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The breeding season of *Coryphoblennius galerita* in Portuguese waters

V. C. Almada, H. Carreiro, C. Faria and E. J. Gonçalves

Unidade de Investigação em Eco-Etologia, Instituto Superior de Psicologia Aplicada, Rua Jardim do Tabaco, 44, P-1100 Lisbon, Portugal

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Coryphoblennius galerita at three sites on the Portuguese coast breeds from February/March to September/October.

Key words: Blenniidae; breeding season; latitudinal variation; littoral fish.

Coryphoblennius galerita (L.) is a widely distributed, rocky intertidal fish (Zander, 1986). It spawns demersal eggs that are cared for by the male until hatching (Milton, 1983). The breeding season of this species varies substantially with latitude: late June to early August on the south coast of the U.K. (Milton, 1983); April to August on the southwest coast of Ireland (Fives, 1980*a*); and April to September in Brittany, France (Fives, 1970). Observations of nests indicated that breeding lasts from March to September along the coast of mainland Portugal (Almada *et al.*, 1983), but there are no reliable quantitative data for this part of the species range. In this paper we present data on the breeding season of *C. galerita* in Portuguese waters, and compare the results with the information available for other parts of the species range.

Most data were collected near the mouth of the R. Tagus (Lisbon) (38°41′ N, 9°22′ W), between June 1991 and November 1994. The area surveyed comprises about 1 km of rocky shore. Additional data were collected between February and September 1993 at Cabo Raso (38°42′ N, 9°29′ W) and at Arrábida coast (38°28′ N, 8°59′ W).

Nests were located at low tide by inspecting small holes and crevices on exposed intertidal rocks. Only holes that contained, or had contained eggs, were classified as nests. The location of each nest was mapped for subsequent visits. All known nests were visited at approximately monthly intervals, and the presence of fish and/or eggs was recorded. From June 1993, 21 nests were inspected regularly, allowing a standardization of the observational effort. Since the eggs and nest are guarded by males (Fives, 1980*b*; Almada *et al.*, 1983), we assumed that males found together with eggs were breeding individuals.

Males of *C. galerita* were found guarding eggs in small holes or crevices in rocks at different levels in the intertidal zone. Visual observation of the nests indicate that they usually contained eggs in different stages of development, showing that males guard eggs spawned at different times. Regular monthly inspections of all known nests recorded eggs up to September in 1991, from March to September in 1992 and 1994, and from March to October in 1993 (Fig. 1).

Females with a red genital papilla, which in the related species *Salaria pavo* (Risso) indicates spawning (Patzner *et al.*, 1986), were found in tide pools only between March and September.

Six nests were found with eggs on 26/27 February 1993 at Cabo Raso. Thus, we conclude that breeding starts at the end of February/beginning of March and ends at the end of September/beginning of October along the Portuguese coast.

Few fish were found in the holes used as nests outside the breeding season. There was a significant positive correlation between the number of holes occupied by fish and the

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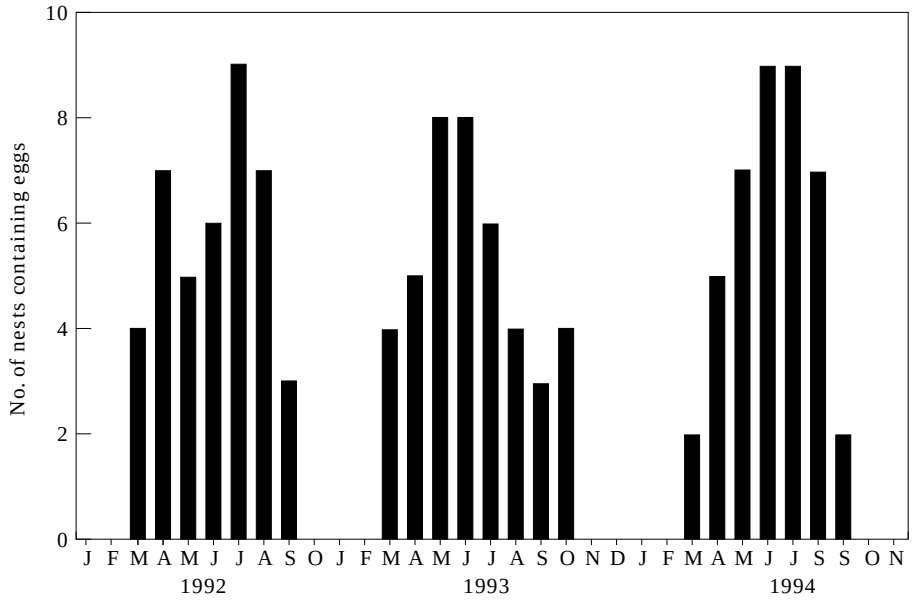

FIG. 1. Number of nests containing eggs during the years 1992, 1993 and 1994. The exact date for each month and the number of nests checked at each visit (*n*) was as follows: 1992: 22 Jan. (7); 21 Feb. (7); 19 Mar. (10); 17 Apr. (14); 16 May (14); 15 Jun. (15); 15 Jul. (18); 4 Aug. (18); 12 Sep. (18); 10 Oct. (18). 1993: 21 Jan. (20); 9 Feb. (20); 26 Mar. (20); 12 Apr. (20); 3 May (20); 2 Jun. (21); 4 Jul. (21); 1 Aug. (21); 4 Sep. (21); 2 Oct. (21); 28 Nov. (21); 30 Dec. (21). 1994: 26 Jan. (21); 24 Feb. (21); 15 Mar. (21); 24 Apr. (21); 24 May (21); 22 Jun. (21); 21 Jul. (21); 4 Sep. (21); 20 Sep. (21); 3 Oct. (21); 17 Nov. (21).

number of holes containing eggs (Spearman Rank Correlation: $r_s = 0{\cdot}801$, $P < 0{\cdot}001$, number of monthly visits = 23). These results suggest strongly that territorial defence of the nests is restricted to the breeding season, a situation that contrasts with the pattern of permanent territoriality of some tropical blenniids (Fishelson, 1975; Losey, 1976; Nursall, 1977; Phillips, 1977).

In this population most nests were used for periods that were much shorter than the breeding season as a whole. The duration of occupancy of both eggs and males in each nest varied (eggs: mean = 1·88 months, S.D. = 1·36, range 1–6 months; males: mean = 2·14 months, S.D. = 1·47, range 1–7 months) (data for 20 nests followed during 1993). Occupancy in six nests was intermittent, and in one nest a male was present even in months when there were no eggs in the nest.

The breeding season of *C. galerita* in different locations increases in duration from cooler to warmer waters. In Portugal, where temperatures are higher, breeding not only starts earlier (February/March) but it also ends later (September/October) than in the northern part of the species range. This difference is not due to methodological differences. Indeed, while for instance Milton (1983) based his results on the inspection of fish, our data are based on the occurrence of eggs in the nests. This method is likely to underestimate the onset and the end of the breeding season, when very few nests contained eggs. This means that, if anything, the breeding season in Portugal may be somewhat longer than reported here.

An increasing duration of the breeding season with decreasing latitude was found by several authors [e.g. Dahlberg & Conyers (1973) for fish of the Atlantic coast of the United States and Miller (1961) for west European species]. Conover (1992) argued that at high latitudes natural selection would favour fish that start to breed as soon as environmental conditions are favourable in order to maximize the size attained by juveniles when they reach their first winter. The onset and the end of the breeding season

of several western Atlantic species tend to occur at similar temperatures at different latitudes, leading to a marked reduction in the duration of the breeding season at higher latitudes (Conover, 1992). Miller (1961) also argued that latitudinal variation should be more pronounced for the beginning of the breeding season, since larvae that hatch late in the year should be subjected to unfavourable conditions in terms of reduced food availability and low temperature. This pattern was confirmed in *C. galerita*. Indeed, latitudinal variation is more pronounced at the onset than at the end of the breeding season.

These results stress the need for a more comprehensive comparative work on the breeding season of inshore fish along their geographical ranges.

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