

## The Systematics and Distribution of Oceanic Cephalopods in the South China Sea, Area IV: Vietnamese Waters

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### ABSTRACT

Oceanic cephalopod exploration was conducted by M.V. SEAFDEC in Vietnamese waters during 21 April- 5 June 1999, as part of SEAFDEC's collaborative research survey on the fisheries resources of the South China Sea Area IV (Vietnamese waters) with focus on tuna, oceanic squid and other highly migratory species. Squid fishing activities were conducted in 10 stations, ranging in the depth from 600-4000 m, using four automatic jigging machines at night. The purpleback flying squid, *Sthenoteuthis oualaniensis* (Lesson, 1830) was the only species caught throughout the fishing area. Diagnosis and distribution of the species in the study area are reported.

**Key words:** South China Sea; Vietnam; systematics; oceanic squids; squid jigging; Ommastrephidae; *Sthenoteuthis oualaniensis*

### Introduction

Oceanic squids spend their entire life span in the open ocean. More than 200 oceanic species have been described from the world oceans (Worms, 1983). Of these, some species are commercially and potentially important. However, most of the oceanic squid resources in the South China Sea are poorly known. Vietnamese waters comprise a vast area of oceanic waters (depth > 200 m) in the eastern part of the country. The area offers vast potential for future harvesting of oceanic squids. A survey on oceanic squid, therefore, has been launched in this area as part of the SEAFDEC Interdepartmental Collaborative Research Program in the South China Sea, area IV (Vietnamese waters). 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 aim of this study is to determine the species and distribution of the oceanic squids in Vietnamese waters based on automatic squid jigging machines. This research will provide information for the management of fishery resources in this area.

### Materials and Methods

The study area is in the northern part of South China Sea (Area IV, Vietnamese waters). The area covers from latitude 7°N to 21°N and longitude 103°E to 112°E (Fig.1). A total of 10 stations for fishing surveys on the oceanic cephalopods were carried out using a squid jigging machine by M.V.

SEAFDEC during 21 April to 5 June 1999 in the study area. Descriptions of fishing method are described in Siriraksophon *et al.* (2000). Squid samples were preserved in 10% neutralized formalin. The fixed-specimens were later transferred to 75% ethyl alcohol for permanent storage.

All collected 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.

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

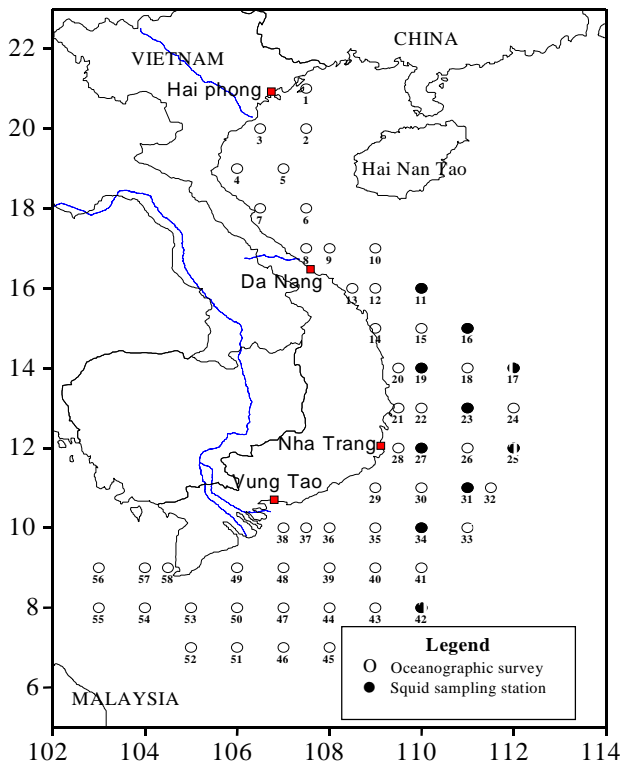


Fig. 1. Squid survey station in the Vietnamese waters.

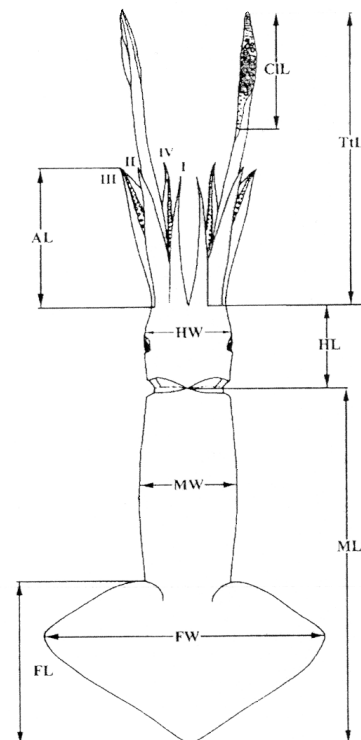


Fig. 2. Diagrammatic illustrations of the measurements in squids. Dorsal view, AL=Arm Length, CIL = Club Length, FL=Fin Length, FW = Fin Width, HL=Head Length, HW= Head Width, ML=Mantle Width, MW = Mantle Width, I= dorsal arm, II= dorso- lateral arm, III= ventro-lateral arm, IV= ventral arm, TtL = Tentacular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

**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.
CILI	Club Length Index	Length of designated club as a percentage of mantle length.

### Systematic Account

Family Ommastrephidae  
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.3 A-D

*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; Nateewathana *et al.* 2000: 84-93, figs.5A-D

**Material Examined :** A total of 99 sampling material from 10 stations were measured and examined (Table 2-11).

**Description:** Drawing figures of the species followed Nateewathana *et al.* (2000). Mantle (Fig.3A-a)

long, muscular and cylindrical up to the point of origin of fins and tapers abruptly to a narrow point at the posterior end (Fig.3A-b). Dorsal margin is slightly produced in the middle. Fins short, muscular and broad with convex anterior margin. Head (Fig.3B-a) large and as wide as mantle and bears comparatively short arms. Funnel short, compact and set in a deep pit present on the ventral side of the head; foveola (Fig.3B-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.3B-c).

Arms large, strong in the order III.II.IV.I and compressed with the third pair strongly keeled. Arm sucker biserial; the protecting membranes have prominent trabeculae; the larger arm suckers are provided with about 7-12 sharp teeth around the entire rim of the horny rings (Fig.3B-d). Left arm IV in males thick, longer than the right arm and hectocotylyzed (Fig.3C-a). Two rows of 14-15 suckers protected by flap-like membranes present on the basal portion of the hectocotylyzed arm. Suckers and papillae absent on about one half of its distal part. A series of pits present in a single row along the base of the protective membranes (Fig.3C-b). Tentacles are short, muscular and laterally compressed. Clubs (Fig.3C-c) small, slightly expanded; suckers (Fig.3C-d) quadriserial with the inner rows on the manus larger. Larger suckers of the club bear about 20 sharp teeth on the rims of which four are larger and located one in each quadrant. Gladius (Fig.3C-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. Beaks (Fig.3D-a&b) strong. Radula (Fig.3B-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.3D-c,d&e) long and small, sperm mass comprises 50-60% of total length; cement body oval, slightly constricted at the posterior quarter of the body; ejaculatory apparatus coiled at oral end.

Head, dorsal mantle, fins and arms are uniformly of chestnut brown colour. An oval photophoric patch present on the antero-dorsal surface of mantle.

**Distribution:** Tropical and subtropical seas of the Indo-Pacific region.

**Remarks:** A unique character of *S. oualaniensis* is mantle element of T-shaped locking apparatus curved with an anterior bifurcation, fused to funnel element along the posterior third of the longitudinal groove.

The species has been considered as a single species by Nesis (1993). It was first described as *Loligo oualaniensis* by Lesson (1830). Later Pfeffer (1900) transferred to genus *Ommastrephes*, and subsequently to genus *Symplectoteuthis*. 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).

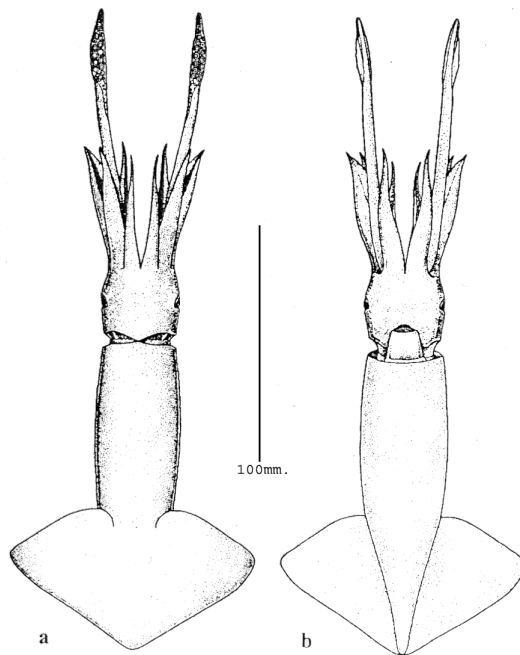


Fig. 3A. *Sthenoteuthis oualaniensis*. a, dorsal view and b, ventral view.

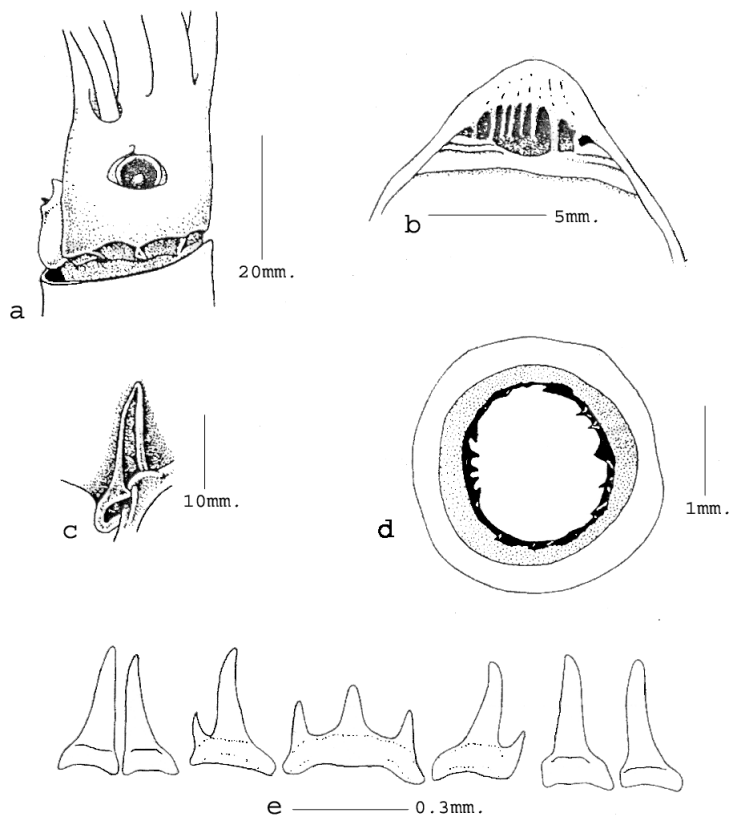
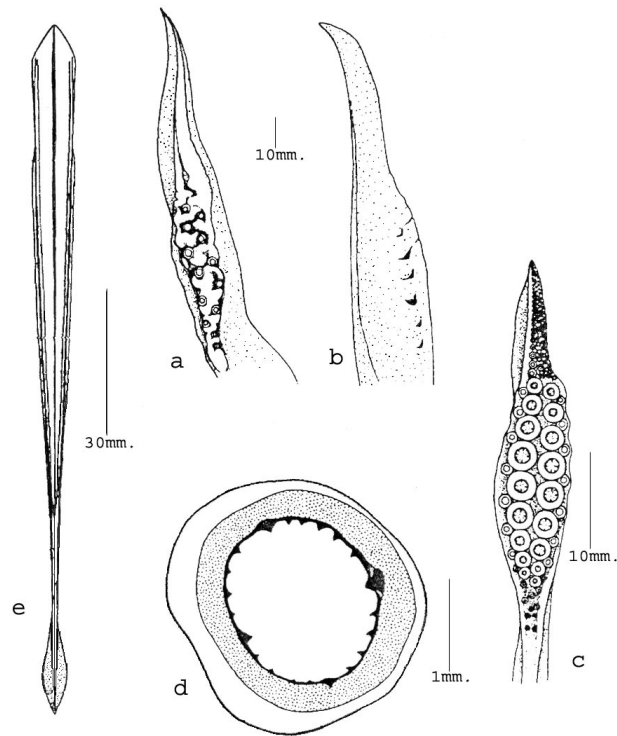
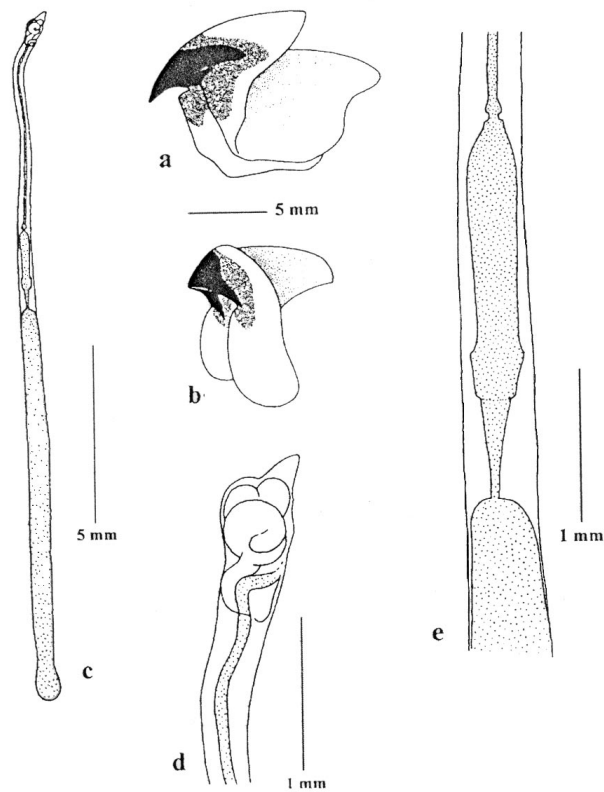


Fig. 3B. *Sthenoteuthis oualaniensis*. a, head. b, foveola and side pockets. c, funnel and mantle locking cartilages. d, arm sucker. e, radula.



**Fig. 3C.** *Sthenoteuthis oualaniensis*. a, hectocotylied arm. b, lateral view of hectocotylied arm showing series of pits. c, tentacular club. d, club suckers. e, gladius.



**Fig. 3D.** *Sthenoteuthis oualaniensis*. a., upper beak. b, lower beak. c, spermatophore. d, enlargement of oral cap. e, enlargement of cement body.

**Table 2.** Means, standard deviations and ranges of selected measurements and indices (in percent) of *Sthenoteuthis oualaniensis*. Station 11. Lat. 16° N, Long. 110°E. M.V.SEAFDEC, automatic squid jigging machines, depth 844 m. 3 May 1999.

Index	MALES				FEMALES			
	n	mean	s.d (n-1)	Range	n	mean	s.d. (n-1)	Range
ML(mm)	2	132.9	10.2	125.7-140.1	11	143.2	27.4	107.3-182.0
MWI	2	23.6	2.6	21.8-25.5	11	23.4	1.4	21.8-25.6
HLI	2	22.4	2.7	20.5-24.3	11	21.3	2.7	16.9-26.1
HWI	2	20.9	0.5	20.6-21.3	11	20.8	1.7	18.8-24.0
FLI	2	47.2	0.0	47.2-47.2	11	44.9	2.4	40.5-48.1
FWI	2	86.1	1.3	85.2-87.1	11	74.1	3.2	68.3-79.4
AL <sub>I</sub> I	2	36.6	1.7	35.4-37.8	11	36.1	3.8	28.2-40.6
AL <sub>II</sub> I	2	42.0	5.6	38.1-46.0	11	42.1	5.7	29.3-49.2
AL <sub>III</sub> I	2	45.1	2.8	43.2-47.1	11	43.6	4.0	35.2-48.5
AL <sub>IV</sub> I	2	42.9	1.3	42.0-43.8	11	41.2	4.9	31.4-47.3
TtLI	2	67.5	23.5	50.9-84.2	11	91.1	15.9	70.0-117.0
CILI	2	35.9	1.2	35.1-36.8	11	33.9	5.0	24.9-42.2

**Table 3.** Means, standard deviations and ranges of selected measurements and indices (in percent) of *Sthenoteuthis oualaniensis*. Station 16. Lat. 15°N, Long. 111°E, M.V. SEAFDEC, automatic squid jigging machines, depth 1,277 m. 7 May 1999.

Index	MALES				FEMALES			
	n	mean	s.d (n-1)	Range	n	mean	s.d. (n-1)	Range
ML(mm)	6	122.1	8.0	110.7-129.8	5	115.5	12.1	104.7-131.1
MWI	6	20.4	1.0	19.5-22.4	5	23.1	2.4	19.8-25.5
HLI	6	20.1	2.2	17.2-22.9	5	21.5	0.9	20.1-22.4
HWI	6	20.7	0.4	18.5-24.0	5	19.7	1.4	18.2-21.7
FLI	6	44.1	1.0	42.9-45.8	5	44.7	2.1	41.2-46.4
FWI	6	75.0	4.2	70.6-80.8	5	76.1	13.4	64.6-98.3
AL <sub>I</sub> I	6	34.0	3.3	30.1-39.0	5	31.5	3.4	26.2-34.9
AL <sub>II</sub> I	6	37.6	1.5	36.0-39.7	5	37.7	1.1	36.8-39.4
AL <sub>III</sub> I	6	41.3	1.6	39.0-43.4	5	40.0	3.0	36.3-44.5
AL <sub>IV</sub> I	6	38.5	1.5	37.0-41.3	5	38.9	3.1	35.5-43.8
TtLI	6	82.2	12.0	66.1-94.7	5	76.9	10.9	69.1-95.4
CILI	6	32.0	1.5	29.8-34.0	5	28.8	2.8	25.8-32.5

**Table 4.** Means, standard deviations and ranges of selected measurements and indices (in percent) of *Sthenoteuthis oualaniensis*. Station 17. Lat. 14°N, Long. 112°E. M.V.SEAFDEC, automatic squid jigging machines, depth 1,207 m. 8 May 1999.

Index	MALES				FEMALES			
	n	mean	s.d (n-1)	Range	n	mean	s.d. (n-1)	Range
ML(mm)	5	129.3	11.3	118.8-147.4	7	157.7	27.0	115.2-177.0
MWI	5	22.4	1.4	20.7-24.0	7	22.7	2.0	20.0-25.2
HLI	5	23.1	1.8	20.7-25.3	7	22.6	1.7	20.3-25.1
HWI	5	23.7	2.4	21.0-25.6	7	23.7	1.5	21.8-26.2
FLI	5	45.1	1.2	44.1-46.9	7	45.1	1.5	43.1-47.3
FWI	5	77.8	2.6	74.0-80.0	7	74.1	2.0	71.8-77.5
AL <sub>I</sub> I	5	39.0	3.0	35.0-42.0	7	38.6	2.8	34.3-42.2
AL <sub>II</sub> I	5	46.4	2.5	43.2-48.9	7	45.3	3.9	39.9-51.1
AL <sub>III</sub> I	5	49.2	4.0	43.4-54.2	7	45.5	5.4	35.8-51.6
AL <sub>IV</sub> I	5	48.3	3.9	42.0-52.9	7	46.0	2.5	41.4-48.9
TtLI	5	109.6	7.4	101.1-117.4	6	101.8	46.0	96.6-138.4
CILI	5	36.7	2.3	34.5-39.2	6	36.6	3.3	33.0-41.7



**Table 5.** Means, standard deviations and ranges of selected measurements and indices (in percent) of *Sthenoteuthis oualaniensis*. Station 19. Lat. 14° N, Long. 110°E. M.V.SEAFFDEC, automatic squid jigging machines, depth 1,000 m. 10 May 1999.

Index	n	value	n	mean	s.d. (n-1)	Range
ML(mm)	1	126.7	5	158.8	28.8	143.6-210.2
MWI	1	21.6	5	23.4	3.2	19.3-26.7
HLI	1	22.7	5	21.4	0.8	20.1-22.4
HWI	1	23.4	5	20.7	2.9	16.9-23.9
FLI	1	45.5	5	46.9	1.1	45.5-47.9
FWI	1	77.3	5	78.3	5.4	71.6-84.3
AL <sub>I</sub> I	1	35.2	5	38.1	2.6	35.6-41.2
AL <sub>II</sub> I	1	42.5	5	41.3	3.7	35.7-45.1
AL <sub>III</sub> I	1	48.5	5	45.2	7.0	34.2-54.0
AL <sub>IV</sub> I	1	46.9	5	45.5	4.2	41.5-52.0
TtLI	1	108.0	5	104.1	24.1	77.9-139.3
CILI	1	36.2	5	34.2	4.5	28.9-38.8

**Table 6.** Means, standard deviations and ranges of selected measurements and indices (in percent) of *Sthenoteuthis oualaniensis*. Station 23. Lat. 13°N, Long. 111°E. M.V.SEAFFDEC, automatic squid jigging machines, depth 2,703 m 12 May 1999.

Index	MALES				FEMALES			
	n	mean	s.d (n-1)	Range	n	mean	s.d. (n-1)	Range
ML(mm)	6	120.5	4.5	115.6-128.0	6	145.5	43.1	112.3-210.3
MWI	6	24.4	1.4	22.6-26.2	6	24.7	2.1	22.2-27.3
HLI	6	22.6	1.3	20.8-24.2	6	23.3	1.3	21.8-25.0
HWI	6	22.3	1.9	19.8-25.3	6	23.2	1.2	21.6-24.7
FLI	6	45.0	1.2	43.4-47.0	6	45.2	1.1	43.6-46.3
FWI	6	82.1	3.4	77.9-87.2	6	81.5	1.7	78.8-83.8
AL <sub>I</sub> I	6	39.5	4.9	35.3-48.7	6	39.1	2.4	34.5-40.9
AL <sub>II</sub> I	6	45.7	3.1	42.7-50.2	6	46.5	1.5	44.7-48.8
AL <sub>III</sub> I	6	48.1	4.7	43.4-54.5	6	49.1	2.1	46.2-52.0
AL <sub>IV</sub> I	6	46.6	5.0	41.9-55.1	6	47.2	3.6	42.6-53.0
TtLI	6	97.5	32.4	52.1-140.6	6	113.2	19.6	85.6-138.0
CILI	6	30.3	6.5	17.6-35.5	6	38.4	6.7	27.9-47.5

**Table 7.** Means, standard deviations and ranges of selected measurements and indices (in percent) of *Sthenoteuthis oualaniensis*. Station 25. Lat. 12° N, Long. 112°E. M.V.SEAFFDEC, automatic squid jigging machines, depth 4,412 m. 13 May 1999.

Index	MALES				FEMALES			
	n	mean	s.d (n-1)	Range	n	mean	s.d. (n-1)	Range
ML(mm)	4	125.8	11.5	116.3-142.5	6	131.7	19.1	112.1-160.9
MWI	4	24.7	4.3	21.3-30.8	6	26.5	4.8	20.6-33.9
HLI	4	24.3	1.4	22.7-25.7	6	21.3	2.1	17.8-23.8
HWI	4	23.1	2.6	19.4-25.5	6	24.0	2.2	20.5-26.8
FLI	4	44.0	2.4	41.5-46.5	6	46.2	2.2	43.5-49.3
FWI	4	76.3	4.2	70.9-80.6	6	77.6	5.7	67.8-82.7
AL <sub>I</sub> I	4	39.2	1.4	37.4-40.6	6	37.8	3.7	33.8-43.7
AL <sub>II</sub> I	4	44.7	1.3	42.9-46.0	6	44.4	4.8	40.6-53.6
AL <sub>III</sub> I	4	46.9	5.0	42.4-53.9	6	46.8	2.6	43.2-50.1
AL <sub>IV</sub> I	4	47.3	2.4	44.5-50.0	6	45.2	3.7	40.6-51.8
TtLI	4	114.6	14.5	92.9-123.9	6	118.5	14.0	107.9-143.3
CILI	4	35.8	2.1	34.1-38.9	6	37.6	4.9	32.0-46.1



**Table 8.** Means, standard deviations and ranges of selected measurements and indices (in percent) of *Sthenoteuthis oualaniensis*. Station 27. Lat. 12° N, Long. 110°E. M.V.SEAFDEC, automatic squid jigging machines, depth 883 m. 14 May 1999.

Index	MALES				FEMALES			
	n	mean	s.d. (n-1)	Range	n	mean	s.d. (n-1)	Range
ML(mm)	8	121.9	8.9	111.6-134.4	6	120.9	14.3	111.1-149.5
MWI	8	23.0	2.0	21.3-26.6	6	23.1	1.6	20.5-25.2
HLI	8	22.4	1.8	20.0-25.6	6	20.7	1.8	18.6-23.2
HWI	8	22.7	1.6	20.0-24.6	6	21.6	1.5	19.7-23.9
FLI	8	45.4	1.1	43.5-46.6	6	43.4	1.7	41.6-45.9
FWI	8	78.9	3.7	73.5-84.4	6	75.4	5.7	65.8-83.7
AL <sub>I</sub>	8	35.2	3.4	32.4-39.5	6	33.8	3.3	30.2-37.0
AL <sub>II</sub>	8	40.7	5.8	29.5-47.6	6	38.6	3.1	33.7-42.6
AL <sub>III</sub>	8	43.8	3.4	38.3-47.7	6	41.2	3.0	37.8-45.2
AL <sub>IV</sub>	8	42.2	4.4	35.2-48.3	6	41.1	3.8	36.4-46.0
TtLI	8	96.3	20.9	67.4-125.1	6	89.5	15.4	70.5-110.1
CILI	8	30.0	2.8	27.3-33.9	6	32.0	7.0	22.5-43.3

**Table 9.** Means, standard deviations and ranges of selected measurements and indices (in percent) of *Sthenoteuthis oualaniensis*. Station 31. Lat. 11° N, Long. 111°E. M.V.SEAFDEC, automatic squid jigging machines, depth 2,940 m. 18 May 1999.

Index	MALE			FEMALES			
	n	value		n	mean	s.d. (n-1)	Range
ML(mm)	1	124.1		3	136.6	55.1	102.9-200.2
MWI	1	24.0		3	20.3	3.7	17.1-24.4
HLI	1	22.4		3	22.2	1.3	20.8-23.5
HWI	1	26.3		3	21.7	1.9	19.6-23.4
FLI	1	53.3		3	43.7	4.4	39.6-48.4
FWI	1	74.0		3	65.5	7.8	60.9-74.5
AL <sub>I</sub>	1	39.5		3	31.3	2.8	29.3-34.5
AL <sub>II</sub>	1	44.7		3	37.2	4.9	31.7-41.3
AL <sub>III</sub>	1	45.3		3	39.3	3.9	36.7-43.8
AL <sub>IV</sub>	1	54.0		3	38.9	3.3	36.5-42.7
TtLI	1	100.8		3	101.5	11.9	93.1-109.9
CILI	1	30.5		3	35.9	15.1	25.2-46.6

**Table 10.** Means, standard deviations and ranges of selected measurements and indices (in percent) of *Sthenoteuthis oualaniensis*. Station 34. Lat. 10° N, Long. 110°E. M.V.SEAFDEC, automatic squid jigging machines, depth 1,640 m. 22 May 1999.

Index	MALES				FEMALES			
	n	mean	s.d. (n-1)	Range	n	mean	s.d. (n-1)	Range
ML(mm)	7	125.8	6.9	117.6-138.8	5	116.4	26.2	90.2-160.0
MWI	7	22.8	1.7	20.6-25.6	5	21.5	3.0	18.5-26.3
HLI	7	23.3	2.8	19.6-27.5	5	22.1	2.9	18.7-26.3
HWI	7	22.1	1.6	20.0-24.0	5	20.9	1.9	18.2-23.6
FLI	7	45.9	2.0	43.7-48.6	5	42.1	2.2	40.0-45.9
FWI	7	77.9	5.3	70.6-84.3	5	68.7	6.2	60.7-77.8
AL <sub>I</sub>	7	37.3	2.9	32.4-40.5	5	35.5	5.5	29.7-44.4
AL <sub>II</sub>	7	43.3	1.9	39.8-45.2	5	43.4	9.4	36.9-58.6
AL <sub>III</sub>	7	48.2	4.2	41.8-52.6	5	44.5	8.6	33.8-55.4
AL <sub>IV</sub>	7	46.3	4.0	42.0-51.9	5	42.6	5.4	35.7-48.2
TtLI	6	101.0	18.3	75.0-128.0	4	107.8	13.9	93.1-122.5
CILI	6	33.6	3.3	30.7-38.2	4	31.0	2.9	28.5-35.1

**Table 11.** Means, standard deviations and ranges of selected measurements and indices (in percent) of *Sthenoteuthis oualaniensis*. Station 42 Lat. 8° N, Long. 110°E. M.V.SEAFFDEC, automatic squid jigging machines, depth 640 m. 26 May 1999.

Index	MALES				FEMALES			
	No sampling specimens				n	mean	s.d. (n-1)	Range
ML(mm)	-	-	-	-	5	130.4	7.8	123.8-144.0
MWI	-	-	-	-	5	23.0	2.3	20.4-25.5
HLI	-	-	-	-	5	22.7	2.8	19.5-26.6
HWI	-	-	-	-	5	22.1	2.8	19.1-25.2
FLI	-	-	-	-	5	45.5	2.2	41.8-47.1
FWI	-	-	-	-	5	74.5	3.8	68.2-77.8
AL <sub>I</sub> I	-	-	-	-	5	34.4	2.9	31.6-38.4
AL <sub>II</sub> I	-	-	-	-	5	41.2	2.7	38.2-44.9
AL <sub>III</sub> I	-	-	-	-	5	43.0	5.4	37.6-51.4
AL <sub>IV</sub> I	-	-	-	-	5	41.9	4.2	36.4-46.3
TtLI	-	-	-	-	5	93.9	26.2	63.8-117.4
CILI	-	-	-	-	5	32.3	6.7	21.0-38.5

### Discussion

Species composition of cephalopods in the Vietnamese waters at the 100 - 1300 m depth has been reported by Duc (1997). The list comprises of 69 species belonging to 24 genera, 14 families and 3 orders. Five species of the family Ommastrephidae are recorded *i.e.* *Symplectoteuthis* (= *Sthenoteuthis*) *oualaniensis* (Lesson, 1830), *Nototodarus sloani* (Gray, 1849), *N. hawaiiensis* (Berry, 1912), *Ornithoteuthis volatilis* (Sasaki, 1915) and *Todarodes pacificus* Steenstrup, 1880. The two genera, *Nototodarus* and *Todarodes* were mainly caught in the depth between 300-500 m, while *Sthenoteuthis* and *Ornithoteuthis* were caught in the deeper water between 500-700 m depth. Since during the fishing operations of 10 stations in the present survey, the depth of sampling area is between 600-4,000 m. It is only one species of the purpleback flying squid, *S. oualaniensis*, was caught by the automatic jigging gears operated at night. The result of the present fishing operations in Vietnamese waters is the same as those in the Western Philippines waters (Labe, 2000; Nateewathana *et al.* 2000; Siriraksophon *et al.* 2000). It is shown that the most abundant oceanic squid sampling by the automatic jigging gear in the South China Sea is *S. oualaniensis*. Besides, other oceanic commercially species recorded in the area were not caught a single specimen during the surveys might be due to many factors, such as type of fishing gear (jigging, trawl, purse seine *etc.*), biology (positive or negative phototactic) and ecology of the squids (depth and environment).

Squids having the following conditions are potentially useful as fisheries resources, especially for human consumption: (1) medium or large-sized, (2) sufficient biomass for sustainable fishing and (3) forming dense aggregation at least some stages of their lives (Okutani, 1995). The above results on the *S. oualaniensis* in the South China Sea seem to satisfy these conditions. However, the real potential of this squid as a fishery resource in this area must be evaluated. Catch-per-unit-effort (CPUE) of the species is provided by Siriraksophon *et al.* (in prep.).

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