Blurry-eyed beachcombers beat birds

April 14 2011

A fiddler crab stares into the camera. Photo by Jeff Wilson.

(PhysOrg.com) -- A study from The Australian National University has revealed for the first time how an animal sees and responds to predatory attacks in its natural environment.

The study was undertaken by Dr Jochen Smolka, formerly of the ANU Research School of Biology and now based at Lund University in Sweden. He and his ANU colleagues, Professor Jochen Zeil and Dr Jan Hemmi, filmed a colony of fiddler crabs at the exact moment they were avoiding air-borne predators.

Dr Smolka said that he and his co-researchers discovered that crabs use multiple visual cues to distinguish between friend and foe, react to attacks and increase their overall chance of survival.

“Crabs are hunted by fast and agile aerial predators such as terns,” said Dr Smolka. “For example fiddler crabs need to take shelter from birds every two to three minutes.

“It is therefore essential for their survival to have a fast and effective escape mechanism. However due to the very limited resolution of their eyes, crabs only see an approaching bird as one or a few ‘pixels’ of their retinal image.

“This makes it impossible to distinguish the shape of a potential predator. To make matters worse, because of their closely set eyes crabs lack the ability to determine distance. Crabs thus face the problem of distinguishing between predators and harmless flying animals based on very limited and unreliable information.”

To overcome these problems crabs respond at the limits of their optical resolution to a combination of multiple visual clues, including retinal speed, elevation in the visual field, and visual flicker, and which reflect distinct bird and insect flight styles and behaviours.

“Our research revealed that the response criteria crabs use reflect the way that they usually see their natural predators,” said Dr Smolka. “For example, an approaching tern is likely to produce a conspicuous visual flicker signal when its beating wings catch the sunlight. A soaring kite, on the other hand, rarely flickers like that. Crabs thus employ clever computation to compensate for bad vision.”

Dr Smolka added that the ability of distinction allowed crabs to enjoy the finer things in life – like mating and eating.

“At the same time as escaping from predators crabs have to avoid reacting to harmless flying animals like kites or insects that are constantly in the sky. Too many false alarms are problematic as the crabs

only have a few hours around low-tide available every day for feeding, mating and other social interactions."

The study's findings were published in the *Proceedings of the Royal Society B* earlier today.

Provided by Australian National University