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TAXONOMY OF THE CHAETOGNATHS OF THE BIGHT OF PANAMA

A redescription of *Sagitta pacifica* TOKIOKA, 1940, *Sagitta bedoti* BERANECK, 1895 and *Sagitta pulchra* DONCASTER, 1903.

by

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ABSTRACT

Confusions arising on the taxonomy of *Sagitta pacifica*, S. *bedoti* and S. *pulchra* are mainly the result of imprecise and subjective descriptions. A new modern account on two of the three species as they appeared in plankton samples collected off the colombian Pacific and the Bight of Panama is provided, including meristic and morphological information. For the third species S. *bedoti*, only the relevant meristic and morphometric information gathered is included since published accounts are adequate. It is hoped that this work will represent a contribution in future taxonomic and ecological studies on these species.

RESUMEN

Las confusiones que se observan en la taxonomía de *Sagitta pacifica*, S. *bedoti* y S. *pulchra* son principalmente el resultado de descripciones imprecisas y subjetivas. En el presente trabajo se provee una nueva y moderna descripción de dos de las tres especies tal y como ellas aparecen en muestras de plancton colectadas frente a la costa Pacífica colombiana y la ensenada de Panamá, incluyendo información tanto merística como morfológica. Para la tercera especie, S. *bedoti* se incluye solamente la información morfométrica que se considera puede ser útil, puesto que las descripciones ya publicadas son adecuadas. Se espera que este trabajo pueda representar una contribución en futuros trabajos taxonómicos y ecológicos de estas especies.

INTRODUCTION

Eighteen species of chaetognaths representing three genera have been identified from zooplankton samples taken off the colombian Pacific and the Bight of Panama.

The species *Sagitta hexaptera*, S. *enflata*, S. *neglecta*, S. *regularis*, S. *minima*, S. *bierii*, S. *bipunctata*, *Krohnitta subtilis*, K. *pacifica* and *Pterosagitta draco* are easily identified from adequate published accounts

ALVARIÑO, 1967; TOKIOKA, 1959; FURNESTIN, 1953, 1957, and require no further discussion. However, the taxonomy of closely similar species such as the *Sagitta ferox – robusta-americana* and the *Sagitta fridericiperuviana-euneritica* groups, deserve special attention and analysis. Our findings on these two groups are published elsewhere. In this account we are concerned with morphological and morphometric information gathered for the remaining three species, *Sagitta pacifica,* S. *bedoti* and S. *pulchra,* which will facilitate future comparisons.

MATERIALS AND METHODS

The chaetognaths were obtained from samples taken in 1969 along the colombian Pacific coast by the author with the assistance of students and technicians of the Biological Sciences Department of the Universidad del Valle; a standard ½ m net towed horizontally at 0 - 20 meters depth, 1 - 30 miles off the coast was used.

The ACENTO (Augmented Colombian El Niño Tuna Oceanography) Program samples collected in the Panama Bight by the Interamerican Tropical Tuna Commission in 1965 - 1966, provided also specimens of the three species (FORSBERGH, 1969).

All the samples utilized were preserved in 5% buffered formalin. The animals were sorted, mounted under coverslip and studied with the compound microscope. The morphometric information was recorded in milimetres and transformed to % total length for standarization.

The regression statistics were calculated using the predictive regression computer program given by SOKAL and ROHLF (1969).

Redescription of *Sagitta pacifica* TOKIOKA, 1940.

The presence of a fine serrulation on the hooks differentiate the species of the "serratodentata group" from most species of the genus *Sagitta.* The taxonomic status of the forms assigned to this group has been a matter of disagreement among the authors. FURNESTIN (1953) supported by morphological and ecological evidences, concluded that *Sagitta serratodentata atlantica* and S. *serratodentata tasmanica* are valid species. She proposed the following for the group:

Sagitta serratodentata KROHN, 1853.
Sagitta tasmanica THOMSON, 1947.
Sagita pacifica TOKIOKA, 1940.

TOKIOKA (1959) felt that the forms of the "serratodentata group" showed intergradation and are better treated as sub-species. He added a fourth entity to Furnestin's (1953) list: S. *serratodentata pseudoserratodentata* TOKIOKA, 1939, described from Japan.

BIERI (1959) in his ecological study of the Pacific chaetognaths, mentioned the presence of *Sagitta sp.* "serratodentata group". ALVARIÑO (1961), working with new material described this as S. *bierii,* adding a fifth member. She treated all members of the group as separate species.

The studies of FURNESTIN (1953, 1957), FAGETTI (1958) and ALVARIÑO (1961, 1967) indicate what appear to be distinctive features separating S. *serratodentata,* S. *tasmanica,* S. *pacifica* and S. *bierii.* However, the work so far done on these species is largely qualitative. Quantitative

studies of characters in population samples sufficiently large to permit statistical treatment of the variation observed is urgently needed.

Two members of the "serratodentata group" were found in our samples: S. *pacifica* and S. *bierii*. In the hope that in the near future material will be available for a comprehensive comparison of all five species, we are treating these two forms as species as suggested by ALVARIÑO (1961, 1967). Information on selected characters of S. *pacifica* only are included since the material available of S. *bierii* is too poorly preserved to permit a similar study.

Sagitta pacifica TOKIOKA, 1940.

Synonymy: see ALVARIÑO, A. 1967.

Diagnosis:

Head: small and elongated.

Buccal armature: hooks 5 - 8, usually 7, strong, fine serrulation not observed at 15X magnification; anterior teeth 5 - 13, usually 9, small, close together; posterior teeth 12 - 24, usually 17, and well separated.

Eyes: small, elongated along the longitudinal axis of body; lightly pigmented zone T-shaped (Pl. 1).

Neck: not very conspicuous.

Collerette: small around neck, extending as thin layer posteriorly to about half way between neck and ventral ganglion; collerette tissue present at ovopores and just anterior and posterior to seminal vesicles.

Corona Ciliata: begins at level of eyes, long and sinusoidal.

Trunk: translucent in juvenile individuals, becoming pink and opaque at maturity.

Gut: not vacuolized, no intestinal diverticulum.

Musculature: strong, preserved animals retain shape well.

Anterior Fins: completely rayed, rounded, starting at posterior end of ventral ganglion; always shorter than posterior fins (mean length 23,8% T. L., range 14,3 - 29,5% T. L., Table 1).

Posterior Fins: rounded, starting very close to anterior pair, with rayless zone along medial margin in front of ovopores extending anteriorly almost to anterior end; maximum laminar extension posterior to trunktail septum; always longer than anterior fins (mean length 27,3% T. L., range 20,9 - 32,4% T. L.); extent of posterior fins on trunk is greater than on caudal segment (11 exceptions in 237 individuals, Table 1).

Ovaries: filamentous in juveniles, at maturity almost filling space between gut and body wall (Pl. 1-a); eggs maximum diameter 0.015 mm, in one row, growth rapid ($b = 3.63348$, Table 2), elongating from mean length 9,3% T. L. at T. L. 7,0 - 7,5 mm to mean length 37,8% T. L. at T. L. 13,1 - 13,5 mm; ovaries occasionally reaching anteriorly as far as ventral ganglion.

Seminal Vesicles: triangular at maturity, separated from posterior fins by (0,1 - 0,2 mm) about $\frac{1}{8}$ length of seminal vesicle; separated from caudal fin by a distance equal to $\frac{1}{3}$ length of vesicle, filled with collerette tissue; spermatophore clearly defined, early stages showing

disc bearing a tuft of short filaments (Pl. 1-c) which are later replaced by 6 - 7 chitinous teeth (Pl. 1-d); vasa deferentia conspicuous at maturity.

Caudal Segment: mean length 23,6% T. L., range 21,0 - 29,6% T. L.; growing more slowly than rest of the body (b=0.91973, Table 2); ending in an acute angle.

Discussion:

Important diagnostic characters distinguishing the members of the "serratodentata group" have been summarized by ALVARIÑO (1967). Our observations on S. *pacifica* and S. *bierii* confirm her observations.

The posterior fins extend more on the trunk than on the caudal segment in S. *pacifica* and S. *bierii;* this character distinguishes these two species from the other two members of the group in which the posterior fins are more extended on the tail than on the trunk. A total of 9 specimens of S. *pacifica* out of a total of 237 examined, which proved exceptions to this rule appeared to have damaged fins.

S. *pacifica* has triangular seminal vesicles, each bearing an anteriolateral lid or cap provided with 6-7 chitinous teeth; S. *bierii* has pear-shaped seminal vesicles with a rounded prominence at the top (see ALVARIÑO, 1961).

S. *pacifica* has a rayless zone along the internal margin of the posterior fin that extends from the ovopores to almost the anterior end of the posterior fins. S. *bierii* has no rayless zone on the posterior fins.

S. *serratodentata,* S. *tasmanica* and S. *pseudoserratodentata* are separated by the structure of the seminal vesicles. S. *serratodentata* has two prominences or horns at the anterolateral corner (FURNESTIN, 1957); and S. *tasmanica* has the anterior end of the seminal vesicles covered by numerous soft protuberances or papillae.

S. *serratodentata* has a small rayless zone at the anterior end of the anterior fins. S. *tasmanica* and S. *pseudoserratodentata* have anterior fins completely rayed.

Sagitta bedoti BERANECK, 1895.

S. *bedoti* has a confused taxonomic history (see Doncaster 1903), and descriptive accounts contain some contradictions. For example the length of the posterior fin is given as "about the same length as the anterior" according to Fowler (1906), while Michael (1911, 1919) states that the anterior fin is longer than the posterior.

TOKIOKA (1942) recorded two entities, in Japanese waters: a big form which he called S. *bedoti* BERANECK, 1895 (T. L. up to 30 mm); and a smaller form (T. L. ca. 13,0 mm) from the tropical western Pacific and also Indian Ocean, which he named S. *bedoti-f-minor.* ALVARIÑO (1967) restudied a population of S. *bedoti-f-minor* from the tropical South China Sea and concluded that it was synonymous with S. *bedoti* BERANECK, 1895. The bigger form, which occurs in the north Pacific in general, she described as a new species, *Sagitta nagae* ALVARIÑO, 1967.

Meanwhile, TOKIOKA and PATHANSALI (1965) described a new form, S. *bedoti-f-littoralis,* from the waters off Penang, Malasya. DALLOT

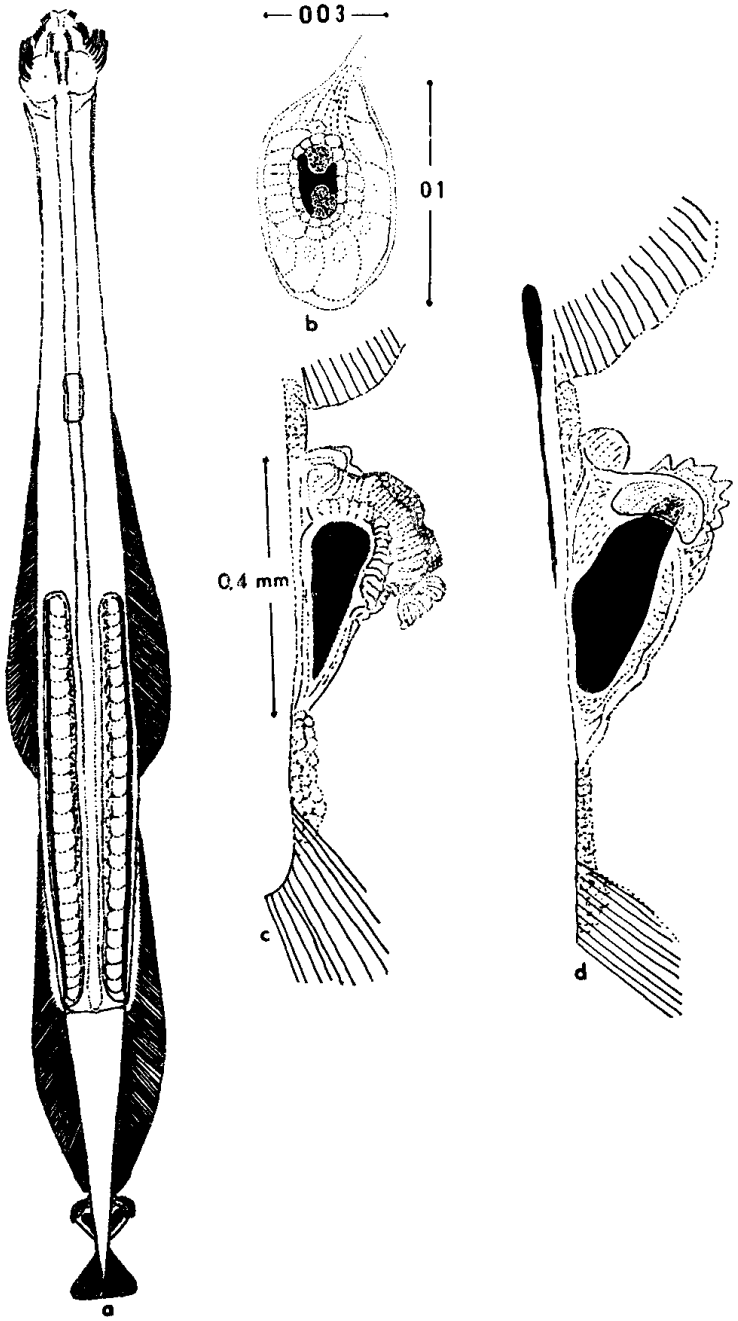

Plate 1. *Sagitta pacifica* Tokioka, 1940.

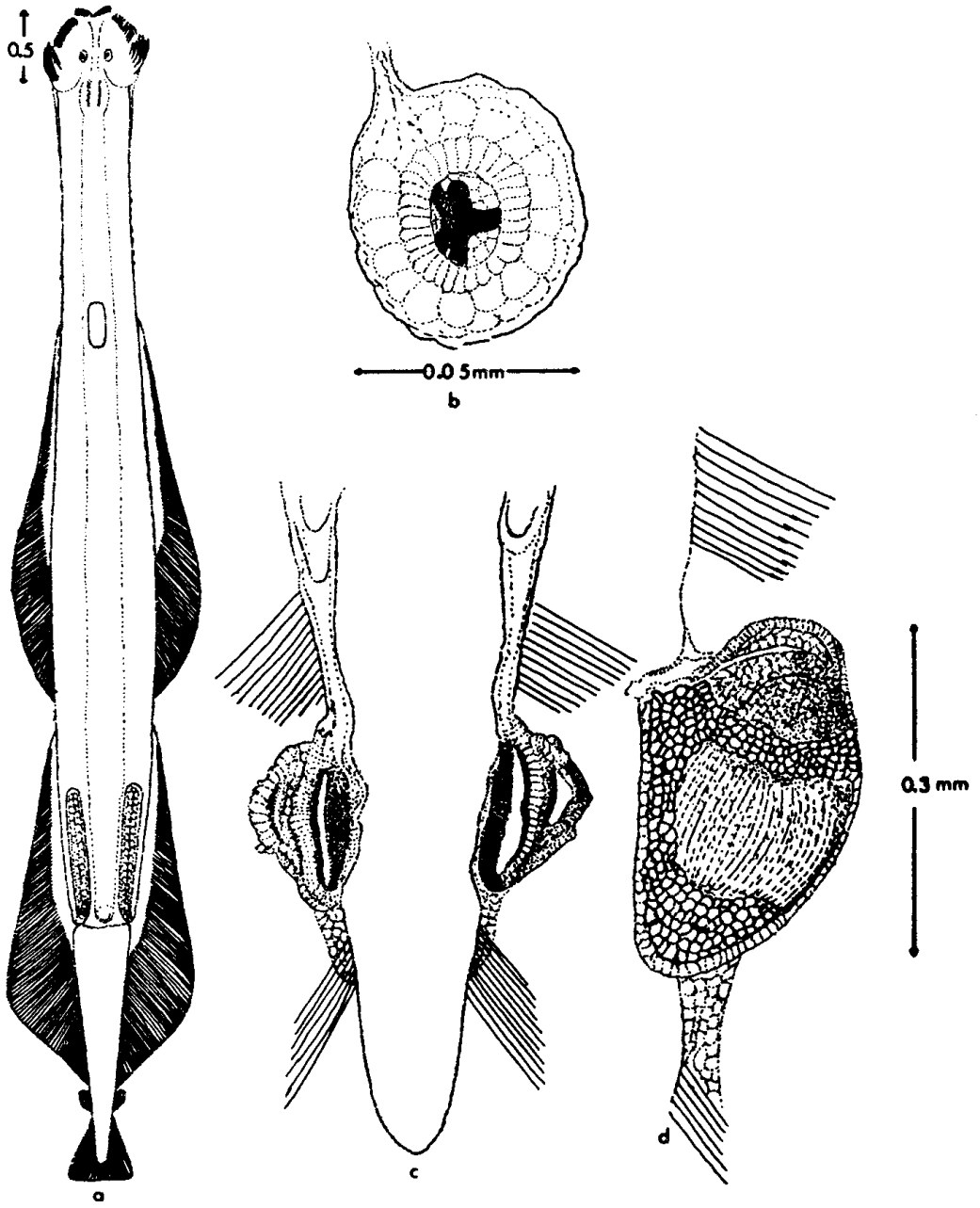

Plate 2. *Sagitta bedoti* BERANECK, 1895.

and LAVAL (1974) have now concluded that this is a distinct species which they have named *Sagitta littoralis* DALLOT and LAVAL, 1974.

Only S. *bedoti* BERANECK, 1895, appeared in our samples. This species, in the eastern tropical Pacific, shows little variation as is evident from the very similar descriptions given by TOKIOKA (1959), SUND (1959) and ALVARIÑO (1963). These descriptions fit the colombian Pacific population very well but suffer of a lack of quantification in the most important morphological characteristics. To facilitate future identifications and statistical comparisons with other populations only morphological and morphometric information on the colombian population is given in Plate 2 and Tables 3 and 4.

Sagitta pulchra DONCASTER, 1903.

This species, originally described by DONCASTER (1903) from the Indian Ocean, has been redescribed from the west Pacific by fowler (1906), MICHAEL (1911, 1919), BURFIELD and HARVEY (1926), TOKIOKA (1942), THOMSON (1947) and ALVARIÑO (1967). It has been described from the west Indian Ocean by FURNESTIN and RADIGUET (1964), and from the eastern tropical Pacific by SUND (1959).

A description of the species as found in the Colombian Pacific is presented here:

Diagnosis:

Head: small, wider than long.

Buccal Armature: hooks 5 - 9, usually 7, thin, slender, curved at distal tip; anterior teeth 5 - 9, usually 8, short, close together; posterior teeth 5 - 16, usually 11, short, close together.

Eyes: small, slightly oval, closer together than to sides of head, pigmented area resembling a five-pointed star (Plate 3).

Neck: almost as wide as head.

Collerette: well developed, extending posteriorly to anterior end of anterior fins.

Corona Ciliata: starting at level with eyes, straight, short, extending posteriorly over the trunk 1 - 1,5 times length of head.

Trunk: transparent, becoming opaque at maturity.

Gut: simple, no intestinal diverticulum.

Musculature: weak, though animals still retain shape after preservation.

Anterior Fins: starting at middle of ventral ganglion, longer than posterior fins (mean length 34,6% T. L., range 26,7 - 39,5% T. L.), rayless zone very distinctive in extent and form (Pl. 3-a).

Posterior Fins: triangular, starting close to anterior pair as fine rayless lamella extending posteriorly to a level just below trunk tail septum (Pl. 3-a); maximum laminar extension posterior to trunk-tail septum; extending more on trunk (3/5) than on caudal segment (2/5); mean length 24,4% T. L., range 20,8 - 28,1% T. L. (Table 5).

Seminal Vesicles: small, elongated, structure close to "*bedoti*" type (see Dallot and Laval, 1974); slightly separated from posterior fins, united to caudal fin by bridge of collerette tissue.

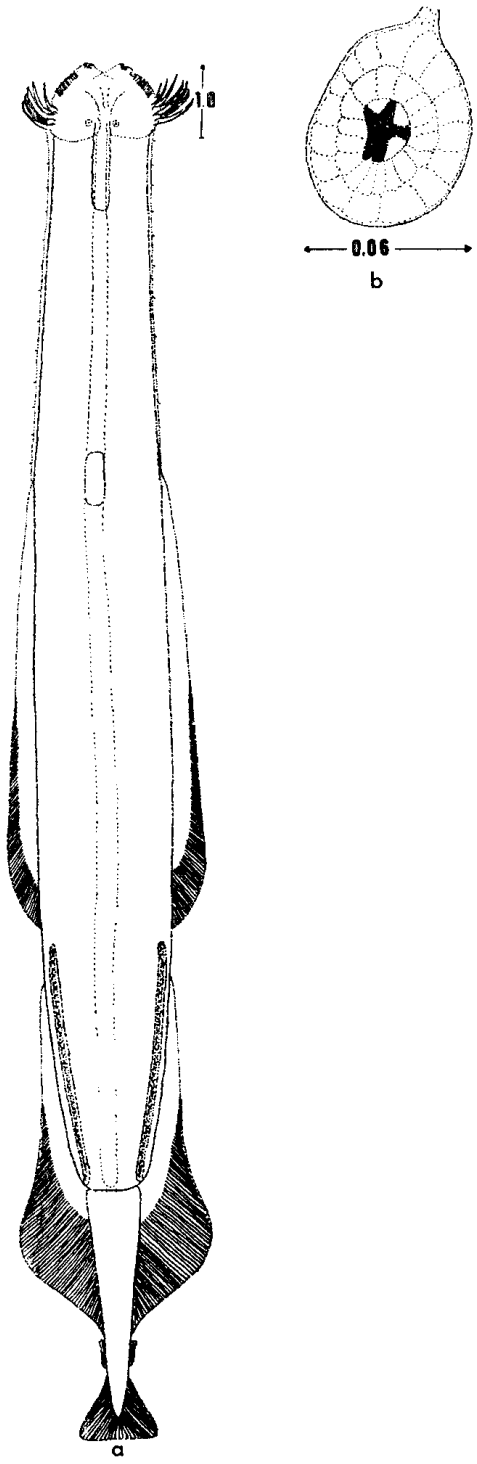

Plate 3. *Sagitta pulchra* DONCASTER, 1903.

Ovaries: slender, small eggs arranged in two or three rows visible only laterally; reaching anteriorly to level of ventral ganglion at maturity (mean maximum Lov 60% T. L.).

Caudal Segment: mean length 18,6% T. L., range 15,8 - 22,7% T. L.; enlarging less rapidly than rest of body with growth (regression C. S. vs. T. L., b=0.66535, Table 6).

Discussion:

The general morphology of the colombian Pacific population of S. *pulchra* is almost as described by FOWLER (1906), MICHAEL (1919), SUND (1959) and ALVARIÑO (1967). The most important characters for diagnosing this species population are:

— A distinctive rayless zone is characteristic of both pairs of lateral fins. The anterior fin have complete rays on the posterior 1/9 of their length (Pl. 3). The posterior fin has a rayless zone extending from a level posterior to the ovopores to the anterior end of the fins.

— The body wall is thin and transparent or semitransparent; body width is almost uniform from the base of the head to a distance close to the trunk-tail septum, where the body begins to narrow rapidly (Pl. 3-a).

— The length of the caudal segment is relatively short for colombian specimens (range 15,8 - 22,7% T. L., Table 5); 18,0 - 27,0% T. L. based on other authors: MICHAEL (1919), SUND (1959) and ALVARIÑO (1967).

— That anterior fins are longer than the posterior fins (see Table 5 for data).

— The collerette is prominent extending from the base of the head to the anterior end of the anterior fin (Pl. 3). On this respect, colombian specimens do not agree with published information since all the authors mentioned above found a short collerette. However, it must be recalled that the collerette may be easily damaged and this sole difference does not justify erecting a new species for the colombian specimens.

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TABLE 1

N	T. L. mm	Hooks	A. T	P. T.	A. F. % T. L.	P. F. % T. L.	Lov % T. L.	C. S. % T. L.	T/C x 100
4	7.0- 7.5	6-8	5-9	12-14	14.3-20.5-24.7	26.0-26.6-27.1	5.3- 9.3-15.7	23.3-25.0-28.6	107.4
2	7.6- 8.0	6-7	4-6	12-14	24.5	28.6-29.0-29.5	6.2- 9.2-24.4	23.1-24.2-25.6	97.9
18	8.1- 8.5	6-7	5-9	12-16	18.5-23.0-28.2	24.7-27.8-29.8	5.8-10.5-21.2	22.4-25.0-29.6	103.7
29	8.6- 9.0	6-7	4-9	12-18	18.4-23.5-26.7	20.9-26.6-29.0	6.2-11.3-36.8	22.7-23.6-25.6	103.7
39	9.1- 9.5	6-7	5-12	12-18	21.7-23.6-29.5	25.2-27.2-29.7	6.3-13.5-28.3	21.2-23.5-25.3	103.7
31	9.6-10.0	6-7	5-11	12-23	20.6-23.4-25.5	24.5-26.7-29.2	6.0-15.2-30.6	21.0-23.3-25.5	103.5
23	10.1-10.5	6-7	6-11	14-23	17.3-22.8-25.2	24.0-26.8-32.4	7.8-17.8-61.2	21.0-22.7-24.3	107.4
14	10.6-11.0	6-7	7-9	15-19	23.2-24.8-26.6	26.2-27.4-28.9	9.3-18.1-36.4	22.0-22.8-25.9	105.9
17	11.1-11.5	5-7	6-11	17-21	21.9-24.3-26.6	26.1-27.4-29.2	9.6-19.9-40.9	22.3-23.5-26.1	111.1
29	11.6-12.0	6-7	9-11	18-22	23.1-24.7-26.7	25.2-27.3-28.3	9.4-20.4-35.3	22.2-23.5-24.6	105.8
12	12.1-12.5	6	8-10	22	22.4-23.9-24.7	25.0-27.2-28.9	20.0-27.8-41.3	22.6-23.7-24.8	106.5
12	12.6-13.0	6	8-11	20-22	23.8-24.9-25.8	26.2-27.0-29.4	12.7-27.1-42.9	21.4-23.3-24.0	111.8
7	13.1-13.5	6	11-13	20-24	21.4-24.9-26-7	25.2-27.7-28.2	28.1-37.8-41.4	22.2-22.6-22.9	112.2
	mean	—	—	—	23.8	27.3	—	23.6	106.2
	range	5-8	5-13	12-24	14.3-29.5	20.9-32.4	5.3-61.2	21.0-29.6	97.9-112.2
	mode	7	9	17	—	—	—	—	—

Table 1. Meristic and morphometric characteristics of *Sagitta pacifica* TOKIOKA 1940, from Colombian Pacific coast. T. L., total length (mm); Hooks, number per side; A. T., number of anterior teeth per side; P. T., number of posterior teeth per side; A. F., length of anterior fins (% T. L.); P. F., length of posterior fins (% T. L.); Lov, length of the ovaries (% T. L.); C. S., length of caudal segment (% T. L.); T/C × 100, ratio of length of posterior fins on trunk region over length of posterior fins on caudal segment. Numbers-in-series represent Min-*Mean*-Max. N-237.

TABLE 2

Y	N	n_i	r	b	a	t_s	Level of significance
Length of C. S.	270	59	0.9780	0.91973	—0.54951	6.47	+++
Length of ovaries	259	58	0.8859	3.63348	—3.46413	5.64	+++
Length of A. F.	237	56	0.9513	1.20646	—0.83188	4.98	+++
Length of P. F.	236	56	0.9838	1.01528	—0.58394	7.96	+++
Length, P. F. on trunk	236	55	0.9649	1.06905	—0.92680	5.52	+++
Length, P. F. on C. S.	239	55	0.9775	0.94956	—0.83116	6.50	+++

Table 2. Regression statistics (on total length) for six morphometric characters of *Sagitta pacifica* TOKIOKA, 1940. All measurements in mm transformed to logarithms. P. F., posterior fin; C. S., caudal segment; Y, dependent variable; N, number of individuals examined; n_i, number of size classes (groups); r, correlation coefficient; b, regression coefficient; a, intercept with the Y-axis; t_s, Student t. H°: $\beta = 0$. +++, $>$ P(0.001).

TABLE 3

N	T. L. mm	Hooks	A. T.	P. T.	A. F. % T. L.	P. F. % T. L.	Ovaries % T. L.	C. S. % T. L.	T/C x 100
2	6.0- 6.5	6	10	22	30.8-*31.5*-32.3	26.6-*27.0*-27.4	—	22.6-*23.0*-23.3	*100.0*
2	6.6- 7.0	6	11	23	31.4-*22.6*-33.8	26.4-*26.8*-27.1	—	22.1-*22.5*-22.9	*100.0*
6	7.1- 7.5	6-7	6-7	10-18	30.7-*31.5*-34.2	25.3-*26.4*-28.8	4.0- *8.4*-12.2	21.9-*23.0*-24.0	*105.3*
12	7.6- 8.0	6	9	22	28.8-*32.1*-34.2	25.0-*27.0*-30.4	6.8-*12.9*-28.4	22.3-*22.2*-25.0	*101.7*
12	8.1- 8.5	7	10	31	30.9-*32.7*-34.1	26.8-*27.8*-29.4	5.2-*11.6*-24.1	20.7-*22.9*-24.4	*101.5*
24	8.6- 9.0	7-8	8-12	19-22	27.6-*31.7*-34.8	23.0-*27.0*-27.9	4.4-*11.1*-16.3	20.9-*22.2*-24.1	*100.0*
27	9.1- 9.5	6-8	6-11	19-23	26.4-*30.9*-40.2	23.2-*26.7*-32.6	3.3- *8.4*-20.7	20.4-*22.6*-26.3	*100.0*
27	9.6-10.0	6-7	7-11	19-26	26.5-*30.4*-33.7	20.6-*25.6*-29.2	5.1- *7.9*-25.0	20.0-*22.2*-24.0	*100.0*
16	10.1-10.5	6-7	10-11	22-26	25.7-*31.3*-35.2	21.9-*26.8*-28.7	4.9- *6.0*- 9.5	20.6-*22.0*-23.3	*107.1*
18	10.6-11.0	6	8-12	21-26	29.9-*32.2*-34.5	22.2-*26.7*-31.2	4.6- *7.2*-15.9	20.9-*22.1*-23.1	*106.3*
23	11.1-11.5	6-8	9-10	18-27	28.1-*32.1*-34.5	26.1-*27.1*-29.6	6.9-*10.7*-21.6	18.9-*22.0*-23.5	*113.3*
21	11.6-12.0	6-7	9-14	22-27	29.0-*32.0*-37.5	25.2-*27.2*-30.0	6.7-*14.9*-31.1	20.5-*22.4*-25.0	*100.0*
12	12.1-12.5	6-7	10-13	21-26	29.8-*31.5*-33.6	24.8-*27.1*-28.2	8.2-*16.5*-20.5	20.8-*21.9*-23.4	*108.7*
6	12.6-13.0	7	11	25	32.3-*34.5*-36.4	22.8-*26.9*-29.7	7.8-*19.5*-25.2	21.3-*22.9*-24.2	*120.0*
4	13.1-13.5	7	10	26	30.3-*31.6*-32.8	26.5-*26.9*-27.6	11.4-*15.3*-22.4	19.4-*20.5*-22.4	*101.9*
4	13.6-14.0	7	12	26	31.9-*32.4*-33.6	26.3-*27.3*-27.7	14.5-*20.5*-26.5	20.4-*21.1*-21.9	*109.9*
	mean	—	—	—	*31.9*	*26.9*	—	*22.2*	*105.1*
	range	6-8	6-14	10-27	25.7-40.0	20.6-30.4	—	18.9-26.3	100.0-126.0
	mode	7	10	22	—	—	—	—	—

Table 3. Meristic and morphometric characteristics of *Sagitta bedoti* BERANECH, 1895, from the Colombian Pacific coast. T. L., total length (mm); Hooks, number per side; A. T., number of anterior teeth per side; P. T., number of posterior teeth per side; A. F., length of anterior fins (% T. L.); P. F., length of posterior fins (% T. L.); Lov, length of the ovaries (% T. L.); C. S., length of caudal segment (% T. L.); T/C × 100, ratio of length of posterior fins on trunk region over length of posterior fins on caudal segment. Numbers-in-series represent Min-*Mean*-Max. N = 216.

TABLE 4

Y	N	n_i	r	b	a	t_s	Level of significance
Length of C. S.	216	62	0.9883	0.92558	—0.57964	8.88	+++
Length of ovaries	194	57	0.6975	2.95996	—2.99374	3.13	++
Length of A. F.	186	60	0.9781	1.05252	—0.55041	6.93	+++
Length of P. F.	189	60	0.9671	1.06118	—0.63264	5.68	+++
Length, P. F. on trunk	189	60	0.9391	1.18722	—1.05601	4.41	+++
Length, P. F. on C. S.	189	60	0.9504	0.98236	—0.86075	4.45	+++

Table 4. Regression statistics (on total length) for six morphometric characters of *Sagitta bedoti* BERANECK, 1895, from the Colombian Pacific. All measurements in mm transformed to logarithms. P. F., posterior fin; C. S., caudal segment; Y, dependent variable; N, number of individuals examined; n_i, number of size classes (groups); r, correlation coefficient; b, regression coefficient; a, intercept with the Y-axis; t_s, Student t. H°: $\beta = 0$. ++, $>$ P (0.01). +++, $>$ P (0.001).

TABLE 5

N	T. L. mm	Hooks	A. T.	P. T.	A. F. % T. L.	P. F. % T. L.	Ovaries % T. L.	C. S. % T. L.	T/C x 100
1	7.5	7	9	16	26.7	24.0	4.0	22.7	80.0
2	9.1-10.0	6	5-8	11-12	30.4-32.9-35.5	25.8-25.9-26.1	0.0	25.5-21.6-21.7	100.0
1	10.4	6	9	11	33.7	23.1	4.8	21.2	118.0
3	11.1-12.0	5.7	6-8	10-12	31.7-33.4-34.2	24.1-24.7-25.8	5.2- 5.9- 6.7	19.2-20.5-21.7	123.0
4	12.1-13.0	6-7	5-8	9-14	30.0-34.7-36.8	24.8-25.3-25.5	6.9- 8.3-11.5	18.6-19.5-20.8	128.0
3	13.1-14.0	5-7	5-7	9-11	33.8-35.3-36.3	22.9-24.8-25.7	5.2- 6.8- 8.6	18.6-18.9-19.9	126.0
5	14.1-15.0	6-7	6-8	9-16	31.9-34.3-38.7	23.5-24.5-26.7	8.7-12.0-14.9	16.8-17.9-18.7	126.0
5	15.1-16.0	5-9	5-9	5-13	35.6-36.3-38.8	25.0-26.0-28.1	11.8-15.9-36.3	17.5-18.8-19.3	153.0
3	16.1-17.0	6-7	5-7	11	33.5-35.3-37.1	22.4-24.5-25.7	17.9-19.3-20.6	17.6-17.9-18.2	148.7
8	17.1-18.0	5-9	6-9	10-13	27.0-34.5-39.5	20.7-23.6-26.6	13.2-20.4-24.4	16.7-17.1-17.8	132.5
1	19.0	6	8	12	36.8	23.7	44.7	15.8	200.0
1	20.0	6	7	11	37.5	25.0	60.0	16.5	150.0
1	21.0	7	6	11	35.2	23.3	34.8	16.2	157.0
1	21.7	5	8	10	35.9	23.9	38.7	17.1	135.0
1	22.2	6	5	9	36.7	23.4	47.3	16.7	160.0
	mean	—	—	—	34.6	24.4	—	18.6	135.8
	range	5-9	5-9	5-16	26.7-39.5	20.7-28.1	4.0-60.0	15.8-22.7	80.0-200.0
	mode	7	8	11	—	—	—	—	—

Table 5. Meristic and morphometric characteristics of *Sagitta pulchra* DONCASTER, 1903, from the Colombian Pacific coast. T. L., total length (mm); Hooks, number per side; A. T., number of anterior teeth per side; P. T., number of posterior teeth per side; A. F., length of anterior fins (% T. L.); P. F., length of posterior fins (% T. L.); Lov, length of the ovaries (% T. L.); C. S., length of caudal segment (% T. L.); T/C × 100, ratio of length of posterior fins on trunk region over length of posterior fins on caudal segment. Numbers-in-series represent Min-*Mean*-Max. N = 40.

TABLE 6

Y	N	n_i	r	b	a	t_s	Level of significance
Length of C. S.	42	30	0.9833	0.66535	—0.34065	6.32	+++
Length of ovaries	38	27	0.9535	4.09800	—4.51861	9.39	+++
Length of A. F.	41	29	0.9728	1.21972	—0.71629	6.69	+++
Length of P. F.	41	29	0.9763	0.97806	—0.58063	6.42	+++
Length P. F. on trunk	41	29	0.9686	1.24478	—1.13017	6.49	+++
Length P. F. on C. S.	41	29	0.9375	0.71866	—0.65597	3.39	++

Table 6. Regression statistics (on total length) for six morphometric characteristics of *Sagitta pulchra* DONCASTER, 1903. All measurements in mm transformed to logarithms. P. F., posterior fin; C. S., caudal segment; Y, dependent variable; N, number of individuals examined; n_i, number of size classes (groups); r, correlation coefficient; b, regression coefficient; a, intercept with the Y-axis; t_s, Student t. H°: $\beta = 0$. ++, $>$ P (0.01). +++, $>$ P (0.001).