewitschi*** **Losina-Losinsky, 1929 (Pl. XV, Figs. 12-17)**

Length 10 mm.
High boreal Arctic. Barents, Kara, Laptev, and Bering seas.
Sublittoral. On sand, gravel, rock and silt.

25(24) Dactyls of chela with teeth.

26(29) Fifth article of appendage II shorter than fourth article; up to ten large spines present on middle and distal portions of bottom of foot of eighth article of legs (sometimes poorly developed); accessory claws 2-3 times shorter than main claw.

27(28) Pointed bumps present on dorsal side of first three body segments . . . . . .***N. serratum*** **Sars, 1879 (Pl. XIII, Figs. 1-6)**

Length 12 mm.
Atlantic widespread boreal Arctic. White, Barents, and Kara seas.
Depth 40-888 m. On silty sediments.

28(27) Bumps absent from dorsal surface . . . . . .***N. megalops*** **Sars, 1877 (Pl. XIII, Figs. 7-12)**

Length 13 mm.
Atlantic widespread boreal Arctic circumpolar. Barents, Kara, and Laptev seas.
Depth 51-1534 m. On silty sediments.

29(26) Fifth article of appendage II longer than fourth article; about 20 large spines present along nearly entire length of bottom of foot of eighth article of legs; accessory claws rudimentary . . . ***N. longimanum*** **Sars, 1888 (Pl. XIV, Figs. 1-5)**

Length 5.5 mm.
High boreal Arctic. Barents, Kara, and Laptev seas.
Depth 1-148 m. On silt, sand, shell, and rock.

30(23) Spination and setation of seventh and eighth articles of legs nearly identical, individual large spines lacking; chela long and thin; length of fourth article of appendage II 5-8 times greater than width.

31(32) Fourth article of appendage II substantially longer than fifth; appendage I relatively poorly developed; sixth article of appendage III broadened in males . . . . . ***N. leptocheles*** **Sars 1884 (Pl. XIV, Figs. 6-11)**

Length 6.5 mm.
Atlantic widespread boreal Arctic. Barents, Kara, and Laptev seas.
Depth 9-1264 m. On silty sediments.

32(31) Fourth and fifth article of appendage II of equal length; appendage I very developed; sixth article of appendage III of males thickened.

33(34) Moveable dactyl of chela with blunt rounded tip . . . . . ***N. elegans*** **Hansen, 1887 (Pl. XV, Figs. 1-6)**

Length 9 mm.
High boreal Arctic. Barents, Kara, and Laptev seas.
Depth 30-1358 m. On silty sediments.

34(33) Both dactyls of chela with pointed tips.

35(36) Accessory claws longer than half the length of main claw; second article of appendage II nearly twice the length of third article . . . . . ***N. macrum*** **Wilson, 1880 (Pl. XV, Figs. 7-11)**

Length 8 mm.
Atlantic widespread boreal Arctic. Barents and Kara seas.
Depth 73-1095 m. On silty sediments.

36(35) Length of accessory claws less than half the length of main claw; second article of appendage II nearly equal to third.

37(38) Main claw about half the length of eighth article of walking legs; accessory claws ⅓-½ the length of main claw. . . . ***N. stroemi stroemi*** **Losina-Losinsky, 1929 (Pl. XVI, Figs. 1-7)**

Length 15 mm.
Atlantic widespread boreal Arctic. Barents, Kara,
and Laptev seas.
Depth 20-534 m. On silty sediments.

38(37) Length of main claw more than half the length of eighth article of legs; accessory claws less than ⅕ the length of main claw or rudimentary. . . . . ***N. stroemi gracilipes*** **Losina-Losinsky, 1929 (Pl. XVI, Figs. 8-13)**

Length 18 mm.
Arctic. Barents, Kara, Laptev, and East Siberian seas.
Depth 36-422 m. On silty sediments.

Key to genera of the family Callipallenidae

1(2) Mouth opening on a mastoid projection of the proboscis; lateral processes and walking legs with large spines on tubercles . . . . . ***Pseudopallene*** **Wilson, 1870**

2(1) Mouth opening barely protrudes beyond the surface of proboscis; lateral processes and walking legs lacking tubercles or large spines . . . . . ***Cordylochele*** **Sars, 1888**

Key to the genus *Pseudopallene*

1(2) Body disc-shaped, lateral projections nearly touching each other; several tubercles with spines present along the dorsal midline of the body. . . . . ***P. circularis*** **(Goodsir, 1842) (Pl. XVII, Figs. 1-4)**

Length 3.5 mm.
Amphiboreal. White, Barents, East Siberian, and Chukchi seas.
Depth 10-400 m. On silt, gravel, and rock.

2(1) Body elongate, lateral processes separated by a space, the width of which exceeds half the width of the processes in males; dorsal surface of body smooth . . . . . ***P. spinipes*** **(Fabricius, 1870) (Pl. XVII, Figs. 5-9)**

Length 4.5 mm.
High boreal Arctic. White, Barents, Kara, and East Siberian seas.
Depth 6-380 m. On rocky sediments.

Key to the genus *Cordylochele*

1(2) Moveable dactyl on chela of appendage I with smooth inner edge; thin plate present on stationary dactyl; serrated spines on appendage III with undulating plate lacking basal spines. . . . ***C. brevicollis*** **Sars, 1888. (Pl. XVIII, Figs. 1-6)**

Length 7 mm.
High boreal Arctic. Barents, Kara, Laptev, East Siberian, and Chukchi seas.
Depth 12-650 m. On silty sediments.

2(1) Movable dactyl on chela of appendage I with blunt tooth on inner edge, stationary dactyl also has small tooth; serrate spines on appendage III with denticulate edges and two to three pairs of short basal teeth . . . . . ***C. malleolata*** **(Sars, 1879) (Pl. XVIII, Figs. 7-12)**

Length 8 mm.
Atlantic high boreal Arctic. Barents, Kara, and Laptev seas.
Depth 80-1280 m. On silty sediments.

Key to genera and species of the family Phoxichilidiidae

1(2) Neck very long, extending over the base of the proboscis; appendage III six-articulate; accessory claws rudimentary . . . . . ***Anoplodactylus*** **Wilson, 1878, *A. petiolatus* (Krøyer, 1844-1845) (Pl. XIX, Figs. 1-6)**

Length 2 mm.
Atlantic subtropical-boreal. Barents Sea (Kola Peninsula).
Littoral.

2(1) Neck short, appendage III in males five articulate; accessory claws developed. . . . . ***Phoxichilidium*** **Milne-Edwards, 1940, *P. femoratum* (Rathke, 1799) (Pl. XIX, Figs. 7-12)**

Length 8 mm.
Amphiboreal. White, Barents, and Chukchi seas.
Littoral. On algal beds.

Key to species of Colossendeidae

1(2) Body robust, compact, lateral processes touch each other; proboscis very large, almost twice the length of the body with abdomen; sixth article of appendage II almost twice the length of fifth article, seventh article equal to or somewhat longer than eighth, articulation of these articles symmetrical, lacking a break of the axis of appendage II . . . . . ***Colossendeis proboscidea*** **(Sabine, 1824) (Pl. XX, Figs. 1-3)**

Length 50 mm.
Atlantic widespread boreal Arctic. Barents, Kara, and Laptev seas.
Depth 40-2200 m. On silty sediments.

2(1) Body elongate, lateral processes separated by a space approximately equal to width of process; proboscis cylindrical, equal in length to body and abdomen; sixth article of appendage II equal to fifth, seventh article small, asymmetrical, eighth article attaches to seventh article from the side . . . . . ***C. angusta*** **Sars, 1877 (Pl. XX, Figs. 4-7)**

Length 21 mm.
Widespread boreal Arctic. Barents, Kara, Laptev, and East Siberian seas.
Depth 12-5200 m. On silty sediments.

Literature

Child, A. 1955. Pycnogonida of the Western Pacific islands, XI: Collections from the Aleutians and other Bering Sea islands, Alaska. Smithsonian Contributions to Zoology 569:1-30.

Cole, L.J. 1904. Pycnogonida of the West Coast of North America. Harriman Alaska Expedition. Vol. 10, pp. 249-330.

Hedgpeth, J.W. 1963. Pycnogonida of the North American Arctic. J. Fish. Res. Board Can. 20(5):1315-1348.

Hoek, P.P.C. 1882. The pycnogonids, dredged during the cruises of the *Willem Barents* in the years 1878 and 1879. Niederlandisches Archiv fur Zoologie. Suppl. I, pp. 1-28.

Just, J. 1972. Revision of the genus *Boreonymphon* G.O. Sars (Pycnogonida) with a description of two new species, *B. ossiansarsi* Knaben and *B. compactum* Just. Sarsia 49:1-28.

Losina-Losinsky, L.K. 1929. Ubere inige neue Formen der Pantopoda. Zool. Jahrb., Abt. Sist. Bd. 57:537-544.

Losina-Losinsky, L.K. 1933. Pantopoda of the eastern seas of the USSR. Issledovaniya fauny morey CCCP (Investigation of the fauna of the seas of the USSR). Leningrad, Vol. 17, pp. 43-80.

Losina-Losinsky, L.K. 1935. Pantopoda of the arctic seas of the USSR. Vsesoyuznyy Arkticheskiy Institut (All Union Arctic Institute), Glavsevmorput, Vol. 4, pp. 1-140.

Losina-Losinsky, L.K. 1961. Pantopoda of the Far Eastern seas of the USSR. Issledovaniya Dal'nevostochnykh morey SSSR (Investigations of the Far Eastern Seas of the USSR). Leningrad, Vol. 7, pp. 47-117.

Losina-Losinsky, L.K. 1964. Pantopoda from material of expeditions on the *F. Litke* in 1955 and the Ob in 1956. Scientific results of the high-latitude expeditions to the northern Greenland Sea and adjacent regions of the arctic basin. Trudy Arkticheskogo i Antarkticheskogo nauchno-issledobatelskogo instituta (Proceedings of the Arctic and Antarctic Research Institute), Leningrad 259:330-339.

Sars, G.O. 1891. Pycnogonida. Norwegian North-At1antic Expedition, 1876-1878. Vol. 6, (Zool. 20), pp. 1-163.

Shimkevich, V.M. 1929. Pantopoda. In: Fauna SSSR isopredl'nykh stran (Fauna of the USSR and adjacent countries No. 1). Leningrad, I-CXV, pp. 1-224.

Shimkevich, V.M. 1930. Pantopoda. In: Fauna SSSR isopredl'nykh stran (Fauna of the USSR and adjacent countries No. 2). Leningrad, pp. 225-555.

Turpaeva, E.P. 1996. Sea spiders (pycnogonids) of the Kara and Laptev seas. Zool. Zhurn. 75(11):1608-1619.

Turpaeva, E.P. 1997. Pycnogonid fauna of the Chukchi and Bering seas. Zool. Zhurn. 76(10):1131-1140.

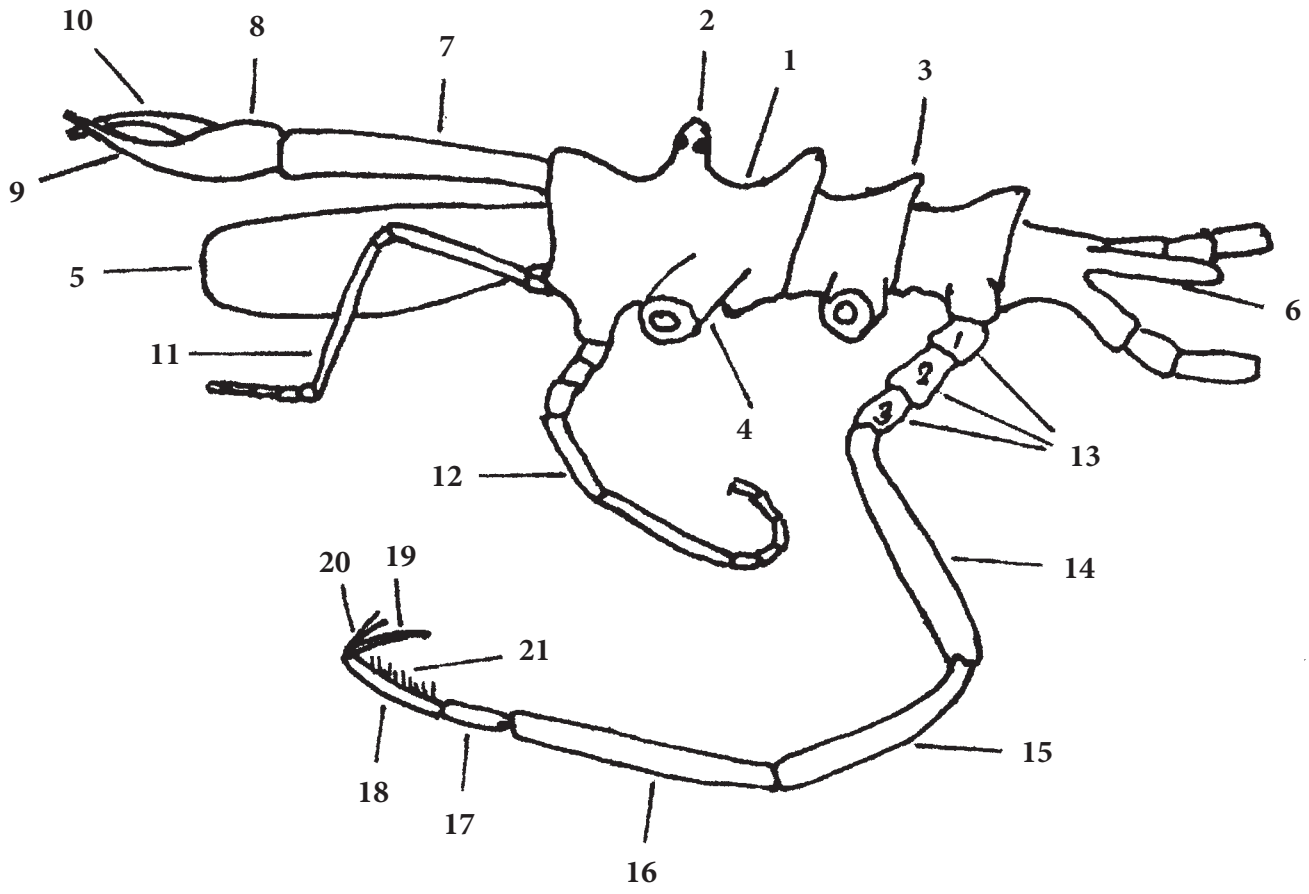


Plate I. Schematic of the body structure of pycnogonids.

Fig. 1 Head (ocular) or cephalic segment.
Fig. 2 Eye tubercle.
Fig. 3 Dorsal keels on body segments.
Fig. 4 Lateral process.
Fig. 5 Proboscis.
Fig. 6 Abdomen.
Fig. 7 First article of appendage I (chelifore).
Fig. 8 Proximal part of second article of appendage I.
Fig. 9 Immobile or stationary dactyl of chela.
Fig. 10 Moveable dactyl of chela.
Fig. 11 Appendage II (pedipalp or palpus).
Fig. 12 Appendage III (oviger).
Fig. 13 Coxae of the walking legs (articles 1, 2, and 3).
Fig. 14 Fourth article of leg (femur).
Fig. 15 Fifth article of leg (first tibia).
Fig. 16 Sixth article of leg (second tibia).
Fig. 17 Seventh article of leg (tarsus).
Fig. 18 Eighth article of leg (propodus).
Fig. 19 Main claw (sometimes called dactyl).
Fig. 20 Accessory claws.
Fig. 21 Spines on the bottom of foot of eighth article of leg.

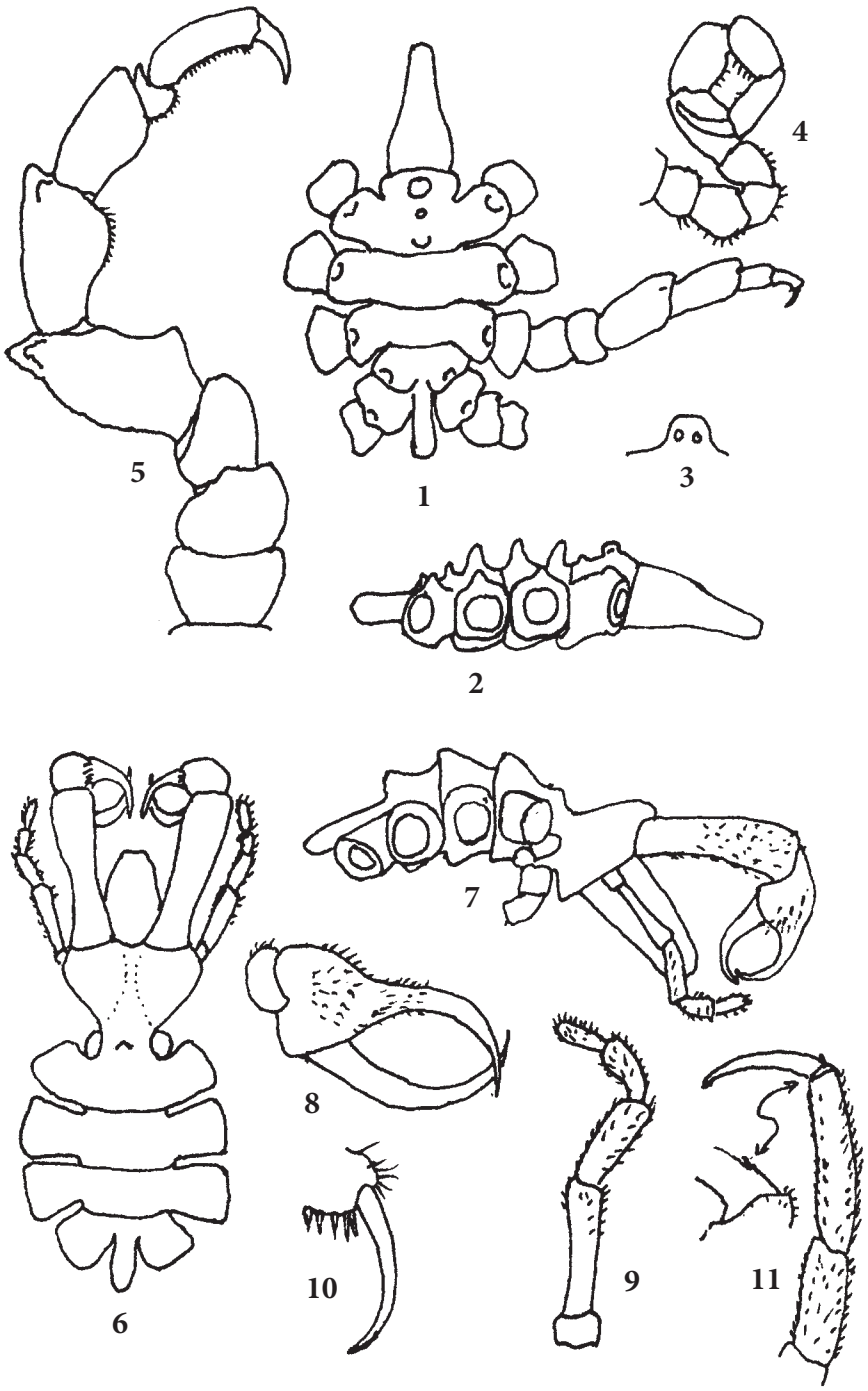


Plate II

Figs. 1-5: *Pycnogonum littorale* (Strom) (abbreviated from Sars 1891).
Fig. 1 Body of female, dorsal view.
Fig. 2 Body of female, lateral view.
Fig. 3 Eye tubercle.
Fig. 4 Appendage III of male.
Fig. 5 Leg.

Figs. 6-11: *Boreonymphon robustum* (Bell) (abbreviated from Sars 1891).
Fig. 6 Body of female, dorsal view.
Fig. 7 Body of female, lateral view.
Fig. 8 Second article of appendage I.
Fig. 9 Appendage II.
Fig. 10 Distal part of appendage III.
Fig. 11 Distal articles of leg.

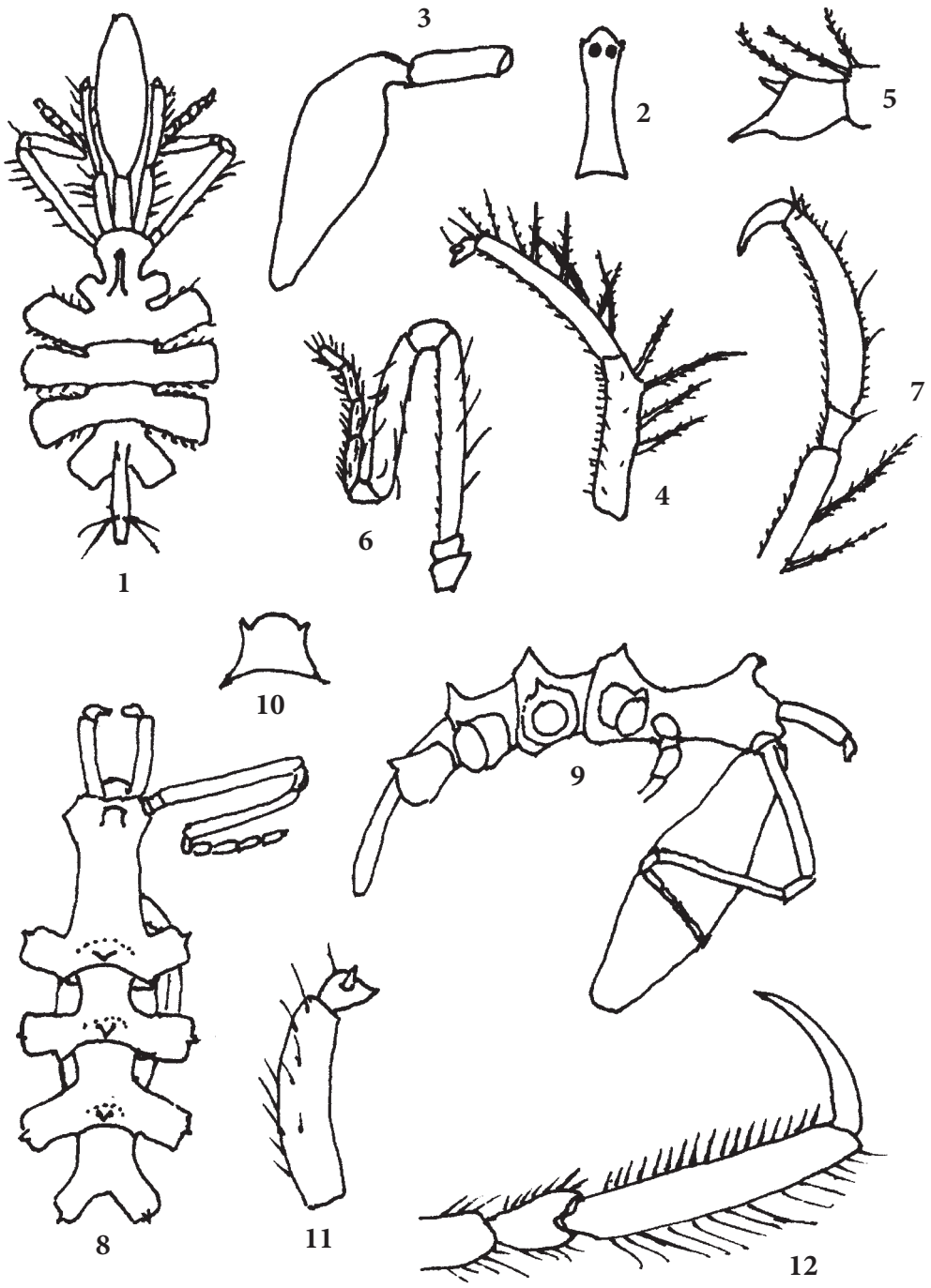


Plate III

Figs. 1-7: *Eurycyde hispida* (Krøyer) (abbreviated from Sars 1891).
Fig. 1 Body, dorsal view.
Fig. 2 Eye tubercle.
Fig. 3 Proboscis.
Fig. 4 Appendage I.
Fig. 5 Third article of appendage I.
Fig. 6 Appendage II.
Fig. 7 Distal part of leg.

Figs. 8-12: *Ascorhynchus abyssi* Sars (abbreviated from Sars 1891).
Fig. 8 Body, dorsal view.
Fig. 9 Body, lateral view.
Fig. 10 Eye tubercle.
Fig. 11 Appendage I.
Fig. 12 Distal end of leg.

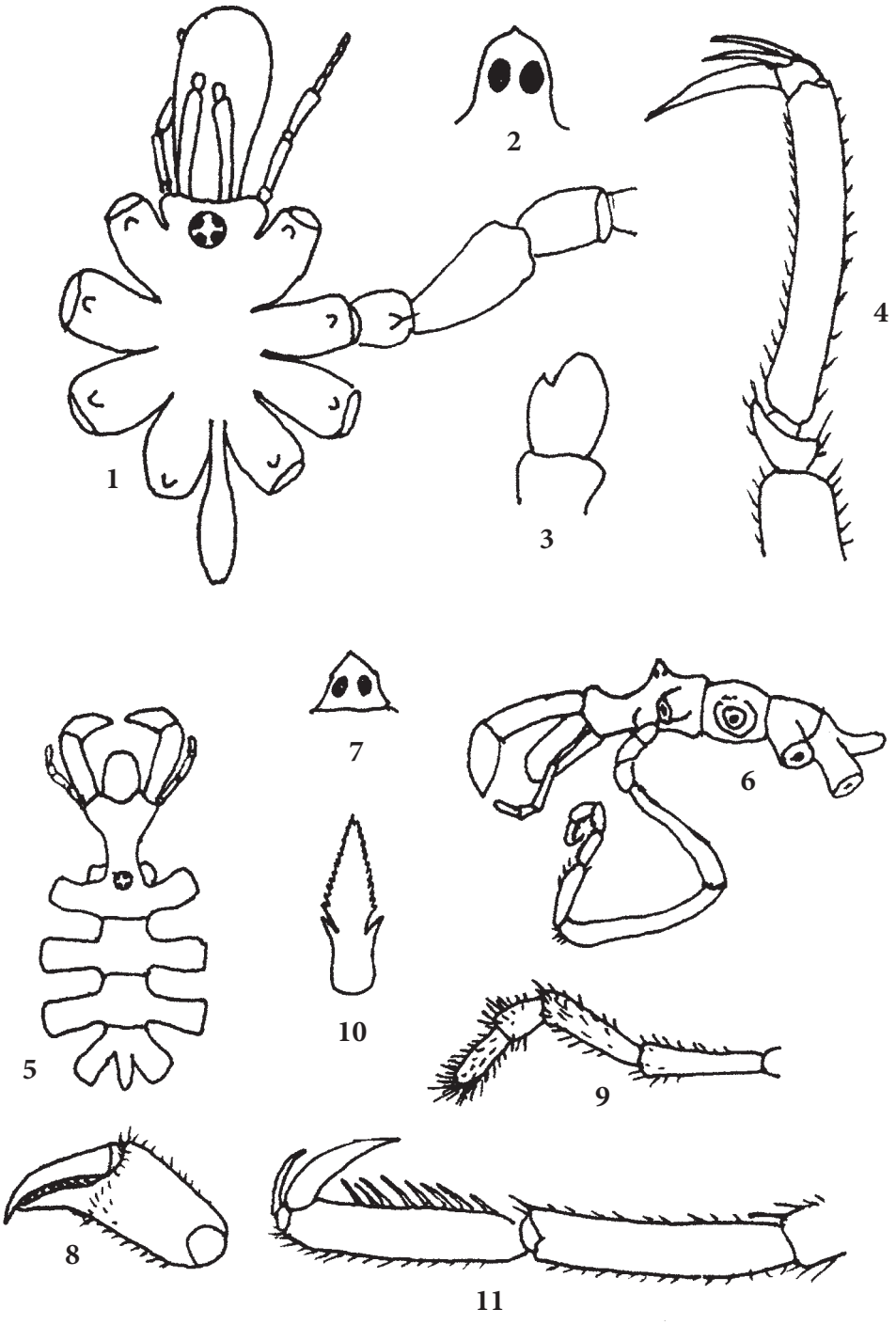


Plate IV

Figs. 1-4: ***Achelia borealis*** **(Schimkewitsch, 1895) (from Shimkevich 1929).**
Fig. 1 Body, dorsal view.
Fig. 2 Eye tubercle.
Fig. 3 Second article of appendage I.
Fig. 4 Distal articles of leg.

Figs. 5-11: ***Nymphon brevirostre*** **Hodge (abbreviated from Sars 1891).**
Fig. 5 Body, dorsal view.
Fig. 6 Body, lateral view.
Fig. 7 Eye tubercle.
Fig. 8 Second article of appendage I.
Fig. 9 Appendage II.
Fig. 10 Serrate spine on appendage III.
Fig. 11 Distal articles of leg.

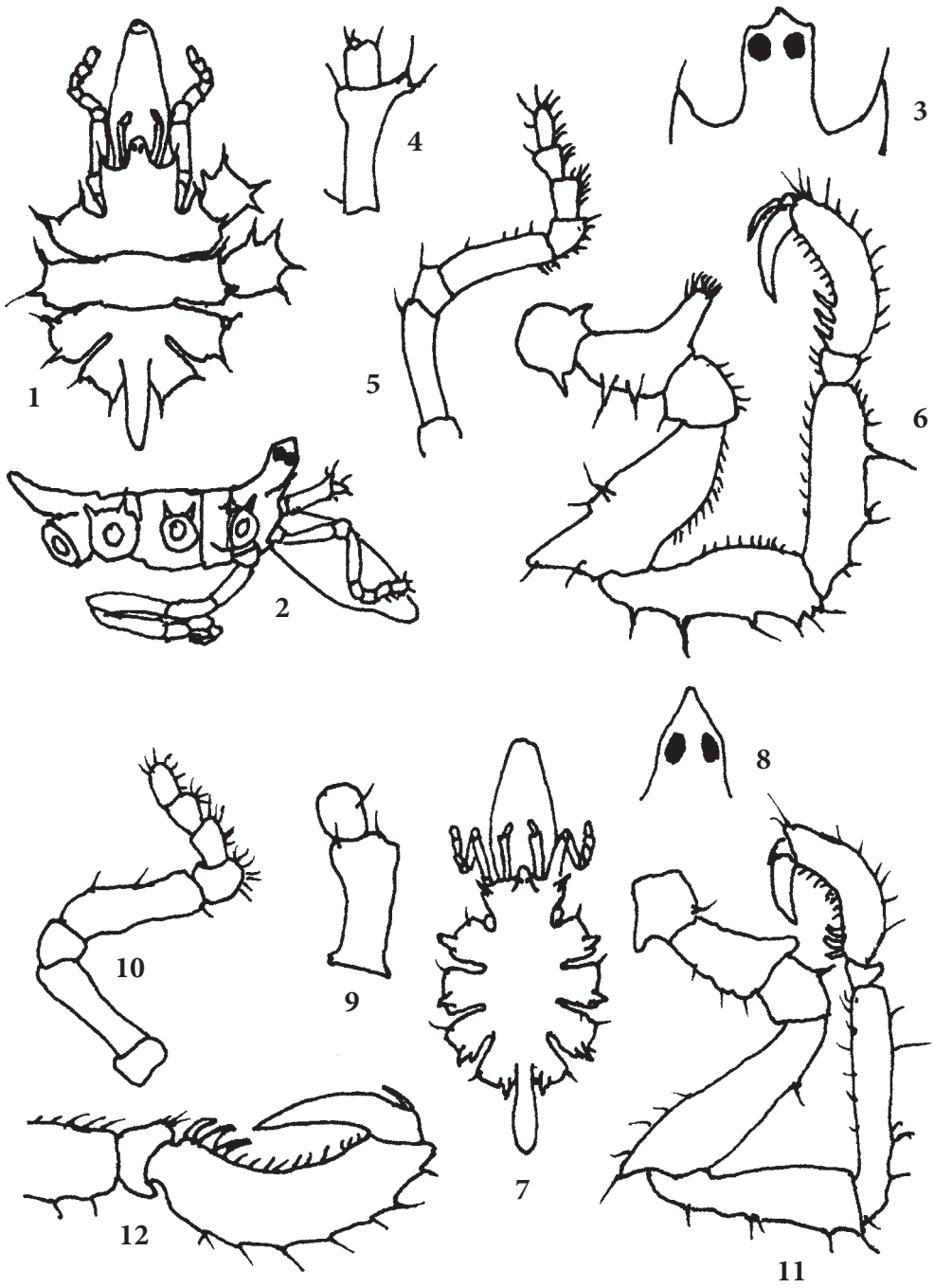


Plate V
Figs. 1-6: *Achelia echinata* Hodge (abbreviated from Sars 1891).
Fig. 1 Body, dorsal view.
Fig. 2 Body, lateral view.
Fig. 3 Eye tubercle with lateral tubercles in the frontal area, posterior view.
Fig. 4 Appendage I.
Fig. 5 Appendage II.
Fig. 6 Leg.

Figs. 7-12: *Achelia levis* Hodge (abbreviated from Sars 1891).
Fig. 7 Body, dorsal view.
Fig. 8 Eye tubercle.
Fig. 9 Appendage I.
Fig. 10 Appendage II.
Fig. 11 Leg.
Fig. 12 Distal articles of leg.

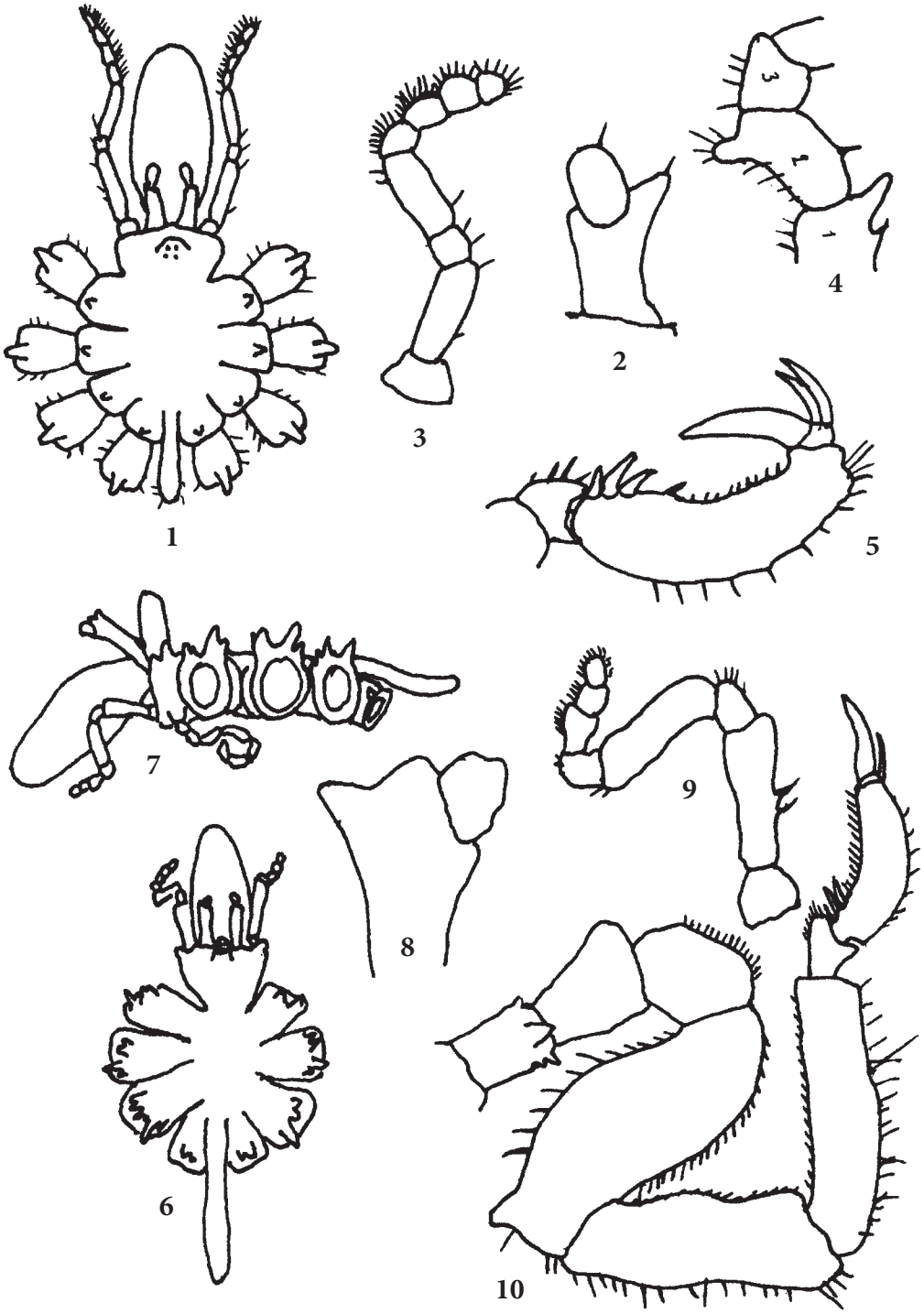


Plate VI

Figs. 1-5: *Achelia alaskensis* (Cole) (1, 3 from Shimkevich 1929. 2, 4, 5 from Cole 1904).
Fig. 1 Body, dorsal view.
Fig. 2 Appendage I.
Fig. 3 Appendage II.
Fig. 4 First three articles of leg.
Fig. 5 Distal articles of leg.

Figs. 6-10: *Achelia uschakovi* Losina-Losinsky (from Losina-Losinsky 1933).
Fig. 6 Body, dorsal view.
Fig. 7 Body, lateral view.
Fig. 8 Appendage I.
Fig. 9 Appendage II.
Fig. 10 Leg.

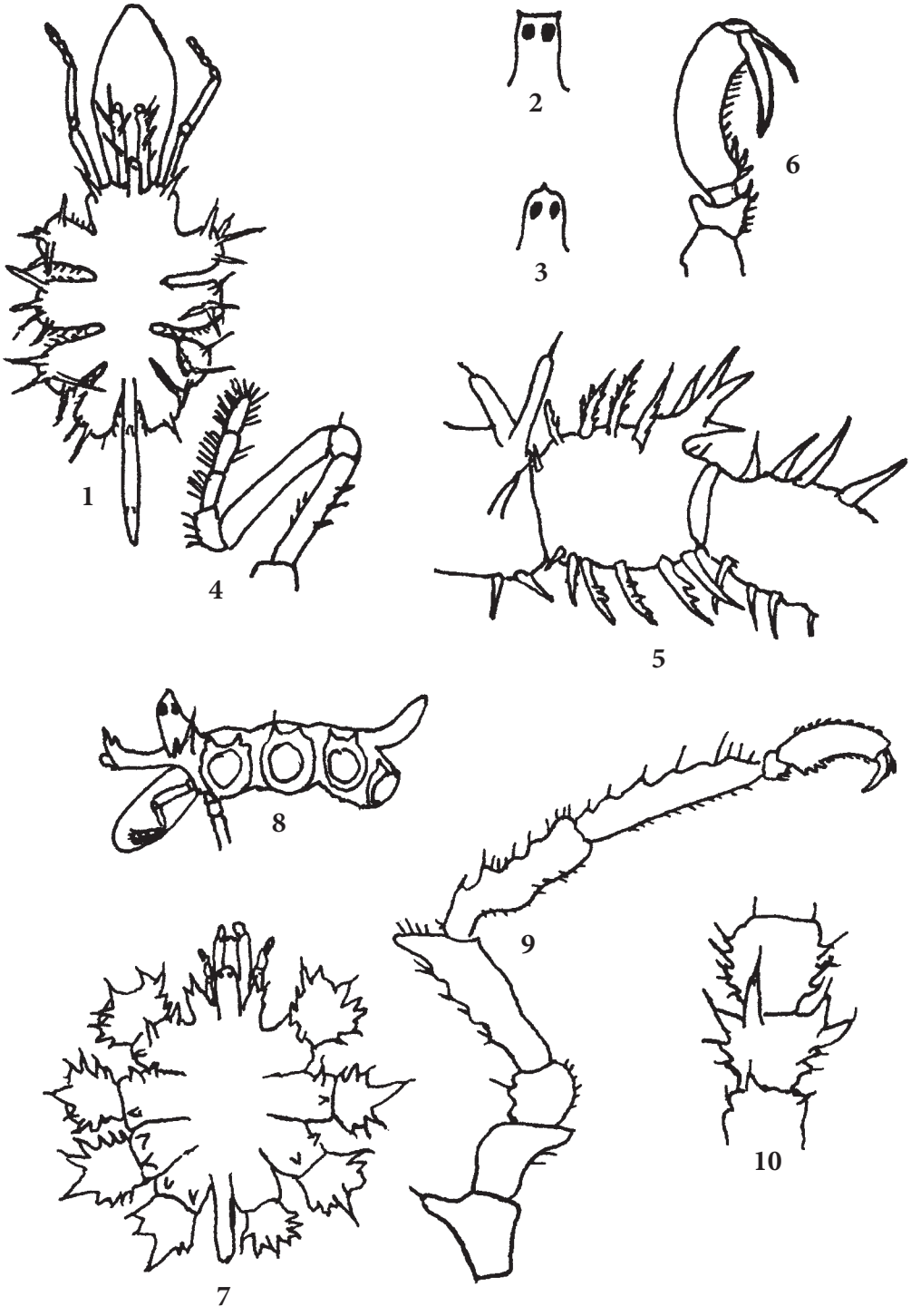


Plate VII

Figs. 1-6: *Achelia salebrosa* Losina-Losinsky (from Losina-Losinsky 1961).
Fig. 1 Body, dorsal view.
Fig. 2 Eye tubercle, anterior view.
Fig. 3 Eye tubercle, lateral view.
Fig. 4 Appendage II.
Fig. 5 Armament of lateral processes and first two articles of leg.
Fig. 6 Distal articles of leg.

Figs. 7-10: *Achelia lavrentii* (Losina-Losinsky) (from Losina-Losinsky 1933).
Fig. 7 Body, dorsal view.
Fig. 8 Body, lateral view.
Fig. 9 Leg.
Fig. 10 Armament of lateral process and first two articles of leg.

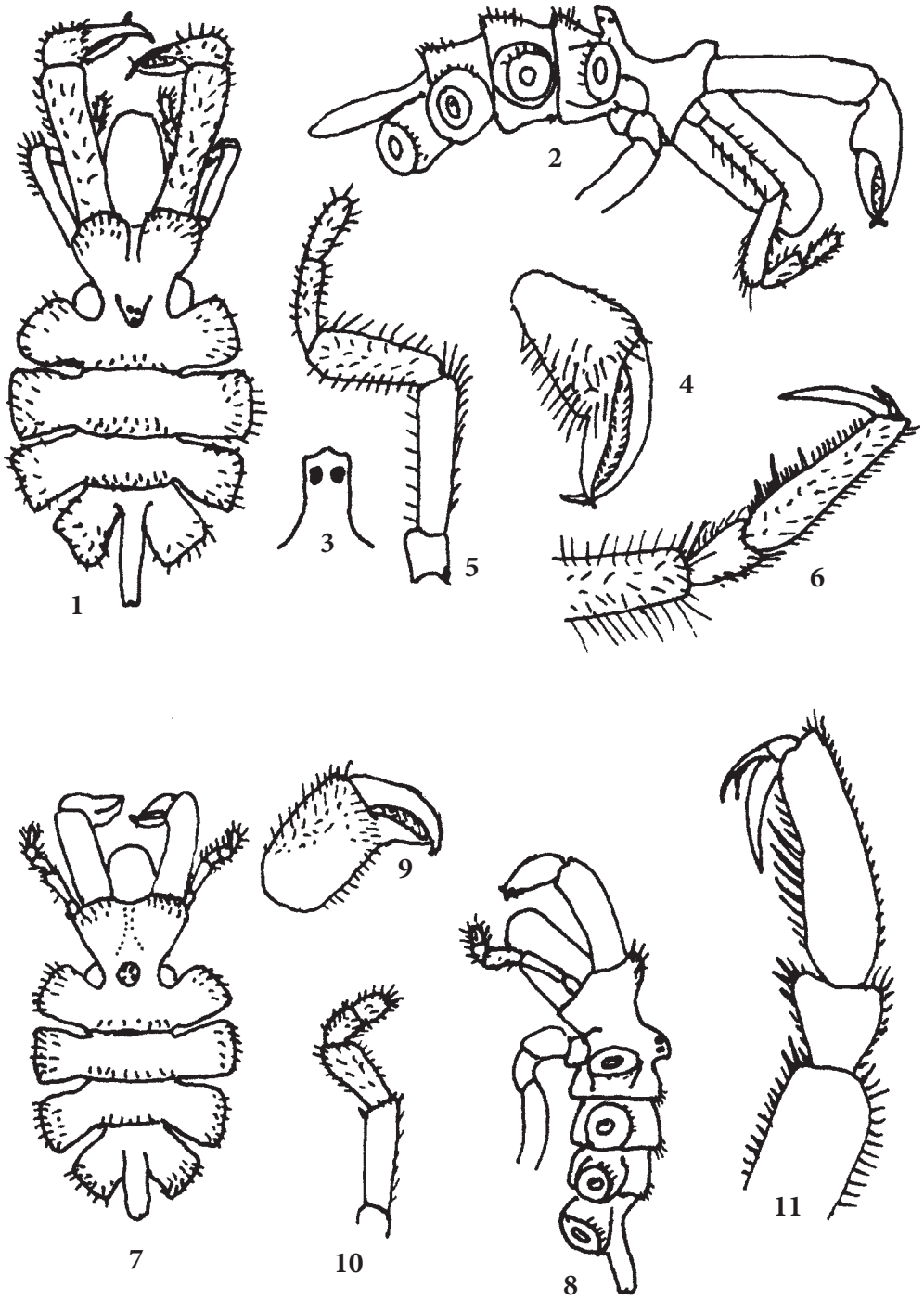


Plate VIII

Figs. 1-6: *Nymphon spinosum hirtipes* (Bell) (abbreviated from Sars 1891).
Fig. 1 Body, dorsal view.
Fig. 2 Body, lateral view.
Fig. 3 Eye tubercle.
Fig. 4 Second article of appendage I.
Fig. 5 Appendage II.
Fig. 6 Distal articles of leg.

Figs. 7-11: *Nymphon hirtum* Fabricius (abbreviated from Sars 1891).
Fig. 7 Body, dorsal view.
Fig. 8 Body, lateral view.
Fig. 9 Second article of appendage I.
Fig. 10 Appendage II.
Fig. 11 Distal articles of leg.

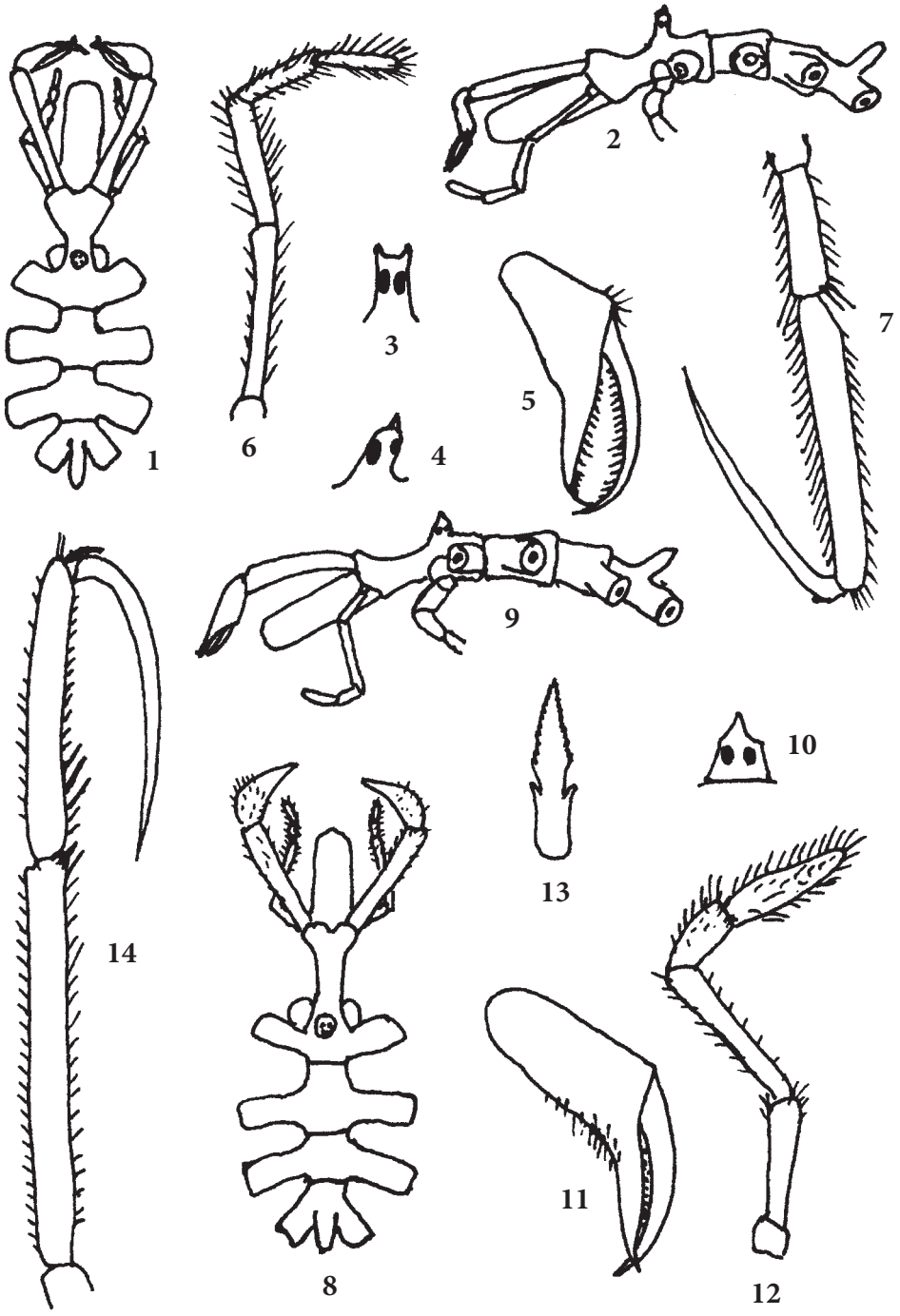


Plate IX

Figs. 1-7: *Nymphon macronyx* Sars (abbreviated from Sars 1891).
Fig. 1 Body, dorsal view.
Fig. 2 Lateral view.
Fig. 3 Eye tubercle, anterior view.
Fig. 4 Eye tubercle, lateral view.
Fig. 5 Second article of appendage I.
Fig. 6 Appendage II.
Fig. 7 Distal articles of leg.

Figs. 8-14: *Nymphon sluiteri* Hoek (abbreviated from Sars 1891).
Fig. 8 Body, dorsal view.
Fig. 9 Body, lateral view.
Fig. 10 Eye tubercle.
Fig. 11 Second article of appendage I.
Fig. 12 Appendage II.
Fig. 13 Serrate spine on appendage III.
Fig. 14 Distal articles of leg.

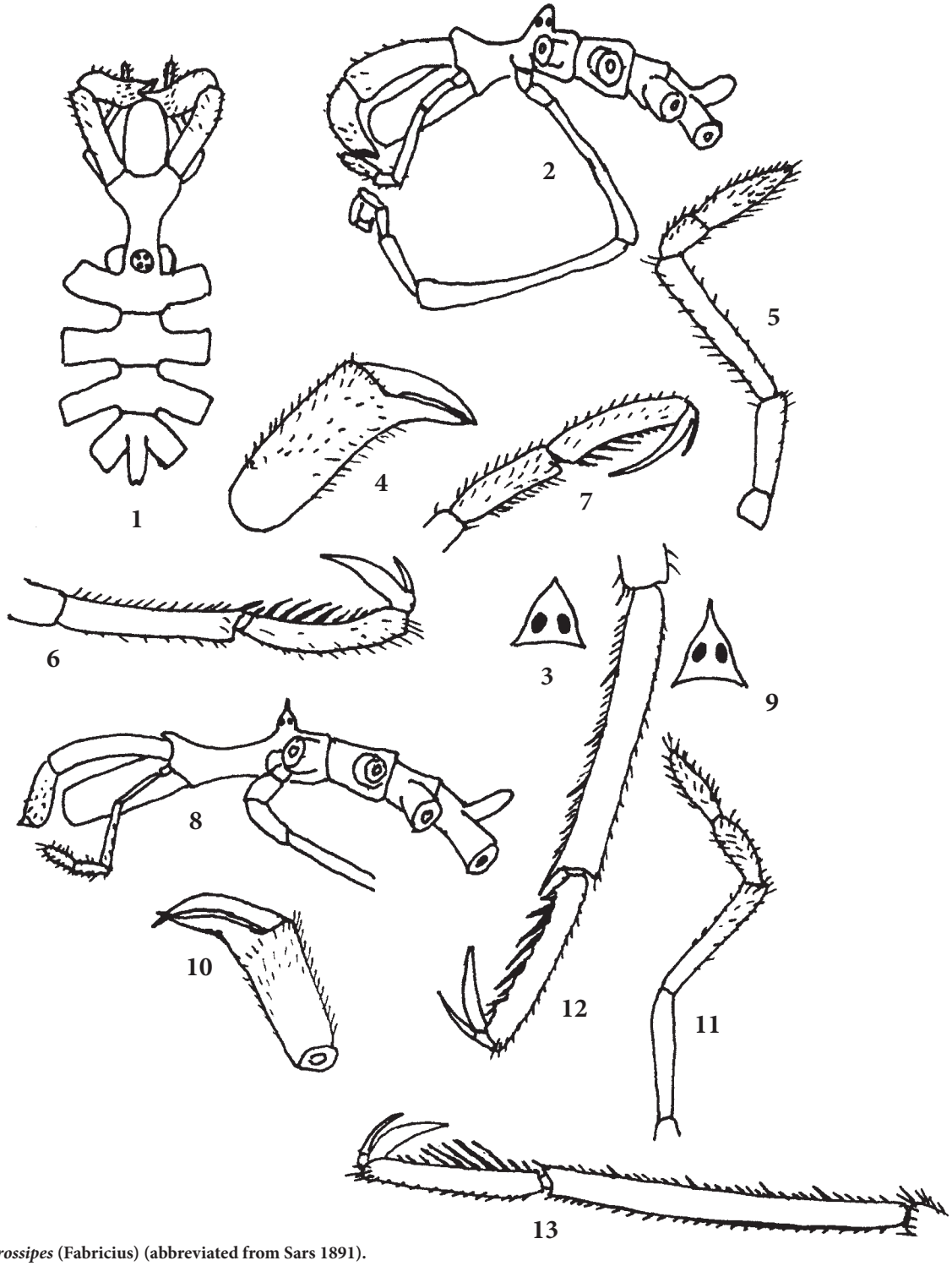


Plate X

Figs. 1-7: *Nymphon grossipes* (Fabricius) (abbreviated from Sars 1891).
Fig. 1 Body, dorsal view.
Fig. 2 Body, lateral view.
Fig. 3 Eye tubercle.
Fig. 4 Second article of appendage I.
Fig. 5 Appendage II.
Fig. 6 Distal articles of leg of adult specimen.
Fig. 7 Distal articles of leg of juvenile specimen.

Figs. 8-13: *Nymphon mixtum* Krøyer (abbreviated from Sars 1891).
Fig. 8 Body, lateral view.
Fig. 9 Eye tubercle.
Fig. 10 Second article of appendage I.
Fig. 11 Appendage II.
Fig. 12 Distal part of leg.
Fig. 13 Distal part of leg of another specimen with longer seventh article.

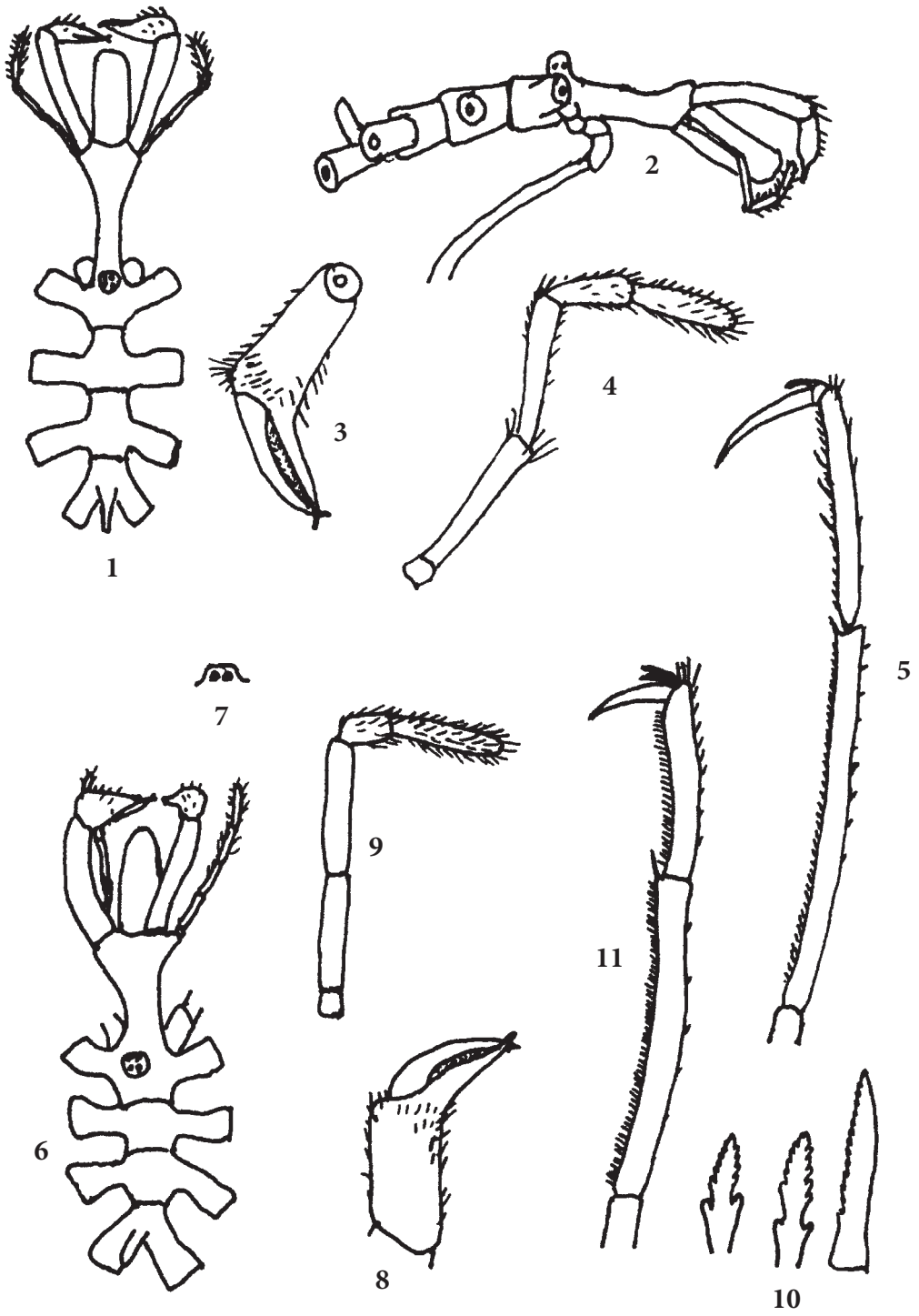


Plate XI

Figs. 1-5: *Nymphon longitarse* Krøyer (abbreviated from Sars 1891).
Fig. 1 Body, dorsal view.
Fig. 2 Body, lateral view.
Fig. 3 Second article of appendage I.
Fig. 4 Appendage II.
Fig. 5 Distal articles of leg.

Figs. 6-11: *Nymphon longitarse brevicollis* (from Losina-Losinsky, 1929).
Fig. 6 Body, dorsal view.
Fig. 7 Eye tubercle.
Fig. 8 Second article of appendage I.
Fig. 9 Appendage II.
Fig. 10 Serrate spines and claw of appendage III.
Fig. 11 Distal articles of leg.

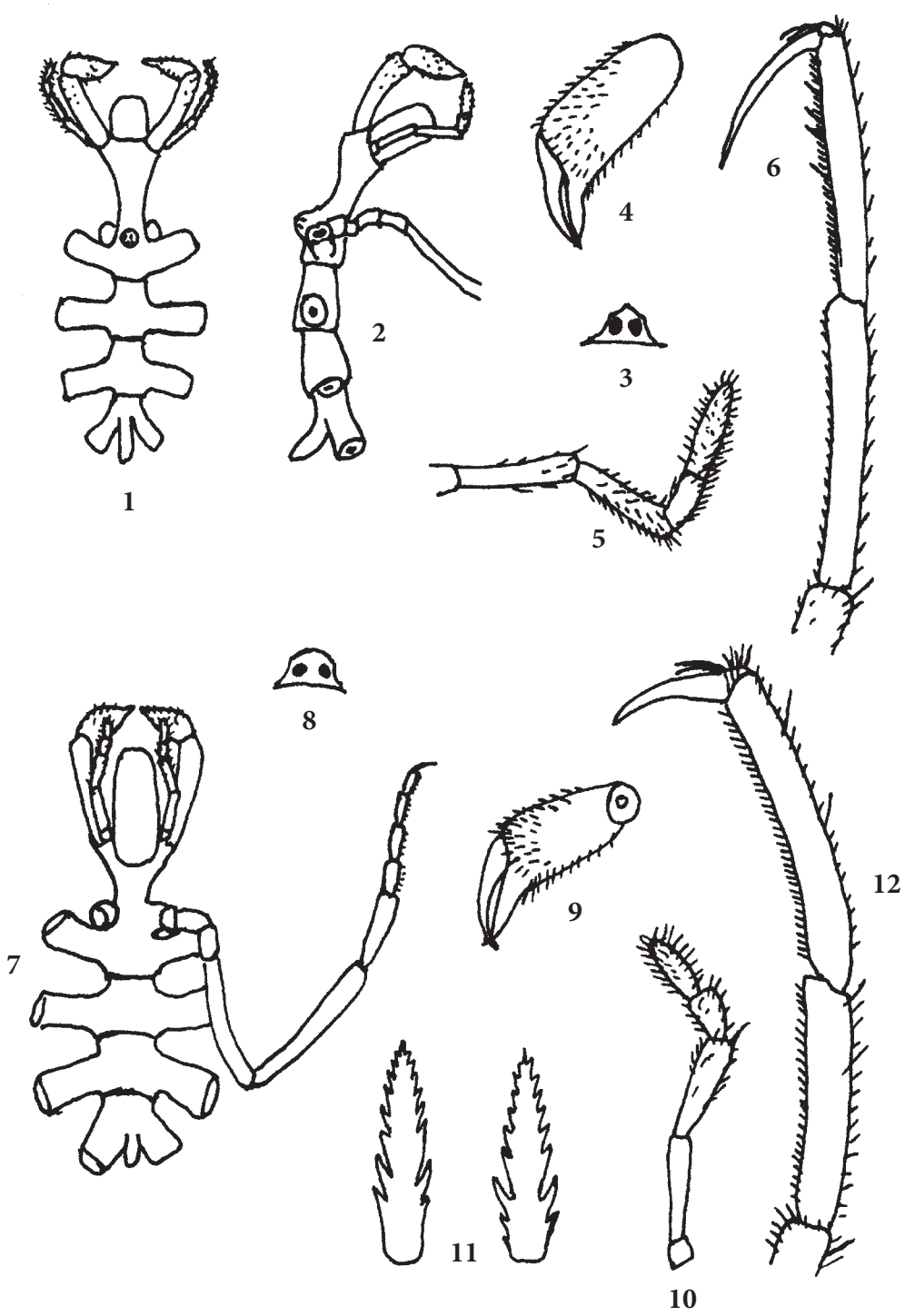


Plate XII

Figs. 1-6: *Nymphon microrhynchum* Sars (abbreviated from Sars 1891).
Fig. 1 Body, dorsal view.
Fig. 2 Body, lateral view.
Fig. 3 Eye tubercle.
Fig. 4 Second article of appendage I.
Fig. 5 Appendage II.
Fig. 6 Distal articles of leg.

Figs. 7-12: *Nymphon micronyx* (Sars) (abbreviated from Sars 1891).
Fig. 7 Body, ventral view.
Fig. 8 Eye tubercle.
Fig. 9 Second article of appendage I.
Fig. 10 Appendage II.
Fig. 11 Serrate spines of appendage III.
Fig. 12 Distal articles of leg.

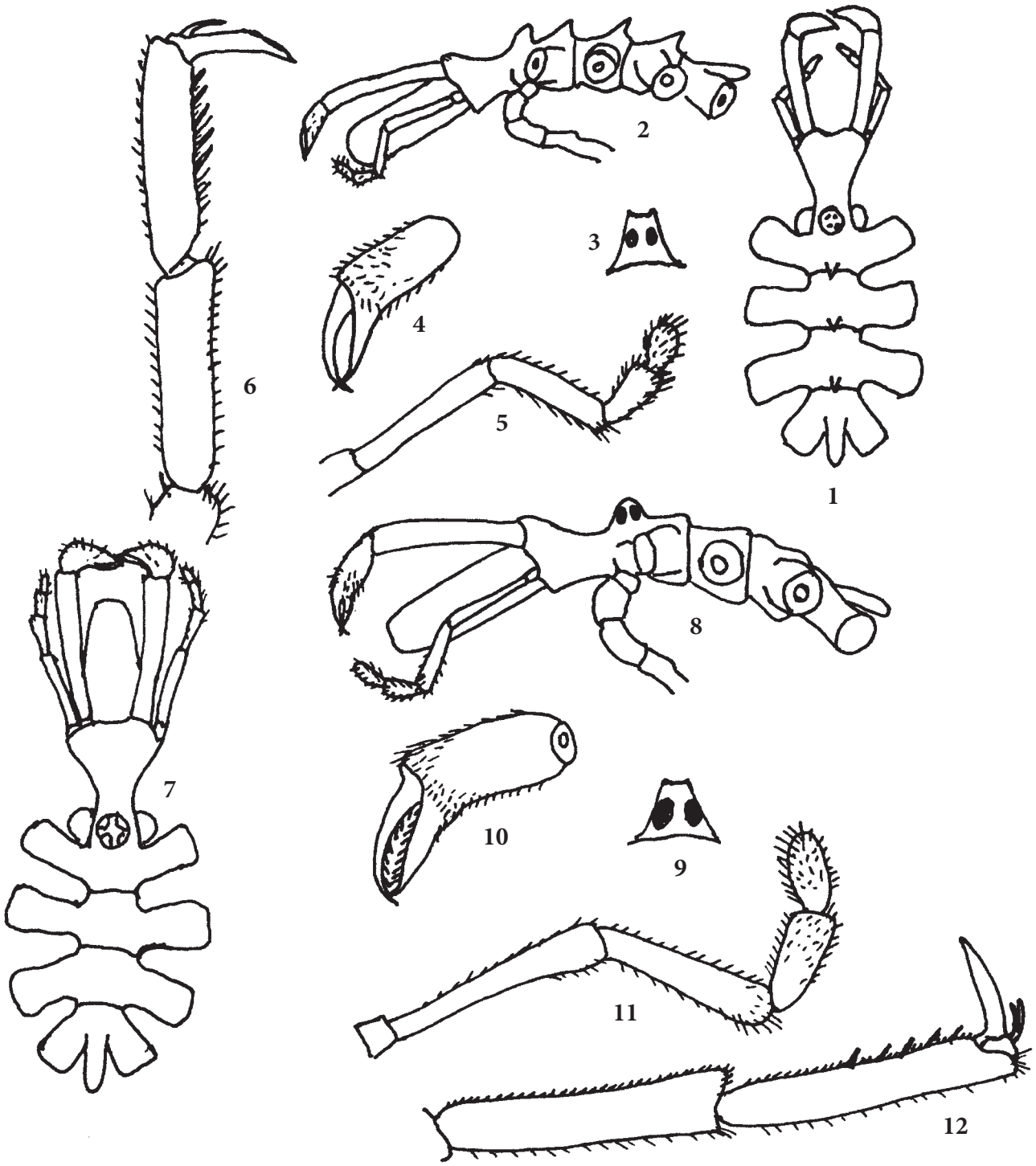


Plate XIII

Figs. 1-6: *Nymphon serratum* Sars (abbreviated from Sars 1891).
Fig. 1 Body, dorsal view.
Fig. 2 Body, lateral view.
Fig. 3 Eye tubercle.
Fig. 4 Second article of appendage I.
Fig. 5 Appendage II.
Fig. 6 Distal articles of leg.

Figs. 7-12: *Nymphon megalops* Sars (abbreviated from Sars 1891).
Fig. 7 Body, dorsal view.
Fig. 8 Body, lateral view.
Fig. 9 Eye tubercle.
Fig. 10 Second article of appendage I.
Fig. 11 Appendage II.
Fig. 12 Distal articles of leg.

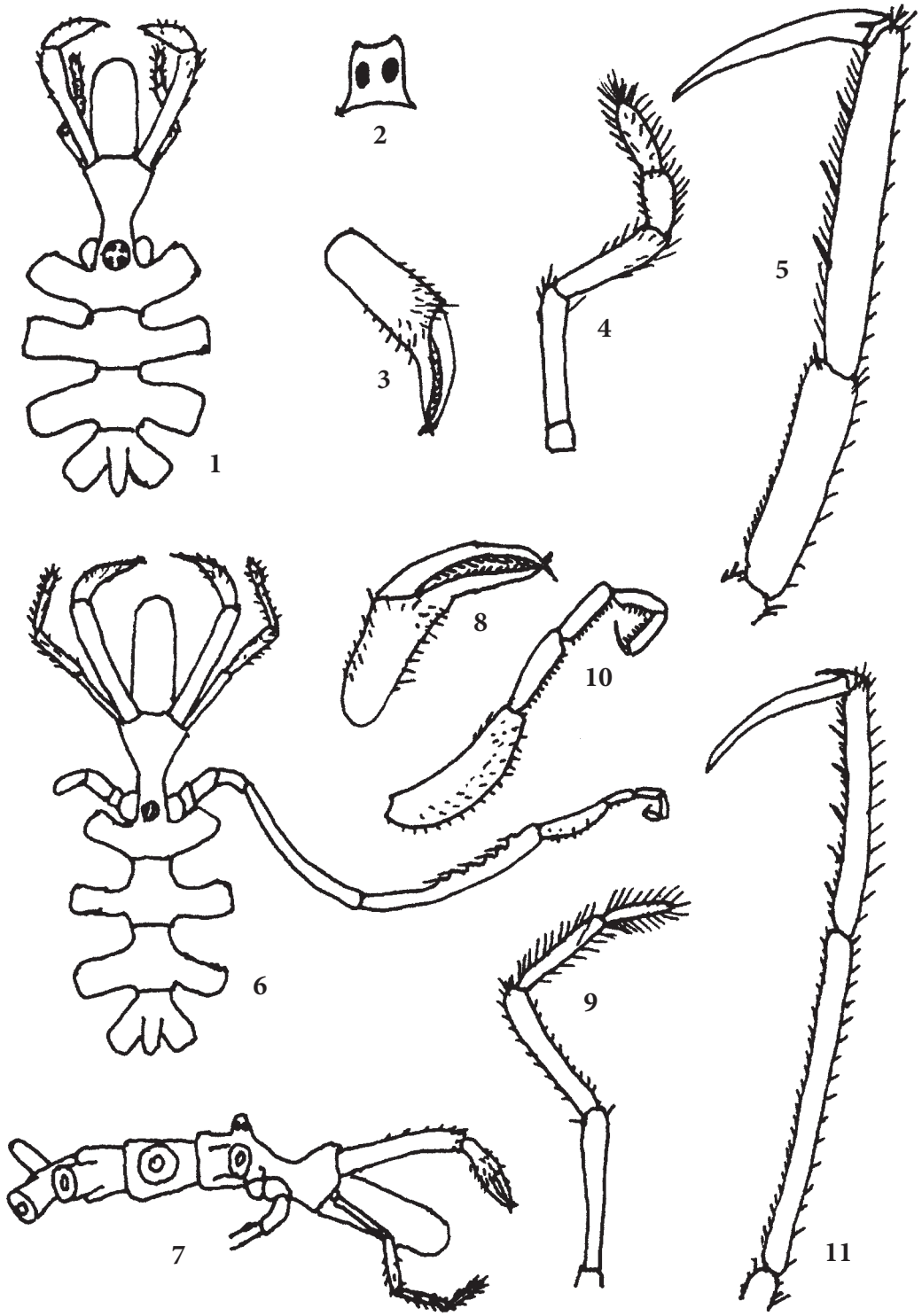


Plate XIV

Figs. 1-5: *Nymphon longimanum* Sars (abbreviated from Sars 1891).
Fig. 1 Body, dorsal view.
Fig. 2 Eye tubercle.
Fig. 3 Second article of appendage I.
Fig. 4 Appendage II.
Fig. 5 Distal articles of leg.

Figs. 6-11: *Nymphon leptocheles* Sars (abbreviated from Sars 1891).
Fig. 6 Body, dorsal view.
Fig. 7 Body, lateral view.
Fig. 8 Second article of appendage I.
Fig. 9 Appendage II.
Fig. 10 Sixth to tenth articles of appendage III.
Fig. 11 Distal articles of leg.

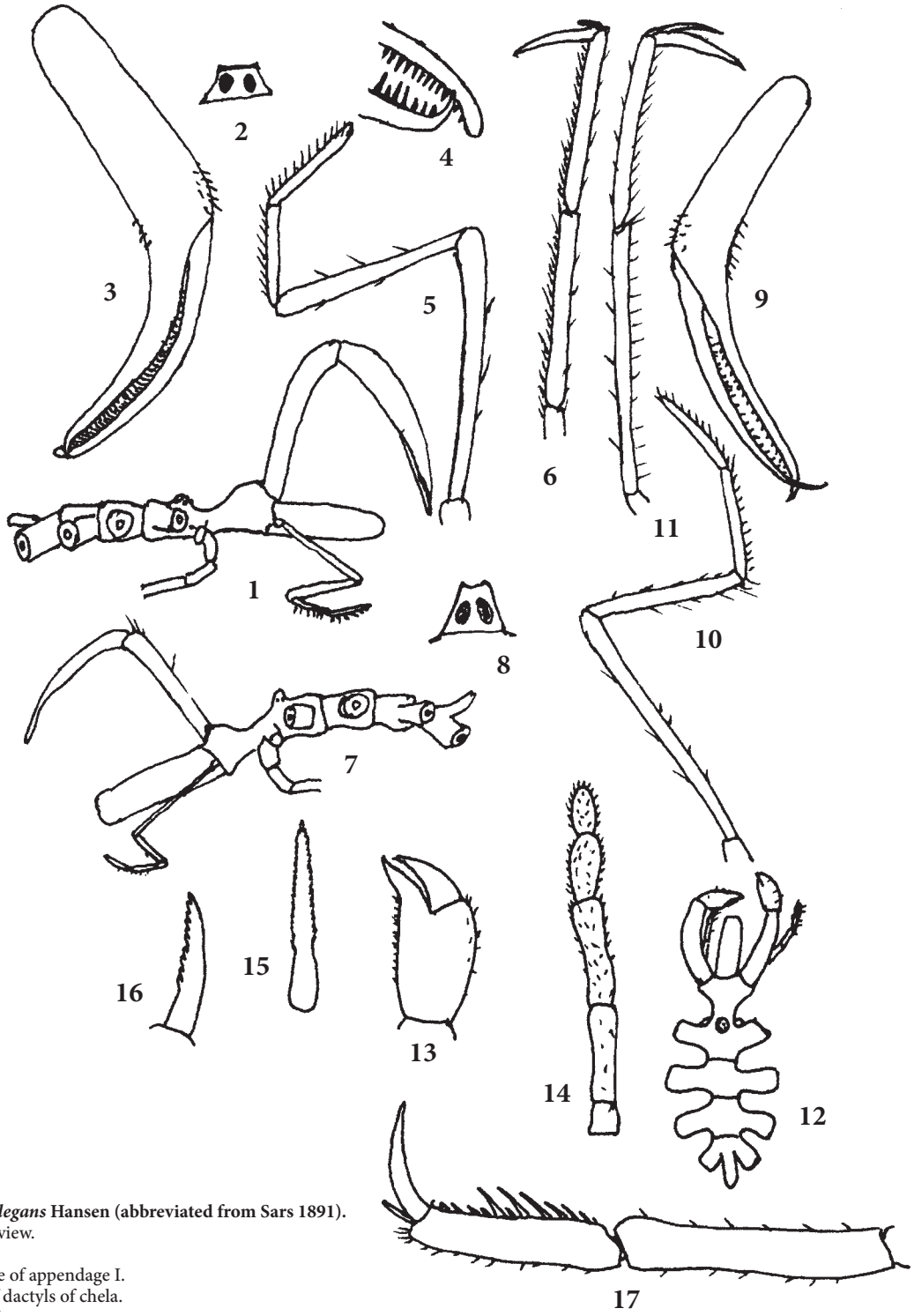


Plate XV

Figs. 1-6: *Nymphon elegans* Hansen (abbreviated from Sars 1891).
Fig. 1 Body, lateral view.
Fig. 2 Eye tubercle.
Fig. 3 Second article of appendage I.
Fig. 4 Distal part of dactyls of chela.
Fig. 5 Appendage II.
Fig. 6 Distal articles of leg.

Figs. 7-11: *Nymphon macrum* Wilson (abbreviated from Sars 1891).
Fig. 7 Body, lateral view.
Fig. 8 Eye tubercle.
Fig. 9 Second article of appendage I.
Fig. 10 Appendage II.
Fig. 11 Distal articles of leg.

Figs. 12-17: *Nymphon schimkewitschi* Losina-Losinsky (from Losina-Losinsky 1929, 1935).
Fig. 12 Body, dorsal view.
Fig. 13 Second article of appendage I.
Fig. 14 Appendage II.
Fig. 15 Serrate spines of appendage III.
Fig. 16 Claw of appendage III.
Fig. 17 Distal articles of leg.

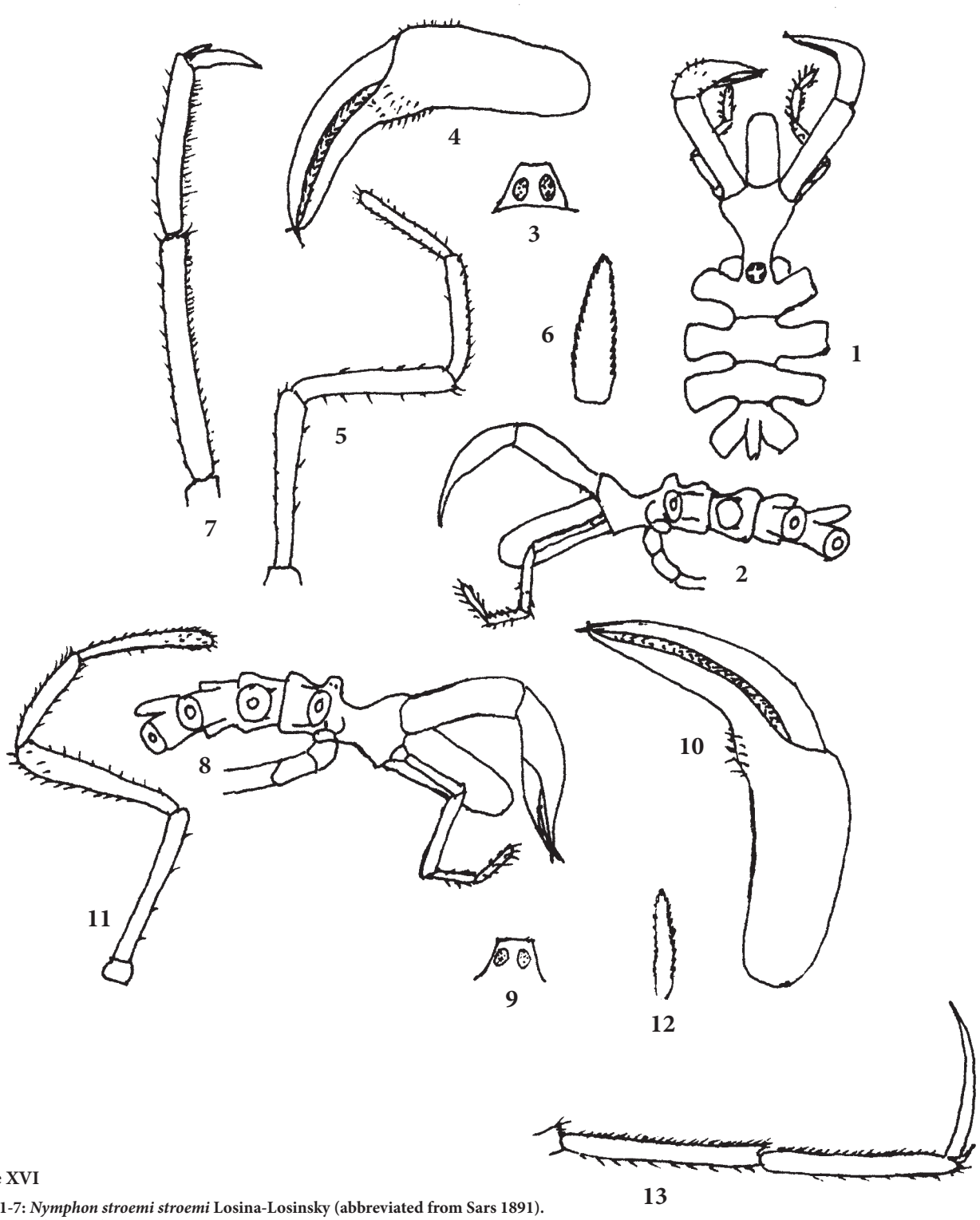


Plate XVI

Figs. 1-7: *Nymphon stroemi stroemi* Losina-Losinsky (abbreviated from Sars 1891).
Fig. 1 Body, dorsal view.
Fig. 2 Body, lateral view.
Fig. 3 Eye tubercle.
Fig. 4 Second article of appendage I.
Fig. 5 Appendage II.
Fig. 6 Serrate spine on appendage III.
Fig. 7 Distal articles of leg.

Figs. 8-13: *Nymphon stroemi gracilipes* Losina-Losinsky (abbreviated from Sars 1891).
Fig. 8 Body, lateral view.
Fig. 9 Eye tubercle.
Fig. 10 Second article of appendage I.
Fig. 11 Appendage II.
Fig. 12 Serrate spine on appendage III.
Fig. 13 Distal articles of leg.

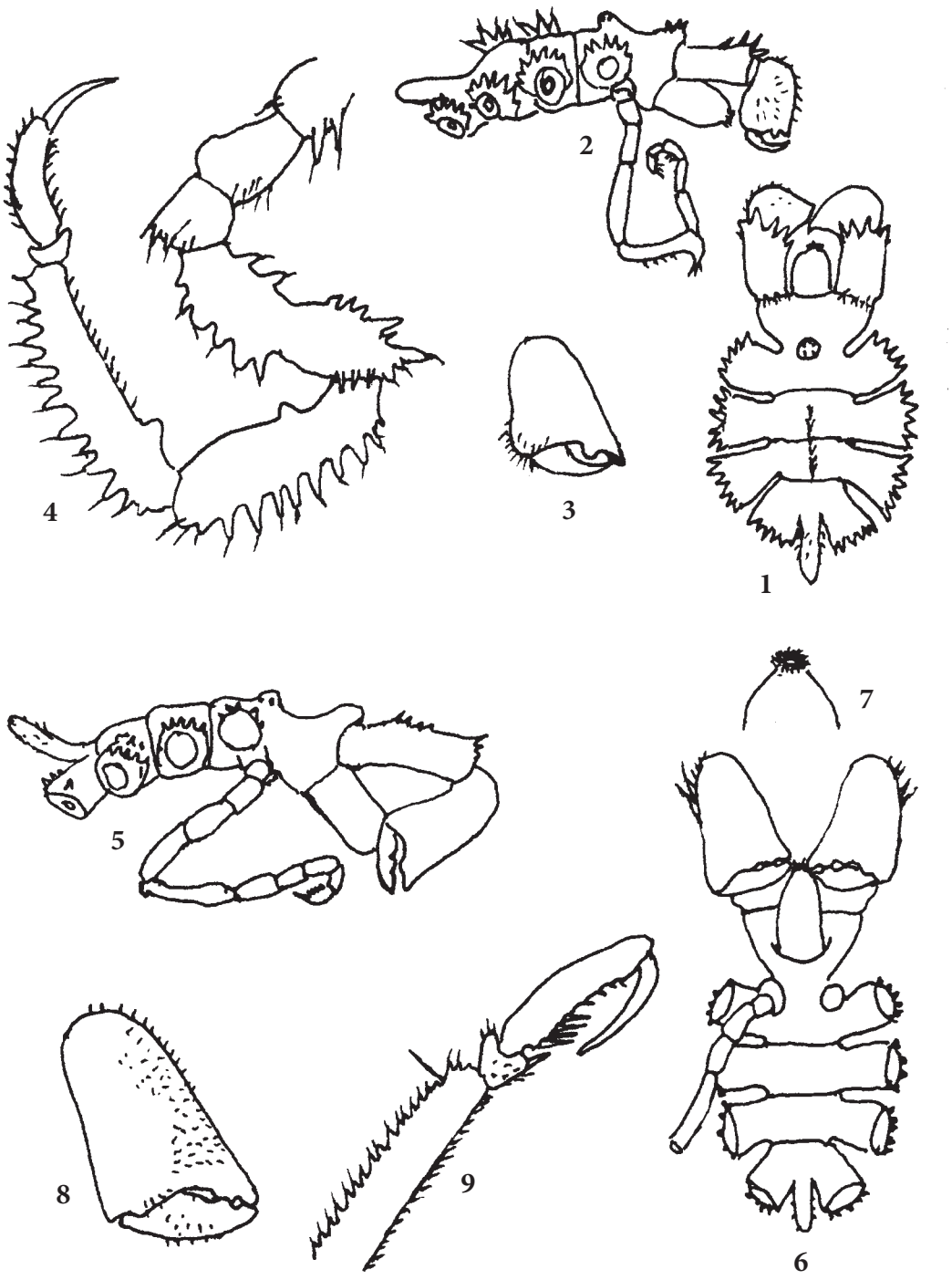


Plate XVII

Figs. 1-4: *Pseudopallene circularis* (Goodsir) (abbreviated from Sars 1891).
Fig. 1 Body, dorsal view.
Fig. 2 Body, lateral view.
Fig. 3 Second article of appendage I.
Fig. 4 Leg.

Figs. 5-9: *Pseudopallene spinipes* (Fabricius) (abbreviated from Sars 1891).
Fig. 5 Body, lateral view.
Fig. 6 Body, ventral view.
Fig. 7 Distal part of proboscis.
Fig. 8 Second article of appendage I.
Fig. 9 Distal articles of leg.

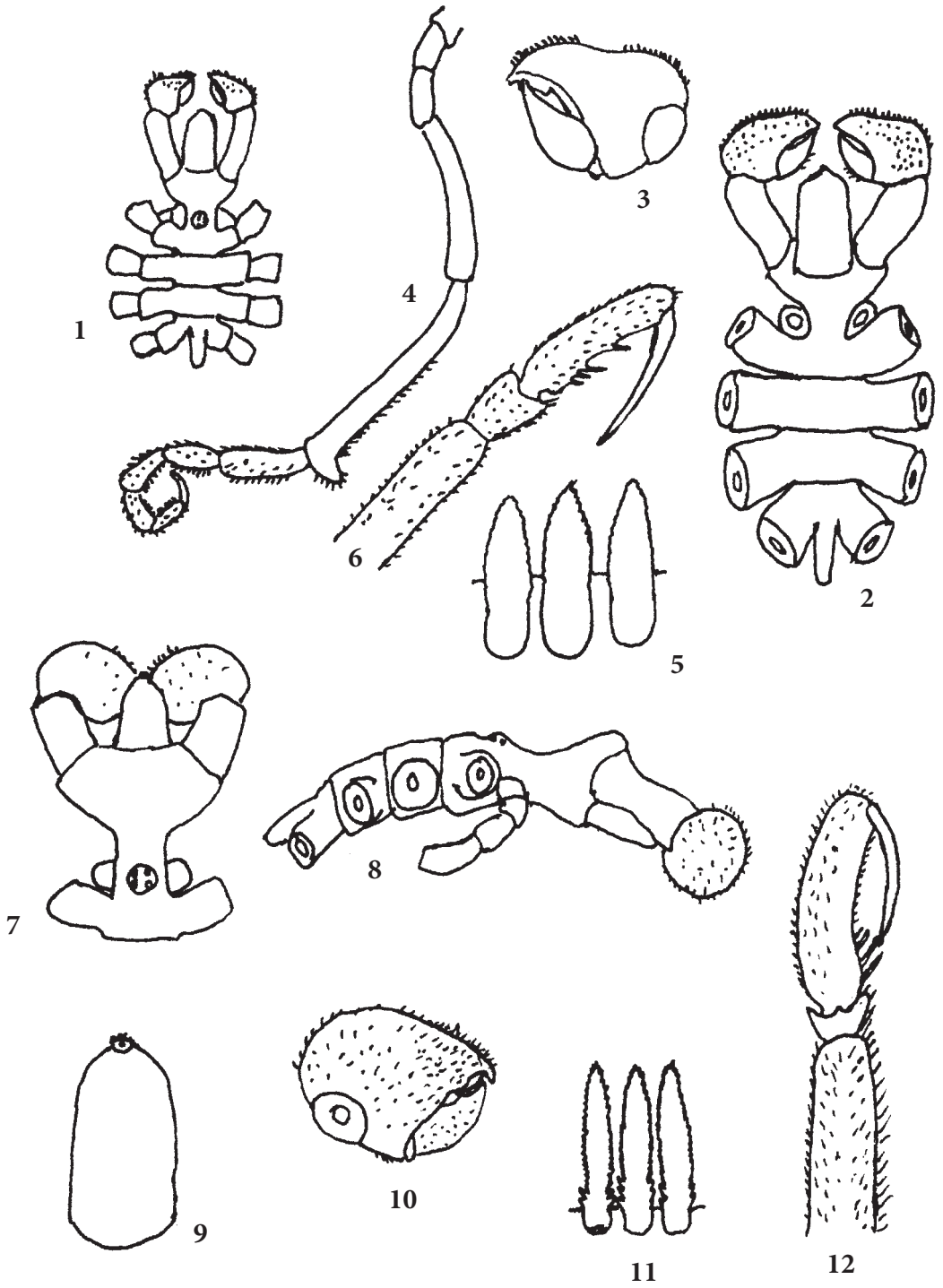


Plate XVIII

Figs. 1-6: *Cordylochele brevicollis* Sars (abbreviated from Sars 1891).
Fig. 1 Body, dorsal view.
Fig. 2 Body, ventral view.
Fig. 3 Second article of appendage I.
Fig. 4 Appendage III.
Fig. 5 Serrate spines of appendage III.
Fig. 6 Distal articles of leg.

Figs. 7-12: *Cordylochele malleolata* (Sars) (abbreviated from Sars 1891).
Fig. 7 Head segment, dorsal view.
Fig. 8 Body, lateral view.
Fig. 9 Proboscis.
Fig. 10 Second article of appendage I.
Fig. 11 Serrate spines on appendage III.
Fig. 12 Distal articles of leg.

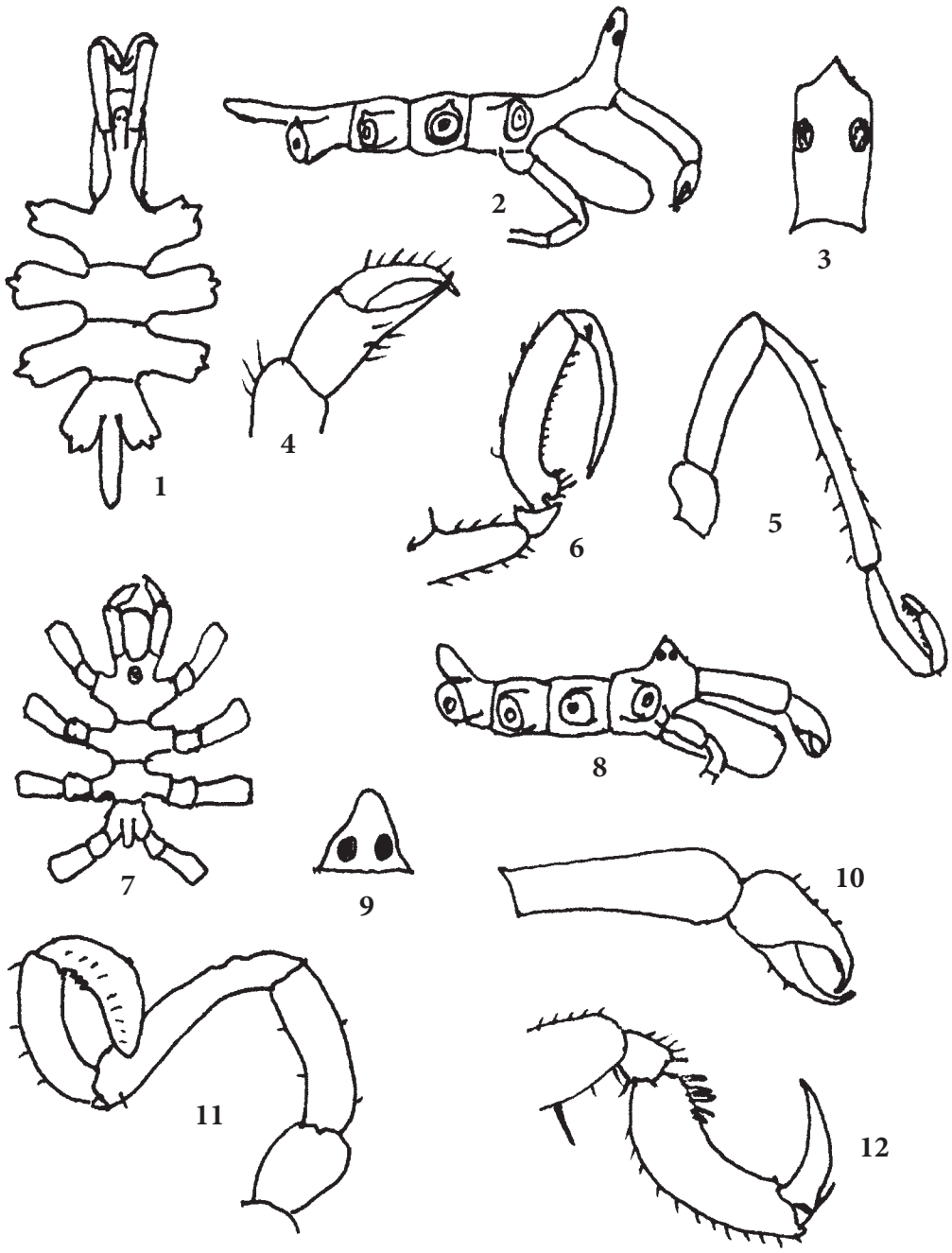


Plate XIX

Figs. 1-6: *Anoplodactylus petiolatus* (Krøyer) (abbreviated from Sars 1891).
Fig. 1 Body, dorsal view.
Fig. 2 Body, lateral view.
Fig. 3 Eye tubercle.
Fig. 4 Second article of appendage I.
Fig. 5 Appendage III.
Fig. 6 Distal articles of leg.

Figs. 7-12: *Phoxichilidium femoratum* (Rathke) (abbreviated from Sars 1891).
Fig. 7 Body, dorsal view.
Fig. 8 Body, lateral view.
Fig. 9 Eye tubercle.
Fig. 10 Appendage I.
Fig. 11 Appendage III.
Fig. 12 Distal articles of leg.

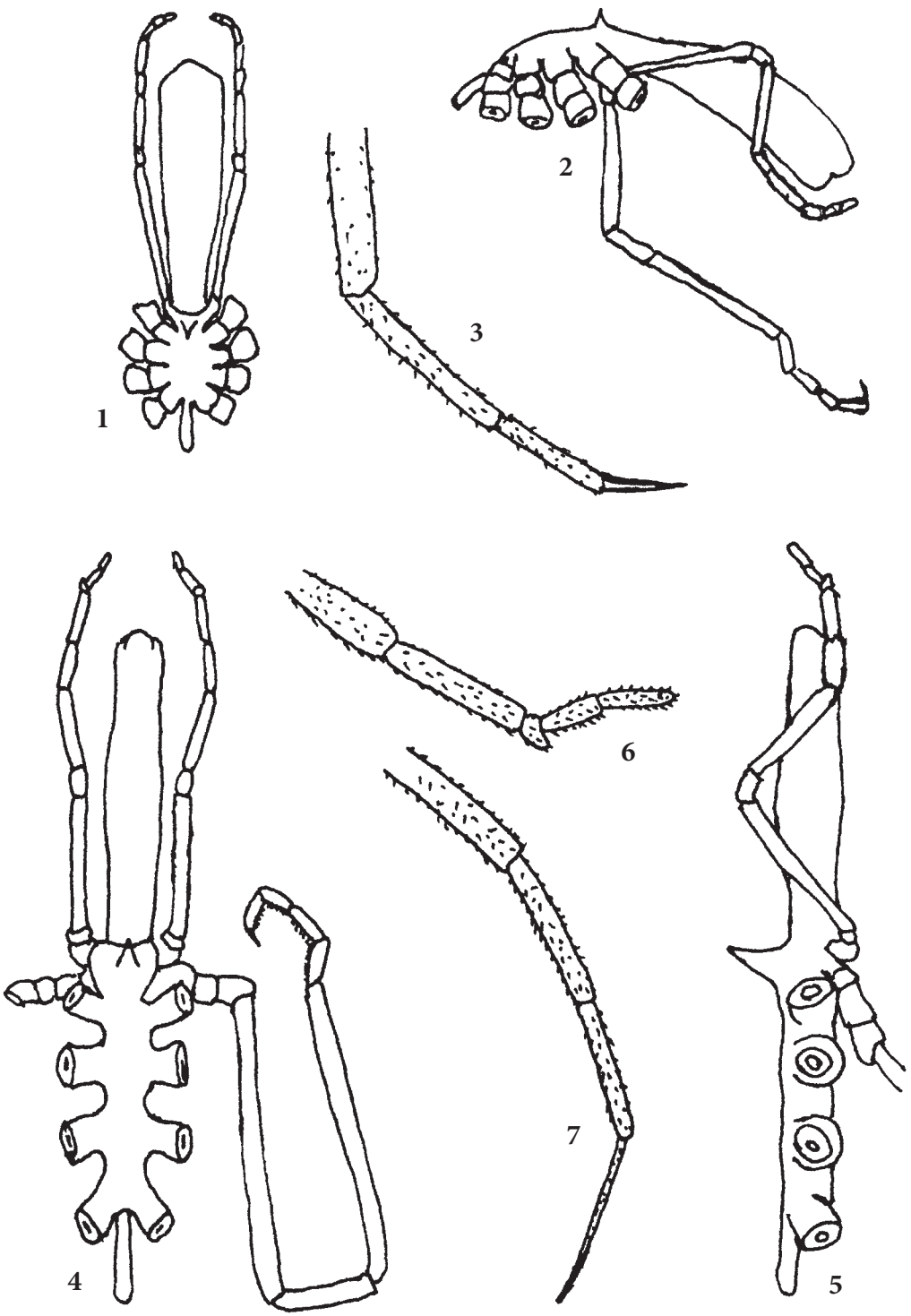


Plate XX

Figs. 1-3: *Colossendeis proboscidea* (Sabine) (abbreviated from Sars 1891).
Fig. 1 Body, dorsal view.
Fig. 2 Body, lateral view.
Fig. 3 Distal articles of leg.

Figs. 4-7: *Colossendeis angusta* Sars (abbreviated from Sars 1891).
Fig. 4 Body, dorsal view.
Fig. 5 Body, lateral view.
Fig. 6 Distal part of appendage II.
Fig. 7 Distal articles of leg.

Subclass Cirripedia (Superorder Thoracica)

G.A. Kolbasov, D.Sc., Leading Scientist
Moscow State University, Moscow, Russia

The morphology of adult stages of barnacles is highly modified by their sessile or weakly motile life styles (often symbiotic). The Cirripedia are divided into three superorders: the Acrothoracica, which are boring animals on calcareous substrates (commensal on corals, mollusks, bryozoans, and thoracican barnacles); the Rhizocephala, which are highly modified parasitic forms (primarily on decapods); and the Thoracica, which are the largest free-living (rarely commensal or parasitic) forms, attaching to a variety of substrates

The Cirripedia have 5-6-5 body segments (or 5-7-4, depending on interpretation), five head segments, six or seven thoracic segments, and four or five abdominal segments. In adult forms, the thoracic legs or thoracopods (originally six pairs and absent in rhizocephalans) are multiarticulate, biramous, and covered with dense setae. The abdomen is reduced. Cyprid larval stages or cypris are present, following naupliar instars (originally six) and function in locating and settling on a substrate. The nauplii have frontal filaments and frontal horns on the anterior edge. The cyprid larvae are covered with a single-valved carapace and the head (cephalon) has four-segmented antennae that are specialized for attachment.

In adult Thoracica, the carapace (mantle) covers the entire body and usually has several calcareous outer plates that form the shell. Originally, five plates were present: a carina (posterior) and a pair of opercular plates, consisting of the tergum joined to the carina and the scutum, surrounding the aperture. The adjoining edges of the scuta and terga are called articula; the opposite edges occludents.

There are two thoracican orders, the Pedunculata and the Sessilia. The body of the Pedunculata is divided into a head and a peduncle. The head, or capitulum, bears plates, and the body proper with appendages and musculature. It is attached to the peduncle, which is bare or covered with small calcareous scales and represents an extension of the anterior end of the animal. The Sessilia lack a peduncle; their shells are attached to the substrate by a flat base, which can be membranous or calcareous.

Additional valves or plates were acquired during the evolution of the Thoracica: a rostral plate on the anterior end near the scutum and various pairs of lateral plates. In the Pedunculata (Scalpellomorpha) there are carino-lateral (near the carina), rostro-lateral (abutting the rostrum), lateral (between the carina and rostro-lateral), and upper-lateral (above the other laterals) plates. All plates have growth rings, which originate around an area called the umbo. The shell of the Sessilia consists of a carina and rostrum, and lateral and rostro-lateral plates (in some Sessilia they are reduced or fused to other lateral plates). The shell is closed from above by a pair of opercular plates. The plates of Sessilia shells abut one another. The central part of the valve is called the parietes, the part overlapping the neighboring valve is called the radius, and the part beneath the radius of the neighboring valve the ala. The parietes may have internal longitudinal tubes and the inner edge has longitudinal ridges. The tergum of the Sessilia has a characteristic basal projection, the spur, which may have a longitudinal furrow on the outer surface.

The body of the Thoracica, or the prosoma, has the mouthparts (mandible, maxillae, and maxillule) grouped in the oral cone at the anterior end and is covered from above by a special fold (a process from the body), the labrum. The thorax has biramous, multiarticulate thoracic legs, known as cirri, which have numerous setae. The anus is located on the reduced abdomen and may be surrounded by two caudal appendages (furcae). Most species are hermaphroditic. Complemental males are occasionally present, and rarely sexes are separate with dwarf males.

Key to orders of the superorder Thoracica

1(2) Body of adults consisting of capitulum and protruding attachment peduncle . . . . . **order Pedunculata**

2(1) Peduncle absent, calcareous shell directly attached to substrate by flat base. . . . . **order Sessilia (p. 51)**

Key for identification of the suborders to the order Pedunculata

1(2) Peduncle bare, capitulum with 0-5 plates . . . . . **suborder Lepadomorpha**

2(1) Peduncle with calcareous scales, capitulum with more than 5 plates. . . . . **suborder Scalpellomorpha**

Key to genera and species of the family Lepadidae (suborder Lepadomorpha)

1(2) Capitulum with 5 developed plates . . . . . **genus *Lepas*, *L. anatifera* Linnaeus, 1758 (Pl. I, Figs. 1-3)**

Length to 30 mm (capitulum), to 600 mm (peduncle).
Panoceanic. Western and northwestern Barents Sea.
Pelagic species, on flotsam (including kelp and animals).

2(1) Capitulum with 2-5 reduced plates (may be absent in adult specimens). . . . . **genus *Conchoderma*, *C. auritum* (Linnaeus, 1776) (Pl. I, Fig. 4-6)**

Total length to 150 mm.
Panoceanic. Western Barents Sea.
Pelagic species, on whales (on the shells of *Coronula* spp., on baleen or teeth), on turtles, and sometimes on fish or the bottoms of ships.

Key to subfamilies, genera, and species of the family Scalpellidae (suborder Scalpellomorpha)

1(4) Carina bent like an elbow, umbo on top of elbow . . . . . **Scalpellinae**

2(3) Umbo of the scutum subapical, on occludent edge; umbo of mid-lateral sub-basal . . . . . **genus *Scalpellum*, *S. scalpellum* (Linnaeus, 1767) (Pl. I, Fig. 7-10)**

Total ength to 50 mm.
Atlantic subtropical-boreal, western Barents Sea.
Depth 10-700 m. On rocks, boulders, hydrozoans, basket stars, polychaete tubes, gastropods, and echinoderms.

3(2) Umbo of the scutum apical; umbo of mid-lateral in center of rostral margin . . . . . **genus *Ornatoscalpellum*, *O. stroemi* (M. Sars, 1859) (Pl. II, Figs. 1-4)**

Synonymy: *Scalpellum stroemi* M. Sars, 1859.
Total length to 19 mm.
Atlantic high boreal Arctic. Southwestern, western, and northwestern Barents Sea.
Depth 2-1600 m. On rocks, boulders, sponges, hydrozoans, basket stars, and octocorrallian corals.

4(1) Carina evenly bent, umbo apical or subapical.

5(6) Capitular plates widely separated, incompletely calcified, rostro-lateral horn-shaped. . . **Meroscalpellinae, genus *Hamatoscalpellum*, *H. hamatum* (G.O. Sars, 1879) (Pl. II, Fig. 5-9)**

Synonymy: *Scalpellum hamatum* G.O. Sars, 1879
Total length to 15 mm.
Atlantic Arctic bathyal, western and northwestern Barents Sea.
Depth 700-1150 m.

6(5) Plates close to each other, completely calcified, rostro-lateral not horn-shaped . . . . . **Arcoscalpellinae**

7(8) Middle-lateral is narrow, hourglass-shaped . . . **genus *Verum*, *V. striolatum* (G.O. Sars, 1877) (Pl. II, Figs. 10-13)**

Synonymy: *Scalpellum striolatum* G.O. Sars, 1877.
Length to 34 mm (capitulum), to 21 mm (peduncle).
Arctic bathyal, abyssal. Arctic Ocean, from northwest Barents Sea to East Siberian Sea.
Depth 348-3941 m. On silty rocky bottom.

8(7) Middle-lateral wide, 4-5 cornered.

9(10) Carino-lateral horn-shaped, protruding over carina . . . . . **genus *Tarasovium*, *T. cornutum* (G.O. Sars, 1879) (Pl. III, Fig. 1-6)**

Synonymy: *Scalpellum cornutum* G.O. Sars, 1879.
Length to 10 mm (capitulum), to 8 mm (peduncle).
Arctic Eurasia. Arctic Ocean, from northwest Barents Sea to East Siberian Sea.
Depth 32-760 m. On rock, gravel, and silty-sand substrate.

10(9) Carino-lateral not horn-shaped, not protruding over carina . . . . . **genus *Weltnerium*, *W. nymphocola* (Hoek, 1883) (Pl. III, Figs. 7-10)**

Synonymy: *Scalpellum nymphocola* Hoek, 1883.
Length to 12 mm (capitulum), to 7 mm (peduncle).
Atlantic high boreal Arctic. Arctic Ocean, from northern Barents Sea to the Laptev Sea.
Depth 28-1360 m. On silty sediment with sand, boulders, and rocks (the type specimen was attached to the appendages of the pycnogonid *Boreonymphom robustum*).

Key to suborders, families, genera, and species of the order Sessilia

1(2) Shell asymmetric, consisting of 4 fixed (carina, rostrum, fixed scutum, and tergum) and 2 moveable plates (scutum and tergum) . . . . . **suborder Verrucomorpha, Verrucidae, genus *Verruca*, *V. stroemia* (O.F. Müller, 1776) (Pl. III, Figs. 11-15)**

Diameter 11 mm, height 2-3 mm.
Eastern Atlantic subtropical-Arctic. Barents and White seas.
Depth 0-548 m. On rocks, hydrozoans, mollusk shells, barnacles, echinoderms, *Laminaria*, etc.

2(1) Shell bilaterally symmetrical, both scutum and tergum moveable . . . . . **suborder Balanomorpha**

Key to families, genera, and species of the suborder Balanomorpha

1(2) Rostrum with only alae, labrum without deep medial furrow. . . . . **family Chthamalidae, genus *Chthamalus*, *C. dalli* Pilsbry, 1916 (Pl. IV, Figs. 1-6)**

Diameter to 10 mm, height to 7 mm.
Pacific subtropical-boreal, Chukchi Sea.
Littoral. On boulders, rocks, gastropod shells, barnacles.

2(1) Rostrum with radii only, labrum with deep medial furrow.

3(4) Opercular plates smaller than the aperture (tergum reduced in adults), scutum and tergum not articulated; on whales . . . . . **family Coronulidae, genus *Coronula***

4(3) Opercular plates completely covering aperture, scutum and tergum articulated. . . . . **family Balanidae**

Key to species of the genus *Coronula*

1(2) Shell shaped like tall crown; parietal parts of plates with protruding outer ribs . . . . . ***C. diadema* (Linnaeus, 1767) (Pl. IV, Figs. 7-10)**

Diameter to 100 mm (often about 50 mm in diameter and 40 mm high).
Panoceanic. Barents and Chukchi seas.
On cetaceans (especially humpback whales).

2(1) Shell a flattened cone, parietal part of plates with flattened outer ribs. . . . . ***C. reginae* Darwin, 1854 (Pl. IV, Figs. 11-14)**

Diameter to 65 mm in diameter, and height to 19 mm.
Panoceanic. Barents Sea.
On cetaceans (especially humpback whales).

Key to genera and species of the family Balanidae

1(2) Base of shell membranous . . . **genus *Semibalanus*, *S. balanoides* (Linnaeus, 1767) (Pl. IV, Figs. 15-21)**

Synonymy: *Balanus balanoides* (Linnaeus, 1767)
Diameter to 25 mm (usually 8-18 mm), lily-shaped, elongate specimens to 60 mm height, diameter 5-6 mm.
Amphiboreal. Barents, White, Kara, and Chukchi seas.
Littoral, upper sublittoral (sometimes to 45 m depth). On rocks, driftwood, other barnacles, gastropod shells, mussels.

2(1) Shell base calcareous

3(4) Shell plates with internal tubes . . . . . **genus *Balanus* (p. 53)**

4(3) Shell plates solid

5(6) Outer scutum without noticeable longitudinal striae, tergal spur short, without well-developed furrow, width approximately ⅓ width of basal edge . . . . . **genus *Solidobalanus*, *S. hesperius* (Pilsbry, 1916) (Pl. V, Figs. 1-8)**

Synonymy: *Balanus hesperius* Pilsbry, 1916.
To 22 mm in diameter, 17 mm height.
Pacific widespread boreal. Chukchi Sea.
Depth 3-150 m. On gastropod shells, crab carapaces, other barnacles, and sometimes on ship hulls.

6(5) Outer scutum with clear longitudinal striae, tergal spur long with deep furrow, width approximately ⅙ width of basal edge. . . . . **genus *Chirona*, *C. hameri* (Ascanius, 1767) (Pl. V, Figs 9-15)**

Synonymy: *Balanus hameri* (Ascanius, 1767).
To 70 mm diameter, to 100 mm height.
Atlantic widespread boreal. Barents and White seas.
Depth 12-300 m. On rocks, mollusk shells, crustaceans, *Fucus* stipes, and corals.

Key to species of the genus *Balanus*

1(2) Tergum with apex sharp, hook-shaped . . . . . ***B. balanus* (Linnaeus, 1758) (Pl. VI, Figs. 1-7)**

To 40-50 mm diameter and usually 20-30 mm height.
Widespread boreal Arctic circumpolar. Arctic Ocean and marginal seas.
Sublittoral, sometimes penetrating to the upper bathyal (0-400 m). On rocks, mollusk shells, crustaceans, bryozoans, brachiopods, etc., rarely on ship hulls; often overgrown with sponges.

2(1) Tergum apex not hook-shaped . . . . . ***B. crenatus* Bruguière, 1789 (Pl. VI, Figs. 8-14)**

To 40 mm in diameter and height; lily-shaped or elongate forms to 50-70 mm height).
Subtropical-Arctic. Arctic Ocean and marginal seas.
Sublittoral, sometimes penetrating bathyal (1-740 m). On rocks, driftwood, ships, crustaceans including other barnacles, etc.; sometimes overgrown with sponges.

Literature

Broch, H. 1924. Cirripedia Thoracica von Norwegen und dem Norwegischen Nordmeere. Eine Systematische und Biologische Tiergeographische Studie. (Cirripedia Thoracica of Norway and of the Norwegian Nordic Seas. A systematic and biological biogeographical study.) Vid. Skrift. I Mat. Naturw. Kl., Vol. 17, pp. 1-121.

Cornwall, I.E. 1927. Some North Pacific whale barnacles. Contrib. Can. Biol. Fish. 3:503-517.

Cornwall, I.E. 1955. Cirripedia. Canadian Pacific fauna, 10. Ottawa. 49 pp.

Gruvel, A. 1905. Monographie des Cirrhipèdes ou Thécostracés. (Monograph of Cirripedia and Theocostracia.) Paris. 472 pp.

Newman, W.A., and A. Ross. 1976. Revision of the balanomorph barnacles: Including a catalog of the species. S. Diego Soc. Nat. Hist. Mem. 9:1-108.

Nilsson-Cantell, C.A. 1978. Cirripedia, Thoracica and Acrothoracica. Marine invertebrates in Scandinavia. Oslo, No 5. 133 pp.

Pilsbry, H.A. 1916. The sessile barnacles (Cirripedia) contained in the collections of the U.S. National Museum including a monograph of the American species. U.S. Natl. Mus. Bull. Smithsonian Inst. 93. 386 pp.

Tarasov, N.I., and G.B. Zevina. 1957. Barnacles (Cirripedia Thoracica) of the seas of the USSR. Fauna of the USSR, Crustaceans. Vol. VI, No. 1. Moscow. 267 pp.

Zevina, G.B. 1981. Barnacles of the suborder Lepadomorpha (Cirripedia, Thoracica) of the world's oceans. Section I. Nauka Press, Leningrad. 404 pp.

Zevina, G.B. 1982. Barnacles of the suborder Lepadomorpha (Cirripedia, Thoracica) of the world's oceans. Section II. Nauka Press, Leningrad. 222 pp.

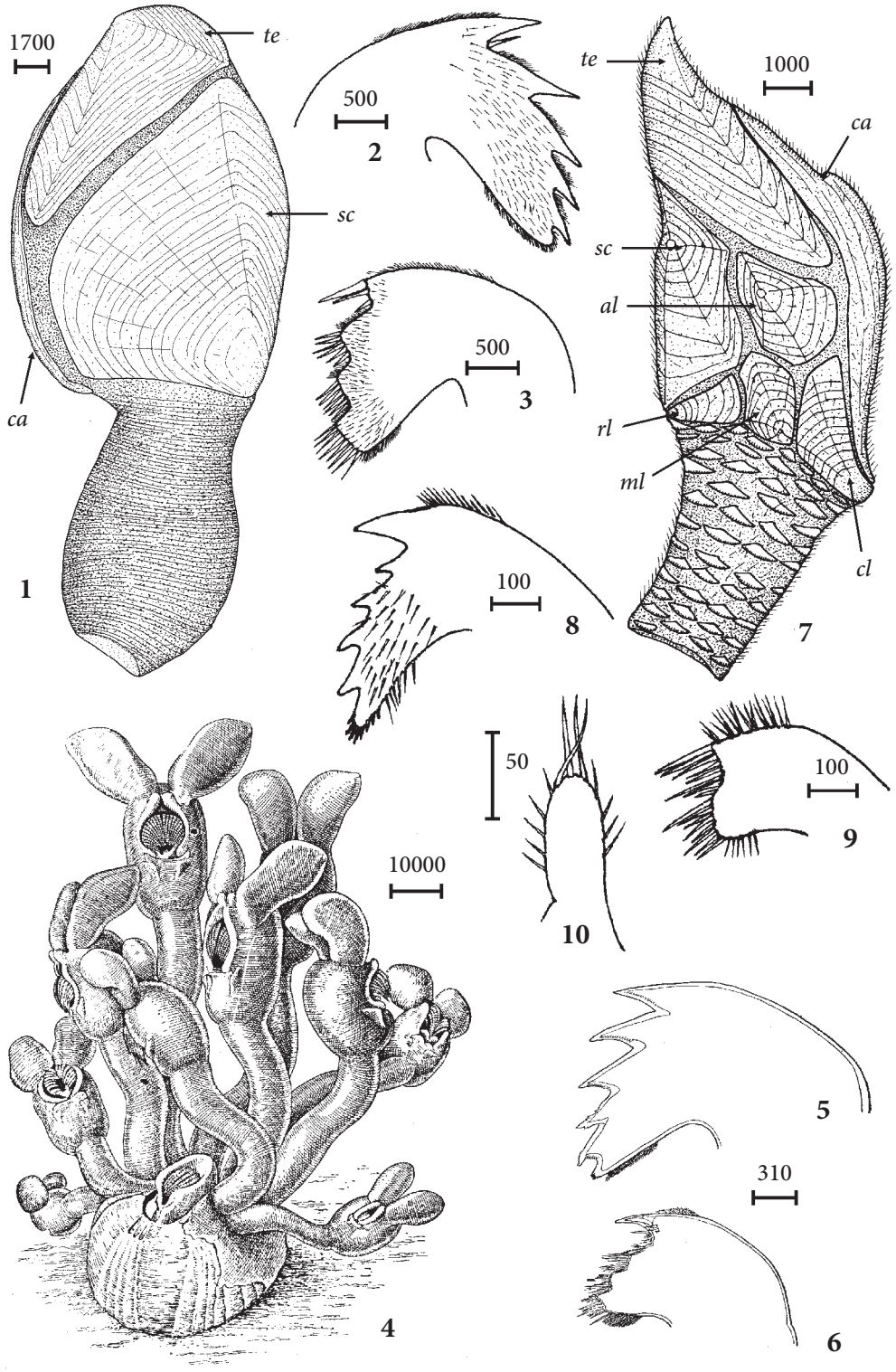


Plate I

Figs. 1-3 *Lepas anatifera* Linnaeus, 1758: 1: whole animal lateral view. 2: mandible. 3: maxillule.
Figs. 4-6 *Conchoderma auritum* (Linnaeus, 1776): 4: whole colony on *Coronula diadema* (Linnaeus, 1867) on whale skin. 5: mandible. 6: maxillule.
Figs. 7-10 *Scalpellum scalpellum* (Linnaeus, 1767): 7: whole animal, lateral view. 8: mandible. 9: maxillule. 10: caudal appendage.

Abbreviations: *al*: upper-lateral, *ca*: carina, *cl*: carino-lateral, *ml*: middle-lateral, *rl*: rostro-lateral, *sc*: scutum, *te*: tergum.
Scale in µm. (1-3, 7-10 original; 4-6 from Tarasov and Zevina 1957).

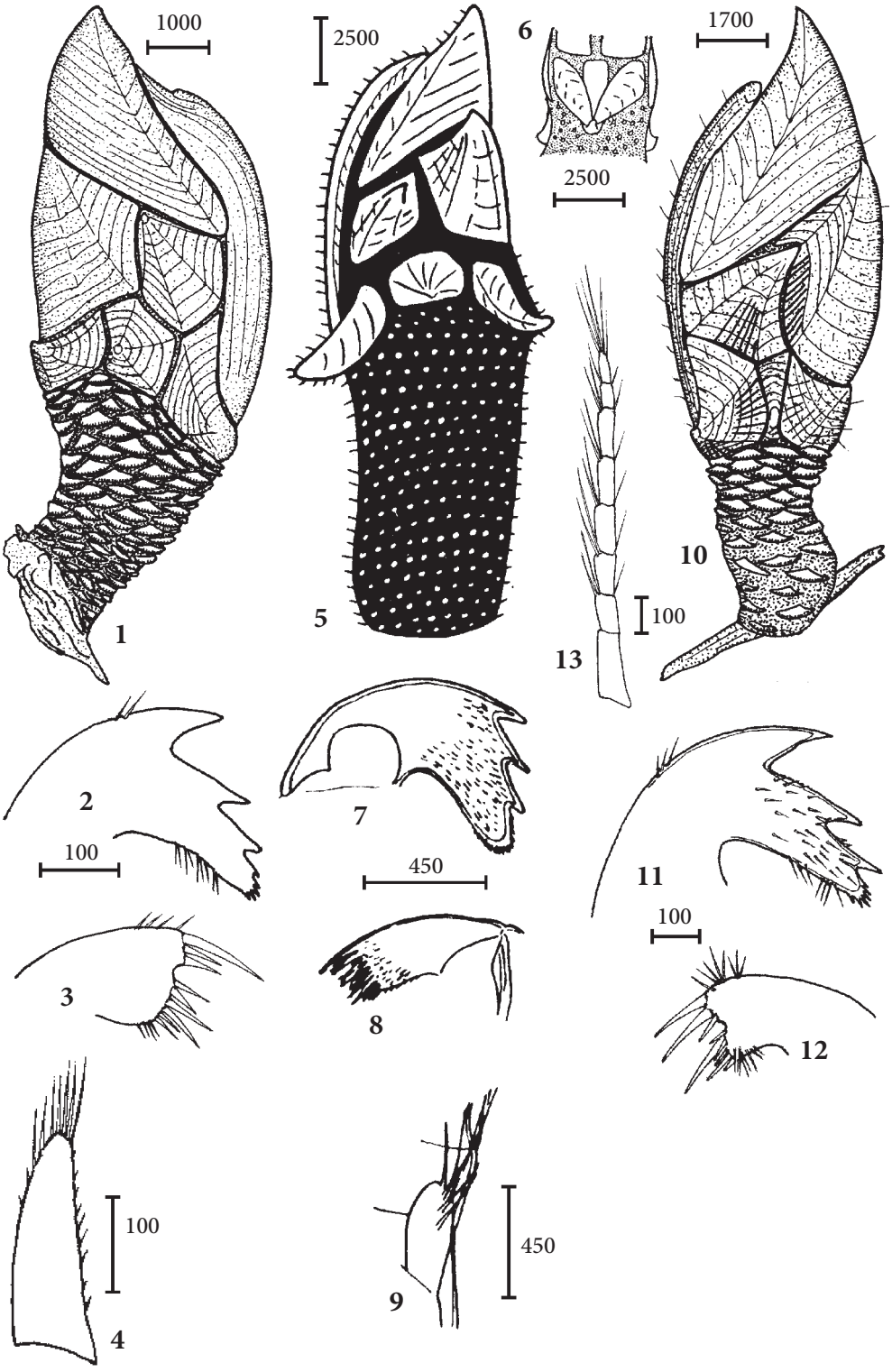


Plate II

Figs. 1-4 *Ornatoscalpellum stroemi* (M. Sars, 1859): 1: whole animal, lateral view. 2: mandible. 3: maxillule. 4: caudal appendage.

Figs. 5-9 *Hamatoscalpellum hamatum* (G.O. Sars, 1879): 5: whole animal, lateral view. 6: rostral plate. 7: mandible. 8: maxillule. 9: caudal appendage.

Figs. 10-13 *Verum striolatum* (G.O. Sars, 1877): 10: whole animal, lateral view. 11: mandible. 12: maxillule. 13: caudal appendage.

Scale in μm. (1-4, 10-13 original; 5: from Zevina 1981; 6-9 from Broch 1924 in Nilsson-Cantell 1978).

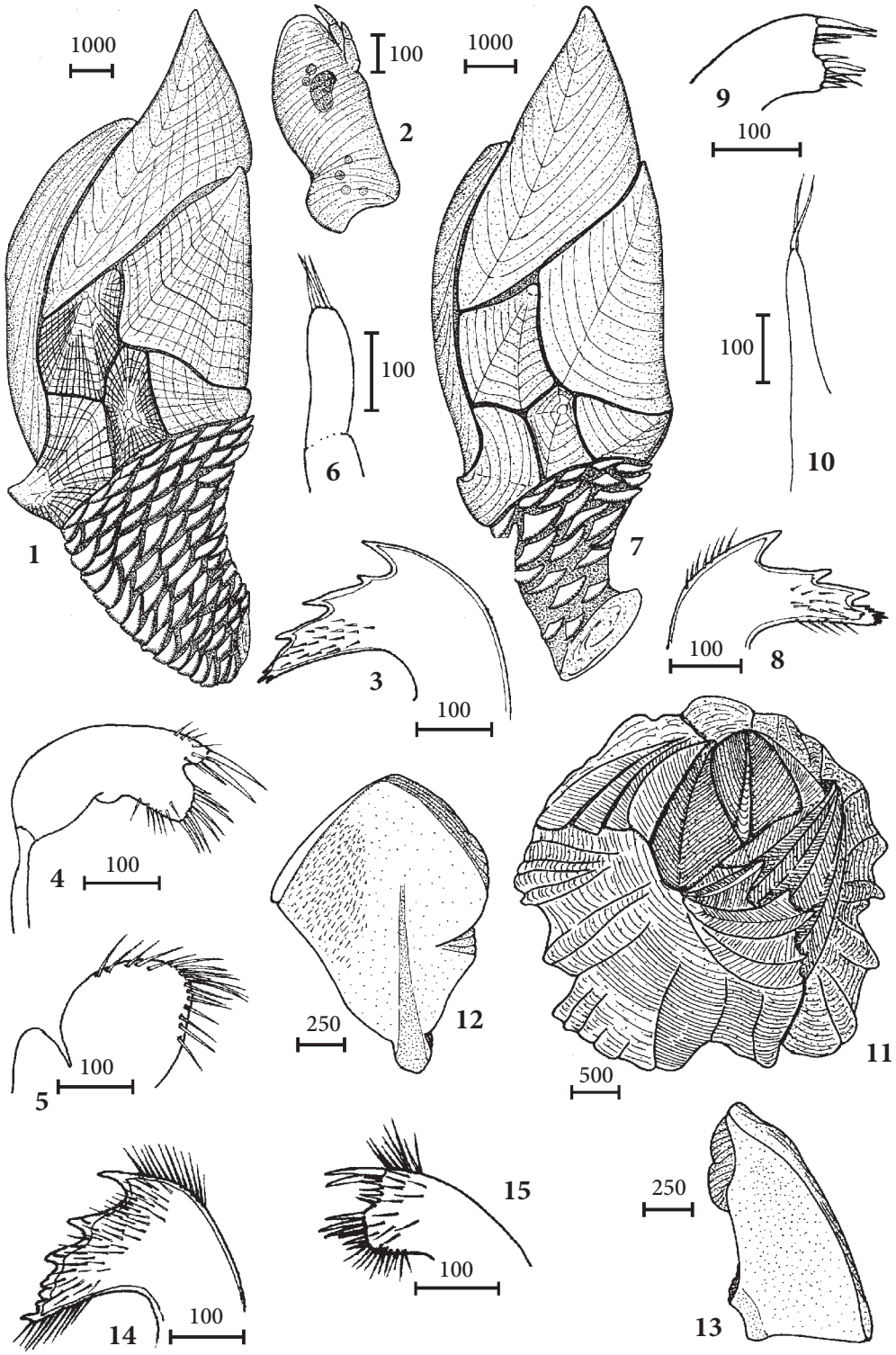


Plate III

Figs. 1-6 *Tarasovium cornutum* (G.O. Sars, 1879): 1: whole animal, lateral view, female. 2: dwarf male, whole animal. 3: mandible. 4: maxillule. 5: maxilla. 6: caudal appendage.

Figs. 7-10 *Weltnerium nymphocola* (Hoek, 1883). 7: whole animal, lateral view. 8: mandible. 9: maxillule. 10: caudal appendage.

Figs. 11-15 *Verruca stroemia* (O.F. Müller, 1776): 11: whole animal, from above. 12: moveable tergum, inner view. 13: moveable scutum, inner view. 14: mandible. 15: maxillule.

Scale in µm. (all original).

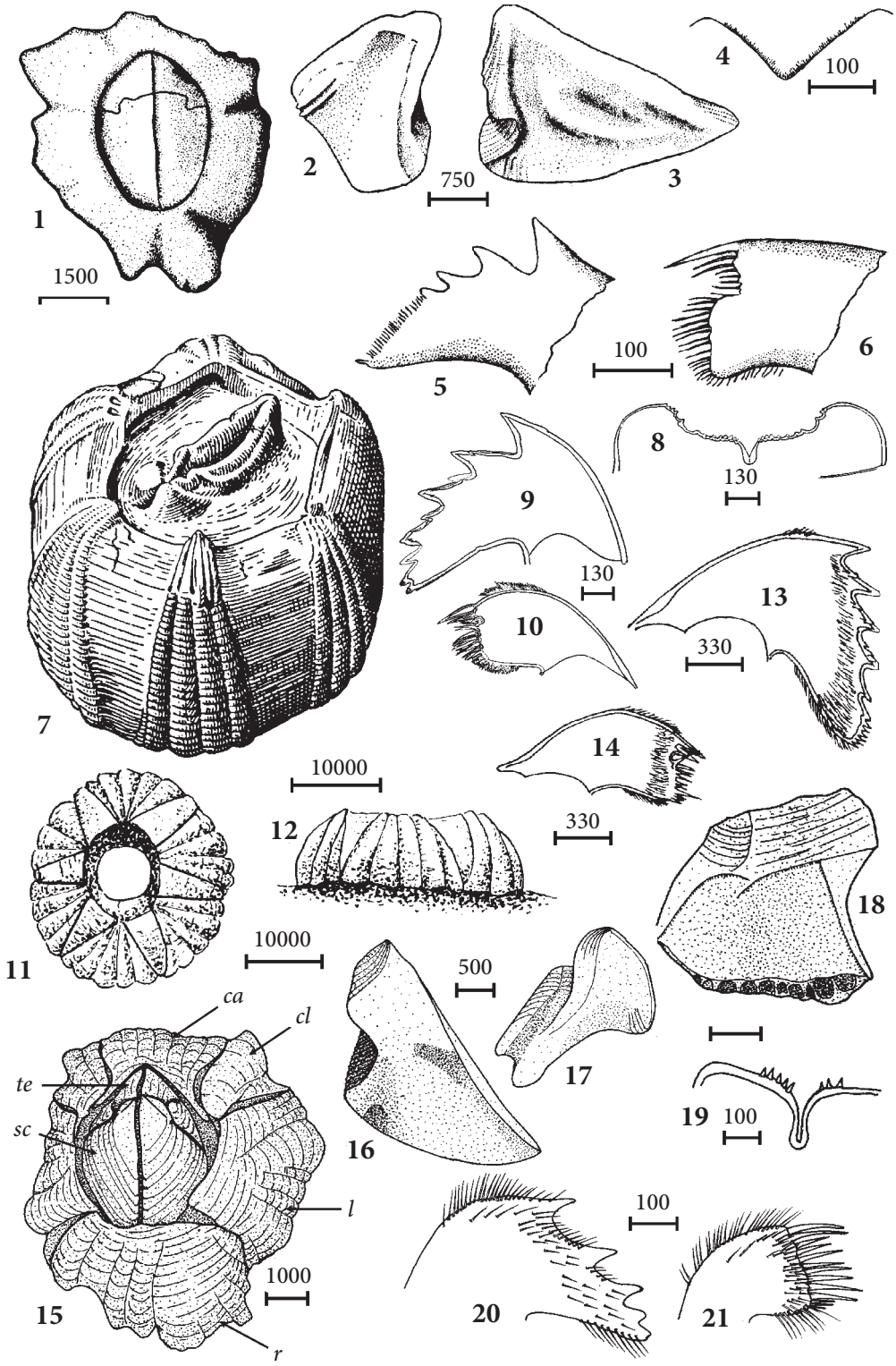


Plate IV

Figs. 1-6 *Chthamalus dalli* Pilsbry, 1916: 1: whole animal from above. 2: tergum inner surface. 3: scutum inner surface. 4: labrum. 5: mandible. 6: maxillule.

Figs. 7-10 *Coronula diadema* (Linnaeus, 1767): 7: whole animal, lateral view. 8: labrum. 9: mandible. 10: maxillule.

Figs. 11-14 *Coronula reginae* Darwin, 1854: 11, 12: whole animal, from the above and lateral view. 13: mandible. 14: maxillule.

Figs. 15-21 *Semibalanus balanoides* (Linnaeus, 1767): 15: whole animal from above. 16: scutum inner surface. 17: tergum inner view. 18: lateral inner view. 19: labrum. 20: mandible. 21 maxillule.

Symbols: *ca*: carina, *cl*: carino-lateral, *l*: lateral, *r*: rostrum, *sc*: scutum, *te*: tergum. Scale in µm. (1-6 from Cornwall 1955; 7-10 from Tarasov and Zevina 1957; 11, 12 from Cornwall 1927; 13, 14 from Broch 1924 in Nilsson-Cantell 1978; 15-21 original.)

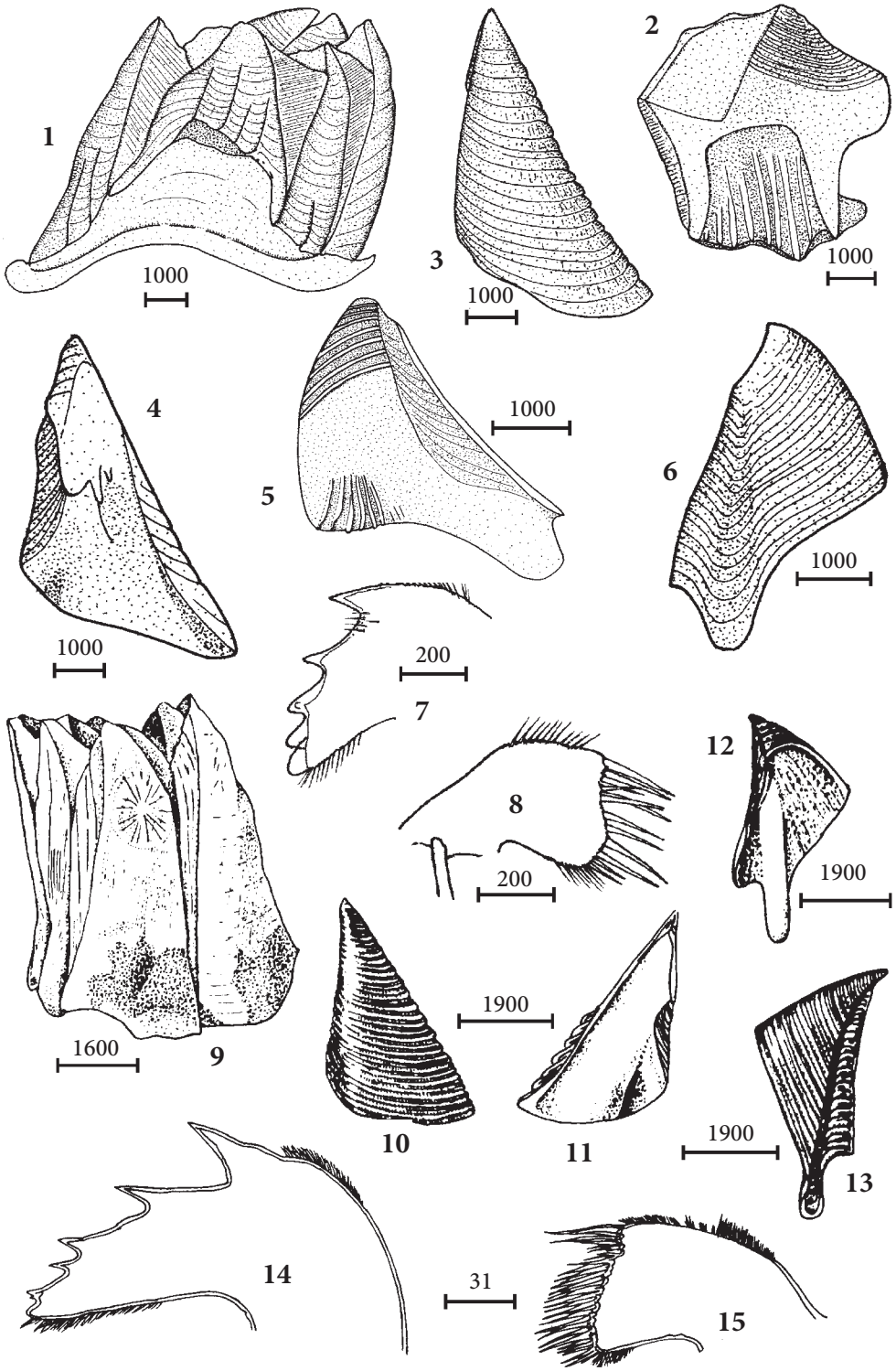


Plate V

Figs. 1-8 *Solidobalanus hesperius* (Pilsbry, 1916): 1: whole animal, lateral view. 2: lateral inner view. 3, 4: scutum inner and outer view. 5, 6: tergum inner and outer view. 7: mandible. 8: maxillule.

Figs. 9-15 *Chirona hameri* (Ascanius, 1767): 9: whole animal, lateral view. 10, 11: scutum outer and inner view. 12, 13: tergum inner and outer view. 14: mandible. 15: maxillule.

Scale in µm. (1-8 original; 9-13 from Pilsbry 1916 in Nilsson-Cantell 1978; 14-15 from Tarasov and Zevina 1957).

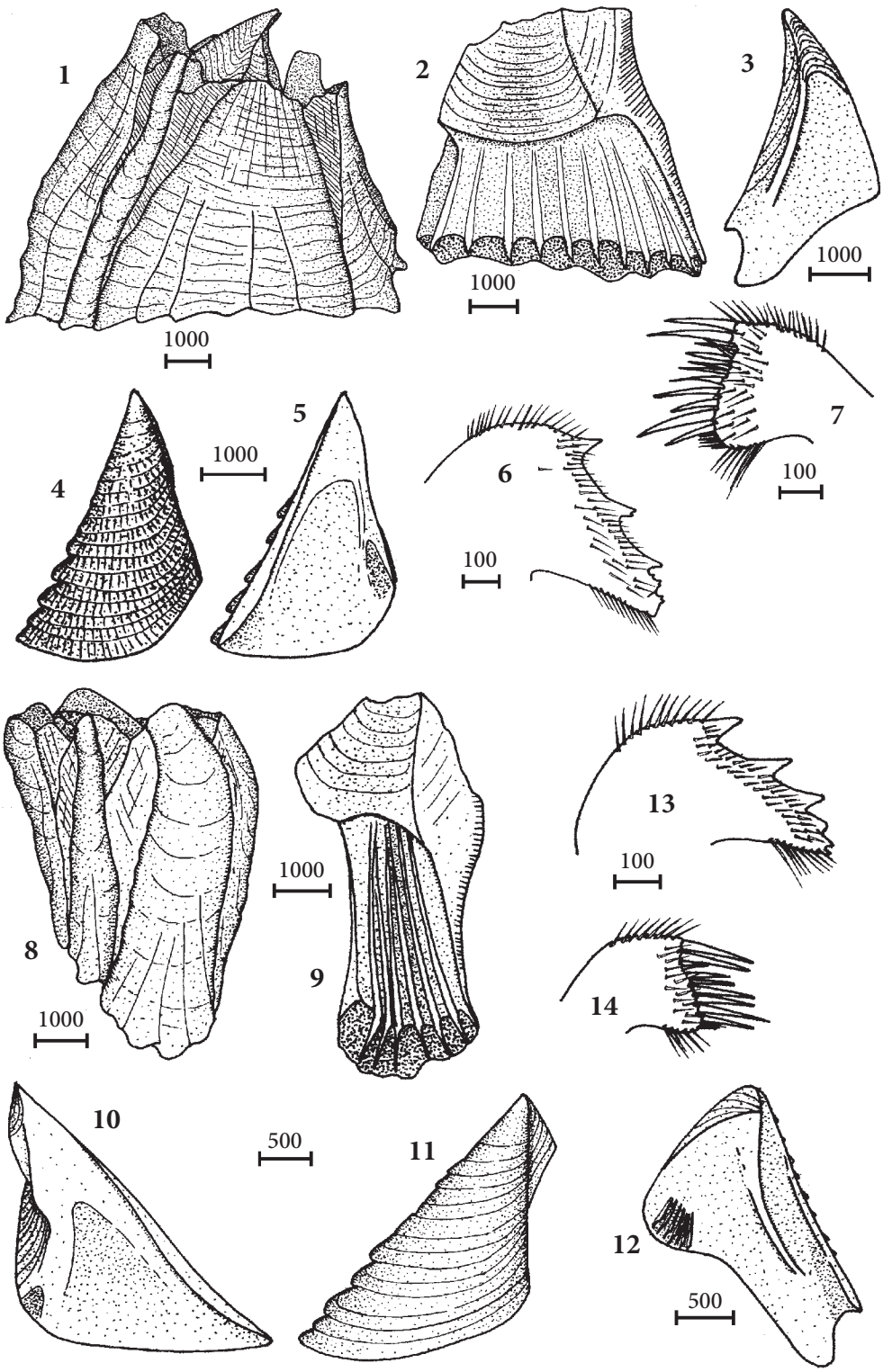


Plate VI

Figs. 1-7 *Balanus balanus* (Linnaeus, 1758): 1: whole animal, lateral view. 2: lateral inner view. 3: tergum inner view. 4, 5: scutum outer and inner view. 6: mandible. 7: maxillule.

Figs. 8-14 *Balanus crenatus* Bruguière, 1789: 8: whole animal, lateral view. 9: lateral inner view. 10, 11: scutum inner and outer view. 12: tergum inner view. 13: mandible. 14: maxillule. Scale in µm. (all original).

Order Leptostraca

V.V. Petryashov, Ph.D., Senior Scientist
Zoological Institute St. Petersburg, St. Petersburg, Russia

Leptostraca are marine crustaceans inhabiting depths from the upper sublittoral to the bathypelagic. They are nekton-benthic, epibenthic, and pelagic organisms. There are currently ten recognized genera and forty species. They occur in all oceans of the world except in arctic waters of the Arctic Ocean basin. They are detritivores, and pelagic species are probably filter feeders.

The body consists of two parts, the cephalothorax and abdomen (Pl. I, Figs. 1, 2). There are five head segments, eight thoracic segments, seven abdominal segments, and a telson, on the end of which is a flattened or blunt fork (furca) (Pl. I, Fig. 11). Eyes are stalked, faceted (Pl. I, Fig. 4); they lack pigment and facets in a number of deep-dwelling species. The head, thorax, and sometimes a substantial part of the abdomen are covered by a bivalve carapace, which is fused dorsally only with the segments of the protocephalon. The carapace lies freely over the remaining segments, covering the dorsal and lateral parts of the body, and sometimes the ventral regions. The valves of the carapace are coupled with adductor muscles. An articulated, moveable, flattened rostrum is present at the anterior end of the carapace (Pl. I, Fig. 3). The antennules (antenna 1) consist of a four-articulate peduncle (the protopodite) and a multiarticulate flagellum and a flattened scale-like structure on the lateral side (Pl. I, Fig. 5). The antenna (antenna 2) is uniramous, consisting of a three (rarely four) articulate peduncle and a multiarticulate (endopodite) flagellum; an exopodite is absent (Pl. I, Fig. 6). Eight pairs of thoracic legs are present; they are flattened and leaf-like, consisting of proto-, epi-, exo-, and endopodites; the latter may consist of one or several articles; articulations between the articles of the thoracic legs can be almost completely reduced (Pl. I, Fig. 7). Six pairs of abdominal legs are present; the anterior four pairs are well developed, consisting of a two-articulate endopodite (in *Nebalia bipes* the length of the exopodite of the first pleopod is about ¾ the length of the exopodite (Pl. I, Fig. 8). The fifth and sixth pairs of abdominal legs are reduced, taking the form of small uniramous plates. The seventh abdominal segment lacks appendages.

An important systematic character for the genus *Nebalia* is the shape of the dorsal half of the distal end of the sixth and seventh abdominal segments, and the location of the anal plate beneath the base of the telson. The dorsal half of the distal edge of pleon segements 6 and 7 has a comb-like series of denticles, the ends of which are narrowly pointed or rounded, as in *N. bipes*. The pointed ends of the two halves of the anal plate can be located near the medial edge (in which case the outer edge has a "shoulder-like" bend as in *N. bipes*), or these ends are displaced to the middle of each half of the anal plate (in which case a "shoulder-like" bend on the outer edge is absent). Females of the family Nebaliidae lay their eggs in a brood pouch formed by setae of the thoracic legs, where full development of the embryos occurs. Species of the family Nebaliopsidae undoubtedly release eggs directly into the water, and development occurs through metamorphosis.

Only one species, of the family Nebaliidae, has been reported from the Eurasian arctic seas and adjacent deep waters.

Family Nebaliidae (order Leptostraca)
Genus *Nebalia*, *N. bipes* (Fabricius, 1780) (Pl. I, Figs. 1-11)

Length to 13 mm.
Amphiboreal. Southern half of Barents Sea; White Sea and southern Chukchi Sea.
Depth 2-320 m. On silt, sand, and rock.

Literature

Dahl, E. 1985. Crustacea, Leptostraca, principles of taxonomy and a revision of European shelf species. Sarsia 70(2-3):135-166.

Haney, T.A., and J.W. Martin. 2004. A new genus and species of leptostracan (Crustacea: Malacostraca: Phyllocarida) from Guana Island, British Virgin Islands, and a review of leptostracan genera. Journal of Natural History 38:447-469.

Walker-Smith, G.K., and G.C.B. Poore. 2001. A phylogeny of the Leptostraca (Crustacea) with keys to families and genera. Memoirs of the Museum of Victoria 58:383-410.

Yashnov, V.A. 1948. Class Crustacea. Keys to the fauna and flora of the northern seas of the USSR. Moscow, pp. 175-343.

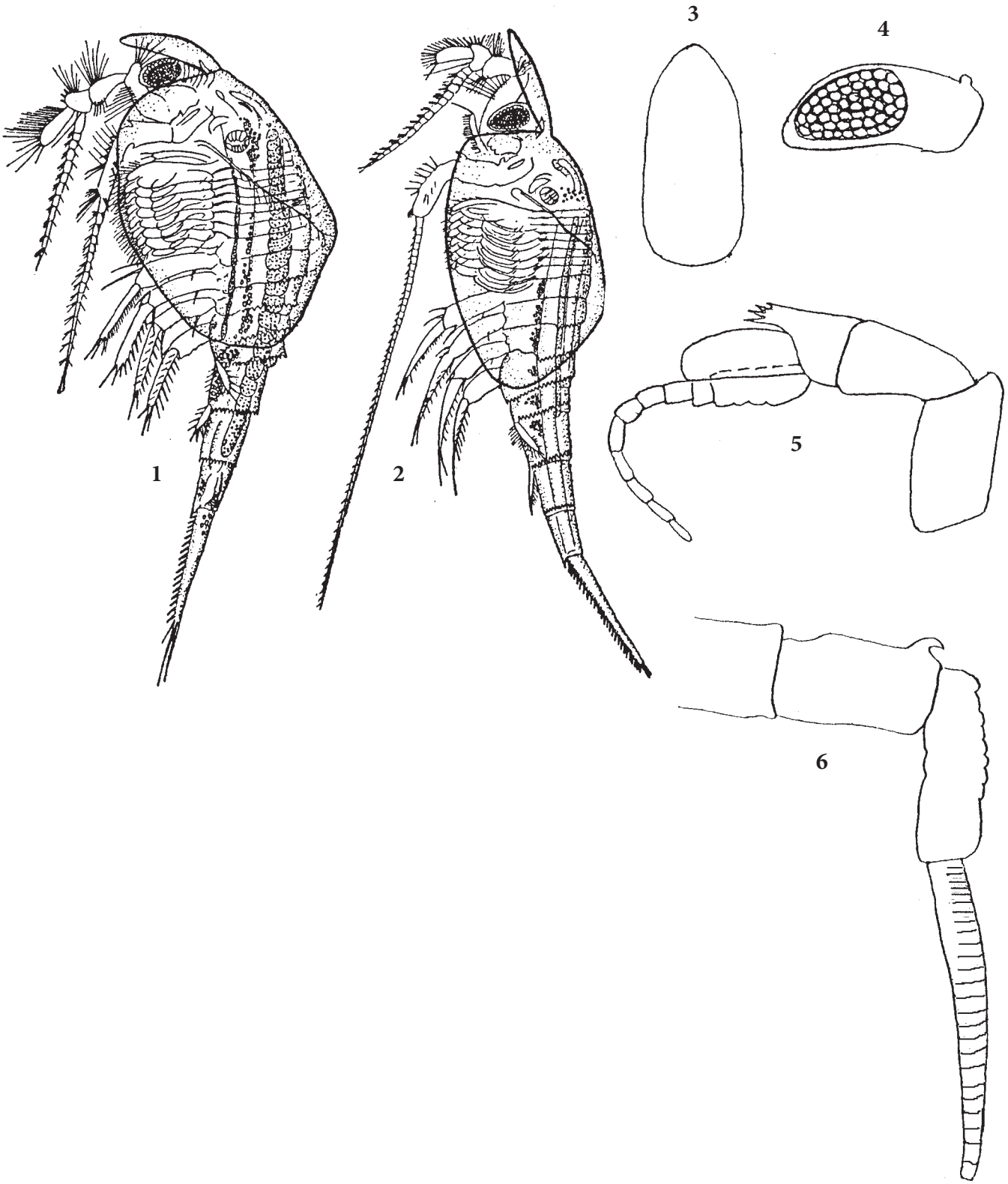


Plate I. Leptostraca of the Arctic Ocean: *Nebalia bipes*.

Fig. 1 Female, whole animal (from Yashnov 1948).
Fig. 2 Male, whole animal (from Yashnov 1948).
Fig. 3 Rostrum (×40).
Fig. 4 Eye (×70).
Fig. 5 Antennule (antenna 1) (×70).
Fig. 6 Antenna (antenna 2) (×58).

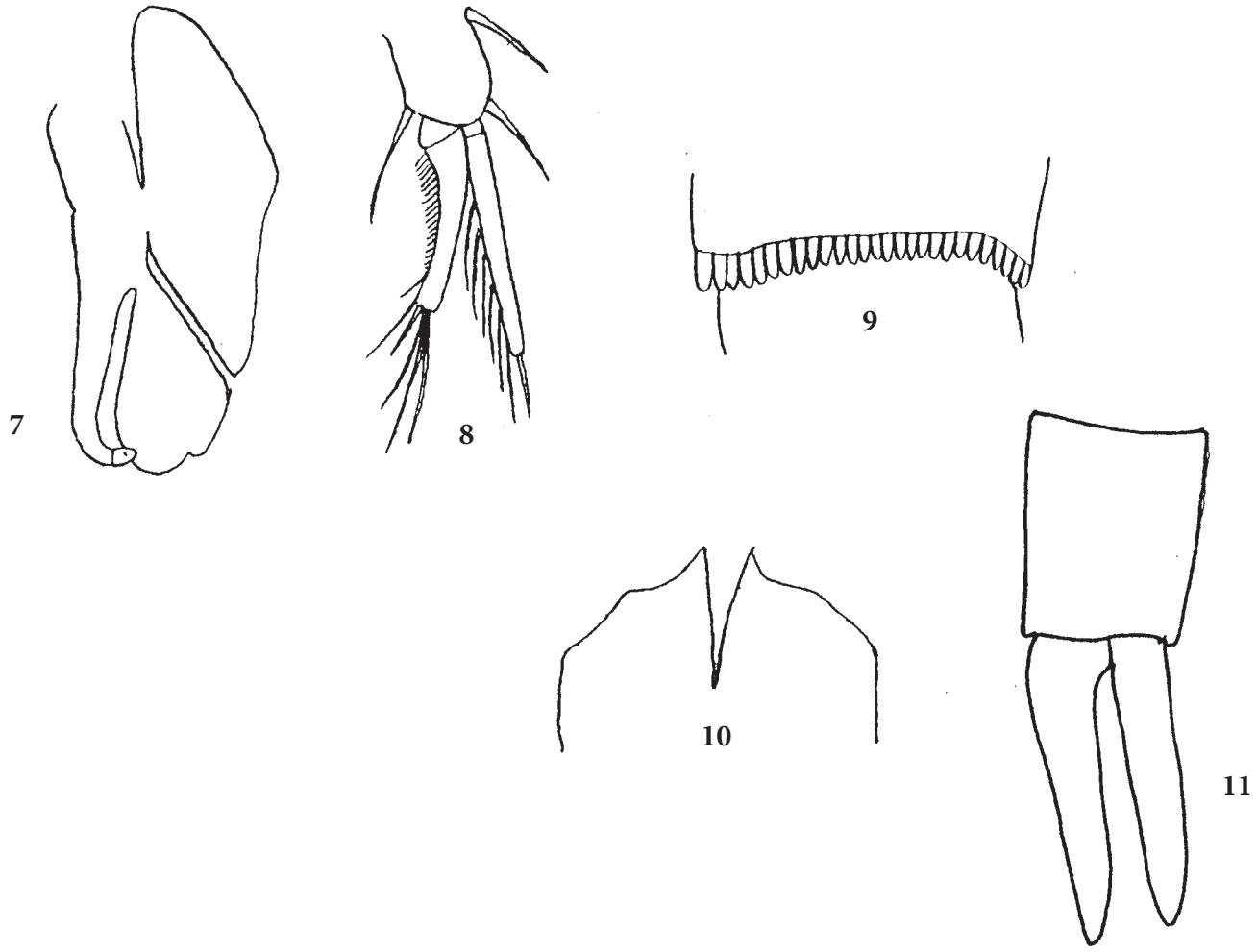


Plate I (continued)

Fig. 7 Third thoracic leg (×40).
Fig. 8 First pleopods (abdominal legs) (×40).
Fig. 9 Distal (posterior) edge of sixth segment of abdomen (×58).
Fig. 10 Anal scale on lower distal end of telson (×70).
Fig. 11 Telson with furca (upper view) (×32).

Order Mysidacea

V.V. Petryashov, Ph.D., Senior Scientist
Zoological Institute St. Petersburg, St. Petersburg, Russia

Mysids are marine, brackish, and freshwater crustaceans, inhabiting depths from 0 to 8500 m. They are benthopelagic, pelagic, and epibenthic and some species are commensal on sponges. Benthopelagic and benthic species live on or above sediments of varying grain size. There are currently known to be about 1000 species. They are seen in all oceans of the planet, and are especially abundant in tropical and subtropical waters. The number of species declines approaching the poles. They are omnivorous, predominantly filter feeders and predators.

Habit is shrimp-like (caridean) (Pl. I). The body is divided into a cephalothorax and abdomen. The cephalothorax consists of six to seven cephalic segments (five segments belong to the protocephalon and one to two are maxillipedal) and six to seven thoracic segments. There are six abdominal segments and a telson. The eyes are compound, stalked, sometimes with reduced visual elements, occasionally involving reduction of the eye itself to one or two optical plates. Most of the head and thorax are covered with a well-developed carapace, which is attached dorsally to the anterior three (rarely four) thoracic segments. It covers but is not attached to the remaining thoracic segments. The antennules (antenna 1) are well developed, consisting of the three-articulate peduncle and two multiarticulate flagella; the anterior edge of the third article of the peduncle in males can have a setose appendage. The antennae (antenna 2) are also well developed, consisting of a three-articulate protopodite, a scale-like exopodite (the antennal scale or squame), and an endopodite, which typically has a three or four articulate base and a multiarticulate flagellum. Eight pairs of thoracic legs are present, of which the anterior one or two are modified as maxillipeds. All thoracic legs are biramous with exopodites and endopodites, and the first thoracic legs also have an epipodite. Gills are absent from species inhabiting the Arctic. The posterior two (rarely three or seven) pairs of thoracic legs in the females have plates (oostegites) on the inner side; oostegites form a brood pouch where complete direct development of the embryos occurs. The abdominal pleopods, if present, consist of five pairs; they are uni- or biramous, often reduced in females, more developed in males than females, and in a number of species, the fourth and sometimes the third pair are modified, elongated for copulation. One pair of flattened biramous uropods is present along with a flattened telson forming a caudal fan. A statocyst is present in the basal part of the inner uropod in arctic species.

Key to families and tribes of the suborder Mysida (order Mysidacea) of the Arctic Ocean

1(2) Brood pouch consists of seven pairs of oostegites; the small basal portion of the outer ramus of the uropod is unarmed; one or two, rarely three, spines present on the distal end and a weakly expressed rudimentary articulation of the terminal article present (Plate II, Fig. 1) . . . . . **family Boreomysidae (p. 66)**

2(1) Brood pouch consists of two or three pairs of oostegites; outer ramus of uropod uniarticulate, without rudimentary articulation, the outer edge has only setae (Plate II, Fig. 2). . . . . **family Mysidae, subfamily Mysinae**

3(6) Carpus and propodus of endopodites 3-8 of the thoracic legs connected by oblique articulation (Pl. II, Fig. 3); outer edge of antennal scale smooth (Plate II, Fig. 4) or with saw-like serrations (Pl. III, Figs. 10, 11), with terminal denticulation. Pleopods 2-5 in males well developed and biramous. Telson whole, not distally emarginate.

4(5) Eyes well developed, stalked (Pl. II, Figs. 5, 6). Antennal gland not hypertrophic . . . . . **tribe Erythropini (p. 67)**

5(4) Eyes reduced, the ocular plates are fused or separate, eyestalks absent (Pl. II, Figs. 7, 8, 9) (degenerate eyestalks present in the genus *Dactylamblyops* [Pl. II, Fig. 10]), with varying degrees of reduction of the light-detection pigments and facets. Antennal gland hypertrophic . . . . . **tribe Amblyopsini**

6(3) Endopodites of thoracic legs 3-8 with fused carpus and propodus, which are secondarily divided into several subarticulations, without oblique articulation (Pl. II, Fig. 11).

7(8) Pleopods 2-5 of males with well developed biramous. Antennal scale with setae along the entire edge (Pl. II, Fig. 12). Telson almost square, with a wide triangular cleft on the distal end (Pl. II, Fig. 13) . . . . . .**tribe Leptomysini. *Pseudomysis abyssi* G.O. Sars, 1885 (Pl. II, Figs. 12-13)**

Length 42.8 mm.
Arctic bathyal. Northern Laptev Sea.
Depth 1421-3081 m.

8(7) At least the second pleopod of males rudimentary and uniramous. Exopodite of the fourth pleopod of males lengthened and modified (Pl. II, Fig. 14; Pl. III, Figs. 1, 2, 3). (Antennal scale and telson are highly variable. Antennal scales with setae are characteristic of species from the northern seas of Russia, but they lack spines along the entire edge or they have smooth, unarmed outer edges, ending with a terminal tooth. In the latter case, the telson has a distal cleft) . . . . . **tribe Mysini (p. 70)**

Key to genera and species of the family Boreomysidae

1(4) Eyes with pigmented corneas, their outer edge is rounded (Pl. III, Fig. 4) . . . . . **genus *Boreomysis***

2(3) Distal end of antennal scale continuous with the inner edge, the inner distal corner of the scale is not developed (Pl. III, Fig. 5) . . . . . ***B. nobilis* G.O. Sars, 1879 (Pl. III, Fig. 5).**

Length to 60 mm.
Atlantic Arctic bathyal. Northern Barents Sea, Kara, Laptev and Beaufort seas and adjacent regions of the arctic basin.
Depth 193-1880 m.

3(2) Distal end of antennal scale perpendicular to the longitudinal axis or oblique to it, forming an acute or right angle at the inner distal corner of the scale (Pl. III, Fig. 6) . . . . . ***B. arctica* (Krøyer, 1861) (Pl. 3, Figs. 4, 6).**

Length to 50 mm.
Atlantic-Pacific-Arctic bathyal. Arctic basin from Spitsbergen to 150°E and north of the Laptev Sea.
Depth 170-2500 m.

4(1) Eyes lacking pigment, their outer edge often concave (Pl. III, Fig. 7). (Inner distal corner of the antennal scale is oblique or broadly rounded (Pl. III, Fig. 8). The unarmed part of the outer ramus of the uropod ⅓-¼ of the complete length (Pl. II, Fig. 1)
genus *Birsteiniamysis*, *B. inermis* (Willemoes-Suhm, 1874) (Pl. II, Fig. 1; Pl. III, Figs. 7, 8)

Synonymies: *Boreomysis scyphops* G.O. Sars, 1879:428; *Boreomysis inermis* W.M. Tattersall, 1951:46; *Birsteiniamysis inermis* Tchindonova, 1979:100-101; *Birsteiniamysis scyphops* Tchindonova, 1979:100-101.
Length to 85 mm.
Bipolar bathyal-abyssal. Arctic basin, north of the Laptev Sea.
Depth 756-7200 m. On silt, sand, and clay sediments.

Key to genera and species of the tribe Erythropini

1(10) Telson trapezoidal, greater in width than length (Pl. III, Fig. 9). Eyes often flattened, kidney-shaped (Pl. II, Fig. 5), sometimes oval, almost round, end of telson with four, rarely with six spines . . . . . **genus *Erythrops***

2(5) Outer edge of antennal scale with saw-like denticulation (Pl. III, Figs. 10, 11)

3(4) Terminal spine on the outer edge of the antennal scale does not extend beyond distal edge of scale (Pl. III, Fig. 10) . . ***E. abyssorum* G.O. Sars, 1869 (Pl. III, Fig. 10)**

Length to 19.6 mm.
Atlantic high boreal Arctic. From northern and western Barents Sea to northwestern East Siberian Sea and adjacent regions of the arctic basin.
Depth 56-1175 m. On silt, sand, and clay sediments.

4(3) Terminal spine on the outer edge of the antennal scale extends beyond the distal edge of the scale (Pl. III, Fig. 11) . . . . . ***E. serrata* (G.O. Sars, 1863) (Pl. III, Fig. 11)**

Length to 11 mm.
Eastern Atlantic widespread boreal. Southwestern Barents Sea.
Depth 54-540 m. On silty sediments.

5(2) Outer edge of antennal scale smooth, with only one terminal, spine-like tooth (Pl. III, Fig. 12).

6(7) Eyes viewed from above do not extend beyond the lateral edge of the carapace (Pl. III, Fig. 13) . . . . . ***E. glacialis* G.O. Sars, 1855 (Pl. III, Fig. 13)**

Length to 20 mm.
Atlantic-Arctic bathyal. Northern Barents Sea and Laptev Sea.
Depth 250-1079 m. On silty sediments.

7(6) Eyes viewed from above extend beyond the lateral edge of the carapace, although sometimes only slightly (Pl. III, Fig. 14).

8(9) Anterior edge of carapace evenly rounded (Pl. III, Fig. 15). Faceted part of the eye occupies roughly half of the eyestalk . . . ***E. microps* (G.O. Sars, 1864) (Pl. III, Fig. 15)**

Length to 14.6 mm.
Atlantic widespread boreal. Arctic basin (north of the Spitsbergen archipelago).
Depth 72-900 m.

9(8) Anterior edge of carapace forms a small triangular rostrum with rounded tip (between the base of the eyes) (Pl. III, Fig. 14). Faceted part of the eye occupies ⅔ of the eyestalk . . . . . .***E. erythrophthalma*** **(Goës, 1864) (Pl. I, Fig. B; Pl. II, Figs. 3, 5; Pl. III, Figs. 9, 12, 14)**

Length to 16 mm.
Atlantic high boreal Arctic. From the western Barents Sea to the northwestern East Siberian Sea.
Depth 15-450 m. On silt, sand, and clay sediments.

10(1) Telson elongate, triangular with a small truncate distal end, much greater in length than width (Pl. III, Fig. 16). Faceted portion of eye rounded (Pl. II, Fig. 6). Tip of the telson with two or three pairs of small spines.

11(14) First pair of pleopods of males rudimentary, as in females, consisting of unarticulated biramous plates (Pl. III, Fig. 17). Tip of telson with two or three pairs of spines. . . . . .**genus *Parerythrops***

12(13) Eyes large, extending beyond lateral edge of carapace. Tip of the telson has two pairs of spines (Pl. IV, Fig. 1) .***P. obesa*** **(G.O. Sars, 1864) (Pl. II, Fig. 6; Pl. IV, Fig. 1)**

Length to 22.7 mm.
Atlantic widespread boreal. Southwestern Barents Sea.
Depth 67-1000 m.

13(12) Eyes small, not extending beyond the lateral edge of the carapace. Tip of the telson has three pairs of spines (Pl. IV, Fig. 2) . . . . . .***P. spectabilis*** **G.O. Sars, 1885 (Pl. III, Fig. 17; Pl. IV, Fig. 2)**

Length 26 mm.
Atlantic-Arctic bathyal. Arctic basin from Spitsbergen to 150°E, north of Barents, Kara, and Laptev seas.
Depth 225-1079 m. On silt, sand, and clay sediments.

14(11) First pleopod of males with normally developed, multiarticulate outer ramus and unarticulated inner ramus (Pl. IV, Fig. 3). Tip of telson with two pairs of spines (Pl. III, Fig. 16). Eyes large, extending beyond the lateral edge of the carapace . . . . **genus *Meterythrops*, *M. robusta*** **Smith, 1879 (Pl. III, Fig. 16; Pl. IV, Fig. 3)**

Length to 24 mm.
Widespread boreal Arctic. Barents, Kara, Laptev, and northwestern East Siberian seas.
Depth 17-620 m. On sediments of silt, sand, and small rocks.

Key to genera and species of the tribe Amblyopsini

1(4) Eyes or eye plates isolated from one another, not coalesced (Pl. II, Figs. 8, 10).

2(3) Eyes more or less pear-shaped, with stalks, slightly flattened dorsoventrally, acute anteriorly, with reduced ommatidia (Pl. II, Fig. 10) . . . . . .**genus *Dactylamblyops*, *D. sarsi*** **(Ohlin, 1901) (Pl. II, Fig. 10)**

Length to 17 mm.
Arctic bathyal-abyssal. Arctic basin (north of the Laptev Sea and Canadian basin).
Depth 49-4356 m.

3(2) Eyes shaped like a flattened rectangular plate with rounded corners, without ommatidia (Pl. II, Fig. 8). Distal tooth on the outer edge of the antennal scale reaches the distal end of the scale or extends beyond it (Pl. IV, Fig. 4). . . . . **genus *Amblyops*, *A. abbreviata* (M. Sars, 1869) (Pl. II, Fig. 8; Pl. IV, Fig. 4)**

Length to 20 mm.
Amphiboreal. Southwestern Barents Sea.
Depth 180-1500 m.

4(1) Eyes transformed into a single plate or two immobile plates, fused at the inner edge (Pl. II, Figs. 7, 9).

5(10) Eyes transformed into two immobile plates, fused together at the inner edge (Pl. II, Fig. 7). Fourth pleopods of the male biramous, inner ramus not longer than outer ramus (Pl. IV, Fig. 5) . . . . . **genus *Pseudomma***

6(7) Tip of telson truncate. Lateral edge of telson with eight small spines, four (rarely six) larger spines on distal edge (Pl. IV, Fig. 6) . . . . . ***P. truncatum* Smith, 1879 (Pl. I, Fig. A; Pl. II, Fig. 7; Pl. IV, Fig. 6)**

Length to 18.8 mm.
Widespread boreal Arctic. Barents, White, Kara, Laptev, and Chukchi seas.
Depth 25-660 m. On silty and sandy sediments.

7(6) Tip of telson rounded (Pl. IV, Figs. 7, 8).

8(9) Tip of telson with one to two pairs of terminal spines (Pl. IV, Fig. 7) . . . . . ***P. roseum* G.O. Sars, 1870 (Pl. IV, Figs. 5, 7)**

Synonymy: *Pseudomma frigidum* Hanses, 1908:109.
Length to 29.4 mm.
Atlantic widespread boreal Arctic. Arctic basin and adjacent regions of the Barents, Kara, Laptev, East Siberian, and Chukchi seas.
Depth 60-911 m. On silt, sand, and clay sediments.

9(8) Tip of telson with four to six pairs of terminal spines (Pl. IV, Fig. 8) . . . . . ***P. affine* G.O. Sars, 1870 (Pl. IV, Fig. 8)**

Length to 12 mm.
Atlantic widespread boreal. Southwestern Barents Sea.
Depth 80 to 900 m.

10(5) Eyes transformed into a single plate (Pl. IV, Fig. 9). Pleopod 4 of males uniramous (Pl. IV, Fig. 9) . . . . . **genus *Michthyops***

11(12) Flattened anterior edge of carapace completely or nearly completely covers ocular plate (Pl. IV, Fig. 10). Length of antennal scale exceeds width by seven times (Pl. IV, Fig. 11).

Tip of telson with three or four pairs of robust spines (Pl. IV, Fig. 12). . . . . ***M. arctica* Petryashov, 1993 (Pl. IV, Fig. 10-12)**

Length to 9 mm.
Arctic bathyal. Canadian basin, north of Laptev Sea.
Depth 1079-3440 m.

12(11) Anterior edge of carapace does not cover much of the ocular plate (Pl. II, Fig. 9). Length of antennal scale exceeds its width by four to five times (Pl. IV, Fig. 13). Tip of telson with four to eight (usually five or six) pairs of robust terminal spines (Pl. IV, Fig. 14). . . . . ***M. theeli* (Ohlin, 1901) (Pl. II, Fig. 9; Pl. IV, Figs. 9, 13-14)**

Length to 21.4 mm.
Arctic circumpolar. Arctic basin, from northern Barents Sea to northern Chukchi Sea.
Depth 27-2245 m. On silty sediments.

Key to genera and species of the tribe Mysini

1(4) Outer edge of lanceolate antennal scale smooth, with only one tooth on the distal end (Pl. V, Figs. 1, 3). Telson with V-shaped cleft (Pl. V; Fig. 2) . . . . . **genus *Praunus***

2(3) Antennal scale three to five times longer than wide (Pl. 5, Fig. 1) . . . . . ***P. inermis* (Rathke, 1843) (Pl. V, Figs. 1-2)**

Length to 18.4 mm.
Eastern Atlantic widespread boreal. Southern Barents Sea.
Entrance to White Sea.
Depth 0-57 m. On rocks, sand, and silty sediments.

3(2) Antennal scale seven-ten times longer than wide (Pl. V; Fig. 3) . . . . . ***P. flexuosus* (Müller, 1776) (Pl. V, Fig. 3)**

Length to 26 mm.
Atlantic widespread boreal. Southwestern coast of Barents Sea.
Depth 0-5 m. On silt, sand, and rock sediments.

4(1) Setae present along the entire edge of the antennal scale. Tooth absent on end of antennal scale (Pl. V, Fig. 4).

5(14) Telson with triangular (Pl. V, Fig. 5) or V-shaped cleft (Pl. V, Fig. 6). Antennal scale lanceolate (Pl. V, Fig. 4) or shaft-shaped (Pl. V, Fig. 7). Third pleopod of males biramous; outer ramus four to six articulate, inner ramus unarticulated (Pl. V, Fig. 8). Outer ramus of fourth pleopod of males with six to seven articles (Pl. II, Fig. 14) . . . . . **genus *Mysis***

6(7) Antennal scale shaft-shaped and pointed on end (Pl. V, Fig. 7) . . . . . ***M.* (Michteimysis) *mixta* Lilljeborg, 1852 (Pl. II, Fig. 14; Pl. V, Fig. 7)**

Length to 30.5 mm.
Atlantic widespread boreal. Southern Barents Sea, White Sea.
Depth 0-294 m depth. On sand, silt, and rock sediments.

7(6) Antennal scale lanceolate with rounded end (Pl. V, Fig. 4). . . . . **subgenus Mysis**

8(9) Cleft on the distal end of telson shallow, 1/30 the length of the telson, lacking denticles along edge (Pl. V, Figs. 9, 10) . . . . . ***M. arcticoglacialis*** **Petryashov, 1990 (Pl. II, Fig. 2; Pl. V, Figs. 9-10)**

Length to 18.4 mm.
Arctic. Near Franz Joseph Land, northwestern East Siberian Sea.
Depth 2-34 m. On boulders, pebbles, and sand.

9(8) Cleft on the distal end of telson deeper, not less than 1/10 the length of the telson, denticulate on the edges (Pl. V, Figs. 5, 6).

10(13) Cleft on the distal end of telson V-shaped (Pl. V, Fig. 6).

11(12) Last pair of spines on lateral edge of telson is anterior to distal-lateral corners of telson, which are rounded (Pl. V, Fig. 11) . . . . . ***M. polaris*** **Holmquist, 1959 (Pl. V, Fig. 11)**

Length to 28.5 mm.
Arctic circumpolar. Arctic basin, Kara, Laptev, and East Siberian seas.
Cryopelagic.

12(11) Last pair of spines on lateral edge of telson right at the posterior lateral corners of telson; corners quadrate or acute (Pl. V, Fig. 12) . . . . . ***M. oculata*** **(Fabricius, 1780) (Pl. I, Fig. C; Pl. II, Fig. 11; Pl. V, Figs. 4, 6, 8, 12)**

Synonymy: *Mysis litoralis* Holmquist, 1958:4-6 (part: in Arctic).
Length to 38.2 mm.
High boreal Arctic circumpolar.
In Barents, White, Kara, East Siberian, Laptev, and Chukchi seas.
Depth 1-243 m. On sandy, silty and rocky sediments.

13(10) Cleft on the distal end of telson triangular (Pl. V, Fig. 5) . . . . . ***M. relicta*** **Loven, 1862 (Pl. V, Fig. 5)**

Synonymy: *Mysis segerstralei* Audzijonyte et Väinölä, 2005:89-141.
Length to 24.7 mm.
Widespread boreal Arctic. Estuaries of the White, Kara, East Siberian, Laptev, and Chukchi seas; southeastern Barents Sea.
Depth 0-22 m. In lakes to 117 m depth. On sand, silt, and rarely on rock or clay sediments.

14(5) Telson complete, without cleft (Pl. V, Figs. 13, 14).

15(16) Brood pouch consists of three pairs of oostegites. Outer ramus of fourth pleopod of males with four to five articles (Pl. III, Fig. 1) . . . . . **genus *Stilomysis*, *S. grandis*** **(Goës, 1864) (Pl. III, Fig. 1; Pl. V, Fig. 13)**

Length to 41 mm.
Widespread boreal Arctic. Barents and Kara seas, northwestern Laptev Sea and southern Chukchi Sea.
Depth 0-402 m. On sand, silt, and less commonly on rocky sediments.

16(15) Brood pouch consists of two pairs of oostegites. Outer ramus of fourth pleopod in males with one to three articles (Pl. III, Figs. 2, 3).

17(22) Distal end of antennal scale pointed (Pl. V, Fig. 15). (Outer ramus of fourth pleopod of males with two articles (Pl. III, Fig. 3). . . . . **genus *Neomysis***

18(21) Width of the truncate tip of telson not less than ⅐ width of base of telson (Pl. V, Fig. 16).

19(20) Rostral plate quadrate with rounded corners (Pl. V, Fig. 17) . . . . . ***N. rayii*** **(Murdoch, 1855) (Pl. V, Figs. 16-17)**

Length to 42 mm.
Pacific subtropical-boreal. Chukchi Sea.
Depth 1-79 m. On sand; rarely on silty or rocky sediments.

20(19) Rostrum triangular with rounded tip (Pl. V, Fig. 18) . . . . . ***N. integer*** **(Leach, 1814) (Pl. V, Fig. 18)**

Length to 17 mm.
Eastern Atlantic widespread boreal. Southwestern Barents Sea.
Depth 0-30 m.

21(18) Width of truncate tip of telson greater than ⅐ width of base of telson (Pl. V, Fig. 14). (Rostral plate triangular with pointed or rounded tip) . . . . . .***N. awatschensis*** **(Brandt, 1851) (Pl. III, Fig. 3; Pl. V, Figs. 14-15)**

Synonymies: *Heteromysis intermedia* Czerniavsky, 1882:30; *Neomysis awatschensis* Zimmer, 1904:468. *Neomysis intermedia* Zimmer, 1904:469.
Length to 18 mm.
Pacific subtropical-boreal. Southeastern Chukchi Sea, Chaunskiy Bay estuary in East Siberian Sea.
Depth 0-11 m. On sand and silt sediments.

22(17) Distal end of antennal scale rounded (Pl. VI, Fig. 1).

23(24) Basal article of outer ramus of fourth pleopod in males robust and bent (Pl. III, Fig. 2). Eyes cylindrical (Pl. 6, Fig. 2). Outer ramus of fourth pleopod of males with one or two articles; if only one article then rudimentary articulation present. Tip of telson rounded, with series of isolated medial spines, which are shorter than lateral telson spines (Pl. VI, Fig. 3) . . . . . .**genus *Xenacanthomysis*, *X. pseudomacropsis*** **(W.M. Tattersall, 1933) (Pl. III, Fig. 2; Pl. VI, Figs. 2, 3)**

Synonymies: *Neomysis pseudomacropsis* W.M. Tattersall, 1933:14; *Acanthomysis pseudomacropsis* Ii, 1936:589; *Xenacanthomysis pseudomacropsis* Holmquist, 1980:501-510.
Length to 20 mm.
Pacific widespread boreal. Eastern Chukchi Sea.
Depth 0-104 m.

24(23) Basal article of outer ramus of fourth pleopod of males thin and straight (Pl. III, Fig. 2). Eyes pear-shaped (Pl. VI, Fig. 4).

25(26) Terga of abdominal segments without folds, smooth (Pl. VI, Fig. 5). Outer ramus of fourth pleopod of males three-articulate: third distal article very small; ratios of length of basal article of outer ramus to middle and distal articles 23:5:1. Telson tongue-shaped, with rounded tip. Spines on the distal ⅓ of the lateral edge of telson in groups: for each large spine there are two to six small spines (Pl. VI, Fig. 6) . . . . . .**genus *Disacanthomysis*, *D. dybowskii*** **(Derhavin, 1913)(Pl. VI, Figs. 4-6)**

Synonymies: *Orientomysis dybowskii* Derjavin, 1913:203;
Acanthomysis dybowskii Ii, 1936:589, 597-600;
Disacanthomysis dybowskii Holmquist, 1981a:386-415.
Length to 30.6 mm.
Pacific widespread boreal. Southeastern Chukchi Sea.
Depth 8-140 m. On sand, silt, and gravel.

26(25) Terga of abdominal segments with transverse folds (Pl. VI, Fig. 7). Outer ramus of fourth pleopod of males two-articulate: basal article three to six times longer than distal. Telson shaped like elongate triangle with small truncation at tip. Lateral spines on distal ¾ of telson grouped: for each large spine there are 1-11 small spines (Pl. VI, Fig. 8). . . **genus *Exacanthomysis*, *E. stelleri* (Derjavin, 1913) (Pl. VI, Figs. 7-8)**

Synonymies: *Orientomysis stelleri* Derjavin, 1913:202; *Acanthomysis stelleri* Ii, 1936:589; *Exacanthomysis arctopacifica* Holmquist, 1981b:260; *Exacanthomysis japonica* Murano, 1991:81-86.
Length to 25 mm.
Western Pacific widespread boreal. Southeastern Chukchi Sea.
Depth 0-104 m.

Literature

Holmquist, C. 1959. *Mysis polaris*: A new species of the genus *Mysis*. Kungliga Physiog. Sallskapets Lund Forhandl. 29:21-25.

Holmquist, C. 1981. The genus *Acanthomysis* Czerniavsky, 1882 (Crustacea, Mysidacea). Zool. Jahrb., Abt. Syst. 108:386-415.

Linko, A. 1908. Schizopoda of the Russian northern seas. Zap. Imp. Akad. Nauk. 18(8):1-76.

Mauchline, J. 1980. The biology of mysids and euphausiids. Adv. Mar. Biol. 18. 677 pp.

Petryashov, V.V. 1990. Mysid fauna (Crustacea, Mysidacea) of the Laptev and New Siberian shallows. In: Ecosystems of the New Siberian shallows and fauna of the Laptev Sea and adjacent waters. Issled. Fauny Morei 37(45):187-209.

Petryashov, V.V. 1992. On the systematics of mysids (Crustacea, Mysidacea) of the Arctic and northwestern Pacific. Zool. Zhurn. 71(10):47-58.

Petryashov, V.V. 1993. Deep-water mysids (Crustacea, Mysidacea) of the Arctic Ocean basin. In: Marine plankton. Systematics, ecology and distribution. II. Issled. Fauny Morei 45(53):70-89.

Sars, G.O. 1870. Carcinologiske Bidrag til Norges Fauna. I. Monographi over de ved Norges Kyster forekommende Mysider. Pt. 1. Christiania. K. Norske Videnskabsselskab Trondhjem, pp. 1-64.

Sars, G.O. 1872. Carcinologiske Bidrag til Norges Fauna. I. Monographi over de ved Norges Kyster forekommende Mysider. Pt. 2. Christiania. K. Norske Videnskabsselskab Trondhjem, pp. 1-34.

Sars, G.O. 1879. Carcinologiske Bidrag til Norges Fauna. I. Monographi over de ved Norges Kyster forekommende Mysider. Pt. 3. Christiania, pp. 1-131.

Sars, G.O. 1885. Crustacea I. Den Norske Nordhavs-expedition, 1876-78. Christiania, 14, Zoology, pp. 1-280.

Sars, G.O. 1886. Crustacea II. Den Norske Nordhavs-expedition, 1876-78. Christiania, pp. 1-96.

Tattersall, W.M. 1951. A review of the Mysidacea of the United States National Museum. U.S. Natl. Mus. Bull. 201. 292 pp.

Zimmer, C. 1909. Die nordischen Schizopoden. Nordisches Plankton. Bd. 12(6), pp. 1-179.

Zimmer, C. 1933. Mysidacea. Die Tierwelt der Nord- und Ostsee. Bd. 23, pp. 29-69.

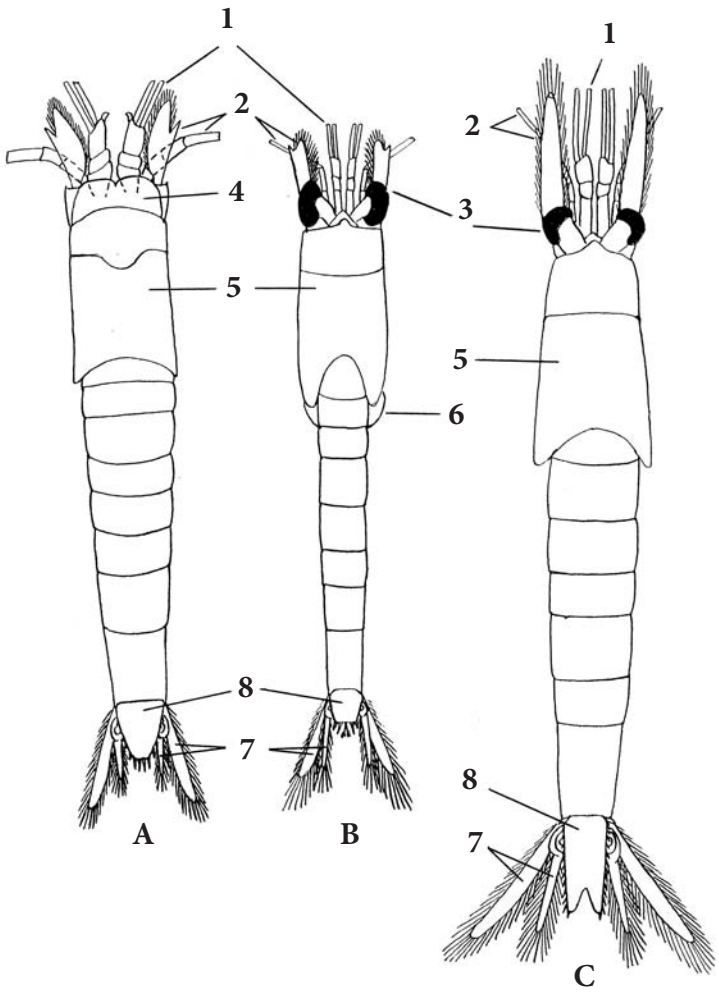


Plate I. Mysidacea from the Arctic Ocean

A: Male *Pseudomma truncatum*: whole animal, dorsal view (×5)
B: Female *Erythrops erythrophthalma*: whole animal, dorsal view (×5)
C: Female *Mysis oculata*: whole animal, dorsal view

Fig. 1 Antennules.
Fig. 2 Antennae.
Fig. 3 Eyes.
Fig. 4 Ocular plate.
Fig. 5 Carapace.
Fig. 6 Brood pouch.
Fig. 7 Uropods.
Fig. 8 Telson.

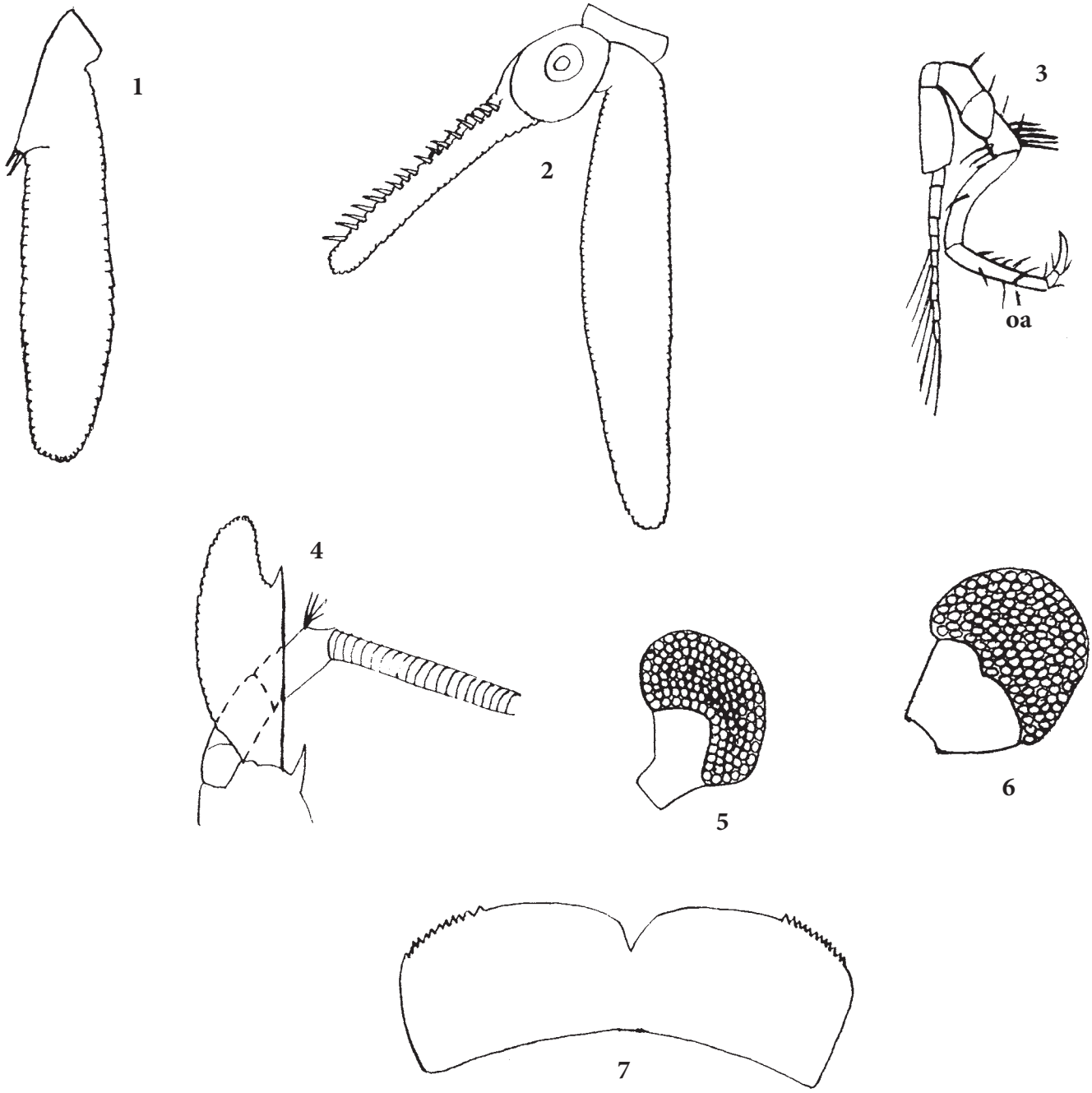


Plate II. Mysidacea of the Arctic Ocean

Fig. 1 *Birsteiniamysis inermis*: exopod (outer ramus) of the uropods (×39).
Fig. 2 *Mysis arcticoglacialis*: uropods, exopods (outer ramus) and endopodite (inner ramus).
Fig. 3 *Erythrops erythrophthalma*: second thoracic leg: oa = oblique articulation (×20).
Fig. 4 *Pseudomma truncatum*: antenna, showing peduncle flagellum and antennal scale (×20).
Fig. 5 *Erythrops erythrophthalma*: eye (×72).
Fig. 6 *Parerythrops obesa*: eye (×72).
Fig. 7 *Pseudomma truncatum*: ocular plate (×36).

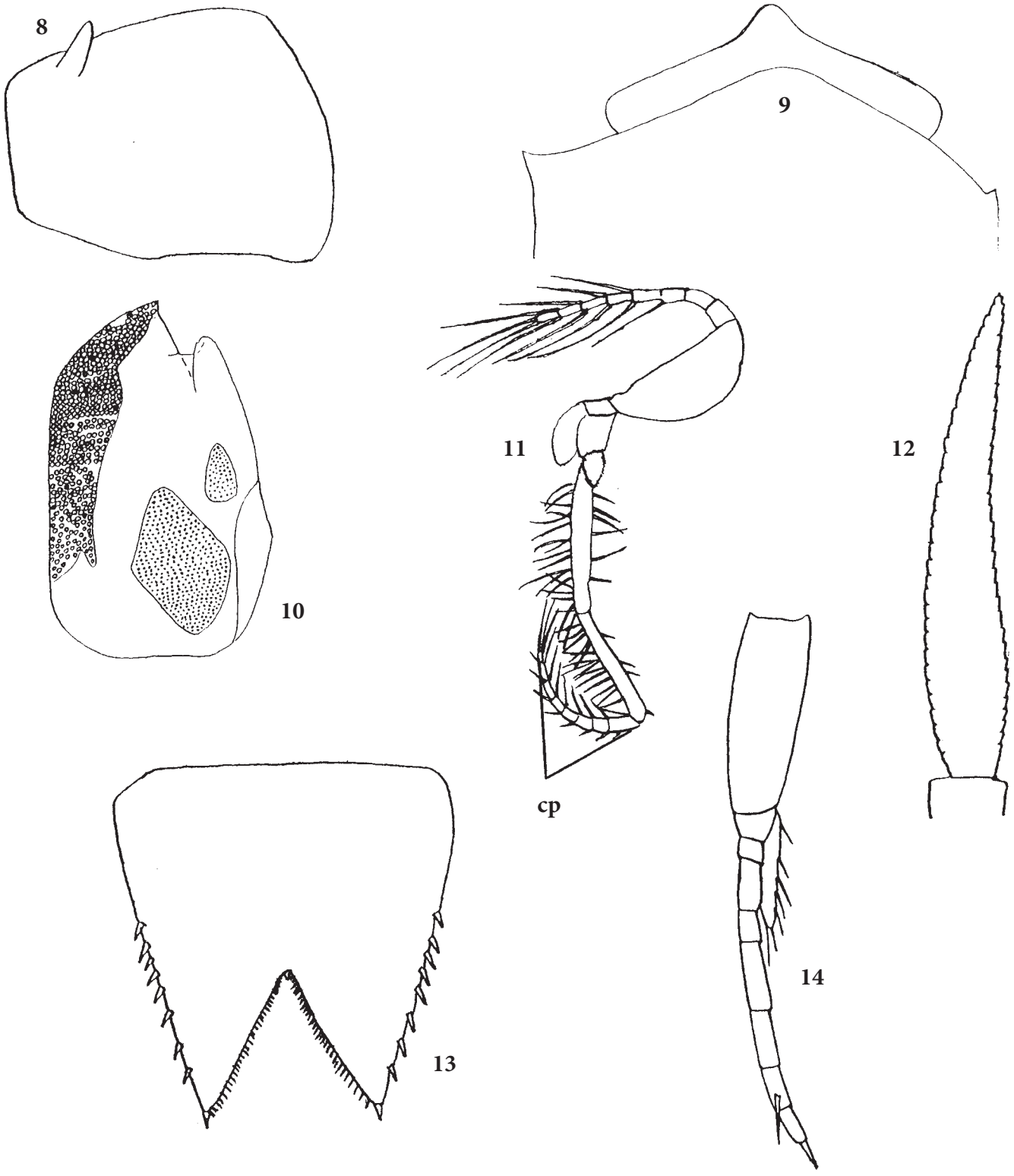


Plate II (continued)

Fig. 8 *Amblyops abbreviata*: right ocular plate (×36).
Fig. 9 *Michthyops theeli*: ocular plate and anterior edge of carapace (×22.5).
Fig. 10 *Dactylamblyops sarsi*: eye (×56).
Fig. 11 *Mysis oculata*: third thoracic leg: cp = carpo-propodus, showing secondary articulations (×20).
Fig. 12 *Pseudomysis abyssi*: antennal scale (×9.5).
Fig. 13 *Pseudomysis abyssi*: telson (×19).
Fig. 14 *Mysis mixta*: fourth pleopod (abdominal leg) of male (×20).

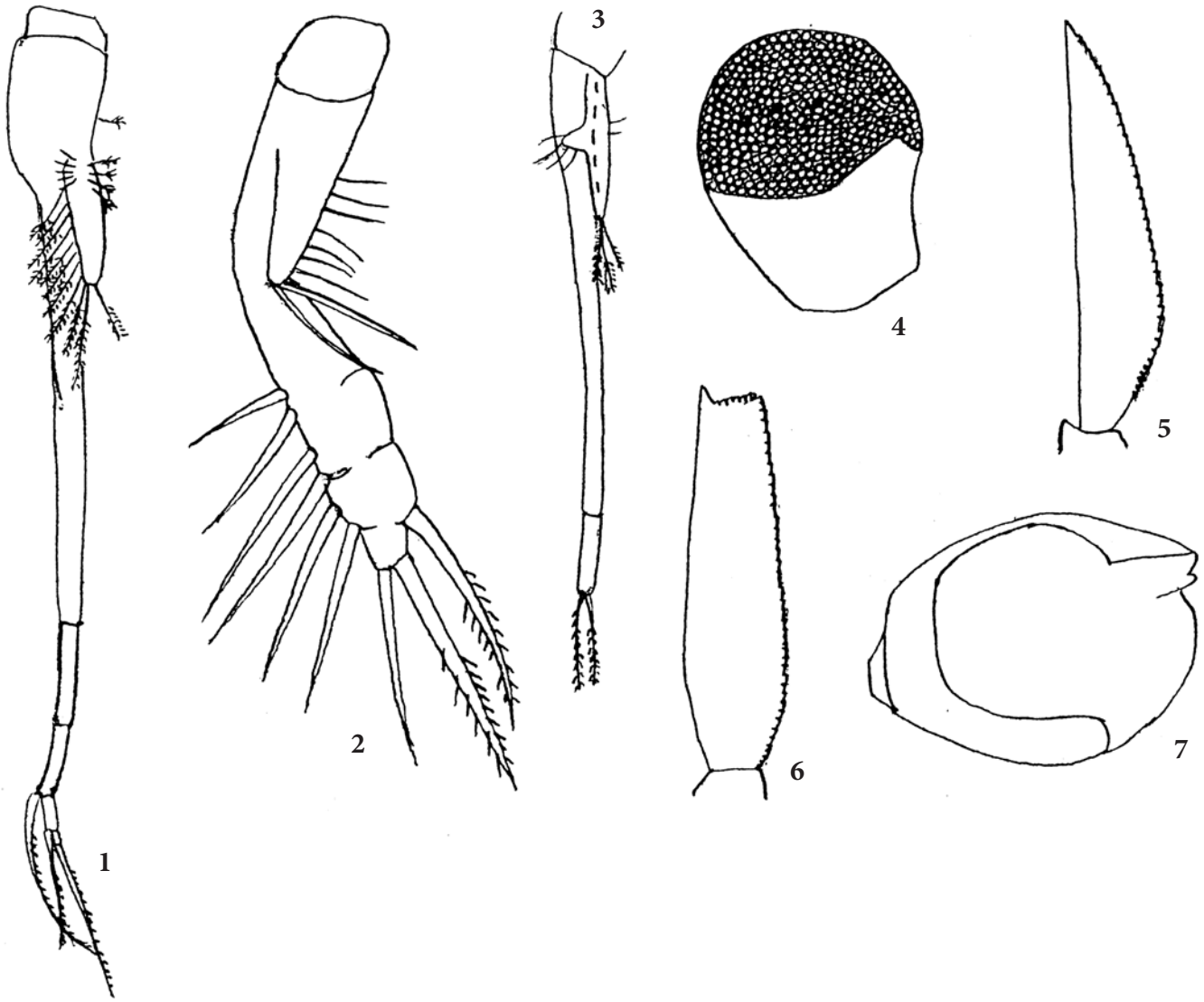


Plate III. Mysidacea of the Arctic Ocean

Fig. 1 *Stilomysis grandis*: fourth pleopod of male (from Tattersall 1951) (×17.5).
Fig. 2 *Xenacanthomysis pseudomacropsis*: fourth pleopod of the male (×58.5).
Fig. 3 *Neomysis awatschensis*: fourth pleopod of male (from Tattersall 1951) (×40).
Fig. 4 *Boreomysis arctica*: eye (×40).
Fig. 5 *Boreomysis nobilis*: antennal scale (exopod of antenna) (×19).
Fig. 6 *Boreomysis arctica*: antennal scale (exopodite of the antenna) (×19).
Fig. 7 *Birsteiniamysis inermis*: eye (×40).

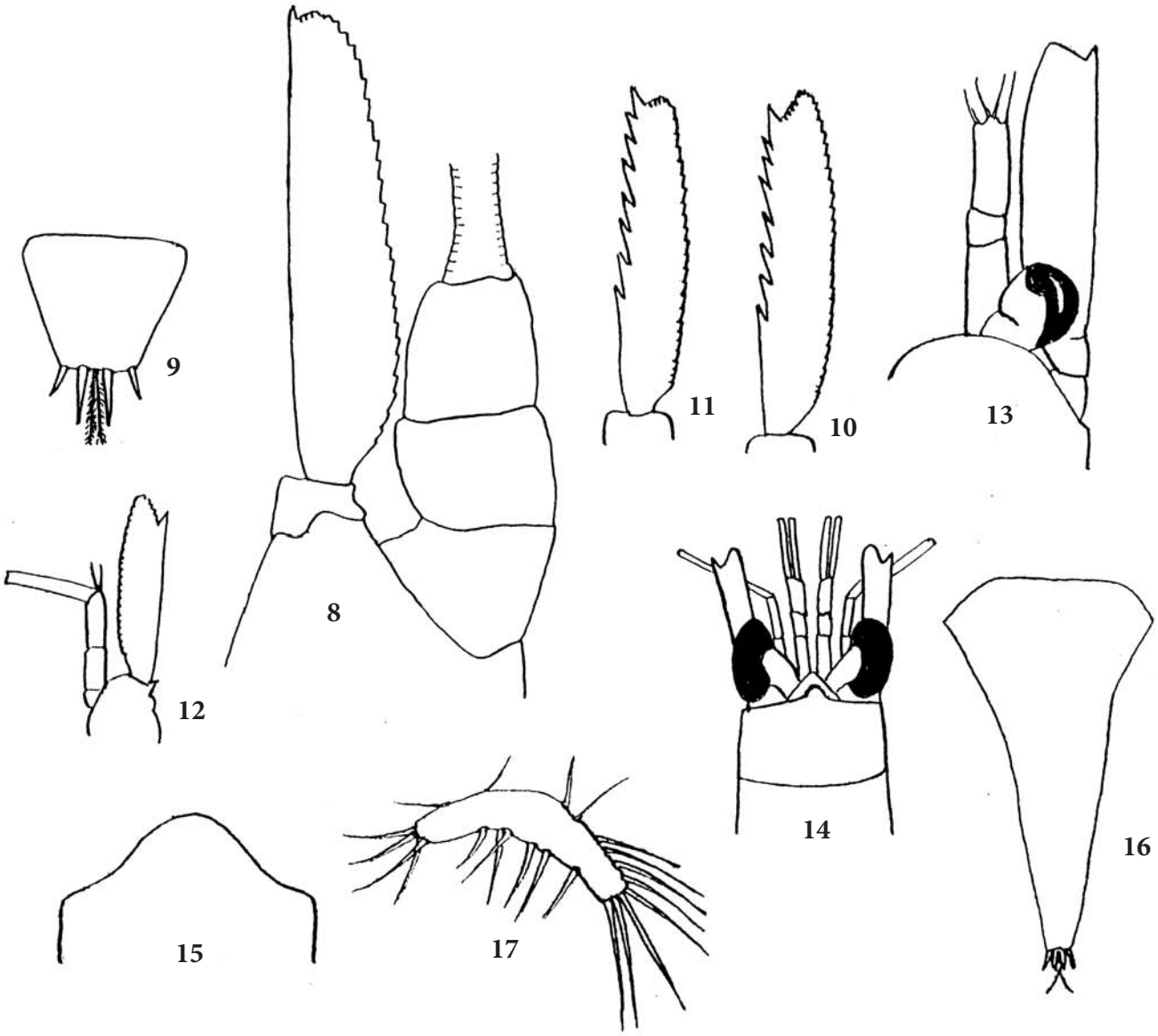


Plate III (continued)

Fig. 8 *Birsteiniamysis inermis*: antennal scale, peduncle, and flagellum (×20).
Fig. 9 *Erythrops erythrophthalma*: telson (×36).
Fig. 10 *Erythrops abyssorum*: antennal scale (exopod of antenna) (×20).
Fig. 11 *Erythrops serrata*: antennal scale (exopod of antenna) (from Zimmer 1909).
Fig. 12 *Erythrops erythrophthalma*: antenna (antennal scale, peduncle, and flagellum) (×20).
Fig. 13 *Erythrops glacialis*: antenna, eye, and anterior edge of carapace (from Zimmer 1909).
Fig. 14 *Erythrops erythrophthalma*: anterior part of cephalothorax (×10).
Fig. 15 *Erythrops microps*: anterior edge of carapace (from Zimmer 1909).
Fig. 16 *Meterythrops robusta*: telson (from Zimmer 1909).
Fig. 17 *Parerythrops spectabilis*: first pleopod (abdominal leg) of male (×70).

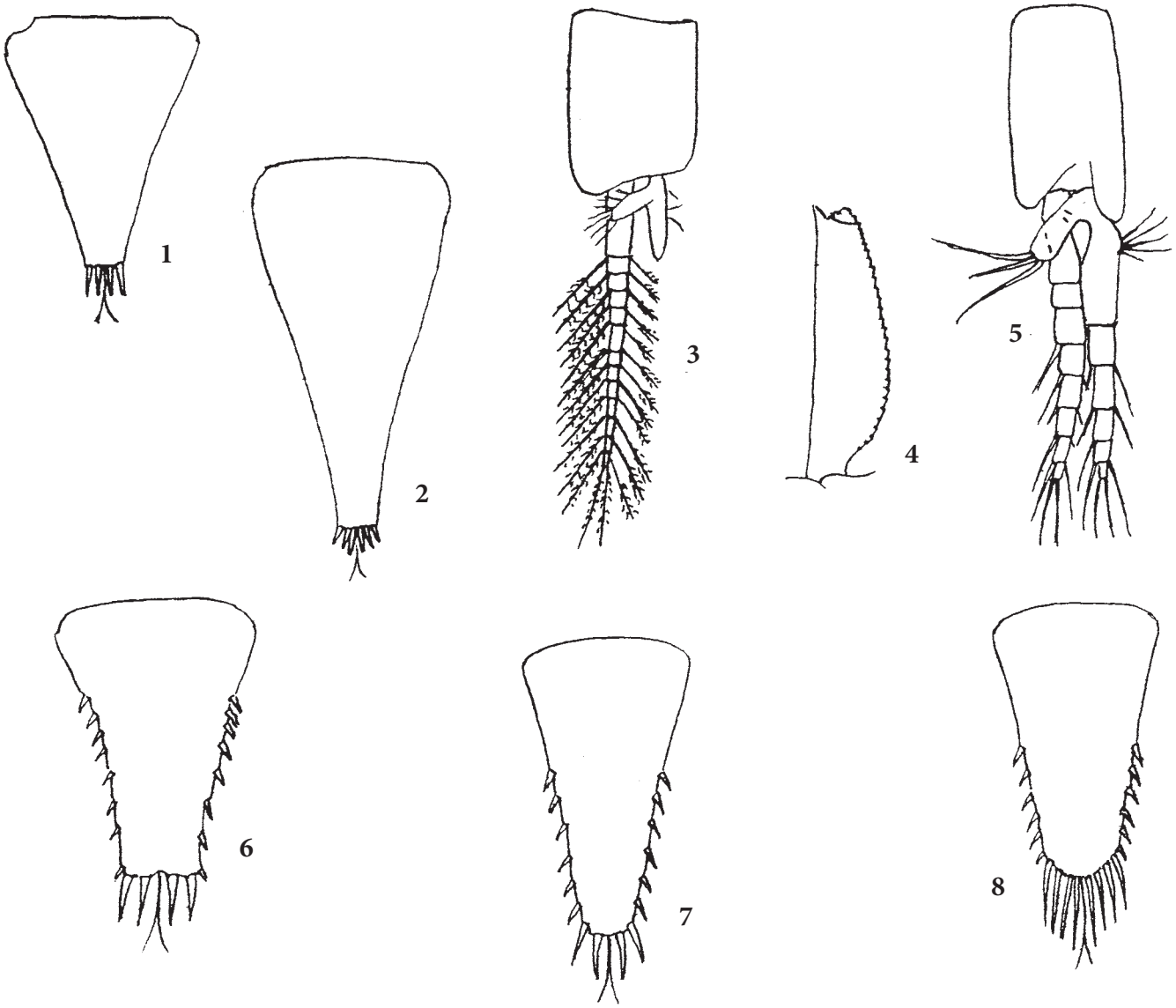


Plate IV. Mysidacea of the Arctic Ocean

Fig. 1 *Parerythrops obesa*: telson (from Zimmer 1909).
Fig. 2 *Parerythrops spectabilis*: telson (from Zimmer 1909).
Fig. 3 *Meterythrops robusta*: first pleopod (abdominal leg) of male (from G.O. Sars 1879).
Fig. 4 *Amblyops abbreviata*: antennal scale (exopod) (from Zimmer 1909).
Fig. 5 *Pseudomma roseum*: fourth pleopod (abdominal leg) of male (×40).
Fig. 6 *Pseudomma truncatum*: telson (from G.O. Sars 1879).
Fig. 7 *Pseudomma roseum*: telson (from G.O. Sars 1879).
Fig. 8 *Pseudomma affine*: telson (from Zimmer 1909).

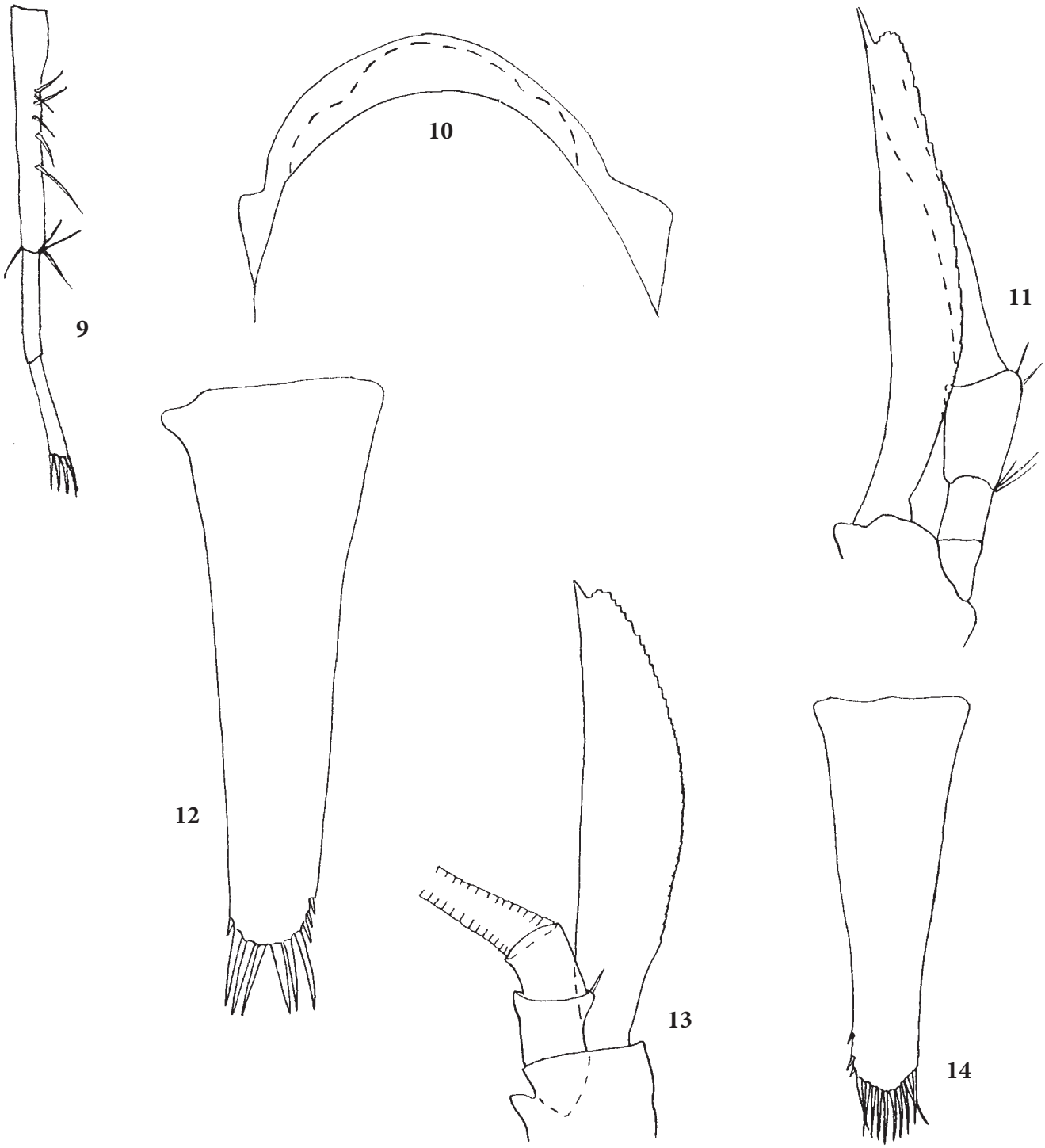


Plate IV (continued)

Fig. 9 *Michthyops theeli*: fourth pleopod (abdominal leg) of male (×40).
Fig. 10 *Michthyops arctica*: anterior edge of carapace and ocular plate beneath (×35).
Fig. 11 *Michthyops arctica*: antenna (antennal scale, peduncle, and flagellum) (×70).
Fig. 12 *Michthyops arctica*: telson (×35).
Fig. 13 *Michthyops theeli*: antenna (antennal scale, peduncle, and flagellum) (×12).
Fig. 14 *Michthyops theeli*: telson (×12).

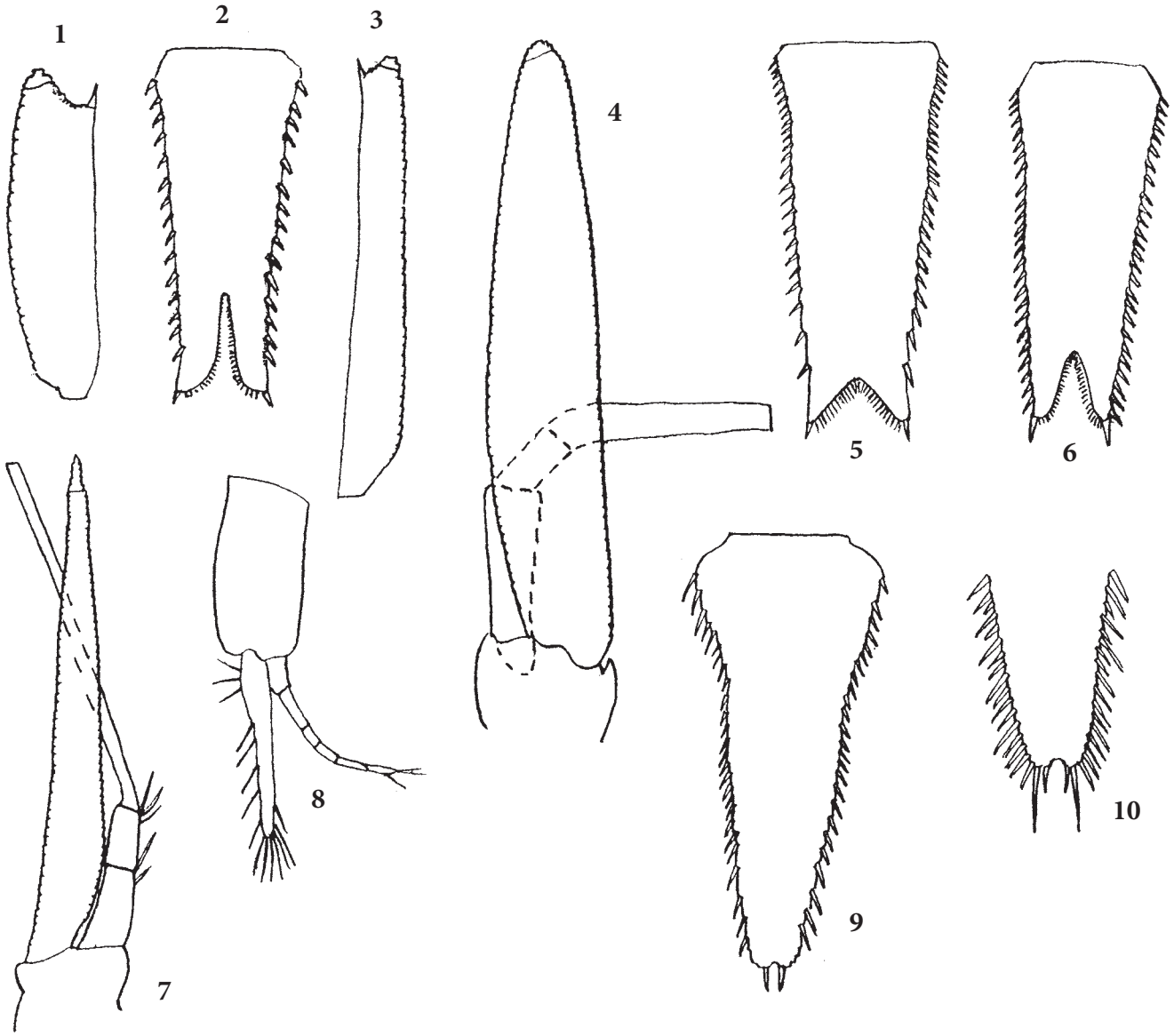


Plate V. Mysidacea of the Arctic Ocean

Fig. 1 *Praunus inermis*: antennal scale (exopod of antenna) (from Zimmer 1909).
Fig. 2 *Praunus inermis*: telson (from Zimmer 1909).
Fig. 3 *Praunus flexuosus*: antennal scale (exopod of antenna) (from Zimmer 1909).
Fig. 4 *Mysis oculata*: antenna (antennal scale, peduncle, and flagellum) (×20).
Fig. 5 *Mysis relicta*: telson (×20).
Fig. 6 *Mysis oculata*: telson (×20).
Fig. 7 *Mysis mixta*: antenna (antennal scale, peduncle, and flagella) (×20).
Fig. 8 *Mysis oculata*: third pleopod (abdominal leg) of male (×20).
Fig. 9 *Mysis arcticoglacialis*: telson (×32).
Fig. 10 *Mysis arcticoglacialis*: right distal end of telson (×57.5).

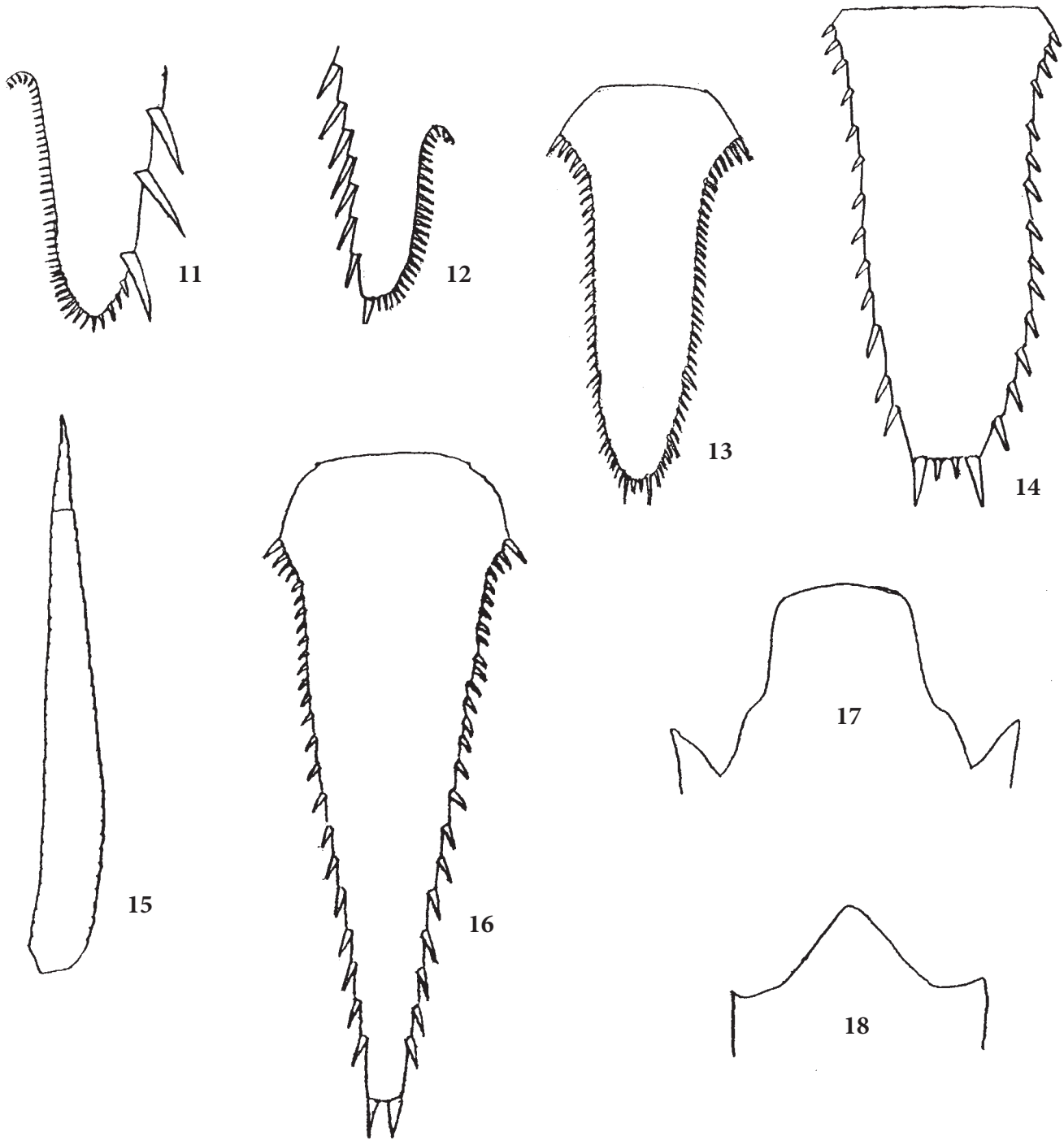


Plate V (continued)

Fig. 11 *Mysis polaris*: right distal part of the telson (×57.5).
Fig. 12 *Mysis oculata*: left distal end of telson (×57.5).
Fig. 13 *Stilomysis grandis*: telson (from G.O. Sars 1879).
Fig. 14 *Neomysis awatschensis*: telson (×57.5).
Fig. 15 *Neomysis awatschensis*: antennal scale (exopod of antenna) (×57.5).
Fig. 16 *Neomysis rayii*: telson (from Tattersall 1951) (×37).
Fig. 17 *Neomysis rayii*: anterior edge of carapace (×15).
Fig. 18 *Neomysis integer*: anterior edge of carapace (×15).

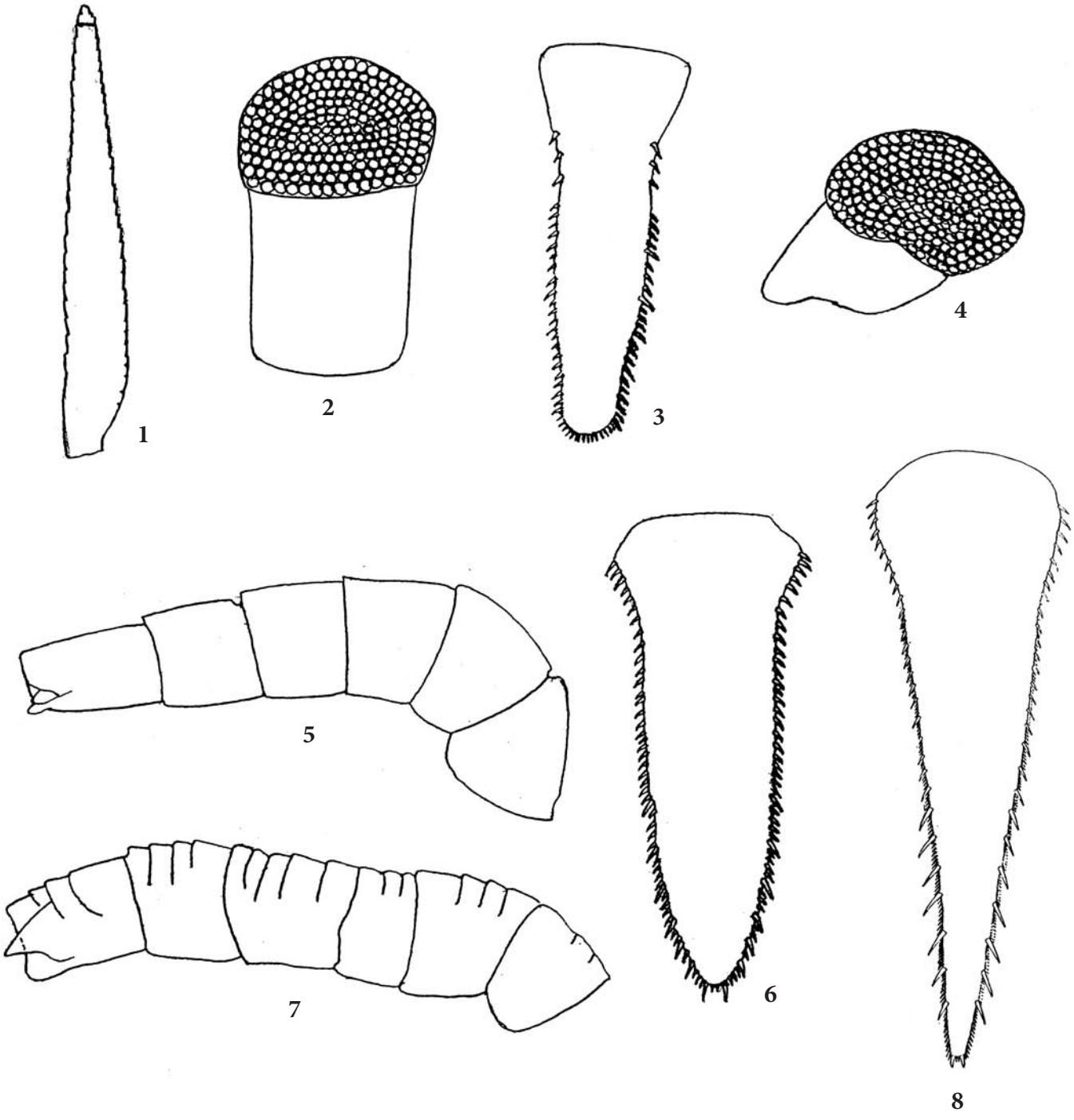


Plate VI. Mysidacea of the Arctic Ocean

Fig. 1 *Exacanthomysis borealis*: antennal scale (exopod of antenna) (×24).
Fig. 2 *Xenacanthomysis pseudomacropsis*: eye (×55).
Fig. 3 *Xenacanthomysis pseudomacropsis*: telson (from Tattersall 1951) (×30).
Fig. 4 *Disacanthomysis dybowskii*: eye (×40).
Fig. 5 *Disacanthomysis dybowskii*: abdomen, lateral view (×16).
Fig. 6 *Disacanthomysis dybowskii*: telson (from Tattersall 1951) (×24).
Fig. 7 *Exacanthomysis stelleri*: abdomen (lateral view) (×16).
Fig. 8 *Exacanthomysis stelleri*: telson (from Tattersall 1951) (×22.5).

Suborder Hyperiidea (Class Crustacea, Order Amphipoda)

M.E. Vinogradov, Deputy Director
Institute of Oceanology, Russian Academy of Sciences, Moscow

T.N. Semenova, Ph.D., Scientist
Institute of Oceanology, Russian Academy of Sciences, Moscow

Hyperiids are exclusively marine pelagic crustaceans. They are free living or sometimes parasitic. They occur from the surface to depths of 7000-8000 m. They are particularly diverse in tropical regions of the oceans. Currently, there are about 250 species of hyperiids described, of which only nine species are reported from the Arctic Ocean.

The body of hyperiids, as with other amphipods, is divided into three parts: the head, thorax, and abdomen. The head (or cephalon) consists of the acron and five body segments, all of which are completely fused together. The head has antennae 1 and 2, the mandibles, maxillae 1 and 2, the maxillipeds, and the unpaired upper and lower lips. The thorax (pereon) consists of seven segments, each of which has a pair of walking legs (pereopods); some of the segments can occasionally be fused. The coxal articles of the pereopods are attached to the sides of the corresponding segments and are modified into coxal plates. The abdomen consists of six segments: the first three segments (the pleon) carry the paired, biramous, multiarticulate swimming legs (pleopods) and the last three segments (urosome) have biramous appendages (the uropods) with uniarticulate rami. The posterior end of the last urosomal segment has a moveable solid plate (the telson), which is occasionally fused to the urosome.

In some deepwater members, particularly parasitic families, the integument is very thin; in the surface-dwelling, fast-swimming species, the integument is hard and pigmented. The body shape, the shape and size of the eyes, the structure of the cephalic appendages, the mouthparts, and walking legs are quite variable. The suborder Hyperiidea is divided into infraorders: the Physosomata and the Physocephalata.

Key to the infraorders of the suborder Hyperiidea

1(2) Head is usually short, not longer than first thoracic segment. Eyes small or absent (in *Scypholanceola* spp. they are aberrant, arranged in a vertical band, covering two lateral concavities in the surface of the head). Flagellum of antenna 1 with strongly conical proximal article and not more than three small distal articles. Mandible lacking molar. Maxilla 1 with inner lobe . . . . . **infraorder Physosomata Pirlot, 1929**

2(1) Head longer than first thoracic segment. Eyes usually large, occupying most of the surface of head. Antenna 1 with proximal article of flagellum not cone shaped, number of distal articles of flagellum greater than three. Mandible usually with molar. Maxilla 1 lacking inner lobe . . **infraorder Physocephalata Bowman and Gruner, 1973 (pp. 86)**

Key to families, genera, and species of the infraorder Physosomata

1(2) Mandibles with three-articulate palp. Pereopods 5-7 with hooded dactyls. . . . . **Lanceolidae, genus *Lanceola* Say, 1818, *L. clausi* Bovallius, 1885 (Pl. I, Figs. 1-9)**

Length 10-20 mm.
Panoceanic. Central arctic basin, Barents, Kara, and Chukchi seas.
Depth 200-3000 m.

2(1) Mandibles lacking palp. Pereopods 5-7 with unhooded dactyls.

3(4) Ramus not fused to peduncle . . . . . **Mimonectidae, genus *Mimonectes* Bovallius, 1885, *M. sphaericus* Bovallius, 1885 (Pl. 2, Figs. 1-9)**

Length 10-18 mm.
Panoceanic. Barents Sea.
Depth 100-2000 m.

4(3) Ramus fused to peduncle. . . . . **Scinidae, genus *Scina* Prestandrea, 1833**

Key to species of the genus *Scina*

1(2) Outer lobes of maxilliped narrow distally, long. Length of terminal urosomite less than width. Telson short, shaped like rounded triangle. Uropods wide, inner edge of first pair of uropods strongly dentate . . . . . ***S. borealis* (G.O. Sars, 1882), (Pl. III, Figs. 1-11)**

Length 7-8 mm.
Panoceanic. Central arctic basin and marginal arctic seas.
Depth 50-3000 m.

2(1) Outer lobes of maxilliped wide, length slightly greater than width, inner and outer distal corners slightly extended. Length of terminal urosomite exceeds width. Telson long, reaching the middle of base of uropod 3. Uropods narrow, inner edge of uropod 1 smooth. . . . . **.*S. pusilla* Chevreux, 1919 (Pl. IV, Figs. 1-9)**

Length 3-4 mm.
Rare species, found at various latitudes of the Pacific Ocean and in the northeastern Atlantic. Occasional reports from the Chukchi Sea and waters of the Canadian Arctic.
Depth 500-1000 m.

Key to genera and species of the family Hyperiidae Dana, 1852 (infraorder Physocephalata)

1(2) Pereopods 5-7 substantially longer than pereopods 3-4 . . . . . **genus *Themisto* Guerin, 1825 (pp. 87)**

2(1) Pereopods 5-7 differ little in length from pereopods 3-4.

3(4) Pereopods 1 and 2 with well developed chela, formed from the propodus and pointed distal process of the carpus, distal process almost reaches end of propodus . **genus *Hyperoche* Bovallius, 1887, *H. medusarum* (Krøyer, 1838) (Pl. V, Figs. 1-8)**

Length 5-15 mm.
Bipolar. Barents and White seas, central arctic basin.
Depth 0-300 m.

4(3) Pereopod 1 lacking chela, distal process of carpus of pereopod 2 spoon-like, not reaching middle of propodus . . . . . **genus *Hyperia* Latreille in Desmarest, 1823**

Key to species of the genus *Hyperia*

1(2) Posterior edge of propodus of pereopods 1 and 2 covered with spines . . . . . ***H. medusarum* (Muller, 1776) (Pl. VI, Figs. 1-10)**

Length 9-20 mm.
Bipolar. Central arctic basin and marginal arctic seas.
Depth 0-300 m.

2(1) Posterior edge of propodus of pereopods 1 and 2 not covered with spines . . . . . ***H. galba* (Montagu, 1815) (Pl. VII, Figs. 1-12)**

Length 10-25 mm.
Widespread boreal Arctic circumpolar. Central arctic basin and marginal arctic seas.
Near-surface dweller.

Key to species of the genus *Themisto*

1(2) Pereopods 5 and 6 similar in length, or pereopod 6 slightly longer than pereopod 5. Dactyls of pereopods 5 and 6 smooth . . . . . ***T. abyssorum* (Boeck, 1870) (Pl. 8, Figs. 1-9)**

Length 10-22 mm.
Widespread boreal Arctic circumpolar. Central arctic basin and marginal arctic seas.
Depth 0-100 m, but can descend to 2000 m.

2(1) Pereopod 5 substantially longer than 6. Dactyls of pereopods 5 and 6 with small setae on proximal end of anterior edge . . . . . ***T. libellula* (Lichtenstein, 1822) (Pl. IX, Figs. 1-9)**

Length to 60 mm.
High boreal Arctic circumpolar. Arctic basin, marginal arctic seas.
Depth 0-100 m, but can descend to 1000 m.

Literature

Barnard, J.L. 1959. Epipelagic and under-ice Amphipoda of the central arctic basin. Geophysical Research Papers 1(63):115-152.

Bowman, T.E. 1960. The pelagic amphipod genus *Parathemisto* (Hyperiidea: Hyperiidae) in the North Pacific and adjacent Arctic Ocean. Proc. U.S. Natl. Mus. 112:343-392.

Bowman, T.E. 1973. Pelagic amphipods of the genus *Hyperia* and closely related genera (Hyperiidea: Hyperiidae). Smithsonian Contributions to Zoology 136:1-76.

Bowman, T.E., and H.E. Gruner. 1973. The families and genera of Hyperiidea (Crustacea: Amphipoda). Smithsonian Contributions to Zoology 146. 64 pp.

Dunbar, M.J. 1963. Amphipoda, sub-order Hyperiidea, family Hyperiidae. Cons. Int. Explor. Mer Zooplankton Sheet 103. 4 pp.

Hurley, D.E. 1955. Pelagic amphipods of the sub-order Hyperiidea in New Zealand waters, 1: Systematics. Trans. Roy. Soc. New Zealand 83(1):119-194.

Sars, G.O. 1890. Amphipoda. Hyperiidea. An account of the Crustacea of Norway. Vol. 1, pp. 1-20.

Sars, G.O. 1900. Crustacea. V. Sci. Res. Norwegian North Polar Exped. 1893-1896. Vol. 1. 141 pp.

Schneppenheim, R., and R. Weigmann-Haass. 1986. Morphological and electrophoretic studies of the genus *Themisto* (Amphipoda, Hyperiidea) from the South and North Atlantic. Polar Biol. 6:215-225.

Shoemaker, C.R. 1945. The Amphipoda of the Bermuda oceanographic expeditions 1929-1931. Zoologica 30, pt. 4(17):185-266.

Vinogradov, M.E. 1970. Hyperiids (Amphipoda-Hyperiidea) of the northwestern Pacific Ocean. Tr. Inst. Okeanol. Akad. Nauk. USSR 86:382-400.

Vinogradov, M.E., A.F. Volkov, and T.N. Semenova. 1982. Amphipoda-Hyperiidae of the world's oceans. Keys to the fauna of the USSR, No. 132. Leningrad, 493 pp. (Smithsonian Institution Library, Washington, D.C. 632 pp.)

Wagler, E. 1926. Amphipoda, 2: Scinidae. Erg. Dtsch. Tiefsee-Exped. Valdivia 1898-1899. Bd. 20(6):317-446.

Woltereck, R. 1909. Amphipoda. Report on the scientific results of the expedition to the eastern tropical Pacific by the U.S. Fish. Comm. Steamer Albatross from October 1904 to March 1905. Bull. Mus. Comp. Zool. Harvard 52(9):145-168.

Yashnov, V.A. 1948. Order Amphipoda. Suborder Hyperiidea: In: N.S. Gaevskaya (ed.), Keys to the fauna and flora of the northern seas of the USSR. Sov. Nauka Press, Moscow, pp. 253-258.

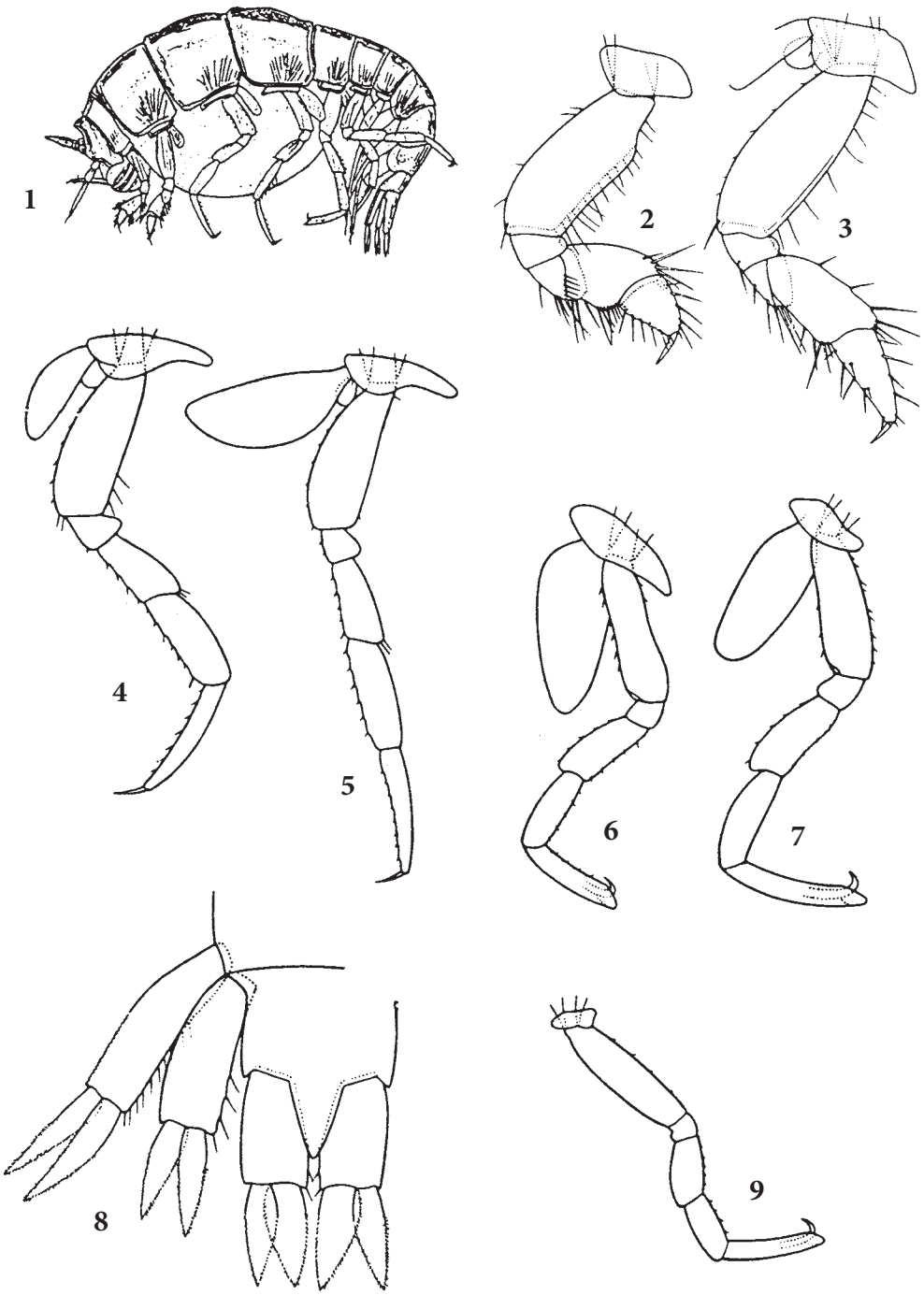


Plate I. *Lanceola clausi* Bovallius, 1885

Fig. 1 Female, whole animal.
Fig. 2 Pereopod 1.
Fig. 3 Pereopod 2.
Fig. 4 Pereopod 3.
Fig. 5 Pereopod 4.
Fig. 6 Pereopod 5.
Fig. 7 Pereopod 6.
Fig. 8 Urosome.
Fig. 9 Pereopod 7.

(1 from Sars 1900; 2-9 from Shoemaker 1945.)

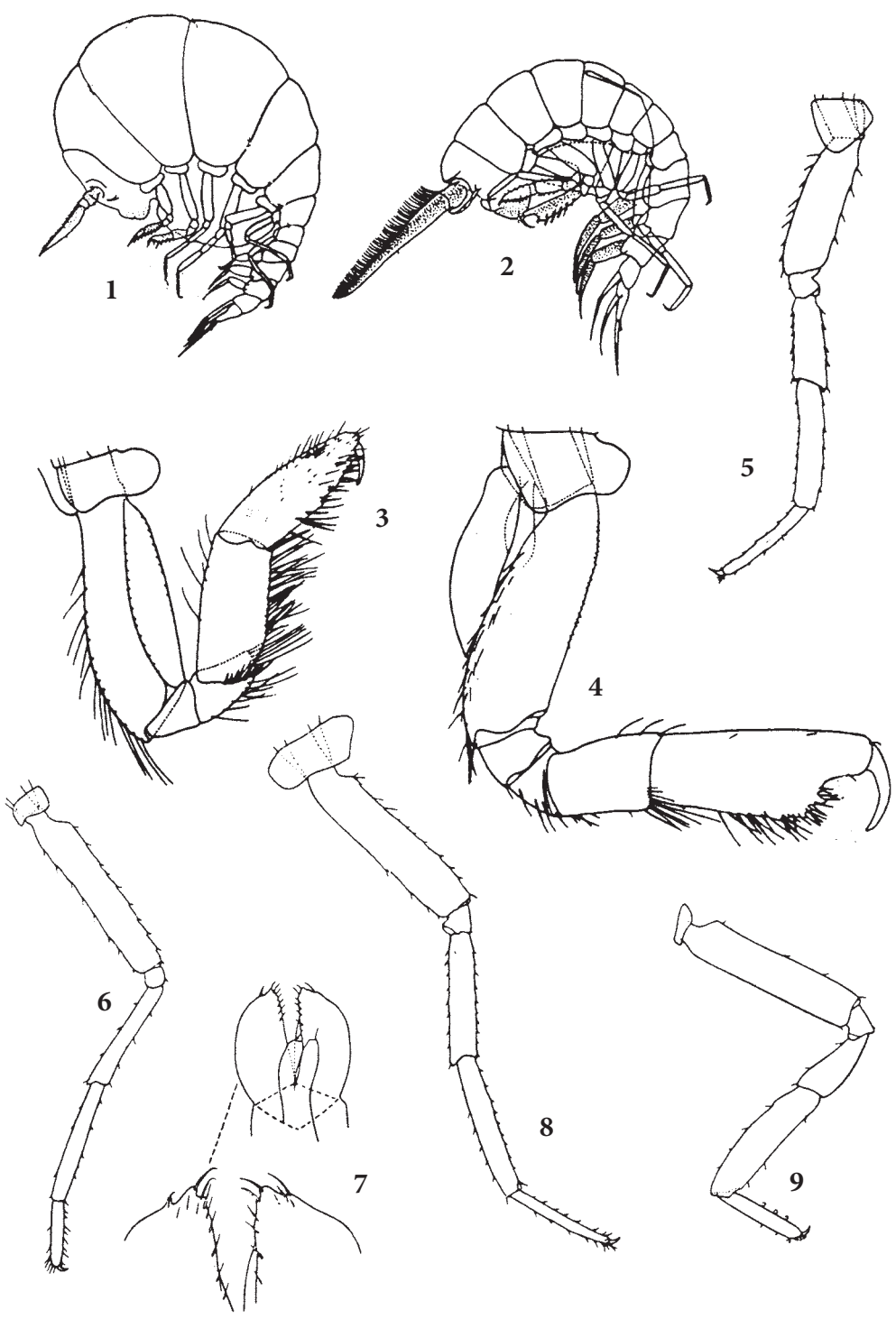


Plate II. *Mimonectes sphaericus* Bovallius, 1885

Fig. 1 Female, whole animal.
Fig. 2 Male, whole animal.
Fig. 3 Male pereopod 1.
Fig. 4 Male pereopod 2.
Fig. 5 Pereopod 3.
Fig. 6 Pereopod 6.
Fig. 7 Maxillipeds.
Fig. 8 Pereopod 5.
Fig. 9 Pereopod 7.

(1-2 from Woltereck 1909; 3-9 from Shoemaker 1945.)

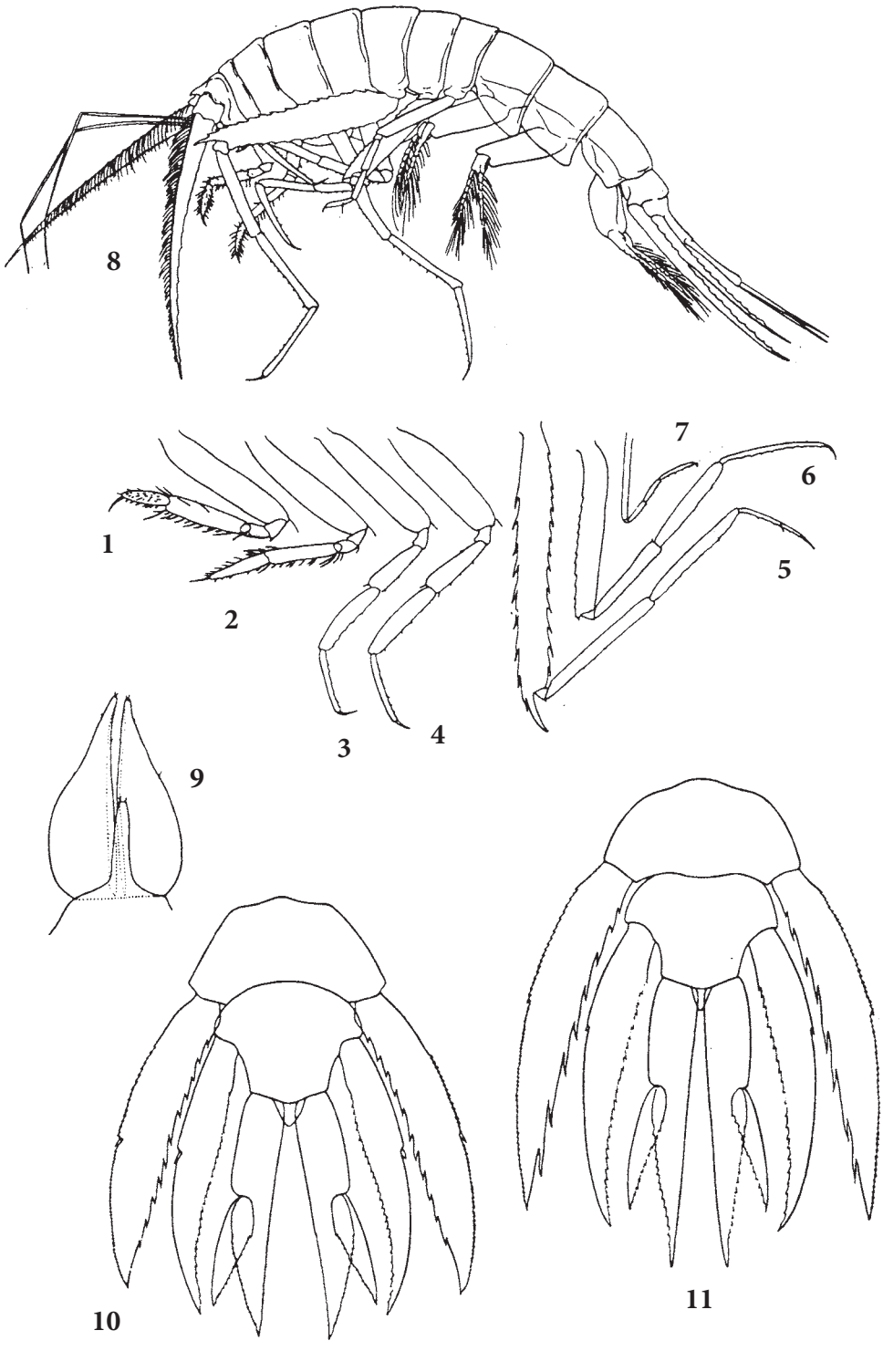


Plate III. *Scina borealis* (G.O. Sars, 1882)

Figs. 1-7 Pereopods 1-7.
Fig. 8 Female, whole animal.
Fig. 9 Maxillipeds.
Fig. 10 Male urosome.
Fig. 11 Female urosome.

(1-7, 9-11 from Wagler 1926. 8 original.)

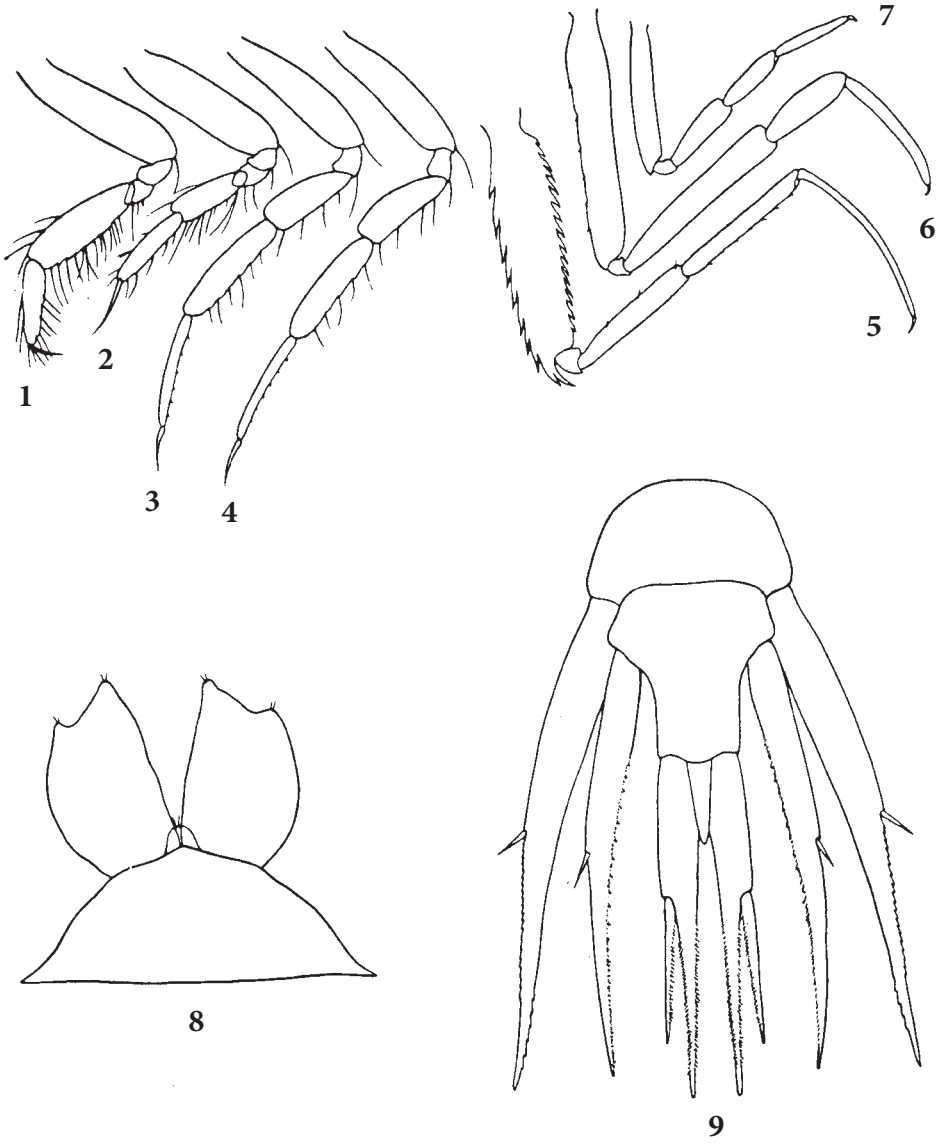


Plate IV. *Scina pusilla* Chevreux, 1919

Figs. 1-7 Pereopods 1-7.
Fig. 8 Maxillipeds.
Fig. 9 Urosome.

(1-9 from Wagler 1926.)

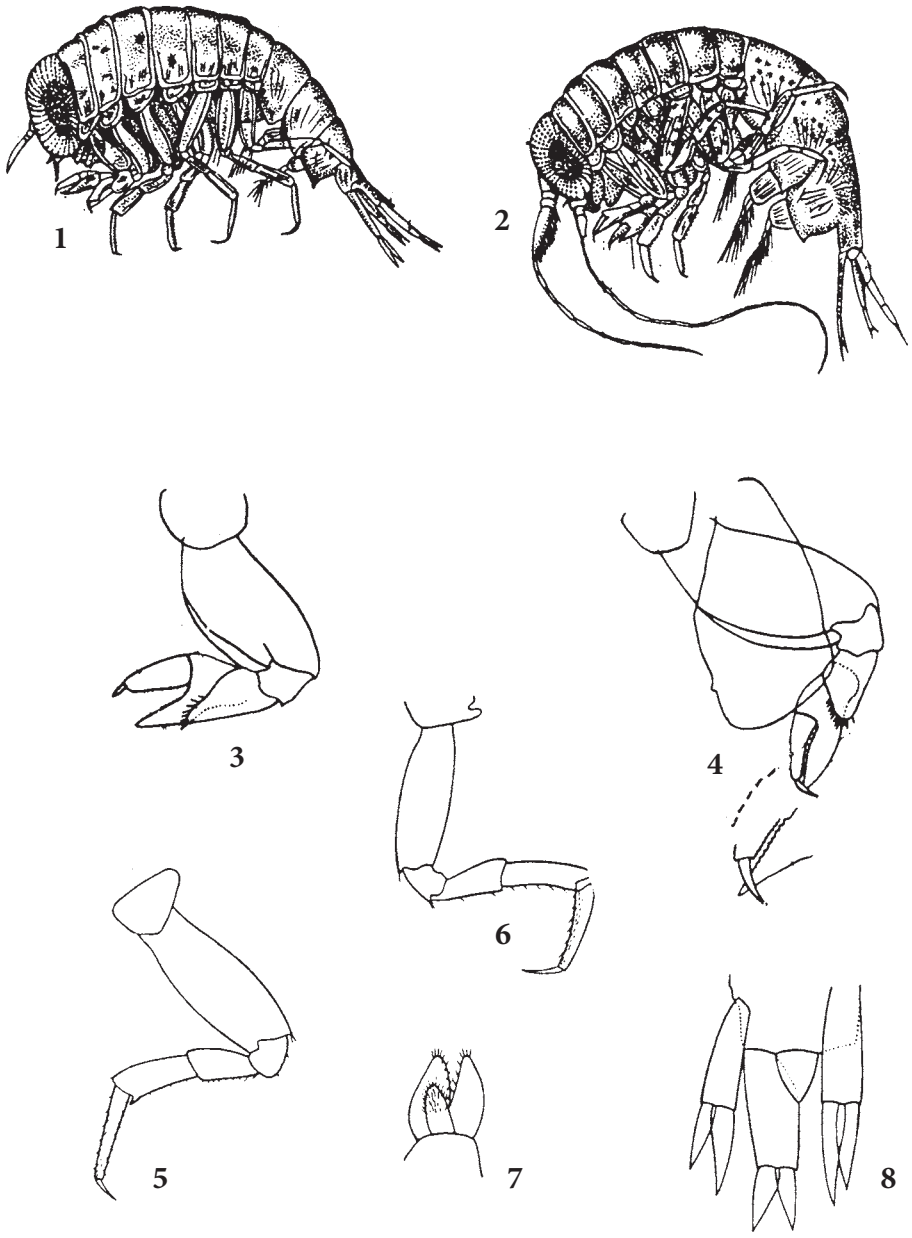


Plate V. *Hyperoche medusarum* (Krøyer, 1838)

Fig. 1 Female, whole animal.
Fig. 2 Male, whole animal.
Fig. 3 Pereopod 1.
Fig. 4 Pereopod 2.
Fig. 5 Pereopod 3.
Fig. 6 Pereopod 7.
Fig. 7 Maxillipeds.
Fig. 8 Urosome.

(1-2 from Sars 1890; 3-8 from Hurley 1955.)

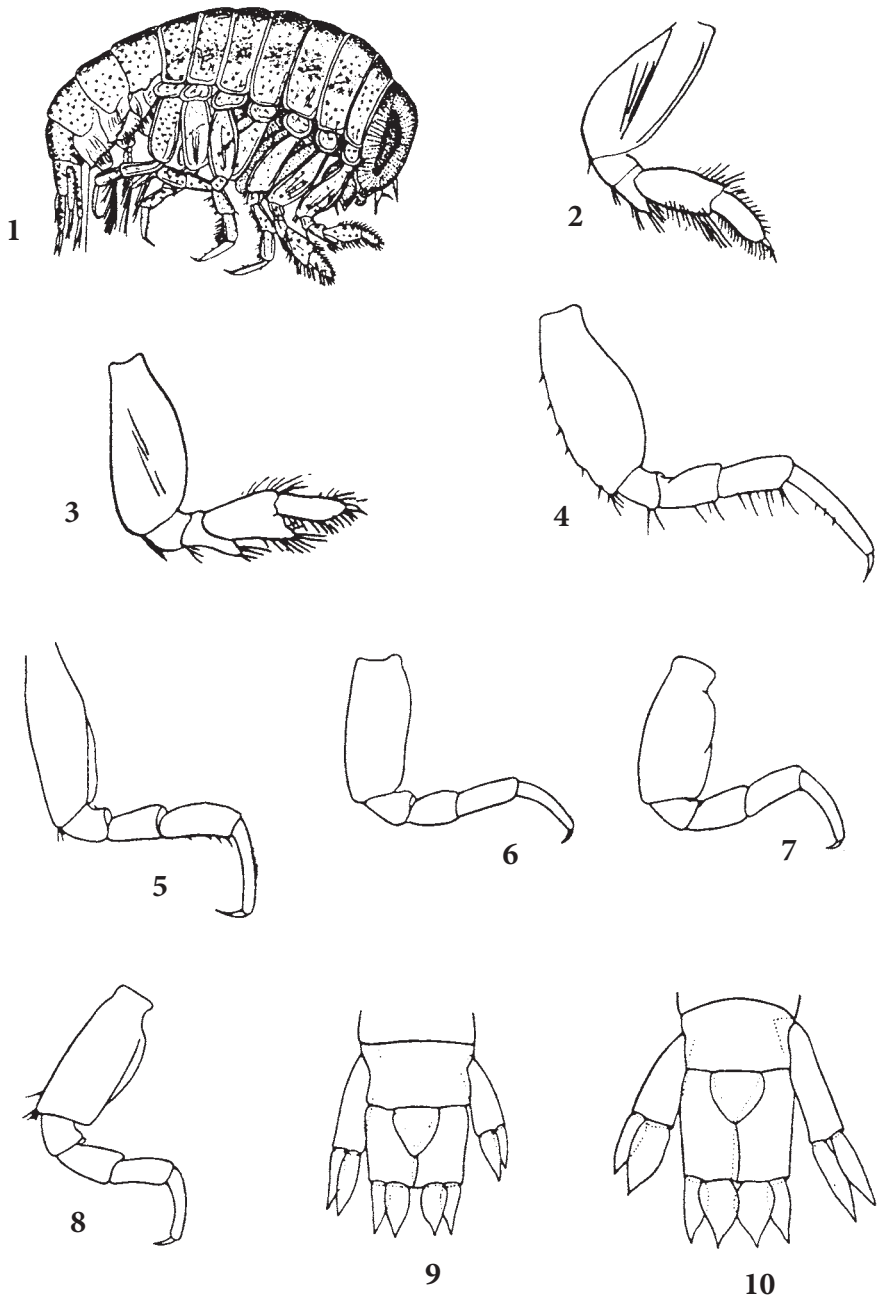


Plate VI. ***Hyperia medusarum*** **(Muller, 1776)**

Fig. 1 Female, whole animal.
Fig. 2 Pereopod 1.
Fig. 3 Pereopod 2.
Fig. 4 Pereopod 3.
Fig. 5 Pereopod 4.
Fig. 6 Pereopod 5.
Fig. 7 Pereopod 6.
Fig. 8 Pereopod 7.
Fig. 9 Female urosome.
Fig. 10 Male urosome.

(1-3 from Sars 1890; 4-10 from Bowman 1973.)

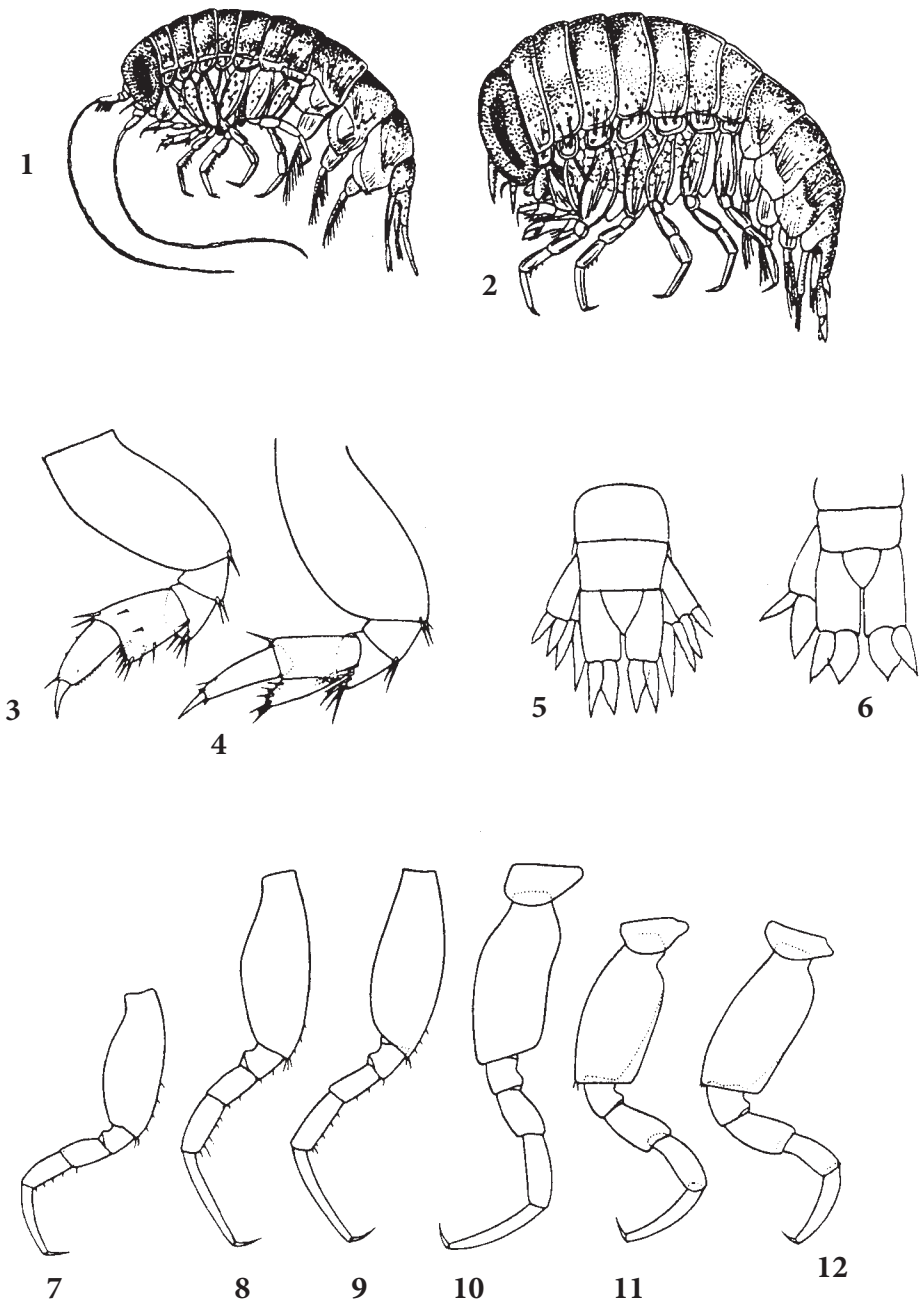


Plate VII. ***Hyperia galba*** **(Montagu, 1815)**

Fig. 1 Male, whole animal.
Fig. 2 Female, whole animal.
Fig. 3 Pereopod 1.
Fig. 4 Pereopod 2.
Fig. 5 Female urosome.
Fig. 6 Male urosome.
Fig. 7 Female pereopod 3.
Fig. 8 Male pereopod 3.
Fig. 9 Pereopod 4.
Fig. 10 Pereopod 5.
Fig. 11 Pereopod 6.
Fig. 12 Pereopod 7.

(1-2, 5-6 from Sars 1890; 3-4, 7-8 from Bowman and Gruner 1973.)

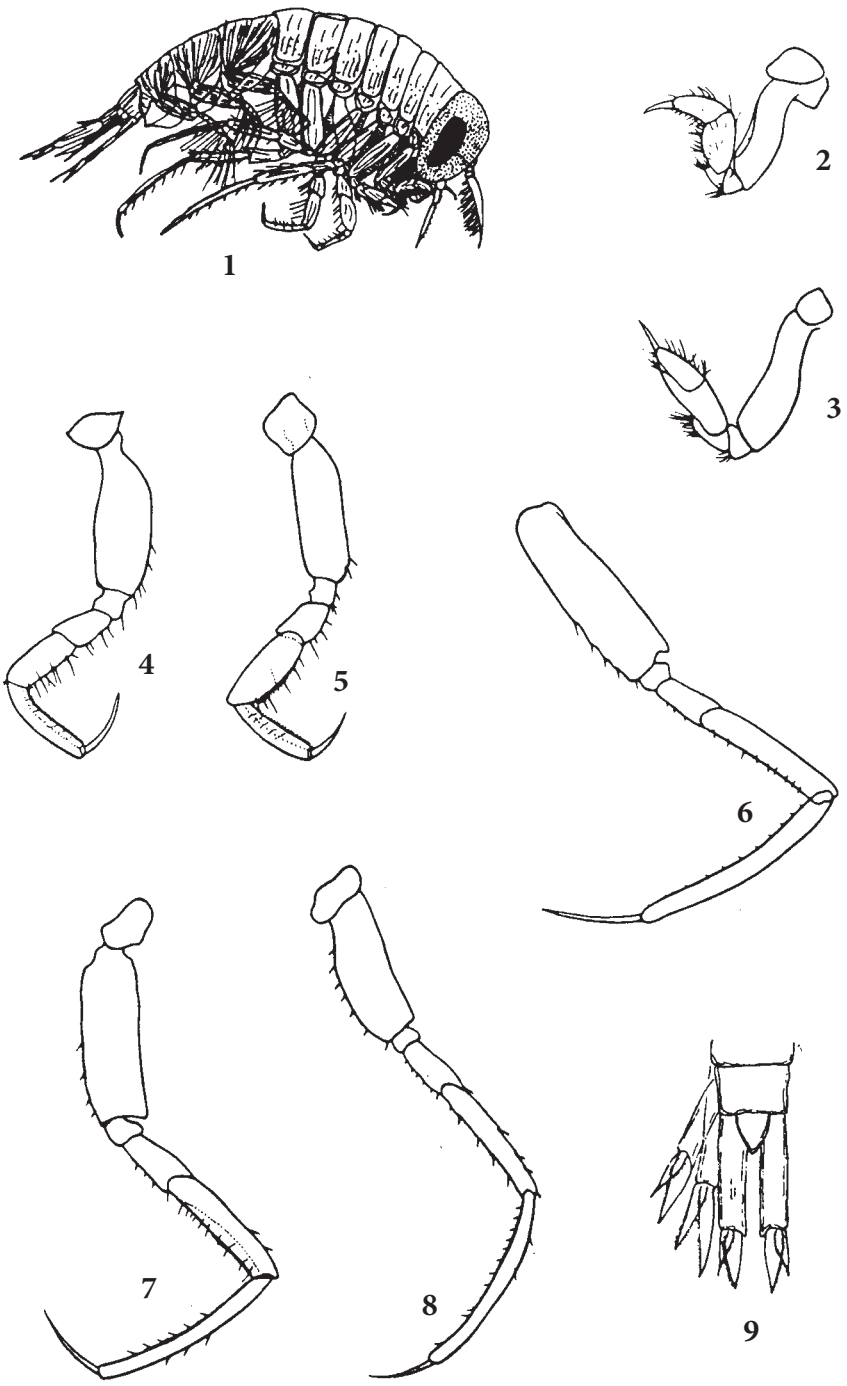


Plate VIII. *Themisto abyssorum* (Boeck, 1870)

Fig. 1 Female, whole animal.
Fig. 2 Pereopod 1.
Fig. 3 Pereopod 2.
Fig. 4 Pereopod 3.
Fig. 5 Pereopod 4.
Fig. 6 Pereopod 5.
Fig. 7 Pereopod 6.
Fig. 8 Pereopod 7.
Fig. 9 Urosome.

(1, 9 from Sars 1890; 2-8 from Barnard 1959.)

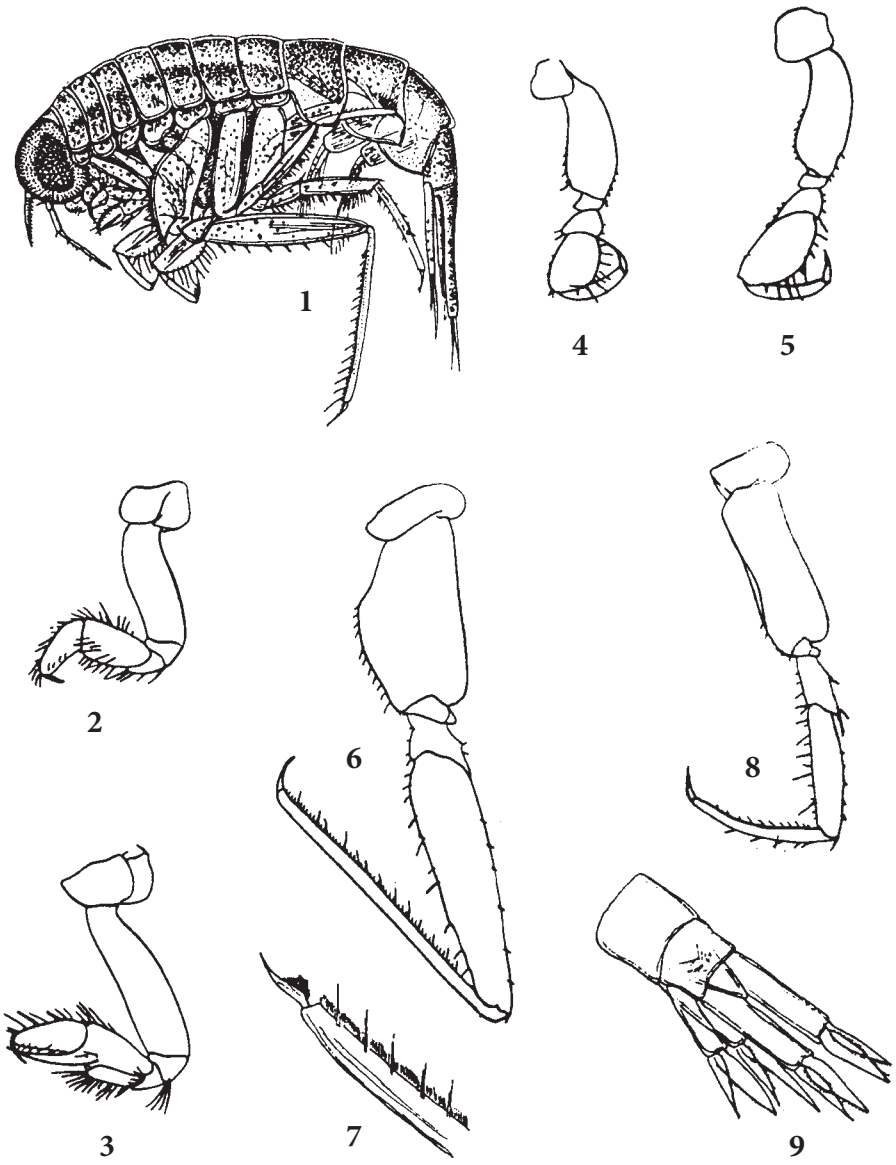


Plate IX. ***Themisto libellula*** **(Lichtenstein, 1822)**

Fig. 1 Female, whole animal.
Fig. 2 Pereopod 1.
Fig. 3 Pereopod 2.
Fig. 4 Pereopod 3.
Fig. 5 Pereopod 4.
Fig. 6 Pereopod 5.
Fig. 7 Distal end of pereopod 5.
Fig. 8 Pereopod 6.
Fig. 9 Urosome.

(1-6, 8-9 from Sars 1890; 7 from Dunbar 1963.)

Suborder Caprellidea (Order Amphipoda, Infraorder Caprellida)

S.V. Vassilenko, Ph.D., Senior Scientist
Zoological Institute St. Petersburg, Russian Academy of Sciences, St. Petersburg, Russia

Crustaceans of the infraorder Caprellida Leach, 1814 are free-living marine organisms adapted to climbing and crawling on various biological substrates (algae, seagrass, hydrozoans, soft sponges, etc.). Caprellids are observed in many marine communities and sometimes form dense populations.

The body of caprellids is stick-shaped, with long, cylindrical thoracic segments (pereonites). The body is differentiated into three regions: a short head (cephalon), consisting of five cephalic segments and one thoracic segment; a very elongated thorax (pereon), consisting of seven segments (or pereonites); and an abdomen, which is rudimentary, often consisting of an unsegmented appendage (Pl. I, II) or very shortened, consisting of five segments separated only by external sutures.

The anterior thoracic segment in caprellids is always fused to the head; its appendage is modified into a maxilliped. The first segment of the thorax proper is not the first thoracic segment, but the second segment (first pereonite). The first pereonite in the majority of genera is partially fused to the head; a suture is retained on the dorsal side between the head and first pereonite. The appendages of the first pereonite (gnathopods 1) are paired and retain the normal structure of the thoracic legs.

In the caprellid literature, the thoracic legs are numbered sequentially: following gnathopods 1 and 2 are pereopods 3-7, and the number of the thoracic legs corresponds to the number of the thoracic segment (pereonite) (Pl. I).

Eyes in all species, except abyssal species, are well developed, sessile (not stalked), faceted, and lateral.

Antenna 1 (antennule) is uniramous, consisting of a three-articulate peduncle and a multi-articulate flagellum. An accessory flagellum is absent, with the exception of a few genera with a rudimentary accessory flagellum consisting of one article (Pl. I, II). Antenna 2 (antenna) is uniramous, consisting of a four-articulate peduncle and flagellum; the lower edge of the peduncle and flagellum has pairs of short (but sometimes long) setae (Pl. I, II).

The upper lip is shaped like a rounded plate, slightly divided on top and situated over the mouth. The lower lip consists of two pairs of lobes: the inner lobes are fused at the base and the lower lateral edge of the outer lobes is drawn out into a mandibular process (Pl. I).

The mandibles are positioned beside the mouth and consist of the body and palp. Most genera have a cylindrical molar on the inner side of the body of the mandible but it can be absent; the mandible also has a denticulate incisor and a single accessory plate or multiple movable plates (lacinia mobilis); below the lacinia mobilis is a row of setae (setal row), often plumose. The mandibular palp can be absent (genus *Caprella*) (Pl. I) or present; in most genera the palp is three-articulate, and the terminal article has a few to numerous setae.

Maxilla 1 (or the maxillule) consists of a base with an outer lobe and a two-articulate palp (the inner lobe is completely reduced) (Pl. I). Maxilla 2 (or maxilla) consists of a base and two lobes which are rounded on the ends and with setae. The maxilliped is a single appendage consisting of two inner lobes, two outer lobes, and a four-articulate palp (Pl. I).

The thoracic appendages or pereopods are always paired; they are usually normally developed on the first, second, fifth, sixth, and seventh pereonites (thoracic segments); they are all uniramous and consist of

seven articles: the coxa (first small article), the basis (second article), ischium (third article), merus (fourth article), carpus (fifth article), propodus (sixth article), and claw or dactylus (seventh article) (Pl. II).

Gnathopods 1 and 2 or the first two pereopods are grasping appendages and subchelate; the subchelate appendage of gnathopods 1 and 2 is formed by the propodus (article 6) and dactylus (article 7): the propodus is widened and the dactylus forms the claw which articulates against the propodus; the edge of the propodus against which the dactylus lies is called the palm (Pl. II).

Gnathopod 1 is located on the anterior lateral side of pereonite 1 and displaced close to the mouthparts; it is fairly uniform in structure (Pl. II). Gnathopod 2 is almost always substantially larger and stouter than gnathopod 1, with a grasping type structure. The specific structure and size of gnathopod 2 in adult males is an important diagnostic character of the species (Pl. II).

Pereopods 3 and 4 can be normally developed (subfamily Phtisicinae) but are often modified (*Caprogammarus* and others) or completely reduced (*Caprella* and others). Pereopods 5-7 in the majority of genera develop normally, with subchelate claws. In many caprellid species the palm edge of the propodus has one pair of spines and the claw closes between them; they are therefore called locking spines (Pl. II). Locking spines are absent in some species. Pereopod 5 is usually normally developed but can be reduced in some genera. Pereopods 6 and 7 are normally developed and adapted for grasping and attachment to branches of the substrate.

Pleopods are reduced to unarticulated bumps with setae on the ends (family Paracercopidae) or are completely absent; pleopods are normally developed only in the family Caprogammaridae and consist of a peduncle and two rami. One or two pairs of uropods or abdominal legs are present, they are rudimentary, consisting of one or two articles (Pl. II) (they are usually absent in females of the genus *Caprella*).

The telson is absent. The gonopore in females is at the base of pereopod 5, in males at the base of pereopod 7. Two or three pairs of gills are present on pereonites 3 and 4 (Pl. I) or on pereonites 2, 3, and 4. Two pairs of brood plates on pereonites 3 and 4 form the brood pouch.

Caprellids undergo direct development. All embryonic development takes place in the brood pouch of the females. Juveniles hatch and leave the brood pouch essentially in adult form. Growth is accompanied by a number of molts. Adult males and females differ from one another. Sexual dimorphism is clearly expressed in size (males of all species are substantially larger than females), and in armament of the body, in the number of articles of the flagellum of antenna 1, in the structure of gnathopod 2, and the abdomen. The following keys are based mostly on adult male characters.

Caprellids are represented by fourteen species in the Arctic Ocean, in seven genera and two families.

Key to families of the infraorder Caprellida

1(2) Abdomen short, divided by external sutures into five segments . **1. Paracercopidae Vassilenko, 1968**
(two pairs of uropods present; pereopod 5 normally developed,
seven-articulate) . . . . . ***Cercops*** **Krøyer, 1843**

2(1) Abdomen in the shape of an unsegmented reduced appendage . . . . . **2. Caprellidae Leach, 1814**

Key to species of the genus *Cercops* (family Paracercopidae)

1(2) Dorsal teeth on pereonites 2-6, very small, low, reminiscent
of tubercles. Terminal article on mandibular palp with three
setae on tip. Anterior edge of merus, carpus, and propodus
of pereopods 5-7 with few setae . . . . . ***Cercops holboelli*** **Krøyer, 1843 (Pl. III)**

Length of males to 8 mm; length of females to 7.5 mm.
Pacific–western Atlantic boreal Arctic. Found in the Chukchi Sea near Point Barrow.
Depth 33-109 m. Reported from the hydroid *Sertularia*.

2(1) Dorsal teeth on pereonites 2-6, pointed, fairly high. Terminal article of mandibular palp with two setae on tip. Anterior edge of merus, carpus, and propodus of pereopods 5-7 with numerous short setae . . . . . ***Cercops dentatus*** **Vassilenko, 1972 (Pl. IV)**

Length of males to 9 mm; length of females to 13 mm.
Pacific high boreal. Found in the Chukchi Sea near Point Barrow.
Sublittoral species. Lives at depths of 28-239 m, on hydroids. Found on sediments of rock, pebbles, gravel, sand, shell, or clay.

Key to subfamilies of the family Caprellidae

1(2) Pereonite 1 not fused to the head, suture present on the lateral surface between the head and pereonite 1. . . . . **Aeginellinae Vassilenko, 1968**

2(1) Pereonite 1 fused to head, suture absent from the side between head and pereonite 1 . . . . . **Caprellinae Leach, 1814**

Key to genera and species of the subfamily Aeginellinae

1(2) Three pairs of gills present, on pereopods 2-4. Antenna 1 with rudimentary accessory flagellum in the form of a single small article . . . . . ***Protellina*** **Stephensen, 1944**

(Pereopods 5 substantially shorter and thinner than pereopods 6 and 7; propodus linear, claw very short, spine-like setae on anterior edge of merus, carpus and propodus absent) . . . ***Protellina arctica*** **Vassilenko, 1974 (Pl. V)**

Length of males to 21 mm, length of females with oostegites to 10.5 mm.
Arctic bathyal. Kara Sea (Voronin Canyon), continental slope to the north Schmidt Island (Severnaya Zemlya) and to the north of the Laptev Sea.
Depth 698-1682 m. On sand, silt, and silty clay.

2(1) Two pairs of gills present, on pereopods 3 and 4. Antenna 1 lacking rudimentary accessory flagellum.

3(4) One pair of uropods present; uropods uniarticulate (in males and females). . . . . ***Aeginella*** **Boeck, 1861**

(Body with paired dorsal spines [up to three] and unpaired spine-like teeth, not more than one on the head and dorsal side of pereonites; pereopods 5-7 similar in structure). . . . . ***Aeginella spinosa*** **Boeck, 1861 (Pl. VI)**

Length of males to 18 mm; length of females to 14 mm.
Atlantic high boreal Arctic. The most eastward report is from the Barents Sea.
Depth 30-1206 m. On algae and hydroids.

4(3) Two pairs of uropods present; anterior pair is two-articulate, posterior pair is uniarticulate . . . . . ***Aeginina*** **Norman, 1905**

(Body with numerous dorsal and lateral, paired and nonpaired teeth and spine-like projections) . . . . . ***Aeginina longicornis* (Krøyer, 1843) (Pl. VII)**

Length of males 40-54 mm; length of females 20-34 mm.
Atlantic widespread boreal Arctic.
Depth 18-368 m, usually 18-80 m. Lives on algae, hydroids, and bryozoans.

Key to genera and species of the subfamily Caprellinae

1(2) Mandible with three-articulate palp, pereopods 3 and 4 rudimentary, uniarticulate (uropods absent) . . . . . ***Tritella* Mayer, 1890**

(Dorsal surface of body without teeth, anterior lateral teeth on pereonites 2, 3, and 4; gnathopod 2 is articulated to the anterior part of pereonite 2, a bidentate coxal plate is present above gnathopod 2 is attachment) . . . . . ***Tritella pilimana* Mayer, 1890 (Pl. VIII)**

Length of males 7-11 mm; length of females 7-9 mm.
Pacific widespread boreal Arctic. In the Arctic Ocean it has been reported near Bennett Island, to the north of Novosibirsk Islands, and in eastern Chukchi Sea.
Depth 35-195 m. On hydroids and soft sponges.

2(1) Mandibles lacking palps, pereopods 3 and 4 completely absent.

3(4) Abdomen of males and females with one pair of uniarticulate uropods . ***Metacaprella* (Mayer, 1903)**
(Only one species of this genus is found in the Arctic Ocean.)

4(3) Abdomen of males with one pair of uniarticulate uropods; abdomen of females lacking uropods . . . . . ***Caprella* Lamarck, 1801**

Key to species of genera *Metacaprella* and *Caprella*

(Genera *Metacaprella* and *Caprella* are only distinguishable as males; therefore the key is presented for both genera.)

1(6) Antenna 1 relatively short, not more than half the total length of the body.

2(3) Head and all pereonites with numerous tubercles and bumps. . ***Caprella carina* Mayer, 1903 (Pl. IX)**

Length of males to 27 mm; length of females to 25 mm.
Arctic circumpolar.
Inhabit upper sublittoral at depths of 4-43 m, on hydroids.

3(2) Head and pereonites 2, 3, and 4 are smooth or with unpaired tubercles and teeth.

4(5) Head and pereonites 1-7 smooth. (Anterior end of head bluntly angular) . . . . . ***Caprella drepanochir* Mayer, 1890 (Pl. X)**

Length of males to 23 mm; length of females to 20 mm.
Pacific widespread boreal. Found in the Chukchi Sea (Kotzebue Sound, Eschscholtz Bay).

Sublittoral species inhabiting depths of 9-303 m. On sponges, hydroids, and rocky and sandy sediments.

5(4) Head and pereonites 1-7 with bumps or tubercles. Armament of head and pereonites variable (upper side of head with barely noticeable bumps or with round or pointed denticles, which are sometimes divided on top; pereonites 2, 3, and 4 smooth or with unpaired tubercles and denticles; pereonites 5-7 often with one or two pairs of teeth. . . . . ***Caprella septentrionalis* Krøyer, 1838 (Pl. XI)**

Length of males to 33 mm; length of females to 23 mm.
Widespread boreal Arctic.
Inhabits the littoral and upper sublittoral to depths of 30 m; sometimes descends to depths of 120 m. Lives on algae (*Fucus*, *Ascophyllum*, *Laminaria*, and others) and on hydroids.

6(1) Antenna 1 long, substantially longer than half the length of the whole body.

7(8) Head and pereonites with numerous pointed teeth of various sizes (the propodus and inner edge of the claw on gnathopod 2 of males with numerous hairs). . . . . .***Metacaprella horrida* (Sars, 1877) (Pl. XII)**

Length of males to 34 mm; length of females 18-20 mm.
Arctic circumpolar.
Depths 43-1359 m. Hydroids and bryozoans, on silty and silty-sandy sediments with rocks.

8(7) Head and pereonites smooth or with individual unpaired or paired tubercles or teeth (not more than four pairs).

9(12) Length of gills usually greater or equal to half the length of the respective pereonites 3 and 4.

10(11) Flagellum of antenna 1 longer than peduncle. Gnathopod 2 attached to center of pereonite 2. . . . . .***Caprella striata* Mayer, 1903 (Pl. XIII)**

Length of males 20-30 mm; length of females 10-30 mm.
Pacific high boreal Arctic. It is reported in the Arctic from the Chukchi and Beaufort seas.
Sublittoral species, inhabiting depths of 7-150 m.

11(10) Flagellum of antenna 1 shorter than peduncle. Gnathopod 2 attached posterior of middle of pereonite 2. (Peduncle of antenna 1 on large males with numerous hairs). . . . . .***Caprella linearis* (Linnaeus, 1767) (Pl. XIV)**

Length of males to 46 mm; length of females to 23 mm.
Widespread boreal Arctic circumpolar.
Often reported at depths of 20-200 m, sometimes descends to 950 m. Lives on algae, hydroids, and sponges, also reported on echinoderms.

12(9) Length of gills substantially less than half the length of the corresponding pereonites 3 and 4.

13(14) Head smooth or with one pair of teeth. Pereonites smooth on the dorsal side or with 1-2 pairs of very small, barely

noticeable, tubercles or denticles. Abdomen relatively broad, large, clearly visible between the articulations of pereopod 7 . . . . . ***Caprella microtuberculata* Sars, 1880 (Pl. XV)**

Length of males to 30 mm; length of females 15-20 mm.
Atlantic high boreal Arctic. Seen in the Arctic from northeastern Greenland and Spitsbergen east to the Kara Sea.
Depth 128-329 m. On hydroids.

14(13) Head with one pair of pointed teeth. Dorsal side of pereonites with 1-4 clearly distinguishable pointed teeth. Abdomen very narrow, small, barely visible between the articulation points of pereopod 7. . . . . ***Caprella dubia* Hansen, 1887 (Pl. XVI)**

Atlantic high boreal Arctic. Reported in the Arctic from northeastern Greenland, Baffin Island, and Franz Joseph Land.
Depth 62-398 m. On hydroids.

Literature

Laubitz, D.R. 1970. Studies on the Caprellidae (Crustacea, Amphipoda) of the American North Pacific. Natl. Mus. Can. Publ. Biol. Oceanogr. No. 1. 89 pp.

Laubitz, D.R. 1972. The Caprellidae (Crustacea: Amphipoda) of Atlantic and arctic Canada. Natl. Mus. Can. Publ. Biol. Oceanogr. No. 4. 82 pp.

Mayer, P. 1890. Die Caprelliden Fauna und Flora des Golfes von Neapel. Nachtrag zur Monogr. Bd. 17. 157 pp. 7 figs.

Mayer, P. 1903. Die Caprellidae der Siboga-Expedition. Siboga Exped. Bd. 34. 160 pp. 10 pl.

McCain, J. 1968. The Caprellidae (Crustacea: Amphipoda) of the western North Atlantic. U.S. Natl. Mus. Bull. Vol. 278. 147 pp.

Sars, G.O. 1877. Prodromus descriptionis Crustaceaorum et Pycnogonidarum, quae in expeditione norvegica anno 1876, observavit. Arch. Math. Naturvidensk. Kristiania. Vol. 2, pp. 237-271.

Sars, G.O. 1880. Crustacea et Pycnogonida nova in itinere 2 et 3 expeditionis Norvegicae anno 1877 et 78 collecta. Arch. Math. Naturvidensk. Kristiania. Vol. 4, pp. 427-476.

Stephensen, K. 1944. The zoology of East Greenland. Amphipoda. Meddelelser Grønland. 121(14):1-165.

Vassilenko, S.V. 1968. On the systematics and main developmental lineages of the family Caprellidae (Amphipoda, Caprellidea). Dokl. Akad. Nauk. USSR 183(6):1461-1464.

Vassilenko, S.V. 1974. Caprellids (sea goats) of the seas of the USSR and adjacent waters. Keys to the fauna of the USSR. Izd. ZIN AN USSR. Vol. 107. 287 pp.

Vassilenko, S.V. 2006. Caprellids (sea goats). In: Biota of Russian waters of the Japan Sea. Vol. 4. 198 pp.

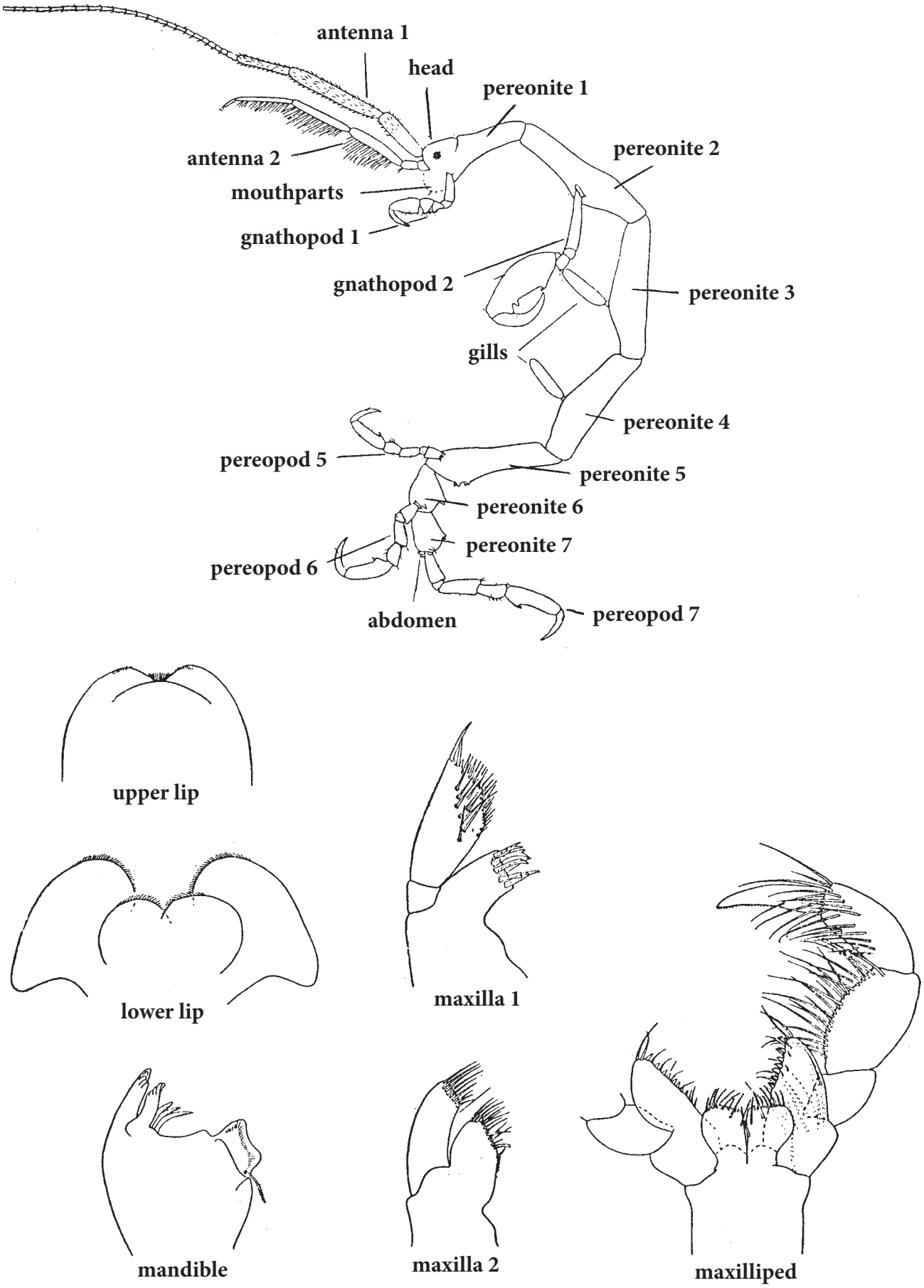


Plate I. ***Caprella linearis*** **(Linnaeus, 1767): external morphology a male and mouthparts.**

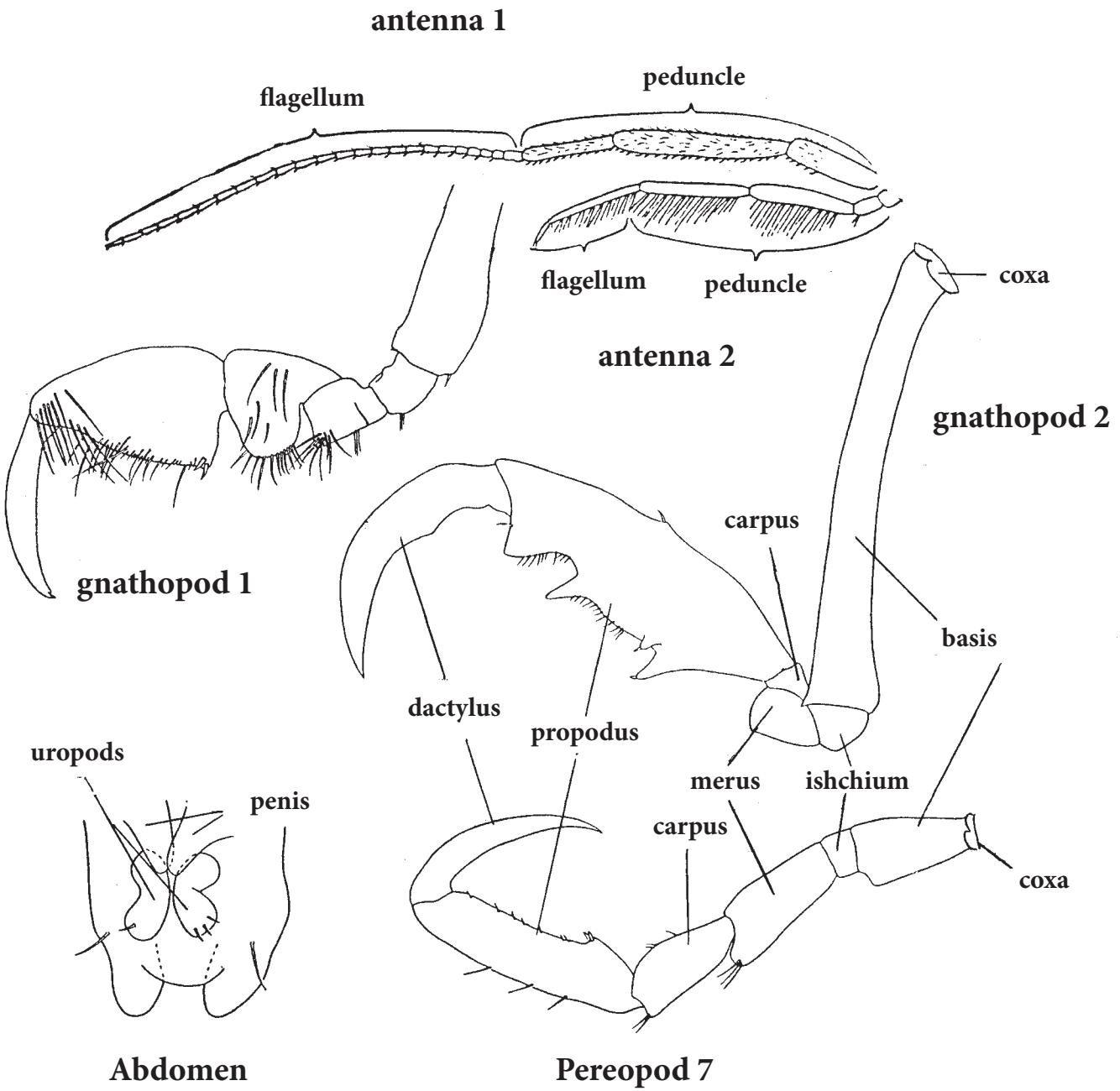


Plate II. ***Caprella linearis*** **(Linnaeus, 1767): antennae, gnathopods, pereopod 7, and abdomen of male.**

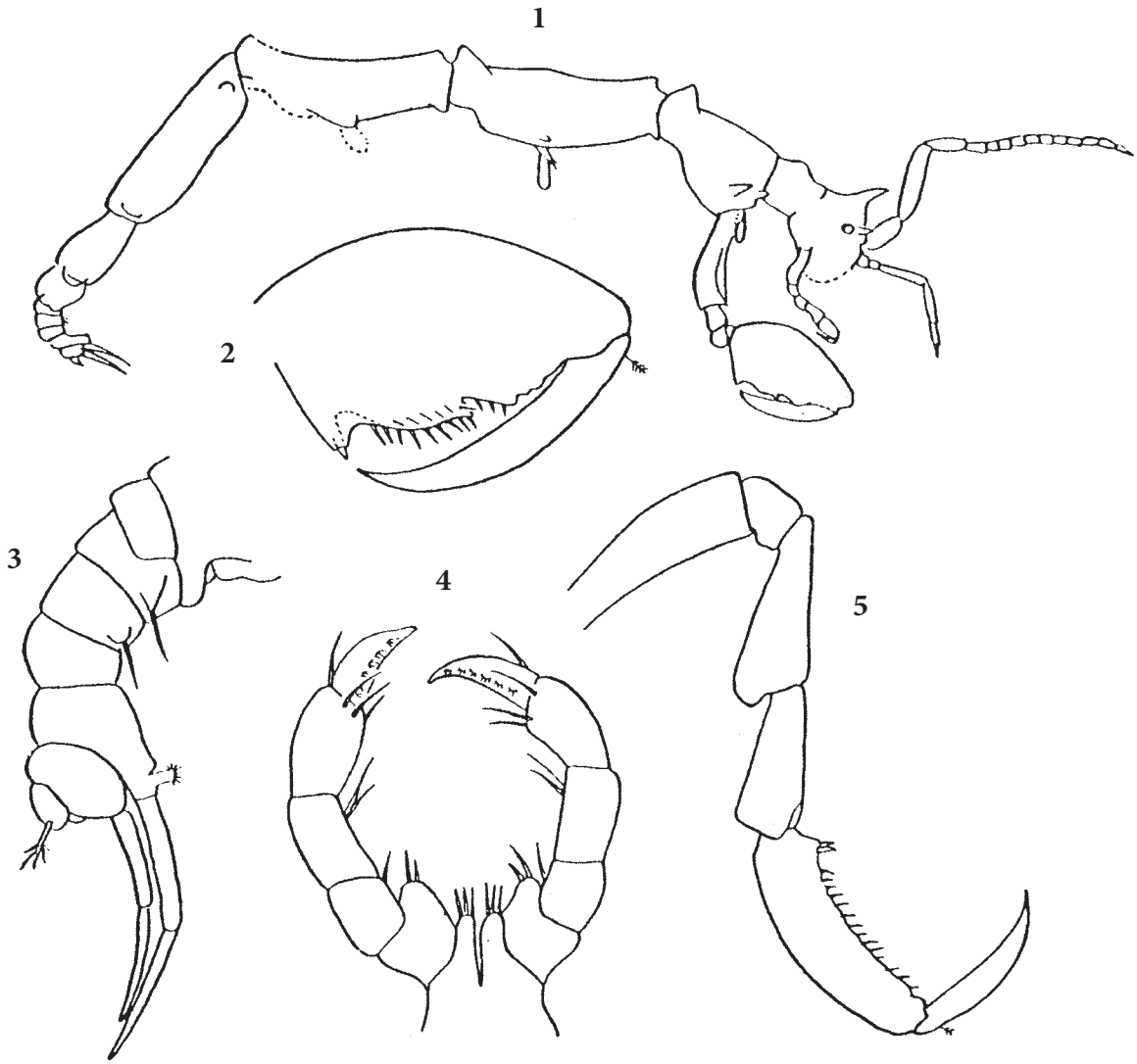


Plate III. ***Cercops holboelli*** **Krøyer, 1843**

Male

Fig. 1 Lateral view.
Fig. 2 Propodus and dactylus of gnathopod 2.
Fig. 3 Abdomen.
Fig. 4 Maxilliped.
Fig. 5 Pereopod 7 (from Mayer 1903).

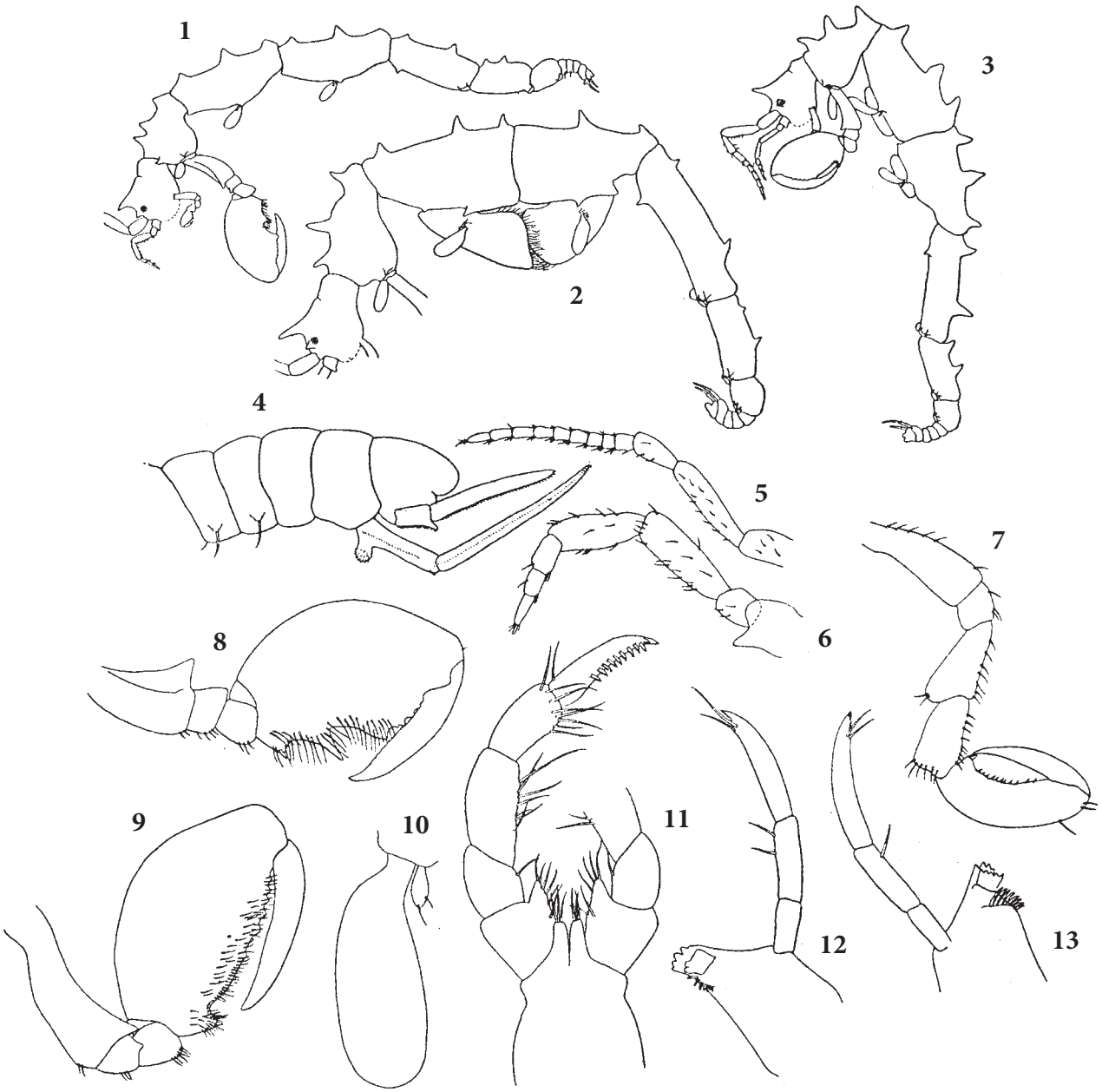


Plate IV. *Cercops dentatus* Vassilenko, 1972

Male

Fig. 1 Lateral view.
Fig. 4 Abdomen.
Fig. 5 Antenna 1.
Fig. 6 Antenna 2.
Fig. 7 Pereopod 7.
Fig. 8 Gnathopod 2.
Fig. 10 Gill and pereopod 3.
Fig. 11 Maxilliped.
Figs. 12, 13 Mandibles.

Female

Fig. 2 Female with brood sac, lateral view.
Fig. 3 Female with buds of oostegites, lateral view.
Fig. 9 Gnathopod 2.

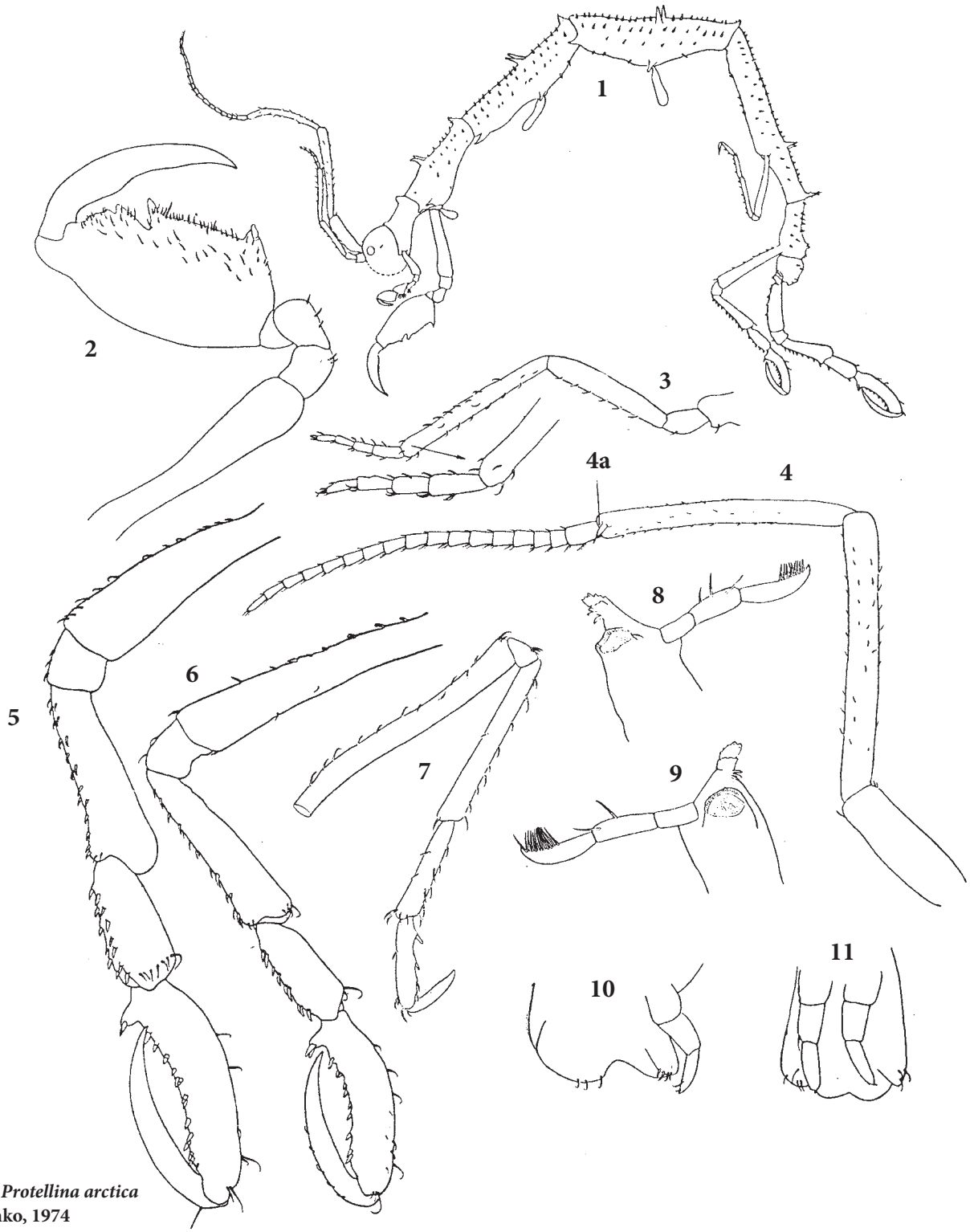


Plate V. *Protellina arctica* Vassilenko, 1974

Male

Fig. 1 Lateral view.
Fig. 2 Gnathopod 2.
Fig. 3 Antenna 2.
Fig. 4 Antenna 1.
Fig. 4a Uniarticulate accessory flagellum.
Fig. 5 Pereopod 7.
Fig. 6 Pereopod 6.
Fig. 7 Pereopod 5.
Figs. 8, 9 Mandibles.
Fig. 10 Abdomen.

Female

Fig. 11 Abdomen.

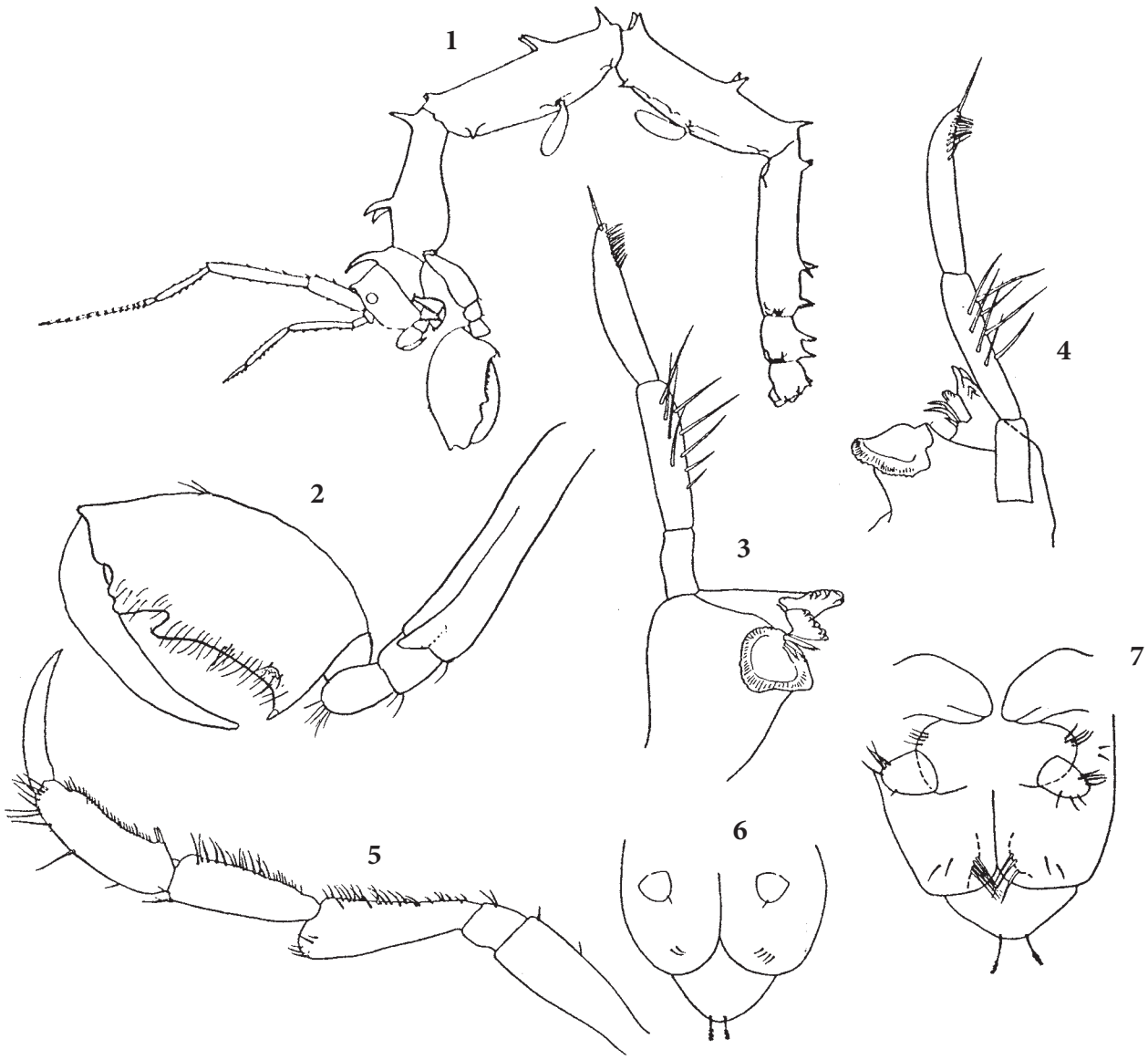


Plate VI. ***Aeginella spinosa*** **Boeck, 1861**

Male
Fig. 1 Lateral view.
Fig. 2 Gnathopod 2.
Figs. 3, 4 Mandibles.
Fig. 5 Pereopod 7.
Fig. 7 Abdomen.

Female
Fig 6 Abdomen.

Plate VII. ***Aeginina longicornis*** **(Krøyer, 1843)**

Male
Fig. 1 Lateral view.
Fig. 3 Pereopod 7.
Fig. 4 Antenna 2.
Fig. 5 Gnathopod 2.
Fig. 6 Abdomen.
Figs. 8, 9 Mandibles.

Female
Fig. 2 Lateral view.
Fig. 7 Abdomen.

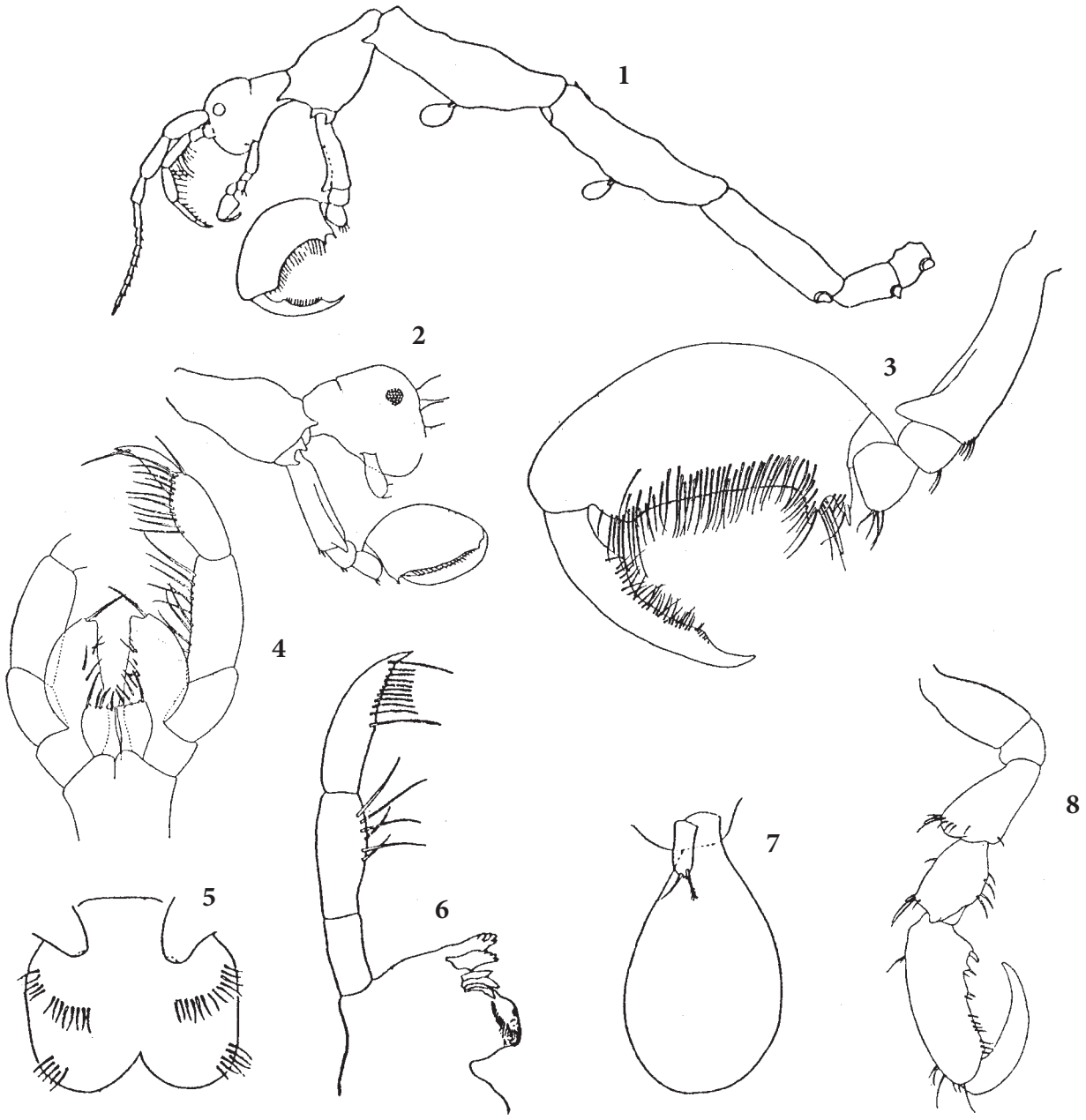


Plate VIII. *Tritella pilimana* Mayer, 1890

Male
Fig. 1 Lateral view.
Fig. 2 Head and first two pereonites.
Fig. 3 Gnathopod 2.
Fig. 4 Maxilliped.
Fig. 5 Abdomen.
Fig. 6 Mandible.

Female
Fig. 7 Gill and pereopod 4.
Fig. 8 Pereopod 5.

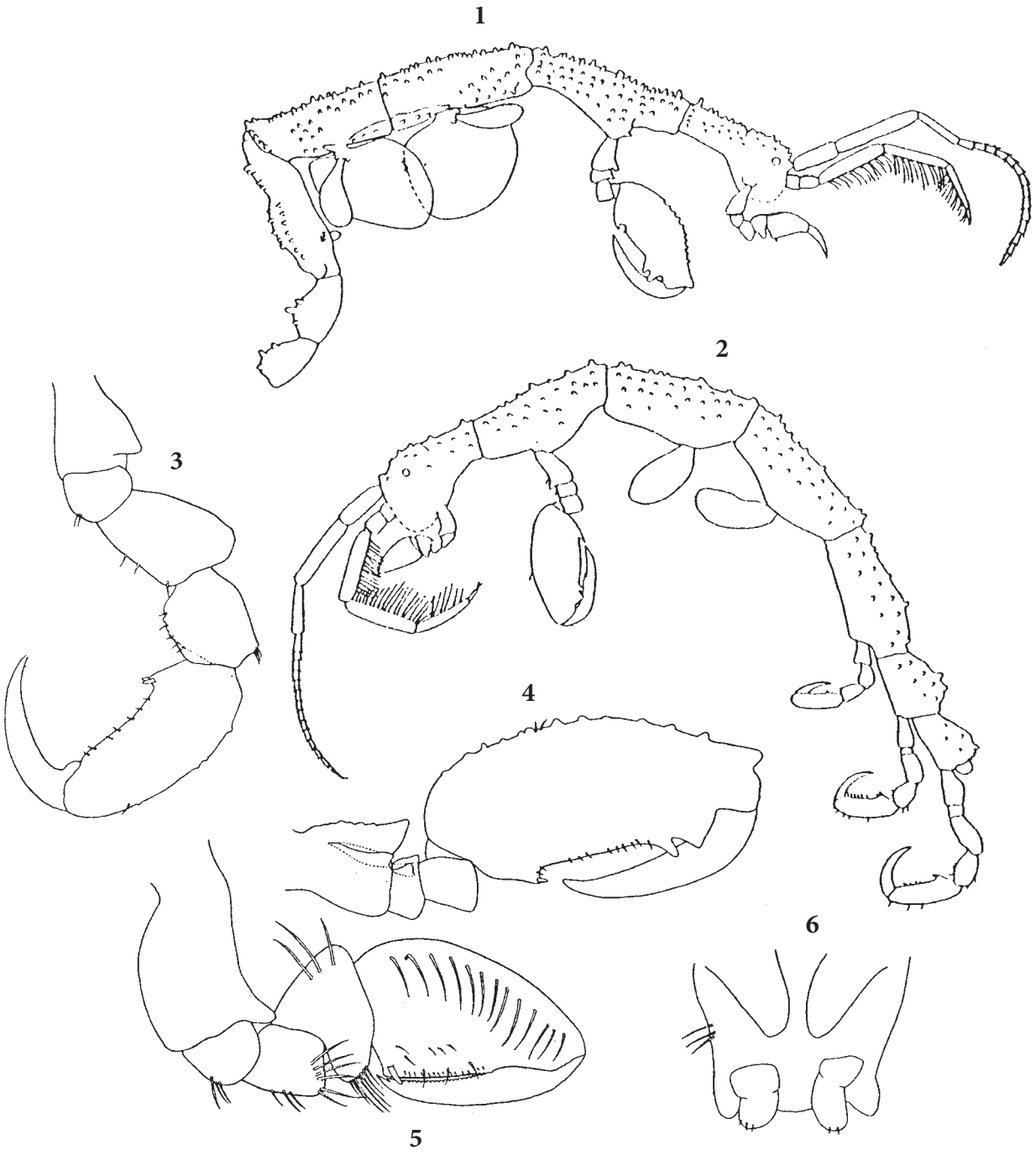


Plate IX. *Caprella carina* Mayer, 1903

Female
Fig. 1 Lateral view.

Male
Fig. 2 Lateral view.
Fig. 3 Pereopod 6.
Fig. 4 Gnathopod 2.
Fig. 5 Gnathopod 1.
Fig. 6 Abdomen.

Plate X. *Caprella drepanochir* Mayer, 1890

Male
Fig. 1 Lateral view.
Fig. 2 Antenna 1.
Fig. 3 Antenna 2.
Fig. 4 Gnathopod 2.
Fig. 6 Pereopod 6.
Fig. 7 Pereopod 7.

Female
Fig. 5 Gnathopod 2.

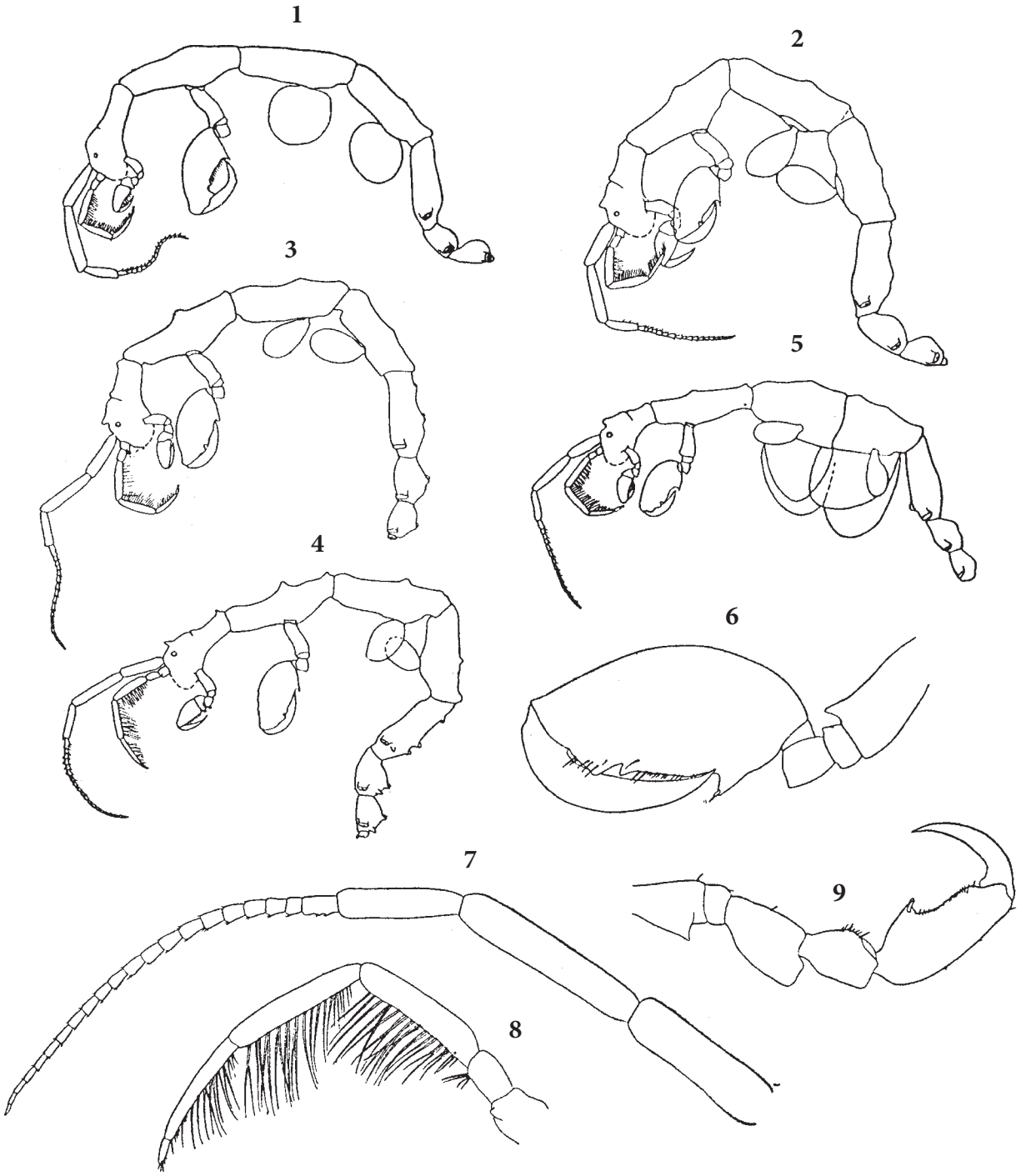


Plate XI. ***Caprella septentrionalis*** **Krøyer, 1838**

Male: Lateral view of specimens from various collection sites

Fig. 1 Barents Sea.
Fig. 2 Novaya Zemlya.
Fig. 3 Spitsbergen.
Fig. 4 Northern Norway.

Male

Fig. 6 Gnathopod 2.
Fig. 7 Antenna 1.
Fig. 8 Antenna 2.
Fig. 9 Pereopod 7.

Female

Fig. 5 Lateral view.

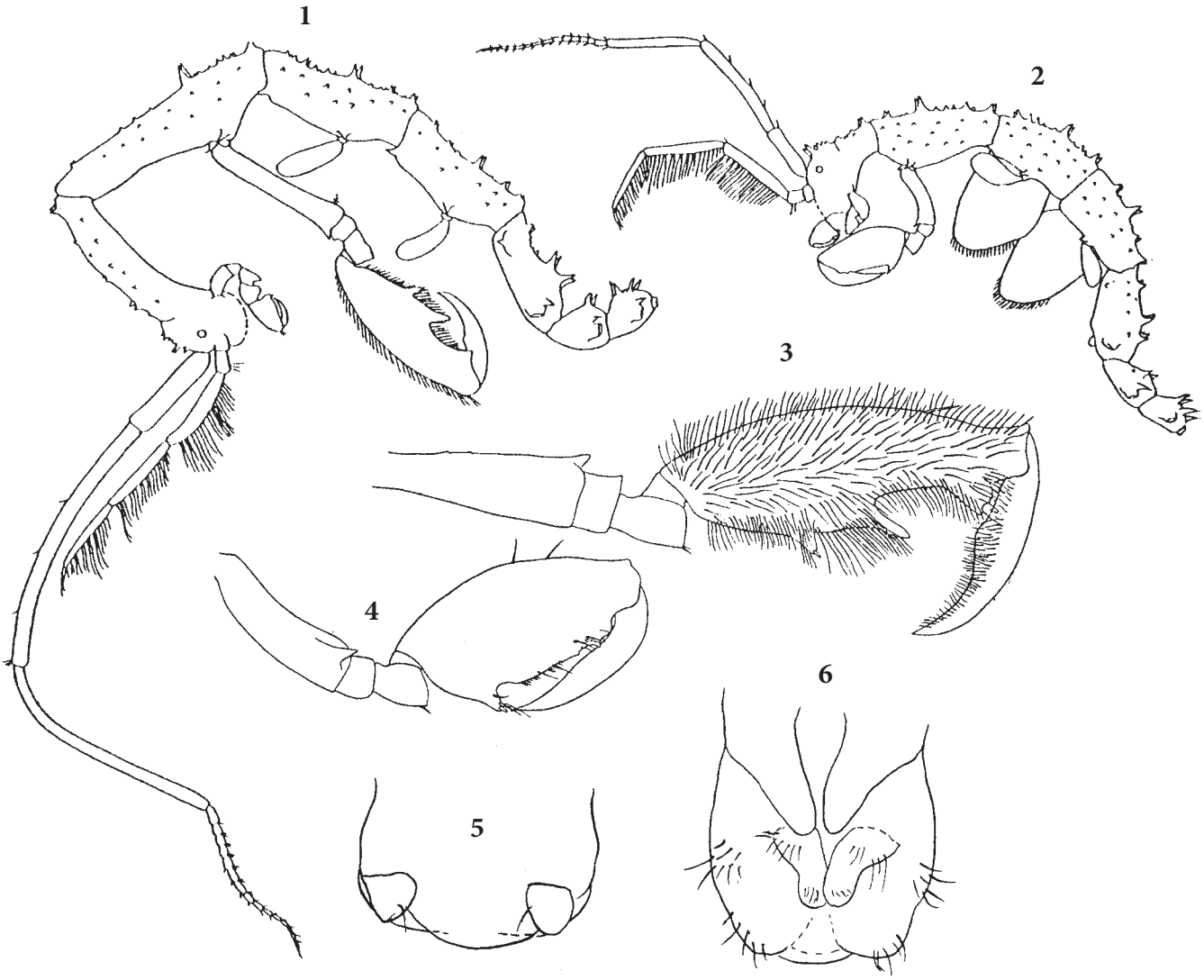


Plate XII. *Metacaprella horrida* (Sars, 1877)

Male
Fig. 1 Lateral view.
Fig. 3 Gnathopod 2.
Fig. 6 Abdomen.

Female
Fig. 2 Lateral view.
Fig. 4 Gnathopod 2.
Fig. 5 Abdomen.

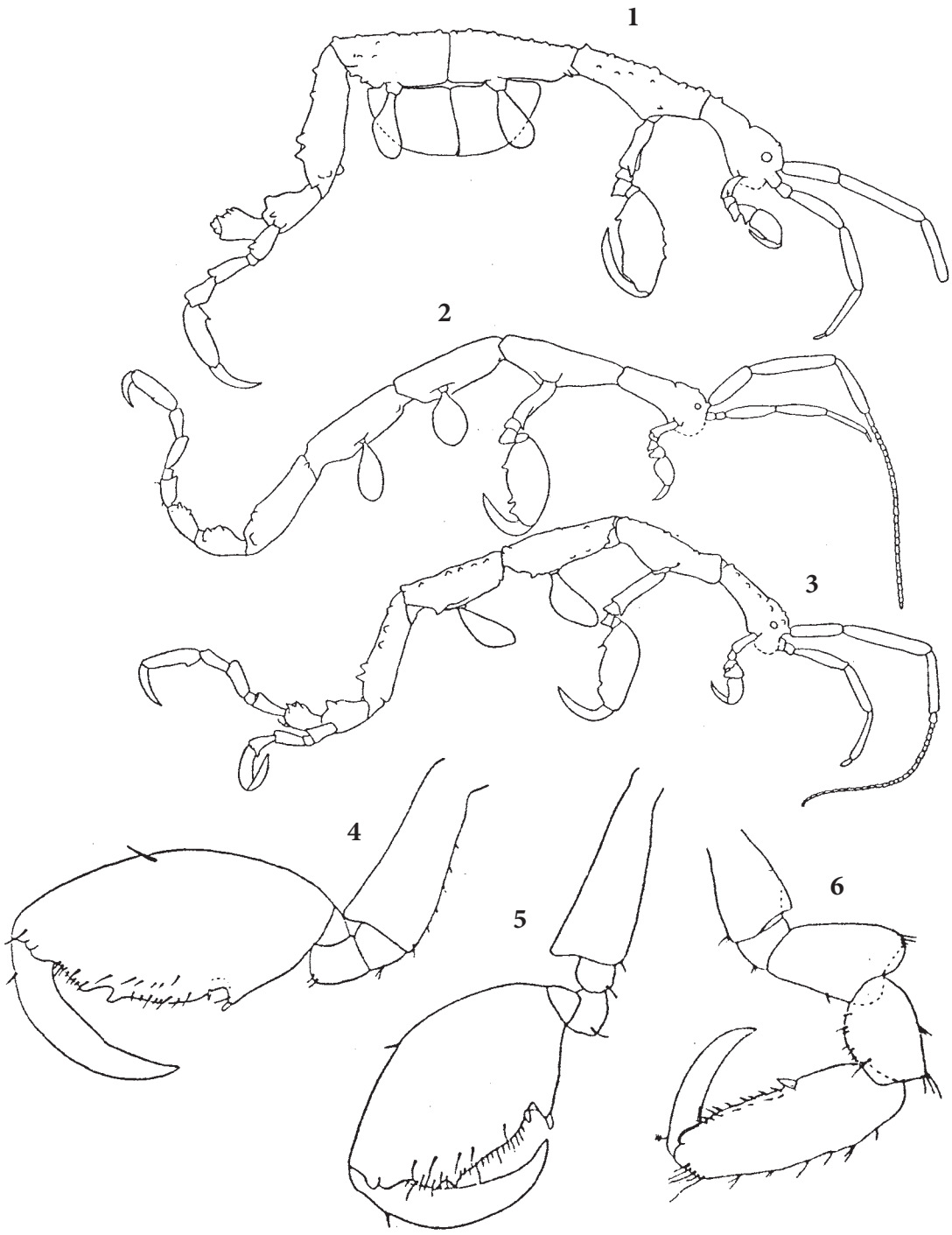


Plate XIII. *Caprella striata* Mayer, 1903

Female
Fig. 1 Lateral view (from Mayer 1903).
Fig. 5 Gnathopod 2 (from Laubitz 1970).

Male, lateral view
Fig. 2 Typical form.
Fig. 3 Glacialis form (from Mayer 1903).

Male
Fig. 4 Gnathopod 2.
Fig. 6 Pereopod 7 (from Laubitz 1970).

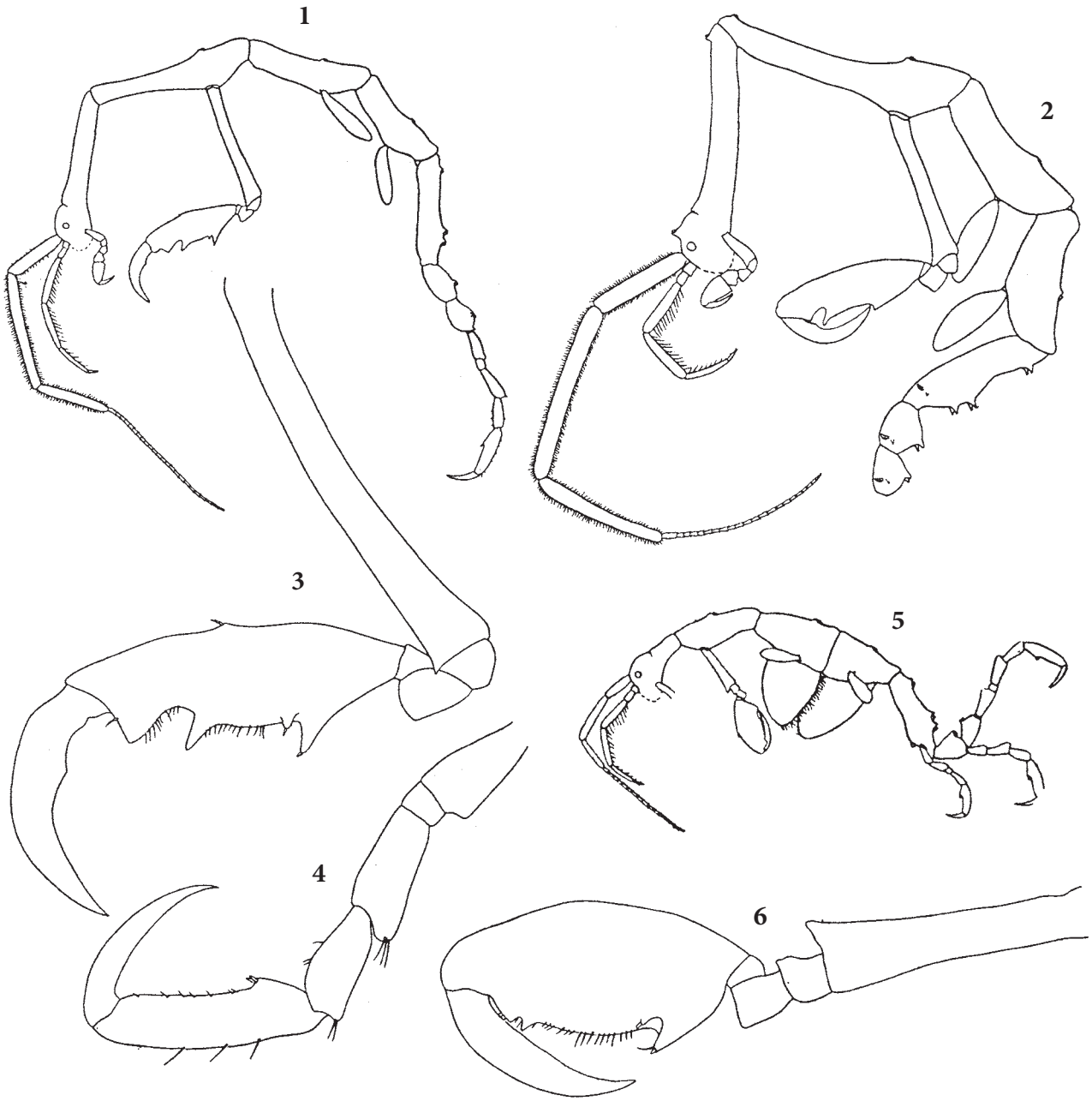


Plate XIV. *Caprella linearis* (Linnaeus, 1767)

Lateral view of male specimens from various collection sites

Fig. 1 Bennett Island (Arctic Ocean).
Fig. 2 Paramushir Island.
Fig. 3 Male: gnathopod 2.
Fig. 4 Pereopod 7.

Female

Fig. 5 Lateral view of specimen from Bennett Island (Arctic Ocean).
Fig. 6 Gnathopod 2.

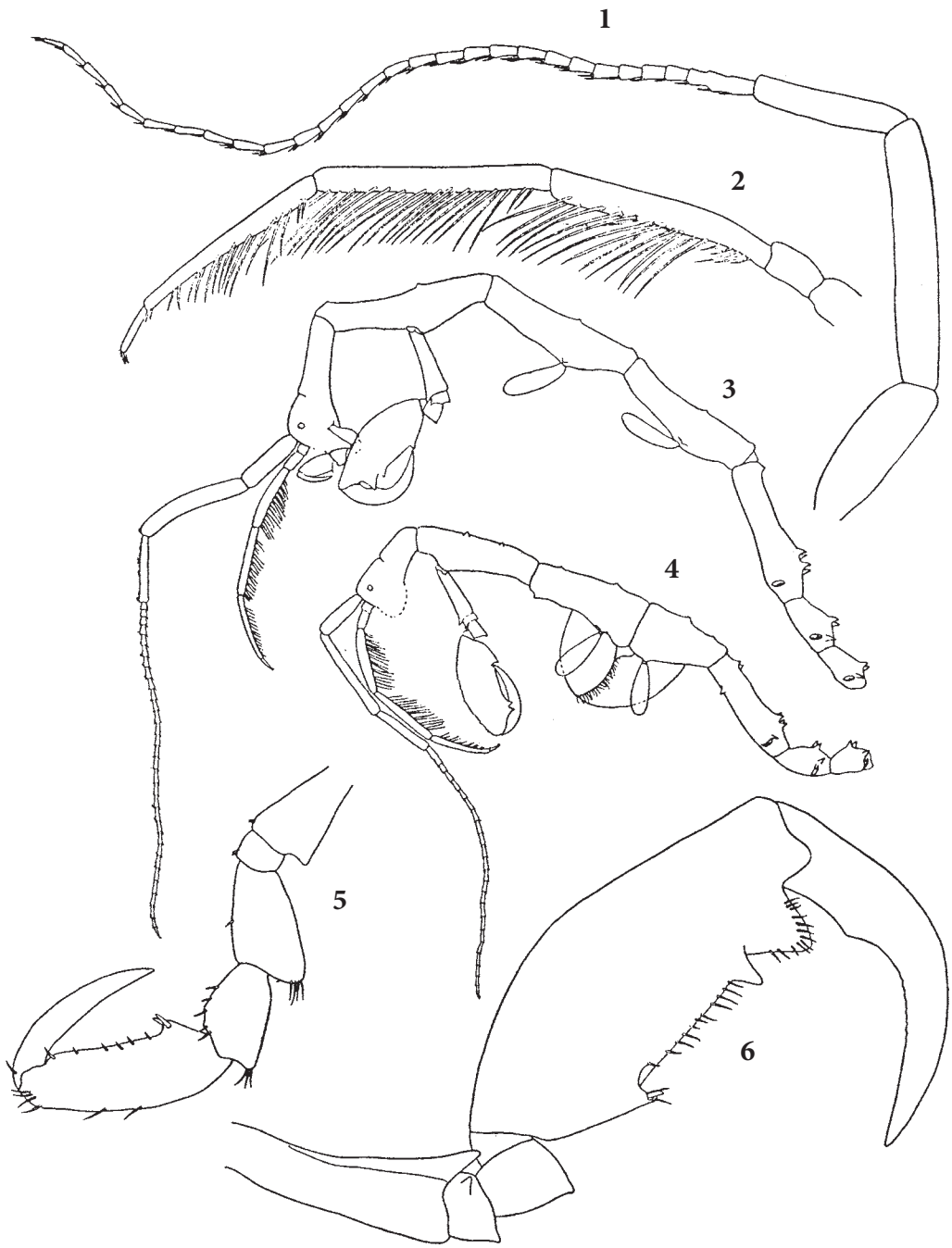


Plate XV. *Caprella microtuberculata* Sars, 1880

Male
Fig. 1 Antenna 1.
Fig. 2 Antenna 2.
Fig. 3 Lateral view.
Fig. 5 Pereopod 6.
Fig. 6 Gnathopod 2.

Female
Fig. 4 Lateral view.

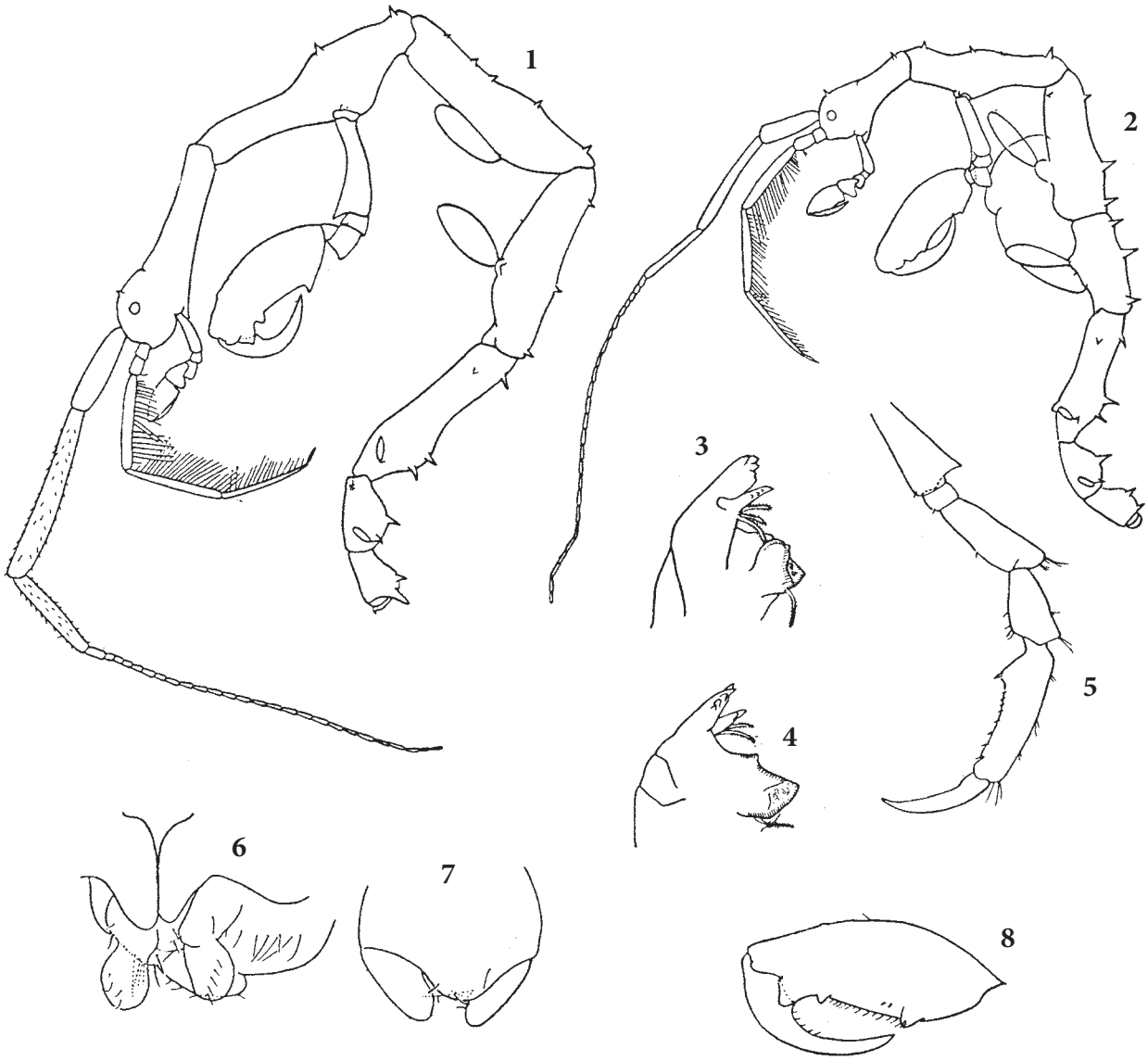


Plate XVI. *Caprella dubia* Hansen, 1887

Male
Fig. 1 Lateral view.
Figs. 3, 4 Mandibles.
Fig. 5 Pereopod 7.
Fig. 6 Abdomen.
Fig. 8 Propodus and dactylus of gnathopod 2.

Female
Fig. 2 Lateral view.
Fig. 7 Abdomen (from Laubitz 1972).

Order Euphausiacea

V.V. Petryashov, Ph.D., Senior Scientist
Zoological Institute St. Petersburg, St. Petersburg, Russia

Euphausiids are exclusively marine crustaceans, inhabiting depths of 0 to 5000 m. Although pelagic, they sometimes descend to the bottom. There are currently 86 species of euphausiids. They occur in all oceans of the planet, but are most abundant in tropical and subtropical waters. The fewest number of species are found in the Arctic, especially in the Arctic Ocean. Euphausiids are predominantly omnivorous; they are primarily filter feeders and predators.

The habit is shrimp-like (caridean) (Pl. I, Figs. 1, 7, 8). The body is divided into a cephalothorax and abdomen; there are five head segments, eight thoracic segments, six abdominal segments, and a telson. The eyes are stalked, faceted, usually well developed, complete or divided into two parts. Much of the head and thorax are covered with a carapace, which is attached dorsally to the thoracic segments along its entire length, but leaving the base of the thoracic legs and gills uncovered. The antennules (antenna 1) consist of a three-articulate peduncle and two multiarticulate flagella. The peduncle in many species may have processes, teeth, or lobes in addition to setae. The antennae (antenna 2) consist of a uniarticulate protopodite (due to fusion of the three articles), a scale-like exopodite (the antennal scale or squame) and an endopodite, consisting of a three-articulate peduncle and multiarticulate flagellum. Eight pairs of thoracic legs are present; they are biramous with exopodites and endopodites. The thoracic legs are relatively similar; none are converted into maxillipeds. The last one or two thoracic legs can be shortened (family Bentheuphausiidae) or reduced (family Euphausiidae). In forms with divided eyes, the second and third pairs of thoracic legs (or second or the third) are modified as grasping appendages. The coxae of the thoracic legs have a pair of epipodites on the outer side forming gills and an inner endite, which is a small lobe-like structure that is most developed on the first pair of legs. There are five pairs of abdominal appendages (the pleopods). They are well developed in both sexes, adapted to swimming, similar in structure; in males the first and second pair have a copulatory organ (the petasma). One pair of uropods is present; they are biramous, both rami are uniarticulate and flattened, and together with the telson they form the caudal fan. Light organs (photophores) are present in the family Euphausiidae; there are usually 10 photophores in ventral view: one on each eye stalk, at the base of the second and seventh pair of thoracic legs, and one between each of pleopods I-IV on the abdomen. Fewer occur only in the genus *Stylocheiron*, where a total of five are present: two on the eye stalks, two at the base of the seventh thoracic legs, and one on the first abdominal segment.

Development involves metamorphosis through several larval stages.

Key to genera and species of the family Euphausiidae (order Euphausiacea)

1(4) Eyes more or less round, lacking constriction (Pl. I, Fig. 2). None of the thoracic legs are elongate or modified as grasping appendages (Pl. I, Fig. 1).

2(3) Seventh pair of thoracic legs with well developed, multiarticulate endopodites (Pl. I, Fig. 3). (Basal article of antenna 1 with membranous leaf-like lobe directed upward and backward [Pl. I, Fig. 4]. Exopodite of the sixth and seventh thoracic legs in both sexes developed, but eighth pair is rudimentary). . ***Meganyctiphanes*, *M. norvegica* (M. Sars, 1857) (Pl. I, Figs. 1-4)**

Length to 44 mm.
Atlantic subtropical-Arctic. Barents Sea, Arctic Basin, and adjacent regions of the Kara and Laptev seas.
Depth 0-500 m.

3(2) Endopodites of seventh pair of thoracic legs rudimentary, consisting of one or two short articles (Pl. I, Fig. 5). . . . . **genus *Thysanoessa* (in part)**

4(1) Eyes with transverse constriction (Pl. I, Fig. 6). Second (Pl. I, Fig. 7) or third pair (Pl. I, Fig. 8) of thoracic legs elongate and modified as a grasping appendage.

5(8) Only second pair of thoracic legs elongate and modified as grasping appendage (Pl. I, Fig. 7).

6(7) Two terminal articles of grasping leg with large setae on end and lateral edges (Pl. II, Fig. 1) . . . . . **genus *Thysanoessa* (in part)**

7(6) Setae on the terminal article of grasping leg form a terminal bundle of large needle-like spines. Lateral edges of the two terminal articles without setae (Pl. II, Fig. 2) . .**genus *Nematoscelis*, *N. megalops* G.O. Sars, 1883 (Pl. I, Fig. 7; Pl. II, Fig. 2)**

Length to 26 mm.
Bipolar. Southwestern Barents Sea.
Depth 0-600 m.

8(5) Third pair of thoracic legs only modified as grasping appendage (Pl. I, Fig. 8). With widened propodus, lacking needle-like setae (Pl. I, Fig. 3). Endopodite of thoracic leg 7 rudimentary, consisting of two articles. Upper and lower portion of eye nearly equal in width (Pl. II, Fig. 4) . . . **genus *Stylocheiron*, *S. maximum* Hansen, 1908 (Pl. I, Fig. 8; Pl. II, Fig. 3-4)**

Length to 33 mm.
Panoceanic bathyal. Southwestern Barents Sea (Motovskiy Bay).
Depth 200-400 m.

Key to species of the genus *Thysanoessa*

1(6) Abdominal segments lacking keels (Pl. 2, Figs. 5, 7)

2(5) Lower edge of carapace lacking denticles (Pl. II, Fig. 6)

3(4) Sixth abdominal segment substantially shorter than two preceding segments taken together. Sixth abdominal segment and occasionally fifth abdominal segment with small spine (Pl. II, Fig. 7). Eyes lacking constriction in *T. inermis f. inermis*, or with transverse constriction in *T. inermis f. neglecta* . . . . . ***T. inermis* (Krøyer, 1864) (Pl. 2, Fig. 6-7)**

Length to 32 mm.
Widespread boreal Arctic. Barents, White, and Chukchi seas, northern and western Kara Sea, northern Laptev and East Siberian Sea.
Depth 0-280 m.

4(3) Sixth abdominal segment almost equal in length to the two preceding segments taken together. Spines on the fifth and sixth abdominal segment absent (Plate II, Fig. 8). Eyes with constriction . . . . . ***T. longicaudata*** **(Krøyer, 1846) (Pl. II, Fig. 8)**

Length to 16 mm.
Atlantic widespread boreal Arctic. Arctic basin, Barents Sea, north parts of arctic seas from Kara to Chukchi seas.
Depth 50-750 m.

5(2) Anterior part of lower edge of carapace with denticle (Pl. II, Fig. 9) Eyes lacking constriction. . . . . ***T. raschii*** **(M. Sars, 1864) (Pl. I, Fig. 5; Pl. II, Figs. 5, 9)**

Length to 30 mm.
Widespread boreal Arctic. Barents, White, and Chukchi seas, northern and western Kara Seas, north of Laptev and East Siberian Sea.
Depth 0-200 m.

6(1) Third-fifth abdominal segment with keels transitioning to spine. Largest spine on third abdominal segment (Pl. II, Fig. 10). Eyes with transverse constriction (Pl. I, Fig. 6) . . ***T. longipes*** **Brandt, 1851 (Pl. 1. Fig. 6; Pl. II, Figs. 1, 10)**

Length to 30 mm.
Pacific widespread boreal. Eastern Chukchi Sea.
Depth 0-50 m.

Literature

Boden, B.P., M.W. Johnson, and E. Brinton. 1955. The Euphausiaceae (Crustacea) of the North Pacific. Bull. Scripps Inst. Oceanogr. 6(8):287-400.

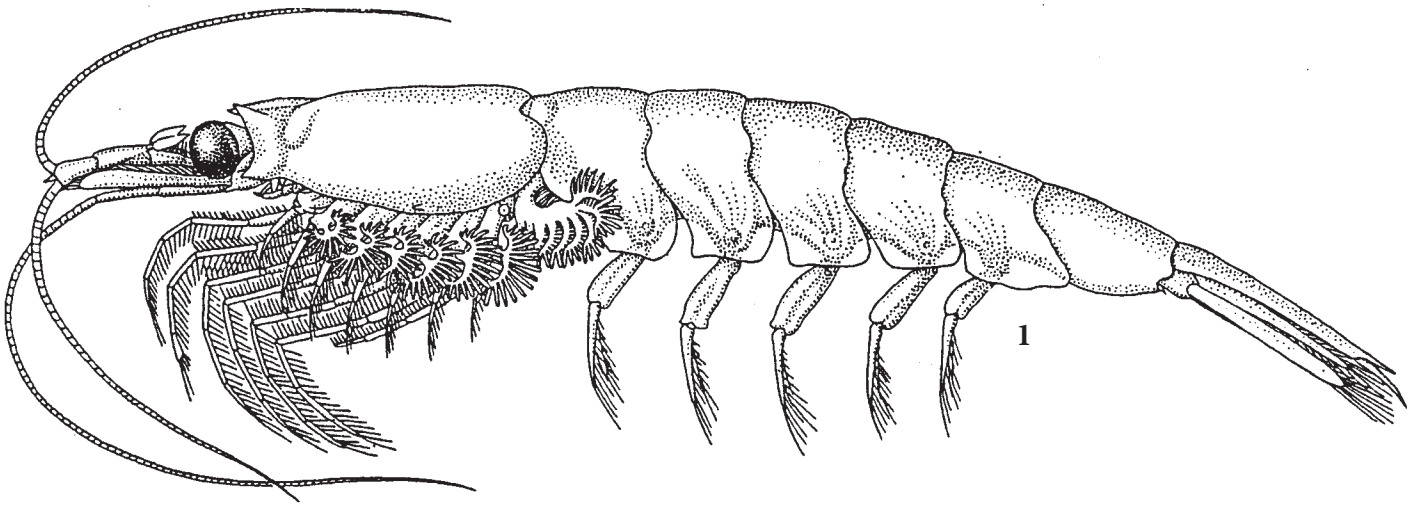
Einarsson, H. 1945. Euphausiaceae. I. North Atlantic species. Dana Rep. No. 27. 185 pp.

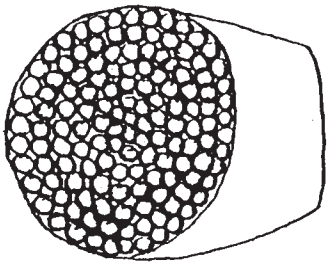
Lomakina, N.B. 1978. Euphausiids of the world's oceans. Keys to the fauna of the USSR, No. 118. Leningrad. 223 pp.

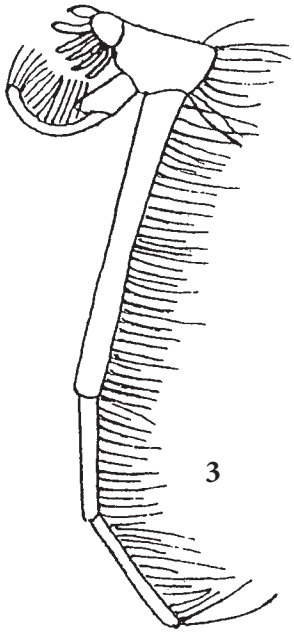
Mauchline, J. 1980. The biology of mysids and euphausiids. Adv. Mar. Biol. 18. 677 pp.

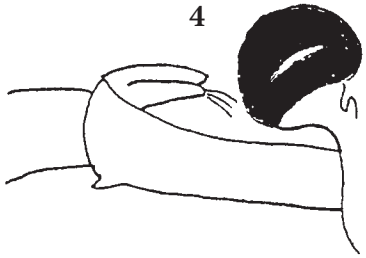
Yashnov, V.A. 1948. Class Crustacea. In: Key to the fauna and flora of the northern seas of the USSR. Moscow, pp. 175-343.

Zimmer, C. 1909. Die nordischen Schizopoden. Nordisches Plankton. Bd. 12(6):1-179.









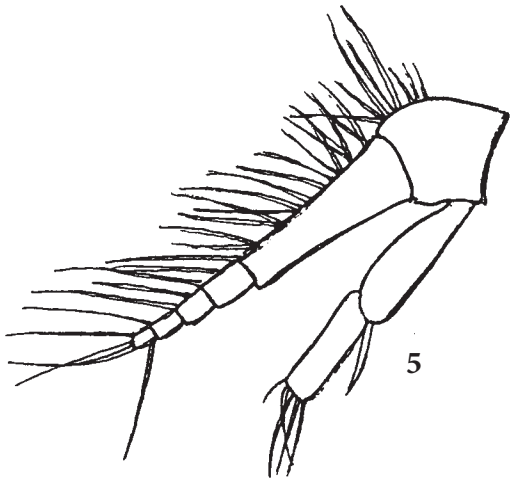


Plate I. Euphausiacea of the Arctic Ocean

Fig. 1 *Meganyctiphanes norvegica*, whole animal, female (from Einarsson 1945).
Fig. 2 *Meganyctiphanes norvegica*, eye (×70).
Fig. 3 *Meganyctiphanes norvegica*, seventh thoracic leg (×20).
Fig. 4 *Meganyctiphanes norvegica*, basal segment of antennule (antenna 1) (×20).
Fig. 5 *Thysanoessa raschii*, seventh thoracic leg (×70).

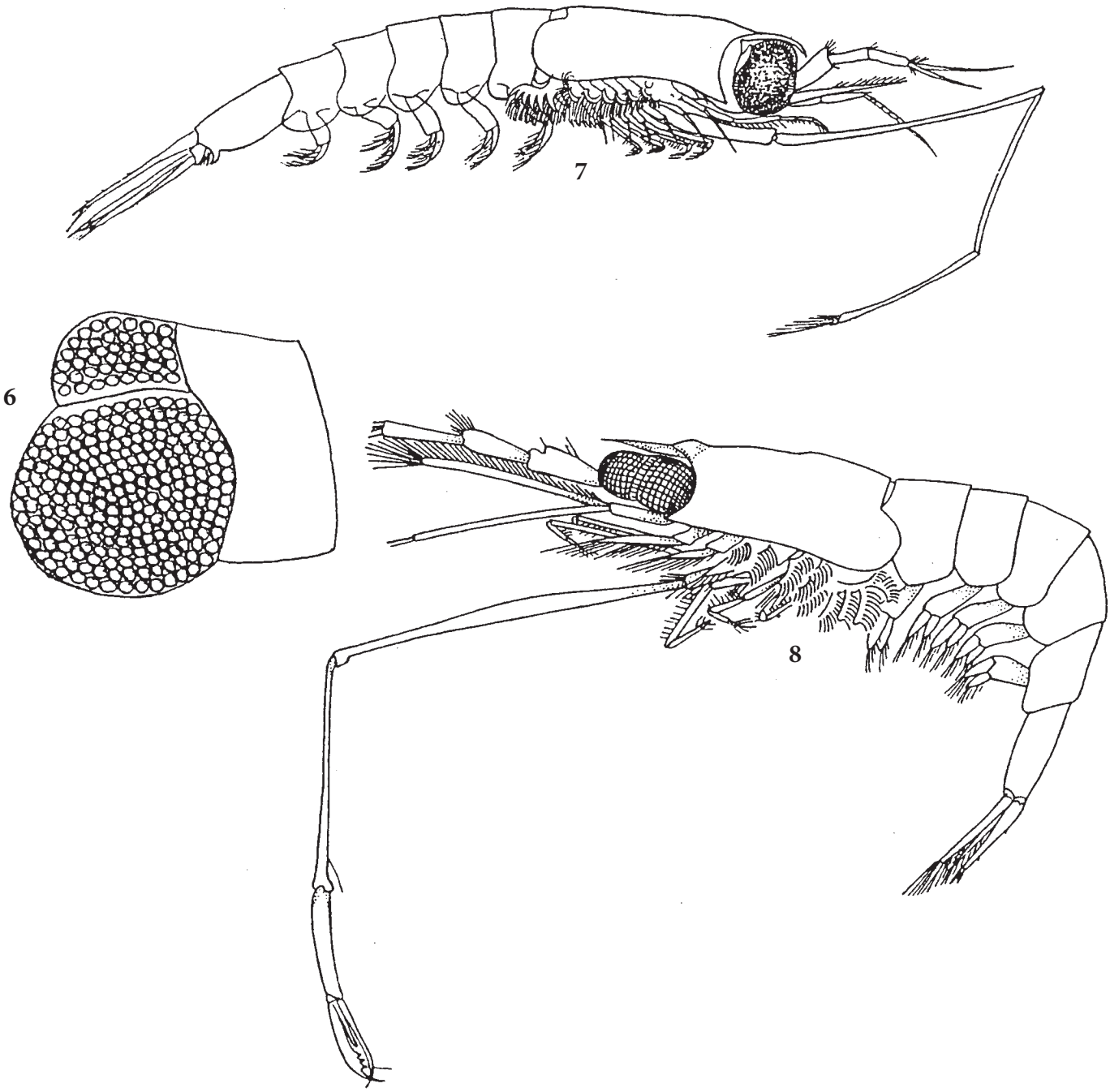


Plate I (continued)

Fig. 6 *Thysanoessa longipes*, eye (×70).
Fig. 7 *Nematoscelis megalops*, whole animal (from Zimmer 1909).
Fig. 8 *Stylocheiron maximum*, whole animal (from Boden et al. 1955).

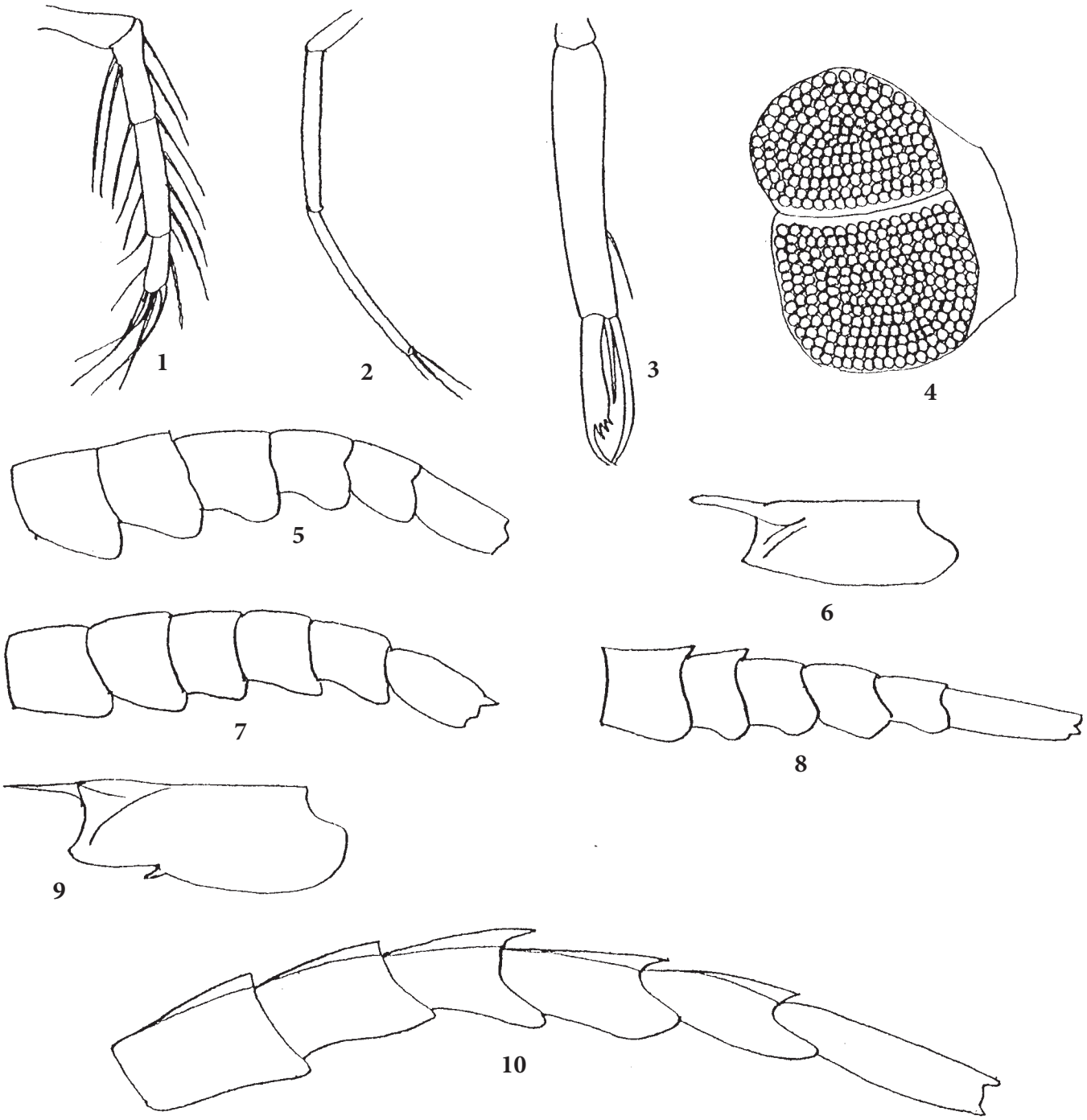


Plate II. Euphausiids of the Arctic Ocean

Fig. 1 *Thysanoessa longipes*, second thoracic leg (propodus and dactylus, two terminal articles) (×40).
Fig. 2 *Nematoscelis megalops*, second thoracic leg (propodus and dactylus, two terminal articles) (×40).
Fig. 3 *Stylocheiron maximum*, third thoracic leg (propodus and dactylus, two terminal articles) (from Lomakina 1978).
Fig. 4 *Stylocheiron maximum*, eye (×70).
Fig. 5 *Thysanoessa raschii*, abdomen (lateral view) (×6).
Fig. 6 *Thysanoessa inermis*, carapace (lateral view) (×6).
Fig. 7 *Thysanoessa inermis*, abdomen (lateral view) (×6).
Fig. 8 *Thysanoessa longicaudata*, abdomen (lateral view) (×10).
Fig. 9 *Thysanoessa raschii*, carapace (×6).
Fig. 10 *Thysanoessa longipes*, abdomen (lateral view) (×7).

Suborder Natantia (Order Decapoda)

V.I. Sokolov, Ph.D., Deputy Director
Russian Federal Research Institute of Fisheries and Oceanography, Moscow, Russia

The Natantia (shrimps, prawns, and relatives) are primarily marine organisms, inhabiting depths from the littoral to greater than 5000 m. The body is cylindrical, often compressed laterally. The cephalothorax is distinct from the abdomen (Pl. I). The carapace completely covers the gills; it is attached dorsally to all segments of the cephalothorax, which it covers. A rostrum is commonly present at the front of the carapace; it is compressed laterally or dorsoventrally into a plate-like structure; it is rarely in the form of an awl-like spine, tooth, or beak. Armature of the rostrum is highly variable. A stylocerite is often present on the peduncle of antenna 1; it is rarely reduced or absent. Antenna 2 has an antennal scale, which is compressed dorsolaterally. The abdomen is segmented with lateral pleurons. The posterior segment of the abdomen (the telson) along with the uropods forms the caudal fan. The pereopods (walking legs) are usually long and thin, although the chela ends in a number of species are fairly short and robust; pereopods are sometimes biramous with exopodites and endopodites. The pleopods (abdominal appendages) are well developed; they are present on all abdominal segments except the telson; they are adapted to swimming. Natantia are widespread in all oceans worldwide, including the high latitudes of the Arctic and Antarctic. The suborder includes predominantly marine species, and fewer freshwater and euryhaline species. They are primarily benthic, epibenthic, and pelagic.

The suborder is divided into three tribes: (1) Penaeidea de Haan, 1949 (40 genera, more than 3500 species); (2) Stenopodidea Bate, 1888 (7 genera, 30 species); and (3) Caridea Dana, 1852 (180 genera, 1000 species). Only members of the Penaeidea and Caridea are found in the Arctic Ocean. The latter are the overwhelming majority of not only the shrimps, but also all decapods in the region.

Penaeids are the most primitive with respect to their morphology and biology. Their life cycles include free-living nauplii, which are not observed in the other tribes. Eggs of the penaeids are usually released directly into the water; they are not carried on the pleopods beneath the abdomen as in the other tribes. The males have a petasma, which is a modification of the first pair of pleopods. Endopodites of the first pair of pleopods in the female are reduced; a thelycum (a combination of a protuberance, hollow, and platform) is present on the abdominal sternites between the fourth and fifth pair of pereopods. The pleuron of the second abdominal segment does not overlap the pleuron of the first abdominal segment. The third pair of pereopods have chela that are not more developed than those of the first two pairs of legs.

The body of carideans is usually somewhat compressed laterally. The abdominal pleurons are well developed. The pleuron on the second abdominal segment overlaps that of the first. The abdomen is bent near the third segment in most species. The third pereopods lack a chela. A petasma and thelycum are absent.

The carapace of stenopodid shrimp has a cervical groove. Antennal scales are reduced or absent. The third pair of pereopods has a chela that is more developed than on the first two pereopods. The pleuron of the second abdominal segment does not cover that of the first. A petasma and thelycum are absent.

Key to the families of Natantia

1(2) Pleuron of the first segment of the abdomen is not covered by the pleuron of the second abdominal segment. Endopodites of the first pair of pleopods are reduced in females and form a petasma in males (Pl. II, Fig. 2). Third pereopods with reduced chela . . . . . **family Sergestidae**

There is only one species in the Eurasian arctic seas . . ***Sergestes arcticus*** **Krøyer, 1855 (Pl. II, Figs. 1, 2)**

Length of carapace 20 mm.
Panoceanic bathyal-abyssal, western Barents Sea.
Depth 250-5030 m, pelagic.

2(1) Pleuron of the second abdominal segment covers the pleurons of the first and third abdominal segments, at least a little. Endopodites of the first pleopods of the female are normal, petasma is absent in males. Third pair of pereopods without chela.

3(4) First pair of pereopods subchelate . . . . . **family Crangonidae Haworth, 1825 (p. 135)**

4(3) First pair of pereopods chelate or simple.

5(8) Pereopods with exopodites. First two pairs of pereopods similar, with chela.

6(7) The dactyl of the chela long, narrow, with many long teeth on the inner edge. The second pair of maxillipeds without exopodites . . . . . **family Pasiphaeidae Dana, 1852**

7(6) The dactyl of the chela fairly short, the inner edge with small denticles or smooth. Second maxilliped with exopodite. . . . . **family Oplophoridae**

There is only one species in the Eurasian arctic seas . . . . . ***Hymenodora glacialis*** **(Buchhols, 1874) (Pl. II, Figs. 3-5).**

Length of carapace 20 mm.
Panoceanic bathyal. Kara, Laptev, and East Siberian seas.
Depth 300-3900 m. Bathypelagic.

8(5) Pereopods without exopodites. The first two pairs of pereopods are very different from each other.

9(10) First pair of pereopods with well developed chela . . . . . **family Hippolytidae Bate, 1888 (p. 130)**

10(9) First pair of pereopods lacking chela . . . . . **family Pandalidae (p. 129)**

1. Key to the species of the family Pasiphaeidae

Three species have been reported from the Eurasian arctic seas, all belonging to the genus *Pasiphaea* Krøyer, 1845.

1(2) End of the telson entire . . . . . ***P. sivado*** **(Risso, 1816) (Pl. III, Figs. 1, 2)**

Length of body 80 mm.
Atlantic subtropical-boreal. Western Barents Sea.
Depth 0-1015 m. Pelagic.

2(1) Telson split at the end.

3(4) Base of the second pereopods with one to five spines . . . . . ***P. tarda*** **Krøyer, 1845 (Pl. III, Fig. 3)**

Synonymy: *Pasiphaea norvegica* G.O. Sars, 1869:325.
Length of carapace 75 mm.
Panoceanic bathyal, high latitude Arctic. Laptev Sea.
Depth 522-1580 m. Bathypelagic.

4(3) Base of the second pereopods with seven to twelve spines . . . . . ***P. multidentata*** **Esmark, 1886 (Pl. III, Figs. 4-6)**

Length of carapace 30 mm.
Atlantic subtropical-boreal. Western Barents Sea.
Depth 0-2000 m. Pelagic.

2. Key to genera and species of the family Pandalidae

1(4) Rostrum short, not greater than half the length of carapace . . . . . **genus *Pandalina* Calman, 1899**

2(3) Dactylus of pereopods three to five, short, fairly massive, with spines along the entire lower edge . . . . . ***Pandalina brevirostris*** **(Rathke, 1843) (Pl. IV, Figs. 1-2)**

Length of carapace 7.5 mm.
Atlantic subtropical-boreal. Southwestern Barents Sea.
Depth 0-180 m.

3(2) Dactylus of pereopods three to five, long and relatively thin, without spines on the distal half of the lower edge. . . . ***Pandalina profunda*** **Holthuis, 1946 (Pl. IV, Figs. 3, 4)**

Length of carapace 8 mm.
Eastern Atlantic widespread boreal. Western Barents Sea.
Depth 50-1068 m.

4(1) Rostrum long, substantially longer than the length of the carapace . . . . . **genus *Pandalus* Leach, 1814**

5(8) The distal third of the upper edge of the rostrum without spines

6(7) Small lobe is present on the dorsal side of the third abdominal segment . . . . . ***Pandalus goniurus*** **Stimpson, 1860 (Pl. IV, Fig. 5)**

Length of carapace 20.3 mm.
Pacific widespread boreal Arctic. Chukchi Sea from Bering Strait to Wrangel Island.
Depth 16-540 m. On sandy and silty sand sediments.

7(6) Dorsal side of abdomen smooth. . . . . ***Pandalus montagui*** **Leach, 1814 (Pl. V, Fig. 1)**

Length of carapace 32 mm.
Atlantic widespread boreal Arctic. White and Barents seas.
Depth 1.9-1003 m. On sand, silty sand, rocks, and shells.

8(5) Upper edge of rostrum with spines along its entire length.

9(10) Length of rostrum exceeds carapace length by 1.3-1.6 times.
Spine on antennal scale often reaches or even extends beyond the anterior edge of antennal scale. . . . . ***Pandalus borealis borealis*** **Krøyer, 1838 (Pl. V, Figs. 2, 3)**

Synonymy: *Pandalus borealis* var. *edenticulatus* Retovskiy, 1946:300, Fig. 2; Yashov, 1948:333.
Length of carapace 29 mm.
Atlantic widespread boreal Arctic. Barents, White, Kara, and Laptev seas.
Depth 7-907 m. On silt and silty sand.

10(9) Length of rostrum usually exceeds carapace length by more than 1.6 times. Spine on antennal scale does not usually protrude beyond anterior edge of scale . . . . . ***Pandalus borealis eous*** **Makarov, 1935 (Pl. V, Fig. 4, 5)**

Synonymy: *Pandalus eous* Squires, 1992:257; Jensen, 1995:54; Komai, 1999:1293-1298.
Length of carapace 39.6 mm.
Pacific widespread boreal. Southern Chukchi Sea.
Depth 20-1450 m. On silt and silty sand.

3. Key to genera and species of the family Hippolytidae

1(35) Rostrum with spines on the top only, or the bottom only, or both the top and bottom. Mandibles with palps.

2(3) Carpus of the second pereopod divided into two articles. . . . . **genus *Caridion* Goës, 1863**

Only one species has been reported from Eurasian arctic seas, ***Caridion gordoni*** **(Bate, 1858) (Pl. VI, Fig. 1)**

Length of body 27 mm.
Atlantic widespread boreal. Western Barents Sea.
Depth 10-312 m. On silt, sand, and silty sand.

3(4) Carpus of the second pereopod divided into seven articles.

4(19) Supraorbital spines absent.

5(6) Third maxilliped without exopodite. . . . . **genus *Heptacarpus* Holmes, 1900**

Only one species has been reported from Eurasian arctic seas, ***Heptacarpus camtschaticus*** **(Stimpson, 1860) (Pl. VI, Fig. 2).**

Synonymies: *Spirontocaris camtschatica*: Rathbun, 1904; Vinogradov, 1947:87. *Eualus camtschatica*: Brazhnikov, 1907:164; Kobyakova, 1958:221, 224.
Length of carapace 8.6 mm.
Pacific widespread boreal. Southern Chukchi Sea.
From littoral to 180 m depth. On silty, sandy sediments and pebbles.

6(5) Third maxilliped with exopodite . . . . . **genus *Eualus* Thallwitz, 1892**

7(8) Dorsal teeth absent from more than half the length of the rostrum. . . . . ***Eualus fabricii*** **(Krøyer, 1841) (Pl. VI, Fig. 3)**

Length of carapace 14 mm.
Pacific–western Atlantic boreal Arctic. Chukchi Sea.
Depth 2-630 m. Silty and silty-sandy sediments, rocks, and pebbles.

8(7) Dorsal teeth on rostrum may be lacking only on distal third of rostrum.

9(12) Rostrum short, not extending beyond peduncle of antenna 1, shorter than half of carapace length.

10(11) Rostrum awl-shaped, very short, does not extend beyond the anterior edge of eyes. Lower edge of the rostrum lacking teeth . . . . . ***Eualus pusiolus*** **(Krøyer, 1841) (Pl. VII, Fig. 1)**

Synonymies: *Spirontocaris pusiola*: Rathbun, 1904:99-100; Vinogradov, 1947:72. *Heptocarpus pusiola*: Yashnov, 1948:335; Kuznetsov, 1964:46; Pakhomova, 1966:64.

Length of body 25 mm.
Amphiboreal. Subtropical-boreal. Barents Sea, southern Chukchi Sea.
Depth 0-1381 m. On silty sand, rocks, and algae.

11(10) Rostrum with developed upper and lower plates, extends beyond anterior edge of ocular orbit. Lower edge of rostrum with 1-3 small teeth . . . . . ***Eualus macilentus*** **(Krøyer, 1841) (Pl. VII, Fig. 2)**

Synonymies: *Spirontocaris macilenta*: Rathbun, 1904:105; Vinogradov, 1947:89. *Spirontocarella macilenta*: Yashnov, 1948:335; Kobyakova, 1955:149.
Length of carapace16 mm.
Pacific–western Atlantic boreal Arctic. Chukchi Sea.
Depth 27-1380 m. On silty sand, silt, rocks, and shells.

12(9) Rostrum long, extends beyond the anterior edge of the peduncle of antenna 1, equal in length or even exceeding length of carapace.

13(14) Rostrum does not extend beyond anterior edge of antennal scale. Dorsal edge of the third abdominal segment always smooth . . . . . ***Eualus suckleyi*** **(Stimpson, 1864) (Pl. VII, Fig. 3)**

Synonymies: *Spirontocaris suckleyi*: Rathbun, 1904:89, Fig. 38; Vinogradov, 1947:87.
Length of body 79 mm.
Pacific high boreal. Southern Chukchi Sea.
Depth 11-1025 m. On silty sand, silt, shells, and pebbles.

14(15) Rostrum clearly extends beyond the anterior edge of antennal scale. Lobe usually present on the dorsal side of the third abdominal segment.

15(16) Dorsal lobe on the third abdominal segment well developed, hook-shaped. Red transverse lines present on abdomen . . . .***Eualus gaimardi belcheri*** **Bell, 1855 (Pl. VIII, Fig. 1)**

Synonymies: *Eualus gaimardi* var. *belcheri*: Yashnov, 1948:335; Pakhomova, 1966:62. *Eualus belcheri*: Udekem d'Acoz, 1999:110.
Length of carapace 22 mm.
High boreal Arctic circumpolar. All northern seas of Russia.
Depth 10-900 m depth. On silt, silty sand, rock, pebbles, shells, and algae.

16(15) Dorsal lobe developed to varying degrees or absent. Red transverse lines absent from abdomen . ***Eualus gaimardi gaimardi*** **(H. Milne-Edwards, 1837) (Pl. VIII, Fig. 2)**

Synonymies: *Spirontocaris gaimardi*: Stephensen, 1939:16; Palenichko, 1940:258. *Spirontocaris gaimardii* forma typica: Heegaard, 1941:37. *Spirontocaris gaimardii* forma gibba: Heegaard, 1941:37. *Eualus gaimardi* var. *gibba*; Yashnov, 1948:335; Pakhomova, 1966:62.

Length of carapace 14 mm.
High boreal Arctic. Barents, White, and Kara seas.
Depth 1-900 m. On silt, silty sand, rock, shell, pebbles, and algae.

17(4) At least one supraorbital spine present on each side of rostrum.

18(21) One supraorbital spine present on each side of rostrum. . . . . .**genus *Lebbeus* White, 1847**

19(20) Pleurons of the first three abdominal segments rounded, without spines. Spine on the dorsal side of carapace only on the anterior third or completely absent. Rostrum compressed laterally, with developed lower plate . . . . . .***Lebbeus polaris* (Sabine, 1821) (Pl. VIII, Fig. 3)**

Synonymies: *Hippolyte mysis*: Birulya, 1898:1; Birulya, 1899:3.
Hetairus polaris: Yashnov, 1948:334, Pl. 98, Fig. 1; Kobyakova, 1958:221, 228; Kuznetsov, 1964:31-38, Fig. 13; Bryazgin and Sennikov 1979:96.
Length of carapace to 20 mm.
High boreal Arctic circumpolar. In all northern seas of Russia.
Depth 0-1447 m. On rock, silty sand, silt, pebbles, algae, and shells.

20(19) Pleurons of abdominal segments with one to five sharp spines on the ventral edge. Four, rarely five, large teeth present on dorsal side of carapace, starting at the posterior edge. Rostrum cylindrical, with unequal upper and lower plates. . . . . .***Lebbeus groenlandicus* (Fabricius, 1775) (Pl. IX, Fig. 1)**

Synonymies: *Hetairus groenlandica*: Makarov, 1941:121; Kobyakova, 1958:221, 227. *Spirontocaris groenlandica*: Urita, 1942:16; Vinogradov, 1947:83.
Length of carapace to 24.6 mm.
Pacific–western Atlantic boreal Arctic. In southern and southeastern Chukchi Sea.
Depth 0-930 m. On silty and sandy sediments, rock, and algae.

21(18) At least two supraorbital spines on each side of rostrum . . . . . .**genus *Spirontocaris* Bate, 1888**

22(25) Posterior tooth on mid dorsal line of carapace is anterior of middle of carapace.

23(24) Rostrum fairly short, not extending beyond anterior edge of antennal scale. Upper plate of rostrum poorly developed. Dorsal teeth on carapace and rostrum (excluding distal end) nearly uniform in size. . . . . .***Spirontocaris phippsii* (Krøyer, 1841) (Pl. IX, Fig. 2)**

Synonymies: *Hippolyte turgida*: Pakhamova, 1966:60, Fig. 3; Bryazgin and Sennikov, 1979:96. *Spirontocaris turgida*: Yashnov, 1948:335; Kyznetsov, 1964:27-31.
Length of carapace to 10 mm.
High boreal Arctic circumpolar. In all northern seas of Russia.
Depth 5-270 m. On silty and sandy sediments, rock, and shells.

24(23) Rostrum usually extends beyond the anterior edge of antennal scale. Upper and lower plates of rostrum in females well developed. Dorsal teeth on carapace and rostrum of varying size. Upper plate is poorly developed in males, dorsal spine on carapace and rostrum small, incompletely developed. . . . . .***Spirontocaris alli* Rathbun, 1902 (Pl. IX, Fig. 3)**

Length of carapace to 13.6 mm.
Pacific high boreal. Southeastern Chukchi Sea.
Depth 11-56 m. On silty and sandy sediments, rock.

25(22) Posterior tooth on mid dorsal line of carapace on posterior half of carapace.

26(29) Dactylus of last three pairs of pereopods long, only 2-2.5 times shorter than length of propodus.

27(28) Dorsal teeth on rostrum of females noticeably smaller than dorsal teeth on carapace (teeth on rostrum of males less developed than in females and can be absent from upper edge). Spine on the antennal scale does not usually extend beyond the anterior edge of plate of antennal scale . . . . ***Spirontocaris murdochi*** **Rathbun, 1902 (Pl. X, Fig. 1)**

Length of carapace to 11 mm.
Pacific high boreal. Southern and southeastern Chukchi Sea.
Depth 12-244 m. On silty and sandy sediments.

28(27) Dorsal teeth on carapace and dorsal side of rostrum (excluding its distal end) do not markedly differ in size. Spine on antennal scale clearly extends beyond the anterior edge of plate of antennal scale. . . . . ***Spirontocaris lilljeborgii*** **(Danielssen, 1859) (Pl. X, Fig. 2)**

Synonymy: *Spirontocaris securifrons*: Yashnov, 1948:335; Pakhomova, 1966:60; Bryazgin and Sennikov, 1979:96.
Length of carapace to 15 mm.
Atlantic high boreal Arctic. Western and southwestern Barents Sea.
Depth 20-1200 m. On silty and sandy sediments, shells, and pebbles.

29(26) Dactylus of last three pereopods short, propodus about three times the length of the dactylus.

30(31) Antennal scale relatively short, does not extend beyond the anterior end peduncle of antenna 1. Spine on antennal scale does not extend beyond anterior edge of plate of antennal scale. . . . . ***Spirontocaris intermedia*** **Makarov in Kobyakova, 1936 (Pl. X, Figs. 3, 4)**

Synonymies: *Spirontocaris spina intermedia*: Vinogradov, 1950:201; Kobyakova, 1958:221, 227. *Spirontocaris spina*: Urita, 1942:4; Miyake, 1982:50 (not photo 3 in Pl. 17). *Spirontocaris spinus* var. *intermedia*: Holthuis, 1947:8.
Length of carapace to 11.7 mm.
Pacific high boreal. Southern Chukchi Sea.
Depth 27-245 m. On silty and sandy sediments.

31(30) Antennal scale long, extends beyond the anterior edge of peduncle of antenna 1. Spine on the antennal scale extends beyond the anterior edge of plate of scale.

32(33) Posterior dorsal edge of abdominal segment 3 extends posteriorly. Dorsal teeth on carapace begin almost at dorsal posterior edge of carapace . . . . . ***Spirontocaris spinus*** **(Sowerby, 1805) (Pl. XI, Fig. 1, 2)**

Synonymy: *Spirontocaris spina* Makarov, 1941:117.
Length of carapace to 17 mm.
High boreal Arctic. Barents, White, Kara, and Laptev seas;
eastern Chukchi Sea.
Depth 5-465 m. On silty and sandy sediments, rock, algae, and shells.

33(32) Posterior edge of third abdominal segment not extending posteriorly, rounded. Posterior dorsal tooth positioned a little less than one third of carapace length anterior to dorsal posterior edge of carapace . . . . . ***Spirontocaris arcuata*** **Rathbun, 1902 (Pl. XI, Fig. 3)**

Length of carapace to 10.4 mm.
Pacific widespread boreal. Chukchi Sea.
Depth 5-641 m. On silt and silty-sand sediment.

34(1) Rostrum unarmed. Mandibular palp absent.

35(36) Rostrum rounded in cross section, awl-shaped, long, extending beyond anterior end of basal article of peduncle of antenna 1. Pleurons of first two abdominal segments with two spines on lower edge . . . . . **genus *Bythocarides* Sokolov, 2002**

There is only one species in Eurasian arctic seas, ***Bythocarides menshutkinae*** **Sokolov, 2002 (Pl. XII, Fig. 1).**

Length of carapace to 8.1 mm.
Arctic bathyal. Laptev Sea.
Depth 945 m. On silt.

36(35) Rostrum usually short, compressed dorsoventrally (except *Bythocaris grumandti* Burukovsky, 1966, which has the rostrum compressed in the vertical plane). Pleurons of first five abdominal segments rounded or bearing not more than one spine . . . . . **genus *Bythocaris* G.O. Sars, 1870**

37(40) Each pleuron of the first five abdominal segments with one spine.

38(39) Rostrum reaches or extends beyond anterior edge of eye. Eyes with black pigment. . . . . ***Bythocaris simplicirostris*** **G.O. Sars, 1869 (Pl. XII, Fig. 2)**

Synonymy: *Bythocaris spinipleura* Squires, 1990:158-162.
Length of carapace 7.5 mm.
Atlantic widespread boreal. Barents Sea.
Depth 50-760 m. On silty and sandy sediments.

39(38) Rostrum does not reach the base of the cornea of eye. Eye unpigmented . . . . . ***Bythocaris kobjakovae*** **Sokolov, 2000 (Pl. XII, Fig. 3)**

Length of carapace to 4.5 mm.
Atlantic bathyal. Laptev Sea.
Depth 1568 m. On silt.

40(37) At least the pleurons of first two abdominal segments rounded.

41(42) Rostrum long, compressed laterally, upper edge clearly raised at the supraorbital spines in lateral view . . . ***Bythocaris grumanti*** **Burukovsky, 1966 (Pl. XIII, Fig. 1)**

Length of body 57 mm.
Arctic. Barents Sea.
Depth 50 m.

42(41) Rostrum compressed dorsoventrally, upper edge not raised at the supraorbital spines in lateral view or raised only slightly.

43(46) Merus of pereopods 3-5 without spines.

44(45) Carapace without dorsal teeth. . . . . ***Bythocaris curvirostris*** **Kobyakova, 1957 (Pl. XIII, Fig. 2)**

Length of carapace 21.8 mm.
Arctic bathyal. Laptev and Chukchi seas, Arctic Ocean.
Depth 856-3440 m. On silty sediments.

45(44) At least one tooth present on mid dorsal line of carapace . . .***Bythocaris leucopis*** **G.O. Sars, 1879 (Pl. XIII, Figs. 3, 4)**

Length of carapace 22.5 mm.
Arctic bathyal. Barents, Laptev, East Siberian, and Chukchi seas.
Depth 650-2850 m. Silty sediments.

46(43) Merus of pereopods 3-5 with spines.

47(48) Eyes with dark pigment . . . . . ***Bythocaris payeri*** **(Heller, 1875) (Pl. XIV, Fig. 1)**

Length of carapace 13 mm.
Atlantic widespread boreal Arctic. In all northern seas of Russia except the White Sea.
Depth 52-2214 m.

48(47) Eyes without pigment or very weakly pigmented.

49(50) Eyestalks long, length not less than twice the width. Width of base of eyestalk distinctly greater than width of distal part of eyestalk. Cornea of the eye small, diameter does not exceed that of eyestalk at distal end . . . . . ***Bythocaris irene*** **Retovsky, 1946 (Pl. XIV, Figs. 2, 3)**

Length of carapace 17.6 mm.
Arctic bathyal. Laptev, Kara, and East Siberian seas.
Depth 520-961 m. On silt and silty sand.

50(49) Eyestalks short, distal part of eyestalks wider than base. Diameter of cornea exceeds maximum width of eyestalk . ***Bythocaris biruli*** **Kobyakova, 1964 (Pl. XIV, Fig. 4)**

Synonymy: *Bythocaris elegans* Bryazgin, 1982:603-605.
Length of carapace 19 mm.
Arctic bathyal. Barents, Kara, Laptev, and East Siberian seas.
Depth 250-2214 m.

4. Key to the genera and species of the family Crangonidae

1(4) Pereopods 2 lacking chela. Carapace with seven denticulate ridges (one in the middle and three on each side) . . . . . **genus *Sabinea* J.C. Ross, 1835**

2(3) Tip of rostrum blunt. . . . . .***Sabinea septemcarinata*** **(Sabine, 1824) (Pl. XV, Figs. 1, 2)**

Length of carapace 21 mm.
High boreal Arctic circumpolar. In all northern seas of Russia.
Depth 0-700 m. On silty and silty-sandy sediments.

3(2) Tip of rostrum pointed. . . . . ***Sabinea sarsi* Smith, 1879 (Pl. XV, Figs. 3, 4)**

Length of carapace 20 mm.
Atlantic widespread boreal. White and Barents seas.
Depth 40-710 m. On silty and sandy sediments, rocks, and shells.

4(1) Pereopods 2 with chela. Sculpturing of carapace not as above.

5(8) Dactylus of pereopods 4 and 5 flattened and widened. Orbital lobe present at base of rostrum; together with short rostrum and robust antennal spine, they form a characteristic complex covering base of eye . . . . . **genus *Argis* Krøyer, 1842**

6(7) Dorsal keels on sixth abdominal segment terminate in points . . . . . ***Argis dentata* (Rathbun, 1902) (Pl. XVI, Figs. 1, 2)**

Length of carapace 27 mm.
Pacific–western Atlantic boreal Arctic. Southern and eastern Chukchi Sea.
Depth 6-367 m. On silt, silty sand, and sand sediments.

7(6) Dorsal keels on sixth abdominal segment rounded at tip. ***Argis lar* (Owen, 1839) (Pl. XVI, Figs. 3, 4)**

Length of carapace 24.3 mm.
Pacific widespread boreal. Southern Chukchi Sea.
Depth 53-180 m. On silty and silty-sandy sediments.

8(5) Dactylus of pereopods usually normal, not flattened. Rostrum, orbital lobe, and antennal spine do not form a shield for the eye.

9(18) Not more than two teeth present on mid dorsal line of carapace. Integument relatively thin, weakly sculptured or smooth . . . . . **genus *Crangon* Fabricius, 1798**

10(11) Two teeth present on mid dorsal line of carapace . . . . . ***Crangon communis* (Rathbun, 1899) (Pl. XVI, Figs. 5, 6)**

Length of carapace 16.9 mm.
Pacific widespread boreal. Chukchi Sea.
Depth 16-1537 m. On silty and sandy sediments.

11(10) Only one tooth present on mid dorsal line of carapace.

12(15) Dorsal keel on sixth abdominal segment absent.

13(14) Length of distal lateral spine on antennal scale less than width of distal end of antennal scale. Ratio of length of plate of antennal scale to its maximal width 2.3-2.5 ***Crangon crangon* (Linnaeus, 1758) (Pl. XVII, Figs. 1, 2)**

Length of carapace 14 mm.
Atlantic subtropical-boreal. In White Sea and Kola Strait of Barents Sea.
Depth 0-130 m. On sand and silty sand.

14(13) Length of distal lateral spine of antennal scale greater than width of distal end of antennal scale. Ratio of length of plate of antennal scale to its maximum width 2.8-2.95 . . . . . ***Crangon septemspinosa*** **Say, 1818 (Pl. XVII, Figs. 3, 4)**

Length of carapace 12.8 mm.
Pacific–western Atlantic boreal Arctic. Southern Chukchi Sea.
Depth 0-440 m. On silt and silty sand sediments.

15(12) Two sub-medial keels present on sixth abdominal segment.

16(17) Rostrum longer than eyestalks . . . . . ***Crangon dalli*** **(Rathbun, 1902) (Pl. XVII, Figs., 5, 6)**

Length of carapace 18.3 mm.
Pacific widespread boreal. Chukchi Sea.
Depth 3-630 m. On silty sand and sand.

17(16) Rostrum does not extend beyond anterior edge of eyestalks . . . . . ***Crangon allmanni*** **Kinahan, 1857 (Pl. XVIII, Figs., 1, 2)**

Length of carapace 16 mm.
Eastern Atlantic widespread boreal. Barents and White seas.
Depth 0-400 m. On silt and silty sand.

18(9) At least three teeth present on mid dorsal line of carapace. Integument usually sculptured.

19(20) Two small non-motile spines at base of rostrum (one on each side). Pleurons of first three abdominal segments rounded, lacking spines. Two keels present on each side of dorsolateral line (upper keel with two, lower keel with three spines) . . . . . **genus *Pontophilus* Leach, 1817**

Only one species is known from Eurasian arctic seas, ***Pontophilus norvegicus*** **(M. Sars, 1861) (Pl. XVIII, Figs. 3, 4).**

Length of carapace 19 mm.
Atlantic widespread boreal. Western Barents Sea.
Depth 50-1450 m. On silt, silty sand, and sand.

20(19) Spines absent from base of rostrum. Pleurons of second and third abdominal segments with at least one spine. Sculpturing on integument not as above. . . . . **genus *Sclerocrangon* G.O. Sars, 1883**

21(22) Pleurons of second and third abdominal segments have single small tooth on the lower posterior edge. One hepatic spine present on each side . . . . . .***Sclerocrangon borealis*** **(Phipps, 1774) (Pl. XVIII, Fig. 5)**

Length of carapace 35 mm.
High boreal Arctic circumpolar. In all northern seas of Russia.
Depth 0-1000 m. On silt, sand, silty sand, pebbles, rocks, and algae.

22(21) Pleurons of the second and third abdominal segments with two sharp spines on the lower edge. Two hepatic spines present on each side . . . . . .***Sclerocrangon ferox*** **G.O. Sars, 1877 (Pl. XVIII, Fig. 6)**

Length of carapace 31 mm.
High boreal Arctic circumpolar. In all northern seas of Russia.
Depth 34-1000 m. On silt, silty sand, and pebbles.

Literature

Allen, J.A. 1967. Crustacea: Euphausiacea and Decapoda with an illustrated key to the British species. Fauna of the Clyde Sea area. Millport. 116 pp.

Burukovsky, R.N. 1966. A new species of shrimp of the genus *Bythocaris*, and some problems of zoogeography of the genus. Zoologicheskiy Journal XLV(4):536-542.

Butler, T.H. 1980. Shrimps of the Pacific Coast of Canada. Can. Bull. Fish. Aquat. Sci. 202. 280 pp.

Holthuis, L.B. 1947. The Decapoda of the Siboga Expedition. Part IX. The Hippolytidae and Rhynchocinetidae collected by the Siboga and Snellius expeditions with remarks on other species. Siboga-Expedite, Monographie 39a8 de. 100 pp.

Holthuis, L.B. 1993. The recent genera of the caridean and stenopodidean shrimps (Crustacea, Decapoda), with an appendix on the order Amphionidacea. Leiden, Nationaal Natuurhistorish Museum. 328 pp.

Makarov, V.V. 1941. Decapod fauna of the Bering and Chukchi seas. In: Research of the Far Eastern seas of the USSR. I. Izd-vo Akad. Nauk. Moscow, pp. 111-163.

Sokolov, V.I. 2000. Deep-sea shrimps of the genus *Bythocaris* G.O. Sars in the collections of Russian museums, with the description of a new species (Crustacea: Decapoda: Hippolytidae). Zool. Med. Leiden 74(24):403-468.

Sokolov, V.I. 2003. Decapod crustaceans (Crustacea Decapoda) of the Barents Sea. In: V.I. Sokolov (ed.), Benthic ecosystems of the Barents Sea. Izd-vo VNIRO, Moscow 142:25-76.

Squires, J.A. 1990. Decapoda Crustacea of the Atlantic coast of Canada. Can. Bull. Fish. Aquat. Sci. 221. 532 pp.

Udekem, d'Acoz, C., d'. 1999. Inventaire et distribution des crustacés décapodes de l'Atlantique nord-oriental, de la Méditerranée et des eaux continentales adjacentes au nord de 25°N. Patrimoines naturales (M.N.H.N./S.P.N.), Vol. 40. 383 pp.

Vinogradov, L.G. 1950. Key to the shrimp, crustaceans and crabs of the Far East. Isv. TINRO 33:179-358.

Yashnov, V.A. 1948. Class Crustacea. In: N.S. Gaevskaya (ed.), Keys to the fauna and flora of the northern seas. Izd-vo Sovetskaya Nauka, Moscow, pp. 175-251.

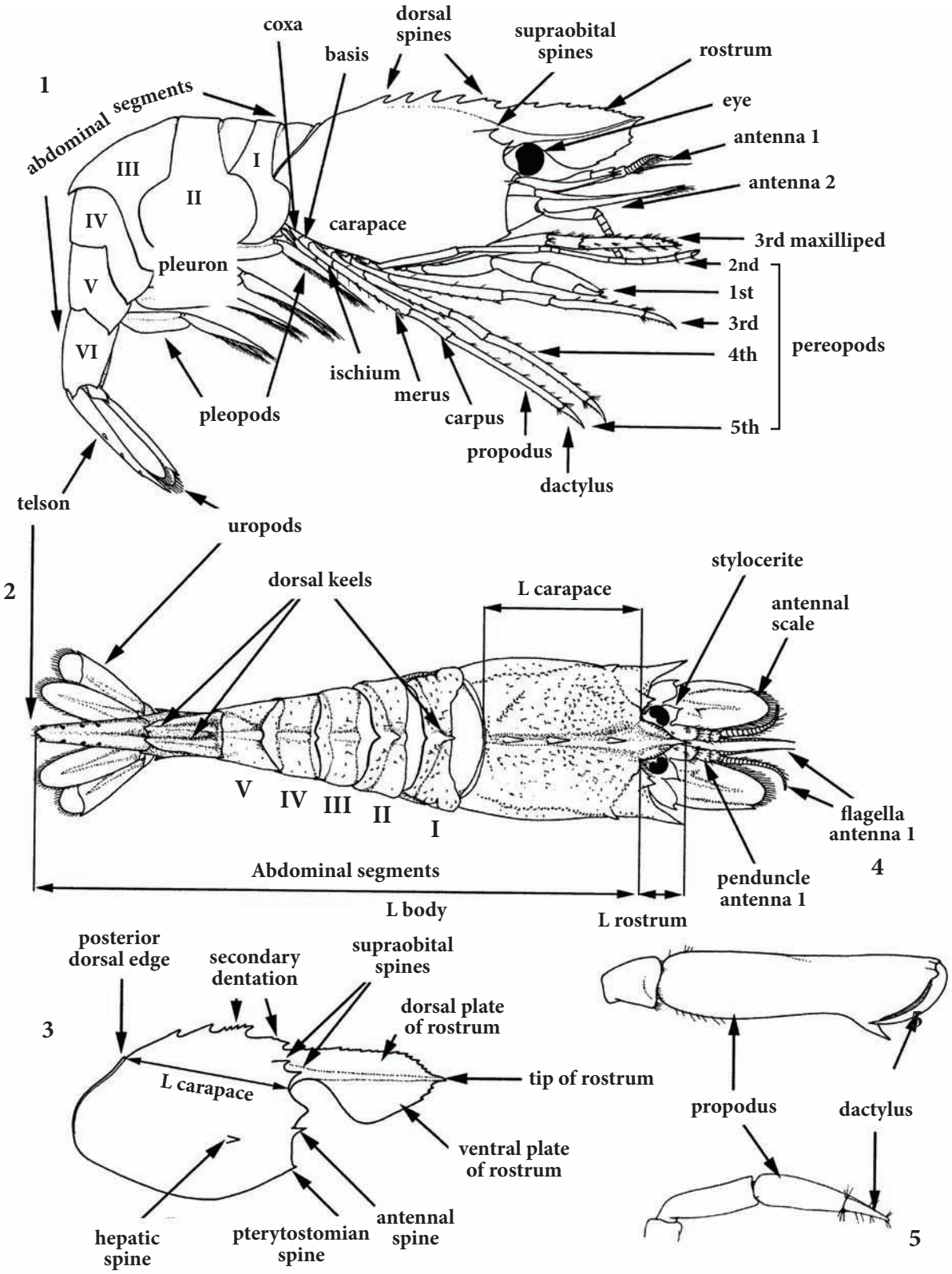


Plate I

Fig. 1 Shrimp, lateral view.
Fig. 2 Shrimp, dorsal view.
Fig. 3 Shape of carapace and rostrum, lateral view.
Fig. 4 Subchela.
Fig. 5 True chela.

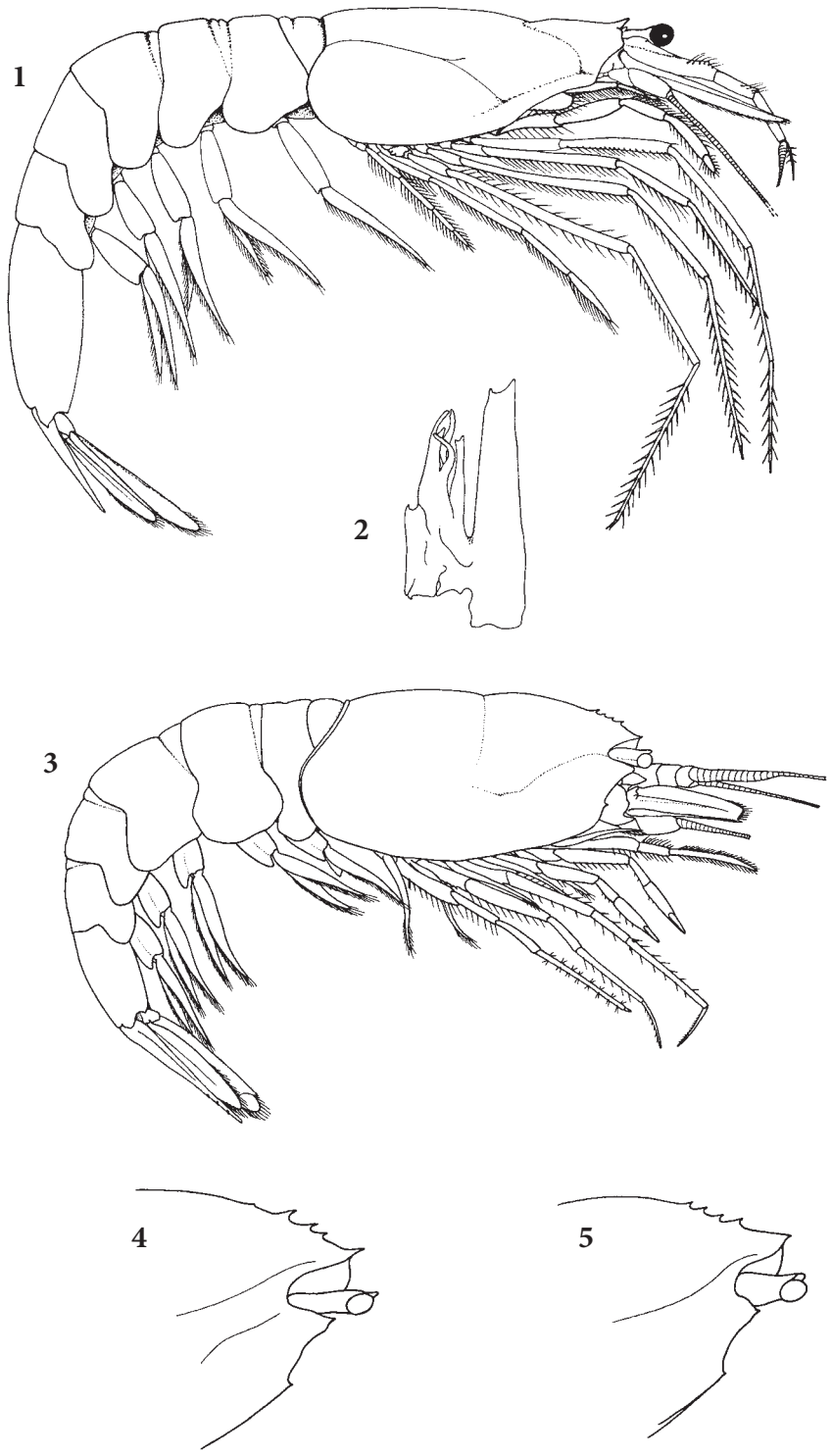


Plate II

Figs. 1-2 *Sergestes arcticus* Krøyer, 1855: 1: whole animal (lateral view). 2: petasma.
Figs. 3-5 *Hymenodora glacialis* (Buchhols, 1874): 3: whole animal (lateral view). 4, 5: anterior part of carapace.

Scale 1 cm (1, 3-5), 1 mm (2).

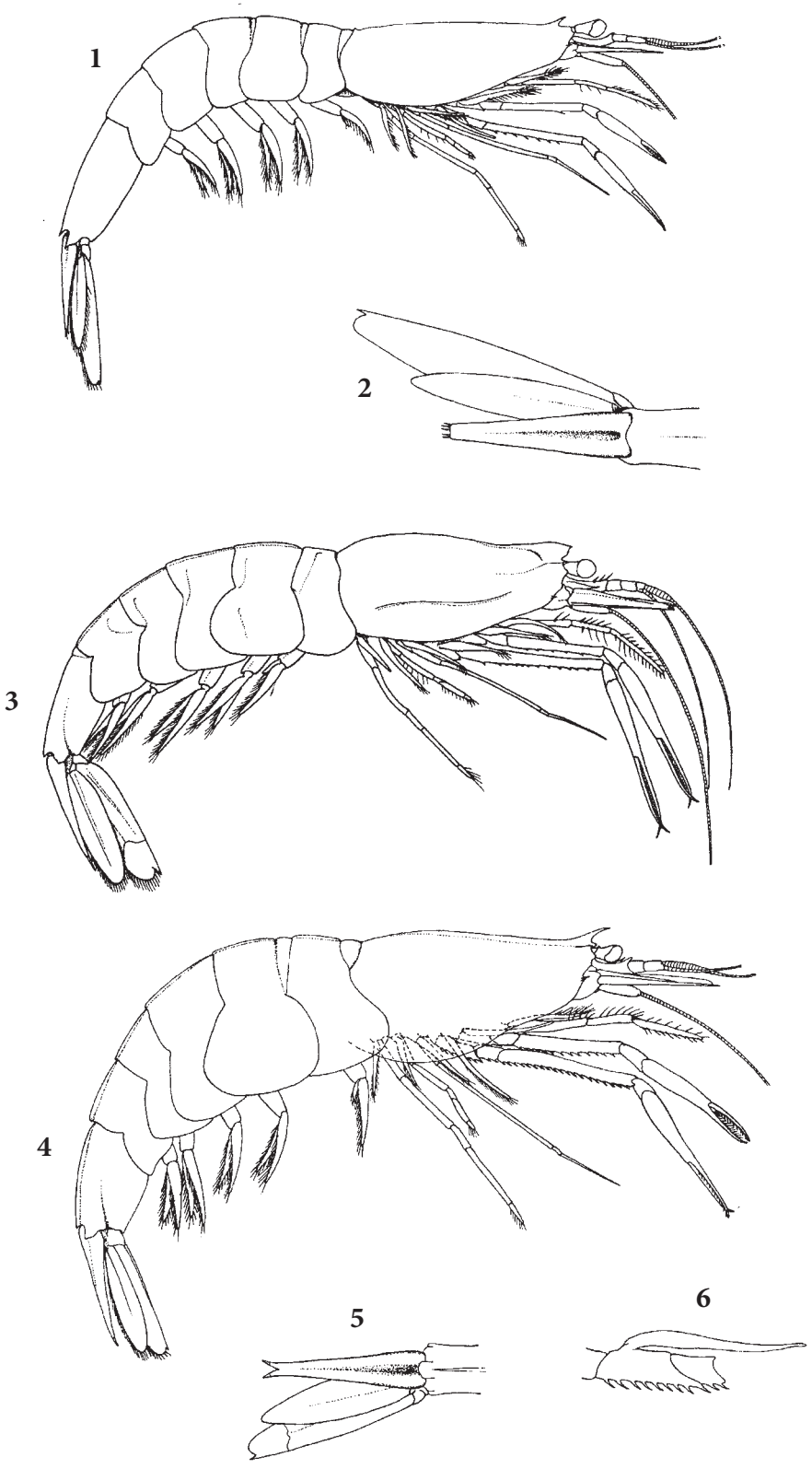


Plate III

Figs. 1-2 *Pasiphaea sivado* (Risso, 1816): 1: whole animal (lateral view). 2: telson
Fig. 3 *Pasiphaea tarda* Krøyer, 1845: whole animal (lateral view).
Figs. 4-6 *Pasiphaea multidentata* Esmark, 1886: 4: whole animal (lateral view). 5: telson 6: base and ischium of second pair of pereopods.

Scale 1 cm (1, 3, 4), 1 mm (2, 5, 6).

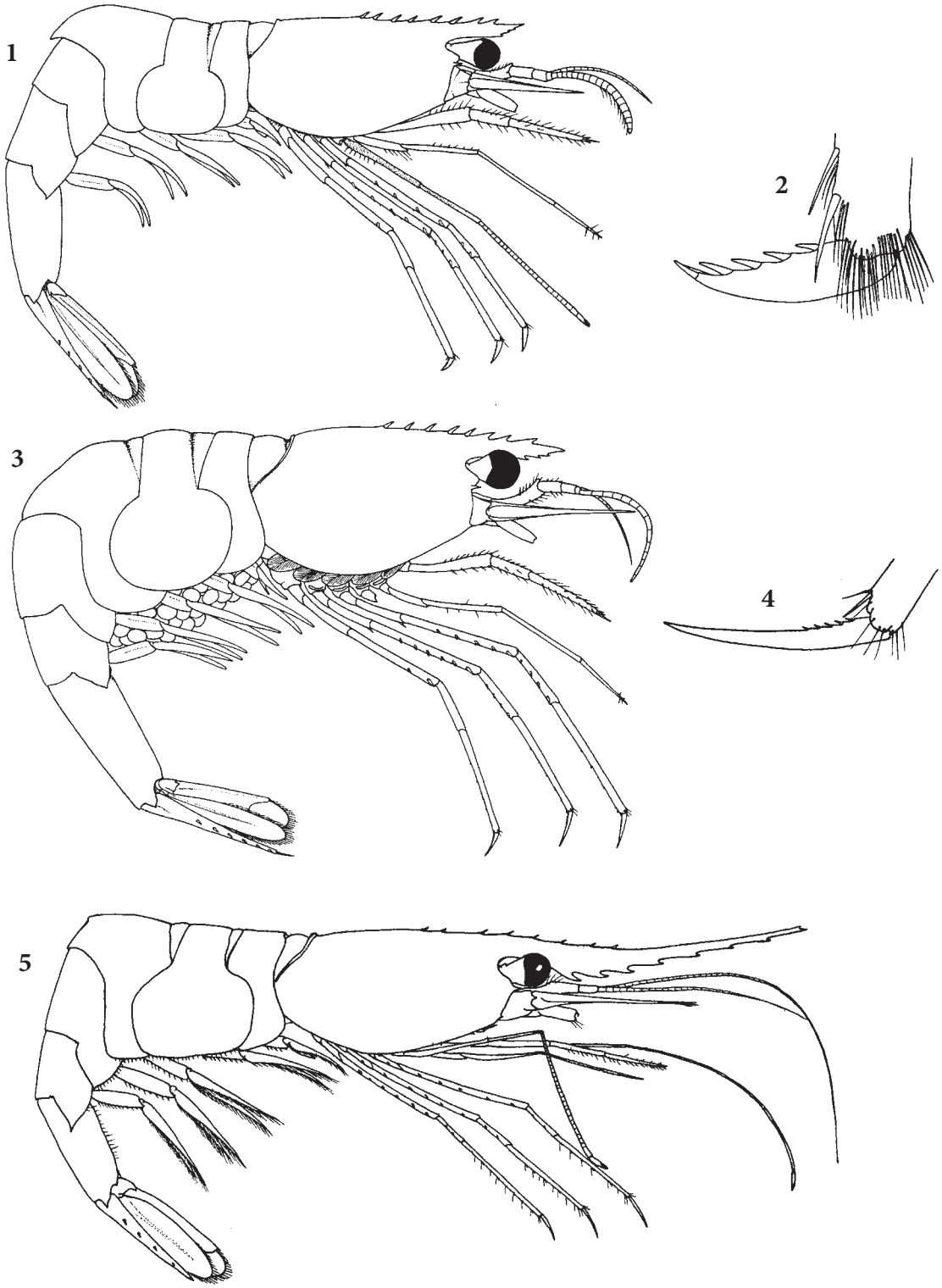


Plate IV

Figs. 1-2 *Pandalina brevirostris* (Rathke, 1843): 1: whole animal (lateral view). 2: dactylus of fourth pereopod.
Figs. 3-4 *Pandalina profunda* Holthuis, 1946: 3: whole animal (lateral view). 4: dactylus of fourth pereopod.
Fig. 5 *Pandalus goniurus* Stimpson, 1860: whole animal (lateral view).

Scale 1 cm (1, 3, 5), 1 mm (2, 4).

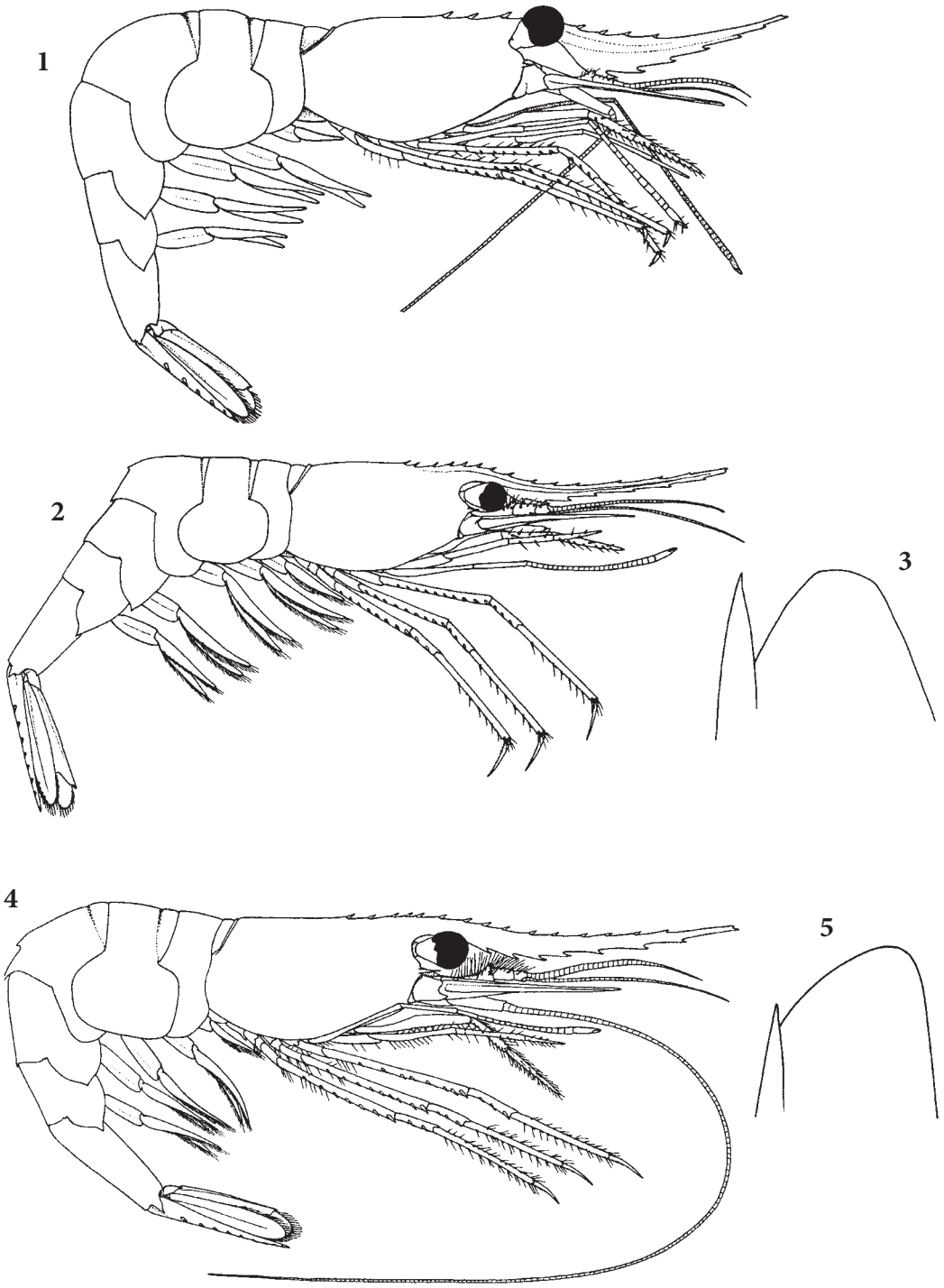


Plate V

Fig. 1 *Pandalus montagui* Leach, 1814: whole animal (lateral view).
Figs. 2-3 *Pandalus borealis borealis* Krøyer, 1838: 2: whole animal (lateral view). 3: anterior portion of antennal scale.
Figs. 4-5 *Pandalus borealis eous* Makarov, 1935: 4: whole animal (lateral view). 5: anterior portion of antennal scale.

Scale 1 cm (1, 2, 4), 1 mm (3, 5).

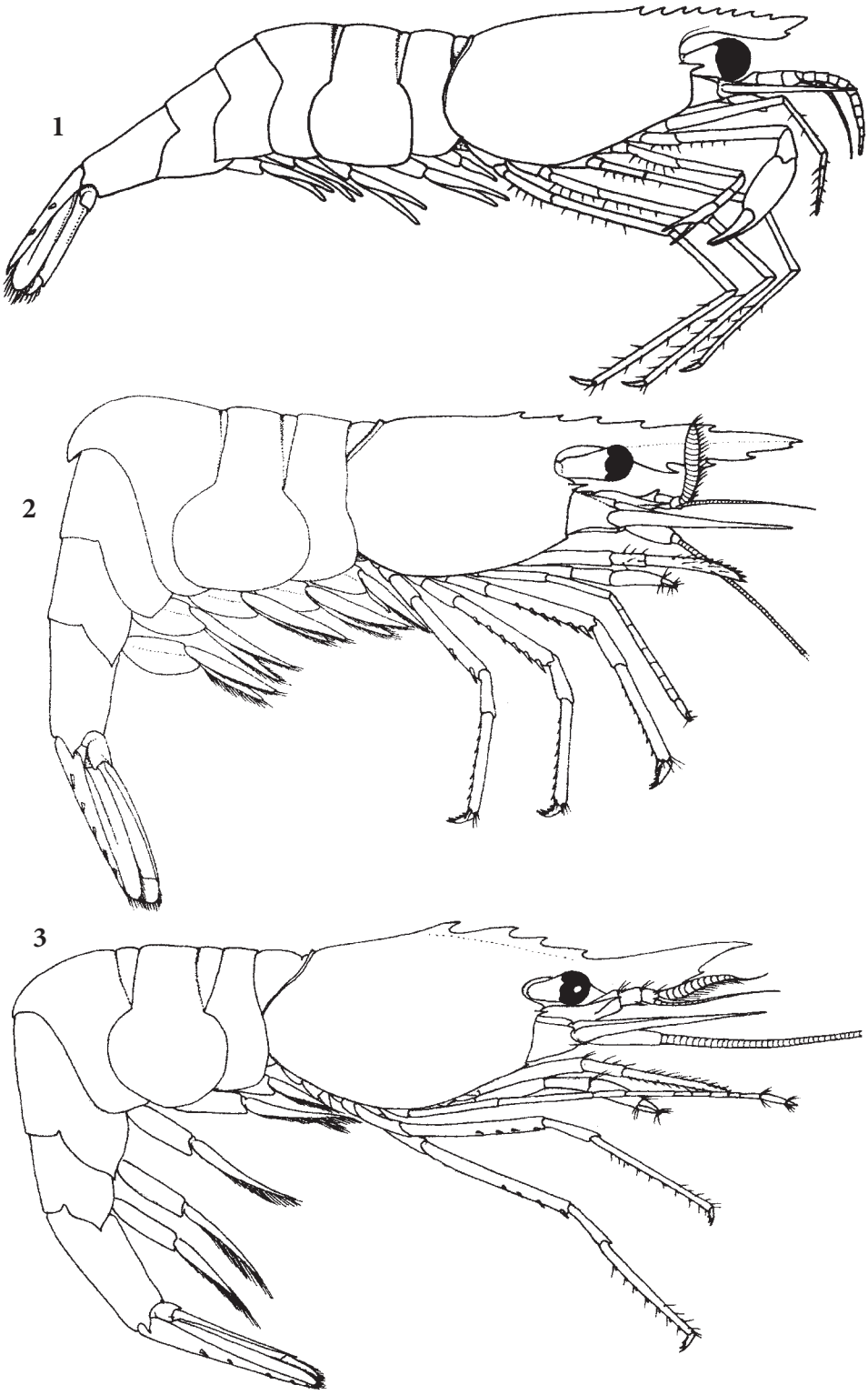


Plate VI

Fig. 1 *Caridion gordoni* (Bate, 1858): whole animal (lateral view).
Fig. 2 *Heptacarpus camtschaticus* (Stimpson, 1860): whole animal (lateral view).
Fig. 3 *Eualus fabricii* (Krøyer, 1841): whole animal (lateral view).

Scale 1 cm.

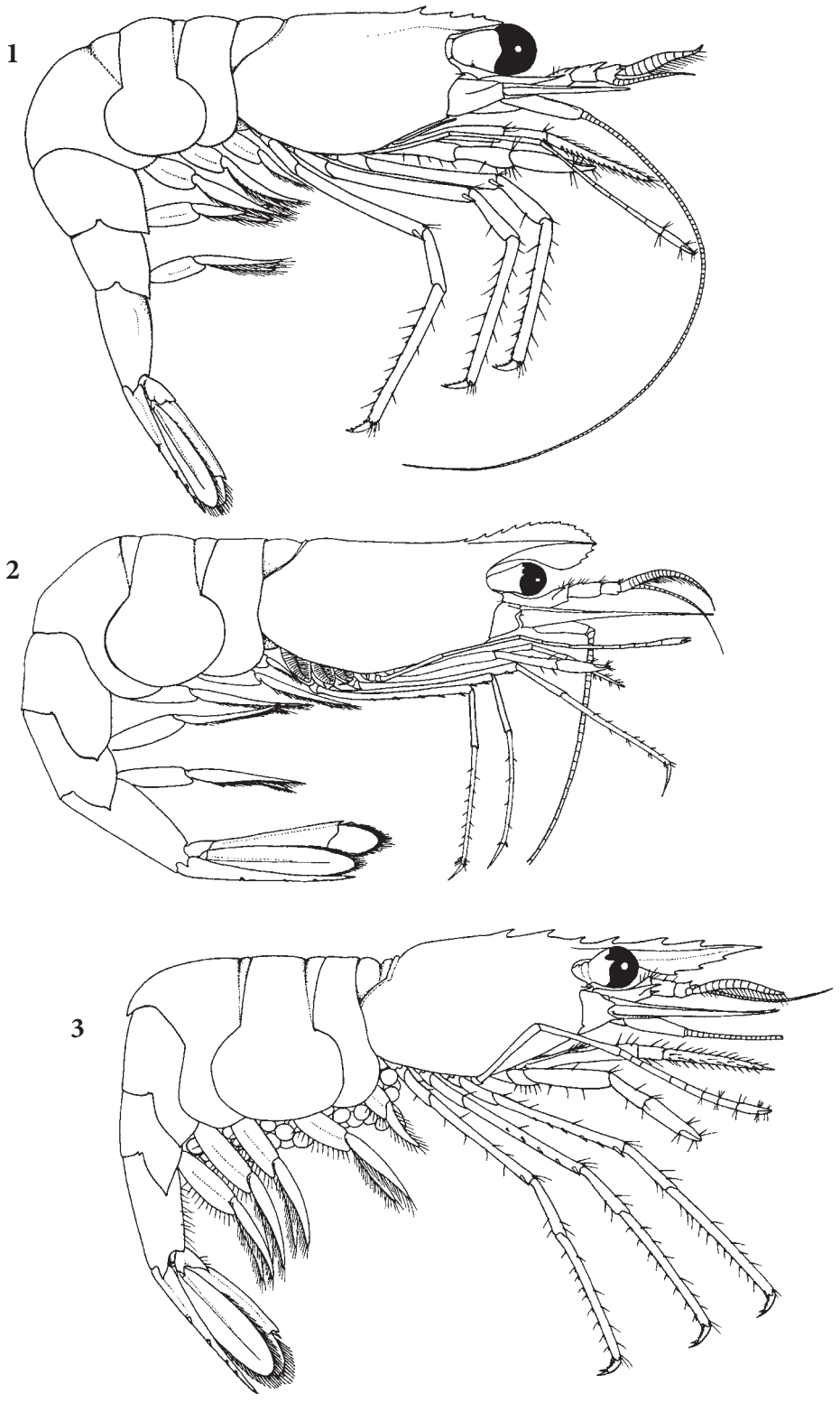


Plate VII

Fig. 1 *Eualus pusiolus* (Krøyer, 1841): whole animal (lateral view).
Fig. 2 *Eualus macilentus* (Krøyer, 1841): whole animal (lateral view).
Fig. 3 *Eualus suckleyi* (Stimpson, 1864): whole animal (lateral view).

Scale 1 cm.

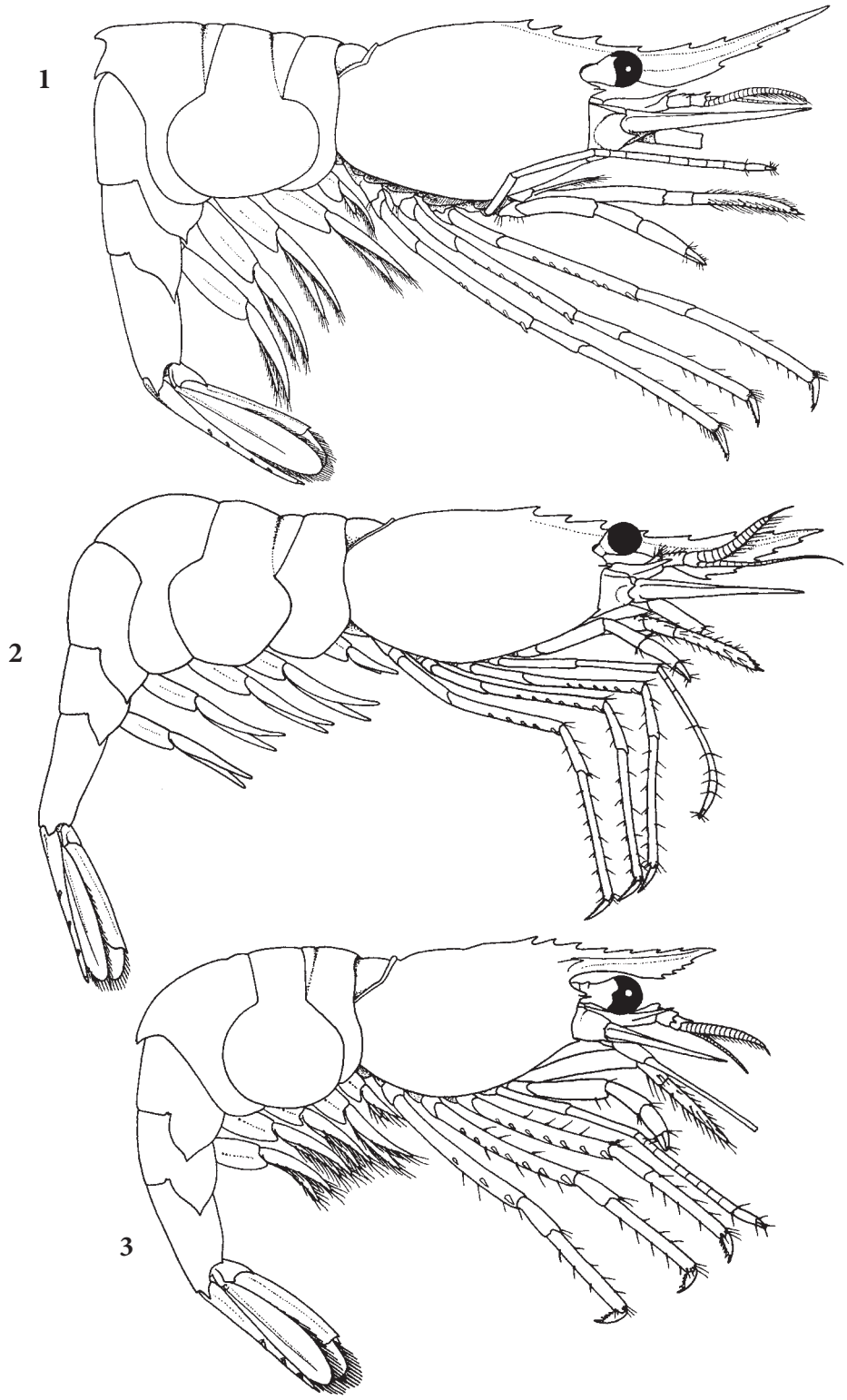


Plate VIII

Fig. 1 *Eualus gaimardi belcheri* Bell, 1855: whole animal (lateral view).
Fig. 2 *Eualus gaimardi gaimardi* (H. Milne-Edwards, 1837): whole animal (lateral view).
Fig. 3 *Lebbeus polaris* (Sabine, 1821): whole animal (lateral view).

Scale 1 cm.

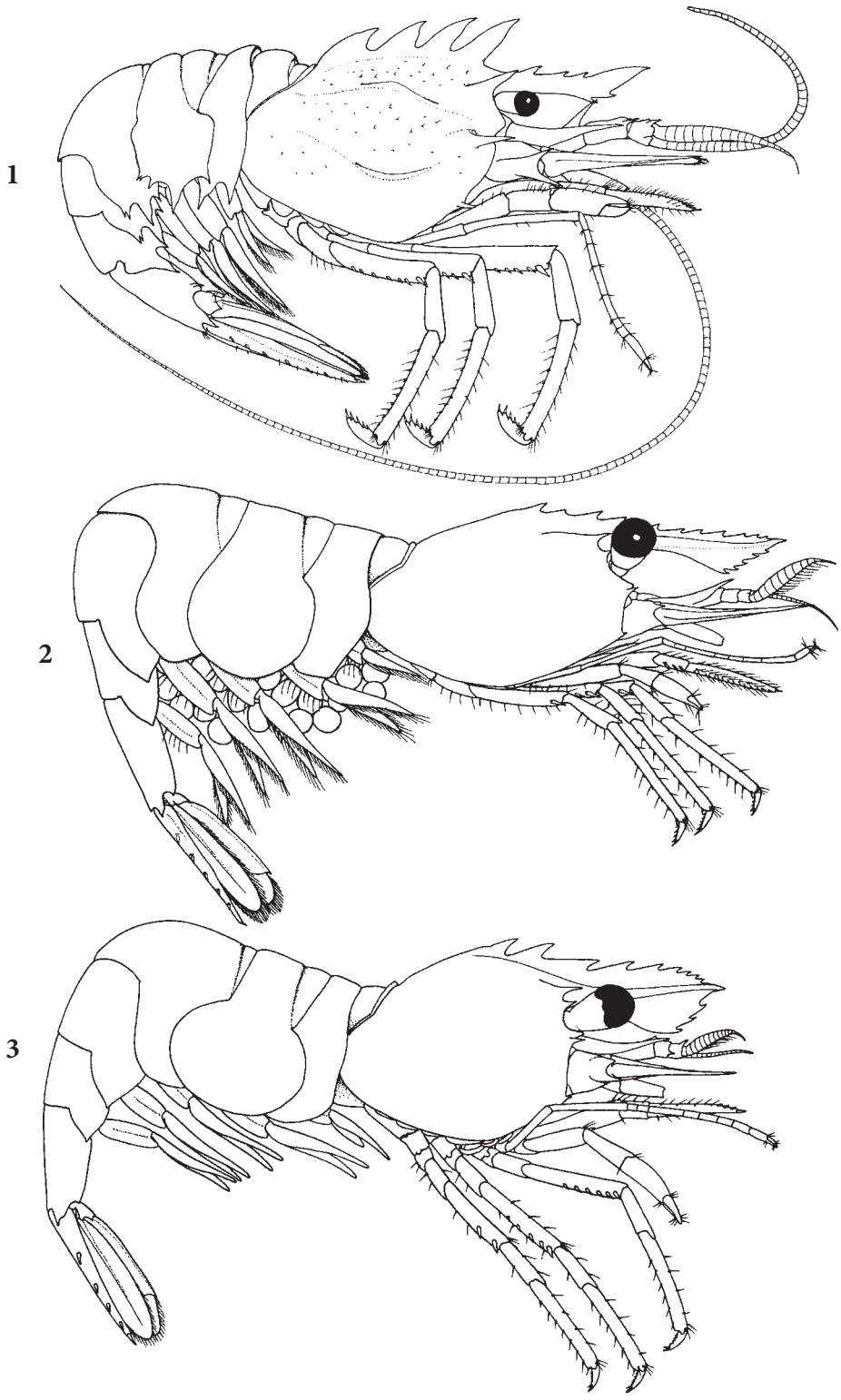


Plate IX

Fig. 1 *Lebbeus groenlandicus* (Fabricius, 1775): whole animal (lateral view).
Fig. 2 *Spirontocaris phippsii* (Krøyer, 1841): whole animal (lateral view).
Fig. 3 *Spirontocaris dalli* Rathbun, 1902: whole animal (lateral view).

Scale 1 cm.

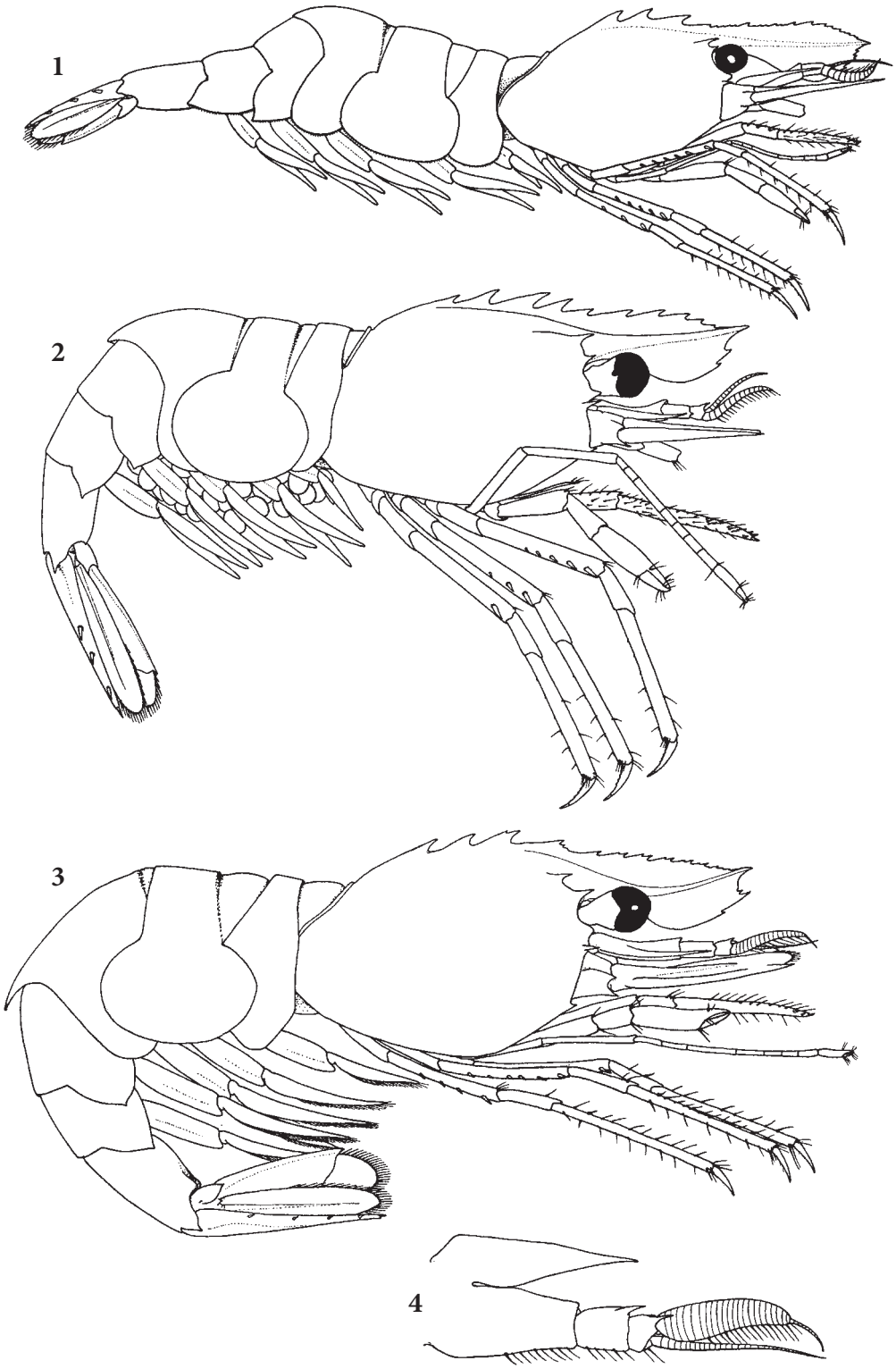


Plate X

Fig. 1 *Spirontocaris murdochi* Rathbun, 1902: whole animal (lateral view).
Fig. 2 *Spirontocaris lilljeborgii* (Danielssen, 1859): whole animal (lateral view).
Figs. 3-4 *Spirontocaris intermedia* Makarov in Kobyakova, 1936: 3: whole animal (lateral view).
4: antenna 1.

Scale 1 cm (1, 2, 3), 1 mm (4).

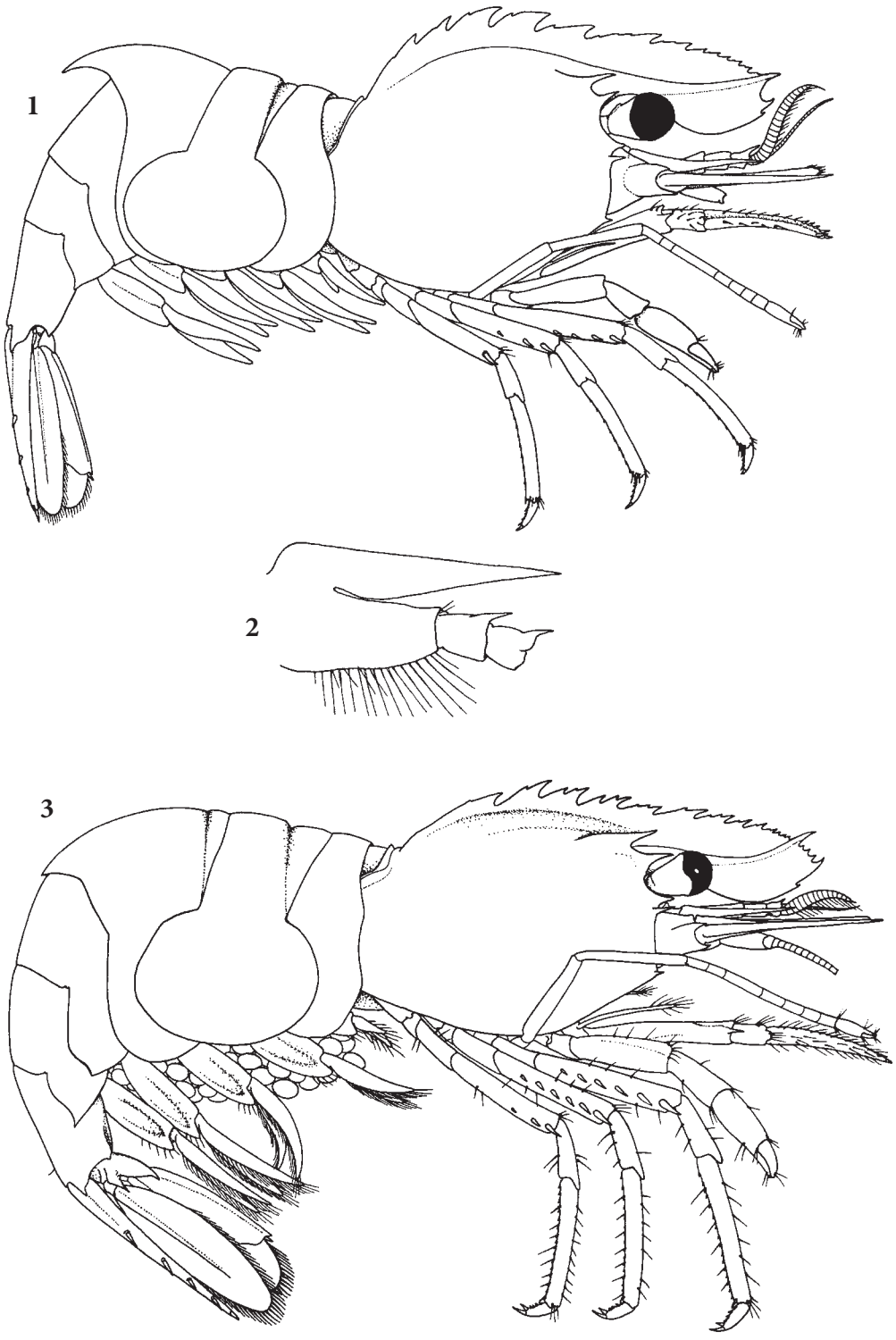


Plate XI

Figs. 1-2 *Spirontocaris spinus* (Sowerby, 1805): 1: whole animal (lateral view). 2: peduncle of antenna 1.
Fig. 3 *Spirontocaris arcuata* Rathbun, 1902: whole animal (lateral view).

Scale 1 cm.

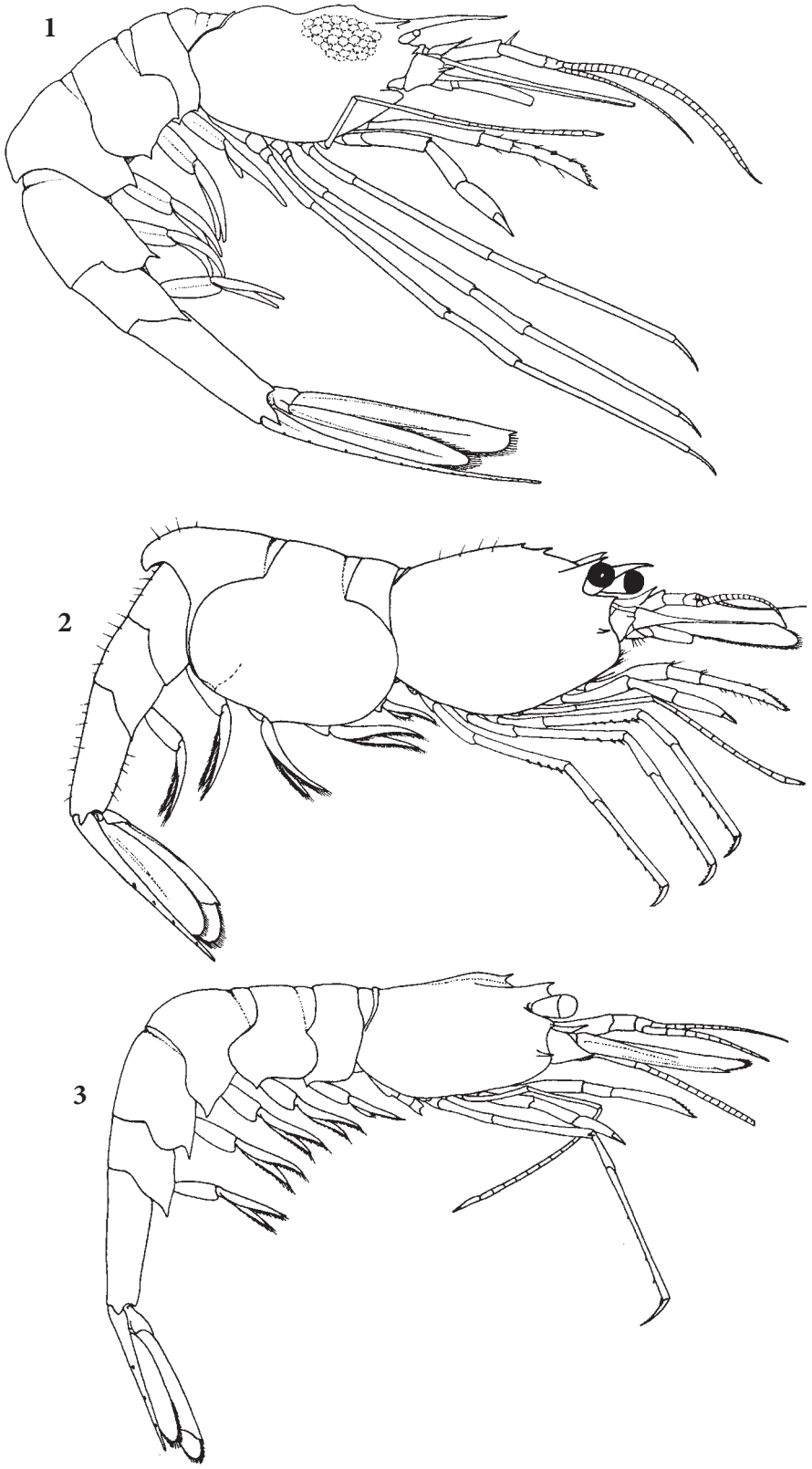


Plate XII

Fig. 1 *Bythocarides menshutkinae* Sokolov, 2002: whole animal (lateral view).
Fig. 2 *Bythocaris simplicirostris* G.O. Sars, 1869: whole animal (lateral view).
Fig. 3 *Bythocaris kobjakovae* Sokolov, 2000: whole animal (lateral view).

Scale 1 cm.

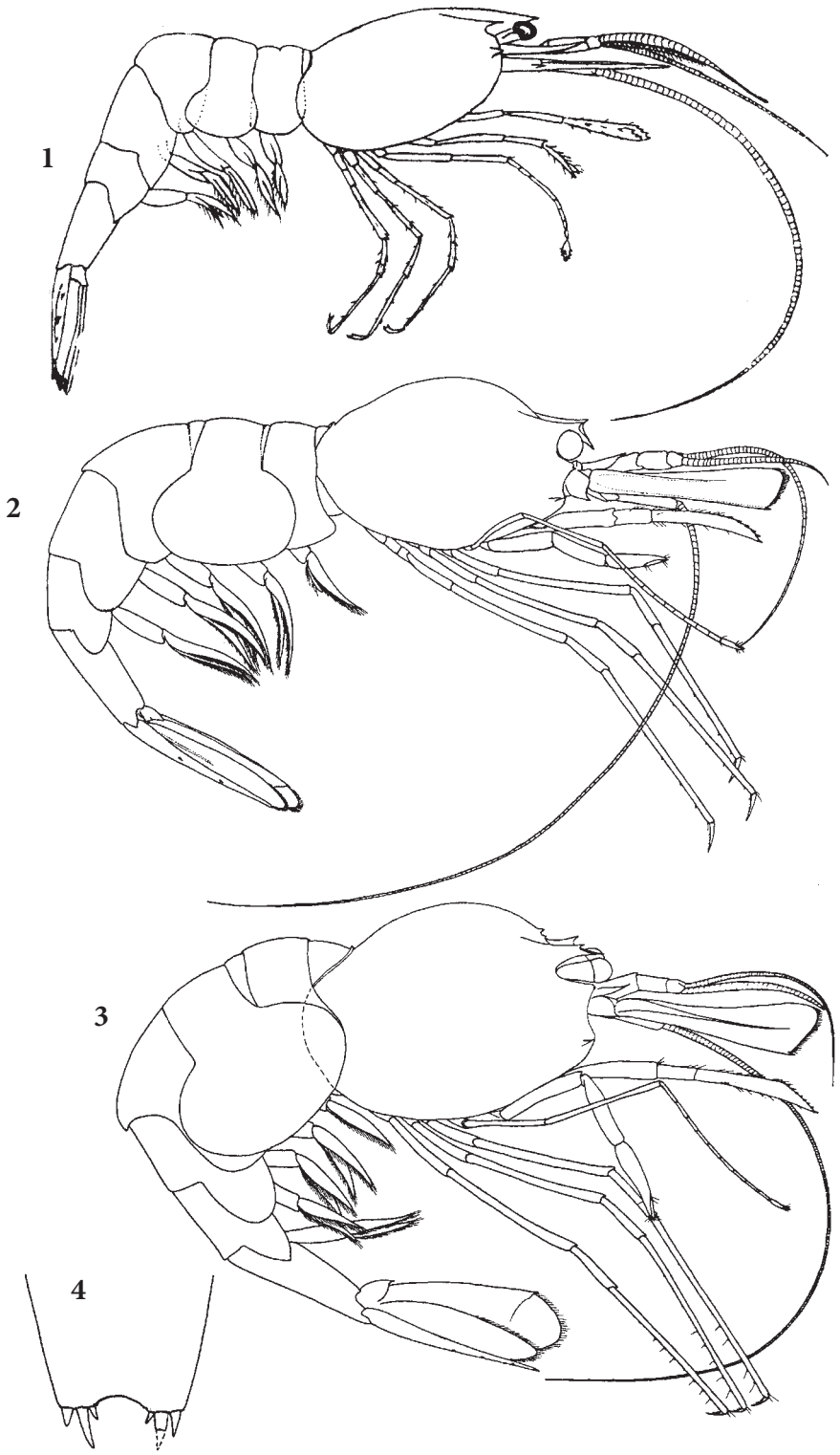


Plate XIII

Fig. 1 *Bythocaris grumanti* Burukovsky, 1966: whole animal (lateral view) (from Burukovsky 1966).
Fig. 2 *Bythocaris curvirostris* Kobyakova, 1957: whole animal (lateral view).
Figs. 3-4 *Bythocaris leucopis* G.O. Sars, 1879: 3: whole animal (lateral view). 4: end of telson, dorsal view.

Scale 1 cm (1, 2, 3), 1 mm (4).

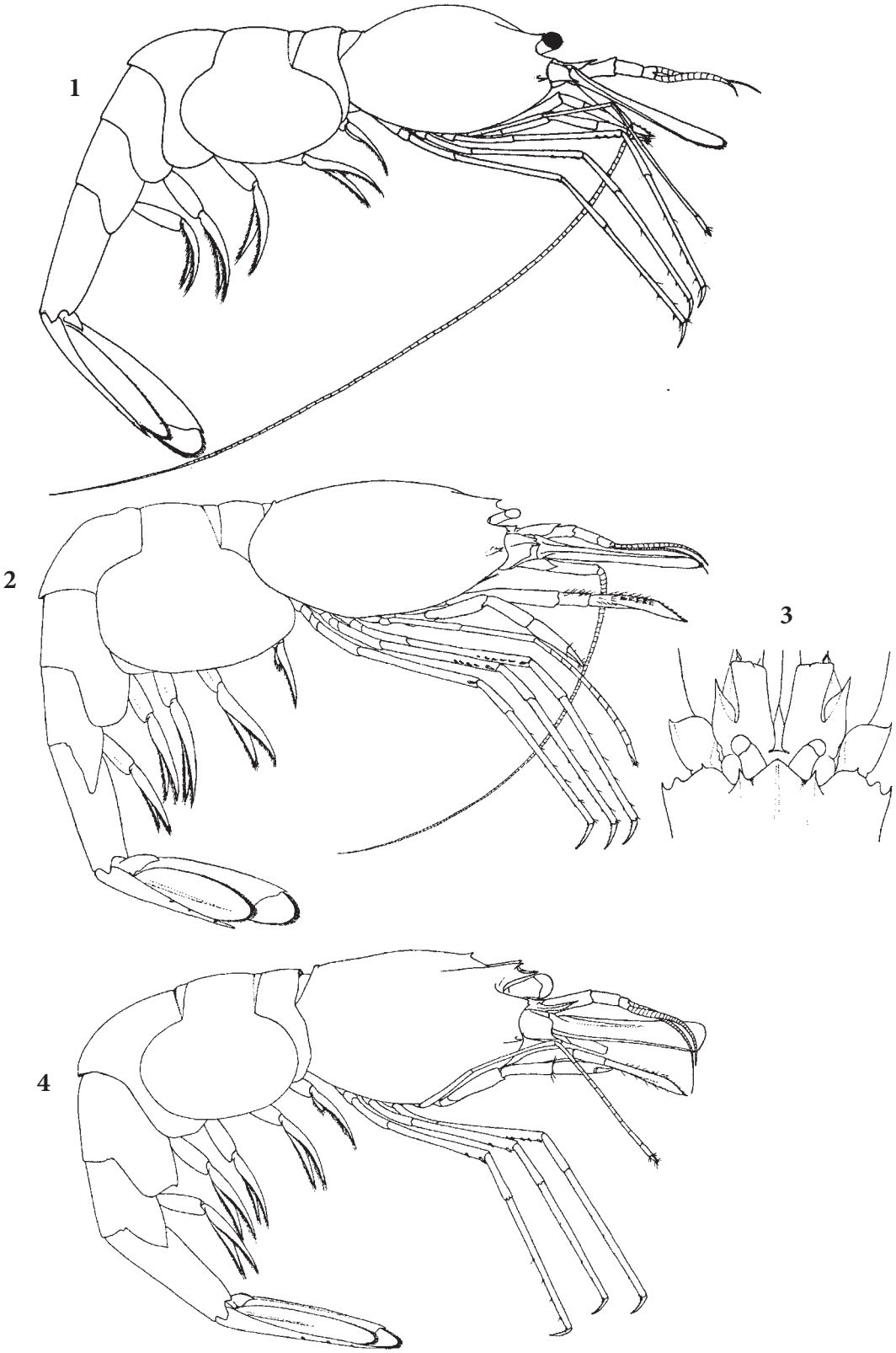


Plate XIV

Fig. 1 *Bythocaris payeri* (Heller, 1875): whole animal (lateral view).
Figs. 2-3 *Bythocaris irene* Retovsky, 1946: 2: whole animal (lateral view). 3: anterior portion of carapace, dorsal view.
Fig. 4. *Bythocaris biruli* Kobyakova, 1964: whole animal (lateral view).

Scale 1 cm (1, 2, 4), 1 mm (3).

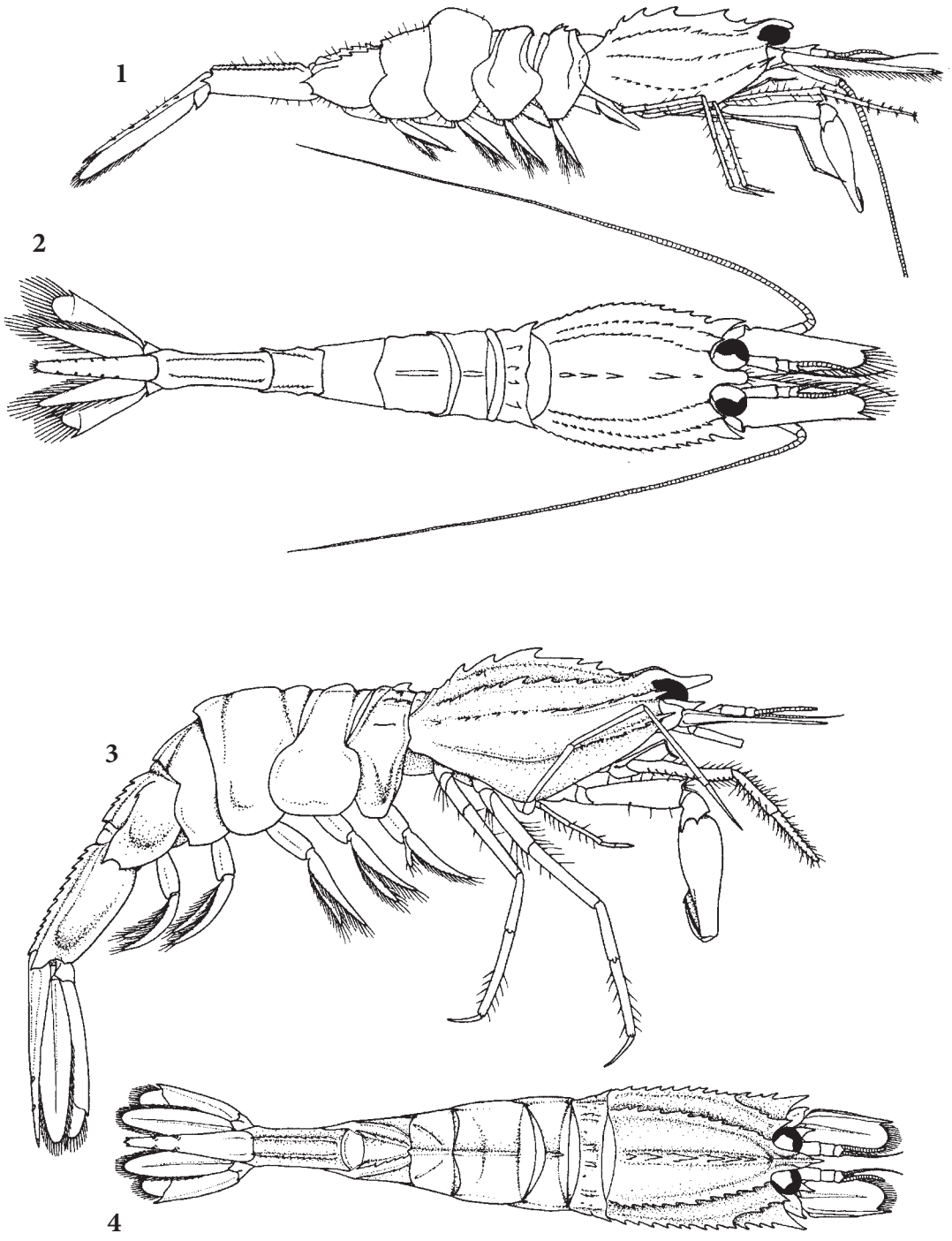


Plate XV

Figs. 1-2 *Sabinea septemcarinata* (Sabine, 1824): 1: whole animal (lateral view). 2: whole animal (dorsal view).
Figs. 3-4 *Sabinea sarsi* Smith, 1879: 3: whole animal (lateral view). 4: whole animal (dorsal view).

Scale 1 cm.

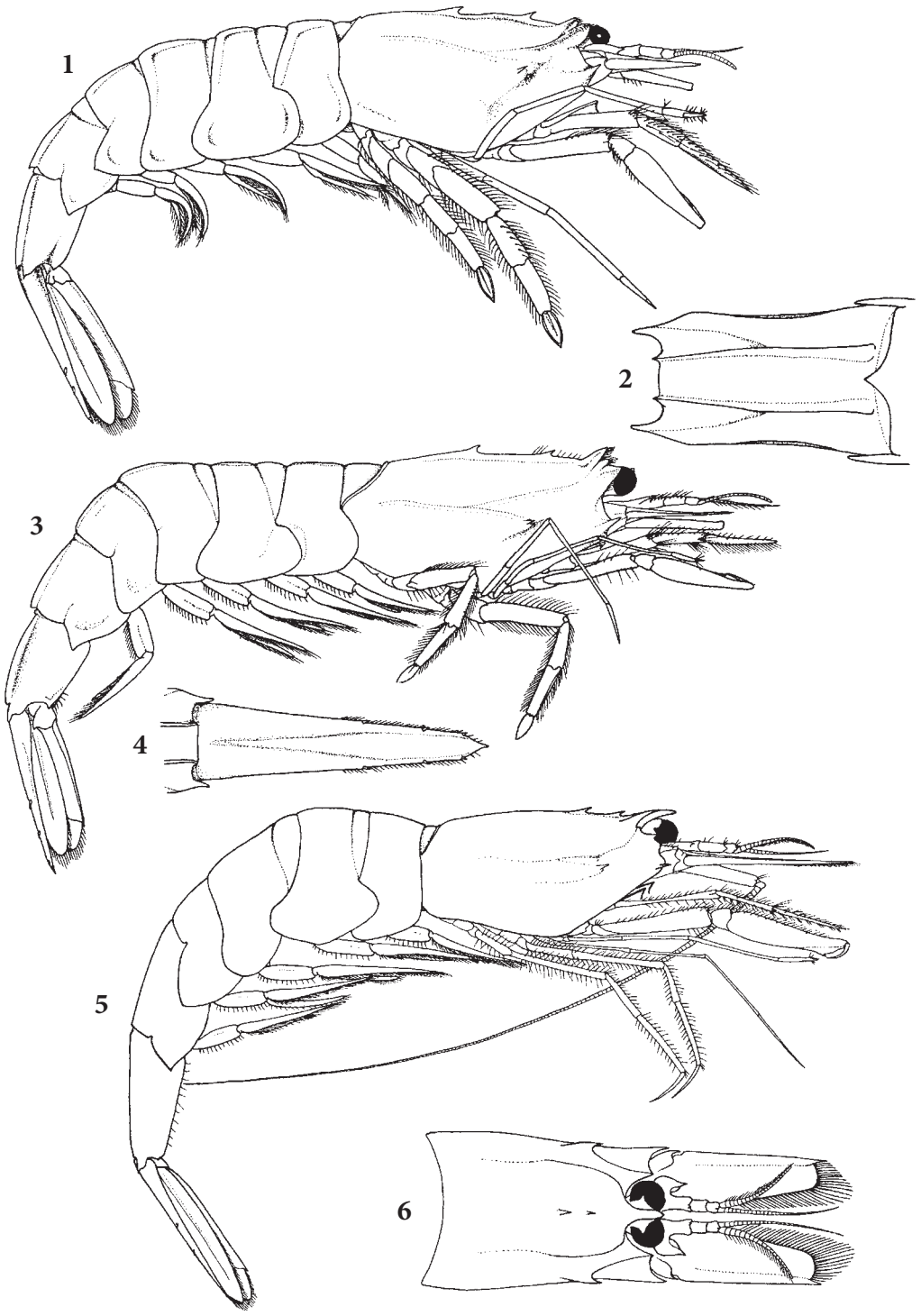


Plate XVI

Figs. 1-2 *Argis dentata* (Rathbun, 1902): 1: whole animal (lateral view).
2: sixth abdominal segment, dorsal view.
Figs. 3-4 *Argis lar* (Owen, 1839): 3: whole animal (lateral view).
4: posterior edge of sixth abdominal segment, dorsal view.
Figs. 5-6. *Crangon communis* (Rathbun, 1899): 5: whole animal (lateral view).
6: carapace, dorsal view.

Scale 1 cm.

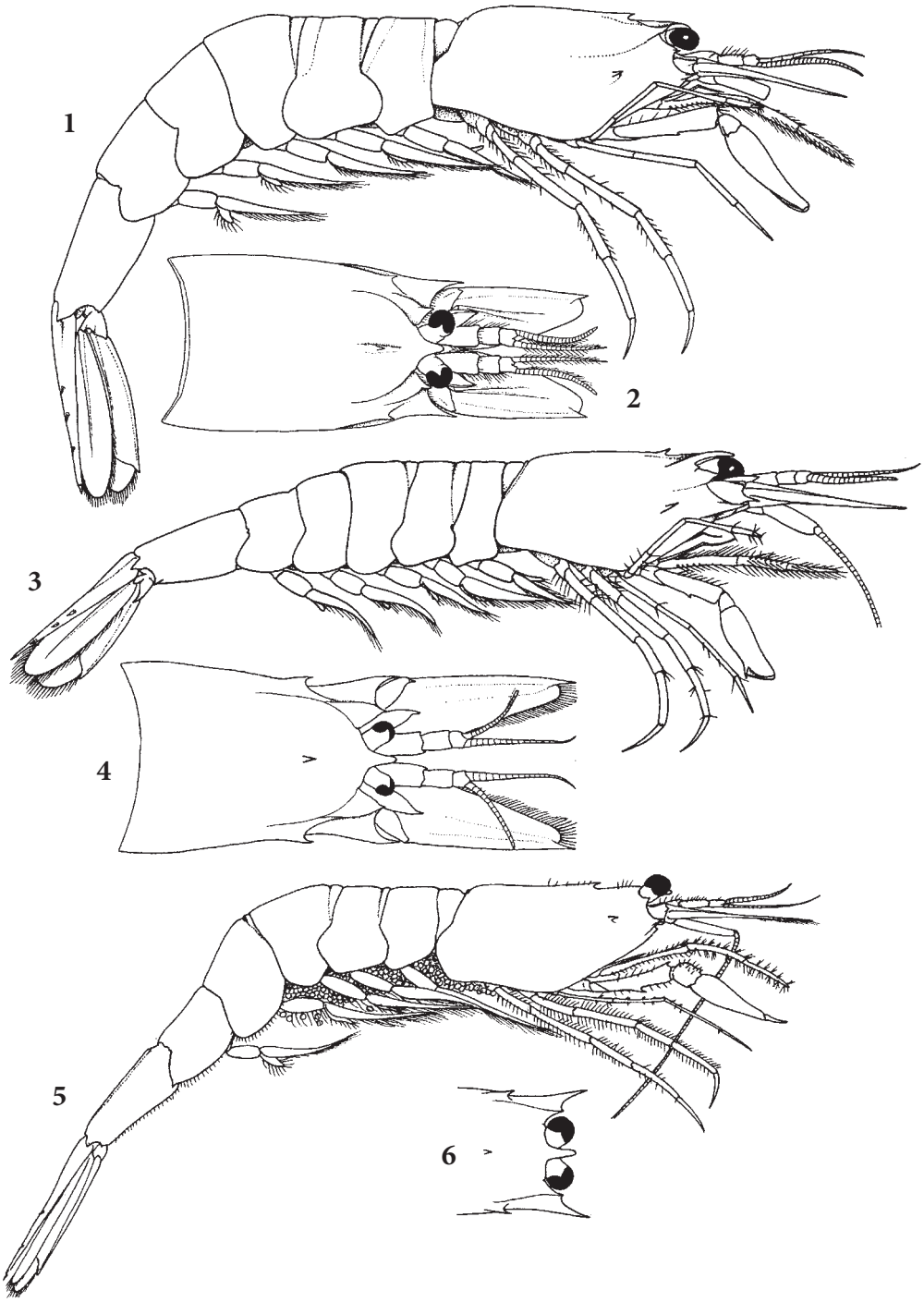


Plate XVII

Figs. 1-2 *Crangon crangon* (Linnaeus, 1758): 1: whole animal (lateral view). 2: carapace, dorsal view.
Figs. 3-4 *Crangon septemspinosa* Say, 1818: 3: whole animal (lateral view). 4: carapace, dorsal view.
Figs. 5-6 *Crangon dalli* (Rathbun, 1902): 5: whole animal (lateral view). 6: anterior portion of carapace, dorsal view.

Scale 1 cm.

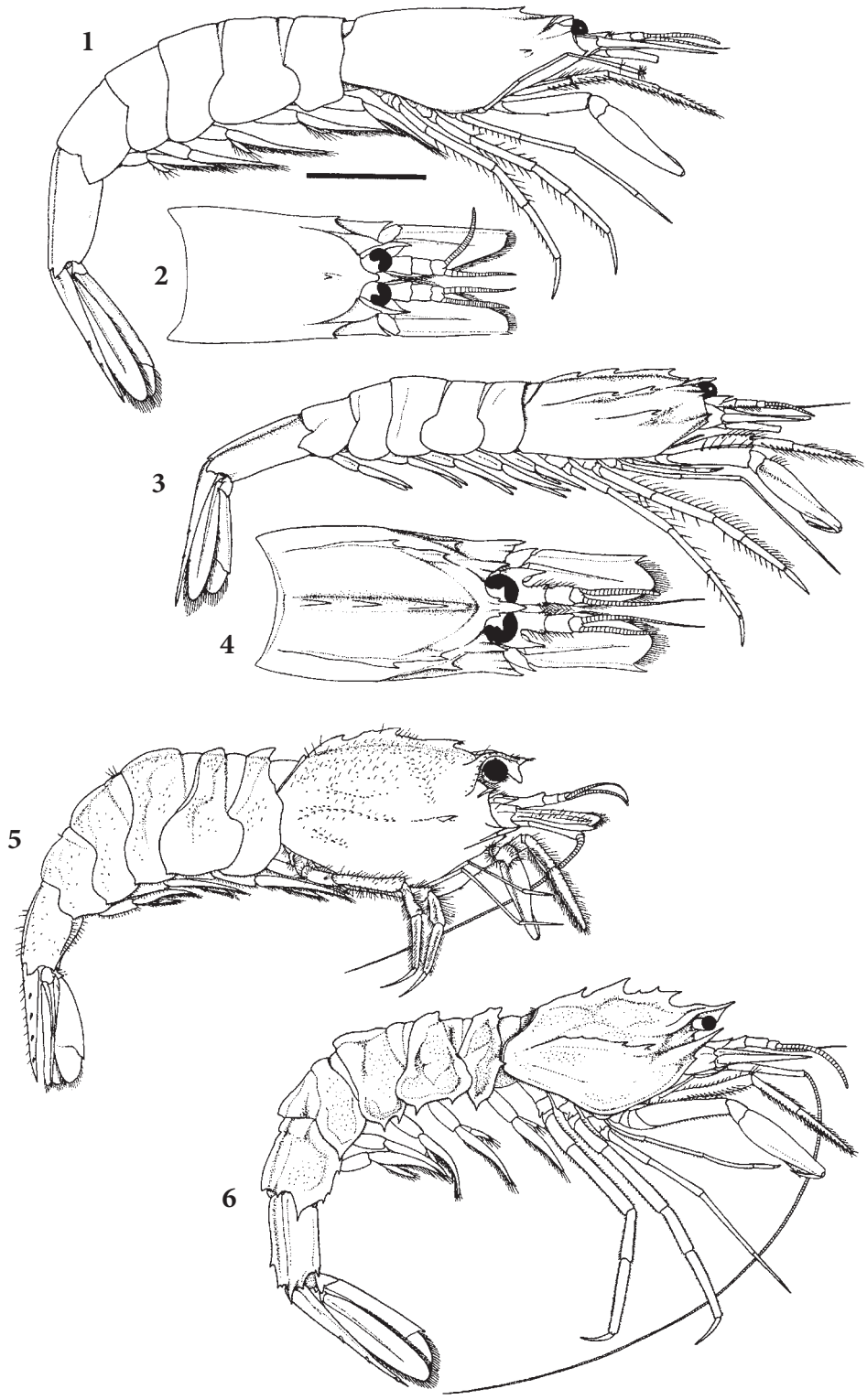


Plate XVIII

Figs. 1-2 *Crangon allmanni* Kinahan, 1857: 1: whole animal (lateral view). 2: carapace, dorsal view.
Figs. 3-4 *Pontophilus norvegicus* (M. Sars, 1861): 3: whole animal (lateral view). 4: carapace, dorsal view.
Fig. 5 *Sclerocrangon boreas* (Phipps, 1774): whole animal (lateral view).
Fig. 6 *Sclerocrangon ferox* G.O. Sars, 1877: whole animal (lateral view).

Scale 1 cm.

Infraorder Anomura (Order Decapoda, Suborder Reptantia)

V.V. Petryashov, Ph.D., Senior Scientist
Zoological Institute St. Petersburg, St. Petersburg, Russia

The Anomura include marine, brackish, freshwater, and terrestrial decapod crustaceans. They inhabit depths from 0 to 5300 m in the world's oceans. Anomura are predominantly epibenthic organisms; some live in burrows. They live on sediments of varying grain size. Currently, more than 1500 species are recognized, belonging to four superfamilies. They occur in all oceans of the planet, but are most numerous in tropical and subtropical waters. The number of species declines toward the poles, and the fewest number of species are observed in the Arctic Ocean, where the fauna consists primarily of boreal and subtropical to boreal species. They are omnivores, predators, scavengers, detritovores, and occasionally filter-feeders.

The habit is crustacean or crab-like (Pl. I, Figs. 1, 2, 3). The body is divided into a cephalothorax and abdomen. The cephalothorax consists of eight cephalic segments including three maxillipedal segments and five thoracic segments. The abdomen has six segments and a telson. The eyes are stalked, faceted, and well developed. The head and thorax is completely or nearly completely covered by a carapace, which is fused dorsally along its entire length with the thoracic segments but it is not usually fused with the epistome (plate above the mouthparts). Laterally, the carapace covers the base of the thoracic legs and gills, forming a branchial cavity. A rostrum is commonly present on the anterior side of the carapace; the shape and armature of the rostrum, and the sculpturing and degree of sclerotization of the dorsal surface of the carapace, are often important systematic characters. Antennules (antenna 1) and antennae (antenna 2) are well developed, but they are substantially shortened in crabs. Antenna 1 consists of a three-articulate peduncle and two flagella. Antenna 2 has a two-articulate protopodite, an endopodite consisting of a two- (rarely three-) articulate peduncle and flagellum, and if present, the exopodite consists of a reduced (in most species) plate or spine-like appendage (antennal scale). The five thoracic legs are uniramous (pereopods or walking legs) and six-articulate (the basis and ischium are fused). The first pair of legs is always chelate or subchelate. The remaining legs are usually not chelate (the third pair is never chelate). The fifth leg in a number of families is partially or completely (Lithodidae) covered by the carapace and functions to clean the gills. The form and degree of sclerotization of the abdomen is highly variable: the abdomen can be projecting out almost straight (as in shrimp) or bent beneath the carapace to varying degrees (as in crabs); it can be soft, uncalcified, spiral, or asymmetric (as in many pagurids and female lithodids). Pleopods are biramous (rarely uniramous); they are usually more developed in females than males (in male lithodids and albuneids they can be completely reduced). Pleopods are usually present on all abdominal segments, but the structure can vary on different sides of the same segment. The first or second pleopods of males are modified into copulatory organs in galatheids and pylochelids. Uropods are usually developed (they are absent in lithodids), but variable in form. Together with the telson they form a caudal fan, but they can be reduced (in porcellanids) or modified (they are often crescent-shaped in pagurids and are used to hold onto a shell). Development is through metamorphosis; the eggs with embryos are retained on the pleopods of the female until hatching.

Key to the families of the infraorder Anomura

1(4) Fifth pair of pereopods located under carapace in branchial cavity; used to clean gills (Pl. II, Fig. 1); (abdomen hard, chitonized, partially or completely folded beneath the cephalothorax).

2(3) Uropods well developed; along with telson they form a swimming (caudal) fan. (Body crayfish-shaped. Second-fourth thoracic legs end in claws. Carapace with long rostrum) (Pl. I, Fig. 2) . . . . . **family Galatheidae**

3(2) Uropods lacking (therefore swimming [caudal] fan lacking) (Pl. II, Fig. 2). (Body is crab-shaped (Pl. I, Fig. 3). Abdomen asymmetrical: pleopods present only in females: pair of pleopods on first segment, unpaired pleopods on left side of segments two-five) . . . . . **family Lithodidae (p. 160)**

1(4) Fifth pair of pereopods never beneath carapace; they are free (analogous to the fourth pair) (Pl. II, Fig. 3). (Abdomen soft, asymmetrical, often twisted spirally; uropods crescent-shaped, they function to keep the animal in the shell.) (Pl. I, Fig. 1). . . . . **family Paguridae**

Key to genera and species of the family Galatheidae

1(2) Rostrum straight, triangular, flattened dorsoventrally, with teeth on the lateral edges. (Basal denticles of rostrum small. Anterior portion of gastric region with only two spines.) (Pl. II, Fig. 4) . . . . . **genus *Galathea*, *G. strigosa* (Linnaeus, 1767)**

Length to 44 mm.
Atlantic subtropical-boreal. In southwestern Barents Sea (Varanger Fjord).
Depth 0-65 m. On rock.

2(1) Rostrum straight, spine-like, lateral edges smooth. (Gastric region of carapace lacking transverse row of spines.) (Pl. II, Fig. 5) . . . . . **genus *Munida*, *M. bamffica* (Pennant, 1777)**

Length to 76 mm.
Atlantic subtropical-boreal. Southwestern Barents Sea.
Depth 23-1244 m.

Key to genera and species of the family Paguridae

1(2) Entire dorsal surface of carapace hard, calcified. (Anterior part of carapace covered with granules. Rostrum short, wide, and horizontal.) (Pl. II, Fig. 6). . . . . **genus *Labidochirus*, *L. splendescens* (Owen, 1839)**

Synonymies: *Pagurus splendescens* Owen, 1839:81; *Labidochirus splendescens* McLaughlin, 1974:339-353.
Length of anterior portion of carapace to 15 mm.
Pacific high boreal. Chukchi Sea, East Siberian Sea (between the mouth of the Kolyma River and Medvyed Islands).
Depth 1-412 m. On silt and sand.

2(1) Only anterior part of carapace hard; the branchial and pericardial portions are soft. (Pl. II, Fig. 7) . . . . . **genus *Pagurus***

3(4) Upper surface of the propodus of right claw evenly convex, covered with round granules (Pl. II, Fig. 8). (Inner surface of right claw strongly convex, with blunt granules giving the surface a shagreen appearance.) . . . . . ***P. bernhardus* (Linnaeus, 1758)**

Length of anterior part of carapace to 13 mm.
Atlantic subtropical-boreal. Southwestern Barents Sea.
Depth 0-477 m.

4(3) Upper surface of propodus of the right claw covered with spine-like granules or conical spines (Pl. II, Fig. 9).

5(6) Left claw more or less symmetrical, oval-shaped, lacking a robust median ridge (Pl. II, Fig. 10). (Upper propodus of right claw covered with more than eight uneven rows of long spines; two of the rows coalesce at the anterior edge, often forming a V-shaped pattern.) (Pl. II, Fig. 9) . . . . . ***P. capillatus* (Benedict, 1892)**

Length of anterior part of carapace to 9 mm.
Pacific widespread boreal. Southern Chukchi Sea.
Depth 0-500 m. On silt, more rarely on sand or rock.

6(5) Left claw having distinct asymmetrical triangular shape with highly developed posterior outer corner and robust median ridge, with one row of spines or granules (Pl. II, Fig. 11).

7(8) Ends of dactylus and propodus of left claw long and bent downward (Pl. II, Fig. 12).
Bundle of setae present in special round depression at anterior inner corner of carpus of right claw (Pl. III, Fig. 1) . . . . . ***P. rathbuni* (Benedict, 1892)**

Length of anterior part of carapace to 15 mm.
Western Pacific widespread boreal. Chukchi Sea, East Siberian Sea (region between mouth of Kolyma River and Medved Islands).
Depth 9-210 m. On silt, sand, clay, and gravel.

8(7) Ends of dactylus and propodus of left claw of the usual form, not bent downward (Pl. III, Fig. 2). Carpus of right claw lacking bundle of setae, individual setae present only near base of spines (Pl. III, Fig. 3).

9(10) Sternites of third pereopods almost semicircular with long setae (Pl. III, Fig 4) . . . . . ***P. trigonocheirus* (Stimpson, 1858)**

Synonymies: *Pagurus pubescens* Brandt, 1851:111 (in Pacific Ocean, not *Pagurus pubescens* Krøyer, 1838); *Eupagurus trigonocheirus* Stimpson, 1858:249; *Pagurus trigonocheirus* Rathbun, 1899:556.
Length of anterior part of carapace to 21.7 mm.
Pacific subtropical-boreal. Chukchi Sea, East Siberian Sea (Cape Billings).
Depth 5-900 m. On silt, sand, and clay.

10(9) Sternites of the third pereopods quadrangular with rounded outer corners (Pl. III, Fig. 5) . . . . . ***P. pubescens* Krøyer, 1838**

Length of anterior part of carapace to 17 mm.
Atlantic widespread boreal Arctic. Barents Sea, White Sea, and southern Kara Sea.
Depth 0-1079 m. On silt, sand, and rock.

Key to genera and species of the family Lithodidae

1(8) Third-fifth segments of abdomen covered with well calcified plates; abdomen usually flattened.

2(3) Plates of the second and largest abdominal segment are completely fused, forming a single structure, sometimes two reduced articulations are preserved (Pl. III, Fig. 6). Antennal scale rudimentary (Pl. III, Fig. 7). (Surface of the carapace covered with large and small spines. Rostrum with eight spines [Pl. III, Fig. 8]. Surface of the second abdominal segment covered with spines) . . . . . **genus *Lithodes*, *L. maja* (Linnaeus, 1758)**

Length of carapace with rostrum to 108 mm.
Atlantic widespread boreal. Southwestern Barents Sea.
Depth 4-790 m. On rock.

3(2) Second largest segment of the abdomen with five distinctly separate plates: one central, two lateral, and two edge plates (Pl. II, Fig. 2). Antennal scale well developed (Pl. III, Figs 9, 10) . . . . . **genus *Paralithodes***

4(5) Antennal scale uniramous, shaped like a simple pointed spine (Pl. III, Fig. 10). Three pairs of spines present on the pericardial region of the carapace in adults (Pl. IV, Fig. 1) . . . . . ***P. camtschaticus* (Tilesius, 1815)**

Length of carapace with rostrum to 105 mm.
Pacific widespread boreal. Chukchi Sea (Kotzebue Sound).
Introduced to the southern Barents Sea.
Depth 4-366 m. On sand, silt, and rock.

5(4) Antennal scale biramous or quadramous (Pl. III, Fig. 9). Usually two pairs (rarely three-four pairs) of spines on the pericardial regions of carapace of adult specimens (Pl. IV, Fig. 2).

6(7) Antennal scale biramous (Pl. III, Fig. 9). Distal end of lower limb of rostrum pointed (Pl. V, Fig. 1) . . . . . ***P. platypus* (Brandt, 1850)**

Length of carapace with rostrum to 90 mm.
Western Pacific widespread boreal. Chukchi Sea (Kotzebue Sound, Point Barrow).
Depth 10-500 m. On sand, silt, and rock.

7(6) Antennal quadramous (Pl. V, Fig. 2). Distal end of lower limb of rostrum rounded, inflated (Pl. V, Fig. 3) . . . . . ***P. brevipes* (Milne-Edwards et Lucas, 1841)**

Length of carapace with rostrum to 83 mm.
Western Pacific widespread boreal. Chukchi Sea (Kotzebue Sound).
Littoral to 82 m depth.

8(1) Third-fifth abdominal segments lacking calcified plates; abdomen appears as a soft inflated membranous sac. Lateral edge of carapace posterior to cervical groove with four-five spines on each side (Pl. V, Fig. 4); upper lateral surface of propodus of right claw with three longitudinal rows of sharp spines (Pl. V, Fig. 5) . . . . . **genus *Hapalogaster*, *H. grebnitzkii* Schalfeew, 1892**

Length of carapace to 19 mm.
Pacific widespread boreal. Chukchi Sea (Kotzebue Sound).
Littoral to 104 m. On rock, more rarely on sand.

Literature

Makarov, V.V. 1938. Crustaceans. Anomura. In: Fauna of the USSR. Vol. 10(16), No. 3. Moscow. 325 pp.

McLaughlin, P.A. 1974. The hermit crabs (Crustacea, Decapoda, Paguridae) of northwestern North America. Zool. Jahrb. Abt. Syst. 130. 396 pp.

Udekem d'Acoz, C. d'. 1999. Inventaire et distribution des crustaces decapodes de l'Atlantique nord-oriental, de la Mediterranee et des eaux continentals adjacentes au nord de 25°N. Patrimoines naturels (M.N.H.N./S.P.N.). Vol. 40. 383 pp.

Vinogradov, L.G. 1950. Key to the shrimp, crustaceans and crabs of the Far East. Isv. TINRO 33:179-358.

Yashnov, V.A. 1948. Class Crustacea. In: Key to the fauna and flora of the northern seas of the USSR. Moscow, pp. 175-343.

Zaklan, S.D. 2002. Reviev of the Lithodidae (Crustacea: Anomura: Paguroidea): Distribution, biology, and fisheries. In: A.J. Paul et al. (eds.), Crabs in cold water regions: Biology, management, and economics. Alaska Sea Grant College Program, University of Alaska Fairbanks, pp. 751-845.

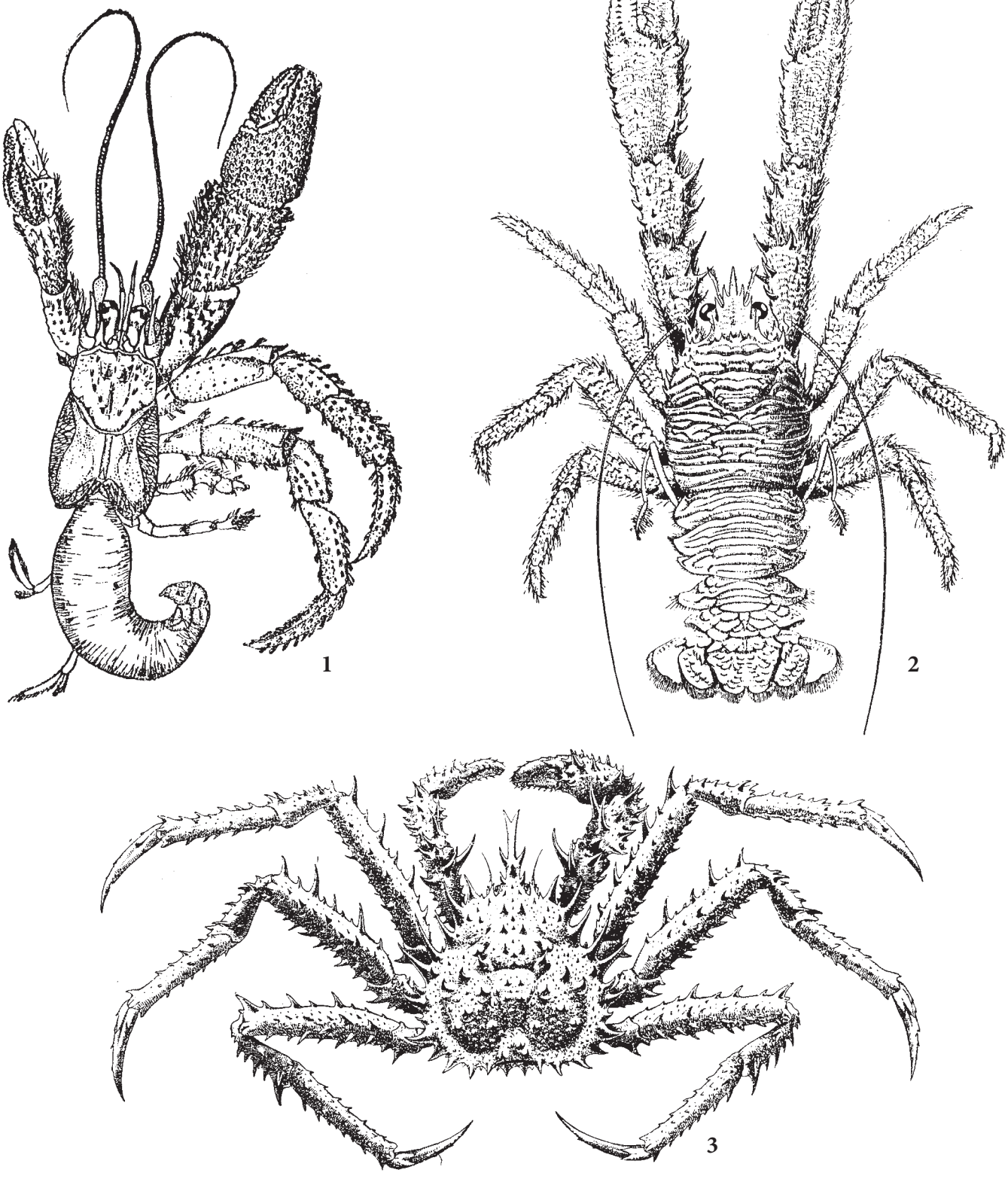


Plate I

Fig. 1 *Pagurus pubescens* Krøyer, 1838: whole animal (from Vinogradov 1950).
Fig. 2 *Galathea strigosa* (Linnaeus, 1767): whole animal (from Makarov 1938).
Fig. 3 *Lithodes maja* (Linnaeus, 1758): whole animal (from Makarov 1938).

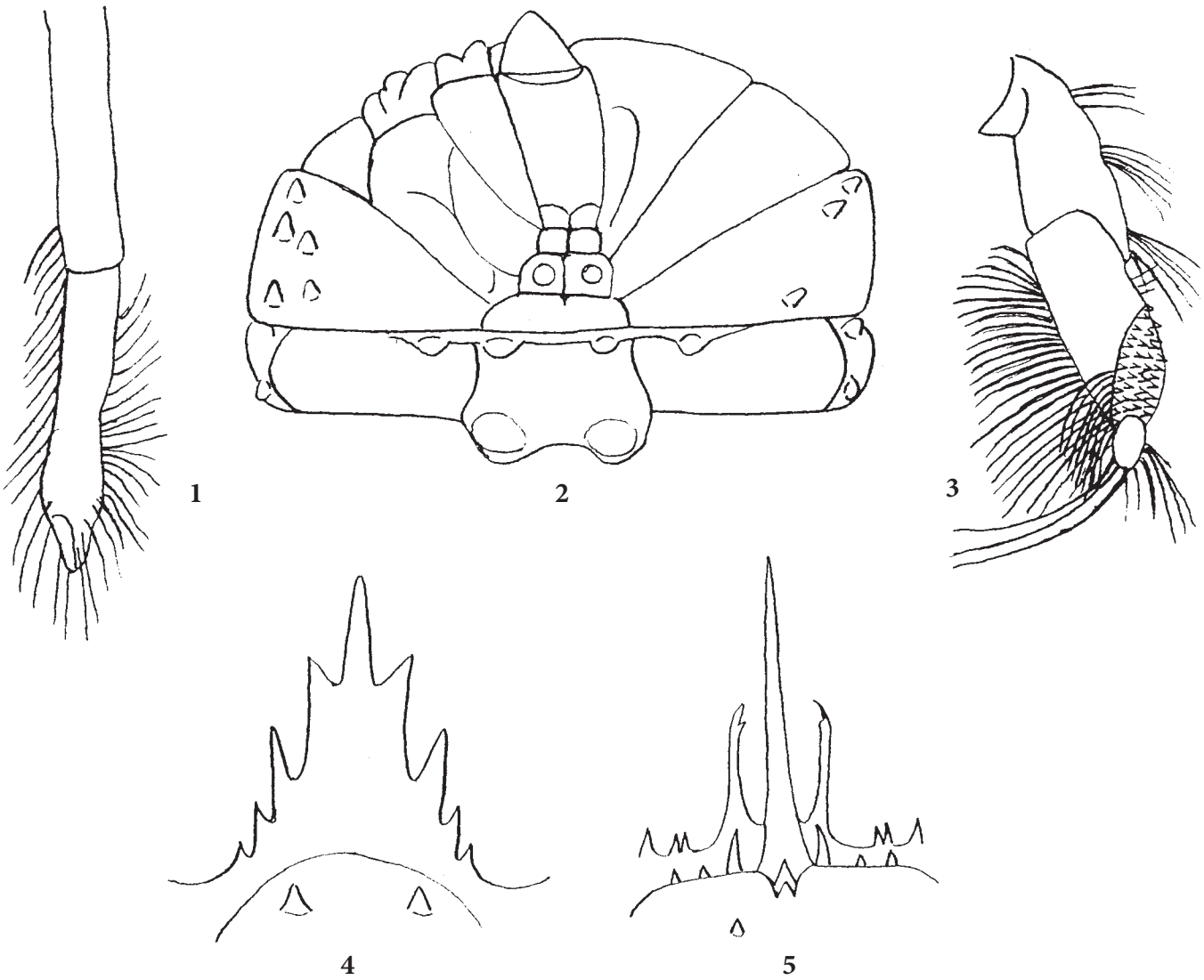


Plate II

Fig. 1 *Galathea strigosa* (Linnaeus, 1767): fifth pereopod (thoracic leg) (propodus and dactylus: two terminal articles) (×5).
Fig. 2 *Paralithodes platypus* (Brandt, 1850): abdomen (×5).
Fig. 3 *Pagurus pubescens* Krøyer, 1838: fifth pereopod (thoracic leg) (carpus, propodus, and dactylus: three terminal articles) (×5).
Fig. 4 *Galathea strigosa* (Linnaeus, 1767): rostrum and anterior part of carapace (×5).
Fig. 5 *Munida bamffica* (Pennant, 1777): rostrum and anterior part of carapace (×5).

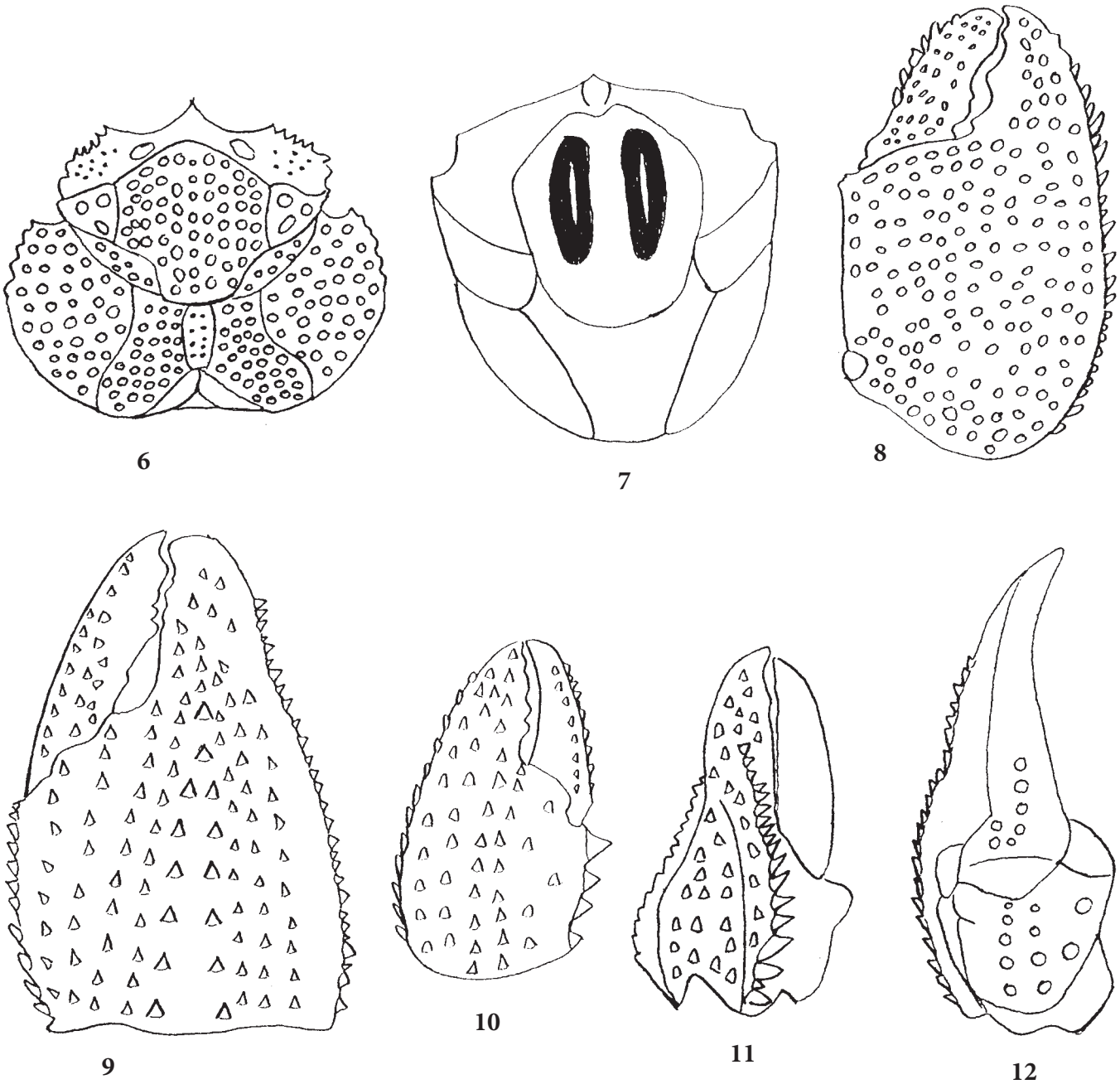


Plate II. (continued)

Fig. 6 *Labidochirus splendescens* (Owen, 1839): carapace (upper view) (×8).
Fig. 7 *Pagurus bernhardus* (Linnaeus, 1758): carapace (from above) (×8).
Fig. 8 *Pagurus bernhardus* (Linnaeus, 1758): propodus and dactylus (last two articles) of right claw (×8).
Fig. 9 *Pagurus capillatus* (Benedict, 1892): propodus and dactylus (last two articles) of right claw (×8).
Fig. 10 *Pagurus capillatus* (Benedict, 1892): propodus and dactylus (last two articles) of left claw (×8).
Fig. 11 *Pagurus pubescens* Krøyer, 1838: propodus and dactylus (last two articles) of left claw (upper view) (×8).
Fig. 12 *Pagurus rathbuni* (Benedict, 1892): propodus and dactylus (last two articles) of left claw (lateral view) (×8).

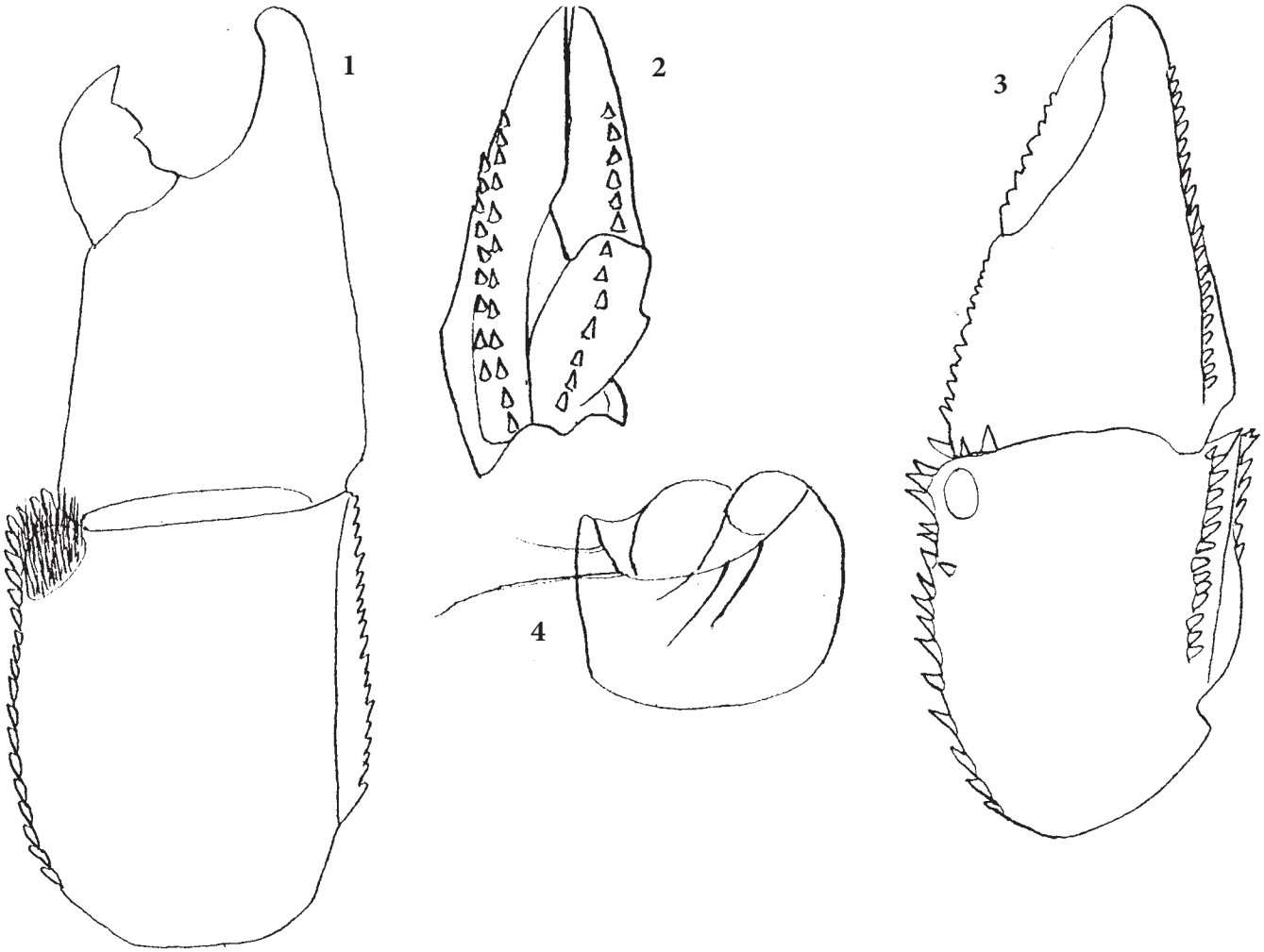


Plate III

Fig. 1 *Pagurus rathbuni* (Benedict, 1892): carpus, propodus, and dactylus (last three articles) of right claw (×5).
Fig. 2 *Pagurus pubescens* Krøyer, 1838: propodus and dactylus (last two articles) of left claw (lateral view) (×8).
Fig. 3 *Pagurus pubescens* Krøyer, 1838: carpus, propodus, and dactylus (last three articles) of right claw (×8).
Fig. 4 *Pagurus trigonocheirus* (Stimpson, 1858): sternite of third pereopod (thoracic leg) (×20).

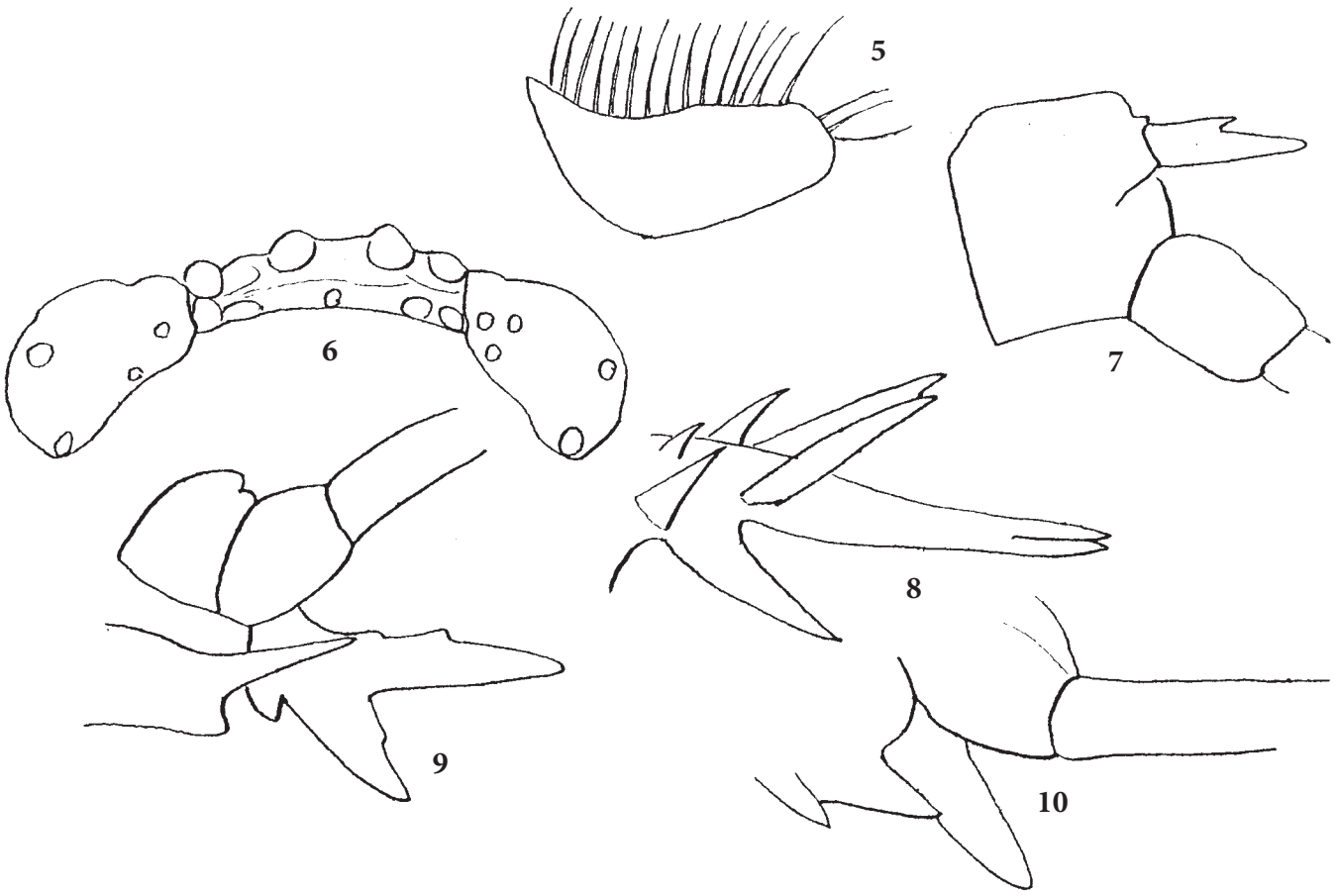
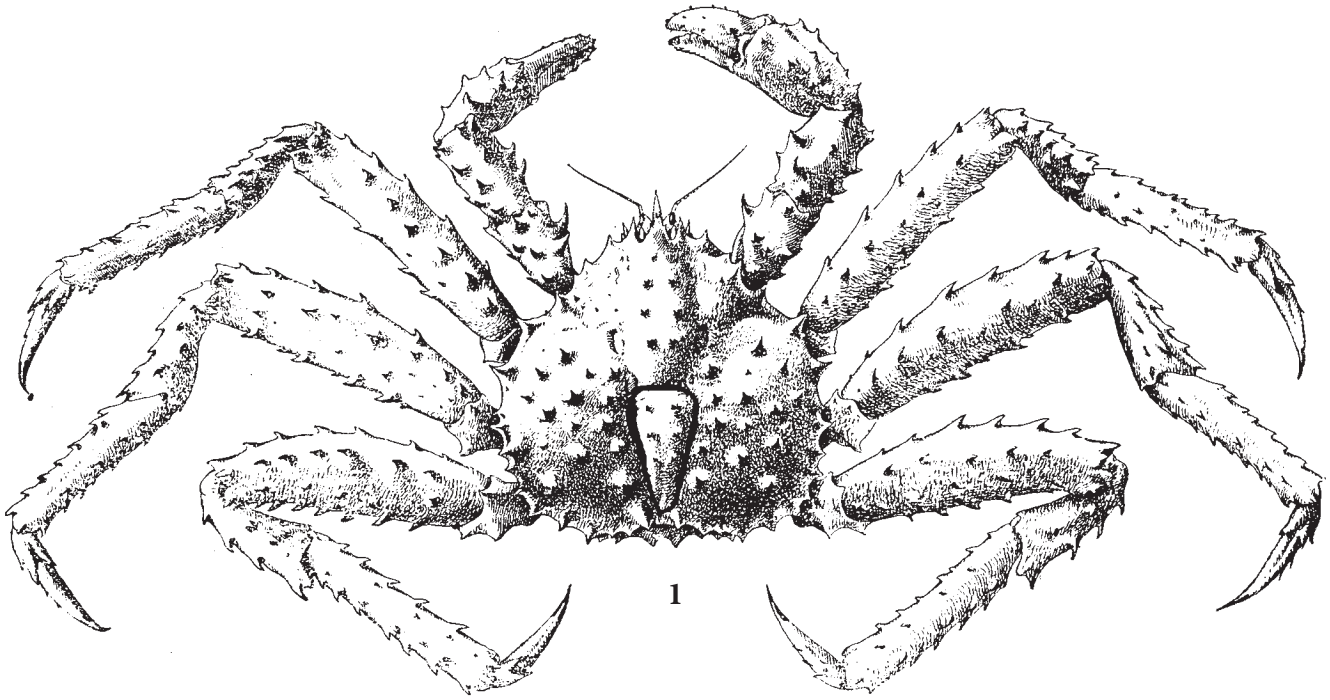
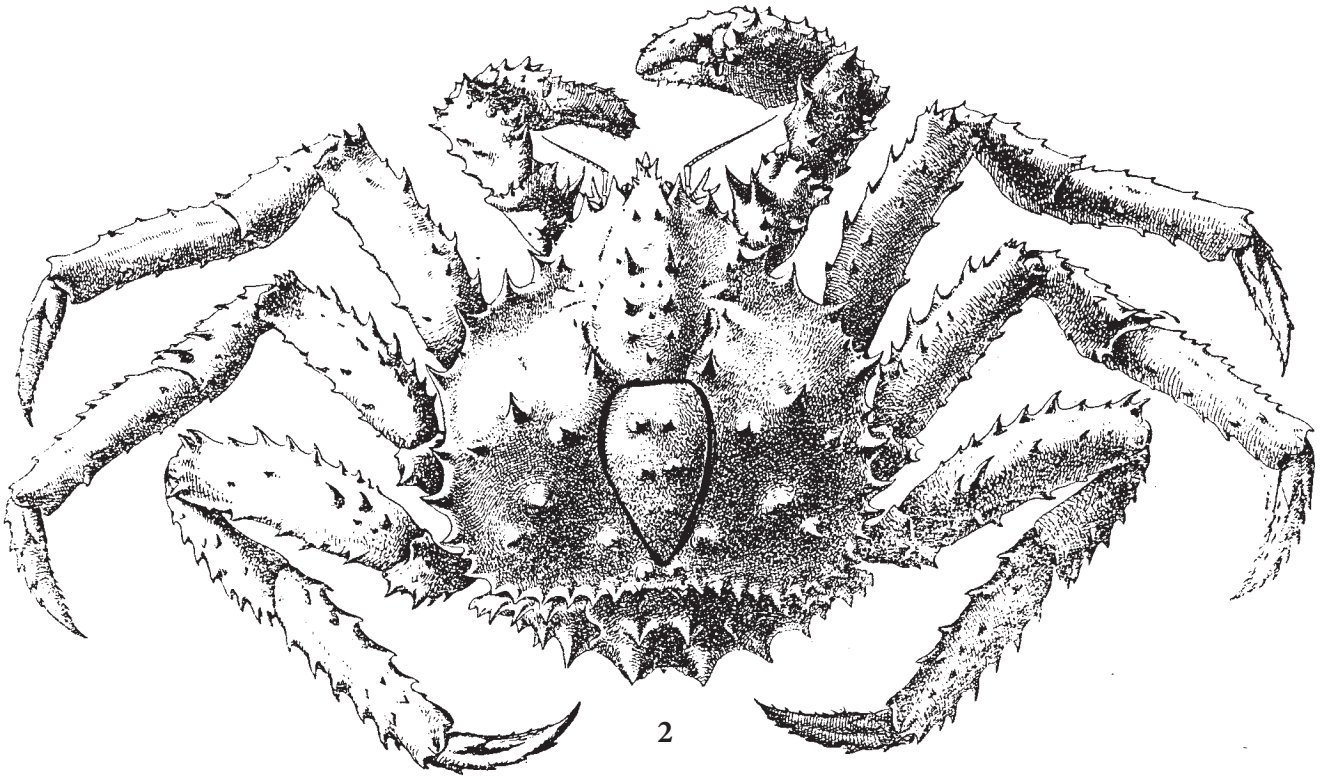


Plate III. (continued)

Fig. 5 *Pagurus pubescens* Krøyer, 1838: sternite of third pereopod (thoracic leg) (×20).
Fig. 6 *Lithodes maja* (Linnaeus, 1758): second segment of abdomen (×6).
Fig. 7 *Lithodes maja* (Linnaeus, 1758): antenna (antenna 2) (×20).
Fig. 8 *Lithodes maja* (Linnaeus, 1758): rostrum (×10).
Fig. 9 *Paralithodes platypus* (Brandt, 1850): antenna (antenna 2) (×20).
Fig. 10 *Paralithodes camtschaticus* (Tilesius, 1815): antenna (antenna 2) (×20).



1



2

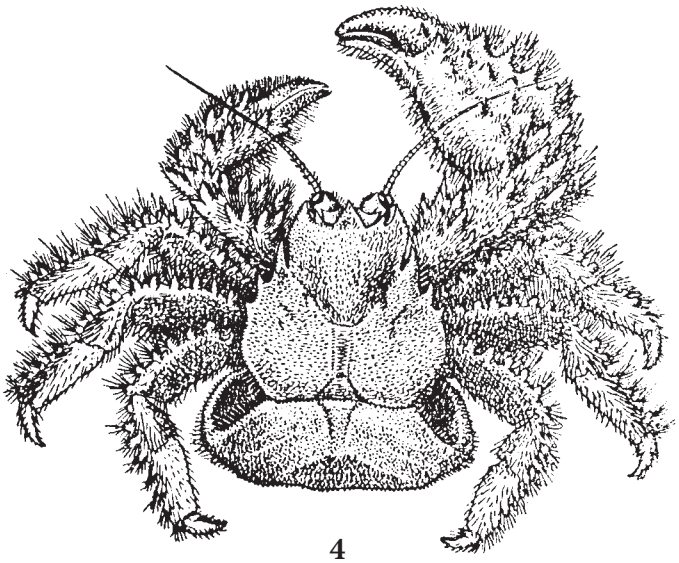
Plate IV

Fig. 1 *Paralithodes camtschaticus* (Tilesius, 1815): whole animal (from Makarov 1938).
Fig. 2 *Paralithodes platypus* (Brandt, 1850): whole animal (from Makarov 1938) (pericardial regions of carapace marked).

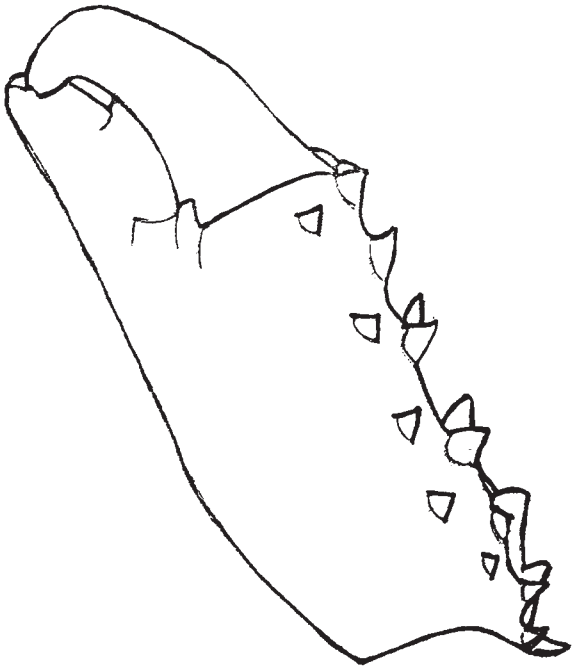
1

2

3



4



5

Plate V

Fig. 1 *Paralithodes platypus* (Brandt, 1850): rostrum (from Makarov 1938).
Fig. 2 *P. brevipes* (Milne-Edwards et Lucas, 1841): antenna (antenna 2) (from Makarov 1938).
Fig. 3 *P. brevipes* (Milne-Edwards et Lucas, 1841): rostrum (from Makarov 1938).
Fig. 4 *Hapalogaster grebnitzkii* Schalfeew, 1892: whole animal (from Makarov 1938).
Fig. 5 *H. grebnitzkii* Schalfeew, 1892: right claw, upper view (×8).

Infraorder Brachyura (Order Decapoda)

S.V. Vassilenko, Ph.D., Senior Scientist
Zoological Institute St. Petersburg, Russian Academy of Sciences, St. Petersburg, Russia

The infraorder Brachyura consists of more than 6793 species and subspecies (Ng et al. 2008) that inhabit predominantly marine ecosystems, but they also occur in freshwater and on land. Crabs occur everywhere in the world's oceans from the Arctic to Antarctic and from the littoral to abyssal depths. They are a component of many biological communities and are important in the diets of fish.

All of the thoracic segments of brachyurans are fused with the head, forming the cephalothorax, which is covered with a chitinous carapace. The carapace is shortened and compressed dorsoventrally. The dorsal surface of the carapace is separated from the lateral surface by a sharp flexion, forming a lateral rib (usually forming the anterior lateral and posterior lateral edge of the carapace). The boundary of the upper and lower part of the carapace is located below the lateral rib (the pleural suture).

The carapace is quite variable, not only in shape but also in relief sculpturing and armament in the form of keels, teeth, tubercles, granules, setae, and hairs. Species living on silty sediments have numerous setae and hairs with hooks at the tips attached to the dorsal surface of the carapace. Grooves are present on the dorsal surface of the carapace; they delineate areas where internal organs occur. The frontal, gastral, cardiac, and intestinal regions occur along the midline. The frontal edge of the carapace is straight or with lobes, teeth, or a rostrum. Paired lateral regions include the orbital, hepatic, and branchial. A schematic of the locations of the regions of the carapace is shown in Pl. I, Fig. 1. The outer integument of the sternites is present on the ventral side of the carapace between the appendages. The anterior sternites, located between the antennae, are fused to form the epistome, which is always laterally fused to the carapace and often also fused at the anterior midsection. The posterior thoracic sternite is fused with the others. The suborbital region is located below the orbits on the ventral side of the carapace along with the subhepatic and subbranchial regions. Between the anterior sternal plate and the subhepatic region are two pterigostomatic areas. The abdomen is short, flat, and symmetrical; it is always bent below the thorax, and fits into a depression in the sternal plates. The individual segments of the abdomen are often fused together; the abdomen is often narrow or narrowly triangular in males, and in females it is broadly rounded (Pl. I, Fig. 2).

The eyes are stalked, consisting to two articles, the basal and terminal with the corneas, sometimes reduced. The eyestalks are often set in the cavity of the ocular orbit.

The antennules (antenna 1) consist of a three-articulate peduncle and often there are two flagella. The antennules are very short and can sit longitudinally or transversely in special depressions on the lower side of the carapace.

The antennae (antenna 2) are small, consisting of a peduncle and very short flagellum; the peduncle consists of five articles; the first three articles are fused with the epistome and front edge of the carapace, forming a portion of the wall of the ocular orbit, and the two terminal articles are free.

The mouthparts consist of one pair of mandibles, pairs of maxillae 1 and 2, and three pairs of maxillipeds. The five pairs of pereopods are uniramous; pereopod 1 (the chelaped) is always chelate and pereopod 3 is always lacking a chela.

The pleopods (abdominal legs) are highly reduced. Sexual dimorphism is observed in the pleopods. The females usually have four pairs of developed pleopods (pleopods 2-5; rarely pleopod 1 is also developed). The pleopods are biramous; their endopodites have long hairs on which the eggs are attached, and the exopodites are free and are always moving to provide a water current for washing the eggs. The females are substantially smaller than the males.

Only the first two pairs of pleopods are developed in males; the pleopods are modified as copulatory organs. The first pair (gonopod 1) is unarticulated, tube-shaped, with a complicated structure on the terminal section (the structure is an important systematic character). The second pair (gonopod 2) is substantially smaller; it is also unarticulated, tube-shaped, and more similar in structure. Uropods are absent in both sexes.

Crabs develop through metamorphism. The eggs are carried by the females on the pleopods beneath the abdomen. The zoeal stage comes from the egg; it goes through several planktonic stages, after which it metamorphoses into a megalopa, which settles to the bottom.

Crabs are warmwater crustaceans. The numbers of species, genera, and families are greatest in tropical and subtropical waters of the world's oceans. The numbers of species, genera, and families markedly decline in temperate waters. In the Arctic Ocean brachyuran crabs are represented by only six species belonging to four genera and three families. These species are seen in regions influenced by boreal waters, and also in the transitional zones between boreal and arctic waters.

Brachyura, section Eubrachyuira
Key to families, genera, and species of subsection Heterotremata Guinot, 1977

(The gonopores in females are sternal. The gonopores in males are sternal or coxal.)

1(2) Antennae 1 are transverse or obliquely transverse (carapace is hexagonal or trapezoidal, anterior lateral edges of carapace with three to five teeth each. Frontal region often with four short teeth. Abdomen of males broadly triangular . . . . . **family Geryonidae Colosi, 1923**

(Carapace hexagonal, anterior lateral edges with three sharp teeth, the latter of the three is largest.). . . . . ***Gerion tridens* Krøyer, 1837 (Pl. II, Fig. 1)**

Males: carapace length 80 mm; width 98 mm.
Atlantic subtropical-boreal. Penetrates into the southwestern Barents Sea.
Sublittoral to upper bathyal, depth 32-690 m, often seen deeper than 100 m.

2(1) Antennae are longitudinal.

3(4) Carapace pentagonal, with either sharp or rounded corners. Lateral surface of carapace clearly delineated from dorsal surface by a sharp bend, forming a ridge with teeth. The dorsal side of the carapace, chelapeds, and pereopods covered with numerous teeth and hairs, giving the animals the common name of hair crab . . . . . **family Cheiragonidae Ortmann, 1893**

(Carapace pentagonal, width exceeds length, four frontal teeth present; anterior lateral edge of carapace with six triangular teeth, including the post-orbital tooth; the posterior lateral edge posterior to the large tooth with two small teeth.) . . . . . **Genus *Telmessus, T. cheiragonus* (Tilesius, 1812) (Pl. II, Fig. 2)**

Male: length of carapace is 83 mm, width 96 mm.
Pacific widespread boreal. Present in the Arctic only in the southern Chukchi Sea.
Littoral and sublittoral. In algae and seagrass, also on silty and silty-sandy beaches; often on beaches at river mouths.

4(3) Carapace flattened, pear-shaped. Lateral surface of carapace not clearly delineated from dorsal surface; there is no sharp bend but a more or less rounded transition, especially in posterior half of carapace. Dorsal side of carapace, chelapeds, and pereopods of species of the genera *Oregonia* and *Hyas* covered with setae having hook-like tips; they use the chelapeds to attach pieces of sponge, bryozoan, hydroids, and algae to the setae, which then grow on the setae to form camouflage. . . . . **family Oregoniidae Garth, 1958**

Key to genera and species of the family Oregoniidae

1(6) Carapace length substantially greater than width; rostral horns elongate. Articles of pereopods almost cylindrical. Abdomen of males with six segments, widening distally.

2(3) Carapace elongate, triangular. Postorbital tooth located some distance from eye . . . . . ***Oregonia*** **Dana, 1851**

(Horns of the pseudorostrum very long, ⅓ to ¼ the length of carapace, parallel, touching one another. Body shape sharply triangular) . . . . . .***Oregonia gracilis*** **Dana, 1951 (Pl. III, Figs. 1, 2)**

Males: carapace length to 50 mm, width to 34 mm.
Pacific widespread boreal. Penetrates the southern Chukchi Sea.
Littoral zone to 400 m depth, usually at depth of 10-150 m. On silty and silty-sandy sediments.

3(2) Carapace lyre-shaped. Post-orbital tooth next to eyes. . . . . ***Hyas*** **Leach, 1814**

4(5) Hepatic region broadened laterally, forming a wing-like process with the post-orbital region. Wing-like process separated from branchial region by deep concavity. . . . . ***Hyas coarctatus*** **Leach, 1815 (Pl. IV)**

Males: carapace length to 84 mm, width to 76 mm.
Widespread boreal Arctic, with a disruption of the range in the European Arctic. Known from the Labrador Peninsula in Hudson Bay, in the Barents Sea near Spitsbergen, also reported from the Chukchi and Beaufort seas, and one record exists from the East Siberian Sea (near Bennet and DeLong islands).
Littoral zone to 500 m depth, usually to 100 m. On rocky, sandy, and silty sediments.

5(4) Hepatic region is not widened laterally and is not separated from the branchial region by a deep concavity. . . . . .***Hyas araneus*** **(Linnaeus, 1758) (Pl. V)**

Males: carapace length to 105 mm, width to 83 mm.
Atlantic widespread boreal. In the Arctic it is known from the north coast of Iceland and western Spitsbergen, in the Barents Sea, and in Yugorskiy Shar Strait.
Depth 1-360 m, usually to 50 m. On rocky, sandy, and silty sediments.

6(1) Length of carapace in adults equal to or less than width. Articles of legs flattened. Abdomen of males with six segments, narrowing distally . . . . . ***Chionoecetes*** **Krøyer, 1838**

(Dorsal surface of carapace covered only with bumps. Blades of the pseudorostrum wide, having broadly rounded triangular shape.). . . . . ***Chionoecetes opilio* Fabricius, 1788 (Pl. VI)**

Males: carapace length to 118 mm, width to 120 mm.
Pacific–western Atlantic boreal Arctic. In the Arctic it is seen in the southern, central, and northern Chukchi Sea and Beaufort Sea, with one report in the eastern Laptev Sea.
Depth 20-600 m. On sand and silty sand.
Chionoecetes opilio (the snow crab) is a commercial species.

Literature

Berestovskiy, E.G., V.N. Semenov, and A.M. Sennikov. 1998. Penetration of the crab *Gerion tridens* Krøyer into the Barents Sea. In: Modern state of the plankton and benthos, conservation of biodiversity in the arctic seas. Report of the International Conference in Murmansk, pp. 8-9.

Christiansen, M.E. 1969. Decapoda. Brachyura. Marine invertebrates of Scandinavia. Vol. 2, 143 pp.

Guinot, D. 1977. Propositions pour une nouvelle classification des Crustacés Décapodes Brachyoures. C. r. hebd. Seanc. Acad. Sci., Paris. ser. D. 285:1049-1052.

Guinot, D. 1978. Principes d'une classification évolutive des Crustacés Décapodes Brachyoures. Bull. Biol. Fr. Belg., n.s. 112(3):211-292.

Jadamec, L.S., W.E. Donaldson, and P. Cullenberg. 1999. Biological field techniques for *Chionoecetes* crabs. Alaska Sea Grant College Program, University of Alaska Fairbanks. 80 pp.

Kobyakova, Z.I., and M.A. Dolgopol'skaya. 1969. Decapoda. In: Keys to the fauna of the Black and Azov seas. Vol. 2, pp. 270-307.

Ng, P.K.L., D. Guinot, and P.J.F. Davie. 2008. Systema brachyurorum, Part I. An annotated checklist of the extant brachyuran crabs of the world. The Raffles Bulletin of Zoology. Suppl. 17. 286 pp.

Rathbun, M.J. 1925. The spider crabs of America.. U.S. Natl. Mus. Bull. 129. 613 pp.

Sakai, T. 1976. Crabs of Japan and the adjacent Seas. Kodansha Ltd., Tokyo. 773 pp. (In English.)

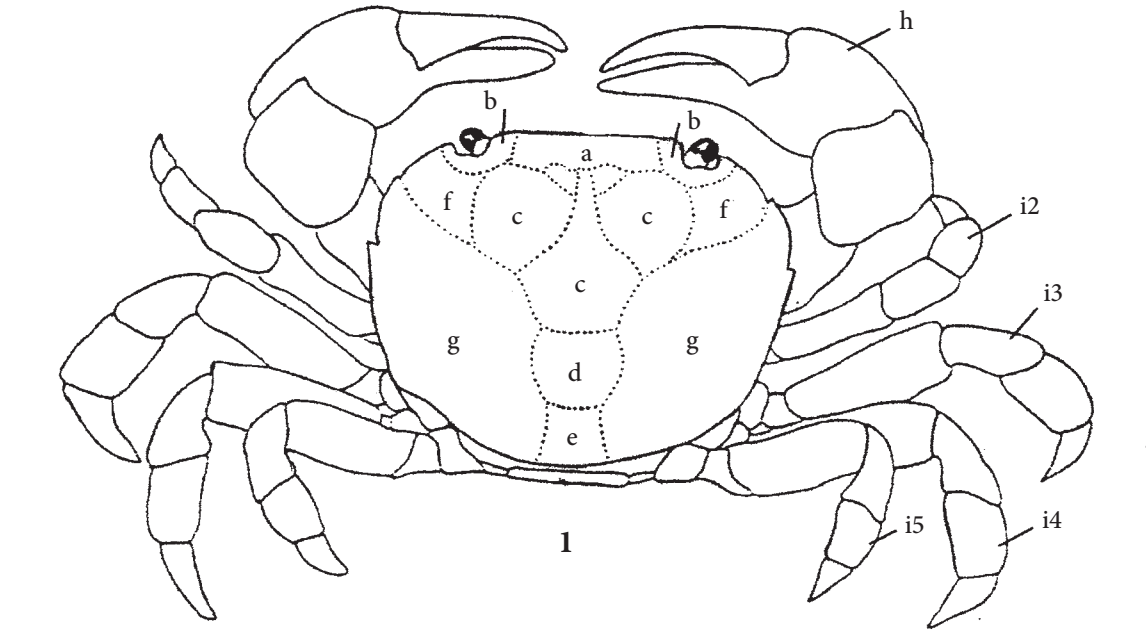
Sirenko, B.I. 1993. Research on the composition and distribution of benthos in the northern Laptev Sea (3.8). In: Material from scientific expeditions. Preliminary report on the expedition to the Taymyr Peninsula and the Laptev Sea in summer 1993 on the *Ivan Kireev* and the icebreaker *Polarstern* as part of the Russian-German cooperative research program. Arctic and Antarctic Science Research Institute, St. Petersburg, pp. 238-251.

Sirenko B.I., and S.V. Vassilenko. 2008. Crabs (Crustacea, Decapoda, Brachyura) of the Chukchi Sea, Chapter VII. In: Fauna and zoogeography of benthos of the Chukchi Sea. Explorations of the fauna of the seas. 61(69):142-148.

Slizkin, A.G. 1982. Distribution of snow crabs of the genus *Chionoecetes* and their habitat in the North Pacific Ocean. Izv. TINRO 106:26-33.

Tavares. M., and G.A.S. De Melo. 2004. Discovery of the first known benthic invasive species in the Southern Ocean: The North Atlantic spider crab *Hyas araneus* found in the Antarctic Peninsula. Antarctic Sci. 16(2):129-131.

Vinogradov, L.G. 1950. Key to the shrimps, lobsters and crabs of the Far East. Izv. TINRO 33:179-358.



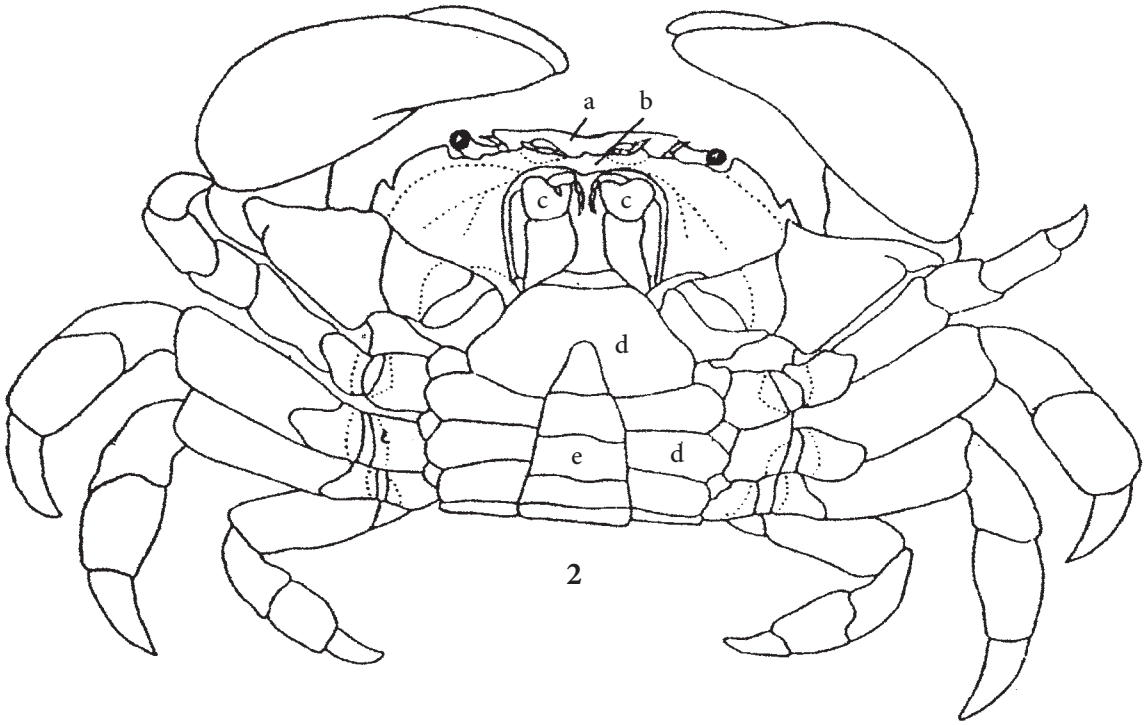


Plate I

Fig. 1 External anatomy of a brachyuran crab (dorsal view): a: frontal region. b: orbital region. c: gastral region with subregions. d: cardiac region. e: intestinal regions. f: hepatic region. g: branchial region. h: chelaped (pereopod 1). i2: pereopod 2. i3: pereopod 3. i4: pereopod 4. i5: pereopod 5 (from Kobyakova and Dolgopol'skaya 1969).

Fig. 2 External anatomy of the crab (ventral view): a: frontal region. b: epistome. c: outer maxillipeds (maxilliped 3). d: thoracic sternites. e: abdomen (from Kobyakova and Dolgopol'skaya 1969).

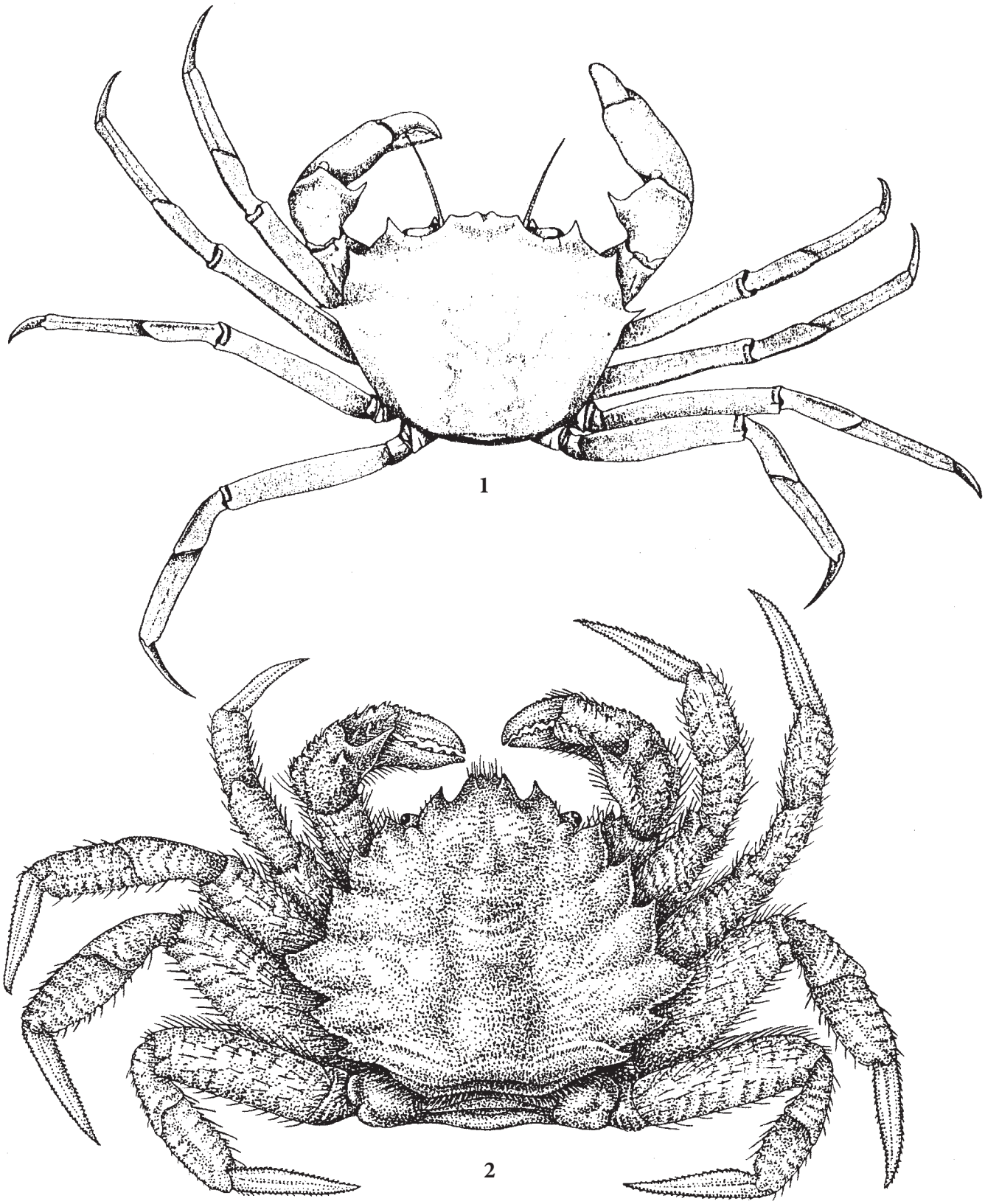
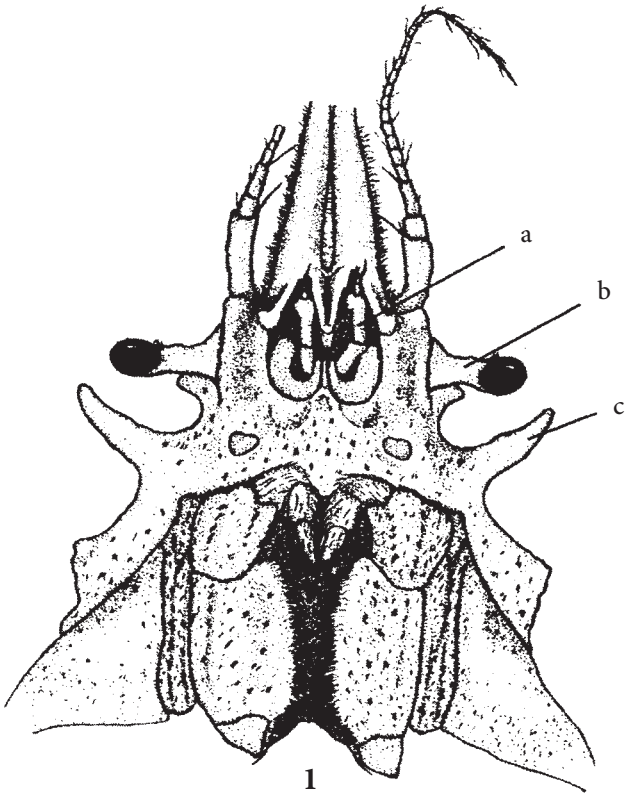
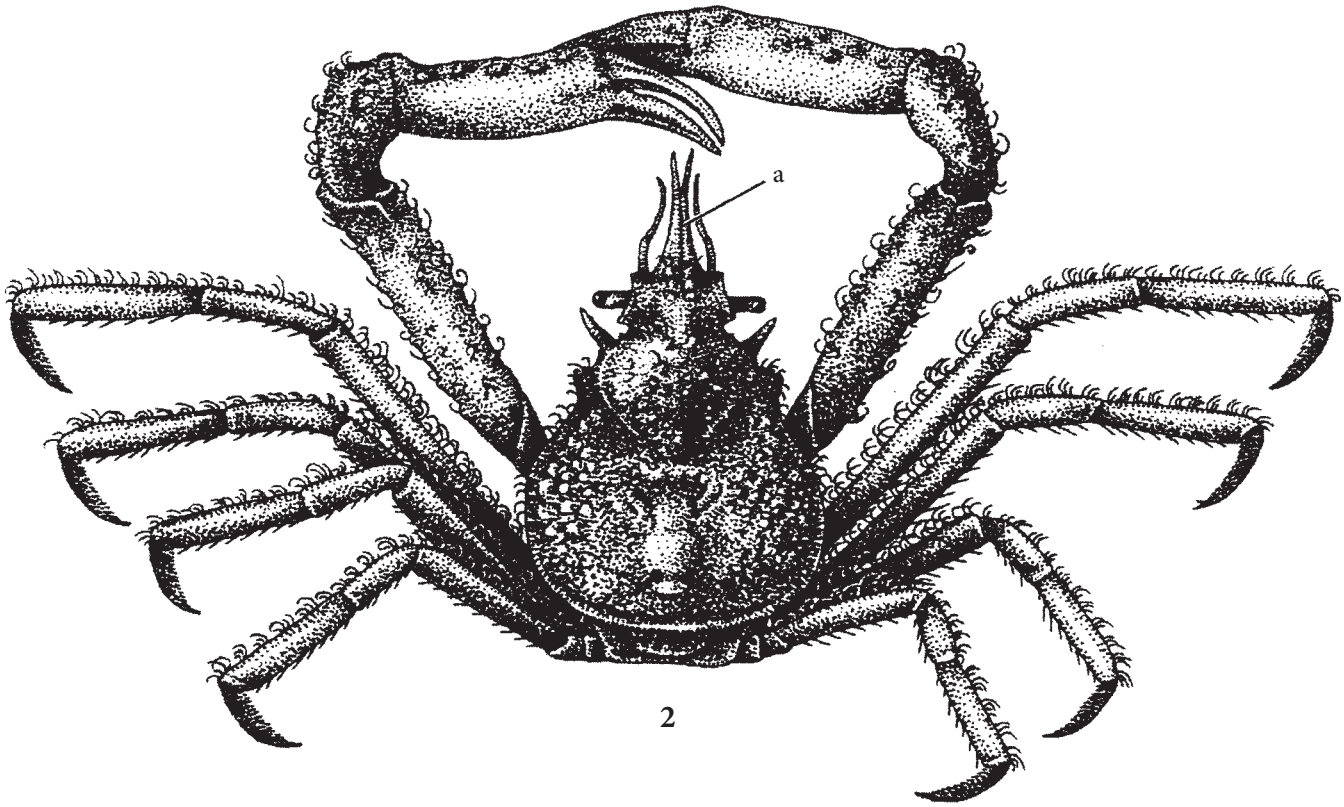


Plate II

Fig. 1 *Gerion tridens* Krøyer, 1837: males, dorsal view (from Christiansen 1969).
Fig. 2 *Telmessus cheiragonus* (Tilesius, 1812) male, dorsal view (original).



1



2

Plate III

Fig. 1 *Oregonia gracilis* Dana, 1851: anterior portion, ventral view. a: antennule (longitudinal position). b: eye. c: post-orbital tooth (original).
Fig. 2 *Oregonia gracilis* Dana, 1851: male, dorsal view (original). a: rostral horns.

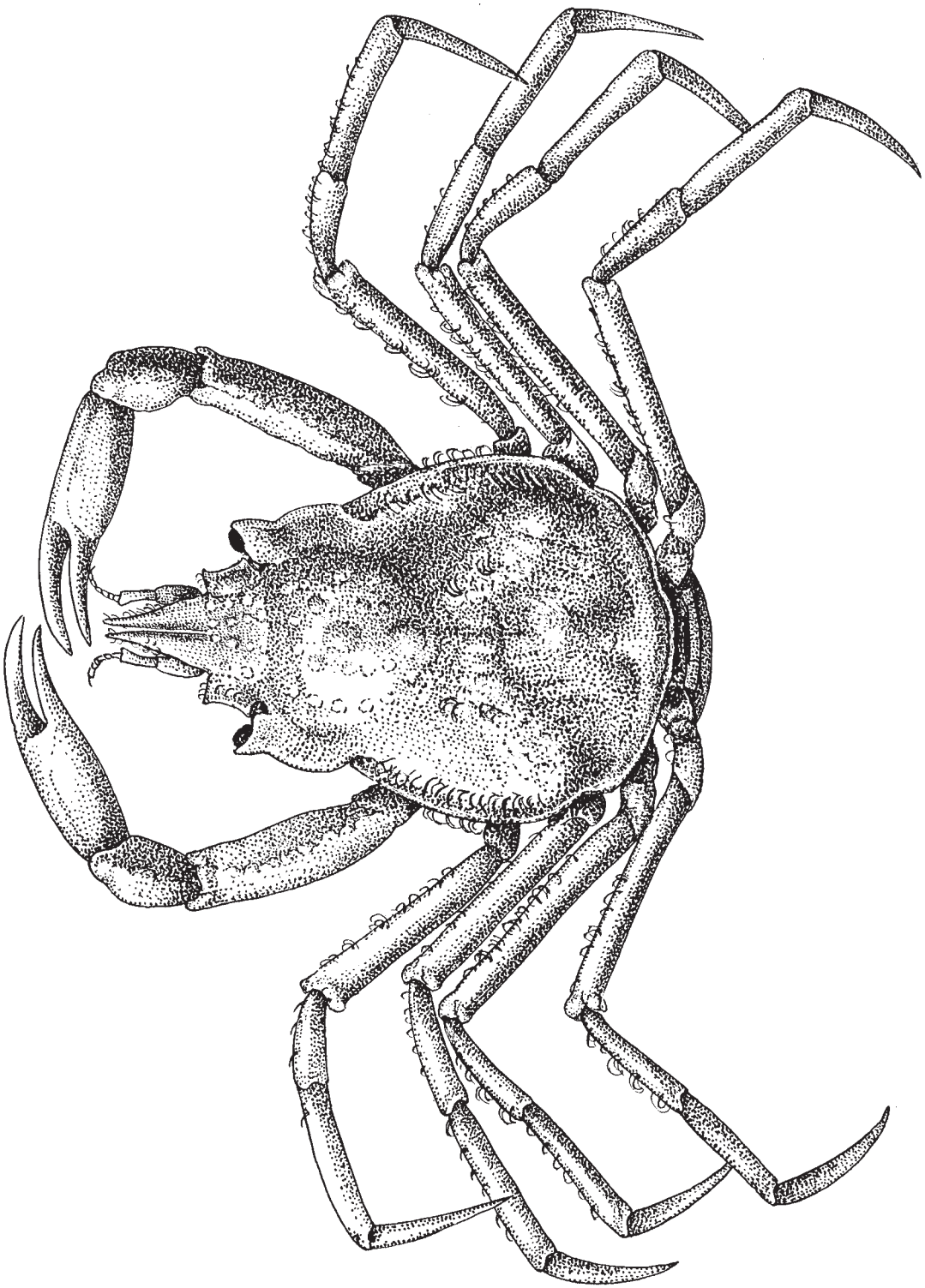


Plate IV. *Hyas coarctatus* Leach, 1815: males, dorsal view (original).

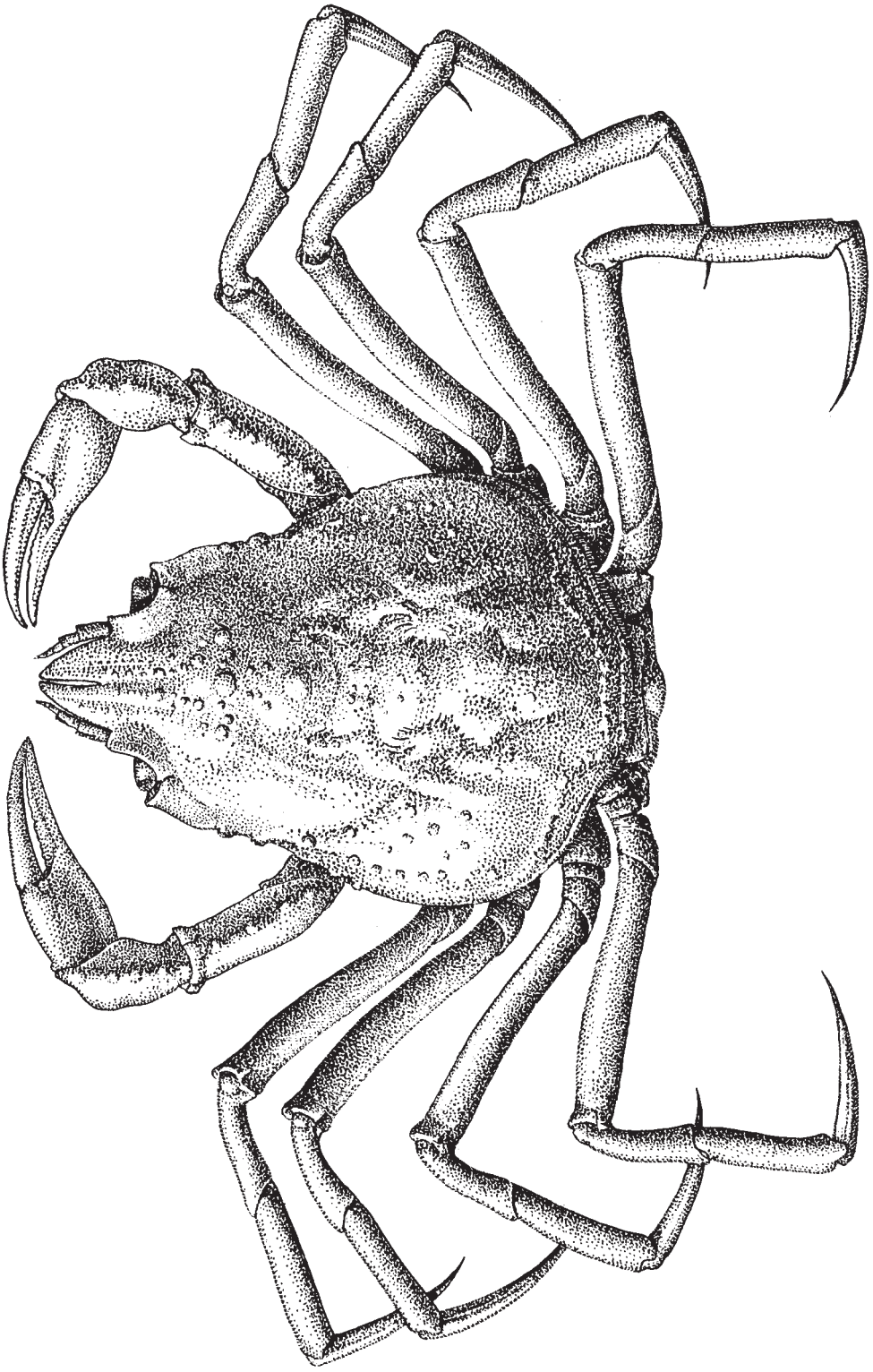


Plate V. ***Hyas araneus*** **(Linnaeus, 1758): male, dorsal view (original).**

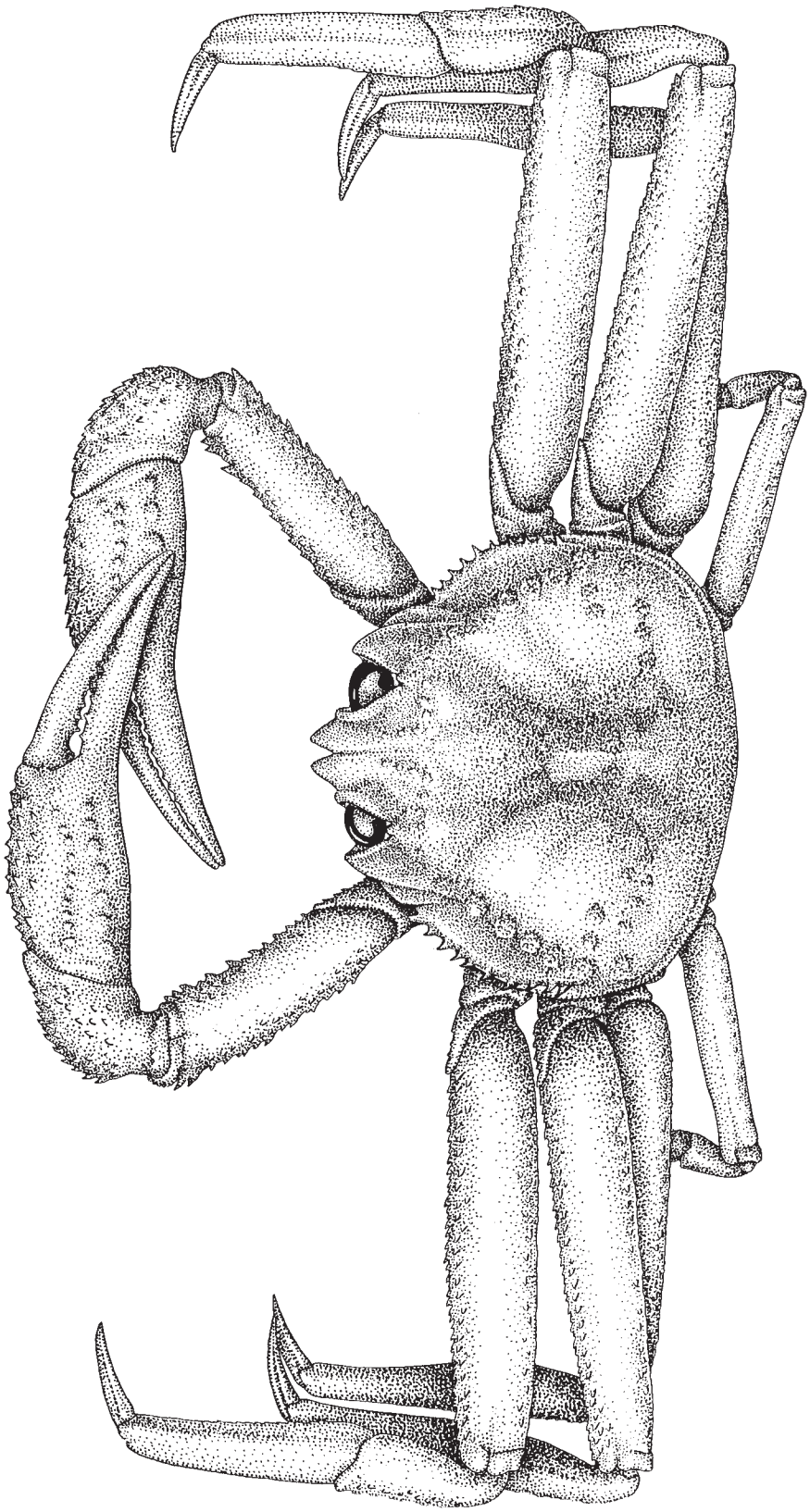


Plate VI. *Chionoecetes opilio* Fabricius, 1788: male, dorsal view (original).

Zoogeographic Descriptions

Shelf Species

Compiled by B.I. Sirenko, S.V. Vassilenko, and V.V. Petryashov

In addition, please see map of Eurasian seas on page 2.

1. **Amphiboreal (see map p. 185):** Distributed in temperate waters of the North Atlantic and North Pacific; sometimes seen in the southwestern Barents Sea and the southern Chukchi Sea.

2. **Arctic (see map p. 182):** Widely distributed in arctic waters on the shelves of the marginal arctic seas, and also on the continental slope of the arctic basin. Arctic circumpolar species have an uninterrupted range in the Arctic Ocean.

3. **Arctic Eurasia (see map p. 182):** The western boundary of their range follows the band from the mouth of the Mackenzie River and Amundsen Sound to the Fox Basin and Hudson Bay. The eastern boundary is in the New Siberian Shallows.

4. **Atlantic high boreal Arctic (see map p. 183):** Temperate waters of the Atlantic north of Cape Cod (on the North American coast) and southwestern Norway; also circumpolar in the Arctic.

5. **Atlantic subtropical-boreal (see map p. 185):** Occur in the North Atlantic (north of South Carolina and the coast of Morocco; the habitat includes the Mediterranean) and in temperate water of the Barents, Norwegian, and Greenland seas.

6. **Atlantic widespread boreal (see map p. 184):** Found in the western Atlantic from Cape Hatteras to the Greenland-Canadian region (almost to the Arctic Circle) and the Denmark Strait. They are seen on the European coast from the English Channel to Cape Kanin Nos (in the Barents Sea) and north to the west coast of Spitsbergen.

7. **Atlantic widespread boreal Arctic (see map p. 183):** North Atlantic (south to Cape Hatteras on the North American coast and to La Manche in the English Channel on the European side); also in the Arctic east to the New Siberian Shallows.

8. **Bipolar (map not provided):** Inhabit primarily temperate and polar waters of the Northern and Southern hemispheres with a break in the range in the tropics.

9. **Eastern Atlantic widespread boreal (see map p. 184):** Seen in the Atlantic Ocean along the coast of Europe from the English Channel to Cape Kanin Nos (Barents Sea) and north to the western coast of Spitsbergen.

10. **High boreal Arctic (see map p. 182):** North Atlantic south to Cape Cod on the North American side and to southwest Norway in Europe. The southern boundary in the Pacific is to Cape Terpeniya (Sakhalin Island) and Ekaterina Strait (south of Iturup Island) and the Strait of Juan de Fuca (south of British Columbia). They also occur in the Arctic Ocean.

11. **Pacific high boreal (see map p. 184):** Occur in the Pacific north of Cape Terpeniya (Sakhalin Island), the Ekaterina Strait (south of Iturup Island), and the Strait of Juan de Fuca (south of British Columbia) up to the Bering Strait; some occur north to Wrangel Island and Point Barrow (Chukchi Sea) and in

refuges for boreal fauna (in the area adjacent to the mouths of the Mackenzie and Kolyma rivers, and also in Chaunsk and Kolyuchin bays).

12. **Pacific high boreal Arctic (see map p. 183):** They occur in the North Pacific—the southern boundary reaches Cape Terpeniya (Sakhalin Island), Ekaterina Strait (south of Iturup Island), and the Strait of Juan de Fuca (south of British Columbia—and in the Arctic Ocean. They do not descend to temperate waters of the Atlantic.

13. **Pacific subtropical-boreal (see map p. 186):** Occur in the Pacific (north of Kyushu Island, the northern Yellow Sea, and southern end of Baja California), in temperate waters of the Chukchi Sea and in refuges for boreal fauna (mouths of the Mackenzie and Kolyma rivers, and also in Chaunsk and Kolyuchin bays).

14. **Pacific–western Atlantic boreal Arctic (see map p. 183):** Widely distributed in boreal waters of the North Pacific and along the west side of the Atlantic from Newfoundland to Greenland. In the Arctic they have been observed in the southeastern Chukchi Sea and along the arctic coast of Canada and northern Greenland.

15. **Pacific widespread boreal (see map p. 184):** Found in the western Atlantic from Cape Hatteras to the Greenland-Canadian region (almost to the Arctic Circle) and the Denmark Strait. They are seen on the European coast from the English Channel to Cape Kanin Nos (in the Barents Sea) and north to the west coast of Spitsbergen.

16. **Pacific widespread boreal Arctic (see map p. 183):** Temperate waters of the Pacific Ocean south to the line between Wonsan Korea and Sado Island on the Japan Sea side of Japan; on the North American side they occur south to Point Conception or San Diego. They also occur in the Arctic but are not found in temperate waters of the North Atlantic.

17. **Panoceanic (map not provided):** Inhabit almost all latitudes of the world's oceans.

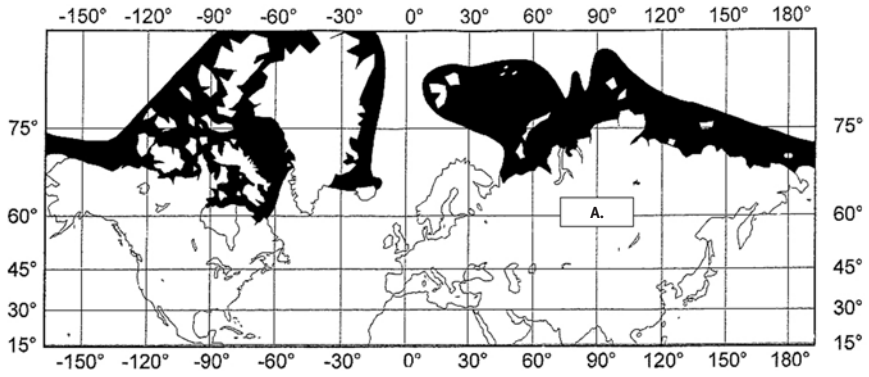
18. **Subtropical-Arctic (see map p. 185):** Distributed in the Atlantic Ocean (the southern boundary on the west side reaches South Carolina; on the east side to the coast of Morocco and the Mediterranean Sea); in the Pacific Ocean (the southern boundary on the west side is the Yellow Sea and Kyushu Island; on the east side from the end of Baja California); and in the Arctic Ocean.

19. **Western Pacific widespread boreal (see map p. 185):** Seen along the Asian coast to north of the line between Wonsan (Korea) and Sado Island (Japan Sea coast of Japan), and Cape Inubo (Pacific coast of Japan) to Bristol Bay and the Bering Strait; some found north to Wrangel Island and Point Barrow (Chukchi Sea) and in refuges for boreal fauna (in the area adjacent to the mouths of the Mackenzie and Kolyma rivers, and also in Chaunsk and Kolyuchin bays).

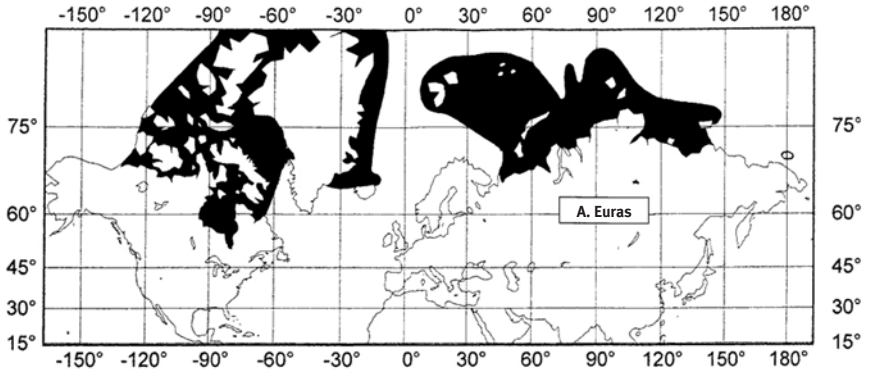
20. **Widespread boreal Arctic (see map p. 182):** Widely distributed in temperate waters of the Atlantic and Pacific; the southern boundary of the range in the Atlantic reaches Cape Hatteras (on the North American coast) and southwest to La Manche in the English Channel (on the European coast). In the Pacific the southern boundary reaches the line from Wonsan, Korea, to Sado Island (Japan Sea coast of Japan) and Cape Inubo (Pacific coast of Japan); on the North American coast it reaches Point Conception or San Diego. The circumpolar species are circumpolar in the Arctic Ocean.

Bathyal and Abyssal Species (Below 200 m)

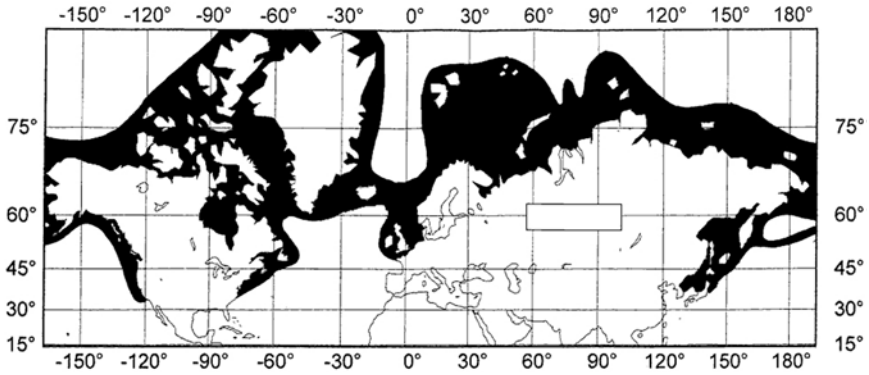
Arctic bathyal, abyssal, or bathyal-abyssal.
Atlantic-Arctic (Arctoatlantic) bathyal or bathyal-abyssal.
Pacific Arctic bathyal or bathyal-abyssal.
Atlantic-Pacific-Arctic bathyal or bathyal-abyssal.
Bipolar bathyal-abyssal.
Panoceanic bathyal or bathyal-abyssal.



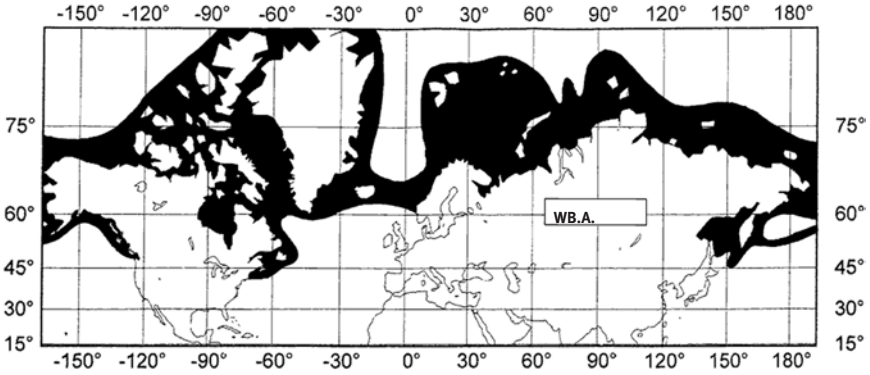
Arctic



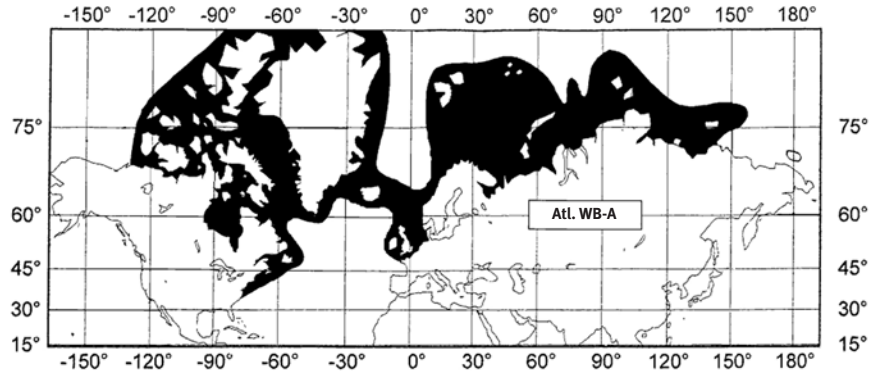
Arctic Eurasia



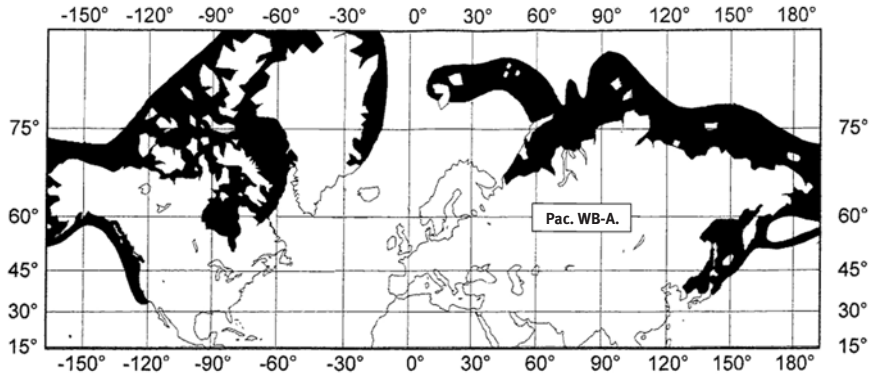
Widespread Boreal Arctic



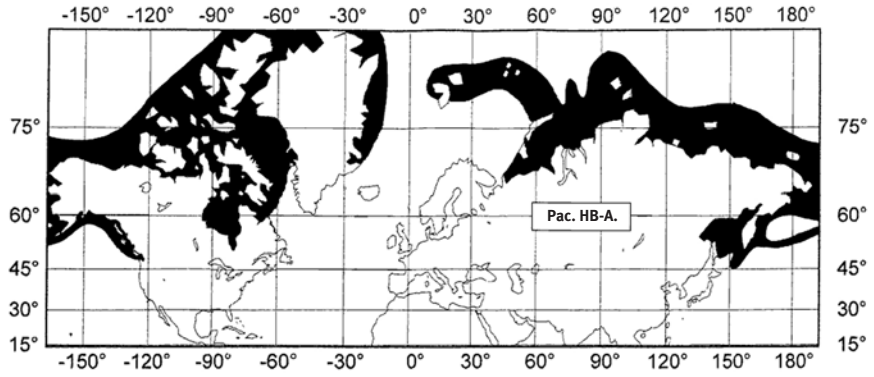
High Boreal Arctic



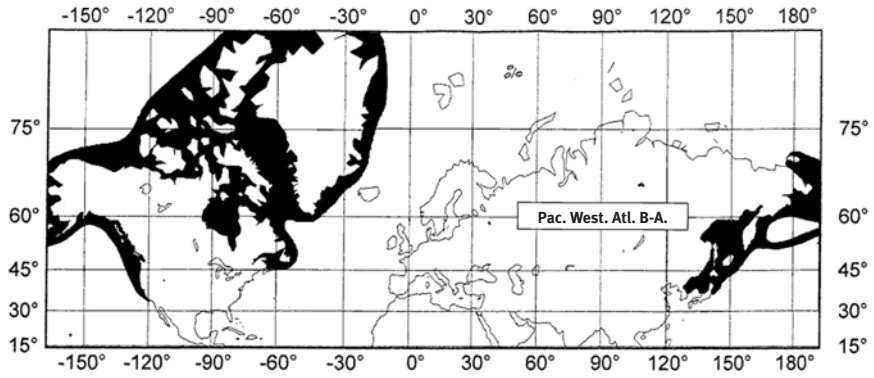
Atlantic Widespread Boreal Arctic



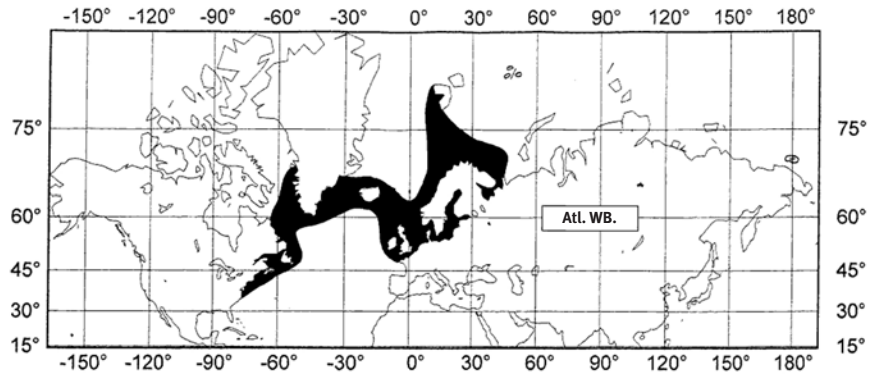
Pacific Widespread Boreal Arctic



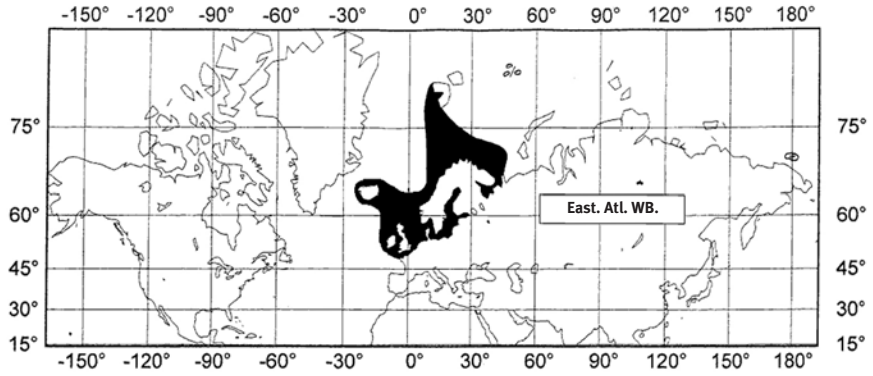
Pacific High Boreal Arctic



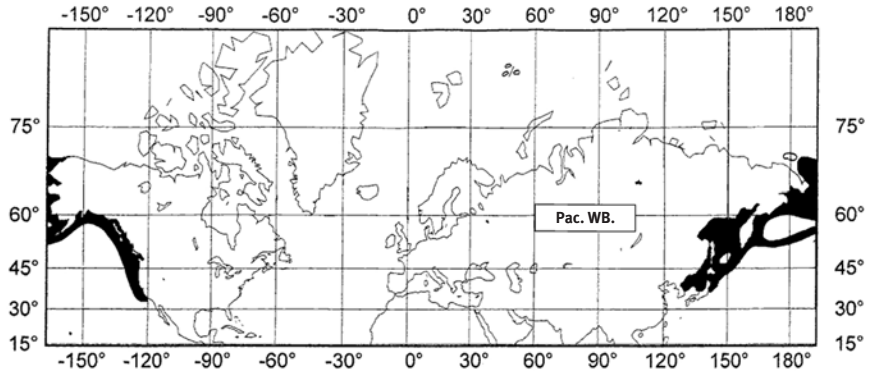
Pacific-Western Atlantic Boreal Arctic



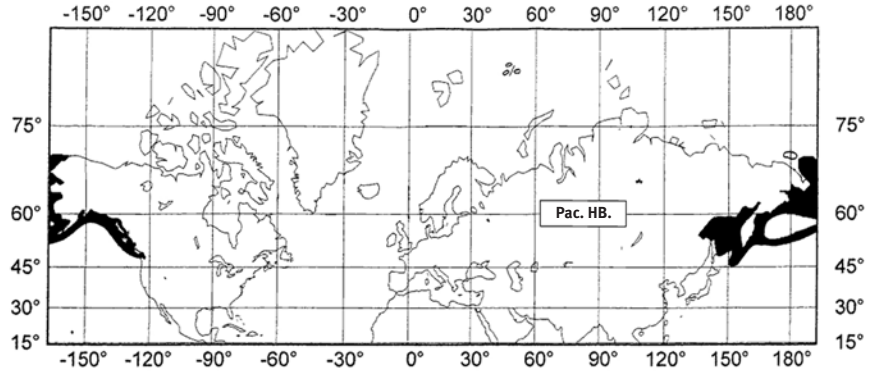
Atlantic Widespread Boreal



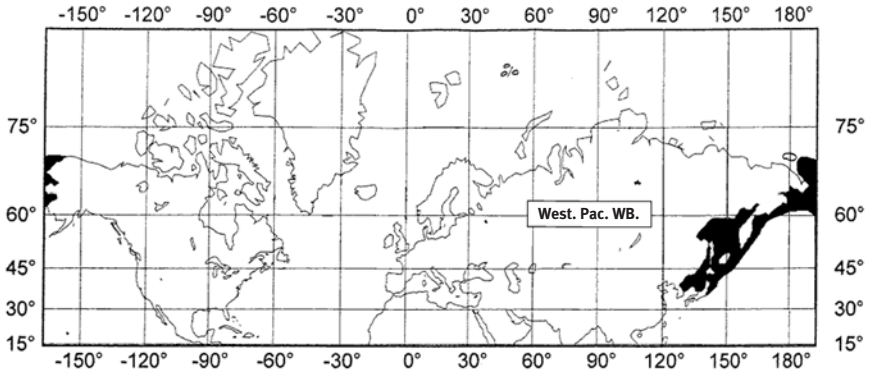
Eastern Atlantic Widespread Boreal



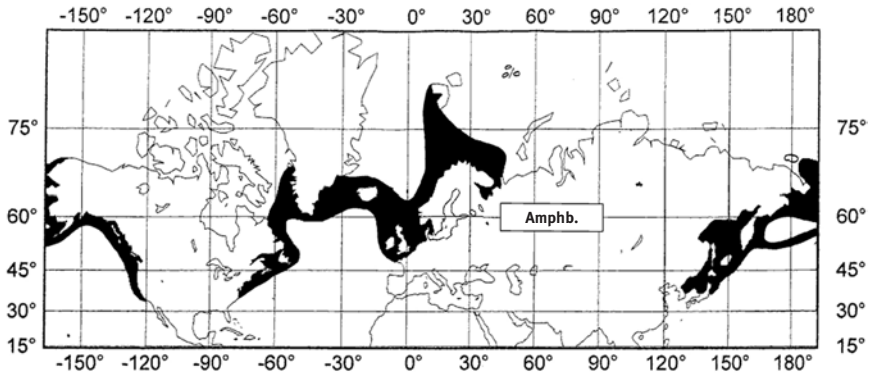
Pacific Widespread Boreal



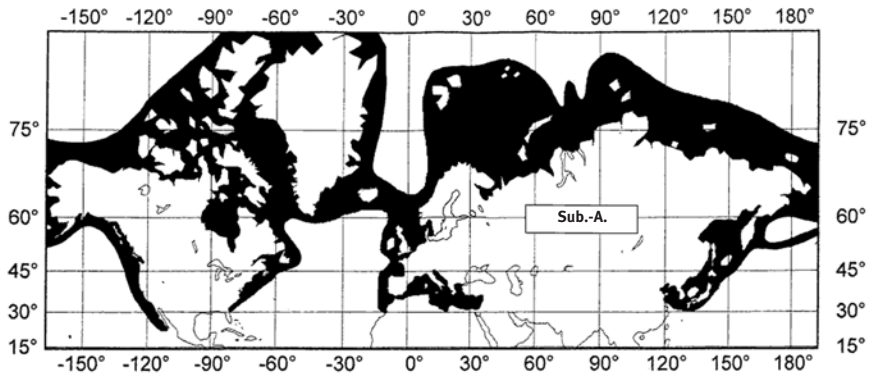
Pacific High Boreal



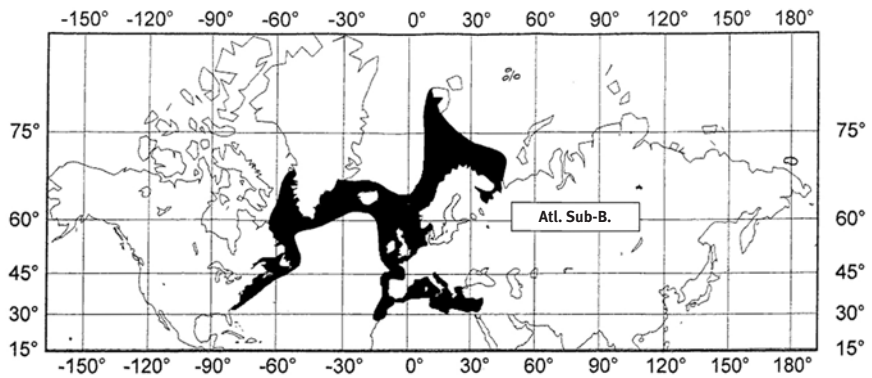
Western Pacific Widespread Boreal



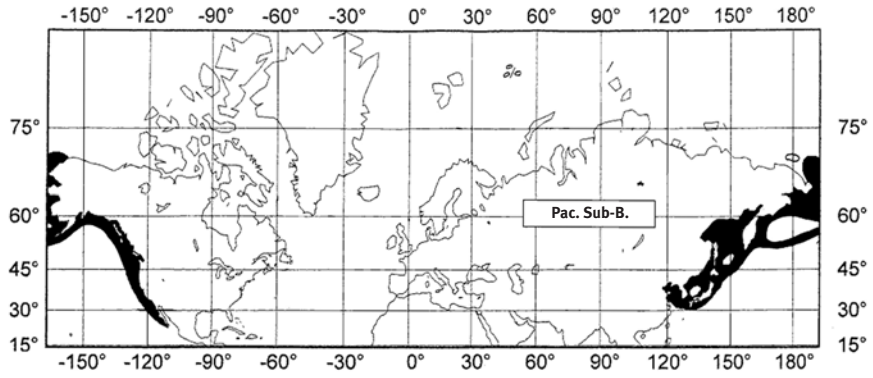
Amphiboreal



Subtropical-Arctic



Atlantic Subtropical-Boreal



Pacific Subtropical-Boreal