

their displays are fundamentally different than the bettas'. Instead of frontal displays and fin biting attacks, male paradise fish have a head-to-tail orientation known as the "mutual lateral display." In this mutual lateral display, the opposing fish align themselves in a head-to-tail fashion, spreading their fins as broadly as possible, and wrapping the tail fin around the head of the opponent, so it is most directly in front of the opponent's eye. This display is accompanied by a vibration of the entire body, a behavior which must send pressure waves toward the opponent. Also, the colors of the fish are darkened. The fish spontaneously relax these displays, circle, and then return repeatedly for more mutual lateral displays. This typically occurs for several minutes, sometimes 15 or 20, and then attacks may occur; but unlike bettas where the attacks are directed toward the fins, the attacks of paradise fish are directed toward the mouth and jaws. Sometimes these attacks result in a "jaw lock" in which the fish then show a rhythmic slow motion struggle, often quite dramatic, until one fish breaks away and retreats.

In nature these aggressive territorial conflicts result in the retreat and departure of one combatant—in aquariums, it is essential to separate the fish before one becomes seriously injured. The display patterns of anabantid fish illustrate many aspects of vertebrate social behavior—communication through several modalities, colorful display, territoriality, complex mating patterns and parental care, and aggression and dominance—all of which can be readily observed in laboratory aquariums.

Further Resources

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Communication—Vocal Alarm Calls

When alarmed by predators, individuals of many species emit loud vocalizations known as alarm calls. Calls may be directed to other members of the caller's species to warn them about the presence of a predator, or to create pandemonium during which time the caller may escape. Calls may also be directed to the predator and may function to discourage pursuit. If alarm calls create pandemonium or discourage pursuit, the caller, by calling, increases its own chance of survival; such behavior requires no complex explanation. However, when calls are directed toward other members of the caller's species, the very act of signaling may also alert the predator to the caller's presence. The explanation of why animals emit potentially costly alarm calls to help others was initially an evolutionary paradox.

The solution lies in considering the fitness obtained by helping relatives survive. By calling, yellow-bellied marmot females warn their vulnerable offspring and presumably increase their survival. Thus calling, a form of maternal care, increases the caller reproductive success. Even more complex is the calling behavior of black-tailed prairie dogs. These

highly social rodents are sensitive to the relationships of nearby individuals and call more when they have other relatives, even those that are not offspring, within earshot.

The structure and function of signals are interrelated. For instance, we expect signals that are directed to a predator to be "obvious." *Mobbing calls* are a specific type of alarm call that animals produce to rally assistance and drive out typically low-risk predators. Many species produce mobbing calls. For instance, many nesting birds will scold and "mob" a jay or crow that comes too close to its nest, and nesting crows will emit mobbing calls when a raccoon comes too close to their nests. Mobbing calls are loud, broad-bandwidth, and rapidly repeated vocalizations. These characteristics make them easy to localize by both potential helpers, as well as the predator. In contrast, alarm calls by birds that are elicited by aerial predators which are hunting them are difficult to localize because they have a relatively narrow bandwidth and fade in and out. Being near a hunting raptor is very risky, and while animals may warn others, they do so in a way that reduces their own conspicuousness while simultaneously warning others.

Alarm calls may communicate different types of information. The calls of ground squirrels and marmots communicate the relative risk a caller experiences when it calls, whereas the calls of chickens and vervet monkeys communicate the species or type of predator. Alarm calls from suricates, a social mongoose, communicate both relative risk and predator type. To understand the meaning of alarm calls, it is important to study the situations under which individuals call and how they respond to calls being broadcast from hidden speakers. In vervet monkeys, snakes elicit "chutters," leopards elicit "barks," and raptors elicit "coughs." And, when these monkeys heard these vocalizations broadcast through hidden speakers, they responded as though there were a snake, leopard, or raptor in the area. Snake calls caused vervets to stand on their toes and look around for snakes (an appropriate response on the savannah). Leopard calls caused the monkeys to run to trees and move out to peripheral branches where leopards could not reach them. Raptor calls sent vervets, caught in the open on the ground, into the central branches on trees—a good place to avoid raptors. If vervets were already in trees, raptor calls signaled a nearby raptor, and monkeys hearing them descended to the ground. These behaviors provided key evidence that these calls function to communicate predator type rather than escape strategy.

See also Antipredatory Behavior—Predator–Prey

Communication

Cognition—Equivalence Relations

Communication—Vocal—Referential Communication
in Prairie Dogs

Further Resources

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