

## Fish recognize friends and foes through their unique faces

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A little striped fish that lives among rocks in Lake Tanganyika in East Africa has the unexpected ability to recognize individual faces, which it uses to keep menacing strangers in sight. The cichlid (*Julidochromis transcriptus*) identifies unfamiliar individuals by looking at the pattern around their eyes rather than at other body parts such as their fins or trunk, researchers have discovered. While facial recognition has been tested in some mammals, including apes, and in birds, animals such as fish or wasps were erroneously thought to have brains too simple for the task. After recent research showed that aquarium fish can be thought to identify the faces of their human owners, the Tanganyikan cichlid has now

demonstrated how facial recognition is used in the wild. Because the fish lives in rock crevices hidden by vegetation on the lakebed, only a small part of its body tends to be visible at any given time. This prompted the researchers to investigate which body element most attracts the fish's attention. "If this fish used only the face to recognize others, that would show that 'face' is an important social cue," says Takashi Hotta of Osaka City University in Japan.

### Wary of strangers

The researchers isolated eight adult males from a group of familiar individuals and placed them in a tank. There they were exposed to digital models of other individuals with a combination of familiar and unfamiliar features on their faces and bodies. "We found that our subjects were especially guarded against only unfamiliar face models, regardless of body type," says Hotta. The males spent longer following the unfamiliar faces as the model moved around the tank, a sign that they were monitoring a potential threat, using their ability to distinguish unique facial patterns. "It's not so much the recognition itself that is difficult, but the fact that they use recognition suggests that they are keeping track of relationships with each other and that's where things may get complicated," says Michael Sheehan of Cornell University in New York. This shows a sophisticated processing ability, he says. "Fish are generally lowly regarded," says Ken Collins of the University of Southampton, UK. "One example is the widespread but false notion that goldfish only have a 3-second memory." However, much like mammals, fish "can have complex lives and consequently need a number of cognitive abilities with which to carry out a range of behaviors". Collins notes that the whole field of determining animal intelligence is dogged by a long history of "inappropriate testing 'proving' that one species is more intelligent than another". This is why, he says, "this new research is noteworthy, having devised a valid testing environment extending the recognition capability to a new group".

## Manta rays are first fish to recognize themselves in a mirror

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Looking good. Giant manta rays have been filmed checking out their reflections in a way that suggests they are self-aware. Only a small number of animals, mostly primates, have passed the mirror test, widely used as a tentative test of self-awareness. "This new discovery is incredibly important," says Marc Bekoff, of the University of Colorado in Boulder. "It shows that we really need to expand the range of animals we study." But not everyone is convinced that the new study proves conclusively that manta rays, which have the largest brains of any fish, can do this – or indeed, that the mirror test itself is an appropriate measure of self-awareness. Csilla Ari, of the University of South Florida in Tampa, filmed two giant

manta rays in a tank, with and without a mirror inside. The fish changed their behavior in a way that suggested that they recognized the reflections as themselves as opposed to another manta ray. They did not show signs of social interaction with the image, which is what you would expect if they perceived it to be another individual. Instead, the rays repeatedly moved their fins and circled in front of the mirror. This suggests they could see whether their reflection moved when they moved. The frequency of these movements was much higher when the mirror was in the tank than when it was not. The rays also blew bubbles in front of the mirror, behavior that Ari had not observed in the rays before. "The behavioral responses strongly imply the ability for self-awareness, especially considering that similar, or analogous,

behavioral responses are considered proof of self-awareness in great apes,” Ari says. Diana Reiss, of Hunter College in New York, says that it is interesting that manta rays did not show social behavior towards the mirror image, as fish usually do. But she says it is unclear whether the rays actually recognize themselves in the mirror.

#### Curious behavior

Gordon G. Gallup Jr, of the University at Albany, New York, who originally developed the mirror test, is also skeptical. The unusual movements in front of the mirror might have merely been a sign of curiosity or exploratory behavior, he says. Other studies have suggested that dolphins, elephants, monkeys and magpies, and even a robot, can recognize themselves in the mirror. But Gallup says these were usually conducted on just one or two animals and the results were not reproducible. “Humans, chimpanzees and orangutans are the only species for which there is compelling, reproducible evidence for mirror self-recognition,” he says. This implies that self-awareness may be limited to humans and some great apes. But Bekoff says that the mirror test may not be the litmus test for self-awareness in all animals. It is a visual measure, so it might not work in species that navigate their worlds primarily using senses other than vision. Such species may fail the mirror test, but they may still be self-aware, Bekoff says. He thinks it is time to raise the bar on the way we study self-awareness in animals, including manta rays. “It would be nice if someone could do neuroimaging while these animals are doing something in response to seeing a reflection,” he says.

#### Article Questions

1. What specific characteristic is the Tanganyikan cichlid using to identify friends and foes?
2. Assess the quote “However, much like mammals, fish can have complex lives and consequently need a number of cognitive abilities with which to carry out a range of behaviors.”
3. How did scientists determine that Manta Rays were able to recognize themselves in a mirror?
4. What species show compelling, reproducible evidence for mirror self-recognition?
5. Do these articles change the way you think about fish? Explain why or why not.