THE

CHAETOGNATHA OF THE SIBOGA EXPEDITION

Siboga-Expeditie
XXI

THE CHAETOGNATHA OF THE SIBOGA-EXPEDITION

WITH A DISCUSSION OF THE SYNONYMY AND DISTRIBUTION OF THE GROUP

BY

G. HERBERT FOWLER, B.A., PH.D.

With 3 plates and 6 charts

LATE E. J. BRILL
PUBLISHERS AND PRINTERS
LEYDEN — 1906

'Quae data est mihi, ut sapiens architectus fundamentum posui, alius autem superaedificet'.

Contents.

THE CHAETOGNATHA OF THE SIBOGA EXPEDITION

WITH A DISCUSSION OF THE SYNONYMY AND DISTRIBUTION OF THE GROUP

BY

G. HERBERT FOWLER, B.A., Ph.D.

With 3 plates and 6 charts.

I. Introduction.

a. THE MATERIAL COLLECTED, AND ITS PRESERVATION.

The material received, amounting to thousands of specimens, was contained in a few tubes of most beautifully preserved specimens in Formalin, and in a large number of tubes of alcoholic specimens very much less well preserved. To have identified every specimen with accuracy would have required years of close application, and the results which might have been expected from this procedure would, apparently, not have been commensurate with the labour involved.

The Formalin specimens were therefore studied first of all with considerable care, until the species represented in this material were thoroughly familiar; afterwards a good deal of the determination was done under a dissecting lens; and only doubtful or unfamiliar specimens were put under the microscope, measured, and counted.

Had not the formalin material been available, and been carefully studied, the determination of the Alcohol material would have been in most cases almost impossible; the fins and corona ciliata had generally entirely disappeared, the body had become shrunken and distorted, thus giving a disproportionately large appearance to the head, and the opacity of the tissues made the counting of the teeth both difficult and uncertain. Except in the case of a few unmistakable species, the determination of alcoholic material cannot be regarded as infallible, and it really seems as if many of the earlier records of Chaetognatha should, properly speaking, be neglected for faunistic purposes, when based solely on alcoholic specimens. Where species are strongly alike, — for example, *enflata pulchra* and (sometimes) *hexaptera*, *robusta* and *ferox*, *Bedoti* and *Sibogae*, *neglecta* and young *serratodentata* and *Bedoti*, — absolute certainty in such material is often unattainable. In small specimens even close microscopic examination often fails; in dealing with small (and in most cases young) specimens we are on most uncertain ground, even in finely preserved material; it seems sometimes as if they might belong to almost any species, for the proportions of tail to body, and the relative proportions of the fins, often alter with age; and of the three parts of the armature — jaws, anterior teeth, and posterior teeth, — the one may increase in numbers more rapidly than the others; again, probably the range of variation, and certainly the probable error in measurement, are greater in young specimens than in older and larger examples. Not even alcohol specimens from the Zoological Station at Naples, prepared with all the care and skill for which that institution is famous, can compare with formalin specimens preserved in the hurry which is inseparable from work at sea. For all plankton except Ctenophora and large fishes, formalin remains by far the best reagent, if followed in the case of some calcareous organisms by a transference to alcohol.

The only safe procedure, therefore, in the case of the spirit material of the Siboga, seemed to be to ascertain which of the species represented in the formalin material occurred also in the remaining hauls; in dealing with these one felt on fairly firm ground. Some deep hauls with the Vertical Net, in which the material, though alcoholic, was in fairly good condition, were studied in greater detail. But it must not be inferred that of necessity no species occurred in the collection beyond those here recorded; indeed, it is nearly certain that at least one new species was captured which is not referred to below, but a diagnosis based merely on the formula of its armature would be valueless.

No great attention has been paid to the numbers of specimens of each species captured in the different hauls; because (fortunately for the reporter), not the whole collection, but only picked specimens, were sent. Some idea, however, of the numbers in which a species occurred may be gathered from the numbers given in the general table, (p. 28), taken mainly from the material preserved in formalin; these are doubtless approximately accurate, although perhaps not absolutely exact, owing to the close resemblance between certain species.

b. THE CHARACTERS ADOPTED FOR DIAGNOSIS.

This report follows in general lines the recently published report on Chaetognatha from the Bay of Biscay[1], which will be quoted below for brevity simply as 'Biscayan Plankton', or the 'Biscayan Report'. The introduction thereto, 'On the systematic determination of Chaetognatha',

1) Biscayan Plankton, collected during a cruise of H.M.S. Research 1900. — Part III. The Chaetognatha: by G. HERBERT FOWLER. — Transactions of the Linnean Society of London, Series II. Zoology, Volume X, pp. 55—87. 1905.

explains the general methods adopted for discrimination between species, and needs not to be repeated here. One or two points, however, require comment.

As in the Biscayan report, a table of (what may be termed) formulae has been furnished for almost every species at different lengths (presumably = ages). In all these tables (1) the first column of figures gives the total length in millimetres: (2) the second, the length of the tail, expressed as a percentage of the total length: (3) the third, the number of jaws (cirrhi, Greifhaken): (4) the fourth, the number of anterior teeth (or of the only row of teeth in the case of *Krohnia*): (5) the fifth (when present), the number of posterior teeth. In the case of common species, the tables have been constructed from about 30—40 specimens: where the range of variation is considerable at a particular length, it generally implies that several specimens have been under observation. This method, however tedious in the working, appears to the writer a necessary step towards putting a species on a sound footing; not only because the numbers of the armature, and the proportion of tail to body, alter with age, nor merely because the range of individual variation is considerable, but also because it is often difficult to count every tooth, so that the recording of numerous specimens tends to neutralise the errors of observation. As regards the lengths, it also tends to correct the error due to different amounts of contraction. It is very desirable that this method should be adopted during the next few years in the case of every Chaetognath recorded, however common or wellknown, notably in collections from distant seas.

The characters given below for the identification of species have been deliberately selected with a view to the needs of a naturalist reporting on a collection of Plankton, in which the material often may be immature or imperfectly preserved. They are mainly external and macroscopic, and practically do not take internal anatomy into account.

Under the heading of 'total length' and 'length of tail', the tail fin has been included in the measurements. The addition of this is not so great as to make comparison with the records of previous observers unreliable, and the actual measurement is made more certain and easy, at a cost of less damage to the specimen by the compasses.

Drawings of the jaws [1]), and teeth when boiled out with caustic alkali from the soft tissues, have been given in many cases, but I doubt whether they have much diagnostic value: especially are the anterior teeth unreliable, for they have so entirely different an appearance according as they are viewed laterally, foreshortened, or in profile. More characteristic is the appearance of the teeth in place, but this view is not always easy to obtain, and is generally impracticable in forms with numerous teeth, such as *Sibogae* and *Bedoti*.

The form of the vestibular ridge seems to prove useful as a diagnostic test of secondary importance; this does not imply that it is always of identical form, papilla by papilla, even in two specimens of the same species; but that its general character, with high or low, sharp or rounded, numerous or few papillae, etc., etc., is a specific constant. The disadvantage of its use is that it is often difficult to get it into exact profile.

---

1) I should have liked to utilise Dr. KRUMBACH's character of the shape of the tips of the jaws, but — if I may be pardoned for a personal explanation — my eyes are no longer reliable for minute transparent objects under very high powers: the tips have been drawn, however, in some cases when fairly large.

The extent and nature of the contraction of the head in death makes a considerable difference to the look of the anterior end of a Chaetognath. Three main conditions are distinguishable:

(1) the jaws are thrown outwards, radiating from the head, divergent from each other, like the sticks of a curved fan; the head is broad and long; the condition is that of extreme expansion:

(2) the jaws are turned inwards, with the tips directed forwards, so that their long axis is nearly parallel to the long axis of the body; they are closely pressed together, and are often covered by the prepuce: the head is long and narrow; the condition is that of normal contraction:

(3) the jaws are turned yet further inwards, so that the tips meet or even pass one another across the mouth: the jaws are then nearly at right angles to the long axis of the body; the head is short and broad; the condition is that of extreme contraction, and may often be seen in specimens killed in the act of swallowing their prey.

Between these three all possible gradations are found, and the alterations produced in the shape of the head, the collarette, and the corona are very great; the comparative position of the rows of teeth, and the angle of inclination of the individual teeth, become greatly altered.

The statement in Biscayan Plankton relative to the diagnostic value of the diverticula on the alimentary canal (p. 56) requires modification to this extent: — that the possibility of recognising these structures, by focussing into a transparent specimen, depends largely upon the state of contraction and expansion of the head and neck. In fig. 100 is represented, diagrammatically over a camera lucida outline, the arrangement of these structures, as seen in a horizontal longitudinal section of a transparent specimen of *ferox*, in which they were conspicuous from the outside. But similarly transparent specimens, in which they were quite unrecognisable beforehand, gave the relations shown in fig. 101 (horizontal longitudinal) and 102 (transverse section). It will be obvious from these figures that the oesophagus (presumably an ectodermal stomodaeum) grows backwards in a dorsal and a ventral prolongation, and that the intestine (presumably an endodermal mesenteron) grows forwards in two lateral prolongations, which, on the fusion of the two parts, give rise to the diverticula. The epithelia of the (presumed) ectoderm and endoderm are of quite distinct characters. If the head is expanded, this whole region is pulled forward, and the diverticula become conspicuous; in strong contraction, it goes backwards, and the structures become so compressed together as to be distinguishable no longer from outside.

I have already contended in 'Biscayan Plankton' that the projection, size, and shape of the vesiculae seminales depend on the sexual condition of the individual at the moment of capture, and cannot be utilised for specific diagnosis. In illustration of this I have here drawn by camera lucida (fig. 103) the outlines of the posterior ends of four specimens of *S. ferox*, which measured respectively 11, 15, 16, 17 mm. of total length. The two longest had developed the 'callotta splendente' of Grassi; in the shortest, hardly any trace of the vesiculae was apparent.

A similar criticism may be applied to the use of the extension of the ovaries in diagnosis;

in the two longest of the above four specimens they reached to the neck of the animal, in the specimen of 15 mm. only to the ganglion; in that of 11 mm. they were mere rudiments.

In the extension of the posterior fin backwards there lies a trap; in young specimens of some Chaetognaths, this fin appears to stop at some distance from the undeveloped vesiculae; but as male maturity approaches, the vesiculae lengthen and swell till they touch the fin. *Mutatis mutandis*, the same is applicable to the tail fin.

The generic nomenclature used here is that of LANGERHANS.

As no less than nineteen out of the twenty-four species of Chaetognatha which appear to the writer to be 'valid', were found either in the Sibogan or the Biscayan collections, an attempt has been made at a faunistic and systematic revision of the whole group.

Every one who has attempted to identify Chaetognatha in recent years must have been painfully aware of a number of very similar forms among the recorded 'species', which for the most part have been but cursorily described. To attempt to reduce the number of species in such a case is an ungracious task, and, if the original specimens are not available for comparison, lays the attempt open to an unsympathetic criticism. Nevertheless, it has been made, in the hope that the task of future workers in this group may thereby be lightened. At least it can safely be maintained that, if a (perhaps 'good') species has been so inadequately characterised that it is possible to confuse it, and on paper to combine it, with another and better known species, its present place should certainly be in the synonymy rather than in the systematic.

II. Systematic.

a. SPECIES CAPTURED BY THE SIBOGA EXPEDITION.

I. Genus **Sagitta** (sensu Langerhans 1880).

1. *Sagitta Bedoti* Béraneck.

ED. BÉRANECK. Les Chétognathes de la Baie d'Amboine. Revue Suisse de Zoologie. Tome III, p. 137.
Sagitta polyodon Doncaster.
L. DONCASTER. Chaetognatha: Fauna and Geography of the Maldive and Laccadive Archipelagoes, Vol. I, p. 209.
Sagitta bipunctata Aida (*nec* Quoy and Gaimard).
T. AIDA. Chaetognaths of Misaki Harbour. Annotationes Zoologicae Japonenses. Vol. I. p. 13.

Characters. Head rather small; neck only slightly marked when in contraction; a very slight thickening of the epidermis at the neck, but no real collarette. Body firm and moderately transparent in formalin. Longitudinal muscles strong but narrow; lateral fields rather large. Body thickest for about the middle third of its length, tapering slightly and gradually forwards, more rapidly backwards, generally with a sudden diminution at the tail septum. Tail segment about 21 to 35 per cent. of the total length.

Anterior fins long, much widest posteriorly, and diminishing rapidly anteriorly; they nearly or quite reach the abdominal ganglion. Posterior fins broader than the anterior, of about the same length as the anterior; more on the tail than on the trunk, widest well behind the septum, reaching nearly (? quite) to the vesiculae seminales.

Jaws broad, not very strongly curved; tip short, thick, obtuse. Anterior teeth closely set, broad below, small. Posterior teeth very numerous, narrow, very closely set; the series curves from the dorsal to the ventral surface towards the mouth as in *macrocephala*. The points of both sets of teeth small and obtuse: both have a dark brown colour in the older specimens.

Vestibular ridge terminating externally in a well-marked rather sharp process, and produced into fairly regular numerous acute prominences. Corona ciliata slightly sinuous, extending from a half to about two-thirds of the distance between the head and the abdominal ganglion.

The tips of the newer jaws are in some specimens distinctly curved, but I have never seen them quite so hooked as in BERANECK's figure (Pl. IV, fig. 10). The same author figures the teeth as terminating in three points („une couronne multicuspide"). Unfortunately I am unable confirm or deny this point with accuracy, but, so far as I can see, the tips of the teeth are of the usual conical character. The appearance of fine points, noticeable occasionally at the tips of both jaws and teeth in Chaetognatha, seems to be often explicable as the result of wear, the tip appearing to fray out into strands.

Bedoti strongly resembles *serratodentata*, but may generally be distinguished under a lens by its smaller head, slenderer body, and more taper tail; under a microscope, the closely set, brown, numerous, obtuse teeth distinguish it at once. Formulae: —

18	22	6	9	21
17	23	6	10—11	17—21
16	28	6	10	21
15	26	6—7	10	27
14	21—28	6—7	9—10	24—29
13	23—30	6—7	10—13	20—32
11	27	5—7	9—11	18—27
8	29	6	7	21
7	28	6—7	7—8	16—20
6	33	7	6	12
5	35	6—7	5	10

The greater variation at about 13 mm. of total length is probably only due to the fact that that was about the usual length of the specimens; hence more were measured at that length than at any other.

A single specimen from Station 168 exhibited an abnormal number of teeth for its length: its formula was

11. 22. 6—7. 10—11. 31—33.

But the arrangement of the fins, the corona, the character of the teeth and jaws, all agreed so well with *Bedoti* that it must provisionally be left as an abnormally or precociously toothed individual, comparable to the Hairy Man or Bearded Woman of a village fair.

I have no doubt that Doncaster's species *polyodon* is merely a synonym for *Bedoti*. *Polyodon* was said to differ "in having a corona, in the length of the ovaries, and the greater number of teeth". With regard to these points — a corona is only to be seen in well-preserved specimens, and had been lost in Béraneck's material; the extension of the ovaries, depending entirely on the age and sexual condition of the animal at the moment of capture, cannot be accepted as a diagnostic character; and the number of teeth is well within the limits of variation tabled above. Doncaster himself expressed the suspicion that the two species might be identical; this seems to be completely justified on the examination of a large number of specimens.

Nor have I any more hesitation in placing the *bipunctata* recorded by Aida from Misaki as a synonym of *Bedoti*. Aida, who quite correctly noted the discrepancy in the number of jaws and teeth, does not seem to have been acquainted with Béraneck's paper.

The table following shows the formulae of *Bedoti*, *polyodon*, and *bipunctata* of AIDA; that of *bipunctata* Quoy and Gaimard, has been added for comparison with the latter.

Bedoti, Amboina	13	25	7	8—10	18—22
Bedoti, 'Siboga' Exped.	14—20	21—28	6—7	9—10	17—29
Polyodon Doncaster	12	25	6—7	9—10	26
Bipunctata Aida	—	—	6—7	10—12	18—21
Bipunctata, 'Research'	12—20	21—25	9—10	4—7	12—18

It is fairly obvious that the first four agree together and differ from the fifth. AIDA's figure of '*bipunctata*' is quite unlike the outline of European specimens of the species of QUOY and GAIMARD, but agrees with that of *Bedoti*.

2. *Sagitta enflata* Grassi.

B. GRASSI. I Chetognati. Fauna und Flora des Golfes von Neapel: Monographie V, p. 13.
T. AIDA. Op. cit., p. 15.
L. DONCASTER. Op. cit., p. 210.
? *Sagitta Gardineri* Doncaster.
L. DONCASTER. Op. cit., p. 212.
? *Sagitta flaccida* Conant.
F. S. CONANT. Notes on the Chaetognatha. John Hopkins University Circulars, vol. XV, p. 85.

Characters. Head rather small in contraction, but quite broad when expanded: it is marked off from the body by a distinct neck; no collarette present. Body tumid, extremely transparent; much thickest about the middle of its length, tapering gradually forward and backward; body very flaccid, owing to the extreme thinness of the longitudinal muscles; lateral fields large. Tail segment about 16 to 25 per cent. of the total length. Ganglion small, about midway between the head and the anterior fin.

Anterior fins narrow, short, broadest behind the middle of their length, not nearly reaching to the ganglion. Posterior fins short, broader than the anterior, widest at about the plane of the septum, slightly more on the trunk than on the tail, not nearly reaching to the vesiculae seminales. Tail fin truncate, reaching the vesiculae seminales when tumid.

Jaws slender, strongly curved, with rather small tips. Anterior teeth rather abruptly pointed, closely set. Posterior teeth clear in colour, strong, rather short in comparison to their breadth, abruptly pointed, with small tips, diverging distally, closely set proximally.

Vestibular ridge with fairly regular low rounded prominences, terminating externally in a considerable blunt process. Corona ciliata short, almost entirely on the head, varying (? with the state of contraction or expansion of the head) from a simple sinuous outline to a complex hour glass shape.

The variation in the corona is very noticeable, and seems to be due to distortion of the simple form shown in fig. 10. It was not figured by GRASSI.

As in other species of the same flaccidity, the lateral fields shrink inwards in poor specimens, so that the anterior fins almost disappear from view. Formulae:

29	18	7—8	10	15—16
28	18—21	7—9	7—10	16—17
27	18—21	8	9—10	14—16
26	16—19	7—8	7—10	16—17
23	21—22	8	8—9	13—14
22	18—21	7—9	8—10	12—16
21	23	9	9—10	16
20	20—25	8—9	8—9	15
17	17	9	8—9	15
16	18	8	8	13
15	20	8—9	8—9	12—17
13	23	8	8	13—14
12	16	7	9	12
11	18	8	8	11
10	20	6—10	7—8	9—12
9	22	7—9	6—8	10—11

If not particularly well preserved, this species often has a strong resemblance under a lens to *pulchra* and to *hexaptera*. *Pulchra* is however slenderer and its head is smaller, with less neck; it also has a well-marked collarette. *Enflata* is generally distinguishable from *hexaptera* by its greater diameter, larger head, more marked neck, and greater transparency; its longitudinal muscles are almost imperceptible under a lens, those of *hexaptera* comparatively conspicuous. The collarette also separates *pulchra* from *hexaptera*. In well preserved specimens, these three species are of course readily separable.

To the best of my belief, DONCASTER's *Gardineri* was only based on large specimens of *enflata*.

Gardineri.	25.	20.	8—10.	12—16.
enflata.	22—26.	16—22.	7—9.	12—17.

DONCASTER lays stress (owing probably to a remark of GRASSI) on the longer ovaries of his species, which I regard as useless for diagnosis; and on the greater number of teeth, which does not appear to hold good when a large series of specimens is examined. He describes the corona of *Gardineri* as pear-shaped, but figures it as shoe-shaped, that is to say, with a constriction; in that condition, it seems to be intermediate between my figures 10 and 11.

As to the relation between *enflata* and *flaccida*, there is not a single point in CONANT's very brief definition of his species which is not in agreement with the characters of *enflata* given by GRASSI and with those given above for the Siboga specimens. Whether CONANT actually had a separate species before him or not, the only reasonable place for *flaccida* at present is in the synonymy of *enflata*. DONCASTER (p. 211) records a single specimen of *flaccida* from the Maldive Archipelago, and states (but without a figure) that its teeth were longer and more slender than in *enflata*, which was not one of CONANT's characters. The greater length of the inner than of the outer teeth, mentioned by both CONANT and DONCASTER, is noticeable in *enflata* and in many other species.

3. *Sagitta ferox* Doncaster.

L. Doncaster. Op. cit., p. 212.

No species in the collection gave greater trouble than this and its ally *robusta* of the same author. Neither of the two was adequately described in the first instance; and the figure of *robusta* contradicted the text in two important particulars, — namely, the proportionate length of the tail segment, and the posterior extension of the posterior fins; even the number of jaws was not correctly drawn. Like most freehand drawings of Chaetognatha, the figure cannot be trusted to give the real outline of the animal. Doncaster's beautiful figures are much more like Chaetognatha than my camera outlines, but no artist can draw with the precision of the camera. Of *ferox* only the front end was figured. A very large number of likely specimens have therefore been carefully examined with a view of placing these alleged species on a more satisfactory footing. As the result I believe that I have found, among the formalin material, representatives of both *ferox* and *robusta*; but whether they are separate species, or the one a precocious variety of the other, or both together forming a highly variable species in the act of splitting up, I have no clear idea. Doncaster himself suggested that *ferox* "should possibly be classed with *robusta*".

There can be no question that the specimens assigned below to *ferox* are readily distinguishable from every other species hitherto described. Those listed as *robusta* generally exhibit one or two more jaws, and one or two more posterior teeth, at a similar length; they are apparently nearly sexually ripe at about 12 mm., but *ferox* at about 15 mm. (to this there seem to be exceptions on both sides). *Robusta* retains its sense papillae much better than *ferox*, and often has a "hispid" appearance. I do not find the constant difference in the tips of the jaws mentioned by Doncaster, although it happens that in some specimens they have been more worn, and are shorter and blunter, than in others. On the whole it seems best to retain both the species, in the hope that further collections may settle their exact relationship.

The "characters" assigned below to *robusta* and *ferox* have naturally been drawn from extreme examples, in order to emphasise the differences as much as possible.

Characters. Head large, in expansion broader than the body at its broadest. Body firm, broad, opaque owing to the marked development of the longitudinal muscles; trunk of nearly uniform width from in front of the ganglion to the tail septum, tapering very gradually forwards to the neck, more suddenly backwards from the tail septum. Lateral fields narrow. There is a well developed collarette, which extends to, or nearly to, the anterior fins, and is powerfully developed in adult specimens. Tail segment about 26—36 per cent. of the total length.

Anterior fins long, rounded, widest posteriorly and narrowing slightly forwards, commencing about on a level with the abdominal ganglion. Posterior fins rounded, slightly shorter than the anterior, more on the tail than on the trunk, extending posteriorly to the vesiculae seminales when these are tumid, widest behind the septum. Tail fin generally rounded, meeting the vesiculae seminales when tumid.

Jaws short, strong, broad at the base, strongly curved; the tip small. Anterior teeth closely set, very broad below. Posterior teeth long, strong, broad, closely set centrally but diverging distally, abruptly pointed. The points of both sets of teeth very small.

Vestibular ridge strongly and regularly mammillated, terminating externally in a very blunt process. Corona ciliata very long, reaching up to three quarters of the distance to the ganglion, or even to close to the abdominal ganglion and anterior fins, commencing in front of the eyes. Formulae: —

20.5	31	6	8	14
20.0	30	5	9	14
19.0	31	5	8	13
18.5	32	5—6	7—8	11—12
18.0	32	6	8	12
17.0	29—30	5—6	6—10	11—13
16.0	31	6	6—7	11—12
15.0	26—30	5—6	7—9	11—14
14.0	28—32	5—6	6—8	10—12
13.0	30	5—6	8—9	12—14
12.0	27	5—6	7—8	11—13
11.5	30	5	6	10
11.0	27—36	6	7—8	11
10.0	30	6	4—7	9—11

Specimens of 11 mm. and less are practically indistinguishable from the supposed *robusta* in most cases.

4. *Sagitta hexaptera* d'Orbigny.

D'ORBIGNY. Voyage dans l'Amerique meridionale. Tome V, 3me Partie, Mollusques p. 140. Paris, 1835—1843, 4to.
O. HERTWIG. Die Chaetognathen. Jenaische Zeitschrift, Band XIV, p. 196.
Sagitta magna Langerhans.
P. LANGERHANS. Die Wurmfauna von Madeira, III. Zeitschrift fur wissenschaftliche Zoologie, XXXIV, p. 135.
? *Sagitta magna* Grassi.
B. GRASSI. Op. cit., p. 11.
Sagitta tricuspidata Kent.
S. KENT. On a new species of Sagitta from the South Pacific. Annals and Magazine of Natural History, Series 4, Vol. V, p. 268.
L. DONCASTER. Op. cit., p. 210.

Of these three "species", *hexaptera*, thanks to the careful monograph of OSCAR HERTWIG, is as easily recognisable as any Chaetognath, although even he gave little detail of the variation in the armature. The other two were most insufficiently characterised by their founders, though a more detailed account, supposed to refer to *magna*, was furnished by GRASSI. In general appearance the three are stated to resemble each other closely, but to differ in their formulae for jaws and teeth:

hexaptera, various authors.	to 70	20—25	6—8	3—4	4—7
magna Langerhans.	to 40	—	7—9	4	2—3
magna Grassi	to 41	20	10—13	4	2—3
tricuspidata Kent	—	20	. 8	3	1
tricuspidata Doncaster	nearly 40	—	4—8	2—3	1—4

Among the Siboga material were specimens which fitted sufficiently to each of these formulae (except for the large number of jaws in *magna* Grassi). On adding to them specimens of *magna* supplied from the Zoological Station at Naples, one felt fairly confident that one had all the species before one. Good specimens were selected and compared, with the result that no specific difference could be detected between them: in all ordinary characters such as the position and extension of the fins, the size and position of the abdominal ganglion, the extension and shape of the corona, the proportion of tail to trunk, and so forth, they were practically identical; the vestibular ridges, and even the tips of the younger jaws, were of the same character. I have no doubt that *hexaptera* d'Orbigny, *magna* Langerhans and *tricuspidata* Kent, form one species. Whether *magna* Grassi is the same or not, is not so easy to say: some of my specimens showed nine jaws with a rudimentary tenth, but ten was the outside number observed. But as the specimens of "*magna*" sent from Naples were undoubtedly hexapteran,

44	20	7	3—4	6
42	19	6	3	5
40	22	7	3	6

it is probable that Grassi had before him specimens of *hexaptera* with numerous jaws and few teeth; such occur in the table below.

Since there is practically nothing in their original definitions to differentiate *magna* and *tricuspidata* from one another and from *hexaptera* except the formulae for armature, it is necessary to show the resemblance between specimens which conform more or less to the formulae; this has been done on plate I. The outlines of the entire animal[1]) (figs. 30, 34, 38) are as alike as could be expected in three different specimens of the same species; the two coronae (figs. 35, 39) agree with each other and with that figured by Hertwig for *hexaptera* (op. cit., pl. IV, fig. 21); those of the distal end of the latest (most anterior) jaw agree in the characteristic outline first recorded by Krumbach (Über die Greifhaken der Chätognathen. Zoologische Jahrbücher, Abtheilung Systematik, u. s. w., XVIII, p. 579, fig. P.); if the figures of the anterior and posterior teeth do not at first sight agree equally well, the failure must be attributed to the impossibility of getting them to lie at precisely similar angles, and to the inability of the draughtsman to represent properly the consequent foreshortening. By focussing it was apparent that they belonged to the same type, — a broad base from which rises an unusually long and slender tooth. In such large, and therefore opaque, heads as most *hexaptera* present, it is generally impossible to see the whole of the vestibular ridge under the microscope

1) As typical specimens of *magna* were only noticed in the alcohol material, the outline for this "species" has been taken from a Naples specimen.

at one time, since it curves round the side of the head: only enough of it therefore has been drawn to show that its character is the same in all three "species". (In some old specimens it exhibits a double row of papillae). Since then the other criteria fail to separate them, it remains to be shown that the numbers of jaws and teeth are also inadequate for this purpose, and that the "species" can be made to grade into each other. This will be sufficiently obvious from the usual table of observed specimens, in which, although specimens of the typical formulae can readily be found, I have not found it possible to group the remainder round these with reasonable sharpness. Formulae of two "species" may be found even in the same individual: for example, a specimen of which part was drawn showed a *magna* formula on one side (8 : 4 : 3), and a *tricuspidata* formula on the other (8 : 2 : 1). Formulae: —

47	18	5	?	2
45	21	6—7	3—4	5
43	18	4	2—3	2
40	21	7	2	4
39	23	6	3	5—6
37	20	5	2—3	4
36	22	4—5	2—4	2—3
34	17	7	3	5
34	20	5	1—2	1—2
33	20	7	4	6
33	21	8	3	6
32	20	5—6	3	3
31	17	5	2	2
30	19	5	2	2
30	20	5	2	3
30	20	6	3	3
30	23	7	4	6
29	?	7	4	2
28	21	8	3	2
27	18	5	2	3
26	19	5	2	3
25	24	5—6	2—3	3
25	22	8	3	5
25	20	6	3	3
24	25	8—9	3	4
24	19	9	3—4	2
23	18	6	2—3	4
22	22	6—7	2	4
22	20	6	3	3
22	18	7—8	3	3—4
21	23	7	4	5

21	19	6	2	1—2
21	23	3—4	4—5	1—2
21	20	5	2—3	3
20	25	9	3—4	3
19	26	8—9	2—3	2—3
18	19	6	4—5	7
17	25	6	3	3
16	21	6—7	3	4
15	23	7	3	3
15	20	8	3	5
15	20	8—9	3	2—3

In the foregoing table the formulae for forty-two specimens have been printed separately, so that future students may know what range to expect. The errors of observation are greater in a species with few teeth and large opaque heads, than in the case of forms with numerous teeth and small transparent heads; but the errors are, of course, not large enough to account for the apparently wide range of variability.

This extent of variation is however more apparent than real, for, by concentrating the observations into groups differing by 5 mm. of total length, it is found that the range of variation in the teeth is not much greater than in many other species; in the jaws it is slightly greater.

40 and more	18—21	4—7	2—4	2—5
35—39	20—23	4—6	2—4	2—6
30—34	17—23	5—8	1—4	1—6
25—29	18—24	5—8	2—4	2—5
20—24	18—25	3—9	2—5	1—5
15—20	19—26	6—9	2—5	2—7

The point, in which *hexaptera* really differs from other forms tabled in this report, lies in the permutations in which the three varying parts of the armature are combined in one individual, — more or fewer jaws being combined with more or fewer anterior teeth as compared with fewer or more posterior teeth. I believe the explanation to lie mainly (perhaps not entirely) in the length and slenderness of the teeth; many of them are probably torn out by the roots; certainly many are broken off short, for their bases may be seen still in place. As a source of additional weakness, the posterior teeth in older specimens often appear not to be attached to the bony bar with which they are united in other species, but to lie at some distance from it in a superficial plate of chitinous material. In the case of the jaws, again, the empty sockets from which they have been torn are often recognisable. In addition to the above, it is possible that, as DONCASTER suggests, teeth may be shed with age.

Characters. Head small when contracted, of medium size when expanded, in comparison with the body; it is not marked off from the body by a neck when contracted. No collarette present. Body flaccid, transparent in formalin; longitudinal muscles broad, but thinly developed; lateral fields large. Trunk generally widest at about the middle of its length. Tail segment 17 to 26 per cent. of the total length. Ganglion small and rather far back.

Anterior fins short, rounded, about midway between the tail septum and the ganglion. Posterior fins longer and rather broader than the anterior, somewhat triangular, about equally on trunk and tail; their widest point at or behind the septum; they do not reach to the vesiculae seminales. Tail fin truncate.

Jaws broad, strongly curved; the concave edge of the younger jaws exhibits a crest followed by a bay, just below the tip (compare KRUMBACH, op. cit.). Teeth long and slender, springing from a broad base.

Vestibular ridge (?) not terminating in an external process; carrying a few strong papillae, of which in older specimens a double row may be present. Corona ciliata extending from in front of the eyes to a short distance on the trunk, sometimes slightly sinuous.

Two specimens from deep hauls with the Vertical net showed the same swelling up of the epidermis as was figured for *furcata* in Biscayan Plankton (op. cit., fig. 10). I have noticed it in one or two other species. It is not unlikely that CONANT's *Spadella maxima* was founded on specimens of this kind, which occurred also in the Biscayan and Faeroe Channel collections.

5. *Sagitta macrocephala* Fowler.

G. H. FOWLER. Biscayan Plankton. Part III, the Chaetognatha. Transactions of the Linnean Society of London, 2nd Series, Zoology, Vol. X, p. 65.

This very unmistakeable species was represented by five specimens only. Its characters have been described in the Biscayan Report, and need not be repeated here. The specimens were all in poor condition.

8	37	11	6	16 – 17
8	?	9 10	7	18
9	38	10 11	7	20
?	?	10 11	7 8	28
15	36	10	9	28

6. *Sagitta neglecta* Aida.

T. AIDA. Op. cit., p. 16.
? *Sagitta bipunctata* Béraneck.
ED. BÉRANECK. Op. cit., p. 153.

Characters. Head small. Body slender, resembling *bipunctata*; firm, not flaccid; the middle third nearly of the same thickness throughout, tapering slightly towards head and tail. There is no marked neck, owing to a long narrow thickening of the epidermis to form a collarette. Longitudinal muscles broad and stout. Tail 26 to 40 per cent. of the total length.

Anterior fins commencing at the posterior end of the ventral ganglion, broadest towards their posterior end. Posterior fins rather longer, separated only by a small interval from the anterior; rather more on the tail than on the trunk, widest behind the septum, reaching to the vesiculae seminales. Tail fin truncate, reaching to the vesiculae seminales when tumid.

Jaws slender, moderately curved, acutely pointed by delicate short tips. Anterior teeth with broad bases, rather short. Posterior teeth slender, sharp, closely set below, diverging distally.

Vestibular ridge high, with numerous, fairly regular, papillae. Corona ciliata fairly long, extending up to or just on to the head, but not reaching to between the eyes; otherwise like that of *bipunctata*; extending for a half or two-thirds of the distance between head and ganglion. Formulae: —

10.0	30	7	6—7	14—15
9.5	31	7	7	15
8.0	30—37	6—7	4—6	9—14
7.5	26—33	6—7	4—5	10—13
7.0	26—35	6—7	4—6	9—12
6.5	30	6—7	4—5	9—10
6.0	33	5—8	3—5	9—11
5.5	30—36	6	4	10—11
5.0	30—40	6—7	3—4	7—10

This species resembles AIDA's *regularis* so closely on paper, that for some time I suspected them of being synonymous; it is therefore worth while to enter into the differences between them in some detail.

Neither *neglecta* nor *regularis* have been fully described, and AIDA's two figures of *regularis* (woodcut 1 and fig. 8) do not agree with one another in the proportional length of corona and tail-segment. Still, accepting these figures, and adding to them the features of the Siboga specimens, we may say that the main points of difference are that in *neglecta* the tail is slightly shorter, the posterior fin reaches further in front of the septum, the corona ciliata is slightly longer; and (what is well brought out in DONCASTER's figure of *regularis*) that the slight epidermic thickening or collarette in *neglecta* is very much more developed in *regularis* both in length and breadth. The numbers of both anterior and posterior teeth are greater in *neglecta*.

At first sight the Siboga specimens seemed to link the two species; they agreed with *neglecta* in the number of anterior and posterior teeth, and in the length of the corona; they better agreed with *regularis* in the number of jaws, in the extension of the posterior fin, and in the proportion of the tail segment. They further agreed with *regularis* in a point on which AIDA laid great stress, namely, the regularity of the tactile prominences; a comparison of his figure A. (Op. cit., p. 17) with my figure 44 will show that these are practically identical, spot for spot. At the same time I think that he exaggerates the importance of this character, which is equally well exhibited by many other species, as for instance by *bipunctata* (compare GRASSI's figure, pl. IX, fig. 2). But eventually the two species fell naturally apart, although showing greater variation of the armature than AIDA's statement suggested, notably as regards the number of jaws.

I must withdraw the suggestion made in the Biscayan Report (p. 72, note to table) that *neglecta* was "almost certainly *bipunctata*". At the same time they are most annoyingly like one another, and are not easily distinguishable except in well preserved material. The main differences are that in *bipunctata* the posterior fin is rather more on the trunk than on the tail, the corona extends on to the head, and the papillae of the vestibular ridge are less developed, than in *neglecta*. For a comparison of the armature in cases of doubt there follows a table of formulae of small *bipunctata* from Parson's Bank in the English Channel:

10.0	20	8	4	8
9.0	22	9	5	10
8.0	25	8	3—5	7—10
7.5	26	8	4	9
5.0	28	8	4	8
6.0	25—28	7—9	3—4	5—8
5.5	27	8	3	4—5

It will be obvious how closely these figures approach *neglecta* at about 7 to 8 mm. of total length, especially as AIDA records 8 jaws for *neglecta*.

It seems very unlikely that the *bipunctata* of BÉRANECK was referable to QUOY and GAIMARD's species. Amboina, whence it was obtained, is near to the centre of the area studied by the Siboga, from the collections of which it appeared to be absent; the expedition could hardly have missed it systematically for a whole year. As already mentioned, except with formalin specimens before one for comparison, it would be extremely difficult to distinguish between *neglecta* and small *bipunctata*, and attention had not been called to the former when BÉRANECK wrote. He records only one or two details; the length of 13 mm. is rather more than that noticed in the Siboga *neglecta*; but his description of the epidermic thickening at the neck (collarette) recalls *neglecta* much more than *bipunctata*: it can hardly be said that the slight thickening in *bipunctata* Q. G., "etablit une transition entre les Sagitta et les Spadella", but this might fairly be said of *neglecta*.

7. *Sagitta pulchra* Doncaster.

L. DONCASTER. The Fauna and Geography of the Maldive and Laccadive Archipelagoes. Vol. I., part 2. The Chaetognatha, p. 213.

Characters. Head rather small; behind it a distinct collarette. Body slender, nearly as transparent as in *enflata*, but firmer. Trunk thickest at about one-half to three-quarters of the distance between head and tail-septum; tapering rapidly to the septum, more gradually forwards. Longitudinal muscles slight, but stronger than in *enflata*; lateral fields large. Tail about 18 to 27 per cent. of the total length.

Anterior fins long, commencing at the ganglion, broadest just before their posterior end; consisting anteriorly of an epidermic thickening without, or with few, rays. Posterior fins shorter, very nearly meeting the anterior, rather more on the trunk than on the tail, broadest at or behind the plane of the septum, hardly reaching the vesiculae seminales. Tail fin slightly rounded.

Jaws of medium strength, strongly curved; tips long, slender, and sharp. Anterior teeth with very broad bases, closely set; posterior teeth long, not very sharp, divergent distally.

Vestibular ridge with sharp, fairly regular, projections, terminating externally in a strong process. Corona ciliata long, extending between the eyes anteriorly, and posteriorly covering from one-third to one-half the distance between head and ganglion. Formulae: —

22	18—20	6—7	7—9	12—14
21	18—21	6	8—9	12—15
20	20—25	5—6	7—10	12—15
19	21—27	5—6	7—8	13—14
18	22	5—6	6	10—11
17	20—23	6	6—7	11—13
16	18—21	5—7	6—9	10—13
15	26	6	10	14
14	21—26	6—7	6—8	12
13	23	6	7	12
12	20	5	7	13
11	22—27	6	6—7	10—12
10	20	7	7	11
9	26—27	6—7	5—6	9

It is almost impossible to separate *pulchra* from *enflata* by the use of a dissecting lens alone, in many cases of spirit specimens; but microscopic examination distinguishes them satisfactorily. The main points of difference are that in *pulchra* there is a collarette, and consequently little neck-constriction between head and trunk; the body is slenderer; the fins longer, broader, and closer together; the corona longer; than in *enflata*. In *hexaptera*, which is also of the same general form, there is again little neck, although no collarette is present; but *pulchra* differs from it just as it does from *enflata* in the fins and corona, and of course markedly in the number of teeth.

8. *Sagitta regularis* Aida.

T. Aida. Op. cit., p. 17.
L. Doncaster. Op. cit., p. 211.

Characters. Head very small; when contracted, not thicker than the body immediately behind it. Body firm; of about the same thickness from the abdominal ganglion to the vesiculae seminales; it tapers forwards from the ganglion, but the development of the collarette at first sight makes it appear of similar thickness anteriorly. A collarette extends from the anterior end of the anterior fins, wider and much longer than in *neglecta*. Longitudinal muscles broad and stout. Tail 28 to 40 per cent. of the total length.

Anterior fins narrower and shorter than in *neglecta*, beginning slightly behind the abdominal ganglion. Posterior fins narrower than in *neglecta*, much more on the tail than on the trunk, reaching the vesiculae seminales. Tail fin rounded, making a more obtuse angle with the tail than is usual in *Sagitta*.

Jaws slender, not very strongly curved, and with small rather blunt tips. Teeth broad below, not very acute, the anterior as long as the posterior.

Vestibular ridge with slight undulations. Corona entirely on the trunk, broad, of medium length.

The following table is based on eight specimens only: —

7.0	28	9	4	6
6.0	33	7—8	2—3	6
5.5	36	7—8	2	4
5.0	40	6—7	2—3	5—6
4.5	33	6—8	2	2

In spite of its very small size, this is undoubtedly not the young of another species, for instance *neglecta*: the extension of the ovaries to about midway between ganglion and head, and the cap on the vesiculae seminales, showed that some specimens were not far from maturity.

The chief differences between *regularis* and *neglecta* have been already discussed (p. 16).

Doncaster's drawing of this species (Op. cit. fig. 7) which is very good as regards the anterior end, seems to err, when compared with my specimens, in making the tail region much too short (23 p. c. of total length without the tail fin, as against Aida's 33), and consequently in placing too much of the posterior fin on the trunk.

9. *Sagitta robusta* Doncaster.

L. Doncaster. Op. cit., p. 212.
? *Sagitta hispida* Aida (non Conant).
T. Aida. Op. cit., p. 18.

The close resemblance of this supposed species to *ferox* has already been discussed in some detail (p. 10), and will be easily realised from a comparison of their descriptions and figures.

Characters. General appearance between that of *ferox* and that of *serratodentata*. Head fairly large, proportionately larger than in *serratodentata*, smaller than in *ferox*. In expansion of the head, the neck is well marked, but almost disappears when the head is contracted under the prepuce. There is a distinct collarette, slightly less both in breadth and length than in *ferox*. Body proportionately slenderer than in *ferox*, but with very strong longitudinal muscles and small lateral fields, somewhat less opaque than *ferox*, more so than *serratodentata*. Trunk of nearly the same thickness from behind the neck up to just in front of the tail septum, thence tapering gradually. Tail segment from 25 to 33 per cent. of the total length.

Anterior fins long, beginning at or just behind the abdominal ganglion, rounded, widest a little before their posterior end and narrowing markedly forwards from that point (unlike *ferox*), narrower and shorter than in *ferox*. Posterior fins larger than the anterior (unlike *ferox*), rounded, more on the tail than on the trunk, widest behind the septum, reaching to the vesiculae seminales when these are tumid.

Jaws short, strong, broad, strongly curved; the tips rather small. Both anterior and posterior teeth as in *ferox*.

Vestibular ridge with very slight undulations (unlike *ferox*). Corona ciliata of the same type as in *ferox*, but not extending quite so far towards the ganglion. Formulae: —

14.0	28	6—7	6—10	12—14
13.5	26	7	5—6	11
13.0	26—30	6—7	5—8	11—15
12.5	32	7	8	13
12.0	25—33	5—7	6—8	11—14
11.5	33	6—7	7	13
11.0	27	7	6—7	11—13
10.5	29	7	7	11—12
10.0	30	6—7	6	11

The points of difference between *ferox* and *robusta* have been emphasised in the foregoing characters rather than the points of similarity; the latter are also numerous and important, but more conspicuous.

It is possible that the specimens from Misaki which AIDA attributed to *hispida*, CONANT, were really referable to *robusta*, which had not been described at the time that AIDA wrote.

Robusta, Siboga Exp.	10—12	25—33	5—7	6—8	11—14
Hispida Aida	11	25	7—8	7—8	11—17
Hispida Conant	7—11	33	8—9	4—5	8—15

At any rate it is apparent from the marked difference in the number of anterior teeth that they were not *hispida* Conant: AIDA further describes the head in his specimens as "comparatively large", while a reference to CONANT's figure of *hispida* shows a very small head. AIDA's description and figure agree sufficiently well with *robusta*, but I have only seen an eighth jaw as a rudiment.

10. *Sagitta serratodentata* Krohn.

A. KROHN. Nachtragliche Bemerkungen über den Bau der Gattung Sagitta. Archiv fur Naturgeschichte. Jahrgang XIX, p. 266.

The characters of this widely distributed species have been given in Biscayan Plankton (p. 58), and need not be repeated here. Such points of interest as were presented by the Siboga specimens will be discussed below (pp. 29, 30) in connection with a more general question.

The outline of a typical specimen (fig. 59) shows one or two slight differences from the Biscayan type. Formulae: —

14.0	28	7	9—10	18
12.0	25	6	9	17—20
11.5	26	6	9	18
11.0	27	6	8—9	17—19

10.0	25—30	5—7	8—9	15—19
9.0	22—33	5—7	6—9	13—18
8.0	25—31	6—7	8—9	14—16
7.0	28—35	6—7	5—8	9—14
6.0	33	6—7	5—6	8—9
5.5	36	7	5	10

11. *Sagitta Sibogae* species nova.

Characters. Head large, separated from the body by a well marked neck, with a very short collarette. Body firm, thickest about the middle third, tapering gradually forward, more rapidly backward. Longitudinal muscles strong and rather opaque; lateral fields conspicuous and fairly wide. Tail segment narrow, about 21 to 33 per cent. of the total length.

Anterior fins long, widest posteriorly (not so wide as in *Bedoti*), diminishing slightly anteriorly; they reach to the abdominal ganglion; rays (?) absent from the anterior part. Owing to shrinkage inwards of the lateral fields, the anterior fins are often hardly apparent. Posterior fins broader than the anterior, but shorter: about equally distributed on tail and trunk, widest near the plane of the septum; ceasing far short of the vesiculae seminales. Tail fin truncate, reaching the vesiculae seminales.

Jaws for the most part slender and comparatively straight; the first (youngest) with unusually strong base and somewhat more curved; their tips simple and rather large. Anterior teeth short, with broad bases. Posterior teeth long, broader and with narrower bases than in *Bedoti*.

Corona ciliata not observed with certainty. Vestibular ridge with numerous large papillae, which are higher, more regular, and not so sharp, when compared with those of *Bedoti*. Eyes with elongated pigment. Formulae: —

20.0	25	6	8	22
19.0	21—23	5—6	9—10	17—20
18.5	24	6	9	20
17.5	22	6	11	22
17.0	26—27	6	9	20—23
16.5	24	6	9	20
16.0	25—28	5—6	7—10	18—23
14.5	27	5—6	8—9	17
14.0	25	6	8—9	16—22
13.5	25	5—6	9—10	19—21
13.0	23—30	6	8—9	17—19
12.5	24	5—6	8—9	15—18
12.0	29	6—7	8	15—17
11.0	22	7	7	16
10.0	30	6	7	13
9.0	33	5	8	16

The general form of the body is much like that of *Bedoti*, so much so that at first the two species were confused with one another. But it can really be quite readily distinguished by the larger head, the elongated eye-pigment, the little collarette, and the smaller extension of the posterior fin. The dotted outline of the corona in figure 61 is a restoration from fragments, and is possibly incorrect.

12. *Sagitta Zetesios* Fowler.

G. H. FOWLER. Op. cit., p. 67.

Three fine specimens from Station 141, well preserved in formalin, and measuring 20, 27 and 30 mm., seemed to be almost certainly referable to this species. The largest of these has been drawn as figure 73, and exhibits a condition of fin and collarette intermediate between figures 22 and 23 of the Biscayan Report. Three small and less well preserved specimens in the same haul, appeared also to be attributable to the same species; one of these is represented in fig. 74. Ten further specimens in the same haul, although at first of a different appearance, yet could be placed in no other species; they were obviously very sharply contracted, judged by the look of the longitudinal muscles, and especially so at the posterior end; this had given them a very thick-set appearance with a stumpy tail, and had exaggerated the width of the posterior fin. The outline of one of these forms figure 75, and the jaws and teeth have been drawn from another of the same set, so that the similarity to *Zetesios* may be observed in the least likely case. Precisely the same contraction, with the same results, was noticeable in many specimens of *Krohnia hamata* from deep vertical nets.

The remainder of the material assigned to this species was preserved in alcohol, and showed for the most part the same effects of sharp contraction; but the specimens could apparently be graded backwards into the large finely-preserved specimens first mentioned. The tail in these contracted forms, not unnaturally, often bore a smaller proportion to the total length than was the case with the Biscayan specimens; and in all the Siboga specimens the lateral fields seemed broader, and the posterior fin more rounded. But the coincidence of more important characters is so close, that there is no necessity to found a new species on such points.

As with the Biscayan material, even the largest specimen was far from maturity, the vesiculae seminales only projecting slightly. Formulae: —

30	26	7	8	17
27	25	9	8	19
25	20	9	9	18
23	26	9—10	8—10	18
22	27	8	8	17
21	21	9	11	20
20	27—30	8—9	7—10	16
19	21—26	8—10	7—8	16—18
18	25—27	8—9	7—9	16—18
16	24	10	8	17

15	23	9	9	18
14	18—25	8	5—6	14
13	23	7—9	8	16
12	20—30	7—8	6—7	13—14
11	22—27	9—10	5—7	13—15
10	25	8—9	7	13
9	27	7—9	5—7	9—14
8	23—30	9—10	5—6	12

It is probably a result of the strong contraction that this table is not quite so level as in some species, certain specimens appearing under a shorter total length than they possessed in life. But on taking the contracted specimens to a separate table, I still got no clue by which to sort them into separate species.

II. Genus **Krohnia** (Langerhans, 1880).

13. *Krohnia hamata* Moebius.

K. Moebius. Zoologische Ergebnisse der ('Pommerania') Nordseefahrt: Vermes. Jahresb. d. Comm. z. wissensch. Untersuch. d. deutschen Meere. Jahrgang I. and II., s. 105.

The characters of this interesting species have been given at length in Biscayan Plankton (p. 74) and need not to be repeated here. There exists a very slight ridge with sense bulbs in the position of the vestibular ridge of *Sagitta*; but it is extremely difficult to see, and I had failed to observe it among the Biscayan and Faeroe Channel specimens. Some of the younger specimens exhibited the sagination of the more ventral jaws already described by Strodtmann and the present writer. Formulae: —

26.0	27	11	20
24.0	29—33	11—12	16—23
20.0	25—27	10—11	19—21
19.0	31	11	15
18.0	27—33	11	20
17.0	29	13	12—14
16.0	28—34	8—12	13—21
15.0	25—30	9—11	19—21
14.5	31	11	18
14.0	28—32	10—12	17—20
13.0	26—30	11—12	17—22
12.0	25—33	10	16—19
11.0	22—27	10—11	11—13
10.5	28	10	16—17
10.0	30	10—11	17
8.5	30	10	9
8.0	25—31	9	12

As in the table of *Zetesios*, and for the same reason, namely the sharp contraction lengthways of many specimens from deep water, the table is slightly irregular.

Up to about 20 mm. the teeth were very much more numerous than in the Faeroe Channel specimens. None of the specimens were in really good preservation, but so far as could be ascertained there was no reason to doubt their specific identity with Moebius' species.

14. *Krohnia pacifica* Aida.

T. Aida. Op. cit., p. 19.
L. Doncaster. Op. cit., p. 215.

Characters. Head of medium size, neck fairly well marked; no collarette. Body slender, but stouter than in *subtilis*, thickest about midway between septum and abdominal ganglion, tapering gradually in both directions. Lateral fins beginning at nearly two thirds of the distance from ganglion to septum, reaching posteriorly to the vesiculae seminales, generally more on the tail than on the trunk, widest behind the septum. Tail fin rounded, extending forward to the vesiculae seminales. Tail segment 25 to 41 per cent. of the total body-length, generally less than in *subtilis*.

Jaws with long acute tip; they begin centrally on a gentle curve, with which the straighter distal portion of the convex side almost makes an obtuse angle; at this point the crest of the convex side is markedly thickened; the crest is thicker and darker in colour than in *subtilis*. Teeth bayonet-shaped, springing from a thinner neck than is the case in *subtilis*, more numerous than in *subtilis* of the same length. Corona ciliata short, clove-shaped, just extending on to the head, but not reaching the eyes. No vestibular ridge observed. Formulae: —

Siboga Ex.:	9.0	27—33	8	12—16
	8.0	25—31	8—9	12—15
	7.5	33	8	15
	7.0	28	8—9	12—13
	6.5	30	6	12
	6.0	33—41	6—9	12
	5.0	30	8—9	13
Aida.	6	30	9	10—11
Doncaster.	7	33	9	13

The differences between this species and *subtilis* are very slight, but I must withdraw the suggestion of their identity made in Biscayan Plankton (p. 70). At the same time the characters set out above do not tally in every point with Aida's brief description; still, the identity of jaws and teeth (the only magnified details which he figures), and the general agreement, leave little room for doubt that we are both dealing with the same forms. He describes the fins as lying equally on trunk and tail [1]), a condition which I have also noticed, but generally more is distributed on the tail than on the trunk.

1) His figure shows much more on the trunk than on the tail.

Aida states that "this species greatly resembles *Krohnia subtilis*, but is distinguished by its small head, regular row of teeth, the smaller number of the teeth, and some other characters". Grassi, it is true, emphasises the size of the head (in the text, though not in the figure) but the camera lucida outline which I have given in Biscayan Plankton (fig. 50) shows that *subtilis* has a medium rather than a large head; the neck in some markedly contracted specimens makes the head look larger than it really is. As to the regularity of the rows of teeth, this depends, both in *subtilis* and *pacifica*, on the amount of expansion of the head at death; the teeth may be spread out into a definite fan-like row, or (more usually) may be compressed together so as to form the walls of part of a cone, the tips of the teeth converging. As to the smaller number of teeth, *pacifica* actually has more than *subtilis* at the same total length, but Aida's recorded specimen measured only 6 mm.

Krohnia pacifica was also recorded by Doncaster from the Maldive Archipelago, represented by two specimens reaching 7 mm. in length, one of which carried mature ova. A 9 mm. specimen from Siboga Station 168, showed the same septate condition of the ovary as Doncaster figured, there being six large ova on each side; this septate condition is noticeable in other species (e. g. *Sibogae*, *serratodentata* and *ferox*), and is apparently only an expression of maturity, probably the only certain symptom of absolute female ripeness.

15. *Krohnia subtilis* Grassi.

B. Grassi. Op. cit., p. 16.

The great slenderness of the body, the high percentage value of the tail segment, the character of the teeth and jaws serve to identify this with Grassi's species. The general characters will be found in Biscayan Plankton (p. 78).

Some points of distinction between this species and *pacifica* have already been mentioned. In addition, the jaws of *subtilis* are thinner when viewed from the outer convex edge, and are more transparent and lighter in colour. Both have much the same outline when viewed antero-posteriorly, but the change of curve on the convex edge is hardly so abrupt as in *pacifica*; and at this point there is in *subtilis* a lesser thickening of the outer crest; on the other hand, the inner concave border appears to be much thicker than in *pacifica*, so that the pulp-cavity becomes very narrow.

The table shows four specimens only:

13.5	37	?	10
12.0	37	8—9	? 10
11.0	45	7—8	9

III. Genus Spadella (*sensu* Langerhans 1880).

16. *Spadella draco* Krohn.

A. Krohn. Op. cit., p. 273.
B. Grassi. Op. cit., p. 15.
? *Spadella Vougai* Beraneck.
E. Béraneck. Op. cit., p. 155.

Characters. Head large with a well marked neck. Body stout, nearly equally thick throughout, but tapering slightly towards head and posterior fin; firm, rather opaque. Longitudinal muscles well developed. Tail segment 41 to 57 per cent. of the total length.

A lateral epidermic expansion, forming an exaggerated collarette, reaches from the widest part of the head to the post-septal fin, with which its outline in older specimens becomes continuous: widest at or just before its junction with the fin. Fins commencing at the tail septum, extending in mature specimens to the vesiculae seminales when tumid; generally rounded. Tail fin truncate, reaching the vesiculae seminales when tumid.

Jaws slender, at first nearly straight, then slightly curved; the internal edge often saginate for some distance about the middle of their length: the tips sharp, of medium size. Anterior teeth with rather narrow bases; dark in colour. Posterior teeth long, slender, closely set, dark in colour.

Vestibular ridge with regular blunt spikes. Corona ciliata oval or hexagonal, lying entirely on the neck and trunk.

The following table has been constructed from 16 specimens.

9.0	44	8	9	? 9
8.0	43—50	8—9	8—9	12—16
7.5	46	8	9	12
7.0	43—57	7—9	7—10	11—15
6.0	41	7	8	12

It may be doubted whether the differences between *draco* and *Vougai* are more than matters of their respective ages (lengths). The smallest specimen which I assigned to *draco* measured 5 mm. and was a giant compared to Béraneck's three specimens of 3 and 4 mm.; its armature formula was 8 : 6 : 10, as against their 9 : 4—5 : 6—7. What at first seems to be an important difference lies in the sharply curved tip of the jaw figured by Béraneck in *Vougai*; but the oldest jaws of young *draco* are often somewhat curved, and hardly exhibit the sagination described above. Even with Zeiss Apochr. 4, oc. 8, I failed to see the points figured by Béraneck at the tips of the teeth of *draco*; and believe that, as in other cases, their appearance is due to wear and damage; this, if true, would break down another distinction between *draco* and *Vougai*.

IV. Species incertae.

? *Sagitta furcata* Steinhaus, and *planctonis* Steinhaus.

O. Steinhaus. Die Verbreitung der Chaetognathen im sudatlantischen und indischen Ocean. Inaugural-Dissertation, Kiel, 1896, 8vo.

Five specimens from deep hauls with the vertical net have been very doubtfully assigned to these two species: regard being had to the armature (practically the same in both) and their comparative firmness and flaccidity. The following table gives their stations and formulae.

Station 118	27	22	6	7	9—10	? *furcata.*
Station 143	23	26	8	7—8	9—11	? *planctonis.*
Station 141	21	23	7—8	6	9—10	? *planctonis.*
Station 141	21	24	7	6	10	? *furcata.*
Station 185	17	23	9	4—5	10	? *planctonis.*

Note to the General Table of Captures.

The following table shows all species except the doubtful *furcata-planctonis* specimens; the details of which have just been given. Some hauls in this list do not occur in the published list, and have been added from the labels.

142 (2). Owing to a bad cork, the material was rotten.

172. Every specimen identified in about a quarter of the total material received.

194—7. These four hauls had been put together.

225c? This was labelled 225, but contained too many, too large, and too well preserved specimens for the Horizontal Cylinder.

In some hauls the number of specimens of each species was counted; in other cases the fact of the occurrence has been merely indicated by a cross. Occasionally the counted material has been supplemented by the occurrence of another species from a separate tube, so that both figures and a cross may be seen under the same haul.

The following abbreviations have been used.

D. Dredge.
H.C. Horizontal Cylinder.
H.V. Hensen Vertical Net.
M.N. Mesoplankton Closing Net.
T. Tow-net and 'Brut-netz'.
Tr. Trawl.
∞ Hundreds of specimens.

Nº	Depth	Net	Bedoti	enflata	ferox	hexaptera	macrocephala	neglecta	pulchra	regularis	robusta	serratodentata	Sibogae	Zetesios	hamata	pacifica	subtilis	draco
1	0	T	×	.	×	.	.	×	×	.	×	×	.	.	.	.	.	.
16	36—0	HV	×	×	.	.	.	×	×	.	×	.	.	.	.	.	.	.
35	1310—0	Tr	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.
35(2)	0	T	.	×	×	.	.		.	.	×	×	.	.	.	.	.	.
36	0	T	×	×	×	×	.	×	.	.	×	×	.	.	.	.	.	.
37	0	T	2	108	14	24	.	×	1	.	1	8	.	.	.	.	.	.
47	0	T	×	×	.	.	.	.	×	.	.	.	.	.	.	.	.	.
50	0	T	×	×	.	.	.	×	.	.	.	.	.	.	.	.	.	×
66	0	T	×	×	×	×	.	×	×	.	×	×	.	.	.	×	.	×
71	0	T	.	×	.	.	.	×	.	.	.	.	.	.	.	.	.	.
75	11—0	HV	×	×	.	.	.	×		.	×	×	.	.	.	×	.	×
81	0	T	×	×	×	×	.	.	×	.	.	×	.	.	.	×	.	.
90	0	T	×	×	×	×	.	×	.	.	.	×	.	.	.	.	.	.
93	0	T	×	×	.	×	.	×	×	.	×	×	.	.	.	.	.	×
96	0	T	×	×	×	×	.	×	×	×	.	×	.	.	.	×	.	×
99	0	T	2	24	3	1	.	.	1	1	1	.	.	.	.	.	.	.
104	0	T	×	×	×	×	.	×	.	.	×	.	.	.	.	×	.	.
106	0	T	29	×	28	×	.	×	5	.	×	×	.	.	.	2	.	1
107	580—0	D	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.
109	0	T	.	36	18	.	.	5	.	.	7	.	.	.	.	1	.	1
110	0	T	3	32	1	1	.	1	.	.	3	13	.	.	.	5	.	.
112	0	HC	.	×	×	.	.	×	.	.	×	×	.	.	.	×	.	.
117[a]	0	T	1	c. 200	12	.	.	.	1	.	.	1	.	.	.	.	.	.
118	900—0	HV	3	17	8	11	.	1	.	.	5	6	.	.	1	.	.	1
122(2)	0	T	3	53	4	.	.	16	.	.	? 4	1	.	.	.	109	.	.
125	0	T	.	×	.	.	.	×	.	.	×	×	.	.	.	×	.	×
128	700—0	HV	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.
133	0	T	×	×	×	×	.	? ×	.	.	? ×	×	.	.	.	×	.	×
136	0	T	62	×	58	×	.	8	14	.	7	22	.	.	.	2	.	8
138	0	T	×	×	×	×	.	×	×	.	×	×	.	.	.	×	.	.
141	1500—0	HV	64	×	2	9	3	.	.	.	15	5	53	14	11	.	1	21
142(2)	0	T	.	×	.	.	.	×	.	.	.	.	.	.	.	.	.	.
143	1000—0	HV	8	×	4	7	.	.	8	.	? 2	5	25	7	4	.	1	4
144	0	T	29	229	21	.	.	1	4	.	7	6	.	.	.	.	.	2
146	0	T	.	24	.	? ×	.	.	.	.	.	.	.	.	.	.	.	1
148	1000—0	HV	4	35	×	1	.	×	×	.	.	5	2	.	3	1	.	4
149	0	T	.	×	.	.	.	×	.	.	.	.	.	.	.	.	.	.
157	0	T	×	×	×	.	.	×	×	.	? ×	.	.	.	.	.	.	×
165	0	T	18	318	47	.	.	4	×	.	4	9	.	.	.	1	.	4
168	0	T	12	+100	19	3	.	15	4	2	3	13	.	.	.	2	.	4
169	0	T	2	68	13	.	.	77	.	.	.	6	.	.	.	.	.	1
172	0	T	46	182	6	1	.	.	22	.	.	1	.	.	.	.	.	5
174	0	T	×	×	.	.	.	×	.	.	.	.	.	.	.	.	.	.
175	1914—0	Tr	.	.	.	.	.	.	.	.	.	.	.	? 1	.	.	.	.
177[1]	0	T	×	×	×	×	.	.	×	.	.	.	.	.	.	×	.	×
184	0	T	6	60	2	×	.	4	×	.	×	6	.	.	.	.	.	.
185	1536—0	HV	×	×	.	×	2	×	.	.	×	×	×	10	5	.	×	.
186	0	T	3	18	.	1	.	.	.	1	.	2	.	.	.	.	.	2
189[1]	0	T	11	165	1	.	.	.	2	.	6	5	.	.	.	.	.	18
194(1)	0	HC	.	3	.	.	.	.	.	.	.	2	.	.	.	.	.	.
194(2)	0	T	16	257	7	.	.	1	1	.	6	8	.	.	.	.	.	4
194—7	0	T	.	.	×	.	.	×	.	.	.	×	.	.	.	.	.	.
203(1)	1500—0	HV	7	105	.	18	.	.	.	.	.	9	3	3	.	.	1	2
203(2)	0	T	3	36	.	1	.	.	.	.	.	1	.	.	.	.	.	.
205	0	T	.	×	.	×	.	×	×	.	? ×	.	.	.	.	×	.	×
208	1886—0	Tr	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.
210[1]	1044—0	Tr	.	.	.	2	.	.	.	.	.	.	.	.	2	.	.	.
210[1](2)	0	T	.	×	.	.	.	×	.	.	.	.	.	.	.	×	.	.
213	0	T	×	×	×	.	.	.	.	.	.	.	.	.	.	.	.	.
215	0	T	×	×	×	.	.	.	×	×	.	.	.	.	.	×	.	.
215[1](2)	0	T	.	×	×	.	.	.	.	.	.	.	.	.	.	×	.	.
216	975—415	MN	.	.	.	.	.	.	.	.	.	.	.	1	2	.	.	.
217(2)	0	T	.	×	.	.	.	.	.	×	.	.	.	.	.	×	.	.
217(3)	0	HC	.	×	.	×	.	.	.	×	.	×	.	.	.	.	.	×
220(1)	0	T	×	×	.	×	.	×	.	.	×	×	.	.	.	×	.	.
220(2)	200—0	HV	.	.	.	.	.	.	.	.	.	.	.	.	.	×	×	.
220(3)	10—0	HV	×	.	.	.	.	.	.	.	.	.	.	.	.	.	.	×
223(2)	0	T	.	.	.	.	.	×	.	×	×	.	.	.	.	.	.	.
224	0	HC	.	10	.	.	.	.	.	.	2	28	.	.	.	.	.	.
225	0	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
229	0	T	4	88	1	.	.	5	.	.	13	1	.	.	.	×	.	.
230(1)	2000—0	HV	.	×	.	.	.	×	.	.	.	×	.	.	.	.	.	.
243	1000—0	HV	1	1	.	.	.	.	.	.	.	2	.	? ×	.	.	×	1
245	0	T	.	.	.	.	.	×	.	.	.	.	.	.	.	.	.	.
252	0	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	×
276	750—0	HV	5	7	×	.	.	.	.	.	1	.	.	×	.	×	.	×
304	0	HC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	×
315	0	T	.	.	.	.	.	.	.	.	.	.	.	.	.	×	.	.

b. ALLEGED DIFFERENCES BETWEEN EUROPEAN AND INDO-PACIFIC SPECIMENS OF THE SAME SPECIES.

Attention has been called to some supposed relations between European and Indo-Pacific specimens, the chief of which is that the latter possess a greater number of teeth than is found in specimens of the same species from European waters: — a relation, which, if proved to be true, would be of considerable interest. The instances on which it has been based are as follows.

AIDA (op. cit.) called attention to this supposed fact in his record of '*bipunctata*'; but there is no doubt in my mind that he had before him, not *bipunctata* Quoy and Gaimard, but *Bedoti* Béraneck (compare pp. 7, 8 above); this instance therefore I believe to lapse. AIDA also made the same comparison with *hispida* Conant: but here again it is practically certain that he was not dealing with CONANT's species (compare p. 20). DONCASTER expresses his agreement with AIDA on this point about '*hispida*', but mentions no such differentiating details of the specimens, as would make it clear to a reader that he had CONANT's species before him.

DONCASTER further states that in *enflata* from the Maldive Archipelago, as compared with European species, the tail segment is 'rather shorter in proportion to the trunk, and the teeth are sometimes more numerous. Exactly the same differences are described by AIDA between the *S. enflata* found in Japan and those of European waters'. AIDA however had recorded for Japan (9—10 : 6—8 : 10—11) much the same formula as GRASSI for the Mediterranean (9 : 6—9 : 9—11); and he reported the tail segment as $^1/_5$ to $^1/_6$ of the total length, while GRASSI described it as little less than a quarter: there is practically no difference here. DONCASTER did not publish the number of teeth on which his statement was based. A reference to the table on page 9 above will show that the teeth in old specimens of *enflata* are often more numerous than GRASSI recorded, but his largest specimen was only 20 mm. long, and did not differ greatly from the Siboga figures for that length.

For *serratodentata* Doncaster records 18—20 posterior teeth and 10 anterior, "instead of 12 and 8 respectively in European waters". The following table bears upon this point.

GRASSI, Naples.	13	33	6—8	6—8	12
KROHN, Messina.	10	—	6—8	8	18
'Biscayan Plankton'.	10—15	25—35	6—8	4—7	7—13
Siboga Exped.	10—14	25—30	5—7	8—10	15—20
BÉRANECK, Amboina.	—	—	—	to 9	to 16
DONCASTER, Maldive Isl.	—	—	—	10	18—20

On the whole the teeth recorded are more numerous in Pacific than in European specimens, but KROHN's record of 18 posterior teeth from Messina upsets at once any conclusion that might be drawn as to this being a mere matter of geographical position.

There certainly is a great difference between the table of *serratodentata* in Biscayan Plankton (p. 59) and that given in this Report (pp. 20, 21); they were based respectively on thirty eight and thirty specimens; roughly speaking, the number of posterior teeth in a Pacific specimen is double that of a Biscayan specimen at the same length. It is possible that this may be correlated with the respective temperatures at which the specimens live, but a long series of similar observations from different latitudes would be necessary before this could be regarded as even probable.

It seemed at first sight possible that in these Indo-Pacific *serratodentata* might be found an instance of the faster rate of life which has been alleged to characterise tropical plankton, as the result of more rapid metabolism at higher temperatures; that these specimens might prove not only to reach a higher complement of teeth, but also to attain sexual maturity at a shorter total length than their Atlantic brethren. But the examination of a number of specimens from both localities showed that the first evidences of sexuality appeared in both sets at about the same total length of 9—11 mm. (it varies a good deal with the individual); it may have proceeded a little more rapidly in the case of the tropical specimens, but there seemed to be at most only the difference of a millimetre of total length on the average, in specimens at the same apparent stage of sexual development. This is by no means definite enough to found a case upon.

In young *Krohnia hamata* from the Siboga Expedition more teeth were observed than in the corresponding specimens from the Faeroe Channel, but the question of sexual maturity could not be well studied owing to the imperfect preservation of the former material.

In summary it may therefore be said that at present there is a lack of positive evidence to prove that European specimens develop fewer teeth than Indo-Pacific at the same total length; and that although such a difference clearly existed between *serratodentata* from the Bay of Biscay and from the area of the Siboga expedition, still it is practically certain from KROHN's observations at Messina that this is not the expression of a mere difference of longitude, but must be capable of some other explanation.

At the same time, it need hardly be pointed out that a case of such wide variation suggests that in the future, when more is known of the group, the number of species may be considerably reduced.

c. NOTES ON SOME SPECIES NOT CAPTURED BY THE SIBOGA EXPEDITION.

Sagitta arctica Aurivillius.

C. W. S. AURIVILLIUS. Das Plankton der Baffins Bay und Davis' Strait. Festskrift WILHELM LILLJEBORG, p. 188. Upsala 1896. 4to.

? *elegans* Verrill.

A. E. VERRILL. Invertebrate Animals of Vineyard Sound and the adjacent water. United States Commission of Fish and Fisheries. Part I, pp. 440, 453, 626. (For the years 1871, 1872; published 1873).

? *falcidens* Leidy.

J. LEIDY. On Sagitta, etc. Proceedings of the Academy of Natural Sciences of Philadelphia. Year 1882, p. 102.

The original diagnosis of this form is too brief to enable any one but its describer to identify it with certainty; it runs as follows: "Flossen wie bei *S. hexaptera* d'Orb. Greifhaken 11 (12), Vorderzähne 6 (7), Hinterzähne 15 (16), Schwanz-Segment (ohne Flosse) = $^1/_4$ des Rumpfes. Körperlänge 28—30 mm.". No figure of the species has been published, so far as I can ascertain.

It seems to be very probable that *arctica* will prove to be identical with VERRILL's *elegans*, and with LEIDY's *falcidens*; possibly also with *Zetesios*.

arctica	28—30	25	11—12	6—7	15—16
elegans [1])	25—30	20	9—12	5—7	12—15
falcidens	19	?	11—14	6—7	18
Zetesios (Bisc. Rept.)	20—32	25—33	8—10	7—9	17—19
Zetesios (Siboga Exp.)	25—30	20—26	7—9	8—9	17—19

That the first three are identical seems to be as certain as mere similarity of formulae can make it; *elegans* would in this case take priority of *arctica*. *Zetesios* carries rather fewer jaws and more anterior teeth, so that the probability of identity is not quite so great. In the Synonymic List and Record of Distribution below, *arctica* and *elegans* stand as independent species, and must remain so until a fuller description of the former is published, or until some observer can compare specimens of the two. *Falcidens* has been placed under *elegans* in the tables.

Sagitta bipunctata Quoy et Gaimard.

J. R. C. QUOY et P. GAIMARD. Observations zoologiques faites à bord de l'Astrolabe en Mai 1826 dans le détroit de Gibraltar. Annales des Sciences Naturelles, Tome X, p. 1.

Of some immature *bipunctata* lately received from the Zoological Station at Naples, the two longest gave a formula of 8.5 : 23 : 8 : 4—5 : 9—11. Some well-developed specimens were also obtained from the Laboratory at Plymouth. The only external difference noticeable between these and the specimens from Parson's Bank (Biscayan Report, p. 69; and p. 17 above) lay in a slightly greater extension backwards of the posterior fin; it thus becomes about equally distributed on trunk and tail, and falls into line with GRASSI's figure of the species (op. cit., Pl. I, fig. 4); in that case the fully developed vesiculae seminales might swell to meet the posterior fins as in his drawing (compare p. 5 above). The characters given in the Biscayan Report seem therefore to require amendment in this point; the following should also have been added to the characters — "a short and narrow thickening of the epidermis behind the head represents the rudiment of a collarette".

The Neapolitan specimens of 8.5 mm. were at the same stage of sexual development as Channel specimens of 19 mm., judged by the length of the ovary and the projection of the vesiculae seminales. This may be connected with the early ripening of a warm-water race, but is as likely to be due to the time of year at which the capture was made.

Sagitta elegans Verrill.

A. E. VERRILL. Op. cit.
F. S CONANT. Notes on the Chaetognaths. Johns Hopkins University Circulars. Vol. XV, p. 82.
gracilis Verrill.
A. E. VERRILL. Results of the explorations made by the steamer "Albatross". United States Commission of Fish and Fisheries. Part XI, p. 303 (For the year, 1883, published 1885).
falcidens Leidy.
J. LEIDY. Op. cit.
? *arctica* Aurivillius.
C. W. S. AURIVILLIUS. Op. cit.

1) From CONANT's redescription.

Of this species, founded by VERRILL in 1873, figured by the same author under the name of *gracilis* in 1885, the following characters have been extracted from his description and figure, and CONANT's description: — Head small, not much broader than the body at its broadest; neck not sharply marked. Body slender, thickest in the middle, tapering slightly towards both ends. Tail segment 20 per cent of the total length.

Anterior fins short, narrow, elliptical, rather far forward. Posterior fins separated from the anterior by a long gap rather less than their length; about equal in length to the anterior [but drawn much longer], elliptical, not reaching to the vesiculae seminales when the latter project only slightly, about equally distributed on trunk and tail [in the figure; but the oviducal papillae at the tail septum are stated in the text to be at about the posterior third of the fins, which would leave two thirds on the trunk]; widest at the plane of the septum. Tail fin broadly rounded.

Jaws considerably curved, with acute tips. Corona ciliata elongated, sinuous, oval. Formula

25—30 20 8—12 5—7 12—15.

The possibility that this may perhaps = *arctica* Aurivillius, and its practical identity with what little we know of *falcidens* Leidy, have been already mentioned. At any rate the latter has not been so fully described as to merit a place among valid species.

Sagitta hispida Conant (non Aida).

F. S. CONANT. Description of two new Chaetognaths. Johns Hopkins University Circulars. Vol. XIV, p. 77.

The following characters have been deduced from CONANT's text and figure. Length 7—11 mm. Head small, with no perceptible neck in contraction. [From the outline of the animal we may fairly presume the presence of a collarette]. Trunk of nearly the same thickness throughout its length, but tapering slightly forwards.

Anterior fins rounded, not reaching the abdominal ganglion; widest a little before their posterior end, narrowing rapidly forwards. Posterior fins long, rounded, much more on the tail than on the trunk, widest well behind the septum; much longer and rather broader than the anterior fins. Tail fin rounded.

Formula 7—11 : 33 : 8—9 : 4—5 : 8—15.

Corona ciliata long and sinuous, extending from in front of the eyes to near [? how near] the abdominal ganglion.

Unfortunately CONANT's figure cannot be trusted implicitly: he described the corona as reaching "almost to the level of the abdominal ganglion", and the anterior fins as extending "from near the level of the abdominal ganglion"; but in the drawing he leaves no less than 14 per cent of the total length between corona and fins, which shows an error somewhere.

So far as the description goes, it is indistinguishable from Mediterranean specimens of *bipunctata*, but the entire absence of a neck in the figure, removes this possibility. So far as description and figure go, there is nothing to separate it from *neglecta* except the extension forwards of the corona between the eyes; from the apparently world-wide *serratodentata* it differs in nothing but the (presumably) smooth jaws, of which however nothing is stated in CONANT's description beyond their number. It is often extremely difficult to detect the serrations in specimens in which it is poorly developed, when the head is (as often) under the prepuce; and it is quite possible that CONANT may have overlooked them. But until *hispida* has been re-studied in American waters, it must stand as a valid species.

It seems hardly probable that AIDA really had CONANT's species before him. Not only, as already pointed out, are the numbers of teeth against this identification, but his figure differs markedly from CONANT's; it shows a marked neck, quite unlike the strong collarette of *hispida*; the anterior fin is widest at about the middle of its length, instead of being widest posteriorly; and the posterior fin is about equally distributed on trunk and tail, instead of being much more on the tail than on the trunk.

DONCASTER also records *hispida* from the Maldive Islands. It is to be hoped that reporters on the next Indo-Pacific collections will consider the possibility that *hispida* Doncaster may = *neglecta* Aida (with which the short description closely tallies), and that *hispida* Aida may = *robusta* Doncaster. But it is of course also possible that I have confused *hispida* with *robusta* or with *ferox* in the Siboga collections.

Sagitta lyra Krohn.

A. KROHN. Op. cit., p. 272.

A few specimens with this label were received from the Zoological Station in Naples. I still think that this species is probably *furcata* Steinhaus. (compare Biscayan Plankton, p. 64), altered by pressure in the tow-net or by the action of reagents, or by both, in a manner which is familiar in several of the more flaccid species (*furcata*, *hexaptera*, *enflata*). But on spirit material it is impossible to feel positive on the point.

Krohnia foliacea Aida.

T. AIDA. Op. cit., p. 19.

Characters (deduced from the describer's text and figure). Head small. Body thickest in the middle third, tapering evenly backwards and forwards. Longitudinal muscles thick. Tail nearly 20 per cent. of the total length.

Lateral fins long, from about the middle of the caudal segment to the front of the abdominal ganglion.

Jaws with the tips curved as in *hamata*. Corona ciliata 'flask' shaped, on the head only.

Formula 11 : 20 : 7 : 5.

But for the short tail and few posterior teeth, this might easily enough be young *hamata*, from the cold water which is stated in some years to reach comparatively low latitudes on the coast of Japan during the period of the N.E. Monsoon. It may yet prove to be so, for the posterior teeth, although too few for the *hamata* of the area studied by the Siboga Expedition, are not too few when compared with specimens from the Faeroe Channel.

Spadella cephaloptera Busch.

W. Busch. Beobachtungen uber Anatomie und Entwicklung einiger wirbellosen Seethiere. Berlin, 1851, 4to.
Claparedi Grassi.
B. Grassi. Op. cit., p. 17.

Specimens received from the Marine Biological Association at Plymouth, and from the Scilly Islands sent by my friend Mr. Rupert Vallentin, seem to leave no doubt of the identity of the species of Busch and of Grassi. As the latter author himself points out (p. 18, note) it is generally impossible to see all the teeth except in preparations made to that end, which removes the chief discrepancy between the two descriptions; the other point which he emphasises, the enlargement of the epidermal expansion behind the head, varies with the amount and character of the death-contraction, and its effect on the width of the collarette (compare p. 4 above).

Characters. Head of medium size, marked off from the body by a distinct neck, which however is obscured by the collarette. Two clavate papillae on the prepuce (lost in my specimens). Collarette very broad just behind the head; its outline indented at the patches of sense cells; behind the neck it narrows, but extends to the tail-septum, where its outline becomes continuous with that of the lateral fins. Body firm, opaque, flattened dorso-ventrally, thickest at about the septal region, more tapered forwards than backwards. Tail about 50 per cent. of the total length.

Lateral fins long, extending from the septum to the vesiculae seminales, of medium width. Tail fin long, spatulate.

Jaws slender, sometimes slightly saginate, their tips curved. The two rows of teeth are very close together; the teeth irregularly set, blunt; the innermost tooth of the anterior row is very long.

Corona ciliata on the neck only; extending outwards over the collarette; with its long axis transverse to that of the body, either a regular oval (Grassi, Hertwig), or slightly waved posteriorly (Busch) or markedly 'invaginated' posteriorly (specimens from Plymouth and Scilly); very broad. Vestibular ridge not seen.

Formula: 5 : 50 : 8—9 : 3—5 : 3—4.

In a carmine preparation, the corona exhibited two parallel bands of cells; the outermost with fine deeply staining nuclei, of the same appearance as those of the patches of sense cells; the innermost were larger and yellowish, and of a more glandular look. The specimen drawn in figure 95 contained large closely appressed ova, evidently nearly ripe; and at the mouths of the oviducts were concave patches of glandular-looking cells. The characteristic adhesive cells have been fully described and figured by Hertwig.

d. SYNONYMIC LIST OF SPECIES.

In the following Synonymic List of Species the present writer's views are expressed as follows:

Thick type used for:	valid species:	**Bedoti** Béraneck 94.
Ordinary type used for:	non valid species:	bipunctata Krohn 44.
Italic type used for:	doubtful species: which require further description or investigation, and meanwhile should be neglected;	*maxima* Conant 96.
= used for:	valid equations;	
= used for:	doubtful or non-valid equations, or the equation of two non-valid species.	

The name of each species is followed by the name and date of its founder, referring to the full title of the memoir in the List of Literature below. In many cases this is followed by the name and date of the chief recent authorities who, in revising the group, have confirmed the species, apparently from personal observation. Authorities for an equation, whether valid or non-valid, are cited in ( ) brackets; some of them for the sake of brevity by initials only:

H = HERTWIG 80. G = GRASSI 82. S = STRODTMANN 92.

References to the present Report are cited in square brackets [p. 30].

Sagitta: sensu Langerhans 80.

arctica Aurivillius 96 (1).
Cleve 00. Conseil Intern. 04 (1).
=? sp. innom. Fewkes 88 — (Aurivillius 98).
=? elegans Verrill 73. — [pp. 30—32].

Bedoti Béraneck 95. — [p. 6].
= bipunctata Aida 97. — [p. 7].
= polyodon Doncaster 03. — [p. 7].

Bedfordii Doncaster 03.

bidentata Vanhöffen 97.
= **bipunctata** Quoy et Gaimard 27.

bipunctata Quoy et Gaimard 27.
Hertwig 80. Grassi 83. Strodtmann 92. Fowler 05.
= bidentata (Möb.) Vanhöffen 97.
= bipunctata Sutherland 52 pars.
= bipunctata Busk 56.
= bipunctata Moebius 75 pars (H. G. S.).
= britannica Forbes 43.
= germanica Frey und Leuckart 47.
= germanica Leuckart und Pagenstecher 58. — (H. G. S.).
= ? germanica Uljanin 70.
= germanica Moebius 73.
= hamata Aurivillius 96 (2). — (Aurivillius 98).
= ? *Marioni* Gourret 84.
= multidentata Krohn 53. — (H. G. S.).
= setosa Joh. Müller 47. — (H. G. S., Busk 56).
= setosa Keferstein 62. — (H. G. S.).
= setosa Langerhans 80. — (H. G. S.).
= ? sp. innom. Slabber 1769—1778.
= sp. innom. Wilms 46. — (H. G. S.).
= ? sp. innom. Oersted 49.
= sp. innom. secunda Gegenbaur 58. — (H. G. S.).
= *lyra* Krohn 53. — (Langerhans 80).

bipunctata Aida 97 = **Bedoti** Béraneck 95. — [p. 7].
Beraneck 95 = ? **neglecta** Aida 97. — [p. 17].
Busk 56 = **hexaptera** d'Orbigny 35—43. — (H. G. S.).
Eydoux et Souleyet 52 = ? **neglecta** Aida 97 **hexaptera** d'Orbigny 35—43.
Gegenbaur 56 = **hexaptera** d'Orbigny 35—43. — (H. G. S.).
Krohn 44, 53 = **hexaptera** d'Orbigny 35—43. — (H. G. S.).
Langerhans 80 = **hexaptera** d'Orbigny 35—43. — (H. G. S.).
Moebius 75 = **hexaptera** d'Orbigny 35—43 **bipunctata** Quoy et Gaimard 27. — (H. G. S.).
Sutherland 52 = ? **bipunctata** Quoy et Gaimard 27 **Zetesios** Fowler 05.

britannica Forbes 43.
= **bipunctata** Quoy et Gaimard 27.

Darwini Grassi 83.
= exaptera Darwin 44 pars. — (G.).
= **hexaptera** d'Orbigny 35—42. — (S.).

decipiens Fowler 05.

diptera d'Orbigny 35—43.
= ? Claparedi Grassi 83. — (G.).

elegans Verrill 73.
Verrill 85. Conant 96.
= ? **arctica** Aurivillius 96 (1). — [pp. 30, 32].
= falcidens Leidy 83. — [pp. 30, 32].
= gracilis Verrill 73. — (Verrill quoted by Conant 96).
? **hexaptera** d'Orbigny 35—43. — (S).

enflata Grassi 81. — [p. 8].
Grassi 83. Strodtmann 92. Béraneck 95. Doncaster 03.
= ? flaccida Conant 96. — [p. 9].
= ? Gardineri Doncaster 03. — [p. 9].
= ? *lyra* Langerhans 80. — (G.).

exaptera d'Orbigny 35—42. Darwin 44.
[Now written **hexaptera**].

falcidens Leidy 83.
= **elegans** Verrill 73. — [pp. 30, 32].

ferox Doncaster 03. — [p. 10].

flaccida Conant 96.
Doncaster 03.
= **enflata** Grassi 83. — [p. 9].

furcata Steinhaus 96.
Gamble 00. Fowler 05.
= ? *lyra* Krohn (Fowler 05). — [p. 33].

Gardineri Doncaster 03.
= **enflata** Grassi 83. — [p. 9].

Gegenbauri Fol 79.
= sp. innom. prima Gegenbaur 56. — (Fol 79).
= ? minima Grassi 83. — (G.).
= **serratodentata** Krohn 53. — (H. G. S.).

germanica Frey und Leuckart 47.
Leuckart and Pagenstecher 58. ? Uljanin 70. Moebius 73.
= **bipunctata** Quoy et Gaimard 27. — (H. G. S.).

gracilis Verrill 85.
= **elegans** Verrill 73. — (Verrill, quoted by Conant 96).
= **hexaptera** d'Orbigny 35—43. — (S.).

hexaptera d'Orbigny 35—43.
(exaptera)
Darwin 44. Hertwig 80. Grassi 83. Strodtmann 92. [p. 11].
= bipunctata Krohn 44, 53. — (H. G. S.).
= bipunctata Eydoux et Souleyet 52, fig. 2. — (H. G. S.).
= bipunctata Gegenbaur 56. — (H. G. S.).
= bipunctata Busk 56. — (H. G. S.).
= bipunctata Moebius 75 pars. — (H. G. S.).
= bipunctata Langerhans 80. — (H. G. S.).
= Darwini Grassi 83. — (S.).
= ? gracilis Verrill 85. — (S.).

= magna Langerhans 80. — (Krumbach 03). [pp. 11—15].
= ? mediterranea Forbes 43.
= tricuspidata Kent 70. — [pp. 11—15].
Darwin 44 pars = Darwini Grassi 83. — (G.).

hispida Conant 95, 96. [p. 32].
Aida 97 = ? **robusta** Doncaster 03. — [p. 20].
Doncaster 03 = ? **neglecta** Aida 97. — [p. 33].

longidentata Grassi 81.
[not repeated in Grassi 83,
= **hexaptera** d'Orbigny 35—43].

lyra Krohn 53.
Langerhans 80. Hertwig 80. Grassi 83.
= ? **bipunctata** Quoy et Gaimard 27. — (Langerhans 80).
= ? **furcata** Steinhaus 96. — (Fowler 05). [p. 33].
= ? sp. innom. secunda Gegenbaur 56. — (Langerhans 80).
lyra Langerhans 80 = ? **enflata** Grassi 83. — (G.).

magna Langerhans 80.
= **hexaptera** d'Orbigny 35—43. — (Krumbach 03). [p. 11—15].
magna Grassi 83. — [p. 12].

Marioni Gourret 84.
= ? **bipunctata** Quoy et Gaimard 27.

maxima Conant 96.
= ? **hexaptera** d'Orbigny 35—43. — [p. 15].

macrocephala Fowler 05. — [p. 15].

mediterranea Forbes 43.
= ? **hexaptera** d'Orbigny 35—43.

minima Grassi 81.
Grassi 83. Doncaster 03. Strodtmann 92.
= ? Gegenbauri Fol 79. — (G.).
= ? rostrata Busch 51. — (G.).

multidentata Krohn 53.
= **bipunctata** Quoy et Gaimard 27. — (H. G. S.).

neglecta Aida 97. — [p. 15].
= ? bipunctata Eydoux et Souleyet 52, fig. 1.
= ? bipunctata Beraneck 95. — [p. 17].
= ? hispida Doncaster 03. — [p. 33].

planctonis Steinhaus 96.
Fowler 05.

polyodon Doncaster 03.
= ? **Bedoti** Béraneck 95. — (Doncaster 03).
= **Bedoti** Béraneck 95. — [pp. 7, 8].

pulchra Doncaster 03.
[p. 17].

regularis Aida 97.
Doncaster 03. — [p. 18].

robusta Doncaster 03. — [p. 19].
= ? hispida Aida 97. — [p. 20].

rostrata Busch 51.
= ? **minima** Grassi 83. — (G.).
= ? setosa Muller 47. — (Krohn 53).
= **serratodentata** Krohn 53. — (H. G. S.).

septata Doncaster 03.

serratodentata Krohn 53.
Hertwig 80. Grassi 83. Strodtmann 92. Fowler 05.
= Gegenbauri Fol 79. — (H. G. S.).
= sp. innom. prima Gegenbaur 56. — (H.).
= rostrata Busch 51. — (H. G. S.).

setosa Joh. Muller 47.
Keferstein 62. Langerhans 80.
= **bipunctata** Quoy et Gaimard 27. — (H. G. S.).

sp. innom. Gegenbaur 56. prima = **serratodentata** Krohn 53. — (H.).
= Gegenbauri Fol. — (Fol. 79).
Gegenbaur 56, secunda = **bipunctata** Quoy et Gaimard 27. — (H.).
Gegenbaur 56, secunda ? *lyra* Langerhans 80. — (Langerhans 80).
Oersted 49 = ? **hamata** Moebius 75. — (S.).
Oersted 49 = **bipunctata** Quoy et Gaimard 27.
Scoresby 20, fig. 1 = ? **Zetesios** Fowler 05.
Scoresby 20, fig. 2 = ? **hamata** Moebius 75.
Slabber 1769—1778 = **bipunctata** Quoy et Gaimard 27.
Wilms 46 = **bipunctata** Quoy et Gaimard 27. — (H. G. S.).
= setosa Muller. — (Muller 47).

tenuis Conant 96.

triptera d'Orbigny 35—43.
Uljanin 70.
= Claparedi Grassi 83. — (G.).

tricuspidata Kent 70.
Grassi 83. Levinsen 85. Doncaster 03.
= **hexaptera** d'Orbigny 35—43. — [p. 11—15].

Whartoni Fowler 96.
Gunther 03.

Zetesios Fowler 05.
= ? sp. innom. Scoresby 20, fig. 1.
= ? bipunctata Sutherland 52 pars.

Krohnia sensu Langerhans 80.

foliacea Aida 97.
= ? **hamata** Moebius 75. — [p. 33].

hamata Moebius 75.
Hertwig 80. Langerhans 80. Strodtmann 92. Fowler 05.
= ? sp. innom. Oersted 69. — (S.).
= ? sp. innom. Scoresby 20, fig. 2.
= ? *foliacea* Aida 97. — [p. 33].

hamata Aurivillius 96 (2) = **bipunctata** Quoy et Gaimard 27. — (Aurivillius 98).

pacifica Aida 97.
Doncaster 03 [p. 24].

subtilis Grassi 81.
Grassi 83. Strodtmann 92. Fowler 05. [p. 25].

Pterosagitta Costa 69.

= *Spadella*: sensu Langerhans 80.

Spadella sensu Langerhans 80.

Batziana Giard 75.
= **cephaloptera** Busch 51. — (H. S.).
= Claparedi Grassi 83. — (G.).

cephaloptera Busch 51.
Hertwig 80. Grassi 83. Strodtmann 92. Claparede 63. [p. 32].
= Batziana Giard 75. — (H. S.).
= Claparedi Grassi 83. — (S.) [p. 33].
= gallica Pagenstecher 62. — (H. S.).
= mariana Lewes 58.
= ? pontica Uljanin.
Busch 51 = Claparedi Grassi 83. — (G.).
Claparede 63 = Claparedi Grassi 83. — (G.).
Hertwig 80 = Claparedi Grassi 83. — (G.).

Claparedi Grassi 83.
= ? Batziana Giard 75. — (G.).
= **cephaloptera** Busch 51, Claparède 63, Hertwig 80. — (G.).
= **cephaloptera** Busch 51. — (S.) [p. 34].
= ? gallica Pagenstecher 62. — (G.).
= ? diptera and triptera d'Orbigny 35—43. — (G.).
= ? exaptera Darwin 44 pars. — (G.).

draco Krohn 53.
Hertwig 80. Grassi 83. Langerhans 80. Doncaster 03.
= mediterranea (Pterosagitta) Costa 69.
= ? *Vougai* Béraneck. — [p. 26].

gallica Pagenstecher 63.
= ? **cephaloptera** Busch 51. — (H. S.).
= ? Claparedi Grassi 83. — (G.).

mariana Lewes 58.
= **cephaloptera** Busch 51. — (S.).

maxima Conant 96.
[see under Sagitta *maxima*].

mediterranea (Pterosagitta) Costa 69.
= **draco** Krohn 53.

pontica Uljanin 70, 80.
= ? **cephaloptera** Busch 51.

schizoptera Conant 95, 96.

Vougai Béraneck 95.
= ? **draco** Krohn 53. — [p. 26].

III. Faunistic.

a. DISTRIBUTION OF SPECIES WITHIN THE AREA OF THE EXPEDITION.

1. Horizontal distribution.

α. As the result of plotting the various captures on the track-chart, no evidence was obtained that any species was confined to a particular district, nor that any district was poorer in species than another. In other words, the Chaetognath fauna was approximately evenly distributed in the various seas traversed by the Expedition (Celebes Sea, Banda Sea, etc.).

β. For the consideration of another question, namely, the effect of the neighbourhood of land upon the fauna, all hauls[1]) containing Chaetognaths were divided into three groups: 42 neritic hauls, made in harbour or close to land; 20 hauls fairly close to land, but over deep water; and 9 'oceanic' hauls made at a distance of more than 40 miles from land. But really 'oceanic' conditions, which include entire independence of the effects of land drainage, are hardly possible in an archipelago (this point will be discussed below).

The number of occurences of each epiplanktonic species in each of the three groups was then calculated as a percentage of the total hauls in that group, and yielded the figures in the table following:

	BEDOTI	ENFLATA	FEROX	HEXAPTERA	NEGLECTA	PULCHRA	REGULARIS	ROBUSTA	SERRATODENTATA	PACIFICA	DRACO
Neritic	88	100	76	54	76	61	11	64	71	47	52
Near land in deep water	75	95	70	55	50	40	10	55	90	35	65
'Oceanic'	66	100	55	44	55	0	33	55	100	55	22

The conclusion to be drawn from this table is that all these epiplanktonic species were fairly evenly distributed over the entire area investigated, irrespective of the distance from shore (never very great), with the apparent exception of *pulchra* which failed entirely at the 9 'oceanic' stations more than 40 miles from land.

1) Excluding 107 (dredge), 35, 175, 208, 210 (trawl); 210 (mesoplankton net); and 142 (2) in which most of the material was rotten and unidentifiable.

At the same time it must be remembered that in order to get precise results from the statistical treatment of distributional questions, percentages should be struck on every haul of the nets made, and every specimen should be identified. Neither of these was practicable in this case, because the whole collection was not sent to me, and because the specimens sent were already too numerous to admit of every one being identified, even had the material been in perfect condition.

2. Diurnal and nocturnal oscillation.

The epiplankton [1]) hauls were then arranged as far as possible into two groups, those of 'daylight' and 'darkness', for which Prof. WEBER was kind enough to give me such data as had been recorded in this connection. The number of occurrences of each epiplanktonic species in each group was then calculated as a percentage of the total hauls in that group. That the resulting table should have yielded no special indications is not really remarkable, because the question of the vertical movements of epiplanktonic species in the twenty four hours can only be attacked by systematised day and night work, in which the numbers of specimens captured are taken into account, and not merely the presence or absence of the species; and this is so, because, if a vertical oscillation really occurs, the most that can be expected is, that the species shall rise or sink in general; in other words, that its centre of distribution shall rise or sink. It is not to be supposed that every single specimen must be found at a fixed depth at a fixed hour of the day or night. The zoological side of the Siboga Expedition was planned for general faunistic collection, and not for the study of such special problems as vertical oscillation.

For the same reasons it was not to be expected that the hauls made during rain would show any marked alteration in the surface fauna; this again is a point which can only be brought out by means of systematic hauls planned for the purpose.

3. Vertical distribution.

In this connexion it is at once noticeable that certain species occurred only in nets which were lowered to a greater depth than 200 metres (100 fathoms), the suggested boundary between the epiplankton and the mesoplankton.

Some misunderstanding appears to exist with regard to the application of certain terms, meant to express briefly the vertical distribution of oceanic plankton, introduced by the present writer (Proc. Zool. Soc. London, 1898, p. 545), and since adopted to some extent by other naturalists. It is generally admitted to be the case that, at any particular locality, the main part of the superficial fauna (owing to its dependence on light, warmth, food, and so forth) may reach to, but does not descend much beyond, 100 fathoms; for this fauna the term Epiplankton was intended. Those floating or swimming organisms, which are closely dependent on the bottom of the sea, for food-supply and for other reasons, were classed as Hypoplankton: to this category, for example, belong the remarkable series of Mysids recently described by Messrs HOLT and TATTERSALL (Annual Report on the Sea and Inland Fisheries of Ireland, 1902—1903.

1) That is to say from 200 m. or less, to the surface. They were almost entirely surface hauls.

Part II, Appendix IV, p. 99, 1905). For the intermediate fauna, the term Mesoplankton was proposed. But it was not intended, and indeed it is obviously not true, that every species may be described as universally epiplanktonic, or as universally mesoplanktonic; a species found among the epiplankton of sub-arctic or of temperate waters may be purely mesoplanktonic at lower latitudes; in the present state of our ignorance the terms can only be applied with safety to the date and place at which the species was actually captured, but even in this limited application they have the advantage of brevity, and condense a number of admitted facts.

Again, it was not intended to imply that the 100 fathom horizon formed a sharp and impassable barrier between two distinct sets of organisms; an epiplanktonic form may descend below 100 fathoms without reaching so far as 250 fathoms; or, an essentially deep-water species may range up into the epiplankton, and yet not come to the surface; or again, the same organism may range through both epiplankton and mesoplankton. The following instances, taken from among the Chaetognatha, illustrate the use of the terms:

Species	Locality	Range (fathoms)	Distribution
serratodentata	Bay of Biscay	0 to 100	epiplankton
hamata	Faeroe Channel	0 to 500	epiplankton and mesoplankton
furcata	Bay of Biscay	0 to 200	epiplankton and upper mesoplankton
hamata	Bay of Biscay	2000—1500 to 50	mesoplankton and lower epiplankton
hamata	Siboga area	highest capture 533—226	mesoplankton

At the moment this scale seems adequate for a comparison of the vertical distribution of a species at different localities, even though with the increase of our knowledge more precise terms become needed in the future.

All the hauls containing Chaetognatha which were lowered to a greater depth than 200 metres (except 107, Dredge), together with the occurrences of these deeper species, are set out in the table below, which has been extracted from the General Table (p. 28):

Haul	Net	Depth (metres)	furcata? and planctonis?	macrocephala	Sibogae	Zetesios	hamata	subtilis
220 (2)	H.V.	200 to 0	.	.	.	.	.	
128	H.V.	700 to 0	.	.	.	.	.	.
276	H.V.	750 to 0	.	.	.	?	.	.
118	H.V.	900 to 0		.	.	.	·	.
143	H.V.	1000 to 0		.	·		·	
148	H.V.	1000 to 0	.	.	†		·	.
243	H.V.	1000 to 0	.	.	.	?	.	†
35	Trawl	1310 to 0	.	.	.	.	.	.
141	H.V.	1500 to 0						
203 (1)	H.V.	1500 to 0	.	.			.	
185	H.V.	1536 to 0		†				
208	Trawl	1866 to 0	.	.	.		.	.
175	Trawl	1914 to 0	.	.	.	?	.	.
210a	Trawl	1944 to 0	.	.	.	.		.
230 (1)	H.V.	2000 to 0	.	.		.		.
216	M.N.	975 to 415	.	.	.			.

H.V. = Hensen Vertical Net. M.N. = mesoplankton closing net.

Unfortunately, all these hauls except one (216) were made with open nets; we can therefore at most say with safety that, since *macrocephala*, *Sibogae*, *Zetesios* and *hamata* were never captured in the numerous hauls at the surface, but were captured with fair regularity in the small number of deeper nets, they probably only lived at some considerable depth, and that the horizon to which the net which caught them at the least depth was lowered, may have approximately represented their upper limit of distribution. Of *Zetesios* and *hamata* on the other hand, we may say positively that they occurred between 975 and 415 metres.

In the case of three of these species, the table below shows in metres the least depth observed, for comparison with inferences drawn from their distribution in the Biscayan report.

	Siboga	Research
macrocephala	1500	Young, ? 639; large, 731—914.
Zetesios	? 750	Young, 182; large, below 548.
hamata	900	Young, 91; large, below 914.

The data yielded by open vertical nets used at considerable depths are too uncertain to allow of any positive deduction, although the figures seem to point in a particular direction.

Subtilis was probably here, as in the Bay of Biscay, a sub-surface form in the lower epiplankton, but the zones of the first 100 fathoms were not so systematically explored by the Siboga that this can be affirmed with certainty; the hauls, so far as they go, point in this direction.

Of the remaining species represented in the collection, it can only be said that they all occurred at the surface, and were therefore epiplanktonic. Some of them may or may not have penetrated into the mesoplankton, but the mere fact that they were captured in open vertical nets lowered to considerable depths, is no evidence of this.

b. COMPARISON WITH THE EPIPLANKTONIC FAUNA OF JAPAN AND OF THE MALDIVE ARCHIPELAGO.

In view of the usually accepted statement of the uniformity of the epiplankton over the Indo-pacific Ocean, it is worth while to compare the captures of Aida in Japan, of Doncaster in the Maldive Archipelago, and of the Siboga Expedition. The comparison certainly strongly points to such an uniformity.

A. 'Valid' species.	Misaki Harbour.	Siboga area.	Maldive Archipelago.
Bedoti	+	.	
enflata	+	+	
ferox	.	+	.
hexaptera	+	.	
minima	+	.	.
neglecta	+		.
pulchra	.	+	
regularis	+		
robusta	.	+	
serratodentata	+	+	+
pacifica	+	+	+
subtilis	.	.	.
draco	+		.

B. Doubtful species.	Misaki Harbour.	Siboga area.	Maldive Archipelago.
hispida	+	.	+
flaccida	.	.	+
Gardineri	.	.	+
septata	.	.	+
lyra	+	.	.
foliacea	+	.	.

c. ON THE GEOGRAPHICAL DISTRIBUTION OF CHAETOGNATHA.

The study of the geographical distribution of terrestrial organisms and of their habitats, has been pursued for many years with considerable success. We know the mammals of (say) India, Peru, and Australia; we know that this is nocturnal, that arboreal, a third of burrowing habits, and so forth. But how far would such knowledge have been attainable, had the sole record of poorly-described species consisted of such vague statements as 'N.E. Asia', 'Africa', with no indication of the exact locality, of the nature of the country, nor of the conditions under which the capture was made? Yet the data provided for the study of the distribution of oceanic organisms have been for the most part of this vague kind till within the last few years, and even some of the more recent expeditions have left a good deal to be desired.

Before the distribution of an oceanic species can be satisfactorily grasped, two things at least are necessary: a fair probability (certainty is rarely obtainable) that the captures recorded of a species really dealt with that species and with no other; and an exact record of the geographical positions. The difficulty of the first of these is proverbial, and is not less in Chaetognatha than in other groups; the second is often vague or difficult to find.

In the case of planktonic oceanic species, these two are not enough for a proper study of distribution, for the depth of capture is also urgently needed. Recent studies tend to suggest that a great factor in oceanic distribution (possibly the greatest) is temperature, that an isotherm may be as great a barrier at sea as a mountain range or wide river is on land, and that the 'distributional area' of a planktonic species is often not an 'area' at all, but a solid figure in three-dimensional space bounded by isotherms and isothermobaths. At present we are unable to draw such a figure for a single oceanic species, not because such species are necessarily of world-wide distribution (for they are obviously not all so), but because our records are so scanty, notably as regards vertical distribution [1]).

Those species, which remain apparently valid after revision, have been clearly marked in the Synonymic List above, which constitutes an attempt at the first of the preliminary steps to a study of distribution. The second step, a compilation of the recorded occurrences of these species, exacted so much time and work that the resulting lists have been printed in full below, in the hope that they may ease the labours of future students of Chaetognatha. They attempt

1) Another point of great importance in the matter is that counsel has been darkened by marine zoologists having allowed themselves in many cases to accept the 'regions' of terrestrial geography, and to apply them to the ocean; but this point is too large for discussion in this place.

to show in each case the locality of capture, the authority for it, and (where practicable) the depth and temperature.

The positions have all been reduced to the meridian of Greenwich, if expressed as latitude and longitude. Those positions which are enclosed in square brackets [ ] were not given in that form by the original authority, but have been roughly measured off on charts and maps, or deduced in some other way; they are not likely to be correct to within a few minutes, but then neither a Chaetognath nor an isotherm can usually be fixed with a greater accuracy. For some not very obvious reason, the positions published by HENSEN for the 'National' were expressed in tenths of a degree instead of in minutes; for these the day's position has sometimes been got from another part of the reports, in other cases the tenths have been multiplied out into minutes, and enclosed in square brackets.

The authority for the record will be found in full in the List of Literature below, the number following the author's name indicating the date of publication.

The depths are only thoroughly satisfactory in the case of closing nets. As open Vertical Nets are absolutely valueless for deciding the maximum depth-distribution of an epiplanktonic species, it seemed useless labour in most cases to reprint the depth to which such nets were lowered. And if such data of depth are valueless, the corresponding temperatures also can have little significance; it is of no great interest to know that an animal was living at a temperature somewhere between 8° and 27°; the limits are too far apart.

But since, if sufficiently numerous, Vertical Nets do yield some indication of the *minimum* depth-distribution of a mesoplanktonic [1]) form, in such cases the depth to which they were lowered has been recorded where practicable.

All depths have been reduced to metres.

The temperatures have all been reduced to the Centigrade scale. Where they were not recorded by the original authority, they have been enclosed in square brackets; in such cases they have generally either been interpolated on curves, the data for which were to be found in the original publication, or are Mean Annual Temperatures [M. A.] for the position and depth, gathered from SCHOTT [2]), MOHN [3]), and KOPPEN [4]).

When two temperatures are given (for example, 0°3 to 3°1) it is not necessarily implied that the species was found actually at either, but that they are the extreme possible temperatures of that particular capture.

Since the temperature of the water of the Eastern coasts of Japan is stated to vary greatly with the time of year, the mean annual of Misaki, from the harbour of which a large number of species have been recorded, is probably a rather vague approximation.

1) At a given position the epiplankton is understood to include the plankton down to about 100 fathoms (182 m.), the mesoplankton to extend from about that level to within about 100 fathoms or less of the bottom. But no sharp line is implied between them, and Chaetognaths have been described as coming to within about 91 m. of the surface, without apparently coming actually to it at that particular position.

2) G. SCHOTT, Ergebn. der deutschen Tiefsee Expedition a. d. Dampfer Valdivia 1898—1899. Band I. Oceanographie und maritime Meteorologie. Jena, 1902. 4to.

3) H. MOHN, Den Norske Nordhavs Expedition. Meteorologi. Christiania, 1883. 4to.

4) Deutsche Seewarte: Stiller Ozean. Atlas. Hamburg, 1896. Fo.

Mere records of 'Sagitta' or of 'Chaetognatha', and, generally speaking, cases where the author expresses himself as doubtful of the identification, have been omitted.

Where the very numerous hauls of the Conseil International [1]) lie within the admitted area of a species, they have not been reprinted in detail, but a reference to the number of their Bulletin will be found.

The Record of Distribution is thus an attempt to reduce the scattered data to a common denominator, in such a way that a naturalist dealing with a particular species may readily discover what information is available about it. No one realises better than the present writer that, in the compilation of such a record, errors of omission and of commission, of copying and of calculating, are sure to occur; he will be grateful if such are brought to his notice, and will take an opportunity to publish such corrections.

In the case of the better-known species, the more important collections have been put first under the name of the recorder; these are followed by more isolated records under the positions or localities (classified, when numerous). It seemed that more would be lost than gained by breaking up big collections under geographical headings.

1) Conseil permanent international pour l'exploration de la mer.

1. Records of distribution.

Sagitta arctica Aurivillius.

	Depth (metres)	Temp. C
AURIVILLIUS 99 (2).		
de Geer Expedition, 1896.		
71° 3' N., 15° 38' E.	0	8°5
Antarctic Expedition, 1898.		
Recherche Bay, [77° 30' N., 14° 30' E.].	0	4°5
77° 39 N., 1° 18' E.	500 to 0	0°7 to 3°8
77° 52' N., 3° 5' W.	500 to 0	0°8 to 3°6
Svenska Förlandet, [78° 40' N., 27° E.].	0	1°C
81° 14' N., 22° 50' E.	130 to 0	0°3 to 1°9
75° 50' N., 15° 25' E.	325 to 0	2°7 to 5°7
AURIVILLIUS 96 (1). (Schwed. Forsch. Ex. 1894).		
[74° N., 75° 30' W.].	probably epiplanktonic	[0° to 3°]
[64° 45' N., 65° W.].		
[70° N., 55° W.].		
CLEVE 00.		
60° N., 1° W. — Nov.	No data	
62° N., 7° W. — Mar.	no data	
65° to 67° N., 1° to 3° W. — June	500 to 200	5°6 to 10°
71° to 74° N., 21° to 18° W. — July	"deep sea haul"	
67° N., 3° W. — Sep.	"from 500"	
VANHÖFFEN 97 [1]), Greenland.	no data	
AURIVILLIUS 98, Skagerak.	20 –120	4°3 to 6°7
CONSEIL INTERNATIONAL 04 (1).		
Stat. 16. 58° 19' N., 11° 32 E.	50 & 100 to 0	5°1 to 18°8

Sagitta Bedfordii Doncaster.

Singapore, DONCASTER 03.	epiplankton	[M.A. 28°]

Sagitta Bedoti Beraneck.

Maldive Islands, DONCASTER 03. (s. n. *polyodon*).	epiplankton	[M.A. 28°]
Amboina, BERANECK 95.	epiplankton	[M.A. 28°]
Misaki [35° N., 139° 30' E.]. AIDA 97. (s. n. *bipunctata*).	epiplankton	[M.A. 21°]
Siboga Expeditie, 6° N. to 8° 30' S., 113° E. to 132° E.	surface and vertical nets	28° to 29°

Sagitta bipunctata [1]) Quoy et Gaimard.

STRODTMANN 92, (s. s. Holsatia, 1885).
54° 34' N., 10° 20' E. — 55° 18 N., 17° 20' E.
[54° 30' N., 12° 00 E.] Gjedser. — 55° 30 N., 19° 37 E.

MOEBIUS 87, (s. s. Holsatia, 1885).
Stat. 6. [57° 40' N., 8° 15' E.]
Stat. 12. 58° 15' N., 0° 30' E. — Stat. 37. [58° 30' N., 7° 0 W.]
Stat. 33. [58° 0' N., 11° 0' W.] — Stat. 59. [58° 28 N., 5° 30 E.]

1) Not charted.

LEVINSEN 86.

Kronprinsen's Island, 68° 57' N., [53° W.]
Godhavn [69° N., 53° W.]
30 m. W. of Cape Farewell [59° 50' N., 44° 30' W.]
Iceland.
12 m. N. of Faeroe Islands.
6 m. N. of Shetland.
Bay of Bengal.
58° 26' N., 19° W.
49° 0' N., 8° 11' W.
46° 23' N., 11° 15' W.
44° 14' N., 129° 34' E.
38° 23' N., 16° 45' W.
36° 22' N., 30° 47' W.
22° N., 20° W.
20° 24' N., 83° W.
13° 51' N., 119° 12' E.
10° N., 30° E. [1]).
10° 22' N., 21° 16' W.
8° 38' N., 24° 58' W.
7° 37' N., 22° 26' W.
4° 20' N., 107° 20' E.
0° 27' N., 20° 12' W.
25° 30' S., 82° W.
34° 49' S., 25° 12' E.
21° 23' S. [2]) ? long.
16° 30' S., 63° E.

MOEBIUS 75, (s. s. Pommerania, 1872).

Stat. 2. Stoller Grund [off Kiel Harbour]. Stat. 9. Grosser Belt [55° 20' N., 11° E.]. Stat. 18. Skagerack [57° 56' N., 9° 20' E.]. Stat. 27. Lindesnaes [57° 45' N., 7° 10' E.]. Stat. 31. S.W. of Bukenfjord [58° 50' N., 5° 7' E.]. Stat. 38. Bukenfjord [59° 20' N., 5° 47' E.]. Stat. 44. Off Bommelfjord [59° 34' N., 4° 47' E.]. Stat. 62. Korsfjord [60° 10' N., 5° 10' E.]. Stat. 92. Off St. Abb's Head [55° 55' N., 2° 5' W.]. Stat. 93. N.E. of Bamborough [55° 30' N., 1° 30' W.]. Stat. 94. E. of Berwick 55° 43' N., 0° 40' W. Stat. 96. W. of Dogger Bank 55° 32' N., 0° 10' E. Stat. 97. W. of Dogger Bank 55° 12' N., 1° 0' E. Stat. 98. Dogger Bank 55° 5' N., 1° 20' E. Stat. 100. Dogger Bank [54° 51' N., 2° 3' E.]. Stat. 103. Dogger Bank [54° 17' N., 2° 5' E.]. Stat. 105. Silver Pit. [54° 1' N., 2° 4' E.]. Stat. 114. E.S.E. of Lowestoft [52° 18' N., 2° 34' E.]. Stat. 123. Nieuwe Diep [52° 59' N., 4° 50' E.]. Stat. 143. N. of Borkum [53° 58' N., 6° 25' E.]. Stat. 147. Helgoland. Stat. 163. Wilhelmshafen. Stat. 201. W. of Jutland 55° 39' N., 6° 35' E. Stat. 246. Kleine Belt [55° 28' N., 9° 40' E.].	All at 0, or at 5 or less to 0.	13°.5 to 19°.7

STRODTMANN 92, (s. s. National, 1889, vertical net).

Stat. VII. 19°. 58° 57' N., 8° 35' W.
Stat. VII. 20°. [59° 12' N., 11° 48' W.].
Stat. VII. 22°. 60° 12' N., 22° 56' W.
Stat. VIII. 2°. [41° 36' N., 56° 18' W.].
Stat. VIII. 3°. [40° 24' N., 57° 0' W.].
Stat. VIII. 3°. [39° 24' N., 57° 48' W.].
Stat. VIII. 4°. [37° 54' N., 59° 0' W.].
Stat. VIII. 4°. [37° 0' N., 59° 54' W.].

STEINHAUS 96, (s. s. National, 1889; vertical net).

J. N. 180. 1° 0' N., 16° 20' W.
J. N. 182. 0° 6' N., 15° 10' W.
J. N. 184. 0° 10' S., 14° 58' W.
J. N. 195. 0° 57' S., 14° 15' W.
J. N. 223. 2° 40' S., 35° 10' W.
J. N. 231. 1° 24' S., 30° 10' W.
J. N. 235. 0° 5' S., 44° 11' W.
J. N. 243. [0° 42' S., 48° 12' W.].

1) The p[illegible] central Afri[illegible]
2) No [illegible]

Steinhaus 96, (s. s. National, 1889; closing net).

J. N. 48.	[40° 24′ N., 57° 0′ W.].	200—0	? to 25°4
J. N. 53.	[37° 54′ N., 59° 6′ W.].	500—300	13° to 16°
J. N. 65.	[31° 48′ N., 61° 12′ W.].	700—500	no data
J. N. 92.	31° 22′ N., 46° 42′ W.	650—450	[12°5 to 15°6]
J. N. 96.	31° 25′ N., 45° 52′ W.	850—650	9°4 to [12°5]
J. N. 134b.	20° 41′ N., 28° 3′ W.	400—200	16° to 18°2
J. N. 165.	5° 40′ N., 20° 2′ W.	400—200	10°7 to 13°2

Steinhaus 96, (Schott and Bruhn Collections 1891—1893).

Stat. 1.	4° 26′ N., 26° 17′ W.	Chiefly surface hauls; no net lowered to a greater depth than 100 m.; consequently all epiplanktonic; neritic and oceanic.	27°6
Stat. 5.	25° 39′ S., 36° 51′ W.		22°0
Stat. 6, 7.	24° 24′ S., 37° 6′ W.		23°2
Stat. 11.	40° 15′ S., 6° 10′ E.		11°7
Stat. 29.	4° 56′ N., 94° 46′ E.		29°1
Stat. 31.	5° 39′ N., 96° 45′ E.		28°9
Stat. f.	24° 30′ S., 4° 35′ E.		17°7
Stat. h.	19° 20′ S., 0° 30′ W.		19°0
Stat. 43.	19° 52′ N., 89° 41′ E.		20°5
Stat. 44.	29° 30′ S., 42° 50′ E.		25°2
Stat. 46.	30° 50′ S., 35° 0′ E.		25°0
Stat. 47, 48.	34° 52′ S., 17° 50′ E.		26°2
Stat. 1.	23° 35′ N., 36° 15′ E.		20°5
Stat. 2.	21° 0′ N., 37° 55′ E.		22°0
Stat. 3.	12° 20′ N., 44° 40′ E.		26°0
Stat. 4.	7° 43′ N., 73° 26′ E.		30°8
Stat. 5.	6° 47′ N., 76° 40′ E.		31°2
Stat. 6.	6° 20′ N., 92° 40′ E.		32°5
Stat. 7.	3° 40′ N., 51° 32′ E.		32°0
Stat. 8.	[19° 20′ N.][1]), 38° 20′ E.		33°6

Steinhaus 96, (Schab Collection; S.M.S. Falke, 1892—1893).

Stat. 2.	[9° 0′ N., 13° 0′ W.].	Epiplanktonic, chiefly neritic hauls.	29°5
Stat. 3, 4.	[6° 0′ N., 0° 50′ E.].		29°5
Stat. 6—10.	[6° 30′ N., 2° 50′ E.].		28°7 to 29°0
Stat. 12—14.	[16° 50′ S., 12° 0′ E.].		18°8 to 20°0
Stat. 15.	[15° 0′ S., 12° 30′ E.].		21°5
Stat. 18, 20.	[9° 0′ S., 13° 0′ E.].		27°4
Stat. 22.	5° 24′ S., 10° 50′ E.		28°4
Stat. 23.	3° 33′ N., 3° 14′ E.		28°4
Stat. 24.	3° 44′ N., 0° 17′ E.		28°2
Stat. 25—26.	[6° 30′ N., 10° 50′ W.].		28°3
Stat. 27.	[4° 20′ N., 7° 40′ W.].		27°2
Stat. 28, ? 29.	[6° 30′ N., 10° 50′ W.].		27°3
Stat. 30, 31.	[0° 0′ N., 6° 30′ E.].		26°0
Stat. 32.	[6° 30′ N., 10° 50′ W.].		26°8

Cleve, 00.

12° to 21° N., 19° to 17° W.	Jan.		
36° N., 27° W., to 46° N., 11° W.			
6° N., 55° W.			
Faeroe Islands.			
5° to 6° S., 9° to 12° E.	Feb.		

1) The position originally given (10° 20′ N.) is on land, and should probably be as above.

6° S., 4° W.			
7° N., 17° W. to C. Verde Islands and 21° N., 18° W.			
36° N., 29° W. to 45° N., 13° W.	Mar.		
44° N., 16° W.			
49° N., 33° W.			
Azores and Faeroe Islands.			
Caribbean Sea.			
34° N., 74° W.	April		
41° N., 19° W.			
32° N., 37° W. to 43° N., 11° W.			
58° N., 4° E.			
11° N., 52° W.	May		
23° N., 56° W.			
41° N., 63° W.			
33° N., 48° W.			
Azores.	June		
17° N. to 19° S. 2° W. to 0°.			
59° N., 2° E.			
21° N., 58° W.	July		
38° N., 74° W.			
Azores and S. Iceland.		presumably all epiplanktonic	from 10°2 to 27°5; mean of 66 observations 19°4.
Faeroe Islands.			
61° N., 4° E.	Aug.		
55° to 56° N., 23° to 26° W.			
8° N., 25° W.			
Azores and Faeroe Islands.			
56° N., 21° W.	Sep.		
56° N., 24° to 30° W.			
Azores to 42° N., 15° W.			
57° N., 18° W.			
Faeroes.	Oct.		
34° N., 74° W.			
53° N., 37° W.			
Area between Rio Janeiro, 26° S., 30° W. and 18° S., 31° W.			
34° N., 10° W.			
Azores, Faeroe Islands.	Nov.		
56° N., 17° W.			
51° N., 21° W.			
49° N., 40° W.			
Azores and Faeroe Islands.	Dec.		
CONSEIL INTERNATIONAL 04 (1).			
R. 1. 69° 44′ N., 37° 20′ E.		110 to 50	1°0
R. 2. 70° 4′ N., 40° 16′ E.		130 to 75, 75 to 30	1°4 to 4°2
R. 3. 70° 30′ N., 44° 20′ E.		80 to 50, 50 to 20	1°2 to 6°7
R. 5. 70° 48′ N., 47° 0′ E.		145 to 50, 20 to 0	0°5 to 7°8
R. 9. 71° 43′ N., 50° 25′ E.		125 to 75, 75 to 0	1°7 to 8°7
R. 12. 71° 0′ N., 33° 14′ E.		210 to 150, 50 to 0	1°8 to 8°8
R. 13. 71° 30′ N., 33° 7′ E.		150 to 50, 50 to 0	4°4 to 8°8
R. 16. 73° 0′ N., 32° 50′ E.		250 to 150, 50 to 0	1°1 to 7°3
R. 17. 73° 45′ N., 32° 37′ E.		285 to 100, 50 to 0	2°1 to 7°3
R. 19. 75° 0′ N., 32° 18′ E.		250 to 100, 50 to 0	0°2 to 5°4
R. 22. 73° 8′ N., 41° 40′ E.		300 to 75, 75 to 0	1°7 to 7°5

R. 24. 71° 30′ N., 37° 55′ E.	285 to 150, 50 to 0	—1° 1 to 8° 2
R. 26. 70° 30′ N., 36° 40′ E.	165 to 50, 50 to 0	2° 6 to 9° 3
R. 27. 69° 30′ N., 32° 57′ E.	280 to 150, 50 to 0	1° 7 to 10° 6

[In the case of several hauls at a station, only the highest and lowest are reprinted here.]

REDEKE 03, (steam trawler 'Nelly').
Stat. D. [56° 30′ N., 2° 0′ E.]
Stat. E. 53° 52′ N., 1° 10′ E.
Stat. F. 53° 40′ N., 0° 50′ E.
Stat. G. [53° 35′ N., 0° 8′ E.]

Arctic Ocean.

White Sea, KHVOROSTANSKY, 92.	? surface	[? M.A. 4° 5]
? Karajak-fjord [70° 30′ N., 50° 30′ W.]. VANHÖFFEN 97.	no data	
? Davis' Straits, Barrow Straits, Baffin's Bay. SUTHERLAND 52.	probably 0	

Norwegian sub-arctic region.

Bergen. SARS (auct. GRASSI 83) NORDGAARD 98.	surface	[M.A. 5°]
Östness fjord [68° 30′ N., 15° 0′ E.] NORDGAARD 99.	surface	[M.A. 5°]
Sunderö [68° 30 N., 15° 30′ E.] NORDGAARD 99.	surface	[M.A. 5°]
Bodö [67° 20′ N., 14° 30′ E.] GRAN 00.	40 to 0	[10° to 13°]
Eidsfjord [68° 38 N., 15° E.] GRAN 00.	80 to 0	[7° 3 to 9° 9]
Tranödybet 68° 15′ N., 15° 49′ E. NORDGAARD 05.		
Tysfjord 68° 12′ N., 16° 12′ E. NORDGAARD 05.	"from the upper layers of water"	[surface temp. 1° 5 to 6° 0]
Gaukvaerö 68° 35′ N., 14° 13′ E. NORDGAARD 05.		
Henningsvaer 68° 15′ N., 14° 10′ E, NORDGAARD 05.		

Skagerak and Kattegat.
AURIVILLIUS 99 (1) CLEVE 99.
CONSEIL INTERN., 04 (1) (2), 05 (1), numerous stations.

Baltic.
CONSEIL INTERN., 04 (1) (2), 05 (1), numerous stations.
Kiel, MOEBIUS 73 (s. n. *germanica*).

North Sea.
CLEVE 99, CONSEIL INTERN. 04 (1) (2), 05 (1), numerous stations. SUTHERLAND 52.
St. Andrew's. M'INTOSH 74, 90.
Cuxhaven. DAHL 93.
Helgoland. FREY and LEUCKART 47, WILMS 46, LEUCKART and PAGENSTECHER 58, APSTEIN 03.
Nymindegab [55° 43′ N., 8° 7′ E.]. KRÖYER, quoted by TAUBER 79.
Ooster-Schelde. REDEKE 03.
Ooster-Schelde, between N. Beveland and Tholen. HORST 84.

Zuijder Zee.
REDEKE 03.

Channel and Irish Sea.

CLEVE 99.		
Isle of Wight. BUSK 56.		
Falmouth. VALLENTIN 98.		
St. Vaast. KEFERSTEIN 62.		
Ilfracombe. GOSSE 56.	epiplankton	[M.A. 12° 5 to 11° 0]
Tenby. GOSSE 56.		
Dublin Bay. HADDON 86.		
Scilly Islands. BROWNE 04.		
Plymouth. MARINE BIOLOGICAL ASSOCIATION 04.		
Firth of Clyde. BROWNE 05.		

Eastern North Atlantic.		
Valencia. GAMBLE 00.	epiplankton	7°0 to 16°0
48° 22′ N., 7° 43′ W. FOWLER 05.	epiplankton	18°5
47° 10′ N., 7° 45′ W. FOWLER 05.	epiplankton	11°5 to 19°
Madeira [32° 30′ N., 17° W.]. LANGERHANS 80.	? epiplankton	[M.A. 19°5]
Mediterranean.		
Messina. KROHN 53, GRASSI 83, GEGENBAUR 56, DONCASTER 02. Mentone. GRASSI 83. Naples. GRASSI 83, CHUN 88, BOVERI 90, DONCASTER 02. Gibraltar. QUOY and GAIMARD 27. Nice. LEUCKART 54. ? Black Sea. ULJANIN 70 (s. n. *germanica*).	apparently all epiplanktonic records	[M.A. 17° to 19°]
Indo-Pacific.		
28° S., 160° E. STEINHAUS 00. Moliendo, 16° S., 74° W. STEINHAUS 00. Bay of Bengal. STEINHAUS 96. Ceylon. STEINHAUS 96.	no data	

Sagitta decipiens Fowler.

FOWLER 05. (H.M.S. Research 1900).			
47° 10′ N., 7° 45′ W.	highest open net	182 to 0	11°5
(mean position)	lowest closing net	365 to 182	11°5

Sagitta elegans Verrill.

Wood's Holl. VERRILL 85, 73 (s. n. *gracilis*), CONANT 96, STEVENS 05. — Vineyard Sound, and Gay Head. VERRILL 85. All three about 41° 20′ N., 70° 40′ W. Atlantic City [39° 20′ N., 74° 25′ W.] LEIDY 83 (s. n. *falcidens*).	No data	no data

Sagitta enflata Grassi.

STRODTMANN 92, (s. s. National, 1889; vertical net).

Stat. VIII, 3ª. [40° 24′ N., 57° 0′ W.]
Stat. VIII, 3ᵇ. [39° 24′ N., 57° 48′ W.]
Stat. VIII, 4ª. [37° 54′ N., 59° 6′ W.]
Stat. VIII, 4ᵇ. [37° 6′ N., 59° 54′ W.]

STEINHAUS 96, (s. s. National, 1889; vertical net).

J. N. 177. 1° 46′ N., 17° 18′ W.
J. N. 180. 1° 6′ N., 16° 26′ W.
J. N. 182. 0° 6′ N., 15° 19′ W.
J. N. 184. 0° 16′ S., 14° 58′ W.
J. N. 186. 1° 24′ S., 14° 49′ W.
J. N. 188. 2° 30′ S., 14° 36′ W.
J. N. 190. 4° 5′ S., 14° 14′ W.
J. N. 194. 5° 10′ S., 14° 15′ W.
J. N. 195. 6° 57′ S., 14° 15′ W.
J. N. 204. 7° 20′ S., 20° 15′ W.
J. N. 207. 6° 56′ S., 23° 20′ W.
J. N. 209. 5° 40′ S., 26° 30′ W.
J. N. 213. 5° 13′ S., 27° 29′ W.
J. N. 216. [4° 16′ S., 29° 12′ W.]
J. N. 218. [3° 48′ S., 32° 36′ W.]
J. N. 223. 2° 49′ S., 35° 10′ W.
J. N. 228. 1° 47′ S., 38° 7′ W.
J. N. 231. 1° 24′ S., 39° 10′ W.
J. N. 232. 0° 26′ S., 42° 22′ W.
J. N. 235. 0° 5′ S., 44° 11′ W.
J. N. 246. 1° 29′ N., 46° 34′ W.

STEINHAUS 96, (Schott and Bruhn Collections, 1891—1893).		
Stat. 1. 4°26′ N., 26°17′ W.	100 to 0	? to 27°6
Stat. 2. 4° 3′ N., 26°37′ W.	0	27°7
Stat. 3. 11°28′ S., 34°48′ W.	100 to 0	? to 26°1
Stat. 7. 24°24′ S., 37° 6′ W.	100 to 0	? to 23°2
Stat. 9. 24°24′ S., 37° 6′ W.	180 to 0	? to 23°2
Stat. 28. 6°32′ S., 86°38′ E.	0	27°9
Stat. 29. 4°56′ N., 94°46′ E.	0	29°1
Stat. 31. 5°39′ N., 96°45′ E.	100 to 0	? to 28°9
Stat. c. 28° 0′ S., 42°32′ E.	100 to 0	? to 22°6
Stat. f. 24°30′ S., 4°35′ E.	0	17°7
Stat. 41. 15°54′ N., 85°38′ E.	120 to 0	? to 22°6
Stat. 42. 15°56′ N., 85°35′ E.	0	22°6
Stat. 43. 19°52′ N., 89°41′ E.	0	20°5
Stat. 44. 29°30′ S., 42°50′ E.	0	25°2
Stat. 47. 34°52′ S., 17°50′ E.	100 to 0	? to 26°2
Stat. 1. 23°35′ N., 36°15′ E.	0	20°5
Stat. 2. 21° 0′ N., 37°55′ E.	0	22°0
Stat. 7. 3°40′ N., 51°32′ E.	0	32°0
STEINHAUS 96 (Schab Collection. S.M.S. Falke, 1892—1893).		
Stat. 3. [6° 0′ N., 4°50′ E.]	14 to 0	29°5
Stat. 7. [6°30′ N., 2°50′ E.]	15 to 0	29°0
Stat. 15. [15°30′ S., 12°30′ E.]	13 to 0	21°5
Stat. 23. 3°33′ N., 3°14′ E.	0	28°4
Stat. 24. 3°44′ N., 0°17′ E.	0	28°2
Stat. 25, 26. [6°30′ N., 10°50′ W.]	16 to 0	28°3
Stat. 27. [4°20′ N., 7°40′ W.]	24 to 0	27°2
Stat. 30, 31. [0° 0 N., 6°30′ E.]	9 to 0	26°0

Messina. GRASSI 83, KRUMBACH 03.	presumably epiplanktonic	[M.A. 19° to 20°]
Naples. GRASSI 83, KRUMBACH 03, DONCASTER 02.		[M.A. 18° to 19°]
Bimini [26°40′ N., 78°30′ W.] CONANT 96 (s. n. *flaccida*).		[M.A. 26°]
3°30′ N., 16° W. to 11° N., 20° W. CLEVE 00.		24°6 to 28°2
? Mozambique (Agulhas current). STEINHAUS 96.		[M.A. c. 25°]
Ceylon [1]). STEINHAUS 96.		[M.A. c. 28°]
Bay of Bengal [1]). STEINHAUS 96.		no data
Australian current [? 28° S., 160° E.]. STEINHAUS 96.		[M.A. 17°]
Amboina. BERANECK 95.		[M.A. 28°]
Misaki, [35° N., 139°30′ E.]. AIDA 97.		[M.A. 21°]
Maldive Islands. DONCASTER 03.		[M.A. 28°]
Siboga Exp. 6° N. to 9° S., 113° E. to 132° E.	surface and vertical nets	28° to 29°

Sagitta ferox Doncaster.

Maldive Islands. DONCASTER 03.	epiplankton	[M.A. 28°]
Siboga Exp. 6° N. to 9° S., 113° E. to 132° E.	surface and vertical nets	28° to 29°

Sagitta furcata Steinhaus.

STEINHAUS 96, (s. s. National, 1889; vertical net).

J. N. 177. 1°46′ N., 17°18′ W.
J. N. 180. 1° 6′ N., 16°26′ W.
J. N. 186. 1°24′ S., 14°40′ W.
J. N. 188. 2°30′ S., 14°30′ W.

1) Not charted.

J. N. 190. 4° 5′ S., 14° 14′ W.
J. N. 194. 5° 10′ S., 14° 15′ W.
J. N. 195. 6° 57′ S., 14° 15′ W.
J. N. 204. 7° 20′ S., 20° 15′ W.
J. N. 206. 7° 33′ S., 21° 19′ W.
J. N. 207. 6° 56′ S., 23° 20′ W.
J. N. 209. 5° 40′ S., 26° 30′ W.
J. N. 213. 5° 13′ S., 27° 29′ W.
J. N. 216. [4° 16′ S., 29° 12′ W.]
J. N. 223. 2° 49′ S., 35° 10′ W.
J. N. 228. 1° 47′ S., 38° 7′ W.
J. N. 231. 1° 24′ S., 39° 10′ W.
J. N. 235. 0° 5′ S., 44° 11′ W.
J. N. 246. 1° 29′ N., 46° 34′ W.

STEINHAUS 96, (s. s. National, 1889; closing net).			
J. N. 65. [31° 48′ N., 61° 12′ W.]		700—500	[5° 3 to 5° 8]
J. N. 112. 29° 52′ N., 36° 54′ W.		1000—800	[8° 4 to 11° 0]
FOWLER 05, (H.M.S. Research, 1900).			
Mean position 47° 10′ N., 7° 45′ W.	open nets	various depths to and at 0	to 17°
	highest closing net	273 to 91	[11° 5]
	lowest closing net	365 to 182	[11° 5]
Valencia. GAMBLE 00.		epiplanktonic	[c. 11°]
Messina. KRUMBACH 03.		no data	

Sagitta hexaptera d'Orbigny.

STEINHAUS 96, (s. s. National, 1889; vertical net).
J. N. 177. 1° 46′ N., 17° 18′ W.
J. N. 180. 1° 6′ N., 16° 26′ W.
J. N. 182. 0° 6′ N., 15° 19′ W.
J. N. 184. 0° 16′ S., 14° 58′ W.
J. N. 186. 1° 24′ S., 14° 49′ W.
J. N. 188. 2° 30′ S., 14° 36′ W.
J. N. 190. 4° 5′ S., 14° 14′ W.
J. N. 194. 5° 10′ S., 14° 15′ W.
J. N. 195. 6° 57′ S., 14° 15′ W.
J. N. 203. 7° 41′ S., 17° 21′ W.
J. N. 204. 7° 20′ S., 20° 15′ W.
J. N. 206. 7° 33′ S., 21° 19′ W.
J. N. 207. 6° 56′ S., 23° 20′ W.
J. N. 209. 5° 40′ S., 26° 30′ W.
J. N. 213. 5° 13′ S., 27° 29′ W.
J. N. 216. [4° 24′ S., 29° 12′ W.]
J. N. 218. [3° 48′ S., 32° 36′ W.]
J. N. 223. 2° 49′ S., 35° 10′ W.
J. N. 228. 1° 47′ S., 38° 7′ W.
J. N. 231. 1° 24′ S., 39° 10′ W.
J. N. 232. 0° 26′ S., 42° 22′ W.
J. N. 235. 0° 5′ S., 44° 11′ W.
J. N. 246. 1° 29′ N., 46° 34′ W.

STRODTMANN 92, (s. s. National, 1889; vertical net).
Stat. VII, 20a. [59° 12′ N., 11° 48′ W.]
Stat. VII, 22a. 60° 12′ N., 22° 56′ W.
Stat. VII, 23a. 60° 12′ N., 28° 18′ W.
Stat. VII, 25a. 60° 5′ N., 36° 47′ W.
Stat. VII, 29a. [50° 48′ N., 47° 18′ W.]
Stat. VII, 29b. [50° 0′ N., 48° 6′ W.]
Stat. VIII, 2b. [41° 36′ N., 56° 18′ W.]
Stat. VIII, 3a. [40° 24′ N., 57° 0′ W.]
Stat. VIII, 3b. [39° 24′ N., 57° 48′ W.]
Stat. VIII, 4a. [37° 54′ N., 59° 6′ W.]
Stat. VIII, 4b. [37° 6′ N., 59° 54′ W.]

STEINHAUS 96, (s. s. National, 1889; closing net).		
J. N. 48. [40° 24′ N., 57° 0′ W.]	200 to 0	? to 25° 4
J. N. 53. [37° 54′ N., 59° 6′ W.]	500 to 300	[13° to 16°]
J. N. 92. 31° 22′ N., 46° 42′ W.	650 to 450	[12° 5 to 15° 6]
J. N. 154. 7° 55′ N., 21° 22′ W.	1000 to 800	[5° 2 to 7° 6]
J. N. 165. 5° 40′ N., 20° 2′ W.	400 to 200	[10° 7 to 13° 2]
STEINHAUS 96, (Schott and Bruhn Collections, 1891—1893).		
Stat. 1. 4° 26′ N., 26° 17′ W.	100 to 0	to 27° 6
Stat. 9. 24° 24′ S., 37° 6′ W.	180 to 0	to 23° 2
Stat. 12. 40° 20′ S., 6° 40′ E.	70 to 0	to 12° 6
Stat. 16. 41° 32′ S., 17° 30′ E.	50 to 0	to 10° 7
Stat. f. 24° 30′ S., 4° 35′ E.	0	17° 7
Stat. h. 19° 20′ S., 0° 30′ W.	100 to 0	to 19° 0

FOWLER 05 (H.M.S. Research, 1900).
Mean position, 47° 10′ N., 7° 45′ W.

	highest open net	91 to 0	11°5 to 18°5
	lowest closing net	1828 to 1371	5°5 to 8°0

LEVINSEN 86.

60° 12′ N., 52° 15′ W.	22° N., 22° W.
59° N., [1] ?	21° N., 36° 30′ W.
58° 17′ N., 30° 59′ W.	20° N., 66° W.
57° 49′ N., 35° 24′ W.	20° N., 26° W.
57° 50′ N., 48° 43′ W.	17° N., 12° W. [2]
44° 20′ N., 31° 40′ W.	15° N., 26° W.
44° N., 43° W.	9° 40 N., 109° 20 E.
43° 23′ N., 43° 35′ W.	9° N., 109° E.
42° 50′ N., 46° 10′ W.	7° 37 N., 22° 26 W.
36° 40′ N., 17° 20′ E.	3° 9′ N., 23° W.
42° 8′ N., 30° W.	2° 34 N., 109° 47 E.
42° N., 44° W.	2° N., 26° 29′ W.
36° N., 36° W.	2° S., 26° W.
34° 40′ N., 24° 20′ W.	8° 30′ S., 23° W.
34° 20′ N., 34° 50′ W.	17° 10 S., 35° 2 W.
34° 20′ N., 18° 30′ W.	23° 5 S., 63° 7 E.
34° 10′ N., 42° 10′ W.	26° 30′ S., 34° 40 W.
34° N., 34° W.	27° 30′ S., 98° E.
34° N., 31° W.	29° 40 S., 96° 20 E.
33° 40′ N., ? long. [1]	30° 12 S., 44° E.
33° 6′ N., 25° 30′ W.	31° 16′ S., 24° 20 W.
32° N., 18° W.	34° 20′ S., 6° W.
31° 20′ N., 34° 40′ W.	35° 12 S., 20° E.
31° N., 35° W.	35° 50 S., 60° 45 E.
30° 34′ N., 30° 50′ W.	36° 40 S., 17° 25 W.
30° 16′ N., 37° 16′ W.	37° S., 49° 20 E.
28° N., 25° W.	38° 16 S., 14° 30 E.
25° 16′ N., 70° 54′ W.	38° 29 S., 29° 20 E.
25° N., 39° W.	40° 4 S., 53° 20 E.
24° 45′ N., 22° 30′ W.	42° 53 S., 46° 38 W.

Arctic Ocean.		
30 m. W. of Cape Farewell [59° 50′ N., 44° 30′ W.]. LEVINSEN 86.	no data	
Karajak Fjord [70° 30′ N., 50° 30′ W.]. VANHÖFFEN 97.	0 and 225 to 0	—1°7 to 0
Spitzbergen [1]. KRUMBACH 03.	no data	no data
North Atlantic, etc.		
'Holsatia', Stat. 33 [58° N., 11° W.]. MOEBIUS 87.		
40° 4′ N., 68° 43′ W. ('Albatross', Stat. 2045). CONANT 96.		
Naples. GRASSI 83.		
Messina. GRASSI 83, GEGENBAUR 56, KRUMBACH 03 (s. n. *magna*).		
25° N., 40° W. STEINHAUS 96.		
Madeira. LANGERHANS 80 (s. n. *magna*).		

1) Not charted.
2) On shore.

Southern Ocean.		
40° S., 18°40 E. STEINHAUS 96.	no data	no data
40° S., 1° E. STEINHAUS 00.		
40° S., 79°40 W. D'ORBIGNY 35—43.		
South Pacific [1]. KENT 70 (s. n. *tricuspidata*).		
North-west Pacific.		
Misaki. [35° N., 139°30 E.]. AIDA 97.	epiplankton	[M.A. 21°]
Indo-Pacific.		
Maldive Islands. DONCASTER 03 (s. nn. *magna* and *tricuspidata*).	epiplankton	[M.A. 28°]
Siboga Exp. 6° N. to 8° S., 117° E. to 132° E.	surface and vertical nets	28° to 29°

Sagitta hispida Conant.

Beaufort, N. C. [34°45′ N., 76°33′ W.] CONANT 95.	surface	[M.A. 22°]
Jamaica [18° N., 76°45′ W.] CONANT 96.	surface	[M.A. 27°]
Bahamas 26°40′ N., 78°30′ W. CONANT 96.	surface	[M.A. 26°]
[?] Maldive Islands. DONCASTER 03.	epiplankton	[M.A. 28°]
[?] Misaki. AIDA 97.	epiplankton	[M.A. 21°]

Sagitta lyra Krohn.

Messina. KROHN 53.	? surface	[M.A. c. 19°]
Naples. GRASSI 83.	surface	[M.A. c. 19°]
Madeira. LANGERHANS 80.	? surface	[M.A. c. 19°]
Misaki. AIDA 97.	epiplankton	[M.A. 21°]

Sagitta macrocephala Fowler.

FOWLER 05, (H.M.S. Research, 1900).		
Mean position 47°10 N., 7°45′ W.		
Highest open net (?)	639 to 0	10°5 to 18°8
Highest closing net.	914 to 731	9°4 to 10°0
Lowest closing net.	3657 to 2742	2°5 to 3°0
Unpublished, (H.M.S. Research, 1896).		
Stat. 19°. 59 N., 7° W.	877 to 639	7°7 to 8°3
Siboga Expeditie.		
Stat. 141. 1° S., 127°25 E.	1500 to 0	4° to 27°2
Stat. 185. 3°20 S., 127°22 E.	1536 to 0	no data

Sagitta maxima Conant.

42°48 N., 50 55 W. (Albatross, Stat. 2428) CONANT 96.	from trawl wings	no data

Sagitta minima Grassi.

Messina. GRASSI 83, KRUMBACH 03.	surface	[M.A. c. 19°]
Naples. GRASSI 83, KRUMBACH 03.	surface	[M.A. c. 19°]
Mediterranean. DONCASTER 02.	no data	
Misaki. AIDA 97.	epiplankton	[M.A. 21°]

1) Not dated.

Sagitta neglecta Aida.

Misaki. AIDA 97.	epiplankton	[M.A. 21°]
Siboga Exp. 6° N. to 9° S., 113° E. to 132° E.	vertical and surface nets	28° to 29°

Sagitta planctonis Steinhaus.

STEINHAUS 96, (s. s. National 1889; vertical net).

J. N. 177. 1° 46' N., 17° 18' W.
J. N. 180. 1° 6' N., 16° 26' W.
J. N. 182. 0° 6' N., 15° 19' W.
J. N. 184. 0° 16' S., 14° 58' W.
J. N. 186. 1° 24' S., 14° 49' W.
J. N. 188. 2° 30' S., 14° 36' W.
J. N. 190. 4° 5' S., 14° 14' W.
J. N. 194. 5° 10' S., 14° 15' W.
J. N. 216. [4° 24' S., 29° 12 W.]

STEINHAUS 96, (Schab collection; S.M.S. Falke, 1892—1893).

Stat. 11.	[16° 50' S., 12° 0' E.]	27 to 0	18° 8 to 20°
Stat. 16.	[14° 0' S., 9° 50' E.]	0	21° 7
Stat. 17.	11° 1' S., 11° 56' E.	0	27° 0
Stat. 18—20.	[9° 0' S., 13° 0' E.]	30 to 0	? to 27° 5

?? FOWLER 05, (H.M.S. Research, 1900).

Mean position, 47° 10' N., 7° 45' W.	Open net.	182 to 0	11° 1 to 18° 8
	Closing net.	365 to 182	c. 11.1

Sagitta pulchra Doncaster.

Maldive Islands, DONCASTER 03.	epiplankton	[M.A. 28°]
Siboga Exp. 6° N. to 8° 30' S., 113° E. to 131° E.	surface and vertical nets	28° to 29°

Sagitta regularis Aida.

Misaki. AIDA 97.	epiplankton	[M.A. 21°]
Maldive Islands. DONCASTER 03.	epiplankton	[M.A. 28°]
Siboga Exp., 6° N. to 6° 30 S., 120° E. to 131° 30 E.	surface	28° to 29

Sagitta robusta Doncaster.

Maldive Islands. DONCASTER 03.	epiplankton	[M.A. 28°]
Siboga Exp., 6° N. to 8° S., 113° E. to 131° E.	surface and vertical nets	28° to 29

Sagitta septata Doncaster.

Maldive Islands. DONCASTER 03.	epiplankton	[M.A. 28°]

Sagitta serratodentata Krohn.

STRODTMANN 92, (s. s. National, 1889; vertical net).

Stat. VII, 20[a]. [59° 12' N., 11° 48' W.]
Stat. VII, 22[a]. 60° 12' N., 22° 56' W.
Stat. VII, 29[a]. [50° 48' N., 47° 18' W.]
Stat. VII, 29[b]. [50° 0' N., 48° 6' W.]
Stat. VIII, 2[b]. [41° 36' N., 56° 18' W.]
Stat. VIII, 3[a]. [40° 12 N., 57° 0 W.]
Stat. VIII, 3[b]. [39° 24 N., 57° 48' W.]
Stat. VIII, 4[a]. [37° 54' N., 59° 6 W.]
Stat. VIII, 4[b]. [37° 6' N., 59° 54 W.]

STEINHAUS 96, (s. s. National, 1889; vertical net).

J. N. 177. 1° 46′ N., 17° 18′ W.
J. N. 180. 1° 6′ N., 16° 26′ W.
J. N. 182. 0° 6′ N., 15° 19′ W.
J. N. 184. 0° 16′ S., 14° 58′ W.
J. N. 186. 1° 24′ S., 14° 49′ W.
J. N. 188. 2° 30′ S., 14° 36′ W.
J. N. 190. 4° 5′ S., 14° 14′ W.
J. N. 194. 5° 10′ S., 14° 15′ W.
J. N. 195. 6° 57′ S., 14° 15′ W.
J. N. 203. 7° 41′ S., 17° 21′ W.
J. N. 204. 7° 20′ S., 20° 15′ W.
J. N. 206. 7° 33′ S., 21° 19′ W.
J. N. 207. 6° 56′ S., 23° 20′ W.
J. N. 209. 5° 40′ S., 26° 30′ W.
J. N. 213. 5° 13′ S., 27° 29′ W.
J. N. 216. [4° 24′ S., 29° 12′ W.]
J. N. 218. [3° 48′ S., 32° 36′ W.]
J. N. 223. 2° 49′ S., 35° 10′ W.
J. N. 228. 1° 47′ S., 38° 7′ W.
J. N. 231. 1° 24′ S., 39° 10′ W.
J. N. 232. 0° 26′ S., 42° 22′ W.
J. N. 235. 0° 5′ S., 44° 11′ W.
J. N. 246. 1° 29′ N., 46° 34′ W.

STEINHAUS 96, (Schott and Bruhn Collections, 1891—1893).

Stat. 1.	4° 26′ N., 26° 17 W.	100 to 0	to 27° 6
Stat. 2.	4° 3′ N., 26° 37′ W.	0	27° 7
Stat. 3.	11° 28′ S., 34° 48′ W.	100 to 0	to 26° 1
Stat. 4.	13° 41′ S., 35° 17′ W.	50 to 0	to 26° 3
Stat. 5.	25° 39′ S., 36° 51′ W.	0	22° 0
Stat. 12—14.	40° 20′ S., 6° 40′ E.	100 & 70 to & at 0	to 12° 6
Stat. 16, 17.	41° 32′ S., 17° 39′ E.	100 & 50 to 0	to 19° 7
Stat. 28.	6° 32′ S., 86° 38′ E.	0	27° 9
Stat. 29.	4° 56′ N., 94° 46′ E.	0	29° 1
Stat. f.	24° 30′ S., 4° 35′ E.	0	17° 7
Stat. h.	19° 20′ S., 0° 30′ W.	100 to 0	to 19° 0
Stat. 41.	15° 54 N., 85° 38′ E.	120 to 0	to 22° 6
Stat. 47.	34° 52′ S., 17° 50′ E.	100 to 0	to 26° 2
Stat. 2.	21° 0′ N., 37° 55′ E.	0	22° 0
Stat. 4.	7° 43′ N., 73° 26′ E.	0	30° 8
Stat. 7.	3° 40′ N., 51° 32′ E.	0	32° 0

STEINHAUS 96, (Schab Collection, S.M.S. Falke, 1892—1893).

Stat. 24.	3° 44′ N., 0° 17′ E.	0	28° 2
Stat. 31.	[0° 0 N., 6° 30 E.]	9 to 0	26° 0

STEINHAUS 96, (s. s. National, 1889; closing net).

Stat. A. 3¹.	[40° 24 N., 57° 0 W.]	200 to 0	to 25° 4

FOWLER 05, (H.M.S. Research, 1900).

Mean position 47° 10′ N., 7° 45 W.	open nets	182 and less to and at 0	11° 1 to 18° 8
	closing net	364 to 182	11° 1

CLEVE 00

15° N., 18 W.	Jan.	presumably epiplanktonic	20° to 27° 5
6° S., 4° W. to 23° N., 28° W.	Mar.		
12 N., 27° W.	Sep.		
19° N., 58° W.	Nov.		

Messina. KROHN 53, GEGENBAUR 56, FOL 70, GRASSI 83.	probably all epiplanktonic	[M.A. c. 19°]
Naples. GRASSI 83.		[M.A. c. 19°]
Stanley Harbour, Falkland Islands. FOWLER 05.		6° 6 to 12° 2
[53 S., 70 40 W.] (Stat. 89, Hamb. Magalh. Sam.). STEINHAUS 00.		[M.A. c. 7°]
Maldive Islands. DONCASTER 03.		[M.A. 28°]
Amboina. BERANECK 95.		[M.A. 28°]
Misaki. AIDA 07.		[M.A. 21°]
Siboga Exp. 6° N. to 9 S., 113° E. to 132 E.	surface and vertical nets	28° to 29°

Sagitta Sibogae sp. n.

Siboga Exp.		
Stat. 141. 1° 0′ S., 127° 25′ E.	1500 to 0	4° to 27°2
Stat. 143. 1° 4′ S., 127° 52′ E.	1000 to 0	about 6° to 27°9
Stat. 148. 0° 17′ S., 129° 14′ E.	1000 to 0	no data
Stat. 185. 3° 20′ S., 127° 22′ E.	1536 to 0	no data
Stat. 203 (1). 3° 32′ S., 124° 15′ E.	1500 to 0	4° to 26°3
Stat. 230 (1). 3° 58′ S., 128° 20′ E.	2000 to 0	no data

Sagitta tenuis Conant.

Kingston Harbour 18° N., 76° 45′ W. CONANT 96.	epiplanktonic	[M.A. 27°]

Sagitta Whartoni Fowler.

FOWLER 96, (H.M.S. Research 1896, 1897).		
Mean position 60° 5′ N., 4° 0′ W.		
Highest open net.	182 to 0	8°8 to 12°2
Lowest closing net.	914 to 731	—1°1 to —0°5
Atlantic. GÜNTHER 03.	no data	

Sagitta Zetesios Fowler.

FOWLER 05, (H.M.S. Research 1900).		
Mean position 47° 10′ N., 7° 45′ W.		
Highest open net.	182 to 0	11°6 to 18°8
Lowest closing net.	1828 to 1371	4°7 to 8°
Siboga Exp.		
Stat. 141. 1° 0′ S., 127° 25′ E.	1500 to 0	4° to 27°2
Stat. 143. 1° 4′ S., 127° 52′ E.	1000 to 0	about 6° to 27°9
Stat. 148. 0° 17′ S., 129° 14′ E.	1000 to 0	no data
? Stat. 175. 2° 37′ S., 130° 33′ E.	(trawl) 1014 to 0	no data
Stat. 185. 3° 20′ S., 127° 22′ E.	1536 to 0	no data
Stat. 203 (1). 3° 32′ S., 124° 15′ E.	1500 to 0	4° to 26°3
Stat. 208. 5° 39′ S., 122° 12′ E.	(trawl) 1886 to 0	no data
Stat. 216. 6° 49′ S., 122° 43′ E.	975 to 415	no data
? Stat. 243. 4° 30′ S., 129° 25′ E.	1000 to 0	no data
? Stat. 276. 6° 47′ S., 128° 40′ E.	750 to 0	about 7°8 to 27

Krohnia foliacea Aida.

Misaki [35° N., 139° 30 E.]. AIDA 97.	epiplanktonic	[M.A. 21°]

Krohnia hamata Moebius.

MOEBIUS 75, (s. s. Pommerania, 1872).		
Stat. 20. N. of Hanstholmen [58° N., 8° 47 E.]	[539] to 0	no data
Stat. 62, 63. Korsfjord [60° 10 N., 5° 10 E.]	[245 or more] to 0	no data
Stat. 224. N.W. from Skagen [58° 7 N., 9° 23 E.]	[584] to 0	no data
MOEBIUS 87, (s. s. Holsatia, 1885).		
Stat. 30. [58° N., 11° W.]	2500 to 0	no data
Stat. 33. [58° N., 11° W.]	200 to 0	no data

STRODTMANN 92. (s. s. National 1889; vertical net).		
Stat. VII, 19$^{\text{th}}$. 58° 57' N., 8° 35' W.	100 to 0	[9° 5] to 12° 5
Stat. VII, 20$^{\text{th}}$. [59° 12' N., 11° 48' W.]	400 to 0	[8° 6] to 12° 4
Stat. VII, 22$^{\text{th}}$. 60° 12' N., 22° 56' W.	400 to 0	[7° 5] to 11° 6
Stat. VII, 23$^{\text{th}}$. 60° 12' N., 28° 18' W.	600 to 0	[7° 7] to 10° 6
Stat. VII, 23$^{\text{th}}$. 60° 12' N., 28° 18' W.	100 to 0	[7° 5] to 10° 6
Stat. VII, 25$^{\text{th}}$. 60° 5' N., 36° 47' W.	400 to 0	[6° 2] to 8° 3
Stat. VII, 29$^{\text{th}}$. [50° 48' N., 47° 18' W.]	500 to 0	[2° 5] to 10° 6
Stat. VII, 29. [50° 0' N., 48° 6' W.]	300 to 0	[2° 5] to 10° 2
STEINHAUS 96. (s. s. National, 1889; closing net).		
J. N. 10. 60° 12' N., 22° 56' W.	1000 to 800	[5° 8 to 7°]
J. N. 53. 37° 54' N., 59° 6' W.	500 to 300	[13° to 16°]
J. N. 69. 31° 30' N., 59° 0' W.	1100 to 900	[7° 9 to 10° 2]
J. N. 105. 31° 29' N., 40° 44' W.	1500 to 1300	5° 2 to [7° 3]
J. N. 154. 7° 55' N., 21° 22' W.	1000 to 800	5° 2 to [7° 5]
J. N. 160. 5° 59' N., 20° 21' W.	1200 to 1000	4° 7 to [6° 1]
J. N. 170. 3° 40' N., 18° 58' W.	900 to 700	4° 5 to [5° 7]
J. N. 198. 6° 57' S., 14° 15' W.	800 to 600	4° 3 to [6° 3]
J. N. 220. 3° 36' S., 33° 12' W.	800 to 600	[4° 2 to 5° 4]
LEVINSEN 86.		
59° N. 57° 50' N., 48° 43' W. 57° 48' N., 43° 45' W. Kronprinsen's Eiland [68° 57' N., 53° W.] 30 m. W. of C. Farewell [59° 50' N., 44° 30' W.]	No data	No data
CONSEIL INTERNATIONAL 04 (1).		
S. 7. 58° 26' N., 9° 44' E.	600 to 200	5° 2 to 5° 7
highest open net	200 to 0	5° 7 to 17°
S. 8. 58° 10' N., 9° 18' E.	200 to 0	[5° 6] to 17°
S. 14. 58° 49' N., 11° 5' E.	240 to 0	5° 6 to 17° 4
D.N., 8. 58° 23' N., 5° 56' E.	320 to 0	5° 8 to 15° 5
CONSEIL INTERNATIONAL 04 (2).		
S. 7. 58° 26' N., 9° 41' E.	300 to 100	5° 7 to 7° 0
highest open net	100 to 0	7° 0 to 8° 7
S. 8. 58° 10' N., 9° 18' E.	300 to 150	5° 7 to 7° 0
	560 to 0	5° 4 to 8° 9
S. 9. 58° 15' N., 9° 5' E.	400 to 0	5° 7 to 8° 9
S. 14. 58° 49' N., 11° 05' E.	235 to 0	5° 6 to 8° 9
AURIVILLIUS 99 (2).		
Antarctic Exp. (1898).		
77° 30' N., 1° 18' E.	100, 200 and 500 to 0	0° 5 to 3° 8
77° 52' N., 3° 5' W.	25, 100, 400 and 500 to 0	0° 8 to 3° 6
78° 13' N., 2° 58' W.	500 and 2000 to 0	0° 3 to 3° 1
76° 30' N., 12° 13' E.	100 to 0	3° 7 to 7° 1
70° 58' N., 0° 35' E.	100 and 400 to 0	1° 5 to 4° 5
AURIVILLIUS 99 (2).		
Svensksund Exp. 1897.		
? 77° 14' N., 11° [illegible] E.	0	5° 4
? 74° 40' N., 14° 12' E.	0	5° 4

RÖMER and SCHAUDINN, 99.			
W. Coast of Spitzbergen [1]).		no data	no data
Jena Island [79° N., 29° E.]			
81° 1/2 N. [81° 30′ N., 21° E.]			
FOWLER 96, (H.M.S. Research, 1896).			
Mean position 60° 5′ N., 4° 0′ W.	open nets	0 and 182 to 0	8°8 to 12°2
	lowest closing net	914 to 731	—1°1 to —0°5
FOWLER 05, (H.M.S. Research 1900).			
Mean position 47° 10′ N., 7° 45′ W.	open nets	91, 137, 182 to 0	11°1 to 18°8
	highest closing net	273 to 91	11°1
	lowest closing net	3657 to 2742	2°5 to 3°0
CLEVE 00.			
67° N., 3° W.		no data	10° to 11°
62° to 67° N., 0° 37′ E. to 2° 52′ W.	June.	"from strata below 100"	
71° to 74° N., 21° to 18° W.	July.	"from 280"	
53° N., 42° W.	July.	no data	
54° N., 47° W.	Aug.	no data	
56° N., 27° to 36° W.	Sep.	no data	
62° to 67° N., 0° 37′ E. to 2° 55′ W.	Sep.	below 50, and 500 to 25	
Arctic Ocean.			
? Spitsbergen [1]). SCORESBY 20.		no data	
73° to 74° N., about 70° W. AURIVILLIUS 96 (1).		no data	c. 0°
W. coast of Spitzbergen [1]). KRUMBACH 03.		no data	no data
Karajakfjord [70° 30′ N., 50° 30′ W.]. VANHÖFFEN 07.		0 and 225 to 0	—1°7 to 6°0
North Atlantic, etc.			
Bergen. NORDGAARD 98, 99.		never in shallow water	optimum 6° to 7°
Lofoten [1]). NORDGAARD 99.			
Hirtsholmen [57° 30′ N., 10° 30′ E.]. KRÖYER, quoted by TAUBER 79.		no data	
Ofotenfjord [68° 13′ N., 16° 30 E.]. GRAN 00.		60 to 40	5°1 to 5°9
40° 4′ N., 68° 43′ W. (Albatross, Stat. 2045). CONANT 96.		in trawl-wings	
Southern Ocean.			
40° 23′ S., 8° 35′ E. (Sch. & Br., Stat. 15). STEINHAUS 96.		70 to 0	[M.A. c. 12°0]
Stanley Harbour, Falkland Islands. FOWLER 05.		6 to 0	6°0 to 12°2
Antipodes Island [49° 30 S., 179° 30′ E.]. PARKER 95.		epiplankton	[M.A. c. 9°0]
Paterson's Inlet, Stewart Island [47° S., 168° 10 E.]. PARKER 95.		epiplankton	[M.A. c. 11°0]
Norman's Inlet, Auckland Islands [50° 30 S., 166° 30 E]. PARKER 95.		epiplankton	[M.A. 8°]
Pacific Ocean.			
Siboga Expeditie.			
Stat. 118. 1° 38′ N., 124° 28′ E.		900 to 0	about 6°5 to 27°
Stat. 141. 1° 0′ S., 127° 25′ E.		1500 to 0	4° to 27°2
Stat. 143. 1° 4′ S., 127° 52 E.		1000 to 0	about 6° to 27°9
Stat. 148. 0° 17′ S., 129° 14′ E.		1000 to 0	no data
Stat. 185. 3° 20′ S., 127° 22 E.		1536 to 0	no data
Stat. 210[1]. 5° 26′ S., 121° 18′ E.		(trawl) 1044 to 0	no data
Stat. 216. 6° 49′ S., 122° 43 E.		975 to 415	no data
Stat. 230 (1). 3° 58′ S., 128° 20′ E.		2000 to 0	no data

1) Not charted.

Krohnia pacifica Aida.

Misaki [35° N., 139° 30' E.]. AIDA 97.	epiplanktonic	[M.A. 21°]
Maldive Islands. DONCASTER 03.	epiplanktonic	[M.A. 28°]
Siboga Exp., 6° N. to 7° 30' S., 117° 30' E. to 131° 30' E.	surface and vertical nets	28° to 29°

Krohnia subtilis Grassi.

STRODTMANN 92. (s. s. National, 1889; vertical net).

Stat. VII, 22ᵃ. 60° 12' N., 22° 56' W.
Stat. VIII, 2ᵇ. [41° 36' N., 56° 18' W.]
Stat. VIII, 3ᵃ. [40° 24' N., 57° 0' W.]
Stat. VIII, 3ᵇ. [39° 24' N., 57° 48' W.]
Stat. VIII, 4ᵃ. [37° 54' N., 59° 6' W.]
Stat. VIII, 4ᶜ. [37° 6' N., 59° 54' W.]

STEINHAUS 96. (s. s. National 1889; vertical net).

J. N. 177. 1° 46' N., 17° 18' W.
J. N. 180. 1° 6' N., 16° 26' W.
J. N. 182. 0° 6' N., 15° 19' W.
J. N. 184. 0° 16' S., 14° 58' W.
J. N. 186. 1° 24' S., 14° 49' W.
J. N. 188. 2° 30' S., 14° 36' W.
J. N. 190. 4° 5' S., 14° 14' W.
J. N. 194. 5° 10' S., 14° 15' W.
J. N. 195. 6° 57' S., 14° 15' W.
J. N. 203. 7° 41' S., 17° 21' W.
J. N. 204. 7° 20' S., 20° 15' W.
J. N. 207. 6° 56' S., 23° 20' W.
J. N. 209. 5° 40' S., 26° 30' W.
J. N. 213. 5° 13' S., 27° 29' W.
J. N. 216. [4° 24' S., 29° 12' W.]
J. N. 218. [3° 48' S., 32° 36' W.]
J. N. 223. 2° 49' S., 35° 10' W.
J. N. 228. 1° 47' S., 38° 7' W.
J. N. 231. 1° 24' S., 39° 10' W.
J. N. 232. 0° 26' S., 42° 22' W.
J. N. 235. 0° 5' S., 44° 11' W.
J. N. 246. 1° 29' N., 46° 34' W.

STEINHAUS 96. (s. s. National, 1889; closing net).

J. N. 48. [40° 24' N., 57° 0' W.]	200 to 0	? to 25° 4
J. N. 53. [37° 54' N., 59° 6' W.]	500 to 300	[13° to 16°]
J. N. 65. [31° 48' N., 61° 12' W.]	700 to 500	[5° 3 to 5° 8]
J. N. 96. 31° 25' N., 45° 52' W.	850 to 650	9° 4 to [12° 5]
J. N. 128. 25° 7' N., 31° 32' W.	600 to 400	[c. 12° 0] to 15° 5
J. N. 165. 5° 40' N., 20° 2' W.	400 to 200	10° 7 to 13° 2

STEINHAUS 96. (Schott and Bruhn Collections, 1891—1893).

Stat. 1. 4° 26' N., 26° 17' W.	100 to 0	to 27° 6
Stat. 2. 4° 3' N., 26° 37' W.	0	27° 7
Stat. 5. 25° 39' S., 36° 51' W.	0	22° 0
Stat. 41. 15° 54' N., 85° 38' E.	120 to 0	to 22° 6
Stat. 43. 19° 52' N., 89° 41' E.	0	20° 5
Stat. 44. 29° 30' S., 42° 50' E.	0	25° 2
Stat. 4. 7° 43' N., 73° 20' E.	0	30° 8

STEINHAUS 96. (Schab Collection; S.M.S. Falke 1802—1893).

Stat. 2. [9° 0' N., 13° 0' W.]	20 to 0	29° 5
Stat. 3. 4. [6° 0' N., 0° 50' E.]	14 to 0	29° 5
Stat. 6—8. [6° 30' N., 2° 50' E.]	14 and 15 to 0	20° 0
Stat. 17. 11° 1' S., 11° 50' E.	0	27° 0
Stat. 23. 3° 33' N., 3° 14' E.	0	28° 4
Stat. 25, 26. [6° 30' N., 10° 50' W.]	16 to 0	28° 3
Stat. 27. [4° 20' N., 7° 40' W.]	24 to 0	27° 2
Stat. 28. [6° 30' N., 10° 50' W.]	10 to 0	27° 3
Stat. 29. [6° 30' N., 10° 50' W.]	8 to 0	27° 4
Stat. 30, 31. [0° 0' N., 6° 30' E.]	0 and 10 to 0	26° 0

Messina. GRASSI 83.		[M.A. c. 19°]
47° 10′ N., 7° 45′ W. (H.M.S. Research 1900). FOWLER 05. highest open net	91 to 0	11°1 to 18°8
Bay of Bengal. STEINHAUS 96.	no data	
Siboga Expeditie.		
Stat. 141. 1° 0′ S., 127° 25′ E.	1500 to 0	
Stat. 143. 1° 4′ S., 127° 52′ E.	1000 to 0	
Stat. 185. 3° 20′ S., 127° 22′ E.	1536 to 0	
Stat. 203(1). 3° 32′ S., 124° 15′ E.	1500 to 0	
Stat. 220(2). 6° 0′ S., 124° 0′ E.	200 to 0	
Stat. 243. 4° 30′ S., 129° 25′ E.	1000 to 0	

Spadella cephaloptera Busch.

Orkney. BUSCH 51.
Skagerak [1]). AURIVILLIUS 99 (1).
Plymouth. [p. 34].
St. Vaast. CLAPARÈDE 63.
Roscoff. GIARD 75 (s. n. *batziana*).
Scilly Islands. BROWNE 04. LEWES 58 (s. n. *mariana*).
Valencia. GAMBLE 00.
Cette. PAGENSTECHER 63 (s. n. *gallica*).
Messina. HERTWIG 80, GRASSI 83.
Trieste. GRASSI 83.
? Black Sea. ULJANIN 70 (s. n. *pontica*).
[Mean annual temperatures from c. 9°5 (Orkney) to c. 19° (Messina).]

Spadella draco Krohn.

STRODTMANN 92, (s. s. National 1889; vertical net).

Stat. VIII, 2^{b}. [41° 36′ N., 56° 18′ W.]
Stat. VIII, 3^{a}. [40° 24′ N., 57° 0′ W.]
Stat. VIII, 3^{b}. [39° 24′ N., 57° 48′ W.]
Stat. VIII, 4^{a}. [37° 34′ N., 59° 6′ W.]
Stat. VIII, 4^{b}. [37° 6′ N., 59° 54′ W.]

STEINHAUS 96, (s. s. National 1889; vertical net).

J. N. 177. 1° 46′ N., 17° 18′ W.
J. N. 180. 1° 6′ N., 16° 26′ W.
J. N. 182. 0° 6′ N., 15° 16′ W.
J. N. 184. 0° 16′ S., 14° 58′ W.
J. N. 186. 1° 24′ S., 14° 40′ W.
J. N. 188. 2° 30′ S., 14° 36′ W.
J. N. 190. 4° 5′ S., 14° 14′ W.
J. N. 194. 5° 10′ S., 14° 15′ W.
J. N. 195. 6° 57′ S., 14° 15′ W.
J. N. 203. 7° 41′ S., 17° 21′ W.
J. N. 204. 7° 20′ S., 20° 15′ W.
J. N. 207. 6° 56′ S., 23° 20′ W.
J. N. 209. 5° 40′ S., 26° 30′ W.
J. N. 213. 5° 13′ S., 27° 29′ W.
J. N. 216. [4° 24′ S., 29° 12′ W.]
J. N. 218. [3° 48′ S., 32° 36′ W.]
J. N. 223. 2° 49′ S., 35° 10′ W.
J. N. 228. 1° 47′ S., 38° 7′ W.
J. N. 231. 1° 24′ S., 39° 10′ W.
J. N. 232. 0° 26′ S., 42° 22′ W.
J. N. 235. 0° 5′ S., 44° 11′ W.

STEINHAUS 96, (Schott and Bruhn Collections, 1891—1893).

Stat. 1. 4° 20′ N., 26° 17′ W.	100 to 0	to 27°6
Stat. 9. 24° 24′ S., 37° 6′ W.	180 to 0	to 23°2
Stat. 16. 41° 32′ S., 17° 30′ E.	50 to 0	to 19°7
Stat. 29. 4° 56′ N., 94° 46′ E.	0	29°1
Stat. f. 24° 30′ S., 4° 35′ E.	0	17°7

1) Not charted.

STEINHAUS 96. (Schab Collection; S.M.S. Falke (1892—1893).		
Stat. 24. 3° 44′ N., 0° 17′ E.	0	28° 2
STEINHAUS 96. (s. s. National, 1889; closing net).		
J. N. 48. [40° 24′ N., 57° W.]	200 to 0	to 25° 4
Mediterranean. HERTWIG 80.	presumably all epiplanktonic	
Messina. KROHN 53, GRASSI 83, KRUMBACH 03.		[M.A. c. 19°]
Naples. GRASSI 83. COSTA 69 (s. n. *Pterosagitta mediterranea*).		[M.A. c. 19°]
Canary Islands. HERTWIG 80.		[M.A. c. 19° 5]
Kingston Harbour, Jamaica. CONANT 96.		[M.A. c. 27°]
Maldive Islands. DONCASTER 03.		[M.A. 28°]
Ceylon. STEINHAUS 96.		[M.A. c. 28°]
Amboina. BÉRANECK 95.		[M.A. c. 27°]
Misaki. AIDA 97.		[M.A. 21°]
Siboga Exp. 6° N. to 9° S., 119° 30′ E. to 132° E.	surface and vertical nets	28° to 29°

Spadella schizoptera Conant.

Bahama Islands. CONANT 95, 96.	epiplanktonic	[M.A. 26°]

2. Summary and conclusions.

The following section summarises, in a digestible form and for those who are not specialists, the conclusions which may be drawn from the foregoing records; it deals only with the species regarded in this Report as valid.

Since mere lists of positions, expressed as latitude and longitude, convey to most of us little idea of the area thereby included, the records of the commoner species (excepting *bipunctata*) have been plotted as Charts I to VI [1]) and exhibit practically all the records, whether definitive or not. They not only enable one to visualise the areas of horizontal distribution, but bring out the amazing fact that between 160° E. and 80° W. we have not a single record of a Chaetognath, — at any rate so far as the present writer can find.

Sagitta arctica Aurivillius. (Chart I).

Localities [2]):

Baffin's Bay and Davis' Strait; E. coast of Greenland to Spitzbergen, and to Faeroes Shetland and Skagerak.

Definitive observations [3]):

Neritic and oceanic.
N. limit: 81° 14' N., 22° 50' E.
S. limit: 58° N., 11° E. (120 to 20 m.).
Surface, between 1° C. and 8°5 C.
Deepest haul: 500 to 200 m.
Highest temperature: below 10° C.
Lowest temperature: between 0°3 and 1°9 C.

Whether the synonymy suggested above (p. 30—32) for this form be correct or not, there can be little doubt but that it is a cold-water form.

So far as its distribution goes, it is curiously like that of *hamata*: and the probability is that it will be found, like *hamata*, to extend further South in the mesoplankton: this suggested its possible identity with *Zetesios*.

Sagitta Bedoti Beraneck.

Localities:

Malay (Siboga area) and Maldive Archipelagos; Japan.

Definitive observations:

Neritic [4]).
Surface.
Temperature: 28° to 29° C., and M.A. 21°.

1) These have been prepared on, and reduced from, the Blank Charts published by the Challenger Society for such purposes.

2) These refer to mere geographical position, irrespective of depth.

3) Under this head are classed those few positive records which allow us to define the limits of a species — in the present state of our knowledge. For this purpose hauls with deep Vertical Nets are generally useless.

4) It is perhaps not possible to describe the plankton of an Archipelago as either 'oceanic' or 'neritic'. What are usually supposed to be truly oceanic conditions, depending on distance from land as well as on depth of water, can hardly apply to the case

Sagitta bipunctata Quoy et Gaimard.

According to the recorded occurrences of this species, it would seem to be equally at home in a brackish estuary or in the centre of a main ocean, at a mean annual temperature of about 0° in the White Sea to 33° in the Red Sea, and from 82° W. to 120° E. If this be correct, *bipunctata* would be about the most eurythermal, euryhaline, and cosmopolitan organism known.

Against such a distribution there is no reasonable argument to allege, but, frankly, I am quite unable to believe it without more evidence. It can only be urged in defence of such incredulity that I know bitterly how difficult it is to distinguish between *bipunctata* and the young of several other species; this has no such unmistakeable features as some species present.

The wide extension of the records is due mainly to LEVINSEN (86) and STEINHAUS (96). Of these, LEVINSEN furnishes only a record of geographical positions without further data. STEINHAUS, who shares with STRODTMANN the credit of the only recent attempts to gauge the distribution of Chaetognatha, dealt with several collections, of which some were well, others badly, preserved; among the latter were numerous Indo-pacific records of *bipunctata*, which I suspect on the ground that this species was not captured by Mr GARDINER in many months work in the Maldive Archipelago, nor by the Siboga in a year of regular townettings; this is sufficiently remarkable in an ocean which is stated to have so uniform a plankton-fauna as the Indo-pacific. As has already been pointed out (pp. 16, 17) there is every excuse for confusing *bipunctata* and badly preserved *neglecta*, which occurs as far north as Japan, and as far south as Java; and the explanation may possibly lie in this fact. It is greatly to be hoped that with the energy displayed at the present time in collecting abroad, and with the increased use of formalin, the extreme records may be either confirmed or refuted. In the meantime it appears to be premature to attempt to define the horizontal distribution of this species, and a waste of labour to plot the captures on a Chart.

It is, however, generally agreed that *bipunctata* is a neritic or coast-wise form, and that its oceanic occurrences are rather exceptional (STRODTMANN, 02 p. 15; STEINHAUS, 96 pp. 28, 39; FOWLER, 05 p. 69). It appears to be euryhaline, and to tolerate a low salinity in the Zuijder See, East Scheldt, at nearly the longitude of Memel in the Baltic, and in the mouth of the Para River.

As regards the vertical distribution, STEINHAUS records no less than 7 specimens from a closing net 850—650 m., at fairly high temperatures (9°.4 to [12°.5]); but it failed at greater depths and lower temperatures. In the Research it failed entirely in all the 35 hauls with the closing net which began at 365 m. or a greater depth: that is to say below the isothermobath of 11 C., which tallies well with STEINHAUS' record.

The mere fact that (so far as our evidence at present goes) this temperature appears approximately to set its depth-limit, forms a certain amount of evidence against its alleged occurrence in the far north, and suggests that the unnamed recorder for the Russian section of the Conseil International 04 (1) may have been dealing really with *arctica*.

of the epiplankton of an archipelago: for the strong tides and currents generally met with in such areas must produce nearly the same epiplanktonic conditions throughout. With the mesoplankton, however, below the action of tide and current, the case is somewhat different: one would not class *hamata*, for example, as neritic, merely because it occurred in the deep water of an archipelago. The epiplankton of the Siboga area has therefore been regarded in this place as neritic, the apparently purely mesoplanktonic species as oceanic.

Sagitta decipiens Fowler.

Locality (mean):

47° 10′ N., 7° 45′ W.

Definitive observations:

Oceanic.
Not taken above 182 m.
Deepest hauls: 365—182 m., at c. 11° 5 C.

Sagitta elegans Verrill. (Chart I).

Localities:

41° 20′ N., 70° 40′ W.
39° 20′ N., 74° 25′ W.

Definitive observations wanting.

As Verrill and Conant in some cases indicate deep-water specimens, the presumption is that this species was captured at or near the surface. The localities lie well within the influence of the cold water which bathes the north-eastern States; they have a mean annual temperature of about 11° C. There is nothing in this distribution inconsistent with the suggested identity with *arctica* (pp. 30—32), and these waters are practically subarctic, in temperature and source, through not in latitude.

Sagitta enflata Grassi. (Charts I—III).

Localities:

Temperate North Atlantic, and Mediterranean; tropical Atlantic; S. Atlantic (Brazil Current, and Benguela Current to the Cape); Indian Ocean and Red Sea; Malay Archipelago and Japan.

Definitive observations:

Oceanic and neritic.
N. limit (Atlantic): 40° 24′ N., 57° 0′ W. — M.A. c. 16° C.
S. limit (Atlantic): 34° 52′ S., 17° 50′ E. — M.A. c. 17° C.
S. limit (Indo-Australian): 29° 30′ S., 42° 50′ E.
Surface (absent from all closing nets).
Highest temperature, 32° C.
Lowest temperature, M.A. 16° C.

There is no trace of this species as a mesoplanktonic form in any locality; it is apparently an epiplanktonic and warm-water form. That its minimal temperature limit is somewhere near 16° C., is confirmed by its absence from the Biscayan stations of the Research, which have a mean annual of 13° to 14° C., although at the moment the surface temperatures were 17° to 18° C.

Sagitta ferox Doncaster.

Localities:

Malay (Siboga area) and Maldive Archipelagos.

Definitive observations:

Neritic.
Surface.
Temperature: c. 28° to 29° C.

Sagitta furcata Steinhaus (Charts I, II).

Localities:

N. temperate and tropical Atlantic, and Mediterranean.

Definitive observations:

Oceanic (and Messina).
N. limit: 51° 55 N., 10° 20′ W. at 11° C.
S. limit: 7° 33′ S., 20° 19′ W.
Surface at 17° C.
Deepest haul (National); 1000 to 800 m. at 8°4 to 11° C., under surface water of M.A. 22° C.
Deepest haul (Research); 365 to 182 m. at 11° 5 C., under surface water of 17° to 18° C.
Highest temperature, 17° C.
Lowest temperature, between 8°4 and 11° C.

This species which is epiplanktonic at Valentia, was found to be also represented by a few specimens in the upper mesoplankton at my Biscayan stations, and was shown by the closing nets of the National at stations yet further south to extend yet more deeply into the mesoplankton. Here, as in other cases, the curious conditions well known at Messina, which bring up deep water species to or near to the surface render a comparison with the truly oceanic records at present impossible.

The species has at present quite restricted limits, of horizontal and vertical range as well as of temperature: these will probably prove to be valid in the future also, as its original describer, Dr. Steinhaus, was dealing at the same time with large collections from other waters in which it was not represented.

Sagitta hexaptera d'Orbigny. (Charts IV—VI).

Localities:

Karajak-fiord in Greenland; Spitsbergen; Atlantic from 60° 12′ N. to 42° 53 S.; Indo-Australian from 40° 4′ S. to 10° N. and 135° E.; S.E. Pacific at 40° S., 79° 40′ W. (Humboldt's Current); Japan.

Definitive observations:

Oceanic and neritic.
Surface; 70° 30′ N., 50° 30′ W. at 6° C.
Surface; in the Siboga area at 28° to 29° C.
Deepest haul; 1828 to 1371 m. at 5° 5 to 8° C.
Highest temperature: 29° C.
Lowest temperature; 6° C.

There seems to be little doubt that *hexaptera* is very nearly what *bipunctata* is alleged to be. But *hexaptera* is much more of an oceanic form (rarely neritic), stenohaline, eurybathic, and eurythermal; it appears to be nearly cosmopolitan, but though eurythermal within wide limits it does not seem to extend into the mesoplankton to the same depths as do some other species[1].

1) Since finishing the Siboga collection, I have found this species among the Chaetognatha taken at the Winter Quarters of the Discovery. This practically completes its record as a cosmopolitan species.

Sagitta macrocephala Fowler.

Localities:

Faeroe Channel; Bay of Biscay; Siboga area.

Definitive observations:

Oceanic, mesoplanktonic [1]),
Highest closing net; 877 to 639 m.
Lowest closing net; 3657 to 2742 m.
Highest temperature: 10° C.
Lowest temperature; 2°5 to 3° C.

So far as it is at present known, this species is purely mesoplanktonic, but it is not impossible that it may come to the surface in polar waters. Its occurrence in the Faeroe Channel and in the Siboga area would seem to indicate a wide distribution in intermediate seas at considerable depths.

Sagitta minima Grassi.

Localities:

Mediterranean and (?) Japan.

Definitive observations:

Neritic.
Surface at M.A. 19° and 21° C.

Sagitta neglecta Aida.

Localities:

Malay Archipelago and Japan.

Definitive observations:

Neritic.
Surface at 28° to 29° C., and M.A. 21° C.

Sagitta planctonis Steinhaus.

Localities:

Tropical [and ? temperate N.] Atlantic.

Definitive observations [2]):

Neritic and oceanic.
N. limit: 1°46′ N., 17°18′ W.
S. limit: 16°50′ S., 12° E.
Surface.
Highest temperature: 27° C.
Lowest temperature: 18°8 to 20° C.

1) Omitting some doubtful young specimens at higher levels.
2) Omitting the very doubtful Biscayan and Siboga records.

Sagitta pulchra Doncaster.

Localities:

Malay (Siboga area) and Maldive Archipelagos.

Definitive observations:

Neritic.
Surface.
Temperature: 28° to 29° C.

Sagitta regularis Aida.

Localities:

Malay (Siboga area) and Maldive Archipelagos; Japan.

Definitive observations:

Neritic.
Surface.
Temperature: 28° to 29°, and M.A. 21° C.

Sagitta robusta Doncaster.

Localities:

Malay (Siboga area) and Maldive Archipelagos.

Definitive observations:

Neritic.
Surface.
Temperature: 28° to 29° C.

Sagitta serratodentata Krohn. (Charts IV to VI).

Localities:

Temperate (N. and S.) and tropical Atlantic; and Mediterranean, Southern Ocean, Tropical Indo-Australian Ocean, and Japan.

Definitive observations:

Neritic and Oceanic.
N. limit: 60° 12′ N., 22° 56′ W.
S. limit: 53° 0′ S., 70° 40′ W.
Surface and Mesoplankton.
Deepest haul: 364 to 182 m. at 11.5° C.
Highest temperature: 32° C.
Lowest temperature: M.A. 0.5° C.

In spite of the wide range of temperature, and the wide horizontal distribution, there is at present a marked northern limit to this very characteristic species at about 60° N. It has so far failed entirely in the north-eastern arctic arm of the Atlantic, although collections from that region have been (comparatively speaking) numerous.

It is curious that while the records show it to be markedly eurythermal, they do not point to its being correspondingly eurybathic; the deepest record is shallow for a species which can tolerate the temperature of the Falkland Islands and Straits of Magellan.

Sagitta Sibogae sp. n.

Locality:

Malay Archipelago (Siboga area).

Definitive observations:

Oceanic.
Absent from surface nets.
Highest open net: 1000 to 0 m.
Temperature at 1000 m., 5° 5 C.

Sagitta Whartoni Fowler.

Locality:

Faeroe Channel, and N. Atlantic.

Definitive observations:

Oceanic.
Highest open net: 182 to 0 m.
Deepest haul: 914 to 731 m.
Highest temperature: between 8° 8 and 12° 2.
Lowest temperature: between —1° 1 and —0° 5.

Sagitta Zetesios Fowler.

Localities:

Temperate N. Atlantic, and Malay Archipelago (Siboga area).

Definitive observations:

Oceanic.
Absent from surface nets.
Highest open net; N. Atlantic, 182 to 0 m., young specimens; Siboga area, ? 750 to 0 m.
Lowest closing net: 1828 to 1371 m.
Highest temperature: 11° 6 C. or more.
Lowest temperature: 4° 7 to 8°.

It is reasonable to expect that this species will be found in the polar epiplankton, and in the mesoplankton of intermediate seas between its two present localities.

Krohnia hamata Moebius. (Charts I to III).

Localities:

The Atlantic, from Baffin's Bay and Spitsbergen, to the Falkland Islands: Malay Archipelago; the New Zealand area; ? [Japan].

Definitive observations:

Oceanic and neritic.
N. limit: 81° 30′ N.
S. limit: 52° S., 58° W.
W. limit: 58° W.
E. limit: 168° 10′ E.
Surface; 52° S. and N. of 60° N., at temperatures not above 12° 2 C.
Epiplankton: N. of 47° N., S. of 40° S., generally young specimens.
Mesoplankton: in tropical and sub-tropical waters.
Deepest haul: 3657 to 2742 m.
Highest temperature: between 13° and 16°.
Lowest temperature: —1° 1 to —0° 5.

The distribution of this much-discussed species, sketched in the Biscayan Report (p. 77) and now enlarged by the Siboga captures, requires no further comment at present.

The table opposite embodies the definitive observations relative to the depth-distribution of *hamata*, arranged by latitude (the temperatures being added): its epiplanktonic distribution towards both poles, and mesoplanktonic distribution in tropical regions may thus be readily grasped[1]).

Krohnia pacifica Aida.

Localities:

Malay (Siboga area) and Maldive Archipelagos: Japan.

Definitive observations:

Neritic.
Surface.
Temperature: 28° to 29°, and M.A. 21° C.

Krohnia subtilis Grassi. (Charts I to III).

Localities:

Temperate (N. and S.) and tropical Atlantic; Mediterranean. Temperate and tropical Indo-Australian.

Definitive observations.

Neritic and oceanic.
N. limit (Atlantic): 60° 12′ N., 22° 56′ W.
S. limit (Atlantic): 25° 39′ S., 36° 51′ W.
S. limit (Indo-Australian) 29° 30′ S., 42° 50′ E.
Surface and mesoplankton.
Deepest haul: 850 to 650 m.
Highest temperature: 30°8 C.
Lowest temperature: 5°3 to 5°8.

The recorded temperature range is so wide as to suggest that this species has occasionally been confused with *pacifica*, which it closely resembles (pp. 24, 25); the latter is a tropical and sub-tropical species. In my own experience, with the Research and Siboga collections, this species uniformly avoided the warm surface water, preferring the lower epiplankton and upper mesoplankton.

Spadella cephaloptera Busch. (Chart IV).

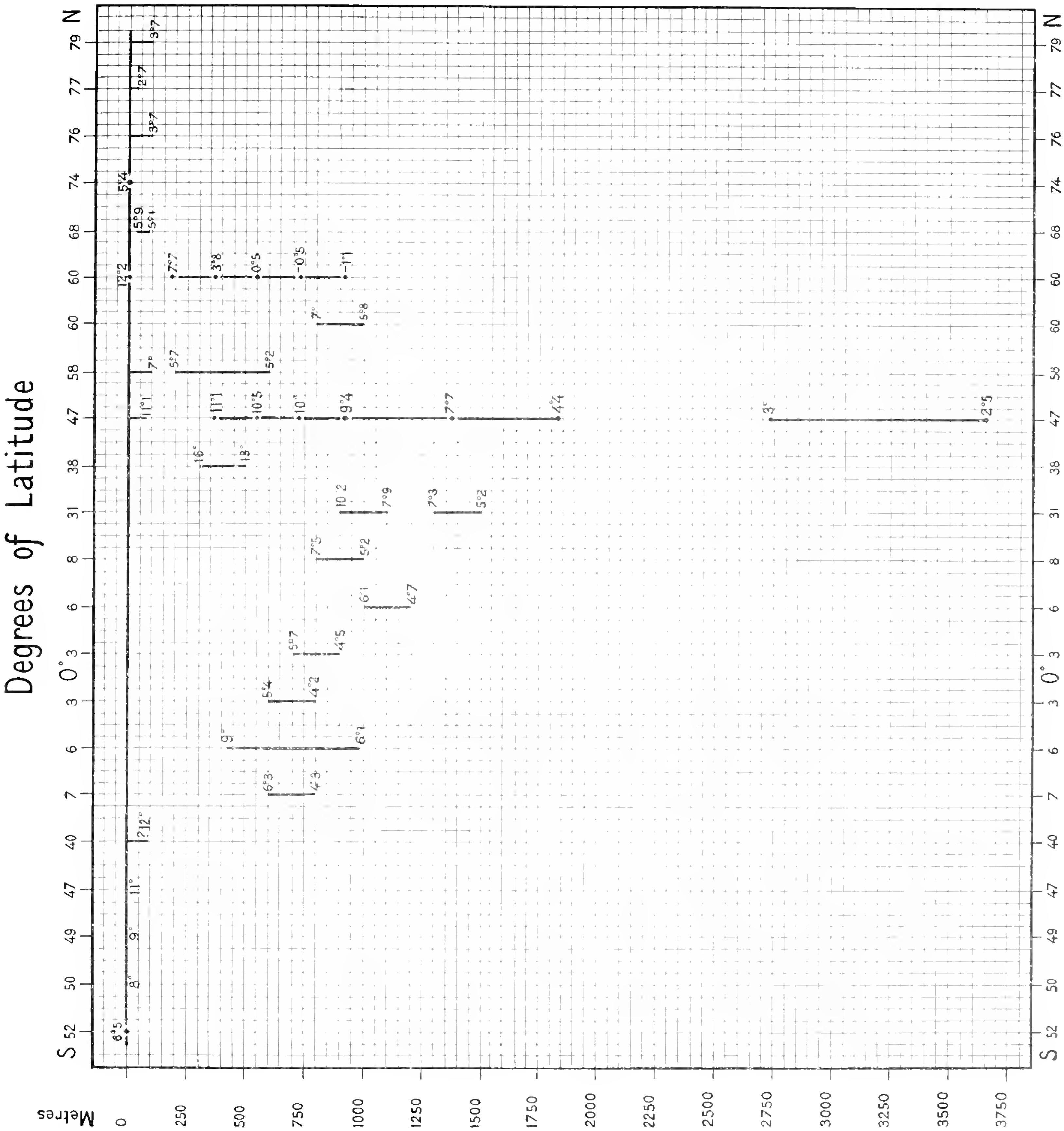
Localities:

Coast of N.W. Europe; Mediterranean.

Definitive observations:

Neritic, often between tide marks.
N. limit: 59° N., 3° W.
S. limit: Messina.
Temperatures: M.A. 9°5 to 19°.

1) VANHÖFFEN's record of *S. [illegible]* in the Karajakfjord at 0 fathoms and 0° C. has been accidentally omitted.


Degrees of Latitude
Metres
N
S
0
250
500
750
1000
1250
1500
1750
2000
2250
2500
2750
3000
3250
3500
3750

Spadella draco Krohn. (Charts IV to VI).

Localities:

Temperate (N. and S.) and tropical Atlantic; Mediterranean. Tropical Indo-Australian, and Japan.

Definitive observations:

Oceanic and Neritic
N. limit (Atlantic): 41° 36′ N., 56° 18′ W.
S. limit (Atlantic): 41° 32′ S., 17° 39′ E.
S. limit (Indo-Australian): 9° S.
Surface, absent from closing nets.
Highest temperature: 29° C.
Lowest temperature: 17°7 C.

This distribution agrees very closely with that of *enflata*.

The following table summarises in comparative form the horizontal distribution of valid species in the epiplankton and mesoplankton; it contains definitive observations only[1]), except for the inclusion of *bipunctata* and of the presumably deep-water species of the Siboga Expedition. The areas named are not intended as 'zoological provinces', but are used merely for convenience of geographical description.

			EPIPLANKTON									MESOPLANKTON						
			Atlantic Ocean					Indo-australian Ocean				Atlantic Ocean					Indo-australian Ocean	
	Neritic	Oceanic	arctic	sub-arctic	N. temperate	tropical	S. temperate	S. temperate	tropical	temp. N. Pacific Ocean	sub-arctic Southern Ocean	arctic	sub-arctic	N. temperate	tropical	S. temperate	S. temperate	tropical
Arctica		+	+	+	.	.	.	.	.	.	.	.	.	+	.	.	.	.
Bedoti	+	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.
Bipunctata	.	+	+	+	+	+	+	+	+	+	.	.	.	+	+	.	.	.
Decipiens	.	+	.	.	+	.	.	.	.	.	.	.	.	+	.	.	.	.
Elegans	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Enflata	+	+	.	.	+	+	+	+	+	+	.	.	.	.	.	.	.	.
Ferox	+	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.
Furcata	+	+	.	.	+	?	.	.	.	.	.	.	.	+	?	.	.	.
Hexaptera	+	+	+	+	+	+	+	+	+	+	+	.	.	+	+	.	.	.
Macrocephala	.	+	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	+
Minima	+	.	.	.	+	.	.	.	.	+	.	.	.	.	.	.	.	.
Neglecta	+	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.
Planctonis	+	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Pulchra	+	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.
Regularis	+	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.
Robusta	+	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.
Serratodentata	+	+	.	.	+	+	+	.	+	+	+	.	.	+	.	.	.	.
Sibogae	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Whartoni	.	+	.	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.
Zetesios	.	+	.	.	+	.	.	.	.	.	.	.	.	+	.	.	.	+
Hamata		+	+	.	+	.	.	.	.	.	+	.	+	+	+	.	.	+
Pacifica	+	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.
Subtilis	+	+	.	.	+	+	+	+	+	.	.	.	.	+	+	.	.	+
Cephaloptera	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Draco	+	+	.	.	+	+	+	.	+	+	+	.	.	.	.	.	.	.

1) The tropical captures of *furcata* in the Vertical net may have been epiplanktonic or mesoplanktonic or both: they are recorded on the table by an interrogation.

It will be apparent from the table that the species of Chaetognatha are, so far as we know, by no means of the universal distribution which some writers have assigned to them. As already mentioned, even such a widely ranging form as *serratodentata* apparently fails to penetrate into the colder parts of the Arctic Ocean. But further conclusions as to epiplanktonic distribution are most safely left, till the results of the National, Valdivia, and the various Antarctic expeditions have appeared.

As regards the Mesoplankton, no less than ten species (omitting *bipunctata*) have been shown definitively by closing nets to penetrate beyond the horizon of 100 fathoms (182 m.); to these may with fair probability be added *Sibogae*, although known only from deep Vertical Nets.

Of these eleven, four — namely *decipiens*, *macrocephala*, *Whartoni*, and *Zetesios*, — have so far been found in the mesoplankton alone. Two more — *arctica* and *hamata*, the former arctic, the latter bipolar, — appear to seek deep water at latitudes with high surface temperatures; and there is some evidence (p. 70) for thinking that *furcata* also may be reckoned in this category. Of *subtilis*, *serratodentata* and *hexaptera*, there is reason to believe that, although markedly eurythermal, they do not descend to such extreme depths as do some other Chaetognaths.

The last table (p. 78) summarises in comparative form the temperature range of the valid species (omitting *bipunctata*), based on definitive observations. Where an exact temperature is not available, the symbol > implies more than, the symbol < less than, the temperature opposite to which the wider part of the symbol is set: thus, for example, *arctica* shows a possible minimum of 0°5, and a possible maximum of 10°.

It would seem that we have here at least four classes:

(*a*) cold-water species with a maximum of (say) 13°:
arctica, *macrocephala*, *Whartoni*, *Zetesios*, *hamata*;

(*b*) temperate species:
furcata, *cephaloptera*;

(*c*) warm-water species, with a minimum of (say) 16°:
Bedoti, *enflata*, *ferox*, *minima*, *neglecta*, *planctonis*, *pulchra*, *regularis*, *robusta*, *pacifica*, *draco*;

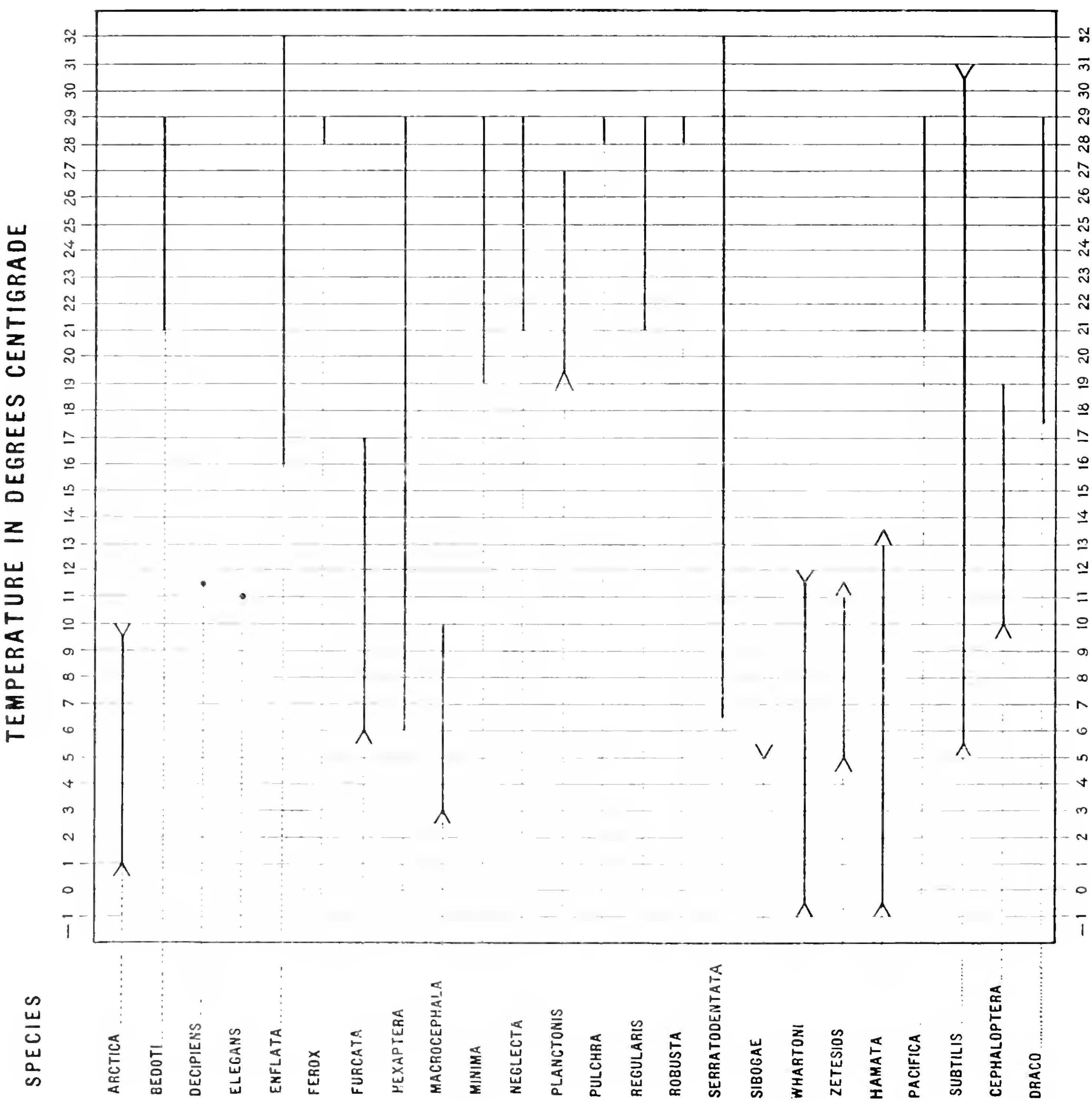
(*d*) eurythermal species:
hexaptera, *serratodentata*, *subtilis*.

Of *decipiens*, *elegans* and *Sibogae* it is not possible to make any statement in this connection.

Of course these limits will probably be extended in some degree as our knowledge increases; it is possible that some warm-water or temperate species may enter the eurythermal class, or even that one of the latter class may leave it; but, little as we know at present, it is fairly safe to prophesy that the cold-water species will not be blended with the warm-water forms.

So far as they go, the definitive observations show no evidence against the idea that temperature is the chief determinant in the distribution; but, unfortunately, it would be still premature to attempt to map the oceans into zoological areas for epiplanktonic Chaetognaths, by means of temperature and of the currents which mainly determine it. If only two or three expeditions gave due attention to this aim in their programme of work, it would be rapidly attained.

For, the moral, which must be obvious to every reader of the foregoing attempt to grasp the distribution of this comparatively small group, is that future expeditions which deal



with plankton should be planned, not so much to produce dramatic surprises in the shape of unknown organisms, but rather to ensure that each haul shall be made in pursuance of a reasoned purpose, and to record all the conditions under which it was made, with the same forethought and precision as is at the moment exhibited by the scheme of the 'Conseil permanent International'. Of the long series of records reprinted above, far more than three-fourths have no value for the purpose of understanding the conditions under which the organism lived. Whether we should understand these conditions or not, supposing that all possible observations had been recorded, is another matter; but it is quite certain that, in their absence and at the moment, we know practically nothing.

IV. List of Literature.

This list includes only faunistic and systematic references; purely embryological and anatomical papers have been omitted, as beyond the scope of this Report.

97. AIDA, T. Chaetognaths of Misaki Harbour. Annotationes Zoologicae Japonenses. Volume I, Part I et II.

93. APSTEIN, C. Die während der Fahrt zur Untersuchung der Nordsee zwischen Norderney und Helgoland gesammelten Tiere. Sechster Bericht der Kommission zur wissenschaftlichen Untersuchung der deutschen Meere. Jahrgang XVII—XXI, S. 191.
Chaetognatha, p. 195.

96. (1) AURIVILLIUS, C. W. S. Das Plankton der Baffins Bay und Davis' Strait: eine Thiergeographische Studie. Festskrift WILHELM LILLJEBORG. Upsala, 1896, 4to, Seite 179.
Chaetognatha, pp. 188, 195, 198, 204, 209.

96. (2) —— Das Plankton des baltischen Meeres. Bihang till kongliga Svenska Vetenskaps-Akademiens Handlingar, Bandet XXI, Afdelning IV, N° 8, p. 23, 37.

98. —— Vergleichende thiergeographische Untersuchungen uber die Plankton-Fauna des Skageraks in den Jahren 1893—1897. Kongliga Svenska Vetenskaps-Akademiens Handlingar. Ny Följd. Bandet XXX, N° 3.
Chaetognatha, pp. 87, 88, 117.

99. (1) —— Om Hafsevertebraternas Utvecklingstider. Bihang till kongl. Svenska Vetenskaps-Akademiens Handlingar, Bandet XXIV, Afdelning IV, N° 4.
Chaetognatha, pp. 17, 60, 62.

99. (2) —— Animalisches Plankton aus dem Meere zwischen Jan Mayen, Spitzbergen, K. Karl's Land, und der Nordkuste Norwegens. Kongliga Svenska Vetenskaps-Akademiens Handlingar. Ny Följd. Bandet XXXII, N° 6.
Chaetognatha, pp. 10, 11, 48, 52, 56, 58, 60, 64, 70.

95. BÉRANECK, ED. Les Chétognathes de la Baie d'Amboine. Revue Suisse de Zoologie, Tome III, p. 137.

90. BOVERI, T. Zellen-Studien. Jenaische Zeitschrift fur Naturwissenschaft, Band XXIV, p. 314.

04. BROWNE, E. T. and R. VALLENTIN. On the marine fauna of the Isles of Scilly. Journal of the Royal Institution of Cornwall, Volume XVI, p. 120.

05. BROWNE, E. T. Notes on the Pelagic Fauna of the Firth of Clyde. Proceedings of the Royal Society of Edinburgh, Volume XXXV, p. 779.
Chaetognatha, p. 787.

51. BUSCH, W. Beobachtungen uber Anatomie und Entwicklung einiger wirbellosen Seethiere. Berlin, 1851. 4to.
Chaetognatha, p. 93.

56. BUSK, G. An account of the structure and relations of Sagitta bipunctata. Quarterly Journal of Microscopical Science. Volume IV, (first series), p. 14.

88. CHUN, C. Die pelagische Thierwelt in grösseren Meerestiefen. Bibliotheca Zoologica. Band I, S. 1. (*Chaetognatha*, pp. 17—18, 61).

63. CLAPARÈDE, R. E. Beobachtungen über Anatomie und Entwicklungsgeschichte wirbellosen Thiere an der Kuste von Normandie angestellt. Leipzig, 1863, 4to.
Chaetognatha, p, 9.

99. CLEVE, P. T. Plankton Researches in 1897. Kongliga Svenska Vetenskaps-Akademiens Handlingar. Ny Följd. Bandet XXXII, N° 7.
Chaetognatha, pp. 15, 32.

00. —— The Seasonal Distribution of Atlantic Plankton Organisms. Göteborgs kunglige Vetenskaps och Vitterhets Samhalles Handlingar. Fjärde följden. Haftet III.
Chaetognatha, p. 90.

95. CONANT, F. S. Description of two new Chaetognaths. Johns Hopkins University Circulars, Vol. XIV, p. 77.

96. —— Notes on the Chaetognaths. Johns Hopkins University Circulars, Volume XV, p. 82.

04. (1) CONSEIL permanent INTERNATIONAL pour l'exploration de la mer. Bulletin des resultats acquis pendant les cours périodiques, Annee 1904—1905, N° I, Aout, 1904.

04. (2) —— Id. N° II. November, 1904.

05. (1) —— Id. N° III. Février, 1905.

69. COSTA, A. Di un nuovo genere di Chetognati. Annuario del Museo Zoologico della Reale Università di Napoli, Anno V, 1865, p. 54. [published 1869].

93. DAHL, F. Untersuchungen uber die Thierwelt der Unterelbe. Sechster Bericht der Kommission zur wissenschaftlichen Untersuchung der deutschen Meere. Jahrgang XVII—XXI, S. 149.
Chaetognatha, p. 171.

44. DARWIN, C. Observations on the structure and propagation of the genus Sagitta. Annals and Magazine of Natural History, Vol. XIII, p. 1.
Translated: Annales des Sciences Naturelles. Series 3 (Zoology), Tome I, p. 360. Also in Froriep's Neue Notizen. Band XXX, N° 630, s. i.

02. DONCASTER, L. On the development of Sagitta; with notes on the anatomy of the adult. Quarterly Journal of Microscopical Science, Volume XLVI, p. 351.

03. —— Chaetognatha, with a note on the variation and distribution of the group. The Fauna and Geography of the Maldive and Laccadive Archipelagoes. Edited by J. STANLEY GARDINER. Cambridge, 1903, 4to.
Chaetognatha, p. 209.

52. EYDOUX, F. et SOULEYET. Voyage autour du monde execute pendant les annees 1836 et 1837 sur la corvette La Bonite. Tome II, p. 645. Paris, 1852, 8vo.
(Atlas: Vers, Planche I, et p. 8).

88. FEWKES, J. W. On Arctic characters of the surface fauna of the Bay of Fundy. American Naturalist. Volume XXII, p. 605.

79. FOL, H. Recherches sur la Fecondation et le commencement de Henogenie chez divers animaux. Memoires de la Societe de Physique et d'Histoire Naturelle de Geneve, Tome XXVI, p. 89.
(*S. Gegenbauri* sp. n., p. 123).

43. FORBES, E. On the addition of the order Nucleobranchia to the British Molluscous Fauna. Report of the Thirteenth Meeting of the British Association. Transactions of the Sections, p. 72.
Abstract in L'Institut. Tome XI, p. 358.

96. FOWLER, G. H. Contributions to our knowledge of the Faeroe Channel, N° I. Proceedings of the Zoological Society of London, 1896, p. 991.

05. FOWLER, G. H. Biscayan Plankton, collected during a cruise of H.M.S. Research, 1900. Part. III. The Chaetognatha. Transactions of the Linnean Society of London, Series 2, Zoology, Volume X, p. 55.

47. FREY, H. und LEUCKART, R. Verzeichniss der zur Fauna Helgoland's gehörenden wirbellosen Seethiere. Beiträge zur Kenntniss wirbelloser Thiere. Braunschweig, 1847, 4to.
Chaetognatha, p. 147.

00. GAMBLE, F. W. The Fauna and Flora of Valencia Harbour: The Chaetognatha. Proceedings of the Royal Irish Academy, Series 3, Volume V, p. 745.

75. GIARD, A. et BARROIS, J. Note sur un Chaetosoma et une Sagitta, suivie de quelques réflexions sur la convergence des types par la vie pélagique. Revue des Sciences Naturelles, Tome III, p. 517.

83. (1) GOURRET, P. Sur l'organisation de la Spadella Marioni. Comptes Rendus de l'Académie des Sciences, XCVII, p. 861.

83. (2) —— Sur la cavité du corps et l'appareil sexuel de la Spadella Marioni. Ibid., p. 1017.

84. —— Considérations sur la Faune Pelagique du Golfe de Marseille. Annales du Musée d'Histoire Naturelle de Marseille, Zoologie, Tome II, mem. 2.

56. GEGENBAUR, C. Über die Entwickelung der Sagitta. Abhandlungen der naturforschenden Gesellschaft in Halle, Band IV, S. 1.
Translation in Quarterly Journal of Microscopical Science (first series). Volume VII, p. 47.

56. GOSSE, P. H. Tenby: a sea-side Holiday. London, 1856, 8vo.

00. GRAN, H. H. Hydrographic-biological studies of the North Atlantic Ocean and the coast of Nordland. Report on Norwegian Fishery and Marine Investigations, Volume I, N° 5.
Chaetognatha, pp. 54, 63, and tables.

81. GRASSI, G. B. Intorno ai Chetognati. Rendiconti della Reale Istituto Lombardo di Scienze e Lettere. Serie II, Volume XIV, p. 199.

83. —— I Chetognati. Fauna und Flora des Golfes von Neapel. Monographie V.

03. GÜNTHER, R. T. On the distribution of Mid-water Chaetognatha in the North Atlantic during the Month of November. Annals and Magazine of Natural History, Series 7, Volume XII, p. 334.

86. HADDON, A. C. Preliminary Report on the Fauna of Dublin Bay. Proceedings of the Royal Irish Academy, Science, Series 2, Volume IV, p. 529.

87. HENSEN, V. Über die Bestimmung des Planktons. Funfter Bericht der Kommission zur wissenschaftlichen Untersuchung der deutschen Meere. Jahrgang XII—XVI, S. 59.

93. —— Das Plankton der östlichen Ostsee. Sechster Bericht der Kommission zur wissenschaftlichen Untersuchung der deutschen Meere. Jahrgang XVII—XXI, S. 115.

80. HERTWIG, O. Die Chaetognathen. Jenaische Zeitschrift. Band XIV (neue Folge, Band VII), s. 196.

84. HORST, R. Anneliden der Oosterschelde. Tijdschrift der Nederlandsche Dierkundige Vereeniging. Supplement-Deel I, bl. 557.

62. KEFERSTEIN, W. Untersuchungen uber niedere Seethiere. Zeitschrift fur wissenschaftliche Zoologie, Band XII, S. 1.
Chaetognatha, p. 129.

70. KENT, S. On a new species of Sagitta from the South Pacific. Annals and Magazine of Natural History, Series 4, Volume V, p. 268.

02. KHVOROSTANSKY, C. Sur la lumination des animaux de la Mer Blanche. Congres international de Zoologie, Session II, premiere partie, p. 185.

44. KROHN, A. Anatomisch-physiologische Beobachtungen uber die Sagitta bipunctata. Hamburg n. d. 4to.

53. —— Nachtragliche Bemerkungen uber den Bau der Gattung Sagitta, nebst der Beschreibung einiger neuen Arten. Archiv fur Naturgeschichte, Jahrgang XIX, S. 266.

03. KRUMBACH, T. Über die Greifhaken der Chätognathen: eine biologische Studie; gleichzeitig ein Beitrag zur Systematik dieser Thiergruppe. Zoologische Jahrbüchern. Abtheilung Systematik, u. s. w., Band XVIII, s. 579.

80. LANGERHANS, P. Die Wurmfauna von Madeira: III. Zeitschrift fur wissenschaftliche Zoologie, Band XXXIV, S. 87.

83. LEIDY, J. On Sagitta, etc. Proceedings of the Academy of Natural Sciences of Philadelphia, 1882, p. 102. Reprinted in Annals and Magazine of Natural History, Fifth Series, Volume X, p. 79.

54. LEUCKART, R. Zoologische Untersuchungen. Heft III: Heteropoden, Zwitterschnecken, Hectocotyliferen. Giessen, 1854. 4to.
Chaetognatha, p. 3.

58. —— und PAGENSTECHER, A. Untersuchungen über niedere Seethiere. Archiv fur Anatomie, Physiologie und wissenschaftliche Medicin, 1858, S. 593.

84. LEVINSEN, G. M. R. Systematisk-geografisk Oversigt over de nordiske Annulata, Gephyrea, Chaetognathi, og Balanoglossi: anden Halvdel. Videnskabelige Meddelelser fra den naturhistoriske Forening i Kjøbenhavn for Aaret 1883, p. 92.
Chaetognatha, pp. 275, 319.

86. —— Spolia atlantica. Om nogle pelagiske Annulata. Kongelige Danske Videnskabernes Selskabs Skrifter. Sjette Raekke. Bind III, S. 321.

58. LEWES, G. H. Sea-side Studies. London, 1858. 8vo., pp. 250, 414.

04. MARINE BIOLOGICAL ASSOCIATION: Plymouth Marine Invertebrate Fauna. Journal of the Marine Biological Association, Volume VII, p. 155.
Chaetognatha, p. 233.

74. M'INTOSH, W. C. On the invertebrate marine fauna and fishes of St. Andrews. Annals and Magazine of Natural History. Fourth series, Volume XIV, p. 154.

90. —— Notes from the St. Andrews' Marine Laboratory: N° XII. Annals and Magazine of Natural History. Sixth series, Volume VI, p. 174.

73. MOEBIUS, K. Die wirbellosen Thiere der Ostsee. Jahresbericht der Commission zur wissenschaftlichen Untersuchung der deutschen Meere fur das Jahr 1871. Jahrgang I, S. 105.

75. —— Zoologische Ergebnisse der Nordseefahrt: VERMES. Jahresbericht der Commission zur wissenschaftlichen Untersuchung der deutschen Meere. Jahrgang II und III, S. 158.
[s. s. 'Pommerania'].

87. —— Systematische Darstellung der Thiere des Plankton gewonnen in der westlichen Ostsee und auf einer Fahrt von Kiel in den atlantischen Ocean bis jenseit der Hebriden. Funfter Bericht der Kommission zur wissenschaftlichen Untersuchung der deutsche Meere. Jahrgang XII—XVI.
Chaetognatha, p. 117. [s. s. 'Holsatia'].

47. MÜLLER, J. Fortsetzung des Berichts uber einige neue Thierformen der Nordsee. Archiv fur Anatomie, Physiologie, und wissenschaftliche Medicin. Jahrgang 1847, S. 147.

98. NORDGAARD, O. Undersøgelser i fjordene ved Bergen, 1897—98. Bergens Museums Aarbog for 1898, N° X.
Chaetognatha, p. 13.

99. —— Contribution to the Study of Hydrography and Biology on the Coast of Norway. Bergens Museum: Report on Norwegian Marine Investigations 1895—97. Bergen, 1899. 4to.
Chaetognatha, p. 20 and tables.

05. —— Hydrographical and Biological Investigations in Norwegian Fiords. Bergens Museum. Bergen, 1905. 4to.
Chaetognatha, p. 46.

49. OERSTED, A. S. Et Bidrag till at besvare det Spörgsmaal hvilken Plads Slaegten Sagitta bör indtage i Systemet. Videnskabelige Meddelelser fra den naturhistoriske Forening i Kjøbenhavn for Aarene 1849 og 1850, bl. 26.
Translated in Froriep's Tagsberichte uber die Fortschritte der Natur- und Heilkunde. Abtheilung für Zoologie und Paläontologie. Band I, Seite 201, 1850.

35—43. D'ORBIGNY, A. Voyage dans l'Amérique méridionale. Tome V. Partie 3. Mollusques. Paris, 1835—1843. 4to.
Chaetognatha, p. 140.

63. PAGENSTECHER, H. A. Untersuchungen über niedere Seethiere aus Cette. Zeitschrift fur wissenschaftliche Zoologie. Band XII, S. 265.
Chaetognatha, p. 308.

95. PARKER, F. J. [Remarks on a Spadella from New Zealand waters]. Transactions and Proceedings of the New Zealand Institute. Volume XXVIII, p. 758.

27. QUOY, J. R. C. et GAIMARD, P. Observations zoologiques faites à bord de l'Astrolabe en Mai 1826 dans le detroit de Gibraltar. Annales des Sciences Naturelles. Tome X, p. 1.
Translated: Oken's Isis. Band XXI, col. 348.

03. REDEKE, H. C. and P. J. VAN BREEMEN. Plankton en Bodemdieren in de Noordzee verzameld van 1—6 Augustus 1901 met de 'Nelly'. Tijdschrift der Nederlandsche Dierkundige Vereeniging. Serie II, Deel II, p. 118.
Chaetognatha, pp. 127, 143.

99. RÖMER, F. and SCHAUDINN, F. Vorläufige Bericht uber zoologische Untersuchungen im nördlichen Eismeer im Jahre 1898. Verhandlungen der deutschen zoologischen Gesellschaft. Jahres-Versammlung IX, S. 227.
Chaetognatha, pp. 245, 246.

00. —— Fauna arctica. Jena, 1900. 4to.
Chaetognatha, p. 55.

20. SCORESBY, W. An account of the Arctic Regions. Edinburgh, 1820. 8vo.
Chaetognatha, Vol. II, plate XVI, figures 1, 2.

1769—1778. SLABBER, M. Natuurkundige Verlustigingen behelzende microscopise Waarneemingen van In- en Uit-landse Water- en Land-Dieren. Haarlem, 1778. 4to.
Chaetognatha, p. 47.
Translated by P. L. ST. MÜLLER as Physicalische Belustigungen oder microscopische Wahrnehmungen in- und auslandischer Wasser- und Landthierchen. Nurnberg, 1775. 4to.

96 STEINHAUS, O. Die Verbreitung der Chaetognathen im sudatlantischen und indischen Ozean. Inaugural Dissertation. Kiel, 1896, 8vo.

00. —— Chaetognathen. Ergebnisse der Hamburger Magalhaensischen Sammelreise. Funfte Lieferung, N° II.

05. STEVENS, N. M. Further studies on the ovogenesis of Sagitta. Zoologische Jahrbucher. Abtheilung Anatomie, u. s. w., Band XXI, S. 243.

92. STRODTMANN, S. Die Systematik der Chaetognathen. Archiv fur Naturgeschichte. Jahrgang LVIII, S. 333.

05. —— Die Chaetognathen. Nordisches Plankton. Lieferung III, Theil X.

52. SUTHERLAND, P. C. Journal of a voyage in Baffin's Bay and Barrow Straits, 1850—51. London, 1852. 8vo.
Chaetognatha, Volume II, p. CCII.

79. TAUBER, P. Annulata Danica. I. En Kritisk Revision af de i Danmark fundne Annulata, Chaetognatha, etc. Kjobenhavn, 1879. 8vo.
Chaetognatha, p. 56.

70. ULJANIN, B. [Materials for a fauna of the Black Sea]. Transactions of the Naturalists Society of Moscow. Volume IX, p. 77. Compare R. LEUCKART, Archiv fur Naturgeschichte, Jahrgang XXVII, Band II, S. 413].

80. ULJANIN, B. Über Sagitta pontica. Zoologischer Anzeiger. Band III, S. 588.

97. VANHÖFFEN, E. Grönland Expedition der Gesellschaft fur Erdkunde zu Berlin, 1891—1893. Vol. II. Die Fauna und Flora Grönlands, pp. 275, 291.

98. VALLENTIN, R. Notes on the Fauna of Falmouth for the years 1895—96. Journal of the Royal Institution of Cornwall, Volume XIII, p. 254.

73. VERRILL, A. E. Report upon the Invertebrate Animals of Vineyard Sound and the adjacent Waters. United States Commission of Fish and Fisheries. Part I. Report on the condition of the Sea Fisheries of the South Coast of New England in 1871 and 1872. [published 1873].
Chaetognatha, pp. 440, 453, 455, 626.

85. —— Results of the explorations made by the steamer "Albatross" off the northern coast of the United States in 1883. United States Commission of Fish and Fisheries. Part XI. Report of the Commission for 1883, p. 503.
Chaetognatha, pp. 594, 688.

46. WILMS, R. Observationes de Sagitta Mare Germanicum circa Insulam Helgoland incolente. Dissertatio inauguralis. Berlin, 1846. 4to.

V. Index

of the more important species.

EXPLANATION OF PLATES

All the figures have been drawn with the Abbé camera lucida, carried either on the microscope, or on the GILTSCH-ZEISS support. The drawings have been reproduced by photography, in order to secure the maximum of accuracy in outline.

In comparing these drawings with those of GRASSI, HERTWIG, etc., it must be remembered that in many cases they had the advantage of working on living material.

There are no figures corresponding to the numbers 24–29.

g. = ganglion. *p.c.* = pulp-cavity.

PLATE I.

Sagitta Bedoti Béraneck.

Fig. 1. — The entire animal.
Fig. 2. — The head, showing the corona ciliata, and some of the patches of sense cells. × 33.
Fig. 3. — A jaw. × 105.
Fig. 4. — The tip of the youngest (most anterior) jaw. × 430.
Fig. 5. — The tip of an older jaw. × 430. The extreme tip has been drawn too squarely blunt.
Fig. 6. — The anterior teeth, boiled out. × 140.
Fig. 7. — The posterior teeth, boiled out. × 140.
Fig. 8. — The vestibular ridge, showing the position of the externmost tooth below the terminal process. × 140.

Sagitta enflata Grassi.

Fig. 9. — The entire animal, from a rather slender specimen.
Figs. 10—13. — The anterior end showing different forms (or distortions) of the corona ciliata: its front end lay under a fold of the prepuce, but appeared to have the form indicated by dotted lines in figure 10. (Fig. 10, × 13; 11, × 25; 12, × 20; 13, × 25).
Fig. 14. — A jaw. × 71.
Fig. 15. — The anterior teeth, drawn in place. × 140.
Fig. 16. — The posterior teeth, drawn in place, with the vestibular ridge: dorsal view. × 140.
Fig. 17. — The vestibular ridge, ventral view. × 140.

Sagitta ferox Doncaster.

Fig. 18. — The entire animal, from a specimen of medium size.
Fig. 19. — The entire animal, from a large specimen, showing the strong development of the collarette.
Fig. 20. — The anterior end of the animal, showing the extension of the corona nearly to the ganglion. The irregularities at its anterior boundary vary in different specimens. × 33.
Fig. 21. — A jaw. × 71.
Fig. 22. — The teeth in place, from a transparent specimen. × 140.
Fig. 23. — The posterior teeth and vestibular ridge: dorsal view. × 140.

Sagitta hexaptera d'Orbigny.

a. *Hexaptera* formula.

Fig. 30. — The entire animal (formula, 6 : 3 : 5 — 6).
Fig. 31. — The distal end of the newest jaw, the anterior and posterior teeth (formula, 8 : 3 : 6). × 105.
Fig. 32. — The distal end of the newest jaw, one anterior tooth in exact profile, and the posterior teeth (formula, 9 — 10 : 3 : 2 — 3). × 105. This formula is nearly that of *magna*.
Fig. 33. — Part of the vestibular ridge; dorsal view (formula 5 : 3 : 4). × 140.

b. *Tricuspidata* formula.

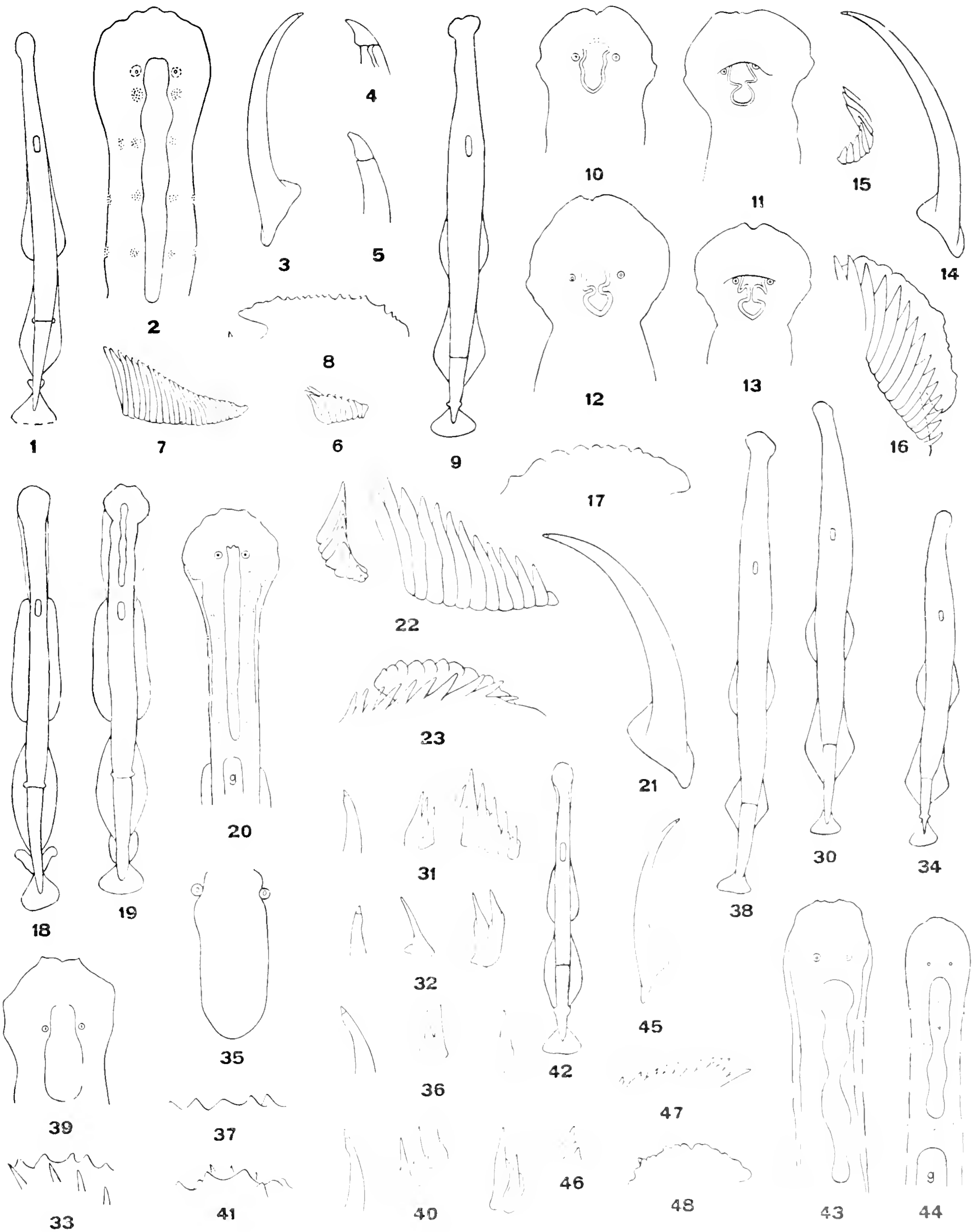
Fig. 34. — The entire animal (formula, 5 — 6 : 3 : 3).
Fig. 35. — The corona ciliata (formula, 4 : 3 — 2 : 2). × 25.
Fig. 36. — The distal end of the newest jaw (formula 5 : 1 : 1), the anterior and posterior teeth (formula 4 : 2 : 1). × 105.
Fig. 37. — Part of the vestibular ridge (formula, 8 : 4 — 2 : 3 — 1). × 105.

c. *Magna* formula and *magna* from Naples.

Fig. 38. — The entire animal, from a Naples specimen.
Fig. 39. — The corona ciliata, from a Naples specimen. × 12.
Fig. 40. — The distal end of the newest jaw, the anterior and posterior teeth (formula, 4 : 3 : 2 — 1). × 105. This formula is nearly that of *tricuspidata*.
Fig. 41. — Part of the vestibular ridge, with the teeth in place (formula, 9 : 4 : 3). × 105.

Sagitta neglecta Aida.

Fig. 42. — The entire animal.
Fig. 43. — The anterior end, showing the corona and collarette. × 33.
Fig. 44. — The anterior end, showing a rather longer corona, the abdominal ganglion, and the tactile prominences: of the latter only the larger were drawn. × 33.
Fig. 45. — A jaw. × 43.
Fig. 46. — The anterior teeth in place, slightly foreshortened. × 210.
Fig. 47. — The posterior teeth in place. × 210.
Fig. 48. — The corona ciliata with the externmost tooth. × 210.



G. H. Fowler del.

PLATE II.

Sagitta pulchra Doncaster.

Fig. 49. — The entire animal.
Fig. 50. — The anterior end, showing the corona ciliata (sometimes a good deal longer), and collarette, with some tactile papillae. × 25.
Fig. 51 — A jaw. × 71.
Fig. 52. — The anterior and posterior teeth. × 140.
Fig. 53. — The vestibular ridge, from the ventral aspect. × 210.
Fig. 54. — The posterior teeth and vestibular ridge, from the dorsal aspect. 210.

Sagitta regularis Aida.

Fig. 55. — The entire animal.
Fig. 56. — The anterior end, showing corona, ganglion, collarette, and the beginning of the anterior fins. × 33.
Fig. 57. — The two anterior and five posterior teeth in place, and part of the vestibular ridge; from the dorsal surface. 430.
Fig. 58. — The vestibular ridge, from the ventral surface. × 430.

Sagitta robusta Doncaster.

Fig. 59. — The entire animal.
Fig. 60. — The anterior end with the corona, showing its extension towards the ganglion. 20.
Fig. 61. — A jaw. × 92.
Fig. 62. — The teeth, boiled out. 105.
Fig. 63. — The posterior teeth in place and vestibular ridge: dorsal view. 105.
Fig. 64. — The vestibular ridge, ventral view, with the first and last teeth. 105.

Sagitta serratodentata Krohn.

Fig. 65. — The entire animal.

Sagitta Sibogae species nova.

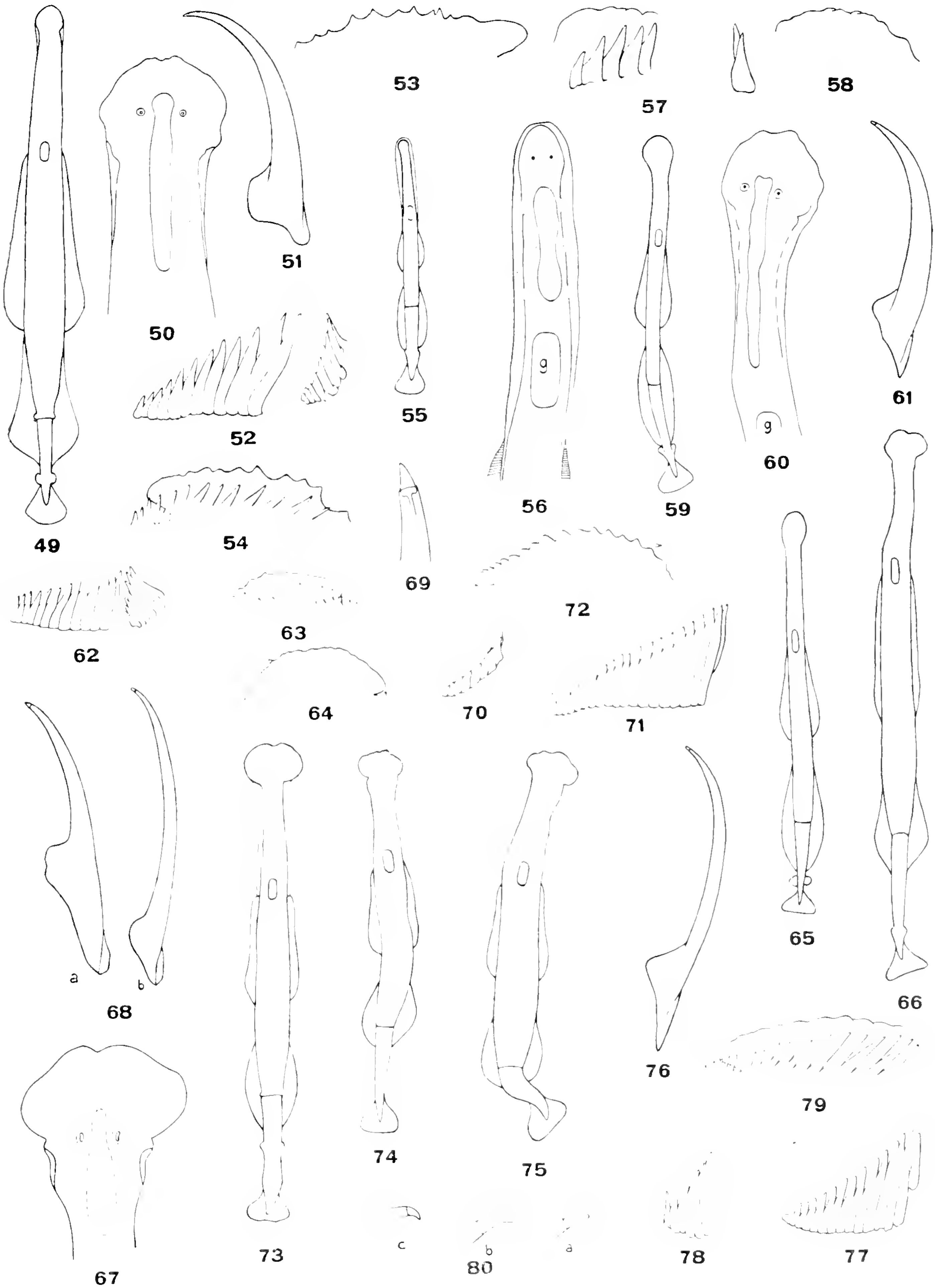
Fig. 66. — The entire animal.
Fig. 67. — The head and neck showing the small collarette, and elongate eyes. The dotted outline of the corona ciliata is of doubtful accuracy. 25.
Fig. 68. — *a.* The first or most anterior (youngest), and *b.* the second, jaw. 87.
Fig. 69. — The tip of a jaw. 287.
Fig. 70. — The anterior teeth, boiled out. 105.
Fig. 71. — The posterior teeth, boiled out. 105.
Fig. 72. — The vestibular ridge from the ventral surface, showing the first and last tooth. 25.

Sagitta Zetesios Fowler.

Fig. 73. — The entire animal, 30 mm. in length.
Fig. 74. — The entire animal, from an apparently uncontracted specimen.
Fig. 75. — The entire animal from a strongly contracted specimen.
Fig. 76. — A Jaw. 71.
Fig. 77. — The anterior teeth, boiled out, from a contracted specimen. 105.
Fig. 78. — The posterior teeth, boiled out, from a contracted specimen. Of the first tooth only the tip is seen. × 105.
Fig. 79. — Vestibular ridge and posterior teeth, dorsal view. 105.

Krohnia hamata Mobius.

Fig. 80. — *a.* and *b.* old and young hooks from the same specimen. 287. *c.* young hook from another specimen. 247.



G. H. Fowler del.

PLATE III.

Krohnia pacifica Aida.

Fig. 81. — The entire animal. The ovaries are shown for comparison with *subtilis*.
Fig. 82. — The anterior end, with the corona. 61.
Fig. 83. — A jaw. 247.
Fig. 84. — The distal end of a jaw, showing the characteristic obtuse angle on the convex edge, and the internal thickening. 430.
Fig. 85. — Four of the teeth. 210.

Krohnia subtilis Grassi.

Fig. 86. — The entire animal. The ovaries are shown for comparison with *pacifica*.
Fig. 87. — A jaw, showing the thickening of the concave and convex edges, and the narrow pulp cavity. 140.
Fig. 88. — Three of the teeth. 140.

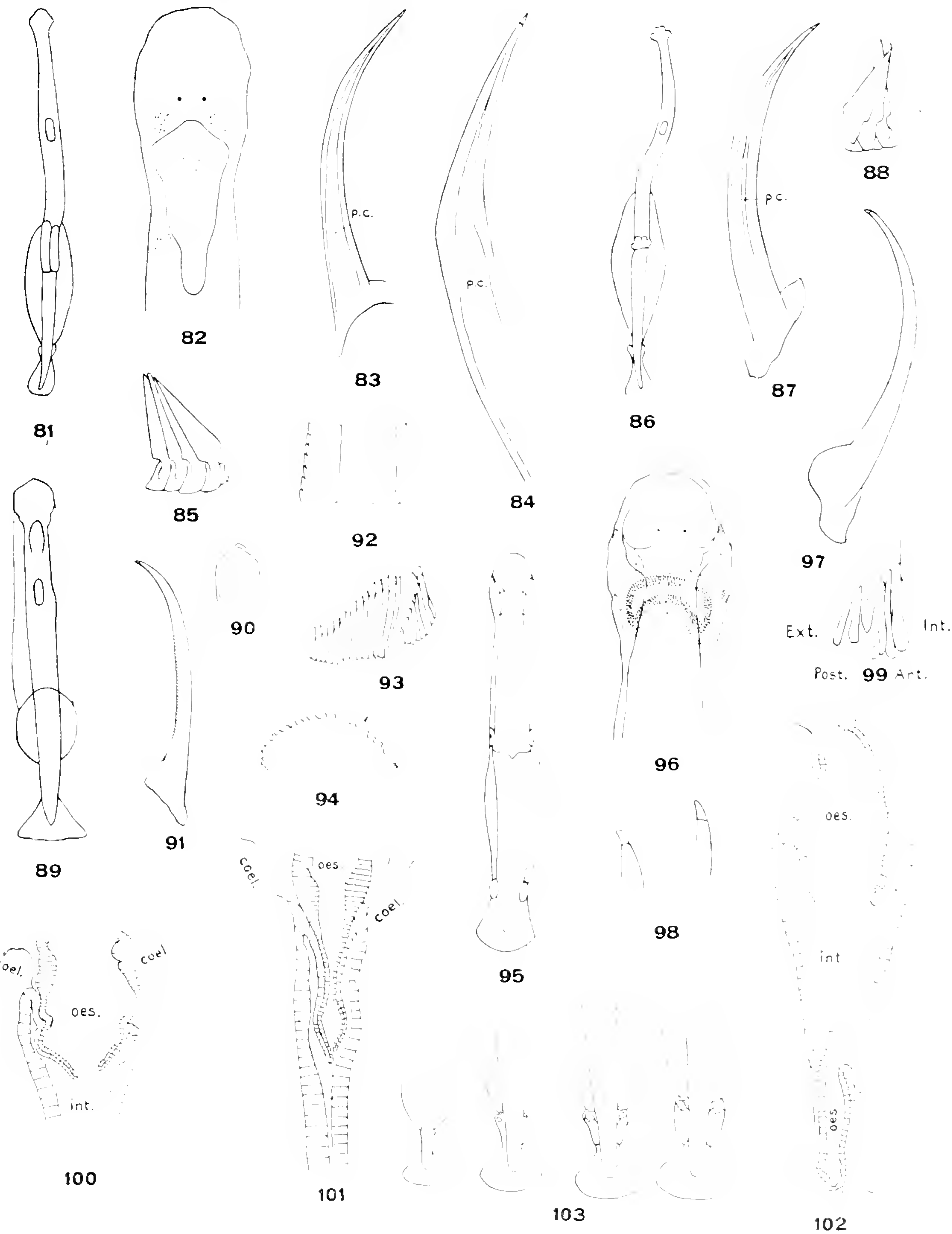
Spadella draco Krohn.

Fig. 89. — The entire animal from an immature specimen. The corona, if complete, would appear to have been like that figured by GRASSI (op. cit., pl. VII, fig. 1).
Fig. 90. — The corona of hexagonal form, from an older specimen. 25.
Fig. 91. — A jaw. 107.
Fig. 92. — Portion of a jaw, showing the sagination. 547.
Fig. 93. — The teeth, boiled out. 140.
Fig. 94. — The vestibular ridge, and two innermost teeth, from the ventral surface. 140.

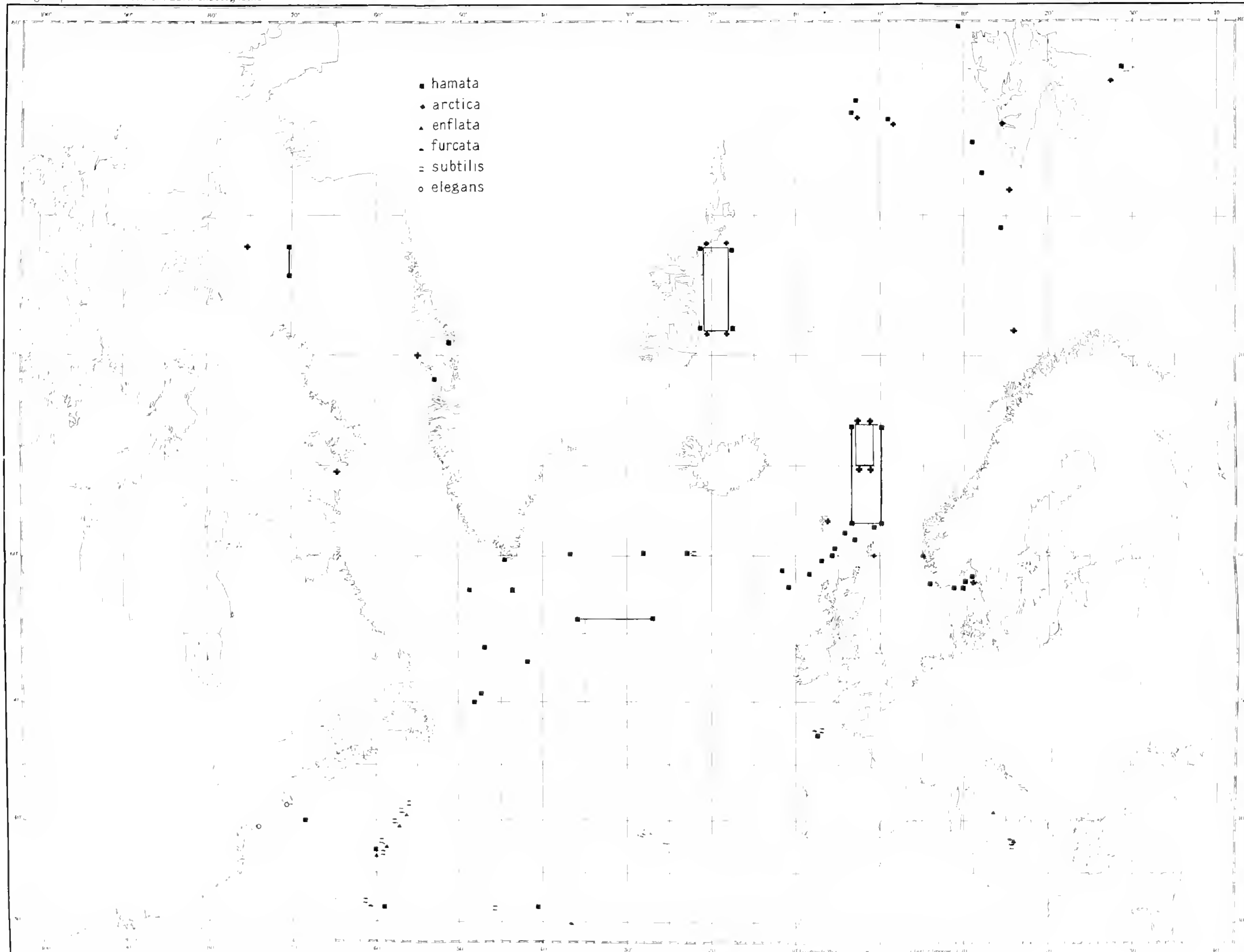
Spadella cephaloptera Busch.

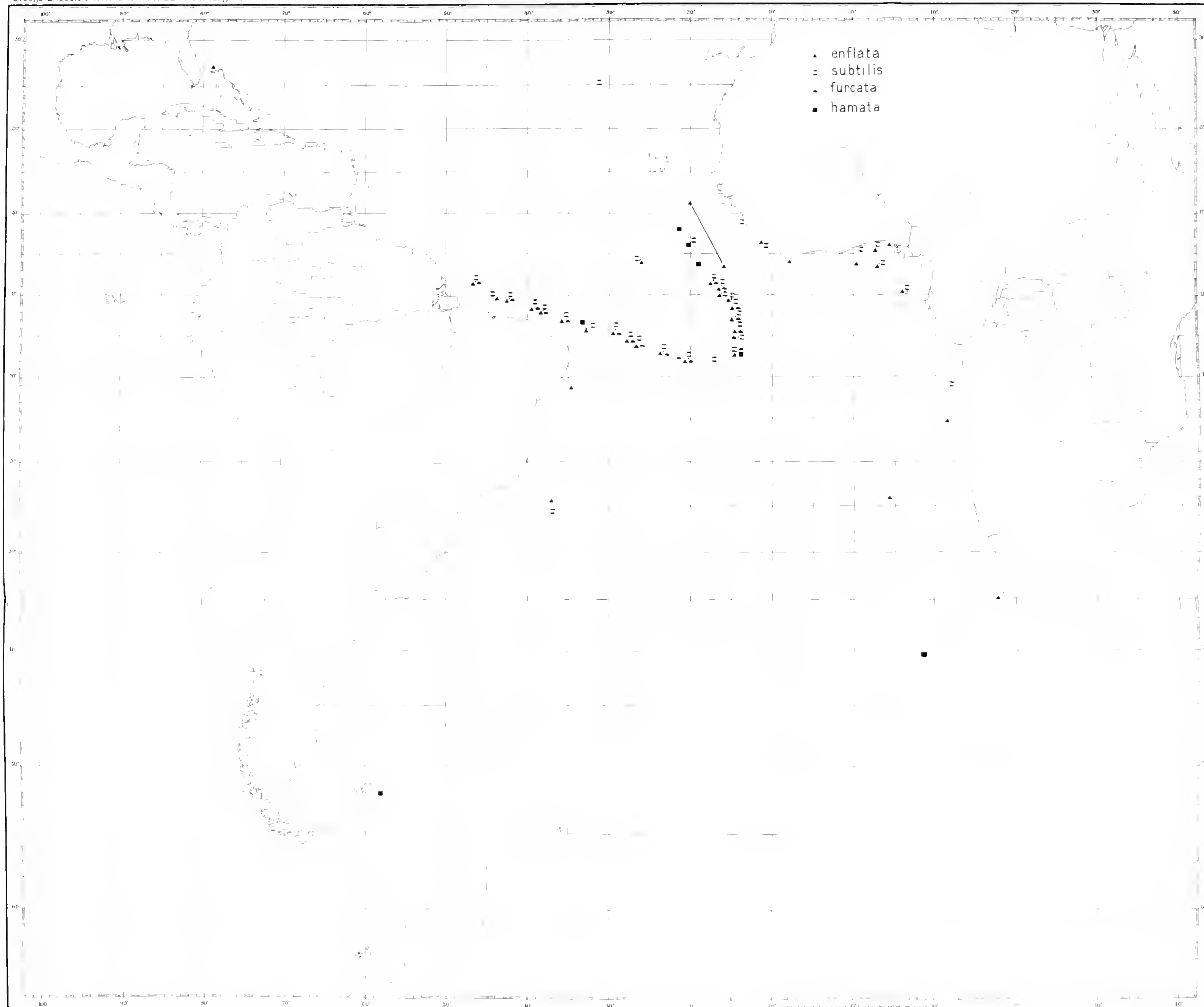
Fig. 95. — The entire animal: the palps had been lost in these specimens.
Fig. 96. — The anterior end, showing corona and collarette.
Fig. 97. — A jaw. 49.
Fig. 98. — The tips of two jaws. 520.
Fig. 99. — Anterior and posterior teeth, boiled out. 287.

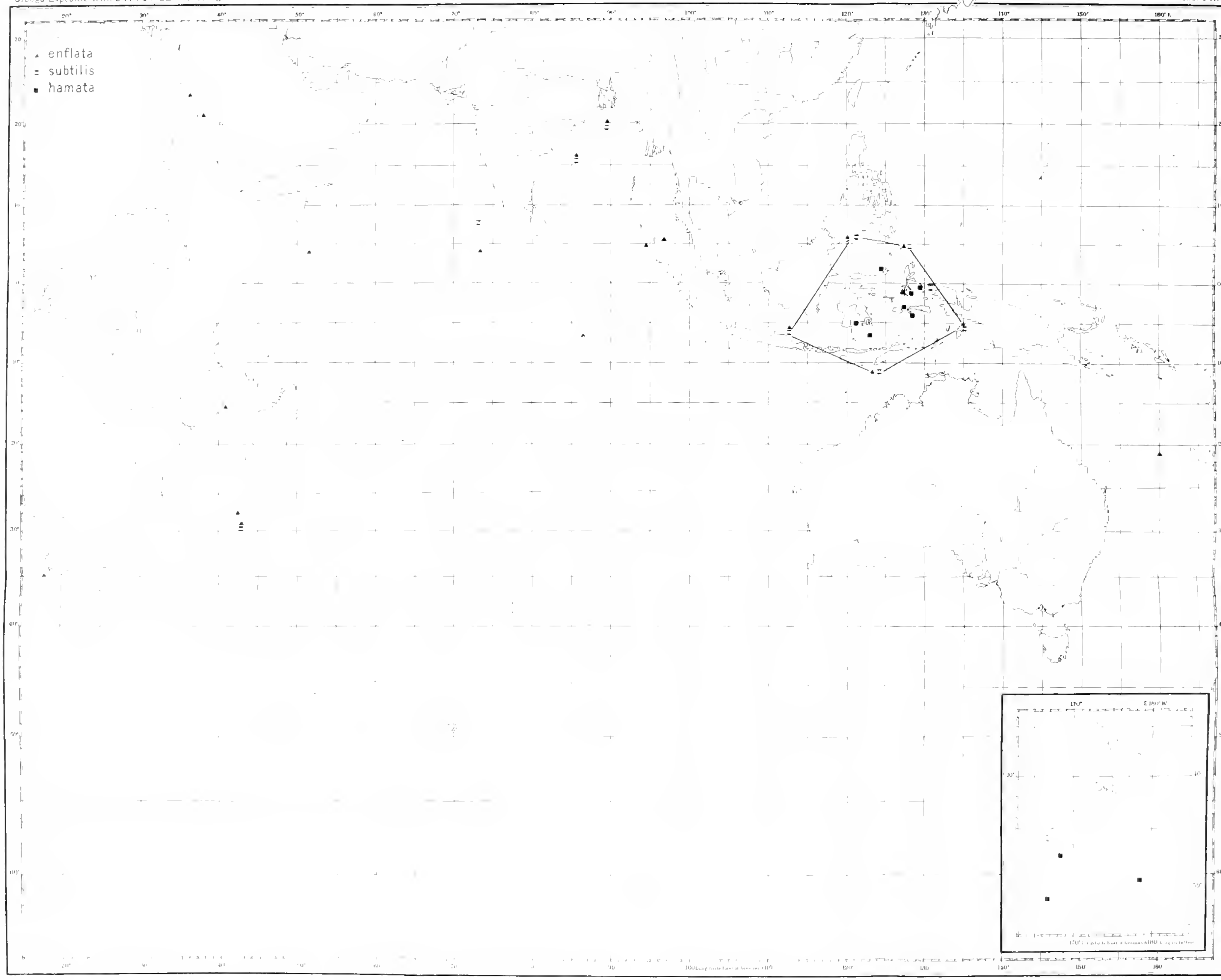
Figs. 100—102. Sections of *ferox* illustrating the relations of the alimentary diverticula (compare p. 4). 100, 101, 61; 102, 140. — *oes.* oesophagus: *int.* intestine: *coel.* trunk coelom, bounded in front by the neck septum.
Fig. 103. Posterior ends of four specimens of *ferox* (compare pp. 4, 5). 75.



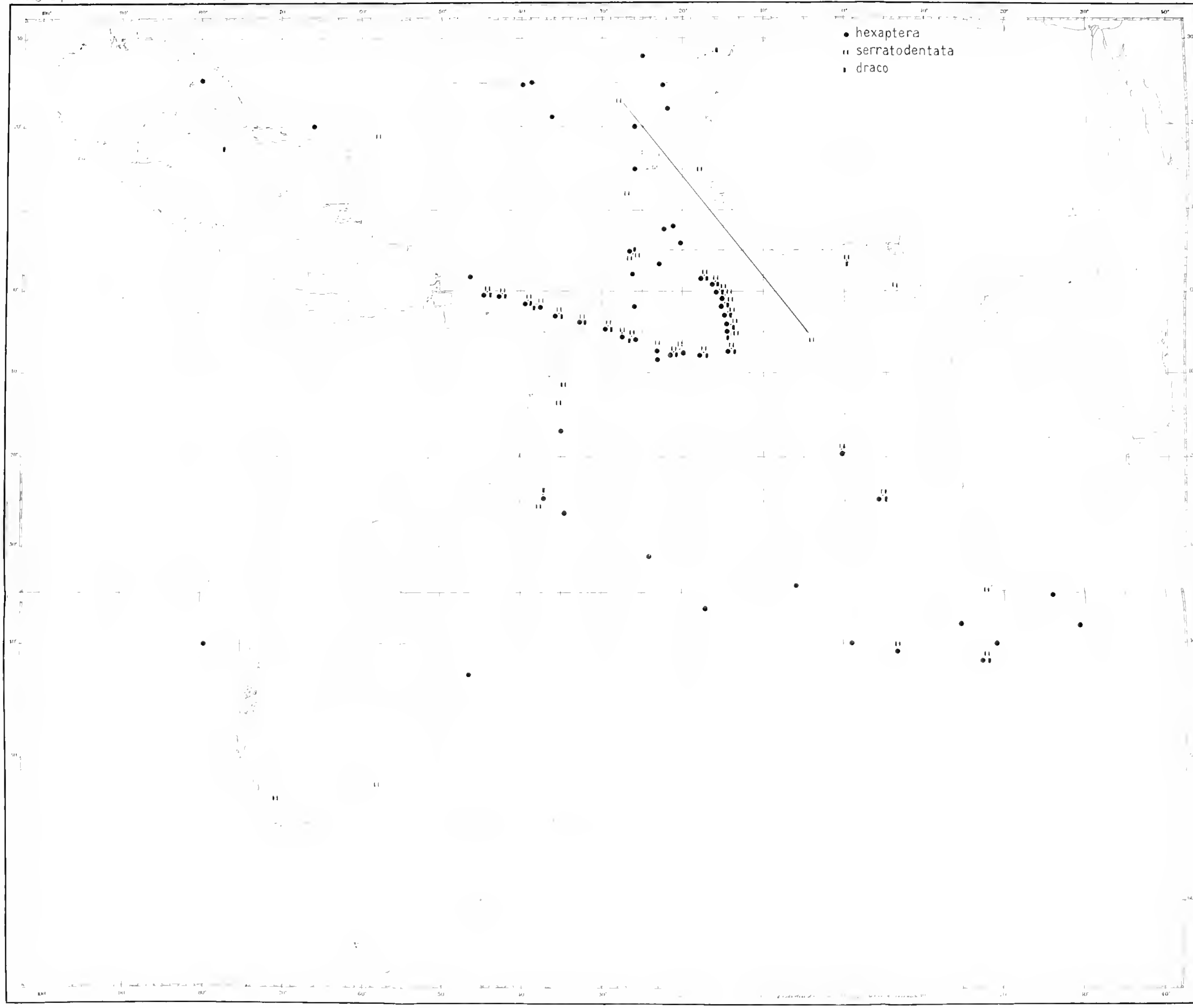
G. H. Fowler del.

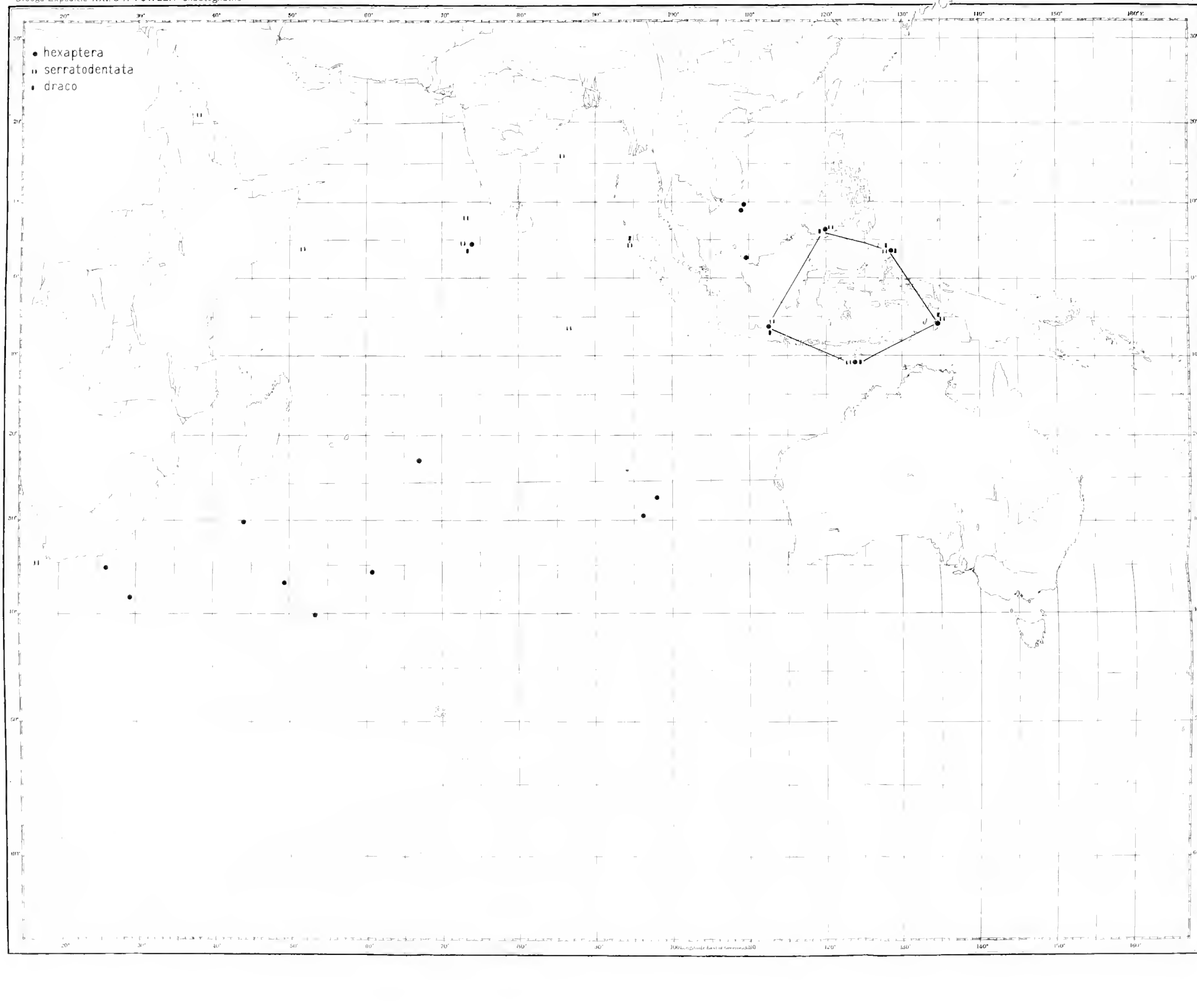

hamata
arctica
enflata
furcata
subtilis
elegans


enflata
subtilis
furcata
hamata


enflata
subtilis
hamata


• hexaptera
ıı serratodentata
▪ draco
▫ cephaloptera


hexaptera
serratodentata
draco


• hexaptera
ıı serratodentata
ı draco

RÉSULTATS DES EXPLORATIONS
ZOOLOGIQUES, BOTANIQUES, OCÉANOGRAPHIQUES ET GÉOLOGIQUES
ENTREPRISES AUX
INDES NÉERLANDAISES ORIENTALES en 1899—1900,
à bord du SIBOGA
SOUS LE COMMANDEMENT DE
G. F. TYDEMAN
PUBLIÉS PAR
MAX WEBER
Chef de l'expédition.

---

*I. Introduction et description de l'expédition, Max Weber.
*II. Le bateau et son équipement scientifique, G. F. Tydeman.
*III. Résultats hydrographiques, G. F. Tydeman.
IV. Foraminifera, F. W. Winter.
IV*bis*. Xenophyophora, F. E. Schulze.
V. Radiolaria, M. Hartmann.
*VI. Porifera, F. E. Schulze, G. C. J. Vosmaer et
VII. Hydropolypi, Ch. Julin. [J. H. Vernhout [1]).
*VIII. Stylasterina, S. J. Hickson et Mlle H. M. England.
IX. Siphonophora, Mlles Lens et van Riemsdijk.
*X. Hydromedusae, O. Maas.
*XI. Scyphomedusae, O. Maas.
*XII. Ctenophora, Mlle F. Moser.
*XIII. Gorgonidae, Alcyonidae, J. Versluys et S. J. Hickson [1]).
XIV. Pennatulidae, S. J. Hickson.
XV. Actiniaria, P. Mc Murrich.
*XVI. Madreporaria, A. Alcock [1]) et L. Döderlein.
XVII. Antipatharia, P. N. van Kampen.
XVIII. Turbellaria, L. von Graff et R. R. von Stummer.
XIX. Cestodes, J. W. Spengel.
XX. Nematodes, H. F. Nierstrasz.
*XXI. Chaetognatha, G. H. Fowler.
XXII. Nemertini, A. A. W. Hubrecht.
XXIII. Myzostomidae, R. R. von Stummer.
XXIV[1]. Polychaeta errantia, R. Horst.
XXIV[2]. Polychaeta sedentaria, M. Caullery et F. Mesnil.
*XXV. Gephyrea, C. Ph. Sluiter.
XXVI. Enteropneusta, J. W. Spengel.
*XXVI*bis*. Pterobranchia, S. F. Harmer.
XXVII. Brachiopoda, J. F. van Bemmelen.
XXVIII. Polyzoa, S. F. Harmer.
XXIX. Copepoda, A. Scott.
XXX. Ostracoda, G. W. Müller.
XXXI. Cirrhipedia, P. P. C. Hoek.
XXXII. Isopoda, H. J. Hansen.
XXXIII. Amphipoda, Ch. Pérez.
*XXXIV. Caprellidae, P. Mayer.
XXXV. Stomatopoda, H. J. Hansen.
*XXXVI. Cumacea, W. T. Calman.
XXXVII. Schizopoda, H. J. Hansen.
XXXVIII. Sergestidae, H. J. Hansen.
XXXIX. Decapoda, J. G. de Man.
XL. Pantopoda, J. C. C. Loman.
XLI. Halobatidae, J. Th. Oudemans.
XLII. Crinoidea, L. Döderlein et C. Vaney.
*XLIII. Echinoidea, J. C. H. de Meijere.
*XLIV. Holothurioidea, C. Ph. Sluiter.
*XLV. Ophiuroidea, R. Köhler.
XLVI. Asteroidea, L. Döderlein.
*XLVII. Solenogastres, H. F. Nierstrasz.
*XLVIII. Chitonidae, H. F. Nierstrasz.
XLIX[1]. Prosobranchia, M. M. Schepman.
XLIX[2]. Prosobranchia parasitica, H. F. Nierstrasz.
*L. Opisthobranchia, R. Bergh.
LI. Heteropoda, J. J. Tesch.
*LII. Pteropoda, J. J. Tesch.
LIII. Lamellibranchiata, P. Pelseneer et Ph. Dautzenberg.
LIV. Scaphopoda, Mlle M. Boissevain.
LV. Cephalopoda, L. Joubin.
*LVI. Tunicata, C. Ph. Sluiter [1]).
LVII. Pisces, Max Weber.
LVIII. Cetacea, Max Weber.
LIX. Liste des algues, Mme A. Weber.
*LX. Halimeda, Mlle E. S. Barton. (Mme E. S. Gepp).
*LXI. Corallinaceae, Mme A. Weber et M. Foslie.
LXII. Codiaceae, A. et Mme E. S. Gepp.
LXIII. Dinoflagellata. Coccosphaeridae, J. P. Lotsy.
LXIV. Diatomaceae, J. P. Lotsy.
LXV. Deposita marina, O. B. Böggild.
LXVI. Résultats géologiques, A. Wichmann.

Siboga-Expeditie

THE CHAETOGNATHA OF THE SIBOGA EXPEDITION

WITH A DISCUSSION OF THE SYNONYMY AND DISTRIBUTION OF THE GROUP

BY

G. HERBERT FOWLER, B.A., PH.D.

With 3 plates and 6 charts

Monographie XXI of:

UITKOMSTEN OP ZOOLOGISCH, BOTANISCH, OCEANOGRAPHISCH EN GEOLOGISCH GEBIED

verzameld in Nederlandsch Oost-Indië 1899—1900

aan boord H. M. Siboga onder commando van
Luitenant ter zee 1e kl. G. F. TYDEMAN

UITGEGEVEN DOOR

Dr. MAX WEBER
Prof. in Amsterdam, Leider der Expeditie

(met medewerking van de Maatschappij ter bevordering van het Natuurkundig onderzoek der Nederlandsche Koloniën)

BOEKHANDEL EN DRUKKERIJ
VOORHEEN
E. J. BRILL
LEIDEN

Publié Avril 1906

* Les numéros avec un astérique ont déjà paru; ceux marqués 1) seulement en partie.

Voor de uitgave van de resultaten der Siboga-Expeditie hebben bijdragen beschikbaar gesteld:

De Maatschappij ter bevordering van het Natuurkundig Onderzoek der Nederlandsche Koloniën.

Het Ministerie van Koloniën.

Het Ministerie van Binnenlandsche Zaken.

Het Koninklijk Zoologisch Genootschap »Natura Artis Magistra" te Amsterdam.

De »Oostersche Handel en Reederij" te Amsterdam.

De Heer B. H DE WAAL Oud-Consul-Generaal der Nederlanden te Kaapstad.

CONDITIONS GÉNÉRALES DE VENTE.

1°. L'ouvrage du „Siboga" se composera d'une série de monographies.

2°. Ces monographies paraîtront au fur et à mesure qu'elles seront prêtes.

3°. Le prix de chaque monographie sera différent, mais nous avons adopté comme base générale du prix de vente: pour une feuille d'impression sans fig. flor. 0.15; pour une feuille avec fig. flor. 0.20 à 0.25; pour une planche noire flor. 0.25; pour une planche coloriée flor. 0.40; pour une photogravure flor. 0.60.

4°. Il y aura deux modes de souscription:

a. La souscription à l'ouvrage complet.

b. La souscription à des monographies séparées en nombre restreint.

Dans ce dernier cas, le prix des monographies sera majoré de 25 %.

5°. L'ouvrage sera réuni en volumes avec titres et index. Les souscripteurs à l'ouvrage complet recevront ces titres et index, au fur et à mesure que chaque volume sera complet.

Déjà paru:

	Prix: Souscription à l'ouvrage complet	Monographies séparées
1e Livr. (Monogr. XLIV) **C. Ph. Sluiter.** Die Holothurien der Siboga-Expedition. Mit 10 Tafeln.	*f* 6.—	*f* 7.50
2e Livr. (Monogr. LX) **E. S. Barton.** The genus Halimeda. With 4 plates.	„ 1.80	„ 2.40
3e Livr. (Monogr. I) **Max Weber.** Introduction et description de l'expédition. Avec Liste des Stations et 2 cartes	„ 6.75	„ 9.—
4e Livr. (Monogr. II) **G. F. Tydeman.** Description of the ship and appliances used for scientific exploration. With 3 plates and illustrations.	„ 2.—	„ 2.50
5e Livr. (Monogr. XLVII) **H. F. Nierstrasz.** The Solenogastres of the Siboga-Exp. With 6 plates.	„ 3.90	„ 4.90
6e Livr. (Monogr. XIII) **J. Versluys.** Die Gorgoniden der Siboga-Expedition. I. Die Chrysogorgiidae. Mit 170 Figuren im Text.	„ 3.—	„ 3.75
7e Livr. (Monogr. XVI*a*) **A. Alcock.** Report on the Deep-Sea Madreporaria of the Siboga-Expedition. With 5 plates.	„ 4.60	„ 5.75
8e Livr. (Monogr. XXV) **C. Ph. Sluiter.** Die Sipunculiden und Echiuriden der Siboga-Exp. Mit 4 Tafeln und 3 Figuren im Text.	„ 3.—	„ 3.75
9e Livr. (Monogr. VI*a*) **G. C. J. Vosmaer** and **J. H. Vernhout.** The Porifera of the Siboga-Expedition. I The genus Placospongia. With 5 plates.	„ 2.40	„ 3.—
10e Livr. (Monogr. XI) **Otto Maas.** Die Scyphomedusen der Siboga-Expedition. Mit 12 Tafeln.	„ 7.50	„ 9.50
11e Livr. (Monogr. XII) **Fanny Moser.** Die Ctenophoren der Siboga-Expedition. Mit 4 Tafeln.	„ 2.80	„ 3.50
12e Livr. (Monogr. XXXIV) **P. Mayer.** Die Caprellidae der Siboga-Expedition. Mit 10 Tafeln.	„ 7.80	„ 9.75
13e Livr. (Monogr. III) **G. F. Tydeman.** Hydrographic results of the Siboga-Expedition. With 24 charts and plans and 3 charts of depths	„ 9.—	„ 11.25
14e Livr. (Monogr. XLIII) **J. C. H. de Meijere.** Die Echinoidea der Siboga-Exp. Mit 23 Tafeln.	„ 15.—	„ 18.75
15e Livr. (Monogr. XLV*a*) **René Koehler.** Ophiures de l'Expédition du Siboga. 1e Partie. Ophiures de Mer profonde. Avec 36 Planches.	„ 16.50	„ 20.50
16e Livr. (Monogr. LII) **J. J. Tesch.** The Thecosomata and Gymnosomata of the Siboga-Expedition. With 6 plates.	„ 3.75	„ 4.70
17e Livr. (Monogr. LVI*a*) **C. Ph. Sluiter.** Die Tunicaten der Siboga-Expedition. I. Abteilung. Die socialen und holosomen Ascidien. Mit 15 Tafeln	„ 6.75	„ 9.—
18e Livr. (Monogr. LXI) **A. Weber—van Bosse** and **M. Foslie.** The Corallinaceae of the Siboga-Expedition. With 16 plates and 34 textfigures	„ 12.50	„ 15.50
19e Livr. (Monogr. VIII) **Sydney J. Hickson** and **Helen M. England.** The Stylasterina of the Siboga Expedition. With 3 plates.	„ 1.50	„ 1.90
20e Livr. (Monogr. XLVIII) **H. F. Nierstrasz.** Die Chitonen der Siboga-Exp. Mit 8 Tafeln.	„ 5.—	„ 6.25
21e Livr. (Monogr. XLV*b*) **René Koehler.** Ophiures de l'Expédition du Siboga. 2e Partie. Ophiures littorales. Avec 18 Planches.	„ 10.25	„ 12.75
22e Livr. (Monogr. XXVI*bis*) **Sidney F. Harmer.** The Pterobranchia of the Siboga-Expedition, with an account of other species. With 14 plates and 2 text-figures.	„ 6.75	„ 9.—
23e Livr. (Monogr. XXXVI) **W. T. Calman.** The Cumacea of the Siboga Expedition. With 2 plates and 4 text-figures	„ 1.80	„ 2.40
24e Livr. (Monogr. LVI*a*) **C. Ph. Sluiter.** Die Tunicaten der Siboga-Expedition. Supplement zu der I. Abteilung. Die socialen und holosomen Ascidien. Mit 1 Tafel.	„ —.75	„ 1.—
25e Livr. (Monogr. L) **Rud. Bergh.** Die Opisthobranchiata der Siboga-Exped. Mit 20 Tafeln.	„ 11.25	„ 14.10
26e Livr. (Monogr. X) **Otto Maas.** Die Craspedoten Medusen der Siboga-Exp. Mit 14 Tafeln.	„ 9.25	„ 12.50
27e Livr. (Monogr. XIII*a*) **J. Versluys.** Die Gorgoniden der Siboga-Expedition. II. Die Primnoidae. Mit 10 Tafeln, 178 Figuren im Text und einer Karte. . .	„ 12.50	„ 16.75
28e Livr. (Monogr. XXI) **G. Herbert Fowler.** The Chaetognatha of the Siboga Expedition. With 3 plates and 6 charts	„ 4.20	„ 5.25

1 flor. = Mrk 1.70 = 1 sh. 8 d. = frs 2.12 en chiffres arrondies.