NOTAS SOBRE LA ABUNDANCIA Y DISTRIBUCION DE CHAETOGNATHA EN LAS AGUAS DEL ORIENTE DE VENEZUELA

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R E S U M E N

Con la finalidad de determinar las especies de quetognatos existentes en el Golfo de Cariaco, Fosa de Cariaco y cercanías de la Isla de Margarita, se analizaron las muestras recogidas en estos lugares, con el resultado de que fueron identificadas diez especies. Esas especies son las siguientes: *Sagitta hispida, S. helenae, S. tenuis, S. enflata, S. bipunctata, S. serratodentata, S. hexaptera, S. decipiens, Krohnitta pacifica* y *Pterosagitta draco.* Las observaciones hechas fueron las siguientes:

1. Los especímenes de *S. hispida* tenían la vesícula seminal cerca de las aletas posterior y caudal. Se combinaron los contajes de *S. helenae* y *S. hispida* debido a dificultades existentes en la identificación de estas dos especies.

2. Los valores TC para los especímenes de *Sagitta tenuis* se clasificaron entre 61.1 y 70.0.

3. La *S. serratodentata* tenía una aleta anterior completamente rayada mientras en otros puntos la aleta se mostraba parcialmente rayada.

4. Algunas *Krohnitta pacifica* ya se encontraban en estado adulto con el tamaño de 4.6 mm., lo que significa un tamaño pequeño para esta especie.

5. Los quetognatos que con más frecuencia se encuentran en la región de Cariaco son los siguientes: *S. hispida* y *S. helenae* (que se encontraron a razón de 62.9%), *S. tenuis* (24.3%), *K. pacifica* (8.2%) y *S. enflata* (1.1%).

6. En la superficie, durante el día, las mismas cinco especies totalizaron el 96.5% de todos los quetognatos recogidos. En la recolección de muestras del fondo hacia la superficie, el porcentaje de las mismas especies subió hasta 94.1%.

7. Las especies que se recogieron en la Fosa de Cariaco, con la exclusión del Golfo, fueron las siguientes: *Sagitta serratodentata, S. bipunctata, S. decipiens* y *Pterosagitta draco*. Aparentemente, las diferencias de temperatura es un factor importante en la ausencia de estas especies del Golfo.

8. En las afueras de la Isla de Margarita, la captura de quetognatos fue la siguiente: 67.9% a 50-0m., 22.3% a 100-50m. y 9.8% a 300-100m. En todos los sectores, los especímenes de *S. enflata* eran los más abundantes. La *S. tenuis* estaba limitada a los 50 metros superiores, la *K. pacifica* muy rara debajo de 50m., la *S. bipunctata* debajo de 50m., la *S. hexaptera* debajo de 100m., y la *S. serratodentata* entre 100 y 50m.

CONTENTS

CHAETOGNATHA OF EASTERN VENEZUELAN WATERS, WITH NOTES ON THEIR ABUNDANCE AND DISTRIBUTION

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ABSTRACT

This is a contribution towards the knowledge of the chaetognath fauna of the coastal waters of Eastern Venezuela. Investigations of the composition, abundance and distribution of the chaetognath communities within the Gulf of Cariaco and the Cariaco Trench were carried out in 1960. Studies were also made on some samples from waters off Margarita Island. Ten species have been identified and the abundance and distribution of each of these is shown. Five species were abundant: *Sagitta hispida, S. helenae, S. tenuis, S. enflata* and *Krohnitta pacifica.* Other species were rare in the collections. The chaetognath community was richer in species in the Cariaco Trench than in the Gulf of Cariaco.

INTRODUCTION

It has been established that chaetognaths are usually associated with a specific hydrographical environment that makes them good indicators of hydrographical conditions. Such studies have been carried out in many parts of the world and results have demonstrated that their reactions to variations in salinity and temperature are clear cut.

In order to make such studies possible, it is necessary to know the taxonomic characteristics of the various species, to locate their area of abundance, their life cycle and the hydrographical conditions of their habitat.

As a preliminary step in that direction, an investigation of the zooplankton of Eastern Venezuela was undertaken by the Institute of Oceanography of the University of Oriente, at Cumaná. The vessel "Guaiqueri" was made available and cruises were made in the Gulf of Cariaco, the Cariaco Trench and off Margarita Island.

MATERIALS AND METHODS

The data presented in this paper are based on plankton collections taken in the Gulf of Cariaco, the Cariaco Trench and off Margarita Island.

In the Gulf and Trench of Cariaco ten stations (Fig. 1) were visited once a month from May to November 1960 (Table I). At the ten stations, a vertical plankton haul was taken from bottom to surface and a 15-minute horizontal haul was made at surface. A detailed study of all chaetognaths was only made on the samples from the first cruise (May 17-18). Collections from other cruises were examined for the possible occurrence of undescribed species.

On June 6, 1960, two stations were occupied in the Caribbean off Margarita Island (Fig. 1). One station was located at Lat. 11°23'18"N., Long. 64°30'00"W. and daytime tows were made at various levels (Table I). The other station was located at Lat. 11°43'00"N., Long. 63°13'00"W. and a 15-minute night tow was made at the surface (Table I).

The samples were analysed in the laboratory with a binocular microscope using a 40 x magnification. An aliquot of 5 cc was used in analysing the horizontal surface hauls. All species descriptions and plates were made from preserved material in 5% formalin. The descriptions are not intended to be exhaustive, as further details are described in the standard monographs on the subject. The works of Fraser (1952, 1957), Owre (1960), Pierce (1951), Tokioka (1955), Trégouboff and Rose (1957) and Vannucci and Hosoe (1952, 1956) were used for identification.

TABLE II. Chaetognatha, Gulf and Trench of Cariaco, May 17 and 18, 1960. TABLA II. Chaetognatha, Golfo y Fosa de Cariaco, mayo 17 y 18, 1960.

Station (Est.)	Depth of haul (Prof. de remolque)	Time (Hora)	Temp. O°C.	Salinity (Salinidad) 0/00	Oxygen (Oxygeno) mg/1	S. hispida S. helenae no.	S. enflata no.	S. tenuis no.	K. pacifica no.	S. serratodentata no.	S. hexaptera no.	S. bipunctata no.	S. decipiens no.	P. draco no.	Others no.
A	65-Om	0655	23.54	36.65	3.29	1	3	2	7	—	—	—	—	—	1
	surface	0714-0729	26.6	36.92	—	1500	100	1020	500	—	—	—	—	—	—
B	30-Om	0835	23.30	36.83	2.86	14	4	—	8	—	—	—	—	—	—
	surface	0848-0903	26.5	36.92	—	350	—	—	100	—	—	—	—	—	150
C	75-Om	0753	21.21	36.69	0.00	—	—	—	2	—	—	—	—	—	—
	surface	0812-0827	26.5	36.89	—	500	—	—	100	—	—	—	—	—	—
D	64-Om	1030	22.10	36.78	0.95	—	—	1	—	—	—	—	—	—	—
	surface	1046-1101	26.4	36.89	—	8000	—	800	500	—	—	—	—	—	—
E	35-Om	1217	24.56	36.69	2.97	1	—	—	—	—	—	—	—	—	—
	surface	1232-1247	26.0	36.76	—	—	50	1700	—	—	—	—	—	—	—
F	12-Om	1420	25.78	36.78	4.27	—	—	—	—	—	—	—	—	—	—
	surface	1430-1445	26.3	36.87	—	200	11	200	—	—	—	—	—	—	—
G	45-Om	1547	22.42	36.85	0.05	—	1	1	—	—	1	—	—	—	1
	surface	1613-1628	26.4	36.83	—	1000	6	650	10	—	—	—	—	—	—
H	50-Om	1004	22.54	36.87	0.95	4	2	—	—	—	—	—	—	—	—
	surface	1016-1031	26.6	36.83	—	250	10	50	—	—	—	—	—	—	500
I	40-Om	1152	23.51	36.91	3.18	2	—	2	4	—	—	—	—	—	—
	surface	1206-1221	26.6	37.00	—	200	4	100	300	—	—	—	—	—	—
K	300-Om	1418	19.28	36.58	2.23	4	30	34	6	1	—	2	2	1	—
	surface	1459-1514	26.1	36.45	—	150	—	150	50	—	—	—	—	—	—

Hydrographical data from Gade (1961); (Datos hidrográficos de Gade (1961).

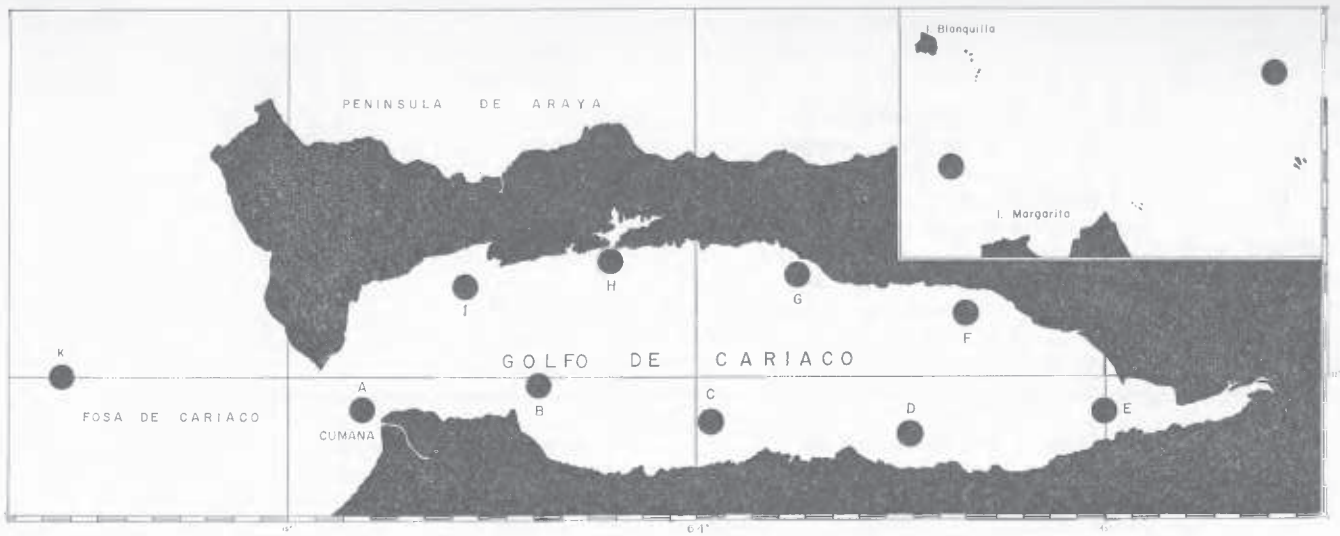

FIG. 1 Stations occupied during the Cariaco cruises in 1960. The insert shows the location of the stations occupied off the Island of Margarita.

FIG. 1. Estaciones ocupadas durante las campañas del Golfo de Cariaco en 1960. La inserción muestra la localización de las estaciones ocupadas afuera de la Isla de Margarita.

TABLE I. Table of materials and methods.

TABLA I. Tabla de materiales y métodos.

Cruises (Campañas)	Date (Fecha)	Stations occupied (Estaciones ocupadas)	Frequency of cruises (Frecuencia de las campañas)	Tows (muestras) Day (Día)	Night (Noche)	Depth of tows (m) (Profundidad de los remolques)	Time of tows (Tiempo de los remolques) min.	Kinds of nets (Tipos de redes)
Cariaco project (Proyecto de Cariaco)	May to Nov. 1960 (mayo a nov. 1960)	10	Monthly (mensual)	132	—	One vertical from bottom to surface; one horizontal at surface (Una muestra vertical del fondo a la superficie; una muestra horizontal en la superficie)	Few for the vertical; 15 for the horizontal (Pocos min. para el vertical; 15 - min. para el horizontal)	For vertical: ½m #0, ½m #20; For horizontal: ½m #0, ½m #10, ½m #3.
Off Margarita Is. (Afuera de Margarita)	June 1960 (junio 1960)	2	One cruise (una campaña)	4	1	300 - 100; 100 - 50; 50 - 0; surface (2)	"	For vertical: ½m #0 closing; For horizontal: ½m #20.

NOTES ON IDENTIFICATIONS

Sagitta hispida Conant, 1895
(Plate 1)

S. hispida is a stout rigid species with prominent lateral muscles. The anterior fin reaches to the ventreal ganglion, is completely rayed and elongated. The posterior fin is longer than the anterior fin, completely rayed and reaches to the seminal vesicles. More than half the posterior fin lies on the caudal segment. The head is large and armed with 5-7 hooks on each side. The anterior teeth vary from 5 to 9 on each side and the posterior teeth from 8 to 13. The eyes are bean-shaped. The collarette is prominent and reaches to two-thirds the distance between the neck and the ventral ganglion. The caudal segment occupies 28.5 to 33.8% of the total body length in animals 6.5 to 11.9mm. The wedge-

Body length (mm)+	Caudal segment (%)	Hooks	Anterior teeth	Posterior teeth
—	—	6-6	7-7	9-9
6.5	33.8	6-6	5-5	8-8
6.6	31.8	6-7	6-6	8-8
6.9	33.3	7-6	6-6	9-9
7.2	30.5	7-7	6-6	9-9
7.3	31.5	7-7	6-6	8-9
8.0	30.0	6-7	6-6	8-8
8.0	31.2	7-7	6-6	10-10
8.2	32.9	6-6	5-5	9-9
9.6	33.4	6-6	6-6	12-11
10.1	31.6	5-6	5-5	10-10
11.9	28.5	7-7	8-9	12-13

+ Length measurements include the caudal fin.

shaped seminal vesicles are located immediately behind the posterior fin and extend close to the caudal fin. Tokioka (1955) showed in this species, seminal vesicles located just behind the posterior fin and separated by half the length of the vesicle from the caudal fin. This distance varies from half the length of the vesicle to almost no distance at all in our specimens. In most cases, the seminal vesicles taper before reaching the caudal find and then extend in a thin line to the caudal fin.

Sagitta helenae Ritter-Záhony, 1910

Some specimens believed to be slightly different from *S. hispida* were sent to Dr. A. Alvariño of the Scripps Institute of Oceanography for verification and were identified as *Sagitta helenae.* Many such individuals had been examined closely by the authors and believed to be *S. hispida.* Since both species were very similar in appearance, they were not separated from one another and often confused in immature individuals. The characteristics differentiating *S. helenae* from *S. hispida* are the arrangement of the numerous anterior teeth, the absence of intestinal diverticula and the location and shape of the seminal vesicles. *Sagitta helenae* has an anterior fin reaching to the ventral ganglion and it is completely rayed. The posterior fin is longer than the anterior fin, is completely rayed and reaches to the seminal vesicles. The head is large and armed with 7 to 8 hooks on each side. The anterior teeth are numerous, ranging in numbers from 8 to 17. The posterior teeth number 11 to 13. The collarette is distinct, extending from the head halfway to the ventral ganglion. The intestinal diverticula is absent. The caudal segment occupies 26 to 29% of the total body length in animals 11 to 13.6mm (Tokioka, 1955). The seminal vesicles occupy the entire distance between the posterior and caudal fins.

Sagitta tenuis Conant, 1896
(Plate I)

The identification of this chaetognath is somewhat difficult. Pierce (1951) is of the opinion that *S. tenuis* is synonymous with *S. friderici.* Fraser (1952) believes that both species should be retained until more work on their biology has been completed and Tokioka (1955) thinks that both *S. tenuis* and *S.friderici* are distinct species. In the specimens at our disposal, the anterior fin is completely rayed and begins slightly behind the ventral ganglion. The posterior fin is completely rayed and it has a TC-value of 61.1 to 70.0. These TC-values are within the limits found by Tokioka (1955) for *S. tenuis.*

$$TC = \frac{\text{anterior part of posterior fin along the trunk}}{\text{posterior part of posterior fin along the caudal segment}} \times 100$$

The head is armed with 6 to 8 hooks, 4 to 7 anterior teeth and 15 to 17 posterior teeth. The collarette is small and the neck distinct. The caudal segment measures 27.9 to 32.3% of the total body length in animals 5.5 to 7.4mm. The seminal vesicles are rounded anteriorly and tapered posteriorly. They touch the posterior and tail fins at maturity. The ovaries reach the middle of the anterior fin and the eggs are large and distinct.

Body length (mm)	Caudal segment (%)	Hooks	Anterior teeth	Posterior teeth	TC
5.5	30.9	6-7	4-4	15-15	61.1
6.0	30.0	7-7	4-5	15-16	66.6
6.0	31.6	6-7	6-6	-	68.7
6.3	28.5	7-7	5-6	17-17	66.6
6.4	31.2	7-6	-	-	-
6.5	32.3	8-8	6-6	15-16	69.0
6.6	31.8	8-8	-	-	-
6.8	29.9	7-7	6-7	16-16	70.0
7.4	29.7	6-7	-	17-17	66.6

Sagitta enflata Grassi, 1881
(Plate 2)

S. enflata is a large, transparent, tumid species. The anterior fin is transparent, rayless in the inside section and located far behind the ventral ganglion. The distance between the ganglion and the fin is slightly larger than the fin itself. The posterior fin is transparent, incompletely rayed, slightly larger than the anterior fin and two-thirds is located on the trunk and one-third on the caudal segment. The head is large and armed with 6 to 10 hooks. Nine to thirteen small teeth are set across the tip of the head, and 11 to 14 posterior teeth are set on each side of the head. The collarette is very small. The caudal segment occupies 16.0 to 21.2% of the total body length in animals 10.1 to 16.8mm.

Body length (mm)	Caudal segment (%)	Hooks	Anterior teeth	Posterior teeth
10.1	17.8	9-9	-	-
10.8	19.4	9-9	-	-
12.5	20.0	9-9	-	-
12.5	16.8	6-8	-	-
13.5	19.2	9-9	-	-12
14.1	21.2	9-8	-	-
14.3	16.0	9-9	-	-
14.6	19.1	9-9	-	-
14.6	19.8	9-8	-	-
14.7	17.0	7-9	-	-
14.7	17.0	-	-	-
15.7	20.3	9-9	-12	13-
15.7	16.5	9-9	10-	11-
16.1	18.0	9-9	-	12-
16.5	18.7	10-10	11-	13-
16.8	18.4	9-9	13-	14-

The seminal vesicles are small, rounded, located near the tail fin and separated from the posterior fin by about two and a half times their size. The ovaries reach the posterior end of the anterior fin. The eggs are small.

Sagitta bipunctata Quoy and Gaimard, 1827

(Plate 3)

S. bipunctata is a small chaetognath with a body comparatively slender and rigid. The anterior fin begins close behind the ventral ganglion and is long and completely rayed. The posterior fin is slightly longer than the anterior fin and completely rayed. The head is armed with 9 hooks and the teeth number 5 anteriorly and 12 posteriorly. The collarette is very strong; in the specimens at our disposal it extended to the ventral ganglion. The sides of the body are covered with numerous tufts of sensitive papillae. The caudal segment measured 26.1% of the total body length in a specimen 9.5mm.

Body length (mm)	Caudal segment (%)	Hooks	Anterior teeth	Posterior teeth
9.5	26.1	9-9	5-5	12-12

The seminal vesicles are close to the tail fin and are separated from the posterior fin by an epidermal thickening.

Sagitta serratodentata Krohn, 1854

(Plate 3)

S. serratodentata is a very rigid, opaque species. The anterior fin is completely rayed and originates near the ventral ganglion. Vannucci and Hosoe (1952) described some specimens from "Trindade" with an anterior fin partially rayed. The posterior fin is partially rayed and it has a lateral depression near the tail's origin. Both fins and the whole body have sensitive papillae on the exterior margin. The head is armed with 5 to 8 serrated hooks, 6 to 7 anterior teeth and 12 to 14 posterior teeth. The collarette is very small. The caudal segment measures 23.6 to 27.4% of the total body length in animals 6.2 to 11.1mm.

Body length (mm)	Caudal segment (%)	Hooks	Anterior teeth	Posterior teeth
6.2	27.4	8-7	-	-
7.9	26.5	7-7	6-6	13-13
8.5	25.8	6-7	7-7	13-13
8.8	26.1	7-7	7-7	13-14
9.0	24.4	-	-	-
9.0	26.6	7-6	6-7	13-14
9.2	25.0	6-6	7-7	14-14
9.2	26.0	6-7	7-7	13-14
9.3	23.6	7-7	6-6	13-13
9.3	25.8	7-7	7-7	13-13
10.4	25.9	5-7	7-7	13-12
11.1	26.1	7-7	7-7	13-13

The seminal vesicles are horn-shaped, conspicous, separated by their length from the tail fin and originate near the posterior fin. The ovaries extend to the anterior fin or beyond.

Sagitta hexaptera d'Orbigny, 1834
(Plate 4)

S. hexaptera is a large, transparent, flaccid species rare in the collections. The anterior fin is small, set at mid-point of the total length and at a great distance behind the ventral ganglion. The fin has an inner rayless zone. The posterior fin is well separated from the anterior fin and is triangular. It also has an inner rayless zone. The head is square and armed with 9 hooks, 3 long anterior teeth and 4 posterior teeth on each side. The collarette is absent. The caudal segment measured 19.5% of the total body length in a specimen 20.5mm.

Body length (mm)	Caudal segment (%)	Hooks	Anterior teeth	Posterior teeth
20.5	19.5	9-9	3-3	4-4

The seminal vesicles were not observed.

Sagitta decipiens Fowler, 1905
(Plate 2)

S. decipiens is a slender but not very rigid species. The anterior fin is very long, partially rayed and originates near the ventral ganglion. The posterior fin is shorter than the anterior fin, partially rayed, distinctly triangular, about two-thirds lies on the trunk and the widest section lies slightly behind the anterior origin of the caudal segment. The tail fin is triangular and is wider than it is long. The head was damaged in the two specimens at our disposal. The collarette is very small, the neck is distinct and the gut is diverticular. The caudal segment measured 25.0% of the total body length. The seminal vesicles are far behind the posterior fin and are located near the tail fin. In immature specimens they are rounded anteriorly and tapered posteriorly.

Krohnitta pacifica (Aida), 1897
(Plate 4)

K. pacifica is a small, flaccid species with one pair of fins. The lateral fin is partially rayed, rounded anteriorly and narrowed posteriorly. It originates at about mid-length, and two-thirds lies on the caudal segment. The caudal fin is longer than it is wide.

The head is elongated, the hooks number from 7 to 9 and the teeth are long and triangular and vary from 10 to 14. The caudal segment measures 29.3 to 34.7% of the total body length in animals 3.6 to 5.8mm.

Body length (mm)	Caudal segment (%)	Hooks	Teeth
3.6	33.3	6-7	10-
3.8	34.2	6-6	-
4.1	34.1	-	11-
4.6	34.7	8-8	-
4.6	32.6	8-8	11-11
4.6	34.7	9-9	12-12
4.7	34.0	8-9	11-11
4.7	36.1	9-9	11-11
4.8	33.3	-	12-12
5.0	32.0	9-9	11-11
5.0	32.0	-	-
5.0	32.0	-	-
5.0	34.0	-	12-12
5.1	33.3	8-9	-
5.5	32.7	-	11-12
5.8	29.3	9-9	13-14

The seminal vesicles are oval and touch the lateral and tail fins. The eggs are large and rectangular, and the ovaries reach beyond the anterior margin of the lateral fin. Some animals in our collections were mature at 4.6mm. At Fernando de Noronha the size at maturity is around 8.4 mm. (Hosoe, 1956).

Pterosagitta draco (Krohn), 1853

(Plate 4)

P. draco is a stout, semi-rigid species with a single pair of lateral fins. The lateral fin is completely rayed, rounded posteriorly, is entirely on the caudal segment and reaches to two-thirds of the segment. The tail fin is triangular. The large head has 9 hooks on each side, 6 to 8 anterior teeth and 12 to 14 posterior teeth. The collarette is voluminous and extends to the lateral fin into which it mingles. The sides of the collarette have sensitive papillae and a pair of well-developed pits from which emanates

numerous bristles. The caudal segment measures 43 to 45% of the total body length in animals 6.2 to 6.5mm.

Body length (mm)	Caudal segment (%)	Hooks	Anterior teeth	Posterior teeth
6.2	45.0	9-9	6-8	12-14
6.5	43.0	9-9	7-8	14-14

The seminal vesicles were not observed.

ABUNDANCE AND DISTRIBUTION OF CHAETOGNATHS

Cariaco region: The abundance of each species present at stations A - K is shown in Table II. Five species made up 96.5% of the catch: *S. hispida* and *S. helenae* (62.9), *S. tenuis* (24.3), *Krohnitta pacifica* (8.2) and *S. enflata* (1.1). *S. hispida* was very abundant throughout most of the Gulf except at the head where it was not common. *S. helenae* was common in the Gulf but less so than *S. hispida. S. tenuis* was relatively common throughout the Gulf. Its greater abundance was found near the entrance to the Manzanares river and at the head of the Gulf. *K. pacifica* was also common throughout the Gulf but more so on the Cumaná side. *S. enflata* was less abundant but could be found throughout most of the Gulf.

In the surface tows, the same 5 species made up 96.5% of the total catch of chaetognaths. The catch was as follows: *S. hispida* and *S. helenae* (63.2), *S. tenuis* (24.3), *K. pacifica* (8.1), *S. enflata* (0.9). Although catches were much smaller in vertical tows 94.1% of the catch was made up of the 5 species: *S. enflata* (28.3), *S. tenuis* (28.3), *K. pacifica* (19.1), *S. hispida and S. helenae* (18.4). A single specimen of *S. hexaptera* was taken in a 45 meter vertical tow at Station G located well inside the Gulf.

S. hispida and *S. helenae* were taken in greatest abundance in the Gulf, *S. enflata* and *S. tenuis* in the Cariaco Trench and *K. pacifica* in the Gulf and in the Trench. The species caught at the Cariaco Trench but not inside the Gulf were *Sagitta serratodentata, S. bipunctata, S. decipiens* and *Pterosagitta draco.* These four species were taken between 300 meters and surface and were only represented by a few individuals. It is possible that some of these species might be present in the Gulf as juveniles, since it has been impossible to ascertain the identity of 652 small juveniles taken in the Gulf.

TABLE III. Percentage abundance by numbers at three depth levels. Numbers in brackets give the total number of chaetognaths counted.

TABLA III. Porcentaje de la abundancia numérica a tres niveles de profundidad. Los números entre paréntesis dan el total de quetognatos contados.

Species (Especies)	50-om		100-50m		300-100m	
Sagitta enflata	(170)	75.5	(54)	72.9	(21)	65.6
Sagitta hispida	(22)	9.7	(13)	17.5	(1)	3.4
Sagitta tenuis	(3)	1.5	—	—	—	—
Sagitta bipunctata	—	—	(3)	4.0	(5)	15.6
Sagitta hexaptera	—	—	—	—	(1)	3.4
Sagitta serratodentata	—	—	(2)	2.8	—	—
Krohnitta pacifica	(30)	13.3	(2)	2.8	—	—
Unidentified (Indeterminados)	—	—	—	—	(4)	12.4
Total	(225)	67.9	(74)	22.3	(32)	9.8

The distribution of the 3 hydrographic variables is given in Table II. The range of salinities throughout the area studied varied in May from 36.45 to 37.00 ‰. Such small variations are unlikely to limit the distribution of chaetognaths. On the other hand, chaetognaths have a sensibility to variations of temperatures of 1° (Trégouboff and Rose, 1957) and this could explain the presence of *S. serratodentata, S. bipunctata, S. decipiens* and *P. draco* in the Trench but not in the Gulf since temperatures of the deeper waters of the Trench are colder than those of the Gulf (Table II). More analyses will be necessary to ascertain if such occurrences are typical for the year or are only seasonal. Off Margarita Island: At Lat. 11°23'18"N., Long. 64°30'00"W., the catch at three depth levels was divided as follows: 67.9% at 50-0m., 22.3% at 100-50m., and 9.8% at 300-100m. (Table III). *S. enflata* made up 75.5% of the catch at 50-0m., *K. pacifica* 13.3%, *S. hispida* 9.7% and *S. tenuis* 1.5%. At 100-50m., *S. enflata* made up 72.9% of the catch, *S. hispida* 17.5%, *S. bipunctata* 4.0%, *S. serratodentata* 2.8% and *K. pacifica* 2.8% while at 300-100m., percentages were *S. enflata* 65.6%, *S. bipunctata* 15.6%, *S. hispida* 3.4% and *S. hexaptera* 3.4%. It is to be noted that only *S. enflata* and *S. hispida* were caught at all depths. Below 50 meters *K. pacifica* was rare. *S. tenuis* was not found below 50 meters. *S. bipunctata* was found below 50 meters, *S. hexaptera* below 100 meters and *S. serratodentata* between 100 and 50 meters. The depth distribution of the chaetognaths agreed with the findings of Ritter-Záhony (1910), Furnestin (1953) and Fraser (1937, 1939).

At Lat. 11°43'00"N., Long. 63°13'00"W., the catch at surface was 50% *S. hispida,* 25% *K. pacifica,* 16.6% *S. enflata,* 4.2% *S. bipunctata* and 4.2% *S. decipiens.*

SUMMARY AND CONCLUSSIONS

Collections from the Gulf of Cariaco, the Cariaco Trench and waters off Margarita Island have been analysed for chaetognaths. Ten species have been identified. They are: *Sagitta hispida, S. helenae, S. tenuis, S. enflata, S. bipunctata, S. serratodentata, S. hexaptera, S. decipiens, Krohnitta pacifica* and *Pterosagitta draco.*

The following significant observations were made:

1. Our specimens of *S. hispida* had seminal vesicles near both the posterior and caudal fins. Counts of *S. helenae* and *S. hispida* were combined because of difficulties of identification.

2. The TC-values for our specimens of *S. tenuis* ranged from 61.1 to 70.0.

3. *S. serratodentata* had an anterior fin completely rayed while in other areas the fin has been described as partially rayed.

4. Some *Krohnitta pacifica* were mature at 4.6mm which is a small size for the species.

5. In the Cariaco region the most common chaetognaths were: *S. hispida* and *S. helenae* (62.9%), *S. tenuis* (24.3%), *K. pacifica* (8.2%) and *S. enflata* (1.1%). They were common throughout most of the region.

6. At surface, in daytime, the same 5 species made up 96.5% of all chaetognaths taken. In vertical tows from bottom to surface their percentage of the catch was 94.1%.

7. The species caught in the Cariaco Trench but not in the Gulf were: *Sagitta serratodentata, S. bipunctata, S. decipiens* and *Pterosagitta draco*. Temperature differences seemed to account for their absence from the Gulf.

8. Off Margarita Island the catch of chaetognaths was as follows: 67.9% at 50-0m., 22.3% at 100-50m. and 9.8% at 300-100m. *S. enflata* was the most abundant species at all levels. *S. tenuis* was limited to the upper 50 meters, *K. pacifica* was rare below 50 meters. *S. bipunctata* was found below 50 meters, *S. hexaptera* below 100 meters and *S. serratodentata* between 100 and 50 meters.

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EXPLANATION OF PLATES
(Explicación de las láminas)

Plate 1. (*Lamina* 1)

1. *Sagitta hispida,* total view (vista total)
2. *S. hispida,* head (cabeza)
3. *S. hispida,* caudal segment and seminal vesicles (segmento caudal y vesículas seminales)

4. *S. hispida,* hook (gancho)
5. *S. tenuis,* total view (vista total)
6. *S. tenuis,* head (cabeza)
7. *S. tenuis,* caudal segment and seminal vesicles (segmento caudal y vesículas seminales)
8. *S. tenuis,* hook (gancho)

Plate 2. (*Lamina* 2)

1. *Sagitta enflata,* total view (vista total)
2. *S. enflata,* head (cabeza)
3. *S. enflata,* hook (gancho)
4. *S. decipiens,* total view (vista total)
5. *S. decipiens,* head (cabeza)
6. *S. decipiens,* caudal segment and seminal vesicles (segmento caudal y vesículas seminales)

Plate 3. (*Lamina* 3)

1. *Sagitta bipunctata,* total view (vista total)
2. *S. bipunctata,* hook (gancho)
3. *S. serratodentata,* total view (vista total)
4. *S. serratodentata,* head (cabeza)
5. *S. serratodentata,* caudal segment and seminal vesicles (segmento caudal y vesículas seminales)
6. *S. serratodentata,* hook (gancho)

Plate 4. (*Lamina* 4)

1. *Sagitta hexaptera,* total view (vista total)
2. *S. hexaptera,* head showing anterior teeth (cabeza mostrando dientes anteriores)
3. *Krohnitta pacifica,* total view (vista total)
4. *K. pacifica,* head (cabeza)
5. *K. pacifica,* caudal segment and seminal vesicles (segmento caudal y vesículas seminales)
6. *Pterosagitta draco,* total view (vista total)
7. *P. draco,* head (cabeza)
8. *P. draco,* caudal segment (segmento caudal)

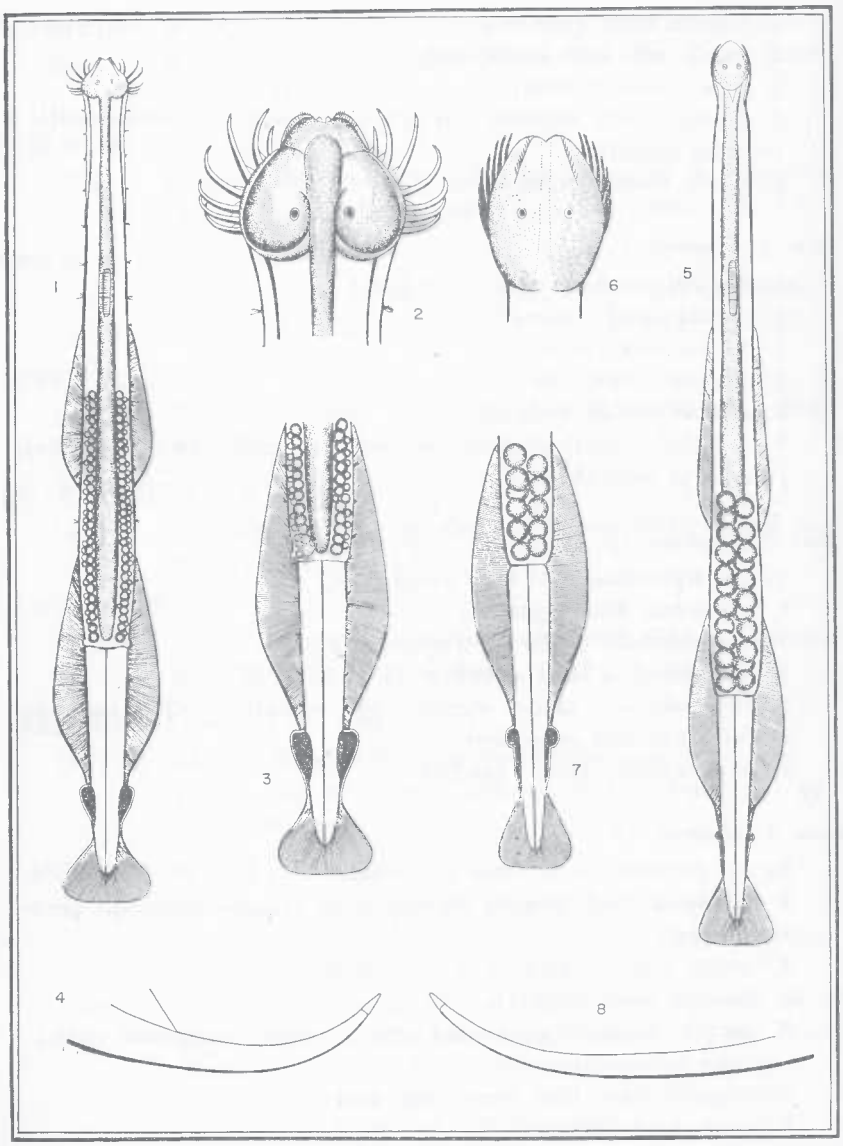

PLATE I
(LAMINA).

LAMINA 1

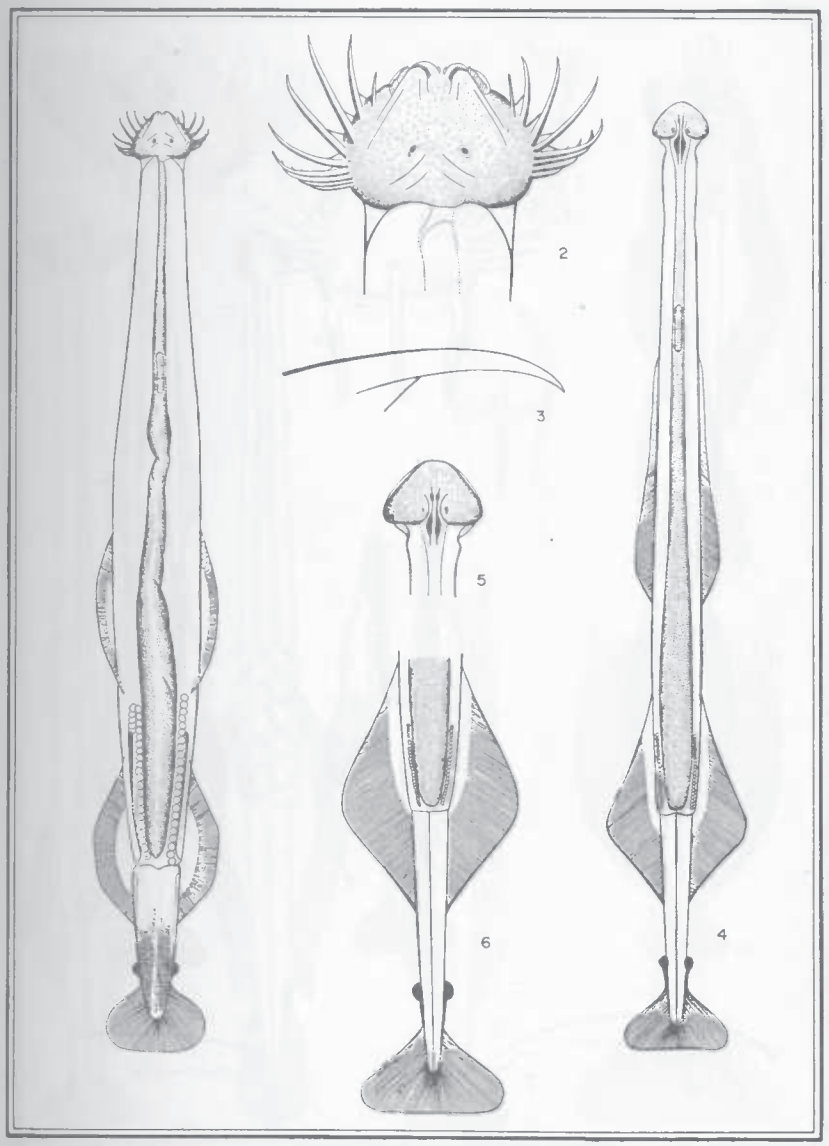

PLATE 2
[LAMINA]

LAMINA 2

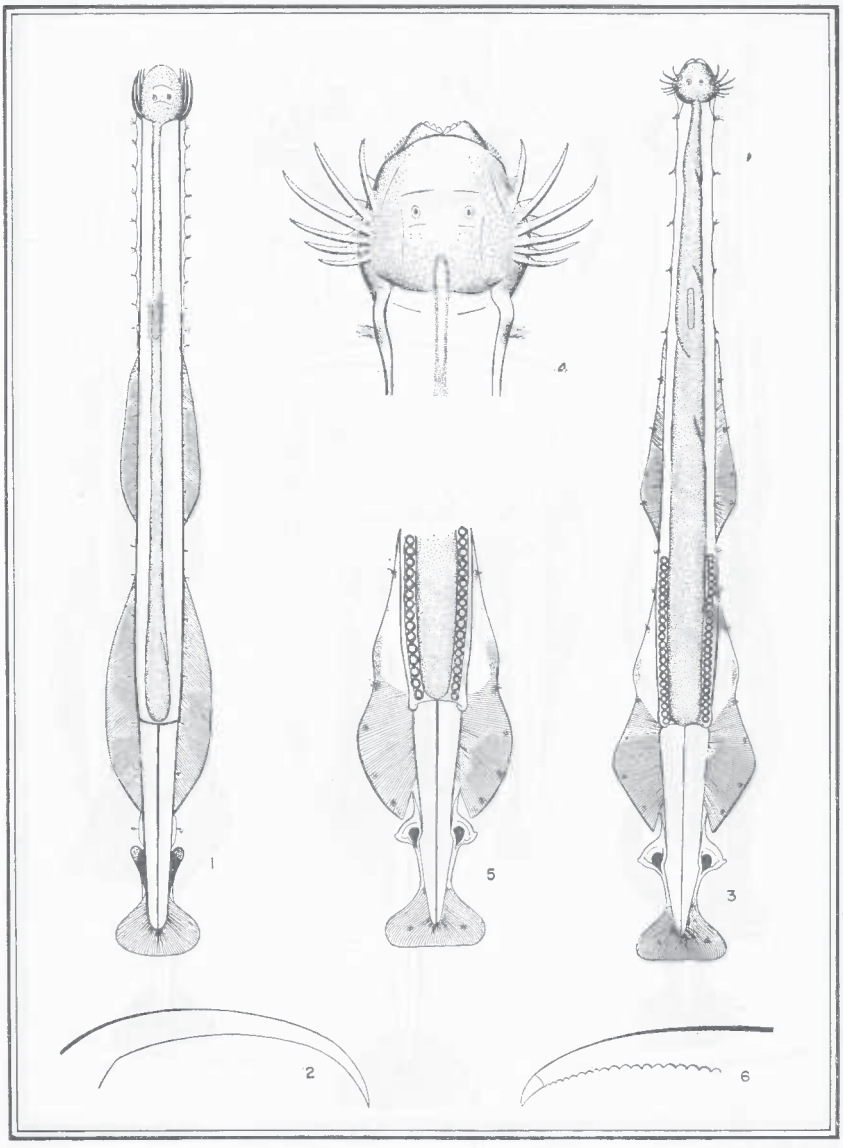

PLATE 3
(LAMINA)

LAMINA 3

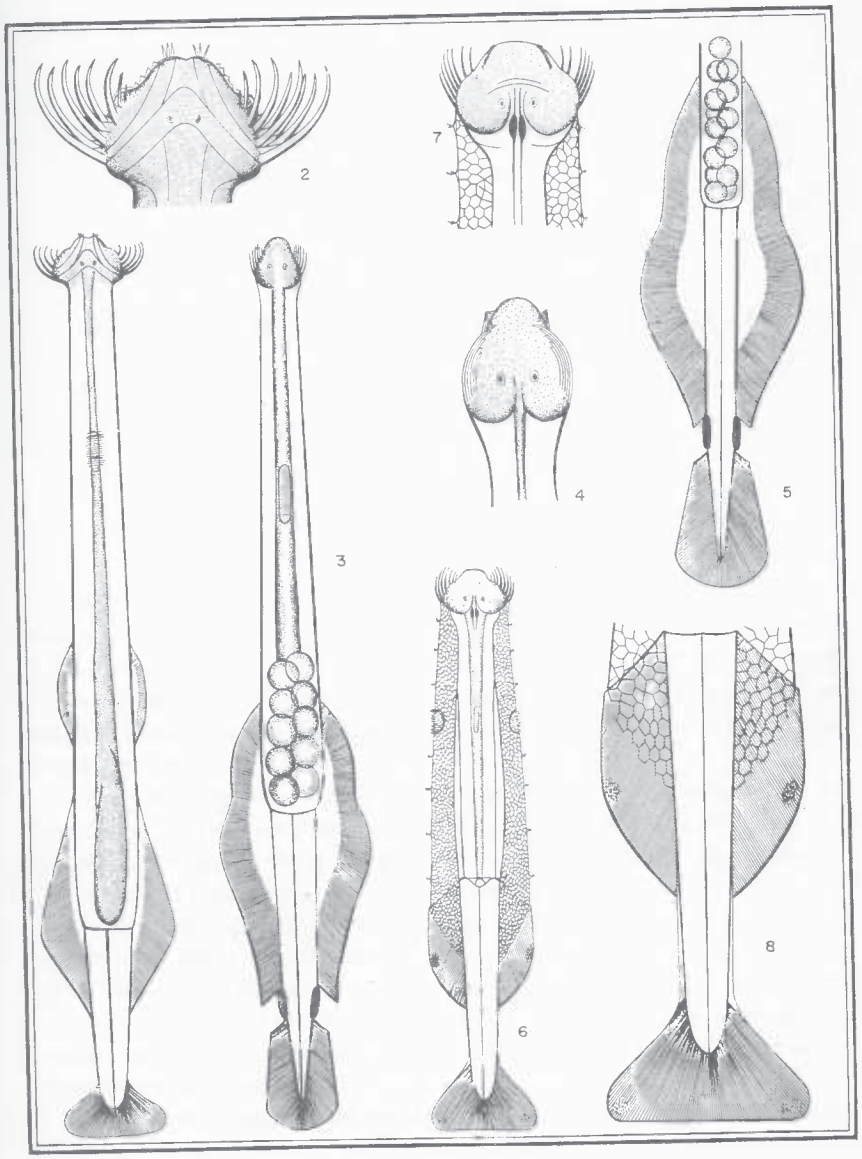

PLATE 4
(LAMINA)

LAMINA 4