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Double Eggs of Pharaoh Cuttlefish, *Sepia pharaonis* Ehrenberg, 1831

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The normal egg capsule of sepiid cuttlefish contains one embryo. in contrast to capsules with many embryos. as those of the loliginid squid. The sepiid egg capsules are attached in clusters to the substratum by the female. A single capsule is globular with a tip and a stalk. The egg stalks are attached to rod and ribbon-shaped or flat substrata. The color of the egg capsule varies among species. It is black in *Sepia officinalis* Linnaeus, 1758 (Boletzky, 1983) and *Sepiella inermis* Ferrussac & d'Orbigny, 1848 (Nabhitabhata et al., 1984); and white in the pharaoh cuttlefish, *Sepia pharaonis* Ehrenberg, 1831 (Nabhitabhata, 1978). The egg capsule of the pharaoh cuttlefish grows larger and more transparent and fragile by absorbing seawater in concert with the embryonic development reaching its largest size near the time of hatching (Figure 1). The embryonic period is 9–25 days, average 14.3 ± 3.0 days at about 28°C. The hatchling is benthic, with an average 7.7 mm mantle length and 0.18 g fresh wet weight (Nabhitabhata & Nilaphat, 1999).

A total of 26 double egg capsules with two embryos in one egg capsule was observed in only one among several egg clusters collected from the wild in February

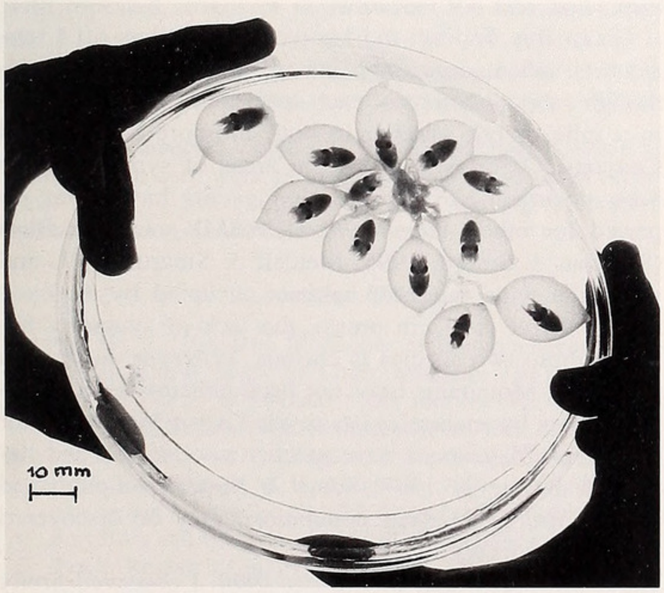

Figure 1. Normal egg capsules of the pharaoh cuttlefish at pre-hatching stages.

Figure 2. The double egg capsules; the upper three capsules with normal development and the lower two with abnormal development.

1997. They were the bycatch of squid traps operating nearshore in the eastern part of the Gulf of Thailand, South China Sea. The shape and size of the double egg capsules are not different from the normal ones. The chorion of each embryo forms a thin layer inside the egg capsule, transversely dividing the capsule into two separated chambers. One embryo occupied one chamber, indicating that the two embryos had originated from different eggs, hence they are not true twins (Figure 2). The two embryos developed independently although following similar embryonic stages. Abnormal development was observed in either one (four capsules) or both of the embryos (two capsules) (lower right in Figure 2). The incubation period of the eggs and the size of hatchlings were similar to the normal ones. The cause of spawning the twins was unknown because the spawner was not collected. The acceleration of egg release relative to capsule formation might be the consequence of the rising temperature of the water body due to the El Niño and La Niña during the observed period. Although it was the winter in Thailand during that period, the temperature did not fall as usual. The seawater temperature was about 29°C, whereas the normal temperature is usually around

26°C. The effect of temperature on the size of the hatchlings may have been different from that reported in *Loligo pealei* by McMahon & Summers (1971).

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Comments on the Natural History of the *Ashmunella* (Gastropoda: Pulmonata: Polygyridae) of White Sands Missile Range (New Mexico, USA) and Fort Bliss (New Mexico and Texas, USA)

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Land snails of the genus *Ashmunella* Pilsbry & Cockerell, 1899, located on White Sands Missile Range (WSMR; New Mexico, USA) and Fort Bliss (New Mexico and Texas, USA) represent relict taxa that display a marked pattern of endemism and exist in fragmented subpopulations. As a result of military security (both installations are closed bases with restricted entry), the malacofauna of WSMR and Fort Bliss have been little studied (Metcalf & Smartt, 1977; Metcalf & Smartt, 1997; Kroll et al., in press), and mostly with regard to distribution and systematics. However, a 2 year field study and a comprehensive risk assessment analysis of *Ashmunella* populations have been completed (Boykin et al., 2001; Kroll et al., in press), allowing for a better understanding of the ecology and distribution of these threatened taxa. Four of the resulting findings are presented here.[1]

Ashmunella harrisi Metcalf & Smartt, 1977, is known to occur in only two unnamed canyons that drain the east face of Goat Mountain, San Andres Mountains, WSMR. Shells of this species have been found at only six localities, and live specimens are known only from Metcalf & Smartt (1977). On 27 July 1999, I found one live *A. harrisi* at an isolated site (the type locality; Metcalf & Smartt, 1977) in the southern canyon, and on 26 September 1999, I found six live *A. harrisi* at an isolated site in the northern canyon. Despite extensive searching on repeated occasions, I found no live *A. harrisi* at the other four localities, nor did I find evidence that other populations existed in nearby locales. This section of WSMR is within a live-fire range, and target debris is found in habitats occupied by this species. *Ashmunella harrisi* is the most restricted in distribution of the taxa under consideration, and the species appears to be extremely rare. Careful consideration of military activities and close monitoring of subpopulations (specific recommendations are made by Boykin et al., 2001) may be required to prevent extinction of this species.

Vagvolgyi (1974) placed the type locality for *Ashmunella auriculata* Vagvolgyi, 1974, in Boulder Canyon, Organ Mountains, Fort Bliss. Metcalf & Smartt (1997) thought this locality was in error because they had found *A. auriculata* only in the northern Organ Mountain and the only species that had been found on their visits to Boulder Canyon was *Ashmunella organensis* Pilsbry, 1936. However, on 18 September 2000, I located *A. auriculata* shells at three different localities in the upper reaches of Beasley Canyon, which lies due north of Boulder Canyon over a low ridge. In addition, live specimens were located at one of these localities. However, no specimens, live or dead, were located in Boulder Canyon proper. Thus, Vagvolgyi's type locality seems only to be imprecise, and not inaccurate.

Given this finding, the known distributions of *A. auriculata* and *A. organensis* are of particular interest. Although subpopulations of each species can be found within a mile of one another in both Fillmore and Soledad Canyons, Organ Mountains, no areas of sympatry have been documented. Hybridization events have been reported for other *Ashmunella* of WSMR and Fort Bliss (Sullivan & Smartt, 1995; Metcalf & Smartt, 1997) and given the wide range of habitats occupied by *A. organensis* (Kroll et al., in press), the lack of sympatry between these two species is curious. However, surveys in the Organ Mountains have not been exhaustive (e.g., despite visits by malacologists to the Organ Mountains for well over 75 years, a new species was located and described as late as 1997; Score & Metcalf, unpublished manuscript) and hybrid populations may be discovered by future workers.

On 25 August and 27 August 1999, I observed firefly larvae (Coleoptera: Lampyridae) feeding on *Ashmunella kochii kochii* Clapp, 1908. The conditions were overcast

[1] Voucher specimens of all taxa discussed here were deposited with Dr. Art L. Metcalf, University of Texas–El Paso.