Anchialine Ostracoda (Halocyprididae) from San Salvador, Bahamas

LOUIS S. KORNICKER
and
DOUGLAS J. BARR

SMITHSONIAN CONTRIBUTIONS TO ZOOLOGY · NUMBER 588

SERIES PUBLICATIONS OF THE SMITHSONIAN INSTITUTION

Emphasis upon publication as a means of "diffusing knowledge" was expressed by the first Secretary of the Smithsonian. In his formal plan for the institution, Joseph Henry outlined a program that included the following statement: "It is proposed to publish a series of reports, giving an account of the new discoveries in science, and of the changes made from year to year in all branches of knowledge." This theme of basic research has been adhered to through the years by thousands of titles issued in series publications under the Smithsonian imprint, commencing with *Smithsonian Contributions to Knowledge* in 1848 and continuing with the following active series:

Smithsonian Contributions to Anthropology
Smithsonian Contributions to Botany
Smithsonian Contributions to the Earth Sciences
Smithsonian Contributions to the Marine Sciences
Smithsonian Contributions to Paleobiology
Smithsonian Contributions to Zoology
Smithsonian Folklife Studies
Smithsonian Studies in Air and Space
Smithsonian Studies in History and Technology

In these series, the Institution publishes small papers and full-scale monographs that report the research and collections of its various museums and bureaux or of professional colleagues in the world of science and scholarship. The publications are distributed by mailing lists to libraries, universities, and similar institutions throughout the world.

Papers or monographs submitted for series publication are received by the Smithsonian Institution Press, subject to its own review for format and style, only through departments of the various Smithsonian museums or bureaux, where the manuscripts are given substantive review. Press requirements for manuscript and art preparation are outlined on the inside back cover.

I. Michael Heyman
Secretary
Smithsonian Institution

SMITHSONIAN CONTRIBUTIONS TO ZOOLOGY • NUMBER 588

Anchialine Ostracoda (Halocyprididae) from San Salvador, Bahamas

Louis S. Kornicker
and Douglas J. Barr

SMITHSONIAN INSTITUTION PRESS
Washington, D.C.
1997

ABSTRACT

Kornicker, Louis S., and Douglas J. Barr. Anchialine Ostracoda (Halocyprididae) from San Salvador, Bahamas. *Smithsonian Contributions to Zoology,* number 588, 20 pages, 11 figures, 3 tables, 1997.—*Spelaeoecia barri* Kornicker, new species, an anchialine halocyprid Ostracoda (Halocyprididae: Deeveyinae), is described and illustrated from collections made at Dixon Hill Lighthouse Cave, San Salvador, Bahamas. Descriptions of adults and four juvenile stages are included and a discussion of ontogeny is given. A key to species of *Spelaeoecia* also is presented.

OFFICIAL PUBLICATION DATE is handstamped in a limited number of initial copies and is recorded in the Institution's annual report, *Annals of the Smithsonian Institution.* SERIES COVER DESIGN: The coral *Montastrea cavernosa* (Linnaeus).

Library of Congress Cataloging-in-Publication Data
Kornicker, Louis S., 1919–
Anchialine Ostracoda (Halocyprididae) from San Salvador, Bahamas / Louis S. Kornicker and Douglas J. Barr.
p. cm.—(Smithsonian contributions to zoology ; no. 588)
Includes bibliographical references (p. 20).
1. Ostracoda—Bahamas—San Salvador Island—Classification.
I.—Barr, Douglas J. II. Title. III. Series.
QL1.S54 no. 588 [QL444.08] 595.3'3—dc21 96-49163

♾ The paper used in this publication meets the minimum requirements of the American National Standard for Permanence of Paper for Printed Library Materials Z39.48—1984.

Contents

Anchialine Ostracoda (Halocyprididae) from San Salvador, Bahamas

Louis S. Kornicker
and Douglas J. Barr

Introduction

DESCRIPTION OF HABITAT.—San Salvador Island (24°N, 74°25'W) is located on the eastern edge of the Bahama Platform, approximately 550 km east of Miami, Florida. Dixon Hill Lighthouse Cave is on the northeastern tip of the island, about 800 m inland, without an obvious connection to the sea. The cave has water-filled passages up to 2 m in depth, with a tidal fluctuation of up to 60 cm. The salinity remains steady at 35 ppt, although the warmer coastal water of San Salvador ranges from 37 to 39 ppt. The water temperature in the cave is approximately 25°C in the summer, slightly cooler than the 30°C of the surrounding coastal water. Dissolved oxygen tests indicate a fairly stable 8–10 ppm year-round.

The water-filled passages of Lighthouse Cave contain a rich organic flocculent layer, up to one foot in depth, that blankets the cave floor. It is composed primarily of bat guano, but it also includes allocthonous material carried in by the tide or washed down by rainwater through a collapsed modified solution pit that enters the cave's large central room.

Observations of the junior author suggest that the new species of ostracode described herein, *Spelaeoecia barri,* dwells in the flocculent layer. Individuals swam out of the layer and into the water above only when the floc was disturbed by the collector. They would spend only a brief time swimming, before darting back to the safety of the organic layer. A similar behavior has been noted previously in Lighthouse Cave for the isopod *Bahalana geracei* (Carpenter, 1981).

OTHER BIOTA IN CAVE.—Biological expeditions to Lighthouse Cave since the mid 1970s have resulted in the description of two new isopods, *Bahalana geracei* Carpenter, 1981, *Neostenetroides stocki* Carpenter and Magniez, 1982; three new sponges, *Pellina pencilliformis, Prosuberites geracei,* and *Cinachyra subterranea* Van Soest and Sass, 1981; and a new genus and species of a demersal copepod, *Enantiosis cavernicola* Barr, 1984. The pink cave shrimp *Barbouria cubensis* (von Martens, 1872) is common. The nonaquatic species include bats, land crabs (*Gecarcinus* sp.), cockroaches, and pseudoscorpions.

METHODS.—With the exception of one juvenile collected in 1986 by Thomas M. Iliffe, specimens were collected by the junior author with baited traps between 28 to 31 January 1984. The traps were constructed using one-quart plastic bottles with the bottom cut off and replaced with a fine-meshed Nitex bolting cloth affixed with a rubber band to allow for better water flow. The cap of the bottle was replaced with a plastic funnel, six inches in diameter. The funnel was glued in place. The purpose of the funnel was to provide a wide opening to guide predators to the bait. The trap was then attached to a small rubber ball on the surface via a nylon line so it could be retrieved easily in the dark, murky water. The bait was pieces of the pink cave shrimp *Barbouria cubensis,* which could be easily captured in the cave. The traps were left in the cave for 24 hours before retrieval.

DISPOSITION OF SPECIMENS.—All specimens examined by the senior author have been deposited in the National Museum of Natural History, Smithsonian Institution, and have been assigned USNM catalog numbers.

ABBREVIATIONS.—In the figures, Arabic numerals indicate limbs 1–7, as well as individual joints of each limb (the location of the numeral indicating whether a limb or joint is indicated). Roman numerals I–III indicate the endites. Arrows indicate anterior.

Louis S. Kornicker, Division of Crustacea, Department of Invertebrate Zoology, National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560. Douglas J. Barr, Biology Department, Schumucker Science Center, West Chester University, West Chester, Pennsylvania 19383.

Review Chairman: Austin B. Williams, National Marine Fisheries Service Systematics Laboratory, National Museum of Natural History, Smithsonian Institution.

Reviewers: Martin V. Angel, Institute of Oceanographic Sciences, Deacon Laboratory, Wormley, Godalming, United Kingdom; Dan L. Danielopol, Institut für Limnologie, Mondsee, Austria.

The following abbreviations are used in the illustrations and legends.

am	central adductor muscle attachments
ant	antenna
Bo	Bellonci organ
bas	basale
co	copulatory organ
cx	coxale
e	valve edge
end	endopodite
epip	epipodite
esop	esophagus
ex	exopodite
fu	furca
gen	genitalia
gl	gland
im	inner margin of infold
iv	inside view of valve
lft	left valve
ll	lower lip
lv	lateral view
mnd	mandible
mv	medial view
nabs	not all bristles shown
ov	outside view of valve
oval	mandibular attachment to valve
precx	precoxale
prot	protopodite
rt, rv	right valve
ul	upper lip
up	unpaired bristle of furca
vv	ventral view

ACKNOWLEDGMENTS.—Collection of a specimen by Thomas M. Iliffe was supported by National Science Foundation Grants (BSR 8215672 and BSR 8417494) to Thomas M. Iliffe. We are indebted to the College Center of the Finger Lakes Bahamian Field Station and its staff on San Salvador Island for logistical support in the Bahamas to both Barr and Iliffe. We also thank Jack R. Schroeder, Jack Schroeder Associates, and Molly K. Ryan, Smithsonian Institution, for inking shell and appendage drawings; Elizabeth Harrison-Nelson, Smithsonian Institution, for general assistance; and Diane M. Tyler, Smithsonian Institution Press, for final editing and preparation of the manuscript for publication. The description of the new species is solely the work of the senior author, who named it for the junior author.

Order HALOCYPRIDA Dana, 1853

Suborder HALOCYPRIDINA Dana, 1853

COMPOSITION.—The suborder comprises the superfamilies Halocypridoidea Dana, 1853, and Thaumatocypridoidea Müller, 1906. Only the former is represented in the collections reported upon herein.

Superfamily HALOCYPRIDOIDEA Dana, 1853

COMPOSITION.—The superfamily includes the single family Halocyprididae Dana, 1853.

Family HALOCYPRIDIDAE Dana, 1853

COMPOSITION.—The family comprises five subfamilies of which only the Deeveyinae Kornicker and Iliffe, 1985, is represented in present collections.

Subfamily DEEVEYINAE Kornicker and Iliffe, 1985

COMPOSITION.—The subfamily comprises the genera *Deeveya* Kornicker and Iliffe, 1985, and *Spelaeoecia* Angel and Iliffe, 1987, of which only the latter is described herein. One specimen, collected by the junior author in a baited trap from the cave on 30–31 Jan 1984, was identified as *Deeveya* sp. by the senior author, but the specimen was lost subsequently. That specimen was collected with a specimen of *S. barri,* indicating that both species occur together.

Spelaeoecia Angel and Iliffe, 1987

Spelaeoecia Angel and Iliffe, 1987:545, figs. 2–6.

TYPE SPECIES.—*Spelaeoecia bermudensis* Angel and Iliffe, 1987:545.

COMPOSITION AND DISTRIBUTION.—The genus includes seven species from anchialine caves: Bermuda: *S. bermudensis* Angel and Iliffe, 1987. Bahamas: *S. capax, S. sagax, S. styx* Kornicker in Kornicker et al., 1990, and *S. barri* Kornicker, new species, herein. Jamaica: *S. jamaicensis* Kornicker and Iliffe, 1992. Cuba: *S. cubensis* Kornicker and Yager, 1996.

Key to the Species of *Spelaeoecia*
(adults)

1. Each lamella of furca with 5 claws . . . . . ***S. cubensis***
   Each lamella of furca with more than 5 claws 2
2. Carapace longer than 2.25 mm . . . . . ***S. capax***
   Carapace shorter than 1.95 mm 3
3. First antenna with ventral bristle on 3rd joint . . . . . ***S. bermudensis***
   First antenna without ventral bristle on 3rd joint 4

4. First antenna with ventral bristle on 4th joint . . . . . ***S. jamaicensis***
   First antenna without ventral bristle on 4th joint 5
5. Each lamella of furca with 7 claws . . . . . ***S. styx***
   Each lamella of furca with 8 claws 6
6. Surface of carapace with oblique striations . . . . . ***S. sagax***
   Surface of carapace with pits . . . . . ***S. barri,*** new species

Spelaeoecia barri Kornicker, new species

FIGURES 1–11

ETYMOLOGY.—Named in honor of Douglas J. Barr who collected most of the specimens upon which the species is based.

HOLOTYPE.—USNM 194399, undissected adult male in alcohol.

TYPE LOCALITY.—Dixon Hill Lighthouse Cave, San Salvador, Bahamas.

PARATYPES.—Baited trap 28–29 Jan 1984: Adult females: USNM 194323; USNM 194395H; USNM 194395J; USNM 194395L; USNM 194395N, 4 specimens; USNM 194395P, 3 specimens; USNM 194395Q, 3 specimens; USNM 194395R, 3 specimens; USNM 194395T, 2 specimens; USNM 194398. Adult males: USNM 194387; USNM 194396; USNM 194397; USNM 194395P, 2 specimens; USNM 194395Q; USNM 194395R, 2 specimens; USNM 194395T, 2 specimens; USNM 194401. A–1 females: USNM 194389; USNM 194390; USNM 194395C; USNM 194395F; USNM 194395G; USNM 194395M; USNM 194395Q. A–1 males: USNM 194390; USNM 194395E. A–2 females: USNM 194388; USNM 194395B; USNM 194395E. A–2 males: USNM 194395A; USNM 194395D. A–3 instars, sex unknown: USNM 194391; USNM 194392; USNM 194393; USNM 194394. A–4 instar, sex unknown: USNM 194400.

Baited trap 30–31 Jan 1984: A–1 male, USNM 194395K.

Plankton net, 13 Jul 1986: A–3 instar, sex unknown: USNM 194324.

DISTRIBUTION.—Dixon Hill Lighthouse Cave, San Salvador, Bahamas; collected in Jan 1984 and Jul 1986.

DESCRIPTION OF ADULT FEMALE (Figures 1–5).—Carapace elongate, dorsal margin straight, ventral margin broadly rounded; anterior incisur dorsal to midheight (Figure 1*a–e*). Anterior of valve viewed from inside with edge of valve indented at incisur (Figure 1*f*); anterior part of rostrum broadly overreaching edge of valve and with tapered tip (Figure 1*f*). In lateral view, posterodorsal corner of each valve broadly rounded and with considerably posterior projection; minute triangular process with small terminal indentation on dorsal edge of left valve (Figure 1*e*); and minute indentation posterior to glandular openings at corner of right valve (Figure 1*g*), with small bristle at anterior end of indentation (Figure 1*d,g*).

Ornamentation: Surface with abundant shallow pits (representative pits shown in Figure 1*a–e*), few scattered long bristles, and minute bristles along valve edge (Figure 1*b,g*).

Infold: Broad infold along free margin, broadest along anteroventral margin of valve (Figure 1*a,f,g*). List forming narrow bar posterior to posterior juncture, then extending ventrally as narrow ridge intersecting posterior edge of valve near midheight (Figure 1*a,d,g*); posterior infold of right valve with row of minute crenulations anterior to dorsal part of list (Figure 1*d,g*). Narrow anteroventral and ventral list present at midwidth of infold and terminating dorsal to midheight near midwidth of posterior infold.

Central Adductor Muscle Attachments (Figure 1*h*): 4 closely spaced ovoid attachments.

Glands: Posterodorsal corner of right valve with minute glandular openings adjacent (anterior) to minute indentation (Figure 1*d,g*); minute bristle at posterior end of glandular process of right valve (Figure 1*d,g*). Posterodorsal corner of left valve with minute triangular process (no internal glandular structures evident) (Figure 1*e*). Short ducts leading to small external pores visible along ventral and anteroventral edges of valve (Figure 1*f*); 1 or 2 similar ducts on posterodorsal infold (Figure 1*g*), but whether they exit on infold or on outer valve surface was not resolved.

Selvage: Indistinct broad striated lamellar prolongation along valve edge medial to inner surface of rostrum (Figure 1*f*).

Carapace Size (length, height in mm): USNM 194323, 1.32, 0.76. USNM 194395H, 1.32, 0.80. USNM 194395J, 1.27, 0.80. USNM 194395L, 1.31, 0.76. USNM 194395N, 4 specimens: 1.30, 0.77; 1.32, 0.75; 1.25, 0.72; 1.22, 0.71. USNM 194395P, 3 specimens: 1.25, 0.69; 1.23, 0.70; 1.28, 0.75. USNM 194395Q, 3 specimens: 1.26, 0.76; 1.24, 0.72; 1.29, 0.75. USNM 194395R, 3 specimens: 1.29, 0.75; 1.30, 0.76; 1.24, 0.76. USNM 194395T, 2 specimens: 1.22, 0.69; 1.27, 0.77. USNM 194398, left valve (posterior of right valve missing), 1.24, 0.75.

First Antenna (Figure 2*a,b*): With 8 joints, but suture separating joints 3 and 4 indistinct away from ventral and dorsal margins. 1st joint with minute distal lateral and medial spines; terminal ventral lobe present but not well developed. 2nd joint with distal medial spinules and somewhat translucent spinous dorsal bristle. 3rd joint shorter than 2nd joint, bare. 4th joint about one-half length of 3rd joint, with terminal dorsal bristle. 5th joint with long ventral filament with minute, widely separated marginal spines. 6th joint bare. 7th joint with short spinous ringed a-bristle and with ventral medial b-bristle about $^2/_3$ length of stouter ventral c-bristle; both b- and c-bristles

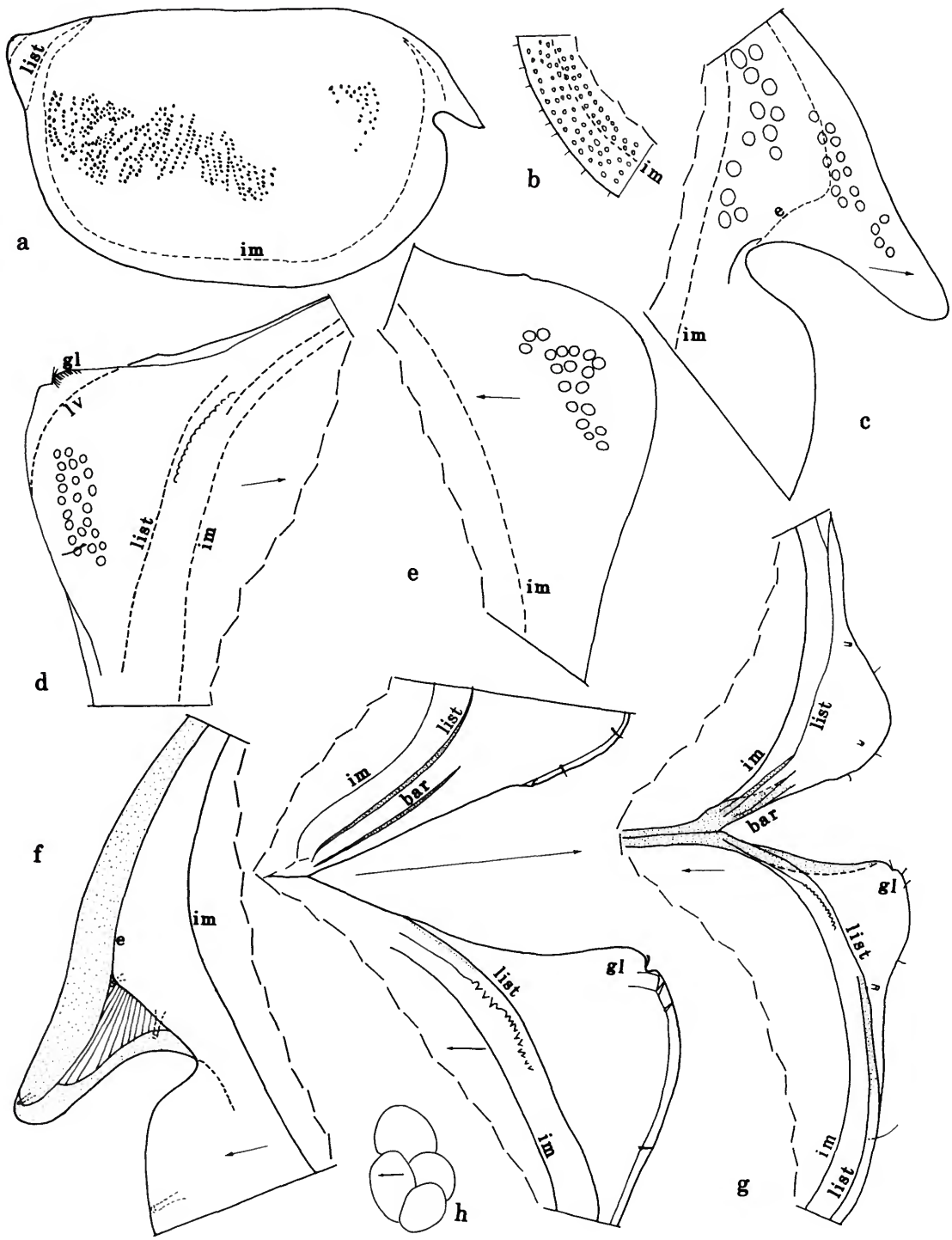


FIGURE 1.—*Spelaoecia barri* Kornicker, new species, paratype, USNM 194323, adult female: *a*, complete specimen from right side showing representative pits, length 1.32 mm; *b*, posteroventral corner right valve, ov; *c*, anterior right valve, ov; *d*, posterodorsal corner of both valves from right side; *e*, posterodorsal corner left valve, ov; *f*, anterior right valve, iv; *g*, inside view of posterior of valves (not completely flattened); *h*, central adductor muscle attachments, left valve.

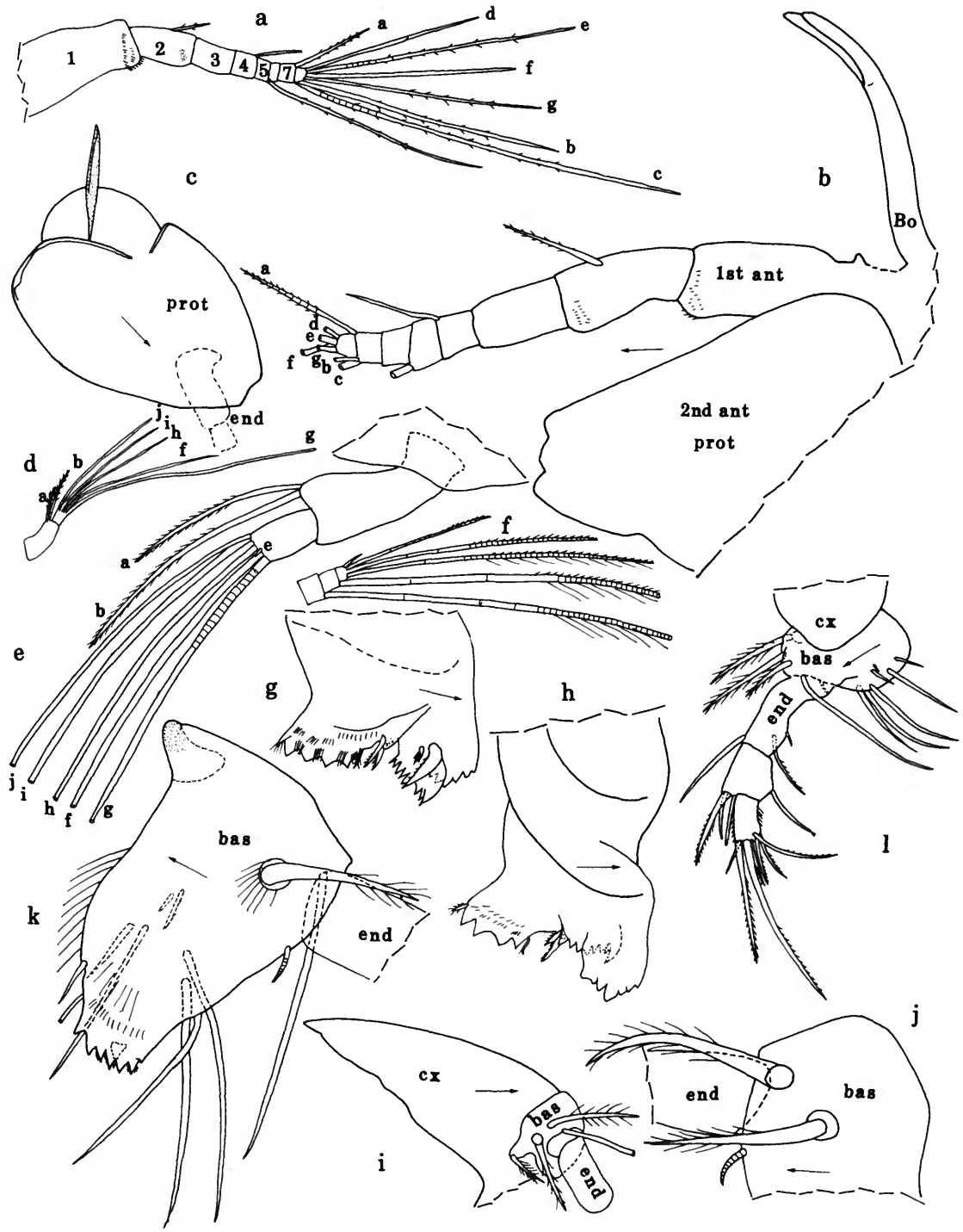


FIGURE 2.—*Spelaeoecia barri* Kornicker, new species, paratype, USNM 194323, adult female: *a*, right 1st antenna, lv; *b*, part of anterior of body from left side, lv; *c*, part right 2nd antenna, lv; *d*, endopodite left 2nd antenna, mv; *e*, endopodite left 2nd antenna, lv; *f*, tip exopodite right 2nd antenna, mv; *g*, coxale endite left mandible, lv; *h*, coxale endite right mandible, mv; *i*, part left mandible (nabs), mv; *j*, part right mandible, mv; *k*, part left mandible, mv; *l*, part left mandible, lv.

filament-like with minute, widely separated marginal spines and with terminal papillae. 8th joint small with 4 bristles: dorsal medial d-bristle filament-like, about twice length of a-bristle; long lateral e-bristle longer and stouter than d-bristle, with indistinct proximal rings and minute, widely separated marginal spines (tip missing from both limbs of USNM 194323); f-bristle medial to e- and g-bristles, shorter than e-bristle, either not oriented ventrally or only slightly ventrally, and filament-like with terminal papilla; lateral g-bristle filament-like, longer than f-bristle, with widely separated marginal spines and with terminal papilla.

Second Antenna: Protopodite bare (Figure 2*b,c*). Endopodite 3-jointed but with 2nd and 3rd joints fused (Figure 2*d,e*): 1st joint with long slender spinous a- and b-bristles; 2nd joint with 3 bristles: minute lateral e-bristle near base of f-bristle (not shown in Figure 2*d*), and 2 long terminal filament-like f- and g-bristles; 3rd joint with equilength filament-like bare h-, i-, and j-bristles each with terminal papillae, and minute medial bristle at base of j-bristle (not shown in Figure 2*d,e*). Exopodite with 9 joints (joints 7–9 shown in Figure 2*f*): 1st joint divided into long proximal and short distal parts, with long terminal bristle with natatory hairs, and with ventral spines on left limb of USNM 194323 but not on right limb; bristles of joints 2–7 with natatory hairs; bristle of 2nd joint with ventral spines on left limb of USNM 194323 but not on right limb; bristle of 8th joint with natatory hairs and long distal dorsal spines; 9th joint with 4 bristles (1 minute dorsal bare, 1 short and 1 medium with dorsal spines but no hairs, 1 long ventral with natatory hairs and distal dorsal spines); all long bristle with 1–3 long proximal segments followed by closely spaced rings. (Exopodial joints 8 and 9 missing on left limb of USNM 194323, apparently lost while specimen was alive because wound seems sclerotized.)

Mandible: Coxale endite with proximal and distal sets of teeth separated by gap (Figure 2*g,h*); proximal set comprising 4 broad cusps plus small posterior triangular tooth; surface between cusps and just proximal to cusps with slender spines; 1 minute indistinct spinous bristle on corner just anterior to anterior cusp and another posterior to posterior cusp; 2 pectinate bristles adjacent to triangular tooth; distal set of teeth comprising 2 flat teeth, each with 7 or 8 cusps; 1 stout curved spinous process and 1 adjacent small spinous bristle proximal to flat teeth (Figure 2*g*). Basale (Figure 2*i–l*) with distal edge having 5 triangular cusps with minute proximal marginal teeth and 1 bare posterior triangular cusp set back from edge (Figure 2*k*); lateral surface near distal edge with sharp triangular tooth near midwidth (dashed in Figure 2*k*); lateral surface distal to midlength with 2 short and 4 longer bristles (none entwined); anterior margin with short proximal bristle (with base on medial side) and long bristle distal to midlength; posterior margin hirsute with 2 short distal ringed bristles (proximal with pointed tip, distal tubular); proximal medial surface with transparent plumose bristle on hirsute protuberance; 2 transparent plumose bristles on or close to dorsal margin (Figure 2*i,l;* only 1 shown in Figure 2*k*); distal medial surface with rows of hairs; lateral surface near insertion of endopodite with long bare bristle (Figure 2*i,k,l*). Endopodite (Figure 2*l*) with 1st joint having 3 distal bristles (1 long dorsal, 1 short ventral, 1 long medial near midwidth); 2nd joint widening distally, with medial hairs, 3 terminal dorsal bristles (1 long stout unringed spinous claw-like, 2 short ringed (1 lateral, 1 medial)), and 1 long terminal ventral bristle; 3rd joint with 7 bristles (2 long stout claw-like spinous bristles, 3 short spinous ringed bristles forming medial row near terminal edge, 1 short lateral bristle on ventral corner, and 1 longer ringed bristles on terminal lateral edge slightly inward from ventral margin); anterior and posterior margins and medial surface of joint hirsute.

Maxilla (Figure 3*a–d*): Endite I with 2 proximal and 11 terminal bristles (5 tubular) (Figure 3*a*); endite II with 2 proximal and 10 terminal bristles (5 tubular) (Figure 3*a*); endite III with 1 proximal and 6 terminal bristles (2 tubular) (Figure 3*a*). Coxale with stout plumose dorsal bristle (Figure 3*c,d;* bristle missing in Figure 3*b*). Basale partly fused to coxale with 1 short pointed bristle (missing on right limb of USNM 194323, Figure 3*b*) and 1 tubular ventral bristle (not shown in Figure 3*c*). 1st endopodial joint with 10–12 bristles (Figure 3*b–d*); 2nd joint with anterior hairs, 2 stout pectinate claw-like bristles, and 5 slender ringed bristles (Figure 3*b–d*).

Fifth Limb (Figure 4*a,b*): Epipodite with plumose bristles forming 3 groups (ventral group with 5 bristles, middle group with 6 bristles, dorsal group with 5 bristles (4 long, 1 short dorsal) (Figure 4*b*). Protopodite without glandular process and with 2 ventral endites (Figure 4*a;* not shown in Figure 4*b*): endite I with medial hairs and 4 bristles (2 ventral with long spines, 1 ventral tubular, and 1 proximal medial with short spines); endite II with 3 bristles (1 long lateral with long spines, and 2 shorter tubular bare and closer to ventral margin). Basale with medial hairs, 1 long lateral anterior bristle with long spines, 1 ventral endite with 1 short proximal medial bristle (with short spines) and 5 bristles closer to ventral margin (1 long and 1 short unringed, claw-like, and pectinate along posterior margins, and 3 tubular either bare or with short spines) (Figure 4*a;* not shown in Figure 4*b*). Endopodite with 1 short proximal medial bristle with short spines, and 10 additional bristles (1 short tooth-like medial subventral, 1 long bare (pointed) lateral subventral, 1 short lateral tubular proximal, 2 tubular ventral bare, 2 claw-like unringed ventral with posterior teeth, 2 anterior long with long spines, 1 long ringed proximal lateral with long spines) (Figure 4*a;* not shown in Figure 4*b*). Exopodite (Figure 4*a,b*): 1st joint: dorsal margin with 1 long bare terminal bristle and 1 plumose subterminal bristle; ventral margin divided into 2 parts by depression in ventral margin near midlength; proximal part with 3 bare ventral bristles, 1 long plumose lateral bristle near midwidth, and 1 fairly long distal medial bristle near ventral margin; distal part with 3 bare ventral bristles and 2 distal plumose lateral bristles, 1 near dorsal margin. 2nd joint: dorsal margin with 1 distal bristle; ventral margin with 4 slender bristles near midlength. 3rd joint with 2 stout claw-like bristles (dorsal with

FIGURE 3.—*Spelaeoecia barri* Kornicker, new species, paratype, USNM 194323, adult female: *a*, endites of right maxilla; *b*, right maxilla (nabs), mv; *c*, right maxilla (not under cover slip, nabs), vv; *d*, left maxilla (nabs), vv; *e*, left 7th limb and genitalia; *f*, left lamella of furca; *g*, apron of furca from right side.

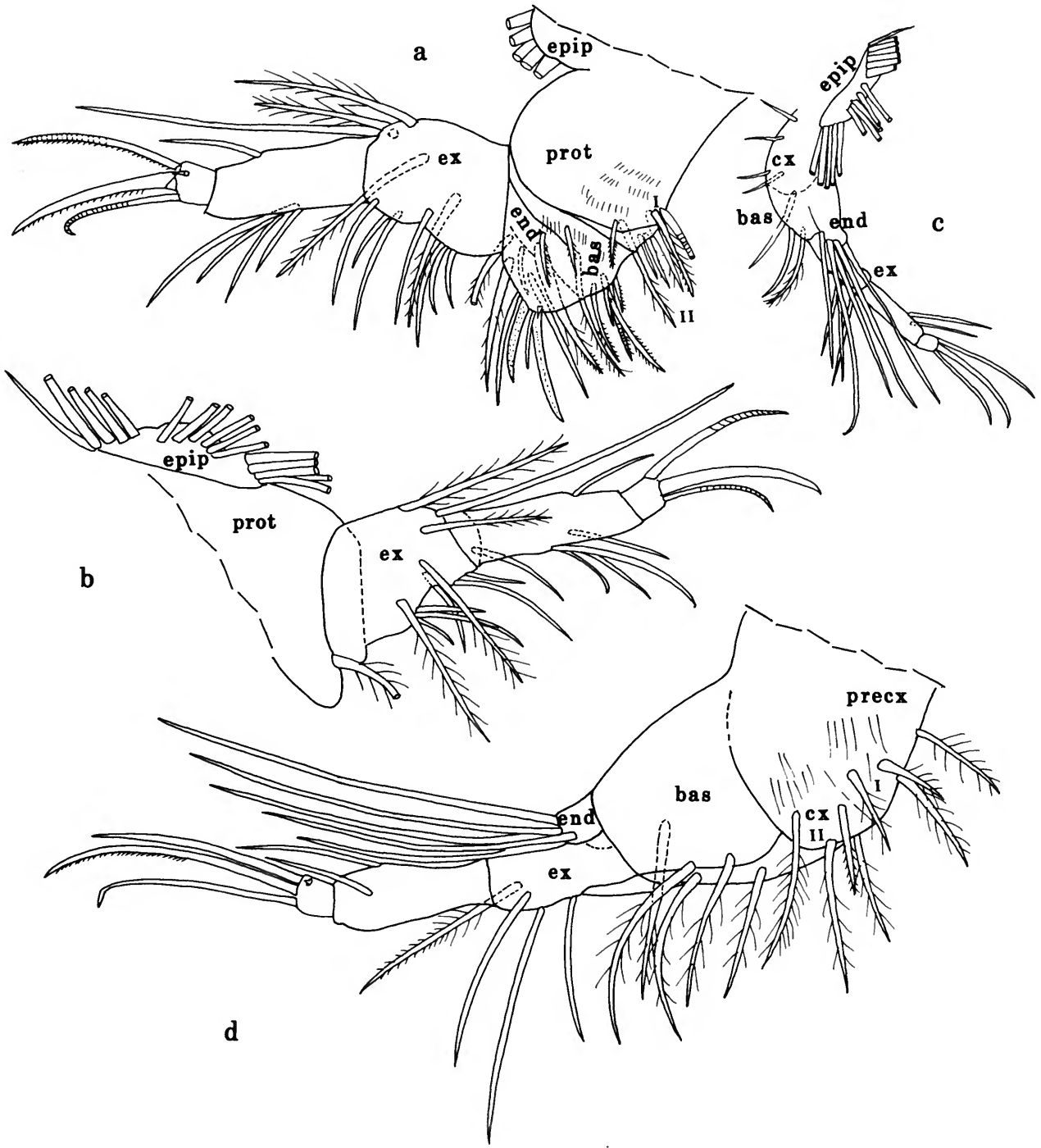


FIGURE 4.—*Spelaeoecia barri* Kornicker, new species, paratype, USNM 194323, adult female: *a*, left 5th limb (under cover slip), mv; *b*, left 5th limb drawn attached to body and not under cover slip (nabs), lv; *c*, left 6th limb drawn attached to body and not under cover slip (nabs), lv; *d*, left 6th limb (under cover slip), mv.

oblique lines, both with minute ventral spines), 1 slender ringed ventral bristle, and 1 minute indistinct spine-like medial bristle.

Sixth Limb (Figure 4*c,d*): Epipodite with plumose bristles forming 3 groups (ventral and middle group each with 5 bristles, dorsal group with 7 bristles (6 long, 1 short)) (Figure 4*c*). Protopodite separated from basale by suture and divided by indistinct suture into 2 parts interpreted to be precoxale and coxale, both with long medial hairs: precoxale with 4 bristles with long spines; coxale with 4 bristles (2 with long spines, 1 with long hairs, and 1 with short spines) (Figure 4*d;* not all bristles shown in Figure 4*c*). Basale with 5 or 6 plumose bristles (4 or 5 near ventral margin, 1 distal lateral near midwidth or close to dorsal margin) (Figure 4*d*). Endopodite well developed with 5 long bristles (3 medial plumose (hairs not shown), 2 lateral bare). Exopodite 3-jointed: 1st joint with 3 bare ventral bristles (left limb of USNM 194323 with additional lateral distal bristle with long proximal and short distal spines (Figure 4*d;* not all bristles shown in Figure 4*c*)); 2nd joint with 2 or 3 bare distal bristles (1 dorsal, 1 medial on left limb of USNM 194323, 2 ventral on right limb); 3rd joint with 3 long terminal bristles (middle bristle claw-like with ventral teeth; dorsal bristle slender, somewhat claw-like, with oblique rings (rings not shown); ventral bristle slightly slenderer than dorsal bristle, ringed (rings not shown), bare) and 1 minute medial indistinct spine-like bristle (Figure 4*d;* not shown in Figure 4*c*).

Seventh Limb (Figure 3*e*): Elongate with 3 bare terminal bristles (1 longer than others).

Furca (Figure 3*f*): Each lamella with 8 claws with minute teeth along posterior edges (teeth not shown); no claws with transverse lines; minute indistinct triangular process with blunt tip (glandular?) between claws 1 and 2 but much closer to claw 2; minute triangular process follows last claw. Bifurcate well-developed unpaired bristle with minute marginal spines just posterior to furca (Figure 3*f*). Apron present anterior to furca (Figure 3*g*).

Bellonci Organ (Figure 2*b*): Branching in distal $^2/_3$, branches slightly unequal in length, each with broadly rounded tip.

Lips: 2 small triangular processes (1 on each side) proximally on anterior margin (stippled in Figure 5*a,b,e*). Upper lip terminating posteriorly in spinous bar (bottom of Figure 5*c*). Row of 4 or 5 small round processes visible on each side of anterior near triangular process (Figure 5*a,b*). USNM 194373 with small area with minute spines on each side of anterior of lip and proximal to triangular processes but precise structure not resolved (Figure 5*a,b*). Lower lip a triangular process (with spines) on each side of mouth (Figure 5*d,e*).

Genitalia (Figure 3*e*): A small process with terminal spine present on left side of body near base of 7th limb.

Gut Content: Gut of USNM 194323 with fragments that may be remnants of crustaceans.

DESCRIPTION OF ADULT MALE (Figures 6–8).—Carapace similar in shape, ornamentation, infold, and glands to that of adult female (Figure 6*a–h*).

Central Adductor Muscle Attachments: Consisting of 4 ovoid attachments (Figure 6*a–c,i*). An oval, forming base of attachment of a ligament extending ventrally from dorsal tip of coxale of mandible, present anterior to muscle attachments (Figure 6*b,c,i*).

Carapace Size (length, height in mm): USNM 194387, 1.23, 0.69. USNM 194396, 1.22, 0.73. USNM 194397, 1.22, 0.72. USNM 194395P, 2 specimens: 1.23, 0.69; 1.22, 0.70. USNM 194395Q, 1.23, 0.70. USNM 194395R, 2 specimens: 1.19, 0.70; 1.22, 0.73. USNM 194395T, 2 specimens: 1.21, 0.72; 1.21, 0.68. USNM 194399, 1.24, 0.72. USNM 194401, 1.17, 0.69.

First Antenna (Figure 6*k,l*): Similar to that of adult female except suture between 3rd and 4th joints well developed.

Second Antenna: Protopodite bare. Endopodite 3-jointed (Figure 7*a–d*): 1st joint with a-bristle and longer b-bristle, both with indistinct spines; 2nd joint with short slender d- and e-bristles, long filament-like f- and g-bristles (with indistinct widely separated minute marginal spines (spines not shown) and with minute indistinct peg at base of f-bristle (detail in Figure 7*b*)); 3rd joint elongate, with filament like h-, i-, and j-bristles and long terminal slightly sclerotized process with bulbous tip with 2 minute terminal spines and lateral node; sclerotized process of right limb longer than that of left limb (Figures 7*c,d,* 8*n,p*). Exopodite: bristles of 1st and 2nd joints of both limbs with ventral spines and natatory hairs, otherwise exopodite similar to that of adult female.

Mandible: Coxale endite similar to that of adult female except distalmost of distal set of teeth of USNM 194357 with 6–9 cusps (Figure 7*e,f*). Basale (Figure 7*g,h,i,j*) and endopodite (Figure 7*k,l*) similar to those of adult female.

Maxilla (Figure 7*m*): Endite I similar to that of adult female; endite II with 2 proximal and 8 terminal bristles (2 tubular); endite III with 1 proximal and 5 terminal bristles (2 tubular). Coxale with spinous dorsal bristle. Basale with 2 ventral bristles (1 long tubular, 1 short). 1st endopodial joint with 10 or 11 bristles; 2nd endopodial joint similar to that of adult female.

Fifth Limb: Epipodite with 5 bristles in ventral group, 6 in middle group, and 5 (4 long, 1 short) in dorsal group (Figure 8*a*). Protopodite with short glandular process (Figure 8*a–c*). Endites, basale, endopodite, and exopodite, in general, similar to those of adult female, except minute medial spine-like bristle of 3rd exopodial joint not observed with certainty (Figure 8*c,d*).

Sixth Limb: Epipodite with 5 bristles in ventral group, 6 in middle group, and 6 (5 long, 1 short) in dorsal group (Figure 8*f*). Basale with 7 plumose bristles (6 near ventral margin and 1 lateral near midwidth or close to dorsal margin). Endopodite similar to that of adult female (Figure 8*g*). Exopodite (Figure 8*g*): 1st joint with 3 ventral bristles on both

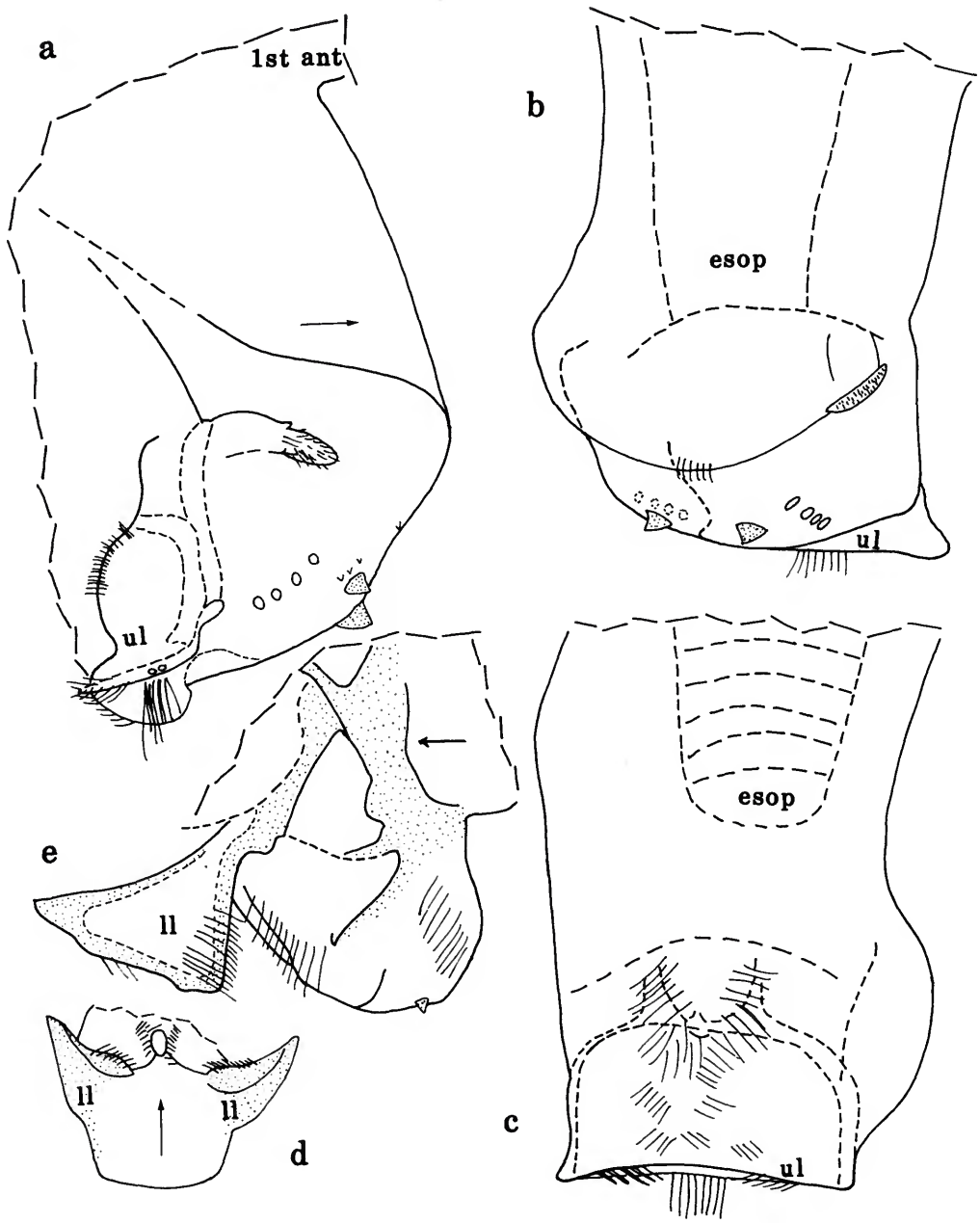


FIGURE 5.—*Spelaeoecia barri* Kornicker, new species, paratype, USNM 194323, adult female: *a*, anterior of body from right side; *b*, anterior view of body (slightly oblique); *c*, posterior view of upper lip; *d*, lower lips, vv; *e*, lower lip area of body from left side.

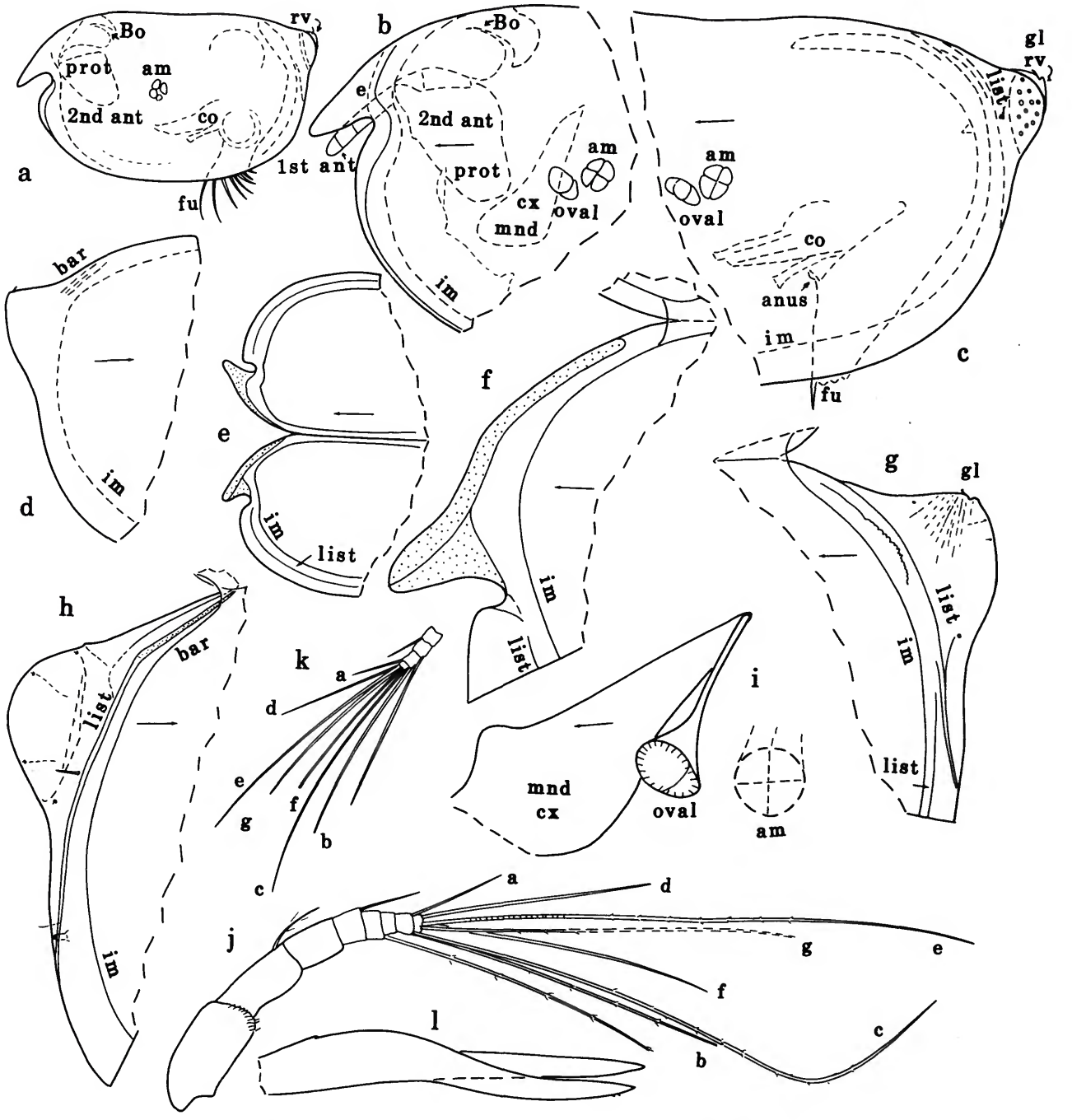


FIGURE 6.—*Spelaeoecia barri* Kornicker, new species, paratype, USNM 194387, adult male: *a,* complete specimen from left side showing some internal structures (dashed), length 1.23 mm; *b,c,* details from *a; d,* posterior right valve, ov; *e,* anterior part of flattened valves, iv; *f,* rostrum and incisur right valve, iv; *g,h,* posterodorsal corners of right and left valves, respectively, iv; *i,* oval attachment of coxale endite ligament and left ends of central adductor muscles, drawn from left side of animal removed from carapace; *j,* right 1st antenna, lv; *k,* distal left 1st antenna, lv; *l,* Bellonci organ from right side.

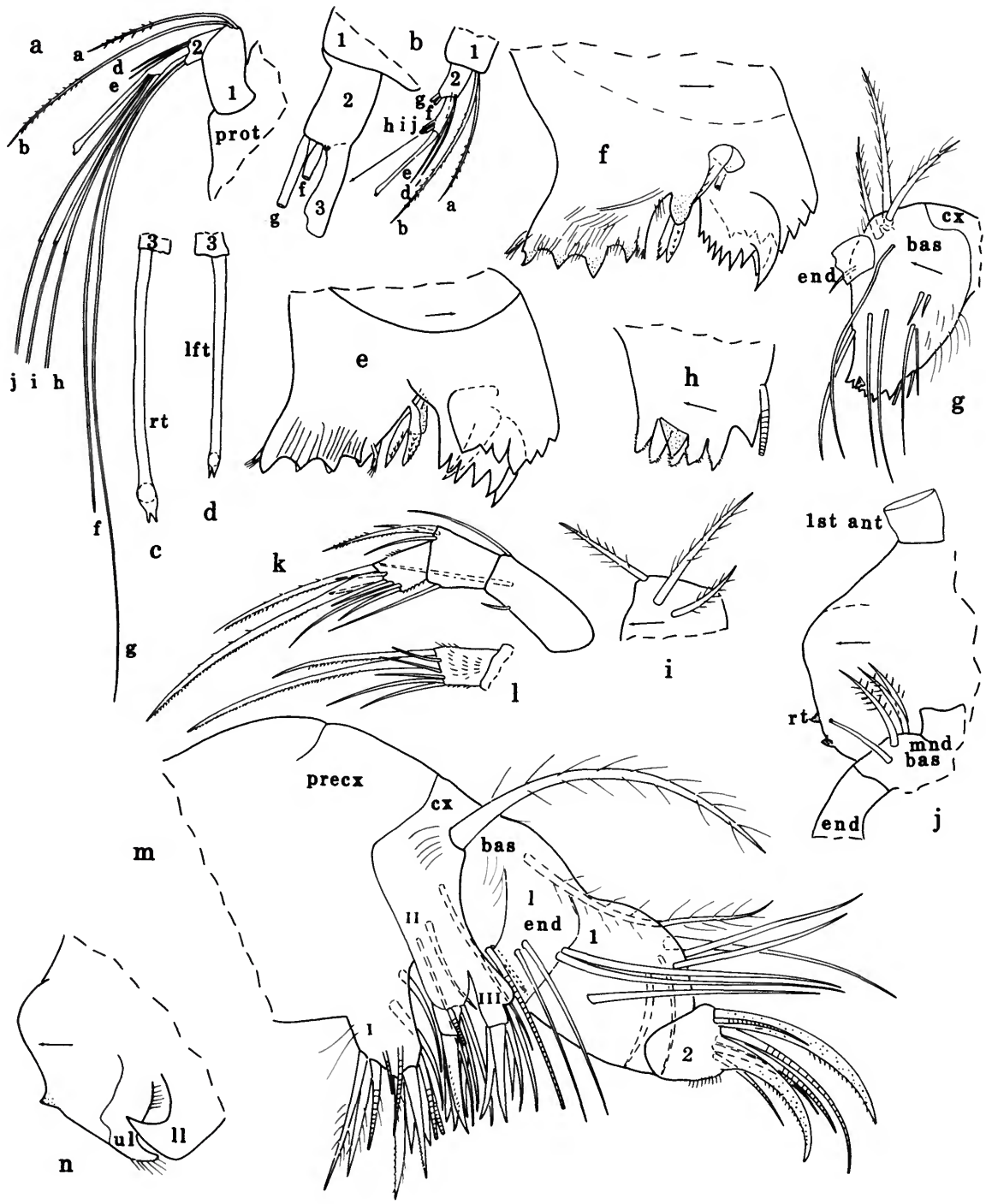


FIGURE 7.—*Spelaeoecia barri* Kornicker, new species, paratype, USNM 194387, adult male: *a*, endopodite right 2nd antenna, mv; *b*, distal endopodite left 2nd antenna, mv; *c,d*, sclerotized process of 3rd joint of right and left 2nd antennae, respectively, mv; *e,f*, coxale endites of left (lv) and right (mv) mandibles, respectively; *g*, part of left mandible, lv; *h*, detail from *g*; *i*, dorsal end of basale of right mandible, mv; *j*, anterior of body from left side showing both right and left sclerotized triangular processes (stippled) (not under cover slip); *k*, endopodite left mandible, lv; *l*, distal part endopodite right mandible, mv; *m*, maxilla; *n*, ventral part of anterior of body showing sclerotized triangular process (stippled).

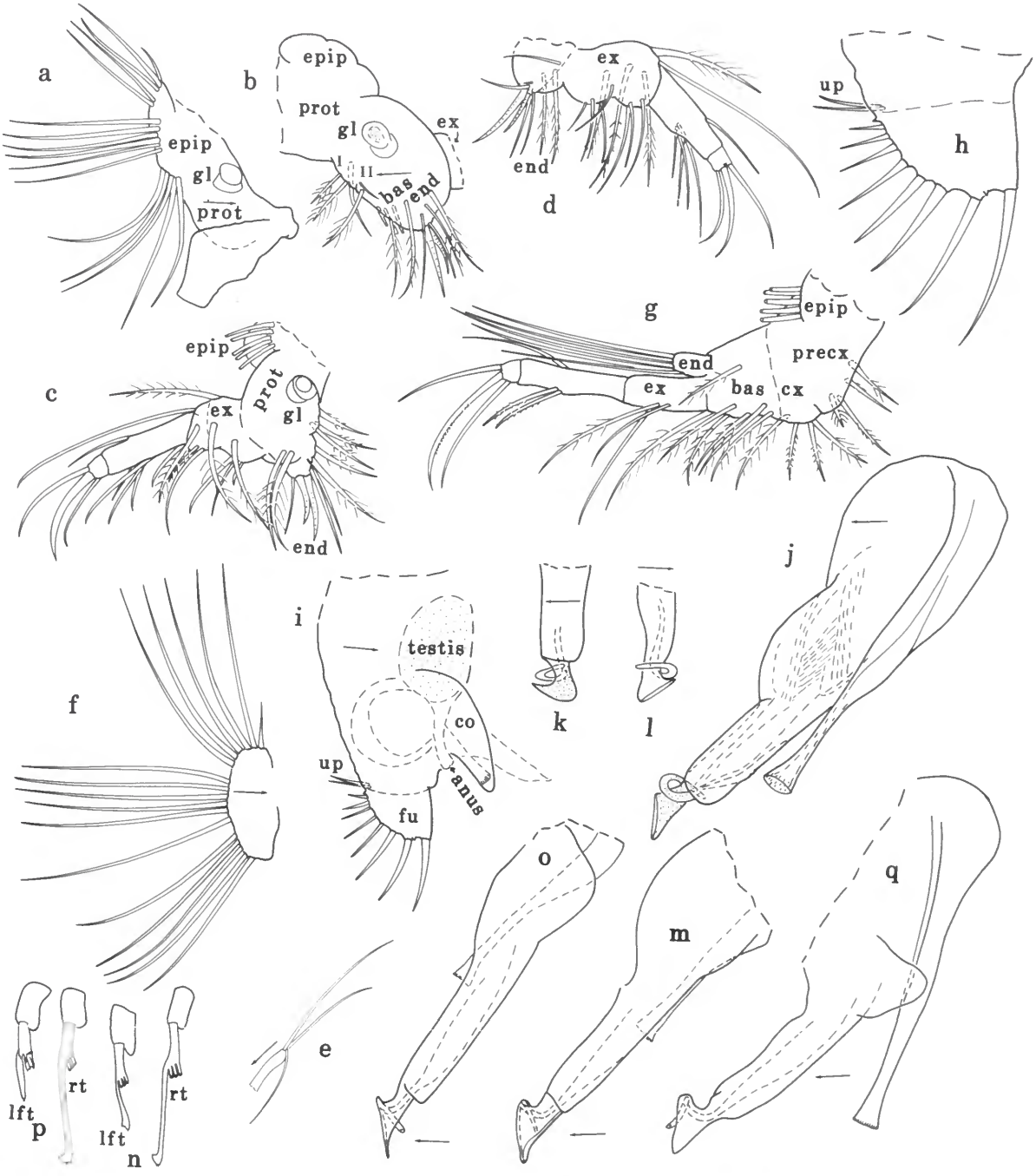


FIGURE 8.—*Spelaeoecia barri* Kornicker, new species, paratype, USNM 194387, adult male: *a*, proximal part of right 5th limb (nabs), lv; *b*, part left 5th limb (epipodial bristles not shown), lv; *c*, right 5th limb (not under cover slip; nabs), lv; *d*, part right 5th limb, mv; *e*, left 7th limb, lv; *f*, epipodite right 6th limb, lv; *g*, right 6th limb (spines not shown on endopodial bristles; not all epipodial bristles shown), lv; *h*, right furcal lamella and unpaired bristle; *i*, posterior of body from right side; *j*, copulatory organ from left side; *k*, tip of anterior process in *j* from left side (under cover slip); *l*, tip of anterior process in *j* from right side. Paratype, adult male, USNM 194396: *m*, copulatory organ from left side; *n*, sclerotized processes of 3rd endopodial joints of 2nd antennae. Holotype, adult male, USNM 194399: *o*, copulatory organ from left side; *p*, sclerotized processes of 3rd endopodial joints of 2nd antennae. Paratype, adult male, USNM 194401: *q*, copulatory organ from left side.

limbs; 2nd joint with 3 bristles (1 dorsal, 2 ventral); 3rd joint similar to that of adult female except minute medial spine-like bristle absent.

Seventh Limb (Figure 8*e*), *Furca* (Figure 8*h*), *Upper and Lower Lips* (Figure 7*n*): Similar to those of adult female.

Bellonci Organ (Figure 6*l*): Tips of branches more pointed than those of adult female.

Genitalia (Figure 8*i–m,o,q*): Copulatory organ consisting of 2 parts: anterior part with sclerotized triangular tip and tubular process; posterior part with broad spinous tip. Copulatory organ located left of apron of furca and right of left 5th and 6th limbs.

Gut: With minute unidentified particles.

DESCRIPTION OF A–1 FEMALE (Instar VI?) (Figure 9*a–d*).—Carapace similar to that of adult female (Figure 9*a,b*).

Central Adductor Muscle Attachments (Figure 9*a,d*): Consisting of 3 or 4 oval attachments (2 or 3 large, 1 small). Oval mandibular attachment similar to that of adult female.

Carapace Size (length, height in mm): USNM 194389, 1.08 mm, 0.67 mm. USNM 194390, 1.05; 0.60. USNM 194395C, 1.02, 0.59. USNM 194395F, 1.03, 0.65. USNM 194395G, 1.07, 0.65. USNM 194395M, 1.08, 0.63. USNM 194395Q, 1.11, 0.63.

Furca (Figure 9*c*): Similar to that of adult female except with only 7 claws.

Remaining Appendages and Upper Lip: Not examined in detail but, in general, similar to those of adult female.

Genitalia: Absent.

DESCRIPTION OF A–1 MALE (Instar VI?) (Figure 9*e–i*).—Carapace similar to that of adults and A–1 female (Figure 9*e*).

Carapace Size (length, height in mm): USNM 194390, 1.05, 0.60. USNM 194395E, 1.08, 0.64. USNM 194395K, 1.07, 0.62.

First Antenna (Figure 9*f*, nabs): Similar to that of adult female.

Second Antenna: Protopodite bare (Figure 9*f*). Endopodite 3-jointed but with 2nd and 3rd joints fused (Figure 9*g*): 1st joint with spinous a- and b-bristles; 2nd joint with stout g-bristle with indistinct widely separated spines, f-bristle thinner and shorter than g-bristle, with indistinct widely separated marginal spines and with minute lateral peg at base of f-bristle; 3rd joint with h-, i-, and j-bristles shorter than f-bristle, and with 2 minute bristles on small medial process at base of j-bristle. Exopodite 9-jointed: 1st joint divided into long proximal and short distal parts, with long terminal bristle with ventral spines; long bristle of 2nd joint with ventral spines and few distal dorsal natatory hairs; bristles of joints 3–8 with natatory hairs, no spines; 9th joint with 4 bristles (1 minute bare, 2 short with dorsal spines, 1 long with natatory hairs).

Mandible: Similar to that of adult female.

Maxilla, Fifth and Sixth Limbs: Not examined in detail but, in general, similar to those of adult female.

Seventh Limb: Similar to that of adult female.

Furca (Figure 9*h,i*) *and Bellonci Organ* (Figure 9*f*): Similar to those of A–1 female.

Genitalia (Figure 9*h,i*): Consisting of 2 lobes: anterior lobe broad with rounded tip (may have 3 subterminal bristles, but not clearly resolved (could be wrinkles) and not shown); posterior lobe narrow with rounded tip bearing 3 small spines. Both lobes on left side of apron of furca.

DESCRIPTION OF A–2 FEMALE (Instar V?) (Figure 9*j–m*).—Carapace similar to that of adult female (Figure 9*j–l*).

Central Adductor Muscle Attachments: Consisting of about 6 small oval attachments.

Carapace Size (length, height in mm): USNM 194388, 0.86 mm, 0.51 mm. USNM 194395B, 0.89, 0.51. USNM 194395E, 0.85, 0.55.

Furca (Figure 9*m*): Similar to that of adult female except with only 6 claws on each lamella.

Remaining Appendages and Lips: Not examined in detail but, in general, similar to those of adult female. 1st endopodial joint of 2nd antenna with 2 dorsal bristles.

Genitalia: Absent.

DESCRIPTION OF A–2 MALE (Instar V?) (Figure 9*n–p*).—Carapace similar to that of adult female (Figure 9*n*).

Central Adductor Muscle Attachments (Figure 9*n, o*): Consisting of 5 or 6 small oval attachments; mandibular oval present anterior to central adductor muscle attachments (Figure 9*o*).

Carapace Size (length, height in mm): USNM 194395A, 0.84, 0.49. USNM 194395D, 0.88, 0.52.

Furca: Similar to that of A–2 female.

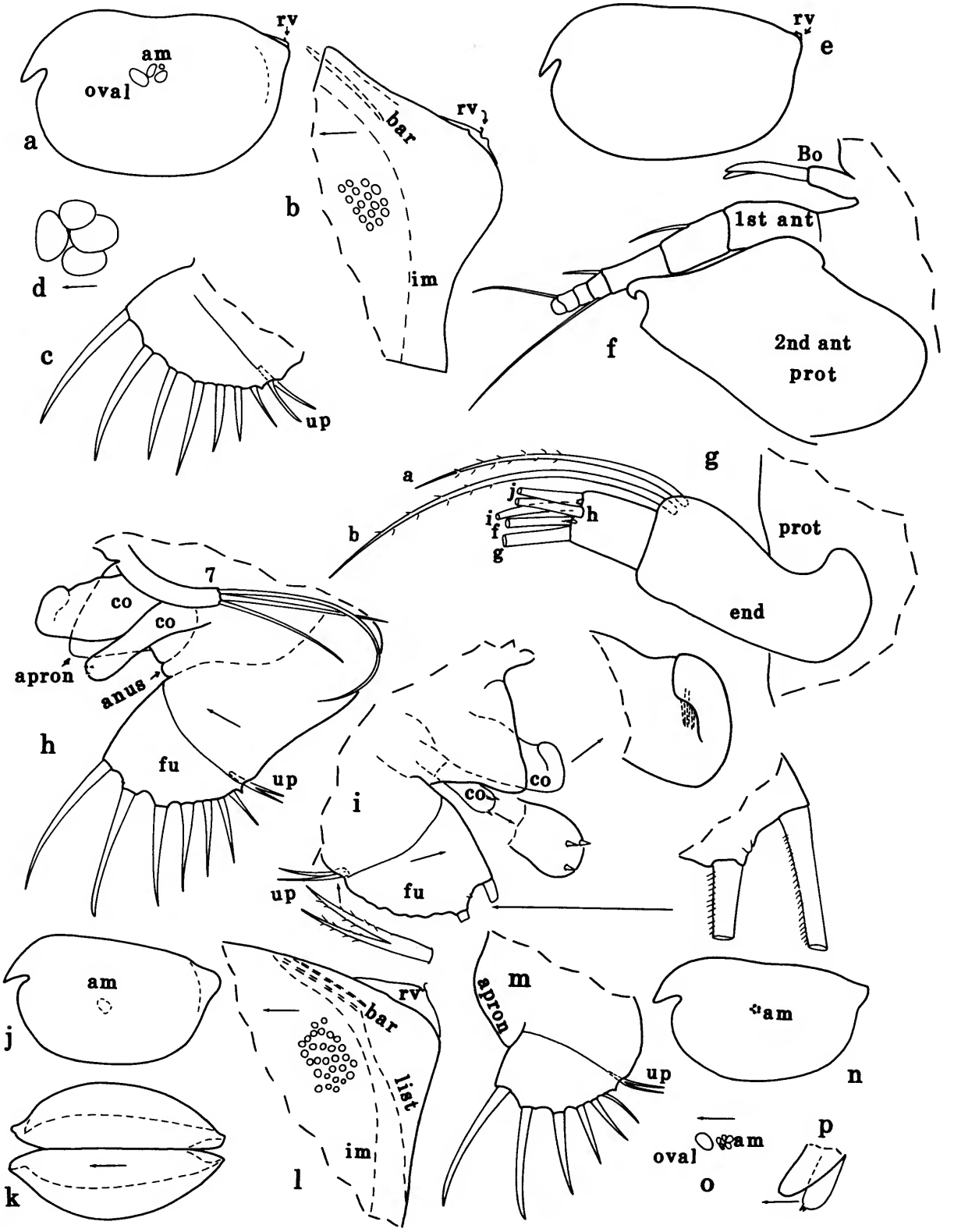
Remaining Appendages and Lips: Not examined in detail but, in general, similar to those of A–2 female.

Genitalia (Figure 9*p*): Consisting of 2 adjacent elongate lobes on left side of body: anterior lobe bare (not observed on USNM 194395A); posterior lobe with 2 small spine-like bristles.

DESCRIPTION OF A–3 INSTAR (Instar IV?) (sex unknown) (Figure 10*a–l*).—Carapace similar in shape, ornamentation, and selvage to those of adults (Figure 10*a,b,d,e,h,i,k*).

Central Adductor Muscle Attachments (Figure 10*a,c,l*): Comprising 7 or 8 small ovoid attachments.

FIGURE 9 (opposite page).—*Spelaeoecia barri* Kornicker, new species, paratype, USNM 194389, A–1 female: *a*, complete specimen from left side, length 1.08 mm; *b*, detail from *a*; *c*, left lamella of furca. Paratype, USNM 194395F, A–1 female: *d*, central adductor muscle attachments of left valve (magnification 4 times that of *a*), ov. Paratype, USNM 194390, A–1 male: *e*, complete specimen from left side, length 1.05 mm; *f*, dorsal part of anterior of body from left side (nabs); *g*, endopodite of right 2nd antenna (only proximal parts shown of long bristles of 2nd and 3rd joints), mv; *h*, ventral part of posterior of body from left side; *i*, copulatory organ and left lamella of furca (not all claws shown) from right side. Paratype, USNM 194388, A–2 female: *j*, complete specimen from left side showing outline of area containing adductor muscle attachments; *k*, dorsal view of *j* with valves partly open; *l*, detail from *j* showing representative shallow surface pits; *m*, left lamella of furca. Paratype, USNM 194395D, A–2 male: *n*, complete specimen from left side, length 0.88 mm: *o*, central adductor muscle scars and mandibular oval of left valve drawn at twice magnification of *n*, ov; *p*, tip of copulatory organ from left side drawn at 4 times magnification of *n*.


a
am
oval
rv
b
bar
rv
im
c
up
d
e
rv
f
Bo
1st ant
2nd ant
prot
g
a
b
j
i
f
g
h
prot
end
h
7
co
co
apron
anus
fu
up
i
co
co
up
fu
j
am
k
l
rv
bar
list
im
m
apron
up
n
am
o
oval
am
p

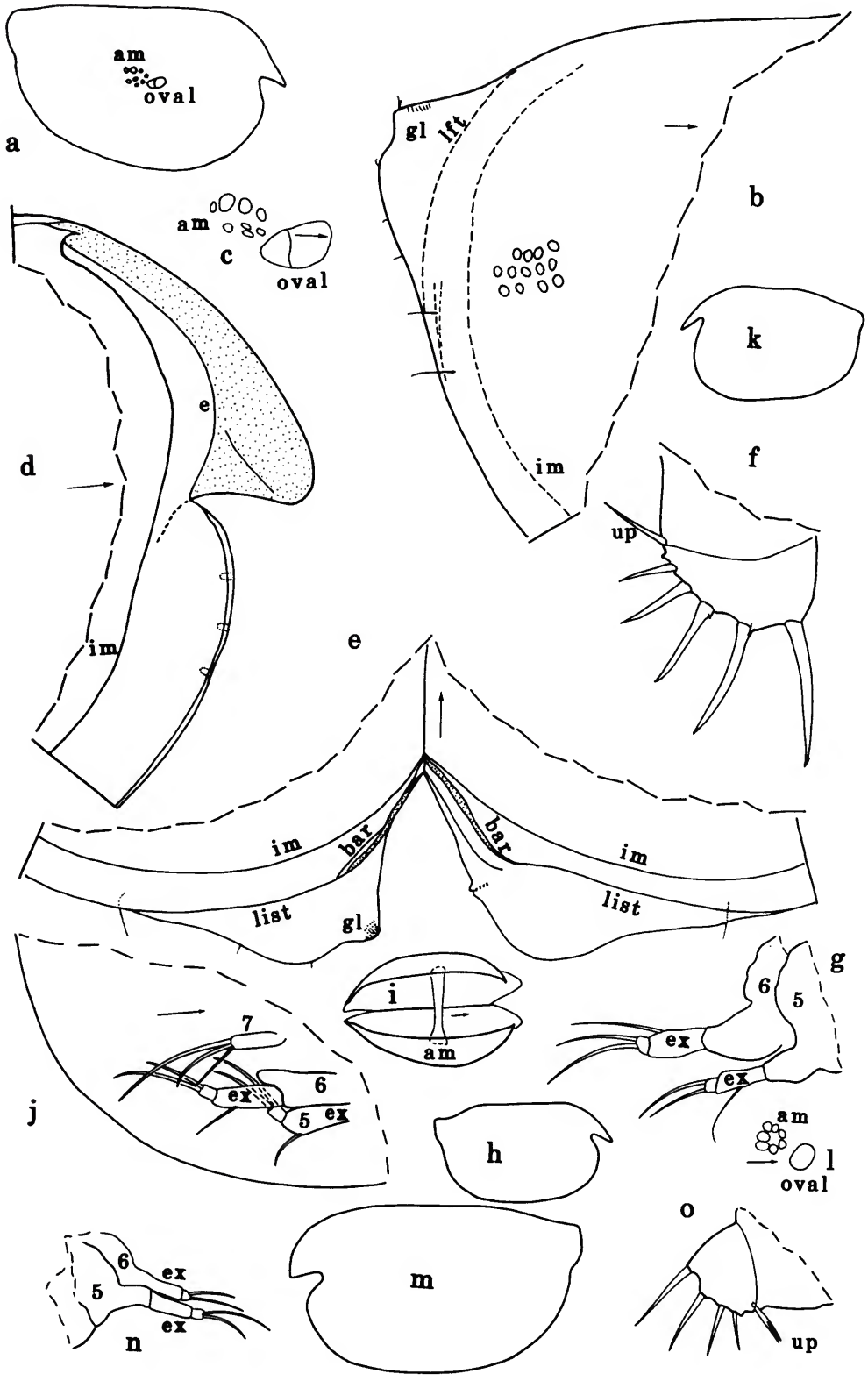

a
am
oval
b
gl
lft
im
c
am
oval
d
e
im
e
im
bar
bar
im
list
gl
list
f
up
g
6
5
ex
ex
h
i
am
j
7
ex
6
5
ex
k
l
am
oval
m
n
6
ex
5
ex
o
up

FIGURE 10 (opposite page).—*Spelaeoecia barri* Kornicker, new species, paratype, USNM 194324, A–3 instar: *a*, complete specimen from right side, length 0.69 mm; *b*, posterior of complete specimen from right side showing representative pits; *c*, detail from *a* of central adductor muscle attachments and mandibular oval; *d*, anterior left valve, iv; *e*, inside view of posterior ends of flattened valves; *f*, right lamella of furca; *g*, 5th and 6th limbs shown attached to right side of body (nabs). Paratype, USNM 194391, A–3 instar (sex unknown): *h*, complete specimen from right side, length 0.68 mm; *i*, ventral view of *h* showing central adductor muscle (valves partly open); *j*, 5th, 6th, and 7th limbs shown attached to right side of body as seen through right valve. Paratype, USNM 194392, A–3 instar (sex unknown): *k*, complete specimen from left side, length 0.71 m. Paratype, USNM 194393, A–3 instar (sex unknown): *l*, central adductor muscle attachments and mandibular oval of right valve, ov. Paratype, USNM 194400, A–4 instar (sex unknown): *m*, complete specimen from left side, length 0.55 mm; *n*, 5th and 6th limbs drawn attached to left side of body (nabs); *o*, left furcal lamella.

Large translucent mandibular oval present anteroventral to adductor attachments.

Glands (Figure 10*b,e*): Similar to those of adult female.

Carapace Size (length, height in mm): USNM 194324, 0.69, 0.41. USNM 194391, 0.68, 0.41. USNM 194392, 0.71, 0.44. USNM 194393, 0.67, 0.42. USNM 194394, 0.68, 0.41.

First Antenna, Mandible, Maxilla, and Bellonci Organ: Not examined in detail but all well developed. One branch of Bellonci organ slightly longer than the other as on adult female.

Second Antenna: 1st joint of endopodite with only 1 dorsal bristle; remaining part of endopodite not studied in detail but, in general, similar to that of adult. Protopodite and exopodite also not studied in detail but similar to those of adult (number of bristles on 9th joint of exopodite not determined).

Fifth and Sixth Limbs (Figure 10*g,j*): 6th limb extending well past 5th limb.

Seventh Limb: Absent on USNM 194324, 194393, and 194394. Well developed on USNM 194391 and 194392.

Furca (Figure 10*f*): Each lamella with 5 claws followed by small triangular tooth-like process. Minute triangular process between claws 1 and 2 but closer to claw 2. Divided unpaired bristle just posterior to furca (illustrated furca has aberrant single bristle). Apron present.

Genitalia: Absent.

Remarks: Five specimens in the collection are interpreted to be the A–3 instar based on their size (length 0.67–0.71 mm) and number of furcal claws (5). Two of the specimens have well-developed 7th limbs, whereas the limb is absent on 3 specimens. On all specimens the 6th limb extends posteriorly well past the 5th limb. The difference in development of the 7th limb on the specimens is interpreted to be the result of intraspecific variability.

DESCRIPTION OF A–4 INSTAR (Instar III?) (sex unknown) (Figure 10*m–o*).—Carapace similar to that of adult female (Figure 10*m*).

Carapace Size (length, height in mm): USNM 194400, 0.55, 0.34.

First and Second Antenna, Maxilla, Mandible, and Lips: Not examined in detail but, in general, similar to those of adult female. 1st endopodial joint of 2nd antenna with 1 dorsal bristle.

Fifth and Sixth Limbs (Figure 10*n*): Not examined in detail but 6th limb not extending past 5th limb.

Furca (Figure 10*o*): Similar to that of A–3 instar except with 4 furcal claws. Unpaired bristle divided.

Bellonci Organ: Similar to that of adult female.

Genitalia: Absent.

ONTOGENY.—The collection from San Salvador contains instars A–4 to the adult (Figure 11). If the species has six juvenile stages, the stages collected probably represent instars III, IV, V, VI, and adult. The 6th limb bears bristles on instar III, but it does not extend past the 5th limb. The 7th limb is absent on instar III and also on some specimens of instar IV. Each lamella of the furca of instar III bears four claws followed by small triangular process, and one claw is added in each subsequent instar, with the adult bearing eight claws (Table 1). The small triangular process follows the claws on the adult as well as on the juveniles. Each furcal lamella of unknown instars I and II probably bears 2 and 3 claws, respectively, as well as a triangular process.

The average growth factor for specimens in the collection is 1.22. The growth factor between instar VI and the adult is 1.14 for the male and 1.20 for the female, which results in adult males being smaller than adult females, but with a slight overlap in lengths (Table 2).

The collection contains specimens captured in a baited trap, and most likely it does not represent the population structure outside the trap (Table 3). The collection contained fewer males than females, but whether this is the result of sampling error or fewer males being present in the cave is unknown; however, the data may suggest that adult males are less numerous than adult females. Collections of another species of the genus, *Spelaeoecia bermudensis* Angel and Iliffe, 1987, also had fewer adult males than females (Angel and Iliffe, 1987; Kornicker, 1989:313). The small number of early instars in the trap suggests that they are less mobile than adults.

COMPARISONS.—The 1st antenna of *S. barri* differs from that of *S. bermudensis* in having no bristles on the 3rd joint and no ventral bristle on the 4th joint, and from that of *S.*

TABLE 1.—Order of appearance of appendages of *Spelaeoecia barri*, new species (+ = present, – = absent), and number of furcal claws. Unlisted appendages already are present on the A–4 instar.

Growth stage	Sixth limb	Seventh limb	Copulatory organ (male)	Number of furcal claws
A–4 (III)	reduced	–	–	4
A–3 (IV)	+	+ or –	–	5
A–2 (V)	+	+	reduced	6
A–1 (VI)	+	+	reduced	7
Adult	+	+	+	8

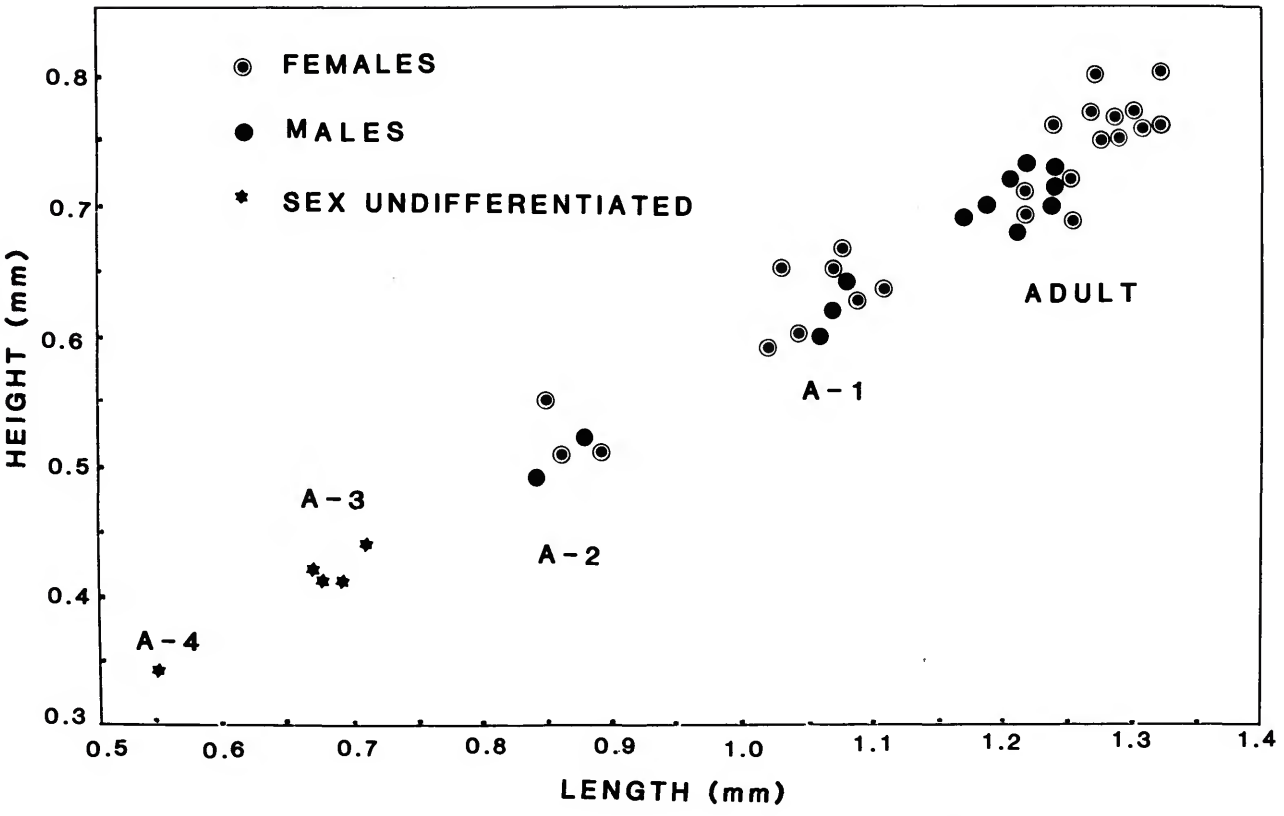


FIGURE 11.—Carapace length-height distribution of growth stages of *Spelaeoecia barri* Kornicker, new species.

TABLE 2.—Average shell lengths and calculated growth factors for males and females of *Spelaeoeca barri*, new species (nd = no data).

Growth stage	Female			Male		
	Average length (mm)	Growth factor	Number of specimens	Average length (mm)	Growth factor	Number of specimens
Adult	1.27		20	1.22		12
		1.20			1.14	
A–1	1.06		7	1.07		3
		1.22			1.24	
A–2	0.87		3	0.86		2
		1.26			nd	
A–3*	0.69		5	nd		nd
		1.25			nd	
A–4*	0.55		1	nd		nd

*Because males and females could not be distinguished for these early stages, males may be included in average dimensions.

TABLE 3.—Number of males and females of *Spelaeoecia barri*, new species, in the collection.

Growth stage	Males	Females	Percent males	Total specimens
A–4*	–	–	–	1
A–3*	–	–	–	5
A–2	2	3	40	5
A–1	3	7	30	10
Adult	13	21	35	34

*Sex unknown.

jamaicensis in not having a ventral bristle on the 4th joint. The carapaces of previously described species of *Spelaeoecia* have lineations, reticules, or are without surface ornamentation, whereas *S. barri* has shallow surface pits (some of the pits are illustrated in Figure 1*a*). The furca of *S. barri* has eight claws on each lamella compared to five for *S. cubensis* and seven for *S. bermudensis* and *S. styx*. The posterior branch of the copulatory organ of *S. sagax, S. styx,* and *S. bermudensis* has a narrow tip compared to a broad tip on *S. barri*. *Spelaeoecia capax,* which is known from only the carapace, is much larger than *S. barri* (length 2.49 mm compared to 1.17–1.32 mm).

Literature Cited

Angel, M.V., and T.M. Iliffe

1987. *Spelaeocia bermudensis* New Genus, New Species, a Halocyprid Ostracod from Marine Caves in Bermuda. *Journal of Crustacean Biology,* 7:541–553.

Barr, D.J.

1984. *Enantiosis cavernicola,* a New Genus and Species of Demersal Copepod (Calanoida: Epacteriscidae) from San Salvador Island, Bahamas. *Proceedings of the Biological Society of Washington,* 97(1):160–166.

Carpenter, J.H.

1981. *Bahalana geracei* n. gen., n. sp., a Troglobitic Marine Cirolanid Isopod from Lighthouse Cave, San Salvador Island, Bahamas. *Bijdragen tot de Dierkunde,* 51(2):259–267.

Carpenter, J.H., and G.J. Magniez

1982. Deux Asellotes Stygobies des Indes Occidentales: *Neostenetroides stocki,* n. gen. n. sp., et *Stenetrium* sp. *Bijdragen tot de Dierkunde,* 52(2):200–206.

Dana, J.D.

1853. Tribe III: Cyproidea = Ostracoda. In *Crustacea of United States Exploring Expedition during the Years 1838, 1839, 1840, 1841, 1842, under the Command of Charles Wilkes, U.S.N., with Atlas of 96 plates,* 14(2):1277–1304, plates 90, 91. Philadelphia: C. Sherman.

Kornicker, Louis S.

1989. The Adult Male of the Troglobitic Ostracode *Spelaeocia bermudensis* Angel and Iliffe, 1987, from an Anchialine Cave in Bermuda (Crustacea: Ostracoda: Halocypridoidea). *Proceedings of the Biological Society of Washington,* 102(2):313–323, figures 1–5.

Kornicker, Louis S., and Thomas M. Iliffe

1985. Deeveyinae, a New Subfamily of Ostracoda (Halocyprididae) from a Marine Cave on the Turks and Caicos Islands. *Proceedings of the Biological Society of Washington,* 98(2):476–493, figures 1–13.

1992. Ostracoda (Halocypridina, Cladocopina) from Anchialine Caves in Jamaica, West Indies. *Smithsonian Contributions to Zoology,* 530, 22 pages, 11 figures, 1 table.

Kornicker, Louis S., and Jill Yager

1996. The Troglobitic Halocyprid Ostracoda of Anchialine Caves in Cuba. *Smithsonian Contributions to Zoology,* 580, 16 pages, 9 figures, 1 table.

Kornicker, Louis S., Jill Yager, and Dennis Williams

1990. Ostracoda (Halocyprididae) from Anchialine Caves in the Bahamas. *Smithsonian Contributions to Zoology,* 495, 51 pages, 30 figures, 4 tables.

Müller, G.W.

1906. Ostracoda. In *Wissenschaftliche Ergnebnisse der Deutsche Tiefsee-Expedition ... 1898–1899,* 8(2): 154 pages, 31 plates.

Van Soest, R.W.M., and D.B. Sass

1981. Marine Sponges from an Island Cave on San Salvador Island, Bahamas. *Bijdragen tot de Dierkunde,* 51(2):332–344.

Von Martens, E.

1872. Ueber Cubanische Crustaceen nach den Sammlungen Dr. J. Gundlach's [sic]. *Archiv für Naturgeschichte,* 38(1):77–147, 257, 258, plates 4, 5.

☆ U.S. GOVERNMENT PRINTING OFFICE: 1997 405-261/20021

REQUIREMENTS FOR SMITHSONIAN SERIES PUBLICATION

Manuscripts intended for series publication receive substantive review (conducted by their originating Smithsonian museums or offices) and are submitted to the Smithsonian Institution Press with Form SI-36, which must show the approval of the appropriate authority designated by the sponsoring organizational unit. Requests for special treatment—use of color, foldouts, case-bound covers, etc.—require, on the same form, the added approval of the sponsoring authority.

Review of manuscripts and art by the Press for requirements of series format and style, completeness and clarity of copy, and arrangement of all material, as outlined below, will govern, within the judgment of the Press, acceptance or rejection of manuscripts and art.

Copy must be prepared on typewriter or word processor, double-spaced, on one side of standard white bond paper (not erasable), with 1¼″ margins, submitted as ribbon copy (not carbon or xerox), in loose sheets (not stapled or bound), and accompanied by original art. Minimum acceptable length is 30 pages.

Front matter (preceding the text) should include: **title** page with only title and author and no other information; **abstract** page with author, title, series, etc., following the established format; table of **contents** with indents reflecting the hierarchy of heads in the paper; also, **foreword** and/or **preface**, if appropriate.

First page of text should carry the title and author at the top of the page; **second page** should have only the author's name and professional mailing address, to be used as an unnumbered footnote on the first page of printed text.

Center heads of whatever level should be typed with initial caps of major words, with extra space above and below the head, but no other preparation (such as all caps or underline, except for the underline necessary for generic and specific epithets). Run-in paragraph heads should use period/dashes or colons as necessary.

Tabulations within text (lists of data, often in parallel columns) can be typed on the text page where they occur, but they should not contain rules or numbered table captions.

Formal tables (numbered, with captions, boxheads, stubs, rules) should be submitted as carefully typed, double-spaced copy separate from the text; they will be typeset unless otherwise requested. If camera-copy use is anticipated, do not draw rules on manuscript copy.

Taxonomic keys in natural history papers should use the aligned-couplet form for zoology and may use the multi-level indent form for botany. If cross referencing is required between key and text, do not include page references within the key, but number the keyed-out taxa, using the same numbers with their corresponding heads in the text.

Synonymy in zoology must use the short form (taxon, author, year:page), with full reference at the end of the paper under "Literature Cited." For botany, the long form (taxon, author, abbreviated journal or book title, volume, page, year, with no reference in "Literature Cited") is optional.

Text-reference system (author, year:page used within the text, with full citation in "Literature Cited" at the end of the text) must be used in place of bibliographic footnotes in all Contributions Series and is strongly recommended in the Studies Series: "(Jones, 1910:122)" or "...Jones (1910:122)." If bibliographic footnotes are required, use the short form (author, brief title, page) with the full citation in the bibliography.

Footnotes, when few in number, whether annotative or bibliographic, should be typed on separate sheets and inserted immediately after the text pages on which the references occur. Extensive notes must be gathered together and placed at the end of the text in a notes section.

Bibliography, depending upon use, is termed "Literature Cited," "References," or "Bibliography." Spell out titles of books, articles, journals, and monographic series. For book and article titles use sentence-style capitalization according to the rules of the language employed (exception: capitalize all major words in English). For journal and series titles, capitalize the initial word and all subsequent words except articles, conjunctions, and prepositions. Transliterate languages that use a non-Roman alphabet according to the Library of Congress system. Underline (for italics) titles of journals and series and titles of books that are not part of a series. Use the parentheses/colon system for volume (number):pagination: "10(2):5–9." For alignment and arrangement of elements, follow the format of recent publications in the series for which the manuscript is intended. Guidelines for preparing bibliography may be secured from Series Section, SI Press.

Legends for illustrations must be submitted at the end of the manuscript, with as many legends typed, double-spaced, to a page as convenient.

Illustrations must be submitted as original art (not copies) accompanying, but separate from, the manuscript. Guidelines for preparing art may be secured from the Series Section, SI Press. All types of illustrations (photographs, line drawings, maps, etc.) may be intermixed throughout the printed text. They should be termed **Figures** and should be numbered consecutively as they will appear in the monograph. If several illustrations are treated as components of a single composite figure, they should be designated by lowercase italic letters on the illustration; also, in the legend and in text references the italic letters (underlined in copy) should be used: "Figure 9b." Illustrations that are intended to follow the printed text may be termed **Plates**, and any components should be similarly lettered and referenced: "Plate 9b." Keys to any symbols within an illustation should appear on the art rather than in the legend.

Some points of style: Do not use periods after such abbreviations as "mm, ft, USNM, NNE." Spell out numbers "one" through "nine" in expository text, but use digits in all other cases if possible. Use of the metric system of measurement is preferable; where use of the English system is unavoidable, supply metric equivalents in parentheses. Use the decimal system for precise measurements and relationships, common fractions for approximations. Use day/month/year sequence for dates: "9 April 1976." For months in tabular listings or data sections, use three-letter abbreviations with no periods: "Jan, Mar, Jun," etc. Omit space between initials of a personal name: "J.B. Jones."

Arrange and paginate sequentially every sheet of manuscript in the following order: (1) title page, (2) abstract, (3) contents, (4) foreword and/or preface, (5) text, (6) appendices, (7) notes section, (8) glossary, (9) bibliography, (10) legends, (11) tables. Index copy may be submitted at page proof stage, but plans for an index should be indicated when the manuscript is submitted.