A SURVEY OF NUTRIA HERBIVORY DAMAGE IN COASTAL LOUISIANA IN 1998

Conducted by

Fur and Refuge Division
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as part of the

Nutria Harvest and Wetland Demonstration Project*

submitted by

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Introduction

The nutria (Myocastor coypus) is a large semi-aquatic rodent indigenous to South America. The first introduction of nutria occurred in California in 1899, however it was not until the 1930's that additional animals were introduced in seven states. These importations, primarily for fur farming, failed during the Second World War as a result of poor pelt prices and poor reproductive success. Fifteen states now have feral populations of nutria.

The Gulf Coast nutria population originated in Louisiana in 1937 from 13 animals imported from Argentina by E. A. McIlhenny. After numerous escapes in earlier years, approximately 150 nutria escaped during a hurricane in 1940. McIlhenny expected that the animals would perish in a few days because of high alligator densities in the surrounding marshes, but the nutria survived and by 1956, the annual harvest was 419,000. Populations first became established in the western portion of the state then later spread to the east through natural expansion as well as stocking. During the mid-1950's muskrat populations were declining, nutria had little fur value, and serious damage was occurring in rice fields in southwestern Louisiana and sugarcane fields in southeastern Louisiana. The nutria problem became critical with rice and sugarcane farmers complaining about damage to crops and levee systems and muskrat trappers blaming the nutria for declining numbers of muskrats. In 1958, the Louisiana Legislature placed the nutria on the list of unprotected wildlife and created a $0.25 bounty on every nutria killed in 16 south Louisiana parishes, but never appropriated the funds.

Research efforts were initiated by the federal government in the southeastern sugarcane region of the state to determine what control techniques might be successful. This research conducted by the U.S. Fish and Wildlife Service during the 1960's examined movements in relation to sugarcane damage and recommended shooting, trapping, and poisoning in agricultural areas. Ted O'Neil, Chief of the Fur and Refuge Division, LDWF, believed that the problem could only be solved through the development of a market for nutria pelts. A market for nutria developed slowly during the early 1960's and by 1962 over 1 million pelts were being utilized annually in the German fur trade. The nutria surpassed the muskrat in 1962 in total numbers harvested and has remained the backbone of the Louisiana fur industry since that time. In 1965, the state legislature returned the nutria to the protected list. As prices showed a slow rise during most of the 1970's and early 1980's, the harvest

averaged 1.5 million pelts and complaints from agricultural interest became uncommon. From 1971 through 1981 the average value of the nutria harvest to the coastal trappers was $8.1 million. The nutria harvest in Louisiana from 1962 until 1982 remained over 1 million annually. In 1976 the harvest peaked at 1.8 million pelts worth $15.7 million to coastal trappers.

However, the market began changing during the early 1980's. In 1981-82, the nutria harvest dropped slightly below 1 million. This declining harvest continued for two more seasons, then in 1984-85, the harvest jumped back up to 1.2 million. During the 1980-81 season, the average price paid for nutria was $8.19. During the 1981-82 season, the price dropped to $4.36, then in 1982-83, the price dropped to $2.64. Between the 1983-84 season and the 1986-87 season, prices fluctuated from slightly over $3.00 to slightly under $4.00. Then in 1987-88 and again in 1988-89 prices continued to fall (Figure 1). From 1982 through 1992 the average value of the nutria harvest was only $2.2 million. Between 1988-89 and 1995-96 the number of nutria harvested annually remained below 300,000 and prices remained at or below a $3.00 average. During the last two trapping seasons, prices have increased and during the 1997-98 season 359,232 nutria were harvested at an average price of $5.17. The current outlook for the 1998-99 season is not good. Collapse of the Russian economy and general instability in the Far East economies has weakened the demand for most wild furs including nutria.

Reports of marsh vegetation damage from land managers became common again in 1987 after 28 years of no problems. Such complaints became routine by 1988, and the Fur and Refuge Division, LDWF initiated limited aerial flights, particularly in southeastern Louisiana. These flights showed that damage was occurring, but the severity, distribution, and duration of the damage was unknown.

The first region-wide aerial survey became possible because of the interest and concern of many state and federal agencies, coastal land companies and, in particular, funding provided by the Barataria-Terrebonne National Estuary Program (BTNEP). The objective of the aerial survey was to: (1) determine the distribution of damage along the transect lines as an index of damage region wide, (2) determine the severity of damage as classified according to a nutria relative abundance rating, (3) determine the species of vegetation being impacted and (4) determine the status of recovery of selected damaged areas (Linscombe and Kinler 1997).

Helicopter surveys were flown in May and December 1993 and again in March and April 1996 across the Barataria -Terrebonne Basins. During the December 1993 survey 90 damaged sites were observed amounting to over 15,000 acres of marsh impacted along the transects and extrapolated, estimated at 60,000 acres across the study area. In 1996, a total of 157 sites were observed. The damage observed along the transects lines increased to 20,642 acres and extrapolated, estimated at over 80,000 acres. Of all the 1993 sites evaluated again in 1996, only 9% showed any recovery. Clearly, the trend identified was a continued increase in both the number of sites and the extent of nutria damage in the Barataria-Terrebonne Basins.

Vegetative damage caused by nutria has been documented in at least 11 Coastal Wetlands Planning Protection And Restoration Act (CWPPRA) project sites in the Barataria-Terrebonne Basins. The estimate of 80,000 acres of marsh damaged was conservative because only the worse (most obvious) can be detected from aerial surveys. The number of acres being impacted was certainly higher. When vegetation is removed from the surface of the marsh, as a result of over grazing by nutria, the very fragile organic soils are exposed to erosion through tidal action. If damaged areas do not revegetate quickly, they will become open water as tidal scour removes soil and thus lowers elevation. Frequently the plant's root systems are also damaged, making recovery through vegetative regeneration very slow.

Certainly the problems being addressed in coastal restoration are major challenges. Nutria herbivory may be minor compared to the other factors causing wetlands loss, but the additional stress placed on the plants, by nutria herbivory, may be very significant in CWPPRA projects sites.

State and federal agencies, reviewing the results of aerial surveys considered and approved a five-year Coastal Wetlands Planning Protection and Restoration Act (CWPPRA) demonstration project. The project entitled "Nutria Harvest and Wetland Demonstration Project" (LA-2, PTV-5) was approved as a part of the 6th Priority Projects List (PL-101-646). This project was authorized as a demonstration by the CWPPRA TASK FORCE on April 24, 1997. The project is being conducted by the LDWF and includes three major components: 1) plan, develop and conduct nutria meat marketing activities, 2) conduct a coast wide nutria herbivory survey to assess the extent of habitat damage, and 3) provide incentive payments to trappers and nutria meat processors. This document reports on the 1998 coast wide herbivory survey.

Methods

A coast wide nutria herbivory survey was conducted in the Spring of 1998. This effort represented the first attempt at quantifying the impact of nutria herbivory on a coast wide basis.

North-South transects were flown throughout the fresh, intermediate and brackish marshes of coastal Louisiana. Portions of Cameron, Calcasieu, Vermilion, Jeff Davis, Iberia, St. Mary, Terrebonne, Lafourche, Jefferson, Plaquemines, St. John, St. Charles, St. Bernard, Orleans, St. Tammany and Tangipahoa Parishes were included in the survey. Transects were spaced approximately 1.8 miles apart, starting at the swamp-marsh interface and continuing south to the beginning of the salt marsh. Due to low nutria population density, salt marsh habitat was not included in the survey. Although altitude did vary, depending upon visibility and vegetative conditions, an altitude of 300-400 feet was considered optimum. At this altitude, vegetative damage was identifiable and allowed for a survey transect width of 1/4 mile on each side of the helicopter. Flight speed was approximately 60 mph.

Two observers were used to conduct the survey, each positioned on opposite sides of the helicopter. In addition to locating vegetative damage, one observer navigated along the transect and the other observer recorded all pertinent data.

When vegetative damage was identified, the following information was recorded (Figure 2):

1) Location of each site was determined by recording latitude and longitude utilizing GPS equipment. A differential GPS (Trimble Ag 122) was utilized to allow for accurate location of damaged sites. The ocular estimate of the size of each damage site was recorded. Additionally, for large areas of damage, the circumference of the area was flown, logging in numerous data points so that size of the area impacted could be accurately determined.

2) The severity of damage was classified in one of the following nutria relative abundance rating categories: no nutria sign visible, nutria sign visible, abundant nutria sign, heavy feeding sign, moderate vegetative damage or severe vegetative damage.

3) The dominant plant species in the damaged area that were impacted by nutria feeding activity and those in the adjacent area were identified and recorded.

4) The age of damage and condition was determined from one of the following categories: recovered, old recovering, old not recovering, recent recovering, recent not recovering, or current (occurring now).

5) The prediction of vegetative recovery by the end of 1998 was characterized by one of the following categories: full recovery, partial recovery or increased damage.

6) The number of nutria observed at each site was recorded.

In addition to searching for new damaged sites, all previously identified damaged sites were revisited to assess extent and duration of damage or to characterize recovery. All data were entered into a computer for compilation and transferred to the National Wetlands Research Center (NWRC), National Biological Survey in Lafayette, Louisiana. Damaged site locations are provided on the attached herbivory map and a data summary is provided in Appendix A.

Results and Discussion

In the Spring of 1998, a coast wide herbivory survey was conducted, covering all marsh areas in the coastal parishes. All previously identified damaged sites (143) were visited and reevaluated. A total of 204 sites were visited, 34 of which were considered recovered and 170 with currently identifiable nutria herbivory impacts (Table 1).

An estimated total of 23,960 acres were impacted by nutria feeding activity along the transects (Table 2). Of the 170 sites, Terrebonne Parish contained 69 sites (41%) and 10,700 damaged acres (45%). Lafourche Parish accounted for 24 sites (14%) and 5,041 acres of damaged marsh (21%) . Twenty-two sites (13%) and 4,212 acres (18%) were located in Jefferson Parish. Plaquemines Parish accounted for 16 sites (9%) and 1,462 acres (6%) . A total of 9 sites (5%) and 975 damaged acres (4%) were found in St. Charles Parish. Smaller amounts of damaged wetlands were located in

Cameron, St. Bernard, St. John, Iberia, St. Tammany, St. Mary and Vermilion Parishes. Only two parishes surveyed contained no nutria herbivory damage, Calcasieu and Orleans Parishes. As in 1996, Terrebonne, Lafourche, Jefferson, Plaquemines, and St. Charles continue to be the Parishes most affected by nutria herbivory. Coastal marshes in Southwest Louisiana had relatively few damaged sites as compared to Southeast Louisiana.

Marsh vegetative type (based on the Linscombe and Chabreck 1997 survey) was recorded at each damage site (Table 3). Intermediate marsh contained only 55 sites (32%) but accounted for 10,168 of the damaged acres (43%). One-half of the sites (85) were located in fresh marsh. These sites contained 8,666 of the damaged acres (36%). Brackish marsh accounted for 30 sites (18%) and 5,126 damaged acres (21%). The typical vegetation impacted in fresh marsh was Eleocharis spp. and Hydrocotle spp. and Scirpus olneyi and Eleocharis spp. in intermediate and brackish marshes. In previous survey years (1993 and 1996), damaged acres were highest in fresh marsh. In this survey damaged acres were highest in intermediate marsh, but the highest number of damaged sites were in fresh marsh. The number of damaged sites increased in both the fresh and intermediate marsh types in 1998 but decreased in the brackish marsh type.

The nutria relative abundance rating (NRAR) was used to identify the degree of nutria herbivory at each identified damage site (Table 4). Each of the six ratings utilized are self-explanatory. They included: (1) nutria sign visible (feeding and trails), (2) abundant nutria sign, (3) heavy feeding sign (minor vegetative damage), (4) moderate vegetative damage, (5) severe vegetative damage and (6) no nutria sign or activity visible (this rating was utilized for an area previously identified as damaged, but had no current nutria feeding activity). The two most severe NRAR categories, moderate and severe vegetative damage, characterized 88 sites (52%) and 20,749 acres (80%). A total of 42 sites (25%) comprising 1364 acres (6%) were classified as having heavy feeding sign with minor vegetative damage. The remaining 3 NRAR classifications contained 40 sites (23%) and 847 acres (8%) of impacted marsh. Of special significance is the fact that 80% of the damaged areas were classified as moderate or severe vegetative damage. As the impact of nutria feeding activity progresses to moderate and severe vegetative damage the less likely an area is to fully recover, even if nutria populations are dramatically reduced.

The age of damage and condition rating was utilized to characterize each of the damage sites (Table 5). The six classifications included (1) current damage, (2) recent damage-recovering, (3) recent damage not recovering, (4) old damage-recovering, (5) old damage-not recovering, and (6) recovered. During the 1998 survey 60 sites (35%) comprising 7,999 acres (33%) were classified as having current, ongoing nutria herbivory impacts. A total of 74 sites (44%) containing 10,086 acres (42%) were classified as old damage sites which were recovering. Twenty-five areas (15%) were classified as old damage and not recovering containing 5,610 acres (23%). These areas will probably not recover and are being converted from vegetated wetlands to open water ponds. Only 34 sites, comprising 4447 acres, out of the 204 sites visited were classified as recovered. Over half of these recovered acres were accounted for by 1 fresh marsh site in Lafourche Parish.

For each site with current damage, the degree of recovery by the end of the 1998 growing season was predicted (Table 6). These ratings were (1) full recovery, (2) partial recovery, (3) increased damage and (4) no recovery predicated. The majority of the sites were projected to recover partially by the end of the 1998 growing season (128 sites and 16,085 acres). For 26 sites containing 7,340 acres, no short term recovery was predicted.

During the survey, several marsh areas that were damaged by muskrat were observed. An attempt was made to collect data on each muskrat damage site but it was soon realized that this effort would be too time consuming and could not be accomplished within the constraints of the nutria survey. Eleven individual sites encompassing 2,247 acres of wetlands were identified and evaluated. There were 7 sites (1951 acres) in Vermilion Parish, 3 sites (266 acres) in Terrebonne Parish and 1 site of 30 acres in Iberia Parish. Significantly more acres of muskrat damage were observed in both Terrebonne and Vermilion Parishes. All of the areas impacted by muskrats were classified as either moderate or severe vegetative damage.

Conclusion

During the 1998 survey a total of 23,960 acres of coastal marshes were identified as being negatively impacted by nutria feeding activity. This damage was observed along transects located at 1.8 mile intervals. Due to the distance between survey lines, all areas impacted by nutria herbivory could not be identified. Although it is difficult to extrapolate or expand from these survey results to a coast wide estimate of nutria herbivory damage, it is obvious that total acres impacted is probably 3 to 4 times larger than the area estimated by this survey. Additionally, there were many survey miles where we observed obvious nutria herbivory activity but marsh conditions did not warrant a "damage" classification. These areas, should however, be closely observed during future surveys. The overwhelming bulk of the damage is located in southeastern Louisiana with only very isolated small areas of damage in southwestern Louisiana.

The most significant findings include: 1) Impact of nutria herbivory in southeastern coastal marshes continues to play a major role in vegetated marsh loss, 2) the damage is rated as moderate or severe for 80% of the damaged acres, 3) no recovery was occurring on 5,610 acres of damaged wetlands and 4) no recovery was predicted for 7,340 acres of damaged wetlands.
Nutria herbivory damage continues to increase with each additional survey.

Survey results strongly support the need for continued development of a trapping system which will facilitate significantly higher nutria harvest. The Louisiana Fur and Alligator Advisory Council and the Louisiana Department of Wildlife and Fisheries will continue with marketing projects to encourage improved prices to trappers.

This information should be helpful to local, state, and federal agencies and land companies planning marsh restoration projects and developing marsh management plans. Hopefully it will encourage and assist researchers to initiate studies to further improve understanding of the problem. It has improved the data base available to the LDWF to explain the significance of the problem and suggest potential solutions to decision makers.

In conclusion, nutria herbivory is playing a major role in the coastal marshes of Louisiana. Direct vegetation removal contributes to permanent loss of vegetated wetlands; however, vegetative loss is not the only impact observed. Nutria are currently, and are suspected to have historically, played a major role in affecting plant species composition throughout the coast. Of great concern is that only a small fraction of damage sites have recovered since our initial surveys in 1993. Most areas identified during those initial surveys are still being impacted in 1998. These fragile wetlands may not be able to withstand this continued stress in years to come.

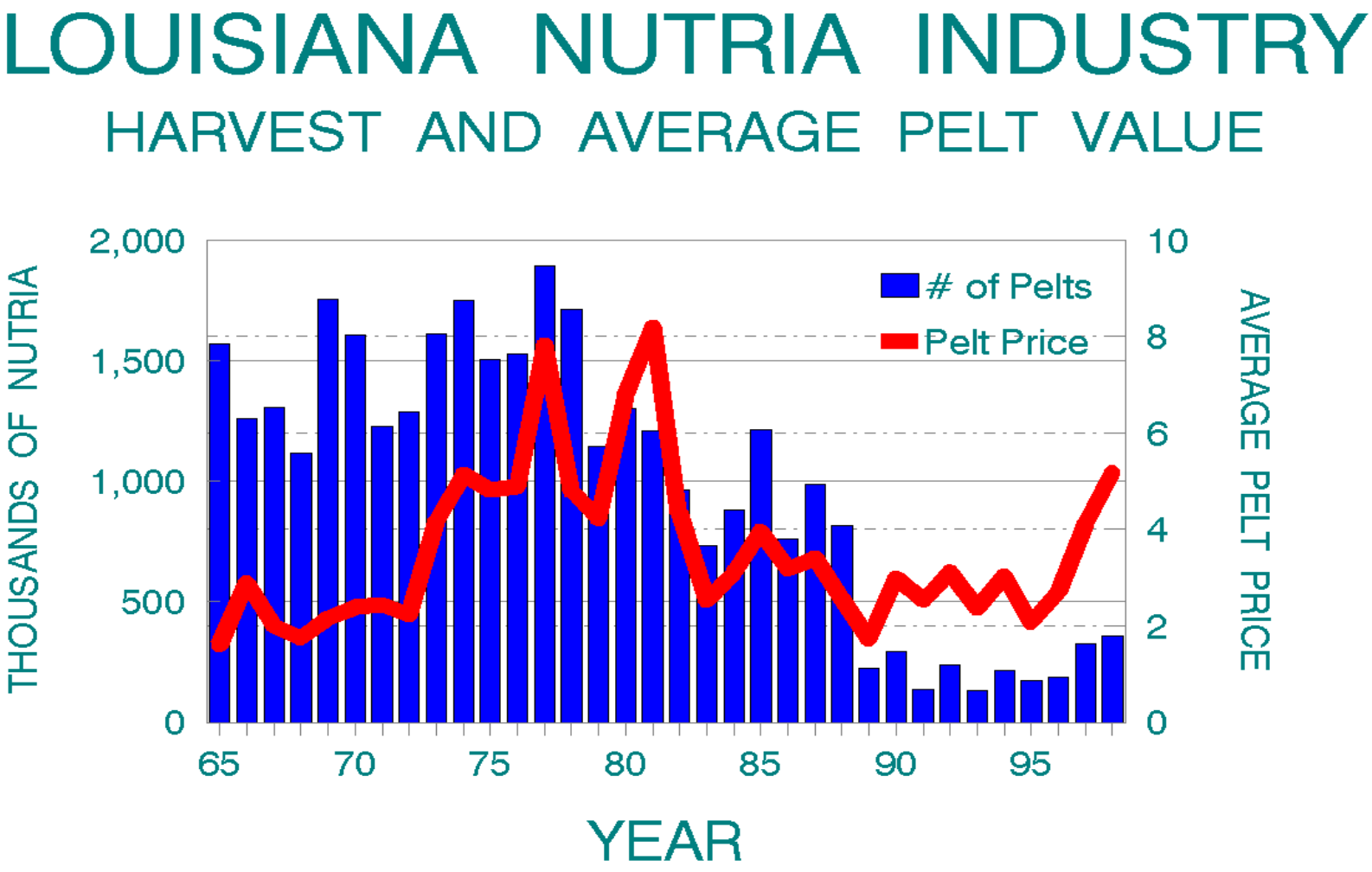

Figure 1. Annual harvest and average price of nutria from 1965-1998.

1998
NUTRIA VEGETATIVE DAMAGE SURVEY
DATE: _____

TRANSECT#:_____
MARSH TYPE:_____
WAY POINT #:_____
LAT:_____ GPS LAT:_____
LON:_____ LON:_____

LAT:_____ LAT:_____
LON:_____ LON:_____

LOCATION DESCRIPTION

ON TRANSECT_____
EAST OF TRANSECT_____
WEST OF TRANSECT_____

DAMAGE DESCRIPTION

_____DAMAGE NOT RELATED TO NUTRIA FEEDING
_____DAMAGE - STORM RELATED
_____DAMAGE - OTHER_____
_____DAMAGE - MUSKRAT
_____DAMAGE - NUTRIA
_____ESTIMATED SIZE OF AREA (ACRES)
_____DAMAGED AREA SUBJECT TO TIDAL ACTION:____YES____NO

NUTRIA RELATIVE ABUNDANCE RATING

_____NUTRIA SIGN VISIBLE (FEEDING/TRAILS) (1)
_____ABUNDANT NUTRIA SIGN (2)
_____HEAVY FEEDING SIGN (MINOR VEGETATIVE DAMAGE) (3)
_____MODERATE VEGETATIVE DAMAGE (4)
_____SEVERE VEGETATIVE DAMAGE (5)

PLANT SPECIES IMPACTED

_____ _____
_____ _____
_____ _____

PLANT SPECIES ADJACENT

_____ _____
_____ _____
_____ _____

AGE OF DAMAGE AND CONDITION

_____OLD RECOVERING
_____OLD NOT RECOVERING
_____RECENT RECOVERING
_____RECENT NOT RECOVERING
_____CURRENT (OCCURRING NOW)

PREDICTION OF RECOVERY BY END OF 1998 GROWING SEASON

_____FULL RECOVERY
_____PARTIAL RECOVERY
_____INCREASED DAMAGE

NUTRIA VISIBLE ABUNDANCE IN AREA

_____WERE NUTRIA SIGHTED:_____YES_____NO
_____IF YES, HOW MANY?_____

Figure 2. Data sheet utilized for 1998 nutria herbivory survey.

Table 1. Status and number of nutria herbivory sites surveyed in 1996[1] and 1998[2].

	Number of		
Year	Sites Surveyed	Sites with current damage	Sites with vegetative recovery
1996	158	143	15
1998	204	170	34

[1]Barataria-Terrebonne Estuary survey only

[2] Coast wide survey

Table 2. Number of damaged sites and acres damaged along transects by Parish in coastal Louisiana in 1998.

Parish	Number of	
	Sites	Acres Damaged
Terrbeonne	69	10,700
Lafourche	24	5,041
Jefferson	22	4,212
Plaquemines	16	1,462
St. Charles	9	975
Cameron	9	720
St. Bernard	7	280
St. John	6	95
Iberia	2	125
St. Tammany	3	330
St. Mary	2	10
Vermilion	1	10
Total	170	23,960[1]

[1] This figure represents acres damaged along transects only. Actual damage coast wide is approximately 4 times larger than the area estimated by this survey.

Table 3. Number of damaged sites and acres damaged by marsh type along transects in coastal Louisiana during 1998.

Habitat Type	Number of	
	Sites	Acres Damaged
Brackish	30	5,126
Fresh	85	8,666
Intermediate	55	10,168
Total	170	23,960

Table 4. Number of damaged sites and acres damaged by nutria relative abundance rating in coastal Louisiana during 1998.

Nutria Relative Abundance Rating	Number of	
	Sites	Acres Damaged
No Sign Visible[2]	13	402
Nutria Sign Visible	14	520
Abundant Nutria Sign	13	925
Heavy Feeding Sign	42	1,364
Moderate Vegative Damage	69	12,391
Severe Vegative Damage	19	8,358
Total	170	23,960

[2]Used for areas previously identified with damage, but there was no nutria sign visible at the time of the 1998 survey.

Table 5. Number of damage sites by age of damage and condition rating in coastal Louisiana in 1998.

Age of Damage and Condition Rating	Number of	
	Damage Sites	Condition Rating
Old Recovering	74	10,086
Old Not Recovering	25	5610
Recent Recovering	8	225
Recent Not Recovering	3	40
Current Damage	60	7999
Total	170	23,960
Recovered[1]	34	4447[2]

[1]Sites previously identified as damaged, but had recovered at the time of the 1998 survey.

[2]One site in fresh marsh in Lafourche Parish that recovered accounted for 2,767 acres of this total.

Table 6. Number of damage sites and acres damaged by prediction of recovery rating in coastal Louisiana in 1998.

Prediction of Recovery by End of 1998 Growing Season	Number of	
	Sites	Acres
Full Recovery	14	265
Partial Recovery	128	16,085
Increased Damage	2	270
No Recovery Predicated	26	7340

Appendix A. Data collected at each damage site during the 1998 survey.

1998 NUTRIA DAMAGE SITES

SITE	MARSH TYPE	LATITUDE	LONGITUDE	DAMAGE	ACRES	NRAR	AGE OF DAMAGE	PREDICTION OF RECOVERY	SPECIES
2	F	29.3913333	91.181694	Nutria	0	0	1	1	
3	I	29.3726700	91.177500	Nutria	10	1	1	2	Scirpus olneyi
8	F	29.5706700	91.168000	Nutria	1500	5	2	2	Hydrocotyle spp
9	F	29.5643300	91.137330	Nutria	152	4	1	2	Eleocharis spp
10	F	29.3590000	91.127830	Nutria	50	4	2	0	Eleocharis spp
12	B	29.3003700	91.107510	Nutria	1006	5	5	0	Scirpus olneyi
13	I	29.3576700	91.106330	Nutria	5	3	1	2	Scirpus olneyi
14	F	29.4923300	91.093500	Nutria	200	4	5	2	Bidens laevis
17	F	29.5313400	91.065670	Nutria	100	3	1	2	Eleocharis spp
18	F	29.4515000	91.040660	Nutria	30	4	5	2	Eleocharis spp
25	F	29.4188300	90.887170	Nutria	5	2	5	1	Typha spp
39	F	29.8185000	90.150830	Nutria	10	4	1	2	Eleocharis spp
40	F	29.8155000	90.174000	Nutria	50	4	1	2	Eleocharis spp
42	F	29.8630000	90.525500	Nutria	200	1	2	2	Eleocharis spp
43	F	29.8495000	90.486340	Nutria	200	2	1	2	Eleocharis spp
45	I	29.4923300	90.224830	Nutria	500	4	1	2	Scirpus olneyi

SITE	MARSH TYPE	LATITUDE	LONGITUDE	DAMAGE	ACRES	NRAR	AGE OF DAMAGE	PREDICTION OF RECOVERY	SPECIES
46	F	29.5556700	90.225000	Nutria	100	4	5	2	Scirpus olneyi
47	I	29.6788800	90.130170	Nutria	4	3	5	2	Scirpus olneyi
48	I	29.6671700	90.132000	Nutria	10	4	1	2	Scirpus olneyi
49	I	29.6496900	90.133970	Nutria	166	5	2	2	Scirpus olneyi
50	B	29.5656700	90.127830	Nutria	1606	5	5	0	Scirpus olneyi
52	F	29.9433300	90.635170	Nutria	25	4	5	2	Hydrocotyle spp
53	F	29.9441700	90.649330	Nutria	15	2	5	2	Eleocharis spp
55	F	29.9856600	90.564330	Nutria	10	1	1	2	Typha spp
56	F	29.9823000	90.543500	Nutria	10	4	5	2	Hydrocotyle spp
60	F	29.7180000	90.052670	Nutria	40	4	5	2	Scirpus olneyi
62	F	29.5386700	91.123000	Nutria	10	3	3	2	Hydrocotyle spp
64	F	29.4718300	91.118840	Nutria	5	3	3	2	Typha spp
66	F	29.4151600	91.105330	Nutria	25	3	1	2	Eleocharis spp
67	F	29.3901700	91.076000	Nutria	20	2	1	2	Spartina patens
68	F	29.4586600	91.074660	Nutria	5	3	5	2	Hydrocotyle spp
71	F	29.3956600	91.040330	Nutria	5	2	1	1	Scirpus olneyi
75	F	29.3868400	90.945000	Nutria	15	1	1	2	Scirpus olneyi

SITE	MARSH TYPE	LATITUDE	LONGITUDE	DAMAGE	ACRES	NRAR	AGE OF DAMAGE	PREDICTION OF RECOVERY	SPECIES
77	B	29.4226700	90.685840	Nutria	10	0	2	0	Spartina patens
80	F	29.5683300	90.455670	Nutria	80	3	5	2	Hydrocotyle spp
81	I	29.5015000	90.415340	Nutria	500	4	1	2	Eleocharis spp
82	F	29.8828300	90.610500	Nutria	50	3	5	2	Hydrocotyle spp
83	F	29.9053300	90.626600	Nutria	25	3	5	2	Hydrocotyle spp
85	F	29.8971700	90.460840	Nutria	25	1	5	1	Eleocharis spp
86	F	29.9631700	90.621330	Nutria	10	1	1	2	Panicum hemitomon
87	F	29.9655000	90.519000	Nutria	10	3	5	2	Hydrocotyle spp
90	I	29.6193300	90.106670	Nutria	200	4	1	2	Scirpus olneyi
92	F	29.7020000	90.073330	Nutria	150	4	5	2	Scirpus olneyi
94	F	29.8636000	90.291200	Nutria	500	4	5	2	Hydrocotyle spp
95	F	29.4935000	90.476500	Nutria	500	5	2	0	Eleocharis spp
97	F	29.7025000	90.195000	Nutria	150	4	1	2	Scirpus olneyi
98	I	29.4520000	90.201500	Nutria	100	5	5	0	Scirpus olneyi
99	I	29.4623300	90.233000	Nutria	1217	4	5	2	Spartina patens
101	I	29.3506700	90.860340	Nutria	25	4	1	2	Spartina patens
104	F	29.4098300	90.890170	Nutria	30	3	3	1	Scirpus olneyi

SITE	MARSH TYPE	LATITUDE	LONGITUDE	DAMAGE	ACRES	NRAR	AGE OF DAMAGE	PREDICTION OF RECOVERY	SPECIES
105	I	29.3698300	90.884500	Nutria	3070	4	1	2	Spartina patens
106	I	29.3651700	90.913670	Nutria	30	5	2	0	Spartina patens
107	F	29.5305000	90.942000	Nutria	10	1	1	2	Panicum hemitomon
108	I	29.4311700	90.949670	Nutria	50	1	1	1	Hydrocotyle spp
109	F	29.5281700	90.986340	Nutria	100	3	3	2	Eleocharis spp
111	F	29.3978300	90.826330	Nutria	5	4	1	2	Eleocharis spp
112	F	29.4006700	90.797160	Nutria	20	3	5	2	Hydrocotyle spp
113	F	29.5403300	90.802530	Nutria	25	0	2	0	Eichhornia crassipes
114	F	29.5436700	90.794500	Nutria	20	3	3	2	Hydrocotyle spp
115	B	29.3585000	91.009670	Nutria	100	0	2	0	Scirpus olneyi
117	F	29.3925000	91.057000	Nutria	25	4	5	2	Scirpus olneyi
118	I	29.3543300	91.042170	Nutria	10	3	1	2	Scirpus olneyi
119	F	29.5361700	91.120160	Nutria	10	3	4	2	Eleocharis spp
120	F	29.6058300	91.072840	Nutria	1000	5	2	0	Eleocharis spp
121	I	29.3728300	91.104330	Nutria	5	3	3	2	Scirpus olneyi
122	I	29.3515000	91.254600	Nutria	40	4	1	2	Scirpus olneyi
124	F	29.5280000	91.196170	Nutria	253	3	1	2	Hydrocotyle spp

SITE	MARSH TYPE	LATITUDE	LONGITUDE	DAMAGE	ACRES	NRAR	AGE OF DAMAGE	PREDICTION OF RECOVERY	SPECIES
126	F	29.5458400	91.180170	Nutria	45	3	1	1	Eleocharis spp
128	F	29.5781700	91.129330	Nutria	110	4	1	2	Eleocharis spp
130	B	29.2910000	91.171660	Nutria	10	3	1	2	Scirpus olneyi
131	I	29.3498300	91.257840	Nutria	20	4	1	2	Scirpus olneyi
133	I	29.3350000	91.228000	Nutria	60	4	1	2	Scirpus olneyi
136	B	29.3047000	91.203300	Nutria	25	5	1	2	Scirpus olneyi
137	B	29.3088400	91.190000	Nutria	20	1	1	2	Scirpus olneyi
138	F	29.5858300	91.099170	Nutria	30	4	3	2	Eleocharis spp
139	F	29.5510000	91.096500	Nutria	25	3	5	2	Eleocharis spp
140	F	29.4818300	91.095660	Nutria	461	5	5	0	Hydrocotyle spp
141	F	29.4051600	91.071170	Nutria	30	3	1	2	Scirpus olneyi
142	F	29.5993300	91.013500	Nutria	15	4	5	2	Hydrocotyle spp
143	F	29.5918400	91.009500	Nutria	2	4	2	2	Hydrocotyle spp
144	I	29.3343300	90.977000	Nutria	25	0	2	0	Spartina patens
145	I	29.3481700	90.977000	Nutria	50	0	2	0	Spartina patens
146	F	29.5473300	90.935840	Nutria	25	2	1	2	Hydrocotyle spp
147	B	29.3456700	90.917000	Nutria	45	5	2	0	Spartina patens

SITE	MARSH TYPE	LATITUDE	LONGITUDE	DAMAGE	ACRES	NRAR	AGE OF DAMAGE	PREDICTION OF RECOVERY	SPECIES
148	F	29.4068300	90.907830	Nutria	25	3	3	2	Spartina patens
150	F	29.5180000	90.885830	Nutria	25	0	2	0	Panicum hemitomon
152	B	29.2858300	90.795000	Nutria	100	0	1	2	Spartina patens
153	I	29.4088300	90.795000	Nutria	50	5	2	0	Scirpus olneyi
154	F	29.5218400	90.762830	Nutria	50	5	1	2	Hydrocotyle spp
157	I	29.4870000	90.484170	Nutria	200	5	2	0	Sagittaria lancifolia
159	F	29.6370000	90.659170	Nutria	10	2	5	2	Hydrocotyle spp
160	I	29.5170000	90.425670	Nutria	952	4	2	0	Sagittaria lancifolia
161	I	29.4978400	90.251500	Nutria	5	3	1	2	Spartina patens
162	F	29.5840000	90.219670	Nutria	60	3	1	2	Spartina patens
163	I	29.4865000	90.198670	Nutria	10	3	5	2	Scirpus olneyi
164	I	29.4858300	90.209170	Nutria	100	4	5	2	Scirpus olneyi
165	I	29.4818500	90.191500	Nutria	30	3	1	2	Scirpus olneyi
166	B	29.4481700	90.150500	Nutria	15	3	5	2	Scirpus olneyi
167	F	29.9143300	90.618000	Nutria	10	3	5	2	Eleocharis spp
169	F	29.9068300	90.488300	Nutria	100	3	5	2	Eleocharis spp
170	F	29.8273300	90.493000	Nutria	150	1	5	2	Panicum hemitomon

SITE	MARSH TYPE	LATITUDE	LONGITUDE	DAMAGE	ACRES	NRAR	AGE OF DAMAGE	PREDICTION OF RECOVERY	SPECIES
171	F	29.9235000	90.471830	Nutria	255	2	5	3	Eleocharis spp
173	F	29.8048400	90.166500	Nutria	5	1	1	1	Eleocharis spp
174	F	29.7676700	90.138330	Nutria	150	4	5	2	Eleocharis spp
175	I	29.6886700	90.174670	Nutria	25	3	5	2	Scirpus olneyi
176	I	29.6131600	90.105830	Nutria	25	4	1	1	Scirpus olneyi
177	F	29.7440000	90.092000	Nutria	523	4	2	0	Scirpus olneyi
178	F	29.7173300	90.091170	Nutria	80	3	5	2	Scirpus olneyi
179	I	29.6670000	90.016330	Nutria	15	4	5	3	Eleocharis spp
180	B	29.5595000	90.013160	Nutria	20	4	5	0	Scirpus olneyi
181	B	29.5496700	90.004670	Nutria	300	4	5	0	Scirpus olneyi
182	B	29.5508300	89.974670	Nutria	200	4	5	0	Scirpus olneyi
183	B	29.5548300	89.941000	Nutria	250	3	1	2	Scirpus olneyi
184	B	29.5298300	89.939670	Nutria	20	3	1	2	Scirpus olneyi
201	I	29.7408000	92.216600	Muskrat	500	5	4	2	Scirpus olneyi
202	I	29.7171000	92.220300	Muskrat	200	5	4	2	Scirpus olneyi
203	I	29.6921000	92.221900	Muskrat	100	5	4	2	Scirpus olneyi
204	I	29.6825000	92.212900	Muskrat	25	5	5	3	Scirpus olneyi

SITE	MARSH TYPE	LATITUDE	LONGITUDE	DAMAGE	ACRES	NRAR	AGE OF DAMAGE	PREDICTION OF RECOVERY	SPECIES
205	I	29.6727000	92.220300	Muskrat	1000	5	4	2	Scirpus olneyi
206	I	29.6412000	92.230200	Muskrat	25	4	1	2	Hydrocotyle spp
207	I	29.7162000	92.190000	Muskrat	101	5	4	2	Scirpus olneyi
208	F	29.5846000	91.480500	Nutria	5	1	5	2	Hydrocotyle spp
209	F	29.5882000	91.511900	Nutria	5	1	5	2	Eleocharis spp
210	B	29.4990000	91.798050	Nutria	85	5	2	2	Scirpus olneyi
211	I	29.6041000	91.884800	Nutria	40	4	1	2	Scirpus olneyi
212	B	29.6156000	91.902800	Muskrat	30	4	1	2	Scirpus olneyi
213	I	29.6937000	92.605200	Nutria	10	3	5	2	Scirpus olneyi
214	F	29.6983000	92.637400	Nutria	5	3	5	2	Scirpus olneyi
215	I	29.6653000	92.697400	Nutria	10	4	1	2	Scirpus olneyi
216	F	29.7307000	92.761000	Nutria	5	4	5	1	Scirpus californicus
217	F	29.9645000	92.670900	Nutria	10	2	5	2	Panicum hemitomon
218	F	30.0001000	92.768800	Nutria	40	3	5	2	Eleocharis spp
219	F	29.8477000	92.951000	Nutria	15	3	5	2	Spartina patens
220	B	29.8524000	93.228000	Other	30	0	3	2	Scirpus olneyi
221	B	29.3132000	91.288900	Nutria	40	4	1	2	Scirpus olneyi

SITE	MARSH TYPE	LATITUDE	LONGITUDE	DAMAGE	ACRES	NRAR	AGE OF DAMAGE	PREDICTION OF RECOVERY	SPECIES
222	B	29.2687000	91.286500	Muskrat	5	5	1	2	Scirpus olneyi
223	B	29.2537000	91.261300	Nutria	40	4	1	1	Scirpus olneyi
224	I	29.3459700	91.268290	Nutria	633	5	1	2	Scirpus olneyi
225	I	29.3629000	91.243600	Nutria	313	5	1	2	Scirpus olneyi
226	I	29.3230000	91.225500	Nutria	208	5	1	2	Scirpus olneyi
227	B	29.2723000	91.229700	Nutria	147	4	1	2	Scirpus olneyi
228	B	29.2468000	91.197000	Muskrat	111	5	2	2	Scirpus olneyi
229	B	29.2595000	91.200100	Muskrat	150	5	1	2	Scirpus olneyi
230	F	29.9069600	93.420290	Nutria	10	2	5	1	Paspalum spp
231	B	29.8271500	93.665650	Nutria	25	4	3	2	Scirpus olneyi
232	B	29.8221500	93.666110	Nutria	600	4	1	2	Scirpus californicus
233	F	29.6063000	90.982100	Nutria	50	4	5	2	Eleocharis spp
234	B	29.2966000	90.729300	Nutria	15	3	5	2	Typha spp
235	F	29.4562000	90.698500	Nutria	25	3	5	2	Typha spp
236	F	29.5766000	90.576500	Nutria	2	3	5	2	Bidens laevis
237	F	29.9463000	90.512100	Nutria	15	4	5	2	Eleocharis spp
238	F	29.9243000	90.518500	Nutria	10	4	5	2	Eleocharis spp

SITE	MARSH TYPE	LATITUDE	LONGITUDE	DAMAGE	ACRES	NRAR	AGE OF DAMAGE	PREDICTION OF RECOVERY	SPECIES
239	B	29.5780000	89.945500	Nutria	100	3	5	2	Scirpus olneyi
240	F	29.6226000	90.194000	Nutria	10	3	1	2	Eleocharis spp
241	I	29.5814000	90.170800	Nutria	25	4	1	2	Scirpus olneyi
242	I	29.5939000	90.163200	Nutria	25	4	1	2	Scirpus olneyi
243	I	29.6838000	90.133500	Nutria	240	4	1	2	Scirpus olneyi
244	F	29.7318000	90.097300	Nutria	15	4	1	2	Scirpus olneyi
245	F	29.7451000	90.073300	Nutria	380	5	5	2	Scirpus olneyi
246	F	29.7209000	90.071600	Nutria	98	4	5	2	Scirpus olneyi
248	I	29.7290000	89.759700	Nutria	10	4	5	2	Scirpus olneyi
249	I	29.8133300	89.957000	Nutria	5	0	1	2	Scirpus olneyi
250	I	29.7918000	89.913400	Nutria	25	4	1	2	Scirpus olneyi
251	I	29.7691700	89.924170	Nutria	30	4	1	2	Scirpus olneyi
252	I	29.7455000	89.923830	Nutria	100	4	1	2	Scirpus olneyi
253	I	29.7299000	89.918400	Nutria	350	4	1	2	Scirpus olneyi
254	I	29.7153400	89.882330	Nutria	240	4	1	2	Scirpus olneyi
255	I	29.7800000	89.891170	Nutria	30	4	1	2	Scirpus olneyi
256	I	29.7691000	89.882100	Nutria	50	4	1	2	Scirpus olneyi

SITE	MARSH TYPE	LATITUDE	LONGITUDE	DAMAGE	ACRES	NRAR	AGE OF DAMAGE	PREDICTION OF RECOVERY	SPECIES
257	I	29.8480000	89.861500	Nutria	10	4	1	2	Scirpus olneyi
258	I	29.8413400	89.850500	Nutria	200	4	1	2	Scirpus olneyi
259	I	29.8225000	89.844340	Nutria	25	4	1	2	Scirpus olneyi
260	I	29.8131700	89.850830	Nutria	25	4	1	2	Scirpus olneyi
261	I	29.6506700	89.854670	Nutria	25	0	2	0	Scirpus olneyi
262	B	29.8260000	89.791000	Nutria	5	3	3	2	Scirpus olneyi
263	B	29.5465000	89.721660	Nutria	2	0	2	0	Scirpus olneyi
264	B	29.6961700	89.668170	Nutria	25	0	2	0	Spartina patens
265	B	29.7341700	89.670010	Nutria	5	1	1	1	Scirpus olneyi
266	I	30.2453000	89.821800	Nutria	30	4	1	2	Scirpus olneyi
267	B	30.2468000	89.857500	Nutria	150	4	1	2	Scirpus olneyi
268	B	30.2568000	89.883450	Nutria	150	4	1	2	Scirpus olneyi
269	B	29.7496700	89.612830	Nutria	10	0	2	0	Spartina alterniflora

[1]Marsh Type

Brackish	B
Fresh	F
Intermediate	I

[2]Nutria Relative Abundance Rating

Nutria Sign Visible	1
Abundant Nutria Sign	2
Heavy Feeding Sign	3
Moderate Vegetative Damage	4
Severe Vegetative Damage	5
No Nutria Sign Visible	0

[3]Age of Damage and Condition

Old Recovering	1
Old Not Recovering	2
Recent Recovering	3
Recent Not Recovering	4
Current (Occurring Now)	5
Recovered	0

[4]Prediction of Recovery by End of 1998 Growing Season

Full Recovery	1
Partial Recovery	2
Increased Damage	3
No Recovery Predicted	0