History of Wildlife Water Development, Inyo County, California

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Abstract. Inyo County, California, is an extremely arid region, and water is an important limiting factor for many wildlife species. The California Department of Fish and Game, in cooperation with other agencies, has carried out an aggressive, long-term water development program to insure the availability of water at historically important, natural locations and to provide additional water for native species through the development of artificial water catchments. Water development techniques, with application to natural springs as well as artificial catchments, are described. Impacts of the California Environmental Quality Act and the National Environmental Policy Act on the philosophy of wildlife water development are discussed.

INTRODUCTION

Inyo County, located east of the Sierra Nevada, is an extremely arid region. Average annual precipitation at Bishop, located in northern Inyo County, is 14.0 cm (5.5 in); at Death Valley, in south-central Inyo County, that figure is markedly lower, *i.e.*, 5.0 cm (2.0 in). Thus, in the majority of Inyo County, rainfall is extremely limited, and water is an exceedingly limited resource for humans and other forms of life.

It is axiomatic that food, cover, and water are necessary to support wildlife populations [Leopold, 1933]. Indeed, Weaver *et al.* [1959, p. 333] noted that, "Water, or the lack of it, is a major controlling factor on game populations in arid areas." Thus, in eastern California, efforts to enhance habitat for both game and nongame animals have emphasized the development of permanent and dependable supplies of water in those areas deficient in that resource. In essence, water has been judged to be a factor limiting the distribution of a number of wildlife species that inhabit Inyo County.

Although the majority of lands in this region are owned publicly, differing philosophies guide the activities of those agencies charged with land management responsibilities [Bleich *et al.*, 1991]. The California Department of Fish and Game (CDFG) has, over the years, worked closely with those agencies to enhance conditions for numerous species of wildlife that might benefit from an improved distri-

bution of water sources. The majority of these activities have occurred on lands owned by the Bureau of Land Management (BLM), but CDFG has cooperated with the U.S. Forest Service, Los Angeles Department of Water and Power, the Department of Defense, and the National Park Service in their efforts to restore or enhance wildlife habitat through the management of dependable water sources. These activities have been carried out cooperatively with those agencies and within the management frameworks that guide the missions of each of those agencies.

It is probable that wildlife benefited somewhat from the activities of early settlers, particularly homesteaders and prospectors, when wells were dug, water was piped to remote locations, and springs were developed for human use. However, it is equally probable that those early settlers had a detrimental effect on wildlife in arid regions. For example, water was usurped from existing, natural springs and diverted for agricultural or industrial uses; settlers established homesteads at historically important wildlife watering sites; and, perhaps most importantly, pioneers introduced exotic animals to arid regions, including domestic cattle (*Bos taurus*), domestic sheep (*Ovis aries*), and feral asses (*Equus asinus*). These species were potential competitors with several species of large, native mammals, and feral asses have radically altered desert ecosystems when their populations were left unchecked. Moreover, it is likely that Mountain Sheep populations were severely impacted by diseases contracted from domestic sheep [Buechner, 1960].

During modern times, wildlife managers have used two primary techniques in their efforts to improve the availability of water sources for desert wildlife: (1) enhancing the availability of water at natural springs, and (2) constructing artificial devices that trap rainwater and store it for use during the dry seasons of the year. Both of these techniques have played important roles in managing water availability in Inyo County.

DEVELOPMENT OF NATURAL WATER SOURCES

Although no "official" inventory of natural springs in Inyo County is available, it is probable that they number many hundreds. For example, 364 ephemeral or permanent water sources have been recorded in Death Valley National Monument (DVNM) alone (Death Valley National Monument, 1990], and at least 337 other sources have been appropriated for human uses outside of DVNM (California Department of Fish and Game, unpub. data). Thus, it is possible that >1,000 naturally occurring desert water sources exist throughout Inyo County, but many of these have been modified over the years by human activities.

Historically, hand tools have been the most important method employed to enhance flows from natural springs [Weaver *et al.*, 1959]. Such methods involve digging out the actual source of a spring, installing a collection box constructed of redwood, and either building a ramp down to the water source, or piping the water to a trough that is removed from the spring source [Kie *et al.*, in press].

Figure 1. A fence has been installed at Last Chance Spring, Inyo County, to prevent access to this wet meadow system by range cattle. The fence is designed to allow native species, including Mule Deer and Mountain Sheep, to access the high quality forage associated with the spring site.

Other manual methods that have been used to improve water availability at desert springs include prescribed fire, herbicides, and, occasionally, explosives [Kie *et al.*, in press]. Today, these techniques are rarely used and, if used improperly, have the potential to impact unique biotic resources (*e.g.*, Hershler and Sada [1987], Hershler [1989], Hershler and Pratt [1990], Eng *et al.* [1990]) that commonly are associated with desert riparian areas. However, with proper planning and implementation, these techniques can be safely used to enhance water availability at specific sites, without causing undue environmental damage. For example, herbicide application may be the only effective way of controlling the establishment of tamarisk (*Tamarix aphylla*) at desert springs [Neill, 1990]; the benefits for native species associated with the removal of tamarisk probably far outweigh the potential damages associated with the proper use of approved herbicides. Moreover, concern for the affects of single-species management activities, and their consequences for sympatric, but "non-target," species is becoming more prevalent among wildlife managers [Kie *et al.*, in press]; thus, contemporary managers are more likely to use conservative techniques when working in sensitive ecosystems.

In areas where heavy use by exotic species may impact vegetation associated with spring sites, fences can be installed to preclude access to the water source by those species. Such fences can be designed to provide access by large native mammals and yet prevent access by exotic species [Brigham, 1990]. This technique has been used to help protect vegetation at Last Chance Spring, Inyo County, from damage by exotic species, while simultaneously providing large, native herbivores with enhanced forage availability (Figure 1).

Horizontal wells have been utilized to enhance surface flows at ephemeral water sources, or at permanent sources where increased surface flows may benefit terrestrial species of wildlife [Bleich, 1982; Bleich *et al.*, 1982a; Coombes and Bleich, 1979; Bleich, 1990]. This

*Figure 2. Horizontal well development necessarily involves the transport of numerous pieces of heavy equipment. When completed, this well will provide a permanent water supply for Tule Elk (*Cervus elaphus*) and Mule Deer.*

technology necessarily involves the transport of heavy equipment (Figure 2), as well as a large amount of other material. However, numerous advantages are associated with the development of horizontal wells, including: (1) controlled flows; (2) lack of contamination of the water source; (3) relatively low cost; (4) enhanced success rates; and (5) low chance of mechanical failure (because there are no moving parts). Perhaps most importantly, horizontal wells may result in minimal surface disturbance, an important consideration when working in areas that are especially sensitive.

DEVELOPMENT OF ARTIFICIAL WATER SOURCES

Until very recently, CDFG has used two primary types of artificial catchments to provide sources of water for desert wildlife [Bleich *et al.*, 1982b]. In the early 1940s, CDFG began to build artificial catchments to capture and store rainwater for use by small animals [Glading, 1943, 1947]; to date, 2,213 of what have become known as "small game guzzlers" have been constructed (Figure 3). These catchments generally consist of a 2,500 ℓ (600 gal), underground, fiberglass tank that stores rainwater collected from an artificial surface made of concrete or some other impervious material [Kie *et al.*, in press]. Although these catchments originally were installed to benefit upland game species, including quail (*Callipepla* spp.), chukar (*Alectoris chukar*), and rabbits (*Sylvilagus* spp.), other wildlife species are known to make effective use of these sources. Construction of these guzzlers has been extremely limited in Inyo County; only twenty such units were built. Unfortunately, the effectiveness of these

Figure 3. Over 2,000 "small game guzzlers" have been constructed in the arid regions of California, but only 20 such units have been built in Inyo County. Rainfall throughout most of Inyo County is too limited to fill the underground storage tank on an annual basis.

Figure 4. Eight artificial catchments designed to provide a permanent water source for large, native herbivores have been constructed in Inyo County. These catchments capture rainfall from large, natural drainages and store it for use during the hot summer months.

catchments has not been formally evaluated; however, surveys conducted in June of each year indicate that these artificial water sources have important demographic consequences for local populations of several wildlife species.

Development of artificial water sources for large, native mammals in Inyo County has centered around the construction of catchments that capture and store up to 20,000 ℓ (5,000 gal) of rainwater for use during the hot summer months (Figure 4). Eight such catchments have been constructed since 1973, primarily in efforts to create additional summer range for Mountain Sheep (*Ovis canadensis*; Figure 5), as recommended by Weaver [1973]. These catchments are located in exceedingly rugged terrain, but occasionally they must be fenced to preclude access by feral or domestic livestock. A major advantage of these catchments is that they do not involve the disturbance of natural water sources, although they can be designed to capture and store flows from such water sources.

Figure 5. Mountain Sheep make heavy use of artificial water developments in the Nopah, Last Chance, and Panamint ranges, as well as at Dry Mountain and Pyramid Peak, in Inyo County. Photo by Ron Sanford.

Fifty-five such catchments have been constructed in the desert regions of southeastern California. Evaluation of 22 of these indicates that such developments operate as designed and provide a dependable source of water for Mountain Sheep [Bleich and Pauli, 1990]. In some areas, these catchments are used extensively [Jaeger *et al.*, 1991] and may, in fact, have contributed to increased populations of Mountain Sheep in selected desert mountain ranges [Bleich, 1983].

In the late 1980s a new-style, fiberglass catchment, designed for use by large mammals, became available (Figure 6). These catchments consist of a large storage tank that is buried in the ground and has a curved top that collects rainwater and allows it to flow into the tank. These units are more simplistic than the traditional large mammal catchments described above and have no moving parts. However, their use may be limited in extremely arid regions due to the small surface area from which water is collected. Installation is simple, because the only work necessary is to create a depression large enough and deep enough to contain the storage tank. One such catchment has been installed in the Inyo Mountains to benefit Mule Deer (*Odocoileus hemionus*), and BLM has installed three nearby, in southern Mono County, to provide water for Mule Deer and Pronghorn (*Antilocapra americana*). Preliminary data indicate that these catchments receive heavy use, but it has been necessary to transport water to some of them because of inadequate rainfall to fill the storage tanks (T. L. Russi, pers. comm.).

Figure 6. Because of their limited surface area, fiberglass catchments that collect water directly from curved lids are of limited use in areas with insufficient annual rainfall to fill the storage tanks.

SUMMARY

When CDFG began its aggressive water development program, little consideration was given to the effects of such activities on non-target organisms. Indeed, many projects that modified habitats associated with natural water sources likely resulted in impacts that today are considered unacceptable. With the passage of the National Environmental Policy Act (NEPA) in 1969, Federal agencies began to require environmental assessments of impacts associated with efforts to enhance the distribution of water on Federal lands. Following passage of the California Environmental Quality Act (CEQA), similar considerations are now given to activities that occur on private lands, or other lands not owned by the Federal government. Guidelines contained in NEPA and CEQA have resulted in an enhanced awareness of the need to consider resources other than the target management species. This awareness will, no doubt, continue to result in better planning, implementation, and conservation efforts by those manipulating habitats specifically to enhance wildlife populations.

REFERENCES

Bleich, V. C., Horizontal wells for mountain sheep: Desert bighorn "get the shaft," *Desert Bighorn Counc. Trans., 26,* 63-4, 1982.

Bleich, V. C., Big game guzzlers and mountain sheep, *Outdoor Calif., 44 (6),* 10, 1983.

Bleich, V. C., Horizontal wells for wildlife water development, in *Wildlife Water Development,* edited by G. K. Tsukamoto and S. J. Stiver, pp. 51-58, Nevada Department of Wildlife, Reno, 1990.

Bleich, V. C., L. J. Coombes, and J. H. Davis, Horizontal wells as a wildlife habitat improvement technique, *Wildl. Soc. Bull., 10,* 324-328, 1982a.

Bleich, V. C., L. J. Coombes, and G. W. Sudmeier, Volunteer participation in California wildlife habitat management projects, *Desert Bighorn Counc. Trans., 26,* 56-58, 1982b.

Bleich, V. C., C. D. Hargis, J. A. Keay, and J. D. Wehausen, Interagency coordination and the restoration of wildlife populations, *Proc. Yosemite Centennial Symp.,* 277-284, 1991.

Bleich, V. C. and A. M. Pauli, Mechanical evaluation of artificial watering devices built for mountain sheep in California, in *Wildlife Water Development,* edited by G. K. Tsukamoto and S. J. Stiver, pp. 65-72, Nevada Department of Wildlife, Reno, 1990.

Brigham, W. R., Fencing wildlife water developments, in *Wildlife Water Development,* edited by G. K. Tsukamoto and S. J. Stiver, pp. 37-43, Nevada Department of Wildlife, Reno, 1990.

Buechner, H. K., The bighorn sheep in the United States, its past, present, and future, *Wildl. Monogr., 4,* 1-174, 1960.

Coombes, L. J. and V. C. Bleich, Horizontal wells: the DFG's new slant on water for wildlife, *Outdoor Calif., 40 (3),* 10-12, 1979.

Death Valley National Monument, Death Valley Hydrographic Survey, Death Valley, California, 1990.

Eng, L. L., D. Belk, and C. H. Ericksen, Californian Anostraca: distribution, habitat and status, *J. Crust. Biol., 10,* 247-277, 1990.

Glading, B., A self-filling quail watering device, *Calif. Fish and Game, 29,* 157-164, 1943.

Glading, B., Game watering devices for the arid southwest, *Trans. North Am. Wildl. Conf., 12,* 286-292, 1947.

Hershler, R., Springsnails (Gastropoda: Hydrobiidae) of Owens and Amargosa river (exclusive of Ash Meadows) drainages, Death Valley System, California-Nevada, *Proc. Biol. Soc. Wash., 102,* 176-248, 1989.

Hershler, R. and W. L. Pratt, A new *Pyrgulopsis* (Gastropoda: Hydrobiidae) from southeastern California, with a model for historical development of the Death Valley hydrographic system, *Proc. Biol. Soc. Wash., 103,* 279-299, 1990.

Hershler, R. and D. W. Sada, Springsnails (Gastropoda: Hydrobiidae) of Ash Meadows, Amargosa Basin, California-Nevada, *Proc. Biol. Soc. Wash., 100,* 776-843, 1987.

Jaeger, J. R., J. D. Wehausen, and V. C. Bleich, Evaluation of time-lapse photography for estimating population parameters of desert-dwelling mountain sheep, *Desert Bighorn Counc. Trans., 35,* 5-8, 1991.

Kie, J. G., V. C. Bleich, J. W. Thomas, and J. D. Yoakum, Managing rangeland wildlife habitats, in *Wildlife Techniques Manual,* edited by T. H. Bookhout, The Wildlife Society, Washington, D.C., in press.

Leopold, A., *Game management,* Charles Scribner's Sons, New York, 1933.

Neill, W. M., Control of tamarisk at desert springs, in *Wildlife Water Development,* edited by G. K. Tsukamoto and S. J. Stiver, pp. 121-126, Nevada Department of Wildlife, Reno, 1990.

Weaver, R. A., California's bighorn management plan, *Desert Bighorn Counc. Trans., 17,* 22-42, 1973.

Weaver, R. A., F. Vernoy, and B. Craig, Game water development on the desert, *Calif. Fish and Game, 45,* 333-342, 1959.