RHYNCHOTEUTHION LARVAE FROM NEW ZEALAND COASTAL WATERS (CEPHALOPODA : OMMASTREPHIDAE)

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RHYNCHOTEUTHION
NOTOTODARUS SPP.
OMMASTREPHIDÉS
CÉPHALOPODES

RÉSUMÉ. — Des « larves » (stade de rhynchoteuthion) d'Ommastrephidés des eaux côtières de la Nouvelle-Zélande sont analysées quant à leur morphométrie; le développement de la « trompe » (proboscis) formée par les tentacules fusionnés est étudié au microscope électronique à balayage. Beaucoup de spécimens présentent des déformations caractéristiques dues à la rétraction de la tête et de la partie postérieure du manteau. La forme du manteau est souvent cylindrique dans la partie antérieure et légèrement gonflée en ampoule dans la partie postérieure. Les bras dorsolatéraux (2) sont en général plus longs que les bras dorsaux (1) à partir d'une longueur dorsale du manteau (DML) de 2 mm. Les bras latéraux (3) se développent lorsque le manteau mesure environ 2,0 mm, sans que l'on puisse les intégrer dans une formule précise, les variations étant trop importantes. Les bras ventraux (4) se développent lorsque le manteau a atteint une longueur d'environ 2,4 mm. L'extrémité de la trompe porte 8 ventouses de taille à peu près égale, disposées régulièrement. Avant la séparation des tentacules, l'indice tentaculaire moyen est de 3,74 ± 1,42 (1 écart-type) n = 32. La trompe est généralement plus longue que les bras jusqu'à la taille de 4,0 mm DML. La séparation des tentacules, à partir de la base de la trompe, commence à une taille d'environ 5,0 mm DML; la séparation complète la plus précoce a été observée à 8,4 mm DML. Il est probable que tous les rhynchoteuthions étudiés dans ce travail appartiennent à *Nototodarus sloani* et *Nototodarus gouldi*.

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ABSTRACT. — Rhynchoteuthion stage ommastrephid larvae from New Zealand coastal waters were measured and the developing proboscis studied by scanning electron microscope. Many specimens show some retraction of the head and posterior mantle. Mantle shape is frequently cylindrical anteriorly and slightly expanded posteriorly. Arm 2 is generally longer than arm 1 after 2 mm dorsal mantle length (DML). Arm 3 develops around 2.0 mm DML but is too variable to include in an arm formula. Arm 4 develops around 2.4 mm DML. The proboscis tip bears 8 approximately equal sized suckers, evenly spaced and similarly orientated. The mean tentacle index prior to separation at the base is 3.74 ± 1.42 (1 std dev) n = 32. The proboscis is usually longer than all arms in length until 4.0 mm DML. Splitting of the proboscis base commences around 5.0 mm DML and earliest complete separation was observed at 8.4 mm DML. It is believed these larvae belong to *Nototodarus sloani* and *Nototodarus gouldi*.

INTRODUCTION

The first record of a rhynchoteuthion larva from New Zealand was a single specimen from northern New Zealand waters captured by the British Antarctic (Terra Nova) Expedition 1910 (Massy 1916). This specimen was not assigned to any particular genus. Specimens from the eastern Australian coast were described as larvae of *Nototodarus gouldi* by Allan (1945) based only upon family characteristics and without regard to other ommastrephid species occurring in the region. There followed several papers in which larval characteristics of genus *Nototodarus* were described based upon unverified captures of *N. nipponicus, N. sloani hawaiiensis, N. sloani philippensis* and *N. sloani gouldi*. All assumed that the species formed a geographic cline through the northern, western and south western Pacific and that similarities between adults within the genus implied similar, if not identical, larvae. Yamamoto and Okutani (1975) recognised shortcomings in the descriptions of *Nototodarus gouldi* by Allan (1945) and Shojima (1970) and questioned the tentative description of *Nototodarus* by Sato (1973). They also suggested that the features of larval *Nototodarus* might be similar to those of *Todarodes*. This is a view shared by Nesis (1979). In the english translation, Nesis' descriptions of the two genera are virtually identical. In the present study a larger range of features is considered than in previous studies and more detailed observations have been made on the proboscis. The collection is from regions of the New Zealand continental shelf where only a limited number of other ommastrephid species occur.

METHODS

Specimens were selected from a collection held at Fisheries Research Division on the basis of least damage and providing an adequate size range. 21 specimens were obtained from ichthyoplankton surveys between 1979 and 1984, 24 from plankton tows specifically aimed at capturing squid larvae and 5 specimens were from plankton surveys by Mr. M. Kingsford, Auckland University, N.Z. Four types of gear were used and are listed in table 1. Bongo plankton nets were hauled obliquely from 200 m of the bottom, whichever was the lesser, using 303 µm and 505 µm mesh. Towing speed was 2 knots. The 2 m × 2 m net with 1 mm mesh was towed near the surface at 2 knots. The modified Gulf III high speed plankton sampler (Colman, 1979) was towed 50 m below the surface at 5 knots. The 1 m × 1 m net with 1 mm mesh was hauled obliquely from the bottom in shallow water. No attempt is made to treat catches quantitatively.

All plankton samples were fixed in 5 % borax buffered formalin in seawater. Ommastrephid squid were separated and transferred to 70 % ethanol. Relevant features were measured and described using a light microscope fitted with an electronic micrometer.

Larvae with a proboscis suitable for scanning electron microscope observation were put through a graded dehydration series of alcohols culminating with 10 minutes in propylene oxide and then placed in a critical point dryer.

Where the dorsal mantle length (DML) of the larva was less than 5 mm, the entire squid was dried. Where the DML was greater than 5 mm, only the head and arms were dried. In all cases, for viewing, only the proboscis was mounted in colloidal graphite and coated with gold using a sputter coater.

The mounted and coated specimens were photographed using a Philips Scanning Electron Microscope 505 and Ilford FP4, 125 ASA film.

RESULTS

Distribution

Table 1 contains capture positions for 50 rhynchoteuthion larvae. All specimens are from continental shelf areas within the New Zealand 200 mile exclusive economic zone (EEZ). The majority were captured close to the coast in the main current fishing areas for *Nototodarus* spp. (Fig. 1). In general *N. gouldi* is distributed along the western coast of the North and South Islands and the north east coast of the North Island (in effect, north of the subtropical convergence). *N. sloani* occurs on the east coast of the South Island and in subantarctic waters, including the Auckland Islands. There is some overlap between the two species on the west coast of the South Island (Smith, Roberts and Hurst 1981; Smith, 1985). Specimens 21, 24, 26, 29, 36, are from the Hauraki Gulf (North Island) from enclosed shallow waters where *N. gouldi* is abundant although not a target fishery (Fig. 1). Specimen 42 is the only rhynchoteuthion recorded from the Auckland Islands where there is an annual 30,000 tonne fishery based on *N. sloani*. Specimen 38 is from the west of the Chatham Islands, a region where *N. sloani* is also abundant.

Description

Dorsal mantle lengths (DML) in this study range from 1.25 mm to 10 .10 mm (Table I). Some rhynchoteuthion larvae from all N.Z. regions show complete retraction of the head within the mantle until at least

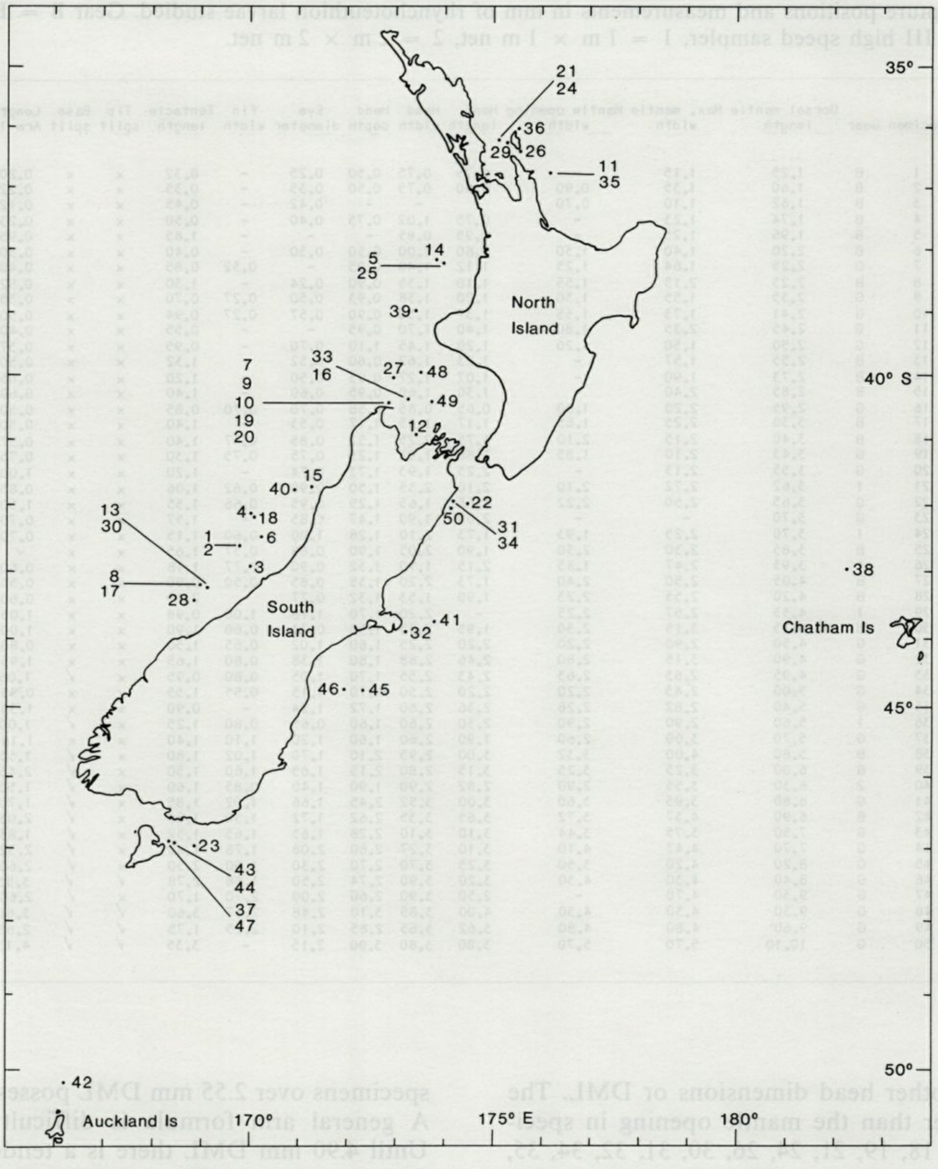

Fig. 1. — Capture positions for rhynchoteuthion larvae listed in table I.

3 mm DML. The preserved specimens frequently exhibit shortening of the mantle which results in retraction of the posterior portion of the mantle making measurement of the fins difficult. Another distortion frequently encountered is outward curling of the mantle lip, and in more severely damaged specimens, the mantle is turned inside out. This may occur in specimens up to 6 or 7 mm DML.

Mantle shape in this collection is only rarely conical and more usually slightly constricted at the mantle opening or cylindrical anteriorly, with an expansion in the posterior third. The extreme posterior of the mantle is bluntly rounded. There is a strong direct relationship between mantle width (MW) and DML. The regression equation is MW = 0.668 + 0.451 DML, R^2 = 92.6 %, n = 49. The anterior mid dorsal extension of the mantle is not pronounced in young specimens and only a slight crescent-like emargination exists on the ventral mantle lip between the funnel locking cartilages. In the majority of specimens the outer mantle skin was damaged or missing. Intact fin margins were rare and no attempt has been made to correlate fin width with DML. Over the DML range of this collection, fin shape changes from nearly spherical to ovoid.

Head length was measured dorsally from the junction of arms 1 to the posterior border of the head cartilage. Head width was greatest at, or just posterior to the eyes. The regression equation for head width (HW) on head length (HL) was HW = − 0.494 + 0.535 HL, R^2 = 93.2 %, n = 48. Head depth was usually the least dimension and did not

Table I. — Capture positions and measurements in mm of rhynchoteuthion larvae studied. Gear B = Bongo nets, G = modified Gulf III high speed sampler, 1 = 1 m × 1 m net, 2 = 2 m × 2 m net.

Position		Specimen	Gear	Dorsal mantle length	Max. mantle width	Mantle opening width	Head length	Head width	Head depth	Eye diameter	Fin width	Tentacle length	Tip split	Base split	Length Arm 1	Length Arm 2	Length Arm 3	Length Arm 4
42°38'S	169°48'E	1	B	1.25	1.15	-	0.75	0.75	0.50	0.25	-	0.32	×	×	0.20	0.25	-	-
42°38'S	169°48'E	2	B	1.60	1.35	0.90	0.60	0.75	0.50	0.35	-	0.35	×	×	0.22	0.22	-	-
42°57'S	170°00'E	3	B	1.62	1.10	0.70	-	-	-	0.42	-	0.45	×	×	0.12	0.12	-	-
42°10'S	170°02'E	4	B	1.74	1.23	-	0.75	1.02	0.75	0.40	-	0.50	×	×	0.23	0.18	-	-
38°14'S	173°58'E	5	B	1.96	1.25	-	0.95	0.85	-	-	-	1.85	×	×	0.95	1.05	0.65	0.15
42°30'S	170°14'E	6	B	2.20	1.40	1.30	0.60	1.00	0.50	0.30	-	0.40	×	×	0.30	0.30	0.30	-
40°27'S	172°51'E	7	G	2.25	1.64	1.25	1.12	1.48	0.95	-	0.32	0.85	×	×	0.40	0.66	0.55	0.10
43°13'S	168°59'E	8	B	2.25	2.15	1.55	1.10	1.35	0.90	0.24	-	1.30	×	×	0.52	0.45	0.37	-
40°27'S	172°51'E	9	G	2.35	1.55	1.30	1.20	1.38	0.93	0.50	0.27	0.70	×	×	0.35	0.35	0.30	-
40°27'S	172°51'E	10	G	2.41	1.73	1.55	1.37	1.50	0.90	0.57	0.27	0.94	×	×	0.50	0.50	0.30	0.10
36°46'S	176°12'E	11	G	2.45	2.35	1.80	1.40	1.70	0.95	-	-	0.55	×	×	0.40	0.55	0.40	0.25
40°56'S	173°24'E	12	G	2.50	1.50	1.20	1.20	1.45	1.10	0.70	-	0.95	×	×	0.37	0.27	0.32	-
43°16'S	169°12'E	13	B	2.55	1.57	-	1.23	1.62	0.60	0.52	-	1.32	×	×	0.50	0.58	0.20	0.10
38°12'S	173°51'E	14	B	2.73	1.90	-	1.07	1.27	0.95	0.50	-	1.20	×	×	0.65	0.70	0.44	0.10
41°44'S	171°18'E	15	B	2.85	2.40	-	1.30	1.60	0.95	0.60	-	1.40	×	×	0.60	0.75	0.45	0.12
40°23'S	173°14'E	16	G	2.95	2.20	1.00	0.65	0.85	0.58	0.70	0.70	0.85	×	×	0.50	0.40	0.50	0.10
43°13'S	168°59'E	17	B	3.30	2.25	1.65	1.17	1.65	1.17	0.53	-	1.40	×	×	0.50	0.62	0.37	0.25
42°11'S	170°06'E	18	B	3.40	2.15	2.10	1.75	2.25	1.52	0.85	0.47	1.40	×	×	0.57	0.65	0.67	0.30
40°27'S	172°51'E	19	G	3.43	2.10	1.85	1.80	1.95	1.25	0.75	0.75	1.30	×	×	0.75	0.80	0.80	0.27
40°27'S	172°51'E	20	G	3.55	2.13	-	2.25	1.93	1.73	0.74	-	1.20	×	×	1.00	0.80	0.73	0.27
36°14'S	175°08'E	21	1	3.62	2.72	2.10	2.10	2.35	1.50	0.90	0.62	1.06	×	×	0.85	0.95	0.95	0.30
41°59'S	174°27'E	22	G	3.65	2.50	2.22	1.65	1.65	1.25	0.95	0.66	1.55	×	×	1.50	1.95	1.20	0.45
46°59'S	168°51'E	23	G	3.70	-	-	2.00	1.90	1.47	0.85	-	1.57	×	×	0.70	-	0.49	0.35
36°15'S	175°07'E	24	1	3.70	2.25	1.93	1.73	2.10	1.28	1.00	0.60	1.15	×	×	0.70	0.90	0.65	0.20
38°14'S	173°58'E	25	B	3.85	2.30	2.30	1.90	2.05	1.90	0.88	0.57	1.65	×	×	-	-	0.80	0.30
36°21'S	175°19'E	26	1	3.95	2.47	1.85	2.15	1.90	1.32	0.90	0.77	1.18	×	×	0.60	0.70	0.80	0.28
40°04'S	172°57'E	27	B	4.05	2.50	2.40	1.73	2.20	1.35	0.85	0.50	0.90	×	×	0.55	0.75	0.95	0.15
43°27'S	168°52'E	28	B	4.20	2.55	2.23	1.90	1.53	1.32	0.77	-	2.10	×	×	0.60	0.75	0.90	0.35
36°16'S	175°17'E	29	1	4.33	2.57	2.25	-	2.20	1.70	1.10	1.00	0.98	×	×	1.05	1.55	1.35	0.40
43°16'S	169°12'E	30	B	4.35	3.15	2.30	1.95	2.35	1.55	0.73	0.60	1.90	×	×	1.00	1.27	0.80	0.30
41°58'S	174°10'E	31	G	4.50	2.90	2.20	2.20	2.25	1.60	1.02	0.65	1.50	×	×	0.80	1.08	0.77	0.27
43°54'S	173°11'E	32	G	4.90	3.15	2.80	2.46	2.88	1.80	1.38	0.80	1.65	×	×	1.95	2.23	1.47	0.40
40°23'S	173°14'E	33	G	4.95	2.63	2.63	2.43	2.55	1.70	1.05	0.80	0.95	×	✓	1.06	1.55	1.15	0.50
41°58'S	174°10'E	34	G	5.00	2.43	2.20	2.20	2.50	1.70	1.15	0.55	1.55	×	×	0.95	0.75	0.70	0.30
36°46'S	176°12'E	35	G	5.40	2.82	2.28	2.36	2.60	1.72	1.24	-	0.90	×	×	1.33	1.47	0.70	0.50
36°06'S	175°28'E	36	1	5.60	2.90	2.90	2.30	2.60	1.60	0.65	0.80	1.25	×	✓	1.00	1.50	1.40	0.40
46°55'S	168°20'E	37	G	5.70	3.00	2.60	1.90	2.60	1.60	1.20	1.10	1.40	×	×	1.10	1.20	1.10	0.10
42°58'S	177°44'W	38	B	5.80	4.00	3.32	3.00	2.95	2.10	1.70	1.02	1.80	×	✓	1.55	2.15	1.82	0.62
39°00'S	173°25'E	39	B	6.00	3.25	3.25	3.15	2.80	2.15	1.65	1.60	1.50	×	✓	2.45	3.10	2.50	1.02
41°47'S	170°54'E	40	2	6.30	3.55	2.90	2.82	2.90	1.90	1.40	0.85	1.60	×	✓	1.50	1.70	1.55	0.62
43°46'S	173°48'E	41	G	6.80	3.95	3.60	3.00	3.52	2.45	1.66	1.02	1.85	×	✓	1.70	2.55	1.97	0.82
50°11'S	166°11'E	42	B	6.90	4.37	3.72	3.65	3.35	2.62	1.72	1.30	1.85	×	✓	2.05	2.37	2.10	0.55
46°56'S	168°26'E	43	G	7.50	3.75	3.44	3.10	3.10	2.28	1.65	1.65	1.52	×	✓	1.83	2.35	2.38	1.00
46°56'S	168°26'E	44	G	7.70	4.47	4.10	3.10	3.27	2.60	2.08	1.78	1.80	×	✓	2.32	2.32	2.25	1.00
44°46'S	172°19'E	45	G	8.20	4.20	3.50	3.25	3.70	2.70	2.30	1.90	2.30	×	✓	2.60	3.25	3.00	1.00
44°45'S	171°55'E	46	G	8.40	4.30	4.30	3.20	3.90	2.74	2.50	1.68	2.78	✓	✓	3.55	3.40	3.22	2.05
46°55'S	168°20'E	47	G	9.30	4.70	-	2.50	3.90	2.60	2.00	2.70	1.70	×	✓	2.60	2.40	2.10	1.10
39°59'S	173°30'E	48	G	9.30	4.30	4.30	4.00	3.85	3.10	2.48	2.17	3.60	✓	✓	3.60	4.45	4.57	2.95
40°26'S	173°44'E	49	G	9.60	4.80	4.80	3.62	3.65	2.85	2.10	2.25	1.75	✓	✓	2.65	3.10	2.80	1.67
42°04'S	174°08'E	50	G	10.10	5.70	5.70	3.80	3.80	3.00	2.15	-	3.35	✓	✓	4.13	3.85	3.40	2.17

relate well to other head dimensions or DML. The head was wider than the mantle opening in specimens 7, 9, 12, 18, 19, 21, 24, 26, 30, 31, 32, 34, 35, 45. The head was narrower than the mantle opening in specimens 2, 6, 8, 10, 11, 16, 22, 25, 27, 28, 29, 33, 38, 39, 41, 42, 43, 44, 46, 48, 49, 50. This division corresponds to neither geography nor ontogeny, suggesting individual variation and the effects of contraction and preservation.

Eye position and colour changes during development. Small specimens have bright brick red eyes positioned antero-dorsally on the head. The eye is oriented forwards and has an almost stalked appearance. As DML increases, the eye position becomes more lateral and less anterior. The colour changes to a reddish brown and the silvery iridescent coating of the eye increases in its extent and thickness. In the largest specimens this tends to obscure the underlying eye colour. No light organs were found on or around the eyes.

Specimens 1-4 lack a third arm of measurable dimensions, although the precursor buds are visible. The third arm develops around 2 mm DML. All specimens over 2.55 mm DML possess a fourth arm. A general arm formula is difficult to determine. Until 4.90 mm DML there is a tendency for arm 2 to be longest (19/26) and the arm formula is frequently 2 > 1 > 3 > 4 (11/26 specimens). The differences in length between arms 1, 2 are small. After 4.90 mm DML the relative lengths of the arms 1, 2, and particularly arm 3, become increasingly variable. However, throughout the size range there is good correlation between the length of arm 1 and DML, arm 1 = − 0.528 + 0.376 DML, R^2 = 84.9 %, n = 49. Specimens differing a little from this relationship are numbers 5, 46, 50. The youngest specimens possess a single sucker on each arm.

The fused tentacles, or proboscis, remain wholly fused until almost 5 mm DML (Table I, Fig. 2a). The young proboscis tip is often oval, but may be preserved in a variety of contortions. The smallest specimens have 8 suckers on the proboscis tip. The suckers are of roughly equal size, evenly spaced and without particular orientations (Fig. 2a, b). A longitudinal groove along which splitting later occurs was evident at the base of the proboscis and less

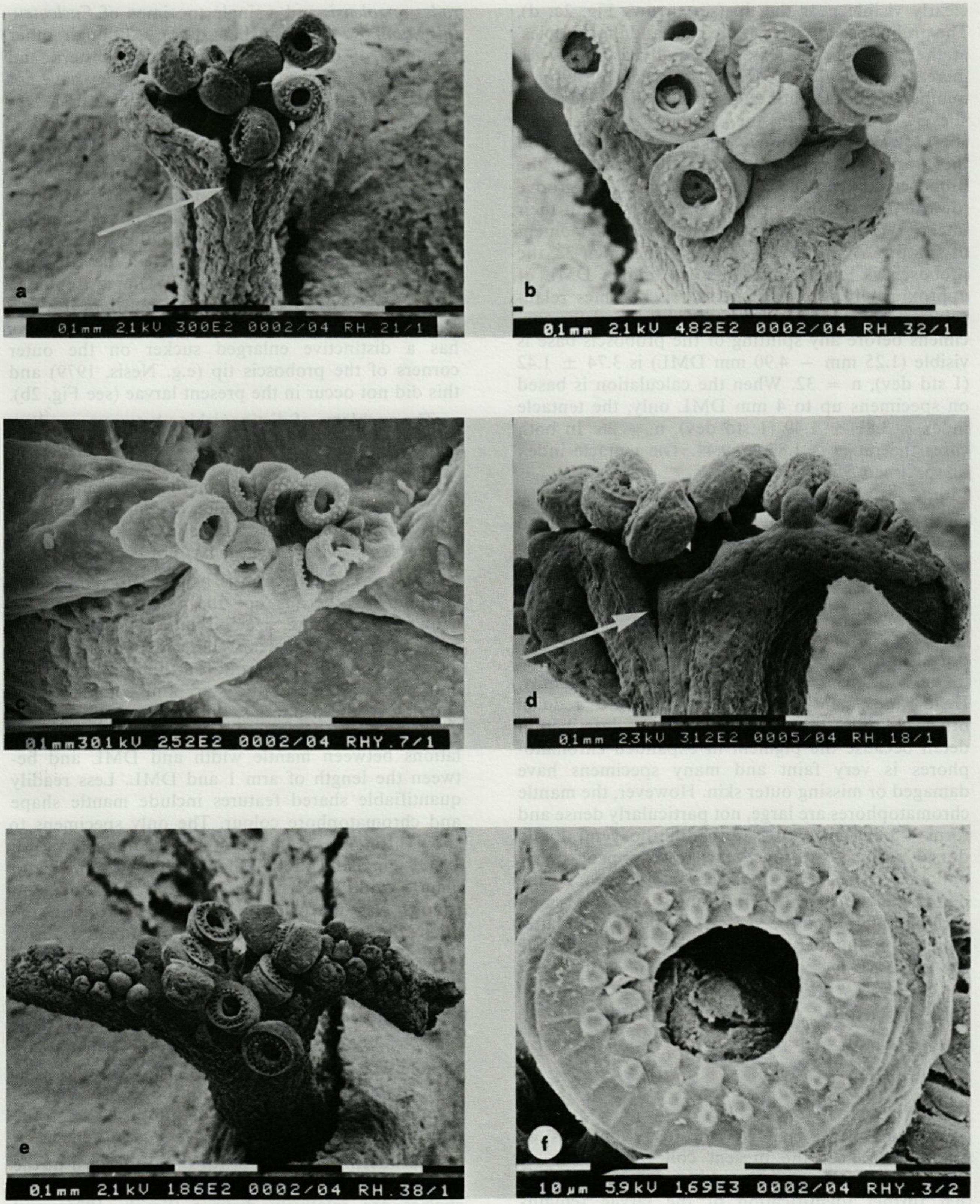

Fig. 2. — Scanning electron microscope photographs of rhynchoteuthion larval proboscis. a-e scale bar = 0.1 mm, f scale bar = 10 µm. a, proboscis tip of small larva (specimen 18). Arrow indicates future splitting groove; b, proboscis tip showing equal sized suckers and developing 'auricles' (specimen 25); c, further 'auricle' development (specimen 37); d, sucker primordia developing (specimen 25). Arrow indicates future splitting groove; e, typical larger larva showing continued integrity of original tip suckers; f, arrangement of 'scales' on an original proboscis sucker of specimen 47.

clearly visible near the tip (see arrows Fig. 2a, d). The proboscis elongates at the base and the 'auricles' at the proboscis tip extend laterally as the DML increases (Fig. 2b, c). These 'auricles' develop a number of sucker buds (Fig. 2d) which develop into suckers smaller than the original 8 tip suckers (Fig. 2e). While additional suckers are developing on the 'auricles' a split develops at the base of the proboscis and proceeds up the longitudinal groove towards the tip. The original 8 suckers retain their integrity, form, and orientation until the last moment of splitting. With the exception of specimen 22, the proboscis is longer than all arms until a DML of approximately 4 mm. Thereafter it becomes relatively shorter. The tentacle index calculated for specimens before any splitting of the proboscis base is visible (1.25 mm – 4.90 mm DML) is 3.74 ± 1.42 (1 std dev), n = 32. When the calculation is based on specimens up to 4 mm DML only, the tentacle index is 3.81 ± 1.49 (1 std dev), n = 26. In both cases the range is 1.82 – 9.44. The tentacle index of specimen 5 is 9.44.

Fig. 2f has been included since no reference exists on the form of the early suckers in rhynchoteuthion larvae. The feature of 33-34 'scales' arranged in two concentric rings may prove a useful taxonomic tool for distinguishing closely related species or genera within the family Ommastrephidae.

The positioning and order of appearance of dorsal and ventral head chromatophores is similar to descriptions for other members of the family. Head and mantle chromatophores are reddish brown. Mantle chromatophores are not described in detail because the pigment in expanded chromatophores is very faint and many specimens have damaged or missing outer skin. However, the mantle chromatophores are large, not particularly dense and form 4-5 irregular rows on both the ventral and dorsal surface. At times the rows appear to be oblique. There is a small chromatophore at the dorsal junction of the fins and a row of small chromatophores on the ventral mantle lip. The latter increase in number and eventually form a double row as DML increases.

DISCUSSION

Presence of the characteristic fused tentacles, or proboscis, places the present collection of larvae within the family Ommastrephidae but it is realized that further identification of the larvae remains unverified.

Ommastrephid squid captured within the New Zealand EEZ by Fisheries Research Division up to 1985 are *Nototodarus sloani, Nototodarus gouldi, Ommastrephes bartrami, Todarodes filippovae, Todarodes angolensis* and a single specimen of *Eucleoteuthis luminosa* (unpublished data). Although other members of the family occur in the western and northern Tasman sea (Dunning, 1985), they have not been captured on New Zealand continental shelves and it seems that mature females do not occur towards the southern extent of their range (Dunning, pers. comm.).

It could be argued that the absence of other ommastrephids is a result of inadequate sampling. The absence of light organs on either the eyes or viscera of the larvae indicates that they do not include members of the subfamily Ommastrephinae other than possibly *Ommastrephes bartrami* (Lu and Dunning, 1982). However, *Ommastrephes bartrami* has a distinctive enlarged sucker on the outer corners of the proboscis tip (e.g. Nesis, 1979) and this did not occur in the present larvae (see Fig. 2b).

The problems of distinguishing between members of the subfamily Todarodinae, *Nototodarus* and *Todarodes,* remain. *Todarodes angolensis* is comparatively rare and does not occur on the continental shelf, but *Todarodes filippovae* does overlap *Nototodarus* spp. distribution. Unfortunately the larva of the species *Todarodes filippovae* has not been described.

The present collection is believed to represent a single genus because of the relative consistency shown in the timing, size and nature of the development of some characters. These include the size at appearance of the third and fourth arms, eye colour and position, size at the start and completion of splitting of the proboscis, the proboscis tip suckers and sequential changes in the 'auricles', the correlations between mantle width and DML and between the length of arm 1 and DML. Less readily quantifiable shared features include mantle shape and chromatophore colour. The only specimens to show differences from the others are number 5 (arm 1 and tentacular index) and number 50 (arm 1 and mantle width). Specimen 42 from the Auckland islands was narrower in mantle length than the others. In every other observed feature the above three specimens corresponded with the remainder of the collection.

The specimens in this study were largely obtained from coastal locations in the main fishing grounds for *Nototodarus* spp. On the basis of overwhelmingly greater observed abundance of *Nototodarus* spp. over *Todarodes filippovae* and the consistency in several larval characters, it is proposed that the present collection consists of *Nototodarus* species.

Considering that except for the west coast of the South Island, the distribution of the two *Nototodarus* species are relatively distinct (Smith, 1985) and specimens have been obtained from most regions in which the two adult species occur, it is reasonable to expect both species to be represented in the present collection. However, as has been mentioned above, there is remarkable consistency within the observed features and such variations as do occur do not relate to the known geographic distribution of the two *Nototodarus* species.

POSTCRIPT. — After completion of this research by the present author, a further squid larval survey was carried out in New Zealand waters in conjunction with the Japanese Government. Recent discoveries include rhynchoteuthion larvae without light organs and roughly equal sized proboscis tip suckers i.e. probably subfamily Todarodinae. However, one specimen possessed bright yellow chromatophores on the head, another had a more ventral eye position and a third was more than 10 mm in DML but with an incompletely separated proboscis (Forch and Uozumi, unpublished data). Those data are still subject fo considerable analysis, but mention thereof serves to illustrate the uniformity exhibited by the present collection.

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