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DRC-1339 Use and Control of Common Ravens

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Abstract: The U.S. Fish and Wildlife Service (USFWS) and the Nevada Division of Wildlife (NDOW) have both observed an increase in the population of common ravens (*Corvus corax*) throughout Nevada. This increase is suspected to be the result of, at least in part, supplemental feeding sources (landfills, road kills, feedlots, etc.). The increase is of concern to wildlife managers because ravens are known nest predators, and in excessive numbers they could adversely affect a wide variety of game birds, including the sage grouse (*Centrocercus urophasianus*). During the spring in both 2000 and 2001, Wildlife Services (WS) was contracted to manage raven numbers in a critical sage grouse nesting area in northern Washoe County. The primary management tool used by WS was the registered avicide DRC-1339, because it can be selectively used on birds that feed on eggs. A prepared DRC-1339 solution was injected into hard-boiled chicken eggs and placed in artificial nest sites located throughout the project sites. Ravens foraging in the nesting area for sage grouse eggs found and consumed the treated eggs and died, thus selectively removing the nest-raiding birds from the immediate area of the grouse nesting sites. No long-term effect is anticipated on the raven population, because treated eggs were placed out only in the immediate area of the nesting grouse and only during the brief nesting period. The possibility of secondary poisoning resulting from DRC-1339 use is considered unlikely because the active ingredient, 3-chloro-*p*-toluidine hydrochloride, is broken down into a non-toxic substance and expelled prior to the bird expiring. Consumption of DRC-1339 results in death due to renal failure in avian species. Ravens found after treatment were monitored for the presence of West Nile virus titers.

Keywords: common raven, *Corvus corax*, sage grouse, *Centrocercus urophasianus*, DRC-1339, Wildlife Services, Nevada Division of Wildlife, United States Fish and Wildlife Service

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INTRODUCTION

The Common raven (*Corvus corax*) is a large native migratory bird known to be predatory, highly intelligent, mobile, and adaptive to its environment. The statewide population of common ravens has increased dramatically in Nevada during recent years as evidenced by the North American Breeding Bird Surveys and spring breeding bird surveys (Spencer, unpublished data). The Nevada Division of Wildlife (NDOW) has reported a 300% increase in the raven population during the past 10 years (N. Saake, NDOW ret., pers. comm.).

Ravens have been implicated in nest predation and early brood (chick) mortality of sage grouse (*Centrocercus urophasianus*), which appears to have had a significant role in the statewide decline in populations of the sage grouse (S. Stiver, NDOW, pers. comm.). Studies conducted in Washoe and Elko Counties showed that ravens have the potential to seriously impact sage grouse production (Alstatt 1995). Research in other regions of the country has shown that the removal of nest predators can have a dramatic benefit for nesting birds (USFWS 1994). The negative effect raven predation is having on nesting bird populations has been a growing concern for wildlife biologists and wildlife management agencies, especially in light of the current emphasis on the declining sage grouse population.

The Wildlife Services (WS) Program in Nevada has received a significant increase in wildlife damage complaints involving raven predation over the last 5 years. Damage caused by ravens has included the negative effect on ground nesting birds, damage to

newborn calves and lambs, injury to adult livestock, damage to property, and threats to human health and safety.

Recently, the U.S. Fish and Wildlife Service received a petition to include the sage grouse on the threatened and endangered species list. In the spring of 2000, NDOW requested the Nevada WS Program provide Wildlife Damage Management (WDM) to target the common ravens in and around certain sage grouse nesting areas. The requested actions were aimed at protecting the resource, sage grouse, not reducing the raven population. Although the raven population is not targeted for reduction, ravens causing damage to the nesting sage grouse within the specific and defined nesting area are removed. However, because the WS' WDM activities are both localized and temporal, there is no threat of any lasting effect on the raven population. The sage grouse is thus provided protection during the very critical nesting period.

AN AVICIDE FOR MANAGING RAVEN DAMAGE

The primary method for removing ravens from the grouse nesting areas is through the use of the avicide DRC-1339 (3-chloro-*p*-toluidine hydrochloride). The DRC-1339 formulation registered for the management of ravens is "Compound DRC-1339 Concentrate-Livestock, Nest & Fodder Depredations" (EPA Reg. No. 56228-29), also referred to as DRC-1339/29 (USDA 2001). DRC-1339/29 is made into a 4% solution and is injected into hard-boiled chicken eggs, which are placed in or near

areas incurring nest predation from ravens. When DRC-1339/29 is consumed by certain avian species, the chemical shuts down the bird's kidney system, resulting in the bird experiencing renal failure and eventual death.

DRC-1339/29 is a slow-acting avicide. Ravens that consume the DRC-1339/29-treated eggs very seldom succumb to the avicide at the nesting location; rather, they generally return to their roosting area or loafing sites when they experience the listlessness caused by the chemical's effect on the renal system. Because the affected bird's kidneys cease functioning and fail to remove the natural toxins from the bird's blood, the bird then becomes unconscious and dies. The treated ravens usually die within 1 to 3 days. Secondary poisoning to non-target wildlife is not likely, because the ingested DRC-1339/29 is broken down into a non-toxic substance and is expelled prior to the bird experiencing any significant symptoms. All ravens found after the treatment were collected and blood samples taken for disease monitoring. The raven carcasses were properly disposed of in accordance with the label.

The use of DRC-1339/29-treated eggs specifically targets nest-raiding ravens. Foraging ravens attracted to the nesting grounds find and consume the treated eggs during their search for grouse eggs. The use of eggs as the bait carrier greatly increases the specificity of the treatment and makes it possible to selectively remove offending ravens from areas that require special protection from nest predation.

ESTABLISHING THE PROBLEM

Because the wildlife damage management activities conducted by WS are aimed at protecting the sage grouse from raven nest predation, increases in raven counts within nesting areas are an important trigger for control actions. WS personnel conduct bird count surveys to establish the population levels of the raven in non-nesting areas as well as in the immediate area of the nesting grounds. WS' WDM actions are then aimed at reducing the raven population levels within the nesting site area to levels recorded for the non-nesting site areas. During the spring in 2000 and 2001, when raven numbers exceeded "non-nest site" levels, the decision was made to treat nesting areas with DRC-1339/29.

The bird count surveys were conducted monthly, as were DRC-1339/29 treatments when survey results indicated a need for raven population reduction. The bird count surveys consisted of a 40-km survey route on which the surveyor stopped each 0.8 km, for a total of 50 survey site counts. The surveyor counts the number of birds present at each site during a 5-minute period. This 50-site survey run was completed daily for 3 days beginning at sunrise and continuing until about noon. The same established survey route was used for the duration of the project, which continued until the end of the sage grouse nesting season. DRC-1339/29 treatments ended in July, when the majority of the sage grouse chicks were large enough to avoid predation by ravens.

STANDARD OPERATING PROCEDURES (SOP) FOR EGG PREPARATION

The DRC-1339/29 label requires that chicken, turkey, or duck eggs are used to bait ravens. Chicken eggs are highly recommended because of their more readily availability in local grocery stores. The label also requires that the eggs be boiled. The larger grade of eggs is preferred because the small eggs are more difficult to fill with the required amount of DRC-1339/29 solution; however, small chicken eggs can suffice.

The tools required for the standard operational procedure (SOP) for bait preparation include: a propane burner with an output of at least 140,000 BTUs, a small propane tank (11.4 - 38 L), a large cooking pot capable of holding 22.8 liters of water, two wire mesh baskets, a thermometer, a 6.3-mm ratchet hex screwdriver, a rubber stamp with the required "skull & crossbones" or the word "poison," a timer, and a syringe with a 20-ga hypodermic needle. Protective gloves and safety goggles should also be worn when cooking large numbers of eggs.

Begin the process of cooking the eggs by placing 15.2 L of water into a 22.8-L cooking pot and heat the water to a temperature of 100°C. Remember that changes in elevation will influence the egg cooking time. At higher elevations, eggs take longer to hard boil. Gently place 10 dozen raw chicken eggs into a wire mesh basket. Ten dozen appears to be about the maximum number of eggs that can be layered in a basket before significant egg breakage occurs. The DRC-1339/29 label requires that treated eggs be hard-boiled. After placing the eggs in the cooking pot, allow about 11 to 13 minutes cooking time (at an elevation of 1260 m). Eggs that are cooked beyond the recommended time are more difficult to work with, so overcooking should be avoided.

After the first basket of eggs finishes cooking, these are removed from the water and placed aside. A second basket containing 10 dozen eggs is then placed into the cooking pot. As the second batch of eggs cooks, place the recently cooked eggs into their original cartons. These eggs are now ready to be stamped with the warning "label."

Either a "skull and crossbones" or the word "poison" must be visible on each treated egg. A red skull and crossbones insignia is highly recommended, as it serves as a universal sign of danger. WS's Pocatello Supply Depot produces sheets of gummed stickers made specifically for labeling the eggs, or a rubber stamp can be prepared. The rubber stamp is the most efficient means of applying the warning. However, if the rubber stamp is to be used, it is important to stamp the egg prior to making the entry hole in the boiled eggs, as the eggshell will likely break during the stamping process if it is already fractured.

An injection hole should be made in the "small" end of each egg, to the depth of the yolk. An excellent tool for making the "injection reservoir" hole is a 6.3-mm ratchet hex screwdriver. It is important that the hole be "punched" as soon as possible after the egg is removed

from the water, because the eggshell is much more pliable when saturated. If the injection reservoir hole is made after eggshell has lost moisture (this usually occurs after 30 minutes) the shell is likely to fragment when the entry hole is forced into the egg. A broken shell is undesirable because it can allow the DRC-1339/29 solution to leak out before it has time to be absorbed into the yolk.

The injection reservoir hole serves two purposes. First, this chamber will create the reservoir for the DRC-1339/29 solution to be absorbed into the egg yolk. Second, the hole helps disperse heat from the egg after the cooking process. The cooked egg with a hole punched into its center requires about 3-4 hours (depending on climatic conditions) to cool to the level that is safe for the addition of the DRC-1339/29 solution. Because the active ingredient of DRC-1339 is known to break down and become less efficacious when exposed to heat, the solution should not be injected into an egg that is still hot.

Once the egg has been boiled, stamped, “punched” with a reservoir hole, and cooled, the applicator is ready to inject the DRC-1339/29 solution. At this stage, the egg is fairly resilient and can be stored, if kept in a cool dark area, for several days without noticeable deterioration.

PRE-BAITING/ TREATED EGG PLACEMENT

“Pre-baiting” is the application of non-toxic hard-boiled eggs at the proposed treatment area prior to the actual treatment with the toxic eggs. Pre-baiting is not an option; it is a vital element in an effective treatment program. Pre-baiting helps the applicator determine a number of extremely important factors relative to a successful operation, some of which are:

- The number of ravens present at the “treatment” location
- The number of treated eggs needed to effectively treat the targeted raven population
- When is the optimal time of day to get best bait consumption
- If the location is the best “feeding site” or if another site provides a more justifiable location for raven removal
- How long it takes for the birds to consume the eggs (duration of treatment)
- If there are non-target species likely to feed on the bait.

Correctly done, pre-baiting provides information to the applicator, which allows him/her to narrow treatment to a short time frame (window of opportunity) when the greatest number of ravens will most likely consume the treated egg baits.

When grouse nest locations are known, pre-baiting should be established at some distance away from the actual nest sites. Distancing the pre-baiting accomplishes two goals: 1) pre-baiting acts as a lure crop, luring the foraging ravens away from grouse nesting locations; and 2) it reduces the chance that the pre-baiting activity will disturb the nesting birds. Pre-baiting will also make

known whether non-target species which could interface with the treated eggs are present. Forewarned is forearmed, and the applicator can then take actions to mitigate the threat of the interfering non-target species. If the threat of non-target species cannot be mitigated, the treated eggs cannot be placed out.

Label requirements state that no more than 18 DRC-1339/29-treated egg baits may be present at any one site at any given time. The label defines a site to be an area no larger than 25 ft. (7.6 m) from the center point of the site, or within a 50-ft (15.2-m)-diameter circle. The label allows for a maximum of 18 treated eggs per site but does not limit the number of sites per treatment area. Furthermore, the label does not place restrictions on the placement of the 18 eggs within the site location. Experience indicates that 9 two-egg “artificial nests” spaced out within the site’s perimeter will afford the optimal contact with the target species, will give a means of estimating the number of ravens that consume the egg baits (one raven/two eggs), and reduces the likelihood of the ravens caching surplus supplies of eggs. The ultimate aim is to afford all the ravens access to bait but limit each raven’s access to as few eggs as possible.

The label requires that the treated egg sites be inspected at least every 48 hours. However, extremes in temperature can affect the treatment’s success and thus may require increasing the inspection schedule. In locations where temperatures reach below freezing (32° F, 0° C), treated egg baits will freeze. Ravens tend not to consume frozen eggs, but they may cache them. Therefore, eggs that are not immediately eaten may freeze and will need to be removed, thawed, and replaced to the treatment area. In locations where temperatures are greater than 26.7° C (80° F) daily, the DRC-1339/29 egg baits can lose their inner mass (dry up) and the toxicant’s effectiveness can be adversely affected by the heat. In such heat, it is thus important to check the treated egg baits at 24-hour intervals to enhance the effectiveness of the treated baits.

FORMULATING THE TOXICANT FOR EGG BAITS

DRC-1339/29 is a restricted use pesticide. It is a federal offense to use DRC-1339/29 in a manner that is inconsistent with its labeling. You should never use a pesticide without first reading the entire label, and this is no exception. Strictly adhere to all precautionary statements and directions. Because DRC-1339/29 is restricted use pesticide, it can only be applied by Certified Applicators or persons under their direct supervision. DRC-1339/29 is further restricted to use by USDA Wildlife Services personnel trained in bird control or persons under their supervision.

Personal protective equipment is required when handling DRC-1339/29 concentrate; the label requires the use of goggles or a face shield and rubber gloves. Handlers who mix packages of 1 lb or more of DRC-1339/29 concentrate must also wear additional protection,

including a respirator.

DRC-1339/29 should be kept in a cool, dry storage area, away from heat and direct sunlight, to ensure maximum effectiveness. Because DRC-1339/29 can be adversely effected by moisture, heat, and sunlight, one should prepare only the quantity of chemical needed for treatment. Any excess formulated product should be discarded (per label instructions) and not held over for later use.

For egg baits, the label allows for the toxicant to be used either as a 2% solution applied at 1 ml/egg, or as a 4% solution applied at 0.5 ml/egg. We recommend the applicator 4% solution, because it is much easier to inject 0.5 ml of solution into the yolk of the egg.

To prepare a 4% solution, dissolve 4 g (0.035 oz) of Compound DRC-1339/29 Concentrate in 100 ml (0.2 pt) of warm potable water at 43.3° C (110° F). Make only the amount of DRC-1339/29 solution needed to treat the desired number of eggs. If less than 100 ml of the chemical is needed, the 4 g /100 ml ratio should be adjusted accordingly.

It is suggested that the DRC-1339/29 solution be placed into a brown glass (or opaque) container to lessen its exposure to direct sunlight. Using a syringe capable of injecting accurate increments of the chemical solution, inject the desired 0.5 ml of the 4% DRC-1339/29 solution into the “reservoir hole” created in the hard-boiled egg directly after cooking. It is important that the solution is injected into the yolk of the egg and that the reservoir hole is sufficient in size to contain all of the solution. It will generally take about 6 hours for the egg to absorb all of the injected liquid, so it is advised that the eggs be injected at least 6 hours prior to field exposure. Once the liquid has been completely absorbed into the “stamped” hard-boiled egg, the egg is fully functional as a DRC-1339/29-treated egg bait and complies with the label.

DISEASE SURVEILLANCE

An effort was made to collect blood samples from up to 50 ravens from each treatment area. The blood samples were tested for the presence of West Nile virus, and St. Louis and western equine encephalitis. Wildlife Services works closely with the State Health Department, the Washoe County Vector Control, The Nevada Department of Agriculture’s Animal Testing Laboratory and Veterinary Services, and the Centers for Disease Control. To date, no West Nile virus has been detected in any of the samples WS has taken, but several instances of positives for encephalitis have been found.

Corvids are an excellent avian species to sample for West Nile virus, as they are a susceptible host and their territories encompass large areas. Because of the need for active monitoring of West Nile virus, blood samples should be taken from an adequate sample of the birds collected after a DRC-1339/29 treatment. Safety gloves should be worn at all times when handling the birds, and the handler should avoid contact with blood. Nubuteo strips are recommended for collection of the samples. When possible, a Global Positioning System (GPS) reading should be taken at the collection location.

Agencies responsible for disease monitoring are often extremely happy to receive samples, but you should make the proper contacts prior to securing samples so that the proper collection protocol is followed.

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