

Mrs Mary Rathbun
with kind regards
from the author

III.

SOME NOTES ON FISH PARASITES.

BY THOMAS SCOTT, LL.D., F.L.S.

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By THOMAS SCOTT, LL.D., F.L.S.

(Plates III.—VII.)

Papers containing records and descriptions of parasites more or less peculiar to fishes have been contributed at various times to Part III. of the Annual Reports published during previous years by the Fishery Board for Scotland. In the present paper there are notes on several additional species, some of which are interesting because of their strange and unusual forms.

These notes have been prepared from specimens obtained at various times chiefly in connection with research work undertaken on behalf of the Board, but a few have reached me from other sources. Some of the specimens have been in my possession for several years, while others have only recently been obtained.

I am indebted to my colleague, Dr. Williamson, for some of the species recorded, and to my son, Andrew Scott, A.L.S., for the drawings and photographs with which the paper is illustrated.

The species to be described comprise examples both of the Ectoparasites and the Endoparasites of fishes. Three species belonging to the former group appear to be new to science, while some rare and curious forms are included among those belonging to the second group.

The various species mentioned in the sequel are arranged and described in the following order :—

(1) Ectozoa.

CRUSTACEA.

COPEPODA.

Pandarus bicolor, Leach, var.
Hatschekia cornigera, sp. n.
Chondracanthus Williamsoni, sp. n.

PLATYHELMINTHA.

TREMATODA-ECTOPARASITICA.

Octobothrium Sybilleæ, sp. n.

(2) Entozoa.

TREMATODA ENDOPARASITICA.

Distoma cestoides, Ed. van Beneden.

CESTODA.

Bothriocephalus proboscideus, Rudolphi.
" *punctatus* (Rudolphi).
Ancistrocephalus microcephalus (Rudolphi).

Schistocephalus solidus, Creplin.
Tetrarhynchus minutus, P. J. van Beneden
 „ *tetrabothrius*, P. J. van Beneden.
 „ *megacephalus*, Rudolphi.
Phyllobothrium thridax, P. J. van Beneden.
 „ *lactuca*, P. J. van Beneden.
Acanthobothrium coronatum, P. J. van Beneden.
Dinobothrium septaria, P. J. van Beneden.
Diplobothrium simile, P. J. van Beneden.
Abothrium rugosum, Goeze.
Taenia sp.

NEMATHELMINTHA

ACANTHOCEPHALA.

Echinorhynchus proteas, Westrumb.
 „ *acus*, Rudolphi.
 „ „ ? var.
 „ *agilis*, Rudolphi.

ADDITIONAL NOTES.

- (1) On a large Cestode from the intestines of a Common Porpoise.
- (2) On Nematodes observed in the viscera of a Common Porpoise.
- (3) On the injurious effects of parasites on fishes.

The following are descriptions of the various species mentioned above:—

CRUSTACEA.

COPEPODA-CALIGOIDA.

Genus *Pandarus*, Leach (1816).

In a previous paper* I gave a description and figures of *Pandarus bicolor*, Leach. These specimens had been obtained from the Tope, *Galeus canis*, Rondel. I have now to record the same kind of parasite from the Picked Dog-fish, *Squalus acanthias*, Linn. A considerable number of these fishes, captured off the West of Scotland and landed at the Fish Market at Aberdeen in March of this year (1908), were examined at the Laboratory at the Bay of Nigg. On these Dog-fishes quite a number of *Pandarus bicolor* were observed; they resembled those previously described in form and colour. Figure 19, Plate III., represents one of the specimens. The cephalon is ornamented by deep chocolate-brown pigment, as shown in the drawing; the middle plates are also coloured, but not so deeply. The body seen from above is elongated and somewhat elliptical in outline, but flat when seen from the side. Among the specimens of normal form and colour was one that differed from the others in both characters, but especially in colour. This specimen is represented by figure 18 on the same plate. This form resembles in some respects a species described in 1888 by Lay under the name of *Pandarus sinuatus*, and to that species I was at first inclined to ascribe it. Probably, however, it

* *Eighteenth Annual Report of the Fishery Board for Scotland*, Part III., p. 157, Pl. VI., figs. 33-38 (1900).

may only be a somewhat abnormal variety of the more common *P. bicolor*. This form has scarcely any trace of the brown colouration so conspicuous in *P. bicolor*; it is also rather broader in proportion to the length. The second dorsal plate is as wide as the posterior part of the cephalic shield, and the posterior margins of each of the two lobes is obliquely truncated instead of being rounded as in the normal form. The lobes of the next plate, which have their posterior margins somewhat evenly rounded, are separated by a semicircular hollow and are not spread so widely apart as in the normal *P. bicolor*. The anal lamina are also more prominent than in the normal form. Till further specimens of this pale-coloured form are obtained, I prefer to regard it as only an accidental variety of *P. bicolor*.

Genus *Hatschekia*, Poche (1902).

(syn. *Clavella*, Oken, nec. Cuvier).

Hatschekia cornigera, sp. n. Pl. III., figs. 1-7.

I found this Copepod moderately frequent on the gills of several specimens of Sea Bream, *Pagellus centrodonatus*, De la Roche, sent to the Laboratory from the Fish Market at Aberdeen. The species, however, does not appear to be generally common, for a considerable proportion of the fishes examined had their gills apparently free from the parasites.

Hatschekia cornigera is a small species, and measures only about 2.4 millimeters in length exclusive of the ovisacs, which are moderately elongated. It is, like some other species of the same genus, of a narrow elongated form (fig. 1), but may be distinguished from them by the cephalon being produced backwards in the form of a short blunt-pointed, spur-like process on the median dorsal aspect, as in the drawing (fig. 2), which shows a profile view of the head and part of the thorax.

The antennules are short, stout, and five-jointed, and sparingly setiferous, the third and last joints being shorter than the others (fig. 3).

The antennæ are small, but being armed with stout terminal hooked spines they form effective grasping organs (fig. 4).

The mandibles, maxillæ, and maxillipeds do not appear to differ greatly from the corresponding appendages of other members of the genus. Figure 5 represents one of the second pair of maxillipeds; they are each three-jointed, moderately elongated, and armed with a stout terminal claw which is bifurcated at the extremity; the second joint bears also a small curved spine near its proximal end; there is also a small seta at the base of the terminal claw.

The thoracic limbs comprise apparently only two pairs, as in other members of the genus. Both pairs are somewhat alike in structure, but the first are considerably smaller than the second pair. One of the first pair is represented by figure 6; it consists of a moderately stout, two-jointed basal part and two, two-jointed branches. The inner branch is rather shorter than the outer, and the first joint is shorter than the end one; in the outer branch the joints are nearly of equal length. Both branches are furnished with several stout spines. In the second pair, one of which is represented by figure 7, the inner branches are stouter and rather longer than the outer, and the end joint is about twice the length of the first. In the outer branch the end joint is the smallest. Both branches are furnished with a few terminal spines, one of which is considerably stouter and rather more elongate than the others.

The colour of the parasites resembles that of the gills of the fish.

Genus *Chondracanthus*, De la Roche.

Chondracanthus Williamsoni,* sp. n. Pl. III., figs. 8-17.

In this species the body is depressed, and of an ovate form when seen from above. Length about 7.5 millimeters, greatest width equal to about half the length. The head, which is articulated to the thorax, is subquad-rangular in its general outline, but has a shallow rounded projection on each side, as shown in the figure (fig. 8). There is only a slight constriction between the cephalon and the thorax, and the neck is very short. The thorax, which is considerably depressed, has the lateral margins coarsely crenulated, or lobate; there are about six rounded but somewhat irregular projections or lobes on each side, the second and the last three being more prominent than the others. The posterior end of the thorax also terminates in a narrowly rounded median lobe, as shown in the figure (fig. 8). The abdomen is much reduced in size and of a rounded form.

The antennules are small, unarticulated, and rather rudimentary in structure (fig. 10).

The antennæ are moderately large, and each consists of a stout basal part, to which is articulated a strong terminal hooked spine, the whole appendage thus forming a powerful grasping organ (fig. 11).

The mandibles are similar to those observed in other species of *Chondracanthus*; they consist each of a very short basal joint, and a terminal and broadly falciform masticatory part, both edges of which are finely serrated (fig. 12). The dilated appendage, armed with two short stout spines, situated at the base of the mandible, represents the maxilla (see fig. 12).

Both pairs of maxillipeds are very small. The first pair are very similar in structure to those of *Chondracanthus cornutus*; each consists of a moderately stout base and terminating in a straight claw-like spine, finely setose on the inner edge (fig. 13).

The second pair are rather larger than the first; they each consist of two joints of nearly equal width, but differing slightly in length, and armed at the apex with a short and claw-like spine and a small rounded process, as shown in the drawing (fig. 14).

There are only two pairs of thoracic limbs; both pairs are rudimentary, and are also similar in structure. Each limb consists of a short and broad basal part, gibbous on each side, which bears a small oblong process, separated from the basal part by a narrow constriction (figs. 15-16).

The ovisacs were not very slender, and appeared to be of moderate length, but they were more or less incomplete.

Figure 9 represents a young female which, though resembling the adult in having the lateral margins coarsely crenulated, differs in being proportionally narrower.

The male of this species is somewhat similar in form and structure to that of *Chondracanthus cornutus* (O. F. Müller). It is considerably dilated in front, but tapers towards the posterior end (fig. 17). The male is very small, being rather less than the $\frac{1}{40}$ of an inch in length.

The colour of this form is opaque white with a slight trace of red.

Host *Sebastes norvegicus* (Ascan.), from Aberdeen Fish Market, February 1908. Several specimens were found in the angles formed by the gill cover and gill-arches, with the claw-like antennæ of the specimens firmly fixed in the tissues of the host.

* After my colleague, Dr. H. C. Williamson, to whom I am indebted for this and several other species.

Sebastes norvegicus does not appear to be a very rare fish in the waters round the more northerly parts of the Scottish coasts, but the examples from which the specimens of *Chondracanthus* here recorded were obtained were captured in the vicinity of Iceland.

PLATYHELMINTHA.

TREMATODA.

Genus *Octobothrium*, Leuckart (1828).

Octobothrium Sybille,* sp. n. Pl. IV., fig. 12.

This is a small species, being only about two and a half millimeters in length. Like some others of the same genus, it is flat, elongated, and narrow. The anterior extremity is about half the width of the middle portion of the body, and is narrowly rounded in front. There are two small submarginal suckers on the ventral aspect, one being on each side and a little in front of the mouth, which is in the median line. From the anterior end the width gradually increases towards the middle, then tapers slightly posteriorly. The posterior end expands and assumes a fan-like outline, but with the apex truncated. Round each of the two lateral margins of the fan-like expansion are four prominent "suckers." Each sucker appears to be divided into two subequal portions, as shown in the drawing (fig. 12).

A single specimen of this species of Trematode was obtained on the gills of a Trout, *Salmo fario*, Linn., captured by Dr. H. C. Williamson in Loch Tay, Perthshire, in August 1901.

Genus *Distomum*.

Distomum cestoides, Ed. van Beneden. Pl. V., fig. 12; Pl. VII., figs. 3-5.

1870. *Distoma cestoides*, P. J. van Ben. Les Poissons des cotes de Belgique, p. 17, Pl. IV., fig. 9.

P. J. van Beneden, in the work referred to above, mentions the occurrence of a large trematode in the œsophagus of *Raia batis* captured on the coast of Belgium, which he records under the name of *Distoma cestoides*. A few specimens, comprising adults and young, of what appear to be the same species of the Trematoda have been observed in large *Raia batis* brought to the Fish Market at Aberdeen. One of the adult specimens is represented by the Photograph Plate VII., fig. 3. It measures nearly two inches in length and between five and six millimeters in diameter. The specimen is cylindrical in form, and the ventral sucker is situated near the terminal one. One or two of the other specimens were even longer than that photographed, the largest measuring about two and three-quarter inches in length.

It was observed that one or two of the larger specimens were deeply pigmented immediately posterior to the ventral sucker; these when dissected were found to contain ova in abundance; the ova were of a dark chocolate-brown colour, oval in form, and measured about $\cdot 1147 \times \cdot 0806$ mm. (Pl. V., fig. 12). Besides the mature specimens, others varying in size and evidently immature were also observed, the smallest of which being only six to eight millimeters long (Pl. VII. fig. 4).

* Sybilla, Queen of Alexander I. of Scotland and daughter of Henry I. of England, is buried in a small island near the east end of Loch Tay. *The Highland Tay*, by Hugh Macmillan, p. 80.

Several young specimens of a Distomum, which closely resemble the immature *D. cestoides* from the Skate, were found encysted on the walls of the stomach of a Witch Sole, *Pleuronectes microcephalus*, captured in the Moray Firth. There were several cysts observed, and all those examined contained only young Distomids—in some cases one, in others two examples. Two of the young forms and one of the cysts are shown on Plate VII., figs. 5 and 6; the figures are about twice the natural size.

Fishes form a considerable proportion of the food of large Skates, and probably the Witch Sole, which lives in moderately deep water, sometimes becomes the prey of these large Plagiostomes. Should this happen, the encysted Distomids will be liberated and reach maturity in the alimentary passages of their new host.

Several other large Distomids besides the one here referred to have been recorded as the parasites of various fishes. One of the largest, perhaps, was that obtained by Nardo in 1827, from a fish captured in the Gulf of Venice. Two specimens of this parasite were obtained, one of which measured five inches in length.* This species was named by Nardo *Distoma gigas*, but Dr. Cobbold, the English authority on Entozoa, considered that Nardo's *Distoma* belonged to the same species as that described by Rudolphi in his history of Entozoa published in 1808, under the name of *Distoma clavatum*.* The species described by Creplin as *Distomum veliporum* is also a moderately large one. It is said to attain a length of three inches, and as it has been recorded from the same species of Skate as those described above,† I was at first under the impression that those found by me might belong to that species.

Our specimens, however, agree better with van Beneden's figure in his work *Les Poissons des cotes de Belgique*, p. 17, Pl. IV., fig. 9., than with the description of *D. veliporum* in Diesing's *Systema Helminthum*. I have therefore provisionally ascribed our specimens to van Beneden's species *Distomum cestoides*.

It may be noted here that *D. veliporum* is apparently a widely-distributed species. Prof. E. Linton, of Washington and Jefferson College, U.S.A., has described in the proceedings of the U.S. National Museum (vol. xx., p. 521) a large *Distomum* from the stomach of a "Barudoor Skate," *Raia lowis*, captured at Wood's Hole, Massachusetts, which he ascribes to this species. This specimen, however, like that of *D. cestoides* recorded by van Beneden, was incomplete. The specimen recorded here is in fairly perfect condition.

CESTODA.

Genus *Bothriocephalus*, Rudolphi (1808).

Bothriocephalus proboscideus, Rudolphi. Pl. V., fig. 4.

1808. *Bothriocephalus proboscideus*, Rud., Entoz. Hist. Nat., vol. iii., p. 39.

1850. *Dibothrium proboscideum*, Dies., Syst. Helminth., vol. i., p. 590.

This Cestode was obtained in the intestine of a Trout captured in Loch Tay, in August 1901, by my colleague, Dr. H. C. Williamson. The

* See "Parasites," by T. Spencer Cobbold, M.D., p. 460; and "Systema Helminthum," Diesing, vol. ii., p. 366.

† Catalogue des Poissons des cotes de la Manche dans les environs de Saint-Vaast, par M. A.—E. Malard. Bull. Soc. Philomathique de Paris, 8 ed., Ser. t. II., p. 70 (1890).

drawing shows the anterior portion, including the head, of the specimen. The entire worm may reach a length of one or even two feet. *B. proboscideus* is one of the most common species of the genus, and is of frequent occurrence in Trout and Salmon, and, as Dr. Cobbold remarks, when the parasite is present in large numbers it cannot fail to prove injurious to the bearer.*

Bothriocephalus punctatus, Rudolphi. Pl. V., fig. 3.

1808. *Bothriocephalus punctatus*, Rud., Entoz. Hist. Nat., vol. iii., p. 50.

1858. *Dibothrium punctatum*, Dies., Syst. Helminth., vol. i., p. 593.

The specimen of *B. punctatus* represented by the drawing was obtained in the intestine of a common Eel, *Anguilla vulgaris*, Leach, captured at the mouth of the River Dee at Aberdeen in July 1905. The whole specimen measured 235 millimeters in length, or fully nine inches, but specimens double that length have been recorded. Only the head and anterior part of the body are represented by the drawing. In this species the head is elongated and narrow, and the articulations (proglottides) are also long and narrow. This parasite appears to be widely distributed, and common to a number of fishes. Professor Linton also records what he regards as the same species from several of the fishes frequenting the Atlantic coast of America, but the Eel does not appear among the various hosts mentioned by Diesing, van Beneden, or Linton. *B. punctatus* is found sometimes abundant in the Turbot, *Rhombus maximus*. I found the stomach of a large and fine Turbot crowded with them; they formed a living mass, so inextricably mixed up together, that it was almost impossible to separate one of the specimens without breaking. They extended from the stomach down into the intestines. J. P. van Beneden records this parasite as abundant in the Turbot, and states that it "est tout aussi abondant dans le Turbot de la Méditerranée."† Linton records the parasite from the Sand Flounder, *Bothus maculatus*, from Woods Holl, Massachusetts; one of the longest specimens, preserved in alcohol, measured 223 millimeters; a considerable number of specimens were also found in the stomachs of Sea Raven, *Hemitripterus americanus*, the largest of which measured about 300 millimeters.‡ In report No. XIV. on the Lancashire Sea-Fisheries Laboratory, Mr. J. J. Johnstou describes two forms of *B. punctatus*, one of which he finds in Turbot captured in the Irish Sea, and the other, which is more slender, in the Brill. He has counted over sixty specimens in a single Turbot.§

Genus *Ancistrocephalus*, Monticelli (1890).

Ancistrocephalus microcephalus (Rudolphi). Pl. V., fig. 5; Plate VI., fig. 2.

1819. *Bothriocephalus microcephalus*, Rud. Entozoorum Synopsis, pp. 138, 473.

1850. *Dibothrium microcephalum*, Dies., loc. cit., vol. iii., p. 592.

This species was obtained from a Short Sunfish, *Orthogoriscus mola*, landed at the Aberdeen Fish Market in September 1899. The worms

* Parasites, a Treatise on the Entozoa of man and animals, p. 468.

† Les Poissons des cotes de Belgique, p. 73.

‡ Notes on Cestode parasites of fishes, Proc. U. S. National Museum, vol. xx., p. 430.

§ Report for 1905 on the Lancashire Sea-Fisheries Laboratory (1906), p. 152.

were still alive when observed, and appeared to be endeavouring to leave the fish, and making their exit by the mouth. In this species the head is comparatively small and compressed and provided with two nearly circular suckers placed opposite each other on the flattened sides, as shown in the drawing (Plate V., fig 5). Each of the suckers measure about 5 mm. in diameter, and they are surmounted by a slightly projecting ledge armed on the under side with numerous minute hook-like denticles.

One incomplete specimen measured about 26 inches in length, and another about half that length, (Pl. VI., fig. 2). According to Diesing, this Cestode may attain a length of six feet. It has been recorded by Rudolphi from *Orthogoriscus mola*, captured in the Mediterranean. Prof. Linton also records this species, and mentions one of the specimens as being 150 centimetres long (nearly sixty inches). Van Beneden records the same worm from the coast of Belgium, and states that he has seen a score of individuals in a single fish,* while Malard also records it from the coast of La Manche, and apparently all from the same species of Sunfish.

Genus *Schistocephalus*, Creplin (1829).

Schistocephalus solidus (O. F. Müller). Pl. VII., figs. 7-8.

1776. *Tenia solida*, O. F. Müller, Zool. Danicæ Prodromus, pp. 26-37.
 1808. *Bothriocephalus solidus*, Rud., Entozoorum, Hist. Nat., p. 54.
 1829. *Schistocephalus dimorphus*, Crep., Nov. obs. de Entoz., p. 95.
 1850. *Schistocephalus dimorphus*, Dies., Syst. Helminth., vol. i., p. 584.
 1893. *Schistocephalus dimorphus*, Ölsson, Bidrag till Skand Helminth fauna, ii., p. 15.
 1896. *Schistocephalus solidus*, F. W. Gamble, in the Camb. Nat. Hist., vol. ii., p. 84.

The three-spined Stickleback, *Gasterosteus aculeatus*, is a little fish not uncommon in the Loch of Loirston, near the village of Cove, Kincardineshire. On visiting this loch towards the end of May 1901, my colleague, Dr. H. C. Williamson, found a large proportion of the Sticklebacks infested with worms, so much so that many of the little fishes had their abdomens distended with the parasites, causing them to assume an abnormal appearance. Many of the fishes examined had the entire abdominal cavity occupied by the parasites. In some cases there was only a single worm of large size, folded upon itself two or three times, and which, when straightened out, was much longer than the fish. In other cases two, and sometimes several, specimens were present, but these were generally of smaller size.

The loch is frequented by a number of water-birds such as Sea-gulls and Terns, and the Heron is also occasionally observed about the loch. These birds are liable to be infested with the tape-worm, *Schistocephalus solidus*, Rudolphi, in its sexually-mature stage, and the Stickleback parasite mentioned above is the same worm in its sexually-immature condition.

It is thus evident that some of the birds frequenting the loch had been giving shelter to the *Schistocephalus*, and that larvæ hatched from the

* Les Poissons des cotes de Belgique, 87.

eggs produced by the mature worm had found their way by some round-about road to the abdomen of the fish, there to continue the cycle of their curious and highly interesting life-history.

Figure 7, Plate VII., is a photograph of one of the little fishes infested with the parasite showing the distended abdomen, and figure 8 is the photograph of another fish showing the worms *in situ*.

This Cestode is apparently widely distributed; not only has it been recorded under one or other of its different names by European writers on Helminthology, but Prof. Edwin Linton mentions its occurrence in the abdominal cavity of the Blob, *Cottus bairdii*, captured in Swan River, Montana, August 3rd, 1891. (Proc. U.S. National Museum, vol. xx., p. 427, pl. xxviii., figs. 4-5.)

Genus *Tetrarhynchus*, Rudolphi (1808).

Tetrarhynchus megacephalus, Rudolphi. Pl. IV., figs. 9-10; Pl. VI., fig. 3.

1819. *Tetrarhynchus megacephalus*, Rud. Entozoorum Synopsis, p. 129 et 447. Tab. II., fig. 7-8.

1878. *Tetrarhynchus megacephalus*, Van Ben., Pois. d. cotes. d. Belgique, p. 12, Pl. VI., figs. 8, 9-15.

This *Tetrarhynchus* is one of the largest of this curious group of parasites; the specimen represented by the photograph (Pl. VI., fig. 3) measured about eighteen inches in length, and nearly half an inch in width. It was obtained by my son in the intestine of a Greenland Shark, *Scimnus borealis*, Flem., captured at the mouth of the Forth estuary many years ago. This parasite has also been found, but in a sexually-immature state, in the Blue Shark, *Carcharias glaucus*, and some other species of the shark family,* but though it appears to be limited in its distribution chiefly to that group of Selachians, it has also been recorded as occurring in other fishes, one of which is *Scorpaena porcus*, a Mediterranean fish. Van Beneden remarks that the same worm, or a near ally, has been found on the gills of a Sparoide, as well as in the mouth of a turbot; but, he adds, "Dans cette situation le ver est errant." †

Tetrarhynchus tetrabothrius, P. J. van Beneden. Pl. IV., fig. 11.

1850. *Tetrarhynchus tetrabothrium*, van Ben., Les Vers Cestodes, *l'Acad. Roy. de Belgique*, Tom. XXV., p. 154, Pl. XVIII.

This was obtained in the intestine of Picked Dog-fishes, *Squalis acanthias*, Linn., examined at the Laboratory in March 1902. The fishes had been captured in the North Sea and landed at the Fish Market at Aberdeen. In these Dog-fishes this parasite was of frequent occurrence, being observed in nearly all the specimens examined. Van Beneden also records the occurrence of this Cestode in the same species of Dog-fish, as well as in *Mustelus vulgaris*, taken off the coast of Belgium. ‡ Olsson has recorded *T. tetrabothrius* from Picked Dog-fishes captured in the Skagar-

* This *Tetrarhynchus*, in Dr. Baird's catalogue of Entozoa in the British Museum, is recorded from a large Spotted Dog-fish, *Scyllium catulus* (p. 68).

† Les Poissons des cotes de Belgique, p. 5.

‡ Les Poissons des cotes de Belgique, pp. 6-10.

rack and Öresund * and Johnston from similar Dog-fishes and from Thornback Skates, trawled in the Irish Sea.†

Tetrarhynchus minutus, P. J. van Beneden. Pl. V., figs. 7-8.

1850. *Tetrarhynchus minutus*, van Ben., Les Vers Cestodes, p. 157, Pl. XX.

This Cestode was obtained in the intestine of an Angel-fish, *Squatina angelus*, captured in the Firth of Clyde in May 1904; it is a small species and easily overlooked. As indicated above, this species was described by van Beneden in 1850, and the characters by which he distinguishes it are as follows:—"Les bothridies ne sont pas complètement séparées les unes des autres; les trompes sont couvertes de crochets recourbés; les gaines des trompes forment des tours de spire; les segments sont très-longs et peu nombreux," and he adds that the species may be recognised from closely-allied forms by its small size, the length of the segments, which are several times longer than broad, and the number of articulations, which seldom exceed six, the last segment being already mature when five or six rings can be counted, whereas in other species mature segments do not usually occur till a larger number of rings have been formed. Van Beneden's specimens of *T. minutus* were also obtained from *Squatina angelus*, which appears to be the only kind of fish this Cestode has been recorded from.

Another species of *Tetrarhynchus*—*T. erinaceus*, P. J. Van Beneden, described in 1858,‡ has been noticed in fishes examined at the Laboratory, usually in small cysts on the walls of the stomach, and pyloric cæca of Gadoids (Cod-fishes and Saithe). *T. erinaceus*, in this encysted state, according to van Beneden, is unable to attain sexual maturity, and is therefore placed by him among the *zenosites* or strangers—parasites that have not yet reached their ultimate destination, or, as that author remarks, "Ce sont des parasites en transit." The encysted *Tetrarhynchus* can only reach the sexually mature stage after it has been transferred to the stomach of some Plagiostome, and the fish belonging to that group in which the parasite has been most frequently observed in a sexually mature condition is the Thornback Skate, *Raja clavata*. The proboscides do not appear to be exerted while the parasite remains within its cyst, but when removed from it and placed in a little sea-water the Cestode, apparently recognising the change in its environment, soon begins to push out its formidably armed proboscides. So far as I have observed, the thrusting out of these armed appendages is not completed by a continuous movement, but intermittently, as if the operation were a work of some difficulty, and that a pause was necessary for further effort. I have also observed that, though the fish may have been dead for a good while, the encysted parasite would be still alive, and on being removed from its prison would in a short time begin to thrust out its proboscides. *T. erinaceus* is a widely-distributed species, either in its encysted state or in its state of sexual-maturity, for it has been recorded not only by van Beneden, Ölsson, and other European Helminthologists, but also by Linton in his papers on the Entozoa of American fishes.

Two of the species of *Tetrarhynchus* mentioned here—*T. tetrabothrium* and *T. minutus*—have also been assigned to the genus *Rhynchobothrium*, Rudolphi, but meanwhile I leave them where van Beneden placed them.

* Bidrag till Scandinaviens fauna, Kongl. Sr. vet. Akad. Handl., Bd. 25, No. 12, p. 25 (1893).

† Rept. for 1905 of the Lancashire Sea Fisheries Laboratory, p. 174 (1906).

‡ Mem. sur les Vers intestinaux, p. 128, Pl. XVIII.

Genus *Phyllobothrium*, P. J. van Beneden (1850).*Phyllobothrium thridax*, van Beneden. Pl. V., fig. 9.1850. *Phyllobothrium thridax*, Les Vers Cestodes, p. 122, Pl. V.1906. *Phyllobothrium thridax*, Johnston, Report for 1905 of the Lancashire Sea Fisheries Laboratory, p. 161.

This Cestode was obtained in the intestine of the same fish in which the *Tetrarhynchus minutus* was observed, viz., in *Squatina angelus*, captured in the Clyde near Girvan in May 1904. The specimen was small and appeared to be immature, though possessing the characters of the species.

Van Benden obtained *P. thridax* also in the Angel-fish, as well as in *Raia batis*, and Johnston records it from *Raia clavata* captured in the Irish Sea. Olsson has recorded the same Cestode from *Raia batis* captured in the Öresund, and Lönnberg and Monticelli have also recorded it, but it does not appear to be so common as some of the others mentioned here.

Phyllobothrium lactuca, P. J. van Beneden. Pl. V., fig. 1.1850. *Phyllobothrium lactuca*, van Ben., *op. cit.*, 120, Pl. IV.1906. *Phyllobothrium lactuca*, Johnston, *op. cit.*, p. 159.

This was also observed in the Angel-fish from the Clyde mentioned above. Johnston records it from *Raia batis*, *Raia clavata*, and *Raia circularis* captured in the Irish Sea. Van Beneden states that it is common in the Smooth Hound, *Mustelus vulgaris*, and records it also from the Picked Dog-fish, the Grey Skate, and the Thornback, and Malard records it from *Trygon vulgaris* and one or two of the Plagiostomes already referred to

Genus *Acanthobothrium*, P. J. van Beneden (1849).*Acanthobothrium coronatum* (Rudolphi). Pl. V., fig. 2.1819. *Bothriocephalus coronatus*, Rud., Entozoorum Synopsis, p. 141.1850. *Acanthobothrium coronatum*, van Ben., *op. cit.*, p. 129, Pl. VIII. and IX.1906. *Acanthobothrium coronatum*, Johnston, *op. cit.*, p. 155.

I obtained this species in specimens of Grey Skate, *Raia batis*, from the Fish Market, Aberdeen, in March 1901. The specimen, of which only the head (or scolex) is represented by the drawing (fig 2), measured sixty-five millimeters in length. One of the more important characters by which *A. coronatum* is distinguished seems to be the presence of a group of three suckers above each of the four *bothria*. These accessory groups of suckers form a sort of crown on the apex of the scolex, while immediately beneath each group two moderately strong bifid hooks may be seen, as indicated in the drawing.

This species is found in the sexually-mature stage in various sharks and rays, and is apparently widely distributed. The following European fishes are mentioned among the hosts of this Cestode:—*Scyllium cancula*, the lesser Spotted Dog-fish; *Mustelus vulgaris*, the Smooth Hound; *Squatina angelus*, *Trygon pastinaca*, *Torpedo marmorata*, *Raia batis*,

and *Raia clavata*; while Linton records the same parasite from the Barn-door Skate, *Raia laevis*, captured at Woods Hole, Massachusetts.

Genus *Dinobothrium*, P. J. van Beneden (1889).

Dinobothrium septaria, van Beneden. Pl. VI., fig. 4.

1889. *Dinobothrium septaria*, van Ben., Bull. l'Acad. Roy. de Belgique, 3me. série., tom. 17, p. 69, Pl. I., figs. 1-3.

The specimen represented by the photograph Plate VI., figure 4, is from the intestine of a Porbeagle Shark, *Lamna cornubica*, captured in the North Sea in May 1901. The specimen measures about forty-five millimetres in length. Each pair of bothria measure about nine millimetres across by about seven millimetres in length. This Cestode is readily distinguished by the peculiar form and arrangement of the bothria from all other species belonging to this group of parasites. As the species does not appear to have been previously recorded from Scottish waters, it may be of interest to give the following extract from Prof. van Beneden's description. The scolex, he says, is surrounded with four bothria, as in the majority of the Cestodes of Sharks and Rays; these bothria are placed back to back, and possess no appearance of hooks. The worms having been preserved in alcohol had become somewhat contracted, and the form of the bothria was not unlike a shell of the genus *Septaria*. These bothria are large, of an oval form, and attached by the whole length of their base; the external face is concave and crowned above by a projection which in some respects resembles the hinge of certain bivalve shells.*

The specimens recorded by van Beneden measured twenty-five to thirty millimeters, and were thus considerably smaller than the specimen recorded here.

Genus *Diplobothrium*, P. J. van Beneden (1889).

Diplobothrium simile, van Beneden. Pl. VII., fig. 2.

1889. *Diplobothrium simile*, van Ben., *op. cit.*, p. 70, Pl. I., figs. 4-8.

A specimen of a Cestode that appears to belong to this species is represented by the photograph, Plate VII., figure 2. This, like the species just described, was obtained in the intestine of the same Porbeagle Shark in which the other was found. The specimen measured fully 70 millimeters in length—nearly three inches.

This Cestode was described by van Beneden at the same time as the *Dinobothrium*, and was also found in a Porbeagle Shark. The Scolex or "head" does not at first sight present so remarkable a form as the *Dinobothrium*, but its structure suggests a more or less near relationship with species already known to science. A closer examination, however,

* Le scolex est entouré de quatre bothridies, comme dans la plupart des Cestodes de poissons Plagiostomes; ces bothridies sont placées dos à dos et ne possèdent aucune apparence de crochets. Dans l'état de conservation actuelle des vers, contractés par l'alcool, elles ressemblent, à une coquille du genre *Septaria*.

Les bothridies sont larges, de forme ovale, attachées par toute la largeur de la base, la face externe concave et couronnées en haut par une saillie qui rappelle jusqu'à un certain point, la charnière de certaines coquilles bivalves. Van Beneden, *op. cit.*, p. 69.

reveals certain interesting differences, which are fully described by Professor van Beneden in the paper referred to, published in the Bulletin of the Royal Academy of Belgium for 1889.

In this paper he remarks that at first sight it suggested to him a likeness to *Tetrabothrium maculatum*, Ölssohn, a form previously recorded from the same kind of fish, and therefore he gave the species the name of *Diplobothrium simile*—the generic name *Diplobothrium* referring to the peculiar arrangement of the bothria. He states further that “ce qui caractérise surtout ce genre, c’est qu’il a, comme le précédent, une cloison complète entre les deux couples of bothridies; cette cloison présente à son sommet quatre pièces qui semblent fournir des points d’appui à la couche musculaire; sous certains aspects, ce Cestode ressemble beaucoup au Cestode, dont nous venons de parler, et qui a été décrit par Ölssohn; mais les organes qui lui ont fait donner le nom de *Tetrabothrium* sont complètement isolés, tandis que dans le *Diplobothrium* ils sont réunis deux par deux; à l’extérieur on croirait voir par moments quatre orifices parfaitement séparés, tandis qu’en réalité il y’a, de chaque côté, une séparation qui ne s’étend pas jusqu’au bord des orifices.”

Genus *Abothrium*, P. J. van Beneden (1870).

Abothrium rugosum (Goeze).

1782. *Taenia rugosa*, T. A. S. Goeze, Versuch siner Naturg. der Eingeweidervürmer thierscher Körper, p. 411. Tab. xxxiii., figs. 1-5.

1808. *Bothriocephalus rugosus*, Rudolphi, Entoz. Hist. Nat., Vol. III., p. 42.

1850. *Dibothrium rugosum*, Diesing, Syst. Helminth, Vol. I., p. 591.

1870. *Abothrium gadi*, van Beneden, Poissons des cotes de Belgique, p. 56, Pl. V., fig. 14.

This Cestode appears to be common in the sexually-mature stage in the larger gadoids. Its head is invariably inserted in one of the cæcal tubes and so intimately incorporated with its tissues as to have the appearance of forming an integral part of the tube. For this reason, the attempts made to remove the head of the worm from the tissues of the pyloric cæca have usually ended in failure, and no satisfactory description of this part of the worm has yet been published.

The piercing of the wall of the pyloric cæca by the head of the Cestode produces certain curious results; the cæcal tube becomes distorted sometimes to a considerable extent, nodular processes are formed, and frequently, as remarked by Linton, a yellowish waxy deposit is formed consisting of the degenerated tissue of the cæca. The worm, which extends from the cæcal tube to the intestine, is often in the larger fishes of considerable length; specimens from such fishes sometimes reach to twenty-five and thirty inches, but as, like most other Cestodes, they are very contractile, the specimen that may, while living, stretch to thirty inches will be found to be little more than half that length when preserved, especially if the preservative be alcohol. Linton records a specimen 65·5 millimeters in length, while Johnston obtained one that measured 85 centimeters,* equal to about 34 inches.

* Report for 1906 on the Lancashire Sea Fisheries Laboratory, p. 171.

Genus *Taenia*, Linné.

Taenia sp. Pl. V., figs. 10–11.

A specimen of a Cestode that appears to belong to the genus *Taenia* was obtained in the intestine of an Eel captured in the Loch of Loirston, near Cove, Kincardineshire, in 1901. The specimen measured about 75 mm. in length, and was moderately slender. The head seen in front is obscurely quadrangular, with the bothria occupying the bluntly-rounded corners, and nearly equidistant. In the centre is a minute stellate disk, somewhat difficult to make out. The bothria are circular, surrounded by a muscular ring, and with a membrane extending over the inner half. The head appears to be unarmed. This specimen has some resemblance to a form mentioned by Linton found in the intestine of "*Anguilla chrysypa* (*Anguilla vulgaris*)," and named by him *Taenia dilatata*.* The Loch of Loirston specimen may belong to this species, but I scarcely think so; the *T. dilatata* Linton, shows the front aspect of the head made uneven by shallow "dilatations" which is not the case with the specimen recorded here. I therefore prefer for the present to leave the species unnamed.

NEMATHELMINTHA.

Sub-Order ACANTHOCEPHALA, Rudolphi.

Genus *Echinorhynchus*.

Echinorhynchus proteus, Westrumb. Pl. IV., figs. 3–4; Pl. VI., fig. 1.

1821. *Echinorhynchus proteus*, Westrumb, De Helminth. Acanth., p. 37, tab. 1, figs. 11–12.

1850. *Echinorhynchus proteus*, Diesing, Syst. Helminth., Vol. II., p. 57.

This curious species was observed in the intestine of an Eel, *Anguilla vulgaris*, Cuv., captured near the mouth of the River Dee at Aberdeen in July 1905. In this species the proboscis is short and feebly armed; it is also sub-clavate in form, rather linear or cylindrical. Immediately posterior to the proboscis is a large bulb-like expansion (or *bulla*), which the parasite seems to have the power to compress or dilate at will, for it can insert not only the proboscis but the *bulla* also into the tissues of the muscus membrane of the intestine, as shown by the photograph (Pl. VI., fig. 1). This figure represents a small portion of the inner surface of the intestine of of the Eel with two *Echinorhynchi in situ*; the proboscis and *bulla* of the parasites are entirely immersed in the substance of the intestinal wall. A careful examination of the fish revealed the fact that in a few instances the proboscis of the parasite had pierced right through the intestine so that the apex of the proboscis could be easily seen projecting slightly on the outside surface of the wall of the intestine.

Between the *bulla* and the body of the Cestode there is a long slender neck, and both the *bulla* and the neck are unarmed.

The length of the specimen represented by the drawing (Pl. IV., fig. 3), is sixteen millimeters, or fully half an inch.

* Parasites of Fishes of the Woods Hole region, U.S. Fish Commission Bull. for 1899, p. 435, Pl. XXV., figs. 272–273.

Echinorhynchus proteus, being a widely distributed and apparently a somewhat variable form, has been described under many different names. It has also been recorded from many kinds of fishes, both marine and freshwater; at least over forty different kinds are mentioned as being the hosts of this worm.*

Echinorhynchus acus, Rudolphi. Pl. IV., figs. 7-8.

1808. *Echinorhynchus acus*, Rudolphi, Entoz. Hist. Nat., Vol. II., p. 279.

1850. *Echinorhynchus acus*, Dies., Syst. Helminth., Vol. II., p. 39.

Many examples of this *Echinorhynchus* were observed in the intestine of a large cod-fish captured in the Moray Firth in June 1897, and though frequently observed at other times and places, the species has not been represented so numerously as on that occasion. They were found fairly numerous in the intestine of a saith captured recently in the nets of the salmon fishers working near the Laboratory.

Although the hosts of *Echinorhynchus acus* are said to include a number of different kinds of fishes such as *Cottus scorpius*, the Conger, the Angler-fish, and one or two kinds of flat-fishes, this parasite seems to be more frequently met with in Gadoids than in any other fishes captured off the coasts of Scotland.

In this species the hooks with which the proboscis is armed are numerous and large; they are arranged in close set and slightly oblique rows. There are about twenty hooks in a complete series extending once round the circumference, but scarcely half that number are in view at one time. Each hook is bent backwards at a sharp angle, as shown in the drawings (figs. 7 and 8). The length of this species, as given by Diesing, is from one to three inches; the largest I have noticed, however, scarcely exceeded 50 millimeters in length.

The *Echinorhynchus* represented by the drawings, figures 5 and 6 on Plate IV., was obtained in the intestine of a common Trout captured in Loch Tay in August 1901. The number of hooks in the series is rather less than in the specimen from the Gadoid—the number in view at one time being eight. But it so closely resembles *Echinorhynchus acus* that it is probably only a variety or a slightly immature form of that species.

Echinorhynchus agilis, Rudolphi. Pl. IV., figs. 1-2.

1819. *Echinorhynchus agilis*, Rud., Entozoorum, Synopsis 67 et 316.

1850. *Echinorhynchus agilis*, Diesing, Syst. Helminth., Vol. II., p. 35.

Diesing's definition of this species is as follows:—"Proboscis clavata, uncinorum seriebus 3. Collum brevissimum inerme. Corpus utrinque attenuatum, densissime transversim striatum. Longit. 2-3." And he mentions as the hosts of this entozoon *Mugil cephalus*, captured at Spezia (Gulf of Genoa), and *Mugil labeo*, captured at Remi. This description by Diesing applies fairly well to an *Echinorhynchus* observed in the intestine of a Grey Mullet, *Mugil chelo*, captured in the nets of the salmon fishers near the Laboratory in June 1900. One of the specimens is repre-

* Linton has also observed *E. proteus* in a number of American fishes.

sented by the drawings (figs. 1 and 2, Pl. IV.). The body tapers slightly towards both ends, and is marked by numerous transverse striæ, and thus far it agrees with the definition of *E. agilis* of Diesing; there seems, however, to be a slight difference in the number of hooks on the proboscis, of which there are apparently six in the series instead of three. The hooks as shown in the drawing are of moderate size; those surrounding the summit of the short truncated proboscis extend more or less outwards, while the others, which spring from about the middle and have stout gibbous bases, are turned downwards.

I was at first inclined to ascribe this form to *Echinorhynchus gracilis*, van Beneden, as the proboscis and its armature resemble somewhat closely that author's figure in Plate V. of his work on the Fishes of the Coasts of Belgium,* which species he also obtained in the intestine of *Mugil chelo*, but I scarcely think that van Beneden's *E. gracilis* can be the species of that name which Diesing ascribes to Rudolphi, for Diesing's definition of Rudolphi's *Echinorhynchus gracilis*, is as follows:—"Proboscis cylindrica, uncinorum minorum seriebus, 10-12. Collum nullum. Corpus cylindricum retrorsum attenuatum,"† and there is no reference to transverse striæ. Moreover, the *Echinorhynchus gracilis*, Rudolphi, is, according to Diesing, found in the intestine of a bird, *Coracias garrula*, Linn. et Gmel. I have, therefore, for the several reasons stated, referred our specimens to *Echinorhynchus agilis*, Rudolphi.

SOME ADDITIONAL NOTES.

(1) ON A LARGE CESTODE FROM THE INTESTINES OF A COMMON PORPOISE.

Diphyllobothrium stemmacephalum, Cobbold, Pl. V., fig. 6; Pl. VII., fig. 1.

1858. *Diphyllobothrium stemmacephalum*, Cobbold, Trans. Linn. Soc., vol. xvii., p. 167.

1879. *Diphyllobothrium stemmacephalum*, idem, Entozoa of Man and Animals, p. 422.

This large Cestode was obtained in the intestines of a Common Porpoise, *Delphinus phocaena*, cast ashore in front of the Laboratory at the Bay of Nigg. The porpoise had become entangled in the nets belonging to the salmon fishers, and being unable to extricate itself had been drowned. Dr. Cobbold, who described the Cestode in 1855, and who also obtained it in the same species of Cetacean, states that "the small intestine of the Porpoise was completely choked for the space of eight or nine feet by fine tapeworms so closely packed together that the gut presented the appearance of a solid cylinder." These tapeworms, he remarks, were of various sizes; four of them measured respectively from seven to ten feet in length, while a fifth was only eighteen inches.

The Porpoise cast ashore near the Laboratory, and which I had the privilege to examine, had the small intestine also crowded with the same kind of parasites, and so much so that it seemed to be impossible that any matter could pass, yet the Cetacean had the appearance of being in perfect health. The removal of the parasites in anything like a complete condition was very difficult owing to their great length, their being so crowded together, the extreme attenuation of the anterior end with its

* Les Poissons des cotes de Belgique, p. 28, Pl. V., fig. 7 (1870).

† Systema Helminthum, vol. ii., p. 37 (1850).

minute head, and the readiness with which the lower "joints" (proglottis), separated from each other. The longest example I obtained measured fully nine feet, and appeared to be fairly complete. Another specimen reached to about seven feet in length, and there were a number of smaller pieces.

The proglottides or "joints" near the middle and towards the posterior end of the larger specimens measured from ten to twelve millimeters in width and nearly the same in length. The head or scolex seen in profile is very compressed, but viewed in front its outline is somewhat triangular, and the suckers—two in number—occupy the two sides of the triangle, as shown in the drawing (fig. 6, Plate V.). The neck is extremely slender, measuring only about .08 mm. in width.

There appears to be very little known concerning the life-history of this Cestode, but probably in its larval stage it lives encysted in the body of some species of fish such as the whiting, considerable numbers of which are sometimes captured by this Cetacean for food; the Cestode being in this way introduced into the stomach of the Porpoise would obtain its freedom and be able ere long to attain to sexual maturity in the intestine of its new host.

Figure 1, Plate VII., is from a photograph, about natural size, of the largest of the specimens of the *Diphyllobothrium*, from the Porpoise referred to. The Cetacean was obtained in May 1900.

(2) ON NEMATODES OR THREADWORMS OBSERVED IN THE STOMACH AND OTHER VISCERA OF A COMMON PORPOISE.

In another Porpoise obtained on June 18th, 1902, under much the same conditions as the one mentioned above, no Cestodes of any kind were observed, but in the stomach and some of the other internal organs many small threadworms were noticed. The length of some of these measured between forty-five and fifty millimeters, but the majority were considerably smaller. The worms occurred in abundance in the stomach and other portions of the viscera, and were of a dull reddish-brown colour.

Strongyloid Nematodes, known as Lung-worms, are found parasitic in the Common Porpoise; they are all viviparus. Three species have been recorded, *Prosthecosacter inflexus*, Diesing, measuring 6 to 9 inches in length; *P. minor*, Diesing, the length of which is about an inch; and *P. convolutus*, Diesing, the length of which may extend to a little over one and a half inches (18–20^m).

Dr. Cobbold, referring to these worms, states that when "they are examined in a fresh state the young may occasionally be seen escaping from the vagina, that Professor van Beneden noticed this phenomenon in *Prosthecosacter inflexus*, and the same was observed by Busk in *P. convolutus*."*

The Entozoa from the Porpoise examined at the Laboratory in 1902, like those mentioned above, are apparently also viviparus, and they agree fairly well with the species last named—*P. convolutus*, Diesing.

Though the specimens when removed from the Porpoise were still alive, they had to be put into preservative fluid straight away, and therefore I had not the good fortune to observe the phenomenon referred to by Cobbold. Afterwards, however, when a few of them were dissected, fully formed larvæ were obtained in considerable numbers.

Figure 13, Plate V., represents the posterior portion of a female specimen showing the larvæ *in situ*. Figures 13 a., b., and c. represent three

* Entozoa of Man and Animals, p. 423.

of the larvæ greatly enlarged, while figure 6, Plate VI., represents a small portion of the viscera crowded with the parasites and figure 7 on the same plate shows a few of them separated out; both of these figures are from photographs enlarged about twice the natural size.

Like most of the Entozoa mentioned in the preceding notes, these parasites of the Porpoise are in their early stages probably migrants, but little or nothing appears to be known concerning their life-history. In Dr. Cobbold's opinion "it is highly probable that the embryos enter the bodies of various fishes before they acquire sexual maturity. Thence they will be passively transferred to the stomachs of cetacea, whence they bore their way through the tissues to the bronchi and pulmonary vessels," and thus reach the goal of all their wanderings—an environment where they can accomplish the purpose of their life, viz., the development of young, on which in their turn will devolve the responsibility for their continuance of the species.

(3) ON THE INJURIOUS EFFECTS OF PARASITES ON FISHES INFESTED BY THEM.

In the many cases of parasitism that have come under my observation, I have usually been unable to notice any very serious results produced by the presence of such unbidden and, perchance, unwelcome guests. Occasionally evidence of injury apparently caused by them has been obtained.

Whittings and other Gadoids have been captured reduced almost to skin and bone, having one or more large worm-like *Lernæa* hanging at their gills full of the red blood they had extracted therefrom. Yet, even in cases like these, it may be a moot point whether the emaciation is caused by the *Lernæa*, or that their presence is simply owing to the emaciated condition of the fish—the emaciation itself being due to other causes—which by reducing the fishes' vitality has left it more exposed to the attacks of these parasites. But though there may be no direct proof that the emaciated condition referred to was caused by these crustacean parasites, their presence doubtless tended to aggravate the trouble, and the same may be said about the attacks of parasites in other directions. The next example of parasitism to which I have to refer shows how these vermin (fishermen have a more suggestive name for them) may be injurious to fishes in other ways. Figure 5, Plate VI., reproduced from a photograph, represents the pectoral fins of a flounder infested with crustacean parasites, *Lepeophtheirus pectoralis*. They are so numerous that a large portion of both fins is covered by them. The soft tissues of the fins, more especially round the edges and between the spiny rays, was extensively lacerated, and this with the added encumbrance of so many beasts hanging on to them must have interfered greatly with their movements. These parasites are usually found adhering to the underside of the fins, and in this position they are more sheltered and less likely to be rubbed off, and the irritation they may produce will be the more exasperating.

A careful scrutiny of the photograph shows considerably over a hundred specimens of the *Lepeophtheirus* adhering to the pair of fins; they are so crowded towards the outer edges of the fins that they overlap each other two or three deep, and the delicate margin of the fins has been destroyed.

EXPLANATION OF THE PLATES.

PLATE III.

Hatschekia cornigera, sp. n.

Diam.

Fig. 1.	Female, dorsal view,	-	-	-	-	-	×	40
Fig. 2.	Female, side view of cephalothorax,	-	-	-	-	-	×	80
Fig. 3.	One of the antennules,	-	-	-	-	-	×	410
Fig. 4.	One of the antennæ,	-	-	-	-	-	×	410
Fig. 5.	One of the maxillipeds,	-	-	-	-	-	×	550
Fig. 6.	Foot of first pair,	-	-	-	-	-	×	550
Fig. 7.	Foot of second pair,	-	-	-	-	-	×	410

Chondracanthus Williamsoni, sp. n.

Fig. 8.	Female, dorsal view (adult specimen),	-	-	-	-	-	×	12
Fig. 9.	Female, dorsal view (specimen scarcely mature),	-	-	-	-	-	×	13½
Fig. 10.	One of the antennules,	-	-	-	-	-	×	72
Fig. 11.	One of the antennæ,	-	-	-	-	-	×	72
Fig. 12.	Mandible and maxilla,	-	-	-	-	-	×	200
Fig. 13.	First maxilliped,	-	-	-	-	-	×	144
Fig. 14.	Second maxilliped,	-	-	-	-	-	×	144
Fig. 15.	One of the first pair of thoracic appendages,	-	-	-	-	-	×	36
Fig. 16.	One of the second pair,	-	-	-	-	-	×	36
Fig. 17.	Male, side view,	-	-	-	-	-	×	120

Pandarus bicolor, (?) var.

Fig. 18.	Female, dorsal view,	-	-	-	-	-	×	12
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Pandarus bicolor.

Fig. 19.	Female, dorsal view,	-	-	-	-	-	×	12
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PLATE IV.

Fig. 1.	<i>Echinorhynchus agilis</i> , Rudolphi,	-	-	-	-	-	×	15
Fig. 2.	Proboscis of the same,	-	-	-	-	-	×	136
Fig. 3.	<i>Echinorhynchus proteus</i> , Westrumb,	-	-	-	-	-	×	12½
Fig. 4.	Proboscis of the same,	-	-	-	-	-	×	72
Fig. 5.	<i>Echinorhynchus</i> , sp. from a common trout,	-	-	-	-	-	×	10
Fig. 6.	Proboscis of the same (6a a spine more enlarged),	-	-	-	-	-	×	50
Fig. 7.	<i>Echinorhynchus acutus</i> , Rudolphi,	-	-	-	-	-	×	11
Fig. 8.	Proboscis of the same,	-	-	-	-	-	×	96
Fig. 9.	<i>Tetrarhynchus megacephalus</i> , Rudolphi (Scolex),	-	-	-	-	-	×	5
Fig. 10.	A proboscis of the same,	-	-	-	-	-	×	28
Fig. 11.	<i>Tetrarhynchus tetrabothrius</i> , van Beneden,	-	-	-	-	-	×	24
Fig. 12.	<i>Octobothrium Sybilla</i> , n. sp.,	-	-	-	-	-	×	70

PLATE V.

Fig. 1.	<i>Phyllobothrium lactuca</i> , van Beneden,	-	-	-	-	-	×	48
Fig. 2.	<i>Acanthobothrium coronatum</i> , van Beneden,	-	-	-	-	-	×	48
Fig. 3.	<i>Bothriocephalus punctatus</i> , Rudolphi,	-	-	-	-	-	×	25
Fig. 4.	<i>Bothriocephalus proboscideus</i> , Rudolphi,	-	-	-	-	-	×	48
Fig. 5.	<i>Ancistrocephalus microcephalus</i> , Rudolphi,	-	-	-	-	-	×	36
Fig. 6.	<i>Diphyllobothrium stemmacephalum</i> , Cobbold,	-	-	-	-	-	×	60
Fig. 7.	<i>Tetrarhynchus minutus</i> , van Beneden,	-	-	-	-	-	×	72
Fig. 8.	Portion of a proboscis of the same, near proximal end,	-	-	-	-	-	×	615
Fig. 9.	<i>Pyllobothrium thridax</i> , van Beneden,	-	-	-	-	-	×	72
Fig. 10.	<i>Tenia</i> sp. from a common Eel,	-	-	-	-	-	×	48
Fig. 11.	Head of the same seen from above,	-	-	-	-	-	×	108
Fig. 12.	An ovum of <i>Distomum cestoides</i> , van Beneden,	-	-	-	-	-	×	410
Fig. 13.	(†) <i>Prosthecosacter</i> sp., posterior end of ♀ with larvæ <i>in situ</i> ,	-	-	-	-	-	×	74
Fig. 13.	a. b. c., Three larvæ of the same removed,	-	-	-	-	-	×	340

PLATE VI.

Fig. 1.	<i>Echinorhynchus proteus</i> with their heads embedded in Eel intestine,	-	-	-	slightly enlarged.
Fig. 2.	<i>Ancistrocephalus microcephalus</i> (Strobile),	-	-	-	slightly enlarged.
Fig. 3.	<i>Tetrarhynchus megacephalus</i> , (Strobile),	-	-	-	slightly enlarged.
Fig. 4.	<i>Dinobothrium septaria</i> , van Beneden, (Strobile),	-	-	-	x 2
Fig. 5.	<i>Lepeophtheirus pectoralis</i> , adhering to pectoral fins of flat fish,	-	-	-	-
Fig. 6.	(?) <i>Prosthecosacter</i> in viscera of Porpoise,	-	-	-	x 2
Fig. 7.	Specimens of the same shown separately,	-	-	-	x 2
Fig. 8.	<i>Echinorhynchus acus</i> , with their heads embedded in intestine of Coal-fish,	-	-	-	x 2

PLATE VII

Fig. 1.	<i>Diphyllobothrium stemmacephalum</i> , Cobbold,	-	-	-	about the natural size.
Fig. 2.	<i>Diphlobothrium simile</i> , van Beneden,	-	-	-	slightly enlarged.
Fig. 3.	<i>Distomum cestoides</i> , van Beneden,	-	-	-	about twice natural size.
Fig. 4.	The same, young examples,	-	-	-	about twice natural size.
Fig. 5.	(?) The same, young examples from cysts on the stomach of a Witch Sole,	-	-	-	twice natural size.
Fig. 6.	One of the cysts containing young Distomides,	-	-	-	twice natural size.
Fig. 7.	Three-spined Stickleback infested with Cestode worms,	-	-	-	natural size.
Fig. 8.	A Stickleback, showing the worms <i>in situ</i> ,	-	-	-	natural size.



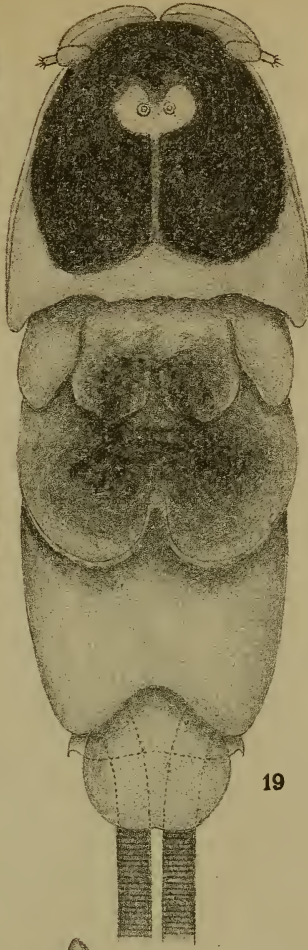
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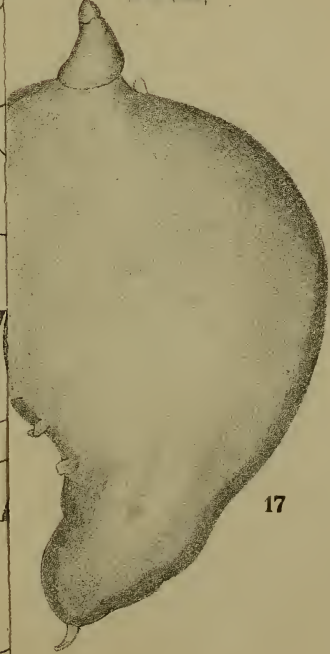
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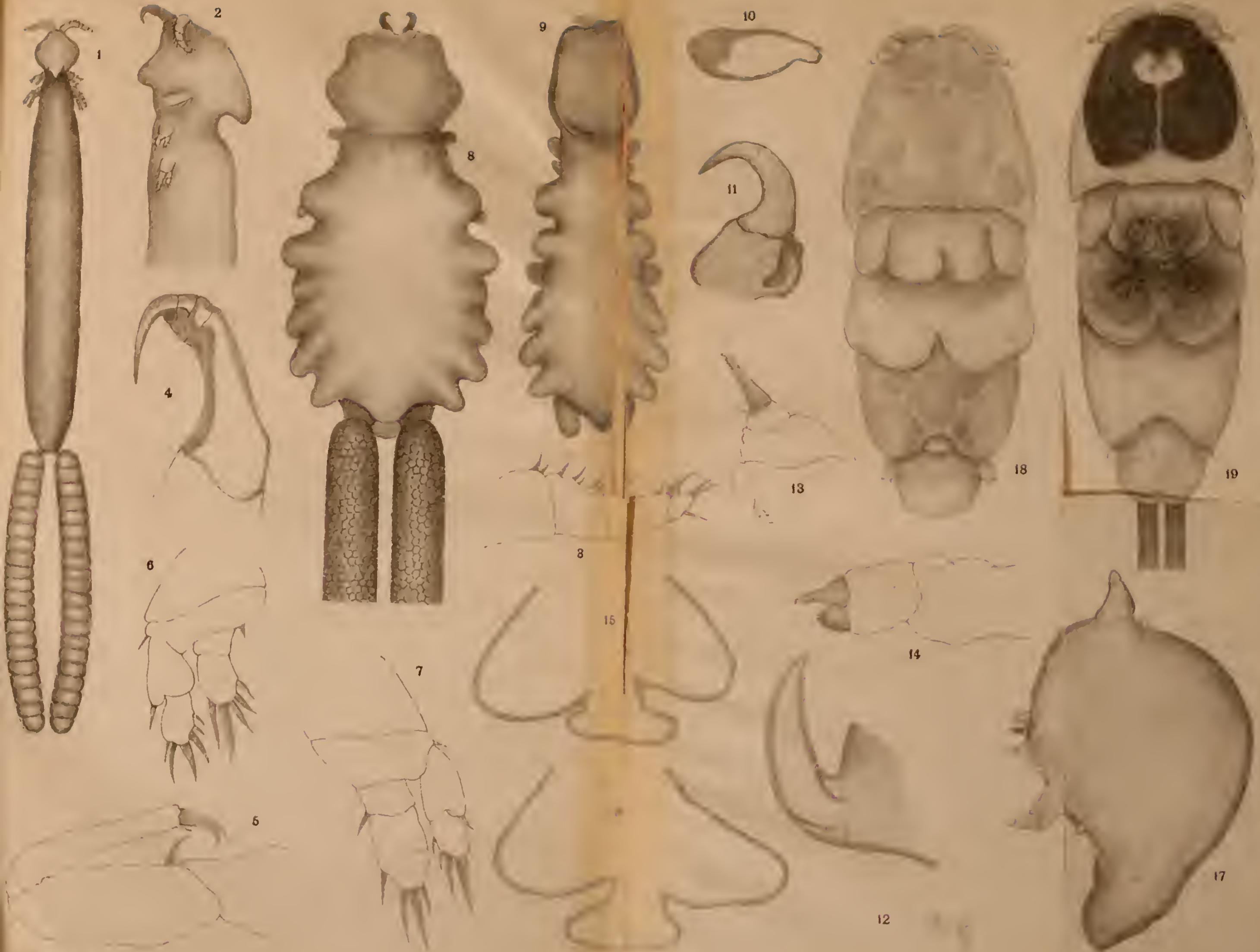
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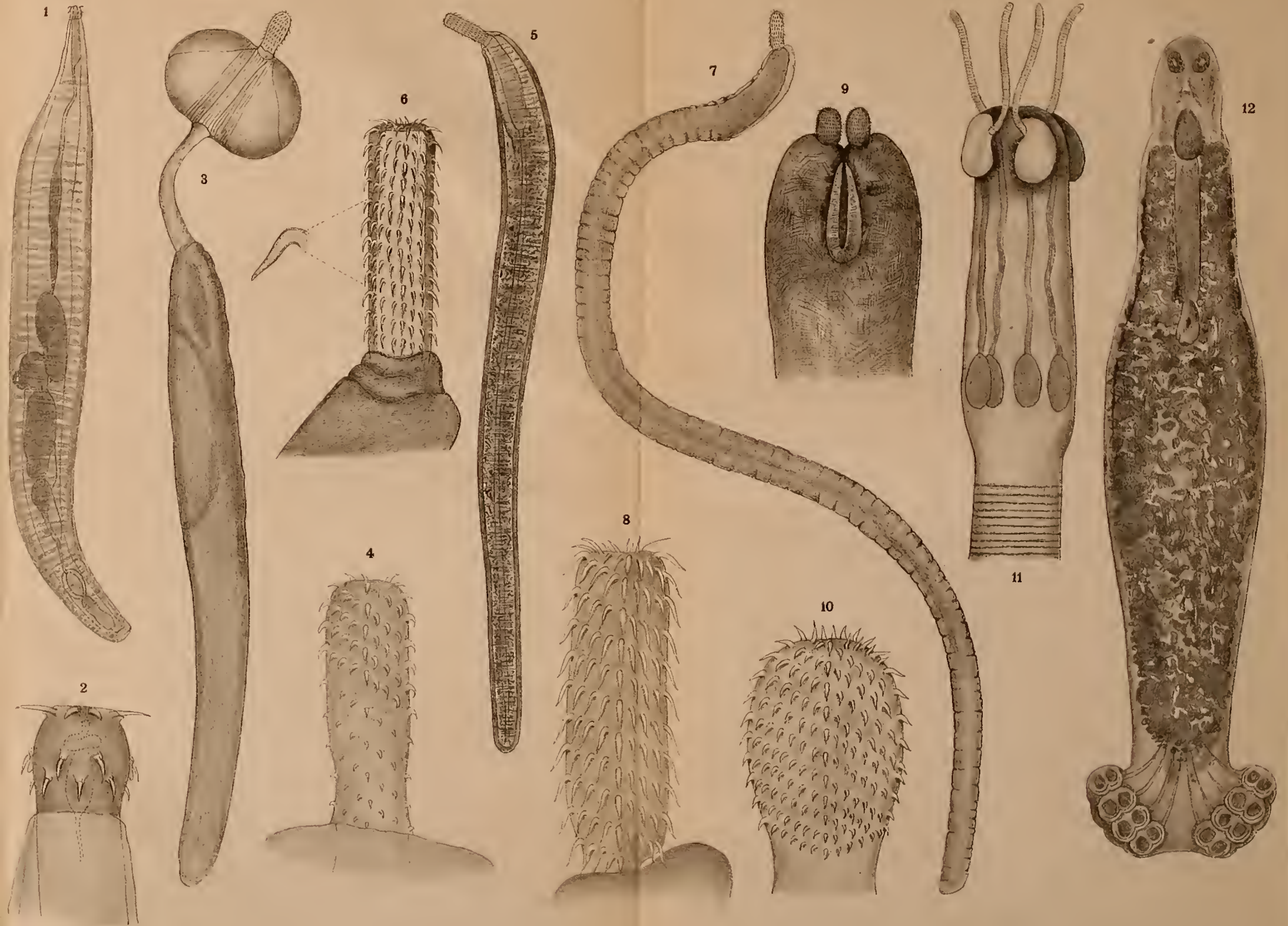


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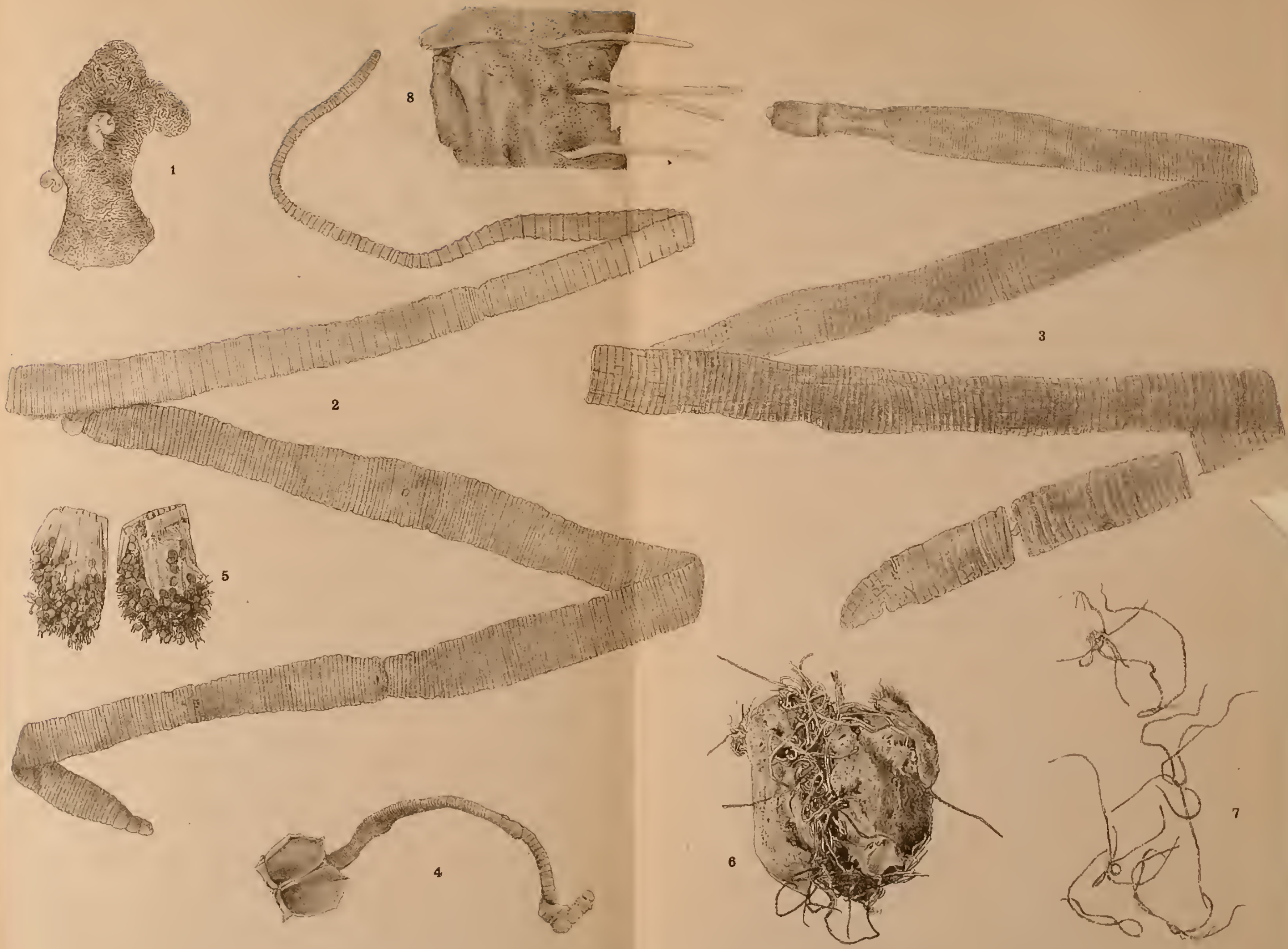
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PARASITES OF FISHES.



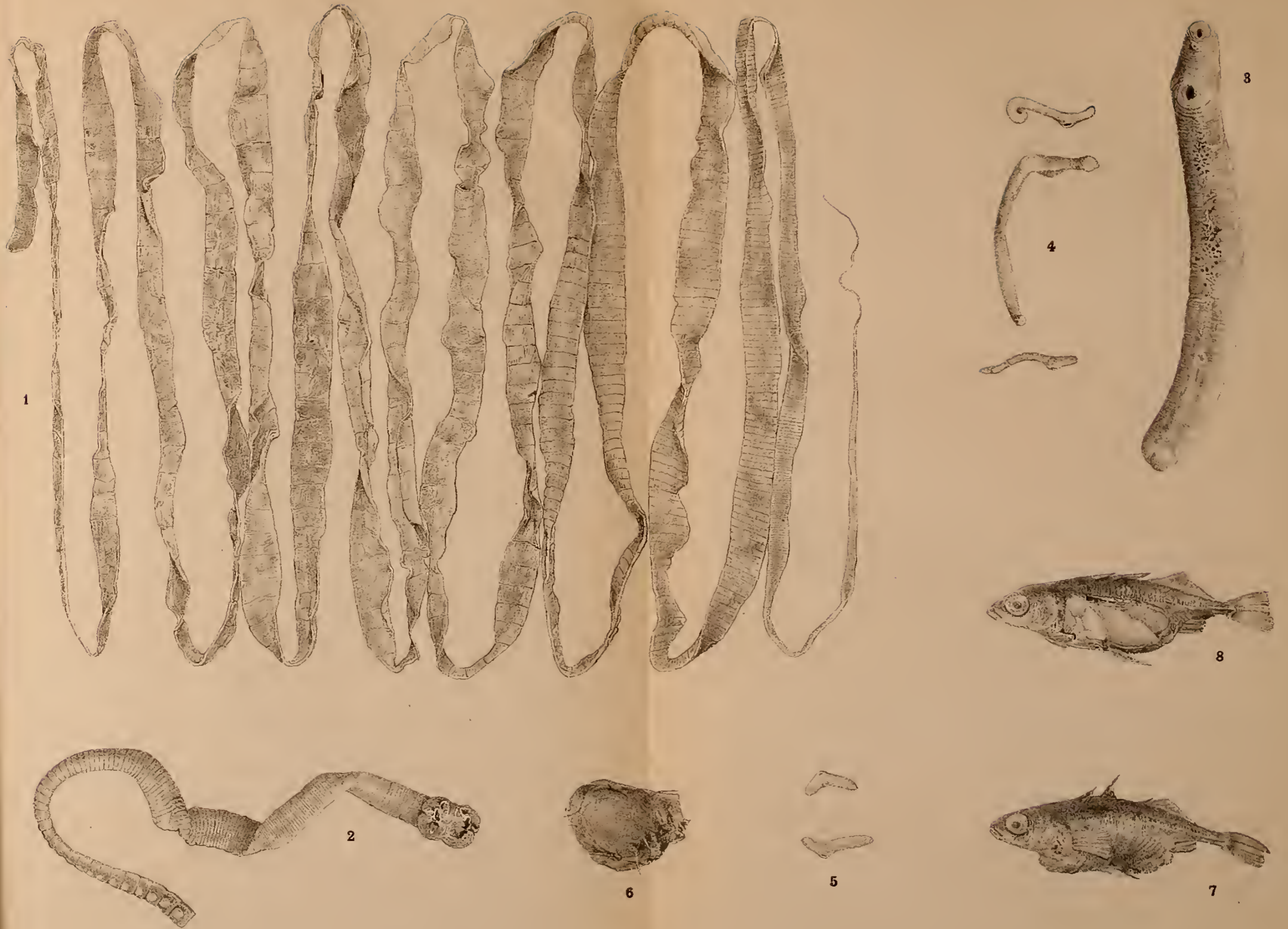
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FIGS. 1-5 and 7-12 PARASITES OF FISHES. FIGS. 6 and 13 a.b.c. PARASITES OF PORPOISE.



A. SCOTT,
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FIGS. 1-5 PARASITES OF FISHES. FIGS. 6 and 7 PARASITES OF PORPOISE.



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FIG. 1 PARASITE OF PORPOISE. FIGS. 2-7 PARASITES OF FISHES.