

***Somniosus (Rhinoscyrnus) cheni* sp. nov., A New Species of Sleeper Shark (Squaliformes: Somniosidae) from Eastern Taiwan, with Aspects of Embryo Biology**

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A new species of sleeper shark is described on the basis of a 134.0 cm total length pregnant female collected from off Hualien, eastern Taiwan. The species belongs to the small species group (subgenus *Rhinoscyrnus*) and can be distinguished from its congeners in having a smaller second dorsal fin, smaller eyes, more tooth rows in the upper jaw, less in the lower jaw, and different body proportion. Moreover, the specimens has 33 embryos which is clearly more than the two other small species in the subgenus. Information of embryo biology are provided as well.

**Key words:** Elasmobranch, Litter size, Morphology, Sex-bias, Taxonomy.

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## BACKGROUND

The family Somniosidae contains five genera, including *Centroscyrnus*, *Scymnodalatias*, *Scymnodon*, *Somniosus*, and *Zameus*. Most Somniosid sharks inhabit near the seabed on continental and insular slopes, but few species are oceanic and semi-oceanic (Ebert et al. 2013a). *Somniosus* differs from the other genera in having first dorsal fin situated at middle of dorsum, well behind the pectoral fin, but well before the pelvic fin, both dorsal fins without spines, second dorsal fin slightly

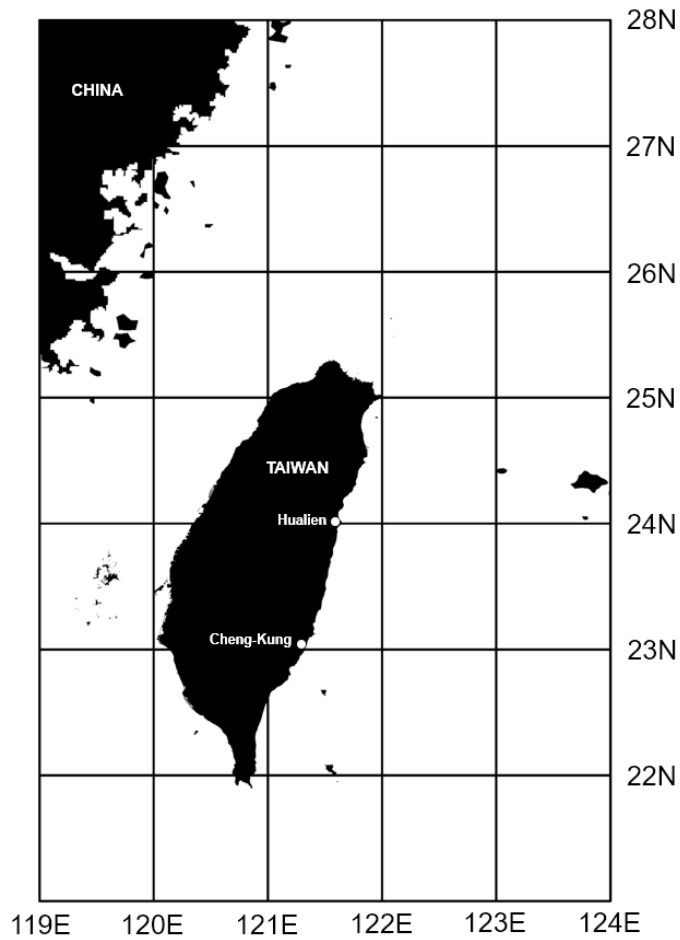
smaller than first, and paddle-shaped caudal fin with long lower lobe (Compagno 1984; Yano et al. 2004; Ebert et al. 2013a). Yano et al. (2004) divided the genus *Somniosus* into two subgenera, and recognized five nominal species. The subgenus *Somniosus* with total length (TL) higher than four meters is a large species group which comprises the Greenland shark *S. (S.) microcephalus* (Bloch and Schneider 1801) from the Arctic and North Atlantic; the Antarctic sleeper shark *S. (S.) antarcticus* Whitley (1939), from the Southern Hemisphere; and the Pacific sleeper shark *S. (S.) pacificus* Bigelow and Schroeder (1944), from the Arctic and North Pacific. The subgenus *Rhinoscyrnus* is a small species group (< 150 cm TL) which comprises the frog shark *S. (R.) longus* (Tanaka 1912) from the western Pacific, and the little sleeper shark *S. (R.) rostratus* (Risso 1827) from the eastern North Atlantic and Mediterranean Sea, respectively (Compagno 1984; Francis et al. 1988; Yano et al. 2004; Yano et al. 2007; Ebert et al. 2013a).

Cigala Fulgosi and Gandolfi (1983) redescribed *S. (R.) rostratus* based on the examination of external morphology of eight free-swimmers and 15 embryos; Francis et al. (1988) recorded *S. (R.) rostratus* that occurred in New Zealand waters of the Southern Hemisphere for the first time; pregnant females of *S. (R.) rostratus* females from Mediterranean Sea were reported by Barrull and Mate (2001) and Vella et al. (2013), and length-weight relationships of *S. (R.) rostratus* were reported by Loyola Fernández et al. (2017). In contrast, records or information of *S. (R.) longus* are very rare. The holotype of *S. (R.) longus*, a 136 cm TL female, was collected from the Tokyo Market, Japan, and only five additional individuals were reported from Japan and New Zealand waters, western Pacific (Yano et al. 2004).

In Taiwan, three somniosids, *Zameus squamulosus*, *Scymnodon ichiharai* and *Somniosus pacificus*, have been reported with vouchers (Ebert et al. 2013b; White et al. 2014). A pregnant female of sleeper shark was caught recently by a deep sea longliner, collected by Mr. Wen-Jong Chen (landings consignee) at a fish market on 17 March 2017, and then sent to Shouu Jeng Joung. Close examination on the specimen revealed that it belongs to the small species group (subgenus *Rhinoscyrnus*) with a short lateral keel present on caudal fin base (Compagno 1984). However, it is clearly different from the two congeners recognized at present and represents a new species. Herein we describe this new sleeper shark and also report aspects of the embryos.

## MATERIALS AND METHODS

Type specimen was collected from Cheng-Kung fishing harbor and fish market, east of Taiwan (Figs. 1, 2). This individual was caught by a deep sea longliner which operated in Hualien waters off Taiwan on 21 March 2017.



**Fig. 1.** Landing position, Cheng-Kung, and the fishery boat's base, Hualien of the specimen in this study.



**Fig. 2.** Holotype of *Somniosus (Rhinoscyrnus) cheni* sp. nov. (EBFSFSX001), pregnant female, 1340 mm total length. Photo by C. Y. Lin.

Total length (TL) and head length (HL) are used throughout. Methods for taking morphometric

measurements followed Yano et al. (2004). Data used for comparisons were those provided in from Francis et al. (1988), Barrull and Mate (2001), and Yano et al. (2004). All measurements are reported in mm and presented as percentage of TL.

Meristic characters including upper and lower tooth row counts were measured from holotype, and its vertebrae number was counted from soft X-radiograph. A 147.0 mm TL male and a 134.9 mm TL female embryos were dissected to investigate their vertebral counts and numbers of turns in spiral valve, and another 145.5 mm TL male and 134.9 mm TL female embryos were also stained for counting their vertebrae. Dermal denticles from lateral trunk below first dorsal fin were photographed. A t-test was used to distinguish difference between the measurement of present individual and the mean of measurements of specimens from literatures when present measurement was out range of other specimen measurements.

The difference of embryonic sex ratio (male: female) was tested using a chi-square test, and average TL and body weight (non-yolk total weight, BW) between sexes were tested using *t*-tests. The holotype and 29 embryos are preserved at the Department of Environmental Biology and Fisheries Science (EBFS), National Taiwan Ocean University, Keelung, Taiwan. The other four embryos are preserved at the National Museum of Marine Biology and Aquarium, Pingtung, Taiwan (NMMB-P33387).

## RESULTS

### *Somniosus (Rhinoscyrnus) cheni* sp. nov.

#### Taiwan Sleeper Shark

(Fig. 2, Tables 1, 2)

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*Holotype*: EBFSFSX001, 1340 mm TL, pregnant female, off Hualien, ca. 23°50'N, 121°50'E, eastern Taiwan, northwestern Pacific Ocean, landed at Cheng-Kung fish market, Taitung, long line, 17 March 2017.

*Paratypes*: NMMB-P33387, 2 males 145.5–147.0 mm TL and 2 females 134.9–135.8 mm TL, embryos taken from EBFSFSX001.

*Etymology*: The species is named in honor of Mr. Wen-Jong Chen, Taitung Xin Gang District Fisherman's Association, for his contributions of chondrichthyan fish samples provision and research assistance with Taiwan and international researchers for over 30 years.

*Diagnosis*: A species of *Somniosus (Rhinoscyrnus)* can be distinguished from its congeners by a combination of the following characters: no anal fin; two spineless dorsal fins, first dorsal fin

higher and larger than second dorsal fin; a short lateral keels on the caudal peduncle, no precaudal pits; caudal fin asymmetrical and paddle-shaped, with a relatively short upper lobe and long lower lobe; rhomboid-shaped dermal denticles; teeth dissimilar in upper and lower jaws, upper-jaw teeth small with lanceolate, in 72 rows, lower-jaw teeth semioblique with low roots, in 28 rows; precaudal vertebrae 60–61, caudal vertebrae 15–18, and 75–78 in total; number of turns in spiral valve 25–26. In mid-term embryo stage (12.8–15.0 cm TL), body color light brown to yellow-grayish; teeth and dermal denticles absent; sexes identifiable; caudal keel present.

*Description:* Proportional dimensions in percentage of TL are given in table 1. Body slender, almost cylindrical, no anal fin. Fork length 93.1% TL, precaudal length (PCL) 82.5% TL (Fig. 2). Snout rounded, short and conical (Fig. 3); preoral length 26.2% HL. Head moderately long, HL 25.5% PCL. Gill opening moderately wide, last one about as long as first four, length of fifth gill opening 8.5% HL (Fig. 3). Mouth slightly arched, its width 35.1% HL (Fig. 3). Eye oval, horizontal diameter of eye 21.3% of length from snout tip to eye. Spiracle small, almost circular, maximum diameter of spiracle 6.1% prebranchial length.

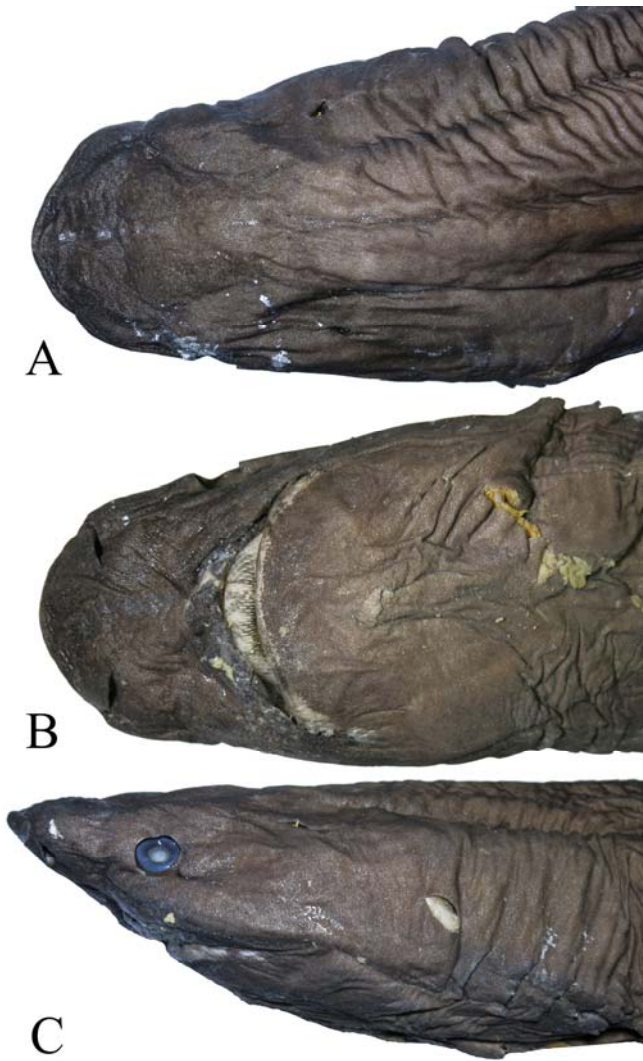
Two spineless dorsal fins, first dorsal fin higher than second dorsal fin, height of first dorsal fin 4.9% PCL and height of second dorsal fin 2.9% PCL; overall length of second dorsal fin 88.7% of that of first dorsal fin (Fig. 4). Interdorsal space longer than HL, its length 30.7% PCL. Pectoral fins short, broadly rounded free rear tips, length of anterior margin 15.5% PCL (Fig. 4). Pelvic fins small, overall length 85.3% of distance between base of pelvic fin and caudal fin (Fig. 4). Distance between base of pectoral fin and pelvic fin 42.3% PCL. Caudal peduncle short, distance between base of second dorsal fin and caudal fin 9.6% PCL; short lateral keels on the caudal peduncle, length of keel 5.1% PCL. No precaudal pits. Caudal fin asymmetrical and paddle-shaped, with a relatively short upper lobe and long lower lobe, and strong subterminal notch; length of lower caudal lobe and 90.2% of length of upper lobe (Fig. 4).

Color uniformly brownish, with narrow but not conspicuous dark brown edges on dorsal, pectoral and pelvic fins, and caudal fin with wider but also not conspicuous dark brown edge (Fig. 2).



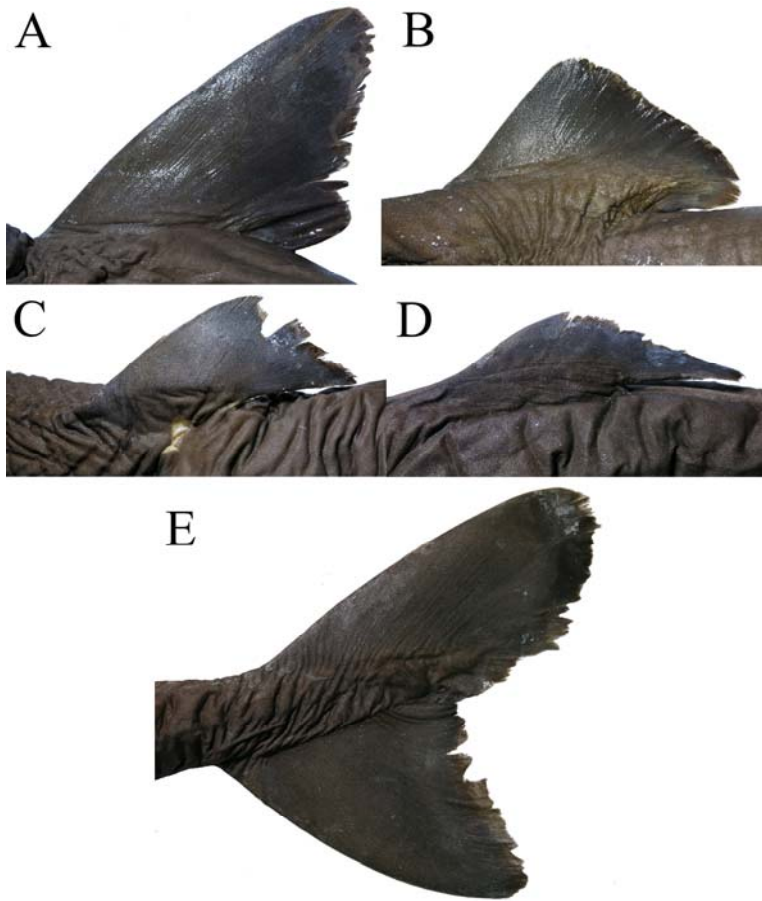
31 horizontal diameter	1.19		1.5	2.9	2.2	1.9	1.8	1.7	1.7	1.6	1.5	1.3
32 vertical diameter	1.12			1.4	0.8	1.6	1.2	1.4	0.7	1.5		
1st dorsal fin:												
33 overall length (from AO)	19.10 <sup>#S</sup>			14.7	13.3	14.6	10.4	12.5	13.7	13.7		
34 overall length (from PO)	10.60		13.5									
35 length base (from AO)	7.99 <sup>#S</sup>			9.0	8.1	8.4	8.4	8.9	7.4	8.6	8.1	7.8
36 length base (from PO)	6.94	6.4	7.5									
37 length posterior margin	5.60	5.1		5.7	6.7	6.6	3.0	4.2	7.6	5.9		
38 height	4.03	4.0	5.5	3.6	4.2	3.7	3.6	3.9	4.4	3.8	4.0	4.0
39 Interorbital width	8.66			9.7	9.0	8.3	7.8	8.8	7.6	8.3		
2nd dorsal fin:												
40 overall length	9.40		10.0	11.8	11.8	11.2	10.4	11.3	13.6	13.7		
41 length base	5.97	5.9	5.0	6.1	6.8	5.6	5.9	6.3	7.5	8.8	5.7	4.7
42 length posterior margin	6.27	4.5		7.2	6.7	6.0	5.5	7.3	7.5	6.8		
43 height	2.39	2.2	7.0	2.5	2.1	2.2	2.3	2.4	2.5	2.1	2.5	2.4
Pectoral fin:												
44 length base	6.49	5.3	5.5	6.8	4.2	5.6	5.5	5.6	5.4	5.5	6.4	6.9
45 length anterior margin	12.76	12.7	12.0	13.3	11.8	12.7	11.6	11.5	13.5	11.4	12.2	12.4
46 length distal margin	2.84		2.5	6.8	4.8	5.3	4.7	3.8	5.0	4.6		
47 length posterior margin	7.99 <sup>#S</sup>			6.1	7.3	6.6	5.5	7.3	7.8	6.4	6.6	6.6
Pelvic fin:												
48 overall length	9.93			10.0	9.3	9.5	8.8	9.5	11.5	9.6	9.4	9.7
49 length base	7.01 <sup>#</sup>	5.6	5.0	6.8	5.7	6.8	6.4	7.1	6.5	5.7		
50 length anterior margin	6.42		5.5	6.5	5.1	6.0	5.2	6.5	6.5	6.1	5.6	6.8
51 length distal margin	5.30 <sup>#S</sup>		3.5	3.6	3.9	2.9	2.7	2.5	0.3	0.7		
52 length claspers									9.0	7.1		
53 (from pelvic axil)									1.3	1.6		
Caudal fin:												
54 length dorsal lobe	15.97	19.90	17.5	19.7	17.6	18.9	16.7	18.4	19.6	18.2	17.8	18.9
55 length ventral lobe	14.40	15.5	14.0	14.7	13.3	14.4	14.4	13.1	15.0	14.8	13.6	14.0
56 dorsal tip to notch	7.91			5.7	8.4	7.2	8.1	8.9	9.0	8.3		
57 depth notch	1.64 <sup>#</sup>		7.5	2.9	2.1	2.4	1.7	1.5	1.3	1.5		
Trunk at pectoral origin:												
58 width	11.34			10.8	11.5	13.0	11.8	11.5	10.1	10.7		
59 height	17.01 <sup>#S</sup>			9.7	10.3	10.6	11.6	12.5	7.6	11.2		
60 Length from snout tip to pectoral end	28.73			36.6	33.7	34.0	30.1	32.1	32.9	32.6		
61 Distance between preoral clefts	8.51											
62 Length eye to 1st gill opening	7.84 <sup>#</sup>			8.2	9.5		8.0	9.0	9.0	8.8		
63 Keel length	4.18 <sup>S</sup>			4.3	3.6	4.4	4.6	2.2	3.2	3.6	2.8	3.9

Each number of measurements is according to that of Fig. 1 in Yano et al. 2004. #: significant different from mean of Sr and Sb ( $P < 0.05$ ). S: significant different from mean of SI ( $P < 0.05$ ).



**Fig. 3.** Closeup of head portion of *Somniosus (Rhinoscyrnus) cheni* sp. nov., from the holotype. A, dorsal view. B, ventral view. C, lateral view of right side (reversed laterally). Not to scale.





**Fig. 4.** Closeup of fins of *Somniosus (Rhinoscyrnus) cheni* sp. nov., from the holotype. A, right pectoral fin, dorsal view. B, right pelvic fin, dorsal view. C, first dorsal fin, left side, lateral view. D, second dorsal fin, left side, lateral view. E, caudal fin, left side, lateral view. Not to scales, anterior to left.

Teeth dissimilar in upper and lower jaws, upper small, with lanceolate, arranged in 72 rows; lower with semioblique with low roots, arrange in 28 rows (Fig. 5). Precaudal vertebrae 60 (60–61), caudal vertebrae 17 (15–18), and 77 (75–78) in total; number of turns in spiral valve 25–26 (Table 2).

Dermal denticles of lateral trunk flat basically rhomboidal in shape with wide crowns and without conspicuous horizontal cusps, giving the skin a smooth texture (Fig. 6).

*Distribution:* Currently known from the holotype collected in canyons surroundings by deep-sea longliner off eastern Taiwan at a depth greater than 500 m.

*Comparison:* According to comparison of length proportional measurements among present individual and two other *Rhinoscyrnus* species, a total of 18 item values are out of measurements range of *S. (R.) rostratus*. Among 18 items, there are 11 items with significant difference from average length ( $P < 0.05$ ) (Table 1). In addition, a total of 25 item values are out of measurements range of *S. (R.) longus*, and among 25 items, there are 12 items with significant difference from

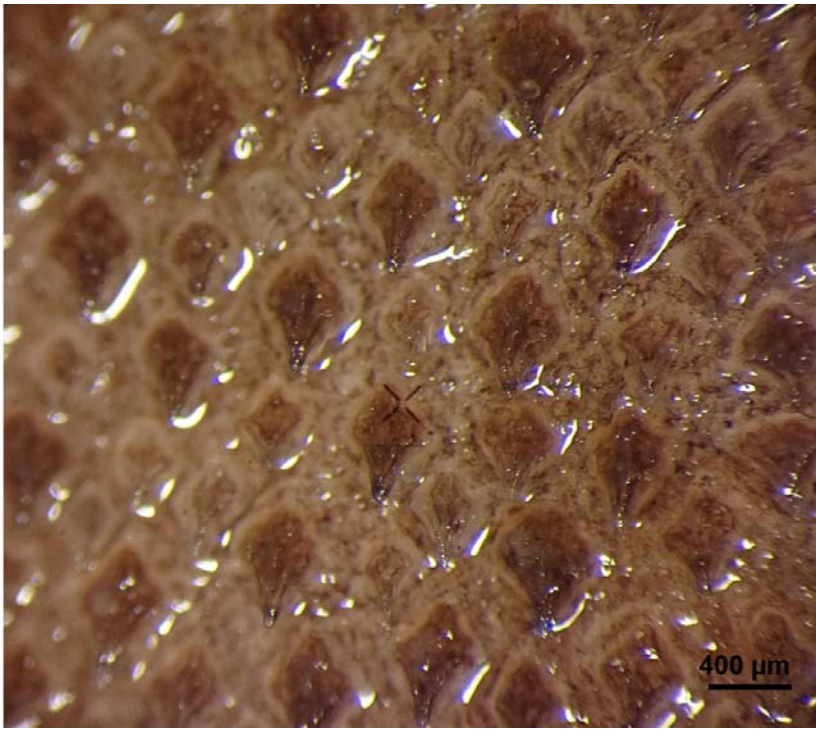
average length ( $P < 0.05$ ) (Table 1). In total, 16 item values are out of measurements range of both *S. (R.) rostratus* and *S. (R.) longus* simultaneously, and among 16 items, there are six items with significant difference from average length of both species ( $P < 0.05$ ) (Table 1).

**Table 2.** Meristic characters of *Somniosus (Rhinoscyrnus) cheni* sp. nov., *S. (R.) rostratus* and *S. (R.) longus*

Species	<i>Somniosus (R.) cheni</i> sp. nov.	<i>S. (R.) rostratus</i>	<i>S. (R.) longus</i>
	Sources	This study	Yano et al. 2004
Number of tooth rows			
Upper jaw	72	53	56–57
Lower jaw	28	31–36	31–32
Number of spiral valve turns	25–26	23	26–27
Vertebral count			
Precaudal	60–61	58	58–59
Caudal	15–18	20	18–21
Total	75–78	78	77–79



**Fig. 5.** Closeup of teeth of *Somniosus (Rhinoscyrnus) cheni* sp. nov., from the holotype.



**Fig. 6.** Dermal denticles on the trunk below first dorsal fin of holotype, *Somniosus (Rhinoscyrnus) cheni* sp. nov., anterior to up.

In meristic counts, number of tooth rows in the upper jaw 72 and number of tooth rows in the lower jaw 28 are clearly different from 53–57 tooth rows in upper jaw and 31–36 in lower jaw in two other *Rhinoscyrnus* species (Table 2, Fig. 5). The number of turns in the spiral valve 25–26 is similar to that of *S. (R.) longus* (26–27) but higher than *S. (R.) rostratus* (23) (Table 2). The total vertebral number 77 is similar to other two species (77–79), with similar combination of precaudal and caudal vertebrae.

Dermal denticles (Fig. 6) arrangement is loose, there are spaces among denticles, similar to *S. (R.) longus* (Yano et al. 2004: fig. 8C), but unlike *S. (R.) rostratus* (Cigala Fulgosi and Gandolfi 1983: fig. 8G) which denticles are arranged closer with more overlaps. The shape of dermal denticles without conspicuous horizontal cusps is different from two other *Somniosus (Rhinoscyrnus)* species (Fig. 6; vs. Cigala Fulgosi and Gandolfi 1983: fig. 8G; Yano et al. 2004: fig. 8C).

Moreover, Yano et al. (2004) reported that the overall length of second dorsal fin in that of first dorsal fin and horizontal diameter of eye of length from snout tip to eye are diagnostic for distinguishing *S. (R.) rostratus* and *S. (R.) longus*. The overall length of second dorsal fin 49.2% of first dorsal fin is lower than those of *S. (R.) rostratus* (76–88%) and *S. (R.) longus* (91–100%); horizontal diameter of eye of length from snout tip to eye 21.3% is lower than 33% of *S. (R.) rostratus* and 46% of *S. (R.) longus*.

## Key to species of the genus *Somniosus*

- 1a. Small sharks with adults not exceeding 1.5 m in total length; rhomboid-shaped dermal denticles; semioblique cusps teeth on lower jaw, number of tooth rows in the lower jaw 28–36; number of turns in spiral valve less than 28; vertebral counts more than 74 ..... 2
- 1b. Large sharks (adults about 4 m or more); hook-shaped dermal denticles; strongly oblique cusps lower teeth, number of tooth rows in the lower jaw 45–63; number of turns in spiral valve more than 29; vertebral counts less than 45 ..... 4
- 2a. Number of tooth rows in the upper jaw 72, number of tooth rows in the lower jaw 28 .....  
..... *S. (R.) cheni* (Eastern Taiwan)
- 2b. Number of tooth rows in the upper jaw 53–57, number of tooth rows in the lower jaw 31–36 .. 3
- 3a. Overall length of second dorsal fin 76–88% of that of first dorsal fin; horizontal diameter of eye 27–37% (mean 33%) of length from snout tip to eye; number of tooth rows in the upper jaw 53; number of turns in spiral valve 23 .....  
..... *S. (R.) rostratus* (Mediterranean, Atlantic Ocean and New Zealand)
- 3b. Overall length of second dorsal fin almost equal to first dorsal fin (91–100%); horizontal diameter of eye more than 30–56% (mean 43%) of length from snout tip to eye; number of tooth rows in the upper jaw 56–57; number of turns in spiral valve 26–27 .....  
..... *S. (R.) longus* (Japan and New Zealand)
- 4a. Interdorsal space almost equal to length from snout tip to first gill opening (prebranchial length); length from snout tip to first dorsal origin less than 45% of total length; number of turns in spiral valve 29–34 (mode 31) ; precaudal vertebral number 31–36 .....  
..... *S. (S.) microcephalus* (Arctic and North Atlantic)
- 4b. Interdorsal space less than length from snout tip to first gill opening; length from snout tip to first dorsal origin more than about 45% of total length; number of turns in spiral valve more than 32; precaudal vertebral number less than 31 ..... 5
- 5a. Interdorsal space about 70% of prebranchial length; height of first dorsal fin about 3.7% of precaudal length (PCL), height of second dorsal fin about 3.4% of PCL; number of turns in spiral valve 32–37 (mode 33); precaudal vertebral number 28–30 (mode 29) .....  
..... *S. (S.) pacificus* (North Pacific)
- 5b. Interdorsal space about 80% of prebranchial length; height of first dorsal fin about 3.0% of PCL, height of second dorsal fin about 2.9% of PCL; number of turns in spiral valve 36–41 (mode 39); precaudal vertebral number 30–31 (mode 30) .....  
..... *S. (S.) antarcticus* (South Indo-Pacific, South Atlantic)

*Embryos biology:* A total of 33 mid-term embryos including eight males and 25 females were found in the specimen and preserved in EBFS and NMMBA (Fig. 7). The sex ratio of 8:25 indicated that female embryos was significant more than males ( $X^2 = 8.76, P = 0.003$ ). All embryos contained a huge yolk sac, body pigments has been deposited as light brown to yellow-grayish, teeth and dermal denticles are totally absent, sexes could be identified, and a caudal keel has been developed (Fig. 7). However, only two male and two female embryos with complete yolk sac were preserved, one female remained partial yolk, and others' yolk sac was damaged in transportation and dissection (Figs. 7 and 8). Embryonic TLs were 13.7–14.7 cm for male (average 14.3 cm,  $n = 8$ ) and 12.8–15.0 cm for female (average 14.0,  $n = 25$ ), and BWs were 15.70–19.62 g for male (average 17.4 g,  $n = 6$ ) and 13.47–19.54 g for female (average 16.3 g,  $n = 22$ ), respectively. The average TL was not significant difference between sexes ( $t = 1.54, P > 0.05$ ) and the average BW was also not significant difference between sexes ( $t = 1.58, P > 0.05$ ), thus the average TL and BW of embryos were 14.0 cm and 16.55 g respectively. Total weights of other four embryos with complete yolk were 90.92–100.00 g, with an average of 95.47 g.



**Fig. 7.** Embryos of holotype, *Somniosus (Rhinoscyrnus) cheni* sp. nov., individuals of the first column from the left are males, the others are females.



**Fig. 8.** Male A and female B embryos with complete yolk sac. Scale bar = 15 cm.

## DISCUSSION

Before present specimen, only *S. (S.) pacificus* of genus *Somniosus* has been recorded in Taiwan, and most of individuals were caught in Hualien by deep-sea longline fishery, a small and localized fishery where very few coastal fishing boats are involved. This kind of deep-sea fishery deployed 500-1000 m deep bottom-set longlines in canyons surrounding seamounts in a small region, and present specimen was also caught by the same fishery from similar operation area (Wang and Yang 2004).

Small size sleeper sharks were found and named in 1827 and 1912, however there were very limited encounter records, particular for *S. (R.) longus* (Risso 1827; Tanaka 1912). The *S. (R.) rostratus* specimens were also only found from the Mediterranean, the North Atlantic, and New Zealand waters in south hemisphere (Yano et al. 2004; Ebert et al. 2013a).

In the report of Yano et al. (2004), the ratio of two dorsal fins overall length and the proportion of the horizontal diameter of eye of the length from snout tip to eye are two of keys to distinguish *S.*

(*R.*) *longus* and *S. (R.) rostratus*. In *S. (R.) cheni*, these two values are clearly smaller than two other species, although these small parts measurements might be affected by measuring preserved specimens (Sotola et al. 2019). In addition, at least 6 morphometric measurements in *S. (R.) cheni* are significant from *S. (R.) longus* and *S. (R.) rostratus* (Table 1).

The other keys using tooth count and the number of turns in the spiral valve to distinguish *S. (R.) longus* and *S. (R.) rostratus* were also used to distinguish *S. (R.) cheni* (Table 2; Yano et al. 2004). The tooth count in the upper jaw is clearly higher in *S. (R.) cheni* than that in *S. (R.) rostratus* or *S. longus*, and the tooth count in the lower jaw is clearly lower in *S. (R.) cheni* than that in *S. (R.) rostratus* or *S. (R.) longus* (Yano et al. 2004). The number of turns in the spiral valve of *S. (R.) cheni* is similar to *S. (R.) longus* but clearly higher than that of *S. (R.) rostratus* (Table 2; Yano et al. 2004).

There were some observations on the reproduction of *S. (R.) rostratus* in previous studies. Two pregnant females from Mediterranean Sea contained nine and eight embryos respectively, one litter of them contained six males and two females (Cigala Fulgosi and Gandolfi 1983; Barrull and Mate 2001). Litter sizes of two *S. (R.) rostratus* individuals were close (8–9), but relatively smaller than *S. (R.) cheni*'s 33 embryos (Cigala Fulgosi and Gandolfi 1983; Barrull and Mate 2001). Embryonic sex-bias with more males occurred in one Mediterranean *S. (R.) rostratus*, the status was on the contrary for *S. (R.) cheni*, although there was only one specimen with embryonic description for both species (Barrull and Mate 2001).

## CONCLUSIONS

The tooth rows of upper and lower jaws distinguished present specimen and other sleeper shark species. The high degree of variability in morphometric measurements and meristic counts among three small sleeper shark species, and different reproductive strategy between *Somniosus (R.) rostratus* and *S. (R.) cheni*, concluded that *S. (R.) cheni* is a new sleeper shark species.

### List of abbreviations

TL, total length.

*S. (S.)*, *Somniosus (Somniosus)*.

*S. (R.)*, *Somniosus (Rhinoscyrnus)*.

BW, body weight (non-yolk total weight).

EBFS, Department of Environmental Biology and Fisheries Science.

NMMBA, National Museum of Marine Biology and Aquarium.

PCL, precaudal length.

HL, head length.

Sc, *Somniosus (R.) cheni* sp. nov.

TW, Taiwan.

Sr, *S. (R.) rostratus*.

Sb, *S. bauchotae*.

MD, Mediterranean.

NZ, New Zealand.

NA, North Atlantic.

Sl, *S. (R.) longus*.

JP, Japan.

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