NOAA Technical Report NMFS Circular 413

Marine Flora and Fauna of the Northeastern United States Crustacea: Branchiura

Roger F. Cressey

May 1978

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service

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Juanita M. Kreps, Secretary
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Richard A. Frank, Administrator
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FOREWORD

This issue of the "Circulars" is part of a subseries entitled "Marine Flora and Fauna of the Northeastern United States." This subseries will consist of original, illustrated, modern manuals on the identification, classification, and general biology of the estuarine and coastal marine plants and animals of the northeastern United States. Manuals will be published at irregular intervals on as many taxa of the region as there are specialists available to collaborate in their preparation.

The manuals are an outgrowth of the widely used "Keys to Marine Invertebrates of the Woods Hole Region," edited by R. I. Smith, published in 1964, and produced under the auspices of the Systematics-Ecology Program, Marine Biological Laboratory, Woods Hole, Mass. Instead of revising the "Woods Hole Keys," the staff of the Systematics-Ecology Program decided to expand the geographic coverage and bathymetric range and produce the keys in an entirely new set of expanded publications.

The "Marine Flora and Fauna of the Northeastern United States" is being prepared in collaboration with systematic specialists in the United States and abroad. Each manual will be based primarily on recent and ongoing revisionary systematic research and a fresh examination of the plants and animals. Each major taxon, treated in a separate manual, will include an introduction, illustrated glossary, uniform originally illustrated keys, annotated check list with information when available on distribution, habitat, life history, and related biology, references to the major literature of the group, and a systematic index.

These manuals are intended for use by biology students, biologists, biological oceanographers, informed laymen, and others wishing to identify coastal organisms for this region. In many instances the manuals will serve as a guide to additional information about the species or the group.

Geographic coverage of the "Marine Flora and Fauna of the Northeastern United States" is planned to include organisms from the headwaters of estuaries seaward to approximately the 200-m depth on the continental shelf from Maine to Virginia, but may vary somewhat with each major taxon and the interests of collaborators. Whenever possible representative specimens dealt with in the manuals will be deposited in the reference collections of major museums in the region.

After a sufficient number of manuals of related taxonomic groups have been published, the manuals will be revised, grouped, and issued as special volumes. These volumes will thus consist of compilations of individual manuals within phyla such as the Cnidaria, Arthropoda, and Mollusca, or of groups of phyla.

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Marine Flora and Fauna of the Northeastern United States. Crustacea: Branchiura

ROGER F. CRESSEY[1]

ABSTRACT

Eleven species of *Argulus* are known from the northeastern United States. An illustrated key and an annotated list of these species with notes on their hosts and distribution within and without the study area are included. New host records are included.

INTRODUCTION

The class Branchiura, once considered a subgroup of the class Copepoda, consists of a single order (Argulidea) and two families (Argulidae and Dipteropeltidae); the first with three genera (*Argulus, Chonopeltis,* and *Dolops*) and the latter with two (*Dipteropeltis* and *Talaus*). *Argulus* is cosmopolitan in distribution and the only genus reported from North America and Europe.

Members of the class (commonly known as "fish lice") are parasitic on freshwater and coastal marine fishes. They are characterized by the presence of compound eyes, prehensile antennae, and the second maxillae transformed into sucker disks (except *Dolops*). The feeding mechanism consists of a long preoral stylet or "string" and a posterior mouth tube (Fig. 1). The parasite repeatedly pierces the host tissue with the stylet and probably uses the mouth tube to ingest fluids oozing from the resultant wounds.

Eggs are attached to substrate objects (rocks, vegetation, etc.). Development is direct (newly hatched forms resemble the adult). Tokiota (1936) described seven larval stages and several subsequent molts for *Argulus japonicus*, and he reported that sexual maturity was achieved in about 30 days. The sexes can be distinguished in the first larval stage. Adult males are generally smaller than females and can be distinguished from them by the presence of a pair of elongate testes within the abdomen along each side of the midline and by the presence of sclerotized processes on the basal segments of thoracic legs 2, 3, and 4. Females possess a pair of rounded spermathecae in the proximal third of the abdomen; the basal portions of the legs are unmodified.

Argulids are "loosely" associated with their hosts and quickly drop off when the fish is removed from water. Consequently, fish should be examined as soon after capture as possible. The parasites are found on the body surface, in the gill chamber, and in the mouth of the host. Argulids are often collected in plankton samples as well, due to their transient attachment to their hosts. Collections should be preserved in 70% ethyl alcohol; 5% Formalin is acceptable for short-term preservation. Where Formalin is used, the material should be transferred to alcohol as soon as possible as Formalin tends to decalcify materials over a long period of time. It may be necessary to clear heavily pigmented specimens in a warm solution of 10% KOH for 15 min or more in order to study them microscopically. Small or less pigmented specimens may be cleared in lactic acid for study. To examine the respiratory area it may be necessary to dissect one side of the carapace from the rest of the body.

GLOSSARY

Carapace dorsolateral plate covering cephalothorax.

Respiratory areas two areas on each ventrolateral part of the carapace devoid of sclerotization and open to the overlaying tissues.

Scales short integumental processes with blunt or broadly rounded tips occurring singly or in groups.

Spines short integumental processes with pointed tips occurring singly or in groups.

Sucker modified second maxilla, seen ventrally, one on each side of the oral area.

Sucker rod supporting structures composed of a series of sclerotized processes radiating outwardly in the membrane fringing the outer edge of the sucker.

[1]Smithsonian Institution, U.S. National Museum of Natural History, Washington, DC 20560.

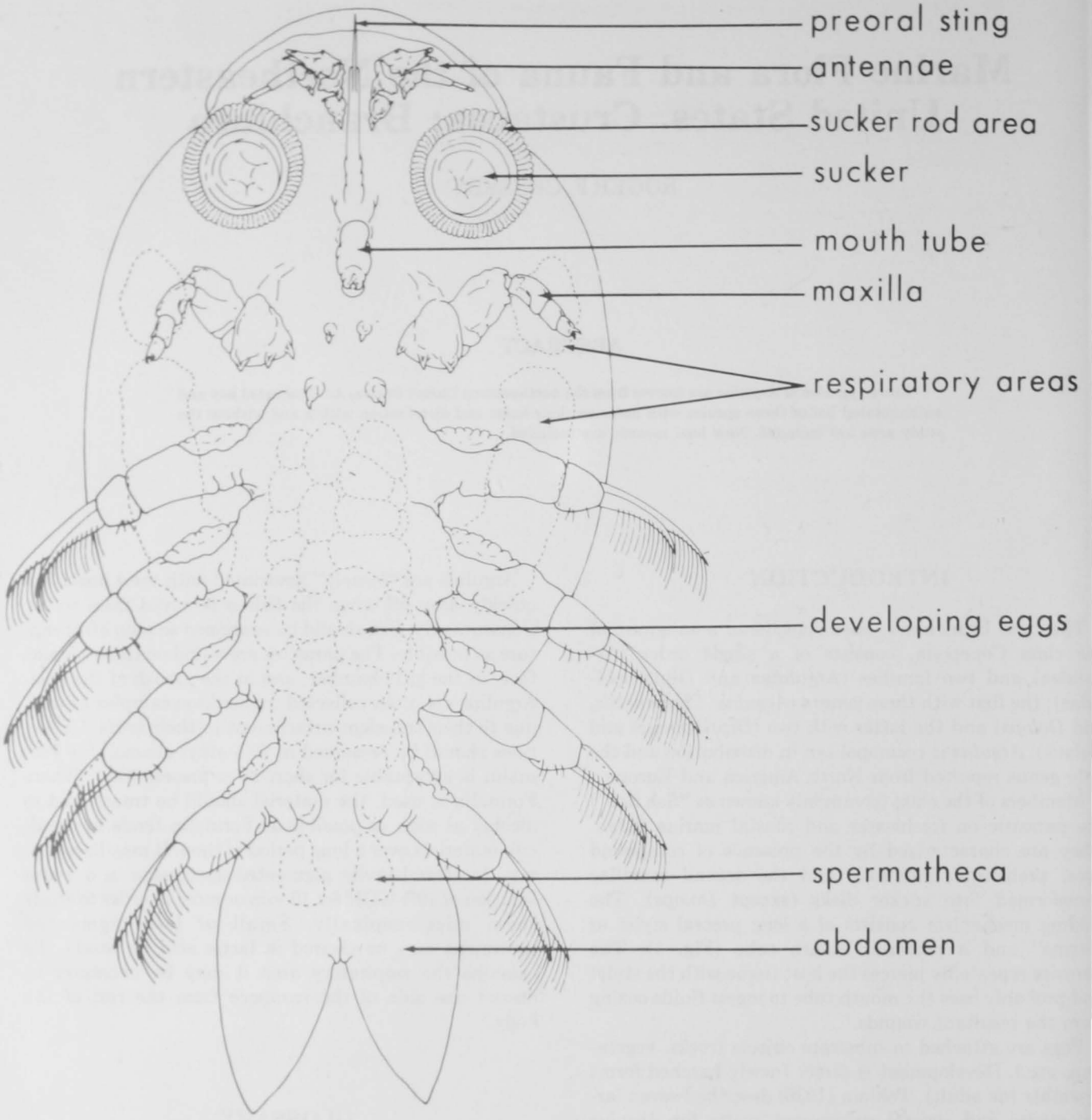


Figure 1.—Argulus alosae, female, ventral view, labeled.

1 Smaller respiratory area mostly or entirely anterior to larger (specimens "mostly anterior" have sucker rods of 5-7 elements) 2

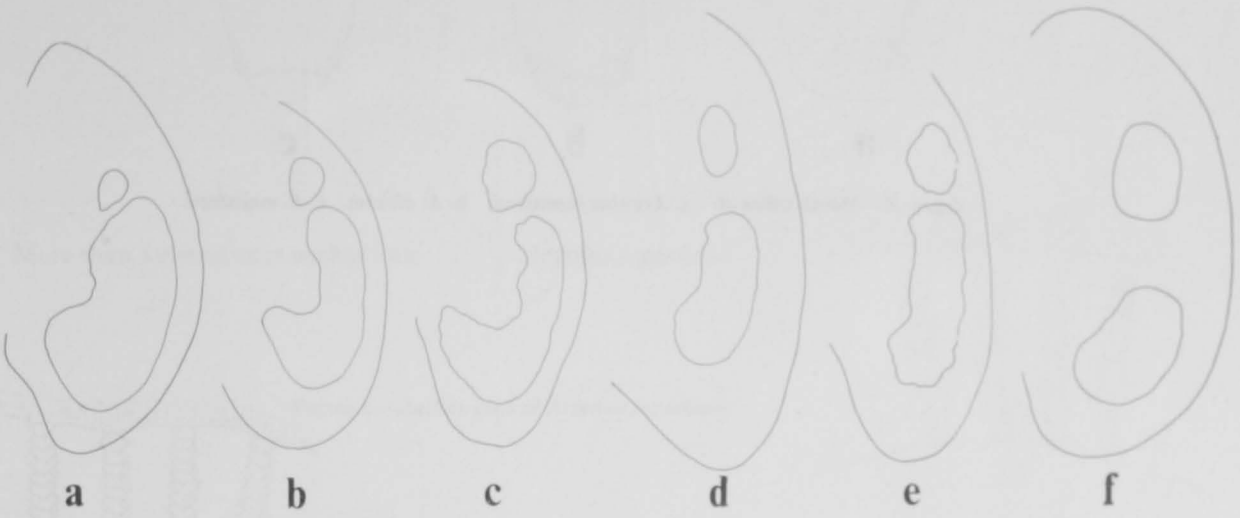


Figure 2.—Respiratory areas of: a. *Argulus japonicus*; b. *A. chesapeakensis*; c. *A. laticauda*; d. *A. megalops*; e. *A. alosae*; f. *A. funduli*.

1 Smaller respiratory area mostly or entirely lateral to larger (specimens "mostly lateral" have sucker rods of 2 elements) 7

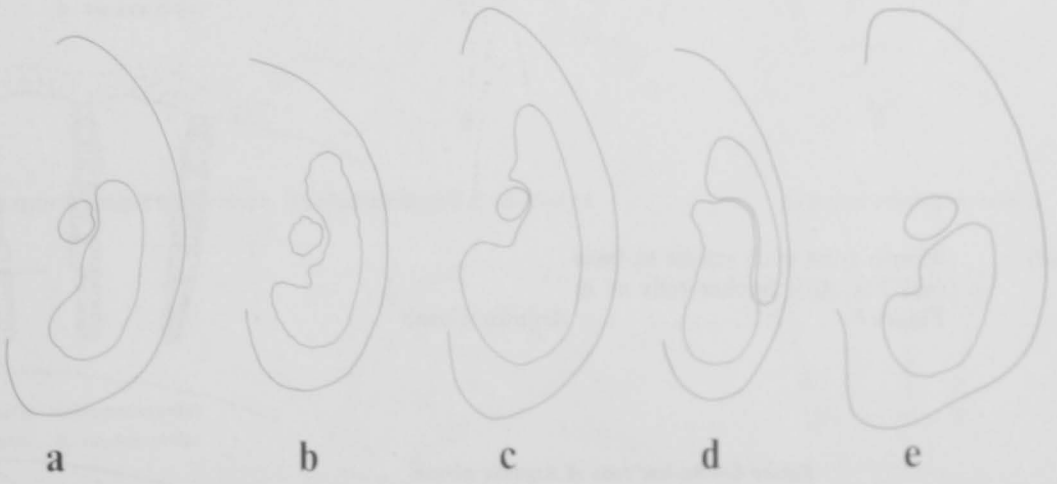


Figure 3.—Respiratory areas of: a. *Argulus versicolor*; b. *A. catastomi*; c. *A. appendiculosus*; d. *A. stizostethi*; e. *A. maculosus*.

2 (1) Mouth tube with spines or scales at base 3

2 (1) Mouth tube without spines or scales at base 5

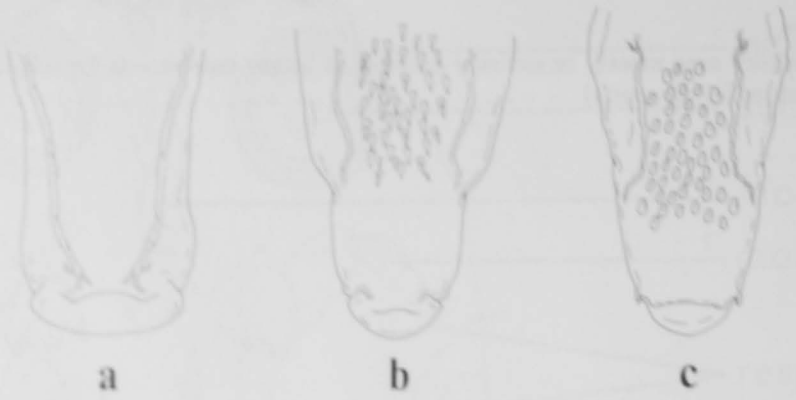


Figure 4.—Mouth tubes of: a. *Argulus japonicus*; b. *A. alosae*; c. *A. megalops*.

3 (2) More than 15 elements in sucker rods . . . . . *Argulus funduli*

Figure 5.—Sucker rods of *Argulus funduli*.

3 (2) Less than 15 elements in sucker rods 4

4 (3) Mouth tube with spines at base (see Fig. 4b). Sucker rods as in Figure 6 . . . . . *Argulus alosae*

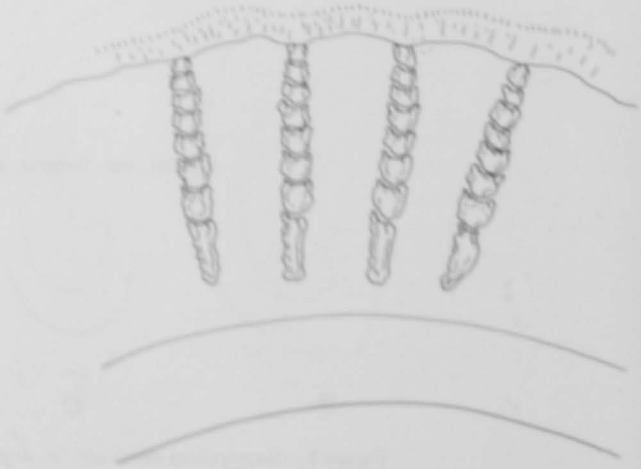
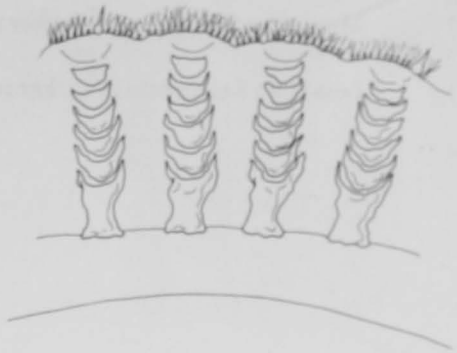


Figure 6.—Sucker rods of *Argulus alosae*.

Figure 7.—Sucker rods of *Argulus megalops*.



4 (3) Mouth tube with scales at base (see Fig. 4c). Sucker rods as Figure 7 . . . . . .*Argulus megalops*

5 (2) More than 5 elements in sucker rods . . . .*Argulus japonicus*

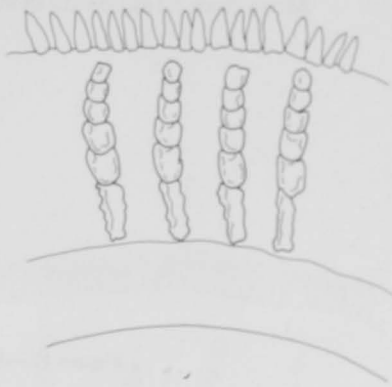


Figure 8.—Sucker rods of *Argulus japonicus*.

5 (2) Less than 6 elements in sucker rods 6

6 (5) Antennal spines nearly as wide as long. Sucker rods of 4-5 elements . . . . . .*Argulus laticauda*

Figure 9.—*Argulus laticauda*: a. antennae; b. sucker rods.

6 (5) Antennal spines much longer than wide. Sucker rods of 3-4 elements . . . . . *Argulus chesapeakensis*

Figure 10.—*Argulus chesapeakensis*: a. antennae; b. sucker rods.

2 (*1*) Mouth tube with spines or scales at base 3

2 (*1*) Mouth tube without spines or scales at base 5

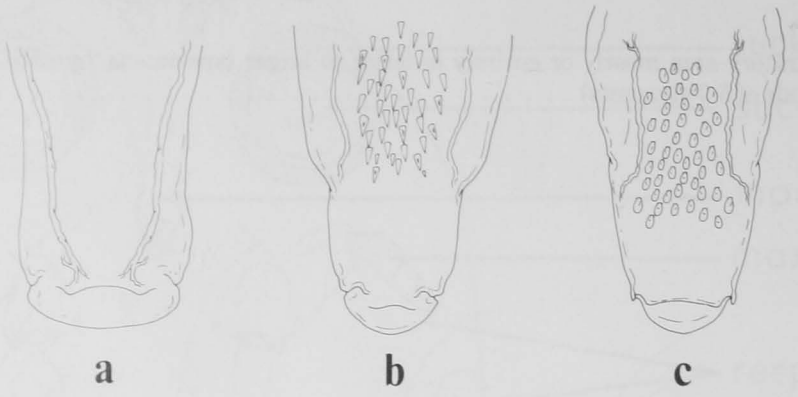


Figure 4.—Mouth tubes of: a. *Argulus japonicus*; b. *A. alosae*; c. *A. megalops*.

3 (*2*) More than 15 elements in sucker rods . . . . . *Argulus funduli*

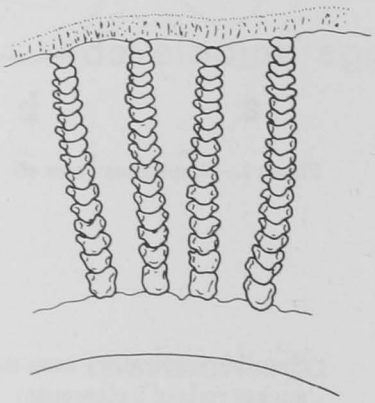


Figure 5.—Sucker rods of *Argulus funduli*.

3 (*2*) Less than 15 elements in sucker rods 4

4 (*3*) Mouth tube with spines at base (see Fig. 4b). Sucker rods as in Figure 6 . . . . . *Argulus alosae*

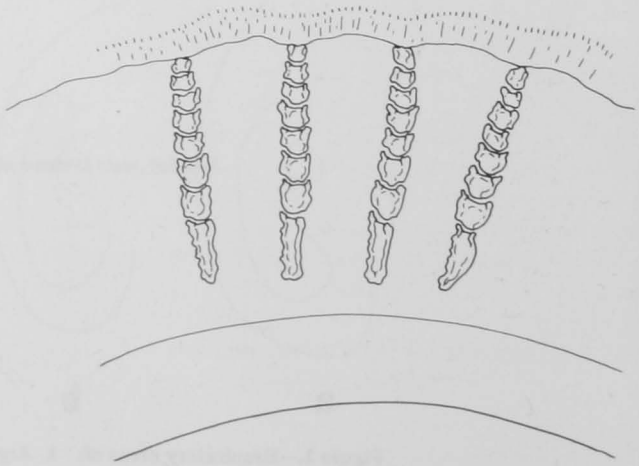
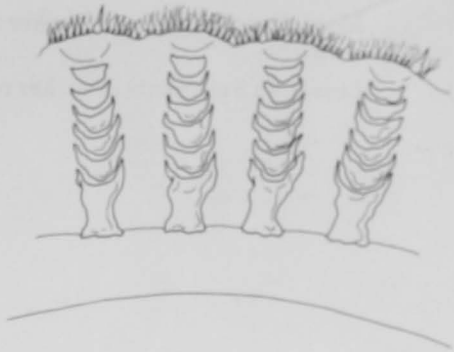


Figure 6.—Sucker rods of *Argulus alosae*.

Figure 7.—Sucker rods of *Argulus megalops*.



4 (3) Mouth tube with scales at base (see Fig. 4c). Sucker rods as Figure 7 . . . . . .*Argulus megalops*

5 (2) More than 5 elements in sucker rods . . . .*Argulus japonicus*

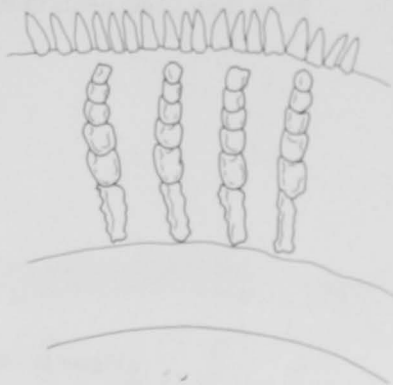


Figure 8.—Sucker rods of *Argulus japonicus*.

5 (2) Less than 6 elements in sucker rods 6

6 (5) Antennal spines nearly as wide as long. Sucker rods of 4-5 elements . . . . . .*Argulus laticauda*

Figure 9.—*Argulus laticauda*: a. antennae; b. sucker rods.

6 (5) Antennal spines much longer than wide. Sucker rods of 3-4 elements . . . . . *Argulus chesapeakensis*

Figure 10.—*Argulus chesapeakensis*: a. antennae; b. sucker rods.

7 (*1*) More than 8 elements in sucker rods 8

7 (*1*) Less than 8 elements in sucker rods 9

8 (*7*) More than 12 elements in sucker rods . . . . . *Arbulus stizostithi*

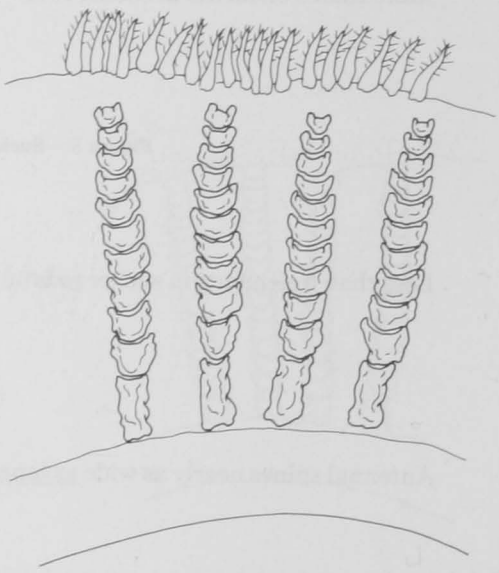


Figure 11.—Sucker rods of *Argulus stizostethi.*

8 (*7*) Less than 12 elements in sucker rods . . . . . *ARgulus catostomi*

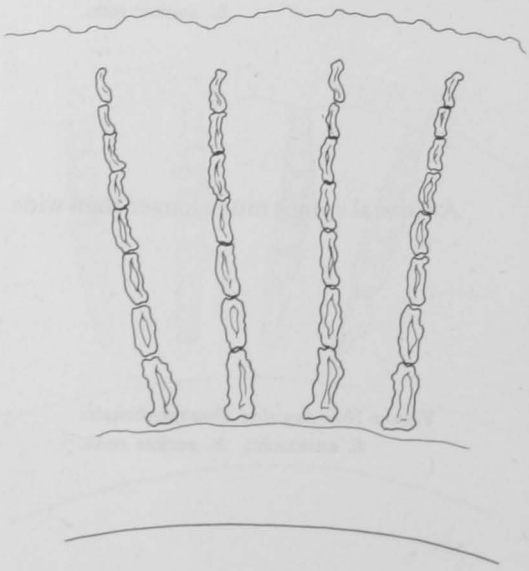


Figure 12.—Sucker rods of *Argulus catostomi.*

9 (7) More than 3 elements in sucker rods . . . . . .*Argulus versicolor*

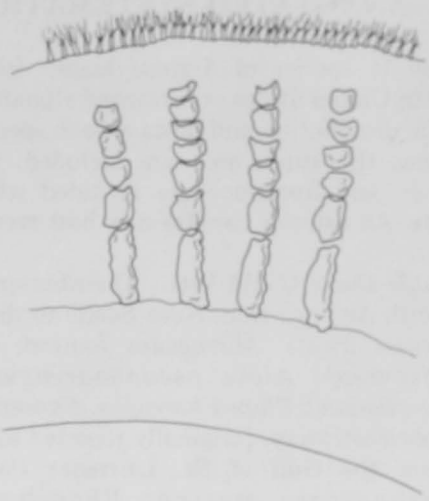


Figure 13.—Sucker rods of *Argulus versicolor*.

9 (7) Less than 3 elements in sucker rods 10

10 (9) Basal element of sucker rod longer than terminal . . . . . .*Argulus maculosus*

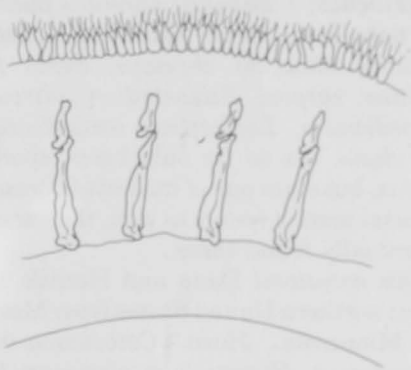


Figure 14.—Sucker rods of *Argulus maculosus*.

10 (9) Basal element of sucker rod shorter than terminal . . . . . .*Argulus appendiculosus*

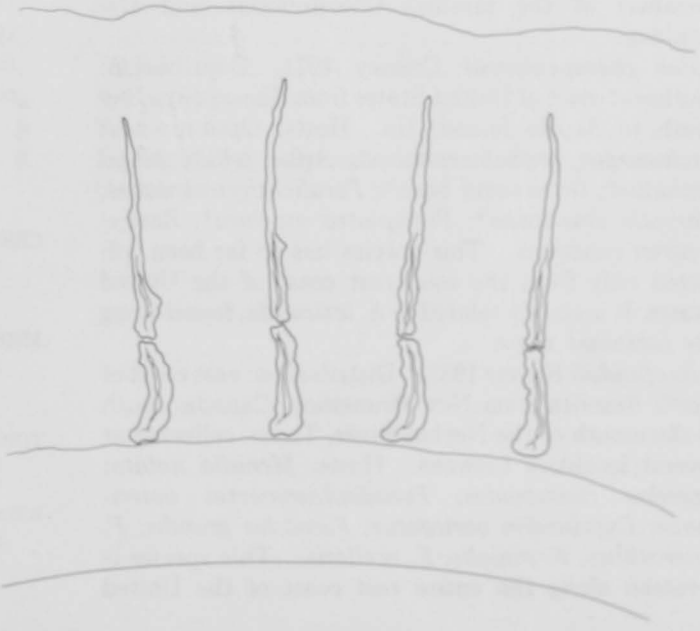


Figure 15.—Sucker rods of *Argulus appendiculosus*.

ANNOTATED SYSTEMATIC LIST

The 11 species of *Argulus* known from the northeastern United States are arranged alphabetically. Notes on the distribution and hosts of each species within and without the study area are included. Comments on ecology and frequency are included wherever appropriate. An asterisk denotes new host record.

Argulus alosae Gould 1841. Distribution: east coast of North America from Nova Scotia to the Gulf coast of Texas. Hosts: *Microgadus tomcod*; *Tautogolabrus adspersus*; *Alosa pseudoharengus*; *Dorosoma cepedianum*; *Clupea harengus*; *Cynoscion nebulosus*; *Gasterosteus* sp. [originally reported as *G. bispinosus* from the Gulf of St. Lawrence (Wilson, 1902)]; *Strongylura marina*; *Rhopilema verrilli** (medusa). This species has been reported from several species of inshore marine fish but its repeated occurrence on clupeids (*Alosa, Clupea*, and *Dorosoma*) may indicate a preference for that host family.

Argulus appendiculosus Wilson 1907. Distribution: northern half of United States from Vermont to Virginia west to Wyoming and also Texas and Louisiana. Hosts: *Catostomus catostomus*; *Ictiobus cyprinellus, I. bubalus*; *Ictalurus punctatus, I. melas, I. nebulosus*; *Amia calva*; *Micropterus salmoides*; *Morone (Roccus) chrysops*; *Perca flavescens*; *Cyprinus carpio*; *Stizostedion vitreum*; *Dorosoma cepedianum*; *Lepisosteus osseus**. *Argulus appendiculosus* has so far only been reported from freshwater, but since one of its hosts (*Dorosoma*) is found in coastal marine waters as well, the parasite may also be eventually found there.

Argulus catostomi Dana and Herrick 1837. Distribution: northern United States from Massachusetts west to Minnesota. Hosts: *Catostomus commersoni, C. catostomus*; *Hypentelium nigricans*; *Erimyzon sucetta*; *Cyprinus carpio*; *Notemigonus crysoleucas*. So far this parasite has been found only in freshwater and on members of the families Catostomidae and Cyprinidae.

Argulus chesapeakensis Cressey 1971. Distribution: southeast coast of United States from Chesapeake Bay south to Sapelo Island, Ga. Hosts: *Opsanus tau*; *Archosargus probatocephalus**; *Arius felis**; *Mugil cephalus**; *Gobiosoma bosci**; *Paralichthys dentatus*; *Dasyatis americana**; *Pteroplatea maclura**; *Rachycentron canadum*. This species has so far been collected only from the southeast coast of the United States. It is closely related to *A. laticauda*, found along the northeast coast.

Argulus funduli Kroyer 1863. Distribution: east coast of North America from New Brunswick, Canada, south to the mouth of the Neches River, Texas, collected at several localities between. Hosts: *Menidia notata*; *Lagodon rhomboides*; *Pseudopleuronectes americanus*; *Cyprinodon variegatus*; *Fundulus grandis, F. heteroclitus, F. majalis, F. ocellaris*. This species is common along the entire east coast of the United States and is most often associated with marine cyprinodontids.

Argulus japonicus Thiele 1900. Distribution: entire United States. Hosts: *Carassius auratus* (goldfish). This argulid is an introduced species brought into the United States from the Orient on aquarium fish. It is very common anywhere goldfish are found. No records from marine waters to date.

Argulus laticauda Smith 1873. Distribution: northeast coast of United States from New England south to Long Island Sound. Hosts: *Prionotus* sp.; *Anguilla rostrata*; *Pseudopleuronectes americanus*. Common on the American eel and winter flounder of the northeast coast.

Argulus maculosus Wilson 1902. Distribution: eastern half of United States and southeastern Canada as far west as Iowa and collected in northern and southernmost states. Hosts: *Ictalurus natilis, I. nebulosus*; *Amia calva*; *Ambloplites rupestris*; *Erimyzon sucetta*; *Esox* sp.; *Umbra limi*; *Lepisosteus osseus**. This common argulid has so far been collected only in freshwater.

Argulus megalops Smith 1873. Distribution: east coast of North America from New Brunswick, Canada, to Florida. Hosts: a wide variety of inshore marine fishes (recorded from 16 species) with no indications as to host preferences.

Argulus stizostethi Kellicott 1880. Distribution: northeastern quarter of the United States from Iowa and Minnesota east to New England and New Brunswick, Canada. Hosts: *Salvelinus fontinalis*; *Stizostedion vitreum, S. canadense*; *Acipenser fulvescens*; *Esox masquinongy*; *Aloso sapidissima*; *Gasterosteus* sp.; *Notropis* sp.; *Coregonus* sp.; *Dorosoma cepedianum**. This parasite seems to be restricted to those states near the Great Lakes and St. Lawrence River. All collections are from freshwater except that from *Dorosoma* from Woods Hole, Mass.

Argulus versicolor Wilson 1902. Distribution: scattered throughout the eastern half of the United States. Recorded in Massachusetts, Maryland, Indiana, Georgia, and Texas. Hosts: *Esox niger*; *Ambloplites* sp.; and "perch." So far there are no marine records for this species, but four of the recorded states are marine coastal.

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The Board, which established the format for the "Marine Flora and Fauna of the Northwestern Unites States," invites systematists to collaborate in the preparation of manuals, reviews manuscripts, and advises the Scientific Editor of the National Marine Fisheries Service.

The illustrations were done by Hillary Boyle. The manuscript was critically reviewed by Roland Wigley and Arthur Humes. The materials and records embodied in this paper are housed in the National Museum of Natural History, Washington, D.C.

COORDINATING EDITOR'S COMMENTS

Publication of the "Marine Flora and Fauna of the Northeastern United States" is most timely in view of the growing universal emphasis on environmental work and the urgent need for more precise and complete identification of coastal organisms than has been available. It is mandatory, whenever possible, that organisms be identified accurately to species. Accurate scientific names unlock the great quantities of biological information stored in libraries, obviate duplication of research already done, and often make possible prediction of attributes of organisms that have been inadequately studied.

Roger Cressey started working with parasitic copepods and branchiurans as a graduate student at Boston University in 1958. After receiving his doctoral degree in 1965, he joined the staff of the National Museum of Natural History, Smithsonian Institution. His studies on parasitic crustaceans have resulted in over 40 publications. He has conducted field work in the Indian Ocean, Madagascar, southeastern Pacific Ocean, and Gulf of Mexico off the west coast of Florida.

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