CHUFA TUBER PRODUCTION AND ITS RELATIONSHIP TO WATERFOWL MANAGEMENT ON CATAHOULA LAKE, LOUISIANA

Dewey Wills
Louisiana Wildlife and Fisheries Commission
Baton Rouge, Louisiana

ABSTRACT

As a waterfourl wintering area, Catahoula Lake, is of national significance and one of the most important natural wintering areas in the Nation. It is the key to waterfowl abundance and hunting success in Central Louisiana.

Chufa, *(Cyperus esculentus)* is one of the principal waterfowl foods on Catahoula Lake. A study was conducted to determine chufa tuber production on the Lake for a five year period. A total of 96 ground samples were taken each year from a series of exclosures and exposed plots. Chufa production per acre is given. Chufa tuber production is compared in exclosures and exposed plots. Comparisons of tuber production on the open lake bed zone and under the tree canopy zone are made.

INTRODUCTION

Catahoula Lake is one of the most important waterfowl wintering areas in North America. It is the key to waterfowl abundance and hunting success in Central Louisiana. This unique area has been an important wintering ground for many years. Early explorers reported immense flocks of waterfowl on the Lake (Dunbar, 1804). Older residents of the area state that Catahoula Lake was an important source of waterfowl during the market hunting era.

Luxurious stands of chufa, *(Cyperus esculentus)*, grow on the lake bed each year when the lake becomes dewatered and chufa tuber is considered the most important waterfowl food on the lake as revealed by a recently completed food habits study, (Unpub. Report, La. Wild Life and Fisheries Comm. 1970).

The purpose of this study was to determine the production of chufa tubers on the lake bed for a period of five years, 1962-66.

DESCRIPTION OF STUDY AREA

Location and Description

Catahoula Lake is located in Central Louisiana about 20 miles northeast of Alexandria. This important wildlife area is situated on the western edge of the Mississippi River alluvium in the complex Red River backwater area, and is a structural formation. It is a large, shallow, poorly drained, flat, sump area that is subject to drastic seasonal water fluctuations. It is approximately 14 miles long, 3 miles wide and contains about 20,000 acres of open lake bed. At high water the lake bed contains about 30,000 acres. From the tree line to the lowest area in the lake bed, there is a drop in elevation of about three feet. The lake is bounded on the north by land that rises abruptly to a height of 20 to 30 feet above the high water stage and on the south by low land that is subject to annual overflow.

Catahoula Lake is fed by Little River and numerous smaller streams from the north and west. At high water, drainage is to the east and south through Old River, French Fork of Little River, and several small bayous. At low water, the lake drains only through French Fork of Little River. The lake receives

"overflow" or "backwater" from the Red, Black-Ouachita and Mississippi Rivers. The water level is dependent on the seasonal stages of these rivers. Water gradually rises in these river systems and enters the lake by backing up through the normal drainage channels, as well as over the lowland from a southerly direction.

High water normally prevails from late winter to early summer. The time of flooding and depth of water vary from year to year but generally follow a distinct pattern. A gradual rise in the water level usually begins in November and December, increases sharply in January, remains at a high level through June, then recedes in July. The lake drains to a low water stage about the first of August exposing approximately 15,000 acres of mud flats. At that time, about 5,000 acres are covered by water normally ranging in depth from 1 to 12 inches. Soils over much of the lake bed are of fine silty loam and silty clay loam. Stranded low sandy ridges parallel the perimeter of the lake. A hard clay pan exists at variable depths below the soil surface.

Plants

The lake bed is generally flooded from December through July. The water level fluctuates a great deal during this period and at its peak reaches a depth of 15 to 25 feet. The winter rise and the summer drop are normally gradual. Because of the shallowness of the water and the softness of the bottom, wave action maintains a turbid condition. Few plants are adapted to such a drastic water fluctuation, long period of flooding, and high turbidity; therefore the number of species growing on the lake is limited. Because of the small number of species, interspecific competition is reduced. As a result, the lake is characterized by large acreages of uniform plant types.

Plant zonation, which is pronounced, is correlated with lake bed contour, the length of time of flooding, and the length of the growing period.

Woody plants that withstand flooding, primarily water elm *(Planera aquatica)* and swamp privet *(Forestiera acuminata)*, form dense stands on the perimeter of the lake. There is some scattered cypress *(Taxodium distichum)*, water locust *(Gleditsia aquatica)* and buttonbush *(Cephalanthus occidentalis)* in this zone. The water elm is slowly advancing into the lake.

Herbaceous plants make up all the vegetation in the lake bed. The outer contour of the lake which is higher, firmer and dewatered first, has the longest growing season. The first herbaceous plant zone is dominated by chufa *(Cyperus esculentus)*, but it also contains some spike rush *(Eleocharis sp.)*, highland pursley *(Ammania coccinea)*, heliotrope *(Heliotropium sp.)* and cocklebur *(Xanthium sp.)*. When this zone is dewatered early, the broad-leaved plants just mentioned spread and occupy a far greater area than normal. *Chufa makes up about 85 percent of the vegetation in this zone.*

The next concentric zone is dominated by a mixture of sprangletop *(Leptochloa filiformis)* and teal grass *(Eragrostis repens)*, but it also contains a little chufa.

Millet *(Echinochloa sp.)* does not exhibit the same degree of concentric zonation. Although it is scattered thinly over much of the lake, pure, dense, tall stands occupy the more marshy, seepy areas in which there is some humus in the soil. Millet stands occupy "pockets", rather than concentric zones.

The lowest elevation on which plant growth occurs is covered by extensive stands of bull tonge *(Sagittaria sp.)*, mud plantain *(Heternantheria limosa)*, swarf spikerush *(Eleocharis parvula)*, and scattered water hyssop *(Bacopa rotundifolia)*. True aquatics are excluded from the lake by water depth, period of flooding, and high turbidity. The acreage and the kind of plants occupying the lower zones may vary from year to year but the relative position of each plant species in the zones remain the same.

Utilization

Waterfowl. For a 10 year period from the fall of 1960 through the winter of 1969-70 Louisiana Wild Life and Fisheries Commission biologists reported a yearly average usage of 20,369,000 duck days for Catahoula Lake (La. Wild Life and Fisheries Commission, 1960). Ducks found in greatest abundance were pintail, mallard, teal, baldpate and gadwall. Those present in lesser numbers were ringneck, scaup, shoveller, ruddy, canvasback and wood ducks. A few geese and coots were present. Waterfowl species and abundance on the lake are influenced by water levels and migrational movements. They are most abundant in the fall when water levels range from 6 to 8 inches. Under present conditions, the water cycle is highly favorable to the production of two excellent duck foods, chufa and millet. The widespread and intensive rooting by hogs in search of chufa tubers probably creates excellent feeding conditions for ducks by not only exposing tubers but also by tilling the feeding site so that ducks can readily puddle out additional tubers.

Hunting. Between 600 and 700 permanent duck blinds are maintained on the lake. In addition, many people hunt the brushy edges without erecting a blind. It is estimated that 7,000 hunters use the area annually.

Cattle - Hogs - Hay. Thousands of acres of sedges and grasses are produced on the lake bed and provide grazing for many cattle and hogs. Cattle utilization occurs over a 3 to 4 month period during the latter period of the summer, while hog usage extends over a 4 to 5 month period during summer and fall. In addition to providing grazing and forage for livestock, many acres of sedges and grasses are cut and baled for hay. During "lowwater" years the lake yields up to 150,000 bales of hay.

Fishing. Catahoula Lake provides excellent temporary habitat for sport and commercial fish by increasing available nutrients, establishing large nursery areas, and by initiating a favorable food chain. At high water stages many residents of the area use the Catahoula Lake complex for commercial fishing to supplement their annual income. Annually sport fishermen from all parts of the state take advantage of the high quality fishing found near the channel entrances and exits of the lake and in the connecting bayous.

Oil Production. There are approximately 50 active oil and/or gas wells on the lake bed plus several thousand in the surrounding watersheds. Exploratory drilling is in progress when water conditions permit.

Study Procedure

A series of fenced and exposed plots were established at three sites on Catahoula Lake. One transect was located at Big Bend Area, one in the Willow Springs Area, and one in the Stock Landing Area. Each series of plots consisted of four fenced exclosures and four exposed plots on the Lake. On each transect, two plots were placed in the water elmswamp privet zone of the lake and two were located on the open lake bed.

The plots were one-mil acre in size. A 30-inch woven wire fence with two strands of barbed wire was erected around a 10 x 10 foot plot to exclude livestock from exclosures. The exposed plots which were one mil-acre in size, were located adjacent to fenced plots. There was a total of 24 mil acre plots (12 exclosures-12 exposed plots) on the Lake. Each mil acre plot was further divided into quarter mil acres which in turn were divided into quarter sections. This gave a total of eight sampling stations at each plot site (four from exclosures and four from exposed plots). Since 32 samples were taken from each transect, a total of 96 samples were taken from the three transects annually for a grand total of 480 during the five year study.

Samples were collected in October each year as this was the end of the growing season and it was just prior to normal flooding of the lake bed. A metal sampling devise 3⅞ (3.875) inch inside diameter with a depth of eight inches was used for taking soil samples. This sampler was inserted into the ground by

various methods. In some areas the sampler could be pressed into the ground by hand, but on hard sites the sampler had to be driven into soil with a sledge hammer. Each sample was labeled, placed into plastic bags and transported to the lab. At the beginning of the study, every fifth sample was sliced into two-inch sections; however, due to the extra work involved, the slicing of the samples was discontinued. Stratification of the tubers was not determined.

Laboratory Procedure The samples were placed in cold storage until they could be analyzed. The tubers were then separated from the soil by a series of screens of different sizes. The screening was done with the aid of running water. After screening, each sample was wrapped inabsorbent paper to remove excess moisture. The chufa tubers were then counted and weighed on a Mettler electronic balance.

A split plot analysis of variance was performed for weight. Means are presented on a plot basis where plot is 1/532,030.5 acre in size.

RESULTS AND DISCUSSION

Chufa, *(Cyperus esculentus)*, is in the sedge family Cyperaceae. Of a total of about 600 species in the genus, *Cyperus*, there are nearly 90 representatives in the United States and the name "chufa" is properly applied to a single important species, *Cyperus esculentus*. (Martin, Zim and Nelson, 1951).

The value of chufa to waterfowl is probably much greater than that of all other species of *Cyperus* combined. Based on the analysis of 7,887 duck gizzards of 18 species collected in 247 localities in the United States and Canada, chufa ranked tenth in order of importance of all food eaten. In the lower Mississippi region, chufa ranked first in order of percentage of total foods eaten as indicated by the analysis of 1,228 gizzards (Martin and Uhler, 1939). Chufa was found to be the most important waterfowl food on Catahoula Lake as revealed by a recently completed food habits study. (Unpub. Report, La. Wild Life and Fisheries Comm. 1970).

The production of chufa on Catahoula Lake is dependent upon the annual water fluctuation. After the water recedes from the Lake bed thousands of acres of chufa are produced. The tubers produced by this plant are a favorite food of hogs as well as waterfowl. The rooting activity of hogs in search of tubers completely overturns the top layer of soil in the chufa producing areas. This activity probably makes some tubers more available to waterfowl by exposing them on the surface and by loosening the soil so that ducks can puddle out additional tubers.

Chufa tuber production by location, plot type and for the entire lake bed per year is presented in Table 1. There was a significant difference between locations. Location 2 (Willow Springs) was superior to Location 1 (Big Bend) and Location 3 (Stock Landing). There was very little difference between Location 1 and 3. (Table 2).

Table 1

Mean Production of Chufa by Location, Year and Plot Type in Pounds Per Acre

		Location 1 Big Bend		Location 2 Willow Springs		Location 3 Stock Landing		Year Means
		Canopy	Open	Canopy	Open	Canopy	Open	
Year 1	Exposed	258.0	1548.2	375.3	1407.9	1055.6	703.7	973.5
	Exclosed	375.3	1313.6	598.2	3284.1	410.5	363.6	
Year 2	Exposed	738.9	2979.2	105.5	1477.8	480.8	973.5	2310.6
	Exclosed	516.0	3858.8	1055.6	10520.9	551.2	4410.1	
Year 3	Exposed	269.7	5266.3	152.5	1829.7	246.3	1125.9	2510.0
	Exclosed	351.8	3295.8	1360.6	9864.1	492.6	5817.6	
Year 4	Exposed	527.8	1046.2	0.0	1313.6	715.4	2908.8	2134.6
	Exclosed	246.3	9394.9	516.1	6181.2	715.4	2087.7	
Year 5	Exposed	258.0	2592.1	23.4	2193.3	316.6	1360.5	1888.3
	Exclosed	281.5	1595.1	762.4	6216.4	175.9	6849.7	
Location Means		1841.4		2463.1		1595.1		

Table 2

Analysis of Variance of Chufa Production by Location, Year and Plot Type on Catahoula Lake

Source	d. f.	Sum of Square	Mean Square	F
Total	479	2979.05		
Location (A)	2	47.30	23.65	7.73*
Canopy (B)	1	784.67	784.67	256.43**
A x B	2	47.32	23.66	7.73*
Error (a)	6	18.34	3.06	
Type of Plot (C)	1	219.09	219.09	15.27**
B x C	1	168.16	168.16	11.72*
A x C	2	115.87	57.93	4.04
A x B x C	2	56.62	28.31	1.97
Error (b)	6	86.08	14.35	
Year	4	99.20	24.80	5.38**
A x D	8	54.69	6.84	1.48
B x D	4	101.17	25.29	5.49**
A x B x D	8	54.64	6.83	1.48
C x D	4	47.79	11.95	2.59*
A x C x D	8	168.54	21.07	4.57**
B x C x D	4	32.23	8.06	1.75
A x B x C x D	8	162.28	20.28	4.40**
Error (c)	48	221.34	4.61	3.36**
Sampling error	360	493.68	1.37	

* P .05
**P .01

Comparison of tuber production in exposed plots and exclosures is presented in Table 3. There was a highly significant difference between plot types (Table 2). A little more than twice as much tubers were found in the exclosures as compared to the exposed plots (a ratio of 2.35 to 1). This difference was apparently caused from utilization of tubers by hogs in the exposed plots. Large numbers of hogs forage the lake bed over a four to five month period during summer, fall and winter.

Table 3

Mean Comparison of Weight of Chufa in Exposed Plots and Exclosures

	Canopy	Open	Plot Means
Exposed	363.6	1982.2	1172.9
Exclosed	562.9	4949.6	2756.3

Comparison of chufa tuber production under the canopy and on the open lake bed is presented in Table 4. There was a significant difference between production under the canopy and on the open lake bed (Table 2). The highest production occurred on the open lake bed. The canopy zone produced only 13 percent as much as the open lake bed.

The over-story competition from water-elm and swamp privet was probably responsible for this decrease in production. Shading and root competition are the factors most likely responsible for reduced production under the canopy.

Table 4

Mean Comparison of Weight of Chufa Under Canopy and Open Lake Bed

Location	1	2	3	Canopy Means
Canopy	367.1	493.7	494.9	469.1
Open	3284.1	4433.5	3131.6	3658.4
Location Means	1841.4	2463.1	1595.1	

A significant difference in chufa production between years was observed with a peak production occurring in the third year and lower production occurring in years one and five (Table 5). As indicated previously, the production of chufa on Catahoula Lake is dependent upon water fluctuation which in turn determines the length of growing season. The growing season in the chufa zone on Catahoula Lake averages about 5½ months under normal conditions. However, during the third year of this study the growing season extended for approximately 6½ months and produced a peak crop. In the fourth year of this study the water began to recede from the lake in early July and a good "stand" of chufa was growing. Then in early September, heavy rains from Hurricane Betsy inundated the lake bed and flooded the chufa producing areas. The water did not begin to recede until mid-October of that year. During the fifth year the growing season was shorter than normal because water remained on the chufa producing zone most of the summer. This resulted in even less production than was made during the fourth year.

Table 5

Mean Weight of Chufa by Year and Plot Type

Year	1	2	3	4	5	Plot Type Mean
Exposed	891.4	1266.7	1477.8	1090.8	1125.9	1172.9
Exclosed	1067.3	3342.7	3530.4	3190.3	2650.7	2756.3
Year Mean	973.5	2310.6	2510.6	2134.6	1888.3	

SUMMARY

Catahoula Lake provides a wintering area for large concentrations of waterfowl. The lake winters between 150 thousand and 450 thousand waterfowl annually. It provides the most valuable waterfowl habitat in Central Louisiana. During most growing seasons Catahoula Lake produces many tons of tubers which are considered to be the most important waterfowl food on the lake. Production of chufa on Catahoula Lake is dependent upon the annual drawdown of the lake to a dry condition. Therefore, any permanent pooling of water on the lake bed will destroy the value of Catahoula Lake as a waterfowl wintering area.

ACKNOWLEDGEMENTS

The author wishes to acknowledge the assistance given by Dr. Prentiss E. Schilling, Department of Experimental Statistics, Louisiana State University and Randy Perry, Graduate Student in Wildlife Management.

Special credit goes to Dr. Leslie L. Glasgow, former Professor of Forestry and Wildlife Management, Louisiana State University, who directed and supervised the research on this project for the first two years.

The author also expresses his appreciation to Mr. John D. Newsom, Leader, Cooperative Wildlife Research Unit, LSU, for assisting in preparing the paper; Robert Murry, Assistant Federal Aid Coordinator, Louisiana Wild Life and Fisheries Commission for assistance in editing and to Mrs. Paula Callais for typing the manuscript.

LITERATURE CITED

Martin, A. C., Zim, H. S., Nelson, H. L. 1951. American Wildlife and Plants, McGraw-Hill Book Co., Inc., New York, N. Y. 443 pp.

_____, and Uhler, F. M. 1939. Food of Game Ducks in the United States and Canada. U. S. Dept. Agr., Tech Bull. 634, 156 pp.