Redescriptions of two species of *Lepeophtheirus* (Copepoda, Siphonostomatoida, Caligidae) parasitic on teleost marine fishes from the coastal zone of the State of Rio de Janeiro, Brazil

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ABSTRACT. Two species of *Lepeophtheirus* Nordmann, 1832 parasitic on the ariid fish *Netuma barba* Lacépède, 1803, and the bothiid fish *Paralichthys* sp. from the coastal zone of the State of Rio de Janeiro, are redescribed and illustrated: *L. bagri* Dana, 1852, and *L. monacanthus* Heller, 1865. New junior synonyms for these species are proposed: *L. marginatus* **syn.n.**, *L. christianensis* **syn.n.** and *L. platensis* **syn.n.** of *L. bagri* and *L. unispinosus* **syn.n.** of *L. monacanthus*.
KEY WORDS. Copepoda, Caligidae, *Lepeophtheirus bagri*, *Lepeophtheirus monacanthus*, Ariidae, Bothiidae, *Netuma barba*, *Paralichthys*, Brazil

In the second half of the 19th century, some extensive works on Crustacea from South America included descriptions of caligid copepods parasitic on marine fishes from the Brazilian coastal zone (DANA 1852; HELLER 1865). Because of insufficient description or illustration of diagnostic characters, or because the deposited type material is unknown, some of these species were considered as *species inquirendae* (see PARKER 1968). Others need full redescriptions, which in many cases, would require the collection of additional specimens from the type localities.

From Brazil, four species of *Lepeophtheirus* are known: *L. bagri* Dana, 1852; *L. monacanthus* Heller, 1865; *L. curtus* (Wilson, 1913); and *L. rhinobati* Luque, Chaves & Cezar, 1998 (see YAMAGUTI 1963; LUQUE *et al.* 1998a,b); two of them, *L. bagri* and *L. monacanthus*, are redescribed in the present paper.

MATERIAL AND METHODS

Some of the copepods studied were obtained from the Museu Nacional Collection, Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brasil. Other specimens were taken from *Netuma barba* (Lacépède, 1803) (Ariidae) collected by the authors in the coastal zone of the State of Rio de Janeiro during 1996. The fishes were identified according to FIGUEIREDO & MENEZES (1978). The copepods were fixed and preserved in ethanol 70°GL. For microscopical study, specimens were cleared in 85% lactic acid and the appendages were dissected with fine needles.

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Hoyer's medium (HUMASON 1979) was used, in some cases, for mounting appendages and entire specimens. The illustrations were made with the aid of a drawing tube mounted on a Wild M-20 phase contrast microscope. Voucher specimens were deposited in the Coleção Carcinológica do Museu Nacional (MNRJ), Rio de Janeiro, Rio de Janeiro, Brasil and in the Departament of Invertebrate Zoology, United States National Museum of Natural History, Smithsonian Institution (USNM), Washington, D.C., U.S.A.

RESULTS

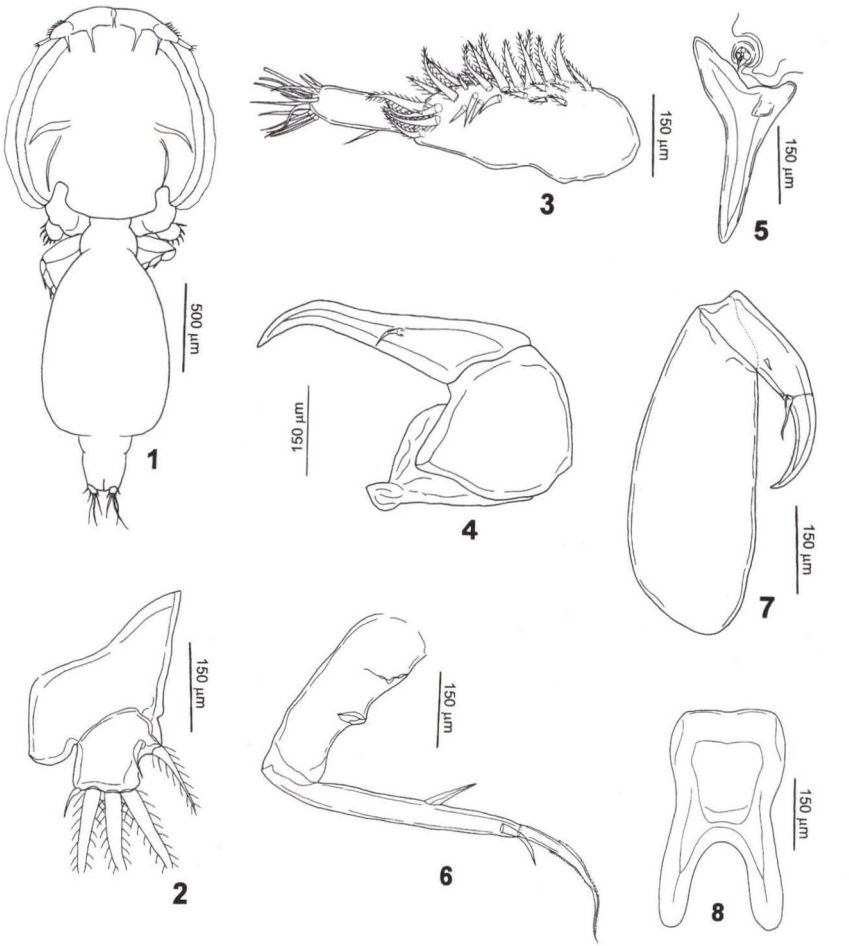
Lepeophtheirus bagri Dana, 1852

Figs 1-18

Lepeophtheirus marginatus Bere, 1936, **syn.n.**
Lepeophtheirus christianensis Wilson, 1944 **syn.n.**
Lepeophtheirus platensis Thomsen, 1949, **syn.n.**

Specimens examined. Five females (MNRJ No. 7270), 10 females (MNRJ No. 8493), two males (MNRJ No. 8493) and four females (USNM No. 288087) taken on 21 February 1992 on gills of *Netuma barba* (Lacépède, 1803) (Ariidae) from Ipanema, Rio de Janeiro, Brazil (approx. 22°35'S, 41°30'W). Ten females and 10 males (MNRJ No. 12881) taken on gills of *Paralichthys* sp. from Ilha do Governador, Rio de Janeiro, Brazil (approx. 22°56'S, 41°42'W). Also examined: *Lepeophtheirus marginatus* Bere, 1936: One female (Holotype) and one male (USNM No. 069860), taken in 1935 on outside skin of *Galeichthys felis* (Linnaeus, 1758) (Ariidae) from Englewood, Florida, U.S.A. *Lepeophtheirus christianensis* Wilson, 1944: One female with one male attached (Syntypes) (USNM No. 060548), taken in 1928 on gills of *Galeichthys* sp. from Pass Christian, Mississippi, U.S.A. *Lepeophtheirus orbicularis* Shiino, 1965: One female (Holotype), nine females (paratypes) and five males (paratypes) (Collection of Faculty of Bioresources, Mie Prefectural University, Japan, No. 577), taken on 30 May 1960 on the surface of *Galeichthys* sp. from Mancora, Peru.

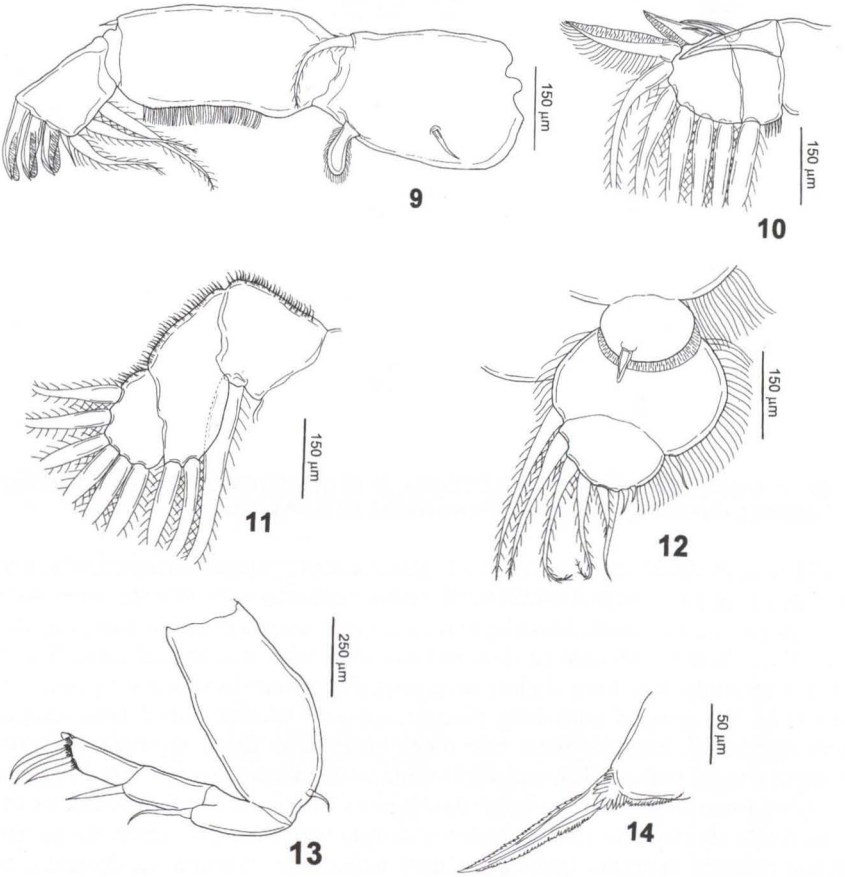
Female (Fig. 1). Cephalothorax suborbicular, lateral zones of dorsal shield not reaching posterior margin of thoracic zone. Genital complex ovoid, with rounded postero-lateral corners. Abdomen indistinctly two-segmented, subcylindrical, length approximately one-third that of genital complex. Caudal ramus (Fig. 2), subquadrangular, with four pinnate setae and two smaller naked setae, lateral pinnate seta based on jutting-out process. Dimensions (in mm), based on 21 specimens, as follows: Total length 5.57-6.76 (mean=6.36); cephalothorax length 2.49-2.92 (2.75), width 2.43-3.07 (2.80); genital complex length 2.03-2.74 (2.34), width 1.35-1.87 (1.68); abdomen length 0.75-0.93 (0.85), width 0.56-0.72 (0.64); caudal rami length 0.08-0.12 (0.09, N=8), width 0.08-0.12 (0.10, N=8); egg-sac length 5.40-8.46 (6.43) (N=8), diameter 0.37 (N=8). Antennule (Fig. 3) with basal segment relatively narrow at base, larger than distal segment. Antenna (Fig. 4) with short rounded spatulate posterior process. Postantennary process not observed. Maxillule (Fig. 5) with wide base, tapering evenly to single tip, with short process on base; adjacent papilla with three unequal diminutive setae. Maxilla (Fig. 6) brachiform



Figs 1-8. *Lepeophtheirus bagri*, female: (1) Entire, dorsal view; (2) Caudal ramus; (3) antennule; (4) antenna; (5) maxillule; (6) maxilla; (7) maxilliped; (8) sternal furca.

and two-segmented; lacertus with prominence on upper margin, unarmed; brachium slender, bearing elongated spiniform flabellum; calamus with delicate outer distal membrane, canna naked. Maxilliped (Fig. 7) with corpus broad at base, tapering distally; subchela with hooked claw and seta; shaft with seta. Sternal furca (Fig. 8) with trapezoidal box; tines slightly divergent, shorter than box, round-tipped. First leg (Fig. 9), sympod with long pinnate seta and smaller naked seta; exopod two-segmented, basal segment two times longer than distal segment, posterior margin fringed with setules, and small spine on distolateral corner; distal segment carrying three progressively shorter distal spines with outer membrane shorter and naked seta shorter than spines; posterior margin with three progressively pinnate setae; endopod elongate, spatulate, fringed with setules. Second leg exopod (Fig. 10), basal segment with strong spine on distolateral corner and one long pinnate seta on posterior margin; second segment with spine on distolateral corner, posterior

margin with small fringe of setules and one long pinnate seta; anterior margin of distalmost segment with small spine and two setae, shorter with membrane flange on medial margin, longer semipinnate seta with similar flange on lateral margin, and five long pinnate setae on posterior margin. Endopod of second leg (Fig. 11), bearing fringe of fine setules on anterior margin; proximal, second and distalmost segments with one, two, and six long pinnate setae on posterior margin, respectively. Third leg exopod (Fig. 12), proximal segment with fine membrane, exopod hook much reduced; second and distalmost segments rounded, lateral margins fringed with setules; second segment with pinnate seta; distal segment with three unequal naked setae and four pinnate setae; endopod without distinguishing characteristics. Fourth leg (Fig. 13), sympod robust with seta; exopod three-segmented, proximal and second segments each with spine on distal corner, distalmost segment with three spines of similar size; spines of second and distal segments with pectens (Fig. 14). Fifth leg consisting of papilla bearing three subequal pinnate setae.



Figs 9-14. *Lepeophtheirus bagri*, female. (9) First leg, entire; (10) second leg exopod; (11) second leg endopod; (12) third leg exopod; (13) fourth leg; (14) spine of fourth exopod, detail.

Male (Fig. 15). Cephalothorax shield similar to that of female. Genital complex suboval, shorter than cephalothorax. Abdomen one-segmented, length about, or less than, 75% that of genital complex. Dimensions (in mm), based on eight specimens, as follows: Total length 4.35-5.49 (5.16); cephalothorax length 1.88-2.76 (2.19), width 1.63-2.62 (2.03); genital complex length 1.24-1.44 (1.35), width 1.08-1.28 (1.16); abdomen length 0.75-0.92 (0.89), width 0.54-0.59 (0.56); caudal rami length 0.14-1.18 (0.16), width 0.14-0.17 (0.16). Appendages similar to those of female, with the following exceptions: Antenna (Fig. 16) with two unequal adhesion pads on second segment, larger adhesion pad on distalmost segment; conspicuous bifid claw, one spine, and on smaller, slender seta. Sternal furca (Fig. 17) with more slender box and tines than in female. Fifth leg (Fig. 18) comprising four pinnate setae on posterolateral corner of genital complex. Sixth leg (Fig. 18) represented by three pinnate setae distalmost to fifth leg.

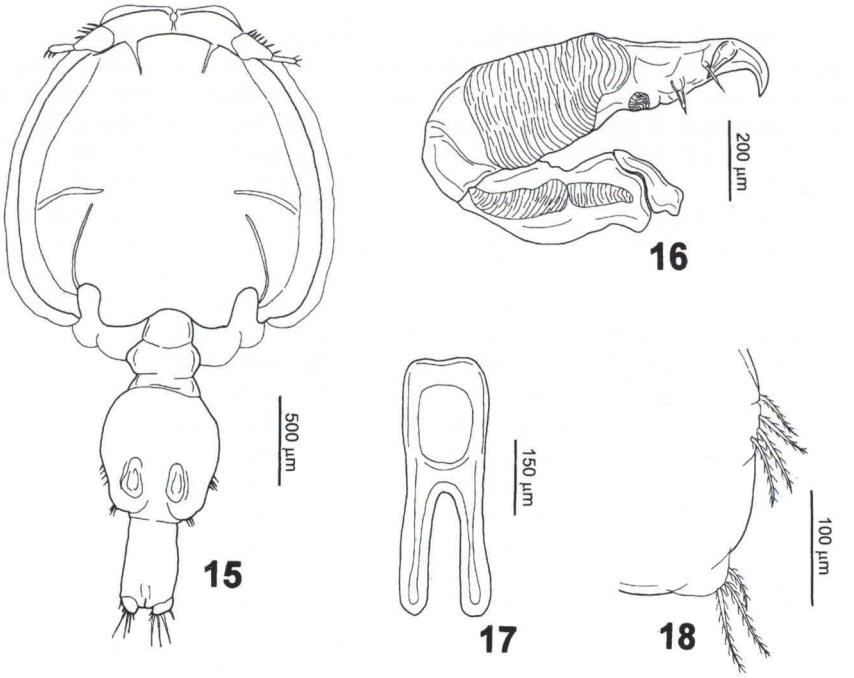
Remarks. The original description by DANA (1852) was based on female and male specimens collected from *Bagrus* sp. from Rio de Janeiro. No additional records of *L. bagri* have been made to date, but this species was listed by MARGOLIS *et al.* (1975), who mentioned that the location of the type material is unknown.

Two other species of *Lepeophtheirus* were described as parasitic on ariid fishes from the Atlantic Ocean: *Lepeophtheirus marginatus* Bere, 1936 on *Galeichthys felis* (Ariidae) from Englewood, Florida, U.S.A. and *L. christianensis* on *Galeichthys* sp. from Pass Christian, Mississippi, U.S.A. (see BERE 1936; WILSON 1944). Examination of the type material of these two species demonstrated that they are clearly conspecific with *L. bagri*, showing small differences from the Brazilian specimens: the sternal furca box is more robust and the third exopod hook is slightly smaller and more slender. In addition, the specimens of *L. marginatus* and *L. christianensis* have smaller body size than specimens of *L. bagri*. These differences are insufficient to separate these taxa; therefore, *L. marginatus* and *L. christianensis* are considered as junior synonyms of *L. bagri*.

THOMSEN (1949) established *L. platensis*, parasite of the characinid *Astyanax* sp. (probably an erroneously determined host) from the Uruguayan coastal zone, and mentioned some differences in the body dimensions and proportions from *L. christianensis*, without giving specific details. It was not possible to examine the type material of *L. platensis* (according to the Curator of the Colección del Museo de Historia Natural de Montevideo, these specimens were not deposited there), but illustrations are sufficient to determine the synonymy of *L. platensis* with *L. bagri*.

SHIINO (1965) described *L. orbicularis*, parasitic on *Galeichthys* sp. from the northern Peruvian coastal zone, in the South Pacific Ocean. Illustrations of *L. orbicularis* showed some similarity to *L. bagri* in the leg armature, but differences in the genital complex shape, sternal furcal shape, antenna and spermatophore were detected. Examination of the type material of *L. orbicularis* confirmed these observations and the validity of this species. There are also differences in spermatophore shape in the specimens of *L. orbicularis* observed. IANNACONE & LUQUE (1993) necropsied 100 specimens of *Galeichthys peruvianus* (Lütken, 1874) from the central Peruvian coastal zone, but did not find *L. orbicularis*.

Paralichthys sp. is a new host record for *L. bagri*, a species previously recorded from ariid fishes only.



Figs 15-18. *Lepeophtheirus bagri*, male. (15) Entire, dorsal view; (16) antenna; (17) sternal furca; (18) fifth and sixth legs.

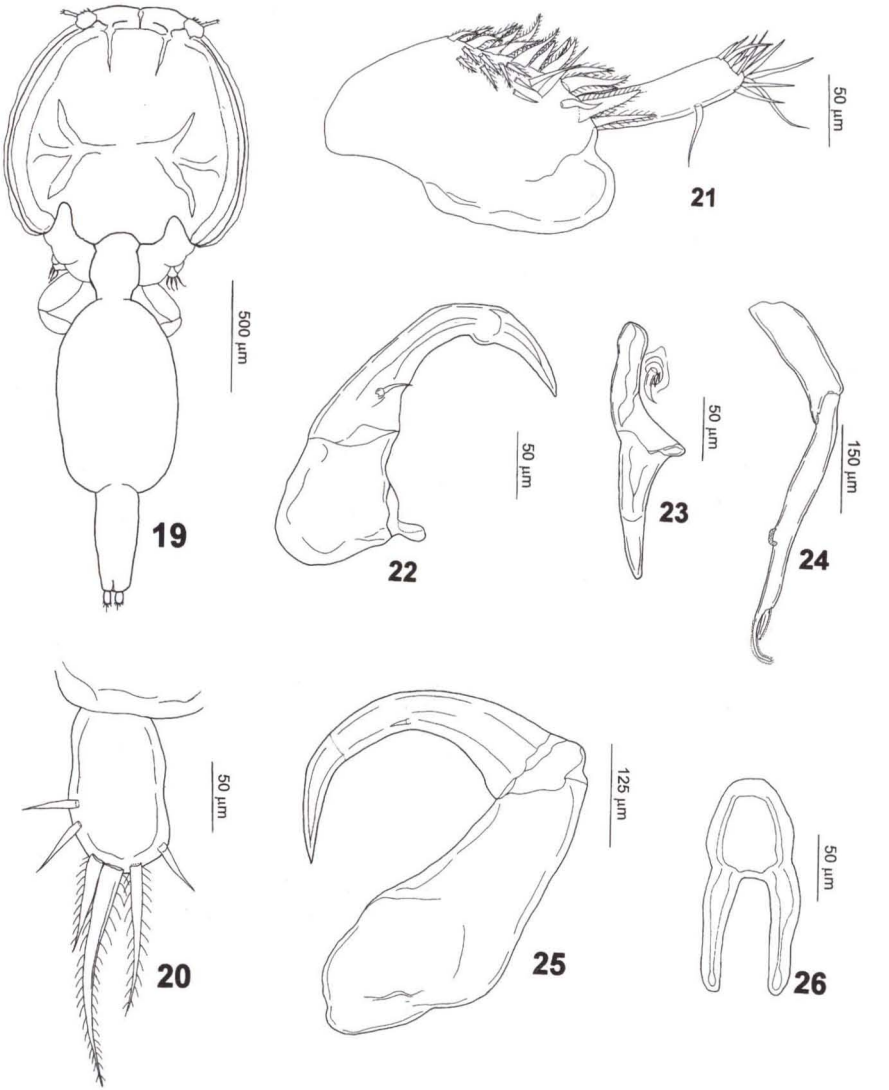
Lepeophtheirus monacanthus Heller, 1865

Figs 19-33

Lepeophtheirus unispinosus Pearse, 1952, **syn.n.**

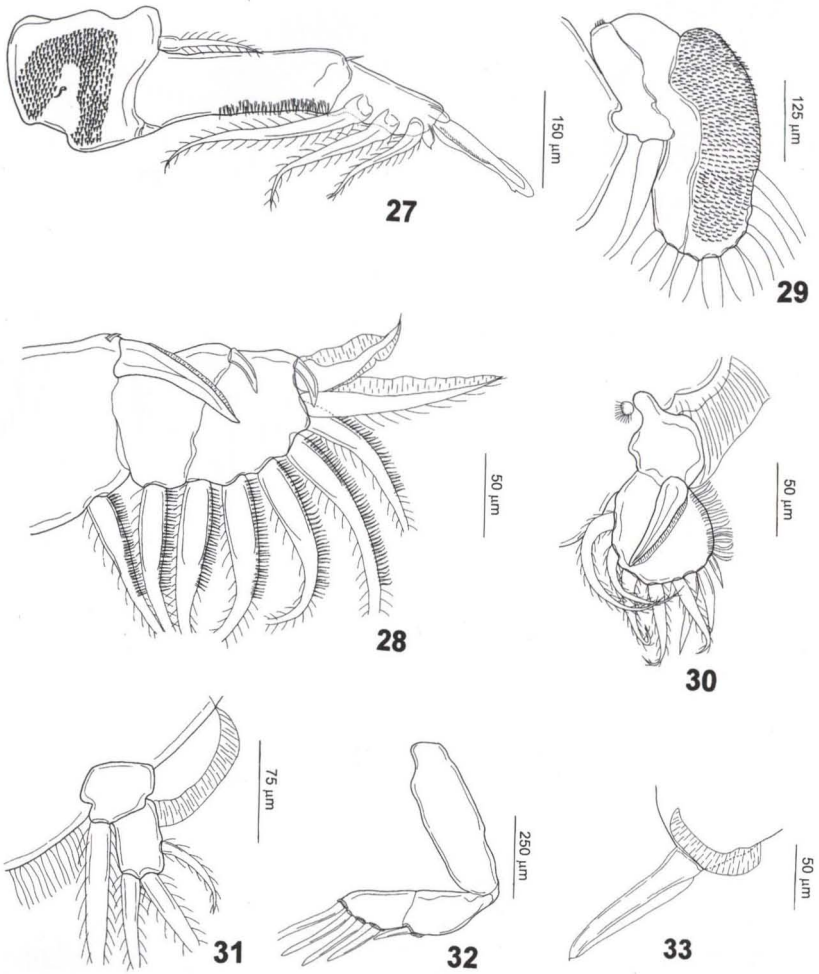
Specimens examined. Seventeen females (MNRJ No. 7274), twelve females (USNM No. 288088), and taken on 11 September 1996 on mouth and gills of *Netuma barba* (Lacépède, 1803) (Ariidae) from Cabo Frio, Rio de Janeiro, Brazil (23°S, 42°W). Also examined: *Lepeophtheirus monacanthus* Heller, 1865: two females (voucher specimens) (USNM No. 92710) taken in 1952 by A.S. Pearse on *Bagre marina* (Mitchill, 1815) from Port Aransas, Texas, U.S.A. *Lepeophtheirus unispinosus* Pearse, 1952: One female (Holotype) (USNM No. 93708) taken on 22 May 1952 by A.S. Pearse on *Galeichthys felis* from Alligator Harbor, Florida, U.S.A.

Female (Fig. 19). Cephalothorax shield suborbicular, longer than wide, posterior margin of thoracic zone protruding as far as tips of lateral zones. Genital complex oblong, longer than wide, with rounded corners. Abdomen one-segmented, subrectangular, length about, or less than 57% of lenght of genital complex. Caudal rami (Fig. 20), length approximately 10% of abdomen; with three pinnate setae and three shorter naked setae. Dimensions (in mm), based on 18 specimens, as follows: Total length 5.50-6.39 (mean=5.88); cephalothorax length 2.40-2.90 (2.66), width



Figs 19-26. *Lepeophtheirus monacanthus*, female. (19) Entire, dorsal view; (20) caudal ramus; (21) antennule; (22) antenna; (23) maxillule; (24) maxilla; (25) maxilliped; (26) sternal furca.

2.22-2.53 (2.37); genital complex length 1.55-1.97 (1.73), width 1.10-1.66 (1.27); abdomen length 0.79-1.13 (0.99), width 0.31-0.49 (0.39); caudal rami length 0.10, width 0.08. Antennule (Fig. 21), proximal segment bearing rounded swelling on its posterior margin, larger than distal segment. Antenna (Fig. 22), basal segment with small digitiform posterior process, claw with swelling at point of flexure. Postantennary process not observed. Maxillule (Fig. 23) with slender, elongate base, tapering evenly to single tip; adjacent papilla with three unequal setae. Maxilla (Fig. 24) brachiform and two-segmented; lacertus unarmed; brachium slender, bearing



Figs 27-33. *Lepeophtheirus monacanthus*, female. (27) First leg; (28) second leg exopod; (29) second leg endopod; (30) third leg exopod; (31) third leg endopod; (32) fourth leg; (33) spine of fourth exopod, detail.

membranous, reduced flabellum; calamus and canna each with delicate outer membrane. Maxilliped (Fig. 25) with corpus slightly longer than subchela, subchela with hooked claw, shaft with small seta. Sternal furca (Fig. 26) with subconical box; tines slightly convergent, longer than box, round-tipped. First leg (Fig. 27), sympod partly covered by spinules and bearing small seta and long pinnate seta on distolateral corner; exopod with proximal segment rectangular, long, with small seta on distolateral corner, and posterior margin partially covered by numerous spinules; distal segment with three pinnate setae, these setae progressively shorter distally on posterior margin; distal armature comprising long spatulate seta and two small

digitiform processes at base. Second leg exopod (Fig. 28), proximal segment with large spine, one setule, and one long pinnate seta with parts of their margins bearing shorter, coarser setules; second segment with spine and pinnate seta; and distalmost segment with one spine, seta with membranes on margins, one membranous semipinnate seta, and five pinnate setae. Second leg endopod (Fig. 29), basal segment modified, shorter than other segments, second and distalmost segment of similar size, third segment densely covered by spinules; segments with typical setation. Third leg exopod (Fig. 30), with hook reaching posterior margin of distalmost segment; distalmost segment with three unequal naked setae and five pinnate setae. Third leg endopod (Fig. 31) two-segmented, proximal segment with pinnate seta; distal segment rectangular, with three pinnate setae, one seta shorter than others. Fourth leg (Fig. 32), exopod two-segmented, proximal segment with spine, this spine shorter than spines of distal segment; distal segment with four spines, fourth spine longest; all spines with delicate membrane and pecten (Fig. 33). Fifth leg represented by diminutive seta on posterolateral corner of genital complex.

Male. Unknown.

Remarks. WILSON (1908) redescribed *L. monacanthus* from material collected from *Hexanematichthys felis* Linnaeus, 1758 and *Felichthys marinus* Mitchill, 1815 from Florida. In Wilson's description, as in the original description by HELLER (1865), the armature of the appendages, including the legs, was poorly detailed. In order to compare with the Brazilian specimens, we requested Wilson's specimens (cat. 32800 and 32804), but they are missing from the USNM Collection. However, it was possible to inspect voucher specimens collected from *Bagre marinus* from Texas, U.S.A., by A.S. Pearse. These specimens are in agreement with the information provided by WILSON (1908) and with Brazilian specimens.

PEARSE (1952) described *Lepeophtheirus unispinosus*, based on a single female parasite of *Galeichthys felis*, in Florida, U.S.A. Observation of the holotype of this species confirmed its close resemblance to the *L. monacanthus* observed in Pearse's illustrations. *Lepeophtheirus unispinosus* is therefore considered a new junior synonym of *L. monacanthus*.

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