DUCK USAGE OF MANAGEMENT UNITS IN THE LOUISIANA COASTAL MARSH

by

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ABSTRACT

Ducks were inventoried monthly over a 2-year period in order to compare usage of management units in the Louisiana coastal marshes. Areas inventoried were brackish and fresh water impoundments, which were managed for ducks, and marsh pump-out units, managed for beef cattle. In addition, natural marshes nearby were sampled as a control. Water depth readings were taken monthly and vegetation was sampledannually to provide information on factors affecting duck usage. Greatest duck usage was in the fresh water impoundments, but usage of the brackish impoundments was very similar to that of the control areas. Marsh pump-outs received lowest duck usage, and birds were present only after heavy rainfall temporarily flooded the areas. The major factors affecting duck were the types of vegetation, water depth, and time of year.

INTRODUCTION

An important aspect of any wildlife management plan is providing optimum habitat. Ducks are no exception and when given a free choice will concentrate in areas which they prefer. Therefore, duck usage in regions where the birds are abundant can be used as an indicator of habitat quality. However, in analyzing the factors which make an area particularly attractive to ducks, a more thorough investigation is necessary.

Considerable effort has been expended to determine the food habits of waterfowl (Martin and Uhler 1951, Chamberlain 1959, Kimble and Ensminger 1959). The highly successful attraction of waterfowl by the provision of food is testimony to the importance of this item (Lostetter 1956). Other requirements of ducks also received attention, for example Rudolph and Hunter (1964) reported that diving ducks (Aythyinae) tolerate a wide range of water depths (Anatinae) are unable to feed in water greater than 18 inches deep.

In the Louisiana marshes, waterfowl usage has been studied from the standpoint of natural and man-made changes. Hurricanes and muskrat eatouts open up marshes having dense stands of vegetation and make them more attractive to ducks (Lynch *et al.* 1947, Harris and Chabreck 1958, Kimble and Ensminger 1959). Duck use of marshes has been increased by encouraging the growth of natural food plants, particularly widgeon-grass *(Ruppia maritima* and millet *(Echinochloa walteri)* (Chabreck 1960, Joanen and Glasgow 1965).

Impoundments were constructed on the Rockefeller Wildlife Refuge in Louisiana as a part of a waterfowl management program and were managed as both fresh and brackish water systems. The exact procedures used to manage the impoundments were described by Chabreck (1960); however, no detailed studies have been conducted to compare duck preferences for these types of management nor to compare duck usage of marsh impoundments with natural marsh.

Land use practices have been changing in recent years and an increasing amount of private marshland in the vicinity of the Rockefeller Wildlife Refuge has been converted to cattle pasture by pumping to remove excessive water. The marsh is drained by enclosing the area with a continuous levee and installed a pump capable of removing surface water at a rate of about 1 inch per day.

The management units installed on the Rockefeller Wildlife Refuge were constructed to improve the area for ducks. The marsh pumpouts result in drying of

marshland and appear to have a detrimental effect on ducks. Therefore, the purpose of this study was to compare the effectiveness of brackish water and fresh water impoundments in improving habitat conditions for ducks and to evaluate the impact of converting marshland to cattle pasture on duck usage.

The study area was situated between the Gulf of Mexico and the Grand Chenier ridge complex, a stranded beach ridge located seven miles inland from the Gulf. The entire area consisted of low marshland with an average elevation of 1.1 feet above mean sea level. Tidewater entered the area from the Gulf of Mexico through five separate channels then spread to all parts of the refuge, outside the impounded areas. The average tidal fluctuation was about 1 foot; however, high tides frequently inundated the marshes with salt water.

The impoundments were completed in 1956 and were managed as either brackish water or freshwater environments. The brackish water impoundments were Impoundment 3(3,700 acres) and Impoundment 4(5,000 acres). Concrete stop-log structures installed in the levee systems provide for draining or filling the impoundments with tidewater.

The fresh water impoundments included in the study were: Impoundment 8(1,000 acres) and Impoundment 10(480 acres). Water levels were regulated in the fresh water impoundment with pumps installed to permit either water removal or flooding of the area. The marsh pump-outs used for creating cattle pastures were similar to the fresh water impoundments, except that water removal was the only function of the pumping system. The pump-outs and natural marsh areas sampled as control areas were adjacent to the refuge and all consitsed of the same type of marsh originally. Ducks had equal access to all areas and no unusual disturbances were present in any of the areas.

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STUDY METHODS

Duck usage of the impoundments, pump-outs and control areas were determined by aerial inventories conducted monthly from August 1970 until July 1972. All ducks were counted on each area and tabulated by species.

Plant species composition and cover were determined by a line intercept method of sampling as described by Chabreck (1960). Lines were extended across each area and sampling stations placed at 100-foot intervals along the line. Each area was visited monthly and the water depth recorded.

The year was divided into seasons for comparison according to the following: fall (August, September October), winter (November, December, January), spring (February, March, April), and summer (May, June, July). The data were analyzed statistically using an analysis of variance and regression as described by Snedecor (1956).

RESULTS AND DISCUSSION

Differences Among Management Units

Differences in duck use of the areas sampled were tested using an analysis of variance. Four types of areas were compared and the differences between areas were highly significant ($P<.01$). The fresh water impoundments received over four times the duck usage of the next highest unit and averaged 3.4 ducks per acre during the 24-hour period (Table 1). Brackish water impoundments averaged 0.8 duck per acre, which was only slightly greater than the control areas (0.7 ducks per acre). The marsh pump-outs, which were dry during much of the study, averaged less than 0.3 duck per acre.

Although duck usage was greatest in the fresh water impoundments on a year round basis, the brackish water impoundments had greater use during the fall season

($P<0.05$). Duck usage of the brakish water impoundments during the first fall season was 6.9 times greater than the usage of the fresh water impoundments. The following winter, however, duck usage of the fresh water impoundments was 5.5 times greater than the brackish water impoundments. The same trend was observed the second year and the brackish area had 11.9 times the usage of the fresh area during the fall; but during the following winter, use of the fresh water impoundments was 6.1 times greater than the brackish. The fresh water impoundments received greater duck usage during the spring and summer seasons of both years than did the other management units of the control areas.

A similar condition was reported by Palmisano (1972) regarding duck usage of vegetative types in southwestern Louisiana. He found that duck use of brackish marsh was highest in the fall and spring months and lowest during the winter. Also the fresh marshes exhibited increased duck use during the winter months.

Factors Affecting Duck Usage

The major factors affecting duck usage of the study area were food availability, water depth, and time of year. A certain amount of interaction took place between these factors, but we were unable to obtain exact measurements of the contribution of each in attracting ducks. For instance, food availability was greatly influenced by water depth. Whenever the marshes were dry, the food present was generally not available; and with excessive flooding, food was unavailable to puddle ducks.

Table 1. Duck usage of management units at the time of sampling, 1970-72.

		Brackish water Impoundments		Freshwater impoundments		Marsh pump-outs		Control areas	
Month		3	4	8	10	1	2	1	2
		Ducks per acre							
Year 1									
Aug.	'70	.01	.03	0	.09	.03	0	0	
Sept.	'70	7.03	.91	.34	.06	0	0	.08	.03
Oct.	'70	0	.01	.75	.01	.02	0	.45	0
Nov.	'70	6.91	.10	17.40	26.02	0	0	.51	12.50
Dec.	'70	1.27	1.03	4.08	9.20	.67	0	.16	2.60
Jan.	'71	.41	2.12	8.25	.57	.10	0	.15	13.00
Feb.	'71	.22	.35	8.45	4.82	0	0	.04	.65
March	'71	.41	.20	15.03	6.86	0	0	1.00	.19
April	'71	.04	.01	3.03	1.19	0	0	.02	1.08
May	'71	0	0	.44	0	0	0	0	0
June	'71	0	0	.35	.01	0	0	0	.03
July	'71	0	0	1.50	0	0	0	0	.24
	Average	1.36	.40	4.97	4.06	.07	.01	.20	2.53
Year 2									
Aug.	'71	1.89	1.70	.08	.15	0	0	.01	0
Sept.	'71	.01	.10	0	0	0	0	0	0
Oct.	'71	0	.01	.03	.05	0	0	0	0
Nov.	'71	.19	.30	34.60	3.51	1.93	.18	.40	.40
Dec.	'71	4.24	1.10	.87	.46	.01	.13	.01	.25
Jan.	'72	0	1.93	5.63	2.27	5.27	0	.09	.09
Feb.	'72	.23	3.72	1.85	2.39	.49	0	.06	.25
March	'72	1.14	1.45	.93	2.25	2.77	.15	.04	.04
April	'72	.01	.05	.38	.44	2.34	0	0	.02
May	'72	0	0	.20	0	.04	0	0	.02
June	'72	0	.01	.25	.01	.01	0	0	.01
July	'72	0	0	0	0	0	0	.02	.01
	Average	1.36	.40	4.97	4.06	.07	.01	.20	2.53

Vegetation

Brackish water impoundments. The major waterfowl food plants in the brackish water impoundments were *Eleocharis* spp. (mainly *E. parvula)* and *Sesuvium portulacastrum* (Table 2 and 3). *Eleocharis* spp. was abundant both years; however, *S. portulacastrum* was not common in either impoundment until 1971, the second year of the study.

Duck usage of the brackish water impoundments was about equal during both years of the study (Table 1) Use of Impoundment 3 was lower the second year of the study, but in Impoundment 4, use increased the second year.

The abundance of *S portulacastrum,* in the presence of *Eleocharis* spp. had no noticeable effect on duck usage. *Eleocharis* spp. was abundant both years and duck use remained essentially the same both years. Duck usage did not respond to the addition of *S. portulacastrum* as an additional source of food. *S. portulacastrum* normally receives heavy use by Blue-winged Teal during September and October. However, during the period when *S. portulacastrum* was abundant in the brackish water impoundments, the water was too deep for Blue-winged Teal *(Anus discors).*

Fresh water impoundments. Major duck food plants in the fresh water impoundments were *Echinochloa walteri, Leptochloa fascicularis, Cyperus* sp. and *Potamogeton pusillus* (Tables 2 and 3). The abundance of each varied considerably from year to year, depending on water levels in the area. Both fresh water impoundments dried during the summer of 1970, resulting in the germination and growth of an abundance of annual plants. Major duck food plants were among the dominant species present.

During the second year, both fresh water impoundments did not dry completely, thus restricting seed germination in annual plants. Impoundment 8 remained flooded throughout 1971, and the growth of aquatic plants was apparently enhanced. *Potamogeton pusillus* and *Chara vulgaris,* both good duck food plants, became abundant. Nevertheless, duck usage declined 25 percent during the second year.

Table 2. Relative abundance[1] of plants in management units, September 1970.

Plant species	Brackish water Impoundments		Fresh water Impoundments		Marsh Pump-outs		Control Areas	
	3	4	8	10	1	2	1	2
Spartina patens	3065	2273	1427	469	748	2861	3021	1978
Eleocharis spp.	2664	702	–	Tr.	–	–	212	51
Bacopa monnieri	80	19	91	–	272	–	233	–
Cyperus sp.	Tr.	Tr.	288	826	544	284	32	–
Echinochloa walteri	Tr.	Tr.	3233	2411	1528	268	466	–
Distichlis spicata	365	26	–	–	–	213	106	1239
Scirpus robustus	–	–	–	–	–	142	–	118
Scirpus californicus	–	Tr.	–	–	–	–	–	–
Phragmites commnis	Tr.	–	46	Tr.	63	85	–	–
Ruppia maritima	–	–	–	–	–	–	217	806
Ipomoea sp.	12	39	Tr.	Tr.	–	28	69	8
Baccharis halimifolia	Tr. 19	Tr.	Tr.	204	–	–	–	
Paspalum distichum	–	–	–	–	816	572	–	–
Pluchea camphorata	Tr.	–	–	215	476	426	111	–
Leptochloa fascicularis	–	21	2333	469	544	582	–	–
Potamogeton pusillus	–	–	–	–	–	–	440	–
Vigna repens	–	–	Tr.	–	–	–	32	–
Setaria magna	–	–	46	Tr.	102	43	–	–
Acida alabamensis	–	–	–	Tr.	136	121	64	–
Sesbania exalta	–	–	23	–	60	–	–	–
Heliotropium curassavicum	–	–	–	–	42	149	–	–
Sesuvium portulacastrum	–	–	–	–	–	355	–	–
Ceratophyllum demersum	–	–	–	–	–	–	–	–
Panicum dichotmiflorum	–	–	–	–	1496	274	106	–
Chara vulgaris	–	–	–	–	–	–	191	–
Lemna minor	–	–	–	–	–	–	–	–
Sagittaria falcata	–	–	–	504	–	–	–	–
Percent vegetation cover	62	32	75	49	68	71	53	42

[1]Relative abundance is the product vegetation cover and the percent of the total plant composition which was made up by the individual species.

Table 3. Relative abundance[1] of plants in management units, September 1971.

Plant Species	Brackish water Impoundments		Freshwater Impoundments		Marsh Pump-outs		Control Areas	
	3	4	8	10	1	2	1	2
Spartina patens	2241	2454	1910	202	576	2373	2835	2187
Eleocharis sp.	2448	2781	–	417	–	–	487	910
Bacopa monnieri	7	Tr.	101	–	403	–	235	–
Cyperus sp.	66	Tr.	Tr.	109	482	211	–	–
Echinochloa walteri	Tr.	–	302	1129	1606	270	–	–
Distichlis spicata	204	Tr.	–	–	–	149	172	788
Scirpus robustus	99	–	–	–	–	–	63	356
Scirpus californicus	–	Tr.	Tr.	Tr.	–	–	–	–
Phragmites communis	Tr.	–	Tr.	Tr.	123	–	–	–
Ruppia maritima	–	122	–	–	–	–	357	185
Ipomoea sp.	46	34	–	–	–	–	51	72
Baccharis halimifolia	Tr.	Tr.	Tr.	Tr.	122	–	–	14
Paspalum distichum	–	14	Tr.	–	907	830	–	–
Pluchea camphorata	Tr.	61	Tr.	139	194	326	–	–
Leptochloa fascicularis	–	Tr.	503	821	634	449	–	–
Potamogeton pusillus	–	–	905	–	–	–	–	–
Vigna repens	Tr.	14	–	17	36	–	–	–
Setaria magna	–	–	Tr.	156	108	41	–	–
Acnida alabamensis	Tr.	7	Tr.	17	158	–	218	–
Sesbania exalata	Tr.	–	–	–	115	–	–	–
Heliotropium curassavicum	–	Tr.	–	–	–	156	–	–
Sesuvium portulacastrum	1278	1338	–	–	–	313	–	–
Ceratophyllum demersum	–	–	48	–	–	–	–	–
Panicum dichotomiflorum	–	–	Tr.	308	1735	164	–	–
Chara vulgaris	–	–	503	–	–	–	–	–
Lemna minor	–	–	101	–	–	–	–	–
Sagittaria falcata	–	–	Tr.	–	–	–	–	–
Percent vegetation cover	66	68	44	33	72	58	42	45

[1]Relative abundance is the product of the percent vegetation cover and the percent of the total plant composition which was made up by the individual species.

Only a portion of Impoundment 10 dried the second year (Table 4). Neither annual plants nor aquatic plants produced outstanding growth, and food production was considerably below the previous year (Tables 2 and 3). Duck usage declined 76 percent the second year and reduced food supplies were probably responsible in part for the decline. Water depths were considerably greater in Impoundment 10, as well as Impoundment 8, and probably accounted for the reduced duck usage also.

Marsh pump-outs. Duck food plants made up a fairly large portion of the plants of the marsh pump-outs (Tables 2 and 3). The east pump-out contained the larger amount and was dominated by *Panicum dichotomiflorum, E. walteri, Paspalum distichum,* and *Leptochloa fascicularis.* The west pump-out also contained valuable duck food plants but in much lesser abundance with *P. distichum, L. fascicularis* and *S. portulacastrum* the major species. A much higher cattle stocking rate in the west pump-out, particularly during the growing season, resulted in a reduced relative abundance of most species. Cattle feed on annual grasses and sedges and at heavy stocking rates will graze the plants back to such an extent that seed production is greatly curtailed (Chabreck 1968).

Insofar as duck food production, the marsh pump-out areas probably equaled that of the impoundments and even exceeded that of the control areas. In fact, the east pump-out contained flora similar to the fresh water impoundments. In spite of the presence of favorable food plants, duck usage was comparatively low in the marsh pump-outs (Table 1).

Control Areas. Control Area 1 was classified as an intermediate or slightly brackish marsh (Chabreck 1972). Important duck food plants during the first year were *Bacopa monnieri, Ruppia maritima, E. walteri* and *P. pusillus.* Important duck food plants were less abundant the second year and major species were *R. maritima* and *B. monnieri* (Tables 2 and 3).

Table 4. Monthly water depth in management units during the study, 1970-72.

Month		Brackish water impoundments 3	4	Freshwater impoundments 8	10	Marsh pump-outs 1	2	Control areas 1	2
		Water depth in feet							
Aug.	'70	dry	dry[1]	dry	dry	dry	dry	.30	.84
Sept.	'70	.40	.50	.53	.80	.46	.53	.48	.94
Oct.	'70	.40	1.30	.68	1.50	.86	.88	.80	1.10
Nov.	'70	.90	1.36	.88	1.53	.46	dry	.90	1.18
Dec.	'70	.30	.42	.35	1.25	.33	dry	.20	.80
Jan.	'71	.36	.20	.30	1.02	.30	dry	.20	.78
Feb.	'71	.20	dry	.30	.98	dry	dry	.44	.66
March	'71	.24	dry	.30	.80	dry	dry	.30	.76
April	'71	.20	dry	.10	.22	dry	dry	.30	.46
May	'71	dry	dry	.22	dry	dry	dry	dry	dry
June	'71	dry	dry	.45	dry	dry	dry	dry	dry
July	'71	dry	dry	.63	dry	dry	dry	dry	.30
Aug.	'71	.45	.20	.82	.33	dry	dry	.48	1.07
Sept.	'71	1.30	1.12	1.76	1.50	1.00	.92	1.28	1.70
Oct.	'71	1.80	1.66	.94	.98	1.00	.86	.84	1.43
Nov.	'71	.75	1.12	.80	.21	.36	.33	.38	1.00
Dec.	'71	1.40	2.02	2.05	2.38	1.84	1.04	1.41	2.26
Jan.	'72	2.40	1.32	1.80	2.29	.86	dry	.94	1.34
Feb.	'72	.70	.54	1.13	1.38	.75	dry	.85	1.10
March	'72	.30	.42	.72	1.11	1.00	.04	.76	.80
April	'72	.02	dry	.50	.94	.88	dry	.90	.60
May	'72	dry	dry	.35	.41	dry	dry	.55	1.03
June	'72	dry	dry	dry	dry	dry	dry	.50	.76
July	'72	dry	dry	dry	dry	dry	dry	.31	.34

Control Area 2 was a brackish marsh with numerous ponds and potholes. The major duck food plants were *R. maritima* and *Eleocharis* sp. which occurred in greater amounts during the second year.

Duck usage of both control areas was greater during the first year of the study and probably reflected the greater food availability that year.

Relationship of Duck Usage to Major Plant Groups. The two major groups of duck food plants were aquatic plants and marsh plants (including grasses and sedges). A regression analysis was used to determine the relationship between the two plant groups and duck usage. The analysis was made using the sum of the relative abundance of important duck food plants. Each of the eight study areas was used independently for both years and provided 16 total observations. Ducks per acre in each area during the fall and winter season was used as the dependent variable.

The analysis disclosed that the relationship between duck usage of the study areas and the two groups of food plants was not significant. The relationship of duck usage to aquatic plants was approaching significance ($P<0.07$); however, the coefficient of determination (r^2) indicated that variation in the relative abundance of aquatic plants accounted for only 21 percent of the variation in duck usage.

The abundance of marsh plants could not be related to duck usage because of other influences, mainly water depth. The marsh pump-outs produced an abundance of marsh plants used as duck foods, but because the areas were dry a large percentage of the time, the food was mostly unavailable. Also, deep flooding made marsh food plants unavailable to puddle ducks in the impoundments at certain times.

Water Depth

Most of the study areas were dry in August, 1970, when the study began and had been dry several months prior to that time. Water was abundant only in the control areas (Table 4). Hurricane "Felice" struck the Louisiana coast in mid-September, 1970, and the heavy rainfall associated with the storm added several inches of water to all study areas. The areas remained flooded throughout the following winter except Marsh Pump-out 2, which was dry by November.

Marsh Pump-out 1 and Impoundment 4 were dry by February, 1971; and the remainder were dry by May, with the exception of Impoundment 8 which remained flooded throughout 1971. Heavy rainfall during late July and early August, 1971, resulted in all areas having water depths favorable for ducks during August. Exceptions were the two marsh pump-outs which were dried as soon as possible.

Favorable water depths in the impoundments and control areas extended into early September, 1971; then, hurricane "Edith" struck the Louisiana coast in mid-September and dumped about 1 foot of water on the study areas. Water depths declined slightly by late November, but another period of unusually heavy rainfall occurred and resulted in excessive flooding in most of the study areas in December. Marsh Pump-out 2 was dry by January 1972, but Marsh Pump-our 1 was not dry until May. By June 1972, all study areas, except the control areas, were dry.

A regression analysis was used to test the relationship between duck usage and water depth. The test desclosed that a significant relationship existed ($P<0.05$); however, the coefficient of determination (r^2) indicated that only 2.8 percent of the variation in duck usage was accounted for by variation in water depth.

Water availability was an important factor affecting duck usage of management units. Naturally, ducks require water and are attracted to aquatic environments rather than dry land areas in Louisiana. Nevertheless, simply the presence of water did not adequately fulfill the requirements of ducks and attract sizable numbers. Other factors relating to water were also important, such as water depth and the water-cover relationship, and probably served to make certain management units more or less attractive than the others.

Several instances were noted where the water depth of study areas affected duck population levels. The study areas normally have high usage by early Blue-winged Teal (*Anus discors*) migrants from mid-August into October. Water depths appeared to be a

major factor regulating the population level of these birds on the study area as well as their distribution.

The brackish water impoundments were mostly dry in August, 1970, and contained very few teal as a result (Tables 1 and 4). Heavy rains associated with Hurricane "Felice" in mid-September raised water levels and teal populations where much larger by the following week.

The following year a contrasting situation was observed in the brackish water impoundments. Water levels and Blue-winged Teal populations in August, 1971, were similar to those present in September, 1970. Then, Hurricane "Edith" struck the area in mid-September, 1971, and over 12 inches of rain fell in the study area. As a result, water greatly increased and teal use declined drastically.

Other species were also responsive to changes in water depth and increased or decreased use of an area as water depths changes. Green-winged Teal *(Anas carolinensis)* preferred areas with water depths less than 0.3 feet and moved from areas whenever the water depth increased. Diving ducks such as Lesser Scaup *(Aythya affinis),* Ring-necked Duck *(Aythya collaris),* and Ruddy Duck *(Oxyura jamaicensis)* generally increased as water depths increased. Gadwall *(Anas strepera),* Baldpate *(Anas americana)* and Shoveller *(Anas clypeata)* feed heavily on aquatic vegetation and were normally found under a wider range of water levels than most other species of puddle ducks.

The brackish water impoundments were characterized by large, open ponds of several hundred acres in size. The fresh water impoundments contained smaller ponds which usually contained the dead stubble of annual plants from the previous growing season. Most dabbling ducks showed little preference for either condition so long as water depths were favorable; however, Mallards *(Anas platyrhynchos)* appeared more secretive and were mostly found in the smaller ponds of the fresh water impoundments.

Duck usage in the marsh pump-outs was very low during the first year of the study. The areas were dry most of the time (Table 4), but duck usage remained comparatively low even when water was present (Table 1). Usage increased considerably during the second year of the study. Not only was duck usage recorded during more months, but the mean density of ducks also increased. During the second year, the pump-outs contained water over twice as long a period as the first year. Increased duck usage mostly resulted from the pump-outs being flooded over a longer period of time. The increase in duck density with time suggested a gradual buildup on the areas.

Time of Year

Most ducks using the study area were migratory with the first arriving in August and the last departing by May. The only species present in sizable numbers throughout the year was the Mottled Duck *(Anas fulvigula).*

Variation was noted in duck usage of different management units at different times of the year; however, these differences resulted more from variation in water depths and vegetation rather than time of year. The greatest direct effect that time of year had on variation in duck usage among management units, was the species of ducks present at a particular time.

Water depth was greatly affected by the time of year and most areas tended to dry during the summer months as a result of evaporation and transpiration. Also, the impoundments were usually drained during the summer to encourage the germination and growth of annual plants. The summer drying reduced druck usage at that time; however, areas, which contained water throughout the summer, received duck usage throughout the summer. The impoundments were important nesting and brooding sites for ducks as well as other wildlife and the availability of water during that time of year was an important factor regulating duck usage.

SUMMARY AND CONCLUSIONS

A comparison was made of duck usage of fresh water impoundments, brackish water impoundments, marsh pump-outs and control areas in southeastern Louisiana on the Rockefeller Wildlife Refuge and adjacent marshes. Fresh water impoundments averaged over four times the duck usage of other areas; however, during the fall season duck usage of the brackish water impoundments was almost seven times greater than the fresh water impoundment. During the remainder of the year, duck usage of the brackish water impoundments declined and was similar to the control areas. Lowest duck usage was found in the marsh pump-outs.

Principal factors affecting duck usage of management units were vegetation, water depth, and time of the year. Shallow water impoundments, which produced an abundance of annual grasses and sedges the previous growing season, received greatest usage. Food availability was also critical; and marsh pump-outs which often contained an abundance of duck food plants, had low duck usage because of the inadequate feeding conditions. Duck usage increased with proper flooding; however, excessive flooding also resulted in reduced duck usage.

Migrants made up the majority of the ducks in the study area; however, areas which contained water throughout the year generally received year round duck usage.

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