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TRABAJOS ORIGINALES

Revision of the genus *Lolliguncula* Steenstrup, 1881 (Cephalopoda: Loliginidae) off the Pacific Coast of South America

Revisión del género *Lolliguncula* Steenstrup, 1881 (Cephalopoda: Loliginidae) frente a la costa del Pacífico de América del Sur

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Abstract

In the present paper the species from the genus *Lolliguncula* Steentrup, 1881 (Cephalopoda: Loliginidae) in Southeastern Pacific Ocean are reviewed. The presence of *Lolliguncula (Lolliguncula) panamensis* Berry, 1911, *Lolliguncula (Loliolopsis) diomedeae* Hoyle, 1911 and *Lolliguncula (Lolliguncula) argus* Brakoniecki and Roper, 1985 are confirmed from Mexican waters to Perú and the species *Lolliguncula (Lolliguncula) argus* collected during a cruise of the R/V *Anton Bruun* from 1966 off the coast of South America is recorded for the first time in Peruvian waters. A key to identification of Pacific species is given. We report a diagnostic feature with taxonomic remarks of these species. Updated information on the distribution, biology, and fisheries of each species also is discussed.

Keywords: *Lolliguncula*; taxonomy; distribution; biology; Southeastern Pacific.

Resumen

En el presente trabajo las especies del género *Lolliguncula* Steentrup, 1881 (Cephalopoda: Loliginidae) en el Océano Pacífico Sudeste son revisados. La presencia de *Lolliguncula (Lolliguncula) panamensis* Berry, 1911, *Lolliguncula (Loliolopsis) diomedeae* Hoyle, 1911 y *Lolliguncula (Lolliguncula) argus* Brakoniecki & Roper, 1985 son confirmados desde aguas Mexicanas hasta Perú y la especie *Lolliguncula (Lolliguncula) argus* colectados durante el crucero R/V *Anton Bruun* de 1966 frente a la costa de América del Sur se registra por primera vez en aguas peruanas. Una clave para la identificación de las especies del Pacífico es proporcionada. Se presenta los caracteres de diagnóstico con las observaciones taxonómicas de estas especies. Información actualizada sobre la distribución, biología y pesquería de cada especie también se discute.

Palabras claves: *Lolliguncula*; taxonomía; distribución; biología; Pacífico Sudeste.

Introduction

The family Loliginidae Lesueur, 1821 includes many species that are important in fisheries world-wide (Nesis 2003, Okutani 2005, Jereb et al. 2010) and in the southeastern Pacific Ocean (Cardoso 1991, Rocha & Vega 2003). At present the phylogenetic taxonomy of the Loliginidae is very confusing, resulting in a number of taxonomic problems that need to be critically resolved. The family according to Jereb et al. (2010) includes ten genera and nine subgenera: *Loligo* Lamarck, 1798 (Eastern Atlantic and Mediterranean Sea); *Sepioteuthis* Blainville, 1824 (Western Atlantic and Indo-West Pacific); *Loliolus (Loliolus)* Steenstrup, 1856 (Indo-West Pacific); *Loliolus (Nipponololigo)* Steenstrup, 1856 (Indo-West Pacific); *Lolliguncula (Lolliguncula)* Steenstrup, 1881 (Eastern Pacific and West Pacific); *Lolliguncula (Loliolopsis)* Steenstrup, 1881 (Eastern Pacific); *Doryteuthis (Doryteuthis)* Naef, 1912 (Western Atlantic); *Doryteuthis (Amerigo)* Naef, 1912 (Eastern Pacific and Western Atlantic); *Alloteuthis* Wülker, 1920 (Eastern Atlantic and Mediterranean Sea); *Uroteuthis (Uroteuthis)* Rehder, 1945 (Western Pacific); *Uroteuthis (Photololigo)* Rehder, 1945 (Indo-West Pacific); *Uroteuthis (Aestuariolus)* Rehder, 1945 (Eastern Australian); *Pickfordiateuthis* Voss, 1953 (Western Atlantic and Eastern Pacific); *Heterololigo* Natsukai, 1984 (Northwestern Pacific) and *Afrololigo* Brakoniecki, 1986 (Atlantic coast of Africa).

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The genus *Lolliguncula* is distinguished from all other loliginids based on the following characters: the mantle lacks a posterior tail-like elongation; fins broadly rounded; and spermatophores have a long cement body. Species in this genus are found both in warm, shallow, inshore waters and brackish waters off the coast of the Americas (Vecchione 1991, Vecchione et al. 1998). They are caught as bycatch in trawl shrimp fisheries and sold in local seafood markets (Cardoso 1991, Filippova et al. 1997, Jereb et al. 2010).

The genus *Lolliguncula* comprises two subgenera and four species of small-sized squids which inhabit the tropical and subtropical West Atlantic, and the tropical eastern Pacific oceans (Okutani 2005, Jereb et al. 2010). *Lolliguncula (Loliolopsis) diomedeae* (Hoyle, 1904), *Lolliguncula (Lolliguncula) panamensis* (Berry, 1911) and *Lolliguncula (Lolliguncula) argus* (Brakoniecki & Roper, 1985) are found on the Eastern Pacific Ocean, whereas *Lolliguncula (Lolliguncula) brevis* (Blainville, 1823) is the only species of the genus that occur in the Western Atlantic Ocean, about 45°N to 28°S (Jereb et al. 2010). In the coastal waters off Peru, two species were previously reported and documented by Castellanos & Cazzaniga (1980), *L. diomedeae* collected off Punta Sal and *L. panamensis* collected off both Caleta La Cruz and Paita.

The objective of this paper is to update the taxonomy, distribution and biology of the genus *Lolliguncula* in the southeastern Pacific Ocean. We describe the morphological features of the three species from the eastern Pacific Ocean and make taxonomic remarks. A key to the species of the genus *Lolliguncula* is presented.

Materials and method

Morphological examination was conducted on preserved material, including type specimens, during numerous visits to museums and collections in the United States and Peru.

The measurements (in mm) and indices used in the work are as defined by Roper & Voss (1983): mantle length (ML); mantle width index (MWI); fin length index (FLI); fin width index (FWI); and hectocotylized arm length index (HcLI). Abbreviations of collections: USNM, National Museum of Natural History, Smithsonian Institution, Washington, D.C.; UMML, University of Miami, Rosenstiel School of Marine and Atmospheric Sciences, Miami, Florida; SBMNH, Santa Barbara Museum of Natural History, Santa Barbara, California; LACMNH, Los Angeles County Museum of Natural History, Los Angeles California; CASIZ, California Academy of Sciences, San Francisco, California; IMARPE, Instituto del Mar del Peru, Callao, Peru; MUSM, Museo de Historia Natural, Universidad Nacional Mayor de San Marcos, Lima, Peru.

Taxonomic section

Family: **Loliginidae** Lesueur, 1821
Genera: ***Lolliguncula*** Steenstrup, 1881

Type Species. *Loligo brevis* Blainville, 1823; by original designation.

Diagnosis. Posterior tail-like elongation of mantle absent. Posterior fins broadly rounded; fin width greater than length in adults. Tentacular clubs expanded; suckers small; arranged in 4 rows. Arm sucker rings with square, plate-like teeth around entire margin. Hectocotylized arm without crest: suckers reduced, sucker stalks elongated to form papillae on either dorsal or both dorsal and ventral rows. Buccal membrane with or without suckers. Photophores absent on ventral ink sac. Spermatophores with long cement body. Eggs small.

***Lolliguncula* (*Lolliguncula*)** Steenstrup, 1881

Type Species. *Loligo brevis* Blainville, 1823; by original designation.

Diagnosis. Length of modified portion of hectocotylus less than entire arm length; proximal portion not modified; hectocotylized arm slightly elongate.

Lolliguncula (Lolliguncula) argus Brakoniecki & Roper, 1985

(Figs. 1A–B)

Lolliguncula argus Brakoniecki & Roper 1985: 47, figs. 1, 2; Brakoniecki 1986: 49, 92, 120, fig. 3D; Nesis 1987: 146; Roper et al. 1995: 326, 5 figs; Okutani 2005: 122.

Lolliguncula (Lolliguncula) argus, Vecchione et al. 2005: 25; Jereb et al. 2010: 84, figs. 115–116.

Type material examined. Holotype. 1 male 29 mm ML; Ecuador, La Plata Island, 01°16'S, 81°05'W; coll. M/V *Argosy*, Station 85, night light dipnet, 10 Oct 1961; USNM 815750.

Paratypes. 2 males 20.8–29.6 mm ML + 1 female 39 mm ML; Ecuador, La Plata Island, 01°16'S, 81°05'W; coll. M/V *Argosy*, Station 85, night light dipnet, 10 Oct 1961; UMML 31.1822.

Other material examined. 81 males 23–30 mm ML + 9 females 22–31 mm ML; Ecuador, La Plata Island, 01°16'S, 81°05'W; coll. R/V *Argosy*, station 79, 9 October 1961; UMML 31.1828. 16 males, 29–37 mm ML + 15 females, 35–45 mm ML; Peru, 04°55'S, 81°19'W, 70 m; coll. R/V *Anton Bruun* , cruise 18B, station 762–A, 08 September 1966; USNM. 1 male 38 mm ML + 2 females 22–61 mm ML + 2 juveniles 13–15 mm ML; Mexico, Baja California, off Cape San Lucas; coll. Orca expedition, night light dip net, 17 March 1953; SBMNH 60043.

Diagnostic features. Morphometric characters are given in Table 1. Mantle short, bluntly pointed posteriorly. Fins small, nearly elliptical in outline, length about 25% of mantle length. Tentacles short, compressed. Buccal suckers absent. Arm suckers with about 5 blunt teeth on distal margin of sucker rings. Right ventral arm hectocotylized in males, about 60% distal part of dorsal row of suckers modified by loss of suckers and development of pedicels.

Holotype. 1 male 28.6 mm ML; USNM 815750.

Type locality. Ecuador, La Plata Island, 01°16'S, 81°05'W, surface depth.

Distribution. Known to occur in the eastern Pacific Ocean from the lower Gulf of California, Mexico, to La Plata Island, Ecuador (Brakoniecki 1986, Jereb et al. 2010). Depths range from 0–70 m.

Size. Very small-sized squid; maximum mantle lengths 37 mm for males and 45 mm for females. The mantle length of a female specimen in SBMNH collection measured 61 mm.

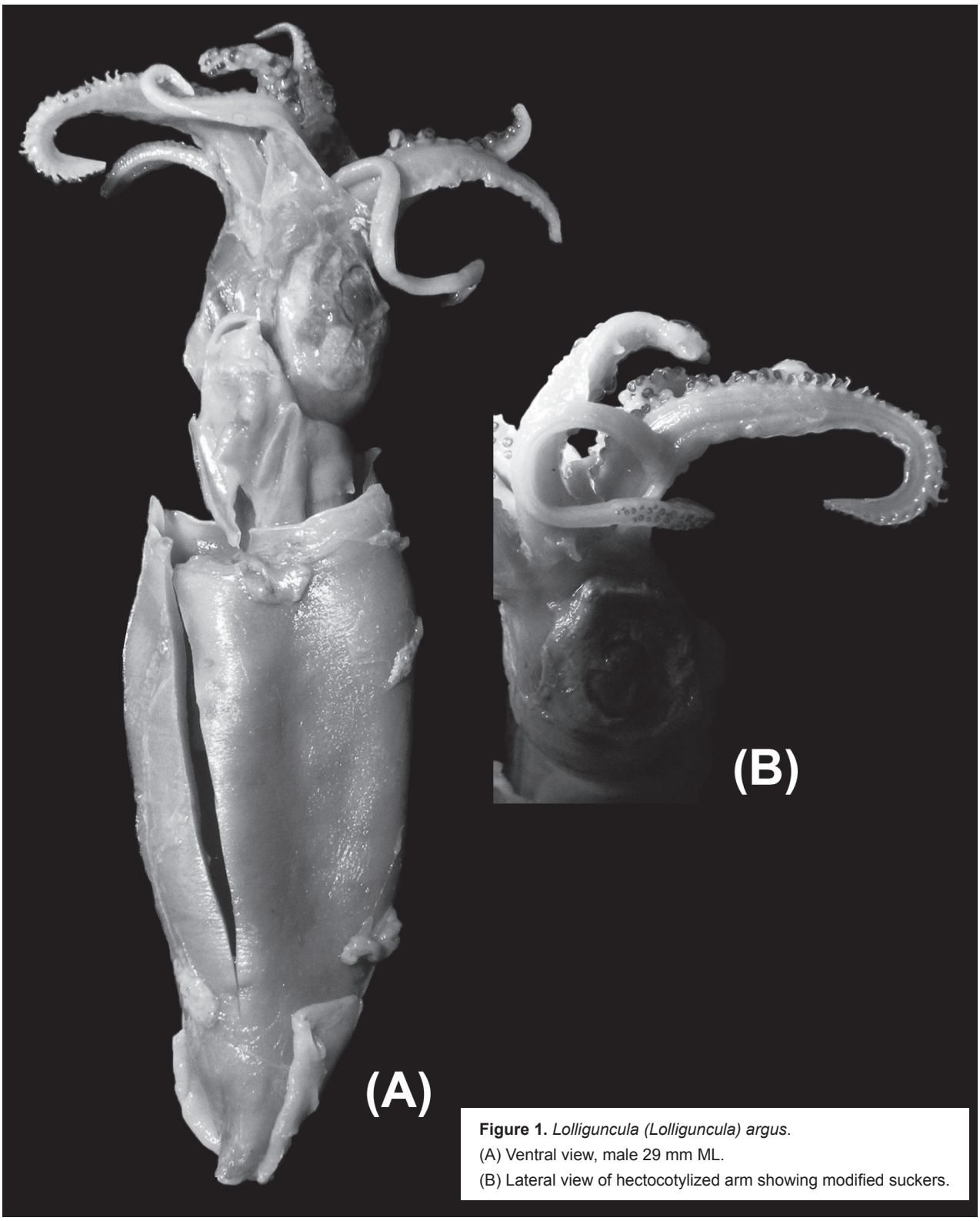

Figure 1. *Lolliguncula (Lolliguncula) argus*.
(A) Ventral view, male 29 mm ML.
(B) Lateral view of hectocotylized arm showing modified suckers.

Table 1. Measurements and indices of bodily proportions of *Lolliguncula* (*Lolliguncula*) *argus*

Character	The present study		Brakoniecki&Roper (1985)	
	Males	Females	Males	Females
Number of individuals	4	4	10	10
ML (mm)	**32.6** (28.3–35.4)	**40.2** (37.4–42.0)	**26.8** (20.8–29.6)	**32.3** (20.6–38.8)
MWI	**30.6** (27.0–33.1)	**28.6** (25.8–29.9)	**33.5** (31.1–35.6)	**30.4** (25.7–34.0)
FLI	**29.6** (28.8–30.2)	**29.0** (25.8–31.0)	**27.0** (24.8–31.3)	**27.3** (24.3–29.9)
FWI	**39.3** (36.4–41.3)	**38.4** (33.4–42.4)	**48.4** (44.4–53.1)	**49.0** (45.2–52.2)
HcLI	**57.4** (52.9–60.7)		**62.6** (56.9–67.2)	

Habitat and biology. A coastal species. The biology and ecology of this species are unknown.

Interest to fisheries. Of no current market value.

Remarks. A total of 130 specimens were examined in this study including those seen by Brakoniecki (USNM 815750, UMML 31.1822 and UMML 31.1828). In addition, specimens from Peru were compared with the type specimens of *L. argus* that are housed in the USNM and UMML collections. Specimens from the two localities are identical. Based on these new records we extend the distribution range from the type locality in Ecuador (01°16'S) south to Peru (04°55'S).

Lolliguncula (*Lolliguncula*) *panamensis* Berry, 1911

Lolliguncula (?) *panamensis* Berry 1911: 100, figs. 1–7, pl. 6, figs. 1,2.

Lolliguncula panamensis, Voss 1971: 8; Castellanos & Cazzaniga, 1980: 24, fig. 2; Voss 1982: 8; Nesis 1982: 136, fig. 35; Roper et al. 1984: 118, 4 figs; Brakoniecki 1986: 46, 92, 120, fig. 3B; Hess 1987: 212; Nesis 1987: 146, fig. 35H; Cardoso 1991: 9, fig. 2c; Roper et al. 1995: 327, 5 figs; Filippova et al. 1977: 102, fig. 59; Okutani 2005: 121.

Lolliguncula tydeus Brakoniecki 1980: 424, figs. 1–2; Nesis 1982: 136, fig. 35; Nesis 1987: 146, figs. 35 E, F; Cardoso & Valdivieso 1988: 303, fig. 1.

Lolliguncula (Lolliguncula) panamensis, Vecchione et al. 1998: 218; Paredes et al. 1999: 34; Vecchione et al. 2005: 25; Jereb et al. 2010: 85, figs. 117–118.

Material examined. 2 males 43–49 mm ML + 4 females 45–97 mm ML; Colombia, 03°40.2'N, 77°17.8'W, 10 m; coll. B/I *Choco*, cruise 7001, station 165, 25 January 1970; USNM 730087. 2 males 44–47 mm ML + 1 female 43 mm ML; Colombia, 03°39'N, 77°21'W, 18.2 m; coll. L. Knapp, R/V *Inderena*, cruise 7009, station 336 70–2LK, 22 October 1970; USNM.

1 female 73 mm ML; Ecuador, 02°38'S, 80°23'W; coll. I. Perez–Farfante, 1963; USNM 730086. 33 males 32–63 mm ML + 44 females, 31–77 mm ML; Ecuador, 03°39'S, 80°41'W, 13 m; coll. R/V *Anton Bruun*, cruise 18B, station 768, 10 September 1966; USNM. 1 male 74.8 mm ML; Peru, 03°28'S, 80°36'W, 5–20 fms [9–36 m]; coll. J. McLean & D. Shasky, shrimp boat Maria Elena, 13–14 April 1972; LACMNH. 1 female 74 mm ML; Peru, Puerto Pizarro, Cherre; coll. E. del Solar, 18 March 1970; USNM 288458. 1 male 39 mm ML; Peru, Tumbes, off Zorritos [03°40'S]; coll. L. Merron, 02 August 1954; UMML 1219. 1 female 45 mm ML; Peru, Piura, off Paita [05°05'S]; coll. E. del Solar, R/V *SNP–1*, station 43, 22 January 1969; USNM 288458. 3 females 63–103 mm ML; Peru, Tumbes, off Caleta La Cruz, 14.4 m; coll. J. Velez, A. Kameya & V. Rivadeneira, 02 December 1987; MUSM. 1 male 70 mm ML + 1 female 119 mm ML; Peru, Callao, Playa El Carpayo; coll. J. Bautista, 28 September 1998; MUSM. 1 female 50 mm ML + 2 males 58–97 mm ML; Peru, 16°25.1'S, 73°33.4'W, 130 m; coll. R/V *SNP–1*, cruise 7201, 26 January 1972; IMARPE. 1 male 61 mm ML; Peru, 06°24.5'S, 81°07.1'W, 105 m; coll. BIC *Humboldt*, cruise 8304, 27 April 1983; IMARPE. 2 males 50–65 mm ML; Peru, possibly Chimbote; coll. G. Voss & V. Valdivieso, 15 September 1981; IMARPE. 1 female 117 mm ML; Peru, Callao, Playa El Carpayo; coll. A. Chipollini & A. Kameya, 22 February 1984; IMARPE.

Diagnostic features. Morphometric characters are given in Table 2. Mantle short, robust, and cylindrical. Fins large, and rounded; lengths 53–60% of mantle length. Tentacles moderately long, robust, sucker rings with 20–27 small, sharp, triangular teeth. Buccal membrane with 1–4 suckers. Arms moderately short, sucker rings with 11–15 truncate teeth, prominent distally. Left ventral arm hectocotylized in males, 15% distal part of dorsal row of suckers modified by loss of suckers and development of pedicels.

Holotype. 1 female 101 mm ML; CASIZ 537.

Type locality. Gulf of Panama, Panama.

Distribution. Known to occur in the eastern Pacific Ocean from the west coast of Baja California and Gulf of California, through Mexico to northern Peru (Jereb et al. 2010); Caleta La Cruz, Tumbes to Atico (16°25'S), Peru (Cardoso & Valdivieso, 1988). Filippova et al. (1997) and Okutani (2005) stated that the southern distribution limit was restricted to Ecuador. For the specimens at hand depths range from 9–130 m. The species is most abundant in waters less than 50 m deep off the west coast of Mexico (Sanchez 2003). However, in the Gulf of California Arizmendi-Rodriguez et al. (2012) reported greater abundances in waters deeper than 80 m.

Size. Small-sized squid; maximum mantle lengths to 119 mm in females and 97 mm in males. Arizmendi-Rodriguez et al. (2012) reported maximum mantle lengths to 110 mm in males and 115 mm in females.

Habitat and biology. Nectobenthic species, living at temperatures between 23–29 °C (Cardoso & Valdivieso, 1988). Arizmendi-Rodriguez (2010) reported two different groups of females spawning in February and July. Females are larger than

Table 2. Measurements and indices of bodily proportions of *Lolliguncula* (*Lolliguncula*) *panamensis*

Character	The present study		Brakoniecki (1980), as *L. tydeus*	
	Males	Females	Males	Females
Number of individuals	6	5	7	1
ML (mm)	**69.2** (50.3–96.8)	**77.7** (35.3–117.0)	**33.3** (26.0–40.0)	46.0
MWI	**35.8** (28.9–40.3)	**34.3** (30.3–40.3)	**33.5** (30.0–35.3)	36.9
FLI	**53.1** (47.8–58.8)	**53.6** (48.7–56.4)	**46.0** (38.5–50.0)	47.8
FWI	**66.7** (60.4–76.9)	**68.4** (54.9–76.6)	**64.1** (60.0–67.6)	69.6
HcLI	**15.2** (13.3–16.2)		**12.8** (11.4–14.7)	

males. The sizes of sexes at first maturation in Colombia are 76–79 mm ML for females and 40 mm ML for males (Barragan 1977b). The diet consists of fishes and crustaceans (Barragan 1977a). Arizmendi-Rodriguez et al. (2011) also identified fishes and crustaceans but most notably found samples of juvenile of Pacific sardine (*Sardinops sagax*).

Interest to fisheries: Taken as bycatch in shrimp trawl fisheries in Panama, Colombia (Barragan 1977a), off the Pacific coast of Mexico (Alejo-Plata et al. 2001), and off Ecuador and Tumbes, Peru. Small quantities are found in local seafood markets.

Remarks: The expansion of the species to the south of Peru (16°25'S) is related to the incursion of warm waters caused by El Nino event (Paredes et al. 2004).

LOLLIGUNCULA (*LOLIOLOPSIS*) BERRY, 1929

Type species. *Loligo diomedeae* Hoyle, 1904; by monotypy and synonymy with original designation, *Loliolopsis chiroctes* Berry, 1929.

Diagnosis. Hectocotylized arm greatly elongate, modified along entire length.

Lolliguncula (*Loliolopsis*) *diomedeae* (Hoyle, 1904)

Loligo diomedeae Hoyle 1904: 29, pl. 5, fig. 13, pl. 6, figs. 1–7; Castellanos & Cazzaniga 1980: 24, fig. 1

Loliolopsis chiroctes Berry 1929: 267, pl. 32, figs. 1–2, pl. 33, figs. 1–6.

Loliolopsis diomedeae, Voss 1971: 7; Nesis 1982: 131, fig. 34; Toll 1982: 41, pl. 3c; Roper et al. 1984: 119, 4 figs; Alamo & Valdivieso 1987: 169; Nesis 1987: 143, fig. 34 K–N; Cardoso et al. 1989: 90, fig. 1; Okutani 1995: 63, fig. 79 a–c; Roper et al. 1995: 325, 4 figs; Filippova et al. 1997: 102, fig. 60.

Lolliguncula diomedeae, Brakoniecki 1986: 48, 92, 120, fig. 3A; Cardoso 1991: 7, fig. 2b.

Lolliguncula (Loliolopsis) diomedeae, Vecchione et al. 1998: 218; Paredes et al. 1999: 34; Okutani 2005: 122; Vecchione et al. 2005: 25; Jereb et al. 2010: 86, figs. 119–120.

Type material examined. Holotype- 1 female 85 mm ML; Mexico, off Acapulco, 16°47'30"N, 99°59'30"W, 141 fm [253 m], green mud; coll. R/V *Albatross*, station 3422, 12 April 1891; USNM 574847.

Other material examined. 1 male 42 mm ML + 7 females 56–76 mm ML; Humboldt Bay, Colombia, 07°00'N, 77°45'W, 40 fm [72 m]; coll. Cacique commercial vessel, 02 March 1970; USNM 730085. 1 female 44 mm ML; Colombia, 06°35.5'N, 77°33'W, surface; 15–16 June 1972; UMML 1501. 1 male 59 mm ML; Colombia, 04°48'N, 81°17'W, 16 m; coll. R/V *Anton Bruun*, cruise 16, station 624–B, 02 June 1966; USNM. 2 females 53–57 mm ML; Colombia, 04°06'N, 81°09'W, 90 m; coll. R/V *Anton Bruun*, cruise 18B, station 764, 08 September 1966; USNM. 6 males 46–53 mm ML + 6 females 55–75 mm ML; Colombia, 03°43'N,77°35'W, 80 m; coll. R/V *Anton Bruun*, cruise 18B, station 782, 16 September 1966; USNM. 1 female 80 mm ML; Colombia, 03°39'N, 77°21'W, 18.2 m; coll. L. Knapp, R/V *Inderena*, cruise 7009, station 336, 22 October 1970; USNM. 23 males 36–53 mm ML + 60 females 33–81 mm ML; Colombia, 03°35'N,78°35'W, 70–80 m; coll. R/V *Anton Bruun*, cruise 18B, station 783, 16 September 1966; USNM. 1 male 49 mm ML + 59 females 54–82 mm ML; Ecuador, 00°58'N,80°08'W, 100 m; coll. R/V *Anton Bruun*, cruise 18B, station 779, 13 September 1966; USNM. 1 female 67 mm ML; Ecuador, 35 mi NW Pasado; coll. W. L. Klawe, night light dip net, 03 April 1962; UMML 2104. 1 female 71 mm ML; Ecuador, 00°57'S, 80°57'W, 120–150 m; coll. R/V *Anton Bruun*, cruise 18B, station 776, 12 September 1966; USNM. 1 female 77 mm ML; Peru, Paita; coll. E. del Solar, R/V *SNP–1*, station 43, 22 January 1969; USNM 288458. 4 females 74–96 mm ML; Peru, 03°52.5'S, 80°55'W; coll. E. del Solar, R/V *SNP–1*, cruise 6901, 22 January 1969; IMARPE. 1 male 51 mm ML + 4 females 57–63 mm ML; Peru, 03°24'S, 80°38'W, 50 m; coll. R/V *SNP–1*, cruise 6905, station 5, 08 May 1969; IMARPE. 1 male 66 mm ML; Peru, off Reventazon, 105 m; coll. fishing vessel Audaz, 30 May 1969; IMARPE. 1 female 92 mm ML; Peru, Tumbes, northwest Bocapán; coll. fishing vessel Ilo, station 8, 08 April 1970; IMARPE. 15 females 74–96 mm ML; Peru, 03°33'S, 80°44.5'W, 72 m; coll. R/V *SNP–1*, cruise 7008–09, 31 August 1970; IMARPE. 1 female 72 mm ML; Peru, 03°33'S, 80°54'W, 130 m; coll. R/V *SNP–1*, cruise 7008–09, 31 August 1970; IMARPE. 4 females 82–101 mm ML; Peru, 16°25.1'S, 73°33.4'W, 130 m; coll. R/V *SNP–1*, cruise 7201, 26 January 1972; IMARPE. 2 males 65–73 mm ML + 13 females 69–104 mm ML; Peru, 05°39.8'S, 81°05'W, 65 m; coll. R/V *SNP–1*, cruise 7205, 13 May 1972; IMARPE. 2 males 64–76 mm ML + 1 female 91 mm ML; Peru, 07°03'S, 80°32.5'W, 65 m; coll. R/V *SNP–1*, cruise 7205, 15 May 1972; IMARPE. 1 female 113 mm ML; Peru, 05°21'S, 81°10'W, 62 m; coll. R/V *Professor Mesyatsev*, cruise 7210, 09 October 1972; IMARPE. 1 male 67 mm ML + 3 females 86–114 mm ML; Peru, 07°20'S, 80°19'W, 100 m; coll. R/V *TAREQ II*, cruise 7605, 18 May 1976; IMARPE. 2 males 62 mm ML + 4 females 63–68 mm ML; Peru, 04°04.15'S, 81°08.13'W, 115 m; coll. R/V *TAREQ II*, cruise 7605, 30 May 1976; IMARPE. 1 male 56.2 mm ML + 1 female 77 mm ML; Peru, 03°28.8'S, 82°42.9'W, 55 m; coll. R/V *Professor Siedlecki*, cruise 7911–12, 05 December 1979; IMARPE. 1 female 94 mm ML; Peru, 05°41.6'S, 81°09.3'W, 78 m; coll. BIC *Humboldt*, cruise 8007, 30 July 1980; IMARPE. 3 females 84–90 mm ML; Peru, Tumbes, off Caleta La Cruz, 11 m; 15 November 1982; IMARPE. 2 females 97–98 mm ML; Peru, 10°53.6'S, 77°45.8'W, 35 m; coll. BIC *Humboldt*, cruise 8301, 13 January 1983; IMARPE. 1 male 69 mm ML; Peru, 09°14.9'S, 78°35.9'W, 64 m; coll. BIC *Humboldt*, cruise 8301, 15 January 1983; IMARPE. 1 male 61 mm ML; Peru, 06°54.7'S, 80°38.6'W, 73 m; coll. BIC *Humboldt*, cruise 8301, 21 January 1983; IMARPE. 4 females 87–99.7 mm ML; Peru, 06°20.6'S, 80°52.9'W, 62 m; coll. BIC *Humboldt*, cruise 8301, 21 January 1983; IMARPE. 1 female 92 mm ML; Peru, 05°03.6'S, 81°15.8'W, 115 m; coll. BIC *Humboldt*, cruise 8301, 22 February 1983; IMARPE. 1 female 100 mm ML; Peru, Tumbes, off Caleta La Cruz, 11 mm; 24 June 1987; IMARPE. 1 male 77 mm ML + 1 female 82 mm ML; Panama, 08°00'N, 79°31.1'W, 99–95 m; coll. R/V *Pillsbury*, station 518, 04 May 1967; UMML 1836.

Diagnostic features. Morphometric characters are given in Table 3. Mantle elongate, narrow, with slightly pointed

Table 3. Measurements and indices of bodily proportions of *Lolliguncula (Loliolopsis) diomedeae*

Character	The present study		Berry (1929), as *Loliolopsis chiroctes*	
	Males	Females	Males	Females
Number of individuals	12	64	5	3
ML (mm)	**64.2** (51.1–75.6)	**86.9** (57.0–114.2)	**48.0** (45.0–50.0)	**56.5** (53.5–61.0)
MWI	**24.9** (21.8–27.4)	**24.0** (19.4–29.3)	**27.7** (27.0–28.7)	**22.8** (21.3–23.6)
FLI	**33.3** (30.7–35.8)	**36.6** (30.5–40.8)	**32.0** (30.0–34.0)	**33.0** (31.8–34.4)
FWI	**44.0** (39.7–47.9)	**45.2** (36.8–56.1)	**49.7** (47.8–54.0)	**48.3** (46.7–50.8)
HcLI	**25.2** (21.2–29.6)		**27.6** (25.0–29.3)	

posterior end. Fins short with rounded heart–shaped profile, length 30–40% of ML. Females with larger body, relatively shorter arms and fins larger than males. Tentacles short, sucker rings with about 24 square teeth. Buccal membrane with 4–10 suckers. Arm sucker rings with 10–11 square teeth, prominent distally. Both ventral arms conspicuously modified in males. Left ventral arm hectocotylized in males, very long, whip–like in appearance, 6 or 7 rows of small suckers present at base, of arm, devoid of suckers medially, distal end of arm with row of papillae. Right ventral arm with broad, membranous flap, and suckers of reduced size.

Holotype. Female 85 mm ML, USNM 574847.

Type locality. Mexico, off Acapulco, 16°47'30"N, 99°59'30"W, 141 fm [253 m], green mud.

Distribution. Known range in the eastern Pacific Ocean from off the west coast of Baja California and Gulf of California, to southern Peru (Cardoso et al. 1989, Jereb et al. 2010). Depths range from 0–150 m but off the coast of Mexico specimens were most abundant in deeper waters, between 50–200 m (Sanchez 2003).

Size. Small sized-squid; maximum mantle lengths of females to 114 mm and males to 76 mm.

Habitat and biology. Nectobenthic species, living at temperatures between 21–28 °C (Cardoso et al. 1989). Females are present in greater proportion than males and the males are typically smaller than females (Cardoso et al. 1989).

Interest to fisheries. Taken as bycatch in shrimp trawl fisheries in Panama (Voss 1971), off the Pacific coast of Mexico (Alejo–Plata et al. 2001) and off Tumbes, Peru. Small quantities are found in local seafood markets.

Discussion

Vecchione et al. (1998) verified that *L. argus* is a valid loliginid species. However, they failed to conclude whether *L. argus* should be assigned to the genus *Loligo* or to *Lolliguncula*. Vecchione et al. (2005) later confirmed that the spermatophores of *L. argus* have long cement bodies and by consensus they determined that the species should be placed in the subgenus *Lolliguncula (Lolliguncula*).

Brakoniecki (1980) differentiated *Lolliguncula panamensis* from *Lolliguncula tydeus* based on the relative length of the hectocotylized arm, which in *L. panamensis* is about equal in length to its opposite arm. Because no male *L. panamensis* were examined, *L. brevis* (from the western Atlantic Ocean) was used for comparison because it is morphologically nearly identical to *L. panamensis*. Later Brakoniecki (1986) considered *Lolliguncula tydeus* to be conspecific with *Lolliguncula panamensis*, of which previously he had seen only females. Vecchione et al. (1998) verified that *panamensis* is a valid loliginid species. They also assigned *L. panamensis* to the subgenus *Lolliguncula* (*Lolliguncula)*.

Hoyle (1904) described *Loligo diomedeae* based upon a single female collected off Acapulco, Mexico. Later, Berry (1929) described another loliginid species, which he named *Loliolopsis chiroctes* based on multiple specimens collected off Baja California, Mexico on which he based his new genus *Loliolopsis*. As these species are synonymous (based on Voss 1971), Hoyle's species name has priority as the type species of Berry's genus. Vecchione et al. (1998) verified that *L. diomedeae* is a valid loliginid species. They assigned *diomedeae* to the subgenus *Lolliguncula* (*Loliolopsis)*.

We question reports of the presence of *Lolliguncula* (*Loliolopsis) diomedeae* in waters off Valparaiso, Chile (Boone 1938, Thore 1959, Rocha 1997) and instead agree with Nesis (1973), who identified loliginid squids found in Chile as "*Doryteuthis" (Amerigo) gahi* d'Orbigny, 1835.

Sales et al. (2013) using sequences of mitochondrial and nuclear genes by studying the squids of the familiy Loliginidae in the southern Atlantic detected the not monophyly of *Lolliguncula*, but they when using just mitochondrial tree, *Lolliguncula* is sister to *Doryteuthis*.

The three species of the Eastern Pacific, *Lolliguncula (Loliolopsis) diomedeae, Lolliguncula (Lolliguncula) panamensis* and *Lolliguncula (Lolliguncula) argus* apparently would have no problem except the status of *Lolliguncula tydeus* as a synonym of *L. panamensis* requiring genetic studies to substantiate the points made by Brackoniecki (1986). The status *Lolliguncula (Lolliguncula) brevis*, a species that inhabits western Atlantic Ocean waters and the Caribbean has been questioned by Simone (1997), reporting morphological and morphometric differences between squid Brazil's southern coast (the probable type locality) and the north; however Jereb et al. (2010) considered to be "morphotypes" probably intraspecific variation.

Key to the species of *Lolliguncula*

1a. Both ventral arms of the male hectocotylized, arms modified along their entire length; arm sucker rings with 10–11 square teeth; with 4 to 10 suckers on lobes of buccal mambrane; restricted to the eastern Pacific Ocean. ..... *Lolliguncula* (*Loliolopsis*) *diomedeae*

1b. Single ventral arm of male hectocotylized, less than entire arm modified, proximal portion not modified.

..... *Lolliguncula* (*Lolliguncula*). 2

2a. Restricted to the western Atlantic Ocean. Left ventral arm hectocotylized; arm sucker rings with 7 or 8 broad flat teeth; with 3 to 5 suckers on lobes of buccal membrane.....*Lolliguncula* (*L.*) *brevis*

2b. Restricted to the eastern Pacific Ocean..... 3

3a. Left ventral arm hectocotylized; arm sucker rings with 11 to 15 blunt teeth; with 1 to 4 suckers on lobes of buccal membrane.
..... *Lolliguncula* (*L.*) *panamensis*

3b. Right ventral arm hectocotylized; arm sucker rings with about 5 long, bunt teeth; suckers absent on lobes of buccal membrane.
..... *Lolliguncula* (*L.*) *argus*

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