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FIRST RECORD OF PREDATION BY A TOMPOT BLENNY ON THE COMMON CUTTLEFISH *SEPIA OFFICINALIS* EGGS

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PREDATION
EGGS
PARABLENNIUS GATTORUGINE
SEPIA OFFICINALIS
CEPHALOPODS

ABSTRACT. – We present for the first time evidences of predation on black, ink-stained eggs of the cuttlefish *Sepia officinalis*. Observations were carried out in the Ría de Vigo (NW Spain) at a depth of 10 m, in late April 2010. The behavior was photographed. The predator was a Tompot blenny *Parablennius gattorugine*. The fish attacked a cuttlefish egg mass laid on a Podweed (*Halydris siliquosa*). Cuttlefish embryos were in a late stage of development. The blenny behavior is described. How the fish was able to discover potential prey items in the egg capsules is discussed. We suggest that cuttlefish embryos at late developmental stages are also able to recognize potential predators during the perinatal period and avoid them after hatchling.

INTRODUCTION

Sepia officinalis L., 1758 is abundant in the Ría de Vigo (NW Spain) where it lives and achieves its whole life cycle supporting a small scale fishery (Guerra and Castro, 1988; Rocha *et al*., 2006). In this estuary the species inhabits predominantly sandy and muddy bottoms from the coastline (2-3 m depth) to approximately 60 m depth; it is exposed to hydrologically unstable conditions, and because of this *S. officinalis* is relatively tolerant to variations in salinity (Guerra, 2006).

S. officinalis generally lays its eggs in shallow waters at depths rarely greater than 30 or 40 m. Each egg is fixed by means of a ring-shaped basal structure of the envelope. To produce this ring the animal draws with its arm tips the gelatinous envelope of the egg into a pair of processes and winds them round the support so that they stick together. *Sepia* eggs are thus attached to various plants, sessile animals like tubeworms, to *Sepia* eggs deposited earlier, and to dead structures such as sunken trees, cables or netting (Boletzky 1983). Recently, a seahorse (*Hippocampus ramulosus*) was observed swimming along with two cuttlefish eggs attached to its tail near the Toralla beach within the Ría de Vigo (M Garcia Blanco pers com)

Freshly laid eggs are very soft and gelatinous. The spirally coiled envelopes are stained black with ink. Subsequent shrinkage and hardening of the outer jelly coat produces a globular shape. The minimal diameter then is about 1 cm for a total length of 2 cm (without the fixating ring). During later embryonic development, the still elastic envelope is dilated by the chorion which expands due to the osmotic pressure of the perivitelline fluid (Lemaire 1971, Boletzky 2003). The envelope reaches a maximum diameter of about 1.5 cm by the time of hatching. Sometimes eggs are not stained with ink and the envelopes become perfectly transparent when stretched by the expanding chorion. Embryonic development is not influenced by the lack of pigmentation in the envelopes (Boletzky 1983). Obviously, the biological role of these "obstructive" covers is to protect the embryos against microbial attack and predation, and to provide a physical and chemical buffer between the immediate microenvironment of the embryo and the surrounding milieu (Boletzky 2003).

Predation can be assumed to be the major cause of mortality at all stages. No form of egg care has ever been observed in *Sepia* species (Hanlon & Messenger 1996). To avoid predation at the egg stage females of the broadclub cuttlefish *Sepia latimanus* seek out coral crevices of the exact dimensions to protect eggs from predation by chaetodontid fishes (Corner & Moore 1980). The pharaoh cuttlefish *S. pharaonis* in the Arabian Sea also protect their eggs against predation by using suitable crevices; fishes of the families Chaetodontidae, Balistidae, Monacanthidae and Zanclidae have been observed preying upon eggs (Gustal 1989). In the golden cuttlefish *S. esculenta*, the eggs are deposited with a sticky clear surface that accumulates sand or other adventitious material for crytic coloration (Natsukari & Tashiro 1991, Hanlon & Messenger1996, photo 5.4 Hanlon).

The aim of this note is to document for the first time that predation on *S. officinalis* eggs has been observed.

MATERIAL AND METHODS

The photographs on which the results are based were obtained with scuba-diving in the Ría de Vigo on 04/24/2010 at 12:00. The depth at which they were taken was 10 m. The camera was a Nikon F4S. The film was VELVIA 50 ASA. The *S. officinalis* eggs had been laid on a Podweed (*Halydris siliquosa*).

RESULTS AND DISCUSSION

Figure 1 shows the sequence of a successful attack of the Tompot blenny *Parablennius gattorugine* on a *S. officinalis* egg mass.

All the eggs were stained black with ink. Their size (2.4-2.8 cm) indicates that embryos were an advanced stage of development, close to hatching. After more than 20 years diving we thought that the eggs of *S. officinalis* were protected from any predator due to this black coloration concealing the embryos. In other words the ink serves in this case as visual defense. Moreover, the ink of *S. officinalis* contains millimolar levels of total free aminoacids (FAA) and ammonium in these secretions, and the

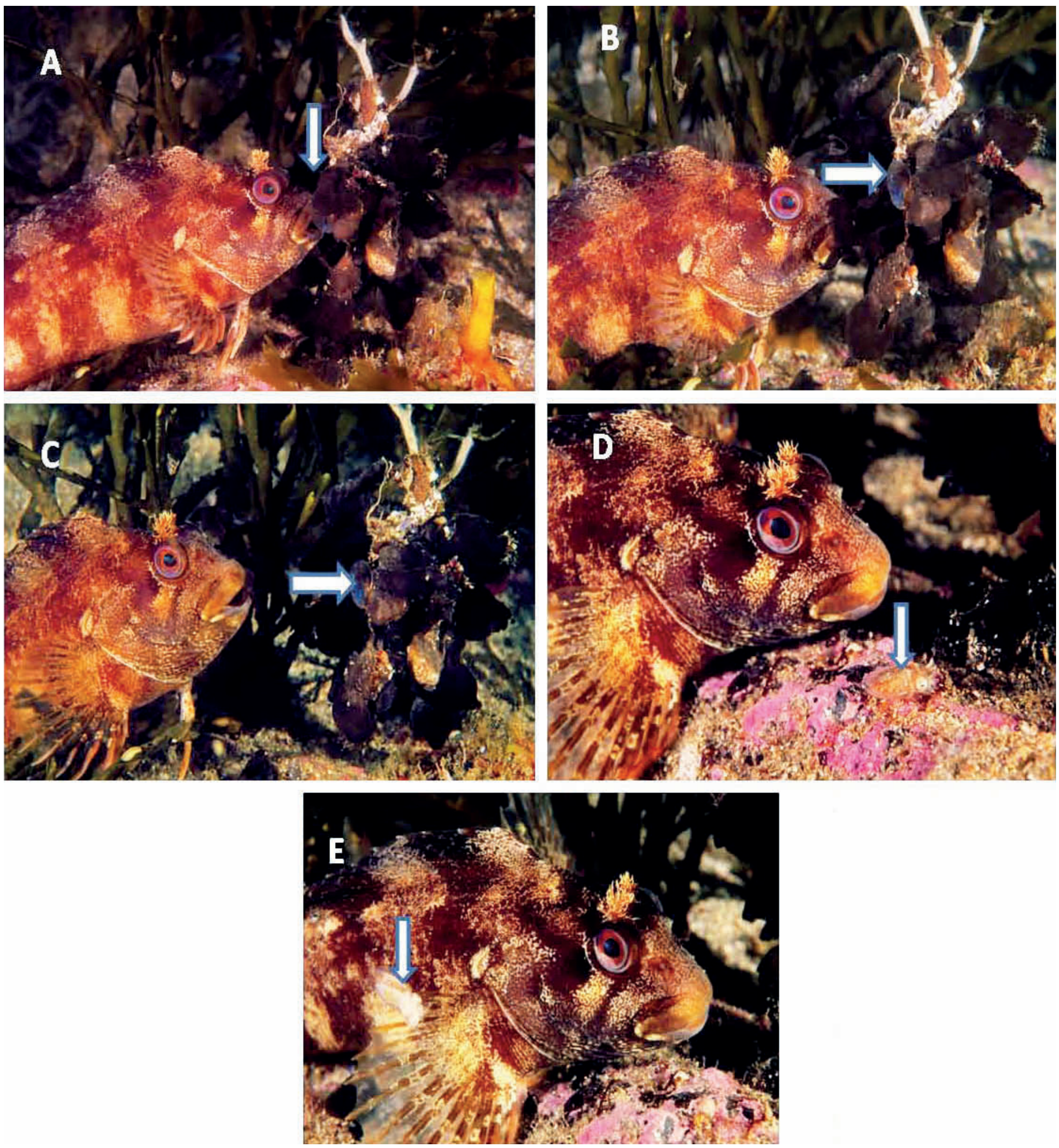

Fig. 1. – Sequence showing a successful attack of a Tompot blenny *Parablennius gattorugine* on a mass of eggs of *Sepia officinalis*. The fish approached the mass of eggs with the mouth directed to one of the eggs (A, arrow). Once having seized the egg, the blenny began to pull on it strongly up to breaking the thick outer capsule, leaving the chorion exposed (B, arrow). The fish has pulled off an egg of the cluster and the egg, which still preserves its typical black coloration, is in the mouth of the fish (C, arrow a). There is also one egg whose black outer capsule has completely disappeared (C, arrow b). The attempts to eat the prey are not always successful. The arrows in D and E show a newly hatched cuttlefish that escaped from the mouth of the blenny.

Fig. 2. – Egg of *Sepia officinalis* at a late stage of embryonic development (Photo by John Neuschwander)

FAA in highest concentration were taurine, aspartic acid, glutamic acid, alanine, and lysine, which could be used for sensory disruption (Derby *et al.* 2007).

The Tompot blenny approached the mass of eggs without any hesitation, with the mouth directed to one of the black eggs (Fig. 1 A). Eggs of *S. apama* are white in colour, and as the embryo develops, the egg expands, becomes more translucent and often discoloured (Cronin & Seymour 2000). The eggs of *S. latimanus* as well as the eggs of *S. pharaonis* do not contain ink and are translucent (AG pers obs). Therefore, butterflyfish, bannerfish and coralfish (Chetodontidae), triggerfishes (Balistidae), and moorish idols (Zanclidae) can easily distinguish the embryos inside the egg capsules, and although their diet is not mainly composed by embryos of cuttlefish (see for example Hobson, 1974 in the case of *Zanclus cornutus*), they can be a usual and/or accidental prey when feeding mainly on coral reefs, which are the suitable places for the spawning of the three above mentioned *Sepia* species (Norman 2000). However, how the Tompot blenny recognized the ink stained *S. officinalis* eggs as a potential food is not yet known. Nevertheless, as during late embryonic development the elastic envelope is dilated (Boletzky 1983) and becomes more transparent (Fig. 2), it could be that the blenny sees the embryos of the cuttlefish, already perfectly formed within the eggs, and recognizes them as a potential prey. The results obtained by Darmaillacq *et al.* (2008) showed that the visual system of *S. officinalis* embryos in the last stages of development is functional and efficient enough to perceive the shape of a potential future prey through the egg envelope. The authors showed that cuttlefish from eggs exposed to crabs subsequently preferred crabs whether the egg envelope was intact or not, which means that the envelope does not prevent the embryos from perceiving the immediate surrounding environment. These authors have shown for the first time that cognitive processes occur in cuttlefish embryos and emphasized a continuity of the interactions between the organism and its environment during the perinatal period. To perceive visually and to process and learn particular characteristics of prey present in the vicinity of the eggs may confer important adaptive advantages to *S. officinalis* (Darmaillacq *et al.* 2008). Female cuttlefish generally lay their eggs in shallow water (Boletzky 1983), and may choose places where newly hatched juveniles can easily find potential prey. The ability to learn the visual characteristics of the prey in ovo would facilitate postnatal imprinting on this kind of prey. We suggest that late-stage embryos of cuttlefish are also able to recognize potential predators during the perinatal period and avoid them after hatching. However, further experiments need to be carried out to test this hypothesis.

Once having seized the egg the blenny began to pull on it strongly to break the thick outer capsule, leaving the chorion exposed (Fig. 1 B). The Tompot blenny have powerful teeth to crush winkles or mussels but they also feed on soft anemones (Fish DataBase page of the British Marine Life Study Society, www.glaucus.org.uk/tompot.htm). The tropical species of fish that were found preying upon egg masses of other *Sepia* species, also have powerful teeth and their diet spectra are broad being mainly composed by benthic invertebrates, including bivalves molluscs, sea urchins, sponges, coral polyps and sea anemones (see Fish Data Base http://www.fishbase.org/).

Fig. 1 C shows that the fish has pulled off an egg of the cluster and that the egg, which still preserves its typical black coloration, is in the mouth of the fish. There is also one egg whose black outer capsule has completely disappeared.

The attempts to eat the prey are not always successful. Figs 1 D and E show that a newly hatched cuttlefish has escaped from the mouth of the blenny.

Finally, if the cuttlefish is capable of seeing and learning when it is still inside the egg capsule (Darmaillacq *et al.* 2008), the blenny could also see the almost fully developed cuttlefish embryos from outside, when the egg's envelopes become sufficiently transparent. That scenario can allow the blenny to distinguish a developed embryo as a prey from previous experiences in which it had fed on hatched cuttlefish, mainly because there are not differences in morphological traits nor in basic chromatic pattern between fully developed embryos of *S. officinalis* and newly hatched animals (Boletzky 1983, Hanlon & Messenger 1996). However, the eggs of cuttlefish not always are semitransparent before hatching. In that case, the blenny might have learned also, from its own experience or copying the behaviour of others, that a black opaque grape-shape egg hides a suitable prey. These are only assumptions and appropriate experiments would need to test this hypothesis.

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