

# SQUIDS FOUND IN THE STOMACH OF SPERM WHALES IN THE NORTHWESTERN PACIFIC\*

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## ABSTRACT

The squids obtained from the stomachs of sperm whales caught off Joban, the northwestern Pacific in November, 1972 were examined. It was found that the squids were the most important food for sperm whales in this sea area. The species found were *Moroteuthis robusta*, *Gonatus* sp., *Gonatopsis borealis*, a member of Gonatidae, *Ommastrephes bartrami* and *Histioteuthis dofleini*.

## INTRODUCTION

It is well known that squids are the important food for sperm whales, *Physeter catodon* (Linnaeus).

Omura (1950) and Mizue (1951) also reported that squids were the most important for the food of sperm whales in the waters adjacent to Japan. Ishikawa and Wakiya (1914) reported a gigantic squid, *Moroteuthis robusta* (Verrill), from the stomach of a sperm whale caught "in the open sea off the south of the strait of Tugaru" in August, 1911.

The specimens of squids in the stomachs of eight sperm whales caught in the waters off Joban in November, 1972 were examined. Here this report deals with the result of identification of these specimens.

## MATERIALS

The present samples were collected through the surveys carried out at the whaling station in Ayukawa in November, 1972.

The field observations were made on all sperm whales caught, and the contents of stomachs were classified into squids, fish and others. The observation was made on the first stomach contents. The squids were preliminary classified into A, B, C, D, E and F, and a part of samples were preserved in 10% formalin water to be brought home for close examination.

The localities of the capture of the sperm whales observed are shown in Fig. 1.

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\* Contribution from Tokai Reg. Fish. Res. Lab., B628.

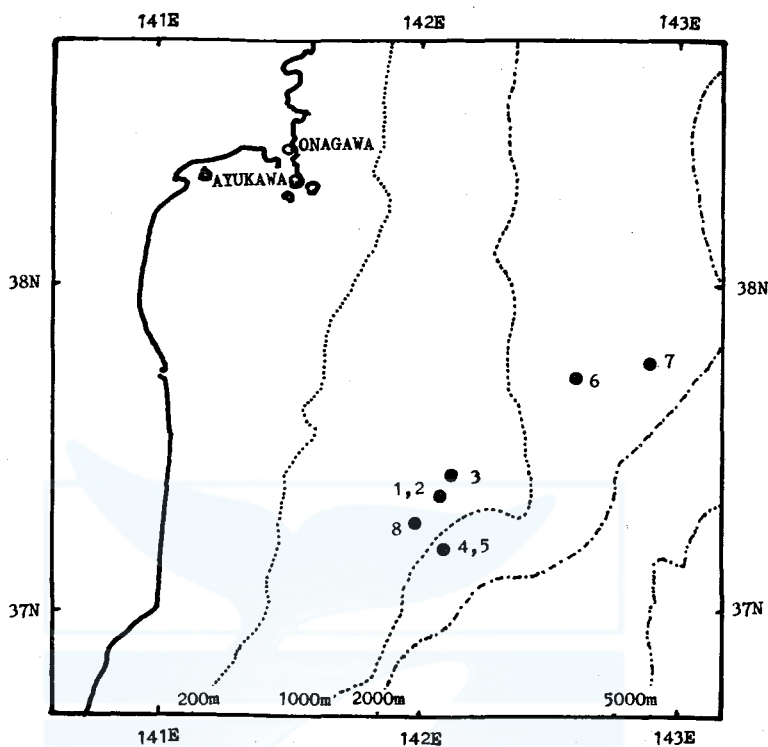


Fig. 1. Localities of catch of sperm whales off Joban, the northwestern Pacific. Numerals in the figure suggest the animals given in Table 1.

#### SYNOPSIS OF THE SPECIES IDENTIFIED

The species of squids are shown in Table 1. On the basis of the samples brought to the Whales Research Institute, each group was found to be composed of the species as follows:

A: *Histioteuthis dofleini* (Pfeffer, 1912)

B: *Moroteuthis robusta* (Verrill, 1876)

Gonatidae (species is unknown)

*Gonatus* sp.

*Gonatopsis borealis* Sasaki, 1923

E: *Moroteuthis robusta* (Verrill, 1876)

F: *Ommastrephes bartrami* (Lesueur, 1821)

The exact identification for C and D could not be made, because no specimens of these two groups were brought home. The reason why only the Group B contained four species may be due to that they are much looked alike each other since specimens removed from stomach are so frequently badly mutilated and lost the characters such as hooks and suckers. Sometimes samples are only stripped mantles without arm-head part.

TABLE 1. SPERM WHALES OBSERVED AND THEIR STOMACH CONTENTS

No.	Date of capture	Locality of capture	Sperm whale		Stomach contents			Species of squid
			Sex	Body length	Kind (Group)	Quantity	Freshness	
1	14 Nov. '72	37-21 N 142-04 E	Female	11.3 m	Squid (A)	rr	ff	<i>Histioteuthis dofleini</i> (Pfeffer)
2	" "	" "	"	10.2	" (B)	rrr	fff	<i>Moroteuthis robusta</i> (Verrill) <i>Gonatopsis borealis</i> Sasaki
3	16 "	37-24 N 142-07 E	Male	9.5	" (AB)	rrr	fff	<i>Moroteuthis robusta</i> (Verrill) <i>Histioteuthis dofleini</i> (Pfeffer)
4	" "	37-11 N 142-05 E	Female	11.4	" (AB)	rr	ff	Gonaidae (species is unknown) <i>Histioteuthis dofleini</i> (Pfeffer)
5	" "	" "	"	10.9	" (AB)	rrr	ff	<i>Gonatus</i> sp. <i>Gonatopsis borealis</i> Sasaki <i>Histioteuthis dofleini</i> (Pfeffer)
6	20 "	37-49 N 142-36 E	Male	10.8	" (ABCD)	rrr	ff	<i>Moroteuthis robusta</i> (Verrill)
7	23 "	37-46 N 142-52 E	"	12.3	" (E)	r	ff	<i>Moroteuthis robusta</i> (Verrill)
8	24 "	37-16 N 141-59 E	Female	10.1	" (F)	rr	ff	<i>Ommastrephes bartramii</i> (Lesueur)

Remarks) R, rrr, rr and r indicate the relative quantity in decreasing order.

F, fff, ff and f indicate 4 grades of freshness in decreasing order.

## OEGOPSIDA

## Onychoteuthidae

*Moroteuthis robusta* (Verrill, 1876)

This species was found in the stomachs of four of eight sperm whales.

The specimens brought home were measured about 43.5 cm, 30 cm, 26.5 cm, *ca.* 80 cm and *ca.* 90 cm. The last two specimens are only of very large broken mantles like waste pieces of cloth. But, characteristic warty sculptures of the integument showed that they belong to *M. robusta*.

## Gonatidae

*Gonatius* sp.

This species was found in the stomach of only one of eight sperm whales. The dorsal length (on only remaining portion) was measured 12 cm, but the gladius length was 16.5 cm. The specimen has very long tentacles of about 30 cm (right) and 28 cm (left) long. Both of them have a single large hook on their club. This is decidedly one of a species so far called *G. fabricii* (Lichtenstein, 1818) (Plate I, fig. 1).

*Gonatopsis borealis* Sasaki, 1923

This species was found in the stomachs of two of eight sperm whales. The mantle of one specimen without head and arms is about 26 cm long and has a large rhombic fin (length: *ca.* 10.5 cm, width: *ca.* 16 cm). The posterior end of the mantle is obtuse (Plate I, fig. 2). The mantle of the other specimen is about 22.5 cm long and the width and the length of the fin is about 16 cm and 8 cm respectively. The ends of the both sides of the fin are deformed to be sharp as shown in Plate II, fig. 1. The mantle and fin might have shrunk lengthwise in formalin water. Arm formula is 3, 2, 1≐4. From the characters of general shape, skin and mantle cartilage these specimens were identified to be this species.

A member of Gonatidae, the species of which is unknown

A specimen of only mantle of about 14 cm long was found from the stomach of a sperm whale. It has no fin, which seems to have been attached to the posterior part of the mantle. It has no character for identification to species, but seeing from its shape and the feature of muscle, it seems to belong to Gonatidae (Plate II, fig. 2).

## Ommastrephidae

## Ommastrephinae

*Ommastrephes bartrami* (Lesueur, 1821)

This species was found in the stomach of only one of eight sperm whales. The specimen is lacking in head and arms. The mantle is about 40.5 cm long and has a muscular and rhomboidal fin of *ca.* 15.5 cm long and 25.5 cm wide (Plate III, fig. 1). The inverted T-shaped funnel elements of the mantle-funnel fusion are easily separated from the mantle elements. A lot of photogenic tissues are observed in the ventral integument of the mantle.

## Histioteuthidae

*Histioteuthis dofleini* (Pfeffer, 1912)

Nine specimens from the stomachs of four of eight sperm whales were examined, the dorsal mantle length of which measured from about 6.5 cm to about 12 cm. The neck is separated from the mantle. Arms have no hooks, the both sides of the fin attached to the posterior part of the mantle are muscular and convex. All specimens have tentacles missing. Because of numbers of photophores over the surface of the mantle, head and arms, these specimens were easily discriminated to belong to Histioteuthidae. The final identification to the species was made because of the triserial photophores on the arm IV and the shape of the funnel organs (Plate III, fig. 2).

## THE OCCURRENCES OF SQUIDS

Among the sperm whales caught off Joban and Sanriku and dissected at the whaling stations at Onagawa and Ayukawa in November, 1972, 65 whales were observed of their stomachs, all of which had only squids. Though the number of samples may not be large enough for discussing the important species as food for sperm whales, *Histioteuthis dofleini* and *Moroteuthis robusta* might be considered the most important for this sea area (Table 1). The members of Histioteuthidae have not been reported as the food for the sperm whales in the North Pacific, but were reported numerically dominantly in the diet of sperm whales from the Azores Region (R. Clarke, 1956) and Madeira (M. R. Clarke, 1962). The members of Onychoteuthidae have already been reported as the most important food for sperm whales in the waters adjacent to the Aleutian Islands (Okutani and Nemoto, 1964: *M. robusta*), off central California (Rice, 1963: *M. robusta*) and in the Antarctic (Korabelnikov, 1959: *Onychoteuthis banksii*). The members of Gonatidae also seem to be important as the food for sperm whales in the waters off Joban, because Beteshava and Akimushkin (1955) and Sleptozov (1955) reported that the members of Gonatidae are the most important diet of sperm whales in the Kuril waters. Okutani and Nemoto (1964) also found considerable number of Gonatid family in the sperm whale's food

in the Bering Sea and the northern North Pacific. This time *Ommastrephes bartrami* was found in the stomach of one sperm whale. It is noteworthy that this species has not hitherto been reported as the food for sperm whales before the present finding.

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## EXPLANATION OF PLATES

## PLATE I

- Fig. 1. *Gonatus* sp., gladius length 1.65 cm.  
Fig. 2. *Gonatopsis borealis*, dorsal mantle length ca. 26 cm.

## PLATE II

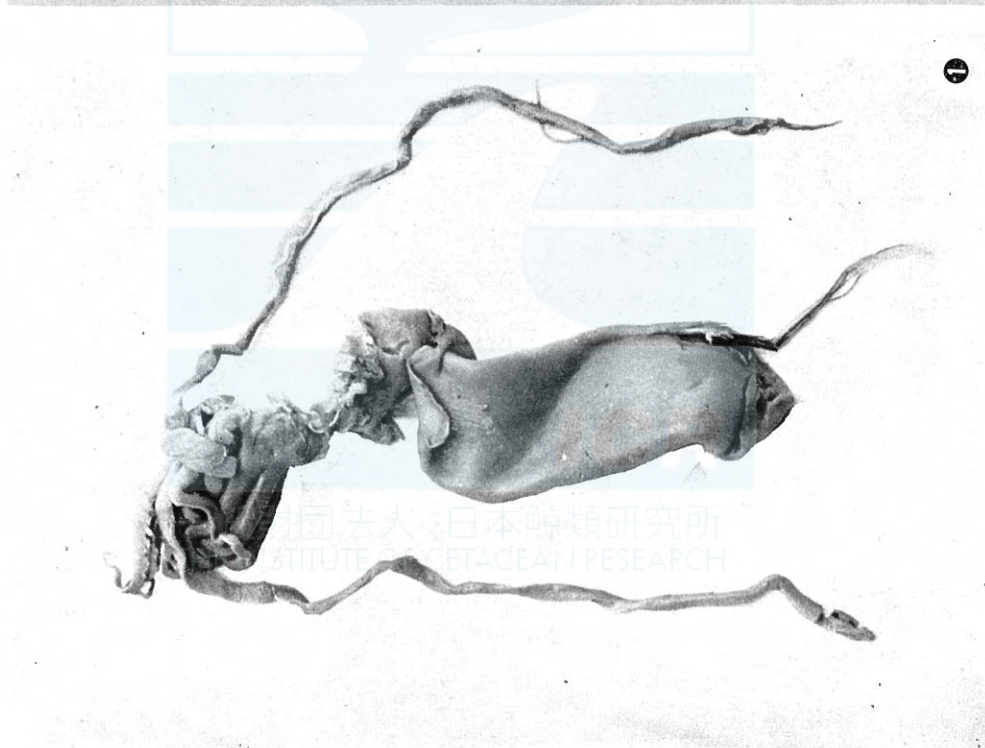
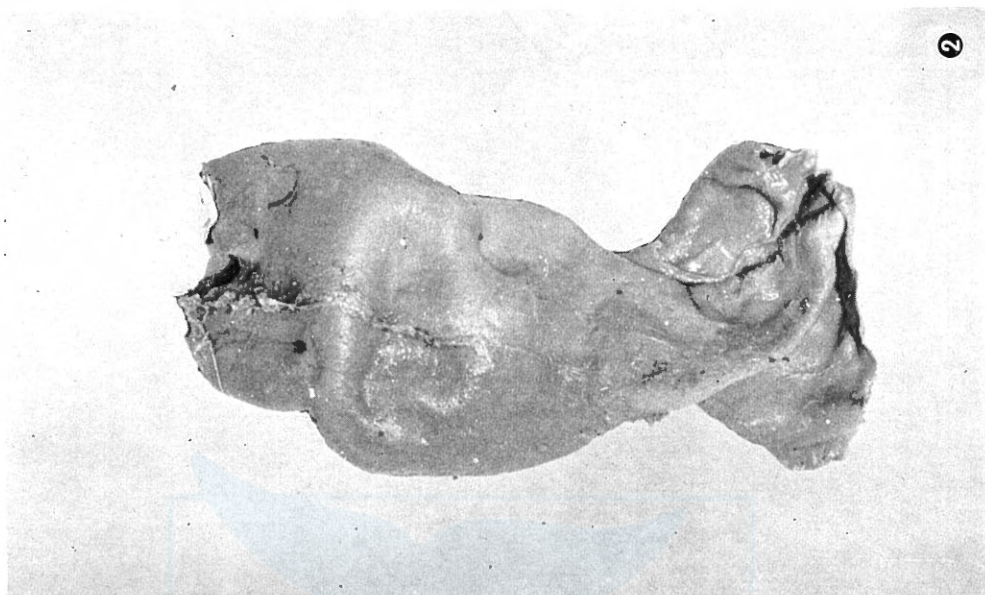
- Fig. 1. *Gonatopsis borealis*, dorsal mantle length ca. 22.5 cm.  
Fig. 2. A member of Gonatidae, dorsal mantle length ca. 14 cm.

## PLATE III

- Fig. 1. *Ommastrephes bartrami*, dorsal mantle length 40.5 cm.  
Fig. 2. *Histioteuthis dofleini*, dorsal mantle length ca. 12 cm.



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