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## Round Herrings (Family Dussumieridae) found in the Ryukyu Islands

Shinsho NISHISHIMAMOTO

### Abstract

Round herrings are very important bait fishes in the Ryukyu Islands which is referred, in this paper, to the former Okinawa Prefecture of Japan including three groups of islands of Okinawa, Miyako and Yaeyama. Three species of the genus *Spratelloides* and one of the genus *Dussumieria*, namely *Spratelloides delicatulus* (BENNETT), *S. japonicus* (HOULTUYN), *S. atrofasciatus* SCHULTZ, and *Dussumieria hasseltii* BLEEKER, are described. The later two species are recorded from the Ryukyu Islands and Japan for the first time.

### Introduction

Round herrings (family Dussumieridae) are very important bait fishes for the skipjack fishery in the Ryukyu Islands which is referred, in this paper, to the former Okinawa Prefecture of Japan including the three groups of islands of Okinawa, Miyako and Yaeyama. Classification of the fishes from the area is, however, far from complete in many respects.

Occurrence of *Spratelloides delicatulus* (BENNETT) was reported from Amami Oshima by YOSHIDA<sup>1)</sup> and from Miyako-Jima by AOYAGI<sup>2)</sup>. According to OKADA<sup>3)</sup>, the Okinawa Fisheries Experimental Station published lists of the fishes found in the waters, in which *Spratelloides japonicus* (HOULTUYN) was included.

While working in an investigation on the bait fishes of the Ryukyu Islands, the author collected a number of specimens of *Spratelloides atrofasciatus* SCHULTZ and three of *Dussumieria hasseltii* BLEEKER, both unrecorded from the Ryukyu Islands, along with specimens of *S. delicatulus* and *S. japonicus*.

In this paper, the above-mentioned four species found in the Ryukyu Islands, namely *Spratelloides delicatulus* (BENNETT), *S. japonicus* (HOULTUYN), *S. atrofasciatus* SCHULTZ, and *Dussumieria hasseltii* are described. So far, no other species or genera of the family have been found from the area.

The author wishes to express his sincere acknowledgement to Dr. LEONARD P. SCHULTZ of the United States National Museum for the identification and comment on specimens of *S. atrofasciatus*. Many thanks are due to the fishermen who cooperated in collecting specimens.

### Key to the Species of Dussumieridae from Ryukyu Islands

- 1a. Branchiostegal rays 14; dorsal rays 17; anal rays 14; origin of dorsal nearer to base of caudal than tip of snout. *Dussumieria hasseltii* BLEEKER
- 1b. Branchiostegal rays 6; dorsal rays 11-13; anal rays 10-13; origin of dorsal nearer to tip of snout than base of caudal.

- 2a. Scale rows from upper edge of gill opening to caudal base 35-38; back and upper sides bluish black, no lateral band present. *Spratelloides delicatulus* (BENNETT)
- 2b. Scale rows from upper edge of gill opening to caudal base 41-47; back and upper sides pale or whitish, distinct lateral band present.
- 3a. Gill rakers on first gill arch 10-12+34-37; scale rows from upper edge of gill opening to caudal base 45-47; pectoral rays 13-15; snout length 11.3-12.9 in standard length, longer than eye diameter; greatest width of lateral band 16.0-20.8 in standard length, smaller than eye diameter. *Spratelloides japonicus* (HOULTUYN)
- 3b. Gill rakers on first gill arch 7-9+20-24; scale rows from upper edge of gill opening to caudal base 41-43; pectoral rays 10-12; snout length 13.2-16.3 in standard length, usually shorter than eye; greatest width of lateral band 12.0-16.3 in standard length, greater than eye diameter. *Spratelloides atrofasciatus* SCHULTZ

## DUSSUMIERIA HASSELTII BLEEKER

Japanese name: "Nise-Giniwashi"

Fig. 1

*Dussumieria hasseltii* BLEEKER, Nat. Tijds. Nederland, Indie, vol. 1, p. 422, 1850 (type locality: Batavia, Cheribon, Samarang, Surabaya).

### 1. Specimens Studied

Motobu, Okinawa-Jima; 3 specimens, 70.5, 70.0 and 57.5 mm. in standard length, provided from fishermen's catch by a driving into net, Aug. 5, 1959, all damaged.

### 2. Description

The following counts and measurements are recorded for the three specimens: Dorsal 17; anal 14; pectoral 14; pelvics 8; branchiostegal rays 14; gill rakers 7+20-21; scale pockets from end of dorsal fin base to caudal base about 20 in two larger specimens (could not be counted on the other parts); number of vertebrae 59 in the largest specimen.

Length of head 3.8-4.0; greatest depth of body 6.1-6.9; width of body 9.0-9.8; tip of snout to dorsal origin 1.67-1.75; to anal origin 1.26-1.29, to pelvic insertion 1.61-1.67; pectoral insertion to pelvic insertion 2.9-3.0; pelvic insertion to anal origin 5.2-5.8; all in standard length. Eye 4.0-4.2; snout 2.8-3.0; tip of snout to rear of maxillary 2.8-3.1; interorbital space 4.2-4.6; postorbital length of head 2.2-2.4; least depth of caudal peduncle 3.1-3.2; length of caudal peduncle 1.8-2.0; dorsal fin base 2.1-2.2; anal fin base 2.7-3.1; all in head length.

Body elongate, moderately compressed, its ventral profile as convex as the dorsal. Snout longer than eye. Maxillary nearly reaching below front margin of eye. Teeth on jaws, palatines and tongue, and longer, curved along maxillary and posterior part of dentary, and imbedded in fleshy edge of lips. Rear of isthmus without deep notch as observed in the species of *Spratelloides*. Pelvics inserted under anterior half of dorsal fin base. Last rays of dorsal fin not buried in a groove as observed in the species of *Spratelloides*.

The specimens were stained with rust by accident so that the color was not typical. Body pigmented dorsally and a double row of pigments along middorsal.

Dorsal surface of head, tip of snout, lower jaw, and caudal fin pigmented. Black spots along gill opening. A black line from end of anal fin base to caudal base in the smallest specimen. Peritoneum with numerous black pigment cells.

SPRATTELLOIDES DELICATULUS (BENNETT)

Japanese name: "Minami-Kibinago"

Okinawan name: "Shiira" or "Iruka-Mizun"

Fig. 2

*Clupea delicatulus* BENNETT, Proc. Comm. Zool. Soc. London, vol. 1, p. 168, 1831 (type locality: Mauritius).

*Spratelloides delicatulus* GUNTHER, Cat. Fishes British Mus., vol. 7, p. 464, 1868 (East Indies and Australia).

*Stolephorus delicatulus* JORDAN and SEAL, Bull. Bur. Fisher., vol. 25, p. 186, 1906 (Apia and Pago Pago).

### 1. Specimens Studied

Motobu, Okinawa-Jima: 201 specimens, 20 to 55 mm. in standard length, provided from fishermen's catch by a driving into net, Aug. 5, 1959.

Chujo-Wan, Okinawa-Jima; 21 specimens, 21 to 45 mm. in length, provided from fishermen's catch by a lift net and fish lamps at night, Sept. 3, 1959.

Unten, Okinawa-Jima; 6 specimens, 51 to 55 mm. in standard length, provided from fishermen's catch by a lift net and fish lamps at night, Sept. 10, 1959.

Ishikawa, Okinawa-Jima; 6 specimens, 32 to 38 mm. in standard length, caught by S. NISHISHIMAMOTO with a dip net and fish lamp at night, May 4, 1962.

Nakadomari, Okinawa-Jima; 9 specimens, 27 to 41 mm. in standard length, caught by S. NISHISHIMAMOTO with a dip net and a fish lamp at night, May 7, 1962.

Bora, Miyako-Jima; 60 specimens, 32 to 45 mm. in standard length, caught by S. NISHISHIMAMOTO and others with a lift net and fish lamps at night, June 1, 1961.

Taira Anchorage, Miyako-Jima; 47 specimens, 23 to 49 mm. in standard length, caught by S. NISHISHIMAMOTO with a dip net and fish lamps at night, June 4, 1961.

Ishigaki Anchorage, Ishigaki-Jima; 10 specimens, 16.5 to 50 mm. in standard length, caught by S. NISHISHIMAMOTO with a dip net and a light at night, Oct. 25, 1959.

Kabira, Ishigaki; 5 specimens, 34 to 47 mm. in standard length, provided from fishermen's catch by a driving into net, July 5, 1960.

Funauki Anchorage, Iriomote-Jima; 40 specimens, 16.5 to 50 mm. in length, caught by S. NISHISHIMAMOTO with a dip net and a light at night, Oct. 26, 1959.

Yonaguni-Jima; one specimen, 40 mm. in standard length, provided from fishermen's catch by a driving into net in the morning, Oct. 28, 1959.

The postlarvae collected along with larger specimens are not used in this study.

### 2. Description

Certain counts and measurements were made, and ranges of the counts and those of the measurements expressed in standard length are shown in table I and table II, respectively, along with similar data on the other species of the genus.

Body elongate, subcylindrical, its ventral profile more convex than the dorsal.

Belly and breast rounded. Snout equal to or shorter than eye. Length of caudal peduncle greater than postorbital length of head, and its least depth larger than eye diameter. Depressed anal usually shorter than depth of head at end of occiput. Longest pectoral ray shorter than greatest depth of body. Last fin rays of dorsal buried in a groove extending from anterior part of the fin to somewhat beyond tips of rays when the fin depressed. Scales from center of body sides with complete transverse grooves.

Colour in formalin bluish black, being pale to silvery ventrally. Dorsal surface of head, tip of snout, lower jaw, and tongue blackish. Operculum and cheek blackish or powdered with black. Inner edge of preorbital with a black spot. Caudal fin with two black-pigmented streaks in each lobe forming part of glandular scales. Other fins hyaline, or plain pale. Peritoneum with scattered black pigment cells.

### 3. Ecological Note

This round herring is very common along the open coasts of the Ryukyu Islands, and extensively caught by the local bait fishermen. The fish was found gathering around a light, although the school was usually not large in number, at almost every locality where collection of fish specimens or fishing was tried at night. The round herrings attracted by a light gathered usually at the surface around the light, not forming a compact school. They would, however, remain at depths when the school is large in number, as observed by SCHULTZ and WELANDER<sup>4)</sup> in Marshall Islands.

Table I. Ranges of certain counts made on the species of  
*Spratelloides* from Ryukyu Islands

Characters	delicatus	japonicus	atrofasciatus
Dorsal rays .....	12-13	12-13	11-13
Anal rays .....	10-11	12-13	10-12
Pectoral rays .....	11-12	13-15	10-12
Gill rakers:			
Upper limb .....	9-11	10-12	7- 9
Lower limb .....	27-30	34-37	20-24
Scale rows from upper edge of gill opening to caudal base .....	35-38	45-47	41-43
No. of specimens examined .....	25	25	55
Standard length in millimeters .....	35.0-54.0	40.0-63.0	33.0-45.0

### SPRATELLOIDES JAPONICUS (HOULTUYN)

Japanese name: "Kibinago"

Okinawan name: "Sururu"

Fig. 3

*Atherina japonica* HOULTUYN, Verh. Holland. Maatsch. Haarlem, vol. 20, p. 340, 1782 (type locality: Japan).

*Stolephorus japonicus* LACÉPÈDE, Hist. Nat. Poiss., vol. 5, pp. 381-82, 1803 (Japan).

*Spratelloides japonicus* MORI, Journ. Pan. Pacific Res. Inst., vol. 3, p. 3, 1928 (Fusan, Korea).

*Clupea gracilis* SCHLEGEL, in Siebols's Fauna Japonica, Poiss., pts. 10-14, p. 238 pl. 108, fig. 2, 1846 (type locality: Southeast coast of Nagasaki).

Table II. Ranges of measurements made on species of *Spratelloides* from Ryukyu Islands and recorded in standard length

Characters	delicatus	japonicus	atrofasciatus
Standard length in millimeters .....	35.3-52.0	39.2-61.0	32.0-41.3
Length of head .....	3.7- 4.1	3.8- 4.2	4.2- 4.5
Greatest depth of body .....	5.7- 6.4	6.6- 7.4	6.1- 7.1
Snout length .....	13.7-17.3	11.3-12.9	13.2-16.3
Eye diameter .....	13.3-16.0	13.8-17.4	15.0-18.6
Maxillary length (from snout tip) ..	10.5-12.4	9.9-11.0	11.0-12.6
Postorbital length of head .....	8.5-10.0	8.5-10.8	9.1-10.6
Head depth at occiput .....	6.2- 7.7	7.1- 8.2	7.0- 7.9
Width of bony interorbital space ....	15.9-18.5	18.4-22.6	16.5-24.8
Snout tip to dorsal origin .....	2.1- 2.3	2.0- 2.2	2.0- 2.3
Snout tip to anal origin .....	1.2- 1.3	1.2- 1.3	1.2- 1.3
Snout tip to pectoral insertion .....	3.7- 4.0	3.8- 4.3	4.0- 4.5
Snout tip to pelvic insertion .....	1.8- 1.9	1.7- 1.8	1.8- 2.0
Pectoral insertion to pelvic .....	3.0- 3.5	3.0- 3.4	2.9- 3.5
Pelvic insertion to anal origin .....	3.5- 4.0	3.5- 4.0	3.3- 3.7
Least depth of caudal peduncle .....	11.3-14.1	13.8-15.4	13.0-16.3
Length of caudal peduncle .....	7.0- 8.4	8.9-10.6	8.2- 9.7
Length of depressed dorsal .....	5.0- 6.3	5.6- 6.2	6.0- 6.7
Length of depressed anal .....	7.5- 9.1	6.1- 7.2	6.6- 8.1
Length of longest pectoral ray .....	6.0- 7.7	6.3- 8.2	7.7- 9.2
Length of longest pelvic ray .....	7.6- 9.9	8.2- 9.6	9.6-11.2
Width between upper bases of pectorals .....	12.0-14.1	16.4-18.9	14.1-16.6
Length of longest gill raker .....	18.5-25.1	17.3-25.5	19.1-23.1
Greatest width of lateral band .....	.....	16.0-20.8	12.0-16.3
No. of specimens measured .....	15	15	20

### 1. Specimens Studied

Unten, Okinawa-Jima; About two thousand specimens, 26 to 56 mm. in standard length, provided from fishermen's catch by a lift net and fish lamps at night, June 12, 1959.

Kantena-Wan, Okinawa-Jima; 59 specimens, 15 to 39 in standard length, caught by S. NISHISHIMAMOTO with a dip net and fish lamp at night, June 15, 1959.

Motobu, Okinawa-Jima; 626 specimens, 20 to 65 mm. in standard length, provided from fishermen's catch by driving into net, Aug. 5, 1959.

Chujo-Wan, Okinawa-Jima; 61 specimens, 47 to 60 mm. in standard length, provided from fishermen's catch by a lift net and fish lamps at night, Sept. 8, 1959.

Kamiyama-Jima, off Naha-City; 5 specimens, 47 to 59 mm. in standard length, caught by S. NISHISHIMAMOTO with a dip net in a dide pool, July 1, 1959.

Postlarvae collected are not used in this study.

### 2. Description

Certain counts and measurements were made, and are shown in table I and table II, respectively.

Body elongate, subcylindrical or slightly compressed, its ventral profile as convex as the dorsal. Belly rounded, ventral edge of breast slightly sharp. Snout remarkably longer than eye. Maxillary reaching to or past a vertical line through front margin of eye. Rear of isthmus with usual notch. Least depth of caudal peduncle nearly equal to or slightly greater than eye diameter, its length

nearly equal to postorbital length of head. Depressed anal quite longer than head depth at occiput. Last rays of dorsal fin buried in a groove. Longest pectoral ray generally longer than or equal to depth of body. Scales from body sides with incomplete transverse grooves.

Colour in formalin pale or brownish white with dark lateral band, greatest width of which is smaller than eye diameter. Scale pockets above lateral band pigmented. Dorsal surface of head, tip of snout, and lower jaw dark brown. Inner edge of preorbital with a dark spot. Middorsal line with a double row of dark pigment cells. Caudal and dorsal fin pale brownish, but no pigmented streaks on the glandular scales of the caudal as observed in *S. delicatulus*. Lower fins translucent. Peritoneum dusky.

### 3. Ecological Note

This round herring was found along the coast of Okinawa-Jima, being very abundant in bays and inlets, and intensively caught by the local bait fishermen with a kind of lift net and fish lamps at night, or with a driving into net in the daytime. It is one of most important bait fishes for the local skipjack fishery.

No specimens were obtained from Miyako and Yeyama Islands in spite of many attempts, although a result of an oral investigation with some bait fishermen and skipjack fishermen indicated the occurrence of the round herring in these islands. It seems, therefore, that there are considerable fluctuations in the populations of the fish in the islands.

When the round herrings were attracted by a fish lamp, the larger ones usually remained at a depth of 1.5 meters or more, forming a compact school when the school was large in number.

### 4. Remarks

An Indo-Pacific species, *Spratelloides argyrotaeniata* (ELEKER), has been usually placed as a synonym of *S. japonicus*, the present species (FOWLER<sup>5)</sup>, BERTIN<sup>6)</sup>). Recent study by SCHULTZ and WELANDER<sup>1)</sup> showed that the former species was a valid one. My specimens agree with their specimens and the description presented by JORDAN and HERRE<sup>7)</sup>. My specimens were also compared with the specimens from Kagoshima given to University of the Ryukyus by SADAHIKO IMAI of the Kagoshima University, and no significant difference was found between the two samples of specimens.

## SPRATELLOIDES ATROFASCIATUS SCHULTZ

Okinawan name: "Baka-Jako"

Fig. 4

*Spratelloides atrofasciatus* SCHULTZ, U. S. Nat. Mus. Bull. 180, pp. 8-9, fig. 1, 1943 (type locality: Tutuila Island, Samoa).

### 1. Specimens Studied

Motobu, Okinawa-Jima; 37 specimens, 29 to 36 mm. in standard length, provided from fishermen's catch by a driving into net, Aug. 5, 1959.

Yonaguni-Jima; 55 specimens, 24 to 45 mm. in standard length, provided from fishermen's catch by a driving into net, Oct. 28, 1959.

Bora; Miyako-Jima; about 2,600 specimens, 20 to 47 mm. in standad length, caught by S. NISHISHIMAMOTO and others with a lift net and fish lamps at night, June 1, 1961.

## 2. Description

Certain counts and measurements were made, and are shown in table I and table II, respectively.

Body elongate, subcylindrical, its ventral profile a little more convex than the dorsal. Belly and breast rounded. Snout usually shorter than eye. Maxillary reaching to or past a vertical line through front margin of eye. Rear of isthmus with deep notch. Length of caudal peduncle greater than postorbital length of head, and its least depth generally greater than eye diameter. Longest pectoral ray shorter than depth of body. Depressed anal nearly equal to head depth at occiput. Last rays of dorsal fin buried in a groove. Scales behind gill opening with incomplete transverse grooves.

Colour in formalin is characterized by blackish lateral band, greatest depth of which is greater than eye diameter. Scale pockets above the lateral band dark pigmented. Dorsal surface of head, tip of snout, and lower jaw black. Operculum, cheek and isthmus powdered with black. Black spots just below posterior nostrils and on inner edge of preorbital. Middorsal line with a double row of pigment cells in youngs, or a thick black line in larger ones. Ventral edge of abdomen black pigmented. Dorsal and caudal fin pale brown, and glandular scales of the caudal without pigmented streaks as observed in *S. delicatulus*. Peritoneum dusky.

## 3. Ecological Note

This round herring was found along open coasts, but not in protected inlets. It is caught by the local fishermen usually with a driving into net in the daytime.

When the round herrings were attracted by a fish lamp at night, they gathered usually at a depth of 1.5 meters or more around the light forming a compact school, and few of them came up to the surface.

Most of the larger females caught at Bora, Miyako-Jima, on June 1, 1961 were distended with eggs in mature condition, indicating occurrence of spawning in summer months.

## 4. Remarks

Certain specimens from Yonaguni-Jima were sent to L. P. SCHULTZ of the United States National Museum, and they were tentatively identified by him as the present species. He (personal comunication) stated that my specimens differed from his specimens in having wider lateral bands, indicating a possible representation of a subspecies or race.

The figure of holotype of the species (SCHULTZ<sup>9</sup>, p.9) shows the lower margin of the lateral band anteriorly ending at the upper edge of gill opening and the upper margin far above the upper edge of gill opening. In my specimens,



however, the upper margin of the lateral band ends anteriorly at the upper edge of gill opening and the lower margin far below. No other significant difference was found between my specimens and the descriptions presented by SCHULTZ<sup>8)</sup>, and SCHULTZ and WELANDER<sup>4)</sup>.

The fish has been known only from Samoa and Marshal Islands, and now made known from the Ryukyu Islands.

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Fig. 1. *Dussumieria hasseltii* Bleeker, 70.5 mm. in standard length, partly stained.

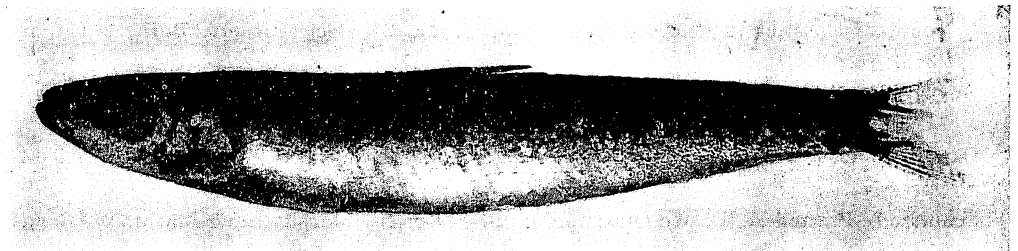


Fig. 2. *Spratelloides delicatulus* (Bennett), 44 mm. in standard length.

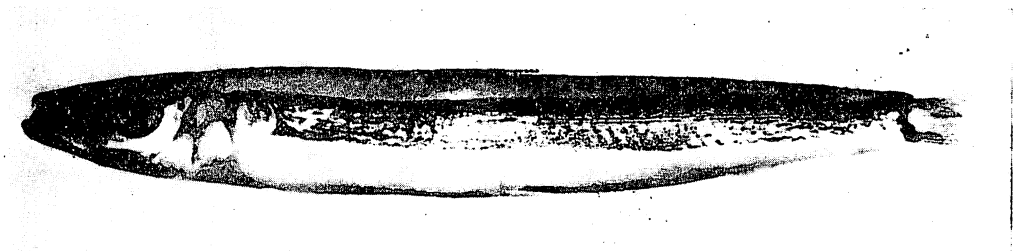


Fig. 3. *Spratelloides japonicus* (Houttuyn), 61 mm. in standard length.

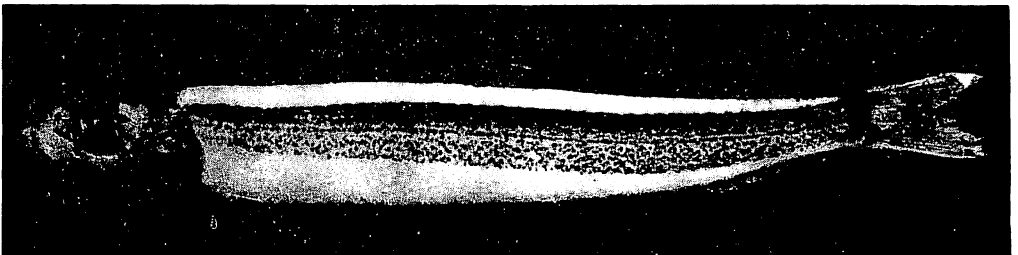


Fig. 4. *Spratelloides atrofasciatus* Schultz, 40 mm. in standard length.