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A MARSH DEER "DIE-OFF" IN LOUISIANA

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Although deer "die-offs" due to starvation have been recorded from many upland areas of North America, to the writers' knowledge none has been reported from marsh habitats nor from the state of Louisiana. The following report is presented because of the increasing interest in deer mortality in the Southeast and because of the unique circumstances encountered in the present investigation.

A few reports of marsh deer (*Odocoileus virginianus mcilhennyi*) mortality were received in the fall of 1953, and many were received through the summer and fall of 1954 from the coastal marsh in south-central Louisiana. The critical deer range was located between White Lake and Marsh Island and comprised approximately 400,000 acres adjacent to the Gulf of Mexico in Vermilion and Iberia parishes. The part of this area that we investigated consisted of approximately 100,000 acres south of Intercoastal City.

Most of this marsh was 1 to 2 feet above mean Gulf level, with scattered ridges elevated to 3 feet. With normal tides, prior to the digging of canals, this area was a fresh-water marsh; however, an extensive canal system has permitted the intrusion of salt water and the conversion of some parts of the area to brackish-marsh communities. The area has an average annual rainfall of about 58 inches, an average January temperature of 54°F., an average July temperature of 82°F., and a growing season of 290 days. The normal tidal fluctuation is about 18 inches.

Widespread canal digging, which began in 1925, has continued to the present time. Most early canals were dug for drainage and transportation, with a few being constructed to confine cattle that had grazed the marsh for many years. During the last few years, there has been much oil activity in the area. Since all wells have been drilled from floating barges, canals were required for this work. After extensive canal digging, deer became more numerous, probably a direct result of the increased acreage of elevated land and the drainage of adjacent marshland that provided better deer range than the marsh proper.

Before 1938, the ridges in the area were cultivated and planted to cotton and corn. Since that time no farming has taken place, and the land has reverted to natural marsh conditions, although drainage left these ridges drier than they formerly were. The incidence of anthrax, which periodically plagued cattle (and probably deer) in the marsh, was reduced in seriousness by the vaccination of cattle. Small, interspersed tracts of privately owned land were incorporated with large landholdings, with a consequent reduction in the illegal killing of deer. These factors undoubtedly contributed to the increase of the deer population.

The land has always been trapped and hunted. It has at various times supported high muskrat (*Ondatra zibethica rivalicius*) populations and more recently a high nutria (*Myocastor coypus*) population. Huge flocks of blue and snow geese (*Chen caerulescens* and *C. hyperborea*) winter in the area annually. Severe "eat outs" have been caused in the past by muskrats and geese, with less severe ones recently by nutria. Scars from these "eat outs" still remain in the form of dense stands of annual plants such as marsh fleabane (*Pluchea purpurascens*).

The elevation of the marsh floor with its associated ecological influences is one of the major factors controlling plant types. Often a difference of two or three inches in elevation is sufficient to limit types. The principal elevations and their major plants were as follows:

1. Canal banks
   (a) Pure roseau (*Phragmites communis*)
   (b) Bermuda grass (*Cynodon dactylon*), marsh-elder (*Iva frutescens*), and winter willow (*Baccharis halimifolia*)
   (c) Brush and scattered trees—dewberry (*Rubus* sp.), wax-myrtle (*Myrica cerifera*), yaupon (*Ilex vomitoria*), hackberry (*Celtis laevigata*), honey-locust (*Gleditsia triacanthos*), rattlebox (*Daubentonia texana*), and a variety of plants including deer pea (*Vicia ludoviciana*);

2. Intermediate elevations
   (a) Pure hogcane (*Spartina cynosuroides*)
   (b) Wiregrass (*Spartina patens*), Olney three square (*Scirpus olneyi*) and cocograss (*Scirpus robustus*);

3. Lower elevations
   (a) Cattail (*Typha* spp.), bulltongue (*Sagittaria* spp.), and bullwhip (*Scirpus californicus*)
   (b) Olney three square.

Several other plants occurred on each area but they usually made up a minor part of the plant community except on disturbed areas where annuals such as millet (*Echinochloa* spp.) formed pure stands. Visits to this area in 1950 and 1951 revealed that cattail and saw-grass (*Cladium jamaicense*) were widely distributed in dense stands over the area, but at the time of this study both had practically disappeared.

FIELD INVESTIGATION

During the present investigation, conducted by personnel of the Louisiana Agricultural Experiment Station and the Louisiana Wild Life and Fisheries Commission, 24 deer were found dead. Nine additional animals in late stages of starvation were collected for autopsy by veterinarians in the Louisiana State University Department of Veterinary Medicine. Many dead deer that could not be checked were reported by men employed in the marsh.

Characteristics of the die-off were as follows: (1) there was a marked deterioration in the physical condition of the deer; (2) the animals became listless, permitting humans to approach them quite closely before making a half-hearted attempt to escape; (3) groups of deer were attracted to small areas containing palatable food; (4) weakened animals that were pursued soon became exhausted and were easily caught; (5) weak deer that concentrated along bodies of water were usually found dead near the same location.

DISCUSSION

During the early stages of the "die-off" in 1953, workers in the marsh reported seeing weakened and dead bucks along canals, but rarely reported a weak doe or fawn. It was not until the summer of 1954 that weak does and fawns were commonly seen and later found dead. The field studies, which supported these reports, showed that the bucks died first, does second, and fawns last. This was in the reverse order of mortality for northern "die-offs" which were due to malnutrition (Dahlberg and Guettinger, 1956). At least 90 per cent of the marsh deer's diet was obtained by grazing; therefore, the necessity to reach high for food did not exist in the marsh. Animal nutritionists (Morrison, 1948) have shown that the males of several species require greater quantities of food to maintain bodily functions than females or young animals. They have also shown that females require greater quantities of food than young animals. Assuming that these assertions are correct, one would expect the above-described death pattern on a coastal deer range where there was an inadequate food supply.

As shown in Table 1, 4 dead fawns and 29 dead adult deer were examined, giving an age ratio of 14 young per 100 adults. The sex ratio of dead animals was 182:100. Sex ratios of live deer were not compiled, but since a buck law prevails in the area, it is probable that there were more females present on the range than males and that the actual percentage of the total bucks that died in the herd was far greater than the percentage of does.

The veterinarians' autopsies failed to reveal any causative pathogenic organisms. Cultures were made of major tissues and their blood. In all animals there were congested areas in the lungs, the bladder of each animal was enormously distended, and there was pronounced edema. The three veterinarians agreed that the ailment was of long standing and that the above symptoms were probably of a secondary nature. They suggested malnutrition as a possible cause of the trouble.

TABLE 1. — AGE AND SEX OF DEER FOUND DEAD AND THOSE COLLECTED FOR AUTOPSY

Age	Sex			Total
(Years)	M	F	Unknown	Animals
½	2	2	0	4
1½	7	3	1	11
2½	5	4	1	10
3½	2	1	0	3
4½	2	0	0	2
7½	1	1	0	2
8½	1	0	0	1
Totals	20	11	2	33

During the field investigations it was evident that there was a lack of suitable forage plants. Some plant species had been killed or reduced in vigor primarily by salt-water intrusion and drouth. Before the construction of canals, fresh water was retained over the marsh for prolonged periods following rains. The canals now not only permit the rain water to run off rapidly but also allow salt water to enter the marsh, especially with a moderate to high south wind, which has more influence on tides than the position of the moon and sun. Therefore, interaction between rainfall and wind govern the degree of salinity in the area.

The investigators were not present in the area during 1952 when a drouth accompanied by occasional high tides extended from the latter part of August through October. It is probable that at this time water containing 5,000 to 7,000 p.p.m. of chloride was driven over the marsh by strong winds. In 1953 a drouth extended from late August through September. In 1954 a prolonged drouth occurred with rainfall considerably below normal in every month except July (U.S. Weather Bureau, 1952, 1953, 1954; U.S. Corps of Engineers, 1952, 1953, 1954a, 1954b).

Following the 1952 inundation with salt water, numerous reports were received from marsh landowners of the disappearance of saw-grass and cattail stands. This decrease continued until both plants were almost exterminated over thousands of acres.

Many acres of marsh remained in a dry or stagnant condition with much of the vegetation making very little or no growth in 1954. Deer pea, as well as other succulent plants such as millet, spike rush (*Eleocharis* spp.) and bacopa (*Bacopa caroliniana*), which normally provide large amounts of forage for deer, were almost completely absent. Other plants that supply deer with food became dry and hard early in the spring and failed to produce succulent growth during the entire season. A range survey in the fall of 1954 revealed that there was practically no suitable food or drinking water available for deer. This condition prevailed prior to and during the period when the greatest number of

weak and dead deer were observed. Nutria, geese, and cattle, which were present in the area, competed directly with the deer for food.

Mosquitoes may have contributed to the poor condition of the deer, since unusually large dark clouds of the insects could be observed almost anywhere in the marsh.

Field examinations of dead deer ruled out screw worms (*Cochliomyia* sp.) as a cause of death. Laboratory autopsies suggested that disease was not the primary cause. The very evident symptoms of malnutrition plus the extremely poor condition of the range indicated that the "die-off" was probably a result of malnutrition due to the scarcity of nutritious food.

In the spring of 1955, rainfall, which again became normal, and an intensive burning program were followed by a lush sprout growth of perennial plants as well as many annuals. It was at this season that the surviving deer began to acquire a normal, healthy appearance.

SUMMARY

A study was made of marsh deer mortality in south-central Louisiana in 1953 and 1954. Strong southerly winds inundated the deer range with saline Gulf water in 1952 at a time of severe prolonged drouth. The salt water and drouth eliminated practically all the succulent fresh marsh vegetation on which deer relied for food. This vegetation remained in a stagnant condition through 1953 and 1954. The death of adult male deer in 1953 was followed by the death of additional males plus does and fawns in 1954. Twenty-four dead deer were examined in the field, and nine weakened animals were autopsied in the Veterinary Science Department at Louisiana State University. Disease symptoms were lacking, but symptoms of starvation were very evident. Because of the lack of nutritious range plants, it is believed the "die-off" was due to malnutrition.

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CROP THICKENING AND SEPTEMBER NESTING OF DOVES

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It is generally accepted that the presence of pigeon milk in the crop of an adult dove indicates that it has dependent young. However, Peters and Wolfe (1954) state that the relationship between "glandular" crop thickening and nestling dependency has not been satisfactorily determined. Little evidence has been presented to date to show that crop thickening is a reliable indicator of nestling dependency, yet the thickened crop is one of the criteria used in determining opening dates for hunting seasons.

During the second and third weeks of September 1954, 36 adult mourning doves (*Zenaidura macroura*) were collected in southern Michigan. The collections were made within ten miles of the Michigan State University Kellogg Bird Sanctuary and Farm where an intensive dove-nesting study was being conducted by the author (Caldwell, 1955). Of the 36 adults collected, 15 (42 per cent) had thickened crop walls, and four others showed a trace of the thickening. Eighteen of these 36 adults were taken under hunting conditions over fields having flocks of from 7 to 45 birds. The incidence of crop thickening in these adults was 39 per cent. Only four (10 per cent) of an observed 41 pairs of breeding doves on the Sanctuary and Farm were nesting in September and thus might be expected to have the thickened crop. Two of these pairs fledged their young before September 8. Since the percentage of the occurrence of the thickened crop in the sample of collected birds was so high, it seems that either the sample was unconsciously biased in favor of doves with a thickened crop or, as also seems likely, the thickened crop in a September adult does not necessarily mean that it is still nesting.

Hamm (1948) reported that 17.8 per cent of 1,187 adult doves shot in eastern Tennessee in September were feeding young as judged by crop conditions. Korschgen (1955) reported that 6.0 to 6.8 per cent of 1,359 September-shot doves examined in Missouri in 1951-53 had thickened crops. Quay (1951) reported that 20.5 per cent of 278 adult doves in North Carolina examined during September in 1939-41 had pigeon milk in their crops at a time when 24 (13 per cent) of 184