LIFE HISTORY CHARACTERISTICS OF *LITHODES FEROX* (ANOMURA: LITHODIDAE) OFF NAMIBIA

Lithodes ferax (Filhol) is a deep water anomuran crab that lives on the upper continental slope off West Africa. It constitutes an important by-catch of the demersal hake fishery (Abelló and Macpherson, 1986) and of the red crab trap fishery (Melville-Smith, 1982) in Namibia. Despite its abundance and its potential as a fishery resource, little is known of its biology and ecology.

L. ferox was sampled off Namibia in the Benguela upwelling region during ten fishery research cruises performed between 1983 and 1989 on board freezer-trawlers. The study area was between latitudes 23°S and 30°S and depths between c. 50 and 500 m. Some deeper trawls were occasionally performed. The area was divided into strata of one degree latitude and 100 m depth.

Sex, carapace length, presence of eggs or egg remains on the female pleopods, and occurrence of a rhizocephalan parasite were noted for all crabs. Occurrence of epibionts was also noted in some cruises. Sex-ratio analysis was performed when more than 10 individuals were caught in a trawl. Fecundity was calculated from recently extruded eggs from dry weight proportions.

Distribution

Some interesting features have been identified in the distribution patterns of *L. ferox*: (1) Occurrence of a seasonal bathymetric migration. The species rarely occurs at depths less than 400 m in summer, while there is a dispersion of the population towards shallower waters (<300 m) in winter. These movements appear to be related to: (a) The reproductive biology of the species: Almost all of the females occurring in the shallowest strata (300–400 m) in winter are ovigerous, the proportion clearly decreasing with depth; and (b) Upwelling-related hydrographic events. Oxygen levels on the bottom show seasonal decreases (Chapman and Shannon, 1985; Mas-Riera *et al.*, 1990). Lowest levels are found in summer. (2) Recruitment to the adult population takes place in deep water. Juvenile crabs are found almost exclusively in areas deeper than those inhabited by the adult population. The mean size of both males and females decreases with depth. (3) Sex-ratio patterns. Sex-ratio distribution shows a clear tendency for the species to form unisexual groups. Males tend to be captured with other males and females with other females.

Reproductive Biology

As stated above, the seasonal movements performed by the population can be partially considered as a reproductive migration. A high proportion of ovigerous females is found in all seasons. Most adult females are ovigerous. The size of female sexual maturity, calculated from the occurrence of ovigerous females, lies between 75 and 90 mm carapace length (CL). The number of eggs carried by ovigerous females is related to size and fluctuates between 2500 and 8000. The mean diameter of recently extruded eggs is 1.97 mm.

The patterns of epibiosis by the pedunculate barnacle *Poecilasma kaempferi* indicate several features related to the reproductive and moulting biology of the host: (a) different moulting patterns occur between the sexes; (b) the approximate size of puberty moult lies between 80–90 mm CL in males and between 70–80 mm in females; (c) males do not have a terminal moult; (d) females apparently have a terminal moult; (e) there is a close match of the ovigerous/size pattern with the epibiosis/size pattern.

Reproductive and epibiosis patterns suggest that (a) puberty moult coincides with terminal moult in females. This would imply (b) that females would accordingly only undergo one reproductive cycle.

A small proportion of adult crabs is infested by the rhizocephalan *Briarosaccus callosus*: 2.6% females and 4.3% males. These crabs are not able to reproduce.

Discussion

Several features of the life history of *L. ferox* may be inferred. Ovigerous females migrate in winter towards shallower (300–400 m) waters, where hatching presumably occurs. Larvae may then be carried to the surface by the upwelling waters and dispersed northwards and offshore by the Benguela current. Recruitment takes place in deeper waters, as happens in other deep-water crabs (Wigley *et al.*, 1975). As crabs grow they move into shallower waters, as shown by size frequency distributions and mean size per trawl. Adult crabs then segregate into unisexual groups in the main habitat (muddy bottoms, 300–500 m depth). In summer, the population moves into deeper waters, presumably in relation to the seasonal decrease in bottom oxygen levels.

Puberty moult apparently coincides with terminal moult in females, but not in males. Females could accordingly only undergo one reproductive cycle. A small part of the population is parasitized by a rhizocephalan and would not therefore be able to reproduce.

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