

REPRODUCTIVE PATTERNS OF *POLLICIPES POLLICIPES* (CIRRIPEDIA: SCALPELLOMORPHA) ON THE SOUTHWESTERN COAST OF PORTUGAL

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ABSTRACT

The brooding period of *Pollicipes pollicipes* on the southwestern coast of Portugal in 1991 began in March and extended to October, and was more intense from April–September. Brooding activity in small animals (12.5–15 mm, rostracarinal distance, RC) was significantly less than in large animals (RC > 15 mm). Brooding activity patterns of this species were considered to be similar at different tidal levels and subtidally. Crowded animals brooded less than uncrowded animals, but results could have been confounded by the fact that only one site was considered. Individuals apparently produce asynchronous broods. Estimates of the annual number of broods varied between 1 (crowded animals), 1 or 2 (small, uncrowded animals), and 4 (large, uncrowded animals). Small animals (mean RC = 15.4 mm; 16,229 eggs) produced about half the number of eggs of large animals (mean RC = 19.6 mm; 34,172 eggs). Fecundity was considered to be a function of size (RC) (after logarithmic transformation; $r^2 = 0.62$). A variable number of eggs was produced by animals of the same size; animals with an RC from 23–25 mm ranging from 30,000–130,000 eggs per brood. Fecundity patterns were considered similar in relation to tidal level, crowding, and time in the reproductive season.

Pollicipes pollicipes (Gmelin, 1790) is generally found from Brittany (France) to Spain and Portugal into the Mediterranean (Algerian coast from Algiers westward; Catalan Bay (Gibraltar), and old references on the southern coast of Spain and France), and in northwest Africa down to Senegal (see extensive review of Barnes, 1996).

On the southwestern coast of Portugal, this species is abundant on very exposed rocky shores, ranging from shallow subtidal to mid-intertidal areas dominated by *Chthamalus montagui* Southward. *Pollicipes pollicipes* forms clumps of different sizes that are frequently damaged by man when harvesting this species. On this coast, it is the most important intertidal economic resource.

Temporal and spatial patterns of reproduction in barnacles have been mostly studied in acorn barnacles and the general factors explaining those patterns include sea-water temperature, light, feeding, age and size, and crowding, among others (see Barnes, 1989, for review).

Reproductive patterns of the genus *Pollicipes* have been described for *Pollicipes polymerus* Sowerby from North America (e.g., Hilgard, 1960; Cimberg, 1981; Lewis and Chia, 1981; Page, 1984, 1986) and recently in *Pollicipes pollicipes* from southwestern Europe (Barnes, 1992; Molares *et al.*,

1994b; Cardoso and Yule, 1995; Cruz and Hawkins, 1998).

Based on these studies and on preliminary observations, the following predictions were tested for *Pollicipes pollicipes* from the southwestern coast of Portugal: (1) the percentage of animals carrying egg masses (this is defined as brooding activity) is smaller in small (and probably younger), compared with large (and probably older) animals (e.g., Page, 1986); (2) brooding activity is more intense at low tidal levels and subtidally than at the midtidal level (more time to feed and more energy available for reproduction at low tidal level; e.g., Cimberg, 1981; Page, 1984); (3) brooding activity is less pronounced in crowded conditions [Barnes (1989) suggested that if breeding is connected with food supply, crowding, which may cause competition for a limited food supply, might be expected to reduce breeding in some way]; (4) broods are produced asynchronously (as *Chthamalus montagui*, *C. stellatus* (Poli), and other multiple brooders of warm waters; see Burrows *et al.*, 1992); (5) the number of broods will vary according to the previous patterns of brooding; (6) fecundity is lower in midtidal than in low tidal levels [the reproductive effort of *Pollicipes polymerus* increases with lower tidal level (Page, 1984)]; (7) fecundity is lower in crowded animals than in less