

by Kim Dickerson

Pesticides and the Wyoming Toad



Wyoming Toad Stamp Sends a Conservation Message

by Ann Haas

Stamps of 15 endangered species, including the Wyoming toad, representing amphibians, were among the most popular with collectors in 1997, according to the U.S. Postal Service. Hobbyists saved 28 million of the endangered species set.

The other endangered species depicted on the 32-cent stamps are the black-footed ferret, thick-billed parrot, Hawaiian monk seal, American crocodile, ocelot, Schaus swallowtail butterfly, brown pelican, California condor, Gila trout, San Francisco garter snake, woodland caribou, Florida panther, piping plover, and West Indian manatee. The range of wildlife—birds, mammals, and marine mammals, along with a fish, a reptile, an insect and an amphibian—illustrate the importance of a variety of initiatives to conserve our land and water to ensure biological diversity. The Fish and Wildlife Service and the National Marine

The preceding article on efforts to recover the Wyoming toad highlights the captive breeding and release program. However, the reintroduction of this species is not enough to secure its future. Until we understand and address the reasons for its decline, the Wyoming toad's survival in the wild is far from guaranteed. Possible causes include climate change, increased predation, changes in agricultural practices, disease, and pesticide use.

For more than a decade, biologists have looked into possible environmental causes of the toad's decline. Studies conducted at Mortenson National Wildlife Refuge (NWR) by our Cheyenne, Wyoming, Field Office's Environmental Contaminants Division during 1989-1991 showed that concentrations of trace elements in water, sediment, and vegetation were below levels harmful to the Wyoming toad. Studies conducted by the Wyoming Game and Fish Department revealed that predation, habitat modification, and soil and hydrologic conditions were not identified as serious threats to the toad. The Wyoming State Veterinarian Laboratory confirmed that the bacterial disease "redleg" was present in the Wyoming toad population, but the lab was unable to determine if this disease was a cause for the drastic population decline.

In 1998, our Cheyenne office conducted a study to determine if pesticides were entering Mortenson NWR through aerial drift and affecting the Wyoming toad. During the 1970's and early 1980's, fenthion (Baytex) was sprayed for mosquito control on lands adjacent to Mortenson NWR. This pesticide was subsequently not reregis-

tered with the Environmental Protection Agency after 1992 for use as a mosquitoicide and therefore was taken off the market. It was replaced with malathion, which is very toxic to fish, amphibians, and aquatic invertebrates, although less so than fenthion. Coincidentally, the last toad population was found in 1987 on lands of the future Mortenson NWR adjacent to a ranch that did not spray for mosquitoes.

To determine if aerial drift was occurring and what effects malathion would have on Wyoming toads in their natural environment, we used a non-endangered species, Woodhouse's toad (*Bufo woodhousii*), as a surrogate for research purposes. Because side effects of a non-lethal dose of malathion include lethargy, intoxication, and paralysis, it is important to know if the pesticide is affecting the toad's ability to escape predation. To have a basis for comparison before and after the non-lethal dose, we conducted behavioral tests called "righting trials," in which the toads are flipped onto their backs to see how long it takes to right themselves. We also took blood samples from some of the toads to compare the level of cholinesterase activity in toads before

and after spraying. Cholinesterase is an enzyme essential for normal nerve function. Certain pesticides, such as malathion, inhibit cholinesterase activity. A significant decrease in the enzyme's activity usually leads to uncontrolled tremors, convulsions, and ultimately death. Pesticides that affect cholinesterase activity attack the nervous systems of all animals.

It was also important to determine if the adult Wyoming toad's food source was being reduced by aerial drift of pesticides. Adult Wyoming toads primarily eat ants and beetles, but they will also consume aquatic insects. To collect terrestrial insects, we placed insect pitfall traps at sampling sites overnight for two consecutive nights prior to spraying. Pitfall traps are containers set into the soil so that their tops are flush with the surrounding ground. Insects fall into the trap but are unable to get out. We also collected aquatic invertebrates from each site. We recorded the species and quantity of terrestrial and aquatic insects captured to estimate the total abundance of insects and the number of individual species. Insects were submitted for chemical analysis prior to the spraying so that results can be compared to chemical levels found in insects collected after the pesticide spraying.

On the day prior to spraying activities, we attached pesticide indicator strips and filter paper spray cards to fence posts at each sampling site and at a control site where we knew aerial drift of pesticides would not occur. Indicator strips are used to detect pesticide exposure and filter paper spray cards are used to determine the concentration of pesticide drift entering the site. Immediately before spraying began, we put the surrogate Woodhouse's toads in wire mesh enclosures and placed them alongside the same fence posts as the indicator strips and filter paper spray cards. We also set insect pitfall traps.

After the spraying was completed, we gathered the material. Eleven of 80 indicator strips showed evidence of

aerial drift. Therefore, we submitted the filter paper spray cards to a laboratory for analysis of malathion concentration. We also submitted the filter paper spray cards from the reference site. A canvas of our study areas revealed no dead or dying insects. We then repeated our collections of terrestrial and aquatic invertebrates and submitted them for analysis of malathion. We also collected the surrogate toads and repeated the righting trials. Results of the post-spraying righting trials did not differ significantly from those seen prior to the spraying. After weighing the toads, we took blood samples and sent them along with the toads to the laboratory for analysis of cholinesterase inhibition.

Although we are still awaiting the analyses, we are hopeful that the data will be useful for guiding management decisions regarding pesticide use on lands bordering Mortenson NWR and thereby help make toad reintroduction efforts successful. The FWS Environmental Contaminants Division plays a significant role in this cooperative effort among the FWS, Wyoming Game and Fish, and AZA members. Through the combined efforts of these partners, the outlook for the endangered Wyoming toad is now promising.

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Fisheries Service work closely with State and Federal agencies and private organizations to conserve endangered species.

In simultaneous ceremonies in California and Mexico City celebrating Stamp-Collecting Month, October 1996, the San Diego Zoo and the Mexican Postal Administration jointly initiated distribution of endangered species stamps highlighting the theme, "Collect and Protect." In this country, the Postal Service issued 223 million of the stamps featuring photographs by James Balog of Boulder, Colorado, whose work has been published in the *National Geographic* magazine, among others.

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