

**A Record of the Eight-Armed Squid, *Gonatopsis octopedatus* SASAKI, from the Japan Sea**  
**(Cephalopoda, Oegopsida, Gonatidae)**

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**I. Introduction**

The eight-armed squid, *Gonatopsis octopedatus* SASAKI, was originally described on a single immature specimen 65 mm in mantle length, which had been collected near Cape Patience of Karafuto (Sakhaline Island) by the U. S. Fisheries steamer "Albatross" in 1906 (SASAKI, 1920). Later, a more detailed description was given on the same specimen by SASAKI (1929).

After these descriptions, no additional specimens had been reported in the literature for so long a period that OKUTANI (personal communication of November 5 of 1968) even dared to call it "a dreamlike squid".

Recently, however, in his monographic work on the cephalopods of the Far Eastern Seas of the USSR, AKIMUSHKIN (1963) reported some additional localities of this species from the waters adjacent to the Kurile chain and Hokkaido with a brief description. His specimens were reportedly less than 135 mm in total length.

Several specimens of interesting squids have been collected during the extensive survey of the unexploited fisheries resources at depths of the Japan Sea currently being undertaken, and all of them have been placed at my disposal for study. Although the majority of them were referred to the common gonatid squid, *Gonatus magister* BERRY, a single specimen of rather small size was readily discriminated from others by its remarkable appearance. As a result of careful examination, this specimen was found convincingly to be referable to *Gonatopsis octopedatus* SASAKI, apparently new to the cephalopod fauna of the Japan Sea.\*

The purpose of this paper is to give a full description of this rare species on a mature male, with special attention to its internal features as well as to its ecological aspects.

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\* AKIMUSHKIN (1963) included the Japan Sea for the range of this species (Table 3 on p. 77), but no relevant symbol was indicated in his map (Fig. 50 on p. 184).

## II. Description of the Present Specimen

*Gonatopsis octopedatus* SASAKI, 1920

(Jap. Name: *Tenaga-Takoika*)

(Figures 1-2)

*Gonatopsis octopedatus* SASAKI, 1920: 198 (original description; type locality, 48°-22'.3N, 145° 43'.3E, 440 fathoms). BERRY, 1921: 352 (critical review on the validity of the genus *Gonatopsis*). SASAKI, 1929: 273 (redescription of the holotype with illustrations and key). GRIMPE, 1933: 506 (an interrogative comment on the identity of this species and *G. borealis*). CLARKE, 1966: 159 (general account on systematics). OKUTANI, 1967a: 11 (faunal record compiled, with proposal of new Japanese name). ———, 1967b: 65 (in part, faunal note compiled)., ———, 1968: 33 (general review of systematics). OKIYAMA, 1969 (in part, diagnostic characters compiled and key).

*Gonatopsis octopedata* AKIMUSHKIN, 1963: 187 (description and additional localities from the western North Pacific).

**Material:** A mature male (partly mutilated; 99+ mm in mantle length). 38°-40'. 5N, 138°-53' E, off Niigata Prefecture, Japan; depth 810 m; coll. Mr. Yasuo TANINO of the Japan Sea Regional Fisheries Research Laboratory, with deepsea trawl, on board the R/V "Koshizi-Maru"; May 3, 1969.

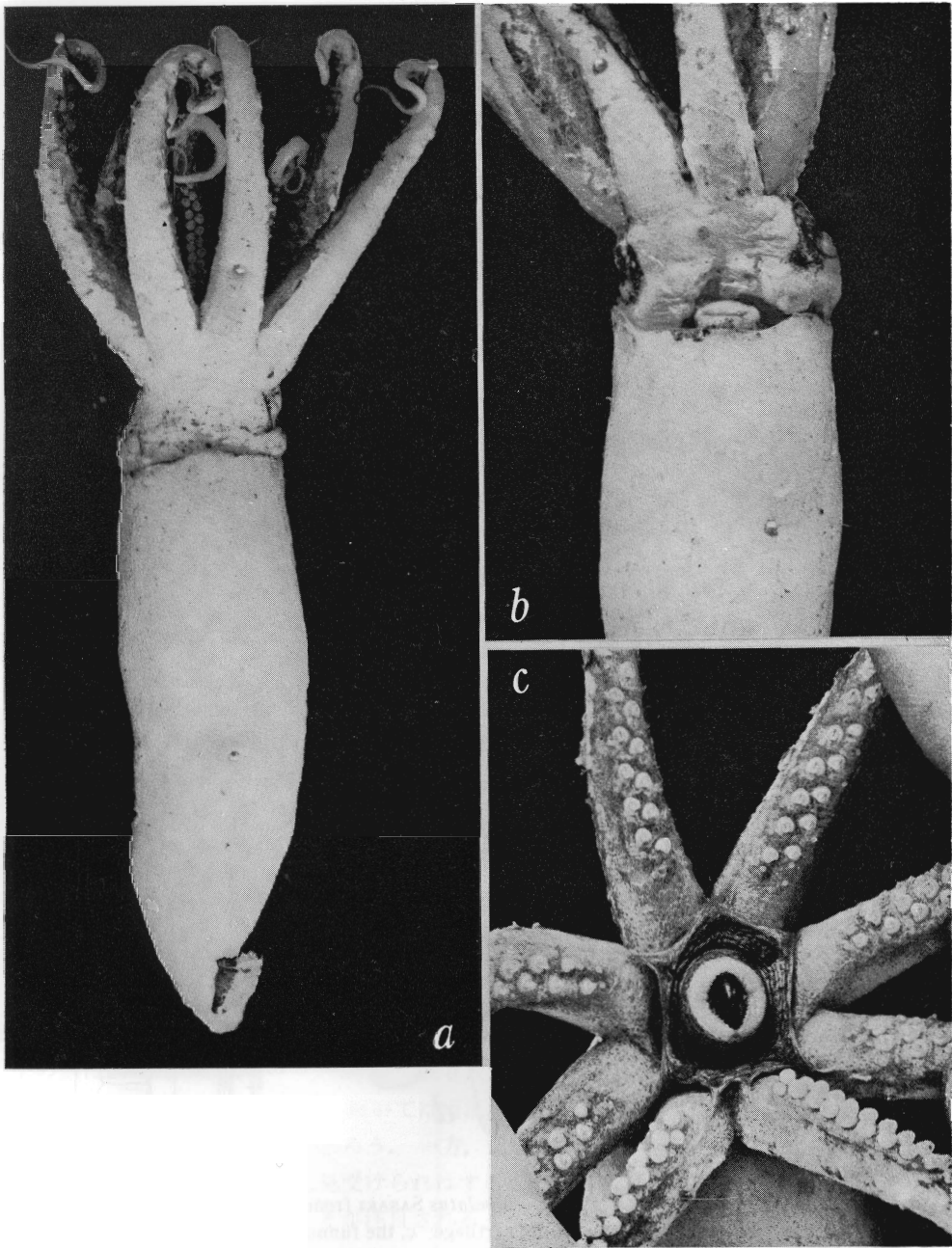
**Description:** Measurements and counts are given in Table 1, together with those of the holotype cited from SASAKI (1929).

The mantle is soft to touch, elongated, cylindrical and slightly expanded at a little anterior to the middle, where the greatest breadth is measured; it tapers in the posterior one-third remarkably, exterminating in seemingly an obtusely pointed posterior end (Fig. 1a). The anterior mantle margin is slightly projected to form an obtuse median point dorsally, but is broadly and rather deeply emarginated on the ventral side between both bluntly angulated lateral angles (Fig. 1b). The fin has been so heavily mutilated that its actual shape is difficult to determine. However, it may be said with certainty that its length is shorter than one-fifth of the mantle length.

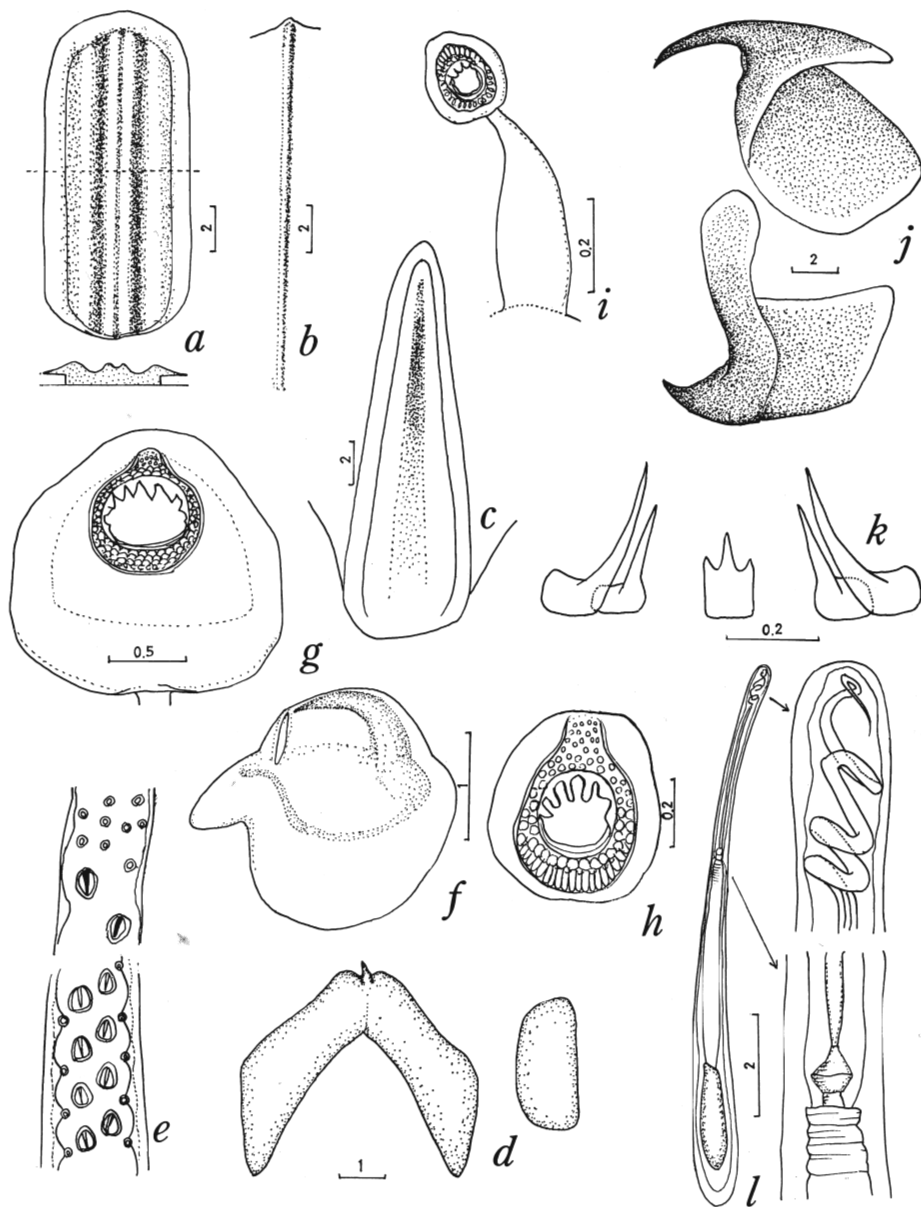
The head is short, as broad as or a little broader than the mantle opening, and somewhat depressed dorso-ventrally. The eye is large and the eyelid bears a deep sinus in front which is provided with a distinct fleshy process dorsally. The neck is weakly constricted and the funnel groove as well as the olfactory crest are poorly defined. The funnel is short and withdrawn deeply into the mantle, hence its anterior tip never extend beyond the level of the hind border of the eyelid. The funnel organ consists of a dorsal inverse V-shaped component with a short process at the apex, and ventral part nearly ovoidal in outline (Fig. 2d).

The nuchal cartilage is nearly elongato-oval in shape and its length is a little more than twice the width; there are 3 straight longitudinal grooves thereupon; among them, the outer pair is much deeper and wider than the middle one (Fig. 2b).

The funnel cartilage is lanceolate with rounded posterior corners; a straight and shallow longitudinal groove is present along the median axis, which is especially



**Fig. 1.** A fully matured male of *Gonatopsis octopedatus* SASAKI from the Japan Sea.  
a, dorsal view (DML: 99+mm); b, ventral view of the head; c, buccal crown showing the buccal membrane connectives and arm armatures in the proximal portions.



**Fig. 2.** A. fully matured male of *Gonatopsis octopedatus* SASAKI from the Japan Sea.  
 a, the nuchal cartilage; b, the mantle cartilage; c, the funnel cartilage; d, the funnel organ;  
 e, the arm armatures at the transition place from hooks to suckers in the distal two-thirds  
 (top), and at the proximal portion (bottom) of the dorsal arm; f, the largest hook from the  
 dorsal arm; g, the largest sucker from the ventral arm; i, the long pedicelled sucker from  
 the distal portion of the same; j, the jaws; k, the radula; l, the spermatophore. Scales in mm.

distinct in its posterior half (Fig. 2c).

The mantle cartilage is straight, ridge-like and as long as the corresponding funnel component (Fig. 2b).

The arms are subequal in length with arm formula, 2, 3, 1, 4; the longest one attains about 80 per cent of the mantle length. In addition, the arms are peculiar in appearance; rather stout at base and gently tapering distally for the distance of about two-thirds of the arm length; the distal one-third is characteristically attenuated and crooked, terminating in a sharply pointed tip.

**Table 1.** Measurements and counts of *Gonatopsis octopedatus* SASAKI

	Present specimen	Holotype††
Sex	male	? †
Measurements (mm):		
Dorsal mantle length	99+	65
Ventral mantle length	95+	61
Greatest mantle width	30	22
Fin length	— †	19
Fin width	—	30
Head width	28.5	19
Arm length, I	(right) 79/76 (left)	(right) 45/45 (left)
II	83/81	55/55
III	82/77	52/52
IV	72/75	53/45
Counts:		
Number of arm hooks, I	32/31	27/ ?
II	32/33	33/ ?
III	32/32	33/ ?
IV	0/0	0/0

† The symbol — indicates the missing portion and ? no available information.

†† The measurement data for the holotype are cited from SASAKI's (1929) description, while the counts of the arm hooks are based on his illustration (op. cit., **Text-fig.** 132).

The arm armatures are composed of hooks and suckers except for the ventral pair which is represented only by the suckers. In the dorsal three pairs, the armatures are quadriserial in about the proximal two-thirds, where the large hook are arranged zigzag in the inner two rows, while the small short pedicelled suckers are arranged likewise in the outer two rows (Figs. 1c, 2e). Distal to these, the armatures consist of the quadriserial rows of small suckers with long pedicels (Fig. 2i) beset in 6—7 rows to the extremity (Fig. 2e). The hooks, covered with the fleshy hoods, are somewhat flattened in profile and broadly excavated underneath; the largest one measures 1.8 mm in height and 2.1 mm in width; the unmodified part is composed of the sharply pointed hook and the weak membraneous base (Fig. 2f). The largest sucker of the outer rows is 0.57 mm in diameter and possesses 5—7 teeth of irregular shape on the distal half (Fig. 2h).

In the ventral pair, the suckers of the inner rows are larger, particularly in the distal one-half; the largest one (Fig. 2g), located in the distal 4–5th transverse row, is approximately three times as large as its outer ones; its chitinous ring is small and has about 9 teeth on the distal half, the median 4 of which are the most prominent with pointed end, distally grading to the knoblike ones.

The tentacles are perfectly absent. Moreover, neither the integumental keels nor the umbrella are discerned clearly.

The buccal membrane is moderately developed and equipped with 7 lappets; the position of its connectives is referred to DDVV-type of YOUNG & ROPER (1968); the oral surface is smooth but provided with several grooves surrounding the buccal mass (Fig. 1c).

The beak is moderate in size and darkly pigmented except for the peripheral portions of the wing and the lateral wall; the rostrum is well pointed, much more strongly in the upper beak, while the jaw angles are not so clearly defined in both elements (Fig. 2j).

The radula is small and possesses only 5 teeth in each transverse row; the rha-chidian is tricuspid with rather pointed tips, most strongly in the median cusp; the lateral two pairs are unicuspid with a pointed tip and a broad base, the outer lateral ones being more elongated (Fig. 2k).

The gladius is not examined.

The present specimen is a mature male with the genital system lodged with fully formed spermatophores; the penis is developed so long that its anterior tip reached as far as it opens inside the funnel. The spermatophore is rather small, 10.7 mm in total length and constructed as shown in Fig. 2l.

As is seen in Fig. 1a, the skin is almost torn off from the body, but several portions such as the sucker-bearing faces of arms, the funnel and the buccal membrane still retain the skin which is pigmented dark brownish.

### III. Discussion

**Comparison with the holotype:** The morphological features of the present specimen so far observed, essentially agree with the original description and redescription of the holotype by SASAKI (1920, 1929), but there are several discrepancies as summarized below:

- (1). The nuchal cartilage: The width of the nuchal cartilage of the present specimen is a little less than half of its length against one-fifth in the holotype.
- (2). The funnel cartilage: The funnel cartilage of the present specimen differs from that of the holotype in a somewhat broader shape with nearly bilaterally symmetrical structure.
- (3). The mantle cartilage: The mantle cartilage of the present specimen is as long as the corresponding funnel component, while in the holotype the former is slightly

longer than the latter.

(4). The arms: The presence of 8–12 rows of suckers in the distal portions of arms is one of the most diagnostic features in the holotype, but at most 7 rows are discriminated in the present specimen.

(5). Suckers: The general arrangement of the suckers in the ventral arm is quite similar to each other, but the largest suckers of the inner rows relative to those of the outer rows are less conspicuous in the holotype than in the present specimen.

(6). Tentacle: Externally, both specimens are completely lacking the tentacles, but SASAKI (1929) found a rounded indistinct tubercles between the third and the fourth arms in the holotype. However, such a structure cannot be found in the present specimen.

Notwithstanding these differences, I think that the present specimen is surely identified with *Gonatopsis octopedatus* SASAKI, since most of those discrepancies are rather minor ones and probably attributable to either the difference in growth stage or the artificial distortion in preservation.

**Distribution:** The localities of this species, including the present record, are compiled in Fig. 3. From this, it is clear that this aberrant form of squid is distributed in a rather restricted region adjacent to the Kurile chain and Hokkaido. More exactly, they are obtained from the area of more than 1000 meter bathymetric line with the exceptions of the holotype and the present specimen. As described above, the present specimen was sampled at the deep floor of 810 meter in a large trough located off the Niigata Prefecture in the Japan Sea, and this bathymetric occurrence coincides well with that of the holotype, i. e., 440 fathoms (792 meter).

According to the kind information of Mr. Y. TANINO of our Laboratory, the animals collected simultaneously with the present squid were largely occupied by a single species of fishes belonging to the family Zoarchidae, *Allolepis hollandi* JORDAN & HUBBS, and the other minor portions were composed of various forms of animal such as the deep sea cottoid fish, *Malacocottus gibber* MATSUBARA-SAKAMOTO, the rajid fish, *Bathyraja smirnovi* (SOLDATOV & PAVLENKO), the majid brachyuran, *Chionoecetes japonicus* RATHBUN, and the deep sea shrimp, *Nectocrangon toyamaensis* YOKOYA. On such a composition, one may recognize at once that all of them are the typical representatives of the so-called “taraba-community III” of NISHIMURA (1966), which is currently regarded to be the deepest bottom community of the Japan Sea. From these facts, it may be concluded that *Gonatopsis octopedatus* SASAKI is a typical boreal deep sea squid and belongs to the cephaloped fauna of the deepest part in the Japan Sea. In this connection, it is worthwhile to note that the peculiar hydrographic circumstances of the deeps of this marginal sea seems not deleterious for the present specimen to become sexually matured.

**Remarks:** In regard to the size of this species, SASAKI (1929) stated, “it (the holotype) seems to attain a further development in size,” but none of the additional

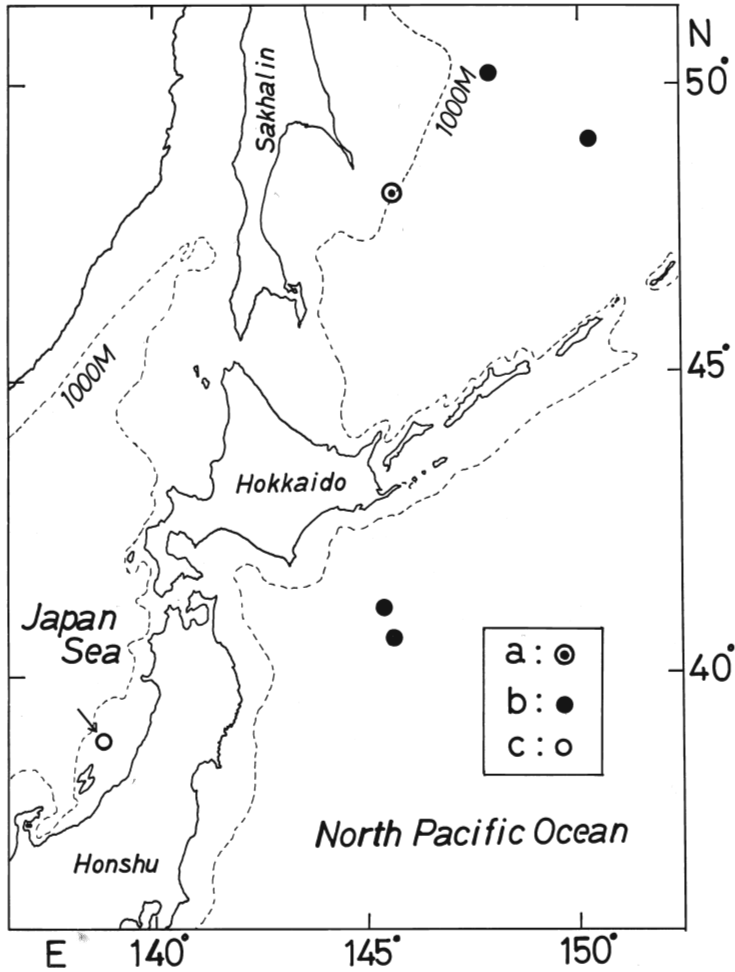


Fig. 3. Distributions of the hitherto known localities of *Gonatopsis octopedatus* SASAKI. a, the type locality; b, the localities after AKIMUSHKIN (1963); c, the present locality.

materials (AKIMUSHKIN, 1963) were so strong enough to verify his supposition. Thus, it is noteworthy and very fortunate to have discovered the present specimen of about 100 mm in mantle length with spermatophores fully formed.

Although there seems to be a considerable variation in the size at maturity in the gonatid squids such as *Gonatus magister* BERRY (OKIYAMA, unpublished), the present species can be referred to the smallest species in the genus *Gonatopsis* and at the same time this status may probably be responsible for the small size of the spermatophores. A situation comparable to this has been found in the genus *Gonatus*; *G. anonychus* PEARCY & VOSS is known to be mature in less than 8 cm in mantle length (PEARCY & VOSS, 1963).

As described previously, the present species bears some characteristic aspects. It

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should be mentioned in the first place that so far as I am aware, such a striking penis as observed in the present species is found common only to one of its congener, *Gonatopsis borealis* SASAKI\* and on the contrary a fully matured male of *Gonatus magister* BERRY has a far less prominent one (OKIYAMA, unpublished). Therefore, this contrast in the male genital system seems to be associated more or less with the discrepancy in the tentacle structures in these two genera.

In the second place, the present species is peculiar in its radula which possesses 5 teeth in each transverse row against 7 in most squids. However, in view of the rather common occurrences of the gonatid squids with 5 teeth, for example, *Gonatus fabricii* (LICHTENSTEIN), and *Gonatopsis japonicus* OKIYAMA (SASAKI, 1929; OKIYAMA, 1969), this character cannot be exceptional in the family Gonatidae.

Lastly, I want to mention here that the rather bizzare, very long, tapering and crooking distally shape of arms in the present species reminds us of a condition in octopods rather than in decapods. Does this superficial resemblance to octopods suggest a clue to the problem bearing upon the mode of existence of this squid in the deeps of the ocean?

I wish to thank Mr. Yasuo TANINO of our Laboratory for the gift of this precious material. I also wish to thank Dr. Saburo NISHIMURA of the Seto Marine Biological Laboratory of Kyoto University, and Dr. Takashi OKUTANI of the Tokai Regional Fisheries Research Laboratory for their encouragement and critical reading of the manuscript. My last but not least gratitude is extended to Dr. Sukekata ITO of our Laboratory for the reading of the manuscript and to Mr. Hiroshi FUKATAKI of the same Laboratory for his assistance in the photograph.

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\* This character was ascertained on a specimen collected off the Pacific coast of Hokkaido, and kindly placed at my disposal through the courtesy of Messers. Hisao ARAYA and Mamoru MURATA of the Third Laboratory of the Hokkaido Regional Fisheries Research Laboratory at Hakodate, to whom I wish to express my cordial thanks.

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## 日本海から初記録のテナガタコイカ

沖 山 宗 雄

### 要 約

日水研・谷野保夫技官の御好意により、新潟県沖合の深所において採集されたイカ類の標本を調べる機会があり、その中からテナガタコイカ *Gonatopsis octopedatus* SASAKI と同定される個体を発見したので、その形態に関する記載をおこなうとともに、分布等についても若干の考察を加えた。

この種は1906年、米国の調査船「アルバトロス」号による北西太平洋調査の際に、樺太東海岸沖合の792mの深海から得られた外套背長65mmの未成熟個体を模式標本として、佐々木望氏によつて1920年に新属・新種として発表されて以来久しく報告を見ることのなかつた種類である。1963年にソ連のアキムシユキン氏がその著書の中で、これが樺太ならびに北海道近海の太平洋において数尾採集されていることを示したが、最大長135mm（これはほぼ模式標本の大きさである）という記述を除き、ほとんど従前の報告を補足する知見も認められず、これまでドスイカ科 *Gonatidae* の中で最も未知のもの一種であつた。

今回報告したものは外套背長100mmにして、すでに完成した精英を保有する雄個体で、その形態的特徴はほぼ原記載に一致する。この種の最も著しい特徴とされる各腕先端部における吸盤の配列などの点に、多少の相異が認められるが、これは標本の固定保存の状態に起因するものと考えられる。新しく加えられた知見として、極めて発達した陰茎の存在と、歯舌が5列よりなること、および、同属内において最小型の種類であることなどがあげられよう。

採集地点の物理的ならびに生物的環境から、この種は日本海においては最深部生物群集に所属することを推測した。この記録は日本海において底生イカ類が採集された最深部の記録であり、日本海の動物分布上、非常に貴重なものである。

なお、採集に関する諸データは次の通りである。採集場所 38°-40'. 5 N, 138°-53' E, 810m. 採集月日：1969年3月3日。採集者：谷野保夫、「越路丸」底曳網による。