Water for Wildlife

A Handbook for Ranchers and Range Managers

Daniel A.R. Taylor
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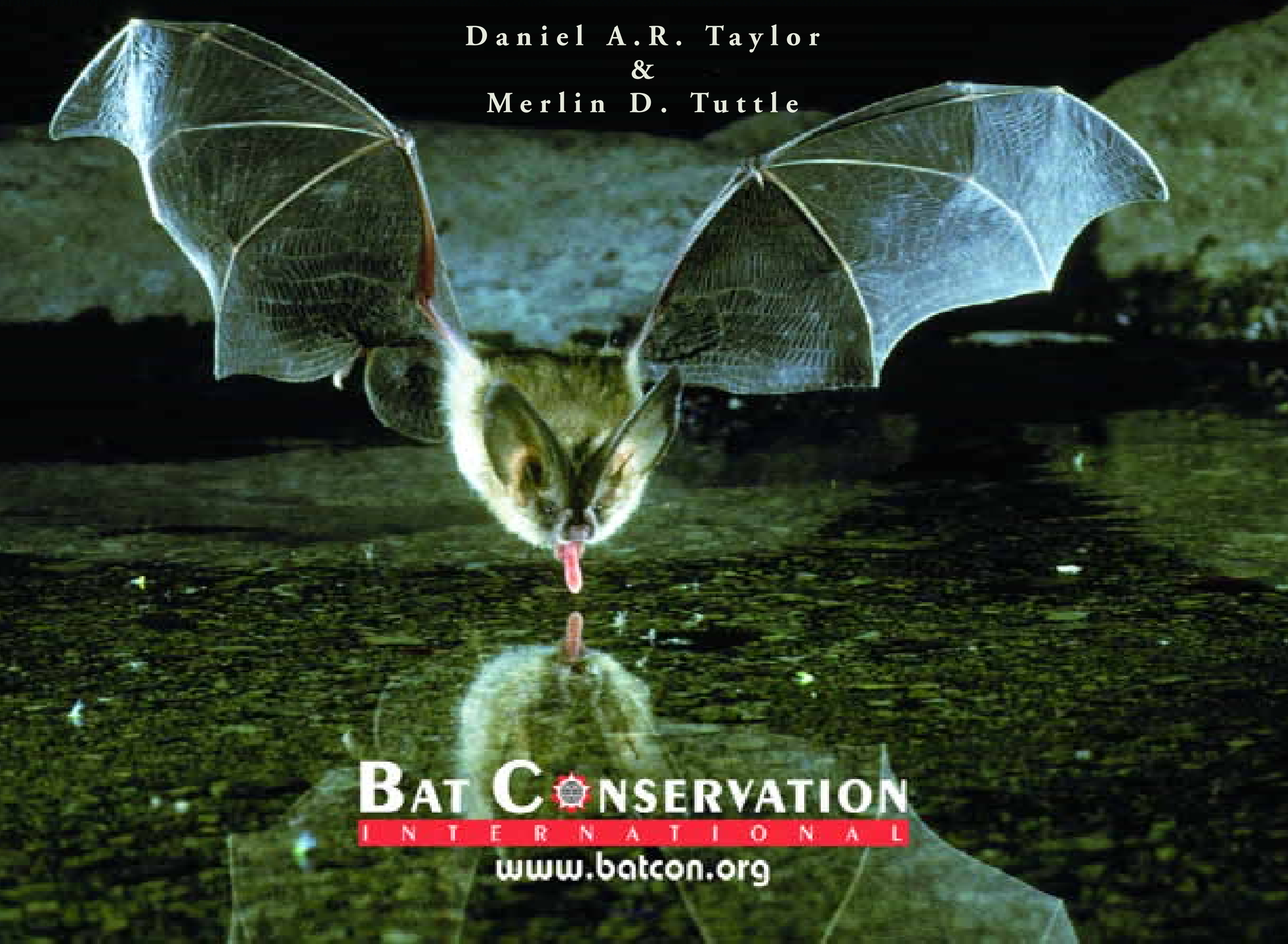

Bat Conservation International
www.batcon.org

This Arizona livestock water trough provides water for hundreds of bats each summer night, including these California myotis. Such resources are increasingly critical for a wide variety of wildlife as natural water sources disappear, especially in the arid and semi-arid West. (Note the use of goldfish to help keep the trough free of algae that can impede or prevent in-flight drinking.)

COVER PHOTO: A Townsend's big-eared bat swoops down to drink on the wing at a shallow pond.

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Watering tanks, troughs and ponds maintained for livestock often double as critical resources for a broad array of wildlife. As development and drought take an increasing toll on natural water sources, especially in North America's arid western regions, these watering sites can be vital, not only for animals but also for the health of ecosystems that rely on them.

This handbook for landowners and range managers describes proven methods for increasing wildlife safety and accessibility at artificial watering features without diminishing their usefulness for livestock. Without reliable sources of water, wildlife must either leave or die – to the long-term detriment of rangelands and forests. Considering the needs of wildlife in the installation and maintenance of livestock water supplies is good business. Although aimed at Western livestock producers, the wildlife escape structures and advice in this handbook apply east of the Mississippi River as well.

Much of the discussion that follows emphasizes bats, not only because they are essential for healthy ecosystems but also because they exhibit exceptionally narrow requirements for their water sources. Bats must drink on the wing over open water, but their needs are - seldom recognized. Improving bats' access to watering sites also benefits other wildlife, especially insect-eating birds, such as swifts, swallows and nighthawks that also drink in flight.

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National Fish and Wildlife Foundation

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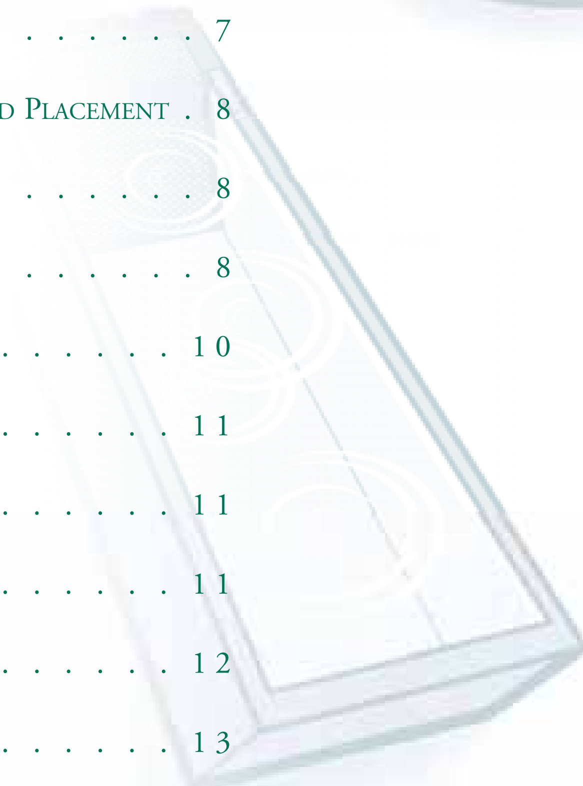
USDA NRCS Natural Resources Conservation Service

TABLE OF CONTENTS



Rangeland Water Development

Water can be a critical factor in determining the abundance and distribution of wildlife, especially in arid western ecosystems, although the impact varies by species, habitat and season.

Over the past 150 years, the availability and distribution of water have been drastically altered by both natural processes and human actions. Among key factors: agricultural irrigation and municipal water use that have lowered water tables; diversions to enhance recreational facilities; historical overgrazing by domestic livestock; damming for irrigation and flood control; and the spread of urban and suburban development. Other factors, such as the disappearance of beaver and changing climatic patterns, exacerbate the problem. By some estimates, 70 to 95 percent of natural riparian ecosystems (those associated with water features) and wetlands in the arid West have already been degraded or lost.[1]

Arizona's Davis Dam across the Colorado River is one of many great dams that altered water resources throughout the American West, often limiting options for wildlife.

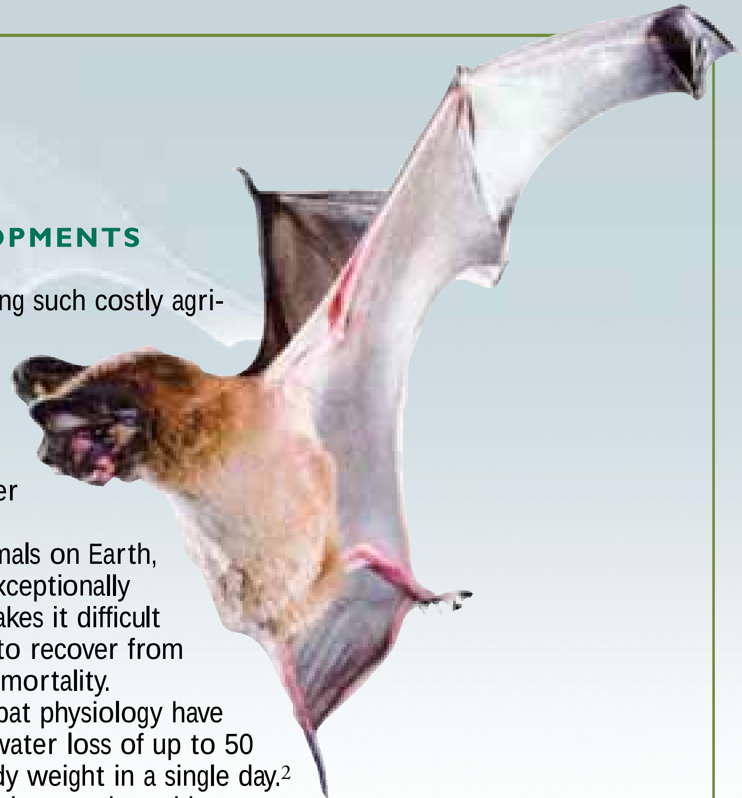
Once-abundant beaver traditionally maintained ponds that were used by a variety of wildlife. But beaver ponds have virtually disappeared from much of the West.

The loss of natural water resources threatens wildlife, but domestic livestock also require water to survive. Since the advent of commercial grazing on western rangelands, ranchers have improved existing water supplies and developed new water systems for their livestock. Hundreds of thousands of these water developments are scattered across the western U.S. By the 1950s, land managers had also begun developing water sources specifically for wildlife, especially game animals. Livestock and wildlife water developments increasingly replace or augment diminishing natural sources in many areas and have become crucial for many species, especially when animals are stressed by drought, high temperatures or rearing young.

Many birds can use even the smallest troughs when water levels are high. However, most bat species, and many birds that drink in flight cannot use such small resources and are easily trapped and drowned if water levels fall and no escape structures are provided.

The presence of livestock water developments also can improve the quality of surrounding habitat, often allowing some wildlife species to expand into previously unsuitable areas. Researchers note that ungulates such as the pronghorn antelope, for example, generally require permanent water sources at intervals of less than five miles within their home range. Most nursery colonies of bats are located within a mile of water.

[1]Ohmart, R.D. and B.W. Andersin. 1986. In: Cooperrider et at. editors. Inventory and Monitoring of Wildlife Habitat. USDI-BLM Service Center: Denver, CO.



Bats and Livestock Water Developments

Bats are primary predators of night-flying insects, including such costly agricultural and rangeland pests as armyworm moths, leafhoppers, grasshoppers and crickets, and they are also important plant pollinators and seed dispersers in southern Arizona, New Mexico and Texas. As such, bats are invaluable allies in maintaining healthy ecosystems and economies. And they probably rely on livestock water developments more than any other wildlife.

Bats are, for their size, the slowest-reproducing mammals on Earth, with females usually rearing just one pup per year. This exceptionally low birth rate makes it difficult for populations to recover from any increase in mortality.

Studies of bat physiology have documented water loss of up to 50 percent of body weight in a single day.[2] Even the most desert-adapted bat species periodically need water, and loss of just one water source can threaten the survival of local populations.

To get water, bats must fly down to the water surface, scoop up a drink and keep flying up and away from the pool – a process that requires an unobstructed "swoop zone," just as airplane pilots need clear approaches to their runways. Obstacles in the flight path can prove deadly. Like many other animals, bats are very susceptible to drowning if trapped in a water tank without an escape route.

The minimum size of the water feature and swoop zone needed varies according to each species' flight characteristics. A few bat species are highly maneuverable with relatively short, broad wings, while most have longer, narrower wings and far less maneuverability. The most maneuverable bats can drink from open water with dimensions as small as three by four feet and are relatively adept at avoiding obstacles. But even these bats normally prefer larger open areas for drinking.

A review of data collected by western bat biologists who often capture bats over water developments (see "Bats' Pond-size Choices," page 13) indicates that most bat species need open water surfaces at least 10 feet long by no less than 2.5 feet wide. Some species apparently require tanks or rivers with stretches of open water at least 50 feet long, and a few need 100 feet. Cross-braces over troughs or other obstructions over the water may prevent even the most maneuverable species from drinking.

The minimum size of water features that bats are able to drink from varies according to the maneuverability of the species. The highly maneuverable California myotis (bottom left) can use small troughs, while the big free-tailed bat (top right) typically needs at least 50 feet of open water.

[2] O'Farrell, M. J., E. H. Studier and W. G. Ewing. 1971. "Energy utilization and water requirements of captive *Myotis thysanodes* and *Myotis lucifugus* (Chiroptera)". Comparative Biochemical Physiology 39A: 549-552.

Common Types of Livestock Water Developments

Even troughs as small as 2.5 by 4 feet may be used by large numbers of the most maneuverable bat species, such as this California leaf-nosed bat, sometimes flying in to drink at rates of up to one per second. Such use likely would be impossible if obstructions such as fencing, braces or vegetation were present. Note the concrete escape ramp at lower left.

Ranchers and range managers of the West have devised a remarkable array of strategies for collecting, storing and distributing water for livestock. This handbook describes how some of the most common watering structures can be made safer and more accessible for wildlife, especially bats. These structures can be divided into three main types: *troughs and drinkers* (steep-sided, open-topped receptacles that allow animal access to the water); *storage tanks* (large water-holding facilities with steep, high walls and open or closed tops); and *open reservoirs* that resemble natural ponds and function both as a trough and a storage facility (often referred to as tanks, dirt tanks or stock ponds).

Troughs

Troughs vary greatly in size, shape and materials. A number of manufacturers produce troughs specifically for livestock, but many objects – including tractor tires, steel drums and old boilers – are also adapted for this purpose. A survey of 367 livestock water troughs in 11 western states (see "Western Water Troughs," page 7) suggests the most common types are round, rectangular or oval metal troughs, followed by rectangular and round fiberglass troughs, round or rectangular concrete or concrete-and-metal troughs, and old tractor tires. The choice of trough size is determined primarily by how many animals need to use it, whether it will be the only water facility available, the desired location and cost.

Livestock troughs are typically filled by water piped from a spring, drawn from a well (by a gasoline-, wind- or solar-powered pump) or hauled by vehicle. When water is delivered through a pipeline, a float valve keeps the trough from overflowing. The ability of wildlife to safely access water troughs is largely determined by the size, shape and height of the trough, the water level and the presence of obstructions over and adjacent to the water surface.

Large storage tanks like this often provide critical drinking water for a wide variety of bats, including most western species. Drinking rates as high as several bats per second are common on hot nights. Yet even these tanks, if they lack effective escape structures, can trap bats and birds such as this drowned quail (inset), especially if water levels fall.

Storage Tanks

Storage tanks come in many sizes and shapes, but are usually at least 20 feet in diameter with walls more than four feet high. Smaller tanks often have correspondingly higher walls to increase storage capacity. Most large storage tanks are made entirely of steel or of steel plates riveted or welded together to form walls that are set into a concrete base. Older storage tanks were sometimes made of wood or wood reinforced with shotcrete.

Non-flying and non-climbing animals often are unable to reach the water in storage tanks because of the high walls, although bats and birds routinely drink from open-topped tanks. When water levels fall even a few inches below the top, however, such animals are easily trapped, and it is extremely difficult for them to climb out unless an escape structure is provided.

Open Reservoirs

Stock ponds are constructed by building earthen dams in locations where surface runoff can be trapped to create a temporary pool of water. These can be excellent sources of water for wildlife. They are easily accessible, and animals that fall into them can usually swim to shore and escape. The primary drawback is that smaller ponds tend to dry up when they are most needed – during times of drought and hot weather.

Enhancing Wildlife Safety and Access

While a variety of wildlife depends on livestock troughs and tanks for water, animals of many species also drown while attempting to drink or bathe in these structures, particularly when water levels are low and escape structures are absent or inadequate. Mortality rates cannot be reliably estimated, but anecdotal evidence suggests that such wildlife drownings are frequent and widespread. One Colorado rancher reported finding 46 drowned bats in a single tire trough, and biologists in West Texas have documented bats of a number of species trapped in livestock troughs.[3]

Biologists collaborating with Bat Conservation International's Water for Wildlife program are studying wildlife use of livestock water facilities throughout the West. Here, Stu Tuttle of the USDA Natural Resources Conservation Service monitors bats drinking at a water trough.

Obstacles over or adjacent to water facilities not only deny access to the water, but can create fatal hazards for wildlife. Bats and birds that fly in to drink on the wing (such as swallows and nighthawks) can be knocked into the water by bracing or fencing in their flight path.

Maintaining consistent water supplies is also critical for healthy wildlife populations. It is a common practice to temporarily shut off water to tanks and troughs when livestock are moved, forcing wildlife that have become dependent on that water supply to find alternative – often distant – sources or perish. This is particularly harmful during the warmest months when many animals are rearing young.

Preventing wildlife fatalities at water troughs not only conserves wild species but also helps maintain the clean, uncontaminated water that is critical for any livestock operation. Decaying animal carcasses greatly diminish water quality.

Wildlife Escape Structures

The need for wildlife escape structures (also called wildlife ramps or bird ladders) in troughs has been documented in range and wildlife publications for more than three decades.[4] Most livestock water troughs were not designed or installed with wildlife in mind, and they seldom include a means of escape for animals that fall in while attempting to drink or bathe. Our survey ("Western Water Troughs," page 7) found that 90% of troughs lack adequate escape structures for wildlife. This has resulted in the accidental drowning of countless birds, bats and other small mammals – and occasionally even such large mammals as pronghorns, mule deer, mountain lions and bobcats.

Escape is especially difficult when water levels fall significantly below the trough rim, leaving a sheer wall the animal must scale. If the sides are rough, climbing animals or those with sharp claws like bats may be able to climb out. More often, however, the sides are slick because of construction materials, water chemistry or livestock rubbing against them. Even animals well adapted to climbing often are thwarted by such walls. They drown

Posts, fences, braces and vegetation around water troughs and other water supplies can severely reduce access and increase risk for bats and birds that must drink on the wing. A well-meaning effort turned this trough into an extraordinarily high-risk trap for bats and birds, with barbed wire stretched over the water's surface and an escape ramp that doesn't reach the water.

[3]Stangel, W., W. Dalquest and R.R. Hollander. 1994. Evolution of a desert mammalian fauna: A 10,000-year history of mammals from Culberson and Jeff Davis counties, Trans-Pecos Texas. Midwestern State University Press, Wichita Falls, TX.

[4]Wilson, L. O. 1977. Guidelines and Recommendations for Design and Modification of Livestock Watering Developments to Facilitate Safe Use by Wildlife. 1977. BLM Technical Bulletin 305. 23 pp.

unless a properly designed and well-placed escape structure is available. Wildlife drownings increase when alternative water supplies are unavailable and escape structures are absent, especially when water levels are lowest and during periods of drought, high temperatures and wind.

Tragically, some of the most common attempts to provide wildlife escape structures do not work or are unreliable.

Especially ineffective examples are branches, logs or boards that are simply allowed to float on the surface. These do little to help animals escape since even animals that are able to find and climb onto them often remain stranded. Many bats and birds find it difficult to take flight while surrounded by the steep sides of a trough with a low water level. Furthermore, wood easily becomes waterlogged and can rot quickly.

Tanks in which water levels are allowed to fall can be difficult to impossible for bats and birds that must fly down to the water surface to scoop up a drink. And without an escape structure that reaches to the bottom of the tank, they can become deadly traps.

Downed birds and bats, like this cave myotis, usually can't find escape ramps that don't have sides that extend into the water and all the way to the edge of the trough. They typically swim under the ramp without noticing it. Without a helping hand, this bat would be doomed.

Another inadequate and unfortunately common escape structure is a ladder or ramp that angles down from the rim of the trough toward the center and does not include vertical sides that extend all the way down to the water and meet the inside wall. Most animals, desperate to escape the trough, swim along the perimeter in search of a way out. They will swim repeatedly under such a ramp without finding it, especially if the water level is low. These side-less escape structures should be replaced with a more effective design.

Piling rocks to the surface along an edge of a trough is also somewhat popular – and unreliable. Rock piles are not secure and rarely withstand jostling by livestock or repeated freezing and thawing. This design should not be used. A much-improved version of rocks secured with mortar is described on page 10.

Western Water Troughs

With the collaboration of state and federal agencies, including the Western Bat Working Group, we collected a wealth of standardized information about existing water troughs and their suitability for wildlife. Data on 367 livestock troughs on private and public lands were gathered in 11 western states. Thirty-five percent were in Arizona, 24 percent in Idaho, and the remainder in New Mexico, Utah, Washington, Oregon, Colorado, Nevada, South Dakota and Wyoming.

Among the findings:

- The most commonly used trough types were rectangular, round and oval metal troughs (72%), followed by round or rectangular concrete or concrete-and-metal (12%), rectangular and round fiberglass (10%) and tractor tires (6%).
- Fewer than 10% of the 367 troughs had a functioning wildlife escape structure.
- Of the 281 troughs where water level was recorded, 80 (28%) were empty, and 85 (30%) had water levels six inches or more below the rim.
- More than half of the troughs had some type of obstruction over the water. The most common were bracing and fencing, followed by bars, wires, vegetation, float valves and algae.

Improving Wildlife Escape Structures: Design and Placement

The good news is that effective wildlife escape structures are easy and inexpensive to build and can virtually eliminate wildlife mortality in water troughs. Properly designed and installed, these structures also improve livestock health by maintaining clean water that's uncontaminated by drowned animals.

A downed cave myotis quickly found this escape structure and climbed out unharmed. Downed animals seeking escape typically swim along the perimeter of water troughs and rarely find escape ramps that do not include sides like this that extend into the water and are flush with trough sides.

Guidelines

Several basic principles should guide the design and installation of all wildlife escape structures. An effective escape device should:

- extend down into the water and meet the inside wall of the trough so animals swimming along the perimeter will find the structure, rather than becoming trapped behind or beneath it or missing it entirely
- reach to the bottom of the trough, so it will be effective even if water levels drop sharply;
- be firmly secured to the trough rim so it will not be knocked loose by livestock or other animals
- be built of grippable, long-lasting materials, such as painted or coated metal grating, roughened fiberglass, concrete, rock and mortar or high-strength plastic composites
- have a ***slope no steeper than 45 degrees*** so animals can climb out without slipping back into the water
- be located to cause minimal interference with livestock

The choice of materials is typically based on the type of trough, cost, availability, weight, surface roughness, personal familiarity and the number of escape structures needed. In narrow (three feet wide or less), rectangular or oval troughs, escape structures should be placed at one end of the trough so they minimize interference with bats and birds swooping in to drink. Because many birds and small mammals tire quickly while swimming, larger troughs should have at least one escape structure placed every 20 linear feet along the perimeter.

In rectangular troughs, the escape structure should be placed at one end to leave as much open water as possible.

Expanded-Metal Structures

One of the most economical and easily constructed wildlife escape structures is made of expanded-metal grating, which is especially well-suited to round and rectangular metal troughs that are no more than four feet deep. Thirteen- or 11-gauge expanded metal with ½-inch mesh is highly recommended. Construction is simple: Cut a square of expanded metal, then bend it into the shape of a ramp that attaches to the trough rim, extends to the bottom and has two sides ("wings") that meet the side of the trough (Figures 1, 2a and 2b). The size of the metal square determines the height of the ramp, which should usually equal the depth of the trough. Expanded-metal escape structures should be finished with a rust-inhibiting paint or coating. Enamel paint used for farm implements is inexpensive, widely available and works well.

Expanded-metal wildlife escape structures must be firmly attached to the trough rim. A metal-tapping screw and washer is simple and effective, or a bracket with a bolt and wing nut can be made or purchased to allow easier removal for trough maintenance. Secure attachment keeps the ramp from being knocked loose by stock or freezing water. The structure can be reinforced by welding a steel strap to the bottom of the mesh at the attachment point where it folds over the trough rim. The strap should be the same width as the ramp and extend at least 6 inches down the slope.

While all escape structures should be checked periodically to ensure proper function, these economical, expanded-metal ramps should last at least 5 to 10 years if properly painted or coated.

Another simple but effective design for rectangular metal and concrete troughs consists of one piece of expanded metal grating that attaches to the rim (with bolts or brackets) at one end of the trough. It should slant down at a 45-degree angle to meet the bottom and have vertical sides flush with the sides of the trough. Strips of 2-inch flat steel bar may be welded to the edges, creating a frame that provides strength and easier attachment to the rim (Figure 3a).

This design can also be modified to protect float valves or other plumbing by extending the expanded metal horizontally from the point of attachment along the top of the trough to form a flat "cover" before it slants down toward the bottom (Figure 3b). Birds are able to land and walk down the ramp to drink. In shorter, rectangular troughs, however, this would reduce the amount of unobstructed surface area available to bats and birds that must drink in flight.

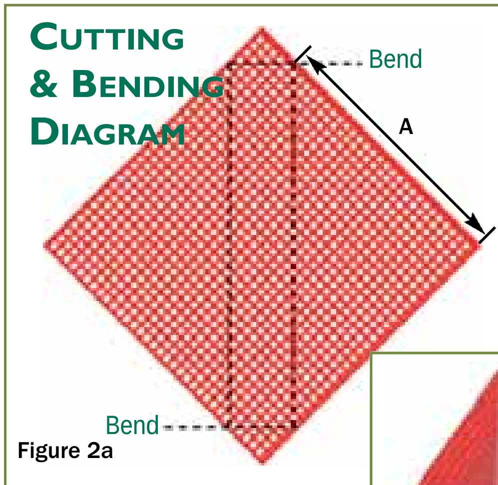


Figure 2a

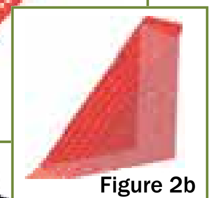


Figure 2b

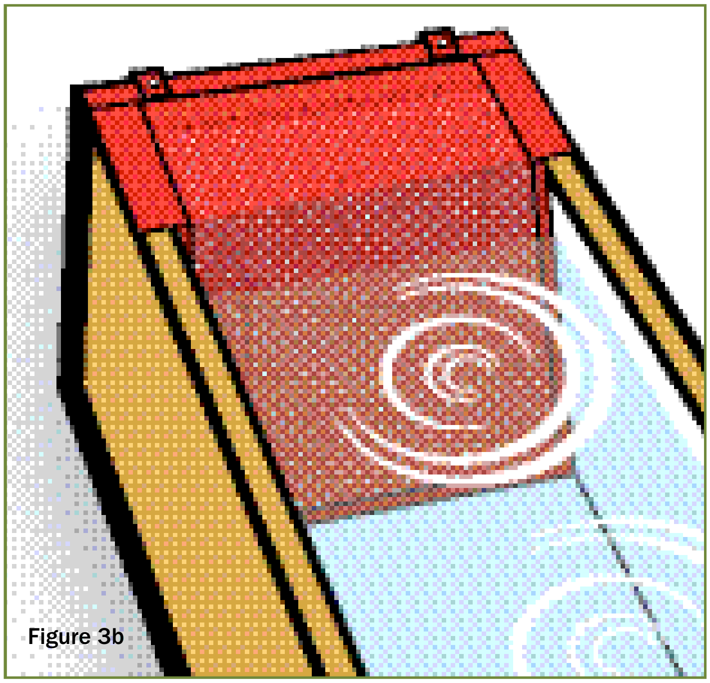


Figure 3b


Figure 1

Expanded-metal grating (with ½-inch mesh) is an effective and inexpensive choice for wildlife escape structures. Use the cutting diagram in Figure 2a, with the length (A) matching the depth of the trough. The ramp is bent as in Figure 2b. The top corner bends over the rim of the trough (Figure 1) and is attached with screws or bolts.


Figure 3a

A good escape ramp for a rectangular trough is simply an appropriately sized panel of expanded-metal grating that spans the width of the trough at one end and slants from the top of the rim to the bottom (Figure 3a). It can be reinforced with steel bars along the edges. By using a larger piece of grating and bending it to provide a flat "cover" at the top (Figure 3b), this design can be used to protect a float valve or other plumbing.

Dan Taylor (right) helps Dennis Maroney and his daughter, Allie, of the Cross-U Ranch in McNeal, Arizona, complete an expanded-metal escape structure by bending the sides to a 90-degree angle.

Concrete and Rock-and-Mortar Escape Structures

Escape structures made of concrete or rocks and mortar can be very effective. They can be used in a variety of troughs, but are best in those made of concrete. Rock-and-mortar ramps can usually be made of local rock, reducing expenses for materials and transportation. Simply set rough-surfaced rocks firmly in mortar to form a ramp from the bottom of the trough to the rim. The ramps may be capped with concrete to withstand bumping by livestock and provide better traction for wildlife (Figure 4).

Concrete ramps are built in much the same way, using concrete mixed on-site and poured into a plywood mold to produce a concrete block that slopes from rim to bottom. Rebar is needed to strengthen the concrete in larger ramps.

Like other wildlife escape structures, rock-and-mortar and concrete ramps should meet the interior sides of the trough to intercept animals swimming along the perimeter and should have a maximum slope of 45 degrees. If the ramp is not heavy and stable enough to keep it from being dislodged, a metal plate can be set into the concrete or mortar and welded or bolted to the trough rim.

Concrete and mortar-and-rock ramps may take longer to build and are difficult to move, but they are highly effective and especially long lasting.

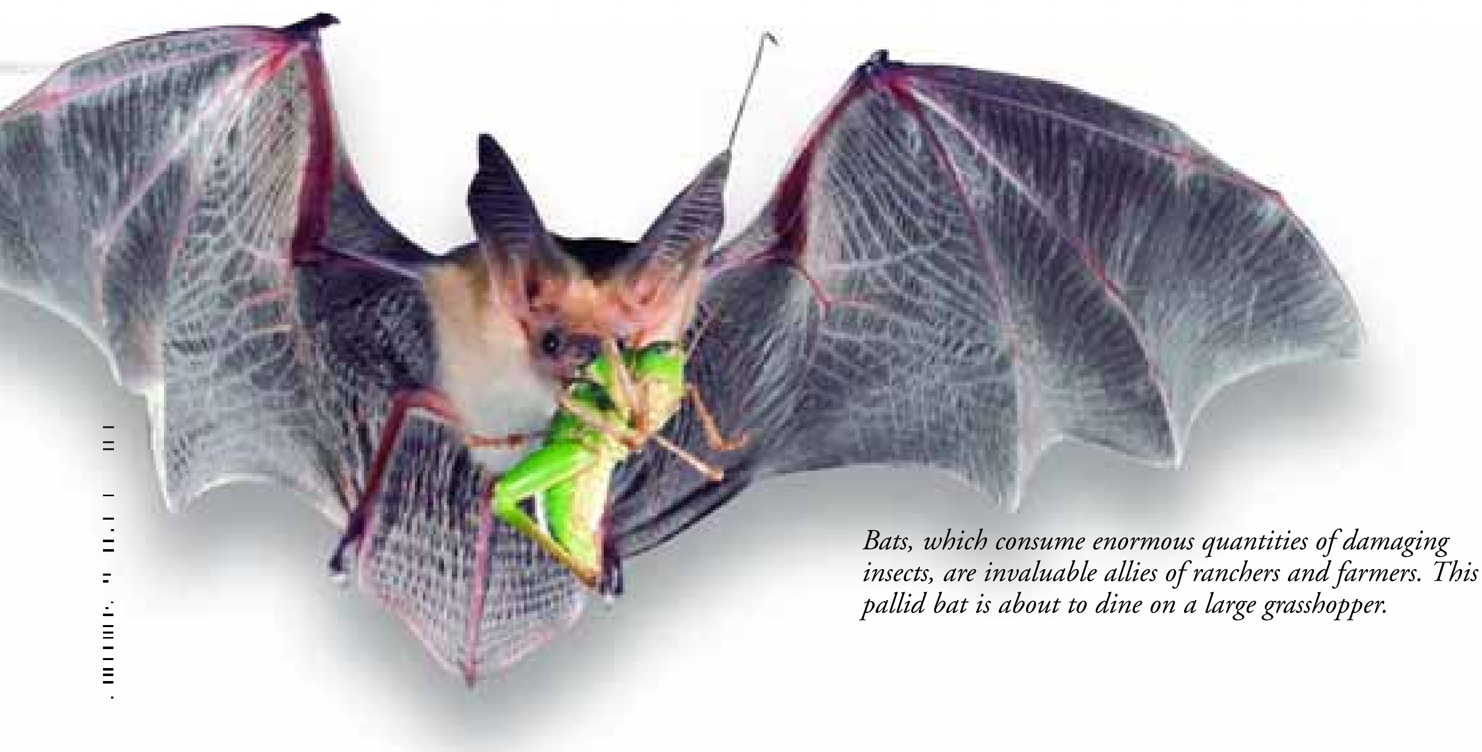
One possible modification that appears promising, although it has not been extensively tested, uses cement cinderblocks to make steps that function as a wildlife escape structure. The cinderblocks can be secured with concrete or mortar and should be rough enough to enable birds and small mammals to climb out. A cinderblock escape structure may have the added benefit of providing a secure foothold for livestock or ungulates that accidentally end up in the trough.

Ramp-like structures built outside the trough to help wildlife gain access generally are not recommended unless they are met by a similar structure on the inside. If the escape route fails, the access structure can lure wildlife into a death trap. If attempted, sturdy concrete or rock-and-mortar structures should be used for both the access and escape structures.

ILLUSTRATION © JASON HUERTA, BCI

Figure 4

Rough-surfaced stones firmly set in mortar to form a slanting, top-to-bottom ramp flush with the side of the trough produce an exceptionally durable escape structure. Concrete poured into plywood forms results in a similar structure.



Bats, which consume enormous quantities of damaging insects, are invaluable allies of ranchers and farmers. This pallid bat is about to dine on a large grasshopper.

Other Escape Structures

Fiberglass escape structures are normally used only in fiberglass troughs. Some manufacturers offer escape structures designed for their products. The fiberglass surfaces may need to be roughened to increase traction. The "Water for Wildlife Resources" section provides contact information for a manufacturer of fiberglass t roughs and escape structures, including a wildlife-friendly trough with a built-in escape structure.

Lumber substitutes, including wood-and-plastic composites such as Trex™ or EON™, provide promising options for wildlife escape structures. These materials can be worked like wood but require no painting or coating and will not rot or degrade due to moisture or exposure to sun.

Figure 5

Wildlife escape structures are built into some manufactured fiberglass troughs.

Special Cases

Two commonly used livestock water developments are especially hazardous to wildlife: troughs made from old truck and tractor tires, and large, open-topped metal storage tanks with fluctuating water levels.

Tire Troughs

We strongly discourage the use of old tires for watering troughs because, without special efforts to improve wildlife safety (Figures 6a and 6b), they are especially prone to trapping animals. Escape structures for tire troughs must be tailored to fit each trough and must be built so that wildlife swimming along the recessed edge of the tire wall (bead) will intercept the escape structure and have easy access out. For expanded-metal escape structures, this can be accomplished by measuring the depth and height of the tire's bead, then cutting the expanded metal so that the sides or wings extend under the bead and meet the tire wall. Rock-and-mortar escape structures also must extend completely into the tire bead so they will intercept swimming animals and provide clear access up and out of the trough. Trimming the overhanging rim of the tire back to where the escape structure meets it can help wildlife escape without compromising the integrity of the trough. Even when best modified for wildlife safety, most tire troughs are too small to accommodate more than a few bat species, although these sometime use such troughs in large numbers.

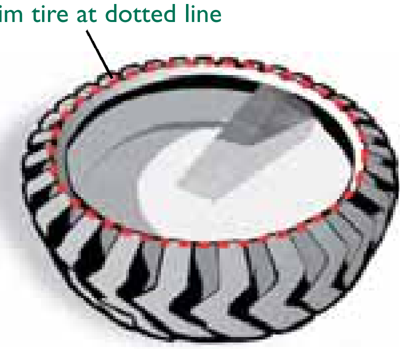


Figure 6b

Figure 6a

Water troughs made from old tires are not recommended. If they are used, however, the escape structure must reach under the rim all the way to the inside back of the tire (Figure 6a) so downed animals can find it. Cutting a few inches of the overhanging rim from the tire (Figure 6b) will also make escape easier.

Storage Tanks

Large storage tanks are typically round and made of metal, with a concrete base, a diameter of 20 feet or more and sides at least four feet high. These facilities are usually accessible only by bats and birds. But when water levels fall even a few inches below their rim, such tanks can pose especially high risks of wildlife entrapment unless escape structures are provided.

If near-full water levels are maintained, then placing one standard, expanded-metal escape structure every 20 linear feet along the perimeter should provide adequate escape routes (Figure 7). Where water levels fluctuate widely, the escape structure should reach from the rim to the bottom of the tank. Two large, expanded-metal escape structures can be made from a 4-by-8-foot sheet of expanded metal grating. If built as outlined in Figure 2a (page 9), these structures will reach the bottom of a 40-inch-deep tank.

Because many large storage troughs are 48 inches or deeper, however, cinderblocks are needed to provide a platform at the bottom of the tank, enabling animals to reach the escape structure even when the trough is almost empty.

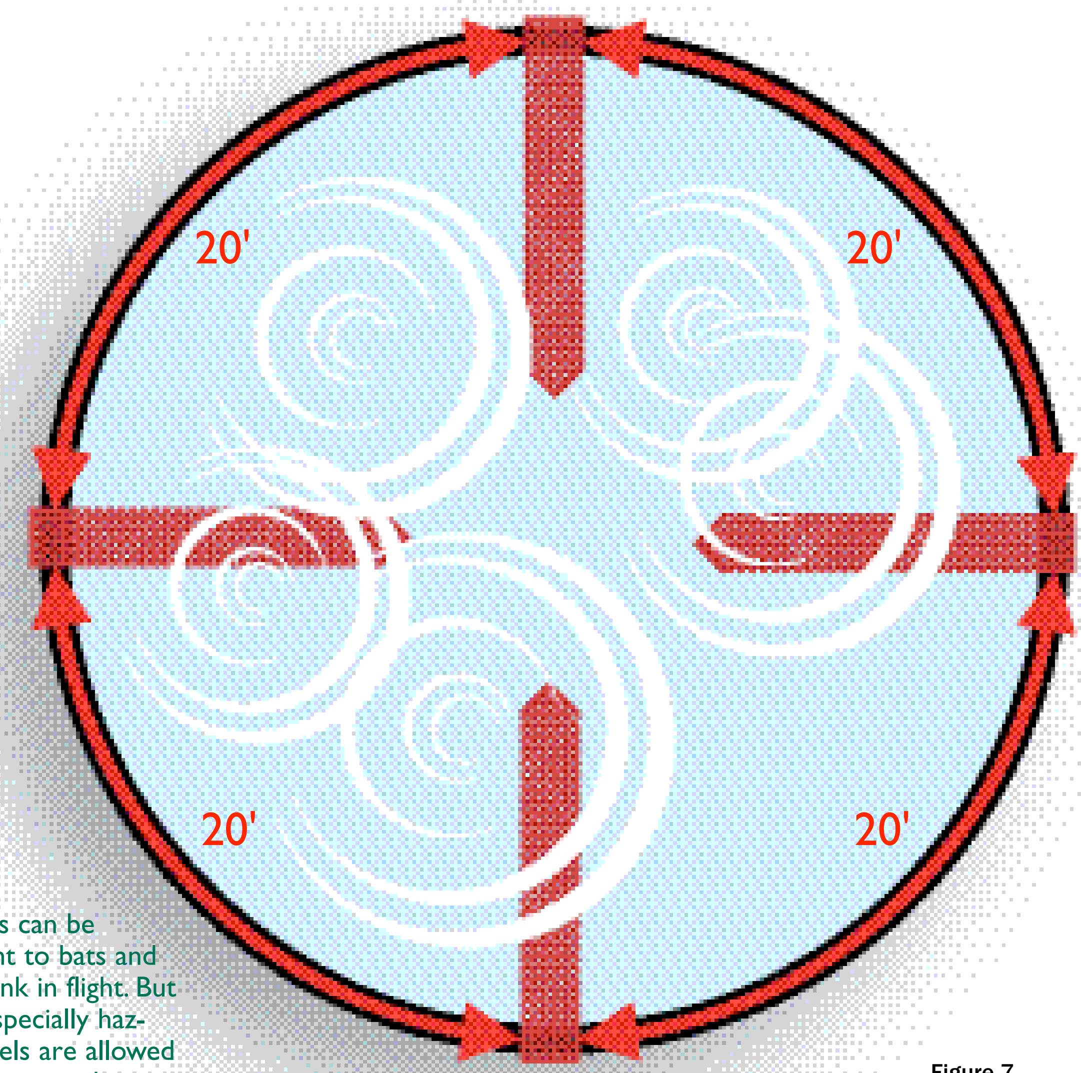


Figure 7

Large storage tanks can be especially important to bats and birds that must drink in flight. But they can also be especially hazardous if water levels are allowed to fluctuate without providing a means of escape. Escape structures should be no more than 20 feet apart and each should extend all the way from the rim to the bottom of the tank.

Increasing Wildlife Access

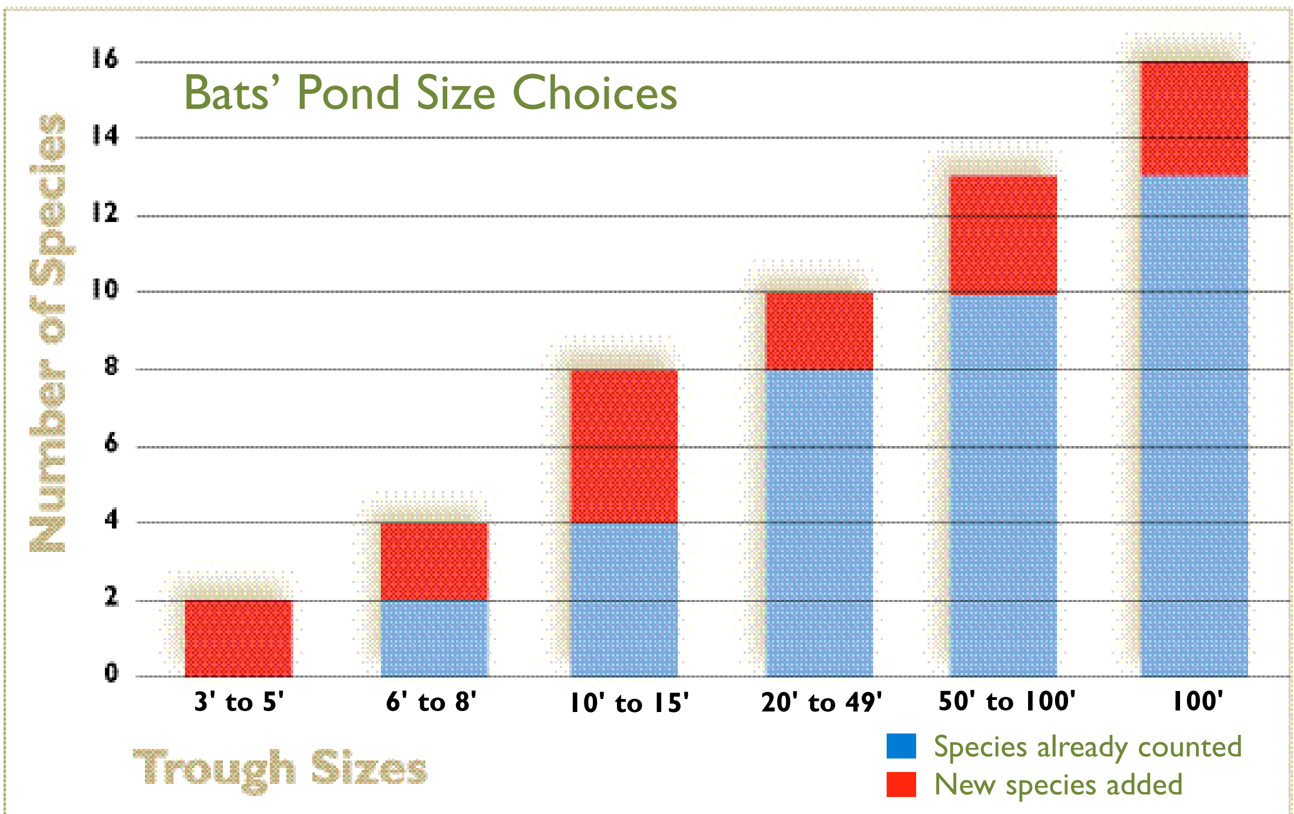
Water is one of the most critical survival requirements for most living things. Ensuring a safe and consistently available water supply for wildlife as a part of livestock production and range management is neither difficult nor expensive. A few basic guidelines can make all the difference, although risks and benefits must often be weighed to determine the most effective strategy.

Size, shape and position of water developments

Simply stated, the more water a stock pond holds, the longer it is likely to serve wildlife as well as livestock. Small, shallow stock ponds typically go dry much earlier in the dry season than larger, deeper ones, so water depth should be emphasized whenever possible.

The minimum size of water sources that bats require varies according to the flight capabilities of each species. However, the larger and less obstructed the water source, the greater the number of bat species it can accommodate. The pond-size chart, based on our analysis of bat-capture data at western water features, shows that the number of species using water sources increases steadily with the size of the water surface. Troughs in the 10- to 15-foot range accommodate twice as many species (8 of the 16 species sampled) as the 6- to 8-foot range. Small troughs may attract high visitation rates and can be important to specific species, but larger is clearly better for meeting the needs of a variety of species. Smaller troughs also increase the risk of capture by predators.

Where funds and livestock management objectives allow, we recommend the use of troughs with a diameter or length of at least 10 to 12 feet, which are commonly available sizes.



This chart presents a measure of the diversity of bat species using water troughs and ponds of various sizes. It clearly shows that the larger the water feature, the greater the number of bat species that are attracted to it. The chart summarizes captures for bats of 16 widespread western species during a total of more than 900 hours of netting at 39 water sources. Note that the greatest increase in species diversity (from 4 to 8, half the total species) appears at the 10- to 15-foot category, a recommended choice for a small trough.

The totals are cumulative, since a species that can drink from a smaller site can almost certainly also drink from a larger one. The blue bars represent the number of species first included at previous sizes, while the red bars show the number of species added at each size.

Size preferences by species were determined by comparing the percentage of total individual captures within a species at each water size with the number of netting hours expended. A species was added to the water size when "captures per net hour" reached 10 percent of the total.

Fencing that controls livestock access to a large stock pond's shoreline can facilitate vegetative cover for wildlife and improve water quality. But too much cover in or adjacent to the tank can also reduce access for bats or birds that require long swoop zones.

Installing a livestock trough flush with the ground (with a proper escape structure) will serve all types of wildlife, as well as livestock. However, this configuration also increases the likelihood that livestock will step into the trough, risking injury and degrading water quality. One solution in areas where most surface water is captured in livestock water developments is to build a second water source specifically for wildlife near an existing livestock trough (and usually drawing from the same water source). These wildlife water developments can be installed flush with the ground and fenced to manage livestock access, provided the fencing does not exclude wildlife or threaten bats or birds swooping low for a drink. Such developments also may be especially helpful for frogs and salamanders that require water for breeding.

Since high, dense vegetation can obstruct bats and birds that drink in flight, manual control of vegetation or managed grazing can improve access to the water. Resources listed at the back of this handbook provide guidance in the design and construction or purchase of wildlife water developments.

Orientation of Water Developments

Consider aligning the long axis of a stock trough parallel to the prevailing wind direction, which can greatly facilitate in-flight drinking, since turbulence from crosswinds can make access difficult or impossible, especially with narrow troughs. Also, placing troughs parallel to windbreaks such as hedgerows, swales or berms can provide shelter from the wind.

Placing troughs immediately adjacent to fencing limits the approach options for bats and birds. This is especially troublesome with rectangular or oval troughs and is exacerbated when they are placed perpendicular to fencing. Whenever possible, new troughs should not be located next to fencing or other obstructions. When oval or rectangular troughs must be placed near a fence, their long axis should parallel the fence.

Obstructions to Access

Obstructions such as bracing, fencing, posts or vegetation over or adjacent to the water surface can drastically reduce access for in-flight drinking. Research by the USDA Natural Resources Conservation Service in Northern Arizona[5] at 10-foot-diameter round and 14-foot-long rectangular metal troughs found that even the most maneuverable bat species required three to six times as many passes to reach the water surface when fences or support braces were placed over the water. That effect is dramatically increased where water surface areas are small. Most bat species simply cannot drink where obstacles prevent them from finding a fully open swoop zone.

Collisions with obstacles such as wires or fencing can also injure bats or cause them to fall into the water, where they may drown unless adequate escape structures are provided.

Our sample of western water troughs (page 7) found that more than half had some type of obstruction over or near the surface that would interfere with bat use. Fencing is an important tool for managing livestock distribution, and bracing troughs is intended to maintain trough integrity and keep livestock from moving the trough or climbing into it. But alternative fencing and bracing methods can meet these objectives without keeping bats and birds from the water.

The most common obstruction at livestock troughs is fencing that bisects the trough to allow access by livestock in more than one pasture. If livestock do not need simultaneous access to the trough,

Storage reservoirs often provide the only drinking opportunities for fast-flying, least-maneuverable bats, while also meeting the needs of most other bats, birds that drink in flight and other wildlife. This water source is completely free of fencing, vegetation and other obstacles, making it especially useful for the fastest-flying, least-maneuverable bat species.

[5]Tuttle, S. R., C. L. Chambers, and T. C. Theimer. 2006. Effects of modified livestock water troughs on bat use in northern Arizona. *Wildlife Society Bulletin* 34(3):602-608.

part of the fence might be replaced with removable fence panels or wires so the configuration can be changed without obstructing the trough.

Where simultaneous access is required and resources permit, a second trough can be added. When that is not feasible, the fence should be placed off-center to maximize the amount of unobstructed surface area on one side of the fence. Removing as many horizontal fence wires over the water surface as possible, starting with those closest to the surface, can also improve bat and bird access if other alternatives cannot be implemented.

Wood and wire bracing over the water surface is often used to increase structural integrity or keep cattle from knocking the trough off its foundation. These can be replaced with braces placed on the sides of the trough below the rim. Where bracing is used to keep livestock from falling or stepping into a trough, it should be arranged to leave as much unobstructed access in the swoop zone as possible.

Fence posts are another common obstruction and, whenever possible, should not be placed adjacent to livestock troughs. Fence posts also provide handy perches where hawks and owls can wait to catch bats and small birds. Trees, shrubs and tall grasses adjacent to or over the trough block the swoop zone and should be removed.

Fencing, cross-bracing, algae on the water and vegetation in the swoop zone of in-flight drinkers renders troughs virtually unusable by most bats and birds that drink in flight.

Many livestock troughs use float valves to control water levels, and these are often protected by housings of varied design. While such structures may not obstruct a large part of the water surface, placing them near the side of round troughs or at one end of oval or rectangular ones will minimize their impact.

As noted earlier, wildlife escape structures can serve double duty as float-valve covers. In some systems, float valves can be housed outside the trough (usually underground). This ensures the widest possible access for in-flight drinking while protecting against damage from livestock.

Water-level Maintenance

Low water levels can be extremely hazardous to wildlife, especially where escape structures are lacking. When troughs are completely full or overflowing, animals that tumble into the water usually swim to the edge and climb out, even without an escape structure. But as water levels fall, especially in smaller troughs, wind turbulence combined with limited room to maneuver can prove disastrous for bats or birds that fly in to drink.

Field experiments demonstrated that when water levels were lowered by even 12 inches in two 14-foot-long rectangular troughs and a six-foot diameter round trough, bats needed an average of 2.7 times as many passes to obtain a single drink as when the troughs were full. Based on 1,172 observed passes, the bats averaged 1.4 attempts per drink at full troughs, but had to fly in 3.8 times for each drink when water levels were a foot lower. Problems almost certainly increase rapidly at lower water levels.

A critical threat facing wildlife in many areas of the West is that livestock water supplies are often turned off and the remaining water left to evaporate when livestock are moved. This can have dire consequences for wildlife that rely on these sources if alternatives are scarce. Wildlife and range managers should collaborate with livestock operators to maintain constant water supplies, whenever possible, regardless of livestock presence.

Simply filling a trough before closing the water supply is a risky solution, since falling water levels reduce access and increase drowning risks. With small and mid-sized troughs, regardless of the presence of escape structures, ***a "full-or-dry" management objective may be advisable***: If a trough cannot be kept full, it may be better to drain it completely. Large troughs with adequate escape structures, however, may support wildlife even at intermediate water levels.

Summary

Natural watering sites are fast disappearing from arid rangelands of the West, forcing wildlife to rely increasingly on livestock troughs, tanks and ponds in order to survive. But without properly designed and placed escape structures, unobstructed access and adequate water levels, these water supplies of last resort can become deadly traps for a wide variety of wildlife. By applying the strategies described in this handbook, ranchers and range managers can, with minimal cost or effort, act as invaluable stewards of wildlife, preventing the loss of whole populations of animals that are essential to maintaining healthy rangelands.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Water for Wildlife Resources

Agencies and Organizations

Bat Conservation International – Dedicated to the worldwide conservation of bats and their habitats, BCI offers extensive information on all aspects of bat conservation, including water issues, and can provide advice on dealing with specific situations. ***www.batcon.org***

Natural Resources Conservation Service – Originally called the Soil Conservation Service, this federal agency helps America's private landowners and land managers conserve soil, water and other natural resources. The NRCS provides technical assistance, based on scientific research, that is customized to each user's specific needs. The NRCS also offers financial assistance for many conservation activities. ***www.nrcs.usda.gov***

Rocky Mountain Bird Observatory – The nonprofit RMBO, founded in 1988, works to conserve birds and habitats in the western United States through research, monitoring, education and outreach. The organization provides assistance to landowners and land managers on how to incorporate birds into their management. ***www.rmbo.org***

Wildlife Water Developments

Developed Waters for Wildlife: Science, Perception, Values, and Controversy. Paul Krausman, R. Rosenstock, S, Steven and James W. Cain III (2006), Water and Wildlife Special Section, The Wildlife Society Bulletin, Vol. 34 (3).

Wildlife Management Techniques Manual. S.D. Schemnitz (1980), The Wildlife Society, Washington, D.C., pp.366-382.

Wildlife Water Development Standards. Arizona Game and Fish Department (2005), Arizona Game and Fish Department, Phoenix Arizona.

Trough and Wildlife Escape Structure Manufacturers

Manufacturers of wildlife escape structures and troughs with built-in escape structures

Fiberglass Structures Inc., 119 South Washington Ave., Laurel, MT 59044; (406) 628-2480. Manufactures fiberglass wildlife escape structures and standard and custom, heavy-duty fiberglass troughs with escape structures. Round troughs: 6' to 12' in diameter, 18" to 24" deep; oval troughs: 4' to 10' long, 2' to 3' wide, 18" to 24" deep.

Rainbow Valley Farms, 11840 State Road 71, Karval, CO 80823; (719) 446-5354. Manufactures steel and aluminum wildlife escape structures.

Manufacturers of livestock watering troughs with dimensions considered appropriate for wildlife

Hutchison Western, 7460 Highway 85, Adams City, CO 80022; (800) 525-0121; (800) 453-5318. Manufactures round and oval steel water troughs. Round troughs up to 11' in diameter and 1' to 2' deep; oval troughs up to 10' long, 2' or 3' wide, 1' to 2' deep.

Powder River Inc., P.O. Box 50758, Provo, UT 84605; (800) 453-5318. Manufactures rectangular steel water troughs (2' deep) in sizes ranging from 6' long by 30" wide to 14' by 48" wide.

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