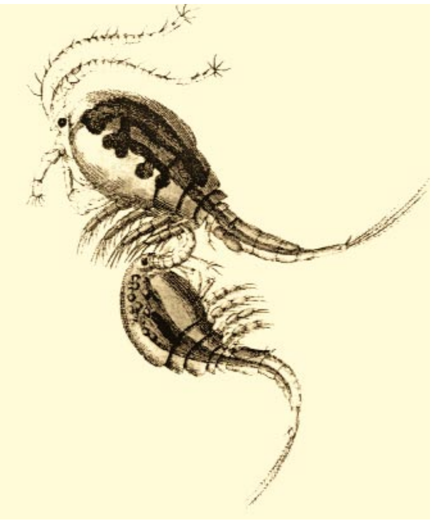

Figure 2 **Mating *Cyclops*, as depicted by L. Jurine in an 1820 publication. (Reproduced from ref. 4.)**

mating (Fig. 1). No contacts are made in the first ten seconds or so. Once the male perceives a female, he changes his swimming pattern, following the female jump for jump in a synchronized swimming display lasting up to 20 seconds. Once within striking distance, the male lunges towards the female, grasps her tightly, and transfers spermatophores to her reproductive tract. Males, then, actively detect and pursue would-be mates.

Other copepods such as the marine species *Temora longicornis* use different strategies to boost the male–female encounter rate (M. H. Doall *et al.*). *Temora* males swim faster than females, and travel more sinuous routes, often spinning and changing direction abruptly — they seem to be intercepting and tracking hydromechanical 'footprints' left in the female wake. This pattern increases the males' chance of detecting females (although it may also increase their vulnerability to predators).

Females also often 'hover' when filter feeding, and males can detect their feeding currents. Whether females actively take part in this ritual by 'loitering with intent' is not clear. But tracking moving females is not always successful, and males often backtrack, and cast around before picking up the trail again.

An open question is whether females actively attract males, and whether they reject undesirable partners by trying to escape from them as they would from a predator. A hint that females are indeed active in courtship comes from the work with tethered *Temora* females, which react to chemical exudates of males with little hops distinct from uniform swimming (L. A. van Duren *et al.*). The hydromechanical signals produced by such hops may act as 'personal ads', attracting males. Because of the viscous regime, these hydromechanical signals are short-lived, but they greatly increase the 'encounter volume' of the female, maximizing her chance of attracting a male.

From studies of the fine-scale kinematics of the movements of male and female *Temora* comes circumstantial evidence that males may also follow chemical trails left by females (M. J. Weissburg *et al.*). Males zero in on females, and aspects of their behaviour are reminiscent of other animals, such as crabs, lobsters and even ants, that track chemical signals. When searching for a female, the male *Temora* zigzag as if moving in and out of a three-dimensional chemical 'corridor'; this behaviour is similar to the cross-stream tracking used by male moths when tracing female pheromonal plumes[3]. Weissburg *et al.* point out that the paired chemosensory organs of the male's antennae would be ideal for sensing a chemical gradient, and that such pheromonal trails might persist for seconds before the gradient disperses.

Chemical cues may be quite widespread in copepod mating behaviour. Another possible example is that of newly moulted females of *Calanus marshallae*, which sink and apparently leave vertical pheromone trails up to several centimetres long (A. Tsuda and C. B. Miller); males casting out horizontally encounter these trails and 'waggle' their way down to the female below. But in both cases, those of *Calanus* and *Temora*, the identity of the presumed chemical cue is unknown.

A further angle emerges from work with *Tigriopus japonicus* (L. S. Kelly *et al.*). Males grab potential partners, and reject them if, for example, they turn out to be of the wrong species. Mate discrimination seems to depend on contact chemoreception, which is probably mediated by lectin-like glycoproteins on the body surface. Similar signalling may also help prevent interbreeding between the estuarine *Coullana canadensis* and a sibling species where the two overlap off the Florida coast (M. A. Frey *et al.*).

The last words should go to J. Yen and colleagues: "Zooplankton are not aimless wanderers in a featureless environment, an image suggested by the Greek word 'planktos'. Their ambit is replete with clues that guide them in their search for food or mates and in their other efforts for survival in the ocean." For all the impressive documentation in the special issue, however, our knowledge of those clues remains preliminary. ☐

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Ecology

Polarized flight

Why do mayflies lay their eggs *en masse* on dry asphalt roads? The answer can be found in the latest *Journal of Experimental Biology* (201, 2273–2286; 1998) — but be prepared for a tale of death and deception.

György Kriska and his colleagues observed that every year, in May and June, swarms of mayflies (Ephemeroptera; pictured) mate, not above lakes and rivers, but above dry asphalt roads. The females then land and each lays up to 9,000 eggs, all of which perish.

To investigate this curious behaviour, the authors studied mayfly nuptials on a stretch of asphalt road near Budapest, Hungary. Flies were given a choice of surface on which to lay their eggs — shiny black, white or clear plastic sheets, shiny aluminium foil, matt black or white cloths, and plain asphalt.

The flies unanimously preferred the shiny black surface, to the extent that they even broke off mating if moved to one of the other surfaces. When Kriska *et al.* studied the reflection–polarization properties of these surfaces, they discovered why.

Although reflected light was polarized parallel to the surface of both the black and white plastic sheets, the degree of polarization was much greater from the black ones. The authors believe that such horizontally polarized light mimics a highly polarized water surface — in other words, the mayflies are deceived into laying their eggs on the road. This ties in with observations that the darker and smoother a region of asphalt (and, hence, the higher the degree of polarization), the more likely the flies are to lay their eggs on it.

This is a real problem. Mayflies could be in danger of extinction as their aquatic habitats are increasingly polluted with herbicides, pesticides and industrial waste. And it's not just asphalt that fools them. These flies have been seen to lay their eggs on the shiny bodywork and windscreens of cars, in tar pits and even in crude-oil lakes. This trick of the light is not only cruel, it's deadly.

Alison Mitchell