SPRING DRAWDOWN AS A WATERFOWL MANAGEMENT PRACTICE IN A FLOATING FRESH MARSH

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Abstract: Spring drawdown was evaluated as a waterfowl management practice in a floating fresh marsh in southcentral Louisiana. Water depths were fluctuated in a shallow marsh impoundment for the study. The impoundment produced more waterfowl food plants than the control area and less water hyacinth (*Eichhornia crassipes*), a pest plant in the area. There was a direct relationship between the vegetative coverage and composition of the impounded area and the species of seeds present in the top 5 cm of soil within the impounded area. Winter usage of the impoundment by ducks and American coots (*Fulica americana*) was 9 times and 4 times greater than winter usage of the control area, respectively.

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The Louisiana coastal marshes cover approximately 1,580,000 ha which is over 50 percent of the total marsh area along the Gulf and Atlantic coasts of the United States (Wilson 1967). This marsh-estaurine environment serves as a wintering area for approximately one-fourth of the waterfowl in North America (Hansen and Hudgin 1966). Freshwater marshes comprise 495,000 ha with approximately 336,000 ha located in the Inactive Delta Marsh Zone of southeastern Louisiana (Chabreck 1970). Various authors indicate that the fresh marshes are significantly more important to waterfowl than the saline, brackish, or intermediate marshes in terms of waterfowl food production and duck-day usage (Chabreck 1961) Chabreck et al. 1975, Palmisano 1972, St. Amant 1959). Fresh marshes however, vary considerably in their attractiveness to waterfowl because of differences in plant species composition and water regimes.

Several previous studies have recommended marsh management procedures to improve habitat for waterfowl (Chabreck 1961, Baldwin 1967, Landers et al. 1976). The majority of these studies have been conducted on areas with mineral soils, while few studies have evaluated management practices on highly organic soils such as those found in the fresh marshes of the Inactive Delta Marsh Zone of Louisiana (Chabreck 1970). Because of the value of the area to waterfowl and the need for additional information, this study was conducted to evaluate various fresh marsh management practices in terms of plant production and waterfowl usage.

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METHODS AND MATERIALS

The study area was located along the central Louisiana coast, 26 km inland from the Gulf of Mexico, in marsh formed by an ancient delta of the Mississippi River. As a result of subsidence, original sedimentary deposits formerly at the marsh surface, are now 1 to 2 m below the surface and overlain by a peaty soil containing over 50 percent organic matter. Plant communities in the area are typical of those described for the fresh marsh vegetative type by Chabreck (1972).

A marsh impoundment comprising approximately 100 ha was completed on the study area during April 1976. Water was removed in May 1976, and the impounded area was kept dry until late August 1976. The purpose of removing the water was to encourage the germination and growth of various annual plant seeds contained in the marsh soil.

A major portion of this study involved the evaluation and comparison of this impounded and drained section of marsh with an adjacent control on the basis of the following criteria: vegetative coverage and composition, seed availability and waterfowl usage.

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Plants within the impounded and control areas were sampled by the line intercept method (Canfield 1941), and a meter rule was used to measure the degree to which various plant species occupied an area at ground level. Samples were taken at a predetermined intervals but the exact sample point was randomly selected. The rule was placed on the marsh surface and the total units occupied by plant species and openings touching the rule were tabulated. Plants were sampled along both sides of a levee separating the impounded and control areas, and sample points were located 10 and 25 m from the levee. Plant species composition and plant coverage of each were computed for 160 samples.

Forty samples were collected from the impounded and control areas to determine the species and quantities of seeds present in the soil. The seeds in each sample were hand-sorted with the aid of a 10 X dissecting microscope, identified, and weighed to the nearest 0.0001g. All weight values of the seeds were expressed as kg/ha.

Five 0.1 ha inventory plots were established in both the impounded and control areas. Inventory plot locations were chosen to allow a relatively unobstructed view of the plot thus facilitating the counting of ducks, coots, and common gallinules (*Gallinula chloropus*) found on the plot. Counts were made in the morning, completed by 2 hours after sunrise, at semi-monthly intervals beginning January 1976 and ending March 1977. Total numbers of ducks, coots, and gallinules were recorded by plot. Information was used as an index to the relative usage of the impounded and control areas.

Steel and Torrie (1960) served as the reference for all statistical tests used in this study. An analysis of variance using a modified split-plot design was employed to analyze the seed availability and vegetative coverage and composition segments of the impoundment evaluation. A modified version of the split-plot design was required because the positions of the impounded and control areas were fixed at each station and thus their positions could not be reassigned. The waterfowl usage segment utilized the randomized block design analysis of variance.

RESULTS AND DISCUSSION

Plant Growth

Vegetation was sampled in both the impounded and control areas to determine species composition, total vegetative coverage and the percentage that waterfowl food plants comprised of all vegetation in the 2 areas.

The major species within the impounded area were *Hydrocotyle* spp., *Eleocharis* spp., and *Paspalum* sp., while *Eichhornia crassipes*, and *Eleocharis* spp. were the major species within the control area. Waterfowl food plants comprised 87.5 percent of all vegetation recorded on transects in the impounded area and 60.7 percent in the control area (Table 1). Waterfowl food plants occupied 50.7 percent of the transects in the impounded area and 40.8 percent of the transects in the control area, a difference which was highly significant ($P < 0.01$).

A greater amount of openings occurred within the impounded area than within the control area ($P < 0.01$). These nonvegetated or open areas comprised 42.1 percent of the impounded area transects and 32.9 percent of the control area transects.

Alternanthera philoxeroides was described by Lynch et al. (1947) as a serious aquatic pest plant in the southeastern United States. He said that in addition to obstructing navigation channels, municipal water supplies, and irrigation systems it crowds out other species of plants that are important as food and cover to many species of wildlife. *A. philoxeroides* occupied a slightly greater percentage of transects in the impounded area (3.0%) than in the control area (1.2%).

Bateman and Owens (1975) described the rapid spread of *E. crassipes* especially in southeastern Louisiana, where the floating plants have choked thousands of hectares of marsh ponds thus eliminating virtually all aquatic vegetation valuable to wildlife and severely restricting hunter, trapper, and fisherman access. The growth of *E. crassipes* was drastically curtailed within the impoundment ($P < 0.01$). The plant occupied 18.8 percent of transects on the control area, but only 0.5 percent within the impoundment. The reduction of *E. crassipes* was probably related to the drier conditions within the impoundment.

Seed Availability

Soil samples were collected from the top 5 cm of soil in the impounded and control areas to determine the difference between the areas in terms of species and quantities of

Table 1. Percentage species composition (SC) and relative abundance (RA)[a] of marsh vegetation in transects in an impounded and control area during August 1976 in Terrebonne Parish, Louisiana.

	Impounded Area		*Control Area*	
Species	*SC*	*RA*	*SC*	*RA*
Alternanthera philoxeroides	5.2	301.1	1.8	120.8
Ammania coccinea	0.1	5.8	0.0	0.0
Bacopa monnieri[b]	7.0	405.3	2.2	147.6
Bidens laevis	3.4	196.9	6.5	436.2
Ceratophyllum demersum[b]	6.9	399.5	3.1	208.0
Cyperus spp.[b]	8.4	486.4	8.2	550.2
Echinochloa walteri[b]	8.3	480.6	2.0	134.2
Eichornia crassipes	0.9	52.1	28.0	1,878.8
Eleocharis spp.[b]	13.0	752.7	24.2	1,623.8
Eupatorium capillifolium	0.3	17.4	0.0	0.0
Fuirena pumila	0.7	40.5	0.7	47.0
Habenaria repens	0.3	17.4	0.0	0.0
Hydrocotyle spp.[b]	18.9	1,094.3	9.5	637.4
Leptochloa fasicularis[b]	3.1	179.5	0.3	20.1
Ludwigia spp.[b]	0.0	0.0	0.2	13.4
Najas guadalupensis[b]	0.0	0.0	1.6	107.4
Paspalum spp.[b]	10.0	619.5	0.8	53.7
Pistia stratiotes	0.0	0.0	0.3	20.1
Polygonum spp.[b]	1.8	104.2	0.3	20.1
Sacciolepis striata[b]	8.0	463.2	7.4	496.5
Sagittaria falcata[b]	1.4	81.1	0.5	33.6
Scirpus californicus	0.0	0.0	0.4	26.8
Scirpus olneyi	0.5	29.0	0.9	60.4
Typha latifolia	1.1	63.7	0.5	33.6
Utricularia sp.	0.0	0.0	0.6	40.3
Total Species Composition (%)	100.0		100.0	
Total Waterfowl Food Plant (%)	87.5	5,066.2	60.7	4,073.0
Total Plant Coverage (%)	57.9		67.1	

[a]Relative abundance is the product of the percentage species composition times the total coverage percentage.

[b]Various food habit studies have identified this species as a waterfowl food plant.

seeds present. Seed located within the top 5 cm of soil was considered available to ducks as food.

Total seed available was similar in the impounded (283.7 kg/ha) and the control (286.5 kg/ha) areas (Table 2). The areas were also similar in mean weights of seeds classified as waterfowl foods. There were, however, differences between the 2 areas in content of certain species of seeds ($P < 0.01$). *Cyprus* spp., *Najas quadalupensis,* and *Carex camosa* were 2 times, 6 times, and 10 times more abundant in the impounded area, respectively. On the other hand, *Sacciolepis striata* and *Fuirena pumila* were more abundant ($P < 0.05$) in the control area. *Dichromena colorata* was over 2 times more abundant in the control area than in the impounded area.

Although *Zizanopsis miliacea* seed was present in the impounded area, it was absent from the control area samples. This was the only species of seed found that was not represented in samples from both areas.

Table 2. Mean weights of seeds available in the soil of the impounded and control areas on 21 February 1977.

Species	*Impounded*	*Control*
	- - - - - - - - *kg/ha* - - - - - - - -	
Carex camosa	1.050	0.100
Cyperus spp.	114.400	50.900
Dichromena colorata	2.600	7.400
Eichornia crassipes	2.025	2.925
Eleocharis spp.	53.250	51.500
Fuirena pumila	2.050	7.100
Hydrocotyle spp.	74.650	100.800
Ludwigia sp.	3.125	1.800
Najas quadalupensis	2.400	0.400
Paspalum sp.	2.200	1.100
Polygonum sp.	4.200	20.000
Sacciolepis striata	7.725	16.275
Scirpus californicus	13.700	26.200
Zizaniopsis mileacea	0.300	0.000
Waterfowl Food Seeds	275.600	269.000
Total Seeds	283.700	286.500

Echinochloa walteri was over 3 times more abundant on transects in the impounded area than in the control area. This was a result of the drying of the soil in the impoundment which encouraged the germination and growth of *E. walteri* seed. There were, however, no *E. walteri* seeds present in soil from the impounded or control areas. During August and September when the majority of the seed had matured, large concentrations of red-winged blackbirds (*Agelaius phoeniceus*) were on the study area. These birds fed heavily on *E. walteri* seed during this period. Blackbird feeding, losses to invertebrates, and the collection of soil samples nearly 6 months following seed maturation, probably all contributed to the lack of *E. walteria* seeds in the soil samples.

The seed availability study conducted during February 1977 indicated that *Cyperus* spp., *Eleocharis* spp., *Hydrocotyle* spp., and *Scirpus californicus* were the major seed species present in soil samples from both the impounded and control areas. These species were also among the dominant plants occupying transects in the impounded and control areas. Although it is not possible to predict the exact order of abundance of seed species present in the soil, based on vegetative composition data, it is possible to predict which species as a group are likely to be most abundant. These findings differed from those of Jemison and Chabreck (1962), who reported little relationship between the vegetative stand composition of an area at the time of sampling and the seeds that were available.

Waterfowl Usage

Waterfowl inventory plots were sampled in both the impounded and control areas to determine waterfowl usage of the 2 areas on a seasonal basis. The year of the study was divided into 4 seasons: spring (March, April, and May), summer (June, July, and August), fall (September, October, and November), and winter (December, January, and February).

Although coots and gallinules are in a different taxonomic order than the ducks and, therefore, not considered true waterfowl, they were included under the heading of waterfowl as a matter of convenience. The results of this segment of the study are expressed on a day-use basis and are included in Table 3.

There was no difference between mean daily waterfowl usage of the impounded (25.9/ha) and the control (22.5/ha) areas on an annual basis; however, seasonal usage differed ($P < 0.01$) in both areas. The greatest usage of the impounded area occurred during the winter (100.4/ha) and the least usage occurred during the summer (0.0/ha). The greatest usage in the control area occurred during the spring (50.0/ha) and the least usage occurred during the fall (4.4/ha). Waterfowl usage was over 6 times greater in the impounded area (100.4/ha) than in the control area (15.2/ha) during the winter.

Table 3 Mean number of waterfowl (birds/ha) present in the impounded and control areas at various seasons.

	Impoundment				*Control*			
Species	*Spring*	*Summer*	*Fall*	*Winter*	*Spring*	*Summer*	*Fall*	*Winter*
Ducks	5.4	0.0	0.8	71.6	26.9	2.0	2.0	8.0
Coots	3.1	0.0	0.0	28.8	21.4	0.0	2.4	7.2
Gallinules	0.5	0.0	0.0	0.0	1.7	7.2	0.0	0.0
Total	9.1	0.0	0.8	100.4	50.0	9.2	4.4	15.2

There was no difference between mean daily duck usage of the impounded (18.2/ha) and control (11.3/ha) areas; however, seasonal usage differed ($P < 0.01$) in both areas. The greatest duck usage of the impounded area was during the winter (71.6/ha) and the least was during the summer (0.0/ha). The greatest duck usage of the control area occurred during the spring (26.9/ha) and the least occurred during the summer and fall (2.0/ha). Duck usage of the impounded area (71.6/ha) during the winter was 9 times greater than usage of the control area (8.0/ha) during the same season.

No difference in mean daily coot usage occurred between the impounded (7.5/ha) and the control (9.0/ha) areas; however, seasonal usage differed ($P < 0.01$) in both areas. The impounded area received the greatest coot usage during the winter (28.8/ha) and the least during the summer (0.0). Coot usage of the impounded area (28.8/ha) during the winter was 4 times greater than that of the control aera (7.2/ha).

A comparison of limited data concerning mean daily gallinule usage of the impounded (0.2/ha) and control (2.2/ha) areas indicates greater ($P < 0.05$) usage of the control area. There was also seasonal variation in gallinule usage of the impounded and control areas ($P < 0.01$). The only gallinule usage of the impounded area occurred during the spring (0.5/ha). The greatest gallinule usage of the control area occurred during the summer (7.2/ha) and the least usage occurred during the fall and winter (0.0).

SUMMARY AND CONCLUSIONS

Spring drawdown within a floating fresh marsh along the southcentral Louisiana coast proved to be an effective waterfowl habitat improvement practice. Transects sampled within an impounded area contained 24.4 percent more duck food plants than transects in a nearby control area. Winter usage of the impounded area by ducks and coots was 9 times and 4 times greater than usage of the control area, respectively.

The growth of *E. crassipes,* a common pest plant in the study area, was greatly curtailed by the drawdown. The plant spreads rapidly during warm weather, often completely covering open water bodies. The dense growth creates problems for boat navigation and blocks access routes in marshes for waterfowl hunting. Dense stands often completely cover the surface of ponds and lakes thereby shading out aquatic plants and making ponds and lakes unusable to waterfowl. However, vegetation sampling in late August disclosed that *E. crassipes* was 36 times more abundant outside the impounded area. Drying the area during the growing season apparently resulted in reduced growth of the plant.

Soils high in organic matter undergo oxidation when subjected to prolonged drying. In several areas along the Louisiana coast, marshes with peaty soil have been drained and placed in agricultural crops. As a result of the permanent drying, surface organic matter decomposed gradually over a period of years and soil elevations were lowered as much as 1 m. An annual drawdown, as evaluated during this study, could possibly result in loss of some soil organic matter. Some natural drying of marshes occurs periodically, but this is usually of only short duration. An important factor regarding drying to produce annual grasses and sedges is to keep the area dry only as long as essential to promote germination and protect young seedlings. Once seedlings have reached a height of about 10 cm, water can be permitted to remain on the area.

The species of seeds present in the upper layers of soil were similar in abundance to plants growing in the area. An outstanding exception was *E. walteri,* which was a common plant in the impounded area but no seeds were found in the soil. Seed depredation by red-winged blackbirds in late summer was considered the main cause of seed loss. Additional study is needed to further evaluate this problem and to test alternate drawdown schedules.

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