Revista Chilena de Historia Natural
68: 303-309, 1995

Ochetostoma baronii (Echiuridae) and *Urechis chilensis* (Urechidae), two echiuran worms from Coquimbo, Chile

Ochetostoma baronii (Echiuridae) y *Urechis chilensis* (Urechidae) dos gusanos equiuros de Coquimbo, Chile

PABLO SCHMIEDE and VICTOR VIDELA

Departamento de Biología Marina, Facultad de Ciencias del Mar,
Universidad Católica del Norte. Casilla 117 Coquimbo, Chile

ABSTRACT

The thalassematinid *Ochetostoma baronii* (Greeff, 1879) Coquimban specimens, with 16 bands of longitudial muscles, two pairs of nephridia, body wall thick and opaque. Fit well the 16-19 bands range for the species. *Urechis chilensis* (Müller, 1852) Coquimban specimens, with three pairs of nephridia and a single circle of 10 anal setae reach smaller size in Coquimbo than previously known from southern Chilean localities. Ventral setae have curved and sharp tips like those of California (U.S.A) thus leaving no character to distinguish between Coquimban and North American *U. chilensis*. Coquimbo population exhibits a different yearly reproductive cycle than that of the much studied Californian one. Descriptions and figures as well as body size measurements are given for both species from Coquimbo, Chile.

Key words: breeding cycle, oocytes, coelom, *Urechis caupo*, new records, south eastern Pacific.

RESUMEN

En Coquimbo, el equiuro, Thalassematinae, *Ochetostoma baronii* (Greeff,1879), tiene 16 bandas de musculatura longitudinal, dos pares de nefridios, pared corporal gruesa y opaca, correspondiendo al rango de 16-19 bandas musculares longitudinales descrito para la especie. *Urechis chilensis* (Müller, 1852) con tres pares de nefridios y un solo círculo de 10 cerdas anales alcanza una talla notablemente menor que la previamente descrita. Las cerdas ventrales tienen extremos curvos y agudos, como los de los descritos para material de California. No hay carácter alguno que permita distinguir el material de Coquimbo del de Norteamérica. La población estudiada exibe un ciclo reproductivo anual diferente al de las de California, ampliamente estudiadas. Se entregan descripciones, figuras y mediciones de tamaño corporal para ambas especies de Coquimbo, Chile.

Palabras clave: ciclo reproductivo, ovocitos, celoma, *Urechis caupo*, nuevo registro, Pacífico suroriental.

INTRODUCTION

The two echiurans reported in this paper were collected by skin divers from a sandy bottom substratum in la Herradura Bay at Coquimbo: 30° S.; 71° W.

There is no previous record for *Ochetostoma baronii* (Greeff 1879) from Chile. Fisher (1946) and Amor (1976) give the Pacific Ocean records, Galapagos islands being the southernmost record

Seitz (1907) studied the anatomy of *Urechis chilensis* (Müller 1852) using specimens from Tumbes (Concepción, Chile).

Retamal and Trucco (1973) record the species from Lirquén (36° 40' S; 73° 02' W). Wesenberg-Lund (1955) maps Chilean localities; Riveros-Zuñiga (1951) extends the range northwards up to Montemar. Amor (1976) gives the only South Atlantic record for *U. chilensis*.

Videla (1991) studied *U. chilensis* reproductive cycle in la Herradura Bay. Amor (1976) maps the South American localities for both echiurans.

Both species are currently the subjects of an ongoing research project on larval gregarious settlement.

(Received 2 may 1994; accepted 3 december 1994)

MATERIAL AND METHODS

On June 15th 1993 a sample of 18 *Ochetostoma baronii*. and 25 *Urechis chilensis* were dug up from a sandy bed 4-10 m deep containing both echiurans. The substrate consisted of fine-medium size particles (Wentworth 1922); scale cf. Leet (1968). Worms were then completely relaxed in a 7% magnesium chloride solution for 24 h and fixed in 10% formalin for 10 days. They were measured to the nearest millimeter and weighted to the nearest 0.1 g after removing mucus and excess fixative with paper towels. Measurements taken were: Proboscis and trunk lengths, worm diameter, and total body weight.

In order to use numerous body weight data of *Urechis chilensis* taken from the same locality by Videla (1991), in the description. A linear regression equation was calculated to convert individual body weights measurements into trunk length data (N = 25; a = 90.12; b = 1.49; r = 0.842). One hundred and twenty estimated trunk length values from Jan-Jun 1988 were pooled and 25 trunk length (mm) measurements from 1993 material were added. With these results a frequency distribution table of trunk length was constructed (Table 2).

Drawings were made from unrelaxed formalin preserved specimens.

Stephen and Edmonds' (1972) anatomical nomenclature is used throughout.

To study spawning, on 21st November 1992, five 5 l, 18 cm tall plastic buckets for each species containing 2 adult worms and 4 l sediment each, were placed underwater over the echiurans sand bed.

Each bucket had a 20mm plastic mesh screen to exclude predaceus fish *Pinguipes chilensis* (Molina 1782) as recorded by Núñez (1988). Buckets were inspected weekly; one worm per species was dug out each time for examination until spawning criteria were met. Both direct observation of spontaneus gamete extrusión and reduction of nephridia volume as perceived trough the opaque body wall were used as spawning criteria. This procedure was repeated on the 1993-1994 season.

To describe the shape of the burrows 5 *O. baronii* and 5 *U. chilensis* worms were place individually into buckets like those used to study spawning and placed under water for two weeks. Buckets were then taken to the laboratory, excess sea water was poured of and the sediment carefully scraped of with a clam shell following the burrow´s shape.

Stephen and Edmonds' (1972) anatomical nomenclature is used throughout.

Drawings were made from unrelaxed formalin preserved specimens.

RESULTS

Ochetostoma baronii (Greeff, 1879)
Fig. 1; Table 1 a

Description:

a) Proboscis: Short, yellowish, fleshy, spoon-shaped measuring less than 1/2 of body length. Juvenile individuals have a pointed, longer, ribbon-like desciduous proboscis.
b) Trunk: Cylindrical opaque. The posterior region is produced into a short stem in the centre of which lies the anus. Neuro-intestinal and dorsal blood vessels join directly through a ring vessel. Longitudinal musculature gathered in 16 discrete bands attached to the inner muscle layer by numerous fascicles of diagonal muscles.

Two pairs of equal finger-like nephridia with apical nephrostomes. Each nephridium bears two long nephrostome lips extended into ribbon-like filaments loosely twisted in spiral. Nephridiopores open externally posterior to the ventral setae. One pair of small shiny golden distally sickle shaped ventral setae. Often with one reserve seta. Ventral setae interbasal muscle runs ventrally to the fore-gut and is surrounded by the neuro-intestinal blood vessel . Anal vesicles are a pair of large smooth brown sacs with numerous unbranched minute sessile ciliated funnels. The globular rectal caecum joins the ventral blood vessel.

Commensals: The species burrows individual burrows in fine-medium sand at 4-10 m depth. Burrows are not "U" shaped but have a single opening and a blind end. It is also

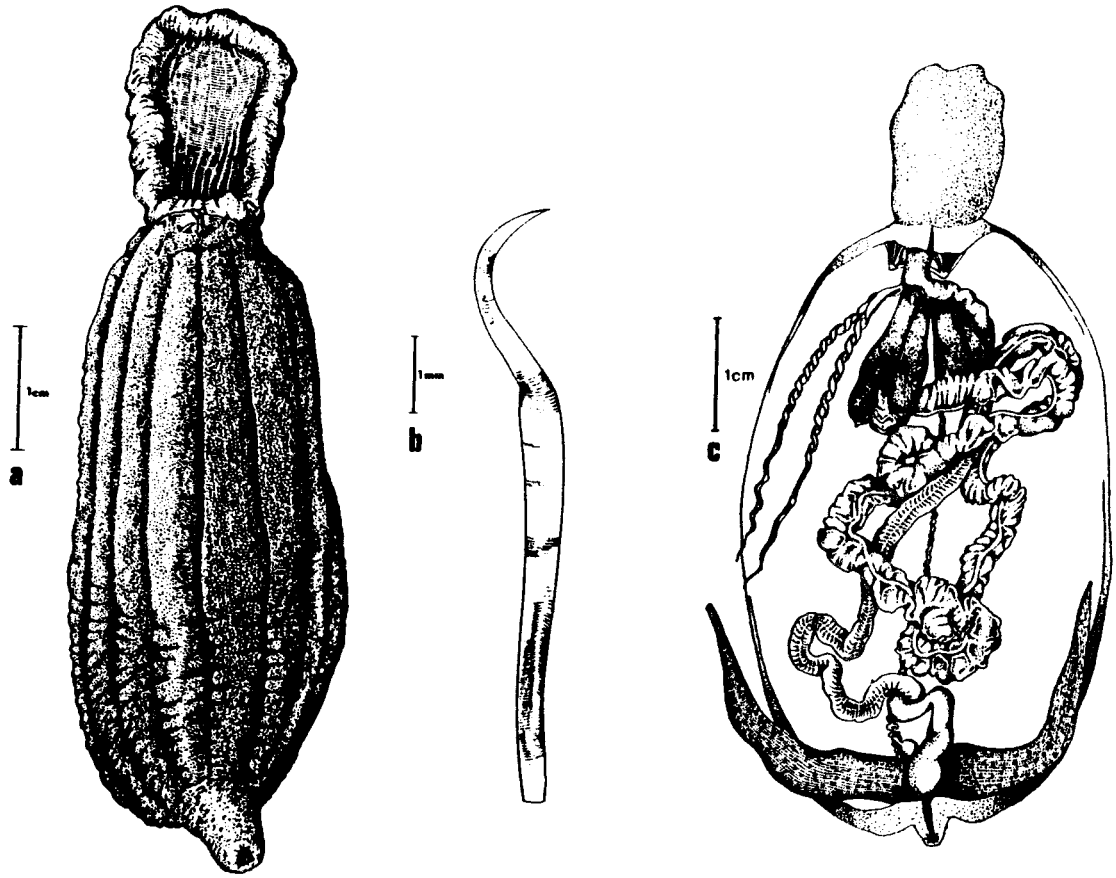

Fig. 1: Ochetostoma baronii. a) Ventral view ; b) Right ventral seta; c) Dorsal view (Internal anatomy). av, anal vesicles; c, cloaca; g, gut; n, nephridium; nc, nerve cord; nl, nephrostome lips (left anterior nephridium); p, proboscis; vsm, ventral setae muscles. Scale bars: a, c = 10 mm; b = 1 mm.

Ochetostoma baronii. a) Vista ventral; b) Cerda ventral derecha; c) Vista dorsal (Anatomía interna). av, vesícula anal; c, cloaca; g, intestino; n, nefridio; nc, cordón nervioso; nl, órganos colectores del nefridio anterior izquierdo; p, proboscide; vsm, músculos basales de las cerdas ventrales.

used as occasional shelter by juvenile individuals of trypterigiid fish *Helcogramoides cuninghami* (Smith). There is usually one fish per burrow.

Burrows, as determined from observations of individual worms placed in underwater buckets with sediment show a small mound of fecal pellets near the opening. They are not "U" shaped but have single opening. Each of the five worms used was found at the blind end of the burrow at the bucket`s bottom.

Spawning: First observed at Coquimbo on January 31st, 1993.

During 1994 breeding season, spawning was observed on January 21st and February 16th. A very young worm was recovered on July, (specimen damaged and lost), suggesting that the species breeding season extends for, at least, six months.

Urechis chilensis (Müller, 1852)
Fig 2; Table 1b,2

Description:

a) Proboscis short and papillated .
b) Trunk sausage-shaped with distinct papillae near both ends. Almost smooth in central portion. Less than 140 mm long. Body wall opaque. Formalin preserved specimens of very dark green color. Adult

TABLE 1

Measurements of echiurans from Coquimbo
Relaxed specimens preserved in formalin.
Measured 06 21 93.

Medidas de Echiura de Coquimbo
Especímenes relajados y fijados en formalina.
Medidos 21 06 1993

MEASUREMENTS	N	MEAN	STD. DEV.	MINIMUM	MAXIMUM
a) *Ochetostoma baronii* (Greeff, 1879) MNHN-ECHI-11130					
Trunk length (mm)	18	102.2	24.50	57	140
Proboscis length (mm)	18	34.22	8.80	24	59
Total weight (g)	18	9.51	3.83	1.7	16.3
Max. Diameter (mm)	18	13.4	2.23	7	17
b) *Urechis chilensis* (Müller, 1852) MNHN-ECHI-11132					
Trunk length (mm)	25	123.16	19.83	96	167
Proboscis length (mm)	25	6.76	1.45	4	10
Total weight (g)	25	22.22	11.23	5.1	48.4
Max. Diameter (mm)	25	24.72	4.95	11	32

live individuals light tan with an orange red tinge. Somewhat pink due to blood color in smaller individuals. A pair of ventral setae with sharp curved tips with interbasal muscle. Anal setae in a single circle of 10. A globular pre-clocal caecum present. Anus not noteworthly eccentric. There are three pairs of nephridia each with a pair of long grooved ciliated spiraling coiled basal nephrostome lips. Nephridiopores open posterior to ventral setae. Anal sacs thin-walled less than half the length of the trunk bearing minute scattered simple ciliated funnels.

Spawning: For six consecutive years: 1989-1995 spawning at Coquimbo was observed to take place by the end of the first half of January (early Summer). After 1993 and 1994 spawning events, several juvenile worms were recovered from sand in buckets placed in the field. No more than three weeks elapsed between spawning observation and young worms finds.

Habitat: The species lives together with *Ochetostoma baronii* forming dense agrupations in fine - medium sand 4 -10 m deep. Individual burrows are similar to those described for *O. baronii* above, the same commensal fish was found but not *Pinixa valdiviensis* as recorded by Retamal and Trucco (1973).

DISCUSSION

If one matches an *Ochetostoma baronii* (Greeff, 1879) specimen from Coquimbo against Stephen and Edmonds' (1972) guide to species for the genus; the result is *Ochetostoma edax* Fisher, (1946) a species recorded from Baja California. According to Fisher *O. edax* is closely related to *O. baronii* (Greff, 1879). Amor (1976) lists *O. baronii* as the only South American *Ochetostoma.*

O. baronii is at least twice as long as *O. edax* (table 1a). The number of longitudinal muscle bands is preserved along the whole range of worm size examined.

Because *O. baronii* specimens from Coquimbo have 16 bands of longitudinal muscle. They differ from *O. baronii* (Greef, 1879) with 17-19, (18-19 according to Amor 1976), and from *O. octomyotum* Fisher, 1946 with 8 bands. Amor (1976) suggests that *O. edax* should be considered a synonym of *O. baronii* . This would extend the range of the number of longitudinal muscles to 16 - 19 allowing Coquimban specimens to fit *O. baronii* description.

Our *O. baronii* specimens have the posterior body region produced into a narrow stem. The posterior short stem is preserved only in non relaxed specimens, but is quite visible on live worms.

Trunk and proboscis size can be trenchant characters in Echiura. Namely, *O. edax* Fisher, 1946 was described from specimens 25-50 mm long, this led us to consider the possibility that they could be young individuals of *O. baronii*. Indeed, *O. baronii* from Coquimbo, of 25-50 mm trunk lenght fully agree with Fisher's description, particularly with his text figure 14 B.

U. chilensis specimens from Coquimbo differ slightly from Wesenberg-Lund (1955) description. From hundreds of specimens examined the earlier rarely exceeds 140 mm of trunk length (Table 2) while the latter are more masive. Retamal and Trucco (1973) specimen from Lirquén (drawing of their Fig. 5) is also only 125 mm long.

Every *U. chilensis* specimen examined has ten anal setae of similar length in a single circle (Fig 2 c). Wesenberg-Lund specimens have 7 to 12, most frequently 11 anal setae. Dorsal setae (hooks) being considerably longer than the ventral. In our material, ventral (anterior) setae are definitely curved and with sharp tips (Fig 2b). Previously known *U. chilensis* ventral setae are rather slightly curved and blunt. New specimens from Coquimbo leave no characters either internal nor external distinguishing *U. chilensis* from *U. caupo* as morpho-species. Fisher (1946) discussed the possibility of *U. chilensis* and *U. caupo* being the same species, (see Stephen & Edmonds 1972: 467).

Development of both echiuran species from Coquimbo appears to ensue rather rapidly in Nature. After 1993 and 1994 spawning events we secured young worms from sediment in buckets placed in the field to study spawning only two or three weeks after witnessing massive spawnings. According to Suer and Phillips (1983); *U. caupo* larvae can be kept for 60 days without rapid settlement in the laboratory.

Pilger (1978), suggests a planktonic larval residence span of two to three months for the phylum. Probably also based on laboratory results.

Suer (1984) suggests that *U. caupo* planktonic larvae are free-swimming for several weeks before settling.

Results by Videla (1991) on the reproductive cycle of *U. chilensis* from Coquimbo are similar to the observations from Suer (1984) who found that during 1978-1980 summers most of *U. caupo* worms from one of her collection sites were spawned out.

TABLE 2

Frequency distribution of U. chilensis (Müller) estimated trunk length (mm). From total weight data from Videla (1991).

Distribución de frecuencias de longitud del tronco U. chilensis (Müller), estimada de Videla (1991)

Class limits	Frequency	Percent	Cumulative Freq.	Cumulative Percent.
0 < 100	6	4.14	6	4.14
100 < 105	23	15.86	29	20.00
105 < 110	47	32.41	76	52.41
110 < 115	35	24.14	111	76.55
115 < 120	14	9.66	125	86.21
120 < 125	8	5.52	133	91.72
125 < 130	4	2.76	137	94.48
130 < 135	4	2.76	141	97.24
135 < 140	0	0.00	141	97.24
140 < 145	0	0.00	141	97.24
145 < 150	2	1.38	143	98.62
150 < 155	1	0.69	144	99.31
155 < 160	0	0.00	144	99.31
160 < 165	1	0.69	145	100.00
TOTAL	145	100.00		

Videla (1991) also found that:

1) Coquimbo's *U. chilensis* worms contain no developing coelomic sex cells from February to May. Furthermore, since the nephridia are empty from late January to June. The sex of the echiurans is not apparent during this time interval.

2) Smallest oocytes are abundant in coelomic fluid only in June.

3) Nephridial ripe egg cells are remarkably invariable in size during the whole reproductive cycle. Monthly nephridial oocytes diameter means range from 140.7 to 142.7 micrometers.

Two egg cell diameter ranges are given by Fisher (1946) for *U. caupo* ripe eggs: 115 -120 micrometers measured by MacGinitie from a southern California specimen and 123-144 measured by C.V. Taylor from a Monterrey Bay worm. But it is to be anticipated that sample means would vary less than individual measurements.

4) Both coelomic and nefridial egg cells (oocytes) are completely spherical, not in-

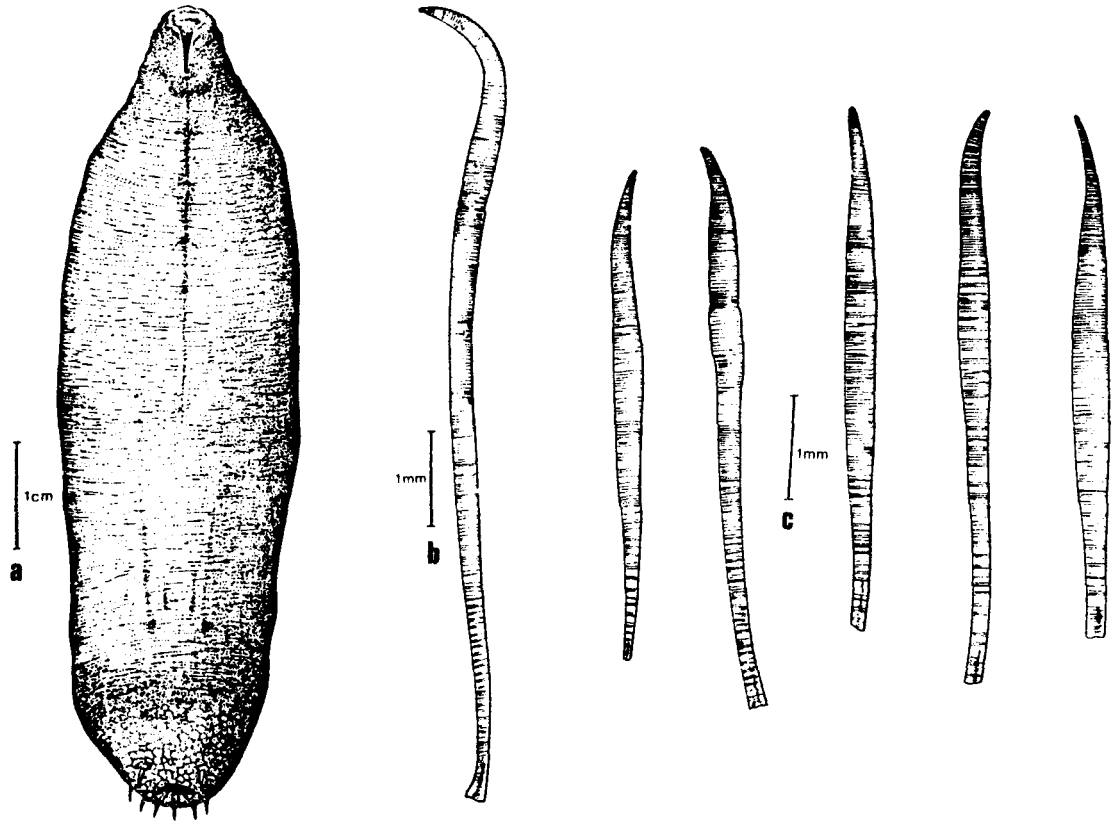

Fig. 2: Urechis chilensis. a) Ventral view; b) Right ventral seta; c) Anal setae (Right side). Scale bars: a = 10 mm; b, c = 1 mm.

Urechis chilensis. a) Vista ventral; b) Cerda ventral derecha ; c) Cerdas anales (lado derecho).

dented. Some coelomic *U. chilensis* oocytes are of larger diameter than nephridial oocytes from the same individual.

5) Spawning is synchronous between sexs and between individuals.

6) There is no breeding season but a single yearly spawning event as only spawned out individuals were found in the field after spawning.

ACKNOWLEDGMENTS

The authors wish to thank Dr. Eduardo Tarifeño from U. Católica de la Santísima Concepción at Talcahuano, Chile, who kindly granted access to his personal literature collection on Echiura. To N. Rozbaczylo from Ecology Dept. P. U. Católica de Chile for additional literature. Drawings of unrelaxed specimens are due to marine biologist Marco León from Universidad Católica del Norte. Dr. Stanley J. Edmonds from South Australian Museum, Adelaide, reviewed an early version of the manuscript providing obliging suggestions. Two anonymous referees offered many helpful suggestions to the final version.

LITERATURE CITED

AMOR A (1976) Genera and species of Echiura known from South America. Proceedings of the International Symposium on the Biology of the Sipuncula and Echiura. M. Rice and M. Todorovic eds. Vol II: 119-126.

FISHER WK (1946) Echiuroid Worms of the North Pacific Ocean. Proceedings of the United States National Museum Vol 96 N/ 3198: 215-292. pl 20-37.

LEET LD (1968) Fundamentos de Geología Física. Ed. Limusa Wiley, S.A., Mexico, pp 52-53.

NÚÑEZ LE (1988) Ictiofauna asociada a un Bosque Submareal de *Lessonia trabeculata:* Abundancia, Distribución espacial y Amplitud trófica. Universidad Católica del Norte, Facultad de Ciencias del Mar. Unpublished thesis, 44 p.

PILGER JF (1978) Settlement and metamorphosis in the Echiura: A review. In, Settlement and Metamorphosis of marine invertebrate larvae edited by F. S. Chia & M.E. Rice, Elsevier, New York pp 103-112.

RETAMAL MA Y R TRUCCO (1973) *Pinnixa valdiviensis* Rathbun (Decapoda, Pinnotheridae) comensal de *Urechis chilensis* (Müller) (Echiuroida)- Registro de un nuevo hospedador. Bol. Soc. Biol. de Concepción, 46: 75-79.

RIVEROS-ZUÑIGA, F (1951) *Pinuca chilensis* (Max Müller), 1852 en Montemar y algunas consideraciones sinonímicas. Revta. Biol. mar. 3:156-157.

SEITZ P (1907) Der Bau von *Echiurus chilensis* (*Urechis* n.g., *chilensis*). Zool. Jahrb., Abt. Anat. 24: 323-356, 3pls.

STEPHEN AC & SJ EDMONDS (1972) The Phyla Sipuncula and Echiura. Trustees of the British Museum (Natural History) London. Publication 717: 343-508.

SUER AL & DW PHILLIPS (1983) Rapid gregarious settlement of the larvae of the marine echiuran *Urechis caupo* Fisher & MacGinitie, 1928. J. Exp. Mar. Biol. Ecol. 67: 243- 259.

SUER AL (1984) Growth and spawning of *Urechis caupo* (Echiura) in Bodega Harbor, California. Marine Biology *78*: 275-284.

VIDELA VG (1991) Ciclo reproductivo de *Urechis chilensis* (Max Müller,1852) en Bahía La Herradura de Guayacán Coquimbo, Chile. Universidad Católica del Norte, Facultad de Ciencias del Mar. Unpublished thesis. 45 pp.

WESENBERG-LUND E (1955) Gephyrea from Chile. Repts. Lund Univ. Chile Expedition. Lund Univ. Arsskr. (New series) 5,**10** (51): 14 - 20,3 charts.