Ectoparasites of Fishes of the Antarctic Peninsular Area

Ervin Lynn Suydam

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ECTOPARASITES OF FISHES OF
THE ANTARCTIC PENINSULAR AREA

A Thesis
Presented to
The Faculty of The School of Marine Science
The College of William and Mary in Virginia

In Partial Fulfillment
Of the Requirements for the Degree of
Master of Arts

by
Ervin Lynn Suydam
1972
APPROVAL SHEET

This Thesis is submitted in partial fulfillment of the requirements of the degree of Master of Arts

[Signatures]

Approved, January 1972

[Signatures]
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respectively, and Dr. G. A. Schultz of Hampton, New Jersey, who
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ABSTRACT

Ectoparasites were studied from nine species of fishes, Chaenecophilus aequalis (Chaenichthyidae); Harpagifer bispinis (Harpagiferidae); Notothenia coriceps, N. gibberifrons, N. nudifrons, Trematomus bernacchii, T. borchgrevinki, T. hansonii (Nototheniidae) collected from the Antarctic Peninsular region.

Two species, Gyrodactylus coriceps and G. nudifrons, are described for the first time and the validities of all species of Antarctic Gyrodactylus are discussed. New hosts and localities are reported for Monogenea: Pavlovskioides antarcticus, P. trema- tomi, Pseudobenedenia nototheniae, P. shorti; Mirudinea: Platybella sp., Cryosellina sp., Tentobdella rugosa, Trulliobdella sp.; Copepoda: Claveliodes intermedius, Teramecopod sp.; Isopoda: Cymothoid sp., Gnathia antarctica. P. nototheniae is redescribed and the number and position of the posthaptoral septa are clarified. Measurements of the taxonomically important structures of Pavlovskioides antarcticus, Pseudobenedenia nototheniae and P. shorti from several different collections are compared and discussed.

Aspects of attachment, orientation and site-specificity of the latter two species and Gnathia antarctica are also examined.

Parasite-host combinations, host-specificity and parasitocoenosia are discussed.
ABSTRACT

Ectoparasites were studied from nine species of fishes, Chaenocephalus aceratus (Chaenichthyidae); Harpagifer hispinis (Harpagiferidae); Notothenia coriiceps, N. gibberifrons, N. nudifrons, Trematomus bernacchii, T. horchrevelski, T. hansonii (Nototheniidae) collected from the Antarctic Peninsular region.

Two species, Gyrodactylus coriiceps and G. nudifrons, are described for the first time and the validities of all species of Antarctic Gyrodactylus are discussed. New hosts and localities are reported for Monogenea: Pavlovskioides antarcticus, P. trematomi, Pseudobenedenia nototheniae, P. shorti; Hirudinea: Cryobdella sp., Cryobdellina sp., Pontobdella sp., Trunliobdella sp.; Copepoda: Clavelildes intermedius, Lernaeopodid sp.; Isopoda: Cymothoid sp., Gnathia antarcticus. P. nototheniae is redescribed and the number and position of the posthaptoral septa are clarified. Measurements of the taxonomically important structures of Pavlovskioides antarcticus, Pseudobenedenia nototheniae and P. shorti from several different collections are compared and discussed.

Aspects of attachment, orientation and site specificity of the latter two species and Gnathia antarcticus are also examined.

Parasite-host combinations, host-specificity and parasitocoenosis are discussed.
ECTOPARASITES OF FISHES OF
THE ANTARCTIC PENINSULAR AREA
INTRODUCTION

Little is known of the ectoparasitic fauna of the Antarctic regions. Early expeditions by English, French, German, Australian, New Zealand and Russian explorers yielded small amounts of information on parasites of mammals, birds and a few fishes, but intensive parasitological studies were neglected (Gussev, 1958). Since 1957, the International Geophysical Year (IGY), scientific activity in Antarctica has increased but studies in parasitology still lag far behind other areas of biological investigation.

In 1958 the Parasitology Section of the Virginia Institute of Marine Science (VIMS) undertook a study of host-specificity and zoogeography of monogenetic trematodes of the world. Collections of host material from Wilkes Station (1958 and 1961-1962), McMurdo Sound (1959-1960, austral summers 1964 and 1965) have provided material for several papers dealing with the endo- and ectoparasites of Antarctic fishes. These collections resulted in publications on Digenea (Byrd, 1963), Acanthocephala (Holloway, 1966; Holloway, Collins and Capraro, 1966; Holloway and Klewer, 1969), Nematoda (Holloway, 1969; Holloway, Klewer and Husain, 1967), Monogenea (Hargis and Dillon, 1968a and b; Dillon and Hargis, 1968), and Copepoda (Zwerner, 1966). Sixteen new species, three new genera and six redescriptions of Antarctic parasites appear in these papers.
These new data have increased our knowledge of the parasite fauna from this part of the world.

The Antarctic Peninsula, the northernmost portion of Antarctica, extends north of the Antarctic Circle and is in close proximity to the tip of South America. The peninsular area is ecologically referred to as the West Antarctic District by Andriashev (1965) and may represent a faunal transitional zone between South America and the continent of Antarctica. It was felt that parasite studies in this area might yield valuable information on host populations and their relationships to their parasites. During 1967 Mr. James K. Lowry and I made collections of vertebrate and invertebrate animals along the Antarctic Peninsula while based at Palmer Station. The taxonomy and certain aspects of the biology of the ectoparasites that were obtained from the fishes in this collection are discussed.
METHODS AND MATERIALS

Fish collections were made near Arthur Harbor, Deception Island, Port Lockroy, Paradise Harbor, and Adelaide Island, Antarctica. Station data are presented in Table 1. Fishes were collected using cylindrical traps, long lines and a 16-foot trawl-net. Our ability to set long lines or to drag a trawl was greatly limited by the rocky character of the bottom, surface ice conditions, and an underpowered collecting boat. Therefore, cylindrical traps were our primary collecting devices. Traps were constructed of one-fourth inch hardware cloth and were four feet long, 18 inches in diameter with six inch diameter openings in both ends.

Mr. James K. Lowry and I tentatively identified the hosts using keys of Norman (1938) and DeWitt and Tyler (1960). Dr. Hugh H. DeWitt, at the University of Maine, is currently reviewing our identifications. Type specimens of most of the species of fishes collected have been placed in the fish collections of VIMS.

Fish were placed in separate buckets, by station and by species in order to minimize spurious infection records, and returned to the laboratory. In the laboratory the integument of each fish was examined and the positions of external parasites were recorded. There were no indications that any parasite changed position on the host between collection and examination in the laboratory.
Table 1. Station data for collections of parasites and fishes.

<table>
<thead>
<tr>
<th>Collecting Areas</th>
<th>Latitude S.</th>
<th>Longitude W.</th>
<th>Depth (meters)</th>
<th>Bottom Type</th>
</tr>
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<tbody>
<tr>
<td>Arthur Harbor, Anvers Island</td>
<td>64°46'</td>
<td>64°04'</td>
<td>3-100</td>
<td>0'-20' rocky 20'-50' rocky with algae, sandy mud in pockets, channels usually gray silty sand.</td>
</tr>
<tr>
<td>N.W. Wylie Bay, Anvers Island</td>
<td>64°43'</td>
<td>64°14'</td>
<td>6-234</td>
<td>rocky with gray silty sand in pockets.</td>
</tr>
<tr>
<td>Port Lockroy, Goudier Island</td>
<td>64°49'</td>
<td>63°30'</td>
<td>100</td>
<td>unknown</td>
</tr>
<tr>
<td>Paradise Harbor, Danco Coast</td>
<td>64°54'</td>
<td>62°59'</td>
<td>0.3</td>
<td>rocky</td>
</tr>
<tr>
<td>Discovery Bay, Deception Island</td>
<td>62°59'</td>
<td>60°34'</td>
<td>2-100</td>
<td>unknown</td>
</tr>
<tr>
<td>Harbor at British base, Adelaide Island</td>
<td>67°47'</td>
<td>68°58'</td>
<td>10</td>
<td>unknown</td>
</tr>
</tbody>
</table>
Ectoparasites collected from the skin were placed in vials containing Chloroetone (Parke-Davis, hydrous chlorobutanol) a relaxant, in local sea water solution, and sporadically agitated over a 15 minute period. The Chloroetone solution was poured off and a solution of 70% ethanol with 5% glycerin was added to kill, fix and preserve the specimens. This method produced well relaxed specimens of skin inhabiting monogenetic trematodes and leeches. Branchial baskets were excised and handled according to procedures outlined by Hargis (1953). This technique results in relaxed, undistorted specimens and is therefore considered superior to the pressure-fixation method which often tends to distort size and position of organs. The mass collection technique of Hargis (1953) works best when the gill arches are separated from each other prior to immersion in the relaxant. Occasionally, because of poor field facilities, separation of arches was not possible, and unseparated arches yielded poorly relaxed specimens which often remained attached to the gills.

Following fixation gills were examined with a stereomicroscope and the parasites removed. Positions of parasites on the gills and the arches on which they occurred were recorded when possible. The animals were transferred to a solution of 70% ethanol with 5% glycerin and held for staining and/or mounting.

Monogenea and Hirudinea were prepared for taxonomic study using the techniques of Hargis and Dillon (1965). Some specimens were stained in Ehrlich's acid hematoxylin following the methods above except that destaining was carried out in 70% ethanol. Ehrlich's acid hematoxylin proved to be an excellent stain for
delineating internal structures. Counterstaining with eosin or, particularly, fast green in 95% ethanol just prior to the final dehydrazation step effectively illustrated capsalid posthaptoral septation. Several unstained Monogenea were taken directly from 70% ethanol with 5% glycerin and mounted in glycerin jelly. This technique worked well for gyrodactylids but is not recommended for other forms. A few monogenids and leeches were sectioned at 5-10 μ and routinely stained in Harris hematoxylin and eosin.

Crustaceans were prepared for study by immersing specimens in lactic acid with a few drops of picro-acid fuchsin in chloral hydrate for a variable period of time depending on the size of the organism. Then whole specimens were mounted in Hoyers or were transferred to lactic acid for dissection and subsequently mounted in Hoyers.

Monogenea selected for taxonomic study and comparisons were chosen on the basis of maturity and condition of the mounted specimen. Maturity was determined by the presence of an egg or eggs in utero or on the posthaptoral peduncle (as in Pseudobenedenia shorti) or by the size of the animal or development of gonads and reproductive structures similar to those in individuals with eggs.

Measurements were made with a filar micrometer and are presented in μ; unless otherwise noted. Measurement data are presented as follows: the number of specimens measured in parentheses, the mean, and the minimum and maximum in parentheses. Where five or more measurements were taken, the standard deviation (S), the standard error (Sx), and the interval estimate at the 95% level of confidence (t0.05Sx), follow the range. For convenience, alphabetical
symbols SE and CL are established for the formal mathematical
designations for standard error and confidence limits or interval
estimates at the 95% level (\(t_{0.05\alpha}\)), respectively. Measurements of
curved structures were made of the lines subtending the greatest
arcs described by those structures. Measurements of body length,
appendages, and most internal organs refer to the distance along
the anteroposterior axis except where otherwise noted. Width re-
fers to a measurement made at right angles to the length. The
length of cirri, sclerotized processes, genital ducts, anchors,
and hooks are along the longest axis of those structures regardless
of orientation. Measurements of soft parts are given to indicate
relative size, and are not presented for specific taxonomic deter-
mination, since they are subject to distortions of size and form.
Handling techniques often cause great variation in the size of these
structures. Hard parts are not subject to such variation and are
thought to be a much better basis for comparison.

The taxonomic schemes used for the parasites are as
follows: Monogenea-Yamaguti (1963); Hirudinea-Caballero (1960);
Copepoda-Yamaguti (1963), and Isopoda-Schultz (1969). Terminology
used for all morphological structures except that of Gyrodactylus
marginal hooks is from Hargis (1958). Terminology of Mizelle and
Kisky (1967) is used to describe the shape of the marginal hooks
of Gyrodactylus.
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designations for standard error and confidence limits or interval
estimates at the 95% level ($t_{0.05}$), respectively. Measurements of
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Krisky (1967) is used to describe the shape of the marginal hooks
of Gyrodactylus.
RESULTS AND DISCUSSION

Taxonomy

Order Monogenea Carus, 1863

Suborder Monopisthocotylea Odhner, 1912

Superfamily Gyrodactyloidea Johnston & Tiegls, 1922

Family Gyrodactylidae Cobbold, 1864

Subfamily Gyrodactylinae Monticelli, 1892

Genus Gyrodactylus Nordmann, 1832

Gyrodactylus nudifrons n. sp.

(Plate I, Figures 1 through 6)

HOST: Notothenia nudifrons Lonnberg; Nototheniidae.

HABITAT: Gills.

LOCALITY: Arthur Harbor, Anvers Island, Antarctica.

NUMBER COLLECTED: 24.

NUMBER MEASURED: 24.

HOLOTYPE: LSP-387G-1.


DESCRIPTION: Body weakly fusiform, (12) 248 (186-306), S=36.8, SE=10.6, CL=23.4 long by (11) 73 (53-109), S=19.2, SE=10.6, CL=12.9 wide. Anterior end bifid. Cuticle thin and smooth. Prohaptor consisting of anterolateral head organs connected by ducts to lateral cephalic glands which extend posteriorly to pharynx. Posthaptor armed with two anchors, dorsal bar, ventral bar with posteriorly
directed ventral shield, and 16 marginal hooks. Anchors stout, (13) 44 (43-45), S=0.7, SE=0.2, CI=0.4 long with ventro- and dorso-medial knobs on which ventral and dorsal bars articulate, respectively. Anchor tips (7) 15 (15-16), S=0.5, SE=0.2, CI=0.5 long; anchor shafts (9) 30 (29-32), S=1.1, SE=0.4, CI=0.8 long; anchor roots (7) 18 (14-20), S=1.9, SE=0.8, CI=1.6 long. Ventral bar (14) 23 (15-27), S=2.8, SE=0.7, CI=1.6 long, consisting of broad dorsal plate, round at ends and ventral plate with arched tapering projections (measurement includes longer projections) (Figure 3). Posteriorly directed ventral shield (6) 14 (10-17), S=3.1, SE=1.3, CI=3.2 long, with longitudinal striations. Dorsal bar (6) 14 (14-15), S=3.1, SE=1.3, CI=3.2 long, of even thickness with enlarged ends. Marginal hooks (11) 23 (22-24), S=0.7, SE=0.2, CI=0.5 long, each with sclerotized process approximately one-third length of handle.

Mouth opening slightly anteroventral to pharynx. Pharynx (5) 26 (24-28), S=1.4, SE=0.6, CI=1.7 long by (5) 26 (22-30), S=3.7, SE=1.7, CI=4.6 wide, with eight long pharyngeal processes extending distally from pharynx into buccal cavity. Esophagus short; gut bifurcated; crura unramified, not confluent posteriorly.

Testes posterior to ovum containing structure. Distal portion of vas deferens expanded (probably serving as seminal vesicle). Cirrus bulbous (5) 10 (8-11), S=0.9, SE=0.4, CI=1.2 in diameter, round with one long and six, occasionally five, small spines (stylets).

Ovum containing structure located at base of or immediately posteriorly to uterus. Uterus usually containing embryo (in most
specimens studied the first embryo was advanced enough to contain a second-generation embryo); no embryo found in holotype specimen (Figure 1). Vitelline bodies situated ventrally and laterally to posterior end of crura. Two glandular areas located in region of gut bifurcation, most prominent when cirrus present.

**DISCUSSION:** *Gyrodactylus nudifrons* is most similar to *G. centronoti* Hargis and Dillon, 1968, but can be distinguished by: (1) the broad dorsal and narrow ventral processes of the ventral bar; (2) the broader, more rounded marginal hook; (3) accessory sclerotized process, being one-third rather than two-thirds length of handle, and (4) host.

**Gyrodactylus coriiceps n. sp.**

(Plate I, Figures 7 through 12)

**HOST:** *Notothenia coriiceps* Richardson; Nototheniidae.

**HABITAT:** Gills.

**LOCALITY:** Arthur Harbor, Anvers Island, Antarctica.

**NUMBER COLLECTED:** 403.

**NUMBER MEASURED:** 61.

**HOLOTYPE:** LSP-385G-1.


**DESCRIPTION:** Body weakly fusiform (32) 327 (213-499), S=56.6, SE=10.0, CI=17.0 long by (24) 84 (50-132), S=20.4, SE=4.2, CI=8.6 wide; anterior end bifid. Cuticle thin and smooth. Prohaptor consisting of anterolateral head organs connected by ducts to cephalic glands extending posteriorly to level of pharynx. Posthaptor armed with two anchors, dorsal bar, ventral bar with shield
and 16 marginal hooks. Anchors stout, (28) 52 (49-55), S=1.9, SE=0.4, CI=0.8 long, with dorso-medial knob articulating with dorsal bar. Anchor tip (27) 19 (12-36), S=3.9, SE=0.8, CI=1.5 long, anchor shaft (29) 36 (34-40), S=1.6, SE=0.3, CI=0.6 long; anchor root (26) 19 (14-26), S=3.0, SE=0.6, CI=1.2 long (ends are occasionally folded). Ventral bar (24) 18 (14-26), S=2.2, SE=0.4, CI=0.9 long with striated posteriorly directed ventral shield (15) 19 (14-21), S=2.4, SE=0.6, CI=1.3 long. Dorsal bar (5) 11 (9-15), S=2.5, SE=1.1, CI=3.1 long, of even thickness with enlarged ends. Marginal hooks (4) 25 (21-28), S=1.4, SE=0.2, CI=0.4 long each with sclerotized accessory process, approximately one-fourth length of handle.

Mouth opening slightly antero-ventral to pharynx.

Pharynx (15) 35 (14-78), S=14.0, SE=3.6, CI=7.6 long by (16) 40 (15-98), S=17.8, SE=4.5, CI=9.5 wide, with eight long pharyngeal processes extending distally from pharynx into buccal cavity. Esophagus short; gut bifurcated; crura unramified, not confluent posteriorly.

Testes situated immediately posterior to ovum containing structure. Cirrus bulbous (12) 9 (6-12), S=2.0, SE=0.6, CI=1.2 in diameter; located, when present, posteriorly and usually to left of pharynx armed with one large and five, occasionally six, small spines (stylets).

Ovum containing structure situated posteriorly to end of uterus. Uterus containing embryo (in most specimens studied the first embryo was advanced enough to contain a second-generation embryo). Vitelline bodies located posterolaterally to ends of crura.
DISCUSSION: *Gyrodactylus corliceps* is most similar to *G. australis* Gussev (1967), but can be distinguished by: (1) the shorter shaft, the longer tip and the more acute bend of the marginal hook; (2) the more rounded ends of the ventral bar, and (3) host.

I hesitate to establish this *Gyrodactylus* as a new species, since few distinct differences exist. However, the classification of this group is not settled, and it is better to separate these forms even on the basis of small differences than to lump them. Further, it is felt that separation of *G. australis* from *G. corliceps*, with a detailed description of the latter, until such time as the group is better understood, will facilitate the task of future workers in defining taxa. Combination or "lumping" can always be accomplished as later evidence dictates.

**Antarctic Gyrodactylus**


Similarities in Antarctic *Gyrodactylus* indicate they are a closely related group of animals. Re-examination of the pharyngeal structures of the eight species of *Gyrodactylus* revealed that seven of the eight species have eight long pharyngeal processes, although in the original descriptions *G. centronotus* was reported to have
short processes, *G. trematomi* was reported to have eight short to medium processes and in *G. rhigophila* the pharyngeal structures were reported as indistinct. In the type material of *G. australis* no pharyngeal structures were visible.

Cirral spines are arranged so that one large spine opposes a single row of from five to eight small spines, depending on the species, in all but *G. australis* (the cirrus could not be found in this species).

Dorsal bars of all nine Antarctic *Gyrodactylus* have enlarged ends and no central depressions. The ventral bars of seven of the eight *Gyrodactylus* vary in shape but consist of a single bar with a posteriorly directed ventral shield. The newly described *G. nudifrons* is the only species which has a ventral bar consisting of dorsal and ventral plates. The similarities above suggest that all Antarctic *Gyrodactylus* have evolved from the same or similar ancestors and that *G. nudifrons*, with its dissimilar ventral bar, probably represents an early deviation from the main stream of the evolutionary line.

Gussev (personal communication) suggested that *G. centronotii* might be conspecific with *G. australis* and that *G. wilkesi* might be conspecific with *G. antarcticus*. Comparison of type material of the first two species indicates that *G. australis* differs from *G. centronotii* in the following: (1) ventral bar broader with antero-lateral ends more pointed, (2) point of marginal hook open and the heel more prominent and broader, (3) host. *G. antarcticus* differs from *G. wilkesi* in the following: (1) point of marginal hooks shorter and more open and the heel broader, (2) host. These
differences are considered by Malmberg (1970) to be diagnostic at the species level, and therefore, these four species appear to be valid. The differences between species of Antarctic Gyrodactylus are sometimes subtle as in the cases discussed above, and a thorough study of living Antarctic Gyrodactylus using the techniques of Malmberg (1970) is necessary to eliminate such ambiguities that may still exist.

Superfamily Tetraonchoidea Yamaguti, 1963

Family Tetraonchoeididae Bychowsky, 1951

Genus Pavlovskioides Bychowsky, Gussev and Nagibina, 1965

Pavlovskioides antarcticus Bychowsky, Gussev and Nagibina, 1965


HOSTS: Trematomus bernachii Boulenger, Notothenia nudifrons Lönmberg; Nototheniidae.

HABITAT: Gills.

LOCALITIES: Trematomus bernachii and Notothenia nudifrons from Arthur Harbor, Anvers Island.

PREVIOUSLY RECORDED HOSTS AND LOCALITIES: Trematomus bernachii Boulenger, T. hansonii Boulenger, T. centronotus Regan from McMurdo Sound and the Windmill Islands; T. borchgrevinki Boulenger McMurdo Sound (Dillon and Hargis, 1968). T. bernachii and T. newnesi Boulenger from the Davis Sea, Antarctica; T. borchgrevinki from near the Sabrina Coast, Antarctica (Bychowsky, Gussev and Nagibina, 1965).
NUMBER COLLECTED: 96.

NUMBER MEASURED: 17.

DISCUSSION: These specimens are conspecific with *Pavlovskioides antarcticus* as described by Bychowsky, Gussev and Nagibina (1965) and redescribed by Dillon and Hargis (1968).

A new host, *Notothenia nudifrons*, is reported. *P. antarcticus* has now been reported from six species and two genera of fishes from the family Nototheniidae. The high degree of host specificity demonstrated for some Monogenea (Hargis, 1953, 1957, and Bychowsky, 1957), suggests that the above hosts are probably closely related and/or have similar habitats. The new locality record increases the range of this monogeneid from the Davis Sea eastward to Anvers Island on the Antarctic Peninsula.

Measurement data of *P. antarcticus* presented by Bychowsky, Gussev and Nagibina (1965) and Dillon and Hargis (1968) are compared with the present sample in Table 2. Measurements of soft parts (body length and width, ovary, testes, etc.) indicate that the specimens described by Bychowsky, Gussev and Nagibina (1965) were much larger than specimens of the two other collections; but when measurements of the hard parts (anchors, transverse bars and marginal hooks) are compared, the size ranges of the three collections overlap.

Bychowsky, Gussev and Nagibina (1965) presented ranges of measurements for the transverse bars for both the adult and the young. If size of the transverse bars were the only criterion, the collections of Dillon and Hargis (1968) and the present might be
Table 2. Comparison of measurements for *Pavlovskioides antarcticus*.

<table>
<thead>
<tr>
<th></th>
<th>Bychowsky, Gussev &amp; Nagibina (1965)</th>
<th>Dillon and Hargis (1968)</th>
<th>Present Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body L</td>
<td>up to 3000</td>
<td>1670 (1500-1940)</td>
<td>1296 (718-2226)</td>
</tr>
<tr>
<td>Body W</td>
<td>600</td>
<td>470 (335-530)</td>
<td>376 (146-603)</td>
</tr>
<tr>
<td>Posthaptor W</td>
<td>100-220</td>
<td>191 (165-214)</td>
<td>147 (116-180)</td>
</tr>
<tr>
<td>Anchor L</td>
<td>78-95</td>
<td>78 (74-87)</td>
<td>78 (65-93)</td>
</tr>
<tr>
<td>Trans. bar L</td>
<td>45-51 adult</td>
<td>41 (38-46)</td>
<td>40 (31-53)</td>
</tr>
<tr>
<td></td>
<td>30-45 young</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marg. hook L</td>
<td>25-29</td>
<td>25 (21-28)</td>
<td>22 (20-26)</td>
</tr>
<tr>
<td>Pharynx L</td>
<td>300 dia.</td>
<td>183 (161-212)</td>
<td>148 (108-190)</td>
</tr>
<tr>
<td></td>
<td>W</td>
<td>186 (162-225)</td>
<td>159 (91-214)</td>
</tr>
<tr>
<td>Ovary L</td>
<td>170-220 dia.</td>
<td>139 (109-162)</td>
<td>118 (66-184)</td>
</tr>
<tr>
<td></td>
<td>W</td>
<td>167 (121-219)</td>
<td>121 (36-192)</td>
</tr>
<tr>
<td>Egg L</td>
<td>110</td>
<td>108 (90-116)</td>
<td>96 (92-112)</td>
</tr>
<tr>
<td></td>
<td>W</td>
<td>109 (101-114)</td>
<td>95 (82-102)</td>
</tr>
<tr>
<td>Acc. Piece</td>
<td>90-107</td>
<td>78 (69-90)</td>
<td>72 (52-88)</td>
</tr>
</tbody>
</table>
considered young worms. Explanations for the variations in size of the transverse bars are not apparent since individuals in the samples of Dillon and Hargis (1968) and the present group were mature, and hard parts are generally not subject to lengthening by compression during mounting. These differences may be the result of inherent variation within this species or some ecological or physiological factors of which we are not aware. Studies of the nature of parasite micro-habitats, nutrition and relationships are necessary to better understand these variations.

The above discrepancies support the suggestions of Mizelle (1944) and Ulmer (1952) that measurements of parasites should be used only to indicate relative size of the animal and its parts and not as a taxonomic tool for separating species. It is suggested that future description should include an explanation of methods used to prepare specimens for study so that measurements and morphology can be properly evaluated.

**Pavlovskiodes trematomi** Dillon and Hargis, 1968

HOST: *Trematomus hansonii* Boulenger; Nototheniidae.

HABITAT: Gills.

LOCALITY: NW Wylie Bay at Anvers Island, Antarctica.


NUMBER COLLECTED: Two

NUMBER STUDIED: Two
DISCUSSION: Identification is based on comparison with type material from collections made earlier by VIMS personnel. New locality records extend the range of this parasite to Anvers Island, Antarctica.

Superfamily Capsaloidea Price, 1936

Family Capsalidae Baird, 1853

Subfamily Trochopodinae (Price, 1936; Sproston, 1946)

Genus Pseudobenedenia Johnston, 1931

Pseudobenedenia nototheniae Johnston, 1931

(Plate II, Figures 13 through 19)

HOST: Notothenia coriiceps Richardson, N. gibberifrons Lonnberg; Nototheniidae.

HABITATS: Skin and gills.

LOCALITY: Arthur Harbor, Anvers Island, Antarctica.

PREVIOUSLY REPORTED HOSTS AND LOCALITIES: Trematomus bernacchii Boulenger from McMurdo Sound (Hargis and Dillon, 1968); Notothenia colbecki Boulenger from Antipodes Island (Johnston, 1931) and the Island of Auckland (see Dollfus and Euzet, 1964, p. 1. footnote 1); N. macrocephala (N. angustata) Gunther from Antipodes Island and Macquarie Island (Johnston, 1931); N. rossi Richardson collected in the Kerguelens (Dollfus and Euzet, 1964).

NUMBER COLLECTED: 401.

NUMBER STUDIED: 250.

NUMBER MEASURED: 42.

DESCRIPTION: Body oval (24) 4769 (2840-5961), S=945.9, SE=193.1, CI=399.5 long by (24) 2512 (1390-3284), S=519.3, SE=106.0, CI=219.3
wide. Cuticle thin, fairly smooth. Prohaptor consisting of head organs connected by ducts to cephalic glands and paired ventrolateral suckers (24) 507 (320-658), $S=107.9$, $SE=22.0$, $CL=45.6$ long by (23) 499 (315-649), $S=103.1$, $SE=21.5$, $CL=44.6$ wide. Well defined lateral notches mark posterior limits of head organs.

Posthaptor well-defined, slightly pedunculate, concavo-convex, circular disc, opening ventrally, (24) 1429 (821-1922), $S=272.9$, $SE=55.7$, $CL=115.2$ long by (24) 1441 (746-1953), $S=333.9$, $SE=68.2$, $CL=141.0$ wide; divided by six well-defined septa (two anterolateral, two posterolateral and two posterior septa) forming four depressions (not loculi) (one anterior, one central T-shaped and two posterolateral). Margin of posthaptor a strong muscular ring surrounded by thin membrane. Posthaptor armed with three pairs of anchors and 14 marginal hooks. Anteriormost anchors (24) 273 (189-350), $S=43.8$, $SE=9.0$, $CL=18.6$ long sharply pointed, slightly curved anteriorly and rounded posteriorly; middle anchors (24) 411 (300-524), $S=63.8$, $SE=13.0$, $CL=26.9$ long slender anteriorly and recurved posteriorly; posterior anchors (20) 165 (125-243), $S=31.4$, $SE=7.0$, $CL=14.7$ long with broad shaft and small recurved hook posteriorly. Fourteen marginal hooks, spaced evenly on margin of posthaptor, (24) 16 (12-18), $S=1.5$, $SE=0.3$, $CL=0.6$ long with accessory process (7) 10 (9-12), $S=1.0$, $SE=0.4$, $CL=0.9$ long.

Forwardly directed ventral mouth opening into crescentric buccal cavity into which projects a prominent glandular pharynx (24) 312 (167-418), $S=64.0$, $SE=13.1$, $CL=27.0$ long by (24) 372 (192-545), $S=83.5$, $SE=17.0$, $CL=35.3$ wide. Esophagus short; gut with anteriorly, posteriorly and laterally directed branches. Posterior
branches not confluent although often in close proximity to one
another. Large brain and two pairs of eye spots situated anteriorly
to pharynx. Two juxtaposed testes (24) 570 (356-726), S=110.3,
SE=22.5, CI=46.6 long by (24) 418 (258-583), S=86.8, SE=17.7,
CI=36.6 wide with indented margins lying posterior to ovary. Vas
deferens extending to left of ovary and vitelline reservoir, passing
anteriorly to vagina looping to right side of midline and back
again continuing with many convolutions anteriorly on left of
ootype, crossing to right penetrating cirrus and joining with
prostatic duct forming ejaculatory duct. Muscular, non-cuticularized
retractable cirrus lying in cirrus pouch. Cirrus pouch (22) 488
(313-616), S=75.7, SE=16.1, CI=33.6 long; extending anterolaterally
to genital atrium just posterior to left prohaptoral sucker.

Median ovary (24) 320 (177-435), S=69.7, SE=14.2, CI=29.4
long by (24) 398 (222-533), S=82.4, SE=16.8, CI=34.8 wide located
between testes and vitelline reservoir. Oviduct arising dorsally
from ovary extending anterolaterally and dorsally to right side of
vitelline reservoir; joined here by common yolk duct from vitelline
reservoir, and extending anteriorly to ootype. Ootype enlarged,
surrounded by Mehlis' glands which empty into ootype ventrally via
many small ducts. Genital atrium lying anterolaterally to ootype
posterior to left prohaptoral sucker. Egg in utero tetrahedral,
(19) 225 (196-246), S=16.4, SE=3.8, CI=9.7 long, with one basal
filament approximately 210 long. Short muscular vagina lying left
of midline just anteriorly to vitelline reservoir, vaginal duct
expanding dorsally forming seminal receptacle apparently entering
vitelline reservoir; opening not located. Vitelline reservoir,
an obvious structure receiving many vitelloducts, lying anterior to ovary.

DISCUSSION: Identification of these specimens is based on descriptions of *Pseudobenedenia nototheniae* by Johnston (1931, 1937).

**Posthaptor Septation**

Johnston (1931 and 1937) described the posthaptor of *P. nototheniae* as having six septa dividing the haptor into depressions. Dollfus and Euzet (1964) in their redescription of *P. nototheniae* reported that the posthaptor was divided by seven septa into one central and seven marginal loculi. They described a seventh anteriormost septum which extended anteriorly from the junction of the two anterolateral septa. Hargis and Dillon (1968), working with only a few specimens, did not find the anteriormost septum and suggested that the haptoral septation was as Johnston had described. Examinations of living and preserved specimens in the present study also did not reveal the presence of the anteriormost septa reported by Dollfus and Euzet (1964). The two anterolateral septa extend across the haptor just anterior to the peduncle and their junction is not intercepted by an anterior septa. In some cases the proximal ends of the posterolateral septa extend further toward the haptoral peduncle than in others. This is apparently the state of contraction of the posthaptoral muscles. These muscles were described by Johnston (1937) and are illustrated from the present sample in Figure 17. There is no indication that these septa enclose a central loculus nor do any of the six septa extend completely to the margin of the posthaptor (Figure 15).
Therefore, the areas divided by the septa must be considered depressions and not loculi.

It is possible that Dollfus and Euzet (1964) mistakenly described the proximal extensions of the posthaptoral muscles as the seventh anteriormost septa and misinterpreted these contracted haptoral muscles as septa isolating a central loculus. The information presented here indicates that the posthaptoral septation is as described by Johnston (1931, 1937), and that the posthaptor is divided by this septation into four depressions (not loculi) as described above.

Comparison of Measurements

Measurements presented by Johnston (1931, 1937), Dollfus and Euzet (1964) and this study are compared in Table 3. Comparison of soft part measurements indicate that specimens in the present sample are smaller than those previously described. However, the size ranges of hard parts for all collections correspond very closely. The upper limit indicated by Johnston (1931) for the anterior anchor is apparently a lapsus on his part. Measurements in the present study indicate that even his largest specimen could not possibly have an anterior anchor larger than the middle anchor.

It is possible that the variation in soft parts measurements in the four collections result from differences in mounting techniques. Ulmer (1952) working with the digenetic trematode Postharmostomum heticus found that flattening of these worms caused nearly a 100% increase in size of the specimen and distortion in the testes and intestines. Although slight distortion resulted from preservation and mounting, my specimens were
Table 3. Comparison of measurements for *Pseudobenedenia nototheniae*.

<table>
<thead>
<tr>
<th>Measurements</th>
<th>Johnston (1931)</th>
<th>Johnston (1937)</th>
<th>Dollfus and Euzet (1964)</th>
<th>Present Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body L</td>
<td>6500-7000</td>
<td>4700-7000</td>
<td>4800-6800</td>
<td>2840-5961</td>
</tr>
<tr>
<td>Body W</td>
<td>4000-4700</td>
<td>2300-4000</td>
<td>3000-4500</td>
<td>1390-3284</td>
</tr>
<tr>
<td>Posthaptor L</td>
<td>2000-2400 (dia.)</td>
<td>1300-2500 (dia.)</td>
<td>2240 (dia.)</td>
<td>821-1222</td>
</tr>
<tr>
<td>Posthaptor W</td>
<td></td>
<td></td>
<td></td>
<td>746-1953</td>
</tr>
<tr>
<td>Ant. Anch. W</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mid. Anch. L</td>
<td>380-530</td>
<td>380-530</td>
<td>500</td>
<td>300-524</td>
</tr>
<tr>
<td>Mid. Anch. W</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post. Anch. L</td>
<td>130-170</td>
<td>130-170</td>
<td>250</td>
<td>135-243</td>
</tr>
<tr>
<td>Post. Anch. W</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pharynx L</td>
<td></td>
<td></td>
<td></td>
<td>167-418</td>
</tr>
<tr>
<td>Pharynx W</td>
<td></td>
<td></td>
<td></td>
<td>192-545</td>
</tr>
<tr>
<td>Testis L</td>
<td>1200-1600</td>
<td>900-1200</td>
<td>1000</td>
<td>409-726</td>
</tr>
<tr>
<td>Testis W</td>
<td>800-1000</td>
<td>600-800</td>
<td>750</td>
<td>260-583</td>
</tr>
<tr>
<td>Cirrus pouch L</td>
<td></td>
<td></td>
<td></td>
<td>313-581</td>
</tr>
<tr>
<td>Ovary L</td>
<td>350</td>
<td>350</td>
<td>600</td>
<td>177-435</td>
</tr>
<tr>
<td>Ovary W</td>
<td>500-550</td>
<td>650</td>
<td>900</td>
<td>222-533</td>
</tr>
<tr>
<td>Ant. sucker L</td>
<td>800 (dia.)</td>
<td>800 (dia.)</td>
<td>700-800 (dia.)</td>
<td>320-658</td>
</tr>
<tr>
<td>Ant. sucker W</td>
<td></td>
<td></td>
<td></td>
<td>315-649</td>
</tr>
<tr>
<td>Egg L</td>
<td>200</td>
<td></td>
<td></td>
<td>196-246</td>
</tr>
<tr>
<td>Egg W</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glands of Goto L</td>
<td></td>
<td></td>
<td></td>
<td>61-111</td>
</tr>
<tr>
<td>Glands of Goto W</td>
<td>30</td>
<td></td>
<td></td>
<td>68-123</td>
</tr>
</tbody>
</table>

*Probably a misprint.*
approximately the same size as living P. nototheniae observed in the field.

Attachment and Adhesive Attitudes

The adhesive attitudes of gill and skin forms of P. nototheniae are similar to Diclidophora Llewellyn (1956) and Llewellyn and Tully (1969) and Entobdella Kearn (1964), respectively. P. nototheniae generally occur between the hemibranchs of a given holobranch with the body lying parallel to the filament and the posthaptor upstream to the gill ventilating current. The posthaptors are turned 90° to the anterioposterior axis when attached to the gills. The disc is folded over the inner margin of a single gill filament with the middle and posterior anchors penetrating the region of the lamellae and the anterior anchors bearing against the inner margin of the filament. When P. nototheniae occurred on the skin the posthaptoral anchors lay in a line parallel with the length of the body and the posthaptor was always toward the anterior end of the fish. This orientation is similar to that described by Kearn (1964) for Entobdella solea.

P. nototheniae, of Notothenia coriiceps, was not found to be evenly distributed on the skin (Figure 20), and an obvious site-specificity was exhibited for the area behind the operculum between the pelvic and pectoral fins. Possible explanations for their site-specificity are: (1) P. nototheniae might exhibit positive rheotaxis, (2) they are in the process of migrating either to or from the gills or (3) feeding is made easier because scales in this area are smaller and more delicate, allowing easier access to the dermis. Further study of parasite physiology and
behavior will enable us to better understand the reasons for their site-specificity.

*Pseudobenedenia shorti* Hargis and Dillon, 1968

**HOSTS:** *Notothenia nudifrons* Lonnberg, *Trematomus bernacchii* Boulenger, *T. hansoni* Boulenger; Nototheniidae

**HABITAT:** Gills.

**LOCALITY:** *Notothenia nudifrons* and *Trematomus bernacchii*, Arthur Harbor, Antarctica; *T. hansoni*, Discovery Bay, Deception Island, Antarctica.

**PREVIOUSLY RECORDED HOSTS AND LOCALITIES:** *Trematomus bernacchii* Boulenger, *T. hansoni* Boulenger, *T. centronotus* Regan, McMurdo Sound and Windmill Islands; *Trematomus* sp., Windmill Islands; *Rhigophila dearborni* DeWitt, McMurdo Sound (Hargis and Dillon, 1966).

**NUMBER COLLECTED:** 468.

**NUMBER STUDIED:** 50.

**NUMBER MEASURED:** Five.

**DISCUSSION:** Identification is based on comparison with type material and description of Hargis and Dillon (1968). New locality records for this parasite extend its range to Arthur Harbor, Anvers Island, and Discovery Bay, Deception Island, and the report of *P. shorti* on *N. nudifrons* constitutes a new host record.

*P. shorti* apparently has a low degree of host specificity. Hargis and Dillon (1968) indicated that their report of *P. shorti* from *Rhigophila dearborni* might be erroneous, and that future studies might indicate that this species occurred only on members of the genus *Trematomus*. However, in the present study 324 specimens
of *P. shorti* were collected from 16 specimens of *Notothenia nudifrons*. The original speculation of Hargis and Dillon (1968) is not supported. *P. shorti* has been reported on six species in three genera in two families of Antarctic fishes, indicating a low degree of host-specificity. This limited specificity seems characteristic of several Antarctic Monogenea and will be discussed in greater detail below.

**Comparison of Measurements**

Measurements of *P. shorti* from my sample are compared to those reported by Hargis and Dillon (1968) in Table 4.

Size variations exist between these two collections, but except for the posthaptor and ovaries the specimens of Hargis and Dillon (1968) are larger than the specimens in my sample. The larger posthaptor and ovaries of the members of the present sample may be the result of individual variances in branchial filament size and alternation of sexual phases of the parasites, respectively. Mizelle (1940, 1944), working with Ancyrocephalinae, *Urocleidus* and *Actinocleidus*, found that the size of soft parts varied inversely with the distance of the region of collection from the geographic poles. Hard parts, on the other hand, were found to be generally similar in size or larger in the less polar forms. The phenomenon described by Mizelle might also be applicable to *P. shorti* because the specimens of Hargis and Dillon (1968) were collected from regions closer to the pole than those of the present sample.

Size variations also may be attributed to differences in growth rates of the parasites, intensity of the infestation, food availability for the host or parasite or both, and genetic differences
Table 4. Comparison of measurements for *Pseudobenedenia shorti*.

<table>
<thead>
<tr>
<th>Measurements Taken</th>
<th>Hargis and Dillon (1968)</th>
<th>Present Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body</td>
<td>L 2150 (1550-2520)</td>
<td>1869 (1651-2113)</td>
</tr>
<tr>
<td></td>
<td>W 590 (450-710)</td>
<td>560 (492-643)</td>
</tr>
<tr>
<td>Posthaptor</td>
<td>L 620 (400-710)</td>
<td>716 (639-874)</td>
</tr>
<tr>
<td></td>
<td>W 700 (490-920)</td>
<td>756 (646-925)</td>
</tr>
<tr>
<td>Anterior Anchor</td>
<td>L 127 (90-181)</td>
<td>112 (107-117)</td>
</tr>
<tr>
<td>Middle Anchor</td>
<td>L 260 (199-308)</td>
<td>262 (221-309)</td>
</tr>
<tr>
<td>Posterior Anchor</td>
<td>L 203 (148-247)</td>
<td>192 (165-233)</td>
</tr>
<tr>
<td>Marginal Hook</td>
<td>L 14 (12-15)</td>
<td>10 (9-12)</td>
</tr>
<tr>
<td>Prohap. Sucker</td>
<td>L 253 (148-347)</td>
<td>199 (58-264)</td>
</tr>
<tr>
<td></td>
<td>W 246 (159-322)</td>
<td>197 (56-264)</td>
</tr>
<tr>
<td>Pharynx</td>
<td>L 159 (129-198)</td>
<td>157 (134-189)</td>
</tr>
<tr>
<td></td>
<td>W 185 (156-216)</td>
<td>182 (158-218)</td>
</tr>
<tr>
<td>Testes</td>
<td>L 103 (87-122)</td>
<td>67</td>
</tr>
<tr>
<td></td>
<td>W 92 (83-118)</td>
<td>60</td>
</tr>
<tr>
<td>Ovary</td>
<td>L 139 (92-231)</td>
<td>148 (125-170)</td>
</tr>
<tr>
<td></td>
<td>W 119 (76-185)</td>
<td>152 (132-173)</td>
</tr>
<tr>
<td>Egg</td>
<td>L 303 (277-310)</td>
<td>204 (184-223)</td>
</tr>
<tr>
<td>Cirrus Pouch</td>
<td>L 272 (216-315)</td>
<td></td>
</tr>
</tbody>
</table>
in these two collections. These factors may operate singly or in consort to cause variations. More study is needed if we are to understand the complexities of the interactions. Such morphological differences illustrate the necessity of relegating size to a less important role in establishing new species.

Site-Specificity, Adhesive Attitudes and Attachment

The spatial locations of these parasites on the gills were recorded on two specimens of *Notothenia nudifrons* (Table 5). It would appear from this small sample that *P. shorti* shows some site specificity for the first two gill arches. In all cases, when parasites were found attached to the gill arches, they were oriented so that their posthaptors were upstream to the gill ventilating current and their bodies were lying parallel to the gill filament. This form of orientation is similar to that of gill inhabiting *P. nototheniae* and that of certain diclidophorids as reported by Llewellyn (1956).

*P. shorti* apparently changes positions on the gill filament as it matures. Immature individuals were found attached to the under surfaces of the gill lamellae with their posthaptors oriented so that the posthaptoral anchors are parallel to the anteroposterior axis of the body. The larger mature individuals were found attached to the inner margins of the gill filaments with their posthaptors rotated 90°. This is similar to the method of attachment of gill inhabiting *P. nototheniae*. *P. shorti* apparently move from the under surfaces of the gill lamellae to the inner margins of the gill filaments as they mature.
Table 5. Sites of branchial attachment of *Pseudobenedenbia shorti* as found on two specimens of *Notothenia nudifrons*. The number and per cent of parasites occurring on each arch are listed.

<table>
<thead>
<tr>
<th>Specimen Number</th>
<th>Gill Arches</th>
<th>Position Unknown</th>
<th>Total number of parasites per host</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I</td>
<td>II</td>
<td>III</td>
</tr>
<tr>
<td>I No. on arch</td>
<td>5</td>
<td>9</td>
<td>-</td>
</tr>
<tr>
<td>% on arch</td>
<td>26</td>
<td>47</td>
<td>-</td>
</tr>
<tr>
<td>II No. on arch</td>
<td>2</td>
<td>6</td>
<td>-</td>
</tr>
<tr>
<td>% on arch</td>
<td>17</td>
<td>50</td>
<td>-</td>
</tr>
</tbody>
</table>
P. shorti individuals may move about on the gill filaments as they grow because the posthaptors of the larger parasites become too large to attach to the small surfaces of the lamellae, or the delicate tissues of the lamellae may not be strong enough to enable the larger P. shorti to maintain their sites of attachment. The more substantial tissue of the inner margins of the gill filaments may provide larger P. shorti with a firm attachment site. The filaments at this site may also provide some protection from the constant flow of the gill ventilating current as suggested by Suydam (1971) for Diulidophora maccallumi.

It is interesting that the adults of both P. shorti and P. nototheniæ attach to the gills in a similar fashion. The 90° turning of the posthaptor and its folding over the inner margin of the gill filaments may be characteristic for all capsalids which occur on the gills. Evidence presented by Kearns (1964) on the attachment of Entobdella soleæ seems to indicate that the musculature of the capsalid posthaptor may be such that it produces the greatest clasping action along a line parallel to the haptoral anchors. This may explain the position of the posthaptors of P. nototheniæ and P. shorti during attachment. Studies of site-specificity and attachment mechanisms are interesting subjects for future research.

Class Hirudinea Lamarck, 1818
Order Rhynchobdelliformes Caballero, 1952
Superfamily Glossiphoniioidea Caballero, 1956
Family Piscicolidae Johnston, 1865
Subfamily Piscicolinae Caballero, 1956
Cryobdellina sp.

HOST:  *Notothenia coriiceps* Richardson; Nototheniidae.

HABITATS:  Skin, gills and oral cavity.

LOCATION:  Arthur Harbor, Anvers Island and Discovery Bay, Deception Island, Antarctica.

PREVIOUSLY RECORDED HOSTS AND LOCALITIES:  *Parachaeocithys georgianus* (Fischer) South Georgia.

NUMBER OF SPECIMENS COLLECTED AND EXAMINED:  nine.

DISCUSSION:  The identification of these specimens is based on internal and external characters of this genus as described by Brinkmann (1946).

Platybdella sp.

HOSTS:  *Notothenia coriiceps* Richardson, *N. nudifrons* Lönnberg; Nototheniidae.

HABITATS:  Skin, gills and inside operculum.

LOCALITY:  Arthur Harbor, Anvers Island, Antarctica.

PREVIOUSLY RECORDED HOSTS AND LOCALITIES:  *Trematomus* sp. (probably *T. bernacchii* or *T. hansonii*) from McMurdo Sound, Antarctica (Harding, 1922).

NUMBER OF SPECIMENS COLLECTED AND EXAMINED:  17.

DISCUSSION:  The identification of these specimens is based on external characters of this genus described by Harding (1922) as *Cryobdella*.

Pontobdella rugosa Moore, 1938

HOST:  *Notothenia coriiceps* Richardson; Nototheniidae

HABITAT:  Skin.
LOCALITY: Arthur Harbor, Anvers Island, Antarctica.

PREVIOUSLY RECORDED LOCALITIES: Commonwealth Bay, King George V Land, 50 meters, from fish, two specimens; 66°32'S 141°39'E, 314 meters, one specimen; 65°42'S 92°10'E, 120 meters, 16 specimens (hosts not indicated) (Moore, 1938). 66°12'S 49°37'E, 300 meters, seven specimens. 65°50'S 54°23'E, 220 meters, three specimens; 66°45'S 62°03'E, 219 meters, one specimen. Hobart, Tasmania one specimen from body of "a fiddler" (Trigonorhina fasciata) (Moore, 1957).

NUMBER OF SPECIMENS COLLECTED AND EXAMINED: one.

DISCUSSION: Identifications are based on descriptions of Pontobdella rugosa by Moore (1938).

Trullicobdella sp.

HOSTS: Notothenia coriiceps Richardson, N. nudifrons Lönнberg, Trematomus bernacchii Boulenger; Nototheniidae.

HABITATS: Skin, inside operculum and oral cavity.

LOCALITIES: Notothenia coriiceps, N. nudifrons and Trematomus bernacchii from Arthur Harbor, Anvers Island, Antarctica; N. coriiceps and T. bernacchii from Discovery Bay, Deception Island, Antarctica.

PREVIOUSLY RECORDED HOSTS AND LOCALITIES: Parechaenictyshs georgianus (Fischer) and Chaenocephalus bouvetensis Nybelin from South Georgia and Bouvet Island (Brinkmann, 1948).

NUMBER OF SPECIMENS EXAMINED AND STUDIED: 17.
DISCUSSION: The identification of these specimens is based on internal and external characters of this genus as described by Brinkmann (1948).

REMARKS: The Hirudinea in this study have been only tentatively identified, and the specimens have been sent to M. G. Meyer (University of Maine) for review.

Order Lernaeopodidea Yamaguti, 1963

Family Lernaeopodidae Olsson, 1869

Subfamily Clavellinae Dana, 1853

Genus Clavellodes Wilson, 1915

Clavellodes intermedius (Quidor, 1906) Wilson, 1915

Synonym: Anchorella intermedia Quidor, 1906

HOSTS: Notothenia gibberifrons Lønberg, N. coriiceps Richardson, Trematomus hansoni Boulenger; Nototheniidae.

HABITATS: Skin, gills and inner surface of operculum.

LOCALITIES: Notothenia coriiceps and N. gibberifrons from Arthur Harbor, Anvers Island, and NW Wylie Bay, Anvers Island Trematomus hansoni, NW Wylie Bay, Anvers Island

PREVIOUSLY REPORTED HOSTS AND LOCALITIES: Trematomus bernacchii Boulenger, T. borchgrevinki Boulenger, T. hansoni Boulenger, Rhicophila dearborni DeWitt, from McMurdo Sound area (77°50'S, 166°45'E) and Windmill Islands area (66°15'S, 110°32'E), Antarctica (Zwerner, 1966); Notothenia sp., Antarctica (Jean Charcot Expedition) (Quidor, 1906).

NUMBER COLLECTED: 25 females, 19 males, 29 larvae.
NUMBER STUDIED: seven females and seven males.

DISCUSSION: These specimens were identified on the basis of descriptions by Quidor (1906) and Wilson (1915) and by comparison with material held by Zwerner (1966). Two new hosts, *Notothenia coriiceps* and *N. gibberifrons*, are reported. This parasite has now been reported from seven species, three genera and two families of Antarctic fishes. Although the validity of the reported two specimens from the zoarcid, *Rhigophila dearborni*, is questionable (Zwerner, 1966), the specificity of these parasites does not appear to be very narrow. With the exception of the possible erroneous report from a zoarcid, *C. intermedius* seems to be limited to members of the family *Nototheniidae*.

Lernaeopodid sp.

HOST: *Trematomus bernacchii;* *Nototheniidae.*

HABITAT: Gills.

LOCALITY: Arthur Harbor, Anvers Island, Antarctica.

NUMBER COLLECTED AND EXAMINED: two.

DISCUSSION: Two charopinid-type males (Wilson, 1915), were recovered, but further identification is not possible without female specimens.

Order Isopoda

Suborder Gnathiidea Hansen, 1916

Family Gnathiidae Harger, 1880

Genus *Gnathia* Leach, 1814

*Gnathia antarcticus* (Studer, 1884)

Synonym: *Anceus antarcticus* Studer, 1884
Ariceus antarcticus Pfeffer, 1886

Gnathia polaris Hodgson, 1902

Gnathia antarctica Richardson, 1906; Richardson, 1908; Hodgson, 1910; Richardson, 1913; Vanhoffen, 1914; Stephensen, 1915; Tattersall, 1921; Monod, 1926.

HOSTS: Notothenia corliceps Richardson, N. gibberifrons Lonnberg, N. nudifrons Lonnberg, Nototheniidae; Harpagifer bispinus (Schneider), Harpagiferidae; Chaenocephalus aceratus Lonnberg, Chaenichthyidae.

HABITATS: Skin and gills.

LOCALITIES: Notothenia corlieceps from Arthur Harbor, Anvers Island; N. W. Wylie Bay, Anvers Island; Discovery Bay, Deception Island; N. nudifrons, Arthur Harbor, Anvers Island; N. gibberifrons, Harpagifer bispinus, Paradise Harbor, Danco Coast; Chaenocephalus aceratus Arthur Harbor, Anvers Island; N. W. Wylie Bay, Anvers Island.

PREVIOUS REPORTED LOCALITIES* (free-living specimens): Off the coast of Patagonia, 1 juvenile at a depth of 110 m (Studer, 1884, in: Monod, 1926).

Prince Edward Island, 1 male at a depth of 91-274 m (Beddard, 1886, in: Monod, 1926).

Cape Adare, Antarctica, males, females and larvae at 20-24 fathoms from roots of seaweed (Hodgson, 1902).

Booth Island, Antarctic Peninsula (Richardson, 1906).

*Monod (1926) re-examined the collection of the French Antarctic Expedition, and prepared a revised listing of locality records.
Booth Island, Antarctic Peninsula, 1 individual (Richardson, 1908).

Winter quarters, McMurdo Bay, Antarctica, numerous males and females of all ages taken at the roots of sponges within 25 fathom line (Hodgson, 1910).


Petermann Island, Antarctic Peninsula. Attached to sponges and among the coral beneath small stones. October 31, 1909 (No. 533).


Petermann Island, Antarctic Peninsula, October 16, 1909. (No. 496).

LeMaire Channel along the north coast of Petermann Island, Antarctica, at a depth of 50-70 m. Attached to sponges, (No. 608, dredge XIVb).

King George Island, South Shetland Islands. Found attached to sponges on a sand beach along Admiralty Bay. Collected by M. Lionville, 15 larvae, nine males, five females. December 26, 1909. (No. 708).

Port-Circumcision, Petermann Island, Attached to Desmarestia at a depth of 6 m. October 3, 1909. (No. 430). Two
individuals, one male and one female (Richardson, 1913). Port on Third Island and Observatory Bay, Kerguelen Islands, five males, two females. January, 1902. Gauss Station, five males, one female (Vanhoffen, 1914). Cape Bird Peninsula entrance to McMurdo Sound, ten males, one female, five larvae from station 331. January 14, 1912. Cumberland Bay, South Georgia, one male, four larvae collected by P. Slammwitz. (Tattersall, 1921).

NUMBER COLLECTED: 120 parasite larvae.

NUMBER STUDIED: 25.

DISCUSSION: These specimens were identified by comparison with previous descriptions and were verified by Dr. G. A. Schultz (Hampton, New Jersey). Although this species has been reported from a large number of localities in Antarctica, it is the first report of larval G. antarcticus from fishes of this area. Tattersall (1921) reported that unidentifiable larval gnathids were collected from Trematomus sp. taken at Cape Evans, McMurdo Sound, but in the present study both host and gnathid have been identified. The new locality records and the fact that G. antarcticus larvae infest several Antarctic fishes, in particular the circumpolar N. coriiceps (Andriashev, 1965), seem to substantiate Monod's (1926) suggestion that G. antarcticus is circumpolar.

G. antarcticus is reported from five species representing three genera and three families of fishes. Nine specimens of this isopod were taken from the gills of four Chaenocephalus aceratus, the "icefish"; it was the only ectoparasite taken from this fish.
It is well known that icefish lack the pigment hemoglobin in their blood, and would seem to suggest that *G. antarcticus* does not require hemoglobin as a part of its diet.

**Adhesive Attitudes and Site-Specificity**

Larval *G. antarcticus* were recovered from the gills, skin and fins of five of the eight species of fishes in this collection. Larvae on the skin were attached with their heads toward the anterior end of the fish, an orientation typical of Gnathiidae (Monod, 1926).

Monod (1926) suggested that gnathids demonstrate some degree of site selection or specificity on their hosts. The number and distribution of *G. antarcticus* larvae occurring on the skin of *Notothenia coriiceps* are illustrated in Figure 21. Sixty-four percent of the *G. antarcticus* occurring on the skin of *N. coriiceps* attached to the areas posterior to the operculum and of these, 72% were attached to the skin behind the bases and on the medial surfaces of the pectoral and pelvic fins. Monod's (1926) suggestion that the fins are primary areas of attachment for gnathids because the blood vessels were close to the surface, vulnerable, and offered a ready supply of nutrients is thus supported. That the fins may also provide protection from abrasion would seem to explain the large numbers of *G. antarcticus* occurring behind and on the medial surface of the fins.

**Suborder Flabellifera**

**Family Cymothoidae**

*Cymothoid sp.*

**HOST:** *Notothenia coriiceps* Richardson; Nototheniidae.
HABITAT: Skin.
LOCALITY: N.W. Wylie Bay and Arthur Harbor, Anvers Island, Antarctica.
NUMBER COLLECTED AND EXAMINED: two.
DISCUSSION: These specimens, apparently the same species, belonging to the family Cymothoidae have been sent to Dr. G. A. Schultz for identification.

Parasite-Host Combinations

A synopsis of the parasite data for those fishes in this study in which both skin and gills were examined is presented in Table 6.

Notothenia coriiceps is infested with the greatest variety of parasite species. This fish is common along the Antarctic Peninsula (DeWitt, personal communication), and was taken more often than any other fish in this collection. N. coriiceps is a ubiquitous species occurring at depths ranging from one to 160 meters (Norman, 1938) with a circum-polar, nearly Panantarctic, distribution (Andriashev, 1965). Noble and Noble (1964: p. 615) indicate that "the size and ecological differentiation of the area in which the host lives is directly correlated with the diversification and distribution of parasites of that host." N. coriiceps is a fairly abundant, widely distributed fish, and this may explain its wide variety of ectoparasites.

The number of parasites occurring on most of the remaining species of fishes varies from three to five species per host species. Harpagifer bispinus is an exception. Only three of the 40 specimens
Table 6. Synopsis of host-parasite relationships in this study. For each host-parasite combination four numbers are given: (1) total number of parasites of a given species from that host (NP), (2) total number of hosts infected with the given parasitic species (HN), (3) per cent of host infected with the given parasitic species (IP) and (4) average number of parasites per host (AP/He).

<table>
<thead>
<tr>
<th>Parasites</th>
<th>Species</th>
<th>Total No. of Parasites</th>
<th>Total No. of Hosts</th>
<th>Per Cent of Host Infected</th>
<th>Average No. of Parasites per Host</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1.0</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1.0</td>
</tr>
<tr>
<td>1</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1.0</td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Number of hosts:

| 1          | 1       | 1                     | 1                 | 1                        | 1.0                            |
examined were infested with one species of parasite, the isopod, *Gnathia antarcticus*. The low diversity of parasite species and the low percentage of infestation may be attributed to the harshness of the fish's environment. *H. bispinis* is the only Antarctic littoral species and is reported by Norman (1938: p. 53) as "occurring in tidepools and also under rocks and stones..." This shallow water environment is subject to rapid changes in temperature, changes in salinity and total freezing during the winter. Dogiel (1958) and Polyanski (1958) suggest that varying temperatures and salinities can cause a reduction in the number of parasite species infesting a host. Therefore, it seems possible that the varying salinity and the complete freezing of the shallow water have reduced or eliminated the ability of adult ectoparasites or their eggs, larval or transmittive forms to survive in this environment. Only *Gnathia antarcticus* has evolved the ability to withstand the harshness of the Antarctic littoral zone.

*Chaenocephalus aceratus*, the icefish, also lacks variety in its parasite fauna. Only four specimens of this fish were collected; it is quite possible a more diversified parasite fauna may have occurred if more specimens of this species had been collected. It is interesting that the gills of all four specimens of *C. aceratus* were infested with *G. antarcticus*. Thus, the incidence of infestation of *C. aceratus* with *G. antarcticus* may prove to be quite high.
Host-Specificity

Monogenetic trematodes infested a greater percentage of fish species than did other parasite forms and, when present on a host species, occurred in greater numbers. One exception is the report of a single specimen of *Pseudobenedenia nototheniae* on *Notothenia gibberifrons*, but this occurrence may have been accidental as previously mentioned. Studies of the Monogenea of the fishes of the Gulf of Mexico (Hargis, 1957) and of 958 species of Monogenea known to the Russian, Bychowsky (1957), indicated host-specificities of 89% and 71%, respectively, at the species level. This indicates that close phylogenetic, physiologic and/or ecologic relationships exist between Monogenea and their hosts.

In our studies only two of the six species of Monogenea (or 33%) collected occur on a single species of fish (Table 7). The two species that are species-specific are the newly described species of the highly host specific genus *Gyrodactylus*. It would be premature to draw conclusions on so little evidence but it does suggest that the Antarctic fishes are closely related phylogenetically, physiologically and/or ecologically. Further studies in host-parasite relationships, host and parasite zoogeography and parasite life histories may yield interesting information on the relationship of Antarctic fishes.

The isopod, *Gnathia antarcticus*, exhibits the lowest degree of specificity. It occurred on five species of fishes belonging to three genera of three families (Table 6) but was not found on fishes belonging to the genus *Trematomus*. Two species of monogenetic trematodes, one species of leech and a copepod are capable
Table 7. Monogenea collected and hosts they infest. * = hosts collected in this study.

<table>
<thead>
<tr>
<th>PARASITE</th>
<th>HOSTS INFESTED</th>
<th>HOST FAMILY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gyrodactylus coriceps</td>
<td>Notothenia coriceps*</td>
<td>Nototheniidae</td>
</tr>
<tr>
<td>Gyrodactylus nudifrons</td>
<td>Notothenia nudifrons*</td>
<td>Nototheniidae</td>
</tr>
<tr>
<td>Pavlovskicoides antarcticus</td>
<td>Notothenia nudifrons*</td>
<td>Nototheniidae</td>
</tr>
<tr>
<td></td>
<td>Trematomus bernacchii*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&quot; hansonii</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&quot; centronotus</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&quot; borchgrevinki</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&quot; newnesi</td>
<td></td>
</tr>
<tr>
<td>Pavlovskicoides trematomi</td>
<td>Trematomus bernacchii</td>
<td>Nototheniidae</td>
</tr>
<tr>
<td></td>
<td>&quot; centronotus</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&quot; hansonii*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&quot; lepidorhinus</td>
<td></td>
</tr>
<tr>
<td>Pseudobenedenia nototheniae</td>
<td>Notothenia coriceps*</td>
<td>Nototheniidae</td>
</tr>
<tr>
<td></td>
<td>&quot; gibberifrons*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&quot; colbecki</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&quot; macrocephala</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&quot; rossi</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Trematomus bernacchii</td>
<td></td>
</tr>
</tbody>
</table>
Table 7. (Cont.)

<table>
<thead>
<tr>
<th>PARASITE</th>
<th>HOSTS INFECTED</th>
<th>HOST FAMILY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pseudoboreocera shorti</td>
<td>Botethenia rubiformis*</td>
<td>Nototheniidae</td>
</tr>
<tr>
<td></td>
<td>Trematomes bernacchii*</td>
<td>&quot;</td>
</tr>
<tr>
<td></td>
<td>&quot; hansenii*</td>
<td>&quot;</td>
</tr>
<tr>
<td></td>
<td>centrenatus sp.</td>
<td>&quot;</td>
</tr>
<tr>
<td></td>
<td>Rhinophila dearborni</td>
<td>Zoaridae</td>
</tr>
</tbody>
</table>
of infesting either genus, *Trematomus* or *Notothenia* of the family Nototheniidae (Table 6) thus suggesting that these genera are closely related physiologically and/or ecologically. Tattersall (1921) reported unidentified gnathids from *Trematomus* sp. taken at Cape Evans on McMurdo Sound, and findings in this study and suggestions by Monod (1926) seem to indicate that the nutrient or other requirements of gnathids may be satisfied by a wide variety of host species. Therefore, an explanation for *G. antarcticus*’ absence from members of the genus *Trematomus* in this collection is not readily apparent, and investigations of the host-parasite interactions are necessary before these relationships or lack of them can be understood.

**Parasitocoenosis**

Data taken from fish in which both skin and gills were examined provided information on parasite mix. These data are presented in Table 8. The most commonly occurring forms of parasite infestation are single species infestations by Monogenea. The only exception is the report of *Pseudobenedenia nototheniae* from *N. giberifrons* which may be accidental, as previously mentioned. The next most common form of parasite infestation involved two parasite species, followed by infestations of three and four parasite species.

Paperna (1964) indicated a competitive exclusion of *Dactylogyrus extensus* by *D. vastator* from the gills of reared carp, and Paperna and Kohn (1964) found a synergistic relationship between ciliate, *Trichodina* sp., and monogenetic trematodes,
Table 8. Parasitocoenosis data for fishes in which both skin and gills were examined. Included are: (1) the parasites and their habitats, (2) the number of hosts infested with a particular parasite or parasite combination and (3) the per cent of infested hosts that number (2) represents. The habitats for each parasite are designated as follows: gills (G), skin (S), pharynx (P), inside operculum (IO).

<table>
<thead>
<tr>
<th>Host: Notochoria coriiceps</th>
<th>No. of hosts examined: 59, Total No. of hosts infested: 45</th>
</tr>
</thead>
<tbody>
<tr>
<td>PARASITES AND HABITATS</td>
<td>No. of Hosts infested</td>
</tr>
<tr>
<td>Gyrodactylus coriiceps (G)</td>
<td>10</td>
</tr>
<tr>
<td>Pseudobenedenia nototheniae (G)</td>
<td>4</td>
</tr>
<tr>
<td>&quot; &quot; (S)</td>
<td>3</td>
</tr>
<tr>
<td>&quot; &quot; (S &amp; G)</td>
<td>2</td>
</tr>
<tr>
<td>Leeches (S)</td>
<td>1</td>
</tr>
<tr>
<td>Clavelloides intermedius (G)</td>
<td>1</td>
</tr>
<tr>
<td>Gnathia antarctica (G)</td>
<td>1</td>
</tr>
<tr>
<td>&quot; &quot; (S)</td>
<td>1</td>
</tr>
<tr>
<td>Gyrodactylus coriiceps (G) P. nototheniae (G)</td>
<td>2</td>
</tr>
<tr>
<td>&quot; &quot; (G) &quot; &quot; (S)</td>
<td>2</td>
</tr>
<tr>
<td>&quot; &quot; (G) &quot; &quot; (S &amp; G)</td>
<td>1</td>
</tr>
<tr>
<td>&quot; &quot; (G) Gnathia antarctica (G)</td>
<td>2</td>
</tr>
<tr>
<td>&quot; &quot; (G) &quot; &quot; (S)</td>
<td>1</td>
</tr>
<tr>
<td>P. nototheniae (G) Gnathia antarctica (G)</td>
<td>2</td>
</tr>
<tr>
<td>&quot; &quot; (S) &quot; &quot; (S)</td>
<td>1</td>
</tr>
<tr>
<td>&quot; &quot; (S) Leeches (S)</td>
<td>1</td>
</tr>
<tr>
<td>&quot; &quot; (S) &quot; (P)</td>
<td>1</td>
</tr>
<tr>
<td>Leeches (S) Gnathia antarctica (S)</td>
<td>1</td>
</tr>
<tr>
<td>Gyrodactylus coriiceps (G) P. nototheniae (S &amp; G) Leeches (S)</td>
<td>1</td>
</tr>
</tbody>
</table>
Table 8. (Continued)

<table>
<thead>
<tr>
<th>PARASITES AND HABITATS</th>
<th>No. of Hosts infested</th>
<th>Infested %</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>P. nototheniae (G) Gnathia antarctica (G) Leeches (S)</strong></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td><strong>(S &amp; G)</strong></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td><strong>(S &amp; G)</strong></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td><strong>Cymothoid (S)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>45</td>
<td></td>
</tr>
</tbody>
</table>

**Host: Notothenia nudifrons**

No. of hosts examined: 60, Total No. of hosts infested: 26

<table>
<thead>
<tr>
<th>PARASITES AND HABITATS</th>
<th>No. of Hosts infested</th>
<th>Infested %</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gyrodactylus nudifrons (G)</strong></td>
<td>6</td>
<td>23</td>
</tr>
<tr>
<td><strong>Pavlovskioide astericus (G)</strong></td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td><strong>Pseudobenedenia shorti (G)</strong></td>
<td>14</td>
<td>54</td>
</tr>
<tr>
<td><strong>Leeches (S)</strong></td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td><strong>P. shorti (G) Gnathia antarctica (G)</strong></td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td><strong>Pavlovskioide astericus (G) Leeches (S)</strong></td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>26</td>
<td></td>
</tr>
</tbody>
</table>

**Host: Notothenia gibberifrons**

No. of hosts examined: 27, Total No. of hosts infested: 13

<table>
<thead>
<tr>
<th>PARASITES AND HABITAT: <strong>Clavelloides intermedius (G)</strong></th>
<th>No. of Hosts infested</th>
<th>Infested %</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>(S)</strong></td>
<td>6</td>
<td>46</td>
</tr>
<tr>
<td><strong>(S)</strong></td>
<td>2</td>
<td>15</td>
</tr>
</tbody>
</table>
### Table 8. (Continued)

<table>
<thead>
<tr>
<th>PARASITES AND HABITATS</th>
<th>No. of Hosts infested</th>
<th>% Infested</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clavelloides intermedius (IO)</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>&quot; &quot; (IO &amp; G)</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>&quot; &quot; (IO &amp; S)</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Pseudobenedenia nototheniae (S)</td>
<td>1</td>
<td>8</td>
</tr>
</tbody>
</table>

Host: *Trematomus bernacchii*

No. of hosts examined: 20, No. of hosts infested: 17

<table>
<thead>
<tr>
<th>PARASITES AND HABITATS</th>
<th>No. of Hosts infested</th>
<th>% Infested</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pavlovskiioides antarcticus (G)</td>
<td>12</td>
<td>70</td>
</tr>
<tr>
<td>Leeches (S)</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Lernaeopodid sp. (G)</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Pavlovskiioides antarcticus (G)</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>&quot; &quot; (G) Leech (S)</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>&quot; &quot; (G) Lernaeopodid sp. (G)</td>
<td>1</td>
<td>6</td>
</tr>
</tbody>
</table>

Total 17

Host: *Trematomus hansonii*

<table>
<thead>
<tr>
<th>PARASITES AND HABITATS</th>
<th>No. of Hosts infested</th>
<th>% Infested</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pavlovskiioides trematomi (G)</td>
<td>1</td>
<td>20</td>
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</table>
Table 8. (Continued)

<table>
<thead>
<tr>
<th>PARASITES AND HABITATS</th>
<th>No. of</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hosts infested</td>
<td>Infested</td>
</tr>
<tr>
<td>Pseudobenedenia shorti (G)</td>
<td>2</td>
<td>40</td>
</tr>
<tr>
<td>Clavelloides intermedius (G)</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>Pavlovskioides antarcticus (G) Pseudobenedenia shorti (G)</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Host: Trematomus newnesi

No. of hosts examined: 3, Total No. of hosts infested: 1

<table>
<thead>
<tr>
<th>PARASITES AND HABITATS</th>
<th>No. of</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hosts infested</td>
<td>Infested</td>
</tr>
<tr>
<td>Pavlovskioides antarcticus</td>
<td>1</td>
<td>100</td>
</tr>
</tbody>
</table>

Host: Harpagifer bispinus

No. of hosts examined: 40, Total No. of hosts infested: 3

<table>
<thead>
<tr>
<th>PARASITES AND HABITATS</th>
<th>No. of</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hosts infested</td>
<td>Infested</td>
</tr>
<tr>
<td>Gnathia antarcticus (S)</td>
<td>3</td>
<td>100</td>
</tr>
</tbody>
</table>

Host: Chaenoecephalus aceratus

No. of hosts examined: 4, Total No. of hosts infested: 3

<table>
<thead>
<tr>
<th>PARASITES AND HABITATS</th>
<th>No. of</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hosts infested</td>
<td>Infested</td>
</tr>
<tr>
<td>Gnathia antarcticus (C)</td>
<td>3</td>
<td>100</td>
</tr>
</tbody>
</table>
D. vastator, D. anchoratus and D. extensus. There was no evidence of any synergistic relationship in this study since no one parasite combination occurred more often than any other nor was there any indication of an increase in the number of individuals of one species when another was present. It is possible that exclusion mechanisms do exist since single parasite infestations occur most frequently, but proof of such mechanisms is left to future workers.
SUMMARY

The taxonomy and some aspects of the biology of 16 species of ectoparasites recovered from eight species of fishes from the Antarctic Peninsula area are discussed.

Two new species of Monogenea, Gyrodactylus coriiceps and G. nudifrons are described. Type material of all Antarctic Gyrodactylus was examined and although differences are subtle all species are considered to be valid. Pseudobenedenia nototheniae is redescribed and the question of arrangement and number of post-haptoral septa is resolved. Other ectoparasites reported are: Monogenea-Tetraonchoididae, Pavlovskioides antarcticus, P. trematomi; Capsalidae, Pseudobenedenia shorti; Hirudinea-Piscicolidae, Platydella sp., Trulliobdella sp., Croybdella sp., Pontobdella rugosa (all tentative identifications); Copepoda-Lernaeopodidae, Clavelloides interradius, lernaeopodid sp.; Isopoda-Gnathiidae, Gnathia antarcticus, Cymothoidae, cymothoid sp.

New host and locality data are presented for all parasite species and all ranges except that of G. antarcticus are extended. Larval forms of G. antarcticus were recovered for the first time from the skin and gills of five species of Antarctic fishes.

Morphometrics from this and previous collections of Pavlovskioides antarcticus, Pseudobenedenia nototheniae and P. shorti are compared and variations are discussed.
The method of attachment and the adhesive attitude of adult _P. nototheniae_ and _P. shorti_ were found to be similar and are suggested as being typical for all gill-infesting capsslids.

Site-specificity is exhibited by skin-infesting forms of _P. nototheniae_ and _Gnathia antarcticus_ for the region on the skin behind the operculum between the pelvic and pectoral fins, and includes the medial surface of and the skin directly behind the pectoral and pelvic fins for _G. antarcticus_. _P. shorti_ exhibits a possible site-specificity for the first and second gill arches of _N. nudifrons_.

Parasite-host combinations are examined and _N. coriiceps_ is infested with eight parasite species. Four host species, _N. nudifrons_, _N. gibberifrons_, _Trematomus bernacchii_ and _T. hansoni_ are infested with from three to five species of parasites and only isopod _G. antarcticus_ infests _Harpacifer hispinis_ and _Chaenocephalus aceratus_.

Examination of host-specificity in Monogenea indicated that _Gyrodactylus coriiceps_ and _G. nudifrons_ infest one host species each while _Pavlovskioides antarcticus_ infests six species and two genera, _P. trematomi_ infests four species in two genera and _Pseudobenedenia nototheniae_ infests six species in two genera of the family Nototheniidae. _P. shorti_ infests five species, two genera in the family Nototheniidae and one species in the family Zoarcidae (possibly an erroneous report). _Gnathia antarcticus_ exhibits the lowest specificity of any parasite in this study. It infests five species in four genera in three families of fishes.
Parasitocoenosis was examined and no synergistic relationships or competitive exclusion mechanisms, if present, were evident; the most common form of infestation is single infestations of Monogenea.
APPENDIX
EXPLANATION OF PLATE I
(measurements in mm)

Cycodactylus nudifrons n. sp.

Figs.
1. Whole mount, ventral view.
2. Dorsal bar.
3. Ventral bar.
5. Marginal hook.
6. Anchor.

Cycodactylus corideops n. sp.

Figs.
7. Whole mount, ventral view.
8. Cirrus.
10. Dorsal bar.
11. Anchor complex, ventral view.
12. Ventral bar.
EXPLANATION OF PLATE II

(measurements in mm)

Pseudobondania nototreta Le Johnst on, 1931

Figs.

13. Whole mount, ventral view.
14. Middle anchor.
15. Posthaptoral septation, ventral view.
17. Posthaptoral mesenchyme, ventral view.
18. Anterior anchor.
19. Reproductive organs and terminal genitalia, ventral view.
EXPLANATION OF PLATE III

Figure 20. Distribution of Pseudobenedenia nototheniae on the skin of Notothenia coriiceps. Divisions on fish are arbitrary and used only to illustrate site-specificity. The three numbers in each square indicate the following (From top to bottom): (1) number of parasites which occurred in that area, (2) per cent of the total number of P. nototheniae on the skin that the first number represents and (3) number of hosts infested by P. nototheniae in that area.
Figure 21. Distribution of Gnathia antarcticus on the skin of Notothenia coriiceps. Divisions on fish are arbitrary and used only to illustrate site-specificity. The three numbers in each square indicate the following (from top to bottom): (1) number of parasites which occurred in that area, (2) per cent of the total number of G. antarcticus on the skin that the first number represents and (3) number of hosts infested by G. antarcticus in that area.
LITERATURE CITED


VITA

Ervin Lynn Suydam


In September 1968, the author entered the College of William and Mary as a graduate assistant in the Parasitology Section of the Microbiology and Pathology Department at the Virginia Institute of Marine Science.(School of Marine Science).