

SEGMENT COMPLETION REPORT

As required by

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TEXAS

Federal Aid Project No. F-3-R-18

Region III-B Fisheries Studies

Job No. 16 Thermal Study in Wilkes Reservoir

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ABSTRACT

Permanent collecting stations were designated within Wilkes Reservoir to gather information relative to the effects of a steam-electric effluent upon aquatic life. A total of 211 fish consisting of 11 species were collected within Wilkes Reservoir and exhibited a parasite infection percentage of 65.34%. Almost 59% of 161 game fish and almost 83% of 50 rough fish were parasitized. Trematodes and lesser concentrations of Nematodes, Cestodes, Acanthocephalans, and parasitic Copepods were encountered during examination of these fish. Plankton volume, composed mainly of Copepods was greater in the warmer water. Plankton abundance within the entire reservoir was greater during the colder months of the year. Chemical water quality did not undergo any significant changes. Parasitic Copepods were more evident on bullhead catfish, Ictalurus sp. during February, March, and April. There did not appear to be any seasonal fluctuation of parasitization rates, or degree of infection with other parasites encountered. Fish moved into water with a surface temperature of 107° F., but specimens netted in this water had high mortality rates.

SEGMENT COMPLETION REPORT

State Texas Name: Region III-B Fisheries Studies
Project No. F-3-R-18 Title: Thermal Study in Wilkes Reservoir
Job No. 16
Period Covered: February 1, 1970 through January 31, 1971

OBJECTIVES:

P.S.: To determine the effects of steam-electric effluent on aquatic life in Wilkes Reservoir.

- Segment:
1. To monitor chemical water quality and temperatures at selected stations within the reservoir.
 2. To record fish population movements in relation to oxygen and temperature fluctuations or variance.
 3. To identify fish parasites and correlate parasite incidence and life cycles with water quality.

TECHNIQUES:

Five permanent collecting stations were selected within Wilkes Reservoir coincident with temperature monitoring stations of Southwestern Electric Power Company. Station No. 1 was 200 yards from the mouth of the discharge canal. The remaining four stations were equally spaced throughout the reservoir to the intake point. Three permanent seine sample stations were set up to sample reproduction, growth, and parasite incidence among fish species in year class 0. Station No. 1 was at the discharge canal; No. 2 was in a cove area midway down the lake; and No. 3 was past the intake point at the far end of the lake. Fish collected were examined in the field for external parasites, then taken to the laboratory. In the laboratory, fish specimens were weighed and measured to obtain coefficient-of-condition, then examined for internal parasites.

Dissolved oxygen and temperature analysis was made at each sampling station with a YSI model 51A oxygen meter. Readings were taken at the surface, 2 feet, 5 feet, 10 feet, 12 feet and then in 5-foot increments to the bottom. These readings were profiled on a data sheet in order to determine the distribution and influence of the heated water.

Plankton samples were taken at the collection stations with a plankton towing net. Two 15-foot samples were taken at each station. These samples were placed in formalin, taken to the laboratory where a volume measurement was done on each sample collected. This measurement was converted into a millileter per cubic foot figure. Plankton samples were checked for species composition. This was done to possibly correlate water temperature with plankton abundance.

Chemical water analysis was conducted at each station during collecting trips. Three samples were collected from each station; a surface sample, a sample from 15 feet, and a bottom sample. These samples were taken to the laboratory where the analysis was conducted using a Hatch portable DR EL chemistry kit. Water analysis was conducted for pH, turbidity, sulfate, alkalinity, hardness, and chlorides.

Specially designed gill nets were prepared for obtaining fish specimens at the collection stations. These nets measured 75 feet in length; 25 feet of 3-inch mesh, 25 feet of 2-inch mesh, 25 feet of 1-inch mesh, and were 24 feet deep. Standard experimental gill nets were also used. These were 150 feet in length and composed of 25 feet of 1-inch mesh progressing in 25-foot increments to 3-1/2-inch mesh.

FINDINGS:

Six netting collections were made during this segment. Two special 75-foot nets were used together with three standard experimental gill nets. On occasions, only the special nets were used over a two-night period. A total of 211 fish were collected by gill net and seine sampling. One hundred and sixty-one of these were game fish, and 50 were non-game fish.

The largemouth bass, Micropterus salmoides, was one of the more dominant species of game fish collected. The largemouth bass had a parasite incidence percentage of 56.25 from 32 fish examined. The average K-factor for 24 largemouth bass was 2.18. The K-factor figure was lower than K-factor figures obtained from largemouth bass in 1969, from Sam Rayburn Reservoir, Dam "B", Lake Livingston, Lake Murvaul, Lake Palestine, and Caddo Lake. K-factor data on other game fish collected during the same periods was generally average.

Game fish reproduction as reflected by seining samples was good. Game fish fry did not show up earlier than other area lakes not affected by a warm water effluent. The initial growth rates for year class 0 largemouth bass, however, seems to be better than samples collected from Lake O' the Pines during the same period.

Of the 129 game fish examined for parasites, 86 or 66.66 per cent, were infected by at least one type of parasite. Most of these parasites were Trematodes, with lesser amounts of Nematodes and Cestodes. Metacercaria of Trematodes were found in internal organs (liver especially), mesenteries, beneath the skin, and in the musculature. Nematodes were found within the body cavity; Cestodes in the intestines. Some Acanthocephalans were found in the intestines of largemouth bass fingerlings.

Eight channel catfish, Ictalurus punctatus, were collected, and all eight were infected with either Trematodes, or Trematodes and Nematodes. The most heavily infected had the lower K-factors; 1.44, 1.58 and 1.84. Fish with higher K-factors, 2.18 and 2.42, were not as heavily infected.

Fifty rough fish specimens were collected, with examinations conducted on 47. The dominant rough fish species have been the yellow bullhead, Ictalurus natalis, and black bullhead, Ictalurus melas. Yellow bullhead and black bullhead were parasitized at the rate of 85.71 and 92.31 per cent respectively. During February, March, and April, nearly all bullheads examined were infected with Argulus sp. During the summer months and fall months only a small number of bullheads were infected with this parasitic copepod.

In August, standard experimental gill nets were set at stations No. 1, No. 3, and No. 5. The two specially built nets were set at station No. 2 and station No. 4. Surface temperature at station No. 1 was 42° C (107.6° F.) and progressively declined to 37.5° C. (99.5° F.) at station No. 5. A total of 68 fish were taken from station No. 1 (34 of them were dead).

Plankton samples were taken February, April, June, August, October, November, and January. Two samples were taken from each station, both from a depth of 15 feet. Fifteen feet was chosen because normal lake temperatures were usually present at this level. It was thought that a representative sample of plankton could be obtained for comparison of the five stations. In August the volume of plankton had declined considerably, so one sample was taken from 15 feet, the other sample was taken from the bottom. There was no appreciable increase in plankton volume so it was assumed the plankton had not moved to cooler water, but had declined in the entire lake.

Station No. 1 had a much greater volume of plankton during February, April, and June. All stations approached equalization during August, October and November. There was an increase of plankton volume at all stations during January, with station No. 1 having a slightly higher volume.

The bulk of the plankton was composed of copepods. A small volume of phytoplankton was present, but no attempt to measure its volume alone was made. The phytoplankton was composed mainly of diatoms. Wilkes Reservoir is exceptionally clear. This clearness of water could possibly be linked to the preponderance of clear zooplankton organisms and small number of the colored phytoplankton.

During February the heated water was noticeable to a depth of 10 feet at station No. 1, and 5 feet at station No. 2. There was no noticeable effect of the heated water at station No. 4 and No. 5. Relative vertical temperature variances correlate with nearby Lake O' the Pines - only the mean in Wilkes Reservoir is higher than the mean in Lake O' the Pines. Dissolved oxygen was inversely proportional to the heated water with the lower readings at station No. 1, then progressively increasing to the last station.

During April, May and June, the extent of the heated water slowly spread through the reservoir. In August, temperature readings exceeding 100° F. were taken throughout the reservoir to a depth of 10 feet. Surface temperature at the first two stations was 107.6° F. - discharge canal reading was approximately 116° F. Dissolved oxygen in the discharge canal was 7.8 ppm. Dissolved oxygen was acceptable to a depth of between 15 and 20 feet. The most noticeable drop in temperature was between 5 and 10 feet at the first three stations, dropping almost 1 degree centigrade per foot of depth.

Chemical water analysis underwent no significant changes during the project segment. There was slight stratification of water quality during the month of August. The lake level had also dropped approximately 4 vertical feet during August as a result of increased evaporation of the heated water.

Circulation of water in the reservoir is very noticeable. Two units in operation now have four water pumps with a combined pumping capacity of 214,000 gallons per minute.

CONCLUSIONS AND RECOMMENDATIONS:

The specially built nets caught a large number of bullhead catfish, but did not give a large enough sample of the different species within the reservoir. Use of the standard experimental gill nets was then employed to increase the number of fish for parasite identification.

The majority of parasitized fish were infected with Trematodes. Lesser amounts of Cestodes, Nematodes, Acanthocephalans, and parasitic copepods were present. Hundreds of metacercaria were present in the more heavily infected specimens.

Heavily parasitized fish were adversely affected in that they had lower coefficients of condition.

Numerous water birds, mainly kingfishers and herons, frequent Wilkes Reservoir and are hosts within the life cycle of most parasites encountered.

Heavier and more frequent infestation of parasites were in part attributed to an ample supply of intermediate and final hosts, and more near optimum temperatures present in the reservoir for long periods of the year.

The volume of copepods is high, especially during colder periods of the year. Chemical water quality differences were insignificant except for a slight stratification of water quality during August. Dissolved oxygen remained at acceptable concentrations within the hotter water. Surface evaporation during the warm months of the year is very high.

Seining samples revealed a preference by fingerling largemouth bass and sunfish for very shallow areas that were much cooler and evidently not affected by the heated water. This was noticed during August when water temperatures were at the maximum. During colder months there is a definite movement of fish into the warmer water at the discharge canal.

Fish within Wilkes Reservoir moved into water with a surface temperature of 107°F, but evidently cannot stay for an extended period of time as reflected by high mortality of netted specimens.

It is recommended that this job be continued to provide additional time for preparation of the final report.

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