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Sounding the alarm: how birds communicate about danger

Our world is quite a noisy place; most animals, from birds to mammals, reptiles to insects, even fish, produce a large amount of this noise. Of these animal-produced sounds, the ones that humans most often notice are from birds.

When people think of bird vocalizations, they most often think of song, as this is one of the most familiar and well-studied types of vocalizations. The majority of the vocalizations many birds make, however, are calls: vocal signals not intended to attract a mate or defend a territory. These calls serve a variety of purposes including: (1) negotiating turn taking during incubation, as zebra finch do, (2) alerting others to the discovery of food patches, as white-tailed ptarmigan do, (3) keeping in contact with dispersed flock members, as black-capped chickadees (a North American relative of the tit species found in the UK) do, and (4) alerting others about predators and the threat they pose, as many species do. This last call, known as an alarm call, is the focus of my research. I am a PhD student at the University of St Andrews supervised by Drs. Sue Healy and Chris Templeton, currently studying how tit species in the UK include information about predators in their calls.

Including information about predators in vocalizations is not something unique to tit species. Many birds include detailed information about predators in their calls. This information often communicates not only whether a predator is present, but also information about the predator itself and the level of danger it poses. White-browed scrubwrens, for example, include information in their calls about how distant a predator is, while black-capped chickadees include information about predator size. Jungle fowl include distance and size as well as a predator's approach speed in their calls. Even more amazing, chaffinches differentiate between different types of predators (e.g. terrestrial vs. aerial), while Siberian jays include information about a predator's behaviour (e.g. flying or perching).

As you might imagine, there are a number of situations in which these types of anti-predator vocalizations are used. My focus is on those calls used during mobbing events. Mobbing is a behaviour many people have witnessed; if you have ever seen crows harassing or attacking an eagle, or oyster-catchers chasing and harassing crows during the breeding season, then you have witnessed mobbing. It occurs when a prey species discovers a predator that is not actively hunting (often perched), then begin to harass and attack it, sometimes even going so far as to purposefully collide with the predator in order to drive it off. During these attacks, prey species use mobbing vocalizations, often referred to as 'scolding' calls in birding books. These calls not only serve to harass the predator while warning others, but also serve to recruit help, as larger mobbing groups prove more effective at driving off predators. Interestingly, these calls not only recruit individuals of the same species, but those of other species as well, creating a mixed-species mobbing flock.

To study mobbing behaviour we need to entice tits to mob a predator of known threat. While this may seem straight forward, it can actually prove quite difficult. Many previous experiments studying mobbing behaviour in birds, or other species, have used a variety of objects to induce mobbing, from plastic models to taxidermy mounts. As tits are very observant, when they see a plastic replica or taxidermy mount of a predator that remains still, they often mob for a short time, then begin to respond inappropriately: feeding next to its head, or using it as a perch to preen on. To make my simulated predator encounters more realistic, eliciting more realistic mobbing responses, I built what I affectionately refer to as robo-raptors: taxidermy mounts with internal robotics that allow their heads to move. These work surprisingly well, so that a wide variety of birds, even crows, will mob these robo-raptors!

After successfully inducing realistic mobbing events, I was able to ask questions about how UK tit species include information about predators in their mobbing calls. Initially, I thought that, like their North American cousins, chickadees, titmice, and Japanese great tits, the species here would use the same ways of including information about predator threat in their calls. However, this was not what I found. The species in the UK are quite different in how they include information in their calls. One species, willow tits, did not differentiate between low and high threat predators as the other five species did.

I am often asked why I study vocal communication in birds, as aside from academic interest there appears to be no benefit from this research. Like many other animal behaviour experiments, however, my research addresses an important part of a larger, ecologically relevant problem.

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As they are a key component of predator avoidance, these vocalizations are thought to be important to survivorship. But although these vocalizations have been shown to increase survivorship in predator encounters, we still do not know the extent to which different species within mixed-species communities rely on these vocalizations in order to survive. Species communities are made up of multiple species, many of which are thought to eavesdrop on the information included in the calls of just a few, often called 'community informants'. If this is true, then the loss of either of these key species, or the calls (and information) they produce, could affect the survivorship of the community as a whole. We still do not know which species provide this information, and which rely on this information, mainly due to scant knowledge of how different species include and use predator threat information in their calls. However, recent studies have shown that anthropogenic (human generated) noise drowns out alarm calls of great tits with the information contained therein. As great tits are possibly 'community informants', the repercussions of their mobbing calls being masked could be severe, especially for those species more vulnerable to predation that rely on this information.

(Photos courtesy Nora Carlson)