DISTRIBUTION AND RELATIVE ABUNDANCE OF BLUE CATFISH, *Ictalurus furcatus*, AND CHANNEL CATFISH, *Ictalurus punctatus*, WITH RELATION TO SALINITY

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ABSTRACT

A study was conducted with blue and channel catfish to determine the effect of salinity upon distribution in a tidal bayou complex on Rockefeller Refuge, Grand Chenier, Louisiana.

Stations were spaced at locations from the Gulf of Mexico to Grand Lake, a large freshwater body of water which is apparently quite productive of blue and channel catfish. Collections were made primarily with an otter trawl towed for 10-minute intervals at each sampling station. Hoop nets, wire traps, trammel nets, trot lines and rotenone were used to verify trawling results.

Distributional data indicated that a 2:1 ratio existed between blue and channel catfish and that they are more abundant in waters with average salinities of 3.7 and 1.7 ppt, respectively. However, both species were collected from waters with salinities ranging up to 11.4 ppt.

INTRODUCTION

The increase in fish farming in hatcheries and impoundments in Louisiana indicates that channel catfish, *Ictalurus punctatus*, and blue catfish, *I. furcatus*, are desirable species to grow as food fish. Commercial fishing alone cannot satisfy the rising demand for catfish as food.

Several states including Arkansas, Alabama, Texas, Georgia, Florida, Oklahoma, Kansas, Missouri, Mississippi, California and Louisiana are conducting management research with catfish. Thousands of pages have been written pursuant to feeding requirements, reproductive needs, parasites, transport and harvest of blue and channel catfish. However, only a few papers have been prepared involving the ecology of the species and among these are only limited accounts of Ictalurid collections in brackish water.

Mather (1881) reported that animals with soft skins are easily affected when changed from fresh to salt water. Frogs die soon, and as they breathe by means of lungs, it follows that it is entirely from osmosis, or absorption by the skin. He states that probably catfish (*Ictaluridae*) would not stand the change as well although there are two marine species (*Galeichthys felis* and *Bagre marinus*) on the coast.

Gunter (1945) took blue catfish in extremely limited numbers from Texas bays. He recorded one specimen taken in water containing 6.3 ppt salinity. Blue catfish were collected by Rounsefell (1964) in waters with salinities of 6.5 ppt.

In a taxonomic survey of the fishes of the Delta National Wildlife Refuge, Kelly (1965) collected 193 specimens from estuarine waters. He concluded that salinity appeared to be a limiting factor on distribution when a concentration of 2.0 ppt was reached. Kelly and Carver (1965) reported that all specimens of blue catfish collected for an age and growth study were taken from waters having salinities less than 7.0 ppt; most individuals were taken in waters having salinities of 0.8 to 2.0 ppt.

[1] This paper is based in part on a thesis presented for partial fulfillment of requirements for the degree of Master of Science while Graduate Assistant, Louisiana Cooperative Fishery Unit, Louisiana State University, Baton Rouge, Louisiana.

Bayless and Smith (1962) reported the absence of channel catfish in the brackish waters of the Neuse River. Kelly (1965) stated that the occurrence of the species on the Delta Refuge was rare. His data indicates that only one specimen 13.0 inches total length was captured in 1.03 ppt salinity.

Fish culture in coastal impoundments of Louisiana is fast gaining in importance. This project was conducted as a pilot experiment for future studies in brackish water pond culture which are presently under way at Rockefeller Wildlife Refuge of the Louisiana Wild Life and Fisheries Commission, Grand Chenier, Louisiana.

DESCRIPTION OF STUDY AREA

Sampling stations were established March, 1965, in a tidal bayou on Rockefeller Wildlife Refuge, Grand Chenier, Louisiana.

Rockefeller Wildlife Refuge comprises 85,000 acres of marshland located in the southeast corner of Cameron Parish and southwest corner of Vermilion Parish (Figure 1). The refuge is situated between 26.5 miles of Gulf shoreline and the Grand Chenier-Pecan Island beach ridge complex.

The Rockefeller marsh, resulting from an ancient change in the course of the Mississippi River, has an average elevation of 1.1 feet above sea level. Tidewater enters the refuge through five separate channels. The average tidal fluctuation is approximately one foot.

Cameron Parish has an average annual precipitation of 52.91 inches. The statewide average is 55.45 inches. July and September are the months of maximum rainfall with approximately eight and seven inches, respectively. The minimum months are November and January which average two and one-half inches. Cameron Parish has a mean temperature of 68.2 degrees, compared to the state average of 67.4 degrees. The warmest month is July, and January is the coldest (Nichols, 1959).

MATERIALS AND METHODS

The sample stations were established in a tidal bayou from the Gulf of Mexico to Grand Lake, a large freshwater lake. This complex is made up of both natural bayous and artificially constructed canals. The study canals were approximately 50 feet wide and 23.5 miles long. Water in the study areas was brackish with salinities ranging from 0.18 ppt to 35.9 ppt. The depth varied from seven to 12 feet. Turbid waters were frequently present in the area. Secchi disk readings ranged from two to 13 inches. The canal bottoms were high in organic matter and free of rooted vegetation.

Research for this study was initiated with the establishment of nine sampling stations (Figure 2) on March 11, 1965, and terminated February 26, 1966. Sample stations were placed in areas that possessed relatively low, medium, and high salinity ranges. Station 1 was located at the entrance of Joseph Harbor Bayou into the Gulf of Mexico. This station had the highest individual salinity reading, 35.9 ppt, and an average of 23.1 ppt. The location of Station 2 was 1.8 miles from the Gulf near the entrance of Humble Canal into Joseph Harbor Bayou with an average salinity of 23.3 ppt. Station 3 is located 3.6 miles from the Gulf on the Humble Canal. This station was placed at the junction of Deep Lake Canal and had an average salinity of 16.5 ppt. This was the station nearest the Gulf of Mexico at which freshwater catfish were collected. The intersection of Headquarters Canal and Humble Canal marked Station 4, 6.2 miles from the Gulf. The salinity average was 13.6 ppt. Station 5, 7.1 miles from the Gulf, was located on the upstream side of the East End Locks in the Property Line Canal. The purpose of the structure was to prevent salt water intrusion in the fresh marsh and to provide drainage and consequently was closed most of the summer and early fall. The average salinity for Station 5 was 5.2 ppt. Station 6, with an average salinity of 6.0 ppt, was 10.5 miles from the Gulf. The last station on the refuge, Station 7, was located three miles from Station 6 and had an average salinity of

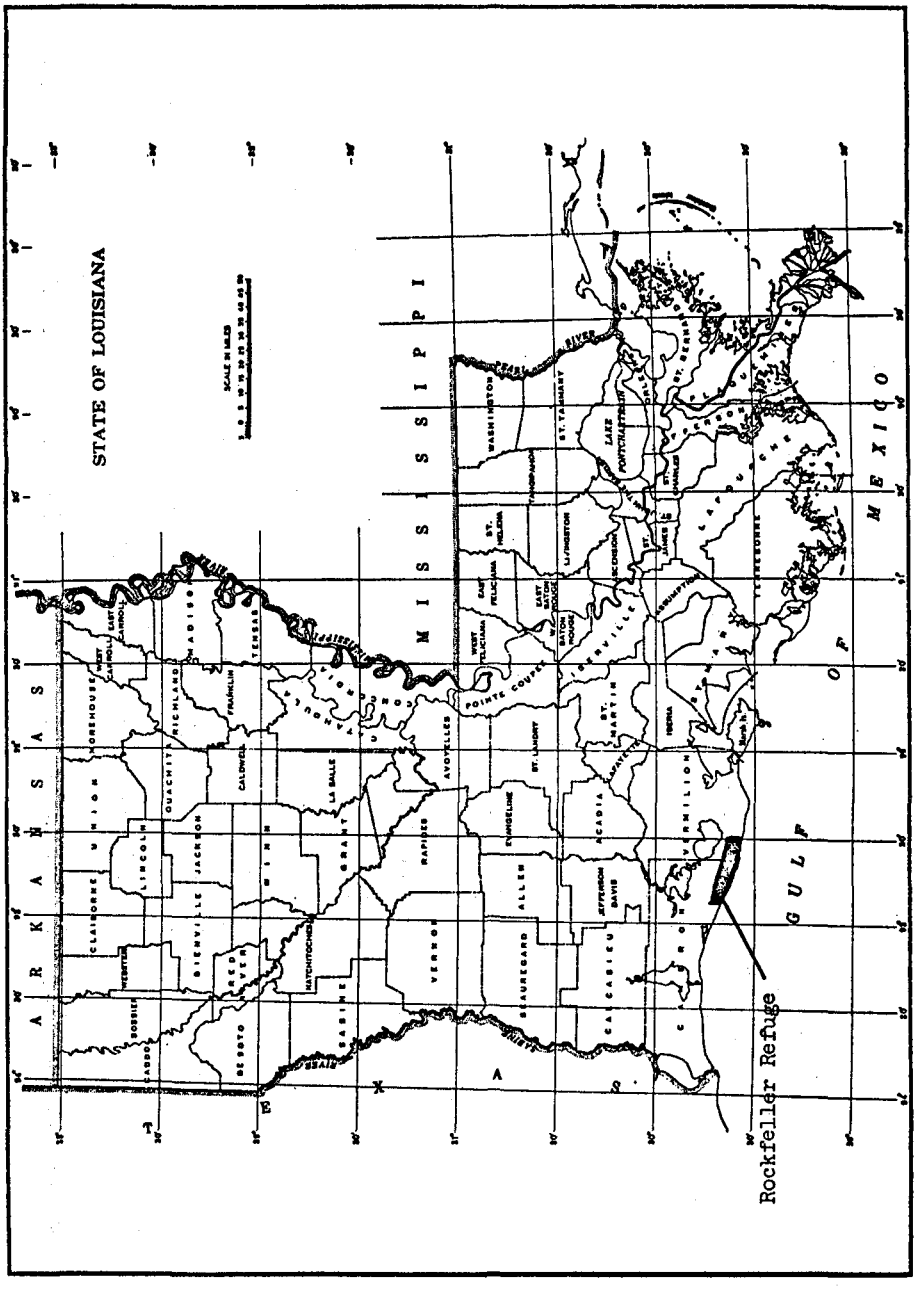

Figure 1. Rockefeller Wildlife Refuge, Grand Chenier, Louisiana

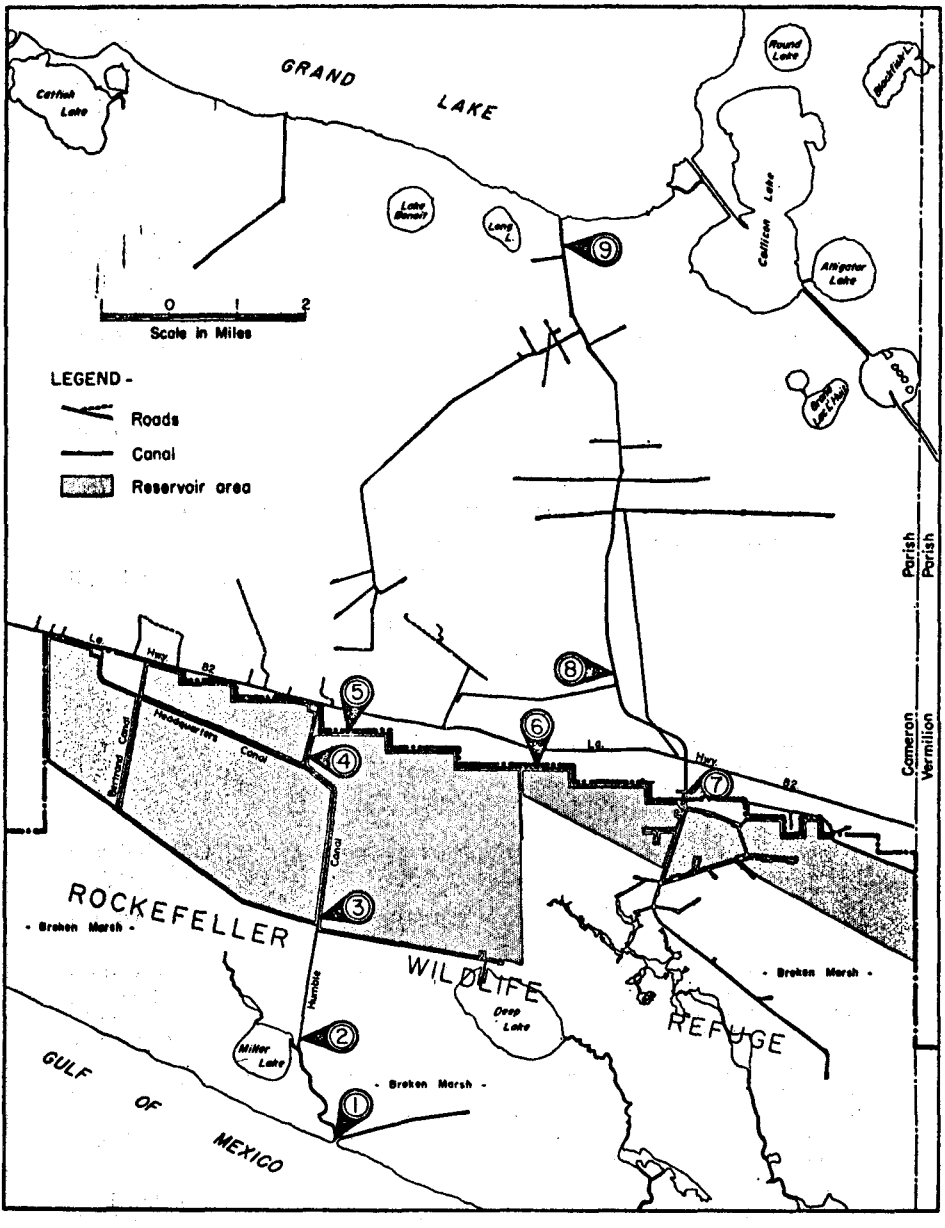

Figure 2. Location of sampling stations, Rockefeller Refuge.

3.7 ppt. Station 8 was placed at the junction of Pan Am and Superior Canals. The average salinity was 3.5 ppt. The last sampling station, Station 9, was at the entrance of Superior Canal into Grand Lake, approximately 23.5 miles from the Gulf. This station had an average salinity of 1.7 ppt.

From March to August, 1965, a Solu Bridge Model RB2-3341 conductivity and temperature meter was used to determine salinity.

For the remainder of the study salinity determinations were made by the Mohr Method (American Public Health Association, 1960).

Gear used to capture catfish included hoop nets, wire traps, trammel nets, trot lines, rotenone and otter trawl. A 16-foot, one-half-inch bar mesh otter trawl towed with 80-foot manila ropes from 10 minutes at each station (approximately one-fourth mile) demonstrated least selectivity among gears used. Sampling was conducted monthly at established stations. The nylon trammel nets used had 10-inch (bar measure) mesh outer walls and a one-inch (bar measure) inner wall. The nets were four feet deep and 50 feet in length. One-inch mesh hoop nets with 18-inch wooden hoops and wire traps constructed of one-inch mesh galvanized wire, were fished along the sampling complex. Rotenone at a concentration of 1 ppm was applied to verify netting results.

Species taken were identified by characters described by Eddy (1957), Moore (1957) and the author. Separating features used were:

1. Blue Catfish — Anal fin with 30 or more rays
   —Maxillary barbel short, not reaching to gill opening
   — eye in anterior part of head
   — three lobed air bladder; appears as two
2. Channel catfish — Anal fin with 20-29 rays
   — maxillary barbel long, reaching beyond gill opening
   — eye in center of head
   — air bladder two lobed; appears as one

RESULTS AND DISCUSSION

Physiological and toxic effects of saline water on freshwater fish have been studied by many workers. Lethal effects may be the result of osmotic pressure rather than the specific toxicity of individual components of the solution.

The abundance of blue catfish in areas north of Station 7 indicate that this species is more abundant in waters with average salinities of 3.7 ppt and lower (Tables I and II). However, one of the 689 blue catfish (305 grams) collected during this study was in an area with a salinity of 11.4 ppt.

Salinity seemed to be the limiting factor on channel catfish in waters with monthly salinities ranging above 1.7 ppt. Of the 338 channel catfish collected, four were obtained from a rotenone sample in an area with a salinity of 11.4 ppt. The sizes ranged from 125 grams to 1.4 pounds.

Both species were observed ranging further downstream in January and February. The salinities at the point of collection had dropped drastically (22.4 ppt December to 1.6 ppt February) as a result of heavy rains. Thus, it seems that the catfish were following the freshwater as the salt water was pushed back.

Rotenone samples of an impoundment taken in June revealed both blue and channel catfish present. Most of the nine channel catfish collected were heavy with eggs. The weights of the catfish ranged from 0.8 to 10.0 pounds. Two blue catfish were collected which weighed 25.5 pounds and 70 grams. The 25.5-pound fish was a male. This 80-acre impoundment often has salinities ranging in excess of 6 ppt. However, the salinity was 4.3 ppt when the fore mentioned sample was taken.

The linear regression calculated for numbers of channel and blue catfish and the salinity at which they were taken from 10-minute trawl samples is represented in Figure 3.

TABLE 1 — MONTHLY SALINITIES (PPT.) OCCURRING AT NINE SAMPLING STATIONS IN JOSEPH HARBOR BAYOU-GRAND LAKE TIDAL BAYOU COMPLEX, ROCKEFELLER REFUGE, 1965 TO 1966.

Month	I	II	III	IV	V	VI	VII	VIII	IX
May	4.3	4.6	5.2	5.0	4.9	7.1	3.3	4.4	0.8
June	19.0	18.8	16.0	17.2	6.8	6.9	6.0	5.7	4.4
July	29.8	29.1	21.3	17.2	6.7	8.4	3.2	2.4	2.0
August	22.8	26.2	17.4	19.9	2.2	2.7	0.9	0.7	1.8
September	16.4	19.6	22.2	11.0	5.9	5.7	3.0	3.1	1.3
October	28.3	30.9	26.0	26.3	6.8	6.4	4.3	5.1	1.6
November	29.4	28.9	21.8	22.1	9.4	11.0	6.5	5.2	1.2
December	27.3	22.5	26.1	14.3	7.0	7.8	7.5	5.0	1.2
January	35.9	35.5	3.8	1.7	1.3	1.4	0.9	1.4	1.7
February	17.6	16.7	5.0	1.3	1.4	2.2	1.0	1.6	1.2
Average	23.1	23.3	16.5	13.6	5.2	6.0	3.7	3.5	1.7

TABLE 2 — PERCENTAGE OF BLUE AND CHANNEL CATFISH COLLECTED AT EACH SAMPLING STATION IN JOSEPH HARBOR BAYOU-GRAND LAKE TIDAL BAYOU COMPLEX, ROCKEFELLER REFUGE, 1965 TO 1966.

Species	Stations								
	I	II	III	IV	V	VI	VII	VIII	IX
Ictalurus furcatus	0.0	0.4	6.0	11.7	5.4	10.0	20.1	19.6	26.8
Ictalurus punctatus	0.0	0.0	0.0	0.0	5.1	2.6	17.8	28.2	46.3
Monthly salinity ppt. (see Table I)									
Low	4.3	4.6	3.8	1.3	1.3	1.4	0.9	0.7	0.8
High	35.9	35.5	26.1	26.3	9.4	11.0	7.5	5.7	4.4
Average	23.1	23.3	16.5	13.6	5.2	6.0	3.7	3.5	1.7

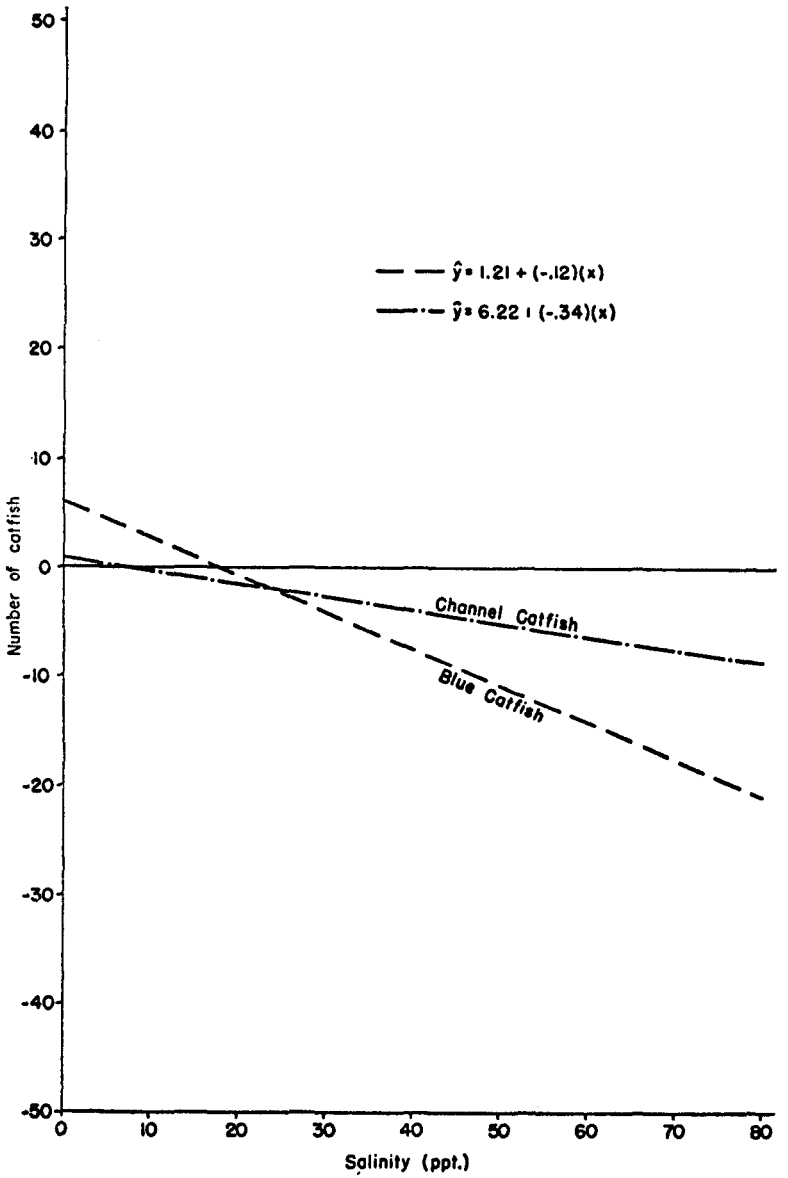

Figure 3. Distribution of channel and blue catfish with salinity.

SUMMARY

Rockefeller Wildlife Refuge is an humid, temperate area characterized by waters of moderate salinity and very high turbidity, although considerable variations in these factors were frequent.

Data collected from monthly samples indicate that blue catfish were more abundant in waters with salinities of 3.7 ppt and below. Channel catfish were more abundant in habitats having sea-water concentrations less than 1.7 ppt. However, a 2:1 ratio existed between blue and channel catfish and they were found in waters with salinities ranging up to 11.4 ppt.

This study, like most others, involves the observation of one stage of the life cycle. There is a definite need for further studies on the effect of salinity upon the commercially important catfish. Laboratory bioassey methods should be used along with field observations to determine effects on eggs, fry, fingerlings, and adult catfish.

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