

we have notes on the oviposition, but some individuals collected as larvae or pupae are included⁴. Diapause has been observed in all species except the three of *Eumenes*. No heterogeneity has been detected between the various samples within a species, except those in *Eumenes campiformis esuriens* (discussed elsewhere^{5,6}) and *Rhynchium* (two species) referred to later. Some non-randomness in the production of the sexes, either in time or space, has been detected in all species except *E. emarginatus conoideus* and *E. pyriformis pyriformis*.

All nine species work with mud. The four potter species build for each egg an individual cell in which it is sealed with paralysed arthropod prey. These cells are built in groups ranging from one to forty-six, though aggregates of more than ten are rare. The squatters lay their eggs in pre-existing cavities which they clean out and then similarly provision, and seal. They also use mud for partitioning and repairing, in which they show considerable versatility, and often associate themselves with a given region for many consecutive days, for example, while re-using the several cells in a deserted potter nest, or filling a hollow stem with a series of eggs laid in tandem.

In four of the nine species the sex ratio approximates to equality. The discovery of such sex ratios among the hymenoptera, where their production is not a necessary consequence of the sex determining mechanism, supports the belief that they possess very general selective advantages. This is argued to be at least one reason for the conservatism of the method of sex determination in which one sex is heterozygous and the other homozygous which, without further modification, ensures a primary sex ratio of unity.

Two species only, both potters, show the expected excess of females, and four, all squatters, show a much greater excess of males. In the three Vespids only is this excess greater among diapausing individuals, and only in *Rhynchium* spp., where twenty male larvae and no female larva have diapaused, are the data heterogeneous. The difference in the maternal behaviour between the potters and squatters, the latter being superficially less exacting for the mother, does not seem sufficient to explain why all the potter samples show an excess of females, while four out of five of the squatter species have produced an excess of males.

The similarity of the sex ratios of *Antodynerus flavescens* and *Chalybion bengalense* may be a response to similar selection pressures. We do not think it a coincidence that we have observed approximately the same numbers in these two species which compete for nesting sites, though not for prey.

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Stimulus for Diurnal Vertical Migration of Pelagic Animals

RECENTLY I correlated¹ the movements of deep scattering layers with the relative decrease in light intensity, using data from Clarke and Backus² and Kampa and Boden³. In my opinion, this correlation supports my hypothesis that the relative change in light intensity is the stimulus which causes pelagic animals to perform at least part of the diurnal vertical migration.

In a recent paper, Clarke and Backus⁴ dispute the validity of the correlation because for my calculation of the stimulus I used "... the change of light intensity at a constant depth, instead of at the changing depths where the migrating animals were found" (ref. 4, p. 11). The relative change in light intensity, however, is the same at all depths at a particular time. Therefore, the foregoing objection is invalid.

The validity of the relative change in light intensity as a stimulus seems to be doubtful whenever the animals swim as fast, or faster, upward or downward as the isoluminescences ascend or descend. For example, when in the afternoon the animals swim as fast upward as the isoluminescences ascend, they will not perceive a change in light intensity. Such situations were actually observed by the authors^{2,4} mentioned.

On the strength of these observations in nature, Clarke and Backus^{2,4} claim that the change in light intensity might act only as a stimulus at the start of migration.

Another solution could be that the animals do not move continuously, but that short periods of vertical swimming alternate with short periods of less or no vertical swimming. This kind of behaviour was observed in *Daphnia magna* in the laboratory. The interpretation is that during a stationary period an excitatory state is built up by the (relative) change in light intensity. This results in a vertical swimming movement. The effect of the stimulus wears off, however, and consequently the swimming stops. Now the animal once more perceives a change in light intensity, the excitatory state is built up again and the swimming is repeated after some time. When the vertical swimming is sufficiently fast the result of the total movement might be that the animal remains in more or less the same light intensity. This hypothesis was fully discussed in my earlier paper¹.

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Parasitic Castration of the Scallop *Pecten alba* (Tate) by a Bucephalid Trematode

THE phenomenon of parasitic castration has been reported in many of the animal phyla including the Mollusca¹⁻⁴. Investigations into the biology and ecology of scallops in Port Phillip Bay, Victoria, have revealed an interesting example of parasitic castration in *Pecten alba*.

Pecten alba, which is normally hermaphrodite, has a tongue shaped gonad attached to the adductor muscle and posterior to the foot. The testicular (proximal) end of the gonad is creamy white in colour, the ovarian (distal) end is coloured pink to red (Fig. 1B). The normal immature gonad is colourless and watery. The reproductive cycle of the normal gonad can be macroscopically divided into seven arbitrary stages based mainly on the state of filling of the gonad^{5,6}.

It is quite common in Port Phillip Bay to find scallops with the gonads coloured red throughout (Fig. 1A). Tissue from both the distal and the proximal ends of such gonads was sectioned and stained with Ehrlich's haematoxylin and eosin. Subsequent examination showed the distal and proximal ends of the gonad to be identical and the entire gonad to be made up of ovarian tissue.

In the hermaphrodites, the ratio of gonad weight to shell length varied with the seasons as would be expected, but for the completely red female gonads collected over a period of 13 months this ratio remained constant. This indication of sterility in the females is supported by further data collected over 6 months which show that the oocyte