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## WINTER STARLING CONTROL IN IDAHO, NEVADA, AND OREGON

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This paper is intended to bring you up-to-date on the progress of various winter starling control projects conducted by our Bureau on feedlots in Idaho, Nevada, and Oregon. This report briefly covers the field work accomplished since that reported by the late Mr. H. Nelson Elliott in his paper delivered to the second meeting of your conference held in Anaheim, California, in March 1964.

Prior to the winter of 1960-61 we experienced a tremendous build-up of starling populations in feedlot situations throughout the Pacific Northwest. The expanding livestock feeding industry was receiving great economic losses from starlings eating livestock feed and fouling additional feed and water. Conventional measures such as hazing and shooting were ineffective in protecting the feed yards. It was evident to this Bureau that means and measures had to be found to reduce starling numbers in feedlot situations.

Due to starling build-ups an intensive experimental control project under field conditions was undertaken in Idaho in the winter of 1960-61. The experimental research was under the leadership of biologists of the Bureau's Denver Wildlife Research Center. The field operations were made possible through financial participation of the Idaho Cattle Feeders and the Idaho Department of Agriculture. Various control techniques were utilized and a summary of these is contained in Mr. H. Nelson Elliott's presentation to the Second Vertebrate Pest Control Conference. He also reported that the use of thallium sulphate baiting had reduced starling damage in feedlots, but the Bureau did not anticipate registration of thallium for bird control and that further emphasis would be placed on the development of more selective lethal agents.

Chemicals with the following characteristics were sought: (1) high toxicity to starlings, (2) low toxicity to mammals, thus minimizing the possibility of accidental poisoning to man or livestock other than poultry, (3) little aversion of starlings to treated baits, (4) a slow, non-violent death, which would eliminate bait avoidance caused by birds displaying symptoms or dying at the baiting site, (5) minimum hazards to avian and mammalian predators that might eat poisoned birds.

Of the chemicals tested, 3-chloro-p-toluidine hydrochloride, coded by the Denver Research Center as DRC-1339, met these requirements. Following three years of field testing by personnel of the Denver Wildlife Research Center, DRC-1339 was released under an experimental permit for limited use for large scale field testing. DRC-1339 was made available as a 75 percent concentrate for operational use. The inert ingredients are 23 percent dextrin and 2 percent Cabosil, the latter a flowing agent. DRC-1339 is a yellow crystalline solid, soluble in highly polar solvents such as water. It sublimates at 220° Centigrade.

The original formulation of DRC-1339 developed by the Denver Wildlife Research Center was not the soluble hydrochloride salt formulation. The manufacturer has informed us that the soluble hydrochloride salt formulation was developed primarily to make application to a variety of baits easier and to avoid the use of acetone. This formulation is not completely soluble in 65% acetone and 35% water due to the presence of dextrin. The manufacturer, therefore, urges that field personnel give consideration to applying the 75% concentrate as a dust, slurry, or water solution to the various baits. The concentrate can also be incorporated in a vegetable oil for use on pelleted or grain baits.

With DRC-1339 displaying the desired qualities through the initial research and field testing, an all out effort has been made to conduct large scale field testing of the material and various baiting techniques on livestock, poultry, and hog feedlots under an experimental registration permit issued by USDA, Pesticides Registration Section. See exhibit attached.

The acute oral toxicity (Approximate LD 50) of DRC-1339 was determined on a variety of bird species (1) to assess the hazards of DRC-1339 baits to such beneficial species as doves, pheasants, and ducks, and (2) to investigate the specificity of DRC-1339 (Table 1). Tests proved that DRC-1339 is super toxic to starlings and redwing blackbirds and highly toxic to most other species of birds. Notable exceptions are house sparrows and hawks.

Toxicity to pheasants, doves, ducks, etc. necessitates precautions in its use as a starling and/or blackbird toxicant.

Table 1. Approximate oral LD<sub>50</sub> of DRC-1339 in water to wild birds mg/kg

Bird	Approximate LD <sub>50</sub>	No. Tested
Starling	3.2	32
Redwing	1.8 - 3.2	10
Pheasant	10	8
Mourning dove	5.6 - 10	5
Common pigeon	17.7	4
Black-billed magpie	5.6 - 17.7	4
Blue jay	10	2
Blue-winged teal duck	10 - 100	4
Mallard duck	10 - 32	6
Pintail duck	32	2
House sparrow	320 - 448	3
Cooper hawk	320 - 1000	4
Sparrow hawk	320	2
Marsh hawk	100	2

DRC-1339 causes a slow, nonviolent death; uremic poisoning and congestion of major organs appear to be the principal causes. For more detailed information, TOXICITY OF DRC-1339 TO STARLINGS, by DeCino, Cunningham, and Schafer, U. S. Bureau of Sport Fisheries and Wildlife, Federal Center, Denver, Colorado, is printed in The Journal of Wildlife Management, Vol. 30, No. 2, April 1966, pp 249-253, and is available as a reprint.

Tests indicate that mammals are much more resistant to DRC-1339. Acute oral toxicity data show white rats-LD<sub>50</sub>, 1170-1770; white mice--no kill at 1,000 mg/kg., dogs--no kill at 10, 50, 100 mg/kg--emesis at all levels; sheep--no kill at 200 mg/kg, 1/2 dead at 400 mg/kg.

The proper use of the new avicide was demonstrated by Denver Center personnel at work-shops held in November 1964, in California (Davis), Idaho (Caldwell), and Colorado (Denver), Reporting forms were distributed to the Division of Wildlife Services, and all personnel conducting field tests were requested to submit completed forms to Denver for analysis. Field testing was conducted at 58 sites in seven states.

During the winter of 1964-65 some very spectacular results were obtained from a large scale field testing of feedlot baiting. Once DRC-1339 proved effective, bait materials were selected on a starling choice basis. The baiting process reduced starlings, provided relief to feedlot operators, and developed information necessary for possible USDA registration.

From that first year of large scale field testing of DRC-1339, 123 report forms were received; the compiled data is tabulated (Table 2). It was impossible to determine the total starling population at feedlots where more than one baiting took place. For tabulating purposes, it was arbitrarily assumed that birds surviving one baiting trial were part of the population estimated on the next trial, although it was evident that this was not always true.

Table 2. Summary of starling control with DRC-1339 at cattle feedlots, winter of 1964-65.

State	No. sites	No. baitings	Acres treated	Lbs. bait used	Starling		
					Kill	Population	Percent reduction
Alabama	1	1	10	500	14,600	30,000	48.7
Calif.	6	23	36	1,315	134,900	178,100x	75.7
Colo.	19	33	162	3,900	Not avail.	Not avail.	-
Idaho	5	25	900	8,590	472,100	579,225x	81.51
Nevada	8	19	72	326	37,655	54,890x	68.6-
Oregon	1	1	Not given	50	300	500	60.0
Utah	18	21	442x	685	81,500	109,000	74.8
Total	58	123	1,622x	15,366	741,055x	951,715x	77.9

By removing the incomplete data from Colorado in the above table results show that more than 741,000 starlings were estimated to have been killed with DRC-1339 in 90 baitings at 39 sites in 6 states. The kill was made from starling populations estimated at about 951,700 birds for approximately 78 percent reduction. A total of 11,466 pounds of treated bait were used and approximately 1,460 acres of feedlot were baited.

Each year since, and including this winter, baitings have been conducted on feedlots with further modification of bait materials and baiting techniques. We have continuously modified the control programs to fit the area and the situation. I would like to go over some of the baiting projects we have conducted in Idaho, Nevada, and Oregon.

#### IDAHO

In Idaho where reject French-fried potatoes are used in cattle feed rations, it has proven to be a first choice food item of the starling. Being available in the area of use, and fortunately an inexpensive bait material, it was selected for use even though it was a more difficult material to handle than prepared poultry pellets or grains.

Outside the area of French-fried potato use, rolled barley proved a preferred starling bait in Idaho and has done a remarkable job in cattle feedlots. Idaho reports the most successful control was attained by using strategically located prebait sites located, in some cases, right in the feedlot alley-ways. Control was also improved by delaying baiting until weather conditions were favorable and acceptance of prebait was good. Lethal baiting was delayed as much as one and one-half weeks until prebaiting had concentrated the starlings.

Scatter baiting was fairly successful with both grain and potato bait. It, too, was improved by scatter prebaiting to condition birds.

During the winter of 1965-66, the estimated starling reduction was 303,240 birds or an average reduction of 88 percent for the nine baitings, about 6.5 percent higher than the figures shown for the winter of 1964-65.

The Richardson feedlot of western Idaho, near Caldwell, feeds up to 20,000 cattle at one time. The feedlot is located adjacent to a large potato processing plant--both activities owned by the J. R. Simplot Co. Not far from this location is a major starling roosting area at Lake Lowell, and other roosting areas are along the river lowlands. Each year the large valley area supports a tremendous number of starlings. Depending upon the severity of winter weather conditions, the numbers of birds using this feedlot and others will fluctuate. It is not uncommon for 100,000 to 350,000 starlings to be using the Richardson lot.

The following information was obtained by the Idaho Division of Wildlife Services during the starling control program in the winter of 1965-66. It is typical of what may be accomplished with use of proper procedures of planning and techniques in spite of previous control work at the feedlot by the owner that certainly did not enhance the baiting program to be described.

Starling control in the Richardson feedlot, west of Caldwell, was not requested until the first part of February 1966. A completely different plan was employed to try to resolve their problem. In the previous winter 18 baitings were made, starting early in December with successive placements as often as twice a week. In 1966 only four baitings were made at two-week intervals, using as many as six prebait sites at a time.

No hazing was attempted in complete contrast to last year's program. The consecutive estimated reductions were 75 percent of 120,000; 75 percent of 40,000; 85 percent of 27,000; and 92 percent of 30,000. Each baiting was initiated as soon as good prebait acceptance occurred. The plan proved quite acceptable, more economical, and fairly efficient, within limitations created by the continuous reinfestation.

Prior to February the owner conducted his own control campaign using TEPP. We do not have any estimates on reductions effected, but it was failing to give satisfactory results when the Bureau was contacted. Appropriate precautions were taken to avoid losses of other valuable species of wildlife, which in itself is most encouraging.

## NEVADA

Nevada had conducted nuisance bird control activities for a number of years resulting in no appreciable reduction of birds. Slow acting toxicants have been much more effective. With the advent of DRC-1339, the first real relief from starling depredations was effected.

Being located in a rather temperate zone, a major problem experienced in Nevada was one of holding the birds on one site long enough to effect control. The magnitude of this problem is readily displayed in baiting success accomplished at the most northern located feedlots, Lovelock-Fallon area, as compared to success in southern Nevada, the Overton-Las Vegas area, where warm temperatures prevail, rarely reaching freezing and snow cover is almost unheard of.

Following the initial success of Idaho, the DRC-1339 treated French-fried potato bait was used in the Fallon area with poor results, yet it was known that the starlings craved most any form of fat or oil. Finally after considerable bait testing, a lard-covered cracked corn, at the ratio of 1 to 6, proved to be the preferred bait. The corn is first treated with DRC-1339, following Denver guidelines, and then coated with melted lard. This has been used successfully in scatter baiting, established bait sites outside the pen areas, and in troughs placed on top of high corral posts. In all types of baiting, prebaiting is a prerequisite.

## OREGON

The Oregon feedlot DRC-1339 baiting program has been restricted to the Ontario area adjacent to the Idaho line and in proximity of much of the Idaho baiting. Many of the starlings in the Caldwell-Ontario area use common roosting sites along the Snake River bottoms and adjacent lowlands.

Of interest to this group might be a word on the present baiting studies in relationship to Oregon holly orchard bird damage. The Bird Control Research Station, Cornelius, Oregon, is working on a technique for baiting starlings on their staging area near hollyorchard roosts. An estimated 600,000 birds are located in one roost near Wilsonville, Clackamas County, Oregon. Eight acres of a total of 200 acres used for staging are being baited by air. The scatter baiting consists of a 2 percent DRC-1339 rolled barley (1 treated grain to 4 1/2 untreated, a 1-9 ratio) coated with a tallow, a rendering plant product, 13 percent by weight. The birds are moved onto the bait site by hazing. Once a number of birds are on the site, others seem to decoy readily. Results to date appear encouraging.

Several interesting observations resulting from field testing are related to show a beneficial characteristic of DRC-1339.

In Idaho during the winter baiting season of 1964-65, two Alaskan Husky dogs fed for a number of days on 1339-killed starlings that had fallen from rest trees enroute to the Lake Lowell roost. The owner testified having seen the dogs on several occasions eat a number of starlings, in preference to their normal rations and on occasion regurgitate some of the birds. The dogs remained healthy and alert.

At Lovelock, Nevada, at one feedlot where exceptional control was accomplished, peafowl which ate quantities of the DRC-1339 bait were not killed and showed no visible effects.

During a 135-day period, a Cooper's hawk was fed 222 starlings that were killed in the field with 1 percent DRC-1339 poultry pellet baits. No visible effects.

In a 104-day period, a marsh hawk was fed 191 birds that were killed with 1 percent DRC-1339. Finalweight 352g. No visible effects. In a 141-day period, a sparrow hawk was fed 60 birds that were killed with 1% DRC-1339. Initial weight 105g, final weight 110g. No visible effects.

## GENERAL OBSERVATIONS

DRC-1339-treated bait diluted with untreated bait has been widely and successfully used. The ratio usually employed is one part treated to five or ten parts untreated. A tendency was noted to use undiluted baits when control was not attained in initial expo-

tures. Use of undiluted bait was generally synonymous with poor and fair starling control ratings.

Bait is most frequently placed in alleys and pens. Scattering bait in these locations was widely employed. However, potatoes and grain baits in piles, and grain bait placed in troughs have accomplished excellent control.

Acetylene gas exploders and other hazing techniques have been used to effectively haze birds out of the feedlot and onto baited sites located on the perimeter of the feedlot. In one instance, however, when this was tried, the birds left the area completely and did not return.

The most effective safeguards taken are the choice of selective starling baits and restriction of baiting to feedlots where protected species were few or absent at the time of baiting. Using elevated troughs, covering bait piles with canvas at night, using rope firecrackers and shellcrackers, placing only enough bait so that it was consumed on the day of exposure, refraining from baiting perimeter areas, and scattering bait very thinly were all commendable practices that aided in preventing loss of non-target species.

Success is improved by delaying baiting until weather conditions are favorable and acceptance of prebait is good. Rainy or warm open days foster poor bait acceptance while cloudy cold days with good snow cover are generally better days for feeding at bait sites. Lethal baiting has been delayed as much as one and one-half weeks until prebaiting had concentrated the starlings.

Scatter baiting throughout feedlot pens and alley-ways has been successful. Scatter prebaiting to condition birds also improves results.

#### SUMMARY

A technique approaching the ultimate in oral starling baiting goals has been developed with the use of DRC-1339. Selectivity, little aversion by target species, low toxicity to mammals, and minimum hazards to avian and mammalian predators makes this program practical.

DRC-1339 is efficient, effective, and safe when used with appropriate consideration for other animals and birds, both domestic and wild.

Emphasis cannot be stressed too strongly for the importance of a thorough knowledge of the bird behavior and habits within the feedlot to be baited. To achieve maximum baiting results, consideration must be given to areas of high bird use and areas of little disturbance by human and machine activity associated with the feedlot activity.

Weather conditions seem to have a definite effect on the extent and severity of starling depredations on feedlots. With an increase in severity of winter weather comes a directly related increase in baiting success. For those areas of little or no severe winter conditions, the baiting procedures necessarily demand additional time, patience, and finesse.

Bait materials of optimum acceptance may vary from one area to another and in most cases are related to feeds available in the locale.

#### LITERATURE CITED

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EXHIBIT

LABEL 1: For Concentrate

1339 Starling Poison

75% Concentrate

Active Ingredients:

3 Chloro p-toluidine hydrochloride

Inert Ingredients

Permit No. S704-EXP-1G

Issued on: 11-19-64

Extension: 10-28-65

Extension: -66

75.0%

25.0%

100.0%

Net Weight

WARNING: Handle only with protective gloves, clothing and face mask or respirator. Avoid inhalation and contact with eyes, skin and clothing. Wash hands with soap and water after handling. May be fatal if absorbed through the skin. Repeated exposure will cause methemoglobinemia.

KEEP OUT OF REACH OF CHILDREN

Do not expose in areas accessible to waterfowl, poultry, or other beneficial birds or contaminate stream, lake, or pond water with this material. Treated food to be used only on experimental animals.

NOT FOR SALE TO PUBLIC--For experimental use only by the Bureau of Sport Fisheries and Wildlife, or under its supervision with cooperating government agencies experienced in bird control operations.

DIRECTIONS

Mixing--10 lbs. of 1339 pelleted starling bait, grains, or other applicable bird foods may be prepared as follows: Dissolve 60 grams of 1339 concentrate in 600 ml. of water or an edible oil (amount can be adjusted to get uniform coverage). For poultry pellets pour mixture over 10 lbs. of bait, rotate or tumble pellets slowly until mixture is evenly distributed. The poultry pellets number approximately 7,000 per lb. Larger pellets require less 1339, smaller pellets requires more. When using bait of different size, amount of 1339 must be adjusted to make one particle lethal.

Directions for preparing baits other than pelleted bait are available upon request.

Application: Starlings ingesting only one treated pellet die one to three days later. Application of bait should be made only after careful observation of starling habits on the problem area to establish preferred feeding sites, best timing for application, and hazards of application to desirable or protected birds.

FOR CATTLE FEEDLOTS: Scatter 1339 bait pellets thinly and uniformly over dry or frozen areas of the pens and alleyways before starlings arrive for first meal in the morning. Pens occupied by cattle are particularly attractive to feeding starlings. Pre-baiting is not normally necessary for successful use of this bait. Baiting rates not to exceed 2 lbs. of 1339 bait pellets per acre for large lots (over 10 acres) nor to exceed 5 lbs. per acre for small lots (under 10 acres) are recommended. Dilution of 1339 bait pellets with 5 to 10 parts of other feeds (poultry pellets and crumbles, grains or silage) is recommended as it allows more uniform distribution of toxic pellets and gives more starlings an opportunity to consume a lethal pellet. Dilution with untreated feed also lessens the possibility of beneficial birds larger than starlings acquiring a lethal dose of 1339 bait pellets.

FOR POULTRY AND HOG FEEDLOTS: Scatter 1339 bait pellets thinly and uniformly over dry and frozen areas on the perimeter of the lot OUTSIDE the pens. Baiting time, rates, and

dilution with other feeds recommended for cattle feedlots also apply to other feedlots.

MATERIAL NOT TO BE USED IN VIOLATION OF STATE OR LOCAL LAWS.

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