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First data on ovary maturation and fecundity in the squid family Histioteuthidae*

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SUMMARY: The potential fecundity of histioteuthid squid ranges from 3,000 to 275,000 oocytes. During maturation a significant oocyte resorption occurs in many species; therefore only advanced maturing females can be taken into account for fecundity estimation.

Key words: Histioteuthidae, fecundity, maturation.

INTRODUCTION

The histioteuthid squids are a mesopelagic family inhabiting all the world oceans from Sub-Arctic to Sub-Antarctic waters. Their systematics and biology were recently revised (Voss *et al.*, 1998). No data exist on patterns of gonad maturation and fecundity, except the description of a single mature female of *Histioteuthis bonnellii* in which the number of eggs was estimated by means of external gonad measurements (Kristensen, 1980). This study aims to shed some light on the reproductive biology of this poorly known family.

MATERIAL AND METHODS

Seventeen females of six histioteuthid species were collected on board several Russian research vessels and the Falkland Islands' P/V "Dorada". Three females of *Histioteuthis atlantica* (Hoyle, 1885) of mantle length (ML) ranging from 81 to 86 mm were caught on the Falkland shelf. Two females of *H. bonnellii* (Férussac, 1834) (ML 83-149 mm) were from the Moroccan slope and the Northwest Atlantic. Six females of *H. eltaninae* N.Voss, 1969 (ML 35-115 mm) were collected in the Southwest Atlantic. One female of *H. arcturi* (Robson, 1948) (ML 40 mm) was sampled in the Northwest Atlantic. Two females of *H. meleagroteuthis* (Chun, 1910) (ML 77 - 84 mm) were caught in the east tropical Atlantic, and three females of *H.reversa* (Verrill, 1880) (ML 37-138 mm) were collected in the Northwest Atlantic.

The ML of sampled individuals was measured to the nearest 1 mm. The body weight (BW) and ovary weight were estimated to the nearest 0.1 g. To estimate the oocyte number in the ovary (the potential fecundity: PF), three 50-100 mg samples (in immature animals, 10-30 mg) were taken from different

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parts of the gonad. The total number of oocytes in the ovary was considered to be the potential fecundity (PF). It was possible to count all oocytes in the samples, as the diameter of oocytes was larger than 0.05 mm. All oocytes were measured without any selection of the longest or shortest oocyte diameter: the micrometer was placed in a horizontal position in the eye-piece and the diameter parallel to the graduation on the micrometer was measured. Females with only protoplasmic oocytes in the ovary were considered immature, whereas if some yolk oocytes were present they were assumed to be maturing.

RESULTS

H. eltaninae. The PF of the three smallest females (35-87 mm ML) was 21,300-26,800 oocytes. In the two larger females (both 105 mm ML) the PF was 7,500 and 8,700 oocytes. Such significant decreases were caused by the resorption of protoplasmic oocytes. In a few protoplasmic oocytes observed in larger females the nuclei were not seen within, and the outer oocyte membranes had shrunk, forming numerous folds. The largest female (ML 115 mm) had no oocyte smaller than 0.6 mm, and the PF was 3,100 oocytes. All oocytes were at the stage of yolk accumulation, most of them measuring 1.0-1.4 mm (Fig. 1).

H. atlantica. The PF of three maturing females was 4,900-6,700 oocytes. The highest values (6,300 and 6,700) were found in the less advanced females, with oocytes of 0.6-0.7 mm predominating. A small number of protoplasmic oocytes were at a stage of degeneration. The lowest PF value was found in the most advanced female (ML 86 mm, oocytes of 0.9 mm predominating). The maximum oocyte size was 1.2 mm. A few degenerating protoplasmic oocytes were still present. This female was mated: one spermatophore was found on the right oviduct.

H. bonnellii. The PF of two immature females was estimated as 255,000 (ML 83 mm) and 275,000 (ML 149 mm). Oocyte size was 0.1-0.3 (mode 0.2) and 0.1-0.5 (mode 0.3) mm respectively. No oocyte degeneration was noticed.

H. arcturi. The PF of the immature female was about 200,000 oocytes of about 0.1 mm.

H. meleagroteuthis. The gonad of a maturing female (ML 84 mm) contained 60,000 oocytes of the same size: 0.38-0.40 x 0.43-0.45 mm, with no smaller or larger oocytes present. The ovary of another female (ML 77 mm) contained about 20,000 oocytes of 0.35-0.70 (mode 0.50) mm. No oocyte degeneration was noticed in either squid.

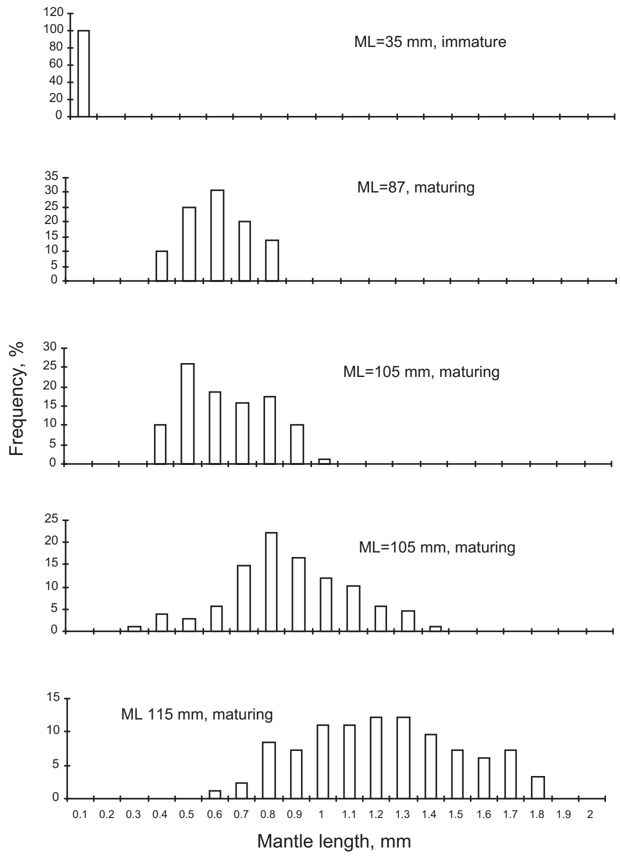

FIG. 1. – Oocyte size distribution in the ovaries of five *Histioteuthis eltaninae*

H. reversa. The PF of two immature squids (ML 37 and 39 mm, all oocytes of about 0.1 mm) was estimated as 64,000 and 39,000 respectively. The ovary of the third female measuring 138 mm ML contained 45,000 oocytes of 0.2-1.2 mm. Twelve ripe eggs were found in the oviducts; they had a size of 1.5-1.6 x 1.6-1.7 mm, a mean weight of 1.6 mg, and no maturing oocytes larger than 1.2 mm (Fig. 2).

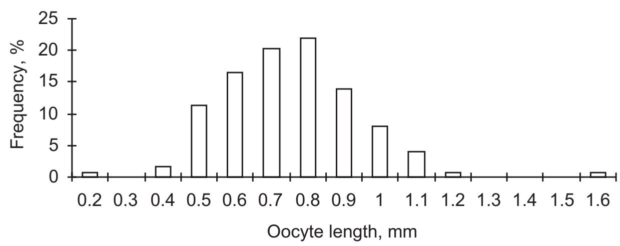

FIG. 2. – Oocyte size distribution in the ovary of a spent (?) *Histioteuthis reversa*. Oocyte of 1.6 mm is a ripe egg.

Thus, a significant gap in size existed between them and the ripe eggs. This indicates that the female was spent rather than maturing, as the continuous size range of the yolk oocytes to ripe eggs seen in maturing squid of any other family was not present. No copulation traces were noticed.

DISCUSSION AND CONCLUSIONS

The data presented here are few and fragmentary, but show some interesting aspects regarding histioteuthid reproductive biology. The lowest fecundity of a few thousand oocytes was found in two of the three species inhabiting the Southern Ocean (there are no data on the third species, *H. macrochista*). In immature *H. eltaninae* the PF is much higher than in maturing squid, because during maturation the oocyte number probably decreases seven to nine fold. Such intensive oocyte resorption has not been observed in any other squid species. A similar degeneration was also noticed in another subantarctic species, *H. atlantica*.

Due to this factor only advanced maturing histioteuthid females should be taken into account for fecundity estimation in future investigations.

H. reversa is the third reprentative of the "*H. reversa* species group", which also includes *H. atlantica* and *H. eltaninae* (Voss *et al*., 1998). The PF of this species is evidently higher than in the two other species. During maturation oocyte degeneration is presumed to be absent, because the PF of immature and spent females was similar, with no resorption of oocytes found. We lack sufficient data to judge the actual fecundity, but it could be as low as that of the other two species.

The highest values of the PF (255,000-275,000) were found in immature *H. bonnellii*. This contrasts with the imprecise estimation of that observed earlier in a single mature female - 20,000 (Kristensen, 1980). Despite all the inaccuracy of the last estimation, this huge difference could probably be explained either by oocyte resorption at maturation or by ripe egg release at spawning.

The ovaries of *H. eltaninae* showed almost simultaneous growth of all oocytes (excluding degenerating ones), with a gradual increase of their modal size. It may well be that the same type of ovary development occurs in *H. meleagroteuthis* as well as in other histioteuthids. The ovary development observed in Histioteuthidae is similar to the "frontal type of ovary development" found in some Antarctic squids (Piatkowski *et al*., 1997), cold-water octopodids (Laptikhovsky, 1999), and onychoteuthid squid *Moroteuthis ingens* (unpubl. data). This is quite different from the well-studied squid families Loliginidae, Ommastrephidae, Enoploteuthidae and Gonatidae. Probable reasons for this similarity are the cold-water environment and spawning patterns when a female is unable to lay more than one egg batch.

Mated females have been found in only two histioteuthid species, *H. hoylei* and *H. celetaria*. In *H. hoylei* and *H. celetaria pacifica* the spermatophores were found attached inside the mantle cavity, whereas in *H. c. celetaria* they were found embedded on the external mantle surface (Voss *et al*., 1998). As in the first two histioteuthids, in *H. atlantica* a spermatophore was found inside the mantle cavity.

Thus, the Histioteuthidae family appears interesting and unusual in terms of its reproductive biology, and promises some surprising discoveries in the future.

REFERENCES

Kristensen, T.K. – 1980 Large mature female of *Histioteuthis bonnellii* (Ferussac, 1835) (Mollusca: Cephalopoda) recorded from the Davis Strait, West Greenland. *Steenstrupia*, 6 (7): 73-79.

Laptikhovsky, V.V. – 1999. Fecundity and reproductive strategy of three species of octopods from the northwest Bering Sea. *Russian J. Mar. Biol*., 25 (4): 342-347. (In Russian with English summary).

Piatkowski, U., P.G. Rodhouse, and Ch.M. Nigmatullin. – 1997. A hypothesis of reproductive strategy in antarctic squids. Cephalopod biodiversity, ecology and evolution: International Symposium and Workshops. 31 August - 14 September, South African Museum, Cape Town, South Africa. Programmes and Abstracts: 73.

Voss, N.A., K.N. Nesis and P.G. Rodhouse. – 1998. The cephalopod family Histioteuthidae (Oegopsida): Systematics, biology, and biogeography. *Smith. Contrib. Zool*., 586 (II): 293-372.

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