THE DUMMY WATERFOWL NEST AS AN INDEX TO PREDATION

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ABSTRACT

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AN INDEX TO PREDATION

by Don Ray Perkuchin

Rates of destruction of artificial waterfowl nests by predators were studied at the Agassiz National Wildlife Refuge in northwestern Minnesota between April 18 and August 11, 1960.

The predator removal area was based on a dike-transect route on the west half of the refuge and the check area on a similar route in the east half of the refuge. Predator numbers were reduced on the removal-zone dikes by setting out strychnine-poisoned eggs. Following predator control, waterfowl breeding-pair and brood counts were determined along the dike-transect routes. Nearly 1100 dummy nests were placed in nearly equal proportions on the two areas as a test of predator control effects.

Increased survival of dummy nests occured where predator control was undertaken. Both before and during the control period, nest survival was significantly higher in the predator-removal zone than in the check area. Following the control program, there was no apparent difference for the two zones. The low survival in the check zone

before control work is attributed to the preponderance of crows there then. Nearly equal artificial-nest survival in both areas following predator reduction efforts is believed to have been due to the greater abundance of food and cover then and to the more nearly equal predator populations occurring after the control campaign stopped.

Pseudo-nests located on dikes suffered higher losses than those situated elsewhere, except during the predator reduction period. Presumably the higher destruction of dike nests before and after the control program was due to the predators' ability to locate these nests more easily on the restricted areas of the dike-tops. The reversal in this dummy-nest destruction pattern during the reduction campaign was almost certainly due to the predator-removal efforts then underway on the removal-zone dikes.

The degree to which artificial nests were exposed to view had no clear-cut effect on their survival. A heavy covering of dried vegetation placed over half the poisoned nests seemed to enhance their survival slightly. In contrast, however, lightly covering the non-poisoned test-nests with a mixture of dried grass and duck feathers did not enable their greater success.

Reproductive success of wild blue-winged teal was higher in the area of predator control. Comparable data for mallards and gadwalls, however, revealed higher success in the check area for the former species and no difference between the two areas for the latter. No decisive

effects of predator control on waterfowl production during 1960 were evident in this study.

The dummy-nest data of this investigation provided indexes to the relative abundance of egg-predators and to the degree of predator control achieved.

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By

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CHAPTER I

INTRODUCTION

Between April 18 and August 11, 1960 on the Agassiz National Wildlife Refuge, Minnesota, I studied dummy, or artificial, waterfowl nests as indicators of duck nest predation. The effort was made to test the values of such nests in measuring (1) the level of abudance of egg predators both with respect to the effectiveness of predator control programs and at other times, and (2) the effect of predator control on waterfowl nest survival and population reproduction. The effects of covering dummy-nests to discourage predation also were studied. My investigation was but a part of a more comprehensive predation study at the Agassiz Refuge which was started in 1958 and is scheduled to be completed during the late summer of 1964. While conducting this study, I was employed as a Wildlife Aid by the U.S. Bureau of Sport Fisheries and Wildlife.

Predation studies using dummy nests comprised of chicken eggs were conducted by Merrill Hammond, Arthur Hughlett, David McGlaughlin and Howard Woon in 1951 on several national wildlife refuges in North Dakota and Nebraska. This was done to test the effect of land use and nest concealment on predation.

These studies indicated that, although predators do not ordinarily depend upon visual clues to find the nests, concealment did reduce predation on the dummy nests (Hammond, unpublished manuscript).

The Study Area and Transects

The Agassiz Refuge comprises about 61,000 acres of the lakebed of ancient Lake Agassiz in Marshall County, northwestern Minnesota. Low earthen dikes have been built to create 14 artificial pools containing about 25,000 acres of shallow marsh and open water. Bulrushes (*Scirpus* spp.) and cattails (*Typha* spp.) are the principal emergent aquatic plants. Crowfoot (*Ranunculus* spp.) and pondweeds (*Potamogeton* spp.) are the most common of the submerged flora.

The dikes, which crisscross the area, are travelways for predators and refuge personnel. Personal observations indicate that uplands on and adjacent to the levees afford important nesting places for blue-winged teal (*Anas discors*), gadwall (*A. strepera*), mallard (*A. platyrhynchos*) and pintail (*A. acuta*) ducks.

Vegetation occurring on these upland sites includes quackgrass (*Agropyron repens*), bromegrass (*Bromus* sp.), bluegrasses (*Poa* spp.), Canada thistle (*Cirsium arvense*), sow thistle (*Sonchus* sp.), nettle (*Urtica* sp.), sedges (*Carex* spp.), red-osier dogwood (*Cornus stolonifera*),

willows (Salix spp.), trembling aspen (Populus tremuloides) and balsam poplar (P. balsamifera). Red raspberry (Rubus idaeus), blueberries (Vaccinium spp.), chokeberry (Prunus virginia) and serviceberry (Amelanchier sp.) also are present and may seasonally bear abundant fruits.

A 17.7 mile transect route was established on dikes in the west half of the refuge (Fig. 1). A similar route plotted on the east half of the area extended for 15.6 miles (Fig. 1). The west transect route and adjacent lands comprised the predator removal area. No predator control work was done on the east side dike-transect route during 1960; it served as the check zone.

From 1958 aerial photos of the refuge, Olsen (Agassiz Refuge files, 1961) computed the habitat-type proportions of the area within one-eighth mile of both dike-transect routes (Table 1). He defined the several habitat types as follows:

1. Open Water - emergent vegetation lacking.
2. Open Marsh - large open water areas interspersed with small islands or patches of emergent aquatic vegetation.
3. Closed Marsh - an area heavily interspersed with extensive zones of emergent aquatic vegetation such as cattail and phragmites.
4. Ditch - borrow canal adjacent to road or dike.
5. Upland Brush - wooded areas including extensive willow patches.

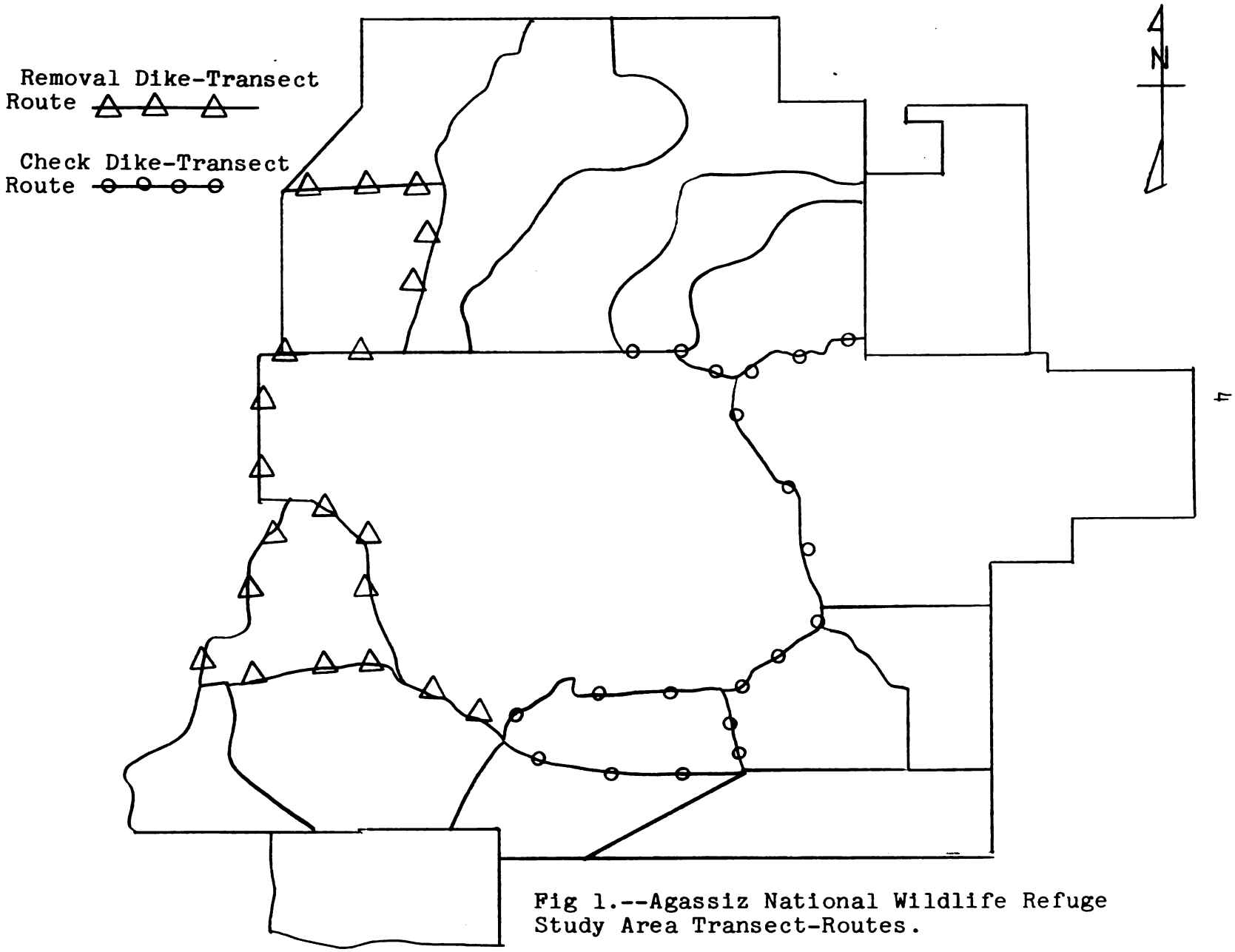

Fig 1.--Agassiz National Wildlife Refuge Study Area Transect-Routes.

Table 1.--A comparison of waterfowl habitat percentages within one-eighth mile of dike-transect routes--Agassiz National Wildlife Refuge, Minnesota, Summer, 1958.

Habitat Type	Removal Zone	Check Zone
Open Water	4.1	7.9
Open Marsh	5.3	5.3
Closed Marsh	7.5	8.2
Ditch	41.9	41.9
Upland Brush		11.2
Open Upland	41.2	25.4

[1]From data of David Olsen, Agassiz Refuge files, 1961.

6. Open Upland - large grass or sedge covered areas which may be lightly interspersed with small willow patches.

The two study areas showed a general similarity except that the uplands of the check zone were less open (Table 1).

CHAPTER II

METHODS

Artificial Nests.--Dummy-nests consisted of three fresh chicken eggs each. A total of 1,084 such nests were set in locations which appeared to be potential nesting sites for dabbling ducks. The vegetation was spread apart and a shallow depression scooped in the soil. The eggs were placed in the depression and the growing plants restored, as closely as possible, to their original condition. These artificial nests were partly concealed by standing vegetation. They were similar in general appearance to a natural duck nest.

Between April 18 and 23, 190 of these dummy-nests were placed in the removal area and 201 in the check zone. Study of these sets terminated on May 10. Between May 10 and 18, 171 new test-nests were distributed in the removal zone and 192 in the check area. Those were observed until June 16. A third group of 314 artificial-sets was put out between June 22 and July 5. Of these, 130 were in the removal area and 184 in the check zone. This group was studied through August 11. Nests of each group for each period were set out during as short a time as possible, the time varying between 6 and 14 days.

Sixty feet was the minimum distance between nest-sets. The average spacing was 125 feet. Three to four-foot long willow wands were placed about thirty feet from each set to assist in relocation. An orange tag with a number and detailed location for each test-nest was attached to each wand.

The pseudo-nests were distributed in lines within a half mile of the dikes in both zones. Lines on the dikes ran parallel to the tops while those off the levees had no particular placement pattern. From four to eight nests were set out in each strip. Most non-dike lines of nests nevertheless were within 200 yards of a dike. Half of the test-sets distributed along each dike-route were put on the dikes, the other half on upland sites adjacent to the levees.

Under natural conditions, mallard eggs are usually exposed to adverse environmental factors, such as weather and predators, for 32 to 38 days prior to hatching. This is based on an incubation period of between 23 and 29 days, usually 26 (Kortright, 1957:154), an average clutch size of 9 eggs, and an average of one egg laid per day. It was intended therefore that data on artificial nests be gathered for about 35 days after all the nests in a group had been distributed. Study of the first group of nests was terminated after only 15 days due to the nearly total destruction recorded on May 10. Observation of

the second group of sets stopped after 37 days on June 16. For the third group of nests study was completed after 50 days on August 11. Personal involvement in other duties during the last two periods prevented the completion of observations on these two groups of nests within the 35-day goal. All sets of each group for each period were checked twice. Nest-surveys were at least eight days apart. Any effects of the observer in possibly leaving trails for predators to follow were assumed to be proportional in both the removal and check zones.

In an attempt to determine the effects of hiding the dummy-nests, alternate sets within the two zones, regardless of site, were lightly covered with a mixture of dried grass and duck feathers.

A dummy-nest was recorded as destroyed when any of its eggs was damaged by a predator or was missing. Sets which were trampled by cattle, or which could not be relocated, were eliminated from the study.

Poison-Nests.--Poison-nests consisted of either two chicken eggs or one turkey egg which had been injected with strychnine. In appearance, the poisoned sets were similar to the dummy-nests. A total of 258 such sets were distributed along the dikes of the removal zone.

On May 3 and 4, 212 poison-nests were put out. The remaining 71 were distributed on May 9. All poisoning operations were terminated on June 10. The strychnine-injected nests were set out along the dike trails where it was believed predators would be most likely to find them. Each poison set was marked by a two to three foot metal rod placed within a few feet of its location. All of the stations were checked daily and any destroyed, missing or spoiled eggs were replaced. Each damaged egg was examined to determine whether a bird or mammal was the plunderer.

As a further check to determine the effects of covering artificial nests, half of all treated sets were covered with a 3 to 6 inch layer of dried vegetation. The remaining nests were not covered (Agassiz Refuge files).

Waterfowl Reproduction Indexes.--Duck pairs and lone males were tallied in estimating the waterfowl breeding populations of the two study zones, as suggested by Williams, et al. (1948).

A marked movement of broods from small to larger water bodies in prairie areas has been reported by Evans et al. (1952) and Berg (1956). Evans et al. (1952) also found that as broods became older their mobility increased. Keith (1961) indicated that tendencies for broods to move may be prevented or at least delayed by

the relative permanency of water in small potholes in his southeastern Alberta study area. Based on these findings, it was assumed that any newly-hatched ducklings observed in a particular zone on the Agassiz Refuge were born there.

On May 27, refuge waterfowl breeding-pair counts were made from roads by counting ducks seen within one-eighth mile on either side of the removal and check zone dikes (Fig. 1). Broods of ducks were counted each week between June 6 and 19 on these same transect-routes. These counts were started when the first group of newly-hatched young was observed in June and were continued until the last newly-hatched ducks were seen in August. Breeding pair and brood data were obtained by refuge personnel for the principal breeding ducks. Since the blue-winged teal, mallard and gadwall were most abundant on the refuge these were selected for use in this analysis. The waterfowl production data are in the process of being written up for publication (Balser, in letter).

Statistical Analysis.--Chi-square in two-by-two contingency tables and the t-test were used in analysis of all data (Snedecor, 1956).

CHAPTER III

RESULTS

The predator-control campaign resulted in the killing of at least 40 mammals and 9 avian predators on the dikes of the removal zone (Table 2). About 650 strychnine-injected eggs were at least partially consumed by predators (Agassiz Refuge files) and the total kill of carnivores was higher than the number found dead. Eighty-two poison-sets were considered to have been broken-up by mammals and eighty-one by birds. Evidence from the remaining 90 plundered poison-nests was inconclusive. In addition to the animals recovered, coyotes (Canis latrans), Franklin ground squirrels (Citellus franklini) and woodchucks (Marmota monax) also were potential egg eaters. They occurred on the refuge and could have participated in egg predation. Bull snakes (Pituophis catenifer) have not been seen there.

The dummy-nest investigation yielded four principal conclusions:

1. The survival rate for dummy nests was greater in the control zone.--Both before and during the predator control period (see Table 3), dummy nest survival was significantly higher on the predator-removal area transect

Table 2.--Summary of predators poisoned and recovered dead as a result of eating poisoned eggs--Agassiz National Wildlife Refuge, Minnesota, May 3 to June 10, 1960

Species	Number*
Striped skunk (Mephitis mephitis)	27
Raccoon (Procyon lotor)	5
Mink (Mustela vison)	5
Badger (Taxidea taxus)	2
Red fox (Vulpes fulva)	1
Marsh hawk (Circus cyaneus)	8
Crow (Corvus brachyrhynchos)	1

*It is known that not all the animals which consumed some of the poison were recovered. Raccoons and crows are often able to travel long distances before death; on the other hand, they may get less than a lethal dose of the strychnine solution.

Table 3.--Seasonal extent of predation on dummy-nests within predator-removal and undisturbed check zones--Agassiz National Wildlife Refuge, Minnesota, 1960

Area	Number	Dates Nests Placed	End of Study Period	Percentages of Nests Not Destroyed	95% Confidence Limits
Removal*	190	April	May 3	24	18-31
Check	201	18 to 23		2	1-6
Removal*	171	May 10 to 18	June 16	71	63-79
Check	192			25	19-33
Removal*	130	June 22	August 11	55	46-64
Check	184	to July 5		57	49-65

*Predator control was conducted on the removal zone dikes between May 3 and June 10 only.

than on the check-area. Following control efforts, there was no apparent difference in nest survival for the two zones.

These results were contradictory to those expected, but the much higher crow population in and near the check zone before the predator control campaign is believed to be the probable cause of the significantly higher extent of nest destruction there then. Two to three hundred crows stopped at the refuge in April and practically all were concentrated in the east half of the refuge. Hammond (1940) found that crows may destroy 30 per cent of the waterfowl nests on some federal refuges in the prairie states. Preston (1957) observed that a pair of crows discovered all early and most late mallard nests scattered in a 100 acre pen. Hence at the Agassiz Refuge, the crows were at least a likely prospect as a nest survival influence. All but a few pairs of these birds migrated further north by mid-May.

By the beginning of the control campaign, there must have been more nearly equal predator populations in the east and west portions of the refuge. A higher nest survival rate prevailed in the removal zone during the May 10 to June 16 period (Table 3) and cannot be accounted for except as a result of the May 3 to June 10 predator reduction program.

The apparently equal dummy nest survival in both the removal and check zones during the test period following predator reduction (Table 3) is considered possibly to have been due to a greater abundance of food for predators which occurred then everywhere on the refuge, to vegetative cover becoming more dense, and/or to predator populations reoccupying the narrow study transects from which they were removed. Whichever of these factors may have been the cause, survival of dummy-nests improved even in the absence of predator control in the check zone as the nesting season progressed. The evidence here supports the conclusions of Sowls (1955) that renesting can be of major importance in maintaining an area's waterfowl production.

2. Dummy-nests located on dikes suffered higher losses than those situated elsewhere.--Both before and after predator reduction work, dummy nest survival was higher off the dikes than on them (Table 4). During the control interval, however, test-nests on the dikes had a higher survival rate.

It seemed likely that predators searching for food along the 50 to 150 foot-wide dike-tops were more successful in finding nests than those foraging for food off those travel lanes. This is presumably the reason that there was higher survival for dummy-nests located off

Table 4.--Percentage survival of dummy nests on the dike and non-dike locations as related to predator-removal and non-removal--Agassiz National Wildlife Refuge, Minnesota, 1960.

Period	Dike		Non-Dike	
	No. of Nests	Percentages of Nests Not Destroyed	No. of Nests	Percentages of Nests Not Destroyed
		Removal Area		
April 18-May 10	99	4	91	13
May 10-June 16*	84	79	87	64
June 22-August 11	73	44	57	70
		Check (Non-removal) Area		
April 18-May 10	99	1	102	3
May 10-June 16*	97	30	95	20
June 22-August 11	92	45	92	68

*Period of predator removal

the dikes of both areas both before and after the control period. The reversal of this nest survival pattern during the control interval seems almost certainly to have been due to the predator-reduction campaign then underway on the removal-area dikes.

3. The degree to which artificial-nests were exposed to view had no clear-cut effect on their survival.-- Of the covered dummy nests studied in the removal zone from May 10 to June 16, eighty-three per cent survived, compared to 78 per cent of the uncovered nests. This difference was not significant. Of the covered poisoned-sets put out during the predator control program, seventy-eight per cent escaped predator-destruction, while only 67 per cent of the uncovered nests were unplundered. This difference was statistically significant, but only at the 90 per cent level.

In view of the results of the non-poisoned dummy nest data and the low level of significance for the poisoned-egg study, it does not seem likely that the visibility of nests had much effect on their survival under the study conditions.

4. Predator control seemed either to have no effects or to have opposite effects on the numbers and sizes of broods of blue-winged teal and mallards during 1960.-- Comparable data for gadwalls indicated that predator reduction had no effect on their reproductive success. The

breeding pair populations of these three species was several times greater in the removal zone (Table 5) probably indicating that the water-fowl breeding habitat was better there, particularly for mallards.

For blue-winged teal, the number of newly-hatched broods per breeding pair was higher in the predator-removal zone than in the check area (Table 5). This difference was significant at between the 90 and 95 per cent level. For the mallard, however, the number of newly-hatched broods per breeding pair in the check area was very significantly higher than that in the removal zone. There was no statistically significant difference between the two areas, though, for comparable data of gadwalls. The relation of these varied results to the predator control program is not clear.

The mean sizes of 106 broods of downy-plumaged young blue-winged teal on the removal-area census route (8.4 young per brood) was significantly larger at the 97 per cent level than that for 93 similar groups on the check-area route (7.7 young per brood). These broods were of size classes Ia, Ib and Ic as described by Gollop and Marshall (1954). Mallard downy broods had a mean size of 7.6 young for 56 broods in the check zone and 6.8 young for 38 similar groups in the removal zone. This difference in brood size was highly significant. For gadwalls, the mean downy brood sizes were 7.6 young for

Table 5.--Proportion of newly-hatched broods and numbers of breeding pairs observed for principal nesting ducks on the waterfowl census routes of the removal and check zones*--Agassiz National Wildlife Refuge, Minnesota, May-June, 1960.

Species	Removal-Zone			Check-Zone		
	Numbers of Newly-Hatched Broods**	Numbers of Breeding Pairs	Newly-Hatched Broods per Breeding Pair	Numbers of Newly-Hatched Broods**	Numbers of Breeding Pairs	Newly-Hatched Broods per Breeding Pair
Blue-winged Teal	52	134	.39	29	108	.27
Mallard	18	274	.07	24	120	.20
Gadwall	11	76	.15	8	50	.16

*Preliminary data taken from the Agassiz Refuge records and subject to possible revision.

**Class Ia broods as described by Gollop and Marshall (1954).

25 broods in the removal area and 7.4 young for 20 broods in the check zone. This difference was not significant.

Each of the three species discussed appeared to have been affected differently by the predator control efforts, if predator control indeed had any affect on the survival of wild nests and young during that year. No conclusive effects of predator removal on waterfowl production on the Agassiz Refuge for 1960 seem evident from this study.

CHAPTER V

SUMMARY

Study of 1,084 artificial waterfowl nests placed in waterfowl habitats on the Agassiz National Wildlife Refuge indicated that dummy nest destruction rates are inversely correlated with predator control. They served as indexes to the relative abundance of egg predators on one area as compared to another and to the degree to which predator control is effective in reducing predators.

Predator removal efforts increased the survival rate for dummy-nests. Test-nests located on dikes suffered higher losses than those situated elsewhere, except during the predator reduction campaign. Artificial-nests covered with grasses and duck feathers showed no clear-cut tendency toward higher survival.

The reproductive success of wild blue-winged teal was higher in the area of predator reduction. Comparable data for mallards and gadwalls indicated higher success in the check zone for the former where predators were not limited and showed no difference between the two zones for the latter. No conclusive effects of predator control on waterfowl production during 1960 seem evident from this study. The dummy-nest data of this investigation did not provide an index to wild nest survival.

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