

not only the basis of a new model but also the importance of these novel processes that the authors have identified.

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## Behavioural ecology

# Follow your Nose

T.C. Sam

The discovery of a peculiar form of chemical communication in the avian community provides one of the first evidences that birds make use of their fully functional olfactory system.

Every bird examined to date has a fully functional olfactory system that is strikingly similar to the mammalian system. Also, many avian species are able to produce odour. However, researchers have struggled to demonstrate the existence of social odours or chemical signals in the avian community.

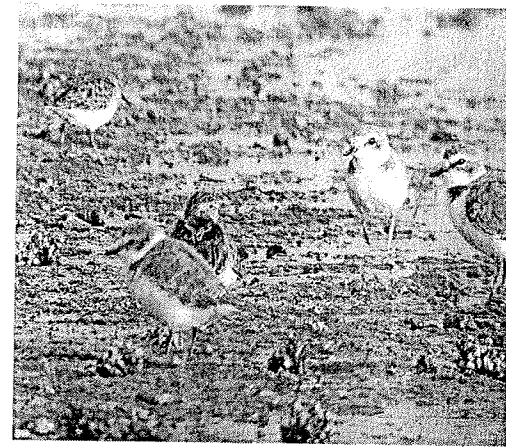
Geruch *et al.*<sup>1</sup> have recently identified a novel form of chemical communication in a population of socially polyandrous shorebirds, Snowy Plovers (*Charadrius alexandrinus*). Gas released from the anal pores of these shorebirds that produce a distinctive sound appears to contain conspecific chemical signals that are recognized by birds in the same social setting.

In the salt flats of the North America bird sanctuary, Bolivar Flats, off the coast of Texas, Geruch and his co-workers captured both male and female snowy plovers for brief periods of time over a year-long observation period using noose carpets. The sex of the bird was determined by differential markings at the fore crown, ear coverts and at the sides of the breasts. Males have black markings whereas females are somewhat browner in colour.<sup>2</sup> Gas samples were collected and then using the Rasmussen<sup>3</sup> solid-phase micro-extraction gas chromatographic and mass spectrometric technique, chemical analysis was performed on the volatile chemical components of the gas emissions. Through comparison to a spectrum library and actual standards, the emission was shown to contain isoamylacetate which is recognized as a sweet, banana fragrance. The male birds produced  $69.8 \pm 0.5\%$  more gaseous emission than the female birds. In both sexes, anal pores appeared to release

the sweet smelling gas only during the breeding period of mid-march to September. Over the course of the breeding period, the composition and release sound of these gas emissions from the Texan Snowy Plover population did not vary significantly indicating that the release is probably not a form of digestive gas.

The social response to odor was tested in a series of behavioral experiments using Plexiglas T-maze trials. The snowy plovers were presented with a choice between various natural and artificial smells and their response was monitored. Geruch *et al* showed that the Snowy Plovers preferred the banana smell of the gas emissions to other sweet smells such as almond (benzaldehyde), vanilla (4-hydroxy-3-methoxybenzaldehyde), and citrus (3,7-dimethyl-2,6-octadienal), and this chemical was preferred to neutral air or to a bland odour control. In addition, when given a choice between the natural odour and one artificially produced to mimic the sweet banana smell, the Snowy Plovers preferred the natural compound.

What this signal means is still not clear. Geruch *et al.* speculates that this may constitute an olfactory mating signal. Although most birds do not appear to assess odours or to deposit scent marks<sup>4,5</sup>, chemical signals could be transferred in more unorthodox mannerisms such as the case described here. This sweet smell may be produced by the males as an olfactory ornament to attract females as potential mates. Perhaps only well-fed, healthy birds can produce this sweet sent thereby indicating to members of the opposite sex that they are ready to mate and are advertising themselves as good mates. Female Snowy Plovers exhibit sequential



**Figure 1** Courtship of the Snowy Plover (*Charadrius alexandrinus*) at the Bolivar Flats Bird Sanctuary off the coast of Texas. These social shorebirds emit a sweet banana sent that is believed to be a form of chemical communication among this species.

polyandry where a female mates with many males in rapid succession over the breeding season and females must choose to mate or not with each male encountered.<sup>6</sup> Males that give a vigorous performance during courtship are usually chosen preferentially as mates by the female bird.<sup>7</sup> As the occurrence of the banana gas emissions increases during the breeding season, the dynamic courtship display by the snowy plovers may include the use of this novel chemical communication to help entice the female.

In the avian community, the basic assumption has been that vision and hearing constitute the main social cues. The discovery that olfaction is utilized in foraging, navigation, attachment and affiliation has already altered the view of avian community dynamics.<sup>8,9</sup> Geruch *et al* have provided further evidence that the sense of smell plays a major role in avian communication.

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