NOTES ON THE RECORD OF GOBLIN SHARK (*Mitsukurina owstoni* Jordan, 1898) FROM INDONESIA

Fahmi*

[1]Research Center of Oceanography – Indonesian Institute of Sciences (LIPI), Jakarta, Indonesia.

Received: December 2016 Accepted: July 2017

ABSTRACT

A goblin shark, *Mitsukurina owstoni*,was captured by deepwater shark longline targeting squaloid sharks off Palabuhanratu, West Java, Indonesia at about 200 m depth. Morphological measurements were taken and compared to other records from Australia, New Zealand and Japan. This new recordfrom Indonesian waters extends the distribution of this species in the Indian Ocean.

Keywords: Record, Goblin shark, *Mitsukurina owstoni,* Indonesia

INTRODUCTION

The goblin shark *Mitsukurina owstoni,* is a peculiar deepwater shark from the Order Lamniformes. This species is the only member of the Family Mitsukurinidae and characterized by: an elongated and blade-like snout, anal fin much larger than dorsal fins, no precaudal pit, and caudal fin without a ventral lobe (Compagno 2001; Compagno *et al*., 2005). The name "goblin" was given due to its unusual appearance when its mouth is protruded (Nakaya *et al*., 2016). This species is also known as a living fossil due to its close relation to the extinct Mesozoic shark of the genus *Scapanorhynchus* (Hussakof, 1909).

The *M. owstoni* specimen was initially identified by the long, flat and blade like snout, protrusible jaws and had its soft and flabby body. The body remained soft after fixation in formalin. This species was described based on a young male specimen collected in near Yokohama, Japan (Jordan, 1898). Prior to 1985, only 33 specimens of *M. owstoni* had been recorded worldwide, with 23 of them from Japan and the remainder from South Africa, Europe, Guiana and Australia (Stevens and Paxton, 1985). In recent decades, it has been reported from New Zealand (Duffy, 1997), the eastern North Pacific (Ugoretz and Seigel, 1999), the Gulf of Mexico (Parsons *et al*., 2002), Colombia (Grijalba-Bendeck and Acevedo, 2009), Atlantic Ocean (Prokofiev and Kukuev, 2009), western South Atlantic (Rincon *et al*., 2012) and western North Atlantic (Driggers III *et al*., 2014).

Many of the known specimens of *M. owstoni* were found with the mouth in the protruded position and once preserved, the jaw can often not be retracted into the normal position (Hussakof, 1909; D'Aubrey, 1969; Glover, 1976; Stevens and Paxton 1985; Parsons *et al*., 2002). Based on thischaracter, Hussakof (1909) describing four specimens of goblin shark as a new species, *Scapanorhynchus jordani*. Subsequently authors considered *S. jordani* as junior synonym of *M. owstoni* (Compagno, 1984; 2001; Stevens and Paxton, 1985; Ebert, 2013).

Mitsukurina owstoni is a poorly known shark due to its occurrence in deepwater habitats as a bottom-dwelling and possibly semioceanic shark (Compagno, 1984; 2001). Most records were taken between 100 and 1200 m depth (Stevens and Paxton 1985; Stewart and Clark 1988; Duffy 1997; Parsons *et al*., 2002; Yano *et al*., 2007; Lee

DOI: 10.14203/mri.v42i2.149

and Shao 2009; Prokofiev and Kukuev, 2009), but it has been taken, rarely, in water as shallow as 40 m (Ebert, 2013). This species is occasionally caught in deepwater bottom gillnet and longline fisheries operating on the outer continental shelves and slopes (Parsons *et al*., 2002; Yano *et al*., 2007). *M. owstoni* has a patchy distribution in all major ocean basins (Compagno *et al*., 2005). In the Indian Ocean, this species has been recorded from South Africa, Mozambique, Australia and New Zealand (Stevens and Paxton, 1985; Duffy, 1997; Ebert, 2013).

This paper details the first record of this species in Indonesian waters.

MATERIALS AND METHODS

Methods of measurements, body terminology and general biological data were taken according to the methods of Stevens and Paxton (1985) and Yano *et al*., (2007). Tooth counts were made using calculation following Yano *et al.,* (2007) as follows: (total number in left side upper jaw) – (total number in right side upper jaw) / (total number in left side lower jaw) – (total number in right side lower jaw).Weight and all measurements were taken using a digital balance and measuring tape for large measurements and calipers for the smaller measurements to the nearest 0.1mm.

All measurements were expressed in percentage of total length (TL). These proportions were then compared to other available data for *M. owstoni* from Australia, New Zealand and Japan (Stevens and Paxton, 1985; Duffy, 1997; Yano *et al*., 2007) in order to determine whether there were any differences in morphology among those locations.

RESULTS

Mitsukurina owstoni Jordan, 1898

Mitsukurina owstoni Jordan 1898:200, Pls. 11-12 (type locality: Misaki, Sagami Sea, Japan); Stevens & Paxton 1985:40, Figure 1 (off Sydney); Duffy 1997 (east coast of New Zealand); Parsons *et al*., 2002: 190, Figure 1 (Gulf of Mexico); Yano *et al*., 2007 (Tokyo Submarine Canyon); Rincon

Figure 1. *Mitsukurina owstoni*Jordan, 1898 from off Palabuhanratu, Indonesia (NCIP-4398, 1137mm TL).

Table 1. Proportional dimensions of Mitsukurina owstoni from Indonesia, comparing to specimens from Australia, New Zealand and Japan (presented as percentage of total length)

Measurements	NCIP 4398	Australia[1)]	New Zealand[2)]	Japan[3)]
Total length (mm)	1137	3840	1260-1350	817 - 2340
Snout to:				
mouth (protruded)	5.5	2.5		5.3
mouth (to upper lip)	10.1		9.7-11.3	9.5-12.3
inner end of nostril	11.5	10	11.1-13.1	10.2-12.8
Eye	13.0	11.8	13.8-15.1	12.6-14.9
spiracle diameter	15.5	12.9	15.9-17.5	14.9-19.3
first gill slit	21.8	16.4	20.7-22.2	21.3-24.0
2nd gill slit	22.9			20.7-25.6
3rd gill slit	23.9			22.0-26.9

4th gill slit	25.2			23.4-28.0
fifth gill slit	26.6	23.4	26.5-28.6	24.1-28.8
pectoral-fin origin	26.4	24.5	26.5-29.0	24.8-29.2
pectoral-fin margin (posterior)	34.2			33.6-37.9
first dorsal-fin origin	33.2	35.7	33.7-34.4	32.5-37.2
pelvic-fin origin	44.3	45.6	43.7-44.3	42.2-46.4
Vent	48.5		48.5-49.8	47.8-52.4
second dorsal-fin origin	53.3	56.3	52.2-53.1	52.3-57.7
anal-fin origin	56.4	60.2	56.3-57.6	54.4-60.7
upper caudal-fin origin	65.3	72.5	64.2-65.2	64.1-68.4
Lower caudal-fin origin	66.4			64.6-68.1
Eye diameter:				
Horizontal	1.0	0.7	0.8-1.0	1.2-1.6
Vertical	0.9			0.6-1.1
Spiracle diameter	0.2	0.2	0.2-0.3	0.1-0.3
Nostril width	1.2	0.9	1.0-1.2	1.0-1.2
Internarial space	4.2	3.7	4.0-4.1	3.8-5.5
Mouth width	6.5	6	7.2-11.1	5.7-8.2
Mouth length	5.2	5.5	6.3-7.0	4.6-6.6
Upper labial furrow length	0.5			0.2-0.5
Lower labial furrow length	1.3			0.9-1.5
First gill slit height	3.7	4.2	3.2-3.5	2.2-4.0
Second gill slit height	3.7			2.4-3.8
Third gill slit height	3.5	4		2.5-3.9
Forth gill slit height	3.3	3.7		2.6-3.9
Fifth gill slit height	3.1		3.1-4.0	2.3-3.9
First to fifth gill slit	4.8	7.5	5.5-7.1	4.8
Interorbital	6.3	5.2	6.5-6.7	6.2-7.8
Posterior eye to spiracle	2.1	1.1	1.2-1.6	1.2-1.8
Pectoral-fin base	4.0	5.5	4.4-5.0	3.4-5.6
Pectoral-fin anterior margin	8.6		7.9-8.1	7.5-9.7
First dorsal-fin length	9.1		7.5-8.9	8.4-10.6
First dorsal-fin posterior margin	2.7			2.4-3.6
First dorsal-fin base	6.1	8.1	4.6-5.9	4.5-6.9
First dorsal-fin height	3.2	3.7	2.3-3.3	2.6-3.9
Second dorsal-fin length	7.8		7.0-7.8	7.1-9.1
Second dorsal-fin posterior margin	2.4			2.4-3.9
Second dorsal base	5.0	6.3	4.5-5.5	4.1-6.3
Second dorsal-fin height	3.1		3.2-3.7	2.7-4.0
Pelvic-fin length	9.8		9.9-9.9	9.8- 11.8
Pelvic-fin base	8.3		8.1-8.5	8.1- 10.6
Pelvic-fin height	4.0		3.7-4.0	4.0
Pelvic-fin anterior margin	6.2	7.6	5.9-6.3	5.2- 6.8
Pelvic-fin distal margin length	2.4			1.7- 2.6
Anal-fin length	9.9		8.5-10.7	9.4-11.2
Anal-fin posterior margin	2.3			0.9-1.5
Anal-fin base	8.7	10.4	7.5-9.6	8.31-10.2
Anal-fin height	3.4	4.1	3.1-3.7	2.5-3.8
Caudal-fin upper lobe	34.7	27.6	34.8-34.9	31.8-36.3
Caudal-fin lower lobe	7.5	7.9	6.3	7.0-9.5
Subterminal notch to caudal tip	4.9	3.6	5.2	4.5-4.8

depth notch	3.7			3.3-5.5
Interdorsal space	13.8	15.9	13.5-14.1	13.0-16.4
Pectoral-pelvic space	14.1	22.5	11.9-13.3	12.2-18.5
Second dorsal and caudal space	7.2	9.6	7.0-7.1	5.9-8.4
Anal-caudal space	2.0	2.3	1.1-2.4	0.4-1.5
Pelvic-anal space	4.5		3.7-5.1	3.3-5.1
Depth at fifth gill slit	10.2	12.2		9.2
Head height (depth at pectoral origin)	10.5	12.5	10.9-11.1	9.2-10.0
Trunk height (depth at pectoral insertion)	11.6		11.5-12.0	10.4
Abdomen height (depth at first dorsal insertion)	11.6	14.3	11.8-11.9	9.6-10.2
Tail height (depth at pelvic insertion)	6.9		6.6-8.5	6.8
Caudal peduncle height	3.8	4.6	3.7-4.8	2.8-4

[1)]Stevens & Paxton (1985)
[2)]Duffy (1997)
[3)]Stevens & Paxton (1985); Yano *et al*. (2007

et al., 2012: 2, Figure 1 (South-western Atlantic); Driggers III *et al*., 2014: 2, Figure 2-3 (western North Atlantic).

Material examined: NCIP 4398, 1137 mm TL, immature female, Citireum waters - West Java, deepwater longline, March 20, 2009, collected by Agus, ~200 m depth.

Figure 2. Lateral view ofhead, *Mitsukurina owstoni* Jordan, 1898 (NCIP-4398)

Description:

The snout long, ~5.5% TL when the mouth protruded and 10.2% in the normal position (snout to upper lip). Eyes small, eye diameter less than 1% TL. Mouth width 6.5% TL and its length 5.7% TL. First gill slit height 3.7% TL while the fifth gill slit 3.1% TL. First dorsal fin origin slightly posterior to the pectoral fin origin. First and second dorsal fins subequal in size. First dorsal fin base slightly larger than second dorsal-fin base, *i.e*. 6.1 vs. 5.0% TL respectively. Pelvic fins slightly larger than first dorsal fin, its length about 9.8% TL. Anal fin longer than dorsal fins, its base length 8.6% TL and its height 3.4% TL. The upper caudal margin subequal to distance from snout to first dorsal fin origin. Terminal caudal-fin lobe well developed, 0.35% of TL.

The tooth count of this female specimen is (16-16) / (14–14). The anterior teeth are large, long, narrow shaped and hooked (Figure 2). There is a gap between the third and the fourth tooth rows in the upper jaw. Lateral teeth have erect cusps and gradually decrease in size towards the mouth corner. The posterior teeth are much smaller and flattened than anterior and lateral teeth.

The skin has small and rough denticles. Colouration was pinkish when in fresh condition, light brown once preserved.

DISCUSSION

The shark was caught by deepwater shark longline boat, targeting squalids and centrophorids, operating off Citireum beach, Palabuhanratu in about 200 m depth.

The goblin shark *Mitsukurina owstoni* (Mitsukurinidae) has a wide, but patchy distribution in all temperate and tropical seas including the Indian Ocean (Compagno, 2001; Ebert, 2013). The specimen collected from off Palabuhanratu, West Java, however, is the first record of the occurrence of this species in tropical Indian Ocean region.

The Indonesian specimen was a juvenile female based on its size. Duffy (1997) found specimens

of 1260 and 1280 mm TL had umbilical scars and categorized them as juveniles. A 1380 mm TL male specimen collected from equatorial East Atlantic (Prokovief and Kukuev, 2009) was also reported as a juvenile. The record of the largest adult size of *M. owstoni* was 3840 mm TL, collected from South Australia as a fully mature male (Stevens and Paxton, 1985). The size at maturity of this species is uncertain, but possibly at about 2600 to 3800 mm TL for males and over 4000 mm TL for females. Size at birth is unknown but the smallest free swimming individual was an 817 mm male (Ebert, 2013).

In general, the Indonesian specimen has similar morphology to specimens collected from Japan, Australia and New Zealand based on its morphometric measurements. However, the measurements taken suggest it has a shorter pectoral-fin base, longer pectoral-fin anterior margins, and having a shorter second dorsal-fin compared to specimens from Australia and New Zealand (Stevens and Paxton, 1985; Duffy, 1997), while specimens from Japan have wider ranging values for those characters (Stevens and Paxton 1985; Yano *et al*., 2007). The available Japanese data had a shorter anal-caudal space and more slender body by having a slightly shorter head, abdomen and caudal peduncle height (see Table 1). This data suggests some intraspecific differences in some characters, possibly also influenced by potential differences in measurement morphology between studies. Yano *et al*., (2007) examined 148 specimens of *M. owstoni* to investigate the morphology of this species and found that the variation of the body proportions was up to 8%. The soft and flabby body of this species may influence to the variation.

Most records of this species are of specimens with protruded jaws (Stevens and Paxton, 1985; Parsons *et al.,* 2002; Grijalba-Bendeck and Acevedo, 2009; Driggers III *et al*., 2014). More than 86% of *M. owstoni* captured during the study in Japan had the upper jaw at least slightly protruding (Yano *et al*., 2007). This protrusible jaw issue made some authors had different ways to measure the length of snout. Some authors previously determined the snout length by measuring between the tip of the snout to actual position of the upper jaw (Jordan 1898; Bass *et al*., 1975, Stevens and Paxton, 1985), but others used the measurement between the tip of the snout to the upper lip with an assumption that the jaws are not protruded (Duffy, 1997; Yano *et al*., 2007; Lee and Shao, 2009; Rincon *et al*., 2012). The first method has a weakness due to the position of the jaws may vary among specimens. The position of the jaws is usually loose when firstly captured and then remain fixed in certain position after being preserved.

Nakaya *et al*., (2016) examined the function and movements of the jaws of *M. owstoni* based on the living specimens captured from Japan and recording their feeding behaviour. They found that *M. owstoni* has the ability to open their mouth widely and rapidly protrude the jaws forward as their feeding behaviour to get the prey. This ability is considered as the fastest and greatest jaw protrusion among sharks.

As a deepwater shark which has a flabby body, *M. owstoni* is considered to be a slow swimmer (Ebert, 2013). The rapid and extensive jaw protrusion may be to counterbalance for its lack of ability for fast and strong swimming to pursue its prey. The jaw protrusion will provide it with the opportunity to expand the accessible distance to the prey and enable it to capture the faster swimming prey (Nakaya *et al*., 2016).

Mitsukurina owstoni is considered to be a very rare shark species and is rarely caught in deep sea fisheries. Even though there were many reports and number of specimens gathered from Japan waters, the catch number of this species have been relatively small, only one or two individuals per record (Yano *et al*., 2007). Due to its rarity in the fisheries and its widespread but sporadic distribution in the Atlantic, Pacific and Indian Oceans, the conservation status of the goblin shark is categorized as Least Concern based on the IUCN Red List (Duffy *et al*., 2004). However, the intensive deepwater shark fishery targeting for the liver oil in certain area may influence its population stability in the future.

ACKNOWLEDGEMENT

The author thank to Agus from Palabuhanratu who collected the specimen and gave valuable information on the fishery. I also thank to Mohammad Adrim and Priyo Agustono of the Research Centre for Oceanography - LIPI for their assistances in preserving the specimen, and Dr. William White of CSIRO Hobart for reviewing the manuscript.

REFERENCES

Bass, A.J., D'Aubrey, J.D. and Kistnasamy, N. (1975). Sharks of the eastcoast of southern Africa. IV. The families Odont aspididae,Scapanorhynchidae, Isuridae, Cetorhinidae, Alopiidae, Orectolobidaeand Rhiniodontidae. *Investigational Report of the Oceanographic Research Institute,* 39, 1–102.

Compagno, L.J.V. (1984). *FAO Species Catalogue. Vol. 4. Sharks of the World. An annotated and illustrated catalogue of shark species known to date*. Rome: FAO, 250 pp.

Compagno, L.J.V. (2001). *FAO Species Catalogue for Fishery Purposes*. *Sharks of the world. An annotated and illustrated catalogue of shark species known to date. Bullhead, mackerel and carpet sharks (Heterodontiformes, Lamniformes and Orectolobiformes).*Rome: FAO, 269 pp.

Compagno, L. J. V., Dando, M. and Fowler, S. L. (2005). *Sharks of the world*. New Jersey: Princeton University Press, 368 pp.

D'Aubrey, J.D. (1969). Two species of shark new toSouth African waters. *South African Association for Marine Biological Research Bulletin,* 7, 30-31.

Driggers III, W.B., Davis, K.S., Moore, C. and Carlson, J.K. (2014). New record of a goblin shark *Mitsukurina owstoni* (Lamniformes: Mitsukurinidae) in the western North Atlantic Ocean. *Marine Biodiversity Records*, Vol. 7: e96.

Duffy, C.A.J. (1997). Further records of the goblin shark, *Mitsukurina owstoni* (Lamniformes: Mitsukurinidae), from New Zealand. *New Zealand Journal of Zoology*, 24, 167–171.

Duffy, C.A.J., Ebert, D.A, and Stenberg, C. 2004. *Mitsukurina owstoni*. The IUCN Red List of Threatened Species 2004. http://dx.doi.org/10.2305/IUCN.UK.2004.RLTS.T44565A10907385.en. Downloaded on 20 October 2016.

Ebert, D.A. (2013). *FAO Species Catalogue for Fishery Purposes No.8:Deep–sea Cartilaginous Fishes of the Indian Ocean. Volume 1. Sharks*. Rome: FAO, 256 pp.

Grijalba-Bendeck, M. and Acevedo, K. (2009) *Mitsukurina owstoni* Jordan (Chondrichthyes: Mitsukurinidae) primer registro para El Caribecolombiano. *Boletin de Investigaciones Marinas y Costeras*, 38,211–215.

Glover, C.J.M. (1976). The goblin shark, *Scapanorhynchus owstoni* (Jordan,1898): confirmation of the first Australian record. *South Australian Naturalist*, 50, 59–62.

Hussakof, L. (1909). A new goblin shark, *Scapanorhynchus jordani*, fromJapan. *Bulletin of the American Museum of Natural History*, 26,257–262.

Jordan, D.S. (1898). Description of a species of fish (*Mitsukurina owstoni*) from Japan, the type of a distinct family of lamnoid sharks. *Proceedings of the California Academy of Sciences (Zoology),* 1, 199–202.

Lee, P.F. and Shao, K.T. (2010). Two new records of lamniform shark fromthe waters adjacent to Taiwan. *Journal of the Fisheries Society of Taiwan*, 36, 303–311.

Nakaya, K., Tomita, T., Suda, K., Sato, K., Ogimoto, K., Chappell, A.,Sato, T.,Takano,K. and Yuki,Y (2016). Slingshot feeding of the goblin shark *Mitsukurina owstoni* (Pisces:Lamniformes: Mitsukurinidae). *Scientific Reports*, 6 (27786), 1-10.

Parsons, G.R., Ingram, Jr.G.W. and Havard, R. (2002). First record of thegoblin shark *Mitsukurina owstoni*, Jordan (Family Mitsukurinidae) inthe Gulf of Mexico. *Southeastern Naturalist*, 1, 189–192.

Prokofiev, A.M. and Kukuev, E.I. (2009). New Findings of Rare Fish Species from Families Mitsukurinidae (Chondrichthyes), Muraenidae, Lophiidae, Macrouridae,and Psychrolutidae (Teleostei) on Raises of the Atlantic Ocean with the Description of *Gymnothorax walvisensis* sp. nova. *Voprosy Ikhtiologii*, 49 (2), 155–167.

Rincon, G., Vaske, Jr, T. and Gadig, O.B.F. (2012). Record of the goblin shark *Mitsukurina owstoni* (Chondrichthyes: Lamniformes: Mitsukurinidae) from the South-western Atlantic. *Marine Biodiversity Records*, Vol. 5: e44.

Stevens, J.D. and Paxton, J.R. (1985) A new record of the goblin shark, *Mitsukurina owstoni* (Family Mitsukurinidae), from eastern Australia. *Proceedings of the Linnaean Society of New South Wales*, 108, 37–45.

Stewart, A.L. and Clark, M.R. (1988). Records of three families and fourspecies of fish new to the New Zealand fauna. *New Zealand Journal of Zoology*, 15, 577–583.

Ugoretz, J.K. and Seigel, J.A. 1999. First eastern Pacific record of the goblin shark, *Mitsukurina owstoni* (Lamniformes: Mitsukurinidae). *California Fish and Game* 85:118-120.

Yano, K., Miya, M., Ayzawa, M. and Noichi, T. (2007). Some aspects of thebiology of the goblin shark, *Mitsukurina owstoni*, collected from theTokyo Submarine Canyon and adjacent waters, Japan. *Ichthyological Research*, 54, 388–398.