

personal observations); *Menippe* (Crane, 1947); *Ocypode* (Alcock, 1902; Crane, 1941; Guinot-Dumortier and Dumortier, 1960; also unpublished personal observations). Other crustaceans producing intimidation sounds include palinurids (Moulton, 1957; Fish, 1964), alpheids (Verrill, 1908; Votz, 1938; Johnson, 1943; Johnson, Everest and Young, 1947; Pope, 1949; Moulton, 1957; Nicol, 1960; Cohen and Dijkgraaf, 1961; Haslett and Winn, 1962a; Fish, 1964); and in special circumstances *Gonodactylus* (see Haslett and Winn, 1962a, but also Dumortier, 1963). Territorial advertisement or sexual menace apparently occurs in a few cases such as *Uca* (Dembowski, 1925; Green, 1961; Altevogt, 1959; von Hagen, 1962) probably in *Ocypode* (Alcock, 1902; Lankester, 1909) and possibly in palinurids (Dijkgraaf, 1955; Linberg, 1955). It has been effectively demonstrated in alpheids by Haslett and Winn (1962a). Maintaining collective grouping is involved in some cases such as palinurids (Moulton, 1957; Green, 1961; Fish, 1964), *Dotilla* (Guinot-Dumortier and Dumortier, 1960) and *Uca* (Burkenroad, 1947). Sexual attraction is involved in *Uca* (Burkenroad, 1947; Altevogt, 1959; von Hagen, 1961, 1962; Salmon and Stout, 1962; Salmon, 1965, 1967), and possibly in *Metaplex*, *Ilyoplax* and one *Sesarma* species (Tweedie, 1954).

The structures modified for stridulation are better developed in males than in females in the *O. punctatus* and the *O. iridescens* subgroups (no females are available in *O. georgei*). It seems that production of the attendant sounds by males is a secondary sexual characteristic, but whether this works at the level of male/male or male/female is unknown. The fact that females have considerable potential vocality suggests that sound communication may also be involved in collective grouping. Small differences occur between the details of the modified structures in individuals of a species, and this suggests a possible method of recognition of individuals within the group.

Unfortunately little data exists upon whether or not species of *Ovalipes* do live gregariously. There is a suggestion of this in the "irregularity" of data upon catches in most of these species as recorded in Stephenson and Rees (1968). Local data upon *O. australiensis* are illustrative. For many years before 1965 only isolated records were obtained, and the vast bulk of Queensland data comes from two trawled catches. Intensive enquiries have failed to reveal later specimens from the same areas and these are still urgently required for aquarium studies. Wear (personal communication) has made the most valuable observations to date upon sociality in *Ovalipes* by noting the regular occurrence of groups of females of *O. catharus* in the Wellington district. They occur at night, in numbers of three to nine, spaced around the perimeter of shallow circular or crescent-shaped depressions up to 18in diameter, just below low tide level.

In each of the subgroups differences between the obviously modified stridulatory structures are of diagnostic importance. It seems most probable that the different qualities of the sounds produced would be important to the species themselves. Whether they act primarily in maintaining the cohesion of groups or to reinforce specific boundaries is conjectural. Two facts are possibly significant. The first is in the Australasian region three species occur apparently in similar habitats, and with one case of overlapping distribution, viz., *O. australiensis* and *O. catharus* in Victoria and South Australia (Stephenson and Rees, 1968). The second fact is that the species are extremely similar, with the main distinctions in "non-adaptive" features which might serve as species indicators. These are pigmentation and the stridulatory structures.

If sound production is to be significant to individuals of a species, they must be able to receive vibrational stimuli. There is now a great wealth of evidence that the otocysts (statocysts) and many of the cutaneous hairs of crustaceans act as vibration receptors (see reviews by Green, 1961; Cohen and Dijkgraaf, 1961; and Frings, 1964).