Tokioka, Takasi, 1940. A small collection of chaetognaths from the coast of New South Wales. *Records of the Australian Museum* 20(6): 367–379. [28 June 1940].

doi:10.3853/j.0067-1975.20.1940.1521

ISSN 0067-1975

Published by the Australian Museum, Sydney

SYDNEY UNIVERSITY PLANKTON INVESTIGATIONS,
under the Direction of Professor W. J. Dakin, D.Sc.

A SMALL COLLECTION OF CHAETOGNATHS FROM THE COAST OF NEW SOUTH WALES.

By

TAKASI TOKIOKA.
(Seto Marine Biological Laboratory, Japan.)

(Figures 1–10.)

Through the kindness of Prof. E. A. Briggs, of the University of Sydney, I had a chance to examine a small collection of chaetognaths obtained by Prof. W. J. Dakin from the waters along the coast of New South Wales, eastern Australia, approximately between the latitudes of 33° and 35° S. and along the 151° E. long. This material includes 126 individuals referable to 10 species. The chaetognath-fauna of the coastal waters of eastern Australia was studied by Ritter-Záhony (1909) and Johnston and Taylor (1919), who recorded *Sagitta bipunctata*, *S. serratodentata*, *S. robusta*, *S. australis*, *S. enflata*, *S. pulchra*, *S. minima*, *S. regularis*, *S. tenuis*, *S. neglecta* and *Spadella moretonensis*. The present material adds 6 species to the above list, namely, *S. hexaptera*, *S. lyra*, *S. ai*, *S. planctonis*, *Pterosagitta draco* and *Krohnitta subtilis*.

In the following, I propose to describe the present material, giving the armature-formula to each species.

Sagitta hexaptera d'Orbigny.

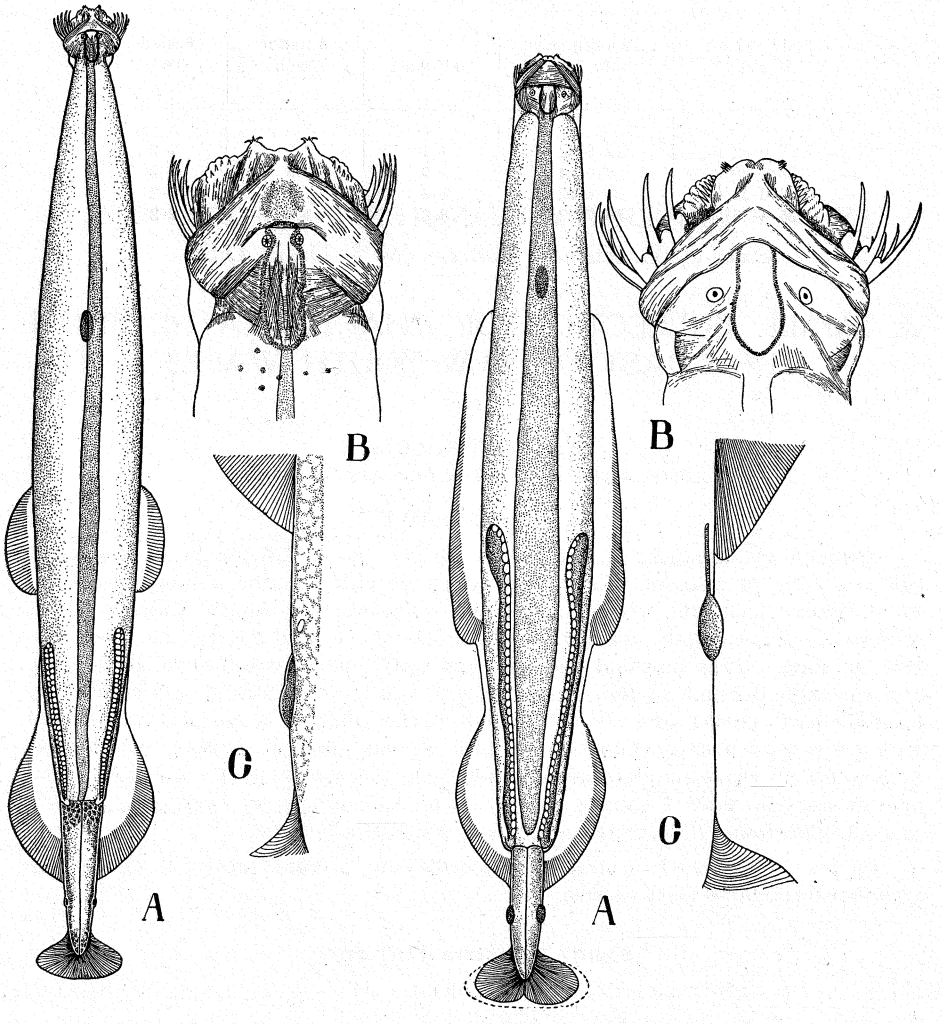
(Fig. 1.)

Sagitta hexaptera Aida, 1897; Fowler, 1906; Ritter-Záhony, 1909, 1911, *a*, *b*; Michael, 1919; Johnston and Taylor, 1921; Tokioka, 1939.

Sagitta tricuspidata Doncaster, 1903.

Sagitta fowleri Benham, 1912.

Twelve individuals, of which nine are from the offshore waters, while the other three were found in the inshore plankton sample which is labelled "All year, commonest species". This species seems, therefore, to be a common visitor to the coastal waters of New South Wales, though not very abundant in quantity. No difference is found between the armature-formulae of the Australian and Japanese specimens.



79 80

1 2

Figures 1-2.

Fig. 1.—*Sagitta hexaptera* d'Orbigny. A, entire animal, dorsal; B, head, dorsal; C, seminal vesicle, dorsal.

Fig. 2.—*Sagitta lyra* Krohn. A, entire animal, dorsal; B, head, dorsal; C, seminal vesicle, dorsal.

Formula:

Body Length in mm.	Tail Segment in %.	Hooks.	Anterior Teeth.	Posterior Teeth.
21·0–22·6	22·6–24·8	7–10	1–3	1–2
24·1–25·0	24·0–24·1	7–9	2–3	2–2
33·0–33·8	20·6–22·2	8–8	1–3	1–2
35·4–35·7	20·7–22·0	8–8	1–2	2–2
37·0–37·3	21·4–21·6	8–9	2–2	1–2
37·4–37·8	21·1–21·2	7–8	0–3	0–4

Sagitta lyra Krohn.

(Fig. 2.)

Sagitta lyra Aida, 1897; Johnston and Taylor, 1921; Tokioka, 1939.
Sagitta gazellae Ritter-Záhony, 1909.
Sagitta lyra + *Sagitta gazellae* Ritter-Záhony, 1911, *a*, *b*.
Sagitta furcata Steinhaus, 1896; Fowler, 1906.

Five individuals, of which two are from the offshore waters and three are found in the sample of *S. enflata* collected from the inshore waters. These five are all of the "*gazellae*"-type.

Formula:

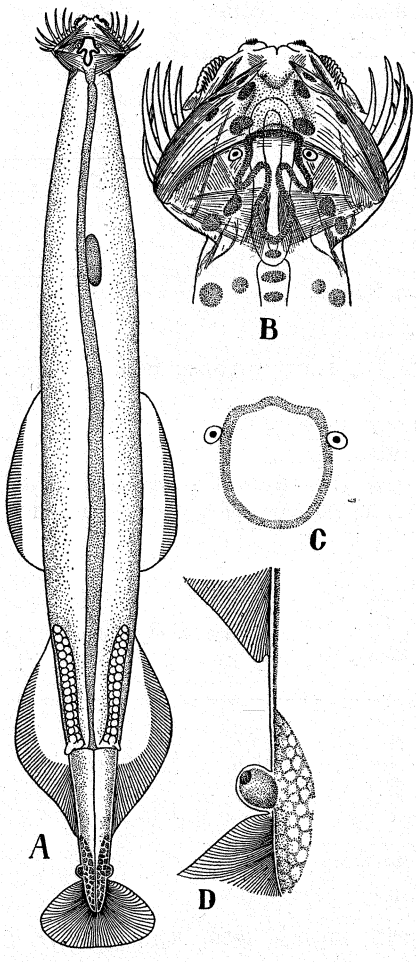
Body Length in mm.	Tail Segment in %.	Hooks.	Anterior Teeth.	Posterior Teeth.
25·1–26·9	15·5–15·6	6–7	3–?	7–?
27·0 (2)	18·5	8–9	4–6	10–10
36·1	13·9	9–9	6	8

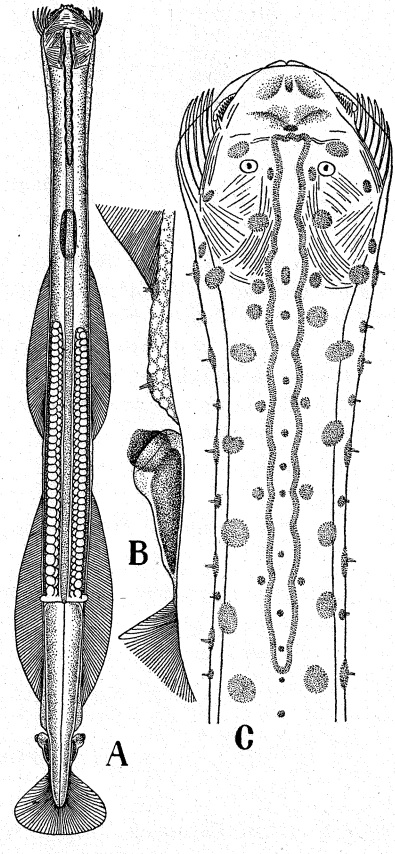
Sagitta enflata Grassi.

(Fig. 3.)

Sagitta enflata Béraneck, 1895-6; Aida, 1897; Fowler, 1906; Ritter-Záhony, 1911, *a*, *b*; Michael, 1919; Tokioka, 1939.
Sagitta enflata + *Sagitta gardineri* + *Sagitta flaccida* Doncaster, 1903.
Sagitta australis Johnston, 1909.
Sagitta enflata f. *minor* Ritter-Záhony, 1909.
Sagitta enflata + *Sagitta australis* Johnston and Taylor, 1919.
Sagitta enflata + *Sagitta gardineri* John, 1933.
Sagitta gardineri Lele and Gae, 1936.

Twenty-four individuals collected from the inshore waters and labelled "All year, commonest species". This species is commonest in the warm oceanic waters of the world. The formula of the Australian specimens is exactly the same as that of the Japanese specimens.





81 82

3 4

Figures 3-4.

Fig. 3.—*Sagitta enflata* Grassi. A, entire animal, dorsal; B, head, dorsal; C, simple corona ciliata; D, seminal vesicle, ventral.

Fig. 4.—*Sagitta bipunctata* Quoy et Gaimard. A, entire, dorsal; B, seminal vesicle, dorsal; C, anterior part of trunk, dorsal.

Formula:

Body Length in mm.	Tail Segment in %.	Hooks.	Anterior Teeth.	Posterior Teeth.
16·0–17·0	20·0–20·6	8–9	6–7	11–13
17·0–17·4	19·4–20·1	7–9	8–8	12–13
17·5–17·6	18·2–18·3	8–8	6–11	12–16
17·7–17·8	19·2–22·5	8–9	7–8	12–14
18·0–18·5	16·7–19·5	8–9	5–8	10–14

Remarks: Johnston claims that *S. australis* is different from *S. enflata* in the beginning point of the anterior fin and in the situation of the broadest portion of the posterior fin. The former character shows, however, a considerably wide range of variation in some species, like *S. lyra*, *S. setosa* and *S. levis*. In fact *S. gardineri* from the Indian Ocean shows the intermediate condition in this respect between *S. australis* and *S. enflata*. Regarding the latter character, the situation of the broadest portion of the posterior fin is at the tail septum in *S. enflata*, although it may be slightly in front of or slightly behind the tail septum in some individuals. This character is difficult to observe in mounted specimens, on which *S. australis* was established originally. It is to be noted that the posterior teeth of *S. australis* are fewer than those of the typical *S. enflata* tabulated above.

Sagitta bipunctata Quoy et Gaimard.

(Fig. 4.)

Sagitta bipunctata Ritter-Záhony, 1909, 1911, *a*, *b*; Johnston and Taylor, 1919; Tokioka, 1939.

Sixteen individuals. Common in the warm oceanic waters. The formulae of both the Australian and Japanese specimens conform exactly with each other.

Formula:

Body Length in mm.	Tail Segment in %.	Hooks.	Anterior Teeth.	Posterior Teeth.
11·2–12·0	27·5–28·6	8–9	5–6	11–12
12·4–13·3	24·8–27·4	9–9	6–8	13–13
13·5–13·6	26·5–27·4	9–9	6–7	11–15
13·7–14·1	27·0–28·4	8–9	6–6	13–16
14·3–14·4	26·6–27·1	9–9	6–7	15–15
15·0	26·0	9–9	7	15

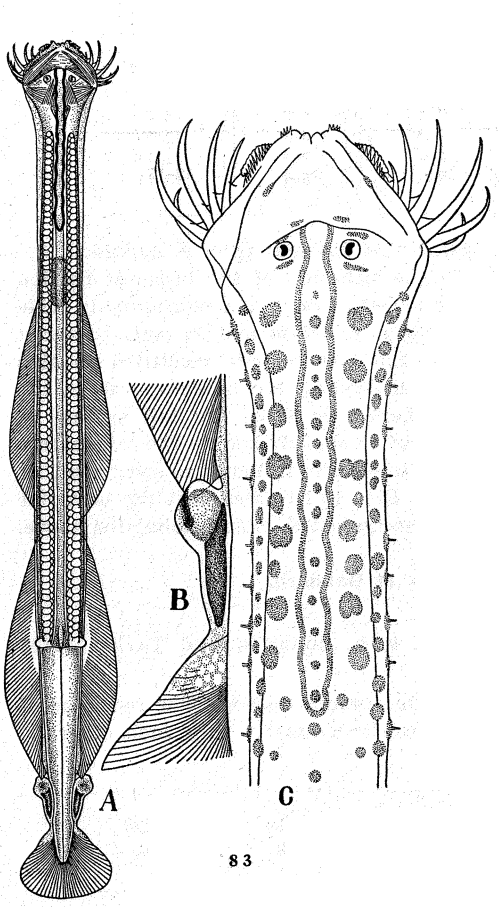
Sagitta robusta Doncaster.

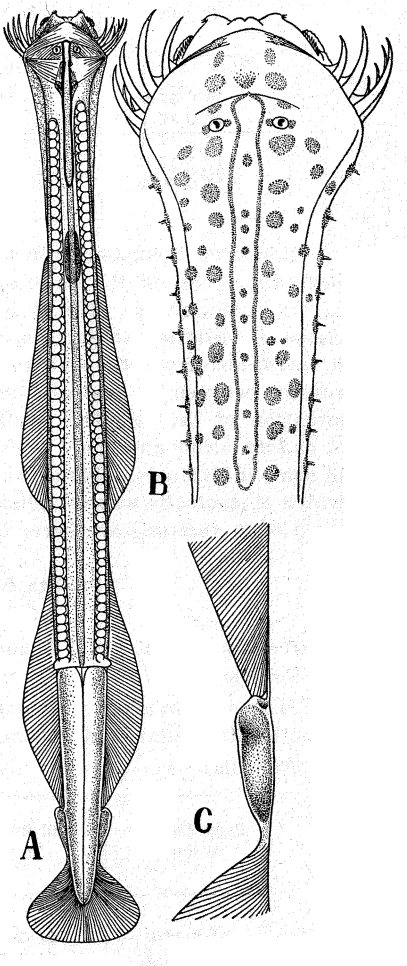
(Fig. 5.)

Sagitta hispida, Aida, 1897.

Sagitta robusta + *Sagitta ferox* Doncaster, 1903.

Sagitta robusta Fowler, 1906; Ritter-Záhony, 1909, 1911, *a*, *b*; Johnston and Taylor, 1919; John, 1933; Tokioka, 1939.





5 6

Figures 5-6.

Fig. 5.—*Sagitta robusta* Doncaster. A, entire animal, dorsal; B, seminal vesicle, ventral; C, anterior part of trunk, dorsal.

Fig. 6.—*Sagitta ai* Tokioka. A, entire animal, dorsal; B, anterior part of trunk, dorsal; C, seminal vesicle, ventral.

Sixteen individuals. Common in the warm oceanic waters. The Australian specimens show exactly the same formula as the Japanese specimens.

Formula:

Body Length in mm.	Tail Segment in %.	Hooks.	Anterior Teeth.	Posterior Teeth.
10·7–11·5	31·8–33·1	7–8	5–6	12–13
11·7 (2)	31·6–32·5	7–7	6–6	11–12
12·0 (2)	28·3–30·0	7–7	6–7	11–12
12·6–12·8	29·7–31·0	7–8	6–7	13–14
12·9–13·0	27·9–30·8	7–8	6–7	13–15

Sagitta ai Tokioka.

(Fig. 6.)

Sagitta ai Tokioka, 1939.

Twelve individuals. Common, but less so than the preceding species. This species resembles very closely *S. robusta*, but differs distinctly from the latter in (1) the body length of mature individuals, (2) the shape of the seminal vesicle, and in (3) the number of hooks, which is usually 5-6 in the former species, while it is 7-8 in the latter.

Formula:

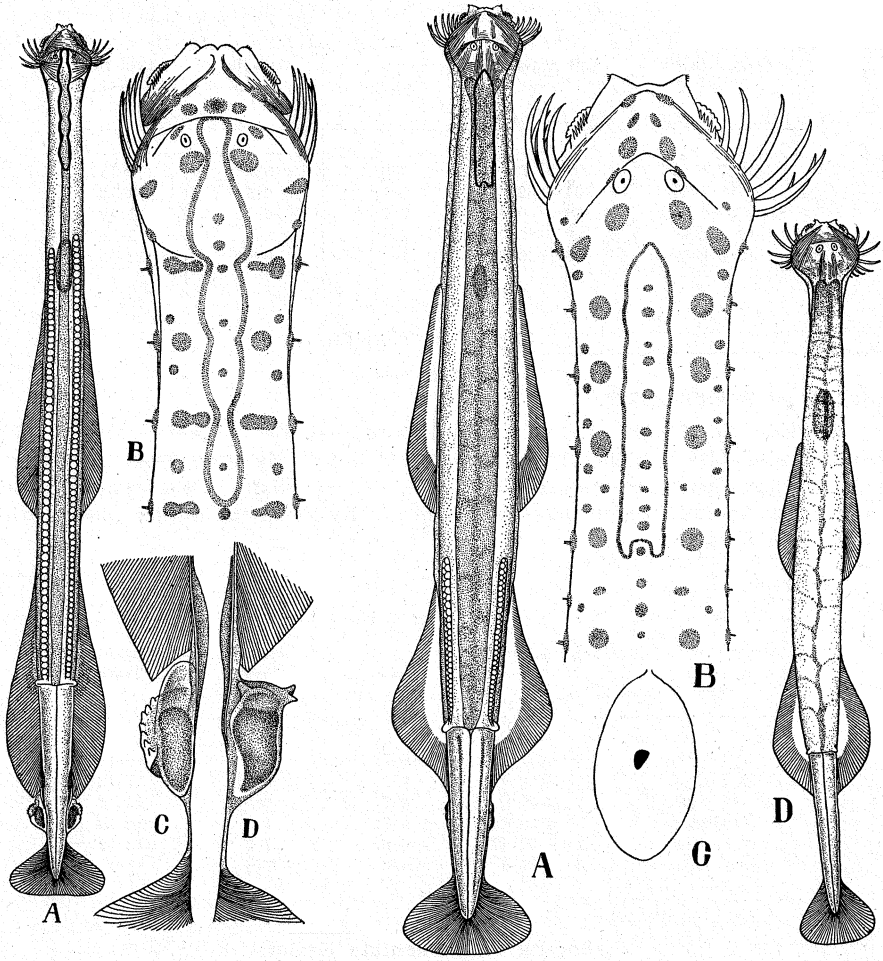
Body Length in mm.	Tail Segment in %.	Hooks.	Anterior Teeth.	Posterior Teeth.
9·5–10·5	30·5–31·6	6–7	6–7	10–11
10·5–11·5	29·5–30·4	6–7	6–6	11–12
13·0 (2)	26·2–30·0	6–7	6–9	13–14
13·6 (2)	28·6–28·7	5–7	7–9	10–13
13·8–15·5	28·4–30·4	6–6	7–7	12–12
15·5–19·0	30·3–31·1	5–6	7–8	11–13

Sagitta serratodentata Krohn.

(Fig. 7.)

Sagitta serratodentata Béraneck, 1895-6; Aida, 1897; Doncaster, 1903; Fowler, 1906; Ritter-Záhony, 1909, 1911, *a*, *b*; Michael, 1919; Johnston and Taylor, 1919, 1921; Tokioka, 1939.

Eight individuals, of which six have the same formula for the cephalic armature and the same appearance of the seminal vesicle (Fig. 7, *c*) with several chitinous teeth as in the Japanese specimens. The other two have the seminal vesicle (Fig. 7, D) differing from those of the preceding six individuals, in that it has two prominences at the antero-lateral corner as in the Atlantic or Mediterranean specimens, but has no chitinous teeth along the lateral side. The number



85 86

7 8

Figures 7-8.

Fig. 7.—*Sagitta serratodentata* Krohn. A, entire animal, dorsal; B, anterior part of trunk, dorsal; C, seminal vesicle of Pacific form, ventral; D, seminal vesicle of Atlantic or Mediterranean form, dorsal.

Fig. 8.—*Sagitta planctonis* Steinhaus. A, entire animal, dorsal; B, anterior part of trunk, dorsal; C, eye; D, young (9 mm.) individual, dorsal.

of the posterior teeth in these two individuals is less than that of the common Pacific individuals (which may be called *forma pacifica*), having the seminal vesicle with the chitinous teeth. Whether any intermediate form exists between the Pacific and the Atlantic or Mediterranean forms in regard to this character, and how the Pacific and the Atlantic or Mediterranean forms are distributed in the waters of the world may be ascertained by a further study.

Formula (common Pacific forms):

Body Length in mm.	Tail Segment in %.	Hooks.	Anterior Teeth.	Posterior Teeth.
10·9–11·5	24·3–24·8	6–6	7–9	17–18
12·0–12·3	24·2–26·8	6–?	9–?	20–?
13·0–13·8	26·2–26·8	6–6	8–10	18–24

Formula (Atlantic or Mediterranean forms):

Body Length in mm.	Tail Segment in %.	Hooks.	Anterior Teeth.	Posterior Teeth.
11·3–12·2	25·4–26·5	6–7	6–7	13–14

Sagitta planctonis Steinhaus.

(Fig. 8.)

Sagitta planctonis, Steinhaus 1896; Ritter-Záhony, 1909, 1911, *a*, *b*; Michael, 1919; Johnston and Taylor, 1921; Tokioka, 1939.

Sagitta planctonis + *Sagitta zetesios* Fowler, 1906.

Twenty-five individuals. In the Japanese waters, this species is a rare mesoplanktonic organism. The Australian specimens, 9-27·2 mm. in body length, are all immature. In none of the specimens does the ovary reach beyond the front end of the posterior fin, nor is there a seminal vesicle. The most striking point of the Australian specimens is the shape of the corona ciliata (Fig. 8, B), which differs from the figure given by Ritter-Záhony (1911, *a*). It begins on the neck and stretches posteriorly about two times the head length. The anterior end is pointed like an apex of a triangle; the posterior end is cut transversely and the middle portion of the posterior border is markedly depressed anteriorly, containing a small sensory spot in this depression. The eye is large, though the eye-pigment is very small. The intestine is usually swollen considerably and fills (in young individuals) the whole trunk coelom, showing a septate appearance as in *S. minima* (Fig. 8, D). The number of the anterior and posterior teeth of the Australian specimens is fewer than that of the Japanese specimens.

Formula (Australian specimens):

Body Length in mm.	Tail Segment in %.	Hooks.	Anterior Teeth.	Posterior Teeth.
9·0	25·6	9–9	5	7
13·0–14·7	23·8–25·4	8–9	5–5	9–9
15·2–15·9	24·5–25·7	6–9	4–4	8–8
16·0 (2)	22·5–24·4	7–10	6–7	9–10
16·0 (2)	23·8–25·0	7–9	3–7	8–11
17·2–17·8	22·7–23·0	7–9	4–6	9–10
18·2–19·0	22·5–23·7	5–9	5–6	11–11
20·0–20·3	22·7–23·0	7–9	6–7	9–13
21·0–21·5	21·4–22·8	7–9	5–7	10–11
22·0–22·5	22·2–22·3	6–9	5–5	10–11
24·8–27·2	22·4–23·8	8–9	5–7	12–12

Formula (Japanese specimens):

Body Length in mm.	Tail Segment in %.	Hooks.	Anterior Teeth.	Posterior Teeth.
17·5–18·5	25·7–25·9	8–9	9–10	16–18
20·0–21·4	25·5–28·0	9–10	10–10	17–19
24·0 (2)	25·4–27·1	9–9	10–11	17–19
25·5–26·0	23·9–28·8	7–8	8–12	14–19
26·1–27·0	24·9–25·9	7–8	8–10	14–16
27·5–31·1	25·5–26·0	8–8	5–10	7–19
34·8	23·9	7–8	11	16

The formulae given by Ritter-Záhony (1911, *a*, *b*) seem to be rather aberrant in the number of anterior and posterior teeth, which fact suggests a rather wide range of variation of this character.

Pterosagitta draco (Krohn).

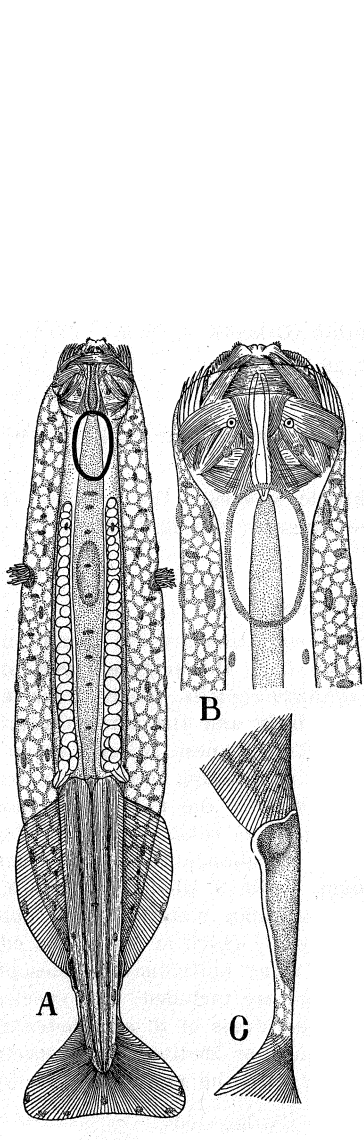
(Fig. 9.)

Spadella draco Aida, 1897; Doncaster, 1903; Fowler, 1906.

Spadella draco + *Spadella vougai* Béraneck, 1895-6.

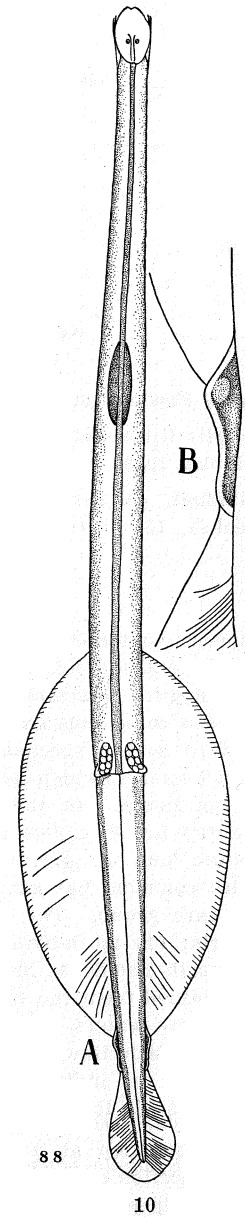
Pterosagitta draco Ritter-Záhony, 1911, *a*, *b*; Johnston and Taylor, 1919; Michael, 1919; Tokioka, 1939.

Seven individuals. This species occurs frequently in the warm oceanic waters, though not large in quantity. The formula of the Australian specimens conforms quite with that of the Japanese specimens.



87

9



88

10

Figures 9-10.

Fig. 9.—*Pterosagitta draco* (Krohn). A, entire animal, dorsal; B, anterior part of trunk, dorsal; C, seminal vesicle, dorsal.

Fig. 10.—*Krohnitta subtilis* (Grassi). A, entire animal, dorsal; B, seminal vesicle, dorsal.

Formula:

Body Length in mm.	Tail Segment in %.	Hooks.	Anterior Teeth.	Posterior Teeth.
7·9–8·5	41·2–45·6	9–10	7–8	12–15
8·9–9·0	43·8–44·4	9–10	7–8	11–15
9·6–10·1	41·7–43·6	10–10	7–8	14–14
10·2	46·1	9–10	9	18

Krohnitta subtilis (Grassi).

(Fig. 10.)

Krohnia subtilis Fowler, 1906.

Krohnitta subtilis Ritter-Záhony, 1911, *a*, *b*; Johnston and Taylor, 1919; Michael, 1919; Tokioka, 1939.

One individual. A rare mesoplanktonic species. The formula—13·6 mm., 36·0%, 7 (hooks), 12 (teeth)—is in the range of the formula of the Japanese specimens.

Concluding Remarks.

All the species contained in the present collection are the inhabitants of the warm oceanic waters and are fished chiefly from the surface layer, except the mesoplanktonic *Sagitta planctonis* and *Krohnitta subtilis*. Each of the ten species shows exactly the same appearance of the body and the same formula of the cephalic armature as the specimens from the Japanese waters, except for the samples of *S. planctonis*, which are provided with fewer teeth as compared with the Japanese specimens. In the Japanese waters, the species commonest and largest in quantity are *S. enflata* and *S. bedoti*. *S. robusta*, *S. ai*, *S. bipunctata*, *S. serratodentata* and *P. draco* are next in abundance. *S. hexaptera* and *S. lyra* are also common, but not abundant, while *S. planctonis* and *K. subtilis* belong to the rare group. The present Australian material is of note in the following respects: (1) no individual of *S. bedoti*, which is one of the commonest species in the north Pacific, is included, (2) many individuals of mesoplanktonic *S. planctonis* obtained from the inshore waters are included; this species is very rare in the Japanese waters, and (3) two individuals of *S. serratodentata* which have the seminal vesicle like that of the Atlantic or Mediterranean specimens are found mingled with the individuals provided with the vesicle of the type found commonly in the Pacific forms.

Taking the collection as a whole the most common form in the inshore plankton off this portion of the New South Wales coast is *S. enflata*, which occurs throughout the whole year.

S. bipunctata, *S. robusta*, *S. ai*, *S. serratodentata*, and *P. draco* occur fairly commonly in the inshore waters in the autumn months (April and May). *S. planctonis* occurs only occasionally in these waters during the summer months—it has appeared more commonly in certain catches taken in more southern waters.

Literature.

AIDA, T. (1897).—Chaetognaths of Misaki Harbor. *Annot. Zool. Japonenses*, i.

BENHAM, W. B. (1912).—Report on Sundry Invertebrates from the Kermadec Islands. *Transact. and Proc. New Zealand Inst.*, xliv.

BÉRANECK, ED. (1895-6).—Les Chétognathes de la Baie d'Amboine. *Revue Suisse de Zool.*, iii.

DONCASTER, L. (1903).—Chaetognatha, with a note on the variation and distribution of the group. In *Stanley Gardiner (editor), The Fauna and Geogr. of the Maldive and Laccadive Archipelagoes*, i.

FOWLER, G. H. (1906).—The Chaetognatha of the Siboga Expedition. *Siboga-Expeditie Monogr.*, xxi.

GRAY, B. B. (1923).—Notes on species of Sagitta collected during a voyage from England to Australia. *Proc. Roy. Soc. Queensland*, xxxiv.

JOHN, C. C. (1933).—Sagitta of the Madras Coast. *Bull. Madras Gov. Mus.* (n.s.), Nat. Hist. Sec., iii.

JOHNSTON, T. H. (1909).—An Australian Chaetognath. *Rec. Austral. Mus.*, vii.

JOHNSTON, T. H., and TAYLOR, B. B. (1919).—Notes on Australian Chaetognatha. *Proc. Roy. Soc. Queensland*, xxxi.

———— (1921).—The Chaetognatha. *Austral. Antarctic Exped.*, 1911-14, *Sci. Rep., Ser. C-Zool. and Bot.*, vi.

LELE, S. H., and GAE, P. B. (1936).—Common Sagittae of Bombay Harbour. *J. Univ. Bombay*, iv.

MICHAEL, E. L. (1919).—Report on the Chaetognatha collected by the United States Fisheries Steamer "Albatross" during the Philippine Expedition, 1907-1910. *U.S. Nat. Mus., Bull.* 100, l.

OYE, P. (1918).—Untersuchungen über die Chaetognathen des Javameeres. *Contrib. à la Faune des Indes Néerlandaises, Fasc.* iv.

PARKER (1895).—Remarks on a Spadella from New Zealand waters. *Transact. and Proc. New Zealand Inst.*, xxviii.

RITTER-ZÁHONY, R. (1909).—Die Chaetognathen der Gazelle Expedition. *Zool. Anz.*, xxxiv.

———— (1911, *a*).—Revision der Chätognathen. *Deutsch. Südpol.-Exped.*, 1901-3, xiii, *Zool.*, v, Hft. i.

———— (1911, *b*).—Chaetognathi. In *Schulze Das Tierreich, Lief.*, 29.

STEINHAUS, O. (1896).—Die Verbreitung der Chaetognathen in südatlantischen und indischen Ozean. *Inaugural-Dissertation z. Erlangung d. philos. Doktorwürde an der Christian-Albrechts-Univ. z. Kiel.*

TOKIOKA, T. (1939).—Chaetognaths collected chiefly from the Bays of Sagami and Suruga, with some notes on the shape and structure of the seminal vesicle. *Rec. Oceanogr. Works in Japan*, x.