Dabbling Duck Response to a Late-winter Variation in Saltmarsh Bulrush Management

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Abstract: Late winter dabbling duck use of experimentally manipulated saltmarsh bulrush (*Scirpus robustus*) was evaluated in managed brackish wetlands in the Santee River Delta, South Carolina, during 3–21 February 1989. Three 1-ha plots were established in each of 3 treatments: saltmarsh bulrush that was dewatered, burned, and reflooded (burned, flooded bulrush [BFB]); saltmarsh bulrush that was dewatered and then reflooded (unburned, flooded bulrush [UFB]); and low stem-density saltmarsh bulrush that was flooded throughout winter (winter-flooded bulrush [WFB]). Species and numbers of dabbling ducks using treatments were identified and counted. Densities of dabbling ducks using BFB ($\bar{x}$ = 100 ± 25.60 [SE], N = 12) and WFB ($\bar{x}$ = 65 ± 8.28, N = 12) were similar ($P > 0.05$); densities of dabbling ducks using UFB ($\bar{x}$ = 5 ± 1.82, N = 12) were significantly lower ($P < 0.05$) than for the other treatments. Dabbling ducks species richness (N = 8) in BFB and WFB was equal, whereas UFB attracted only 3 species. Northern pintails (*Anas acuta*) were most abundant and dominated counts of WFB and BFB on most days, comprising 64% and 75% of the ducks counted, respectively. Mallards (*A. platyrhynchos*) and black ducks (*A. rubripes*) were the most numerous species using UFB and constituted 96% of the ducks counted. Burning created openings in dense saltmarsh bulrush that typically received low use by waterfowl. Thus, a previously little-used habitat was converted into 1 used readily by dabbling ducks.

Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 43:412–420

Wetland habitat management for migrating and wintering waterfowl in South Carolina focuses on the enhancement of naturally occurring plant communities through species- and site-specific management to provide food, cover, and resting areas (Gray et al. 1987, Prevost 1987, Gordon et al. 1989). Management of brackish wetlands targets the production of widgeongrass (*Ruppia maritima*), dwarf spikerush (*Eleocharis parvula*), and saltmarsh bulrush (Gordon et al. 1989), all of which typically occur within the same wetland (Neely 1962). The abundance and distribution of each of these plant species is determined by manipulations of water salinity and hydrological factors in relation to soil salinity and properties, and the elevation of specific wetlands. Widgeongress dominates open water areas and grows in association with dwarf spikerush, which generally occurs in areas not covered by widgeongrass. Saltmarsh bulrush dominates on higher elevations.

A typical brackish marsh annual management scenario (see Gordon et al. 1989) begins in late February—early March when a wetland is gradually dewatered over a 2- to 4-week period. The wetland bed (soil) is kept moist throughout April to promote saltmarsh bulrush germination and dwarf spikerush growth (Prevost 1987). Flushing water over the wetland bed occurs until late May, after which the wetland is shallowly flooded with brackish water (5–15 ppt). During the growing season (until late Oct), water levels are raised incrementally twice per month to maximize above-ground biomass production of widgeongrass and to sustain the growth of saltmarsh bulrush and dwarf spikerush. As foraging waterfowl graze and remove widgeongrass foliage in the upper water column during winter, water levels are lowered incrementally to keep widgeongrass near the water surface and available. These drawdowns maximize duck use of widgeongrass and dwarf spikerush, and can leave saltmarsh bulrush growing on higher elevations dry and unavailable to waterfowl.

Intensive use of open-water areas by foraging dabbling ducks often results in nearly complete removal of available widgeongrass or dwarf spikerush foliage by mid- to late winter (Prevost et al. 1978, Swiderek et al. 1988). As moderate- to low-stem density saltmarsh bulrush interspersed with open water is preferred habitat for certain duck species (Gordon et al. 1987, Gray et al. 1987), late-winter reflooding of dewatered saltmarsh bulrush can make an unused habitat available after widgeongrass and dwarf spikerush standing crops in the same wetland have been depleted. However, saltmarsh bulrush is often dense with few openings which restricts use by waterfowl even when flooded (Neely 1960).

We evaluated a modification of the typical management scenario to enhance late-winter saltmarsh bulrush use by dabbling ducks. Two late-winter management alternatives were tested: 1) burning and reflooding saltmarsh bulrush, and 2) reflooding saltmarsh bulrush without burning. We evaluated the effect of the 2 alternatives based on the subsequent use of the respective treatments by dabbling ducks.

This study was funded by the North American Wildlife Foundation through the Delta Waterfowl and Wetlands Research Station and the South Carolina Wildlife and Marine Resources Department. We thank R. Turner for allowing us access to Kinloch Plantation. B. Gray, T. Strange, and several anonymous reviewers provided helpful comments on previous drafts of this manuscript.

Methods

Study Area

Kinloch Plantation is a privately owned and managed wildlife management area located in the Santee River Delta, Georgetown County, South Carolina. The area has 2,024 ha of brackish tidal wetlands and 242 ha of upland. Water salinities at the site vary from 1–20 ppt. Most tidal wetlands at Kinloch Plantation were modified for rice cultivation during the 18th to 20th centuries (Prevost et al. 1978) and are characterized by networks of remnant dikes and ditches. During the 1950s, about 844 ha of old rice fields were re-diked and water-control structures were installed to enhance management capabilities.

Wetland habitat management for migrating and wintering waterfowl at Kinloch Plantation provides a diversity of submersed and emergent plants. Target species in brackish wetlands include widgeongrass, dwarf spikerush, saltmarsh bulrush, and sea purslane (*Sesuvium maritimum*). Target species occurring in fresh-brackish marsh (1–5 ppt) and sporadically in brackish marsh include sprangletop (*Leptochloa fascicularis*), wild millet (*Echinochloa walteri*), giant foxtail (*Setaria magna*), and fall panicum (*Panicum dichotomiflorum*).

Northern pintails are the most numerous dabbling duck using Kinloch Plantation during winter. Other dabbling ducks, in order of numerical importance, include green-winged teal (*Anas crecca carolinensis*), American wigeon (*A. americana*), northern shoveler (*A. clypeata*), blue-winged teal (*A. discors*), gadwall (*A. strepera*), mallard, black duck, mottled duck (*A. fulvigula*), and wood duck (*Aix sponsa*).

Wetland Manipulation and Experimental Design

Dense 1-m high saltmarsh bulrush within 2 diked and managed wetlands was identified for burning (Fig. 1). This saltmarsh bulrush typically received little use by dabbling ducks because of few openings and high stem densities (D. H. Gordon, unpubl. data). Water levels were lowered beginning 15 January 1989 to dewater and dry saltmarsh bulrush to facilitate burning, which was completed 1 February 1989. Burning resulted in 50%–80% saltmarsh bulrush stem removal.

Three 1-ha plots were established by marking corners with 1.2-m high wooden stakes in each of 3 habitat treatments: saltmarsh bulrush that was dewatered, burned, and reflooded (burned, flooded bulrush [BFB]); saltmarsh bulrush that was dewatered and then reflooded (unburned, flooded bulrush [UFB]); and saltmarsh bulrush with low stem density located in 2 additional managed wetlands (Fig. 1) that was flooded throughout winter (winter-flooded bulrush [WFB]). Plots were located close to dikes to facilitate visual observations of ducks using the plots. Water levels in the 2 managed wetlands with BFB and UFB were increased about 19 cm over a 4-day period beginning 1 February 1989 to an estimated water depth of 10–12 cm. Water levels in the 2 managed wetlands with WFB were maintained at existing levels. Water levels were lowered gradually beginning on 21 February 1989 in all 4 managed wetlands corresponding to the annual early spring drawdown.

We realized that water depth as determined by elevation variation of the wetland

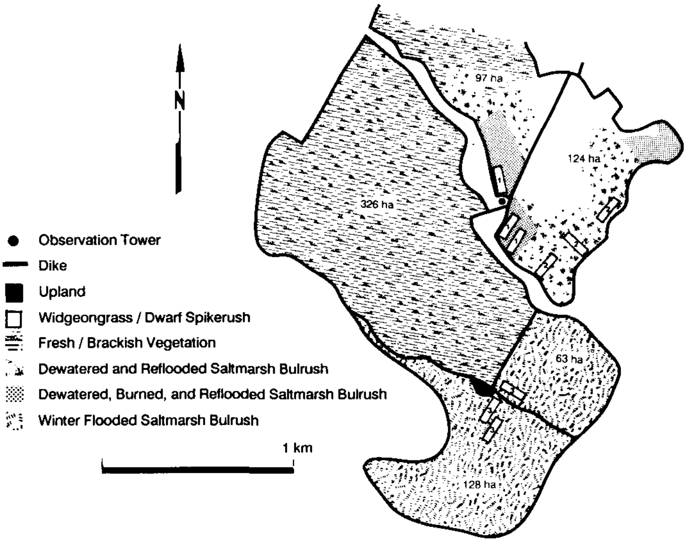

Figure 1. Managed wetlands at Kinloch Plantation, Georgetown County, South Carolina, and the location of treatment plots in saltmarsh bulrush that was (1) dewatered, burned, and reflooded; (2) dewatered and reflooded; or (3) flooded throughout winter included in dabbling duck surveys 3–21 February 1989.

bed within and among experimental plots potentially could influence dabbling duck habitat use. Therefore, water depths were measured at 12 locations in UFB and at 24 locations both in BFB and WFB to determine if desired post-flooding water depths were attained. Only 12 locations were measured in UFB because water levels were lowered before the final 12 measurements could be taken.

Waterfowl Survey Methods

Dabbling ducks using all plots were enumerated during 12 ground surveys conducted 3–21 February 1989. Surveys were conducted daily beginning on the second day of flooding (2 Feb 1989) and continued for 8 consecutive days, with the exception of 5 February 1989. Surveys were conducted every other day for the remainder of the experiment. In the event surveys could not be conducted on a scheduled day, they were resumed the following day. Initially, surveys were conducted during the evening (5 days); however, because dike maintenance activities initiated during the first week of observations could have negatively influenced waterfowl use of the sites, surveys were switched on 9 February 1989 to morning hours for the remaining 7 days. Species present and numbers of ducks using BFB and WFB were identified and counted from 6.1-m towers using a 15X-60X spotting scope. BFB and WFB plots were observed until all dabbling ducks present were counted. Because UFB was dense, ducks in these plots were counted by flushing from adjacent dikes. A minimum of 10 minutes were spent at each UFB plot to ensure all ducks were flushed.

The sequence of surveying treatments was changed randomly every day. Plots within a treatment were in close proximity (Fig. 1), and thus were counted consecutively.

Statistical Analysis

Densities of dabbling ducks for each treatment were computed using daily surveys as replicates. Total numbers and percent composition of dabbling ducks within treatments were computed by summing duck numbers over all surveys. Trends in densities of total dabbling ducks (TDD) (all dabbling ducks counted among species) within treatments were plotted over time. Kruskal-Wallis 1-way analysis of variance was used to detect differences in densities among treatments. Mean densities were compared with a distribution-free multiple comparison test based on Kruskal-Wallis rank sums (Hollander and Wolfe 1973:124–126).

Mean water depths were computed by averaging water depth measurements. Differences between treatments were tested using *t*-tests (Steel and Torrie 1980).

Results

Total Dabbling Duck Response

TDD numbers were largest in BFB (Table 1), but densities were not significantly different ($P > 0.05$) from that of WFB (Table 2). TDD densities increased gradually until 9 February 1989 and then sharply to a high of 305 ducks/ha on 13 February 1989 (Fig. 2). Densities then decreased until the end of the surveys. Dabbling duck species richness was high in BFB (N = 8 different species, Table 1).

WFB attracted the same 8 dabbling duck species and about the same TDD density observed in BFB (Table 2). TDD densities in WFB remained relatively high

Table 1. Cumulative number and percent composition of dabbling ducks observed during 12 surveys in 3 1-ha plots located in each of 3 treatments: saltmarsh bulrush that was dewatered, burned, and reflooded (BFB); dewatered and reflooded (UFB); or flooded throughout winter (WFB) in managed brackish wetlands in South Carolina, 3–21 February 1989.

	BFB		UFB		WFB	
Species	*N*	%	*N*	%	*N*	%
Mallard	367	11	107	57	27	1
Black duck	80	2	71	38	28	1
Northern pintail	2,471	75	8	4	1,488	64
Gadwall	31	1	0	0	283	12
Green-winged teal	266	8	0	0	336	14
Blue-winged teal	30	1	0	0	45	2
American wigeon	51	2	0	0	65	3
Northern shoveler	4	<1	0	0	51	2
Total	3,300	100	186	99	2,323	99

Table 2. Mean density (*N*/ha) of dabbling ducks observed during 12 surveys in 3 1-ha plots located in each of 3 treatments: saltmarsh bulrush that was dewatered, burned, and reflooded (BFB); dewatered and reflooded (UFB); or flooded throughout winter (WFB) in managed brackish wetlands in South Carolina, 3–21 February 1989.

	BFB		UFB		WFB	
Species	$\bar{x}$	SE	$\bar{x}$	SE	$\bar{x}$	SE
Mallard	11A[a]	2.93	3A	0.70	1B	0.27
Black duck	2A	0.72	2A	1.14	1A	0.35
Northern pintail	75A	24.21	1B	0.51	41A	8.60
Gadwall	1A	0.80	0A	0.00	8B	1.35
Green-winged teal	8A	2.49	0B	0.00	9A	2.27
Blue-winged teal	1A,B	0.59	0B	0.00	1A	0.67
American wigeon	2A	0.91	0B	0.00	2A	0.44
Northern shoveler	1A	0.12	0B	0.00	1A	0.47
Total	100A	25.60	5B	1.82	65A	8.28

[a]Row means with unlike letters are different ($P < 0.05$) based on Kruskal-Wallis rank sums mean comparison procedures (Hollander and Wolfe 1973:124–126).

during the first 8 counts, peaking at 126 ducks/ha on 9 February 1989. TDD numbers decreased gradually during the final 4 surveys (Fig. 2).

Dabbling duck species richness ($N = 3$) and TDD density in UFB was significantly lower ($P < 0.05$) than for BFB and WFB (Table 2). TDDs were low for all counts and peaked at 24 ducks/ha on 17 February 1989 (Fig. 2).

Dabbling Duck Species-Specific Responses

Northern pintails were the most abundant dabbling ducks counted using BFB; the other species in decreasing order of numerical importance were mallards, green-winged teal, American wigeon, black ducks, blue-winged teal, gadwall, and northern shovelers (Table 1). During the first 4 surveys, mallards and then green-winged teal were the most abundant species. Thereafter, northern pintails dominated counts and peaked at 265 ducks/ha on 13 February 1989. Duck densities for all species declined during the final 3 surveys.

Northern pintails also were the most prevalent dabbling duck species using WFB, followed by green-winged teal, gadwall, American wigeon, blue-winged teal, northern shovelers, mallards, and black ducks (Table 1). Relative to the other 2 treatments, a large number of ducks used WFB from the onset of the experiment presumably because this habitat was available throughout the winter and had desirable structural characteristics. As in BFB, northern pintails dominated the counts of WFB and peaked at 94 ducks/ha on 9 February 1989. However, a relatively consistent number of gadwall and green-winged teal also were present. During the final 4 surveys, northern pintail and gadwall numbers declined to low levels and green-winged teal were most abundant during the final 3 surveys.

Mallards and black ducks were the most abundant ducks in UFB (Table 1). Northern pintails were observed at both a low density (Table 2) and frequency (2 of

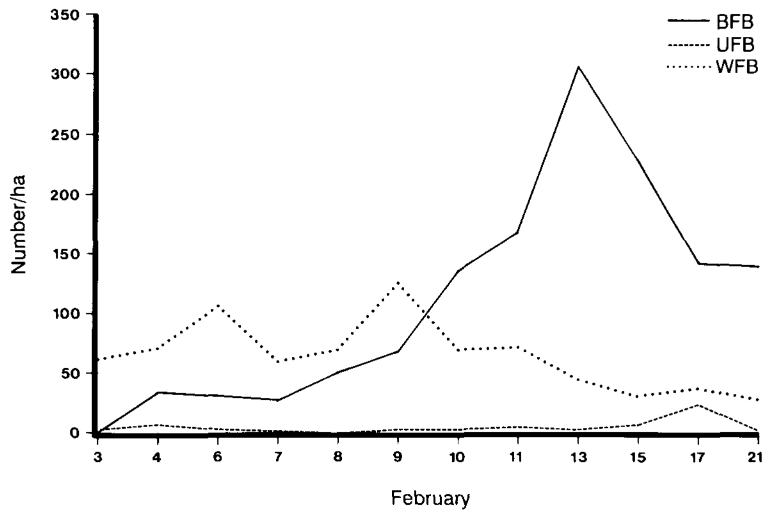

Figure 2. Densities (*N*/ha) of total dabbling ducks in saltmarsh bulrush that was dewatered, burned, and reflooded (BFB); dewatered and reflooded (UFB); or flooded throughout winter (WFB) in managed brackish wetlands in South Carolina, 3–21 February 1989.

12 surveys). Mallards were counted using UFB more consistently (11 of 12 vs. 9 of 12 surveys) and in slightly higher densities than were black ducks (Table 2).

Water Depth

Water depths in BFB ($\bar{x}$ = 20.9 cm, range = 5.1–37.0 cm) were similar ($P >$ 0.05) to those of UFB ($\bar{x}$ = 17.3 cm, range = 10.0–29.0 cm). WFB water depths were significantly ($P < 0.05$) deeper ($\bar{x}$ = 27.0 cm, range = 6.0–59.0 cm) than in BFB or UFB. WFB mean depth was inflated because the water level of 1 treatment plot was increased 5–10 cm during the final 4 observation periods to enhance blue crab (*Callinectes sapidus*) harvest.

Discussion

The switch in survey times (i.e., evening to morning) did not influence numbers of dabbling ducks counted using treatment plots. Although the increases in duck numbers observed in BFB was concurrent with the switch from evening to morning survey times (Fig. 2), we believe this reflected the time needed for ducks to locate the newly available habitat, not the time of day that surveys were conducted. If changes in survey times influenced duck numbers, a similar effect (i.e., an increase in duck numbers) would be expected in all habitats surveyed, which was not the case (Fig. 2). In WFB, a previously existing and used habitat, duck numbers were relatively high and remained so for the first 8 surveys. Also, duck numbers in UFB remained low before and after the change in survey times.

BFB generally was characterized by open water intermixed with patches of partially burned and unburned saltmarsh bulrush. This more open habitat structure improved access to dabbling ducks. Northern pintails were the most numerous species, and their numbers dominated counts most days; however, substantial numbers of mallards and green-winged teal also were present. Water levels were deeper than desired, yet BFB still received relatively high use by dabbling ducks. Few ducks were counted using UFB probably because stem densities were high. Mallards and black ducks, commonly associated with structurally dense microhabitats (Gordon et al. 1987), were most abundant and generally flushed from ditches in interior regions of the plots.

BFB was structurally more similar to WFB (i.e., openings and low-stem densities of saltmarsh bulrush); however, WFB also provided submersed vegetation (e.g., widgeongrass, dwarf spikerush) because it was flooded since the beginning of the previous growing season. Decreased dabbling duck use of WFB during the final 4 surveys (Fig. 1) likely resulted from increased water depths in 1 of the treatment plots.

Species richness and percent composition of ducks using BFB and WFB were similar. However, gadwall use of BFB was minimal and use of WFB was considerable. Conversely, mallard use of BFB was considerable and use of WFB was minimal. The interspersion of cover and open water of BFB coupled with the availability and accessibility of saltmarsh bulrush seeds attracted mallards to BFB. Saltmarsh bulrush is both a preferred habitat (Gordon et al. 1987) and an important food of mallards (Kerwin and Webb 1972, Prevost et al. 1978). Indeed most of the mallard use was noted in BFB, and large amounts of windrowed saltmarsh bulrush seeds were observed. On the other hand, WFB was relatively open and provided submersed vegetation (i.e., widgeongrass, dwarf spikerush) for foraging gadwall (Kerwin and Webb 1972, Landers et al. 1976, Prevost et al. 1978).

Our results show that late-winter burning and shallow flooding of saltmarsh bulrush effectively provides an attractive habitat for dabbling ducks. Application of this modification of brackish wetland management is most appropriate in wetland management units where dense saltmarsh bulrush occurs and restricts waterfowl use. A late-winter (mid Jan) drawdown may be required to expose saltmarsh bulrush beds to allow burning; water levels can then be increased immediately thereafter. We suggest a close monitoring of water depths as water levels are increased to insure an optimum foraging depth of 10–15 cm is maintained to facilitate maximum dabbling duck use.

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