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NEW RECORDS OF OCEANIC DECAPOD CEPHALOPODS (TEUTHIDA, OEGOPSINA) FROM EAST ANDAMAN SEA, THAI WATERS

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ABSTRACT: Specimens of oceanic decapods were collected from the East Andaman Sea, Thai waters from depths of 33 to 649 m. Five species are newly recorded; *Ancistrocheirus lesueurii* (d'Orbigny, 1842), *Abralia spaercki* Grimpe, 1931, *Idioteuthis cordiformis* (Chun, 1908), *Octopoteuthis megaptera* (Verrill, 1885) and *Octopoteuthis rugosa* Clarke, 1980. These records increase the number of oegopsid taxa in this region to forty-five and increase the number of available voucher specimens to thirteen.

Keywords: new record, oceanic decapod cephalopod, Thai waters

INTRODUCTION

Order Teuthida consists of two suborders of neritic (Suborder Myopsina) and oceanic decapod cephalopods (Suborder Oegopsina). Suborder Oegopsina are with 27 families of more than 200 species, distributed throughout the world oceans (Jereb and Roper 2010). Forty-three taxa of oegopsid squids have been reported from Thai waters, with 35 taxa as literature records or voucher unavailable and only 8 taxa with available vouchers in Thailand (Nabhitabhata *et al*. 2009; Nabhitabhata *et al*. 2017a; Nabhitabhata *et al*. 2017b; Nabhitabhata *et al*. 2019). The present study is based on specimens collected from the economic zone of the Thai waters in the Andaman Sea, Indian Ocean, deposited in the Reference Collection of the Phuket Marine Biological Center (PMBC). The present study revealed high diversity of oceanic natural resources in this region as the transitional zone of the Indian Ocean and West Pacific region, and more await future discoveries.

MATERIALS AND METHODS

The materials were collected from the East Andaman Sea, Thai waters and collected by otter trawl from the same region under the Biodiversity of the Andaman Sea Shelf Project (BIOSHELF), 06°46′N 97°18′E to 08°28′N 95°58′E (Fig. 1), during 1990-2000 (Aungtonya *et al*. 2000; Bussarawit and Aungtonya 2002). All specimens were fixed in 10% formalin and transferred for preservation into 75% ethyl alcohol (Roper and Sweeney, 1983). Voucher specimens have been deposited in the Reference Collection of the Phuket Marine Biological Center.

The taxonomic descriptions include morphological terms and morphometry (counts, measurements, and indices) followed Roper and Voss (1983) and Jereb and Roper (2010). Abbreviations of counts, measurement and indices used in the present study, *i.e*., DML = Dorsal Mantle Length (mm), VMLI = Ventral Mantle Length Index, MWI = Mantle Width Index, AL1I = First Arm Length Index, AL2I = Second Arm Length Index, AL3I = Third Arm Length Index, AL4I = Fourth Arm Length Index, TTLI = Tentacle Length Index, CLI = Club Length Index, HLI = Head Length Index, HWI = Head Width Index,EDI = Eye Diameter Index, FNLI = Funnel Length Index, FFNLI = Free Funnel Length Index, FLI = Fin Length Index and Fin Width Index = FWI. Indices (I) are expressed as a percentage of dorsal mantle length (DML).

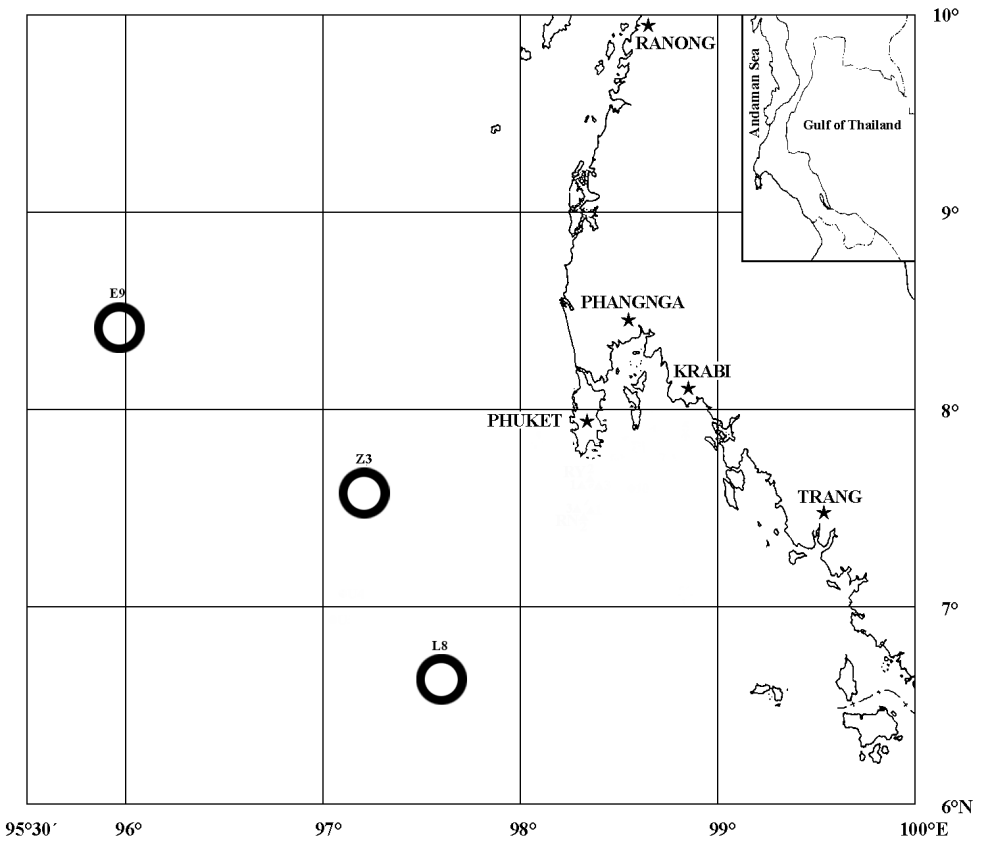

Figure 1. Localities of collected materials in the East Andaman Sea (circles). Numbers indicate sampling stations of the BIOSHELF Project. (Modified from Aungtonya *et al*. 2000; Bussarawit and Aungtonya 2002).

RESULTS

Superorder Decabrachia Boettger, 1952
Order Teuthida Naef, 1916
Suborder Oegopsina d'Orbigny, 1845
Family Ancistrocheiridae Pfeffer, 1912

Genus *Ancistrocheirus* Gray, 1849

D**iagnosis.** Mantle conical, gelatinous, small to medium size. Arm robust, hooks present in all arms. Tentacular club with two series of hooks on manus. Photophore present on ventral mantle, funnel, head, arms and tentacle, absent on visceral and eyeballs. Fin broad, very large.

Ancistrocheirus lesueurii (d'Orbigny, 1842)
Fig. 2, Table 1

Enoploteuthis lesueurii d'Orbigny, 1842: 339–340, figs. 4–10, pl. 11, 14.
Ancistrochirus lesueurii - Pfeffer 1912: 174–177. - Young *et al*. 1998: 251–252.
Ancistrocheirus lesueuri - Clarke 1980: 142–156, figs. 107–121, table 28. - Roper *et al*. 1984: 121. - Nesis 1987: 181. - Okutani 1995: 81, fig. 113, pl. 29. - Filippova *et al*. 1997: 225, fig. 134. - Chen and Liu 2009: 111, figs. 221–222. - Reid 2016: 59–60.
Ancistrocheirus lesueurii - Guerra 1992: 130–132, fig. 39. - Bello *et al*. 1993: 259–266, figs. 1–4. - Arkhipkin 1997: 103–111, fig. 1. - D'Onghia 1997:

389–396, figs. 2–3, tables 1–2. - Sweeney and Roper 1998: 571. - Hoving *et al*. 2005: 341–348, fig. 3, table 1. - Chen *et al*. 2009: 186–188, figs. 4-113–4-115. - Roper and Jereb 2010a: 119–120, figs. 163–164. - Guerra e*t al*. 2014: 451–452. - Sajikumar *et al*. 2014: 79–82, figs. 2–3, table 1. - Okutani 2015: 121. - Norman *et al*. 2016: 569. - Lu and Chung 2017: 298–299, fig. VII-45. - Nabhitabhata *et al*. 2017a: 44. - Nabhitabhata *et al*. 2017b: 210–211, fig. 50.

Material examined. PMBC 19906, 1 juvenile, mantle length 31.3 mm, 07°42′N 97°20′E to 07°42′N 97°18′E (BIOSHELF Station Z3), depth 322–493 m, otter trawl, Coll. S. Bussarawit and C. Aungtonya, 24 January 1999.

Diagnosis. Mantle conical, broad. Fins rhomboidal, large, length 82.6% of mantle length; broad 97.0% of mantle length. Arms subequal, formula II>I>III>IV. Tentacular arm length index 251.7. Club and arm with two series of hooks. Embedded photophores present, similar size, 12 on tentacle, 20 on ventral mantle, 6 on ventral head. Small photophores on ventral arms IV, head, funnel and fins. Photophores absent on eyeballs.

Distribution. Worldwide distribution in tropical, subtropical and temperate zones (Arkhipkin 1997; Roper and Jereb 2010a; Guerra *et al*. 2014; Norman *et al*. 2016) including Indian Ocean, off Japan, Indo-Pacific Ocean and Mediterranean Sea (Bello *et al*. 1993), Andaman Sea (present study).

Remarks. *Ancistrocheirus lesueurii* is currently the only species of this monotypic family, Ancistrocheiridae. The studied material is the first available specimen of *A. lesueurii* from the Andaman Sea, Thai waters, supporting the occurrence of this species in the Indo-Pacific region recorded by Bello *et al*. (1993) and the distribution map of Roper and Jereb (2010a). Nesis (1987) suggested that this species was a doubtful one. However, Roper and Jereb (2010a) suggested that there might be more than one species of *Ancistrocheirus* due to morphological differences among paralarvae from different regions.

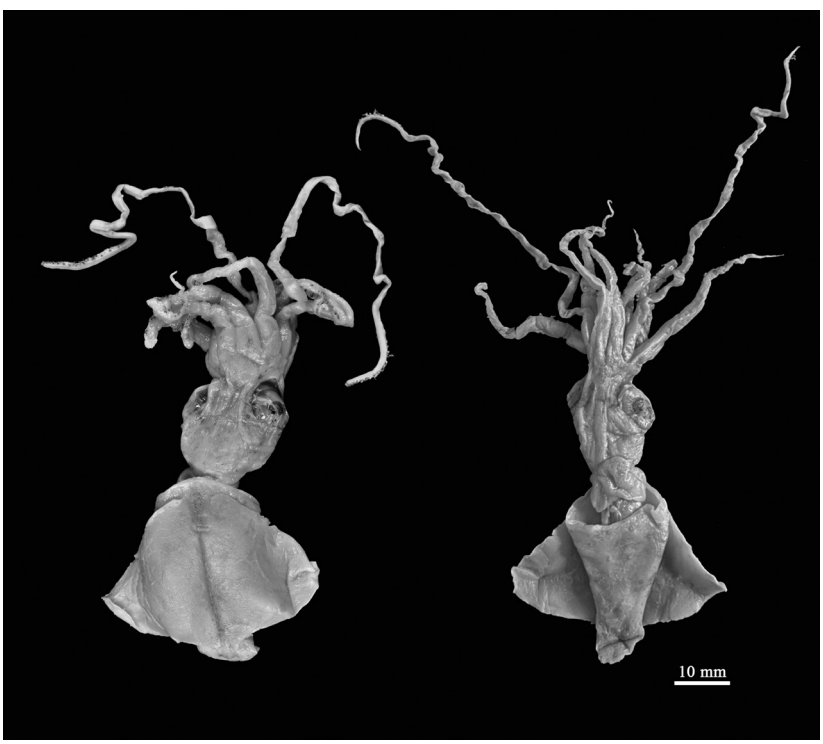

Figure 2. *Ancistrocheirus lesueurii* (d'Orbigny, 1842) (juvenile, PMBC 19906).

Table 1. Mantle length (DML, mm) and indices (index, %DML) of *Ancistrocheirus lesueurii*.

Index	N	
DML (mm)	1	31.3
VMLI	1	78.0
MWI	1	46.7
AL1I	1	98.2
ALI2I	1	111.6
AL3I	1	75.4
AL4I	1	62.7
TTLI	1	251.7
CLI	1	43.9
HLI	1	63.9
HWI	1	52.0
EDI	1	33.0
FNLI	1	25.9
FFNLI	1	36.5
FLI	1	82.6
FWI	1	97.0

Family Enoploteuthidae Pfeffer, 1900
Genus *Abralia* Gray, 1849

Diagnosis. Small size. Mantle slender. Fins terminal. Arm suckers biserial, hooks present/absent. Club suckers biserial, hooks uniserial. Enlarged photophore on tip of arm IV absent.

***Abralia spaercki* Grimpe, 1931**
(Fig. 3, Table 2)

Abralia (*Stenobralia*) *spärcki* - Voss 1963: 112–116, figs. 24–25.
Abralia (*Stenobralia*) *spaercki* - Nesis 1982: 174, fig. 43O, N, R, S. - Chen *et al*. 2009: 197–198, fig. 4-131. - Reid 2016: 113–114.
Abralia (*Abralia*) *spaercki* - Tsuchiya and Okutani 1988: 122–124, fig. 8. - Okutani 2015: 133.
Abralia spaercki -Young *et al*. 1998: 246. - Roper and Jereb 2010b: 193.

Material examined. PMBC 22010, 7 juveniles, mantle length 9.2–15.1 mm, depth 33 m, 25 April 1990.

Diagnosis. Mantle muscular, conical shaped, creamed to brown coloured. Photophores small, scattered on mantle, head and arms. Fins terminal, rhombic shaped, length 38.8% of mantle length, width 65.6% of mantle length. Arms sub-equal, arm formula III>IV>II>I, hooks present, 12–15, two rows on proximal, suckers 12, small, on distal. Tentacular arm length index 125.0. Club dactylus with four series of suckers, manus with two series of suckers on dorsal rows, 5 hooks as one ventral row. Photophores 5, present on ventral eyeball.

Distribution. The West Pacific Ocean, Indonesia, Philippines, Banda Sea and the Gulf of Thailand (Voss 1963; Roper and Jereb 2010d; Okutani 2015) to northern Australia. (Reid 2016).

Remarks. Many authors had assigned this taxon to the subgenus *Stenobralia*, as *Abralia* (*Stenobralia*) *spärcki* (Voss 1963; Nesis 1982; Chen *et al*. 2009; Reid 2016), but Tsuchiya and Okutani (1988) and Okutani (2015) recombined it to subgenus *Abralia*, as *Abralia* (*Abralia*) *spaercki*. This study followed Roper and Jereb (2010d), referring as *A. spaercki*. Tsuchiya and Okutani (1988) suggested that *Abralia armata* sensu Voss, 1963 based on young specimens of *A spaercki*. On the other hand, Tsuchiya and Okutani (1988) also stated that the original description of *Abralia armata* (Quoy and Gaimard, 1832) was not sufficient and based on a single young specimen. Moreover, the holotype is only a gladius. However,

Roper and Jereb (2010d) considered both are valid taxa. Specimens from this study confirm the occurrence of *A. spaercki* in Thai Waters. Since only juvenile specimens were available from shallow waters in the present study, adults might inhabit a deeper zone.

Figure 3. *Abralia spaercki* Grimpe, 1931 (juvenile, PMBC 22010).

Table 2. Mantle length (DML, mm), means, standard deviations (SD) and ranges of selected measurments and indices (index, %DML) of *Abralia spaercki* Grimpe, 1931.

	N	Mean	SD	Range	
				Min	Max
DML (mm)	7	11.8	2.2	9.2	15.1
VMLI	7	68.2	3.4	62.9	72.7
MWI	7	39.5	8.8	28.7	50.3
AL1I	7	44.5	9.1	36.5	59.2
AL2I	7	52.6	9.8	42.8	69.7
AL3I	7	62.0	7.1	48.0	71.0
AL4I	7	57.8	7.2	44.4	66.8
TTLI	7	103.0	17.7	77.0	125.0
CLI	7	34.3	8.4	25.2	46.3
HLI	7	29.4	4.2	22.3	35.2
HWI	7	21.8	3.8	17.3	29.0
EDI	7	18.1	3.4	15.5	23.2
FNLI	7	29.3	4.3	23.4	34.8
FFNLI	7	15.9	4.1	8.9	21.9
FLI	7	34.1	5.6	25.4	43.4
FWI	7	57.6	6.9	51.5	68.2

Family Mastigoteuthidae Verrill, 1881
Genus *Idioteuthis* Sasaki, 1916

Diagnosis. Medium to large size. Mantle soft, semi-gelatinous, conical shaped, reddish to maroon coloured. Fins large, heart or diamond shaped, longer than 50% of mantle length. Ventral arm elongated; suckers biserial, hooks absent. Tentacles long, slender; club elongated. Funnel locking apparatus ear-shaped.

***Idioteuthis cordiformis* (Chun, 1908)**
Fig. 4, Table 3

Mastigoteuthis cordiformis Chun, 1908: 87–88. - Chun 1910: 222–229, pl. XXXIV, figs. 1, 5, 6, 8, 10–14, pl. XXXV, figs. 3–5, pl XXXVI, fig. 5, pl. XXXVII. - Pfeffer 1912: 613–615. - Sasaki 1921: 200. - Sasaki 1929: 310–312, figs. 15–20, pl. XXIV. - Voss 1963: 140–142, fig. 30a–h. - Nesis 1987: 257, fig. 66O–P. - Dong 1988: 64–65, figs. 38–39. - Chen and Liu 2009: 182, figs. 363–364. - Chen *et al*. 2009: 145, fig. 4-45. - Roper and Jereb 2010c: 253. - Braid and Bolstad 2015: 31. - Nabhitabhata *et al*. 2017b: 271–272.
Mastigoteuthis (*Idioteuthis*) *cordiformis* - Okutani 1995: 117, fig. 187, pl. 47.
Idioteuthis cordiformis - Salcedo-Vargas and Okutani 1994: 119–127. - Salcedo-Vargas 1995: 65–77, figs. 6, 7, 11. - Freeman *et al*. 2013: 20. - Braid 2013: 68–83, figs. 29–38, table. 10. - Braid *et al*. 2014: 145–164, table. 1. - Braid and Bolstad 2015: 216–227, figs. 19–28, table 7. - Okutani 2015: 210. - Norman *et al*. 2016: 573. - Lu and Chung 2017: 392–393, fig. VII-66. - Nabhitabhata *et al*. 2017a: 68.

Material examined. PMBC 21215, 2 juveniles, mantle length 83.8–87.0 mm, 06°46′N 97°33′E to 06°44′N 97°35′E (BIOSHELF Station L8), depth 501–513 m, otter trawl, 22 February 2000.

Diagnosis. Mantle conical, anterior wider, soft, semi-gelatinous. Skin irregular, reddish coloured. Fin large, heart shaped or elliptical, length 78–82% of mantle length, width 79–82% of mantle length. Arms subequal, formula IV>II>III>I, suckers biserial, hook absent. Tentacles damaged. Funnel locking apparatus ear-shaped. Photophore absent.

Distribution. Broadly distributed in the Indo-West Pacific region (Nesis 1987; Roper and Jereb 2010c) from Japan (Okutani 1995; 2015) to Australia (Reid 2016) and New Zealand waters (Braid 2013; Braid and Bolstad 2015) including Indonesia and the Philippines of the South China Sea (Voss 1963; Norman *et al*. 2016)

Remarks. The present study extended the distribution range of *I. cordiformis*, in the Indian Ocean from the type locality, southern Sumatra (Voss 1963; Okutani 1995), up into the East Andaman Sea, Thai Waters. Distribution in the Gulf of Thailand, although as a part of the South China Sea, is still unknown. The arm order of both specimens in this study, IV>II>III>I, corresponded to Braid and Bolstad (2015). In contrast, Braid *et al*. (2014) reported that both arms II were longer than IV.

Family Octopoteuthidae Berry, 1912
Genus *Octopoteuthis* Rüppell, 1844

Diagnosis. Small to medium size. Mantle soft, semi-gelatinous. Arms spindle-shaped, photophore present on tips, hooks biserial, tentacles absent in adult. Fins very long. Funnel locking cartilage simple, groove elongated. Photophores embedded in mantle, head and arms, patterns species specific.

***Octopoteuthis megaptera* (Verrill, 1885)**
Fig. 5, Table 4

Ancistrocheirus megaptera Verrill, 1885: 399–400, fig. 1a, pl. XLII.
Octopodoteuthopsis megaptera - Pfeffer 1912: 223–224. - Voss 1956: 125–126, fig. 8b, table 11.
Octopoteuthis megaptera - Stephen 1985: 43–50, 181–182, 195–196, figs. 4-7–4-8. - Nesis 1987: 182–183, fig. 47F–G. - Okutani 1995: 81, fig. 114, pl. 29. - Vecchione *et al*. 2002. 896, fig. 2A–D. - Chen and Liu 2009: 112, figs. 223–224. - Chen *et al.* 2009: 286–287, figs. 4-282–4-283. - Roper and Jereb 2010d: 268. - Guerra *et al*. 2014: 545. - Okutani 2015: 165. - Reid 2016: 152. - Kelly 2019: 96–112, figs. 24–29, table 11.

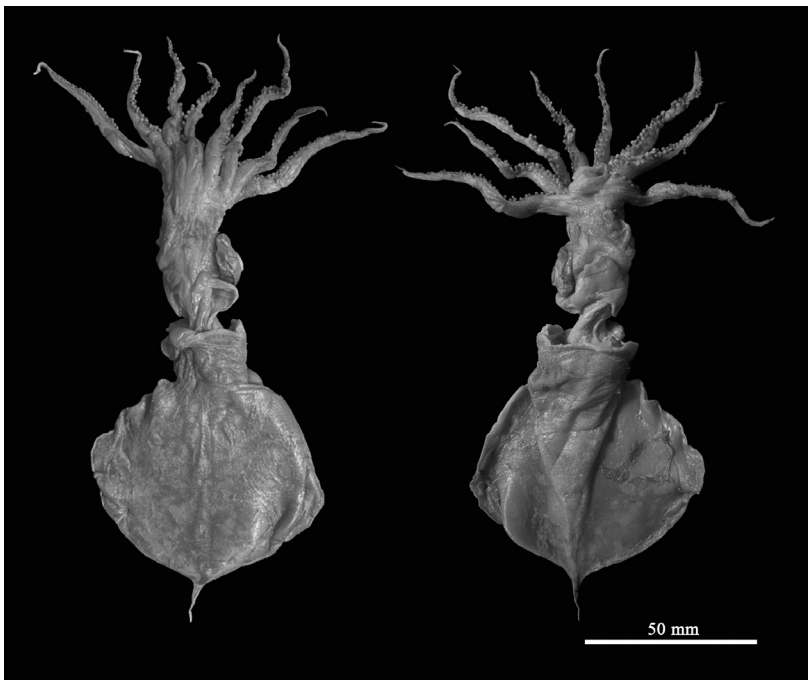

Figure 4. *Idioteuthis cordiformis* (Chun, 1908) (juvenile, PMBC 21215).

Table 3. Mantle length (DML, mm) and indices (index, %DML) of *Idioteuthis cordiformis* (Chun, 1908) (* = damaged).

Index	N	1	2
DML (mm)	2	83.8	87.0
VMLI	2	97.2	98.3
MWI	2	25.4	32.3
AL1I	2	30.8	45.8
AL2I	2	38.8	58.2
AL3I	2	31.5	55.9
AL4I	2	69.1	77.2
TTLI*	2	-	-
HLI	2	25.6	25.8
HWI	2	23.1	33.1
EDI	2	11.0	15.3
FNLI	2	13.0	14.6
FFNLI	2	5.5	6.6
FLI	2	78.2	82.0
FWI	2	79.6	82.3

Material examined. PMBC 19908, 1 female, mantle length 42.8 mm, 07°42′N 97°20′E to 07°42′N 97°18′E (BIOSHELF Station Z3), depth 322–493 m, otter trawl, Coll. S. Bussarawit and C. Aungtonya, 24 January 1999; PMBC 19909, 1 female, mantle length 107.2 mm, 8°30′N 95°58′E to 8°28′N 95°58′E (BIOSHELF St. E9), depth 550–649 m, otter trawl, Coll. S. Bussarawit and C. Aungtonya, 5 February 1999.

Diagnosis. Mantle soft, semi-gelatinous, conical shaped, short, posterior acuminated. Fins not extending to posterior end of mantle, length 76.9%, width 116.8% of dorsal mantle length. Arms subequal, formula II>I>III>IV or II>III>I>IV. Tentacles absent. Photophores pair, embedded around 27% from mantle posterior end.

Distribution. Subtropical and tropical zones of the Atlantic Ocean, the West Pacific Ocean from Japan down to Australia and the Indian Ocean (Nesis 1987; Okutani 1995; 2015; Chen and Liu 2009; Chen *et al*. 2009; Roper and Jereb 2010d; Reid 2016) including the East Andaman Sea, Thai waters (present study).

Remarks. Absence of tentacles in the present materials agrees with Roper and Jereb (2010d) and Kelly (2019), who suggested that they are lost occurred during paralarval and early juvenile stages as in congeners. Roper and Jereb (2010d) stated that *O. megaptera* was cosmopolitan, occurring in the Atlantic, Pacific and Indian Oceans, but distribution maps of Okutani (1995; 2015) and Kelly (2019) included only the Atlantic region. In contrasts, maps of Chen and Liu (2009) and Chen *et al*. (2009) included the occurrence of *O. megaptera* in the Central China Sea from southern Japan to Taiwan. The material in this study is the first ones of this species in Thai waters, and possibly the Indian Ocean, supporting Nesis (1987) and Roper and Jereb (2010d), extending from East Australia (Reid 2016) into the East Andaman Sea.

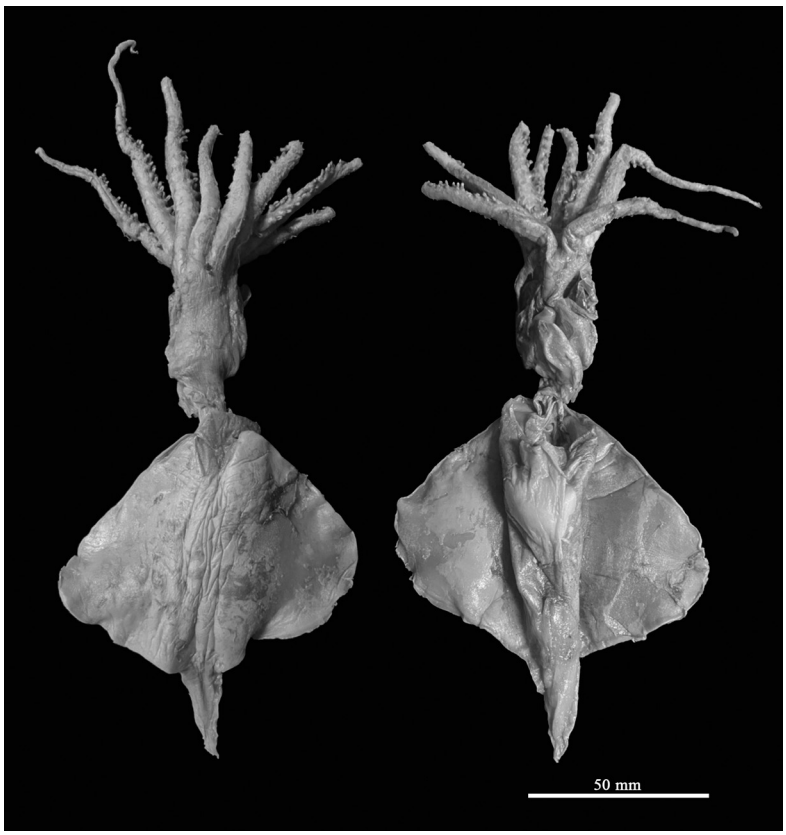

Figure 5. *Octopoteuthis megaptera* (Verrill, 1885) (female, PMBC 19908).

Table 4. Mantle length (DML, mm) and indices (index, %DML) of *Octopoteuthis megaptera* (Verrill, 1885) (** = absent).

Index	N	PMBC19908	PMBC19909
DML (mm)	2	42.8	107.2
VMLI	2	85.1	97.0
MWI	2	19.1	40.4
AL1I	2	48.6	104.6
AL2I	2	75.1	117.0
AL3I	2	74.6	103.1
AL4I	2	36.2	94.4
TTLI**	2	-	-
HLI	2	30.7	57.5
HWI	2	21.2	27.5
EDI	2	10.3	18.4
FNLI	2	20.7	23.0
FFNLI	2	8.5	9.5
FLI	2	76.9	77.0
FWI	2	110.5	116.8

***Octopoteuthis rugosa* Clarke, 1980**
Fig. 6, Table 5

Octopoteuthis rugosa Clarke, 1980: 156–156, figs. 122–132, table 29. - Stephen 1985: 72–77, figs. 4-15–4-16. - Nesis 1987: 183, 189, fig. 47J–K. - Roper and Jereb 2010d: 268. - Guerra *et al*. 2014: 546. - Okutani 2015: 166. - Reid 2016: 153. - Kelly 2019: 113–128, figs. 30–35, table 12.

Material examined. PMBC 21216, 1 female, mantle length 202.2 mm, 8°30′N 95°58′E to 8°28′N 95°58′E (BIOSHELF St. E9), depth 550–649 m, otter trawl, Coll. S. Bussarawit and C. Aungtonya, 5 February 1999.

Diagnosis. Mantle gelatinous, soft, conical shaped, anterior with longitudinal grooves in gelatinous layer, posterior extend beyond margin of fins (tail length about 30% of mantle length). Arm hooks two rows. Tentacles absent. Fin length 67.7% of dorsal mantle length, not extending to posterior end of mantle, width 80.0%. Photophores absent on head and mantle, present at arms tips.

Distribution. Tropical and temperate zones of the Atlantic Ocean and the Indo-West Pacific Ocean (Clarke 1980; Nesis 1987; Roper and Jereb 2010d; Okutani 2015; Reid 2016; Kelly 2019) including the East Andaman Sea, Thai waters (present study).

Remarks. Kelly (2019) reported that arms of *O. rugosa* were long with indices of 80–100. Unfortunately, arms I and II of the only specimen are too damaged to determine their actual length. Absence of tentacles is similar to *O. megaptera* in this study and possibly for the same reason (Roper and Jereb 2010d; Kelly 2019). Absence of photophores on mantle in this study agrees to Clarke (1980) and Okutani (2015), but is contrast to presence of two photophores on posterior ventral mantle reported by Stephen (1985) and Kelly (2019). Additional materials from this region might help resolving this issue. This is the first record of this species in Thai waters, Indian Ocean supporting the distribution in the Indo-West Pacific region (40°N to 40°S) of the above-mentioned literature and extending northward into the Andaman Sea above the equator. Note that the *O. rugosa* specimen was collected from the same locality (BIOSHELF St. E9) as one of the *O. megaptera* specimen (PMBC 19909).

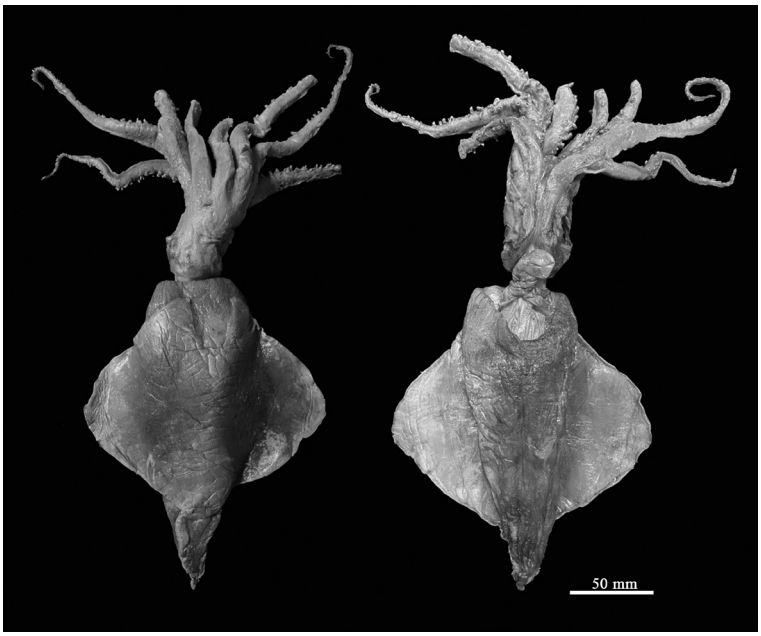

Figure 6. *Octopoteuthis rugos*a Clarke, 1980 (female, PMBC 21216).

Table 5. Mantle length (DML, mm) and indices (index, %DML) of *Octopoteuthis rugosa* (*= damaged, ** = absent).

Index	N	
DML (mm)	1	202.2
VMLI	1	86.2
MWI	1	26.4
AL1I*	1	-
ALI2I*	1	-
AL3I	1	90.5
AL4I	1	72.0
TTLI**	1	-
HLI	1	24.4
HWI	1	19.1
EDI	1	9.2
FNLI	1	19.6
FFNLI	1	8.5
FLI	1	67.7
FWI	1	80.0

DISCUSSION

The five decapods *Ancistrocheirus lesueurii*, *Abralia spaercki*, *Idioteuthis cordiformis*, *Octopoteuthis megaptera* and *O. rugosa* in this study inhabited the oceanic zone. Their pelagic lifestyles are with vertical migration which explains why all specimens were collected at a depth of less than 1000 m. Their occurrence in Thai waters, Indian Ocean supported previous records in the Indo-West Pacific region, extending ranges into the East Andaman Sea. Their distribution in the Gulf of Thailand is still unknown, except records from the literature. Forty-three taxa of oegopsid squids were included in the list of cephalopods in Thai waters of Nabhitabhata *et al*. (2019). Thirty-four taxa were literature records and one taxon was with unknown deposition. Only eight taxa were with available voucher specimens. *A. lesueurii*, *A. spaercki*, and *I. cordiformis* were previously included in that list as literature records, until specimens from the present study enables the availability of vouchers. *O. megaptera* and *O. rugosa* were previously absent from the mentioned list, the present study adds them as the forty-fourth and forty-fifth oegopsid taxa. The materials of this study, therefore, serve as the only available vouchers from this region, increasing the number of available vouchers of oegopsid squids in the list from eight to thirteen.

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