COMPARISON OF WHITE MINERAL OIL AND CORN OIL TO REDUCE HATCHABILITY IN RING-BILLED GULL EGGS

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ABSTRACT: Oiling eggs is a potential management method for controlling nuisance or depredating populations of ring-billed gulls, Canada geese, and other bird species. However, no registration for an oiling compound currently exists with the Environmental Protection Agency. Efficacy data were collected for white mineral oil and corn oil to reduce the hatchability of ring-billed gull eggs. Egg failure was 99% in corn oil, 96% in white mineral oil, and 35% in control eggs. Most treated eggs that hatched were treated early in the incubation period, 1 to 8 days after clutch completion. A Wildlife Service Technical Note on the use of corn oil as an oiling agent is now available.

KEY WORDS: *Larus delawarensis*, corn oil, egg oiling, reduce hatchability, registration, ring-billed gulls

Proc. 18th Vertebr. Pest Conf. (R.O. Baker & A.C. Crabb, Eds.) Published at Univ. of Calif., Davis. 1998.

INTRODUCTION

Egg addling (including shaking, freezing, removal, destruction, puncturing, and oiling) is among several techniques to manage bird populations such as Canada geese (*Branta canadensis*) and gulls (*Larus* spp.) that are implicated in agricultural crop damage, health and safety problems, and nuisance concerns (Laycock 1982; Christens and Blokpoel 1991). One advantage of oiling over other techniques is the incubating birds continue to incubate eggs past the normal hatching time, which precludes renesting (Christens and Blokpoel 1991). For example, Canada geese will incubate their nests from 1 to 30 days beyond the expected hatching date ($\bar{x}$ = 14.2, SD = 10.3 days; Cummings et al. 1997). Further, egg oiling is more socially acceptable than destroying adult Canada geese (Laycock 1982). For example, a survey of Washington residents indicated no opposition to a Canada goose egg oiling program in the Seattle area (Pitzler, USDA, APHIS, Wildlife Services, pers. comm.).

In laboratory and field tests, white mineral oil (Daedol® 50 NF; Daminco, Inc., Mississauga, Ont., Can.) has been used successfully as an egg treatment to almost completely suppress hatchability of chicken, ring-billed gull (*L. delawarensis*), herring gull (*L. argentatus*), and Canada goose eggs (Blokpoel and Hamilton 1989; Christens and Blokpoel 1991; Christens et al. 1995; Cummings et. al 1997). One advantage of using white mineral oil is that it is chemically inert, nonpoisonous, highly purified (100%), and would not create an environmental hazard (Christens and Blokpoel 1991).

There are no oils, including white mineral oil, registered as an egg addling treatment in the United States. Registration of an oiling compound is a requirement for egg oiling to be used as part of a management program. Currently, oil applications used for egg addling fall under Environmental Protection Agency (EPA) guidelines that permit only treatment of <4 ha of nesting area. In 1994, the EPA announced that it was proposing to deregulate several types of "food" oils from the formal registration process (Federal Register 1994). The substances listed would not need to be registered as long as the mode of action of the pesticide was considered non-toxic. However, laboratory and field efficacy data needed to be collected to fulfill registration requirements. The authors have tested food oils (corn, castor, linseed, safflower, and soybean) in incubator tests to determine their effectiveness in reducing hatching success in chicken eggs (Pochop et al. 1998). All five oils were as effective as white mineral oil. Corn oil was selected for field efficacy tests based on its low cost, ease of application, and availability in most areas. In this study, the authors compared the effects of white mineral oil and corn oil on hatchability of ring-billed gull eggs at Cabin Island, Grant County, Washington.

STUDY SITE

The study was conducted on Cabin Island which is located on the Columbia River about 1.5 km north of the Priest Rapids Dam. It is estimated that up to 3,600 ring-billed gull nests on about 4 ha of the 30-ha island.

METHODS

The study was conducted from May 6 to June 13, 1995. Follow-up data was collected May 7 to 21, 1996 and May 6 to July 2, 1997.

In 1995, ring-billed gull nests having ≥3 eggs were selected for this test. A numbered survey stake was placed next to each nest. A 6-l hand-held sprayer was calibrated to deliver white mineral oil at approximately 6 ml/sec at 10 psi and corn oil at approximately 6 ml/sec at 15 psi. Eggs in each nest were sprayed with 2 ml of assigned oil per egg. This amount was adequate to completely coat the egg. During treatment, the tip of the sprayer was held about 5 to 10 cm from each egg. Control eggs were left untreated. The authors randomly selected 319 ring-billed gull nests for the test and randomly assigned 29 as control, 139 as white mineral oil, and 151 as corn oil treatments. The minimum

number of control nests needed for the statistical analysis were used because, in addition to collecting efficacy data on white mineral oil and corn oil, the authors were interested minimizing the number of young reared on the island. About 20% of the eggs were treated 1 to 8 days after clutches were completed and the remaining eggs were treated 9 to 15 days into incubation. Eggs were visually checked for signs of hatching 5, 6, 20, and 39 days post-treatment.

The hypotheses for both eggs and nests were: control hatching success was the same as the treatments, and corn oil hatching success was the same as white mineral oil. The hypotheses were tested using Chi-square analysis. Eggs that failed were the total of all eggs that failed. Nests that failed were defined as nests that had no eggs hatch.

On May 5, 1995, the rest of the nests on the island were treated (estimated 2,900 nests with ≥1 egg) with either white mineral or corn oil. These nests were not used in the comparison of white mineral oil and corn oil hatching suppression but were treated to control the fecundity of ring-billed gulls on the island. On the June 13, six transects (~80 to 120 m long, ~2 m wide) were walked and the number of nests and young present along the transects were recorded.

On May 7, 1996 and May 6, 1997, the authors went to the island to conduct an initial oiling of all nests in the colony with corn oil. Because the sprayer parts were starting to wear out by 1996, the pressure gauges were no longer able to be used as a reliable measurement of oil output for the field. Therefore, the authors pumped the sprayers until the oil sprayed rather than streamed out of the sprayer. It was assumed that the spray of oil was achieving the goal of a 6 ml/sec. application rate. However, that rate was probably being exceeded. The authors returned on May 21, 1996, May 21, 1997, and June 9, 1997 to re-oil all nests and determine hatching success. The number of nests and eggs on these visits were recorded as nests were treated. In 1996, no follow-up visits were conducted after May 21 because inclement weather prohibited travel to the island. In 1997, the colony was visited on July 2 to determine if any further hatching occurred in nests.

RESULTS

Egg failure was 99% with corn oil, 96% with white mineral oil, and 35% with control eggs (Table 1). Corn oil was more successful than white mineral oil in reducing hatching success in eggs ($F_{1,2}$ = 9.371, P = 0.002). All of the corn oil and 90% of the white mineral oil treated eggs that hatched were treated early in the incubation period, 1 to 8 days after clutch completion. Hatching suppression island-wide for eggs in 1995 was 96% (corn and white mineral oil), in 1996 (corn oil only) was 99.7%, and in 1997 (corn oil only) was 99.6%.

Nest failure was 97% in corn oil, 88% in white mineral oil, and 10% in control nests. Corn oil was more successful than white mineral oil in reducing hatching success in nests ($F1,2$ = 8.761, P = 0.003). Hatching suppression island-wide for nests in 1995 (corn and white mineral oil) was 95%, in 1996 (corn oil only) was 99.5%, and in 1997 (corn oil only) was 99.3%.

On June 13, 1995, May 21, 1996, and June 9, 1997, gulls were still engaged in nesting activities. By July 2, 1997, the island was essentially abandoned for the nesting season. Only four adult gulls were observed near the island. There were no eggs in nests and only egg fragments were observed.

Table 1. The effectiveness of white mineral oil and corn oil on hatchability of ring-billed gull nests and eggs, May 5, through June 13, 1995, Cabin Island, Grant County, Washington.

	Total No.		Eggs/Nest	% Failed (No.)	
Treatment	Egg	Nests	($\bar{x}\pm$s.e.)	Eggs[1]	Nests[2]
Control	89	29	3.1±0.05	35 (31)	10 (3)
White Mineral Oil	429[3]	139	3.0±0.02	96 (410)	88 (123)
Corn Oil	458[4]	150	3.0±0.02	99 (453)	97 (146)

[1]For all white mineral and corn oil eggs that failed to hatch, $F_{1,2}$ = 9.371, P = 0.002.
[2]In white mineral and corn oil nests where all eggs failed to hatch, $F_{1,2}$ = 8.761, P = 0.003.
[3]Nine additional eggs were observed in the nest after initial treatment and were figured into the results.
[4]Six additional eggs were observed in the nest after initial treatment and were figured into the results.

DISCUSSION

Hatching suppression for both oils in the study was similar to other field egg oiling studies; 97-100% on ring-billed gulls and 100% on Canada geese (Blokpoel and Hamilton 1989; Christens and Blokpoel 1991; Christens et al. 1995; and Cummings et al. 1997). However, corn oil was more effective than white mineral oil in suppressing hatching success in this study and it is unclear why this would occur in the field. There were no differences observed in the laboratory (Pochop et al. 1998). It is possible that some characteristic(s) of the corn oil are more resistant to weathering such as a higher viscosity or a slightly longer drying time than white mineral oil. Advantages of corn oil over white mineral oil for field use include; corn oil ($2.10/l, 100% pure) costs less than white mineral oil ($8.45/l, 100% food grade) and is readily available in various quantities throughout the United States.

Egg oiling studies in gull colonies suggest that timing is crucial to reducing egg hatchability. Only oiled eggs that were treated early in incubation (1 to 8 days) hatched in this study and was observed in other studies (Blokpoel and Hamilton 1989; Christens and Blokpoel 1991). However, because nesting in gull colonies can be asynchronous, timing of clutches for operational sprays must be closely monitored. Christens and Blokpoel (1991) offer suggestions on timing of operational sprays to minimize the number of sprays needed for hatching suppression.

Concern exists that nesting birds will remain on their nests too long if the eggs are oiled potentially resulting in starvation (Draft Environmental Assessment, Canada Goose Population Management in Anchorage, Alaska, unpublished report September 1997). However, ring-billed gulls left the island in this study by July 2, 1997. No dates are available for 1995 or 1996, but lower numbers of eggs per nest on the early May visits compared to site visits two weeks later indicated that clutch completion occurred later in 1997 (unpublished data). Ring-billed and California gulls will fledge broods hatched in early June by mid July and clutches can be hatched as late as the end of June (Vermeer 1970). The presence of chicks appears to be the primary reason adults remain on nesting grounds (Vermeer 1970). In the case of Canada geese or other bird species where concern exists that they may remain in an area too long, removal of oiled eggs after laying ceases may encourage the birds to move out of the area reducing the potential for negative impacts of egg oiling.

On March 6, 1996, the EPA published in the Federal Register a notice exempting certain materials from regulation under Section 25(b) of the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), as amended. This notice allows corn oil to be used without EPA regulation as long as the uses meet certain qualifications: they are not related to public health, efficacy data are available, and certain labeling requirements are met. The data collected in the authors' incubator study (Pochop et al. 1998) and in this study satisfy the laboratory and field efficacy data requirements for corn oil. A Wildlife Service Technical Note on the use of corn oil as an oiling agent is now available.

ACKNOWLEDGMENTS

The authors thank R. Mason (National Wildlife Research Center [NWRC]) for critical review of an earlier manuscript draft, B. Dunlap (Wildlife Services [WS]), J. Eckenberg (WS), K. Gruver (NWRC), J. Koehler (NWRC), G. Smith (WS), J. Sullivan (WS), and J. Urquhart (WS) for technical assistance. Criteria outlined by the Animal Welfare Act and the NWRC Animal Care and Use Committee was followed during this study. Use of a company or trade name does not imply U.S. Government endorsement of commercial products.

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