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POTENTIAL CHEMICALS TO MANAGE LIGHT GOOSE POPULATIONS

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Part V

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INTRODUCTION

Over-abundant light geese are having long-term negative effects on the Arctic tundra ecosystem. Significant damage to native plants, increases in soil degradation and impacts on bird communities are likely to be the main consequences (Batt 1998). The extent of which over-abundant light geese reduce food and cover for other wildlife on wintering grounds and migration routes is not well documented, although anecdotal observations suggest that light geese could compete with wintering waterfowl for food, i.e. Louisiana rice fields (J. L. Cummings, National Wildlife Research Center, personal observation).

Successful management of over-abundant light goose populations suggests the development of a strategic plan that identifies clear objectives in terms of desired population numbers, management techniques and monitoring. The plan needs the support of various local, state, federal and provincial governmental agencies and private organizations. The success of any light goose management action will require an integrated approach at various locations on the breeding and wintering areas and migration routes, and depend on the expertise and motivation of the personnel involved. These professionals must have an understanding of the problem, the biology of light geese, and the proposed management strategies.

There are various management strategies that could potentially be used to manage over-abundant light goose populations on the breeding and wintering areas and along migration routes (Johnson 1997). The goal of managing over-abundant light geese should be to reduce light goose populations to numbers that will lessen the impacts on the Arctic tundra habitat, other breeding bird species and competition with other wildlife for resources such as food and roosting sites. One approach that could potentially affect thousands of light geese in a relative short time period is the use of chemical avicides at key staging areas on migration routes. Since light geese forage in sizable flocks, up to 20,000 birds (Mark Zaunbrecher, Sweet Water Land Company, personal observation), an effective avicide could potentially affect thousands of birds with one application.

DIRECT CONTROL METHODS

Currently, there are three registered avicides that could potentially be modified and used for light goose population management: 3-chloro-4-methyl benzenamine HCl (Denver Research Center (DRC)-1339) , 4-aminopyridine (Avitrol) and alpha chloralose (AC). Factors affecting the use of these avicides for light goose management are registration issues, environmental

factors, non-target and/or threatened and endangered species, animal welfare concerns and bait acceptance.

3-chloro-4-methyl benzenamine HCl (DRC-1339)

Description

DRC-1339 (Chemical Abstracts (CAS) #774-89-3) is a slow-acting avicide that is registered with the Environmental Protection Agency (EPA) for control of several species of pest birds, including blackbirds, starlings, rock doves, crows, ravens, magpies and gulls. The product was developed jointly by Ralston Purina and the National Wildlife Research Center. Registrations are maintained by PM Resources, Inc. and the U.S. Department of Agriculture (USDA), Wildlife Services (WS). The effectiveness of DRC-1339 as a lethal management tool is largely due to its differential toxicity. It is acutely toxic to a narrow range of avian species, primarily birds that often cause pest problems, such as starlings, blackbirds, rock doves, crows and ravens. The median acute lethal dose $_{50}$ (LD_{50}) for these species ranges from 1 to 14 mg/kg. The LD_{50} is the amount of chemical it takes to cause 50% mortality to a test population. For other species, such as raptors, DRC-1339 is moderately toxic (LD_{50} exceeds 300 mg/kg). It is estimated that the LD_{50} for waterfowl is between 17-48 mg/kg (Hudson et al. 1984; Eisemann and Pipas 2002). Light geese would probably fall within this range. Once ingested, most DRC-1339 is metabolized and excreted from the bird within 4-6 hours. The mode of action of DRC-1339 in birds consuming a lethal dose is irreversible kidney and heart damage; a quiet and apparently painless death normally occurs 1-3 days following ingestion (USDA 1995).

Currently DRC-1339 is used under an EPA Staging Area label to manage blackbird populations that damage agriculture crops (Cummings et al. 1992; Cummings et al. 2002). In these management programs, DRC-1339 baits are diluted 1:25 with untreated bait and applied to areas where target birds congregate with an all terrain vehicle (ATV) equipped with a 25-kg bait spreader. The baits are applied directly to the ground at a rate of 50-100 kg/ha. The amount of treated bait applied to each site is about 75% of the amount of untreated bait taken during a 3 to 5- day pre-baiting period. This procedure assures that all treated baits will be consumed.

DRC-1339 could be used to manage light geese. The selectivity of DRC-1339 for light geese could be enhanced by: (1) pre-baiting with untreated bait and ensuring that light geese are the only species taking the baits, (2) using baits that are most preferred by light geese, (3) using the minimal concentration of chemical to cause mortality, and (4) applying baits to prime feeding locations. The use of DRC-1339 would be most effective at staging areas on wintering areas and along migration routes. It would only be effective on breeding grounds if geese staged in large numbers before dispersing to nest sites. Once geese were on nesting territories, the logistics and costs associated with baiting individual geese would be prohibitive.

There is evidence that traditional baits and baiting techniques used to attract waterfowl and Canada geese to bait sites might not be effective for light geese (Robert Cox, United States Geological Survey, personal communication). However, observational data collected in Louisiana during January, February and March suggest that light geese will feed on whole corn and brown rice that is lightly scattered at sites they are currently using. For example, during January 2001 in Louisiana, light geese foraging in rye grass fields consumed 25-kg of whole corn from a bait site 4 x 20 m and 150-kg of whole corn that was scattered over a 1 ha bait site. In addition, flocks of >10,000 light geese have been observed feeding on waste grain in corn stubble as they migrate from wintering areas in the central and Mississippi flyways. This information

demonstrates that bait placement and/or application timing may be key factors for bait acceptance by light geese.

Cost-benefit estimate

DRC-1339 costs about $0.77/g (Pocatello Supply Depot, United States Department of Agriculture). Based on a LD_{50} of 48 mg/kg or 163 mg of DRC-1339 per goose, an estimated lethal dose would cost $0.12. The logistics and manpower to locate and bait light goose staging areas (wintering areas and migration routes) that would result in removal of 50,000 or 250,000 light geese would cost about $2.96/goose (Table 1). Each person would operate individually and be equipped accordingly. One person could manage up to six bait sites in an area where light geese are staging. Each bait site would be used until light goose numbers were reduced or light geese abandoned the site. Since death occurs from 1-3 days following ingestion, recovery of light geese would be from the bait site only.

The following cost estimates are for removal of 50,000 or 250,000 light geese from wintering areas, along migration routes and/or on the breeding grounds before geese disperse to nesting sites.

Table 1. Estimated program costs to remove 50,000 or 250,000 light geese with DRC-1339 from wintering areas, along migration routes and/or on the breeding grounds before geese disperse to nesting sites.

Average flock size of 3,000 geese per bait site

Time period: December-April

Light geese	50,000	250,000
Personnel	3	15
Salaries	$30,000	$150,000
Travel/per diem	$18,000	$90,000
Equipment		
Vehicles (3 and 15)	$66,000	$330,000
ATV's (3 and 15)	$18,000	$90,000
Bait mixers (3 and 15)	$900	$4,500
Miscellaneous	$2,500	$12,500
Supplies		
Chemical	$7,500	$37,500
Bait	$1,000	$5,000
Fuel	$3,000	$15,000
Miscellaneous	$1,500	$7,500
TOTAL	$148,400	$740,000

Use of birds

Light geese that are collected on and around baits sites could not be used as human or animal food because of potential chemical residues in edible tissues. However, feathers and down could have some economic value and could be collected if a viable market exists. The carcasses of light geese following removal of feathers would have to be disposed of by burial or incinerated.

Problems

The use of this product would depend on approval from PM Resources and USDA. The conventional baiting technique described earlier requires a pre-baiting period prior to the application of treated baits. During the migration period, light geese could potentially leave bait sites before treated baits are applied. Bait type, acceptance and application may present some problems. There is evidence that blackbirds, crows and ravens avoid treated baits due either to the bait carrier or chemical degradation of DRC-1339. There is some potential for non-target species to be affected. Since DRC-1339 is a slow-acting toxicant, light geese could move to other locations before death which prevents recovery of all affected light geese. Light geese could not be used as a food resource because of potential chemical residues in tissues. Baiting operations would be limited to areas where light geese congregate and the potential non-target hazard is low. Under the current EPA label for DRC-1339, no crops could be planted on bait sites for 365 days.

Information needs

Determine optimal baiting techniques, dose levels, application rates, bait carrier, and dilution rates. Evaluate the preference for various bait types by geographic area and time period. Determine specific areas where light geese congregate on wintering areas and along migration routes. Determine the types of permits needed by local, state, federal and provincial governments for baiting with DRC-1339. Determine the potential non-target hazards associated with baiting in different geographical areas.

4-aminopryidine (Avitrol)

Description

Avitrol, a bird management chemical registered with the EPA by Avitrol Corporation, is used as a flock-frightening agent, or at a higher chemical concentration and lower dilution rate a toxicant (Lucid 1980). It is a restricted use avicide that can be used only by certified applicators. Avitrol is an acutely toxic chemical that affects the nervous system in a manner similar to that of organophosphates and carbamates but it is not a cholinesterase inhibitor. Birds and mammals appear equally sensitive to Avitrol. It is usually formulated on grain baits, and LD_{50} levels are generally less than 10 mg/kg for target species, such as blackbirds, pigeons and gulls. For geese, the LD_{50} is 4.3 mg/kg. Treated bait is diluted with untreated bait so that the desired control of a bird population can be achieved. In most cases, Avitrol will affect birds in less than 20-30 minutes. Before dying, affected birds emit distress cries and/or perform visual displays that often frighten the other birds in the flock which causes them to leave the area. Avitrol has been used successfully to lower pigeon and gull populations in a number of situations without any adverse affects to non-target species. In field tests with blackbirds, it was noted that birds reacted about

twice as fast to the chemical when they ingested 2-3 times the normal dose (Knittle et al. 1988). Avitrol could be used to manage light geese following the same criteria outlined for DRC-1339.

Cost-benefit estimate

Avitrol costs about $0.55/g (Avitrol Corporation). Based on a LD_{50} of 4.3 mg/kg or 13.7 mg per goose, an estimated lethal dose would cost $0.007. Chemical application, manpower and logistical support for baiting sites would be similar to those described under the DRC-1339 section. The only difference would be a reduction in the chemical cost. It is estimated that a program for removal of 50,000 or 250,000 light geese from the population would cost about $141,400 or $705,000, respectively or about $2.82/goose.

Use of birds

Light geese that are collected on and around baits sites could not be used as human or animal food because of potential chemical residues in edible tissues. However, feathers and down could have some economic value and could be collected if a viable market exists. The carcasses of light geese following removal of feathers would have to be disposed of by burial or incinerated.

Problems

The use of this product would depend on Avitrol Corporation approval and the use of their data to support a registration. Avitrol baits present similar problems as those of DRC-1339. However, some non-target species are more sensitive to Avitrol. Laboratory tests indicate that Avitrol does not pose a secondary hazard to non-target species such as raptors, except if birds consume treated baits directly from the esophagus or gizzard of the target species. Collected light geese could not be used as a food resource because of potential chemical residues in body tissues. Baiting operations would be limited to areas where light geese congregate and the non-target hazard is low. The EPA label for Avitrol would have to be modified for this type of use.

Information needs

Determine optimal baiting techniques, dose levels, application rates, bait carrier, and dilution rates. Evaluate the preference for various bait types by geographic area and time period. Determine specific areas where light geese congregate on wintering areas and along migration routes. Determine the types of permits needed by local, state, federal and provincial governments for baiting with Avitrol. Determine the potential non-target hazards associated with baiting in different geographical areas.

Alpha Chloralose (AC)

Description

Alpha chloralose (AC) is a narcotic and therefore acts by anesthetizing rather than killing (Agricultural Chemicals Board 1977). It is registered in England, Germany and France to capture and kill birds. Since 1992, it has been used by USDA, Wildlife Services for the capture of pigeons, coots, and waterfowl under an Investigational New Animal Drug authorization from the Food and Drug Administration (FDA). Currently, the use of AC in the United States is not authorized during, or 30 days prior, to hunting seasons that involve Canada geese or waterfowl.

Application of AC is by certified applicators or under the direct supervision of a certified applicator. AC can be incorporated on bread or whole corn baits at about 30 mg/kg for geese. It takes from 30 to 90 minutes for birds to be completely immobilized and about 8 to 24 hours to recover. Target birds that are captured by AC are usually relocated or euthanized.

AC could be used to manage light geese following the same criteria outlined for DRC-1339. The estimated immobilizing dose and LD_{50} for a light goose is 96 mg and 288 mg, respectively.

Cost-estimate benefit

AC costs about $2.90/g (Pocatello Supply Depot, United States Department of Agriculture). Based on an immobilizing dose of 96 mg per goose or a LD_{50} of 288 mg, an estimated immobilizing dose would cost $0.27 and a lethal dose would cost about $0.81. Chemical application, manpower and logistical support for baiting sites would be similar to those described under the DRC-1339 section. The costs related to chemical, manpower for retrieving affected light geese, euthanizing affected light geese and burial or incineration of affected light geese would cost about $8.34/goose (Table 2). However, additional costs would be incurred if light geese will be salvaged for human consumption. In this case, the costs of chemical, retrieving the affected birds and housing them for a period of 30 days or more to eliminate AC residues from the body would increase the overall cost of the program by 40-50%.

Cost estimates for removal of 50,000 or 250,000 light geese from wintering areas, along migration routes and/or on the breeding grounds before light geese disperse to nesting sites are shown in Table 2. Costs are based on an immobilizing dose only, and assume that light geese would not be used for human or animal consumption after capture.

Use of birds

Light geese that are collected on and around baits sites could not be used as human or animal food because of potential chemical residues in edible tissues unless held in captivity for a minimum of 30 days. However, feathers and down could have some economic value and could be collected if a viable market exists. The carcasses of light geese following removal of feathers would have to be disposed by burial or incinerated. If light geese are held for a minimum of 30 days, they could be processed and used for human or animal consumption.

Problems

The use of this product would depend on Food and Drug Administration approval. AC baits may present some non-target hazards should those species forage on bait sites. The time to immobilization (30-90 minutes) could allow light geese to move off site before the chemical takes effect. Light geese could not be used as a food resource unless held a minimum of 30 days in captivity. Housing and feeding light geese would require large bird trailers, large holding pens, extensive maintenance and a method to determine if geese are chemical free before processing. If light geese were not retrieved, there could be the potential for secondary effects (immobilization or poisoning) to non-target species.

Table 2. Estimated program costs to remove 50,000 or 250,000 light geese with alpha-chloralose from wintering areas, along migration routes and/or the breeding grounds before geese disperse to nesting sites.

Average flock size of 3,000 birds per bait site

Time Period: December-April

Light geese	50,000	250,000
Personnel	9	45
Salaries	$90,000	$450,000
Travel/per diem	$36,000	$180,000
Equipment		
Vehicles (9 and 45)	$198,000	$990,000
ATV's (9 and 45)	$54,000	$270,000
Bait mixers (3 and 15)	$900	$4,500
Miscellaneous	$10,000	$50,000
Supplies		
Chemical	$17,000	$85,000
Bait	$1,000	$5,000
Fuel	$8,000	$40,000
Miscellaneous	$3,000	$15,000
TOTAL	$417,400	$2,087,000

Information needs

Determine optimal baiting techniques, dose levels, application rates, bait carrier, and dilution rates. Evaluate the preference for various bait types by geographic area and time period. Determine specific areas where light geese congregate on wintering areas and along migration routes. Determine the types of permits needed by local, state, federal and provincial governments for baiting with AC. Determine the potential non-target hazards associated with baiting in different geographical areas. If light geese will be used for human or animal consumption, an existing method will need to be modified to detect the concentration levels of AC in edible tissues.

Discussion/Research Needs

At this time there are no avicides currently registered or labeled for control of light geese. Such a product would be regulated by the U. S. Environmental Protection Agency (EPA) under the Federal Insecticide and Rodenticide Act (FIFRA). The act requires that all pesticides used in controlling or repelling organisms in the United States be approved and registered by EPA. In addition, a selected chemical avicide should be species selective, safe, effective, humane and economical. The registration of a new chemical to reduce light goose populations on wintering and/or breeding grounds or along their migration routes could take a minimum of 5 years of data collection and review at an estimated cost of $3-5 million.

The alternative to developing and registering a new chemical for light goose management is to take an existing chemical such as DRC-1339, Avitrol or AC that are currently registered with EPA for another target species or situation and amend the label to include the management of light geese. Under FIFRA, EPA can issue a variety of permits to allow the use of a registered chemical for a non-labeled use. This could be accomplished under a Section 24C registration or Section 18 Specific Exemption. Under a Section 24C a State can request an additional use of a federally-registered product to meet a Special Local Need, however this registration is subject to all normal EPA data requirements. Under a Section 18, EPA can exempt State and Federal agencies from any provision of FIFRA, if emergency conditions exist which require an exemption. There are four types of emergency exemptions: Specific, Quarantine, Public Health and Crisis. The light geese problem would fall under a Specific Exemption. This exemption may be authorized in an emergency to avert a significant economic loss or a significant risk to the environment, such as damage to the Arctic tundra. Thus, it is feasible that a permit for DRC-1339, Avitrol or AC could be approved by EPA for use on light geese under a Section 24C or Section 18.

Research Needs

Research has provided much of our understanding of light goose biology, movement patterns, migration routes and wintering/spring staging areas. Our discussion needs to focus on what research is needed to effectively use one of the potential chemicals, and where and when chemical management of light geese would be most effective and socially acceptable. We know that each chemical, DRC-1339, Avitrol and AC, can be formulated on bait that if ingested by light geese will cause death. However, we need first to determine the type of bait light geese would prefer at various geographic locations in their wintering areas, along migration routes and on breeding grounds before they disperse to nesting sites. This could be accomplished within one season by conducting a simple bait preference study in the laboratory and at various geographic locations where light geese are feeding or staging. The field portion of this study would be designed to address three objectives, the first to determine light goose preference for various baits, such as corn, wheat, mixed grains, etc. on a typical light goose feeding or staging area. The second objective would determine consumption of preferred bait. The third objective would determine non-target species use of typical bait sites and their bait preference. Cost for this type of study is estimated at $25,000.

We need to develop a single dose bait that will cause >90% mortality to light geese. This could be accomplished by conducting a laboratory dose response test of DRC-1339, Avitrol and AC with light geese. This type of test would take about 8 weeks and cost about $20,000.

The final step in bait development would be to conduct a pilot field test to evaluate potential baits, dilution rates, and application rates at 2 sites on light goose wintering areas, along migration routes and on breeding grounds before they disperse to nesting sites. This type of test would take about 8-10 weeks and cost about $15,000.

Field application of baits will require development of baiting methodologies and techniques not normally used. However, current methodologies and techniques used by the United States Department of Agriculture (USDA), Wildlife Services (WS) Program to manage blackbirds with DRC-1339 in the Central and Mississippi flyways could be adapted for light goose management (Cummings et al. 1992). USDA guidelines already exist for blackbird baiting programs that address handling chemical baits, mixing baits, bait application with ATV's, non-

target hazards, and estimating take. Limited modifications of these guidelines could adapt them for light goose management.

Bait sites would need to be identified on wintering grounds, along migration routes, and on the breeding grounds that meet the following criteria: control over baiting, disturbances, access, and low non-target use. The question that arises is when will baiting be most effective and where will bait sites be located. Baiting light goose populations when densities are low, late winter/early spring would greatly improve effectiveness, economy and humaneness of the management effort. Bait site locations are numerous but getting access to sites may require a considerable effort. The general public, hunters, farmers and land owners will influence the extent to which a local or regional approach to managing light geese populations with chemicals will be successful. Access to areas where light geese could be baited will be also influenced by animal welfare issues, the fact that light geese are an economic resource, and the ignorance of the damage that over-abundant light geese pose to the Arctic tundra.

In summary, we feel that in less than 2 years and at a cost of under $100,000 that one of the chemical bait discussed could be developed to manage light goose populations at locations in their winter areas, along north migration routes and before they disperse to nesting sites. The success of the chemical baiting program will depend on developing effective baiting methodology and the acceptance of the program by the public.

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