

Spawning of *Holothuria tubulosa* (Holothurioidea, Echinodermata) in the Alboran Sea (Mediterranean Sea)

La freza de *Holothuria tubulosa* (Holothurioidea, Echinodermata) en el Mar de Alborán (Mar Mediterráneo)

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The spawning process has been described for different species of Holothuroids from several seas around the world. This process has been observed in the environment (natural spawning) and also in the laboratory, where it has been induced to achieve fertilization, embryonic development and the subsequent cultivation of Holothuroids for commercial purposes (Battaglione, 1999). Induced spawning for commercial purposes has been carried out on several occasions, especially in India (Asha & Muthiah, 2002) and Taiwan (Chen & Chian, 1990; Chao *et al.*, 1995).

In the Mediterranean, and specifically in *Holothuria tubulosa* Gmelin, 1788, the spawning phenomenon has been observed before in the Adriatic Sea (Despalatovic *et al.*, 2004) and on the Spanish Mediterranean coast of Costa Brava (Valls, 2004).

Holothuria tubulosa is one of the most abundant species of the Mediterranean coast. It lives on rocky substrata, soft sediments and phanaerogam seagrass beds, in depths that vary between 5 m and 100 m. The size of the body of *H. tubulosa* reaches a length of up to 35 cm and a width of 8 cm. Its body is dark brown, although sometimes it is seen with a grayish colour since its epidermis secretes a protective mucous film, often incrustated with particles of sediment or algal remains. It is common to find this film deteriorated and in the areas of deterioration the typical body colour can be seen. When the species is found in the environment in its normal

physiological position, the characteristic conical papillas, which appear in the bivio, are clear, but not especially distinct.

H. tubulosa, as most of the species of Holothurioidea, has separate sexes, although without sexual dimorphisms, and fertilization is external. It has an annual reproductive pattern, in which different phases of gonadal development are differentiated: reabsorption of the gonad after the post-spawning period; gonad recovery stage; growing stage; maturity stage, spawning stage and post-spawning stage (Despalatovic, *et al.*, 2004).

In August, 2003, during the full moon on August 11th and 12th (see Figure 1), at different times in the afternoon, from 4 to 6 h solar time, different individuals were observed in the spawning position. Observation of the phenomenon was carried out in the areas of Cantarriján (La Herradura, Granada, Spain) with U.T.M. coordinates 30SVF3066 and Los Peñones del Santo (Playa de S. Cristóbal, Almuñécar, Granada, Spain) with U.T.M. coordinates 30SVF3866. The water temperature ranged from 24 to 25 °C.



Fig. 1.—Lunar phase for the days when the spawning phenomenon was observed and the days before and after.

Fig. 1.—Fase lunar de los días en los cuales la freza fue observada, así como los días previos y posteriores..

During the period of time when this phenomenon was observed on the Granada Coast (Alboran Sea), it was possible to observe individuals who had changed their typical position, in which all of the ventral surface is in contact with the substratum, to the spawning position. In this position, only the lower ventral half of the body or up to the last third of the body maintains contact with the substratum and the rest of the body stays upright (see Figure 2). In this position, the oral surface, where the genital orifice is located, is as far as possible from the substratum and this proves to be the most efficient position for gaining maximum dispersion of the gametes. In this position, the dorso-lateral papillas of the bivio appeared much clearer and the body surface did not have a mucous film.

We observed individuals that released a homogenous whitish fluid from their genital orifice (which we consider to be male) and one that spilled



Fig. 2.—*Holothuria tubulosa* male during the spawning process.

Fig. 2.—Macho de *Holothuria tubulosa* durante el proceso de freza.

a somewhat denser fluid from its genital orifice and that seemed to have more difficulty in expelling it (probably a female). The observations were carried out in shallow water (between 5 and 7 m). Although no quantitative data were taken, the fact that the males were in larger proportion makes us to assume that their release of sperm into the environment might induce the nearby females to spill their eggs into the water as it is known to occur with other Holothuroidea, e.g., *H. atra* (Asha & Muthiah, 2002). Furthermore, during the hours of observation, some individuals still remained in the normal physiological position, which makes us to assume that the phenomenon takes place over several days.

According to the data taken from Despalatovic *et al.* (2004), the average time for gamete release lasts 20-30 minutes and the environmental factors necessary for the phenomenon of spawning are fundamentally high water temperature, the existence of favourable currents for gamete dispersal and the presence of a full moon.

Our observations of spawning in *H. tubulosa* agree with previous records. For *H. tubulosa*, Valls (2004) indicates that the spawning phenomenon occur from two days before until four days after the new moon. In the Mediterranean Sea, the spawning phenomenon occurs during the summer months, specifically between July and September in the Adriatic (Despalatovic *et al.*, 2004). According to this author, temperature is probably one of the most important factors in determining the period of reproduction.

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