An association between a liparid fish species and the stone crab *Lithodes tropicalis* (Decapoda, Anomura)

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Fish eggs, thought to be those of the liparid fish, *Careproctus griseldea*, were found in the gill chambers of several specimens of the stone crab, *Lithodes tropicalis*, caught in deep-water (~600 m) off the South West African/Namibian coast (~24°46'S/13°28'E). The size class and quantity of crabs involved in this symbiotic relationship are discussed and some observations are made as to the diameter, number and maturity of the fish eggs removed from the crabs.

Viseiers, vermoedelik van die liparidvis *Careproctus griseldea*, is gevind in die kieuholtes van verskeie eksemplare van die klipkrap *Lithodes tropicalis*, gevang in diep water (~600 m) teenoor die kus van Suidwes-Afrika/Namibië (~24°46'S/13°28'O). Die grootteklas van die krappe en die hoeveelheid wat by hierdie simbiotiese verhouding betrokke is, word bespreek, en daar volg enkele opmerkings oor die deursnee, aantal en rypheid van die viseiers wat van die krappe verwyder is.

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Clusters of fish eggs were inadvertently discovered in the gill cavity of a stone crab *Lithodes tropicalis* A. Milne Edwards, 1883, captured off South West Africa/Namibia during October 1980. This phenomenon was observed during sampling of stone crabs undertaken to monitor populations of *L. tropicalis*, since the fishery based on this species had suffered a collapse owing to heavy commercial exploitation that had taken place between November 1979 and April 1980 (Melville-Smith 1982). The fishery had been aimed at large-sized crabs, with those smaller than approximately 102 mm being returned live to the sea. This stock of *L. tropicalis* was previously documented by Kensley (1980), Melville-Smith (1982) and MacPherson (1983) as *Lithodes murrayi* Henderson, 1888, but has since been reidentified as *L. tropicalis* (Abello & MacPherson 1986; E. Dawson, D.S.I.R., Wellington, New Zealand, pers. comm.) The crabs containing fish eggs were caught using beehive traps at approximately 24°46'S/13°28'E, at depths of between 600 and 620 m.

Further crabs were then examined for fish eggs in their gill cavities during October 1980 and September 1981, to determine what portion of the crab population was involved in this relationship.

Of the 152 crabs examined, ranging in size from 76 to 160 mm carapace length (measured from the tip of the most anterior spine to the posterior edge of the cephalothorax), only males of 110 mm and larger were found to have fish eggs present in the gill chamber (Table 1, Figures 1 and 2). The mean size of the six crabs containing eggs was 126 mm, compared with a combined population sample mean for the two cruises of 98 mm. It would therefore appear that the fish responsible for depositing its eggs in the crab's peribranchial cavity selectively choose the larger sized crabs, and since females seldom exceed 105 mm carapace length, it may be assumed that under normal conditions they seldom, if ever, carry these fish eggs.

The number of crabs found to be carrying fish eggs (Table 1) may have been higher than in a crab population that had not been subjected to fishing pressures. The fishery had resulted in an imbalance in the size structure of the population (Melville-Smith 1982), thus leaving fewer large sized male crabs available to the spawning fish. The crab fishery could thus also have had an indirect effect on the successful breeding of this liparid fish.

In all cases in which crabs carried these fish eggs, only one gill chamber was occupied by the egg masses. It is thus unlikely

Table 1 Numbers of male and female stone crab examined for a presence of fish eggs during October 1980 and September 1981

	October 1980		September 1981	
Sex and size	Total	Number with eggs	Total	Number with eggs
Males ≥ 110 mm	25	5	45	1
Females ≥ 110 mm	–	–	–	–
Males < 110 mm	27	–	–	–
Females < 110 mm	8	–	–	–

Figure 1 Lateral view of the peribranchial cavity of *L. tropicalis* dissected, showing the position and size of the fish egg mass in relation to the size of the cavity.

Figure 2 Anterior view of *L. tropicalis* with most of the carapace removed. Note the egg mass occupies the space normally taken by the gills, and the gills are displaced.

that the eggs are drawn into the crab's gill cavity by means of its respiratory current, as the eggs would then surely enter both cavities. Similarly, the eggs would not be cemented together into a compact mass. This points to the probability of direct spawning by the fish into the gill cavity — presumably by means of an ovipositor. Unfortunately no record was kept as to whether the gill chamber of one side was favoured over the other. It would appear, however, that a mechanism may exist that prevents the fish from spawning eggs in both gill chambers of the crab. Such a mechanism would serve to prevent undue stress being placed on the respiratory system of the crab, a problem that might result if both gill chambers were occupied by fish eggs.

The egg masses removed from the gill chambers of the crabs occupied a considerable volume (up to approximately 92 cm^3) and contained an estimated 200 to 1 500 eggs. The individual eggs were large (0,42 to 0,45 mm diameter), almost spherical and were cemented together. Figures 1 and 2 show the crab carapace cut back to expose the peribranchial cavity. The greater portion of the cavity is occupied by fish eggs and the gills can be seen to be compressed and misshapen by the mass of eggs displacing them.

The fish eggs were at different stages of maturity even within a single cluster. Later stage embryos with pigmented eyes were removed from one cluster and were identified as belonging to the family Liparidae.

The occurrence of clusters of fish eggs of a liparid fish (*Careproctus* sp.) in the peribranchial cavity of male king crab (*Paralithodes camtschatica*) has been reported from the North Pacific by Rass (1950), Vinogradov (1950) and Hunter (1969). This type of relationship has subsequently been recorded between several species of *Careproctus* and other members of the crab family Lithodidae. These include the reports of Parrish (1972) (*Careproctus melanurus* and *Lopholithodes foraminatus* from California), Peden & Corbett (1973) (*Careproctus* sp. and *Lopholithodes foraminatus* from British Columbia) and Balbontin, Campodonico & Guzman (1979) (*Careproctus falklandica* and *Lithodes antarctica*, and *Careproctus* sp. and *Paralomis granulosa* from Chile).

According to Stein (1986), there are three liparids which have been recorded from South West Africa/Namibian waters, namely *Careproctus griseldea* Lloris, 1982, *Paraliparis australis* Gilchrist, 1904 and *Paraliparis wilsoni* Richards, 1966. Of these species, *C. griseldea* (which may prove to be a junior synonym of *C. albescens* Barnard, 1927) appears most likely to be responsible for the egg masses in *L. tropicalis*, as it has been recorded from the same area and depths as those in which *L. tropicalis* is most abundant and where the crab specimens carrying the fish eggs were sampled (Lloris 1982; Melville-Smith 1982). *Paraliparis wilsoni* and *P. australis* are recorded from further north, the former in deeper water than where *L. tropicalis* is abundant. It should be noted, however, that relatively little is known about the liparids and their distribution off South West Africa/Namibia.

There are obvious advantages to the fish in depositing its eggs in the peribranchial cavity of the crab, as the eggs are protected from predators and at the same time are well aerated. Although the gills of the crab are compressed, this compression is slight and the 'host' individuals show no other signs of being placed at a disadvantage. Until such time as further sampling and study of this phenomenon show definite disadvantages to the crab, we choose to refer to the association between these two species as a symbiotic (*sensu lato*) relationship.

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