

DESCRIPTION OF A NEW SPECIES OF *UROTEUTHIS (PHOTOLOLIGO)*  
FROM THE MOZAMBIQUE CHANNEL

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**ABSTRACT:** A new species of bioluminescent loliginid is described from the Mozambique Channel. The animals mature at a small size (mantle length 61 and 83 mm in males and females respectively) and are apparently close to *Uroteuthis pickfordae* from Indonesia. They differ consistently, however, in details of sucker dentition, hectocotylus morphology (relative length of modified distal part of arm 35–65% AL IV, 13–16 pairs of proximal suckers, proximal papillae elongate conical) and relative fin, arm and club lengths (39–46%, 19–41% and 18–28% ML, respectively). The presence in the holotype and paratype of *U. pickfordae* of light organs on the ink sac, and its affiliation with *Uroteuthis (Photololigo)*, is confirmed.

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**INTRODUCTION**

During an exploratory fisheries cruise of R.V. *Algoa* in Mozambique waters in 1994 several loliginids were collected that had light organs on the ink sac. These seemed initially to be western range extensions of species from the eastern Indian Ocean. Of particular interest was a species provisionally identified as *Loligo pickfordae*. *L. pickfordae* was described by Adam (1954) from two small specimens, a male and a female, with mantle lengths less than 100 mm. These two specimens were collected by the Siboga Expedition in Indonesian waters off Flores Island. The specimens mentioned by Nesis (1982, 1987), from Mozambique, the Seychelles and the Saya de Malha Bank, Western Indian Ocean, may have belonged to the new species rather than to *L. pickfordae*.

A recent visit to Europe by one of the authors (MR) provided the opportunity to re-examine the type specimens of *L. pickfordae* in the Zoologisch Museum, Amsterdam. The presence of light organs on the ink sac in both the holotype and paratype is here confirmed. Comparison with our specimens from Mozambique showed a number of consistent differences between animals from Flores and Mozambique. These differences, and the wide separation of the two localities, are considered to

be sufficient to describe the Mozambique specimens as a distinct species. Another specimen from the Mozambique Channel was found in the collection of the Muséum National d'Histoire Naturelle, Paris.

The systematics of the family Loliginidae is still incompletely resolved (Vecchione, Brakonieccki, Natsukari and Hanlon 1998). We therefore provisionally place both *L. pickfordae* and the new species in the genus *Uroteuthis*, subgenus *Photololigo* as defined by Vecchione *et al.* (1998), until such time as resolution for loliginid systematics may be found.

**ABBREVIATIONS**

ALI I-III - arm length index of arms I-III:  
arm length as a percentage of mantle length.  
ALI IV nh - arm length index of the non-  
hectocotylized arm IV.  
ALI IV H - arm length index of the  
hectocotylized arm IV in males.  
Carpal suckers - number of suckers on the  
carpus, proximal to quadriserial manus suckers.  
CLI - club length index: length of the club,  
measured from the most proximal sucker or knob  
to the tip, as a percentage of mantle length.

CLTLI - club proportion index: length of the club, measured as for CLI, as a percentage of total tentacle length.

FLI - fin length index: fin length along the dorsal midline from the level of the anteriormost extension of the fin lobe to the posterior tip of the mantle, as a percentage of mantle length.

FWI - fin width index: the greatest width across both fins, as a percentage of mantle length.

HLI - head length index: head length, along dorsal midline from apex of neck fold to junction of dorsal arms, as a percentage of mantle length.

HWI - head width index: greatest head width at level of eyes, as a percentage of mantle length.

LRL - lower beak, rostral length.

Maturity stages I-III - immature, maturing, mature, respectively.

Max S I-IV - position of largest sucker on arms I-IV, counting from the arm base.

MHLI - hectocotylus length index: length of the distal modified portion of the hectocotylized arm, measured from the most distal normal sucker to the tip of the arm, as a percentage of mantle length.

MHLALI - hectocotylus proportion index: length of the distal modified portion of the hectocotylized arm, measured from the most distal normal sucker to the tip of the arm, as a percentage of the total length of the hectocotylized arm.

ML - mantle length, dorsal.

MM teeth, primary - number of primary teeth in largest median manus sucker rings.

MM teeth, total - number of primary and intermediate teeth in largest median manus sucker rings.

MNHN - Muséum National d'Histoire Naturelle, Paris.

MWI - mantle width index: greatest mantle width expressed as a percentage of mantle length.

SAM - South African Museum, now Natural History Museum, Iziko Museums of Cape Town.

SDI I-IV - arm sucker index on arms I-IV, separately for males and females: diameter of largest normal or enlarged sucker on arms I-IV as a percentage of mantle length.

SDI T, MM or LM - club sucker index: diameter of the largest medial or lateral manus sucker as a percentage of mantle length.

SD T, MM/LM - diameter of the largest medial

manus sucker divided by that of lateral manus sucker.

SpL - spermatophore length.

Teeth on arms II-III - number of teeth in sucker rings on arms II-III.

TLI - tentacle length index: total length of tentacle, including club, as a percentage of mantle length.

### SYSTEMATIC DESCRIPTION

*Uroteuthis (Photololigo) machelae* n. sp. (Figs 1–10, Table 1)

?*Loligo (Doryteuthis) pickfordae* (non Adam, 1954) Nesis, 1982: 146, fig. 38 3-K; 1987: 155, fig. 38 H–J.

### MATERIAL

Holotype: SAM-S3981, UM-6 male III 106, Off Beira, R.V. *Algoa* sta. C00818-014-015-2071, 19° 49.0' S, 36° 5.0' E, 54 m, German bottom trawl, 14 June 1994; deposited in the South African Museum, Iziko Museums of Cape Town.

Paratypes, deposited in the South African Museum, Iziko Museums of Cape Town: SAM-S3984, UM-9 female III 83, Off Chinde, R.V. *Algoa* sta. C00829-014-026-2018, 18° 20.0' S, 37° 20.0' E, 68 m, German bottom trawl, 17 June 1994.

SAM-S3985, UM-13 male III 80, S of Beira, R.V. *Algoa* sta. C00835-014-032-2109, 20° 25.0' S, 35° 50.0' E, 60 m, German bottom trawl, 18 June 1994.

### Other material:

SAM-S3143, Off Chinde, R.V. *Algoa* sta. C00829-014-026-2018, 18° 20.0' S, 37° 20.0' E, 68 m, German bottom trawl, 17 June 1994, 2 males, 1 female and 3 juvs.

SAM-S3154, Off Beira, R.V. *Algoa* sta. C00818-014-015-2071, 19° 49.0' S, 36° 5.0' E, 54 m, German bottom trawl, 14 June 1994, 2 males.

SAM-S3163, S of Beira, R.V. *Algoa* sta. C00835-014-032-2109, 20° 25.0' S, 35° 50.0' E, 60 m, German bottom trawl, 18 June 1994, 5 males, 1 female, 2 mantles.

MNHN 2228, W of Cap St Vincent, Madagascar [ $\pm$  E of Inhambane], chalutage 110, 22° 16.8' S,

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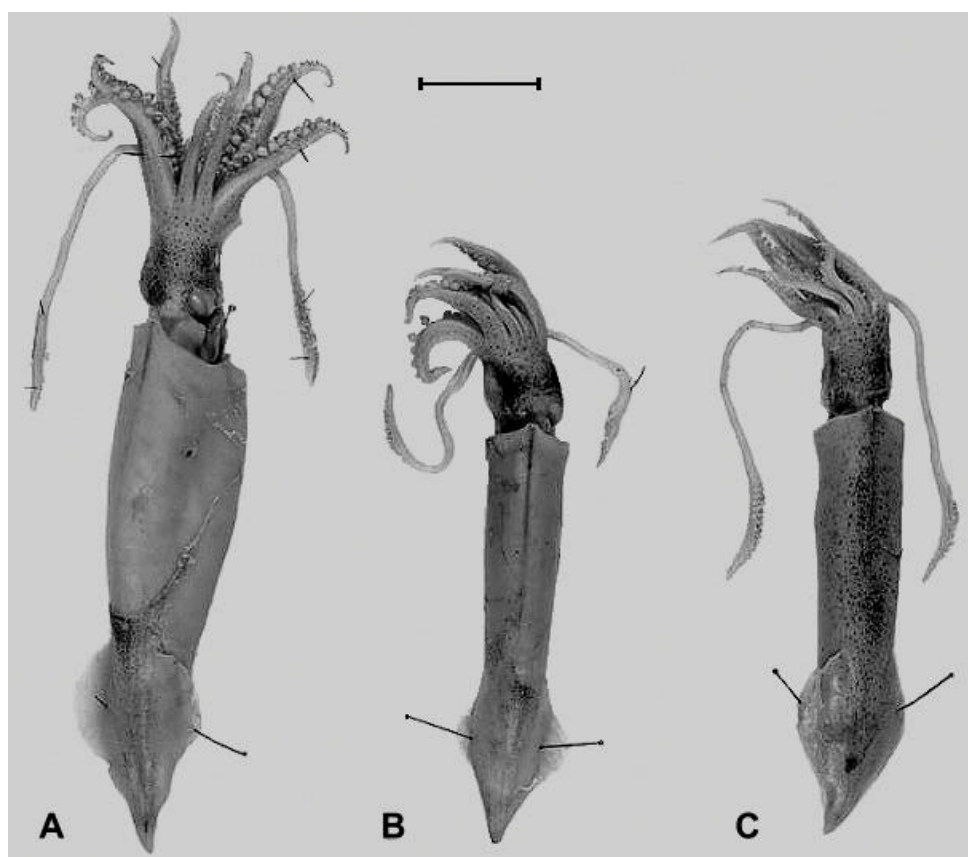
43° 7.9' E, 195–200 m, 1 December 1973, collected A. Crosnier, male III 73.

### DIAGNOSIS

Suckers on arms II-III greatly enlarged in males, much larger than median manus suckers of tentacular clubs; sucker rings on arms in both sexes with wide rough teeth distally and laterally, the proximal edge smooth; arm length index 19–41% ML; left arm IV hectocotyliised with 13–16 pairs of proximal suckers and 35–65% arm length modified distally, the proximal papillae elongate conical; fin length 39–46% ML; club length 18–28% ML and 26–36% TL; two light organs on ink sac. Males mature at 61 mm ML and females at 83 mm ML.

### DESCRIPTION

Animals small, maximum ML 110 mm, males mature from ML 61 mm, females from 83 mm. **Mantle** slender, MWI 18–24% ML, gradually tapering posteriorly (Fig. 1). Anterior mantle margin projected mid-dorsally to form small rounded lappet over anterior end of gladius, excavated mid-ventrally (Fig. 2). **Fins** small, terminal, rhombic, length 39–46%, width 16–39% ML (Table 1). **Head** a little less wide than mantle, HWI 14–19% ML; eyes covered by cornea, not prominent; orbital pore present at base of arm III. Funnel valve present, well developed. Funnel organ well developed, the dorsal member inverted-V shaped, ventral pads elongate, oval (Fig. 3 A). Neck folds form a large W-shape posterior to eyes (Fig. 3 B). Funnel-

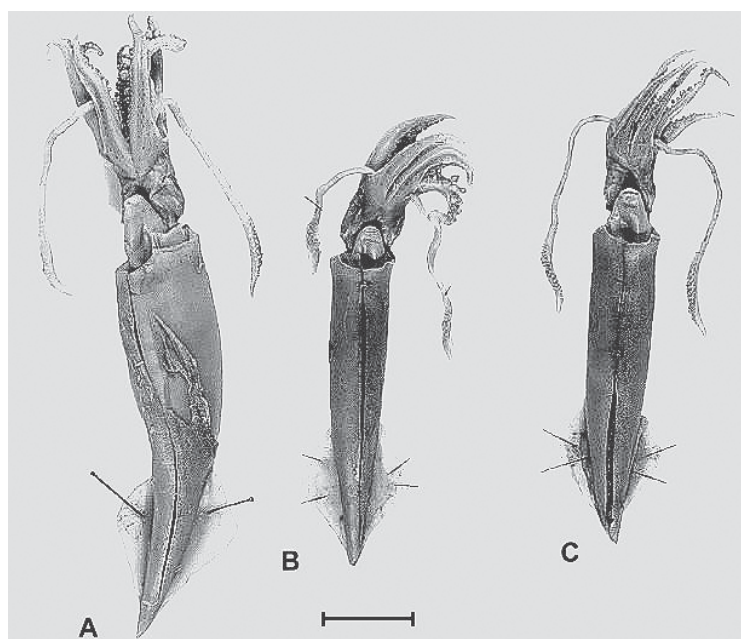


**Figure 1.** *Uroteuthis machelae* n. sp., dorsal views. A, holotype, UM-6 male III 106. B, paratype UM-13 male III 80. C, paratype UM-9 female III 83. Scale = 20 mm.

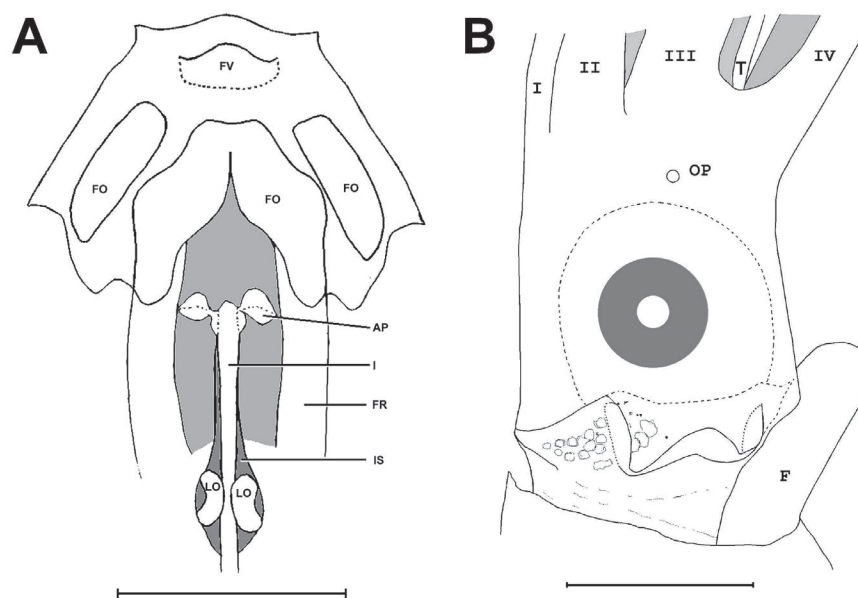
**Table 1.** *Uroteuthis machelae* meristics and morphometrics, compared with *U. pickfordae*.

Counts	<i>U. machelae</i>					<i>U. machelae</i>					<i>U. pickfordae</i>		
	SAM-S3163	SAM-S3163	SAM-S3154	SAM-S3154	SAM-S3143	SAM-S3163	SAM-S3163	SAM-S3143	SAM-S3163	SAM-S3984	Holotype	Paratype	
Code #	UM-2	UM-15	UM-3	UM-5	UM-12	UM-11	UM-13	UM-6	UM-10	UM-8	UM-9	19.1.1909	14.1.1909
Sex and maturity	M III	M III	M III	M III	M III	M III	M III	M III	F II	F II	F III	M III	F II
ML	61	63	67	75	79	80	80	106	60	73	83	64	45
Teeth on arms II-III	9-11	11-12	8	7-c.9	8	12-15	10	8-11	6-7	6-7	6	11-12	11-12
Hectocotylus sucker/prs	13	14	15	14	15	11+	13	16	18	16-18	15	8	8
MM teeth, primary	16	17	15	?16-23	17	18	15	16	18	16-18	18	13-16	13-16
MM teeth, total	16	19	15	?32-46	18	21	17-18	27	18	16-18	18	13-16	13-16
Carpal suckers				2-3	2-3	1-2	2-3	2-3	3-4	3-4	2-2	1	4
Max S I		10		10	10		7	12	12	12	7	10	7
Max S II	13	11	8	8	10	9	12	13	12	12	10	8	13
Max S III	15	13	8	8	10	11	15	14	11	11	11	11	8
Max S IV		10		9	9	7	10	10	11	11	13	7	13
Indices													
Code #	UM-2	UM-15	UM-3	UM-5	UM-12	UM-11	UM-13	UM-6	UM-10	UM-8	UM-9		
Sex and maturity	M III	M III	M III	M III	M III	M III	M III	M III	F II	F II	F III		
ML	61	63	67	75	79	80	80	106	60	73	83	64	45
MWI		22	18	21	c.27	c.25	20	24	20	21	20	17	22
HLI		24	19	18	20	24	21	19	25	—	20	17	16
HWI		19	18	19	16	16	16	14	17	19	16	17	18
FLI	39	41	40	45	44	43	39	44	40	41	46	39	31
FWI	31	32	28	34	25	33	29	30	37	30	33	22	36
ALI I		25	22	19	23	28	23	25	20	21	22	22	16
ALI II		33	34	32	38	39	29	35	28	32	34	25	19
ALI III		38	39	34	41	40	34	37	32	34	36	27	20
ALI Vnh		32	31	26	27	35	29	28	30	33	29	22	18
ALI V H	28	30	33	34	28	35	29	31	30	31	28	25	25
MHLI	16	13	11	12	15	-	13	14				15	15
MHLALI	56	42	35	36	43	-	43	45	0.9	1.5	1.1	60	60
SDI I	2.7	3.0	2.2		2.8	2.6	2.4	2.3	1.7	1.6	1.7	2.3	2.3
SDI II M		2.9	2.6	2.6	2.9	2.7	2.5	2.4	1.7	1.6	1.7	2.3	1.2
SDI II F													
SDI III M		1.3	1.2				1.1	0.9	1.6	1.8	1.5	2.3	1.3
SDI III F									1.1	1.2	1.0	0.9	0.8
SDI IVnh									1.1	1.2	1.0	0.9	0.8
TLI		84	85	59	75	90	49	77	102	74	87	33	36
CLI	25	24	22	18	20	25	18	20	28	25	27	14	18
CLTLI			26	30	34	31	36	26	28	33	31	43	50
SDI T, MM	1.4	1.4	1.3	1.2	1.4	1.3	1.2	1.1	1.4	1.5	1.6	1.0	1.1
SDI T, LM	1.1	1.3	1.0	0.8	1.2	1.1	1.0	0.9	1.1	1.1	1.2	0.8	0.9
SD T, MMLM	1.2	1.1	1.3	1.5	1.2	1.2	1.2	1.3	1.3	1.4	1.3	1.2	1.2

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**Figure 2.** *Uroteuthis machelae* n. sp., ventral views. A, holotype, UM-6 male III 106. B, paratype UM-13 male III 80. C, paratype UM-9 female III 83. Scale = 20 mm.



**Figure 3.** *Uroteuthis machelae* n. sp. A, UM-15 male III 63, funnel and mantle cut open along ventral midline; AP, anal papillae, FO, funnel organ, FR, funnel retractor muscles, FV, funnel valve, I, intestine, IS, ink sac, LO, light organs. B, paratype UM-9 female III 83, lateral view of head showing W-shaped nuchal fold; I-IV, arms I-IV, F, funnel, OP, orbital pore, T, tentacle. Each scale = 10 mm.

mantle locking cartilages typically loliginid, with a simple straight ridge on the mantle and groove on the funnel; nuchal cartilage simple, straight.

**Arms** short, ALI 19–41% ML, length formula  $3 > 2 > 4 > 1$ , longest arm attaining only 32–41% ML (Table 1). No obvious sexual dimorphism in arm length, though female sample very small. Dorsal arms (arms I) flattened aborally at first, more laterally compressed distally, have aboral keel that starts dorsally and well developed protective membranes supported by trabeculae. Dorsolateral arms (arms II) flattened aborally at first, more laterally compressed distally, have well developed aboral keel and protective membranes and trabeculae that are low dorsally, moderately wide ventrally. Ventrolateral arms (arms III) laterally compressed, have aboral keel that is widest one third up from arm base and protective membranes the same as on dorsolateral arms. Ventral arms (arms IV), flattened aborally, have two aboral keels and narrow protective membranes with trabeculae. Arms of female the same as unmodified arms of males.

**Arm suckers** arranged in oblique biserial rows, about 13 enlarged on middle of lateral arms in males (Fig. 4). Arm II with about 4 normal proximal suckers, then 13 enlarged; distal suckers normal. Arm III with 8 normal suckers proximally, followed by 14 enlarged suckers; distal suckers normal. Unmodified right arm IV (not hectocotylized) with normal biserial suckers. Inner rings of largest suckers on arms I (no. 12 from arm base in holotype) with 5–8 rounded to square, subequal, closely spaced distal teeth, proximal edge smooth, rolled over (Fig. 5 A). Enlarged suckers on arm II in males (no. 13 in holotype) with 7–11 widely spaced and broadly triangular distal and lateral teeth, plus 2 rounded teeth on each side; median distal tooth largest, size reducing laterally; small proximal edge smooth, rolled over. Rings of enlarged suckers on arm III (no. 14 in holotype) with 9–11 widely spaced, triangular to rounded distal and lateral teeth as on arm II; small proximal edge smooth, rolled over. Inner rings of largest suckers on unmodified right arm IV (no. 10 in holotype) with 5–7 elongate rectangular to broadly rounded, closely spaced distal teeth. Outer rings

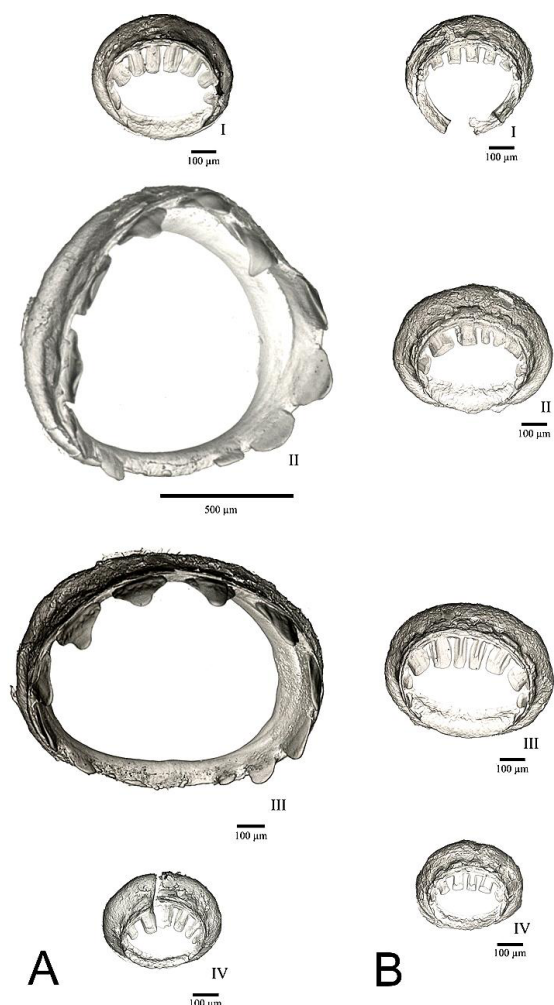


**Figure 4.** *Uroteuthis machelae* n. sp. holotype, UM-6 male III 106, left arm III with enlarged suckers. Scale = 10 mm.

of suckers consist of inner circles of polygonal plates and outer circles of elongate rods, deepest opposite the smooth proximal edge, narrowest and least developed opposite the median distal tooth of the inner ring. Elongate rods of outer ring smaller distally than proximally.

In females suckers not enlarged on lateral

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**Figure 5.** *Uroteuthis machelae* n. sp. paratypes, inner sucker rings from the largest suckers on arms I-IV (top to bottom). A, UM-13 male III 80. B, UM-9 female III 83.

arms. Inner rings of largest suckers on arms II with about 9 square to rectangular (*i.e.* longer than wide) distal and lateral teeth, the broad square teeth breaking up into 2 or more elongate rectangular teeth; proximal edge smooth, rolled over (Fig. 5 B). Inner rings of largest suckers on arms III with 8 closely spaced, rectangular, elongate teeth distally and laterally; proximal edge smooth, rolled over. Outer rings as in males.

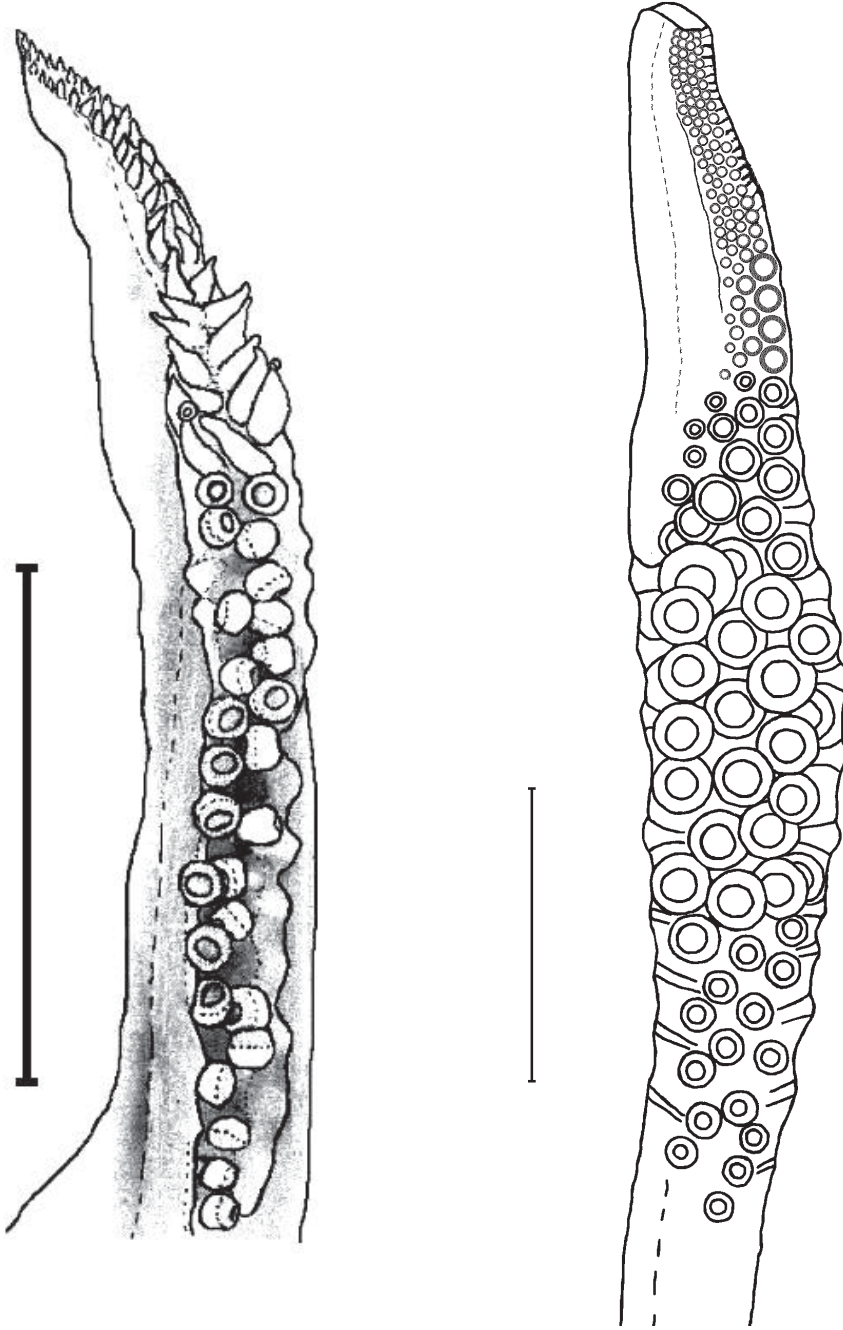
**Hectocotylus:** left arm IV modified in males; 13–16 pairs of normal suckers proximally (Fig. 6), their rings with about 5 long, square, distal teeth,

proximal edge smooth. Distal 35–56% of arm modified (modified part 11–16% ML). Distal suckers lost, their stalks forming about 20–26 pairs of papillae. Dorsal papillae initially elongate conical, the first to third largest; papillae become transversely flattened, triangular, and reducing in size distally. Ventral papillae initially much longer than dorsal ones, elongate conical, first to third papillae largest, the rest rapidly becoming smaller distally, forming low rounded papillae on broad, squat bases. Dorsal and ventral papillae joined by low, folded, longitudinal ridge running between their bases. Protective membranes low distally opposite papillae and eventually disappear.

**Tentacles** 49–102% ML; tentacular clubs 18–28% ML, 26–36% tentacle length. Keel widest opposite distal end of manus and proximal end of dactylus. **Club suckers** arranged in oblique quadriserial rows, except for 1–4 carpal suckers proximally (Fig. 7). Median manus suckers 1.1–1.7 times as large as lateral manus suckers. Median suckers with 15–18 widely spaced primary teeth right round, plus 2–11 smaller intermediate teeth laterally and distally, 15–27 teeth in all (Fig. 8). Primary teeth pointed, elongate, longer distally, median distal tooth largest. Rings of lateral manus suckers with about 15–22 pointed teeth that are longest distally, reducing in size laterally and very small proximally. Outer rings of manus suckers with inner polygonal plates and outer elongate rods. Dactylus suckers in oblique quadriserial rows; suckers decrease in size from ventral to dorsal.

**Buccal membrane** with 7 lappets, each with about 3–9 suckers; buccal connectives attached dorsally to arms I and II, ventrally to arms III and IV (D.D.V.V). The holotype has sperm reservoirs attached to the buccal membrane.

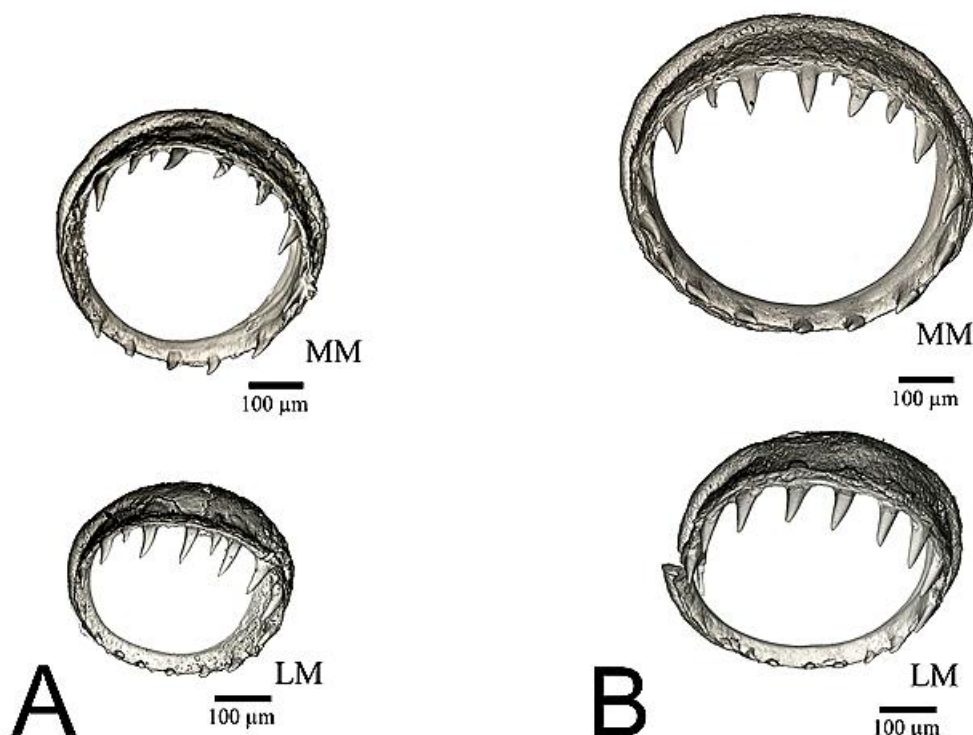
**Spermatophore** of holotype (Fig. 9 A–B) 5.85 mm long (5.5% ML), with relatively small sperm mass, length 2.55 mm (43.5% SpL), leaving long empty aboral region, length 1.94 mm (33.2% SpL); cement body divided into oral and aboral parts, joined by narrow neck, total cement body length 0.42 mm (7.3% SpL); ejaculatory apparatus length 0.79 mm (15.5% SpL), and thread length 2.0 mm



**Figure 6.** *Uroteuthis machelae* n. sp. paratype, UM-13 male III 80, hectocotylus. Scale = 10 mm.

**Figure 7.** *Uroteuthis machelae* n. sp. holotype, UM-6 male III 106, left tentacular club. Scale = 5 mm.

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**Figure 8.** *Uroteuthis machelae* n. sp. paratypes, inner sucker rings from the median manus (MM) and lateral manus suckers (LM). A, UM-13 male III 80. B, UM-9 female III 83.

(34.2% SpL).

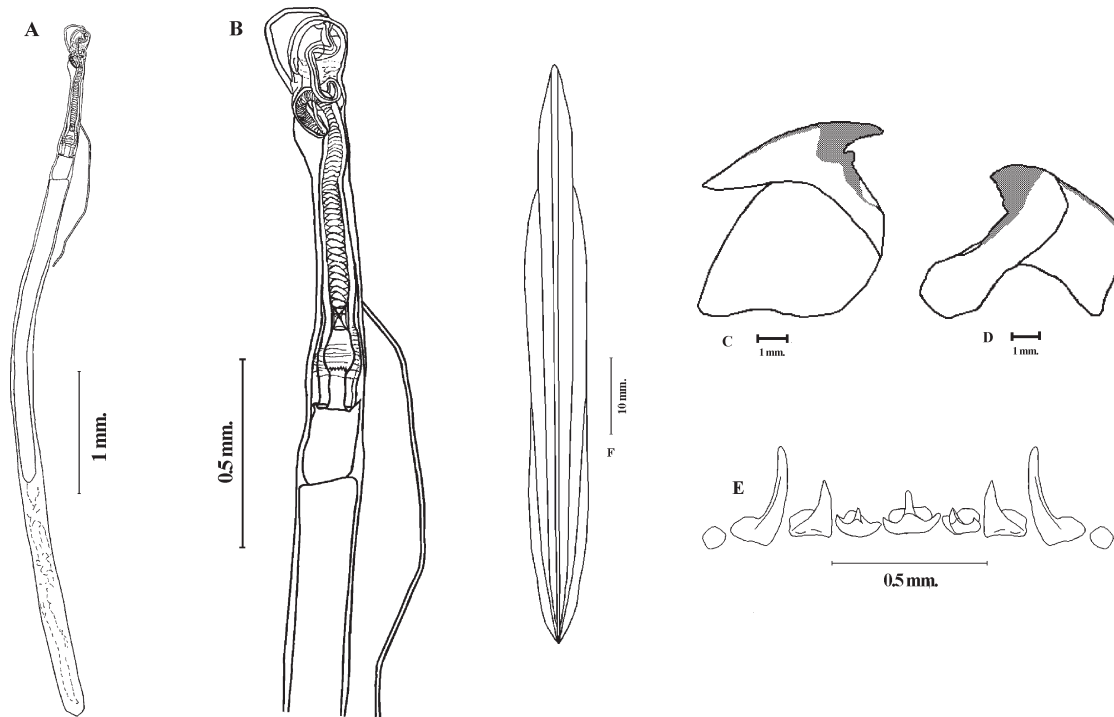
**Upper beak** (Fig. 9 C) darkened along rostrum, shoulder and ridge of hood; with strongly curved crest and rostrum-hood; rostrum short relative to hood length, inner margin of hood-wing strongly curved; jaw angle acute, recessed; lateral wall with slight posterior indentation.

**Lower beak** (Fig. 9 D) darkened along rostrum, shoulder and ridge of crest; jaw angle obtuse, not recessed nor concealed by wing fold; shoulder more or less straight; rostrum small and broad, hood and rostrum short relative to crest and wing lengths; hood longer than rostral edge; crest length about twice hood length; hood-wing width moderate; lateral wall large, with no distinct ridge or fold; rostral edge serrated, not strongly curved.

**Radula** (Fig. 9 E) with seven teeth per transverse row; rhachidian tooth tricuspid, the median cusp much longer than the others; first lateral tooth bicuspid, the medial cusp longer than the lateral; second lateral tooth with a single broad triangular cusp, longer than the rhachidian; third lateral tooth even longer, curved and sabre-like; marginal plates small, more or less round.

**Gladus** (Fig. 9 F) narrow, maximum width 10.5% gladius length and 1.7 times width of broad free rachis; vanes and whole gladius widest at 1/3 from anterior end, vanes well demarcated from rachis, with straight sides. Conus flag reduced, its length 42% gladius length.

Two kidney-shaped **light organs** on ink sac, each slightly concave laterally (Fig. 3 A).



**Figure 9.** *Uroteuthis machelae* n. sp. A, spermatophore and B, enlargement of oral end with cement body, ejaculatory apparatus, cap and thread, holotype, UM-6 male III 106. C, upper beak, D, lower beak and E, radula, UM-11 male III 80. F, gladius, UM-14 male III 75.

**Colour** in ethanol creamish. Band of large brown and smaller black chromatophores scattered along dorsal midline of mantle, much smaller and sparser over fins. Narrow band of sparse chromatophores along ventral midline, mainly anterior to fins. Chromatophores absent on ventral fin surface. Dorsal surface of head and aboral surface of arms and tentacles with sparsely scattered large brown and small black chromatophores; a patch of chromatophores posterior to transverse nuchal crest, on either side of nuchal cartilage. Ventral surface of head with a few very small sparse chromatophores.

#### DISTRIBUTION

Mozambique and western Madagascar (Fig. 10). ?Seychelles, ?Saya de Malha Bank (Nesis 1982, 1987).

#### ETYMOLOGY

Named in honour of that most gracious and humane lady from Mozambique, Graça Machel.

#### REMARKS

Sexual dimorphism in *U. machelae* is evident only in the enlarged suckers on the lateral arms in males.

In comparison with *U. pickfordae*, *U. machelae* has shorter fins, longer arms, hectocotylied arm modified over shorter part, with more proximal suckers; its tentacles and clubs are longer relative to ML and the club is shorter in relation to tentacle length (Table 1). *U. machelae* also differs in having a smooth proximal edge in the rings of the arm suckers in both sexes (Fig. 5); the arm sucker rings are toothed right round in *U. pickfordae*.



