

Tool use in fishes

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Tool use is a behaviour that has been documented mostly in mammals and birds. Examples on the mammal side include primates handling sticks for various purposes, chimps using rocks to break nuts, sea otters carrying rocks with which to crack open the shellfish they catch, and bottlenose dolphins in Shark Bay, Australia, grabbing sponges in their mouth and using them to brush the bottom and flush buried prey out in the open.¹ On the avian side, Caledonian crows use twigs for probing into crevices, as do woodpecker finches with cactus spines, while Egyptian vultures break ostrich eggs by dropping rocks onto them.

Rather few cases could qualify as tool use in fishes. Perhaps this is not surprising given that fishes have only their mouth with which to hold objects. Also, water is more viscous than air, which means that objects cannot be moved as quickly to strike at things. And dropping rocks onto things to break them does not work very well either because rocks weigh less in water and fall more slowly in this viscous environment. Nevertheless, a few piscine examples of tool use have been reported.

Prior to the laying of eggs on a vertical rock face, male and female whitetail majors, *Stegastes* (= *Pomacentrus*) *leucoris*, clean the site by sand-blasting it. These damselfish pick up sand in their mouths and spit it against the rock face. Then they fan the area with their fins. Finally they remove the sand grains that remained stuck to the rock face by picking them off with their mouths.² The efficiency of this cleaning method has not been assessed. It would be interesting to determine whether the method is used more often on rock faces that are dirtier, something that would suggest some sort of “intelligence”.

The banded acara, *Bujurquina vittata* (= *Aequidens paraguayensis*), a South American cichlid, has the odd habit of laying its eggs on a loose leaf. The male and female of a mating pair often “test” leaves before spawning: they pull and lift and turn candidate leaves. They may be trying to select leaves that are easy to move. After spawning, both parents guard the eggs. When disturbed – for example, when a potential predator approaches – the parent acara often seize one end of the egg-carrying leaf in their mouth and drag it to deeper and safer locations.³

Many species of wrasses and tuskfishes (family Labridae) are known to use rocks as anvils. They hold scallops or urchins in their mouth and smash them against the surface of a rock to break them up and get at the meat. Examples include *Halichoeres garnoti*, *Cheilinus trilobatus*, *Coris angulata*, *Thalassoma lutescens*, *Thalassoma hardwicke*, *Semicossyphus pulcher*, *Choerodon schoenleinii*, *Choerodon anchorago*, *Choerodon cyanodus*, and *Choerodon graphicus*.⁴ But purists say that this kind of

behaviour should be called “proto-tool use” because the tool (the anvil) is not manipulated by the animal directly.

In a study on Atlantic cod, a feeder was set up so that the fish had to pull on a string with their mouth to get food. The fish had been individually marked by threading a bead in front of their dorsal fin. By accident, some of the fish swam by the string which caught on their bead, enough to trigger the feeder. These fish learned to swim in a way that made the bead catch the string every time to get food. Inasmuch as the fish used an object foreign to their body (though now intimately connected to it) in a goal-oriented manner, they could be said to have used a tool.⁵

Could blowing water count as “tool” use? If so, then it is worth mentioning the behaviour of the triggerfish *Pseudobalistes fuscus* which blow water to turn sea urchins over and expose their more vulnerable ventral side.⁶ There is also the celebrated case of archerfishes; in the next paragraph I more or less repeat what I wrote on the page “Records in the Fish World”, under “Best shot”.

Archerfishes are found in the tropical mangrove swamps of India and Australasia. They approach the surface, take aim at insects that sit on plants above the surface, squirt a jet of water at them, and grab them after the bugs have been knocked off into the water. The jet of water is formed by the action of the tongue, which presses against a groove in the roof of the mouth. Some archerfish can score a direct hit up to 1.5 m above the water surface (though not necessarily on the first try). They use more water (which gives more force to the impact) when aiming at larger prey. They can even learn to shoot at moving targets, either through practice or by observing an experienced individual in action. Archerfish can be kept in aquaria, and they don't mind shooting jets of water at the eyes of people who blink at them.⁷

Similar to a triggerfish blowing water at sea urchins, archerfish can also use their jets underwater to disturb sediments or lift up debris, probably to unearth food morsels.⁸

For a topic somewhat related to tool use, see the page “Can fish build things?”

¹ For a review of tool use by aquatic animals (not just fishes), see: Mann, J., Patterson, E.M., 2013, Tool use by aquatic animals, *Philosophical Transactions of the Royal Society B* 368: <https://doi.org/10.1098/rstb.2012.0424>.

² Keenleyside, M.H.A., 1979, *Diversity and Adaptation in Fish Behaviour*, Springer-Verlag, Berlin.

³ Keenleyside, M.H.A., and Prince, C., 1976, Spawning-site selection in relation to parental care of eggs in *Aequidens paraguayensis* (Pisces: Cichlidae), *Canadian Journal of Zoology* 54, 2135-2139.

⁴ Coyer, J.A., 1995, Use of a rock as an anvil for breaking scallops by the yellowhead wrasse, *Halichoeres garnoti* (Labridae), *Bulletin of Marine Science* 57, 548-549; Pasko, L., 2010, Tool-like behavior in the sixbar wrasse, *Thalassoma hardwicke* (Bennett, 1830), *Zoo Biology* 29: 767-773; Bernardi, G., 2011, The use of tools by wrasses (Labridae), *Coral Reefs* 31, 39; Jones, A., Brown, C., Gardner, S., 2011, Tool use in the tuskfish *Choerodon Schoenleini*?, *Coral Reefs* 30: 865; Dunn, R.,

2015, Tool use by a temperate wrasse, California sheephead *Semicossyphus pulcher*, *Journal of Fish Biology* 88: 805-810; Harborne, A., Tholan, B., 2016, Tool use by *Chaerodon cyanodus* when handling vertebrate prey, *Coral Reefs* 35: 1069; Pryor, K.J., Milton, A.M., Tool use by the graphic tuskfish *Choerodon graphicus*, *Journal of Fish Biology* 2019: 1-5.

⁵ Millot, S., Nilsson, J., Fosseidengen, J.E., Bégout, M.L., Fernö, A., Braithwaite, V.A., Kristiansen, T.S., 2014, Innovative behaviour in fish: Atlantic cod can learn to use an external tag to manipulate a self-feeder, *Animal Cognition* 17: 779-85.

⁶ Fricke, H., 1975, Lösen einfacher Probleme bei einem Fisch, *Zeitschrift für Tierpsychologie* 38, 18-33, cited in: Bshary, R., Wickler, W., and Fricke, H., 2002, Fish cognition: a primate's eye view, *Animal Cognition* 5, 1-13.

⁷ Schlegel, T., Schmid, C.J., and Schuster, S., 2006, Archerfish shots are evolutionarily matched to prey adhesion, *Current Biology* 16, R836-R837; Schuster, S., Wöhl, S., Griebisch, M., and Klostermeier, I., 2006, Animal cognition: how archer fish learn to down rapidly moving targets, *Current Biology* 16, 378-383; Gerullis, P., Schuster, S., 2014, Archerfish actively control the hydrodynamics of their jets, *Current Biology* 24: 2156-2160; Dill, L.M., 1977, Refraction and the spitting behavior of the archerfish (*Toxotes chatareus*), *Behavioral Ecology and Sociobiology* 2, 169-184.

⁸ Dewenter, J., Gerullis, P., Hecker, A., Schuster, S., 2017, Archerfish use their shooting techniques to produce adaptive underwater jets, *Journal of Experimental Biology* 220: 1019-1025.