

Body Size of Short-finned Squid *Illex illecebrosus* Larvae in the Northwest Atlantic*¹

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The body sizes at early stages of short-finned squid *Illex illecebrosus*, Family Ommastrephidae, in the Northwest Atlantic were described based on 565 individuals of larvae and juveniles collected by R/V KAIYO MARU during January–March 1982. The size ranges at Rhynchoteuthion and transition stages were 1.6–5.7 mm and 4.0–8.2 mm in dorsal mantle length (DML), and change-overs from Rhynchoteuthion to transition stages and from transition to juvenile (post-Rhynchoteuthion) stages occurred at the lengths about 5 mm and 7 mm DML, respectively.

The short-finned squid *Illex illecebrosus* (LESUEUR) is widely distributed in the Northwest Atlantic. This squid is one of the important species to the domestic fisheries of both Canada and the U.S.A. and is also important for the foreign fleets such as from Japan, U.S.S.R., Cuba and so on. The fisheries for this species have developed since the early 1970's with a peak catch of 180,000 metric tons in 1979,¹⁾ but the catch has decreased remarkably in recent years due to the poor recruitment especially in Canadian waters.

A considerable amount of biological information on this species has been obtained.^{2–9)} However, most of the information is concerned with the animals in young and adult stages, and the knowledge of spawning ecology and larval stage is still insufficient.

For the purpose of obtaining information on short-finned squid in the spawning and larval periods, a Japan/Canada/U.S.A. joint survey was conducted on board the research vessel KAIYO MARU (2,540 GRT) during January–March 1982. In the present paper, the body size at early stage of short-finned squid is described based on the specimens collected during the joint survey.

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Materials and Methods

The Japan/Canada/U.S.A. joint squid survey was composed of two cruises, the first from 16 January to 5 February 1982 and the second from 11 February to 5 March 1982. A total of 91 bongo net (Model 1971, 0.5 mm mesh) tows was made in the waters off Canada and the U.S.A. (Fig. 1). Details on the methods and operations of the survey were already described in the cruise report.⁹⁾

Collected samples were preserved in the 5% formalin solution. The catch in one net of every tow (a bongo sampler is composed of two same sized nets) was deposited in Far Seas Fisheries Research Laboratory, Japan and the catch by other net was shared between Canadian and American scientists. Materials used in this paper were those stored in Far Seas Fisheries Research Laboratory.

Rhynchoteuthion type larvae and juvenile squids were sorted from the bongo net samples, and were identified to species according to Roper and Lu⁹⁾ based primarily on the characters of suckers on the tip of rostrum-like tentacle, absence of photophore both on the eye and the liver, and the shape of the liver. A total of 565 individuals were identified as *Illex illecebrosus*. The classification of stages was also based on Roper and Lu,⁹⁾ viz. Rhynchoteuthion having complete rostrum-like tentacle, transition having a split at the base of rostrum-like tentacle (though this stage is included into Rhynchoteuthion in *sensu lato*) and juvenile (post-Rhynchoteuthion) having completely splitted tentacles.

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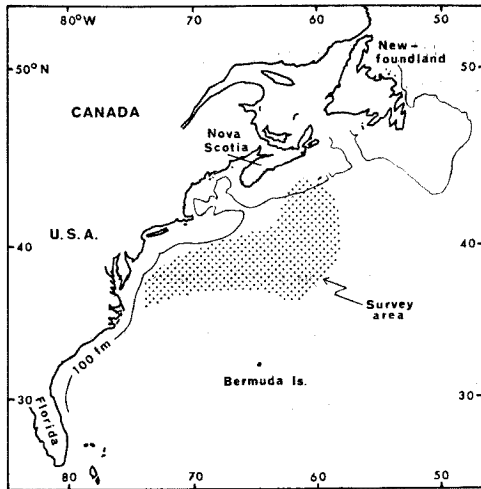


Fig. 1. The survey area of the Japan/Canada/U.S.A. joint squid survey by R/V KAIYO MARU, January–March 1982.

The method of measuring the dorsal mantle length (DML) and head width (HW) is shown in Fig. 2. The mantles of specimens used frequently transformed into obese shape, and so-called "Prerhynchoteuthion", in which the head and arms are withdrawn into the mantle cavity,¹⁰⁾ often occurred. Consequently, DMLs of only 93 individuals (16% of total specimens used) could be measured. Although the degree of protuberance of eye varied from specimen to specimen, the posterior part of head just behind the eyes was scarcely transformed. Therefore, the head width between eyes, a conventional method of measuring, was thought to be unapt, and the width of the head just behind the eyes was measured. The HWs of 549 among 565 individuals could be measured (Table 1). The HW was used as a basic length for the analyses, and the conversion from HW to DML was made by means of a regression equation between HW and DML which obtained

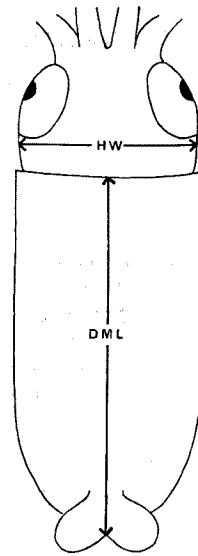


Fig. 2. The measurements of dorsal mantle length (DML) and head width (HW).

from 92 specimens.

Results

On the basis of measurements on specimens in good shape, the relationship between head width and dorsal mantle length was plotted in Fig. 3, and an equation obtained is as follows:

$$DML = 1.57 \times HW^{1.35} \quad r = 0.97$$

where the unit of lengths is mm and r is the correlation coefficient in the logarithmic linear equation.

The size compositions by stage are shown in Fig. 4. Although a sufficient number of specimens is not available for juvenile stage, the lengths by stage are summarized in Table 2. The changeovers from Rhynchoteuthion to transition stages and from transition to juvenile stages occurred at about 2.4 mm HW (5 mm DML) and about 3.0 mm (7 mm), respectively.

Table 1. Number of specimens measured the dorsal mantle length (DML) and/or head width (HW)

Length measured	Stage			Total
	Rhynchoteuthion	Transition	Juvenile	
DML	47	39	7	93
HW	428	110	11	549
Both DML and HW	46	39	7	92
Both unmeasurable	15	—	—	15
Total specimens	444	110	11	565

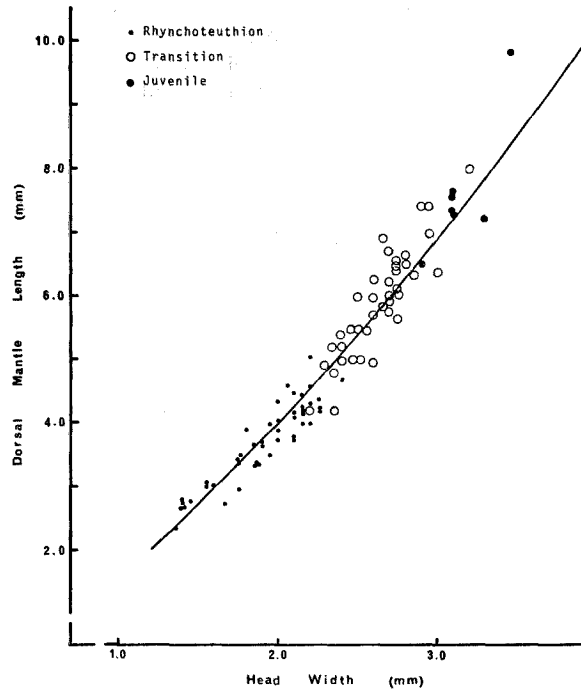


Fig. 3. The relation between head width and dorsal mantle length in the early stages. The regression curve is shown in the figure.

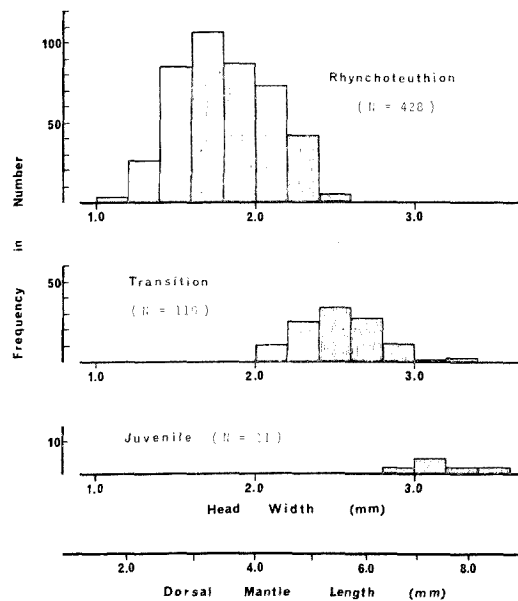


Fig. 4. The size compositions by stage. N denotes the number of specimens used.

Table 2. The lengths (mm) by stage. DMLs are converted from HWs by the regression equation between HW and DML

Length		Stage		
		Rhyncho- teuthion	Transition	Juvenile
Range	HW	1.0-2.6	2.0-3.4	Over 2.8
	DML	1.6-5.7	4.0-8.2	Over 6.3
Mean length	HW	1.8	2.5	—
	DML	3.5	5.4	—
Critical length*	HW		2.4	3.0
	DML	about 5	about 7	

* the length at which the numbers of individuals in adjoining stages are nearly equal.

Discussion

Roper and Lu⁵⁾ described the larvae and juveniles of *Illex illecebrosus* based on 14 specimens from the western North Atlantic. However, the larvae of a closely-related and partially sympatric species, *Illex oxygonius* which is found in the coastal waters from New Jersey to Florida, has not yet been clarified. As far as the larvae used in the present study are concerned, there is no indication that more than one species of larvae are mixed together. As all of the specimens were taken from the offshore waters far northeastward of the known range of *I. oxygonius*, the larvae used are regarded as *I. illecebrosus*.

The mantle length is a basic length for biometrical studies on cephalopods. The mantle was, however, so vulnerable that was frequently transformed in the specimens under study, and consequently mantle length was unmeasurable in 84% of specimens. Head width is, therefore, more practical and reliable for length measurement at least in formalin-fixed larval and early juvenile specimens of this species.

Durward *et al.*⁵⁾ found that newly hatched larvae of this species were about 1 mm DML, and size ranges and changeover sizes in Rhyncho-teuthion to transition stages were reported in the

present paper. In consequence, the body size in the period from the hatch to the beginning of juvenile was observed.

Okutani and Watanabe¹¹⁾ reviewed the reported changeover sizes from transition to juvenile stages for *Todarodes pacificus*, and pointed out the large individual variation from 6.0 mm to 15.5 mm DML by observer. In the case of *Illex illecebrosus*, it was in a narrower range from about 6 mm to 8 mm DML so far observed. However, as the observed specimens larger than 8 mm DML were not sufficient in number, it might not be conclusive whether this species has a wider size range of changeover or such a narrow range here reported is a specific character different from *T. pacificus*.

References

- 1) NAFO: Statistical Bulletin. Vol. 29 for 1979, NAFO, Dartmouth, 1981, pp. 94-95.
- 2) N. Black, T. Amarutunga, and R. K. O'Dor (ed.): *Fish. Mar. Service Tech. Rep.*, No. 833, 1.1-27.19 (1978).
- 3) E. G. Dawe, P. C. Beck, H. J. Drew, and G. H. Winters: *J. NW. Atl. Fish. Sci.*, 2, 75-76 (1981).
- 4) E. G. Dawe, M. C. Mercer, and T. Threlfall: *NAFO S.C. Studies*, No. 7, 77-86 (1984).
- 5) R. D. Durward, E. Vessey, R. K. O'Dor, and T. Amarutunga: *ICNAF Sel., Pap.*, No. 6, 7-13 (1980).
- 6) Japan Fisheries Agency: Survey report on the Japan/Canada/U.S.A. joint survey on short-finned squid in the Northwest Atlantic by R/V KAIYO MARU in January-March 1982. Japan Fisheries Agency, Tokyo, 1982, pp. 1-72 (in Japanese).
- 7) R. K. Mohn: *NAFO S.C. Studies*, No. 3, 47-52 (1982).
- 8) C. F. E. Roper and C. C. Lu: *Proc. Biol. Soc. Wash.*, 91, 1039-1059 (1979).
- 9) H. J. Squires: *J. Fish. Res. Bd. Canada*, 24, 1209-1217 (1967).
- 10) S. Hayashi and S. Iizuka: *Bull. Fac. Fish. Nagasaki Univ.*, No. 1, 1-7 (1953).
- 11) T. Okutani and T. Watanabe: *Kaiyokagaku*, 9, 278-285 (1977).