AT THE WATER'S EDGE

By Bob Waddell and Steven S. Rosenstock
Trail Camera Photos Courtesy of Ben Brochu

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It's a hot July day in the Sonoran Desert and hundreds, maybe thousands of feral honeybees swarm the water trough in front of us. Where the textured concrete ramp meets the water's edge, worker bees line up to drink before carrying the liquid back to cool their hive.

Bees are not the only critters visiting this man-made desert oasis. Other animals have left signs of their presence behind. Nearest the water development, tracks from a small covey of Gambel's quail mix with the hoof prints of a mule deer doe and her twin fawns; a few feet away, coyote prints bisect the elongated tracks made by a jackrabbit.

Who uses wildlife water developments? In the past, we've found answers by watching them or looking for nearby tracks. The bigger picture of exactly which wildlife use water developments and how these man-made waters impact wildlife has been, for the most part, unevaluated — until now.

Arizona Game and Fish Department biologists have used video cameras and other techniques to investigate the biological effects of these wildlife waters. Here's what we have learned.

Watching the Waters

Arizona Game and Fish employees have been constructing wildlife water developments (or drinkers) since 1946. In all, more than 800 such facilities have been built, many in arid parts of central and southern Arizona. According to Ed Jahrke, who has planned and managed the installation of many department water developments statewide, drinkers are especially important during times of drought. "When natural water sources are available, wildlife will seek those opportunities, allowing them to be less dependent on our developments," says Jahrke. "When its 110 degrees and all of the streams, tanks and potholes have dried up, wildlife becomes much more reliant on our drinkers."

Despite their importance, these developments have not been without controversy. Questions have been raised concerning their biological effects and the potential for unintended,

Editor's note: Originally published in the March/April 2007 issue of Arizona Wildlife Views magazine, "At the Water's Edge" explains what we know about how wildlife use man-made water developments.

Who uses wildlife water developments?

Turkey Vulture by George Andrejko

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adverse impacts on wildlife. Some critics of wildlife water developments have presumed that these developments benefit a relatively small number of species (primarily those hunted as game animals), spread waterborne diseases, and increase the risk of wildlife mortality from poor water quality and drowning. Some also worry wildlife waters attract predators and increase predation.

In 1999, the department instituted a multi-year cooperative study with the U.S. Army Yuma Proving Ground Conservation Program, U.S. Fish and Wildlife Service and the University of Arizona to address these concerns. We studied a section of Sonoran Desert in southwestern Arizona, which included the Yuma Proving Ground, Kofa National Wildlife Refuge and adjacent Bureau of Land Management lands. This area contains many wildlife water developments of different designs, including man-made catchments that collect and store rainwater, and natural rock tanks (or tinajas) modified to increase their storage capacity.

Who's Coming to Visit, and When?

We installed surveillance cameras equipped with infrared illuminators for nighttime operation and video recording systems at three catchments. These systems operated year-round for three-and-a-half years, recording nearly 38,000 hours of video footage.

Watching tapes and tallying animal visits was a daunting task, but the results were enlightening. Contrary to the perception that wildlife waters are used mainly by game species, a diverse array of wildlife visited our sites. We identified 29 species, but this number is a substantial underestimate because our video system had insufficient resolution to accurately identify common smaller visitors, such as bats, rodents, lizards and snakes. A later study by Northern Arizona University documented visits by several dozen species of resident and migratory birds at these catchments.

The most common documented catchment visitors are mule deer, turkey vultures, coyotes, great horned owls, gray foxes, bobcats, Western screech-owls, elf owls and red-tailed hawks. We regularly observed kit foxes, even though these animals are thought not to need free-standing water. Mule deer, coyotes and some other species usually drop by at night. During hot weather, desert animals are active at night to conserve water and reduce heat stress.

In 2006, I became the wildlife manager in one of Arizona's iconic Sonoran Desert environments: game management unit 37B, northwest of Tucson. At that time, there were nearly 20 water developments in the unit. While some provided perennial water to wildlife, others were defunct, having been constructed in the 1940s. Much of the unit had earthen stock tanks, but almost none held water between May and July, when desert wildlife need water most. Addressing water availability became my primary focus.

Average rainfall here is about 12–15 inches per year. But over the last decade, Arizona has been in a drought. I started working with landowners and volunteers to respond to the situation.

First, I coordinated and conducted water-hauling efforts to existing catchments, sometimes multiple times per year.

Next, I inventoried and mapped all water sources. A priority list identified which department-constructed waters needed to be repaired. There also were areas without waters, where new developments were recommended.

These days, we usually install higher-capacity 10,000-gallon-plus systems that collect rainfall in a number of ways. Two common methods are metal aprons that drain rainwater into gutters, or check dams in rocky drainages that capture runoff. In some cases, a combination of the two is used. Drilling wells (or tapping into springs) and using solar energy to pump water is also a common, efficient and cost-effective way to distribute adequate water over the landscape.

Since 2006, 13 catchments have been developed or redeveloped in 37B. These wildlife waters are constructed in cooperation with ranchers, sportsmen's organizations and land management agencies, and rely heavily on volunteer efforts. Three old catchments remain on the list for redevelopment.

We're seeing results from these efforts. Beginning around 1995, mule deer numbers in the unit began to decline. They bottomed out between 2002 and 2005. Since 2005, they have steadily recovered, with significant increases beginning in 2008. Hunting permits have doubled since 2007, when 500 tags were issued. Today, we offer 1,000 permits between two hunts.

Management of wildlife and habitat is dynamic and complex. Many factors probably contributed to the increased mule deer herd in 37B. I attribute it (at least in part) to our aggressive water development and redevelopment efforts.

We monitor water catchments in 37B with digital trail cameras. After reviewing hundreds of thousands of photos and countless hours of video, I believe artificial water catchments are not just beneficial to deer. I've seen everything from bats to foxes using these waters. Like Rosenstock, Waddell and their co-authors, I'm convinced that water catchments benefit all water-dependent wildlife.

–Ben Brochu

"Water for Wildlife" is adapted from a longer article published in the September–October 2014 issue of Arizona Wildlife Views magazine.

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As one might expect, hot, dry summer months are the busiest. Mule deer, foxes, coyotes and bobcats use these waters year-round, but the majority of visits occur during May, June and July. Hawks, falcons, owls and vultures primarily visit from April through September, with highest visitation occurring May through July. Doves and quail are in attendance year-round, but we observed them most often from April through October.

Are Developed Waters a Hazard to Wildlife?

One might think predators use waters as convenient places to ambush unsuspecting prey that come to drink. However, in 38,000 hours of videotape, we observed only eight successful or attempted predation events. Bobcats captured or attempted to capture bats on three occasions; a bobcat caught a dove; a Cooper's hawk and red-tailed hawk each captured a dove; a great horned owl grabbed an unidentifiable item from the water; and a great horned owl attempted to capture a young gray fox.

Stories about the Southwest occasionally reference animals that become entrapped and drown when attempting to get water. This has led some to speculate that man-made water developments represent a similar hazard. In some cases, natural waterholes, such as tinajas, can pose such a threat. A steep-sided tinaja can trap animals, especially when water levels are low. These "trap tanks" are relatively uncommon, but once identified are modified by adding steps or ramps allowing animals safer access to the water.

All Arizona Game and Fish catchments have special ramps in the drinking trough designed to prevent animal entrapment. "When we install the ramps, we use cement and local rocks. Usually, this combination is porous enough to offer good traction, even if they get a little mossy," Jahrke says. Other design features built into some drinkers include lining the sides with plaster so bees can crawl out of the water, widening the access to drinkers in elk country so bull elk don't get their antlers entangled, and making sure bats have safe access.

During four years of research, we visited water developments more than 600 times, examining the water and surrounding area for drowned animals or animal remains. We found them on only 19 occasions. While the true causes of death were unknown, observations from our video cameras suggest predators or scavengers may have brought some of these animals in from elsewhere. Given the small number of mortalities, we concluded these water developments do not pose a significant entrapment or drowning risk to wildlife.

Is the Water Safe for Wildlife to Drink?

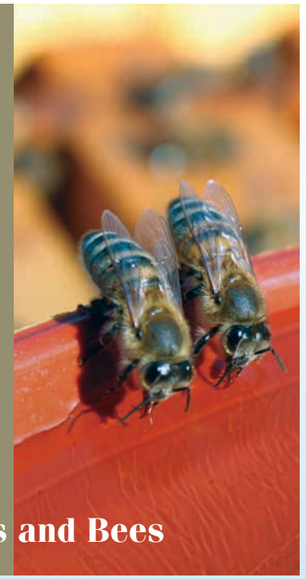
When encountering a wildlife drinker on a sweltering July day, one might not be tempted to pull that trusty tin cup from the backpack and enjoy a cool, refreshing drink. At such times, the water — thick with algae, tadpoles, aquatic insects, dead honeybees and bird feathers — can be less than appealing to the human eye. Mule deer droppings scattered along the access ramp do not improve the situation. Scenes like this have led critics to question whether poor water quality at these developments might be detrimental to wildlife health.

We collected hundreds of water samples from different types of water developments, as well as from natural sources such as springs and tinajas. These samples were analyzed for chemical composition, heavy metals and toxins that can be produced by blooms of blue-green algae. Since water quality standards have not been developed for wildlife, we used guidelines developed for domestic livestock, swine and poultry. Nearly all samples fell well within recommended guidelines. A few samples had slightly elevated fluoride or alkalinity, neither of which was likely to affect animal health. It looks like water at these developed sources is of sufficient quality for consumption by wildlife.

Because honeybees require water for survival, it has been suggested that wildlife water developments have encouraged expansion of feral honeybees in Southwestern U.S. deserts.

Could this have a negative impact on native bees that depend on nectar and pollen resources that honeybees can harvest more effectively?

To test this, the department teamed with local bee experts and set bee traps at varying distances from water developments in southwestern Arizona. Feral honeybees were abundant near water developments, but their numbers decreased rapidly farther from the water. The diversity and abundance of native bee species was high, regardless of trap location, indicating that native species were not being outcompeted, even close to water. More than 200 species of native bees were collected, representing one of the richest native bee communities yet documented in North America.



Wildlife Waters and Bees

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Wildlife Species Identified at Wildlife Drinkers Using Surveillance Cameras

MAMMALS	BIRDS	AMPHIBIANS
Badger	American kestrel	Red-spotted toad
Black-tailed jackrabbit	Burrowing owl	Sonoran Desert toad
Bobcat	Common poorwill	
Coyote	Common raven	
Desert cottontail	Cooper's hawk	
Gray fox	Elf owl	
Kit fox	Gambel's quail	
Mule deer	Gila woodpecker	
	Greater roadrunner	
	Great horned owl	
	House finch	
	Loggerhead shrike	
	Mourning dove	
	Northern mockingbird	
	Red-tailed hawk	
	Sharp-shinned hawk	
	Turkey vulture	
	Western screech-owl	
	White-winged dove	

Red-tailed Hawk By George Andrejko

Can Waters Spread Wildlife Diseases?

For humans, contaminated water sources can play an important role in the spread of diseases such as dysentery and that backpacker's nemesis, giardiasis. Is the same true for wildlife?

Doves and other infected birds can spread the protozoan parasite that causes trichomoniasis via backyard birdbaths. Trichomoniasis commonly occurs in urban areas of Arizona, where severe outbreaks can kill large numbers of birds.

Because wildlife water catchments are likewise visited by large numbers of doves and songbirds, it was suggested they also could facilitate spread of trichomoniasis. Over a three-year period, we collected water samples from different types of water developments in our study area. We also collected samples from water developments in the Kingman area during a 2003 trichomoniasis outbreak. Water samples were cultured in the laboratory and then inspected for the protozoan.

To our surprise, all samples were negative, including those from the Kingman area. One of our collaborating scientists at the University of Arizona found a possible explanation. Much like natural water sources, catchment troughs are home to a rich community of microorganisms, many of which are predators that may be consuming the *Trichomonas* protozoans.

Waters for the Future

Benjamin Franklin once said, "We will only know the worth of water once the well is dry." The same might be said for man-made water sources in the desert Southwest. Water developments are integral to wildlife management in this region and will be of even greater importance if natural water sources are further compromised by human development and climate change.

■ Along with Chantal S. O'Brien and Michael J. Rabe, this article's original authors (Robert B. Waddell and Steven S. Rosenstock) published their results "Wildlife Use of Water Catchments in Southwestern Arizona" in the October 2006 issue of the Wildlife Society Bulletin, Volume 34, Issue 3, pages 582–591.