



Excerpts from “The Misunderstood Fish”

What we casually refer to as “fish” is in fact a collection of animals of fabulous diversity. According to FishBase—the largest and most often consulted online database on fishes—33,249 species, in 564 families and 64 orders, had been described as of January 2016. That’s more than the combined total of all mammals, birds, reptiles, and amphibians. When we refer to “fish” we are referring to 60 percent of all the known species on Earth with backbones.

[...]

We conveniently classify animals with backbones into five groups: fishes, amphibians, reptiles, birds, and mammals. This is misleading because it fails to represent the profound distinctions among fishes. The bony fishes are at least as evolutionarily distinct from the cartilaginous fishes as mammals are from birds. A tuna is actually more closely related to a human than to a shark, and the coelacanth—a “living fossil” first discovered in 1937—sprouted closer to us than to a tuna on the tree of life. So there are at least *six* major vertebrate groups if one counts the cartilaginous fishes.

The illusion of relatedness among all fishes is partly attributable to the constraints of evolving to move efficiently in water. The density of water is about 800 times greater than that of air, so aquatic living has, in vertebrates, tended to favor streamlined shapes, muscular bodies, and flattened appendages (fins) that generate forward propulsion while minimizing drag.

Living in a denser medium also greatly reduces the pull of gravity. The buoyant effect of water frees aquatic organisms from the ravages of weight on

terrestrial creatures. Thus, the largest animals—the whales—live in water, not on land. These factors also help explain the small relative brain size (the ratio of brain weight to body weight) of most fishes, which has been used against them in our cerebrocentric view of other life forms. Fishes benefit from having large, powerful muscles to propel them through water, which is more resistant than air, and living in a practically weightless environment means there is no premium on limiting body size relative to brain size.

[...]

[T]he most exciting breaking news on fishes is the steady stream of discoveries on how they think, feel, and live their lives. Scarcely a week now passes without a revealing new discovery of fish biology and behavior. Careful observations on reefs are uncovering nuanced social dynamics of cleaner-client fish mutualisms that defy the human conceit that fishes are dim-witted pea brains and slaves to instinct. And the notorious three-second fish memory has been debunked by simple laboratory investigations. In the pages ahead we’ll explore how fishes are not just sentient, but aware, communicative, social, tool-using, virtuous, even Machiavellian.

Balcombe, Jonathan. Excerpts from “The Misunderstood Fish.” In *What a Fish Knows: The Inner Lives of our Underwater Cousins*, 11–19. New York: Scientific American/Farrar, Strauss and Giroux, 2016.



Kuroda Tōkō, *Carp* (detail), early 19th century, painting, ink and color on silk, 17 11/16 × 33 3/4 in (44.9 × 85.8 cm). National Museum of Asian Art, Freer Gallery of Art Collection, Gift of Charles Lang Freer (F1896.92).