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WILDLIFE POPULATIONS IN COASTAL MARSHES INFLUENCED BY WEIRS

by

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ABSTRACT

The abundance of various species of wildlife in marshes and ponds influenced by weirs was measured and compared to similar data collected on non-weired or control areas from January through December, 1974. Weirs were constructed in marsh drainage systems and held water levels in ponds and bayous several inches below the elevation of the adjacent marsh; however, control areas were subjected to natural tidal influences. Greater duck, coot, and non-game bird usage was found in ponds influenced by weirs, especially during low water periods occurring in the winter. Field data indicated that weirs had no measurable effects on fur bearer or small mammal populations, with the exception of swamp rabbits. Whether populations were high or low was generally independent of the influence of weirs in the areas surveyed. Survey methods most reliable were aerial bird counts and ground counts of muskrat beds and nutria trails.

INTRODUCTION

Coastal marshes, which extend across the entire coast of Louisiana, cover 4,000,000 acres (O'Neil 1949) and support very high populations of fur bearers, waterfowl, and non-game wildlife (St. Amant 1959). As a result of man's activity, these marshes have undergone tremendous modification and in many instances their wildlife productive capacity has been greatly reduced. Of particular importance are tidal marshes where canals have been dug or channels deepened, thereby causing drastic tidal fluctuation, rapid drainage, and extreme salinity fluctuation. Therefore, as a result of man's activity, it has been necessary to develop special management procedures to offset or moderate the damaging effects on marsh wildlife and wildlife habitat.

One marsh management technique often used in Louisiana coastal marshes to stabilize water levels and salinities and, at the same time, make the marshes more accessible to trappers and hunters is the construction of weirs in the drainage systems of a particular area. Weirs resemble low dams and are

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constructed so that the crest is approximately 6 inches below the level of the surrounding marsh, thus permitting water to flow freely over the structures (Chabreck and Hoffpauer 1962).

Weirs also alter the natural processes which take place in marshes and estuaries, and special studies are required to make sure that the desired objectives of a management program are reached without jeopardizing other resources. Studies along the Louisiana coast have determined the influence of weirs on water levels, water salinity, water turbidity, soil conditions, and aquatic flora and fauna (Chabreck and Hoffpauer 1962, Burleigh 1966, Chabreck 1968, Herke 1971, Wengert 1972, Hoar 1975). However, data on the influence of weirs on wildlife populations are lacking, and in January 1973 a study was initiated to gather this information. As a part of the study an evaluation was made of methodology used to sample wildlife populations in coastal marshes.

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DESCRIPTION OF THE AREA

The study area was located in Jefferson and Plaquemines Parishes in southeastern Louisiana along the northern end of Barataria Bay and about 15 miles inland from the Gulf of Mexico. Marsh soils are peats and mucks (Chabreck 1972), and the average elevation is about 1.0 foot above mean sea level. Tides enter through various passes in Barataria Bay and normal daily fluctuation is less than 2 feet. However, high tides associated with hurricanes may inundate the marshes with several feet of water; and low tides during the winter, associated with strong northerly winds, may cause water levels to drop 2 to 3 feet below the elevation of the marsh.

The study area contains marshes classified as brackish and saline (Chabreck *et al.* 1968). The southern portion of the study area was more saline and characterized by extensive stands of oystergrass (*Spartina alterniflora*). Other common species were saltgrass (*Distichlis spicata*), marshhay cordgrass (*Spartina patens*), black rush (*Juncus roemerianus*), three-cornered grass (*Scirpus olneyi*), and leafy three-square (*S. robustus*). The middle and northern sections contained brackish marshes and did not support any noticeable stands of oystergrass but were dominated by dense stands of marshhay cordgrass. Other common plants were saltgrass, three-cornered grass, leafy three-square, black rush, feathergrass (*Panicum virgatum*), and stinkweed (*Pluchea* spp.).

The most common aquatic plant on all the locations was widgeongrass (*Ruppia maritima*). Watermilfoil (*Myriophyllum* sp.) was present on certain of the southern sites, and stands of southern naiad (*Najas quadalupensis*) and pondweed (*Potomogeton* sp.) were found in the middle and northern locations.

All weirs in the study area were constructed from round timber and wooden sheet pilings pressure-treated with creosote. Weirs were placed across bayous draining the study ponds, usually where the bayous narrowed and near their discharge into a larger body of water. Louisiana Land and Exploration Company periodically added soil to the ends of the weirs in order to halt any movement of water around their ends. The weirs were constructed from 1955 to 1961. Average length of the structures was 83.9 feet with a range from 56 to 150 feet. Weir elevations were set about 6 inches below the level of the surrounding marsh, allowing water to move over the structures during normal and high tides but retaining water levels at the weir crest during low tides.

MATERIALS AND METHODS

Eighteen study sites were selected within the study area. Nine sites were influenced by weirs and nine were control areas. A control area was selected on a basis of its proximity to a particular weir area and for the similarity of a pond or lake to one in the weir area. Locations influenced by weirs were those in which one of the structures was present on a bayou draining the pond and marsh under study. Locations designated as controls were not under the influence of any type of water control structure.

Wildlife populations were inventoried behind weirs and in control areas using bird and fur bearer censuses, scat and trail counts for fur bearers, and small mammal snap-trap surveys. Field research was initiated in January, 1974, and terminated in December, 1974.

Bird censuses were conducted on the study ponds and lakes twice monthly. Censuses were made by aerial counts using light aircraft and from the ground by traversing the areas in small boats. Birds utilizing the ponds and immediate, surrounding marshes were counted and placed into two

categories, ducks and coots and non-game birds. The category, non-game birds, included only cormorants, herons, egrets, ibises, shorebirds, gulls, and terns.

Nutria *(Myocastor coypus)* and raccoon *(Procyon lotor)* night counts were initiated in April and continued through December. The counts were conducted between sunset and sunrise during the period of the new moon for the following months: April to August, October, and December. Counts were conducted over predetermined routes by traversing the areas by boat.

Active muskrat *(Ondatra zibethiens)* beds were inventoried from the ground in conjunction with a marsh vegetation study during August. Four transects were walked in the marshes surrounding the study ponds. Each transect was 500 feet in length, initiated at the shorelines of ponds or bayous, and directed perpendicularly from the pond edge. Five plots, each containing 0.2 acre, were established along each transect at intervals of 100 feet, and active muskrat beds within 43.6 feet of a transect were recorded according to plot number and its direction, right or left, from the transect dividing the plot.

Four scat counts were conducted for nutria, muskrats, swamp rabbits *(Sylvilagus aquaticus)*, and raccoons at 3-month intervals. Five line transects were established for each study location. The starting points of the line transects were within two paces of the shore of a pond or bayou and directed perpendicularly from the shoreline. Each line transect had 10 circular, one-fourth milacre plots which were established at intervals of three paces. The sampling was completed by counting all the fecal deposits existing on each plot.

Nutria and muskrats trail counts were conducted during January and December on each of the study locations. Four line transects were established per study location. Each line transect was 100 yards in length. Line transects paralleled and were located within 10 yards of the shorelines of ponds or bayous associated with the study location. Transect lines were at least twenty yards apart and all active trails crossing the transects were recorded.

A survey of small mammals was made on four of the study locations in December. Four line transects were established on each location. Each line transect started at the edge of the study pond and was directed perpendicularly from the shoreline into the marsh. Trap-sites were established at intervals of three paces on each line transect. A snap-trap (Woodstream Museum Special) baited with peanut butter and oatmeal, was set at each site. Each study location was trapped two successive nights.

All data were collected in the field from January through December, 1974, and were statistically analyzed to determine any difference between areas influenced by weirs and control areas, among sections, among pond sizes, and according to seasons. The data were analyzed using the following tests: Analysis of variance and LSD (least significant difference) as described by Steel and Torrie (1960).

RESULTS AND DISCUSSION

Wildlife Usage

Duck and coot usage.

A total of 2154 ducks and coots were counted on the study pond during the 12 months, which was an average of 0.4 ducks and coots per acre. Ponds influenced by weirs contained 75.0 percent of all ducks and coots counted during the study (Fig. 1). The greatest number of ducks were present during December and February, and ponds influenced by weirs contained approximately four times more ducks and coots per acre than the controls during these two months ($P < .05$). No difference ($P > .05$) was found between treatments during the remaining 10 months.

Water levels were extremely low during the winter months. North winds had forced water out of the ponds, lakes and bayous, leaving extensive tracts of exposed mudflats along the shorelines and completely draining the shallowest ponds. Water levels in areas influenced by weirs receded only to the levels of the weir crests; consequently, they were higher than the controls. This situation was often characterized by the absence of any noticeable movement of water over the structures. During the winter months, adequate water was not available for feeding and resting of duck and coots. As a result of the retention of water by weirs, ducks and coots utilized ponds under the influence of weirs to a greater extent. Once the effects of the north winds diminished, water levels gradually returned to normal in all areas, and ducks and coots again dispersed more equally over both types of ponds.

In coastal Louisiana ducks and coots are present mainly during the fall and winter, except for Mottled Ducks *(Anas fulvigula)* (St. Amant 1959). Mottled Ducks breed throughout these marshes along the Gulf Coast and are considered permanent residents (Lowery 1974a).

Ten migratory species were identified from January to April and September to December: Mallard *(Anas platyrhyncos)*, Gadwall *(A. strepera)*, Northern Pintail *(A. acutus)*, Green-winged Teal *(A.*

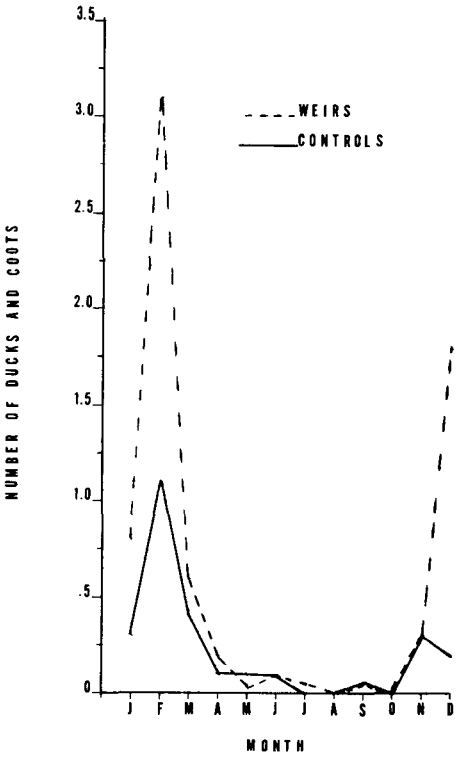

Figure 1. Number of Ducks and Coots Per Acre for Locations Influenced by Weirs and Controls, Jefferson and Plaquemines Parishes, 1974.

crecca), Blue-winged Teal *(A. discors)*, Northern Shoveler *(A. clypeata)*, American Wigeon *(A. americana)*, Lesser Scaup *(Aythya affinis)*, Red-breasted Merganser *(Mergus serrator)*, and American Coot *(Fulica americana)*.

Migratory species made up 92.7 percent of the total 2154 ducks and coots observed on the study ponds; consequently, seasonal differences ($P < .05$) were found in the numbers present. January, February, and December accounted for 74.0 percent of the total ducks and coots observed. Numbers of ducks and coots began to decline sharply in March and remained low until November. The period from April through October accounted for only 6.3 percent of the ducks and coots observed. Mottled Ducks were the only species observed from May through August.

Non-game bird usage.

This segment of the investigation was designed to measure non-game bird use of ponds and lakes influenced by weirs in comparison with their use of similar control areas nearby. Included in the non-game bird classification were only wading birds, shorebirds, gulls, terns and similar groups.

The abundance of non-game birds was measured using both aerial and ground counts. A total of 1976 birds were counted on the study ponds, which was an average density of 0.5 birds per acre. Many non-game birds found in the study area were migrants and were mostly present during the winter season. As a result, seasonal differences were noted in non-game bird populations ($P < .01$). Although bird populations fluctuated during the year, bird usage of ponds influenced by weirs and control areas remained fairly equal ($P < .05$). Increases or decreases in the number of birds in one area usually meant a corresponding change in the other.

Only during the month of December did areas influenced by weirs have more ($P < .05$) non-game birds than control areas (Fig. 2). Weir ponds contained 2.2 birds per acre and the controls 1.7 birds per acre.

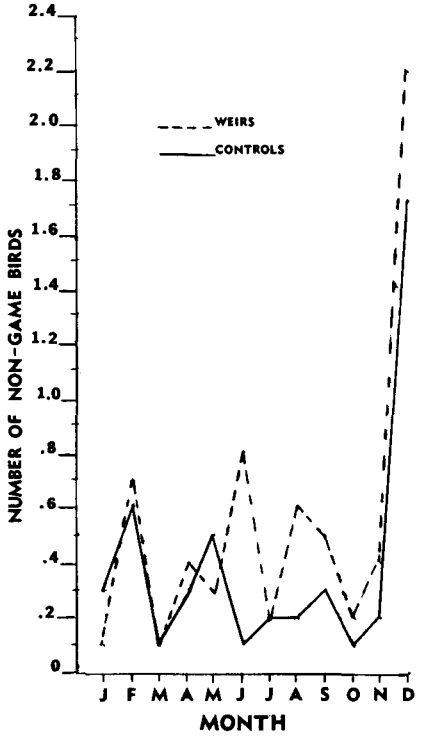

Figure 2. Number of Non-Game Birds Per Acre for Locations Influenced by Weirs and Controls, Jefferson and Plaquemines Parishes.

During the two periods of censusing in December, water levels were extremely low. North winds had forced water from the ponds and bayous, completely removing water from the more shallow areas. Water levels influenced by weirs remained higher than those in control areas. As water levels dropped, ponds became pools, many pools completely drained, and water flow in the smaller bayous often stopped, forming long, shallow basins. These situations concentrated many of the food organisms, such as killifish (*Fundulus* spp.), sheepshead minnow (*Cyprinodon variegatus*), mosquitofish (*Gambusia affinis*), sailfin molly (*Poecilia latipinna*), blue crabs (*Callinectus sapidus*), and shrimp (*Penaeus* spp. and *Palaemonetes* spp.) which are important food sources of most of the non-game birds censused during the study. As a result of the retention of water, areas under the influence of weirs had more suitable feeding areas at the time of the December censuses.

Probably during the early stages of the norther, water levels were first lowered in free-flowing marshes. These control areas were the first to have pools concentrating food organisms utilized by the gulls, terns, egrets, herons, and other non-game birds. As the lowering effect continued, depending on the intensity of the north winds, the food supply in the pools on control areas was depleted or the pools were completely drained. At that time, water levels had fallen sufficiently in areas influenced by weirs to concentrate food organisms in small pools, and the birds were attracted to these areas. Thus, usage by non-game birds may have been dependent upon suitable feeding areas which were directly affected by the intensity and duration of the norther.

Muskrat usage.

Based on the surveys of muskrat beds and scat counts, weirs seemed to have little impact on muskrat abundance. High and low concentrations of muskrats were found in marshes influenced by weirs as well as nearby control areas.

The surveys showed no differences ($P > .05$) between marshes affected by weirs and control areas in the number of active beds or scat deposits during the surveys. Weir areas contained 52.5 percent of the 37 beds observed; however, during the scat counts, 57.4 percent of the scats came from control areas.

Nutria usage.

A total of 54 nutria were recorded during seven night counts, for an average of 0.2 individuals per 2000 feet of shoreline. Scat counts were conducted by establishing ½ milacre plots on transects in the marshes and recording all nutria scats within the plots. A total of 515 nutria scats were counted during four surveys. Trail counts were made in January and December by establishing transects bordering the shorelines of ponds and bayous and recording all trails which intersected the transects. These trails were used mostly by nutria; however, muskrats, raccoons, mink *(Mustela vison)*, and river otter *(Lutra canadensis)* frequently used them also, but to a much lesser extent. A total of 468 trails were counted.

Significant differences ($P < .01$) in the number of trails were found between lands affected by weirs and control areas. During the January trail survey, 67.3 percent of the trails were seen on control areas, but marshes affected by weirs accounted for 55.1 percent of the trails counted during December.

Water levels were higher in marsh behind weirs during January. As a result, trails on control areas were easier to identify, because the water level of the ponds and bayous was below the vegetation line. Thus, the accuracy of the January data is questionable. Water levels were more uniform during the December trail counts and should have more accurately indicated the actual differences.

Marshes affected by weirs accounted for 60.0 percent of the nutria counted during night counts; however, this difference was not statistically significant ($P > .05$).

Weirs had little impact on nutria populations based on scat surveys. No difference ($P > .05$) was found in the number of nutria droppings in marshes influenced by weirs and control areas, although marshes on control areas contained slightly more nutria scats on study plots.

Swamp rabbit usage.

Utilization of marshes influenced by weirs and control areas by swamp rabbits was measured using scat surveys. During the four surveys, a total of 1093 rabbit scats or pellets were counted. More ($P < .05$) rabbit scats were found on lands influenced by weirs in the Feburary-March survey; however, the other three survey periods did not indicate a difference ($P > .05$) between areas. During all counts except the one during the November-December period, marshes affected by weirs contained more scats (Fig. 3). Marshes influenced by these structures accounted for 77.4 percent of the total scats counted.

General analysis of marsh conditions indicated similarity between the two types of study areas as to food and cover. Since these structures moderated water level fluctuations in marshes, areas affected by weirs may not have had excessive flooding. Flooded conditions have often forced rabbits temporarily from otherwise suitable habitats, sometimes even destroying nests (Lowery 1974b).

Marshes were flooded during the June and August surveys and prior to the November-December survey. Chabreck (1968) noted that yearly tidal levels along the Central Louisiana coast were highest from April to November. The back-and-forth movement of water over marshes and high temperatures which removed or helped disintegrate many fecal deposits, were probably responsible for the low figures in the June, August, and November-December pellet surveys.

Small mammal usage.

Weirs had no noticeable effect on small mammal populations. The rice rat *(Oryzomys palustris)* was the only species captured during the trapping survey, and populations of rice rats were similar in marshes affected by weirs to those in control areas. An equal number of traps was used in each area, and marshes influenced by weirs accounted for 55.0 percent of the 20 animals captured; however, the difference between areas was not significant ($P > .05$).

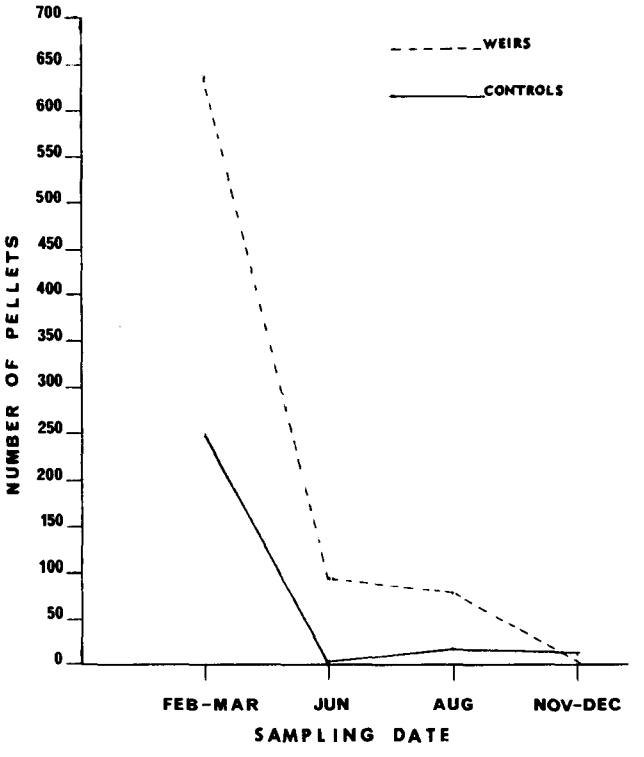

Figure 3. Number of Swamp Rabbit Fecal Pellets on Plots on Locations Influenced by Weirs and Controls, Jefferson and Plaquemines Parishes, 1974.

Other wildlife usage.

Night counts were made behind weirs and in control areas to compare population levels of other wildlife species such as raccoon, mink, river otter, and American alligator *(Alligator missippiensis)*. The number of animals observed during these counts was too low to accurately determine differences between the two treatments.

SUMMARY AND CONCLUSIONS

Low water levels, resulting from strong northerly winds, commonly occurred during the winter months and often completely drained many of the shallower ponds in the study area. Weirs placed across tidal channels inhibited this loss of water at low tides, and water levels in ponds or bayous influenced by the structures could recede only to the weir crests. During the winter, more ducks, coots, and non-game birds utilized wetlands affected by weirs when water levels on control areas were unsuitable as feeding and resting areas.

Information gathered during the study regarding the muskrat, nutria, raccoon, and small mammals indicated that populations in marsh affected by weirs were not different from those of control areas. Populations in the study area were usually high or low independent of the influence of weirs. Significantly higher swamp rabbit usage was noted during certain periods in marsh affected by weirs.

The aerial and ground counts of ducks, coots, and non-game birds, the ground inventory of active muskrat beds, and the small mammal snap-trap survey provided accurate data for estimating relative abundance. However, relative abundance could not be accurately determined from the scat and trail surveys or night counts for selected fur bearers.

An important aspect of weirs was the permanent basin of water held by the structures during low tides. In the several instances where wildlife was more abundant in areas influenced by weirs, the availability of water appeared to be a key factor. The permanent water also aids trappers and hunters by providing all-weather access to areas behind weirs. During this study, we were unable to reach certain sampling stations by boat because of low tides. However, where minimum water levels were established by weirs, the sampling stations could be reached at all times.

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