RoboFish

Collective animal behaviour has attracted much attention recently, but cause-and-effect within interaction sequences has often been difficult to establish. To tackle this problem, we constructed a robotic fish ('Robofish') with which three-spined sticklebacks (Gasterosteus aculeatus L.) interact. Robofish is a computer-controlled replica stickleback that can be programmed to move around a tank.

First, we demonstrated the functioning of the method: that the sticklebacks interacted with Robofish. We examined two types of interaction: recruitment and leadership. We found that Robofish could recruit a single fish from a refuge and could initiate a turn in singletons and in groups of ten, i.e. act as a leader. We also showed that the influence of Robofish diminished after the first 30 min that fish spent in a new environment. Second, using this method, we investigated the effects of metric and topological inter-individual distance on the influence that Robofish had on the orientation of fish in a shoal of ten. We found that inter-individual interactions during this turn were predominantly mediated by topological, rather than metric, distance.

Finally, we discussed the potential of this novel method and the importance of our findings for the study of collective animal behaviour.