Systematics and Distribution of Oceanic Cephalopods in the South China Sea, Area III: Western Philippines

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ABSTRACT

Four species of cephalopods were collected in the South China Sea, area III (Western Philippines) during April–May 1998. An oceanic species, *Sthenoteuthis oualaniensis* (Lesson, 1830) was caught by automatic squid jigging on board M.V SEAFDEC and three additional cephalopod species, *Sepioteuthis lessoniana* Lesson, 1830, *Thysanoteuthis rhombus* Troschel, 1857 and *Nototodarus hawaiiensis* (Berry, 1912) were caught by squid jigging and purse seine of M.V. Maya Maya. *S. oualaniensis* was the dominant oceanic species in the study area. Descriptions, measurements and distributions of these squids were included.

Introduction

The SEAFDEC Interdepartmental collaborative research program in the South China Sea, area III (West coasts of the Philippines) has been carry out by the research vessel SEAFDEC during 7 April –19 May 1998. Main objectives of the program are to collect and analyze data and information necessary for the management of fishery resources and protection of the environment through collaborative research among member countries and organizations concerned. The survey was focused on tuna, oceanic squid and other highly migratory species in the area. A number of the oceanic squid materials were collected during the investigation. Aim of the present study is to describe all these species of the oceanic squids. This research will be provided better foothold for the fishery scientists interested in the exploitation of the oceanic cephalopods in the area.

Materials and Methods

Study area

The study area is in the northern part of South China Sea (Area III, off the West Coast of the Philippines). The area covers from latitude 11°N to 20°N and longitude 117°E to 121°E, a total of 86,400 square miles (Fig.1). Most of the area is rather deep (95% being deeper than 1,000 m). It is characterized as having oceanic conditions.

Collected material

A total of 11 stations for fishing surveys on the oceanic cephalopods were carried out using a squid jigging method by M.V. SEAFDEC during 17 April to 10 May 1998 in the study area. Descriptions of fishing method are described in Siriraksophon *et al.* (1999). Collected materials were preserved in 10% neutralized formalin. All oceanic squids were not relaxed or

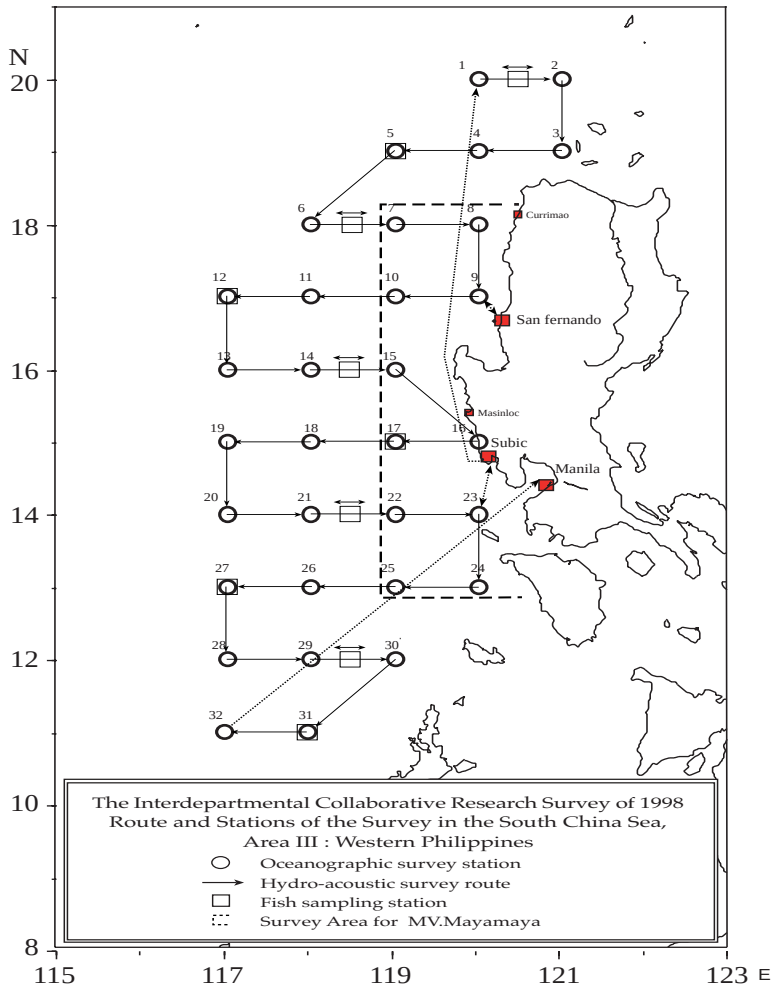

Fig. 1. Map of study area.

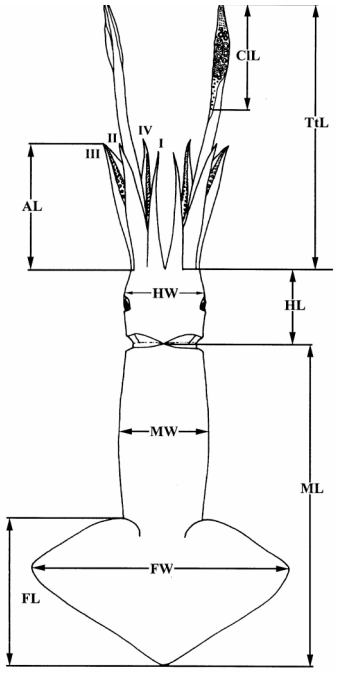

Fig. 2. Diagrammatic illustrations of the measurements in squids. Dorsal view, AL= Arm Length, ClL=Club Length, FL=Fin Length, FW=Fin Width, HL=Head Length, HW=Head Width, ML=Mantle Length, MW=Mantle Width, I=dorsal arm, II=dorso-lateral arm, III=ventro-lateral arm, IV=ventral arm, TtL=Tentacular Length.

killed prior to preservation since they were dead after capture. The fixed-specimens were later transferred to 75% ethyl alcohol for permanent storage. In order to accomplish systematics of the cephalopods in the study area, some additional material were also collected from the purse seine operated by M.V. Maya Maya.

Descriptions and measurements

All specimens were examined, and measurements, body proportions, counts and indices were obtained from the whole body as described by Roper & Voss (1983). Measurements are in millimeters (mm). Indices are expressed as percentage of dorsal mantle length and are denoted by the final initial I, *e.g.* HWI = HW/ML x 100.Diagram and summary of measurements, counts and indices are shown in Fig. 2 and Table 1. The buccal mass was removed from some specimens and the beaks and radulae extracted, cleaned, and illustrated. The beaks, radulae and spermatophores were drawn with the aid of a camera lucida. The enlargement section of the spermatophores and most of the radulae were stained in methylene blue in order to get higher contrast during examination and illustration in the compound microscope.

Voucher material is lodged in the Fisheries Science Museum, Department of Fisheries, Chatuchak, Bangkok 10900, Thailand.

Table 1. Definition of counts, measurements and indices.

ML	Mantle Length	Dorsal mantle length measured from the anterior most point of the mantle to the posterior tip.
MWI	Mantle Width Index	Greatest straight-line (dorsal width of mantle as a percentage of mantle length).
FLI	Fin Length Index	Greatest length of fins as a percentage of mantle length.
FWI	Fin Width Index	Greatest width (dorsally) across both fins as a percentage of mantle length.
HWI	Head Width Index	Greatest width of head at level of eyes as a % of mantle length.
HLI	Head Length Index	Dorsal length of head measured from point of fusion of dorsal arms to anterior tip of nuchal locking-cartilage as a percentage of mantle length.
ALI	Arm Length Index	Length of each designated arm (I, II, III, IV) measured from first basal (proximal most) sucker to the tip of arm as a percentage of mantle length.
TtLI	Tentacle Length Index	Total length of tentacular stalk and club as a percentage of mantle length.
ClLI	Club Length Index	Length of designated club as a percentage of mantle length.

SYSTEMATIC ACCOUNT

Family Loliginidae Lesueur, 1821
Genus *Sepioteuthis* Blainville, 1824
sensu Vecchione *et al.* 1998

Diagnosis:

Fins occupying almost entire lateral margin of mantle, except in paralarvae. Posterior mantle not elongated into tail-like structure. Egg large, length>5 mm. Arm-sucker rings with pointed teeth around entire margin. Proximal suckers on hectocotylus unmodified. Hectocotylus without crest, hectocotylization consists of reduction in sucker size and elongation of sucker stalks along modified portion of arm to form papillae on both dorsal and ventral rows. Photophores absent. Spermatophore with short cement body.

Sepioteuthis lessoniana Lesson, 1830
Fig. 3, Table 2

Sepioteuthis lessoniana –Sasaki, 1929:127, pl. xiv, figs. 15-17, pl.29, figs.8-9, textfigs. 74-77; -Adam, 1939:21, fig.1-2, pl.I; -Voss, 1963:77-81, fig.13; -Voss & Williamson, 1971:66-67, figs. 19,20,26, pl.20; -Lu & Tait, 1983:183-190, figs. 1-4, 8a; -Roper*, et al*., 1984:109-110.

MATERIAL EXAMINED:

7 specimens, 3 males, 4 females, Purse seine operation by M.V. Maya Maya, west coast of the Philippines, 1998.

DESCRIPTION:

Mantle (Fig.3a,b) long, robust, tapering and rounded at posterior end; median antero-dorsal lobe rounded, slightly pronounced; ventro-lateral lobes pointed, conspicuous; ventral mantle margin concave. Fins large, thick, length from 83-94% of ML; anterior lobes narrow and widest at about 1/3 from the posterior end, broadly oval shape, their width from 54-71% of ML. Fins united posteriorly around the end of the mantle by a fleshy ridge. Head large, narrower than the width of anterior mantle; the neck and mantle dorsally connected by a prominent nuchal locking apparatus. Eyes large, entirely covered by a transparent secondary cornea, a distinct pore (lacrimal) present in front of anterior eye, olfactory crest behind eyes prominent (Fig.3c). Funnel (Fig.3d) strong, conical, extends deeply to the ventral surface of the head; funnel valve subterminal and well developed; dorsal funnel organ inverted V shaped, two oblong pads (Fig.3e). Nuchal cartilage fiddle-shaped, slightly wider in anterior than posterior part; funnel cartilage simple, straight and slightly curved outward at the posterior end, a deep groove present in the middle; mantle cartilage straight.

Arms stout with pointed tips, unequal in order of III.IV.II.I. Arm I short, triangular with an aboral keel along its length. Arm II flattened with a low aboral swimming keel, broadest at the middle of arm. Arm III broad, with a thick, low aboral keel. Arm IV lacks aboral keel, broad and flats web present along the edge of dorsal arm. Protective membranes strong trabeculated on arm I-III, weaker on arm IV. Biserial suckers present in all arms; diameter less than 2 mm, the size decreases distally to the tips. Ring of suckers with 17-28 sharp, acute teeth (Fig.3f). Left arm IV of male hectocotylised (Fig.3g), modification of distal 20-30%. Size and general shape of left arm similar to that of right arm. The unmodified proximal portion of arm with 25-30 pairs of suckers arranged in two rows, each sucker bears 25-30 sharp acute teeth, large on proximal part and decreasing in size towards the distal end, trabeculae protective membrane weak, similar to the right ventral arm. Modified distal portion bears biserial, long, fleshy papillae decreasing in size towards the arm tip, each papilla has a small sucker at its apex but lacks sucker rings.

Tentacles long, stout; stalk naked and laterally compressed. Club slightly expanded (Fig.3h), bordered on either side by a strong and well-developed membrane with prominent supports, aboral surface bears a strong keel. Four rows of tentacular suckers on manus and dactylus; 1-2 rows on indistinct carpus. Median manal suckers large and bear 17-18 widely spaced acute teeth (Fig.3i). Dactylus suckers small, decrease in size to distal end.

Gladius with rachis stout, broad anteriorly, then evenly narrowing to the posterior end (Fig.3j); median groove rounded, thickened laterally. Vane broad, greatest width on posterior third; thickened in a broad band on the three-fourth of posterior portion but the edge not thickened.

Buccal membrane with seven buccal lappets, supported by strong buccal membrane connectives; each lappet bears 0-7 buccal suckers, sucker ring comprises of 18-25 small, sharp teeth, which are largest on distal margin. Upper beak (Fig.3k) with long, curved rostrum and hood; hood less than half of crest, rostral tip curved and strong, wing with a large tooth at jaw angle; black to dark brown from rostral tip to anterior half of hood and wing; crest curved and unpigmented, lateral wall large. Lower beak (Fig.3l) short, strong curved rostral tip, hood short, wing large, black on rostral tip and cutting edge of anterior portion of wing, crest curved, unpigmented. Radula (Fig.3m) with seven transverse rows of teeth in both sexes; rachidian tooth short, stout with low lateral cusps, first and second lateral teeth similar to rachidian tooth but somewhat bigger; third lateral row with slender hook-like teeth; oval marginal plate.

Spermatophores (Fig.3n-o) measure about 4.5 mm in length and 0.15 mm in width, sperm mass comprises three-fourth of total length of the spermatophore. Cement body with constriction in the middle, almost separated into two parts, aboral part somewhat bigger than the oral part. Ejaculatory apparatus consists of several tightly large coils in the oral end of the spermatophore. Ink sac pyriform, lacking photophore, silvery and blue-green outer layer, with lines on the ventral side of the visceral mass on the dorsal side of the intestine.

Colour in alcohol cream; dorsal surface of mantle, fins, head and arms covered with large and dense chromatophores; less concentrated on ventral surface of mantle and absent on ventral fin surfaces; dark patch present dorsal to each eye.

Table 2. Means, standard deviations and ranges of selected measurements and indices (in percent) of *Sepioteuthis lessoniana* from the western Philippines.

	MALES				FEMALES			
Index	n	mean	S.D.(n-1)	Range	n	mean	S.D.(n-1)	Range
ML (mm)	3	132.3	5.7	126.0-137.0	4	130.5	11.8	122.0-148.0
MWI	3	36.8	1.9	34.7-38.3	4	37.0	2.8	35.2-41.1
HLI	3	22.4	2.6	20.7-25.4	4	21.8	5.8	17.8-30.3
HWI	3	26.3	1.4	25.4-27.9	4	25.5	1.9	23.5-27.4
FLI	3	94.0	2.0	94.0-96.0	4	91.6	2.5	88.5-93.6
FWI	3	65.9	5.3	61.1-71.6	4	64.4	5.8	57.1-71.3
$AL_{I}I$	3	31.0	3.1	28.4-34.4	4	36.1	7.2	27.8-45.4
$AL_{II}I$	3	44.6	2.1	42.9-47.0	4	41.8	4.6	35.9-45.7
$AL_{III}I$	3	52.2	3.5	48.3-55.0	4	51.8	5.7	45.8-59.4
$AL_{IV}I$	3	51.0	3.6	47.7-54.8	4	53.9	4.1	50.6-60.0
TtLI	3	116.2	20.3	93.6-132.8	4	118.7	19.3	92.5-135.2
ClLI	3	44.7	6.4	37.4-49.6	4	43.6	3.4	40.1-48.3

GEOGRAPHICAL DISTRIBUTION:

Tropical Indo-West Pacific. From the Red Sea, Arabian Sea, northern Australia to Japan and Hawaiian Islands.

REMARKS:

Adam (1939) and Lu & Tait (1983) have reviewed *Sepioteuthis lessoniana in detail*. The species is one of the most widely distributed loliginids in the Indo-Pacific; it is likely to include a number of cryptic species, as proposed by recent findings in Okinawa (Segawa *et al*., 1993). The examined material is in accordance with the description of Voss (1963).

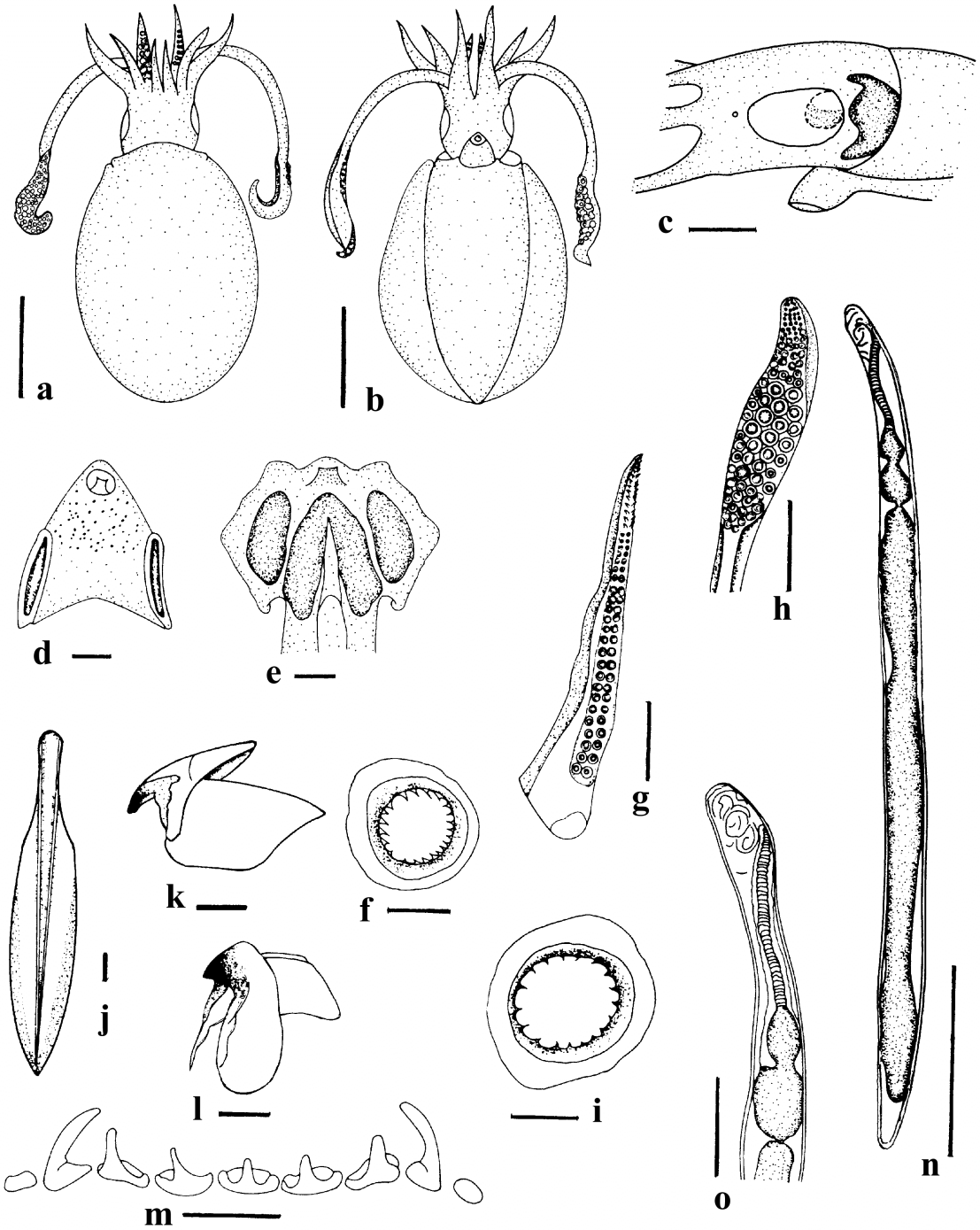

Fig.3. *Sepioteuthis lessoniana*. a, dorsal view. b, ventral view. c, head, side view. d, funnel, ventral view. e, dissected ventral view. f, 3rd arm sucker. g, hectocotylised arm. H, tentacular club. I, club sucker. j, gladius. k, upper beak. l, lower beak. m, radula. n, spermatophore. o, oral end of spermatophore. Scales: a,b,j = 50 mm; c,d,e,g,h = 10 mm; k,l = 5 mm; f,I,n = 1 mm; m, o = 0.2 mm

Family Ommastrephidae Steenstrup, 1857
Subfamily Todarodinae Adam, 1960

Nototodarus Pfeffer, 1912

Diagnosis:

Funnel groove with foveola but without side pockets, dactylus of tentacular club with quadriserial suckers, photophores absent in all life stages, right and left arms IV hectocotylized.

Nototodarus hawaiiensis (Berry, 1912)
Fig.4, Table 3

Ommastrephes hawaiiensis –Berry, 1912:434
Nototodarus sloani philippinensis –Voss, 1962:175; -Voss, 1963:128-133, fig.28
Nototodarus sloani hawaiiensis –Voss, 1962:175
Nototodarus hawaiiensis –Wormuth, 1976:2, 17-21, fig.3; -Dunning, 1988:159-168

MATERIAL EXAMINED:

5 females specimens, Purse seine operation by M.V. Maya Maya, west coast of the Philippines, 1998.

DESCRIPTION:

Mantle (Fig.4a-b) moderately long, cylindrical anteriorly about 2/3 and tapering at about the level of fins to a conical tip; median antero-dorsal lobe low, round; ventral mantle margin excavated. Fins small wider than long; anterior margins convex; lateral lobes pointed; posterior margins slightly concave to a narrow posterior point. Head stout, as broad as mantle; dorsoventrally flattened; three large olfactory crests present on posterior margin. Eyelid large, with a deep distinct sinus on the anteroventral border. Funnel stout, tapering anteriorly; funnel valve subterminal, rectangular and well developed; dorsal funnel organ sharply inverted v-shaped with oval ventral pads. Funnel groove with foveola (Fig.4d), no longitudinal ridges. Locking apparatus inverted T-shaped (Fig.4c), with a deep median pit and longitudinal groove.

Arms moderately long, unequal, in order of III.II.I.IV or II.III.I.IV. Arm I long and slender, low keel presents on basal. Arm II slightly dorsoventrally flattened, with low keel. Arm III stout, with keel and with a deep triangular swimming membrane. Arm IV trapezoidal in section, keel present. Biserial suckers in all arms. Arm sucker rings toothed with about 20 teeth all around; proximally, teeth are flattened broad platelets that grade distally into sharp, pointed teeth, the distal central tooth much enlarged, pointed and curved. No male in the present collection, therefore the hectocotylus could not be observed.Tentacles short and stout (Fig.4e). Tentacular club long, occupy about 60% of ML; carpal area indistinct; about 12 median manal suckers, with 14 to 18 large, sharp teeth, the central one enlarged.

Colour in alcohol yellow cream, dorsal surface of mantle, head, and arms covered with scattered dark gray chromatophores; skin rough.

GEOGRAPHICAL DISTRIBUTION:

Hawaiian Islands to Midway Island, South China Sea, Andaman Sea and northern Australia

REMARKS:

Unique characters of the genus *Nototodarus* are having the simple foveola in the funnel

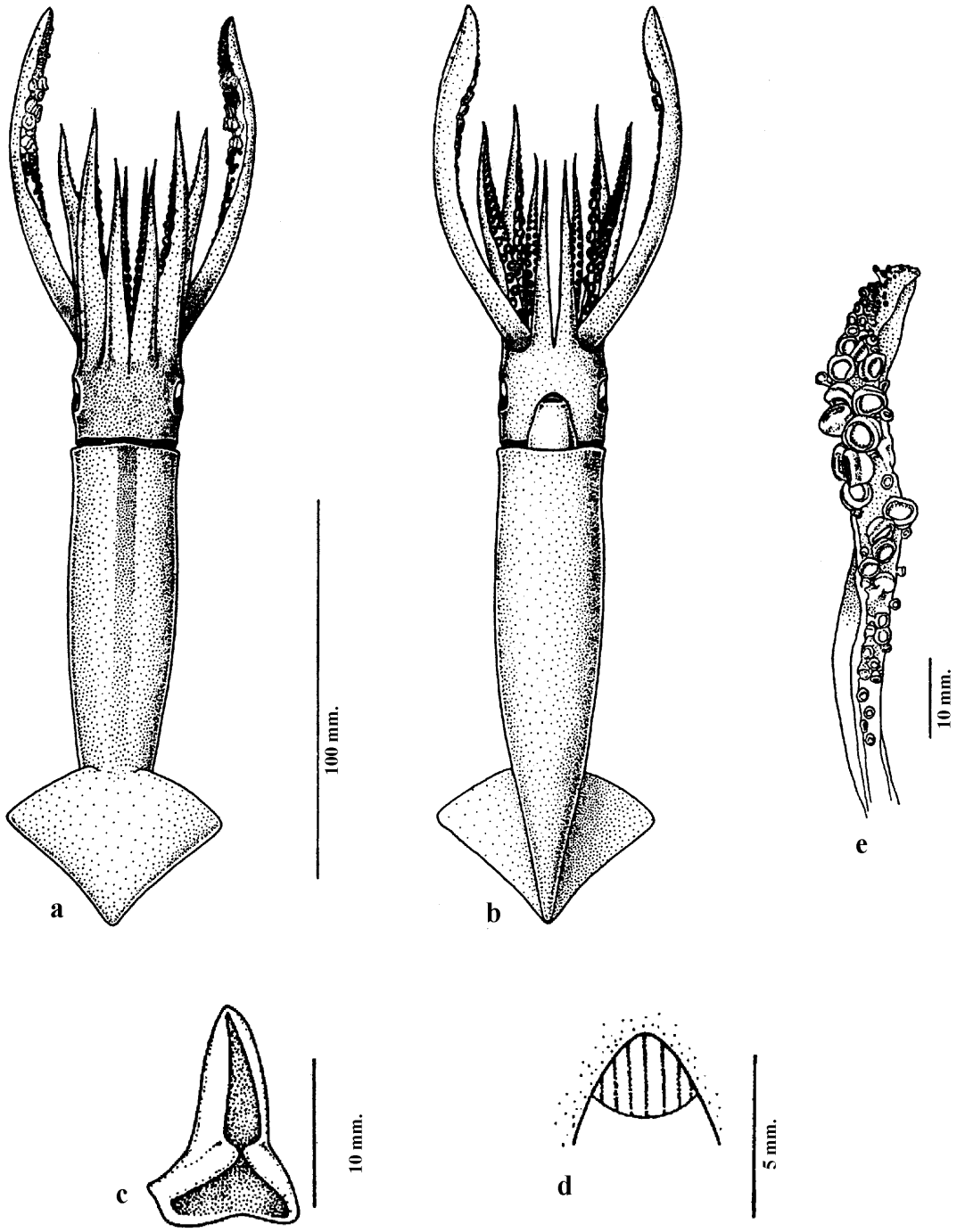

Fig.4.*Nototodarus hawaiiensis*. a, dorsal view. b, ventral view. c, funnel locking cartilage. d, foveola. e, tentacular club.

groove, absence of light organs and hectocotylization of both ventral arms in males. Six nominal forms of the genus *Nototodarus* have been described from continental shelf and slope waters of the Indo-Pacific region. According to Dunning & Forch (1998), of these six nominal species, three are considered valid: *N. sloanii* (Gray, 1849), occurring around southern New Zealand; *N. gouldi* (McCoy, 1888), occurring around northern New Zealand and southern Australia; and *N. hawaiiensis* (Berry, 1912), broadly distributed in slope waters in the Indo-Pacific region. The species differ in the structure of the hectocotylus and in the number, arrangement, and dentition of suckers on the sessile arms.

Table 3. Means, standard deviations and ranges of selected measurements and indices (in percent) of *Nototodarus hawaiiensis* from the Western Philippines.

	MALES				FEMALES			
Index	n	mean	S.D.(n-1)	Range	n	mean	S.D.(n-1)	Range
ML (mm)	-	-	-	-	5	131.8	14.6	118.0-152.0
MWI	-	-	-	-	5	27.1	1.7	25.7-29.6
HLI	-	-	-	-	5	23.4	8.8	18.6-39.2
HWI	-	-	-	-	5	23.8	10.4	15.0-41.8
FLI	-	-	-	-	5	36.0	3.0	33.9-41.1
FWI	-	-	-	-	5	70.6	5.4	65.8-79.1
$AL_{I}I$	-	-	-	-	5	37.4	1.5	35.9-39.3
$AL_{II}I$	-	-	-	-	5	41.9	3.3	36.6-45.1
$AL_{III}I$	-	-	-	-	5	46.4	2.2	43.3-48.5
$AL_{IV}I$	-	-	-	-	5	42.2	5.4	33.6-48.0
TtLI	-	-	-	-	5	98.7	4.9	98.3-104.3
ClLI	-	-	-	-	5	29.7	2.8	25.8-33.6

Subfamily Ommastrephinae
Sthenoteuthis Verrill, 1880

Diagnosis:

Funnel groove with foveola and side pockets, dactylus of tentacular club with tetraserial suckers, large dorsal light organ may be present anteriorly on mantle in larger individuals; either left or right arm IV hectocotylized.

Sthenoteuthis oualaniensis (Lesson, 1830)
Fig.5A-D, Table 4-13

Loligo oualaniensis –Lesson, 1830: 240, pl. I, fig.2.
Ommastrephes oualaniensis –Steenstrup, 1880: 76
Symplectoteuthis oualaniensis –Pfeffer, 1900:180; -Pfeffer, 1912: 502, pl. 40-41, 42, figs.1-4; -Sasaki, 1929: 296, pl. xxx, fig.8, textfigs. 176-178; -Adam, 1954: 157; -Voss, 1963:134, fig. 29; -Voss & Williamson, 1971:74, pl. 23, figs. 20,27,30; -Roper *et al*., 1984:180;
Sthenoteuthis oualaniensis –Zuev *et al.,* 1975:1475; -Nateewathana 1997: 453-464, figs. 2-5.

MATERIAL EXAMINED:

A total of 2,542 specimens were caught during the operations. Only 98 specimens were collected for identification. Data for each station is presented in Table 4-13.

DESCRIPTION:

Mantle (Fig.5A-a) long, slender, cylindrical, muscular, and tapering abruptly from the anterior margin of fins to a sharp pointed end (Fig.5A-b); median antero-dorsal lobe low rounded; ventral mantle margin slightly concave below funnel. Fins terminal, rather large, rhombic, occupying about 42-45% of the mantle length; anterior margins slightly convex; lateral margins pointed; posterior margins straight, continuous to the apex of mantle. Head large, as wide as mantle, sharply set off from the neck by a transverse ridge; each side of the head with three nuchal folds connected to the transverse ridge (Fig.5B-a). Eyes (encircled by a free eyelid, forming a rounded triangle, truncated posteriorly and with a sharp narrow anterior sinus (Fig.5B-a). Funnel large, compact and set in a deep pit on the ventral side of the head; funnel valve large and well-developed; dorsal funnel organ large and inverted v-shaped; ventral pads elongate, oval shape; foveola (Fig.5B-b) with 7-9 longitudinal folds in the central pocket and 3-5 lateral pockets on either side. Funnel locking apparatus inverted T-shaped and fused in its middle portion with the mantle groove (Fig.5B-c).

Arms moderately long, stout with pointed tip, unequal in order of III.II.IV.I. Arms compressed with sharp keel along the edges. Arm III triangular, broad, strongly keeled on the proximal half of arm. Protective membranes well developed with prominent trabeculae. Biserial suckers present in all arms; arm sucker rounded with about 12 sharp teeth laterally and distally, of which the median is largest (Fig.5B-d). Left Arm IV of males hectocotylized (Fig.5C-a), enlarged and thicker than other arms; proximal half of arm with 12 suckers arranged in two longitudinal rows bordered by heavy flap-like modification of the supports of the protective membrane; a series of pits in a single row present along the base of protective membrane on each side of the proximal part of arm (Fig.5C-b); distal arm devoid of suckers and papillae.

Tentacles moderately long, stout, laterally compressed, and with elongated club (Fig.5C-c). Protective membranes slightly expanded on manus, trabeculae well developed. Aboral keel present along the club. Club suckers quadriserial on dactylus and manus; two median rows of suckers 2-3 times larger than the lateral rows; carpal suckers small, arranged in two irregular rows. Enlarged club sucker dentition on dactylus and manus with about 20 sharp teeth and one in each quadrant enlarged (Fig.5C-d); carpal suckers with smooth honey rings; one to four distinct tubercles or knobs present on the carpus.

Gladius (Fig.5C-e) thin and very slender; rachis stout anteriorly, uniformly narrowing to the posterior tip, and with median rib and two marginal ribs along the edges; posterior end with a small vane about one-seventh of the total gladius length. Buccal membrane with seven buccal lappets, and with strong ribs projecting beyond the margin in sharp points; two pores present under arm I and between arm III, continuous with each other below the overhanging dorsal connective membranes; no suckers; numerous small oval seminal receptacles surrounding the mouth of mature females. Upper beak (Fig.5D-a.) with long, sharply pointed, curved rostrum tip; jaw angle deep; hood length almost half of crest; lateral wall large. Lower beak (Fig.5D-b) with short, conical rostrum; hood short; wing large; lateral wall long. Radula (Fig.5B-e) with seven transverse rows of teeth; rachidian tooth tricuspid; first lateral tooth bicuspid, outer cusp small; second and lateral marginal teeth single and slightly curved.

Spermatophore (Fig.5D-c) long and small, sperm mass comprises 50-60% of total length; cement body oval, slightly constricted at the posterior quarter of the body (Fig.5D-e); ejaculatory apparatus coiled at oral end (Fig.5D-d).

Colour in alcohol yellowish brown often with dark purple colouration in the mid-dorsal line of mantle.

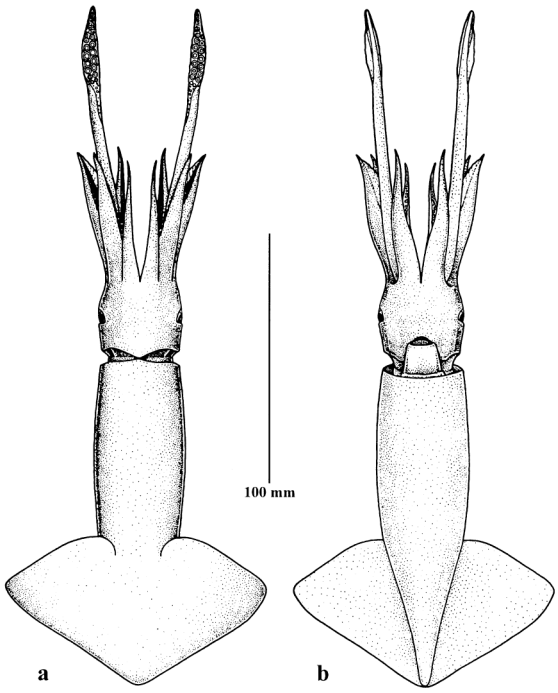

Fig. 5A. *Sthenoteuthis oualaniensis*. a, dorsal view and b, ventral view.

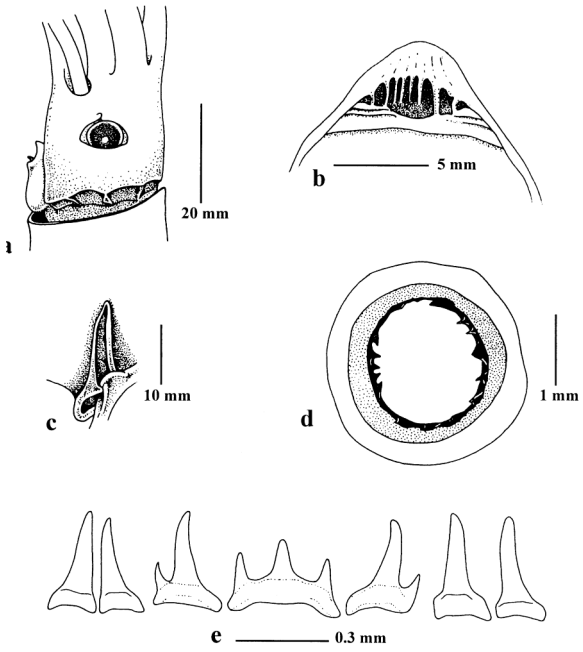

Fig. 5B. *Sthenoteuthis oualaniensis.* a, head. b, foveola and side pockets. c, funnel and mantle locking cartilages. d, arm sucker. e, radula.

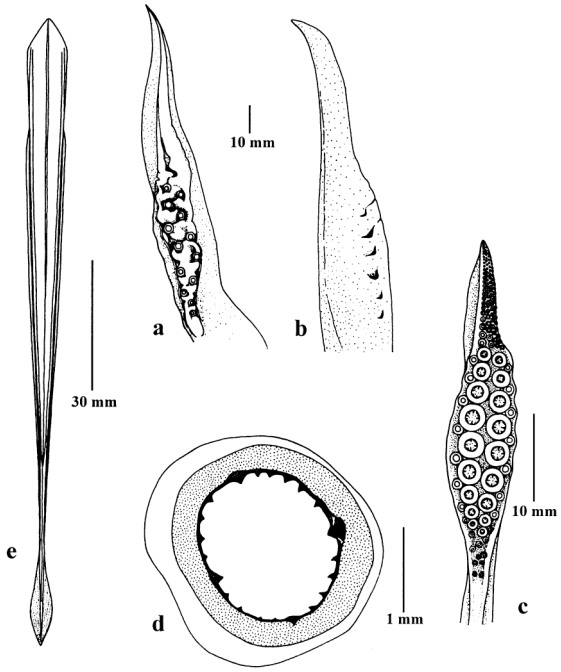

Fig. 5C. *Sthenoteuthis oualaniensis.* a, hectocotylised arm. b, lateral view of hectocotylised arm showing a series of pits. c, tentacular club. d, club sucker. e, gladius.

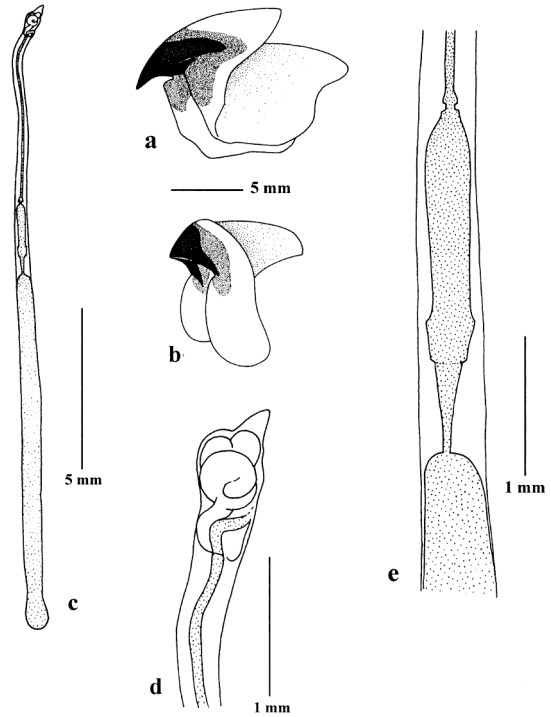

Fig. 5D. *Sthenoteuthis oualaniensis*. a, upper beak. B, lower beak. c, spermatophore. d, enlargement of oral cap. e, enlargement of cement body.

GEOGRAPHICAL DISTRIBUTION:

Tropical Indo-Pacific; from the Red Sea to Mozambique Channel and natal, from southern Japan to southern Queensland and from the south of Baja California to northern Chile.

REMARKS:

S. oualaniensis belongs to subfamily Ommastrephinae of family Ommastrephidae. It has unique character of the subfamily *i.e.* foveola and side pockets, another character, photophore, may be present or absent. Two forms of the species, both forms are represented by males and females, are known: one small, without dorsal photophore, another larger, with dorsal photophore (Clarke 1965; Roper *et al*. 1984). Besides the presence or absence of the dorsal photophore, they differ by the structure of the hectocotylus. Most investigators have suggested that the two forms might present two valid species, but they have not yet been described. Until Nesis (1993) has considered *S. oualaniensis* as a single species.

Table 4. Means, standard deviations and ranges of selected measurements and indices (in percent) of *Sthenoteuthis oualaniensis*. Station no. 1. 8G, 8E, Lat. 20º 02.6N, Long. 119º 56.8 E. Auto squid jigging, angling depth 80-120 m, time 1900-2400 hrs, surface temperature 25ºC, M.V. SEAFDEC 17 Apr. 1998, total catch in weight 25.920 kg and in number 116 pcs.

	MALES				FEMALES			
Index	n	mean	S.D. (n-1)	Range	n	mean	S.D.(n-1)	Range
ML (mm)	8	130.7	14.8	101.0-145.0	8	162.5	40.9	121.0-225.0
MWI	8	22.4	1.2	20.6-24.1	8	22.1	2.9	18.7-28.0
HLI	8	21.1	2.3	17.4-23.6	8	20.3	2.0	17.6-23.2
HWI	8	20.7	1.0	19.0-21.8	8	20.6	3.0	17.9-25.6
FLI	8	42.7	2.7	37.9-45.3	8	40.5	4.3	36.1-45.8
FWI	8	73.6	3.1	69.8-78.9	8	65.8	8.4	55.0-75.6
$AL_{I}I$	8	33.0	2.8	29.5-37.0	8	33.3	4.5	27.9-39.7
$AL_{II}I$	8	40.0	3.5	34.6-45.9	8	39.4	4.7	32.1-45.2
$AL_{III}I$	8	42.5	3.4	38.8-48.1	8	40.1	5.4	32.1-48.7
$AL_{IV}I$	8	40.5	3.1	37.3-45.9	8	38.6	3.5	32.8-43.7
TtLI	8	75.2	11.5	57.5-88.7	8	77.1	16.6	60.9-110.9
ClLI	7	32.9	6.3	22.6-39.2	8	33.0	10.6	19.3-47.3

S. oualaniensis was first described as *Loligo oualaniensis* by Lesson (1830). Later Pfeffer (1900) transferred to genus *Ommastrephes*, and subsequently to genus *Symplectoteuthis* the species. Finally, *Symplectoteuthis oualaniensis* (Lesson, 1830) and *Ommastrephes pteropus* Steenstrup, 1855 were united in the genus *Sthenoteuthis* (Zuev *et al*. 1975; Roeleveld 1982). The typical of the genus is the funnel and mantle cartilage fused at a single point. At present, the genus contains two species; *S. oualaniensis* and *S. pteropus*. The first species is distributed in the Indo-West pacific, while the latter lives in the Atlantic Ocean (Nesis, 1987).

Table 5. Means, standard deviations and ranges of selected measurements and indices (in percent) of *Sthenoteuthis oualaniensis*. Station no. 5. 7E, Lat.18º 59.2 N, Long.118º 59.7 E. Auto squid jigging, angling depth 80-100 m, time 2055-0100 hrs, surface temperature 26.2ºC, M.V. SEAFDEC 19 Apr. 1998, total catch in weight 5.760 kg and in number 29 pcs.

	MALES				FEMALES			
Index	n	mean	S.D. (n-1)	Range	n	mean	S.D.(n-1)	Range
ML (mm)	-	-	-	-	7	217.3	45.6	120.0-257.0
MWI	-	-	-	-	7	23.2	1.5	20.5-25.2
HLI	-	-	-	-	7	17.3	2.5	13.8-20.8
HWI	-	-	-	-	7	21.5	2.3	18.7-25.0
FLI	-	-	-	-	7	44.4	1.3	42.2-46.1
FWI	-	-	-	-	7	69.2	3.0	66.1-72.6
$AL_{I}I$	-	-	-	-	7	33.9	1.7	30.9-36.7
$AL_{II}I$	-	-	-	-	7	40.0	1.1	38.9-41.7
$AL_{III}I$	-	-	-	-	7	40.4	2.9	36.7-44.4
$AL_{IV}I$	-	-	-	-	7	40.4	2.2	37.1-43.1
TtLI	-	-	-	-	6	72.8	16.0	47.6-96.7
ClLI	-	-	-	-	6	42.8	11.3	31.0-54.5

Table 6. Means, standard deviations and ranges of selected measurements and indices (in percent) of *Sthenoteuthis oualaniensis*. Station no. 7. 5G, 5E, Lat. 18º 00.4N, Long. 119º 00.3E. Auto squid jigging, angling depth 70-120 m, time 2224-0300 hrs, surface temperature 25.9ºC, M.V. SEAFDEC 21Apr. 1998, total catch in weight 71.505 kg and in number 422 pcs.

	MALES				FEMALES			
Index	n	mean	S.D. (n-1)	Range	n	mean	S.D.(n-1)	Range
ML (mm)	5	134.0	7.2	126.3-146.0	5	160.1	32.9	116.5-195.0
MWI	5	21.3	0.7	20.4-22.2	5	22.3	1.6	19.7-23.6
HLI	5	21.8	1.7	18.8-22.9	5	20.9	2.1	17.7-22.7
HWI	5	21.5	1.9	19.8-24.4	5	20.7	2.3	17.2-23.4
FLI	5	45.3	1.5	43.8-47.6	5	44.2	1.6	42.6-46.3
FWI	5	72.8	5.3	67.6-79.7	5	67.0	4.1	61.4-71.2
$AL_{I}I$	5	34.4	2.0	32.6-37.2	5	33.4	3.9	26.6-36.3
$AL_{II}I$	5	42.1	2.9	39.2-46.5	5	37.2	3.1	33.9-41.0
$AL_{III}I$	5	40.9	1.9	39.1-43.5	5	39.2	4.9	32.2-45.3
$AL_{IV}I$	5	41.2	3.4	36.9-44.8	5	38.8	3.7	32.9-42.9
TtLI	5	84.6	16.3	66.5-101.1	5	86.1	17.8	63.9-113.3
ClLI	5	39.0	6.8	32.5-49.8	5	39.7	9.3	24.2-49.1

Table 7. Means, standard deviations and ranges of selected measurements and indices (in percent) of *Sthenoteuthis oualaniensis*. Station no. 12. 6G, 6E, Lat. 16º 59.8N, Long. 117º 04.7E. Auto squid jigging, angling depth 100 m, time 1915-0130 hrs, surface temperature 27.8ºC, M.V. SEAFDEC 25 Apr. 1998, total catch in weight 100.299 kg and in number 739 pcs.

	MALES				FEMALES			
Index	N	mean	S.D. (n-1)	Range	n	mean	S.D.(n-1)	Range
ML (mm)	6	131.4	3.8	124.0-135.0	6	192.5	15.1	179.0-216.0
MWI	6	20.2	0.7	19.1-21.2	6	23.3	1.6	21.8-25.7
HLI	6	20.4	1.8	17.8-22.4	6	20.1	2.6	16.1-24.0
HWI	6	20.1	1.6	17.5-22.3	6	20.5	1.7	18.0-23.2
FLI	6	39.0	1.6	37.2-41.7	6	36.6	7.7	21.0-40.2
FWI	6	73.0	4.2	66.9-78.2	6	70.5	2.1	67.1-73.3
$AL_{I}I$	6	33.1	3.6	28.5-37.5	6	34.8	2.1	32.2-37.0
$AL_{II}I$	6	36.7	2.1	34.6-40.7	6	38.9	3.5	33.6-43.7
$AL_{III}I$	6	37.5	3.3	32.1-41.5	6	41.1	2.2	37.0-43.3
$AL_{IV}I$	6	37.6	1.6	36.0-40.3	6	41.0	2.5	37.0-44.3
TtLI	6	70.8	11.3	61.6-90.3	6	89.5	17.6	74.1-122.1
ClLI	6	27.1	1.9	23.3-28.6	6	35.4	2.8	30.2-37.9

Table 8. Means, standard deviations and ranges of selected measurements and indices (in percent) of *Sthenoteuthis oualaniensis*. Station no 14. 4G, 6E, Lat. 15º 59.5N, Long. 118º 00.6E. Auto squid jigging, angling depth 130 m, time 1850-2310 hrs, surface temperature 27.6ºC, M.V. SEAFDEC 27 Apr. 1998, total catch in weight 23.014 kg and in number 141 pcs.

	MALES				FEMALES			
Index	N	mean	S.D. (n-1)	Range	n	mean	S.D.(n-1)	Range
ML (mm)	4	135.2	7.9	127.0-145.0	6	196.2	15.3	176.0-213.0
MWI	4	20.2	0.1	20.1-20.3	6	22.7	4.3	19.1-25.3
HLI	4	21.2	3.1	17.2-24.5	6	20.4	1.7	19.2-23.3
HWI	4	19.1	2.5	16.1-22.1	6	19.6	1.0	18.1-21.1
FLI	4	39.6	0.7	38.6-40.2	6	39.7	0.4	39.2-40.3
FWI	4	73.8	3.9	70.3-79.5	6	70.6	3.8	64.1-72.3
$AL_{I}I$	4	34.3	2.1	32.2-36.8	6	37.5	2.8	34.2-40.0
$AL_{II}I$	4	37.5	4.9	32.3-43.7	6	41.1	3.6	36.4-45.2
$AL_{III}I$	4	40.7	3.6	37.2-45.8	6	41.9	1.9	40.2-45.0
$AL_{IV}I$	4	40.0	1.7	39.0-42.5	6	43.3	3.7	39.6-49.9
TtLI	4	68.1	9.9	58.0-81.2	6	88.7	24.2	64.8-127.8
ClLI	4	29.5	3.3	26.2-34.1	6	32.0	2.2	30.0-35.8

Table 9. Means, standard deviations and ranges of selected measurements and indices (in percent) of *Sthenoteuthis oualaniensis*. Station no 17. 5G, 5E, Lat. 15º 00.6N, Long. 118º 59.5E. Auto squid jigging, angling depth 100-130 m, time 2342-0448 hrs, surface temperature 32.5ºC, M.V. SEAFDEC 29 Apr. 1998, total catch in weight 23.485 kg and in number 131 pcs.

	MALES				FEMALES			
Index	n	mean	S.D.(n-1)	Range	n	mean	S.D.(n-1)	Range
ML (mm)	5	132.6	10.5	118.0-147.0	5	192.6	18.9	171.0-216.0
MWI	5	21.8	1.1	20.0-22.7	5	22.2	2.2	18.7-24.3
HLI	5	20.8	1.1	19.5-22.4	5	18.6	2.6	15.4-22.3
HWI	5	20.6	1.2	19.0-22.4	5	22.5	3.0	19.6-27.5
FLI	5	43.7	1.6	41.1-45.1	5	41.3	2.0	39.5-44.4
FWI	5	71.5	1.8	69.1-73.5	5	71.6	2.7	68.5-74.8
$AL_{I}I$	5	30.7	1.3	29.2-32.0	5	34.4	3.0	30.6-38.1
$AL_{II}I$	5	37.2	2.4	34.1-40.3	5	40.1	4.6	35.2-44.7
$AL_{III}I$	5	37.3	2.0	34.7-40.2	5	39.8	1.7	37.4-41.5
$AL_{IV}I$	5	38.7	2.5	36.2-42.7	5	40.1	4.9	33.8-46.8
TtLI	5	76.8	13.2	55.8-92.3	5	88.1	22.4	59.4-117.5
ClLI	5	28.1	3.5	25.0-33.6	5	31.3	4.2	25.9-36.7

Table 10. Means, standard deviations and ranges of selected measurements and indices (in percent) of *Sthenoteuthis oualaniensis*. Station no 21. 3G, 8E, Lat. 14º 00.5N, Long. 117º 59.9E. Auto squid jigging, angling depth 100mm, time 1910-0100 hrs, surface temperature 30.4ºC, M.V. SEAFDEC 30 Apr. 1998, total catch in weight 39.633 kg and in number 267 pcs.

	MALES				FEMALES			
Index	n	mean	S.D.(n-1)	Range	n	mean	S.D.(n-1)	Range
ML (mm)	3	126.3	6.3	119.0-130.0	8	171.2	25.6	135.0-207.0
MWI	3	19.5	1.1	18.2-20.3	8	22.1	1.6	20.1-25.4
HLI	3	20.9	3.2	17.5-23.8	8	20.1	1.5	16.8-21.8
HWI	3	17.8	2.8	17.0-20.9	8	21.0	1.0	20.3-23.0
FLI	3	37.4	1.0	36.3-38.3	8	39.4	1.4	36.5-40.6
FWI	3	76.2	10.1	64.7-83.8	8	71.8	3.7	64.0-76.1
$AL_{I}I$	3	34.1	2.5	31.9-36.8	8	36.0	2.1	33.2-38.5
$AL_{II}I$	3	37.7	2.1	36.1-40.1	8	39.8	4.7	31.5-45.3
$AL_{III}I$	3	40.0	3.9	37.7-44.6	8	41.6	3.0	37.9-46.3
$AL_{IV}I$	3	41.1	2.6	38.8-44.0	8	41.7	1.9	39.6-45.1
TtLI	3	87.8	19.9	68.9-108.5	8	84.5	20.4	55.6-105.9
ClLI	3	26.3	4.5	23.5-31.5	8	31.5	2.8	28.1-35.7

Table 11. Means, standard deviations and ranges of selected measurements and indices (in percent) of *Sthenoteuthis oualaniensis*. Station no 27. 1G, 3E, Lat. 13º 00.2N, Long. 117º 06.4E. Auto squid jigging, angling depth 100 m, time 1840-0300 hrs, surface temperature 31.3ºC, M.V. SEAFDEC 5 May 1998, total catch in weight 16.506 kg and in number 138 pcs.

	MALES		FEMALES			
Index	n	Value	n	mean	S.D. (n-1)	Range
ML (mm)	1	125.0	3	137.3	10.3	126.0-146.0
MWI	1	20.2	3	19.9	1.9	18.2-22.0
HLI	1	22.5	3	19.5	2.1	17.5-21.7
HWI	1	18.4	3	20.3	0.2	20.1-20.5
FLI	1	40.4	3	38.4	1.5	36.8-39.9
FWI	1	72.8	3	69.4	1.0	68.2-70.0
$AL_{I}I$	1	30.0	3	32.1	1.6	30.3-33.1
$AL_{II}I$	1	40.0	3	37.4	2.9	34.3-39.9
$AL_{III}I$	1	44.2	3	40.6	4.1	36.3-44.4
$AL_{IV}I$	1	45.1	3	40.2	1.9	38.8-42.3
TtLI	1	72.8	3	71.4	21.4	52.0-94.4
ClLI	1	30.9	3	29.1	2.9	25.8-30.9

Table 12. Means, standard deviations and ranges of selected measurements and indices (in percent) of *Sthenoteuthis oualaniensis*. Station no 30A. 1G, 7E, Lat. 11º 59.8N, Long. 118º 45.3E. Auto squid jigging, angling depth 100 m, time 1950-0245 hrs, surface temperature 31.0ºC, M.V. SEAFDEC 8 May 1998, total catch in weight 25.728 kg and in number 159 pcs.

	MALES		FEMALES			
Index	n	Value	n	mean	S.D.(n-1)	Range
ML (mm)	1	119.0	7	151.7	27.0	124.0-191.0
MWI	1	23.8	7	22.5	2.1	20.5-26.6
HLI	1	21.4	7	19.7	2.2	16.6-22.6
HWI	1	20.7	7	22.1	1.9	19.3-25.6
FLI	1	42.0	7	45.1	1.3	43.5-47.0
FWI	1	78.1	7	72.7	4.2	66.7-78.3
$AL_{I}I$	1	33.1	7	35.3	2.3	31.7-37.9
$AL_{II}I$	1	44.5	7	38.5	1.7	35.9-40.6
$AL_{III}I$	1	40.3	7	38.7	2.2	35.2-41.6
$AL_{IV}I$	1	39.5	7	39.2	4.7	31.7-44.2
TtLI	1	85.7	7	68.8	15.4	54.9-82.7
ClLI	1	32.3	7	33.0	3.7	27.6-38.8

Table 13. Means, standard deviations and ranges of selected measurements and indices (in percent) of *Sthenoteuthis oualaniensis*. Station no 30B. 4G, 6E, Lat. 12º 47.6N, Long. 119º 09.0E. Auto squid jigging, angling depth 100 m, time 1845-0300 hrs, surface temperature 31.4ºC, M.V. SEAFDEC 9 May 1998, total catch in weight 62.19 kg and in number 400 pcs.

	MALES				FEMALES			
Index	n	mean	S.D. (n-1)	Range	n	mean	S.D.(n-1)	Range
ML (mm)	4	124.7	4.2	122.0-131.0	6	188.2	14.3	166.0-209.0
MWI	4	20.5	1.2	19.0-21.9	6	21.1	1.4	19.3-22.9
HLI	4	19.1	1.3	17.9-20.2	6	19.4	1.4	18.4-21.0
HWI	4	21.6	1.9	18.8-22.7	6	20.4	1.4	18.4-22.5
FLI	4	34.6	8.7	21.9-41.8	6	39.7	1.3	37.3-40.9
FWI	4	76.7	6.4	69.9-85.2	6	69.8	1.3	67.9-71.1
$AL_I I$	4	30.7	3.1	26.2-32.8	6	32.5	1.6	30.5-34.5
$AL_{II} I$	4	35.2	4.3	30.4-40.5	6	38.8	1.4	37.2-41.4
$AL_{III} I$	4	39.9	3.6	35.9-44.7	6	39.2	1.9	37.4-41.8
$AL_{IV} I$	4	38.1	3.3	33.8-41.6	6	38.9	1.9	35.7-41.2
TtLI	4	69.4	18.2	58.5-95.9	6	58.3	6.9	49.2-66.5
ClLI	4	26.6	4.1	21.1-31.1	6	27.5	1.3	26.2-29.7

Family Thysanoteuthidae

Thysanoteuthis rhombus Troschel, 1857
Fig.6A-B, Table 14

Thysanoteuthis rhombus –Sasaki, 1929: 301-304, pl. XXIV, figs. 6-8, text. 141; –Nateewathana & Hylleberg, 1989: 227-233, figs.1-3; -Nateewathana, 1997: 462-463, fig.6

MATERIAL EXAMINED:
1 G, Western Philippines, M.V. Maya Maya, 1998.

DESCRIPTION:
Mantle (Fig.6A-a,b) long, thick, muscular, truncate anteriorly and tapers to a blunt tip posteriorly. Anterior dorsal margin slightly projection on the middle part, ventral margins almost straight. Fins long, broad, rhombic, occupying almost the entire length of mantle. Head somewhat narrower than mantle, wider than long, separated from the mantle by a distinct neck region. Eyes large, prominent, not projecting and without cornea and in open contact with seawater. Funnel stout, slightly narrowed anteriorly, extends to about mid-eye level; funnel valve broad, semicircular and well developed; dorsal funnel organ inverted V-shaped, two oblong ventral pads. Funnel cartilage (Fig.6B-a,b) large with a long, narrow longitudinal groove and a short, broad transverse groove; a nuchal-mantle lock with two distinct knobs that fit into opposing pits.

Arms subequal, order III. II. IV. I. Arm I about half as long as arm III, dorsal surface with low triangular keel extending for the distal three-fourth of the arm. Arm II similar to arm I, but the keel extends the whole length of the arm, and widens proximal. Arm III largest, compressed

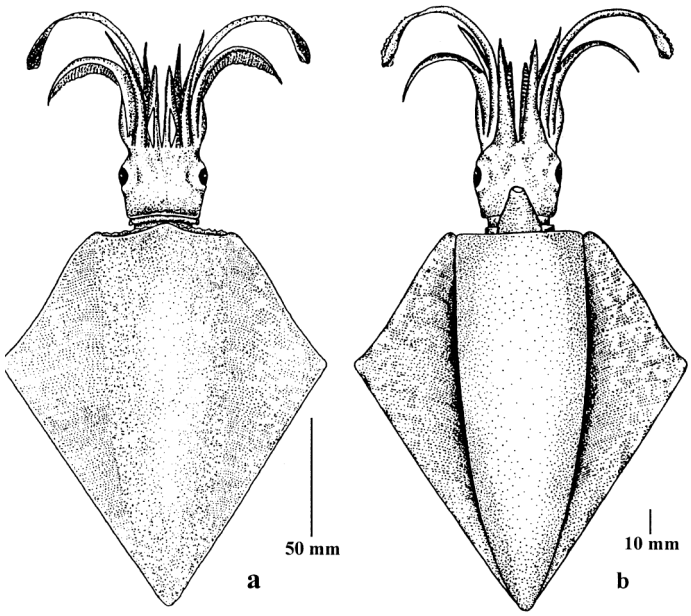

Fig. 6A. *Thysanoteuthis rhombus*. a, dorsal view. b, gladius.

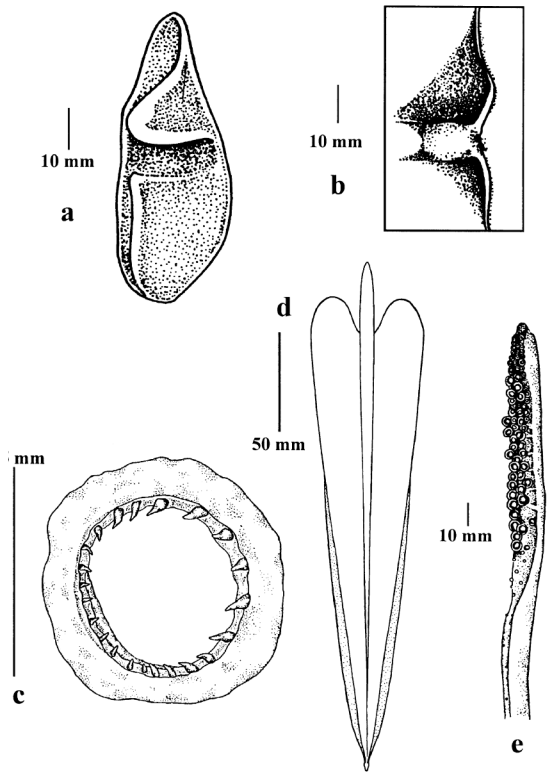

Fig. 6B. *Thysanoteuthis rhombus*. a-b, funnel locking cartilages. c, sucker of left arm III. d, gladius. e, tentacle.

with a conspicuous keel on the proximal half. Arm IV quadrangular, aboral surface marked off by sharp edges on sides, trabeculae well developed about twice as broad as thickness of arms. Buccal connectives attached to ventral borders of arm IV. Biserial suckers present on all arms, sucker rings with 22-25 pointed teeth (Fig.6B-c).

Tentacles (Fig.6B-e) long, about twice of arm lengths. Tentacular club long, narrow, bordered on each side by well developed protective membranes and bears one row of small carpal suckers on middle third of tentacular stalk, four transverse rows of larger suckers on manus and dactylus. Sucker ring with about 17 pointed teeth. Gladius (Fig.6B-d) with long rachis and broad vane. Buccal membrane with seven buccal lappets.

Colour in alcohol grayish brown, deeper above, no special markings discernible.

GEOGRAPHICAL DISTRIBUTION:
Temperate and tropical seas.

REMARKS:
This is a fully described species of unquestioned status.

Table 14. Means, standard deviations and ranges of selected measurements and indices (in percent) of *Thysanoteuthis rhombus* from the Western Philippines.

	MALE		FEMALES			
Index	n	Value	n	mean	S.D.(n-1)	Range
ML (mm)	1	460.0	-	-	-	-
MWI	1	38.0	-	-	-	-
HLI	1	40.2	-	-	-	-
HWI	1	23.9	-	-	-	-
FLI	1	98.9	-	-	-	-
FWI	1	83.7	-	-	-	-
$AL_{I}I$	1	30.0	-	-	-	-
$AL_{II}I$	1	38.0	-	-	-	-
$AL_{III}I$	1	60.2	-	-	-	-
$AL_{IV}I$	1	37.8	-	-	-	-
TtLI	1	101.7	-	-	-	-
ClLI	1	22.8	-	-	-	-

Discussions

Species Composition.

The oceanic squids are comprised of the Oegopsida, which are distinguished by the presence of an opening (slit) in the corneal membrane exposing the lens of the eye to the water. Almost all-oceanic squids spend their entire life span in the open ocean. There are about 200 species of oceanic squids belonging to about 28 families known to occur in the world oceans (Worms 1983). Although a number of species occur in oceanic waters, many owing to their small size and unfavorable consistency of their body, are not suitable for human consumption but are important as forage to tunas, billfishes and toothed whales. Only a few species of oceanic squids are commercially and potentially important and they belong to the families Ommastrephidae,

Histioteuthidae, Lepidoteuthidae, Onychoteuthidae, Veranyidae, Gonatidae and Cranchiidae (Voss 1973). Of these, the members of the family Ommastrephidae are by far the most important because many species of this family, *i.e. Ommastrephes bartramii* (Lesueur, 1821), *Sthenoteuthis* spp. *Illex* spp., *Nototodarus* spp. and *Todarodes* spp., are already exploited in commercial fisheries by some countries particularly in the Pacific and Atlantic waters.

Although more than 50 species of cephalopod fauna have been reported from the Philippines waters, especially an intensive work of Dr Voss (1963), only four species of cephalopods were collected during the present investigation, *i.e. Sepioteuthis lessoniana* Lesson, 1830; *Nototodarus hawaiiensis* (Berry, 1912); *Sthenoteuthis oualaniensis* (Lesson, 1830); and *Thysanoteuthis rhombus* Troschel, 1857. In fact a species of paper nautilus, *Argonauta hians* Solander, 1786 was also collected from the stomach content of a fish during the survey, but the species is excluding from the present report. The species have been described and reported from the Philippine waters by Voss (1963). The first three described species in the present study were collected by squid jigging and purse seine of M.V. Maya Maya. The last species was collected by automatic squid jigging machine on board of M.V. SEAFDEC. *S. lessoniana* is a neritic species, while the last three species are the oceanic species.

Since during the fishing operations of 11 stations in the present study, the automatic squid jigging gear were operated in the upper layer of the ocean. Angling depth of jigging line was between 70-130 m. The dominant oceanic squid caught during the operation was *S. oualaniensis*. Catch and effort data collection of the species will be provided by Siriraksophon *et al.* (1999).

Distribution.

Brief information on distribution of the four species collected from the cruise will be compiled and given herein.

S. oualaniensis. The species occurs throughout tropical surface waters of the Indo-Pacific, with its northern boundary in the Pacific from southern Japan to southern California. It occurs in the Indian Ocean south to southeastern Africa and Cape Leeuwin off Western Australia. In the South Pacific its distribution extends from the Coral Sea eastward to the Line Islands (Dunning 1998). Adults of *S. oualaniensis* occur predominantly in tropical oceanic waters, whereas larvae and juveniles also have been caught on the continental slope and shelf. It exhibits positive phototaxis and is of aggressive nature. Hooks and lines commercially catch it with light at night in the waters around Okinawa to Taiwan. According to Chikuni (1983), in the eastern Arabian Sea, the fishing methods applied were drift gillnet at night by Indian research vessels, round dipnet and pelagic trawl at night with light attraction by the USSR research vessels and jigging both in daytime without light and at night with light attraction by Japanese research vessels. It is interesting to see that squid were caught even in the daytime (16.30-17.20 h) without light attraction, while the species generally appeared to inhabit the 120-200 m depth zone during the daytime judging from the acoustic data. However, once a few squid were jigged at the deep layer by a long-line hook and hauled on board, many specimens were attracted towards the surface and jigged at the near-surface layer. It is reported that *S. oualaniensis* usually forms small schools consisting of about thirty individuals of nearly the same size, most likely to avoid cannibalism (Wormuth 1976).

Some aspects of the fishery biology of this species in the South China Sea have been investigated on the populations around Taiwan. Reproductive development of *S. oualaniensis* from around Taiwan (19°N-26°N) was described by Tung (1976) for squid caught between March and October (spring to autumn). Males reached maturity at smaller sizes than did females. Spermatophores were evident in squid as small as 110 mm ML. Little development of the ovary was evident in females less than 155 mm ML. At 190 mm ML, the majority of females had ova

present in their oviducts.

T. rhombus. This oceanic squid is a cosmopolitan pelagic species usually found in warm water area of the world oceans. This is the only known species of the genus *Thysanoteuthis* and normally occurs in small groups of two or more individuals swimming in the surface waters. Adult commonly grow to a large size of about 60 cm ML (Okutani 1977) and to maximum size is about 100 cm ML (Roper *et al*. 1984). This squid has been subjected to commercial exploitation in Japan. The fishery *for T. rhombus* according to Osako & Murata (1983) was initiated in 1962, in San-in district (the westernmost area of Honshu), Japan. This species is fished mainly by squid jigs and trapnets. It is generally caught in the upper 50 m of the water column. Commercial fisheries for this species from August through December with peak in October are peculiar to the Sea of Japan, while annual catches fluctuate remarkably from 0-500 tons (Kasahara 1991). Occurrences and biology of this squid in Japan were fully discussed by Nishimura (1966).

N. hawaiiensis. The species was recorded from slope waters around the Philippines and Hong Kong where it is a minor component of the bycatch of domestic trawl fisheries (Voss 1963; Voss & Williamson 1971). The species has been taken around Hawaii in shrimp trawls and occasionally on jigs over depths of 230-710 m (Young 1978), and specimens of up to up to 140 mm ML described by Dong (1963) were trawled at a depth of 290 m off Hainan, southern China. Around Hong Kong, the species has been caught on the bottom at depths of 275-650 m (Voss & Williamson 1971*)*. *N. hawaiiensis* were also caught in demersal trawls on the upper continental slope of northern Australia in depths of 162-500 m (Dunning & Förch 1998).

Sepioteuthis lessoniana. The species is a widely distributed in the Indo-West Pacific. It is a neritic species occurring from the surface down to at least 100m depth. The species is of commercial value all over Southeast Asia where it is captured throughout the year, with lure-hooks, seines or purse seines in inshore waters and by trawlers on the continental shelf.

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