



Fig. 1. The oar-fish landed at the Niigata Fish Market.

*Photograph by the Niigata Nippon Sha*

**A Record of *Regalecus russellii* (SHAW) from the  
Sado Straits in the Japan Sea**

BY

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ABOUT midday on February 24, 1960, a moderate-sized specimen of the oar-fish, presumably identified as *Regalecus russellii* (SHAW), was caught by a small motor trawler in the Sado Straits, Japan Sea (the exact locality of sampling position and water depth thereat are unknown), and landed at the Niigata Fish Market at Yanagishima, Niigata, early in the following morning. The fish retailers, being unaware, as the fishermen were, what this gigantic *Trichiurus*-like fish with silvery flank and long filamentous, crimson-colored crest and with a pair of prolonged whip-like pelvic fins should be and whether it was edible or not, all hesitated to purchase so that this remarkable specimen fell into the hands of Mr. HARUSABURO SATO of the Uo-Shun Fish Retail Shop, Niigata, at an extraordinary cheap price\*.

Informed of the landing of the specimen by Mr. KEIICHI ITO of the Niigata Nippo Sha, Niigata, who had took a photograph of the fish at the market, I hastened to Mr. SATO's shop in hopes of making measurements and closer examinations on the specimen. Fortunately enough, the fish had not yet been completely mutilated, although part of the tail and some fins were missing, and Mr. SATO quite generously submitted this precious specimen to my disposal. Herein I wish to place the results of measurements and observations on the present specimen along with a few photographs and to supplement to some extent the elaborate description recently given by Dr. TAMEZO MORI (1956) on this rare fish.

The specimen examined is deposited at the Japan Sea Regional Fisheries Research Laboratory, Niigata.

I wish to return herewith my gratitude to Mr. H. SATO for his kindness extended to me in obtaining the present specimen, and my heartfelt thanks are also due to Mr. K. ITO of the Niigata Nippo Sha and Mr. HATSUTARO SHIMAMURA of the Japan Sea Regional Fisheries Research Laboratory for supplying me with photographs. The following gentlemen have rendered various kind helps to me during course of study: Mr. YOSHIHARU HONMA of the Faculty of Science, Niigata University, Mr. SHUMPEI KOJIMA of the Shimane Prefectural Fisheries Experimental Station, and Messrs. GENDI KATOH, SUKEKATA ITO, AKIRA OUCHI and SHOGO KASAHARA of the Japan Sea Regional

\* Mr. SATO told me that he has paid a hundred yen (=28 cents) for the fish, but *The Niigata Nippo* (February 25, 1960; evening edition) informed that the price was three hundred yen (=83 cents). I failed to ascertain which was true.

Fisheries Research Laboratory. To all gentlemen, my gratitude is sincerely acknowledged.

**Regalecus russellii (SHAW)**

Nom. Jap. "Ryugu-no-tsukai"

*Gymnetrus russellii*.—SHAW, 1803: Zool. IV, Part II, P. 195, Pl. 28 (Sea off Vizagapatam, India). CUVIER & VALENCIENNES, 1835: Hist. Nat. Poiss., X, PP. 377-379 (Br. 4; D. 5/320; A. 0; C. 4; P. 11; V. 1).

*Regalecus russellii*.—GÜNTHER, 1861: Cat. Fish., Vol. III, P. 311 (D. 4-5/320; P. 11; V. 1; C. distinct). DAY, 1878: Fish. India, P. 376, Pl. LXXIX, Fig. 2 (Br. 5; D. 4-5/320; P. 11; V. 1). DAY, 1889: Fauna Brit. India, Fishes, Vol. II, P. 374, Fig. 124 (Br. 5; D. 4-5/320; P. 11; V. 1; C. 4). JORDAN, 1907: Fishes, P. 684 (Santa Catalina, S. California). UI, 1929: Kishu-Gyofu (Cat. Fish. Prov. Kishu), P. 278. KAMOHARA, 1950: Shinkai no Gyozoku (Fishes of the Deep Sea), PP. 150-151. MATSUBARA, 1955: Gyorui no Keitai to Kensaku (Fish; Morphology and Hierarchy), Part I, PP. 463-464, Fig. 193. MORI, 1956: Hyogo Univ. Agr., Sci. Rept., 2(2), Ser. Nat. Sci., PP. 33-36, Figs. 1-7 (One from off Hamada, S. Japan Sea; Total length 124 cm; D. 6/349; P. 13; V. 1; C. 4; Another from off Hamada; Total length 205 cm; D. 6/365; P. 13; V. 1. Off Iwami, S. Japan Sea; Total length 204 cm; D. 6/345; P. 13; V. 1. West of Oki Is., S. Japan Sea; Total length 144+x cm (hinder part of body missing); D. 6/157+x; P. 13).

*Regalecus russelli* (misspelling).—EBINA, 1934: Rakusui-Kaishi, 29 (6), PP. 530-532, Fig. 2 (Yosa-Naikai, Tango, Japan; Body length 1.4 m; D. 6/73(?); V. 1). KAMOHARA, 1950: Tosa oyobi Kishu no Gyorui (Fishes of Prov. Tosa and Kishu), PP. 282-283, Fig. 216.

*Regalecus rurrellii* (misspelling).—KURODA, 1947: Seibutu, Suppl. (1), PP. 25-31, Fig. 3 (Suruga Bay, Japan; Total length 1100 mm; D. 6/136; P. 12; V. 1; A. 0).

*Trachipterus* sp.—NAKAMURA, 1925: Niigata-Ken Tensan Shi (Enumeration of Natural Resources in Niigata Prefecture), P. 401, 1 fig. (Hassaki Coast, Niigata Prefecture; Total length 285 cm).

(Without nomination).—RUSSELL, 1803: Description and Figures of Fishes of Coromandel, I, Pl. 40. HAMANA, 1932: Rakusui-Kaishi, 27(5), PP. 48-49, 2 figs. (Kagoshima Bay, Japan; Body length 540 cm; D. 6/252; P. 6; V. 1).

MEASUREMENTS (in mm): Total length 3225+x (part of tail and caudal fin are missing); Greatest depth of body (a little before base of pectoral fin) 234; Greatest width of body (at base of pectoral fin) 52; Least depth of caudal peduncle 4; Least width of caudal peduncle 2; Length of head 249; Length of snout 78; Length of postocular space 133; Greatest width of head (at center of preopercular bone) 54; Depth of head at anterior margin of eye 177; Depth of head at posterior margin of preopercle 205; Depth of body at anterior end of pectoral fin base 226; Depth of body at vent-opening 179; Width of body at vent-opening 33; Diameter of eye 40; Diameter of pupil 14; Supraorbital depth 64; Suborbital depth 84; Width of interorbital space 53; Length of longest filamentous (first) dorsal fin ray 755+x (distal portion is missing); Length of second dorsal fin ray 62 (above pectoral fin base), 78 (above vent-opening), 67 (at 1300 mm

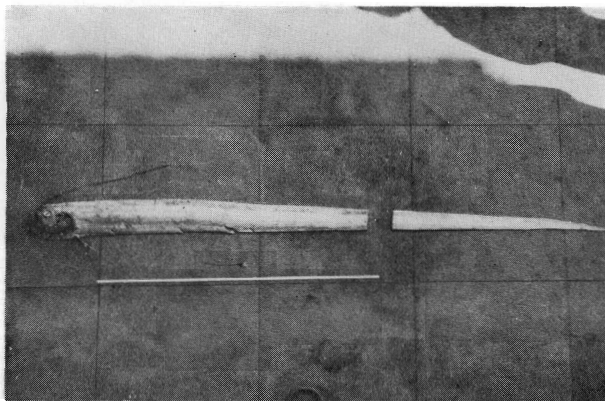


Fig. 2. Side view of the oar-fish. Part of the tail as well as portions of the first dorsal fin rays and the pelvic fin ray are lacking. Length of the scale bar underneath is 160 cm.

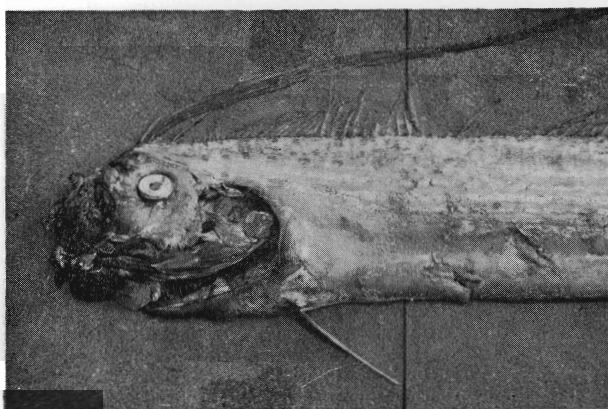


Fig. 3. Lateral aspect of the head and the anterior region of trunk. Opercular bones on the left side are seriously damaged, but those on the right side are complete.

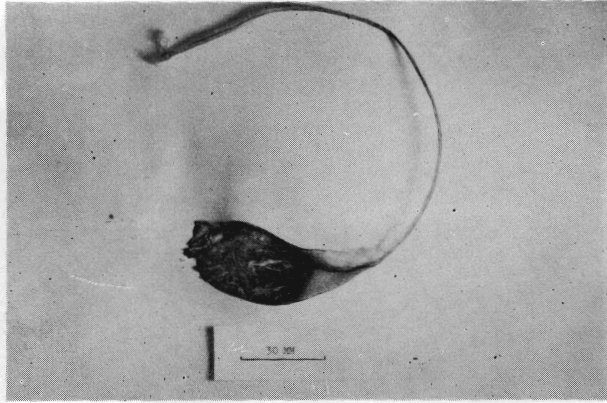


Fig. 4. Membraneous dilation at the extremity of the pelvic fin ray.

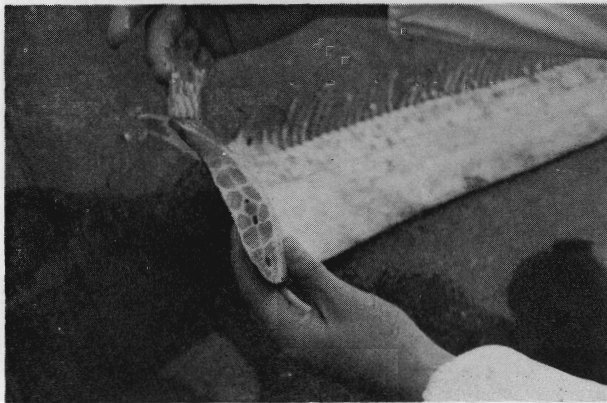


Fig. 5. Transverse section of the tail at 1305 mm from the posteriormost end of the caudal peduncle. Note the longitudinal intermuscular septa which separate lateral muscle cones from one another.

from posterior end of caudal peduncle), 4 (at 100 mm from the same) and less than unity (at posteriormost ray); Length of pectoral fin base 33; Height of pectoral fin (at highest anteriormost ray) 84; Length of pelvic fin — (intermediate portion is lacking); Length of cutaneous dilation at extremity of pelvic fin  $37+x$  (distal tip is somewhat frayed out); Greatest width of the same 30; Thickness of the same 1.2 (at base) to 0.2 (at distal portion); Length of maxillary 45; Height of the same 82; Distance between tip of upper jaw (tuj) and anterior end of filamentous (first) dorsal fin base 103; Distance between tuj and anterior end of second dorsal fin base 149; Distance between tuj and anterior end of pectoral fin base 248; Distance between tuj and anterior end of pelvic fin base 284; Length of space between tuj and vent-opening 1110; Distance between posterior margin of subopercle (pms) and anterior end of filamentous (first) dorsal fin base 222; Distance between pms and anterior end of second dorsal fin base 195; Distance between pms and anterior end of pectoral fin base 35; Distance between pms and anterior end of pelvic fin base 82; Longest gill-lamella on first gill arch 37; Longest gill-raker 29; Longest pseudobranchia 24.

DESCRIPTION: Female. Body is extremely elongate and strongly compressed; greatest body depth at a little before pectoral fin, and the hind part of body is gradually tapering towards the posteriormost tip of caudal peduncle. Head is oblong, snout short and truncated, cleft of mouth almost vertical, jaws much protractile. The lower lip is slightly protruded than the upper, which is rather thin and rolled backward. Both lips soft and gelatinous. The front, which is likewise soft and gelatinous, is laterally very thin, sharply descended from the anterior end of first dorsal fin base, and with a fairly deep, V-shaped groove in the median line. Eye is lateral and large, round in outline, slightly concave in outer surface, situated in the anterior and upper half of head. Maxillary and opercular bones are well developed, coarsely ossified and marked by radiating lines. No tooth on vomer and jaws. Gill-opening is very wide. Branchiostegal rays 6 on each side, the anteriormost ray being but weakly developed. Branchiostegal membranes, free from isthmus, are connected with each other below chin. Gill-rakers are well developed on the outside of first arch,  $15+44=59$  in number including nubs on left side; they are studded with numerous, rather coarse spinules. Gills are 4, with excellently developed lamellae, the fifth arch being somewhat degenerated and destitute of gill-lamellae. Pseudobranchiae fairly well developed. Superior pharyngeal bones numerous studded with minute pointed teeth. Dorsal fin, with its extremely long base, fringes the entire dorsal edge from just behind the frontal region of head backward near to the end of caudal peduncle, but is distinct from caudal fin. The number of dorsal fin rays  $6/322+x$  (part of tail is missing). The anteriormost six rays, separated from the remainder of the fin by a deep notch, are greatly prolonged and connected with one another by membrane, at least, in their basal portion. The second dorsal fin, with its origin over the posterior margin of eye, is highest in the neighborhood of a vertical from vent, and gradually decreases its height backward to the last fin ray. These fin rays are flexible and neither articulated nor branched. The moderate-sized pectoral fin is inserted nearer to ventral margin than to lateral line, or at the lower two-sevenths in body depth, with base almost horizontal, and points sharply posterosuperiorly. Number of pectoral fin rays 12 on each side. Pelvic fin, originating just below pectoral fin base, is reduced to a long filament terminating

in an extremity of lobately dilated cutaneous membrane (Fig. 4). The proximal portion of filament is bony and very stout. Anal fin is absent. Caudal fin is lost in the present specimen, possibly worn out during life. Lateral line, smooth and without spines, extends from immediately behind the upper margin of eye, and, gradually descending towards the lower profile of body (placed at the lower two-fifths in the middle part of body and at the lower fourth in the hind part of tail), reaches the posteriormost end of caudal peduncle. The surface of skin (dermis) of body and the nuchal and suborbital regions of head are numerously studded with small, flat-topped, bony tubercles of irregular sizes. On the side of body, these tubercles are arranged into one to five bands: first appearing in a band and immediately branching into three in the nuchal and occipital regions, in four bands in the pectoral region, and in five bands in the rest of trunk and in the greater part of tail except for its hinder portion, where number of bands gradually decreases from five to three, and eventually to one, the last one band is longest and most conspicuous of the five and runs just along the vertebral column, reaching caudal peduncle. Between and in the outsides of the tubercle bands, there extend longitudinal flattened ridges, destitute of any prominent tubercles, from head to tail. Number of ridges varies according to that of tubercle bands. These ridges on the skin correspond to the lateral musculatures of body underneath\*. In the greater part of body, where six pairs of longitudinal cones of lateral musculatures, viz., *Musculus latero-dorsalis*, *M. latero-ventralis*, *M. carinatus dorsalis*, *M. carinatus ventralis*, *M. supracarinalis dorsalis*, and *M. infracarinalis ventralis*\*\* , are typically developed, four conspicuous ridges are observed on the skin just outside of the foremost four muscle cones and two less conspicuous ridges outside of the last-named two muscle cones (Fig. 5). Enveloping all these lateral muscle cones separately, are remarkably well developed perimysia externa of fibrous-tissue nature, which are indiscriminately fused in the innermost side with thick and tough periosteum of the vertebral column and in the outside with similarly thick and tough horny dermis. The above-mentioned tubercle bands are formed just where the longitudinal inter-muscular septa conjoin with dermis. Tubercles are also developed in short transverse stripes on the skin surface of dorsal fin basement and especially prominently on the ventral edge posterior to vent. Tubercles on the ventral edge, arranged in a row and regularly diminishing their size posteriorly, are neither pointed nor bent backward. At the posteriormost end of ventral edge are protruded two pairs of sharply-pointed, backward-bent spinules. They seem to be the exposed distal portions of haemal processes of the penultimate and the antepenultimate vertebra. Dorsal fin basement, which envelopes cartilaginous pterygophores, is very high, occupying the upper eighth of body depth at a vertical from pectoral fin, the upper fourth at vent and the upper half immediately before the posterior end of caudal peduncle, and strongly compressed. Tubercle stripes on the skin surface of dorsal fin basement are formed just where the cartilaginous pterygophores are in contact with dermis outside. Between pterygophores, antecedent and succeeding, are found well-developed levator and flexor muscles of dorsal fin rays. The former, by far markedly developed than the latter, arises from the side of the anterior half of base of each

\* When the fish is preserved in formalin, the ridges become depressed, presumably due to dehydration of the underlying muscles.

\*\* These muscles are pinkish white and very soft. In the hind portion of tail, lateral musculatures are but poorly developed.

dorsal fin ray, being splitted into two branches underneath, and on some occasions one or both of the branches further splitted into two subbranches, and all these branches or subbranches are attached to the tendonous septum of *Musculus supracarinalis dorsalis*. It is of special interest to note that this levator muscle is "red muscle" whilst lateral and other muscles including the levator and flexor muscles of both pectoral and pelvic fins are all "white muscle". The flexor muscle of dorsal fin ray, which is rather thin and but weakly developed as compared with the levator muscle, originates from the posterior tip of base of each dorsal fin ray and, running anteroinferiorly inside the right and left levator muscles, terminates at the tendonous septum of *M. supracarinalis dorsalis*. Flexor muscles of caudal fin rays are quite degenerated. Body cavity is rather narrow. Peritoneum is pearl white. Swimbladder is absent. The blind sac of stomach is extremely elongate and extended posteriorly far beyond anus. Intestine is rather short and simple in configuration with convolution taking place only once. Pyloric caeca well developed and numerous in number. Liver is rather small in volume. Ovaries are very elongated, extending from above the convolution of intestine to vent-opening, the right and left lobes being conjoined to form a cylinder or braid except for the anterior part. The fecundity is innumerable large, possibly of the order of tens of millions. The frequency distribution of diameter of ovarian eggs is poly-modal\*. No fat-storing tissue in body cavity and under skin. Sagitta and asteriscus are both very minute, the former measuring only 1.36 mm in length.

**COLOR IN FRESH:** The side of body is glistening silvery with weak brownish tint, mottled with several irregular, somewhat waving, subvertical stripes and numerous blotches of darker hue\*\*. Snout and front are dusky-black. Maxillary and opercular bones are also dusky with greenish tint. Iris is platinum-colored. The lower surface of isthmus and the bases of pectoral and pelvic fins are purplish black. The ventral edge of body, particularly behind vent-opening, is also purplish black. Dorsal fin basement is tinged with lavender (possibly due to the "red" levator muscles underneath) and prominently mottled with numerous dark-hued spots. The rays, and the anteriormost six prolonged ones in particular, of dorsal fin are scarlet, and its pinkish fin-membrane being scattered with scarlet dots. Pectoral fin is also pinky. Pelvic fin ray, at least in its proximal and distal portions (the intermediate portion is lacking), is purplish black, and the lobe at the extremity is deep-scarlet, transfused into purplish-black hue both basally and distally.

**FOOD HABITS:** The stomach was completely vacant and the intestine was found filled with dark-red mucus only, in which no food organism nor its remains were identified. A small-sized shrimp-like crustacean was, however, found hung on the gill-rakers.

**REMARKS:** In the Japan Sea, the present species has hitherto been recorded from the following sites: Fusan, South Korea (MORI, 1952); Senzaki, Yamaguchi Prefecture (YOSHIDA & ITO, 1957); off Hagi, Yamaguchi Prefecture (TANAKA, 1934); off Hamada, Shimane Prefecture (MORI, 1956, and S. KOJIMA, personal communication; several specimens); Oki Islands (MORI, 1956); Ôtsuka coast of Province Tohaku, Tottori Prefecture (KURODA, 1947); off Ôya

\* In the present specimen, five modes were discernible: the smallest 20-50 $\mu$ , the second 80-100 $\mu$ , the third 130-160 $\mu$ , the fourth 190-290 $\mu$ , the largest 350-420 $\mu$ .

\*\* The epidermis with its guanine-deposited cells is easily removed by friction, which makes more conspicuous the dusky stripes and blotches underneath.



of Province Iwami, Tottori Prefecture (MORI, 1956); Yosa-Naikai (Miyazu Bay) of Province Tango, Kyoto Prefecture (KUMATARO ITO, cited by EBINA, 1934); Sea off Niigata Prefecture (TANAKA, 1934; KUMATARO ITO, cited by EBINA, 1934; possibly no less than two specimens); Hassaki coast, Niigata Prefecture (NAKAMURA, 1925); Nô coast, Niigata Prefecture (SUKEKATA ITO, personal communication). Most of the specimens are regrettably lacking in measurement data. Only four specimens from the southern Japan Sea are measured and described by MORI (1956) precisely enough to be compared with the specimen at my disposal. The results of comparison are given in Table 1. It may be seen that the present specimen is largest of the five and further that, although there are considerable variations among individuals as regards the relative size of various body parts, the greater the fish, the smaller the eye and the larger the interorbital width in relation to head length. According to Mr. SHUMPEI KOJIMA of the Shimane Prefectural Fisheries Experimental Station, Hamada (personal communication; dated on March 1, 1960), nearly ten specimens of the oar-fish,

Table 1. Comparison of five specimens of *Regalecus russellii* (SHAW) from the Japan Sea†.

Locality	Hamada No. 1	Hamada No. 2	Iwami	Oki Is.	Sado Str.
Total length (mm)	1240	2050	2040	1440+x	3225+x
Snout-vent length (mm)	302	510	475	760	1110
Greatest body depth: % S.-V. L.	17.2	22.2	24.9	16.3	21.1
Body depth at vent: % S.-V. L.	10.9	15.9	16.2	11.2	16.1
Head length: % S.-V. L.	24.5	24.9	27.4	20.4	22.4
Snout length: % Head L.	33.8	32.3	33.8	42.6	31.3
Eye diameter: % Head L.	23.0	22.1	19.3	18.7	16.1
Interorbital width: % Head L.	16.2	17.3	16.9	18.1	21.3

† Measurement data of the four specimens from the southern Japan Sea were quoted from MORI (1956).

including the two given in the Table as Hamada No. 1 and No. 2, have been collected along the sea coasts of Shimane Prefecture from 1948 until now (1960). Of them, the five specimens recorded of the total length measurement range between *ca.* 100 cm to *ca.* 300 cm. The specimen at my disposal, then, may be designated as the largest ever recorded from the Japan Sea.

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要 約

佐渡海峡で捕獲されたリュウグウノツカイの1標本

西 村 三 郎

1960年2月24日、1小型底曳漁船が佐渡海峡においてリュウグウノツカイ *Regalecus russellii* (SHAW) を1頭捕獲した。この標本は全長3225+x mm (尾の1部および尾鰭欠損) の未成熟な♀で、次の形質を備えていた：鰓膜条数6—6；背鰭条数6/322+x (1部欠損)；胸鰭条数12—12；腹鰭条数1—1；尻鰭条数0；尾鰭条数—(欠損)；左第1鰓弓外側の鰓は数15+44。吻—肛門長(1110mm)に対する体各部分の長さは次のとおりである：頭長22.4%；最大頭巾4.9%；最大体高21.1%；肛門位体高16.1%；尾柄高0.36%；最大体

中4.7%；尾柄中0.18%。また、頭長(249mm)に対する各部分の長さは次のとおり：吻長 31.3%；眼間距離21.3%；眼径16.1%；瞳孔径 5.6%。これまで日本海からは20例近くの本種の捕獲が知られており、その若干のものでは測定記録が欠けているが、記録が残っているものと比較すると、今回得られた標本はそのいづれよりも大型である。