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Sagitta batava n.sp. from the Scheldt Estuary, the Netherlands (Chaetognatha)

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ABSTRACT

A new species of Chaetognatha, *Sagitta batava*, is described. The morphological differences between this new species and closely related ones, especially *S. setosa*, are given. Ecological and meristic data concerning *S. batava* are reported.

The only species of Chaetognatha known from the coastal area of the Netherlands, *Sagitta bipunctata* Quoy & Gaimard, 1827, is recorded from the Wadden Sea, Zuider Sea and the Scheldt Estuary (Horst, 1884; van Breemen, 1905).

The investigations carried out by the Hydrobiological Institute, division of Delta Research, Yerseke, provided a new species of Chaetognatha from the Western and the Eastern Scheldt and the Grevelingen, for which the name *Sagitta batava* is proposed.

Sagitta batava n. sp.

Type locality: off Zierikzee (prov. of Zeeland, the Netherlands), depth 40 m, date 4-VIII-1965. Holotype: ZMA. VCH. 324; Paratype: ZMA. VCH. 276.

Description: The total length: 6.6—12.5 mm (mean 9.8 mm, based on 46 specimens) length of the caudal segment 20 %—25 % of the total length (mean 22 %, based on 46 specimens). Total length of the holotype 11.6 mm, the caudal segment occupies 21 %. The caudal segment of animals preserved in formalin, shows the same diameter as the body segment; there is no abrupt decrease of diameter behind the septum (as in *S. setosa*, Müller, 1847). Hooks 5—5, anterior teeth 5—5, and posterior teeth 15—15. The collarete is very small and a fin-bridge is absent, so the fins are separated. The anterior fin

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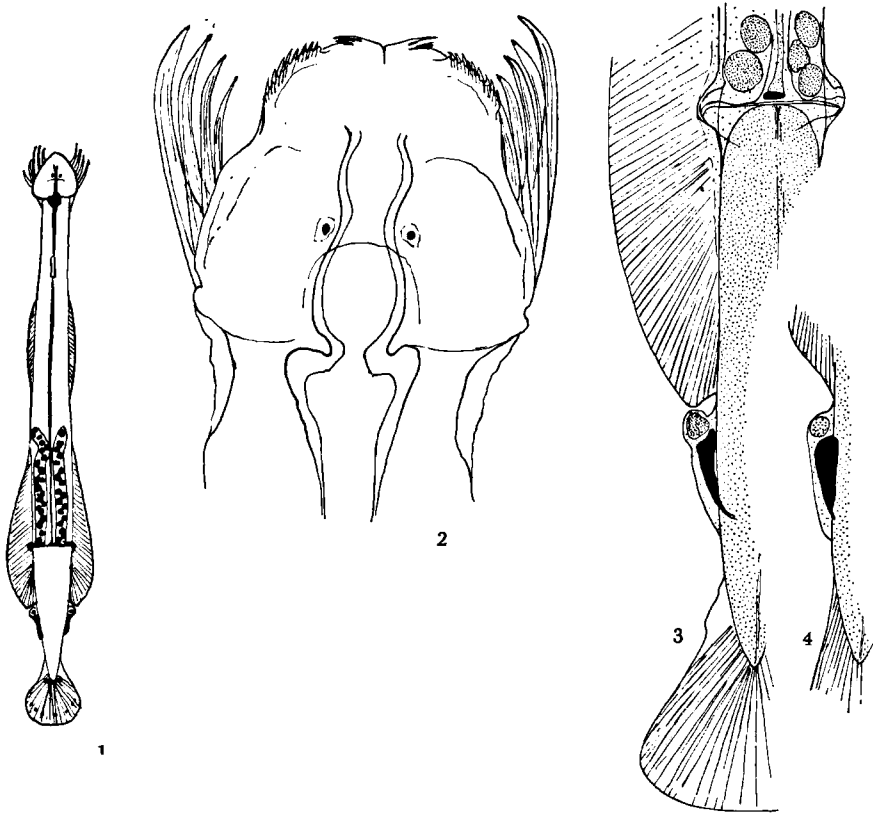


Fig. 1. *Sagitta batava*, from off Zierikzee, ventral view; real length 11.6 mm.
Fig. 2. Head of same specimen in ventral view; more enlarged.
Fig. 3. Posterior part of the same specimen in ventral view; more enlarged.
Fig. 4. *Sagitta bipunctata*, the right seminal vesicle, after a specimen collected in the Spaanse Water, Curaçao.

starts 0.5—1 mm behind the ventral ganglion. The ventral ganglion is very faintly developed and so are the anterior fins, though clearly visible and provided with rays. The posterior fins are well developed and fin-rays are present, except for a small band in the anterior part of the fins along the body. The posterior fin does not end gradually, but a V-shaped opening is left between the body and the caudal top of the fin, in which the seminal vesicles protrude. The vesicles are longdrawn, provided with a bulbous cranial pole, like in *S. robusta*, Doncaster, 1902. The caudal fin is rounded and does not touch the vesicles. Rays are absent in the latero-anterior part of the caudal fin. The female sexual apparatus is rounded and the ovaries, when crowded with the large, rounded eggs, reach just above the anterior border of the posterior fin. The rounded eyes show a clear pigment-spot of a symmetrical star-shape (fig. 6). A small intestinal diverticulum is usually

present. The small, longdrawn corona is difficultly seen. The anterior teeth are in normal position covering each other and directed outwards. The well-developed vestibular ridge is regular, without tubercles. The posterior edge of the vestibular ridge is not rounded as in *S. setosa*, but more angular. The posterior teeth are broadly based and provided with terminal cusp. The hooks show also a clear terminal cusp or tip exactly as described for *S. bipunctata*. The posterior teeth and the base of the hooks are light brown in colour.

Remarks — *S. setosa* is closely related to the new species. In *S. setosa* no intestinal diverticula are found, while in *S. batava* two small diverticula are present. Most characteristic is the difference in length of the caudal segment between the two species. The number of hooks is usually larger in *S. setosa*, but the variation is too large to consider it a distinctive character. The pigment-spot in the eye is constantly T-shaped in *S. setosa*, and more or less rounded in *S. batava*. The shape of the vestibular ridge is rounded in *S. setosa*, and more rectangular in the new species.

S. minima Grassi, 1881, shows a slight affinity to *S. batava*, but in this species the posterior fins do not touch the seminal vesicles and the fin-rays are perpendicular to the body.

S. bipunctata is to be distinguished from the new species by its greater length when full-grown, the somewhat longer anterior fins, the better developed collarette and the coincidence of the anterior fin with the caudal part of the ventral ganglion. A small distance between ventral ganglion and anterior fins is found by Burfield (1927), but this author describes a distinct opening between the seminal vesicles and the posterior fin, which still points at a difference with *S. batava*. The pigment-spot in the eyes of *S. bipunctata* is asymmetrical, star-shaped, thus not symmetrical and rounded as in *S. batava*.

Some species resembling in a few characters the new species differ from *S. batava*:

in having a relatively larger caudal segment (more than 25 % in *S. regularis* Aida, 1897; *S. neglecta* Aida, 1897; *S. friderici* Ritter-Zahony, 1911; *S. pseudoserratodentata* Tokioka, 1939; *S. ferox* Doncaster, 1903; and *S. robusta*);

or having more hooks (*S. elegans* Verrill, 1873; and *S. bipunctata*);

or in having more or less anterior teeth (more than 8 in *S. bedoti* Beraneck, 1895 and *S. helenae* Ritter-Zahony, 1910);

or in having another number of posterior teeth (as *S. regularis*; *S. friderici*; *S. bedoti*; *S. tenuis* Conant, 1896; and *S. elegans*).

Unlike the new species, the vesicles do not touch the posterior fin and reach the caudal fin in *S. robusta*; *S. friderici*; *S. bedoti*; *S. tenuis*; *S. helenae*; *S. pulchra* Doncaster, 1902; *S. decipiens* Fowler, 1905; *S. serratodentata* Krohn, 1853; *S. ferox*; *S. planktonis* Steinhaus, 1896; *S. minima*; *S. elegans*; and *S. bipunctata*. To discriminate them more easily from the new species the above species are mentioned and referred to in table I.

Table I

Measurements and variation in armature of *S. batava* and other *Sagitta* species with under the line the exact data of 16 specimens of *S. batava* and 17 specimens of *S. setosa*.

Species	Total length (mm)	Tail segm. (%)	Hooks	Anter. teeth	Poster. teeth	Seminal vesical touches	
						poster. fin	caudal fin
<i>S. regularis</i>	4—7	29—33	7—8	2—4	4—7	+	—
<i>neglecta</i>	6—8	28—30	6—8	5—7	11—16	+	—
<i>robusta</i>	9—14	25—30	6—8	7—10	11—16	+	+
<i>friderici</i>	9—13	25—26	8—9	6—9	14—22	+	+
<i>pseudoserratodentata</i>	6—7	25—27	6—7	5—6	9—12	+	—
<i>bedoti</i>	7—12	21—28	6—7	10—13	20—30	+	+
<i>tenuis</i>	3—10	20—25	5—8	2—5	4—9	+	+
<i>helenae</i>	10—13	23—25	7—8	15—18	13—14	+	+
<i>pulchra</i>	7—12	16—23	5—6	6—8	8—12	+	+
<i>decipiens</i>	7—15	20—30	5—7	6—9	12—20	—	+
<i>serratodentata</i>	8—14	20—36	5—7	5—11	9—20	+	+
<i>ferox</i>	6—9	24—27	6—7	6—13	8—12	+	+
<i>planktonis</i>	8—40	23—26	6—9	1—10	9—21	—	—
<i>minima</i>	4—9	17—24	7—8	2—4	6—14	—	+
<i>elegans</i>	25—30	17—25	10—12	5—8	12—18	—	+
<i>bipunctata</i>	6—19	21—28	8—10	4—8	9—16	—	+
<i>setosa</i>	6—21	16—20	7—13	4—8	7—19	+	—
<i>batava</i>	5—12.5	20—25	5—11	3—8	9—16	+	—
<i>S. batava</i>	12.5	20.0	7—7	5—5	15—15	+	—
	11.6	21.0	5—5	5—5	15—15	+	—
	11.5	20.5	8—8	8—8	14—14	+	—
	11.3	20.5	8—9	7—7	15—15	+	—
	11.0	20.0	9—9	8—8	13—13	+	—
	10.3	22.0	8—8	7—7	13—13	+	—
	10.1	21.5	7—6	7—7	11—11	+	—
	9.5	21.5	11—11	8—8	16—16	+	—
	9.5	21.0	7—7	8—8	13—13	+	—
	9.5	21.0	8—8	6—6	11—11	+	—
	9.1	22.0	8—8	6—6	10—10	+	—
	8.5	20.0	7—8	6—6	12—12	+	—
	7.4	22.0	6—6	3—3	9—9	+	—
	7.4	25.0	7—7	6—6	11—12	+	—
	7.4	25.0	9—9	5—5	11—11	+	—
	5.8	25.0	8—8	4—5	9—9	+	—
<i>S. setosa</i>	21.0	16.0	10—10	6—7	17—17	+	—
	20.2	15.5	8—9	5—5	19—19	+	—
	20.0	16.0	9—9	6—6	14—14	+	—
	20.0	16.0	7—8	7—7	14—15	+	—
	19.9	16.6	8—8	6—7	12—12	+	—
	19.2	17.0	9—9	7—7	15—15	+	—
	18.7	19.5	8—8	6—6	13—13	+	—
	18.2	16.3	9—9	7—7	13—13	+	—
	18.1	17.5	9—10	5—5	14—14	+	—
	14.9	17.0	9—10	6—6	15—13	+	—
	12.5	17.0	8—8	6—6	13—13	+	—
	11.6	19.0	9—9	5—5	13—13	+	—
	10.9	19.0	8—8	5—6	11—11	+	—
	10.3	19.5	7—8	5—5	13—13	+	—
	8.3	20.0	10—9	6—6	14—15	+	—
	7.0	18.0	7—7	5—5	12—12	+	—
	6.6	19.0	7—7	5—5	11—11	+	—

Sagitta setosa, *S. elegans*, *S. bipunctata*, *S. serratodentata*, *S. maxima* (Conant, 1896), *S. lyra* Krohn, 1853, *S. planktonis*, *S. hexaptera* d'Orbigny, 1834, *S. decipiens* and *S. macrocephala* Fowler, 1905, are recorded from the North Sea area and its direct vicinity. The larger size and relatively small caudal segment in *S. hexaptera* and *S. lyra*, the relatively large tail-segment in *S. macrocephala*, the egg-shaped seminal vesicles and the gradually ending posterior fins in *S. maxima*, suffice to distinguish these species from *S. batava*. For the other species the differences are cited above and in table I.

That *S. batava* is a distinct species and not a variety of *S. setosa* is proved by the complete absence of intermediates between *S. setosa* and *S. batava*, whereas *S. setosa* was found in the Roompot and off Klein Valkenisse together with *S. batava*.

To investigate the variation of *S. setosa*, four samples of this species from the North Sea at 54°10'N 00°00'E; 54°20'N 00°40'E; 53°40'N 00°20'E and 54°33'N 00°40'W were examined. The data obtained from these animals are

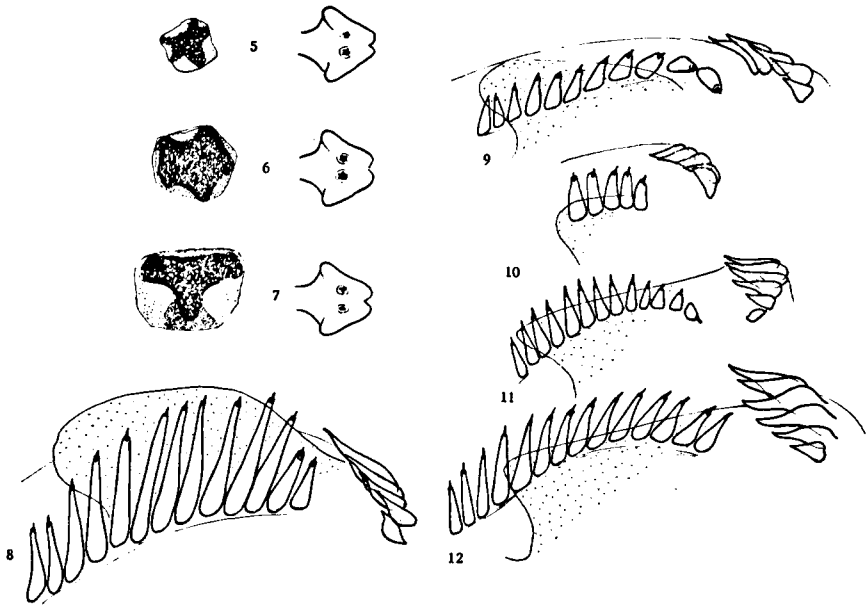


Fig. 5. *Sagitta bipunctata*, head and eye-pigment spot (x 650 approx.).

Fig. 6. *Sagitta batava*, head and eye-pigment spot (x 650 approx.).

Fig. 7. *Sagitta setosa*, head and eye-pigment spot (x 650 approx.).

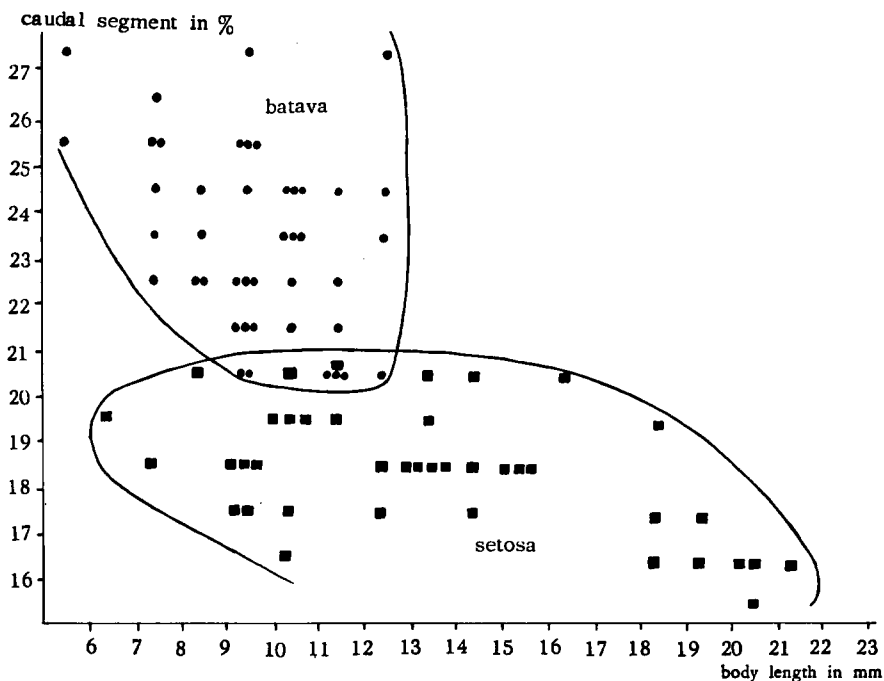
Fig. 8. *Sagitta setosa*, anterior and posterior teeth (x 275 approx.).

Fig. 9. *Sagitta bipunctata*, from Spaanse Water, Curaçao, anterior and posterior teeth (x 275 approx.).

Fig. 10. *Sagitta bipunctata*, from the Eastern Scheldt, anterior and posterior teeth (x 275 approx.).

Fig. 11. *Sagitta batava*, anterior and posterior teeth (x 275 approx.).

Fig. 12. *Sagitta batava*, anterior and posterior teeth, of a larger specimen (x 275 approx.).



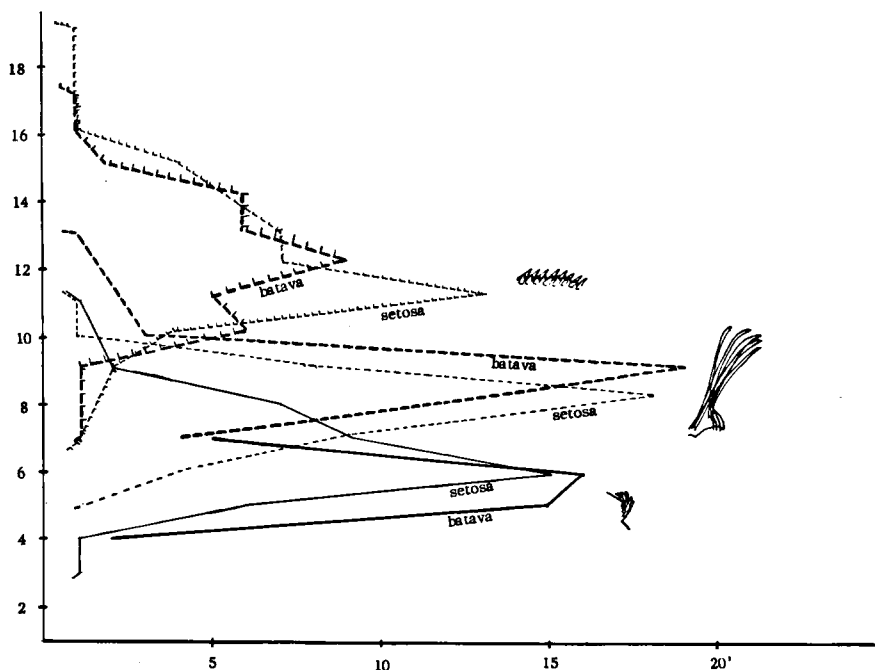
Graph 1. The relation between the total body-length and the length of the caudal segment in %, in *Sagitta batava* and *Sagitta setosa*.

represented in the graphs 1 & 2, together with the data of *S. batava*. A sample collected in the same way as the *S. setosa* samples and also from open water from the mouth of the Eastern Scheldt, the Roompot, proved to be almost completely composed of the new species, the specimens do not show any more affinity to *S. setosa* than the more neritic specimens.

From graph 1 it becomes evident that there is a distinct difference between the length of the caudal segment in the two species. The variation in armature of the species given in graph 2 shows only slight differences between the species. The difference in the number of hooks is perhaps the only significant one.

In the collections of the Zoological Museum in Amsterdam one slide was preserved with *S. bipunctata* from the Eastern Scheldt on which older references as those of van Breemen (1905) were based. This animal with a tail segment of 27% and an opening between the seminal vesicles and the posterior fin belonged to *S. bipunctata* and thus the older data on *S. bipunctata* may be correct. The population of *S. batava* must be a new population or no attention has been paid in the past to the differing animals. References to *S. setosa* in the Scheldt Estuary are not found in literature, so it is reasonable to suppose that *S. batava* was never recorded under the name *S. setosa*.

The area of *S. batava* in the Scheldt Estuary can be populated by *S. setosa*



Graph 2. The relation between the number of posterior teeth (above), the number of hooks (in the centre) and the number of anterior teeth (below) and the number of specimens, in *Sagitta batava* and *Sagitta setosa*, on y-axis.

from the North Sea as proved by one specimen collected together with *S. batava* off Klein Valkenisse.

The hydrography of the area has been described by Den Hartog (1961, 1963). The execution of the "Delta Works" induces important changes in the hydrographical conditions of the area, the geographical indication of the localities is therefore rather insignificant. The ecological characters of the area changed considerably since Den Hartog (1963) made his studies; the Eastern Scheldt, for example, has lost partially the euhaline characters.

S. batava was collected in the euhalinicum and polyhalinicum. In the euhalinicum the chlorinity is usually higher than 16.5 ‰; lower values are only measured exceptionally. The chlorinity of the locality "Nolledijk" in the euhalinicum dropped below 16.5 ‰ by incidental and temporary stronger flow of the river Scheldt. The polyhalinicum is characterized by average chlorinities between 16.5 and 10 ‰. The localities in the euhalinicum are: Westkapelle, Nolledijk, Beach near Dishoek and Beach near Klein Valkenisse, the other localities are of polyhaline character. The chlorinity of the biotope of *S. batava* varies between 10 and 16.5 ‰, the water temperature varies between -1.0° C (Dec. 1964) and 21.0° C (August 1965). The given minimum and maximum values of chlorinity and temperature may be incomplete; further studies on the ecology of the area may result in slightly different values, between which the environmental circumstances fluctuate.

Table II
The localities of *S. batava*

Type locality:

Off Zierikzee (Eastern Scheldt). Collected with Clark-Bumpus net, by Drs. C. Bakker,
Aug. 4, 1965, chlorinity 15.33 ‰, depth 40 m.

Other localities:

- Westbout (Eastern Scheldt, near Burgsluis-Schouwen),
Dec. 28, 1965, chlorinity 13.28 ‰, near surface.
- Nolledijk (Western Scheldt, near Flushing-Walcheren),
March 18, 1965, chlorinity 13.52 ‰, near surface.
- Nolledijk (Western Scheldt, near Flushing-Walcheren),
Jan. 12, 1966, near surface.
- Beach near Klein Valkenisse (Western Scheldt, near Zoutelande-Walcheren),
Jan. 21, 1965, near surface.
- Beach Dishoek (Western Scheldt, near Koudekerke-Walcheren),
Jan. 21, 1965, near surface.
- Pier near Anna Friso Polder (Eastern Scheldt — North Beveland),
Jan. 22, 1965, near surface.
- Off beach East Voorne (North Sea),
Aug. 22, 1964, chlorinity 9.86 ‰, temperature 15.0° C,
near surface.
- Westkapelle (North Sea between Eastern and Western Scheldt — Walcheren),
Jan. 21, 1965, near surface.
- Roompot (Eastern Scheldt — near Schouwen),
Feb., 1964, near surface.

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