SHORT NOTE:

DIURNAL SPAWNING BEHAVIOUR IN THE NATTERJACK TOAD *BUFO CALAMITA*

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INTRODUCTION

Reproductive behaviour in the natterjack toad *Bufo calamita* is primarily a nocturnal activity, unlike the more diurnal common toad *B. bufo*. Spawning has occasionally been recorded is bright sunshine (Beebee, 1983) but the factors influencing such events have not been reported. Whilst investigating the population dynamics of this species at the Ravenglass dunes nature reserve it was noticed that diurnal spawning occurred more frequently at the beginning of the spawning season. Therefore during 1983 and 1984 attempts were made to quantify this observation and to relate it to climatic conditions prevalent at that time of year.

METHODS

The breeding pools were monitored on a regular basis, and the number of fresh spawn depositions recorded. The number of pairs still engaged in spawning behaviour during the day were also recorded. Water temperature data were obtained by placing a max-min thermometer at the edge of the most important spawning pools, with the results being gathered daily where possible. As this was not always attainable further climatic data (air temperatures) were obtained from the local meterological station — Eskmeals. Statistical methods were carried out according to Bishop (1980) and Bailey (1983).

RESULTS

During both years diurnal spawning did occur, with some pairs still engaged in this activity at 15.00 hours on 18.4.1984. Fig. 1 shows that this behaviour was restricted to the beginning of the spawning season. Maximum temperatures at this time were low, but as they increased so the number of daytime spawnings decreased. Although similar data for 1983 were less complete, no natterjacks were observed spawning after 25.4.1983. On those days when water temperature data were available, combining the results for both years, there was a significant negative correlation between the percentage of spawn strings laid diurnaly each day, and the maximum water temperature for the previous day ($r = -0.842$, $df = 13$, $P<0.001$ (after arcsin transformation). There was no such relationship with minimum water temperatures for the night on which spawning occurred ($r = 0.182$, $df = 13$, $P>0.1$).

DISCUSSION

Diurnal spawning only occurred at the beginning of the spawning season, and was clearly related to low maximum water temperatures of the previous day. A likely scenario would seem to be that the males gathered around the breeding pools before water temperatures became warm enough to permit calling. At this site males arrive at the breeding pools some time before calling commences. During 1983 the first males were present on day 76, 20 days before the first calling was heard (unpublished personal observations). Reproductive behaviour is dependent on water temperatures and in Poland Kowalewski (1974) stated that spawning did not occur when water temperatures were below 14°. At the start of the season the water temperature on an evening was just warm enough to allow calling for a short period, attracting a few females to the pool. After the animals paired up water temperatures dropped rapidly, preventing any further calling or spawning activity. The resulting pairs of toads were therefore unable to spawn until the following day when water temperatures began to rise again. Fig. 1 indicates that four days after the start of the 1984 spawning season maximum air temperatures increased greatly allowing spawning to be completed during the night.

There are advantages in breeding as early as possible, and at this site a majority of the females spawn at the beginning of the season (Banks and Beebee, 1986). Natterjack breeding sites are typically ephemeral (Beebee, 1979), and so the earlier the spawn is laid the greater the chances of the tadpoles metamorphosing before the pool desiccates. This advantage is partially offset by an increase in the risk of fungal infestation, which is more virulent during periods of cool weather (Beebee, 1979). In addition to this the adult toads themselves may suffer a greater risk from diurnal predators. On the north-west coast of England disembowelment by sea-birds has been reported to be a common cause of mortality to adult natterjacks during the spring (Beebee, 1979). This form of predation may be greater for pairs of natterjacks spawning during the day, as during early morning the torpid pairs of toads in their typically shallow unvegetated pools would be easy prey.

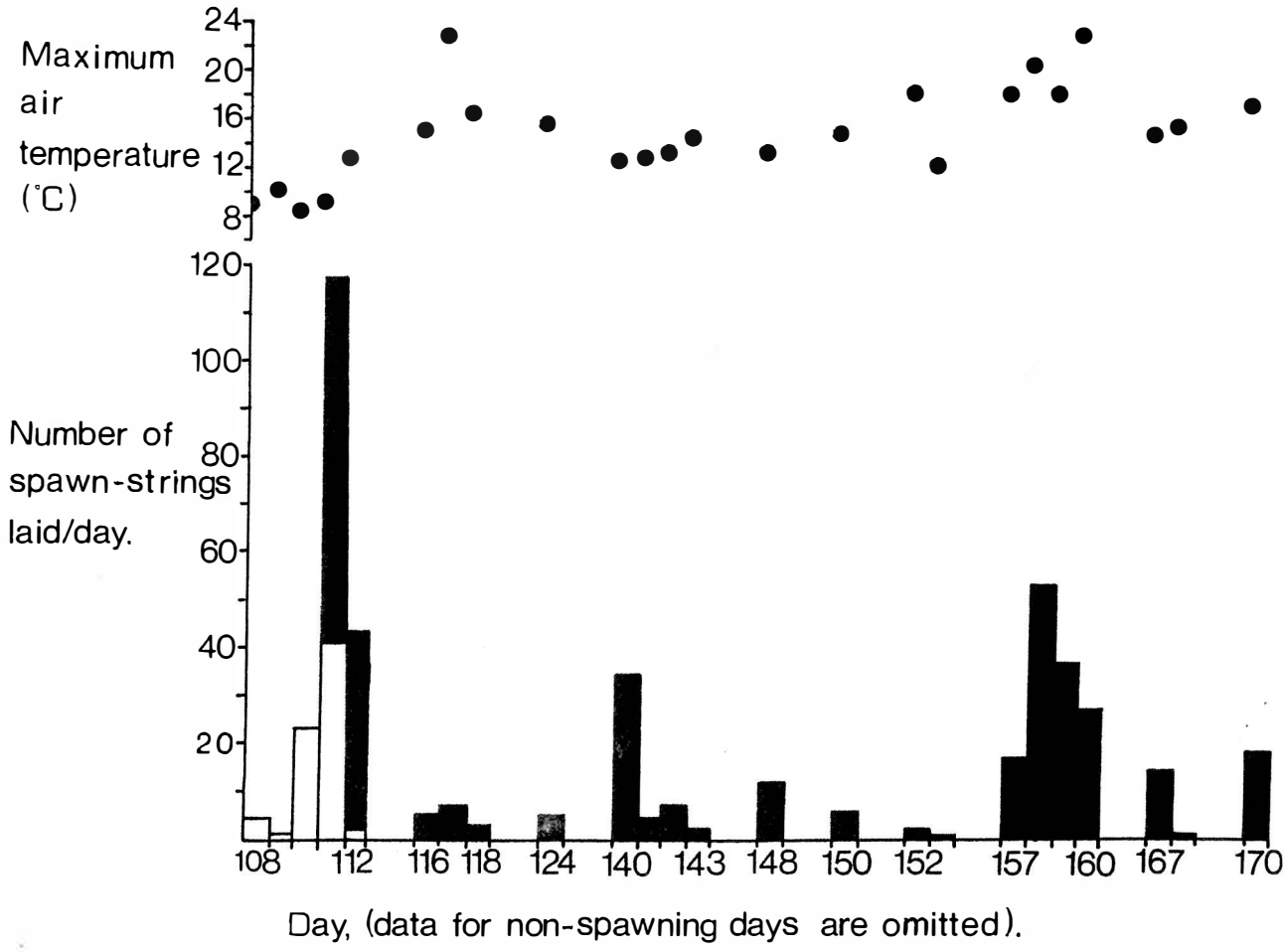

Fig. 1 Frequencies of diurnal and nocturnal spawning by *B. calamita* in relation to maximum air temperatures.

- ■ Number of nocturnal spawnings.
- □ Number of diurnal spawnings.
- • Maximum air temperatures.

Day number = day of the year, i.e. day 108 = 18.4.1984.

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