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Duck Nest Success on South Dakota Game Production Areas

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Abstract - Duck nesting success was studied on South Dakota Game Production Areas in 1985 and 1986. Mayfield success rates for all species combined were 28.0 and 28.4 percent, respectively. Predators were responsible for nearly 90 percent of nest failures. Results from lake Albert Island and Hogsback served to demonstrate potential for intensive management to increase duck nesting success.

INTRODUCTION

Increasing recruitment rates of upland nesting ducks, especially of mallards (Anas platyrhynchos), is a top priority in the Central Flyway. Funds have recently become available from private organizations such as Ducks Unlimited to attain this goal through habitat enhancement and intensive management. To estimate current nest densities and success and thus assess management potential on Game Production Areas (GPAs), the South Dakota Department of Game, Fish and Parks (SDGFP) initiated duck nesting studies in spring, 1985, and continued the work in 1986.

With the recent increased interest in improving nest success and recruitment of prairie nesting ducks, interest in high production potential of islands and other areas inaccessible to predators also increased. High densities of nesting ducks on islands were reported by Duebbert 1966, Newton and Campbell 1975, Duebbert et al. 1983, Browne et al. 1983, and Lokemoen et al, 1984. Drewein and Fredrickson (1970) reported high densities of nesting mallards on a 7.7 ha island in Lake Albert in Kingsbury County, South Dakota (Fig. 1). The island is owned by SDGFP, as is a 21 ha peninsula known as the Hogsback, which extends into the lake from the west shore. Nest searches were conducted on the island and Hogsback to determine nest density and success, to determine whether any changes in nest density had occurred on the island since 1967, and to evaluate suitability of the Hogsback for intensive management.

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STUDY AREAS

Searches were conducted on 19 and 24 GPAs in 13 counties of east-central and north-eastern South Dakota in 1985 and 1986, respectively (fig. 1). Areas were selected by: ease of dragging, management potential and preference of local Conservation Officers.

Lake Albert is a 1764 ha, deep open lake located in northeast Kingsbury and southeast Hamlin counties of South Dakota (fig. 1). Lake Albert Island, located in the southern portion of the lake, is partially wooded but contains an open flat of 3.6 ha dominated by stinging nettle (Urtica procera) and containing patches of western snowberry (Symphoricarpos occidentalis), woods rose (Rosa woodsii) and gooseberry (Ribes sp.). The Hogsback has steep wooded banks and an upland with interspersion of grasses and the same shrubs as occur on the island.

METHODS

Game Production Areas were searched by dragging 48 m of 1.9 mm chain between four-wheel drive vehicles and/or all-terrain vehicles. Search procedures were those described by Higgins et al. (1977). Areas not suitable for vehicular travel were searched on foot. First searches were conducted from 16 May through 16 July. Selected areas were searched a second time between 23 June and 24 July. Area of fields searched was measured using a polar planimeter and aerial photographs

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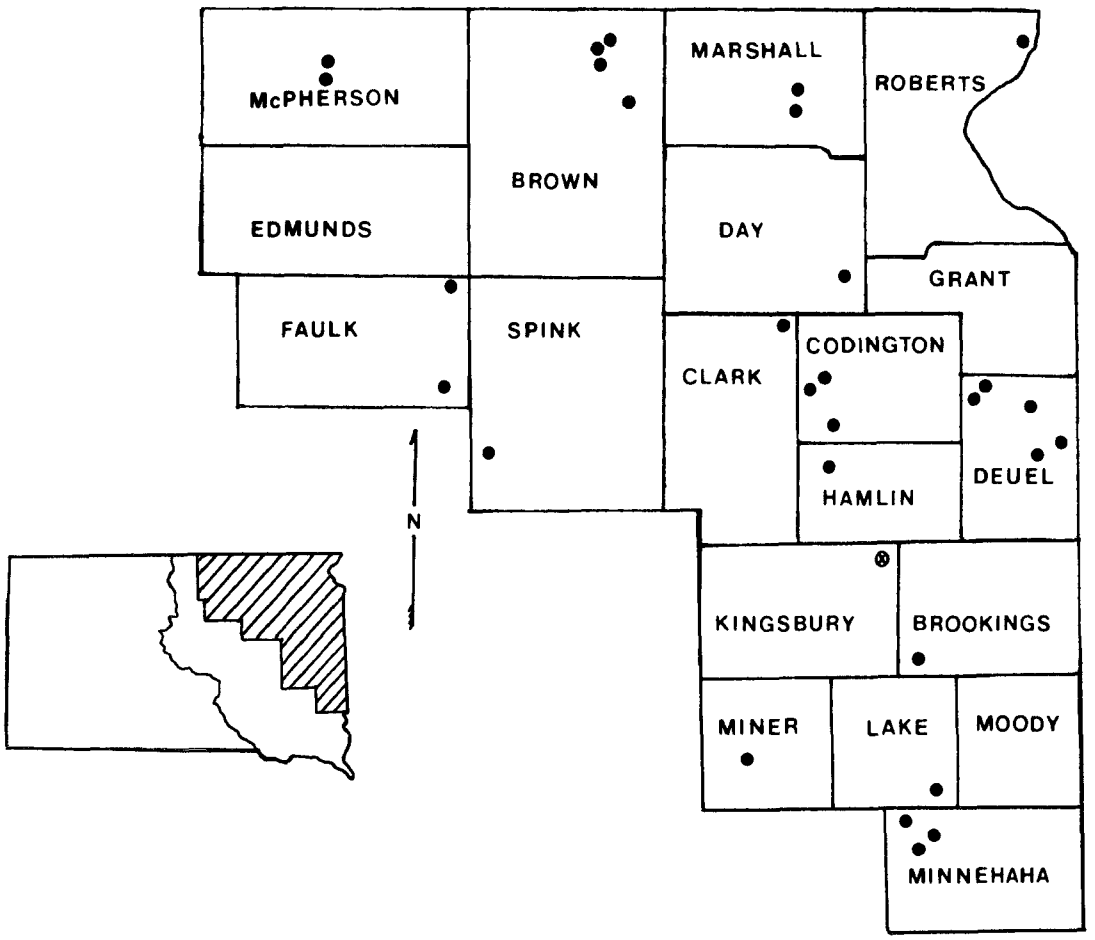

Figure 1. Locations of South Dakota Game Production Areas (●) where duck nesting studies were conducted in 1985 and 1986, and Lake Albert Island (⊗).

(provided by the Agricultural Stabilization and Conservation Service in each county).

Data recorded at each nest included species, clutch size, age of clutch (in days), dominant plant species, vegetation height/density, and (in 1986) whether the nest was in or between vehicle wheel tracks. Vegetation height/density was measured using a Robel pole (Robel et al. 1970) as suggested by Kirsch et al. (1978). We assumed a laying rate of one egg per day and candled eggs to estimate stage of incubation (Weller 1956). All data were recorded on standardized cards provided by Northern Prairie Wildlife Research Center (NPWRC), Jamestown, North Dakota.

Nests were revisited at least once to determine fate. A nest was considered successful if at least one egg hatched. Nests with no sign of eggs, shells or membranes or with scattered and eaten shells present were classified as destroyed (predated). Nests containing whole eggs which had ceased developing were recorded as abandoned.

Mayfield nest success (Mayfield 1961, 1975) and 95 percent confidence intervals were provided by NPWRC. Expanded nest densities accounting for all nests initiated and destroyed between searches (Miller and Johnson 1978) were calculated as in Klett et al. (1986). The G-test of independence was used to compare species composition of nests between years, and the chi-square test was used to compare fates of nests on and off wheel tracks (Sokal and Rohlf 1969).

In 1985, on Lake Albert Island, searchers walked less than 2 m apart and proceeded slowly on transects across the island. The east half of the flat was searched on May 14, the west half on May 19. Searches were conducted between 0700 h and 1400 h. Nests were marked with red survey flags or with orange flagging, wired or tied to residual vegetation at least 1 m tall, not more than 2 m from the nest. Clutch sizes were recorded but eggs were not candled. In 1986, the island was searched on June 30, after hatching had occurred.

The Hogsback was searched on 28 May, 1985, with 48 m of 1.9 mm chain drawn between vehicles. Nests were marked with flagging as on the island. Clutch sizes were recorded and eggs were candled to determine stage of incubation (Weller 1956). Nest locations were recorded on an aerial photograph obtained from the Agricultural Stabilization and Conservation Service. Fate of nests was recorded as on Game Production Areas. Mayfield nests success was calculated based on an average age of nests when found of 10 days, using the method of Johnson and Klett (1985). The Hogsback was not searched in 1986.

RESULTS

Game Production Areas

We located 200 nests on 302 ha in 1985, and 206 nests on 786 ha searched in 1986. Of the nests located each year, approximately 35 percent were found in laying stages, 55 to 65 percent in incubation, and the remainder pipping or hatched.

Species composition (table 1) was significantly different between years ($G = 25.51$, 6 d.f., $p \leq 0.01$). The difference was due to an increase in the proportion of the sample comprised of mallards (21.2 percent in 1986 compared to 7.7 percent in 1985) and a decrease in northern shovelers (A. clypeata) from 8.5 to 1.9 percent. Blue-winged teal (A. discors) comprised the majority of nests located both years and northern pintail (A. acuta), American wigeon (A. americana), and lesser scaup (Aythya affinia) remained unchanged at less than 3 percent of the sample each.

Expanded nest density in 1986 was 0.43 nests per ha, compared to 1.21 nests per ha in 1985. Only "normal" nests were used when calculating nest success. The remaining nests were not used because they were: not relocated, totally or partially destroyed in the search, or found predated during searches. Mayfield nest success was 28.4 percent for all species combined in 1986 (table 1), just very slightly higher than in 1985. Although Mayfield nest success rates for mallard (0.317), gadwall (0.380) and shoveler (0.574) in 1986 were more than double the 1985 rates (table 1), the increase was statistically significant only for gadwalls ($X^2 = 8.50$,1 d.f., $p < 0.01$). Increased sample size of mallards in 1986 probably enhanced Mayfield estimates for that species. Sample sizes for pintails, wigeon, shoveler and scaup were too small both years to provide accurate estimates of nest success, as indicated by 95 percent confidence limits ranging from 0 to 3355 percent (table 1).

Predation was responsible for 87 percent and 88 percent of nest failures in 1985 and 1986, respectively. Attempts were made to identify species of predators responsible for destruction of nests, based on visual evidence, predator sightings and sign, and information from local Conservation Officers. In 1986, skunks were implicated by evidence present at nine destroyed nests, and a ground squirrel at one. Active fox dens were present on nearly all GPAs searched (Conservation Officers, personal communications), and red fox were observed on two of the GPAs during nest searches. One badger (Taxidea taxus) burrow and four northern barrier (Circus cyaneus) nests were located on nest searches, and skunk and raccoon tracks were common. Evidence of hen mortality was found at one nest in 1985, and at three nests in 1986.

Nest success on GPAs was not independent of position of the nest with respect to vehicle tracks ($n=195$, $X^2 = 31.8$, 1 d.f. $p < 0.01$). Proportionately more nests in or between wheel

Table 1. Species Composition and Mayfield Success Rates of Duck Nests on Game Production Areas in Northeastern South Dakota in 1985 and 1986.

	1985			1986		
Species	N (%)	Mayfield Success	95% Confidence Limits	N (%)	Mayfield Success	95% Confidence Limits
		----------%	----------		----------%	----------
Mallard	14(7.7)	15.4	(3.5-61.6)	39(21.2)	31.7	(18.1-56.1)
Gadwall	28(15.5)	16.2	(6.6-38.7)	29(15.8)	38.0	(21.6-66.1)
Wigeon	1(0.5)	1.7	(0.0-2581.3)	1(0.5)	2.4	(0.0-2057.4)
B.W. Teal	117(64.6)	37.5	(27.7-50.7)	105(57.1)	25.8	(17.6-37.8)
N. Shoveler	15(8.3)	21.8	(6.1-74.0)	4(2.2)	57.4	(18.6-171.1)
N. Pintail	5(2.8)	1.0	(0.0-75.0)	5(2.7)	6.0	(0.2-133.6)
L. Scaup	1(0.5)	2.4	(0.0-2057.4)	1(0.5)	1.1	(0.0-3355.2)
All	181	28.0		184	28.4	

tracks were destroyed by predators, suggesting predators use the vehicle tracks as travel lanes.

Lake Albert Island

In 1985 one great-horned owl was seen on Lake Albert Island when nest searching began. We located 63 mallard nests (table 2). Only three were found in the wooded portion of the island, which was not systematically searched; the remainder were found in the 3.6 ha field of nettle. Nest density in the field was 17.5 nests per ha.

We relocated only 44 (70 percent) of the 63 mallard nests on 21 June, and found three nests not located on earlier searches (table 2). Mayfield nest success was 43.2 percent. Fifteen nests (31.9 percent) were abandoned. In four abandoned nests where original clutches numbered 4, 6, 8 and 11, we found 11, 6, 13 and 10 eggs, respectively, at abandonment. Six nests (12.8 percent) were destroyed by predators. Remains of one hen were found near her nest.

We found eight nests on the Hogsback: five blue-winged teal, two gadwall and one mallard. Only three nests were relocated (mallard and gadwall), and all three were destroyed by predators. Cattle destroyed markers of all the teal nests.

In 1986, we located 38 nests on the island (table 2). Of those, 13 were successful (34.2 percent), eight were abandoned (21.1 percent) and 17 were destroyed (44.7 percent). Remains of hens were found at two nests and egg remains ascribed to raccoon activity were found at one nest. In addition, about 30 uneaten eggs were found scattered in the vegetation in an area approximately 8 m in diameter.

Table 2. Numbers and Fates of Mallard Nests on Lake Albert Island in Kingsbury County, South Dakota, in 1985 and 1986.

	1985	1986
Nests Found	63	38
Nests Relocated	47	[1]
Successful (%)	26 (55.3)	13 (34.1)
Abandoned (%)	15 (31.9)	8 (21.1)
Destroyed (%)	6 (12.8)	17 (44.7)
Mayfield Success	43.2%	[1]

[1]Only one search was conducted in 1986. No Mayfield nest success estimate was calculated.

DISCUSSION

Game Production Areas

Habitat conditions varied across the study area and between years. In 1986, both May pond counts and duck breeding populations in South Dakota increased significantly over 1985 levels (Novara 1986). Observed changes between years in nest densities and species composition on GPAs could be attributed in part to these changes in habitat conditions.

Species composition may have been biased by timing of nest searches, which began in mid-May. Klett et al. (1986) indicated that if only a single search were possible, late May would be optimal for mallard, blue-winged teal and all species combined. Of 69 fields searched only once, only seven were searched in late May. Of 20 fields search twice, 14 were searched in late May and again in mid-to-late June.

Estimates of Mayfield nest success on GPAs agreed closely with estimates from similar studies conducted by the U.S. Fish and Wildlife Service (USFWS) on Waterfowl Production Areas (WPAs) in the same region in 1984 and 1985.[3,4] That is, nest success on public lands "managed" for wildlife was approximately 30 percent for all species combined.

The primary cause of nest failure on GPAs was predation. The impact of mammalian predators on upland nesting ducks is well documented (Cowardin et al. 1983, Greenwood 1986, Higgins 1977, Johnson and Sargeant 1977, and others). Identification of predators responsible for destruction of nests from nest site inspection is difficult at best, and far from an exact science (Greenwood, personal communications). I used all available evidence, knowledge of local Conservation Officers, and the experience of one employee to infer which predators had the greatest impact on GPAs. As noted in the aforementioned studies, striped skunk, red fox and raccoon were primary predators.

[3]Rabenberg, M. J. 1984. First year report: nest dragging study, Waubay Wetland Management District. 24pp. Unpubl. report. Waubay Wetland Management District, USDI Fish and Wildlife Service, Waubay, South Dakota.

[4]_____, 1985. Second year report: nest dragging study, Waubay Wetland Management District. 41p. Unpublished report. Waubay Wetland Management District, USDI Fish and Wildlife Service, Waubay, South Dakota.

Use of vehicle tracks as travel lanes by predators was first suspected by L. Kirsch at NPWRC. Fresh sand spread in vehicle tracks on one study area in North Dakota showed higher use by red fox and striped skunk than plots located as far as possible from vehicle paths (NPWRC, unpublished data). Based on the relatively simple approach taken in my study, nest searching with vehicles may significantly reduce probability of survival of nests adjacent to or between vehicle tracks.

Lake Albert Island

Number, density and distribution of mallard nests on Lake Albert Island in 1985 were all comparable to those reported by Drewein and Fredrickson (1970). Those authors did not report fate of nests but noted no evidence of predation and only three abandoned clutches found during searches. Apparent nest success was lower on Lake Albert Island in 1985 (55 percent) and 1986 (34.2 percent) than the 60 to 90 percent reported as typical for island nesting dabbling ducks by Deubbert et al. (1983). In 1985, abandonment was the major cause of nest failure on Lake Albert Island, accounting for 71 percent of unsuccessful clutches. Duebbert et al. (1983) found no difference in rates of abandonment between years when searches were conducted during and after the breeding season, leading them to conclude that abandonment was due to natural behavioral interactions or physiological responses rather than investigator disturbance. In 1986, nest searching was delayed until well after peak hatching. Abandonment accounted for a lower proportion of failed nests (table 2), but increased predation was the primary cause.

The chief benefit of islands for upland nesting ducks is protection from mammalian predators (Townsend 1966, Duebbert 1982, Hines and Mitchell 1983). Lake Albert Island was trapped, through not intensively, each spring from 1980 through 1986. Occasional raccoon and striped skunk were removed. There is a red fox denning site on the island, and red fox were evicted from the island one spring. In spite of the annual (albeit limited) trapping effort on the island, predation by mammals was evident both years. Raccoon, woodchuck (Marmota monax) or mink (Mustela vison) were probably responsible for nest failures in 1986.

CONCLUSIONS

The North American Waterfowl Management Plan (1986) identified recruitment in prairie nesting ducks as the top priority problem facing waterfowl managers today. While duck nest success on GPAs far surpassed that on private lands (Johnson et al. these proceedings), the impact of predation on GPAs was great, especially for some areas and species. Even in 1986, a year of excellent habitat conditions, predation left duck nest success far below potential on GPAs. Intensive management (eg. nest structures, predator-free nesting islands, predator exclusion fences and predator removal) will be necessary to increase nest success and enhance duck recruitment on GPAs.

Lake Albert is well suited for intensive management. Potential production from successful nests on Lake Albert Island in 1985 was 265 ducklings. Brood rearing habitat in the area is in excellent condition due to high water levels and flooding of low-lying areas. Thorough trapping on Lake Albert Island is clearly justified.

Excellent nesting cover but low nest success on the Hogsback peninsula led SDGFP and Ducks Unlimited to construct a predator exclusion fence across the base of the peninsula in the fall of 1986. If high nest densities on the nearby island are one cause of observed abandonment, providing alternative secure nesting cover may allow more hens to nest successfully. Although nothing is known about duckling survival on Lake Albert, recruitment, survival and homing, or immigration are evidently adequate to maintain the population. I hypothesize an increase in nest density on the Hogsback over time as a result of predator exclusion.

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