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**Illustrated keys to the metazoan  
parasites of the Salmonidae of  
insular Newfoundland**



**by John H. C. Pippy**



**FISHERIES RESEARCH BOARD OF CANADA  
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## INTRODUCTION

These keys are intended for use in the field by fisheries biologists and students of the parasite fauna of Newfoundland's freshwater fishes. They are designed to provide only preliminary identification of parasites. Identifications are based on features readily visible with the unaided eye or with a dissecting microscope. An asterisk indicates larval stage. Since it is likely that not all the parasites of Newfoundland's salmonidae have yet been documented, these keys should not be used to make final identifications. Final identifications should be made from original descriptions, references to which may be found in Hoffman (1967) or Bykhovskaya-Pavlovskaya et al. (1962).

Details on known distribution of Newfoundland's parasite fauna may be found in Sandeman and Pippy (1967) and Pippy (1969).

The keys are constructed of mutually exclusive couplets. Each member of each couplet either identifies the parasite or refers the reader to another couplet. The bracketed numbers refer to preceding couplet members, making it possible to move backwards in the key if an error is suspected.

Only the most important and easily visible anatomical details are shown in the illustrations.

PART I

PARASITES OF RESIDENT SALMONIDS

- 1 Parasites with hard chitinous covering; body shape constant; jointed appendages; found externally on the gills, fins and elsewhere . . . . . 2
- 1' Parasites without hard covering; body shape changeable; no jointed appendages; found externally or internally . . . . . 5
- 2(1) Adults (females) permanently attached by means of a bulla (Fig. 1) inserted in the host's tissues; usually with paired egg sacs (Fig. 1) at posterior end . . . . . 3
- 2' Adults not permanently attached; with or without paired egg sacs at posterior end; on gills or external body surface . . . . . 4
- 3(2) Bulla round and distally convex; cephalothorax (Fig. 1) elongate; found on gills and fins of brook trout . . . . . *Salmincola edwardsi* (Fig. 1)
- 3' Bulla heart-shaped and distally concave; cephalothorax triangular; found on the gills, gill opercula and isthmus of immature and adult Atlantic salmon . . . . . *Salmincola salmoneus* (Fig. 2)
- 4(2') Large (3.4-16.0 mm long) brown parasites wandering freely over body surfaces; dorsally convex and ventrally concave; eggs bunched under the abdomen . . . . . *Argulus canadensis* (Fig. 3)
- 4' Small (about 1 mm long) parasites wandering freely over the gills; body convex dorsally and ventrally; paired egg sacs with several longitudinal rows of eggs . . . . . *Ergasilus luciopercarum* (Fig. 4)

5(1')	Anterior end bearing single retractable proboscis with many sharp curved hooks; found in intestine . . . . .	<i>Echinorhynchus lateralis</i> (Fig. 5)	
5'	Anterior end without hooks . . . . .		6
6(5')	Posterior end with eight clamps arranged in two longitudinal rows of four each; found on the gills . . . . .	<i>Discocotyle sagittata</i> (Fig. 6)	
6'	Posterior end without clamps . . . . .		7
7(6')	Parasite in small oval cyst; encysted in host's tissues . . . . .		8
7'	Parasite not enclosed by a definite cyst wall . . . . .		9
8	Encysted in skin, surrounded by a concentration of black pigment cells; two gonotyls (Fig. 7) in front of ventral sucker . . . . .	<i>Apophallus brevis</i> * (Fig. 7)	
8'	Encysted in pericardial cavity, pericardium, renal peritoneum; not surrounded by black pigment cells; large holdfast organ (Fig. 8) behind ventral sucker . . . . .	<i>Tetracotyle</i> sp.* (Fig. 8)	
9(7')	Both ventral and anterior sucker present . . . . .		10
9'	Ventral sucker absent; anterior sucker(s) may or may not be present; may or may not have a posterior sucker . . . . .		14
10(9)	Vitellaria well developed; parasite found in alimentary canal and urinary system . . . . .		11
10'	Vitellaria not well developed; small (about 0.4 mm long) parasite found in humours of eye . . . . .	<i>Diplostomulum</i> sp. (Fig. 9)	

11(10')	Vitellaria compact, anterior to testes and close behind ventral sucker; accessory sucker in front of oral sucker; found in ureters and urinary bladder . . . . .	<i>Phyllodistomum limnosa</i> (Fig. 10)	
11'	Vitellaria follicular, in two lateral bands . . . . .		12
12(11')	Anterior sucker with six anterior processes . . . . .		13
12'	Anterior sucker without anterior processes, usually found in stomach . . . . .	<i>Azygia longa</i> (Fig. 11)	
13(12)	Uterus (outlined by extent of eggs) confined between anterior testis and genital pore; found in stomach, intestine, and gall bladder . . . . .	<i>Crepidostomum farionis</i> (Fig. 12)	
13'	Uterus extends from behind the posterior testis to the genital pore; found in intestine . . . . .	<i>Bunodera luciopercae</i> (Fig. 13)	
14(9')	Body flattened; segmented or nonsegmented; anterior end with distinctive holdfast organs . . . . .		15
14'	Body cylindrical; nonsegmented; anterior end without elaborate holdfast organs . . . . .		20
15(14)	Holdfast organ present at both posterior and anterior end; segmented; black; free moving on external surface . . . . .	leech (Fig. 14)	
15'	Posterior holdfast organ absent; internal parasite . . . . .		16

- 16(15') Apical disc on scolex; two spoon-shaped bothrial grooves on either side of scolex; found in intestine and pyloric caecae . . . . . *Euthbothrium salvelini* (Fig. 15)
- 16' Apical disc absent; holdfast organs in the form of longitudinal slits or forward projecting sucking discs . . . . . 17
- 17(16') Bothria simple, in form of slits on either side of scolex . . . . . 18
- 17' Bothrial grooves absent . . . . . 19
- 18(17) Scolex elongate, bothria in form of two longitudinal slits not continuous at anterior extremity; found in body cavity . . . . . *Dibothriocephalus* sp. (Fig. 16)
- 18' Scolex short, bothria connected by a groove over the apex of the scolex; normally found in body cavity of sticklebacks; usually found with stickleback remains in stomach of salmonid; not parasitic in salmonids . . . . . *Schistocephalus solidus* (Fig. 17)
- 19(17') Anterior end of scolex with chitinous funnel-like holdfast structure. Usually found in pyloric caecae . . . . . *Cyathocephalus truncatus* (Fig. 18)
- 19' Scolex with one or two spherical hollow structures whose apertures face forward; in pyloric caecae . . . . . *Bothrimonas sturionis* (Fig. 19)



- 20(14') Female with eggs containing polar plugs, egg width up to one half diameter of body; male with two small but distinct rounded lobes at posterior extremity; in intestine and stomach . . . . .  
. . . . . *Capillaria salvelini* (Fig. 20)
- 20' Female with very small eggs without polar plugs; male without distinct lobes at posterior extremity . . . . . 21
- 21(20) Mouth connected with esophagus, male tail not bifurcate . . . . . 22
- 21' Mouth not connected with esophagus; male tail bifurcate; (not normally parasitic in salmonids; food item of some salmonids) . . . . *Gordius* sp. (Fig. 21)
- 22(21) Posterior end of male and female pointed, spicules similar; found in body cavity . . . . .  
. . . . . *Philonema agubernaculum* (Fig. 22)
- 22' Posterior end of male and female blunt; spicules dissimilar; found in stomach and intestine . . . . .  
. . . . . *Metabronema salvelini* (Fig. 23)

PART II

COMMON PARASITES OF MIGRATORY SALMON *SALMO SALAR*

1	Parasites with hard chitinous covering; body shape constant; jointed appendages; found externally on the gills, fins and elsewhere . . . . .	2
1'	Parasites without hard covering; body shape changeable; no jointed appendages; found externally or internally . . . . .	3
2(1)	Adults (females) permanently attached by means of a heart-shaped bulla inserted in host's tissues, usually the gills; usually with paired egg sacs at posterior end . . . . . . . . . . <i>Salmincola salmoneus</i> (Fig. 2)	
2'	Adults not permanently attached; large (10-16 mm) brown parasites wandering freely over body surfaces; long egg strings usually present at posterior end . . . . . . . . . . <i>Lepeophtheirus salmonis</i> (Fig. 24)	
3(1')	Anterior end with one or more holdfast organs bearing curved hooks . . . . .	4
3'	Anterior end without hooks . . . . .	6
4(3)	Anterior end with single proboscis; found in intestine . . . . . <i>Echinorhynchus gadi</i> (Fig. 25)	
4'	Anterior end with more than one armed tentacle . . . . .	5

- 5(4') Tentacles short; large (about 30 mm) parasites  
in body cavity . . . . . *Hepatoxylon trichiuri* (Fig. 26)
- 5' Tentacles long; small (about 10 mm) parasites  
in body cavity . . . . . *Tentacularia coryphaenae* (Fig. 27)
- 6(3') Posterior end with complicated clasping  
structures . . . . . 7
- 6' Posterior end without holdfast organs . . . . . 8
- 7(6) Posterior end with 4 pairs of clamps; large  
(2-7 mm long) parasite found on gills . . . . .  
. . . . . *Discocotyle sagittata* (Fig. 6)
- 7' Posterior end without 4 pairs of clamps but  
with two large median hooks, 16 much smaller  
outer hooks; found on gills . . . . .  
. . . . . *Gyrodactyloides bychowskii* (Fig. 28)
- 8(6') Elongate cylindrical worm; pointed posterior  
end; without anterior or ventral suckers . . . . . 9
- 8' Body flattened; rounded posterior end; with  
anterior holdfast organ; may or may not have  
a ventral sucker . . . . . 10
- 9(8) Nematode with simple mouth structures;  
anterior end with single tooth; posterior  
end with simple point; found in musculature  
or in body cavity or attached to outside of  
viscera . . . . . *Anisakis simplex* (Fig. 29)
- 9' Nematode with complex mouth structures;  
anterior end without conspicuous tooth;  
posterior end with serrated point; found  
in stomach, intestine and sometimes in  
body cavity . . . . . *Contracaecum aduncum* (Fig. 30)

10(8')	Body with both anterior and ventral suckers . . . . .	11
10'	Body without ventral sucker . . . . .	17
11(10)	Posterior end retractable into body . . . . .	12
11'	Posterior end not retractable . . . . .	13
12(11)	Vitelline bodies rounded; gonopore close to anterior sucker; seminal vesicle bilobed; found in alimentary canal . . . . . . . . . . <i>Hemiurus levinseni</i> (Fig. 31)	
12'	Vitelline bodies lobed; gonopore midway between anterior and ventral sucker; seminal vesicle round; found in alimentary canal . . . . . . . . . . <i>Brachyphallus crenatus</i> (Fig. 32)	
13(11')	Parasite small (less than 1 mm long) with rounded body . . . . .	14
13'	Parasite large with elongate body . . . . .	15
14(13)	Parasite contained in cyst; found in musculature, peritoneum, and on internal organs . . . . . . . . . . <i>Tetracotyle</i> sp. (Fig. 8)	
14'	Parasite not contained in a cyst; found in humors of eyes . . . . . . . . . . <i>Diplostomulum</i> sp. (Fig. 9)	
15(13')	Vitelline gland consisting of seven long lobes joined centrally; found in alimentary canal . . . . . . . . . . <i>Lecithaster gibbosus</i> (Fig. 33)	
15'	Vitelline glands not consisting of seven long lobes, vitelline glands rounded . . . . .	16

16(15') Vitelline glands conspicuous lying diagonally behind one another behind ventral sucker; ventral sucker larger than anterior sucker; body roughly spindle-shaped; found in alimentary canal . . . . . *Derogenes varicus* (Fig. 34)

16' Vitelline glands not conspicuous; ventral sucker the same size or only slightly larger than anterior sucker; body "E" shaped; found in alimentary canal . . . . .  
. . . . . *Lampritrema nipponicum* (Fig. 35)

17(10') Body segmented; segments with slight median depression; two spoon-shaped bothrial grooves on either side of scolex; scolex with apical disc; large tapeworm found in pyloric caecae and intestine . . . . .  
. . . . . *Eubothrium crassum* (Fig. 15);

The reader is referred to *E. salvelini* which has a form similar to *E. crassum*. *E. salvelini* is of freshwater origin and *E. crassum* of marine origin. The former is smaller (up to 280 mm long by 2.25 mm wide) than the latter (up to 600 mm long by 2.5-5.6 mm wide). Positive identification is based on stained specimens (see Wardle and Mcleod, 1952).

17 Body not segmented; scolex without apical disc; scolex with four sessile bothria; small tapeworm found in pyloric caecae and intestine . . . . .  
. . . . . *Pelichnibothrium* sp. (Fig. 36)

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- Wardle, R. A., and J. A. Mcleod. 1952. The zoology of tapeworms. U. of Minnesota Press, Minneapolis. 780 p.

FIGURES — PART I  
PARASITES OF RESIDENT SALMONIDS

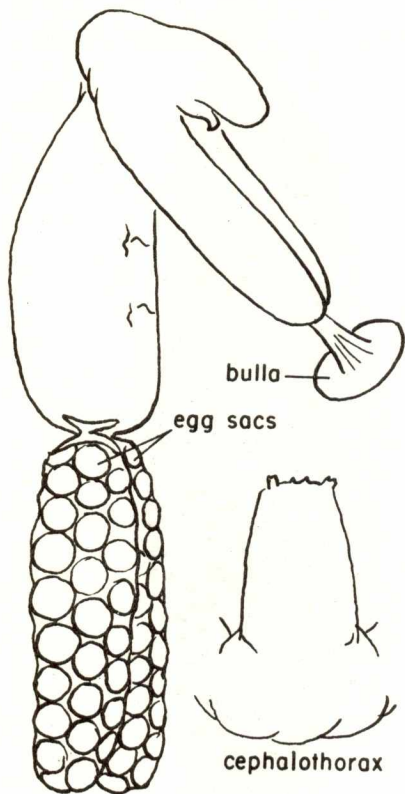


Fig. 1. *Salmincola edwardsi*

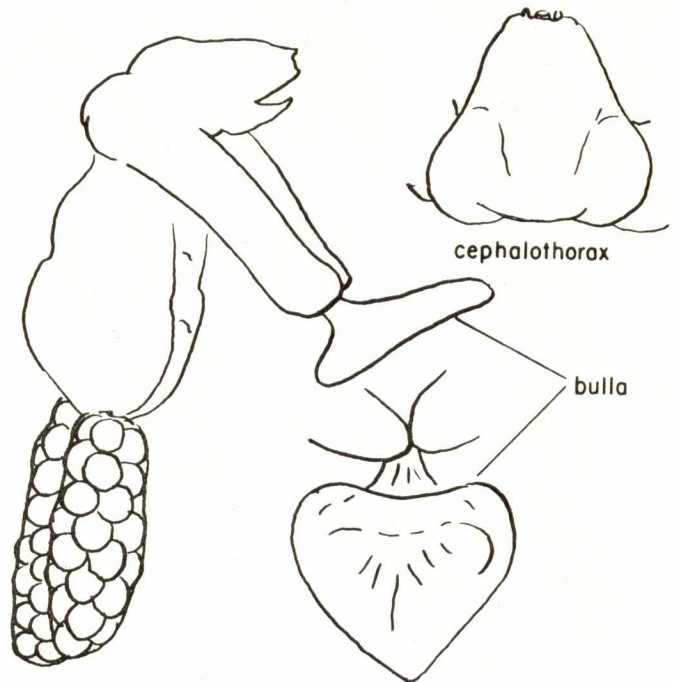


Fig. 2. *Salmincola salmoneus*

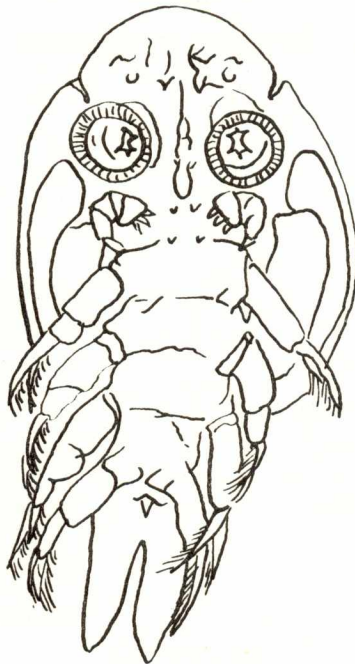


Fig. 3. *Argulus canadensis*  
female, ventral side.



Fig. 4. *Ergasilus luciopercarum*  
female, ventral side.

PARASITES OF RESIDENT SALMONIDS

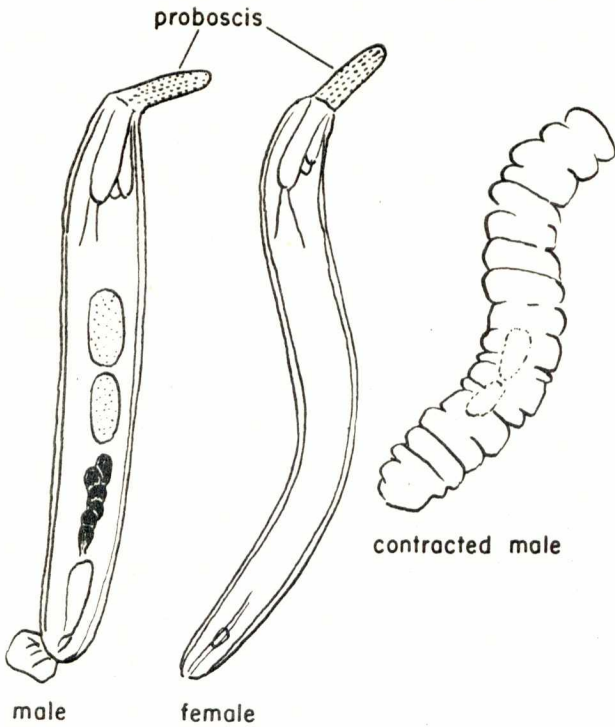


Fig. 5. *Echinorhynchus lateralis*

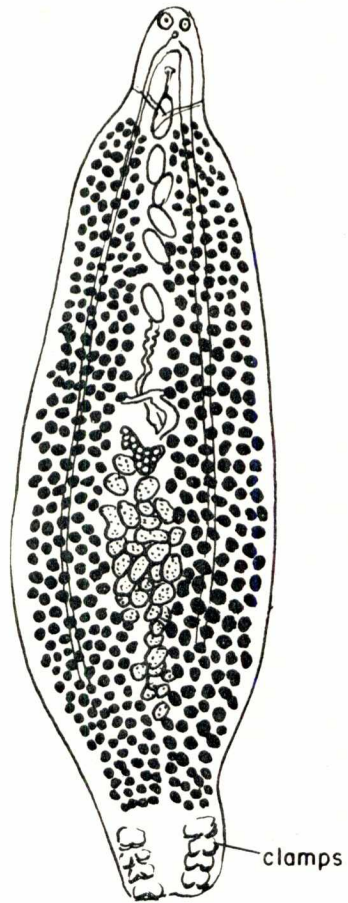


Fig. 6. *Discocotyle sagittata*

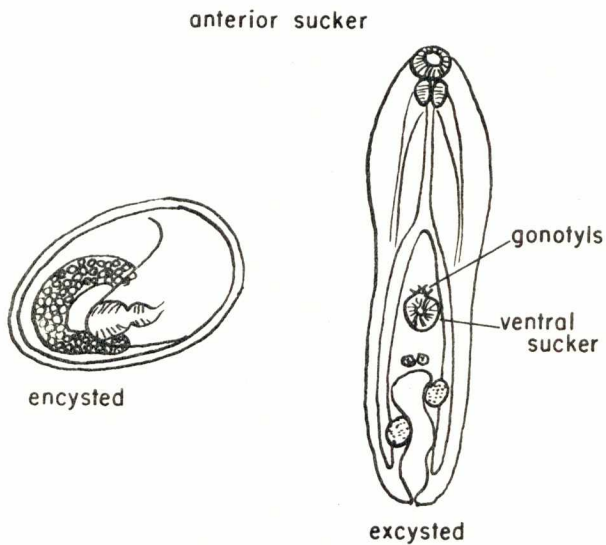


Fig. 7. *Apophallus brevis*

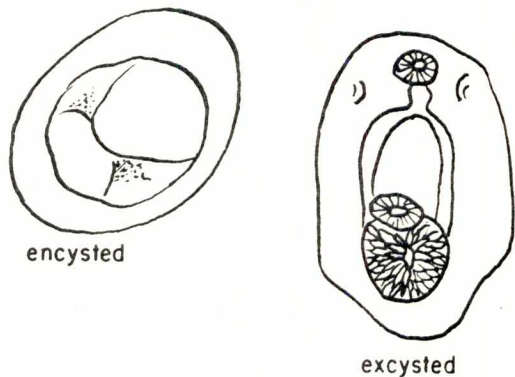


Fig. 8. *Tetracotyle* sp.



## PARASITES OF RESIDENT SALMONIDS

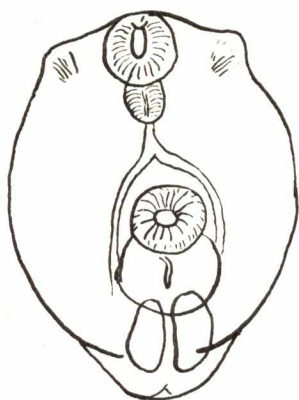
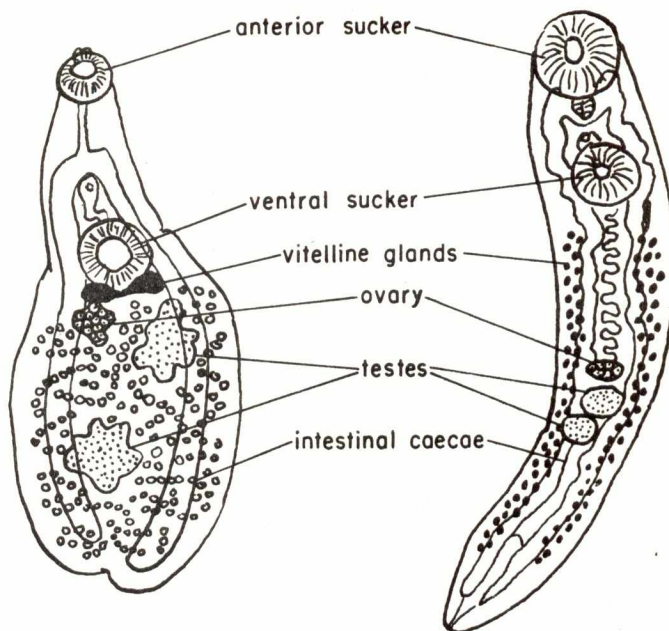
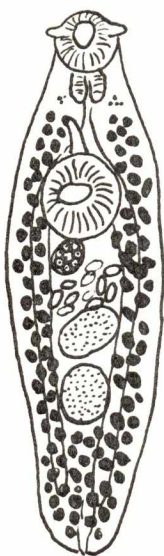
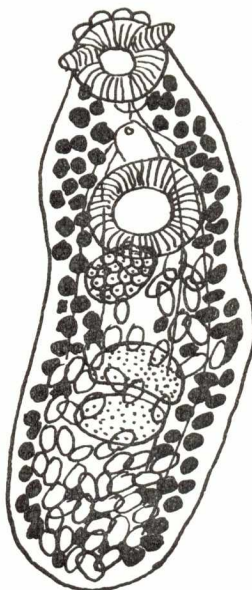
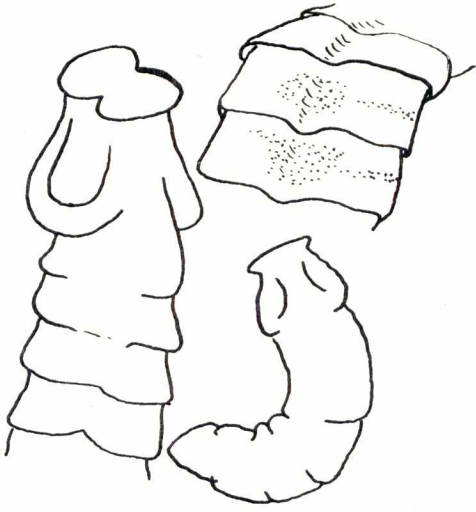
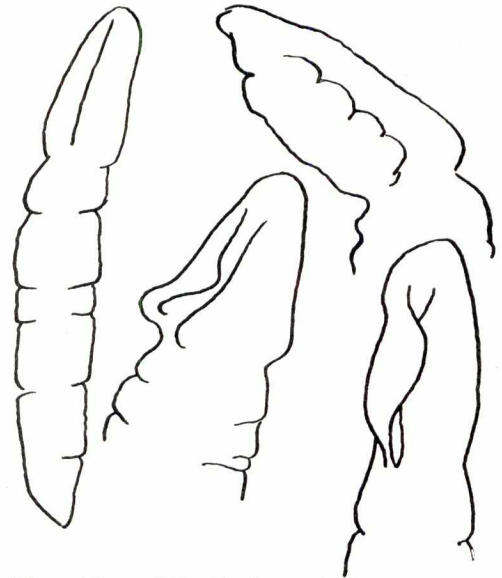
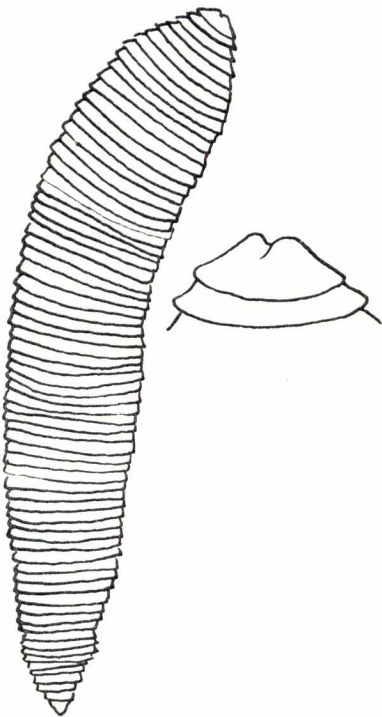
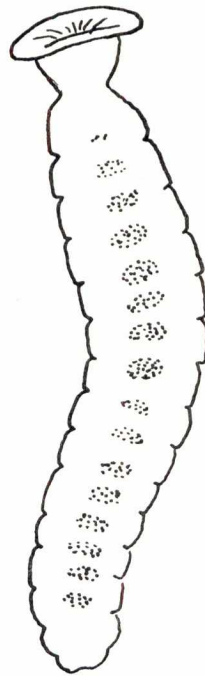
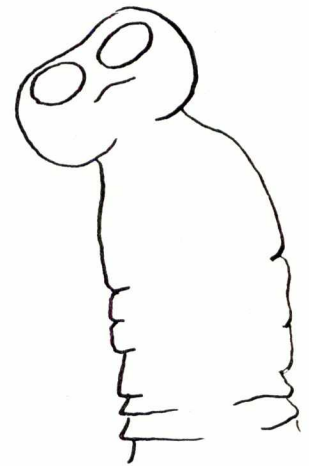
Fig. 9. *Diplostomulum* sp.Fig. 10. *Phyllodistomum*  
*limnosa*Fig. 11. *Azygia longa*Fig. 12. *Crepidostomum*  
*farionis*Fig. 13. *Bunodera*  
*luciopercae*

Fig. 14. Leech

## PARASITES OF RESIDENT SALMONIDS

Fig. 15. *Eubothrium salvelini*Fig. 16. *Dibothriocephalus* sp.Fig. 17. *Schistocephalus solidus*Fig. 18. *Cyathocephalus truncatus*Fig. 19. *Bothrimonas sturionis*

PARASITES OF RESIDENT SALMONIDS

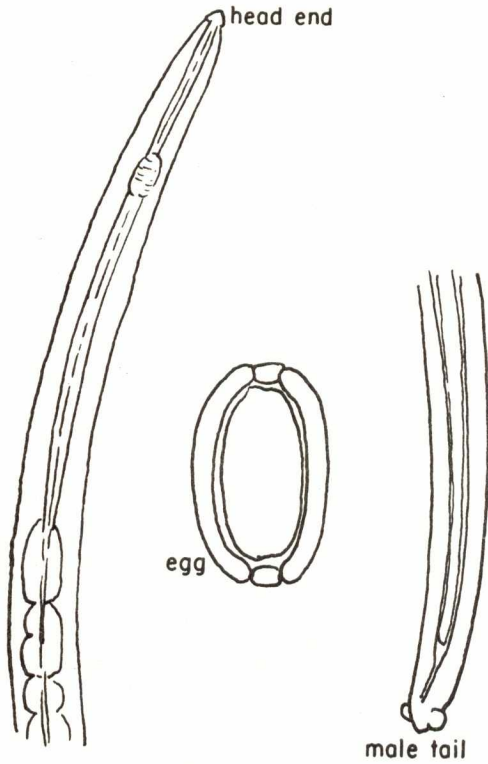


Fig. 20. *Capillaria salvelini*

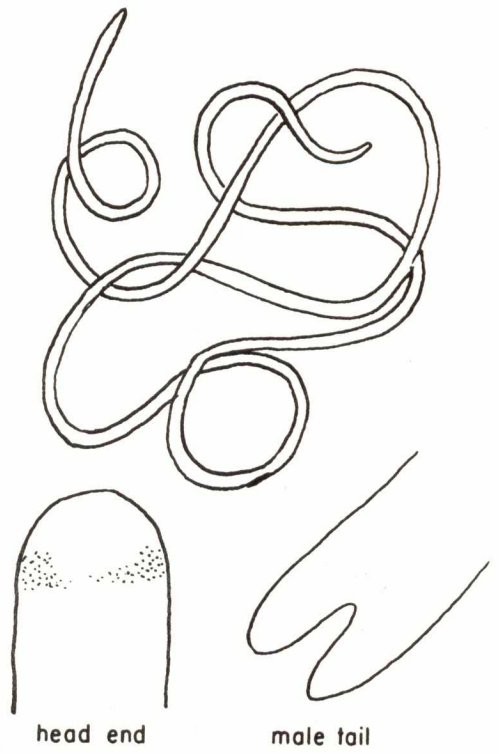


Fig. 21. *Gordius* sp.

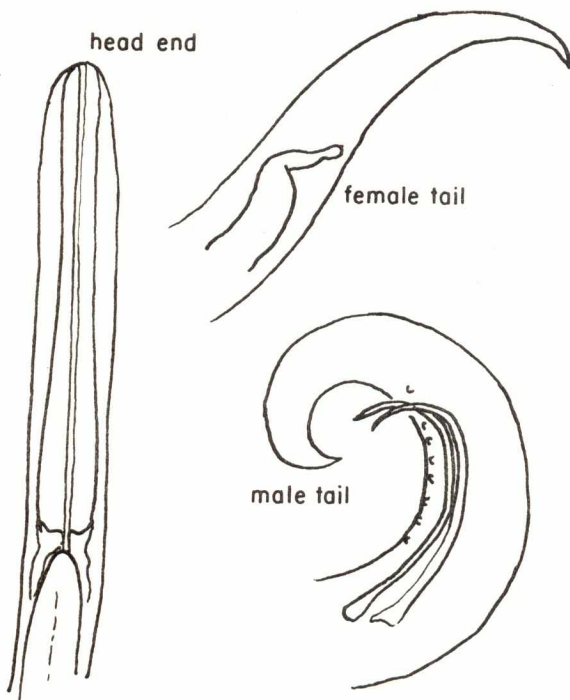


Fig. 22. *Philonema agubernaculum*

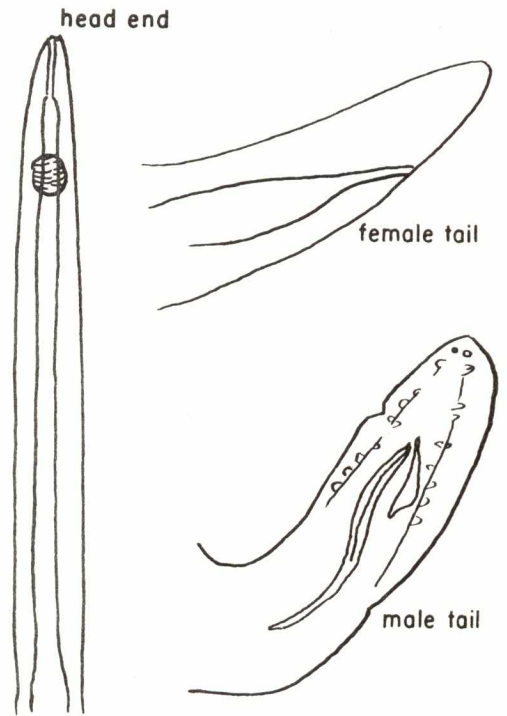


Fig. 23. *Metabronema salvelini*

FIGURES — PART II  
 PARASITES OF MIGRATORY SALMON  
 (see also figures 2, 6, 8 and 9)

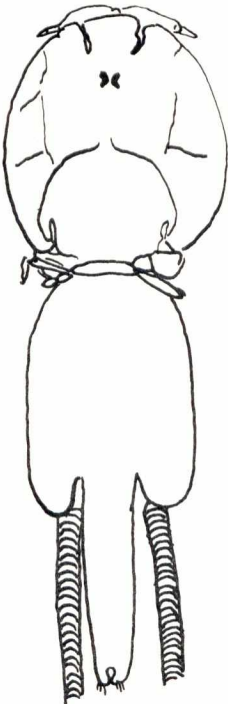


Fig. 24. *Lepeophtheirus salmonis*, female

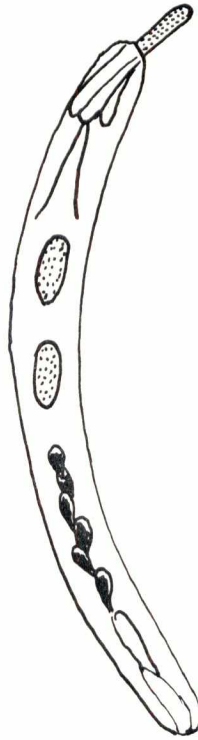


Fig. 25. *Echinorhynchus gadi*, male

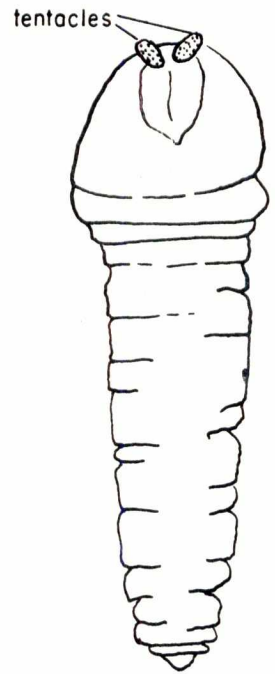


Fig. 26. *Hepatoxylon trichiuri*

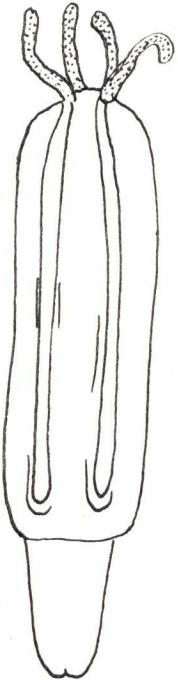


Fig. 27. *Tentacularia coryphorenae*

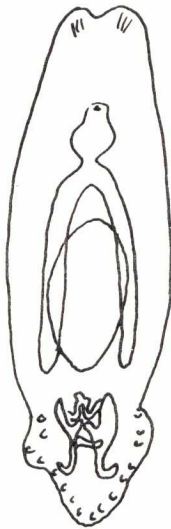


Fig. 28. *Gyrodactyloides bychowskii*

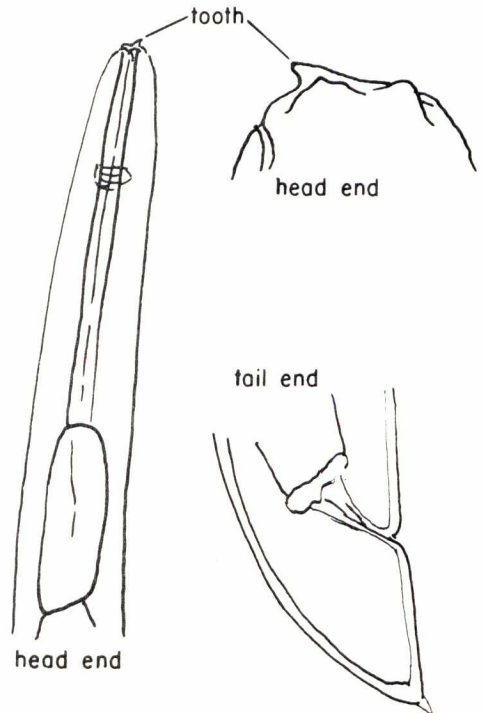
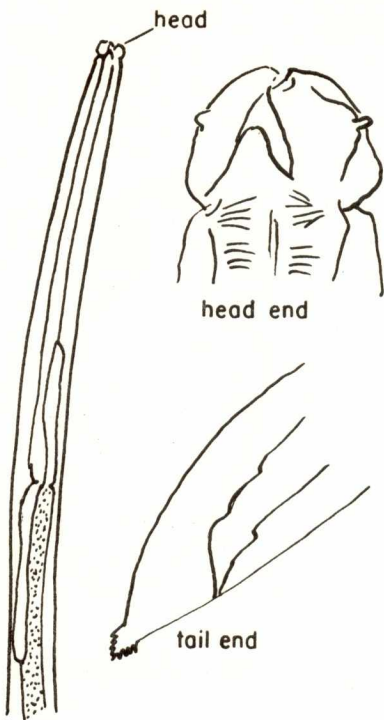
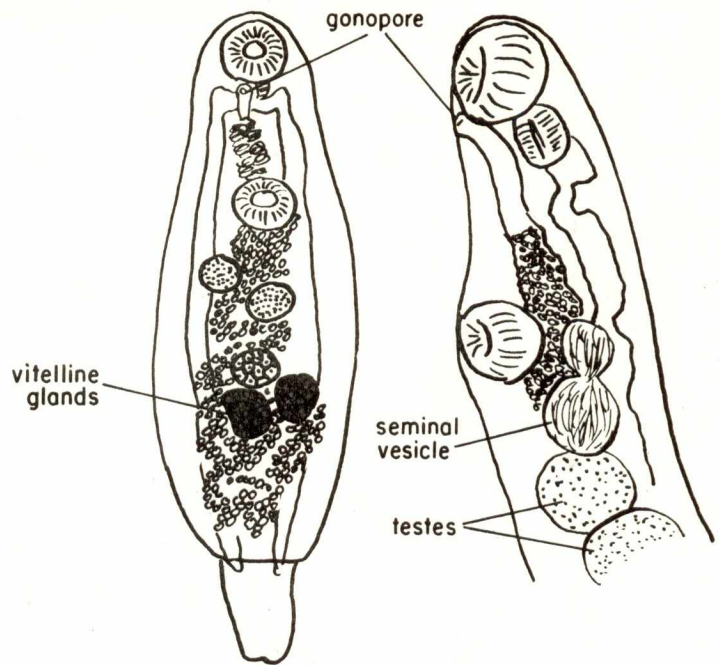
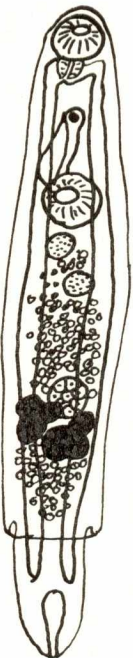
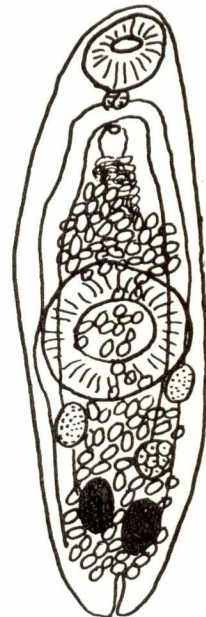


Fig. 29. *Anisakis simplex*

## PARASITES OF MIGRATORY SALMON

(see also figures 2, 6, 8 and 9)

Fig. 30. *Contracaecum aduncum*Fig. 31. *Hemiurus levinseni*Fig. 32. *Brachyphallus crenatus*Fig. 33. *Lecithaster gibbosus*Fig. 34. *Derogenes varicus*

PARASITES OF MIGRATORY SALMON  
(see also figures 2, 6, 8 and 9)

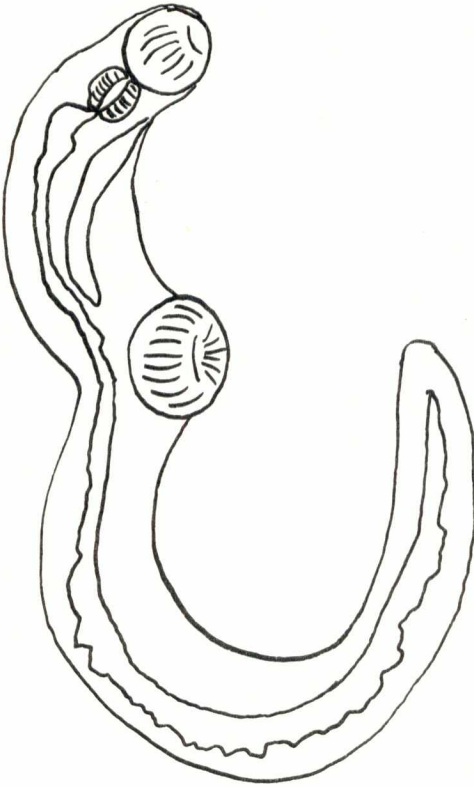


Fig. 35. *Lampritrema nipponicum*

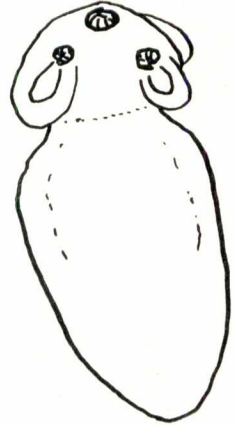


Fig. 36. *Pelichnibothrium* sp.