Comparison of Point-Count and Wade-Flush Methods for Counting Ducks

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ABSTRACT--The effects of human-induced changes in wetland habitat on birds, particularly ducks (Anatidae), must often be assessed during one visit because of limited resources. Thus, selection of count methodology is critical for an accurate assessment of treatment effects. Using the point-count and wade-flush census techniques, we conducted duck counts on 17 wetlands in North Dakota in June 1992 and 1993. Densities of dabbling ducks, diving ducks, and all ducks combined did not differ between point-count and wade-flush methods ($P > 0.05$). Densities of ducks detected with point-counts were positively correlated with percent open water ($P < 0.05$); whereas, densities of ducks detected by wade-flush counts were independent of percent open water ($P > 0.05$). Additional research on various census methods is needed to assess their cost-effectiveness for detecting the diversity and abundance of wetland-dwelling birds.

Key words: cattails, cattail management, census, glyphosate, waterfowl, wetlands, habitat management, *Typha*.

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Emergent vegetation, especially cattail (*Typha* spp.), often forms dense homogenous stands in shallow wetlands of the northern Great Plains (Kantrud 1986). Wildlife agencies attempt to increase wetland habitat heterogeneity by managing cattails with burning, cutting, grazing, herbicides, mechanical destruction, water manipulation, and combinations of these techniques (Payne 1992). In the northern Great Plains, cattail-dominated wetlands are fragmented with glyphosate-based herbicide to deprive red-winged blackbirds (*Agelaius phoeniceus*), yellow-headed blackbirds (*Xanthocephalus xanthocephalus*), and common grackles (*Quiscalus quiscula*) of an essential roosting habitat (Linz et al. 1995) and to increase use by ducks (Anatidae) (Solberg and Higgins 1993, Linz et al. 1996b). The effects of reducing cattail cover on bird-use patterns are quantified by using various census techniques (Solberg and Higgins 1993, Gibbs and Melvin 1990, Linz et al. 1996a). Each technique has its advantages and disadvantages that are associated with the species of interest and the resources available to conduct the counts.

Using point-count (Linz et al. 1996b) and wade-flush techniques (Arnold et al. 1993, Solberg and Higgins 1993), we conducted duck counts in northeastern North Dakota on 17 wetlands in June 1992 and 1993. Our objectives were to compare densities of ducks detected by using these two methods and to describe the relationship between densities of ducks counted with each technique to various wetland habitat variables.

STUDY AREA AND METHODS

Our study area was in northeastern North Dakota near Lakota, North Dakota (48° 03'N, 98° 21'W). Using geospatial processing software (MicroImages, Inc., Lincoln, Nebraska), we determined wetland size and cover of open water, live cattails, and dead cattails from aerial photographs. Twelve of 17 wetlands were treated in July 1990 and 1991 with 5.8 l/ha glyphosate-based herbicide. A fixed-wing spray plane was used to apply 15-m wide parallel strips of herbicide along the long axis of the wetland. Untreated strips of various widths were left so that either 50%, 70%, or 90% of the wetlands were sprayed (Linz et al. 1996b). For additional details of the methods and study area see Linz et al. (1996b).

We established eight points at uniform intervals around the perimeter of each wetland (Linz et al. 1996b). Wetlands were visited in random order between 2 and 18 June 1992 and 1993 by two experienced observers, who conducted point-counts between local sunrise and 5-hr post-sunrise. The observers walked to each point and recorded all ducks seen on the water or leaving the wetland during the next six minutes. Observers took advantage of elevated areas when moving between points to tally and track any ducks seen or flushed. On a different day, but during the same time period, the same wetlands were visited by two experienced observers, not involved in the point-counts, who counted ducks by using the wade-flush method. The observers walked around the wetland and entered areas dominated by emergent vegetation to flush ducks. These observers also used elevated areas to count birds and were in constant contact during the census to prevent counting birds more than once. Censuses were not conducted in steady rain or if the wind velocity exceeded 24 km/hr.

A one-factor analysis of variance (ANOVA) was used to compare arcsine-transformed percent coverages of open water, live vegetation, and dead vegetation among treated and reference wetlands (Cody and Smith 1991, Montgomery 1991). The count data for dabbling ducks, diving ducks, and total ducks were divided by the size of the wetland to obtain the density; these numbers were normalized with the square-root transformation (Montgomery 1991). A two-factor repeated measures ANOVA was used to examine the null hypotheses that densities of dabbling ducks, diving ducks, and total ducks were similar between count techniques. Interactions between count technique and treatment were examined to assess differences in trends in duck densities between treated and reference wetlands.

Pearson correlation analysis (Cody and Smith 1991, Montgomery 1991) was used to measure the relationship between duck density detected by each count method with percent cover of open water, live vegetation, and dead vegetation (regardless of treatment). We set the significance levels at alpha less than or equal to 0.05 for all statistical tests.

RESULTS

Basin areas of the 5 reference and 12 treated wetlands were similar ($F = 0.21$, $df = 1$, $P = 0.651$), and averaged 11.6 ha (SE = 2.8 ha). Post treatment cover of open water was greater ($F = 8.74$, $df = 1$, $P < 0.01$) in the treated wetlands ($\bar{x} = 26.9\%$, SE = 4.5) than in reference wetlands ($\bar{x} = 6.0\%$, SE = 1.6). The cover of live cattail was greater ($F = 34.66$, $df = 1$, $P < 0.001$) in the reference wetlands ($\bar{x} = 77.2\%$, SE = 4.4) than in treated wetlands ($\bar{x} = 26.2\%$, SE = 4.6); whereas, cover of dead vegetation was greater ($F = 10.93$, $df = 1$, $P < 0.01$) in the treated wetlands ($\bar{x} = 47.0\%$, SE = 5.7) than in reference wetlands ($\bar{x} = 16.8\%$, SE = 4.9).

Densities of dabbling ducks ($F = 1.25$, $df = 1$, $P = 0.28$), diving ducks ($F = 3.56$, $df = 1$, $P = 0.08$), and all ducks combined ($F = 2.61$, $df = 1$, $P = 0.13$) were similar between reference and treated wetlands (Table 1). Additionally, densities of dabbling ducks ($F = 0.09$, $df = 1$, $P = 0.77$), diving ducks ($F = 0.28$, $df = 1$, $P = 0.60$), and all ducks combined ($F = 0.12$, $df = 1$, $P = 0.73$) did not differ between point-count and wade-flush methods. However, a significant interaction ($F = 0.168$, $df = 1$, $P = 0.05$) was detected between treatment and census method for diving ducks. In the reference wetlands, the wade-flush method detected 30% more diving ducks than the point-count method. In the treated wetlands, however, both methods produced nearly equal densities of ducks. Densities of ducks estimated by the point-count method were positively correlated with percent open water ($r > 0.67$, $n = 17$, $P < 0.01$); whereas, density estimates by the wade-flush method were not related ($r < 0.41$, $n = 17$, $P > 0.05$) to open water coverage (Table 2).

Table 1. Densities[1] of ducks estimated from point-count and wade-flush methods in 17 wetlands during June 1992 and 1993 in northeastern North Dakota. Sprayed wetlands were treated with glyphosate-based herbicide during July 1990 and 1991.

	Reference				Sprayed			
	Point-Count		Wade-Flush		Point-Count		Wade-Flush	
Ducks	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Dabblers[2]	2.1	0.8	2.6	0.8	3.4	0.6	3.0	0.4
Divers[3]	0.2	0.1	0.6	0.2	1.6	0.4	1.5	0.4
Total	2.3	0.8	3.2	1.0	4.9	0.8	4.5	0.8

[1]Per hectare

[2]Consisted of dabblers occurring on at least 50% of the wetlands in the following proportions: 31% blue-winged teal (*Anas discors*), 17% mallard (*A. platyrhynchos*), 10% gadwall (*A. strepera*), 7% northern shoveler (*A. clypeata*), 4% northern pintail (*A. acuta*), and 4% green-winged teal (*A. crecca*).

[3]Consisted of divers occurring on at least 50% of the wetlands in the following proportions: 15% redhead (*Aythya americana*) and 7% ruddy duck (*Oxyura jamaicensis*).

Table 2. Pearson correlations (r) describing the relationship between densities of ducks in wetlands (n = 17) discovered by using point-count and wade-flush methods and three wetland habitat variables.

	Habitat Variable					
	Percent Open Water		Percent Live Cattails		Percent Dead Cattails	
Ducks	Point- Count	Wade-Flush	Point- Count	Wade-Flush	Point-Count	Wade-Flush
Dabblers	0.69*	0.10	-0.25	0.09	0.19	-0.18
Divers	0.67*	0.41	-0.43	-0.19	0.05	-0.06
Total	0.73*	0.25	-0.33	-0.06	0.12	-0.11

*Significant ($P \leq 0.05$)

DISCUSSION

The ability to see ducks is the single-most critical factor for producing unbiased population counts. Our results showed that the wade-flush method produced density estimates independent of percent cover of open water. In comparison, the densities estimated from the detected point-counts were positively related to coverage of open water. The sample size and variability within treatment groups precluded detecting visibility bias at the 0.05 alpha level (Linz et al. 1996b). Despite our inability to detect significance difference between census techniques, the strong positive correlation between open water and densities of ducks detected by the point-count method suggested that this method was subject to some visibility bias (Linz et al. 1996b).

We recommend that the traditional wade-flush method (Solberg and Higgins 1993) be used for estimating breeding duck populations in cattail-dominated wetlands. However, some environmental studies, particularly those designed to evaluate a treatment effect, e.g., wetland habitat modification with a pesticide, may require density estimates on numerous species with diverse habitat requirements and behavioral patterns. Often, adequate resources are unavailable for using multiple census techniques over many return visits to a study site.

We suggest additional research is needed to develop a cost-benefit analysis for collecting bird population data on multiple species in experimental wetlands. Investigators should test a combination of techniques to discover the best census method. At least three techniques should be tested including: point counts for highly visible birds, e.g., blackbirds, (Linz et al. 1996b); play back calls for secretive birds, e.g., rails (Gibbs and Melvin 1993); and wade-flush surveys for birds that must be flushed to obtain an unbiased count, e.g., ducks (Solberg and Higgins 1993). This research, in addition to assessing cost-benefits, should establish the most effective sequence for using multiple-census techniques.

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