POPULATION CONTROL OF HERRING GULLS BY THE EMBRYOCIDE, SUDAN BLACK*

DAVID K. WETHERBEE, United States Fish and Wildlife Service, Amherst, Massachusetts

INTRODUCTION

The purpose of this experiment was to test the application of a biochemical method proposed to control the hatching of herring gull (Larus argentatus) eggs in a wild population. Sophistication was considered in terms of practicality, effectiveness, selectivity, economy, humaneness, remote application and hazards to and in the environment.

The herring gull, which at the turn of the century was unknown as a breeding bird in northeastern United States, now nests abundantly along the Atlantic coast as far south as Virginia. Its phenomenal increase in numbers has resulted in conflicts with several human interests, including competition with other desirable nesting bird species, navigational hazards at airports, and the desecration of coastal property. Northeasterners, however, are by no means blind to the aesthetic and other values of the herring gull and there are few who would tolerate the outright slaughter of the over-population.

In order to come to grips with this delicate problem in Massachusetts we reviewed the current knowledge about inhibition of avian reproduction (Wetherbee et al., 1962), developed some philosophies of avian biological control (Wetherbee, 1966), discovered the antifertility effects of a biological stain, Sudan Black (Wetherbee et al., 1964), and in 1966 tested the use of this compound in a large-scale ecological experiment on Muskeget Island, Massachusetts.

Muskeget Island is the largest breeding colony of herring gulls and great black-backed gulls (L. marinus) in the Northeast; it harbors a nesting population of at least 20,000 gulls. The small island lying 20 miles off the coast of Cape Cod afforded an extremely challenging test, for the birds had to be treated at a feeding place 20 miles distant from their nests and we had to cope with the potential risk of trying to sterilize selectively 20,000 herring gulls without affecting the laughing gulls (Larus atricilla) that nest among them, without affecting the gray seals (Halichoerus grypus) breeding only on Muskeget Island in the United States, and without affecting the beach vole (Microtus breweri)--the world's total population of which coincides with the 300 acres of this gull colony!

The herring gulls of Muskeget traverse 20-25 miles of ocean to feed on the garbage of municipal refuse dumps on Cape Cod. However, unlike most populations of gulls in New England the Muskeget gulls obtain only a part of their food from garbage dumps. It was reasoned that if it were possible successfully to treat the gulls of this remote island at mainland dumps, then most other New England herring gull populations could be treated at dumps, for none are so remote or so wild in their feeding habits as the Muskeget colony.

MATERIALS

Eighty-two and one-half pounds of Sudan Black was encapsulated in 300,000 soft-shelled capsules using soya oil as a carrier. The cost of the active chemical was $6.69 per pound and the cost of encapsulation $1.75 per thousand capsules. Each capsule contained .125 gms of Sudan Black. Two capsules were inserted into one 1-ounce fish (Smelt, Osmerus mordex) and (Capelin, Mallotus villosus) used as bait. Five tons of fish, at a cost of $200 per ton, and 80 hours of labor at $100 per ton, were prepared. The thawing, handling, refreezing, storage, rethawing and transportation of five tons of messy fish bait was resorted to only after it had been determined that tallow baits and (black) bread baits were not acceptable to the gulls.

Sudan black is a complex coal-tar derivative which is a specific stain for neutral fat. When it is ingested by a female bird during the breeding season it is deposited as a layer in the daily accretion of egg yolk. As each egg yolk takes about seven days to form before the egg is laid it is essential that the female bird ingest the Sudan Black during

---

*This is a contribution of the Massachusetts Cooperative Wildlife Research Unit (supported by the Bureau of Sport Fisheries and Wildlife, the Massachusetts Division of Fisheries and Game, the University of Massachusetts, and the Wildlife Management Institute) and the Massachusetts Agricultural Experiment Station.

the seven days of egg formation. This physiological limitation is the basis for the 7-day operational limitation inherent in the use of this chemical. Sudan Black, even in massive doses, has been found by us to be non-toxic to adult birds but the developing embryo cannot tolerate much of it. White mice have been unaffected in our laboratory tests, probably because their embryos are not dependent upon egg yolk.

METHODS

Two methods were used in this test; one a remote feeding and the other a proximate feeding.

Remote treatments: Baits containing the Sudan Black were spread on all the twelve major Cape Cod garbage dumps on May 4, 5 and 6, 1966 at the rate of 25,000 baits per day. The gulls devoured all the bait in this test of remote embryocidal treatment.

Proximate treatments: After the above remote treatments had been evaluated, baits containing the Sudan Black were spread by tractor uniformly over the easterly half of Muskeget Island on May 18, 19 and 20, 1966, at the rate of 25,000 baits per day. The gulls devoured most of the bait in this follow-up test of proximate embryocidal treatment. The tolling of gulls proved to be an art that had to be practiced on the basis of supply and demand. An adequate supply must be provided to elicit mass-feeding response, but the rate of supply must be less than the demand in order to maintain the continuance of feeding, which seems to be dependent upon behavioral competition for the supply.

The design of the experiment therefore was to compare, on the one hand, how many island eggs would be affected by baits given on the mainland (remote) treatment and, on the other hand, how many island eggs would be affected by baits given on the island itself (proximate treatment).

In order to have cross-reference to how many island gulls were available for treatment on the mainland a sample of the 20,000 gulls on the island were dyed a conspicuous color. The number of colored island gulls that were seen on the mainland furnished this cross-reference.

Therefore, on May 15, 292 pairs of incubating gulls on Muskaget were dyed red by means of sprinkling Rhodamine Red powder on their nests. These nests were broken up by us the next day as part of the evaluation of the previous remote treatment. Simultaneously, 175 pairs of incubating gulls were dyed green by means of Malachite Green powder sprinkled on their nests. These nests were not broken up. The two colors were used because it was thought that gulls with no eggs might range farther from the island than gulls that were incubating. The numbers of green and red gulls on Cape Cod were reported 3 times daily for 2 weeks.

Herring gulls lay only a single clutch of eggs but lay replacement clutches if the eggs are destroyed. There is considerable latitude in the date that individuals of the colony lay, some in late April, most in early May but some as late as early June. Therefore it is not possible to affect the entire colony unless the short-lived embryocidal chemical is repeatedly administered throughout the period of breeding. For purposes of evaluating results, only those eggs laid within 7 days following each treatment were considered; eggs were dated according to the stage of embryonic development.

RESULTS

Remote Treatment

On May 17 a sample of 479 clutches of eggs on Muskeget yielded 33 clutches with yolks stained black from the remote treatment on Cape Cod of May 4, 5 and 6. Twenty-eight percent of these clutches were laid either before or after the effective treatment period (a few as early as April 16). Therefore, at least 10.2 percent of the clutches were affected on Muskeget by the remote treatment on Cape Cod.

On May 18 (12 days after treatment on Cape Cod) 149 clutches on the tip of Cape Cod, (which is only a few miles from the bait site on the municipal dumps and which is as "remote" as most New England gull colonies are from municipal dumps) had 37.6 percent of the eggs affected. The non-affected eggs were all fresh, however, on this date and could be eliminated from the experimental design as having been laid after expiration of Sudan Black

effectiveness, leaving 100 percent of the birds in the colony affected during the period of Sudan Black activity.

Observations of colored gulls on Cape Cod indicated that birds whose eggs had not been broken on Muskeget frequented the dumps as much as those birds whose eggs had been broken, and that 40 percent of the Barnstable dump population of 1500 birds was from the Muskeget population of 10,000 pairs. Therefore, if Muskeget Island were singled out as the exclusive target of the remote operation more than half the bait went to waste-feeding birds that did not nest on Muskeget. Half of the remaining bait went to waste-feeding males (which are not affected by Sudan Black). Probably as much as half of this remainder went to waste-feeding Muskeget gulls that were not laying eggs during the period of baiting.

Proximate Treatment

On June 5th, 1065 clutches of eggs on Muskeget were examined for Sudan Black in the yolks resulting from the proximate treatments. Eliminating those clutches that were too old or too young to fall into the active period of the proximate Sudan Black treatment, it was determined that between 90 and 100 percent of the clutches contained Sudan Black. The samples were taken half on the eastern end of the island where the bait was actually spread and half on the western end of the island where no bait was spread. The eastern sample was near 100 percent affected while the western sample was nearer 90 percent affected.

Gulls continued to incubate the affected eggs for several weeks and renesting was negligible. The beach voles and the gray seals were physiologically immune. The laughing gulls were protected by virtue of the large size of our baits and their later season of breeding.

DISCUSSION

Muskeget Island was used as a sampling ground to test methodology and to draw predictions of how a full-scale operational program would work. Sudan Black was used on a sample of perhaps 1/10 of the Cape Cod and Islands gull population for about 1/6 of the optimal exposure period.

In spite of the probability that Sudan Black is by far the cheapest and most practical material that is likely to be available for several years, this experiment shows that chemosterilization as a means of reducing gull populations is expensive and requires close and long attention. One of the most serious complicating drawbacks is the length of the breeding season. During 1966, gulls were laying first clutches of eggs from mid-April to early June. In order to affect the total population with a chemical that has only 7-day potency (Sudan Black) it is necessary to feed bait to the total population throughout the breeding season, daily at first and then perhaps every other day. While two pills carried by one fish is effective, 40 pills in 20 fish would have to go to waste. Economics notwithstanding, however, this massive over-dose is, fortunately, completely harmless to the adult bird and to the environment.

Economics, again, would probably require remote treatments rather than the highly saturating proximate treatments. The 10 percent success of remote treatment 20 miles from a relatively non-commensal colony bodes well for the success of treatments on the majority of New England (less remote and more commensal) populations. Nearly 100 percent control was demonstrated remotely on the tip of Cape Cod.

It would be possible to effect the virtual annual sterilization of the entire New England gull population by means of a 20-day treatment on the municipal garbage dumps frequented by gulls, with auxiliary treatments on the outer islands. The cost of such an operation would seem high, but when compared to the costs of the sterilization of insect species by the United States Department of Agriculture, sterilization of gulls would be extremely cheap. Further, Sudan Black is selective and essentially non-toxic, a consideration of great magnitude in the present-day state of development of pest control.

CONCLUSIONS

At 1.5 cents per bird per day for 20 days, it would cost $300 per thousand birds to affect wild populations of herring gulls with Sudan Black embryocidally for one season. In order to affect 75,000 pair (a rough estimate of the number of gulls in New England), it would cost $45,000 per year exclusive of storage, transportation, distribution or evalua-

tion. Treatments on the nesting colony affects the greatest number of gulls, but treatment on mainland garbage dumps near the nesting colonies is the practical alternative. The feeding of Sudan Black baits must extend over the greater part of the laying season (late April to early June). Over-dosing is impossible. An effort to saturate the total population of a broad area (New England) is more feasible in terms of economy than an attempt to focus on a small geographical area because of the extensive overlap in home ranges. The treatment tested and recommended is highly sophisticated in terms of remote operation, economy, effectiveness, selectivity, humaneness and relative freedom from the environmental hazards usually associated with chemical pest control.

LITERATURE CITED

WETHERBEE, D. K. (Ed.), R. D. CRAWFORD, P. F. CONSUEGRA, R. P. COPPINGER, M. J. LANDY, R. G. SOMES, JR., B. C. WENTWORTH 1962. Some Recent Findings in the Inhibition of Avian Reproductivity. Bureau of Sport Fisheries and Wildlife, Special Scientific Report--Wildlife, No. 67, 97 pp.

WETHERBEE, D. K., R. P. COPPINGER, B. C. WENTWORTH, R. E. WALSH 1964. Antifecundity effects of Sudan Black B and Transovarian Intravital Staining in Avian Population Control. Univ. of Mass., Experiment Station Bull. 5-13, 16 pp.

WETHERBEE, D. K. 1966, Vertebrate Pest Control by Biological Means. In Knipling, E. F. Pest Control by Chemical, Biological, Genetic, and Physical Means. U.S.D.A. Agricultural Research Service 33-110 pp. 102-111.