

LITERATURE CITED

- Baker, M. F., and F. X. Leuth. 1966. Mandibular cavity tissue as a possible indicator of condition in deer. Proc. Ann. Conf. S.E. Assoc. Game and Fish Commissioners. 20:69-74.
- Bischoff, A. I. 1954. Limitations of the bone marrow technique in determining malnutrition in deer. Proc. Western Assoc. State Game and Fish Commissioners. 34:205-210.
- Dickson, R. R. 1960. Climates of the States, Tennessee. Climatology of the United States. No. 60-40. U.S. Dept. Commerce. Weather Bureau. 10 pp.
- Harris, D. 1949. Symptoms of malnutrition in deer. J. Wildl. 9(4):319-322.
- Marshall, C. M., J. F. Smith, and A. J. Weber. 1964. A simple technique for removing mandibles of deer without trophy defacement. Proc. Ann. Conf. S.E. Assoc. Game and Fish Commissioners. 18:137-140.
- Nichols, R. G., and M. R. Pelton. 1972. Variations in fat levels of mandibular cavity tissue in whitetail deer in Tennessee. Proc. Ann. Conf. S.E. Assoc. Game and Fish Commissioners. 26:57-68.
- Rand McNally and Company. 1970. Official Map of Tennessee.
- Riney, T. 1955. Evaluating condition of free-ranging red deer (*Cervus elaphus*), with special reference to New Zealand. New Zealand J. Sci. Tech. 36(5):429-463.
- Severinghaus, C. W. 1949. Tooth development and wear as a criteria of age in white-tailed deer. J. Wildl. Manage. 13():195-216.
- Verme, L. J., and J. C. Holland. 1973. Reagent-dry assay of marrow fat in white-tailed deer. J. Wildl. Manage. 37(1):103-105.

FOOD PREFERENCES OF DEER IN LOUISIANA COASTAL MARSHES¹

by

*Charles A. Self*²

International Paper Company

Carthage, Mississippi

Robert H. Chabreck

School of Forestry and Wildlife Management

Louisiana State University, Baton Rouge, Louisiana

Ted Joanen

Louisiana Wild Life and Fisheries Commission

Grand Chenier, Louisiana

ABSTRACT

Food preferences were determined for white-tailed deer (*Odocoileus virginianus*) in marshes and spoil areas along the Louisiana coast by using feeding trials with captive deer and browse surveys. Fifty species were offered to 3 deer during the feeding trials. The species selected in largest amounts were *Leptochloa fascicularis*, *Scirpus olneyi*, *Iva annua*, *Echinochloa walteri*, and *Aeschynomene virginica*. Preferred food plants during the browse surveys along marsh levees were *Paspalum vaginatum*, *Mikania scandens*, *Bocopa monnieri*, *Panicum dichotomiflorum*, and *Leptochloa fascicularis*.

INTRODUCTION

Most studies on the food habits of white-tailed deer have been confined to upland areas. However, marshes and the associated ridges and spoil deposits provide excellent deer habitat, and population levels in certain areas along the Louisiana coast are among the highest in the state.

During earlier years the coastal marshes were a major stronghold for white-tailed deer; and, although this region made up only 12.9% of the land area of the state, St.

¹A contribution of the Louisiana Cooperative Wildlife Research Unit: Louisiana State University, Louisiana Wildlife and Fisheries Commission, U.S. Fish and Wildlife Service and the Wildlife Management Institute cooperating.

²Formerly Graduate Assistant, School of Forestry and Wildlife Management, Louisiana State University, Baton Rouge.

Amant (1959) reported that it contained about one-third of the state's deer population. He felt that the existence of a substantial deer population was evidence that food was plentiful but stated that much work was needed on the use of the various marsh plants by deer. Glasgow and Ensminger (1957) investigated a deer "die-off" in the area and attributed it to a lack of nutritious range plants, brought on by adverse weather conditions.

Restocking efforts and increased protection has resulted in tremendous increases in the deer population statewide, and the population was estimated at 200,000 animals in 1967 (Newsom 1967). With increased interest in maintaining high deer populations, a more complete understanding of range conditions is essential.

During studies on marsh productivity, we became aware of the lack of published data on the foods and feeding habits of white-tailed deer in Louisiana coastal marshes. A basic knowledge of food preferences and availability is of primary importance in making range evaluations. This study was set up in order to gain a better understanding of habitat conditions for deer in the coastal region.

The coastal marshes in Louisiana border the Gulf of Mexico, expand the full width of the state, and extend inland for distances varying from 15 to 50 miles. The marshes cover 4.2 million acres and are interlaced with a network of bays, ponds, bayous and canals (Chabreck 1972).

The marshes support a wide array of plants, and the primary factors affecting plant distribution and growth are salinity and water depth. Penfound and Hataway (1938) described the vegetation in the marshes of southeastern Louisiana and subdivided the marshes into four vegetative types on a basis of water salinity. They described the plants in each vegetative type and classified them as fresh water species, nearly fresh water species, brackish water species, and salt water species.

O'Neil (1949) and Chabreck (1972) described the marsh vegetation on a coastwide basis and grouped the plants into the vegetative types reported by Penfound and Hataway (1938). They used the term "intermediate" to describe the vegetative type which included the "nearly fresh water species."

Levees and spoil deposits have been an important addition to the topography of the coastal marshes for deer. The high ground provided diversity and supports plant communities different from the adjacent marsh. The levee plants provide a source of food which would otherwise be unavailable to deer. The levees also provide valuable escape cover, travel lanes, and bedding ground for deer.

Previous studies in the Southeast on marsh deer foods were made on the Everglades deer herd and based on rumen samples. Harlow (1961) noted that from 49 rumen samples collected in the fall and winter four plant species comprised approximately 60 percent of the total volume. These plants were *Nymphaea odorata*, *Osmunda regalis*, *Crinum americanus*, and *Salix caroliniana*. *Baccharis glomerulifera* composed only 2 percent of the total volume, and *Bacopa* sp., *Eleocharis* sp., and *Vigna luteola* occurred only as trace material.

Loveless and Ligas (1959) studied rumen samples from 22 deer taken in the Everglades. Ten species comprised the bulk of the diet and only *Nymphaea odorata* and *Crinum americanum* were typical of aquatic communities.

Deer food preferences were determined in our study by feeding trials with captive deer and by browse surveys. One problem in using captive animals for feeding studies is that the response may not be the same as with animals in the wild. Nichol (1938) used captive white-tailed deer and black-tailed deer (*Odocoileus hemionus columbianus*) in feeding trials to determine preferred foods in Arizona. Bateman (1949) rated certain plants as to preference by white-tailed deer in upland areas of Louisiana using feeding trials with captive animals. Other authors have recorded plants eaten by hand-reared deer permitted to wander at will (McMahan 1964, Watts 1964, Neff 1967, Healey 1968).

Special credit is due Prentiss E. Schilling, Louisiana State University, for assistance in planning the study and analysis of the data.

METHODS AND MATERIALS

Three adult white-tailed deer were used for the feeding trials and were held in separate pens at Rockefeller Refuge in southwestern Louisiana. Each pen was composed of two stalls with a passageway between them, allowing the deer free access to each side. Food and water were kept in the front stall of each pen. The front stall had plywood on three sides to minimize disturbance of the deer. The deer moved into the rear stall when workers entered the front stall.

Two troughs, each with five compartments, were placed in each pen. One trough was placed on the front wall, while the other trough was placed on the opposite wall.

After the deer had become accustomed to the pens, test plants were introduced. Beginning about the same hour each night for three consecutive nights, the same set of five plant species was placed in each trough, thus allowing the deer to feed *ad libitum* (Cafeteria style). The five plants were randomly located in the compartments (using approximately 250 g. each) and each day the location of each species was changed to a different trough compartment to avoid positional bias.

A different set of five species was offered every week for five consecutive weeks. Then, five plant species, composed of the plants which were taken in greatest amounts in earlier feeding trials, were experimentally fed in a three-day trial. The following week, a different set of five plants, composed of the second most preferred plants in the first five weeks, was fed in a second three-day trial. The series was then repeated using 25 different species and during the study a total of 50 species was tested.

A control trough was placed outside the pens in an environment similar to the test troughs. Samples of the approximate weight of the plants being tested was placed in the compartments of the control troughs. The amount of weight lost due to desiccation during the feeding trial was determined.

Plants tested in the feeding trials were marsh and aquatic species, plus species occurring on spoil deposits, levees, and ridges within the marsh. Plants from all vegetative types were tested and included species which were present in quantities large enough to permit the collection of an adequate sized sample. Parts tested were those which would normally be eaten by deer.

Browse surveys were made along levees in an intermediate marsh type on Rockefeller Refuge. The browse surveys were done to provide a field analysis of food preference and to serve as a check on the feeding trials. The surveys were made along the levee because this area contained a wider array of plant species (both marsh and upland plants) and showed more activity by white-tailed deer.

Systematically-oriented sample plots were used on the surveys. The plots were five-foot square and taken every 20 feet along lines spaced 100 feet apart. The percent of the area occupied by a species was determined from the relative abundance values which assigned to each species in a plot according to the following description:

3 - Occupied 75% or more of the plot

2 - Occupied 25 to 74% of the plot

1 - Occupied less than 25% of the plot

$$\text{Percent of area occupied by a species} = \frac{\text{Total of relative abundance value for that species}}{\text{Total of all relative abundance values}} \times 100$$

In order to determine the percent of the deer's diet made up by each plant species, usage values were assigned to each plant on a basis of the intensity of browsing, according to the following scale:

3 - 5 or more bite-sized areas removed

2 - 2 to 4 bite-sized areas removed

1 - one bite-sized area removed.

$$\text{Percent of diet for a species} = \frac{\text{Total of usage values for that species}}{\text{Total of all usage values}} \times 100$$

Relative preference values were calculated using the following formula:

$$\text{Relative preference for a species} = \frac{\text{Percent of diet}}{\text{Percent of area occupied}}$$

A relative preference value greater than 1.0 indicates selectivity for the species.

Monthly availability was determined for the plants used during the feeding trials. Plant availability is not to be confused with plant abundance. An effort was made to record the period when a plant was present.

RESULTS AND DISCUSSION

Plant Availability

Of the 50 plants tested during the feeding trial, 14 species were available to some degree on a year round basis (Table 1). The critical period was December, January, and February because fewer species were available and deer were under stress because of cold weather. Also, water depths increase in the fresh and intermediate marshes during the winter and make travel more difficult and plants less available. Levees, spoil deposits, and ridges are particularly important to deer at this time.

Table 1. Monthly availability of plants used in feeding trials.

Plant Species	Month											
	J	F	M	A	M	J	J	A	S	O	N	D
<i>Aeschynomene virginica</i>			-	*	-	-	*	*	*	-		
<i>Alternanthera philoxeroides</i>	*	*	*	*	*	*	*	*	*	*	*	*
<i>Baccharis halimifolia</i>	*	*	*	*	*	*	*	*	*	*	*	*
<i>Bacopa monnieri</i>	*	*	*	*	*	*	*	*	*	*	*	*
<i>Borrichia frutescens</i>				●	-	-	*	*	-	-		
<i>Cladium jamaicense</i>	●	●	-	-	-	*	*	*	*	-	-	●
<i>Cyperus virens</i>				-	-	*	*	*	*			
<i>Daubentonia texana</i>			-	-	*	*	*	*	-	-		
<i>Distichlis spicata</i>	●	●	●	-	-	*	*	*	*	-	-	●
<i>Echinochloa walteri</i>				●	-	*	*	*	-			
<i>Eichhornia crassipes</i>			●	●	-	*	*	*	*	*	-	●
<i>Eleocharis quadrangulata</i>				-	-	*	*	*	*	-		
<i>Eleocharis sp.</i>	-	-	*	*	*	*	*	*	*	*	*	-
<i>Heliotropium curassavicum</i>				-	-	*	*	*	*	-		
<i>Hibiscus lasiocarpus</i>				-	-	*	*	*	*	-		
<i>Hydrocotyle verticillata</i>	*	*	*	*	*	*	*	*	*	*	*	*
<i>Iris virginica</i>	●	●	-	-	*	*	*	*	*	*	-	●
<i>Iva annua</i>					-	*	*	*	*	-		
<i>Iva frutescens</i>	●	●	-	*	*	*	*	*	*	*	-	●
<i>Juncus roemerianus</i>	●	●	●	-	*	*	*	*	*	-	●	●
<i>Kosteletskya virginica</i>						*	*	*	*			
<i>Lemna minor</i>	-	-	-	*	*	*	*	*	*	*	*	-
<i>Leptochloa fascicularis</i>			●	-	-	*	*	*	*	-		
<i>Ludwigia bonariensis</i>	●	●	●	-	-	*	*	*	*	*	-	●
<i>Lycium carolinianum</i>	-	-	-	*	*	*	*	*	*	*	-	-
<i>Najas quadalupensis</i>	●	●	●	-	*	*	*	*	*	*	*	-
<i>Nelumbo lutea</i>				-	-	*	*	*	*	-		

Paspalum vaginatum	-	-	*	*	*	*	*	*	*	*	*	*	*
Panicum hemitomon								*	*	*	*	-	
Phragmites communis			●	-	*	*	*	*	*	*	*	-	-
Phytolacca americana			-	-	*	*	*	*	*	*	-	●	
Polygonum hydropiperoides	●	●	●	-	*	*	*	*	*	*	*	-	●
Pontederia cordata				-	-	*	*	*	*	*	*	-	
Potamogeton berchtoldii	●	●	-	-	*	*	*	*	*	*	*	-	-
Ruppia maritima	●	●	-	-	*	*	*	*	*	*	*	-	-
Sagittaria falcata			●	-	*	*	*	*	*	*	-	-	●
Sagittaria graminea				-	-	*	*	*	*	*	*	-	
Salicornia bigelovii				-	*	*	*	*	*	*	*	-	
Salix nigra			-	-	*	*	*	*	*	*	*	-	●
Scirpus americanus				-	*	*	*	*	*	*	*	-	●
Scirpus californicus	-	-	-	*	*	*	*	*	*	*	*	-	-
Scirpus olneyi	●	●	-	*	*	*	*	*	*	*	*	-	●
Scirpus robustus			-	*	*	*	*	*	*	*	*	-	
Spartina alterniflora				-	-	*	*	*	*	*	*	-	●
Spartina cynosuroides				-	-	*	*	*	*	*	*	-	●
Spartina patens	*	*	*	*	*	*	*	*	*	*	*	*	*
Tamarix gallica	*	*	*	*	*	*	*	*	*	*	*	*	*
Typha augustifolia			-	-	*	*	*	*	*	*	*	-	
Vigna luteola				-	-	*	*	*	*	*	*	-	
Zizaniopsis miliacea	●	●	●	-	-	*	*	*	*	*	*	-	●

The southerly latitude of the Louisiana Coastal Marshes gives the region a long growing season, and the time from the last frost in the spring to the first, the following winter averages 310 days (Kniffen 1968). Greenup comes early and by late February many species begin to "bud out".

Water depth is a critical factor on marsh plant growth, and seeds germinate after the water is gone and the marshes dry. This usually occurs after May in fresh and intermediate marshes, and often the marshes fail to dry at all.

Highest deer populations in the coastal marshes are found in the fresh and intermediate types. Deer occur in low numbers in brackish marshes, but are rarely found in saline marshes, except in areas with abundant high ground nearby. The factors affecting distribution are not fully understood, but the availability of suitable water for drinking is apparently important.

^aThe three classes of availability are as follows:

- * High availability - more than 75% of peak availability
- Moderate availability - 25% - 75% of peak availability
- Low availability - Less than 25% of peak availability

Table 2. Percent composition and mean daily consumption (g) of marsh plants eaten by captive white-tailed deer during feeding trials.

Plant Species	Percent composition ^a	Mean daily consumption ^b
<i>Leptochloa fascicularis</i>	0.6	198.8
<i>Scirpus olneyi</i>	2.2	180.2
<i>Iva annua</i>	tr.	176.4
<i>Echinochloa walteri</i>	0.8	164.4
<i>Aeschynomene virginica</i>	tr.	147.0
<i>Nelumbo lutea</i>	0.2	146.8
<i>Borrchia frutescens</i>	0.2	145.5
<i>Vigna luteola</i>	1.5	139.8
<i>Polygonum hydropiperoides</i>	tr.	133.8
<i>Sagittaria graminea</i> var. <i>platyphylla</i>	0.1	129.2
<i>Ludwigia bonariensis</i>	tr.	123.3
<i>Cyperus virens</i>	tr.	119.8
<i>Salix nigra</i>	0.2	114.9
<i>Scirpus robustus</i>	0.8	110.3
<i>Lycium carolinianum</i>	tr.	99.3
<i>Tamarix gallica</i>	tr.	97.4
<i>Spartina alterniflora</i>	12.7	92.3
<i>Alternanthera philoxeroides</i>	2.3	91.3
<i>Kosteletskya virginica</i>	0.1	89.9
<i>Typha augustifolia</i>	0.4	84.1
<i>Baccharis halimifolia</i>	0.2	78.4
<i>Pontederia cordata</i>	tr.	73.3
<i>Distichlis spicata</i>	6.8	73.1
<i>Salicornia bigelovii</i>	tr.	72.9
<i>Eleocharis</i> sp.	4.7	66.9
<i>Spartina cynosuroides</i>	0.5	66.5
<i>Iva frutescens</i>	0.1	63.1
<i>Hydrocotyle verticillata</i>	tr.	60.5
<i>Heliotropium curassavicum</i>	tr.	59.8
<i>Scirpus americanus</i>	0.2	58.0
<i>Phytolacca americana</i>	tr.	56.6
<i>Paspalum vaginatum</i>	1.2	45.6
<i>Eichhornia crassipes</i>	0.5	43.3
<i>Cladium jamaicense</i>	0.3	38.5
<i>Iris virginica</i>	tr.	36.8
<i>Potamogeton berchtoldii</i>	0.3	34.4
<i>Phragmites communis</i>	2.0	31.5
<i>Hibiscus lasiocarpus</i>	tr.	27.5
<i>Scirpus californicus</i>	0.4	24.8
<i>Spartina patens</i>	24.6	23.1
<i>Juncus roemerianus</i>	3.3	19.5
<i>Eleocharis quadrangulata</i>	tr.	17.5
<i>Daubentonia texana</i>	0.1	17.3
<i>Sagittaria falcata</i>	6.5	16.6
<i>Lemna minor</i>	0.9	10.9
<i>Panicum hemitomon</i>	9.4	8.7
<i>Ruppia maritima</i>	1.3	2.4
<i>Bacopa monnieri</i>	1.5	2.1
<i>Zizaniopsis miliacea</i>	0.4	1.7
<i>Najas quadalupensis</i>	0.5	0.0

^aComposition as reported by Chabreck (1970), and species listed as trace did not occur during that survey.

^bExpressed on a wet weight basis.

The mean daily consumption by the captive deer exceeded 100 g with only 14 of the 50 species (Table 2). Of the 14 species, 10 were fresh or intermediae marsh plants, two were commonly found in brackish marsh (*Scirpus olneyi* and *S. robustus*), one from saline marsh (*Borrchia frutescens*) and one species commonly grows on marsh levees (*Iva annua*). Practically all species, with the exception of *S. olneyi*, were available only a portion of the year (Table 1); and all made up a small portion of the species composition of the marsh.

Species taken in moderate amounts (50 g to 100 g) included species which were more abundant marsh and levee plants such as *Spartina alterniflora*, *Alternanthera philoxeroides*, *Distichlis spicata*, and *Eleocharis* sp. *Baccharis halimifolia*, a common levee plant, was also in this group.

Browse surveys

The preference value for each species found in the browse survey is listed in Table 3. *Baccharis halimifolia*, the dominant plant, had a preference value of approximately 1.0. Practically all species occurring in the browse surveys, which were tested in the feeding trials (Table 2), received similar use by captive as well as wild deer. *Bacopa monnieri*, a major species in the browse survey received high use under field conditions but very little use in the feeding trial (Table 2). Because of its succulent nature, this species may deteriorate rapidly when collected and stored, thus causing a reduction in palatability.

Table 3. Plants available and plants browsed by white-tailed deer on levees in an intermediate marsh, Rockefeller Refuge, Louisiana.

Plant species	Percent composition	Percent of diet	Preference value ^a
October 1972			
<i>Baccharis halimifolia</i>	38.3	36.6	.9
<i>Bacopa monnieri</i>	10.0	17.3	1.7
<i>Zizaniopsis miliacea</i>	2.5	1.5	.6
<i>Phytolacca americana</i>	4.5	1.3	.3
<i>Spartina patens</i>	8.3	6.9	.8
<i>Cladium jamaicense</i>	8.0	3.0	.4
<i>Panicum dichotomiflorum</i>	4.3	7.3	1.7
<i>Leptochloa fascicularis</i>	4.8	7.0	1.5
<i>Cyperus odoratus</i>	1.8	2.19	1.2
<i>Eupatorium</i> sp	3.3	tr.	tr.
<i>Paspalum vaginatum</i>	1.5	4.0	2.7
<i>Physallis</i> sp.	.5	.7	1.4
<i>Kosteletzkya virginica</i>	1.8	1.8	1.0
<i>Eleocharis parvula</i>	2.3	1.7	.7
<i>Mikania scandens</i>	3.0	5.3	1.8
<i>Vigna luteola</i>	2.3	2.8	1.2
<i>Polygonum hydropiperoides</i>	1.3	0	0
<i>Alternanthera philoxeroides</i>	1.0	.7	.7
<i>Echinochloa walteri</i>	tr.	tr.	tr.
February 1973			
<i>Baccharis halimifolia</i>	44.8	49.5	1.1
<i>Bacopa monnieri</i>	5.8	8.0	1.4
<i>Zizaniopsis miliacea</i>	6.4	9.0	1.4
<i>Phytolacca americana</i>	2.1	0	0
<i>Spartina patens</i>	16.3	7.8	.5
<i>Eleocharis parvula</i>	.5	.2	.4
<i>Rumex crispus</i>	18.3	24.0	1.3
<i>Hydrocotyle verticillata</i>	.5	0	0
<i>Senecio glabellus</i>	4.5	1.5	.3
<i>Phragmites communis</i>	.8	0	0

When making range evaluations for deer, special consideration must be given to the plants needed during the winter. Deer have a wide selection of foods from May until mid-September, but the number of species available becomes less and less numerous from September until the middle of February (Table 1).

The most important food plants in late winter appear to be *Bacopa monnieri*, *Baccharis halimifolia*, *Eleocharis* spp., and *Spartina patens*. *B. monnieri* is possibly the most important at this time, occurs over a wide range of marsh conditions from fresh to brackish, and is tolerant to extreme flooding and drying. *B. halimifolia* is abundant on higher elevations and is eaten in the same proportion to its abundance. *Eleocharis* spp. is widespread in the fresh and intermediate marshes and is particularly important in late winter. *S. patens* is the major plant species in the coastal marshes and receives light use by deer in winter. *Alternanthera philoxeroides* may also be very important. It is available to some extent all year, and is common in areas with highest deer populations.

^aPreference value was obtained by dividing percent of diet by the percent composition. A preference value greater than 1.0 indicated selectivity for the species.

Our findings agree with the observations of Glasgow and Ensminger (1957) who reported that white-tailed deer in the southwestern Louisiana coastal marshes prefer *Vigna luteola*, *Echinochloa* sp., *Eleocharis* spp., and *Bacopa monnieri*.

The absence of escape cover may be a limiting factor on deer populations in many areas and *Phragmites communis*, *Spartina cynosuroides*, *Salix nigra*, *Baccharis halimifolia*, and other robust plants provide excellent cover.

CONCLUSIONS

On a basis of palatability, availability, and abundance, as determined by this study, the following plant species appear to be the most important as food for white-tailed deer in the coastal marshes and the associated levees, spoil deposits, and ridges in Louisiana: *Aeschynomene virginica*, *Alternanthera philoxeroides*, *Baccharis halimifolia*, *Bacopa monnieri*, *Borrchia frutescens*, *Echinochloa walteri*, *Eleocharis* spp., *Iva annua*, *Kosteletskya virginica*, *Leptochloa fascicularis*, *Ludwigia bonariensis*, *Nelumbo lutea*, *Panicum dicotomiflorum*, *Paspalum vaginatum*, *Phytolacca americana*, *Polygonum hydropiperoides*, *Sagittaria graminea* var. *platyphylla*, *Salix nigra*, *Scirpus olneyi*, *Spartina patens*, and *Vigna luteola*.

LITERATURE CITED

- Bateman, B. A. 1949. Wildlife - a secondary crop on forest land managed primarily for timber. Ph.D. dissertation, Univ. of Michigan. 141 pp.
- Chabreck, R. H. 1972. Vegetation, water and soil characteristics of the Louisiana coastal region. La. State Univ. Agr. Exp. Sta. Bull. 664. 72 pp.
- Glasgow, L. L. and A. B. Ensminger. 1957. A marsh deer "die-off" in Louisiana. J. Wildl. Manage. 21(2):245-247.
- Harlow, R. F. 1961. Fall and winter foods of Florida white-tailed deer. Reprint from Quart. J. Fla. Academy of Science 24(1):19-38.
- Healy, W. M. 1968. Forage preference determination through use of tame deer. Proc. Northeastern Sect. Wildl. Soc. Conf. 25:35-39.
- Kniffen, F. B. 1968. Louisiana, its land and people. La. State Univ. Press, Baton Rouge. 196 pp.
- Loveless, C. M., and F. J. Ligas. 1959. Range conditions, life history, and food habits of the Everglades deer herd. Trans. 24th N. American Wildl. Conf. p. 201-214.
- McMahan, C. A. 1964. Comparative food habits of deer and three classes of livestock. J. Wildl. Mgmt. 28(4):798-808.
- Neff, D. J. 1967. Habitat manipulation on pine and juniper watersheds. Pages 153-172. In Wildlife research in Arizona Game and Fish Dept. 172 pp.
- Newsom, J. D. 1959. History of deer and their habitat in the South, p. 1-4. In White-tailed deer in southern forest habitat - proceeding of a symposium. Southern Forest. Exp. Sta. Nacogdoches, Texas.
- Nichol, A. A. 1938. Experimental feeding of deer. Univ. Arizona Ag. Exp. Sta. Tech. Bull. No. 75. Univ. Arizona, Tucson. 39 pp.
- O'Neil, Ted. 1949. The muskrat in the Louisiana coastal marshes. La. Wildlife and Fisheries Comm., New Orleans. 159 pp.
- Penfound, W. T., and E. S. Hathaway. 1938. Plant communities in the marshland of Southeastern Louisiana, Ecological Monogr. 8:1-56.
- St. Amant, L. S. 1959. Louisiana wildlife inventory and management plan. La. Wildlife and Fisheries Comm., New Orleans. New Orleans. 329 pp.
- Watts, C. R. 1964. Forage preferences of captive deer while free ranging in a mixed oak forest. Unpubl. Master's Thesis, Penn State Univ. 65 pp.