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I. Introduction.

On June 1, 1968, faculty and student personnel from the Division of Biological Sciences at Little Rock University began preparations necessary for conducting the Dardanelle Reservoir Illinois Bayou Embayment Background Survey for the Arkansas Power & Light Company hereinafter designated as AP & L. This survey is intended to supply AP & L with data concerning the environmental influence exerted on the water of Dardanelle Reservoir resulting from its utilization as a coolant in a proposed 850 MW nuclear generating facility. The stated purpose of the project is to establish a program for testing and reporting on temperatures, biological conditions, chemical conditions, and radiological conditions in those sections of the reservoir that might be influenced by the Russellville Nuclear Unit. The survey began approximately five years prior to plant operations and will continue five years past the activation of the unit. Assistance and guidance was given to Little Rock University personnel by the AP & L Production Department, U. S. Geological Survey, U. S. Army Corps of Engineers, U. S. Coast Guard, Arkansas Pollution Control Commission, Arkansas Game and Fish Commission, Arkansas State Department of Health, U. S. Department of Interior Bureau of Fish and and Wildlife, and Dr. Joe Nix of Ouachita Baptist University. The survey consists of four phases: thermal, chemical, biological, and radiological surveys.

II. Procedures.

A. *Site Locations.* The sites for sampling were established from a grid network determined by AP & L. Sites on specified line transects are located 500 feet, 800 yards, and 1800 yards from the entrance of the discharge canal, plus other designated points. These sites have been marked by use of permanent marker buoys, sight transects from permanent shore markers, and depth soundings made with a Jefferson sonar instrument. These are shown by number on the map given in Figure 1. There are ten sites within the potential affected area and two sites well outside the area. The latter two will serve as control sites. It is estimated that the test sites can be relocated within a fifty foot radius.

B. *Thermal Survey.* Thermal measurments were made during the months of January, April, June, July, August, and October. They were made at depths of 1, 2, and 7 feet below the surface, and each

succeeding 5 foot interval to bottom. Thermal values were taken by means of a YSI Model 54 Oxygen Meter with an automatic temperature compensating oxygen probe on a 100 foot cable. The instrument was checked with a mercury laboratory therometer before each test series.

C. *Chemical Survey.* Chemical tests included determinations for dissolved oxygen, hydrogen ion concentration (pH), iron, manganese, chlorine, boron, total hardness, and turbidity. Dissolved oxygen content was determined in parts per million by means of the YSI Oxygen Meter. The sensing element was a Clark type membrane-covered polarographic probe which was calibrated before each test series by means of a standard Winkler determination as described in Standard Methods (Anon. 1965).

The remainder of the tests were performed on water samples pulled from the designated depths by means of a 2 liter Van Dorn Water Sampler Model 120. Determinations of pH, chlorine, tubidity, iron, and manganese were made on site. Water for the boron and total hardness tests was then collected into 18 ounce sterile plastic bags and transported in an insulated ice chest to the university laboratory for testing.

The pH measurements were made on site by means of a Taylor pH slide Comparator, model T-O. Chlorine, iron, manganese, and turbidity measurements were made on site by means of a Hach 1967). The Hach orthotoluidine method was used for chlorine determination, the total iron 1,10-Phenanthroline method was used for measurements of iron, and the Cold Periodate Oxidation method was used for manganese. These values were recorded in parts per million. The Hach Turbidity method was used for turbidity determinations and results were reported as the number of Jackson Turbidity Units (JTU).

In the laboratory, an Orion Research Model 401 specific ion meter with a divalent cation electrode and single junction reference electrode was used to determine total hardness values. These values were recorded as parts per million of calcium carbonate. This instrument was calibrated against an EDTA titrametric method determination before each test series.

The measurement of boron has presented certain problems. The Hach carmine method of boron determination using a B and L Spectronic 20 Colorimeter was utilized first, but the results seemed questionable. An acid-base titration method recommended by the research staff at the Connecticut Yankee Nuclear Power station which titrates the mannitoboric acid complex was also used, but with uncertain results (Thorpe 1968). An ion exchange method as described by Carlson and Paul (1968) which utilized the Orion

Specific Ion meter and fluoroborate electrode is also being tested. The Curcumin Colorimeter method from standard methods (Anon. 1965) is currently being utilized in our laboratory.

D. *Biological Survey.* The biological survey includes a fish population and species count, a bottom sample analysis, and a plankton analysis for zooplankton, phytoplankton, and periphyton. General observations were made on the quantity of aquatic life in these samples. A fish population survey was made by use of nylon gill netts with 24 hour sets in three sites during mid-summer and mid-winter. The test sites are shown on the map in Figure 1. Site I, in the discharge cove, was checked by use of a 6 foot x 100 yard sinking ttype gill net composed of 100 feet each of 1, 1½, and 2 inch mesh. Site II, on Goose Island, was tested by use of a 12 foot x 100 yard sinking type gill net consisting of 100 feet each of 2, 3, and 4 inch mesh as was Site III which was located approximately 500 yards south of Bunker Hill. At the end of the 24 hour set, the nets were pulled and the fish were counted and typed with reference to the mesh size from which they were taken.

The bottom samples were collected at Sites 5, 10, and 11 which were approximately 500 feet, 800 yards, and 1800 yards from the entrance of the discharge cove. These collections were made at mid-summer and mid-winter intervals. Samples were taken by use of a 6 inch x 6 inch Ekman type dredge. Dredgings were then screen-washed through a U.S. Standard Sieve Series No. 30 with openings of 0.589 mm. Residual material was transfered into 18 ounce sterile plastic bags and placed in an insulated ice chest which was transported to the laboratory. With the aid of a stereo-microscope, living material was observed in the sample, removed, and preserved in 10 percent formalin. The organisms were then counted, identified, and the results reported in terms of the number of organisms per square foot of bottom sampled (Welch 1948).

The water for plankton samples was pulled from representative depths using a 2 liter Van Doren Water Sampler. Plankton from 10 liters of water was concentrated by means of a Wisconsin type plankton net made up of No. 25 size nylon mesh with 200 meshes to the linear inch. Ten ml. of concentrated sample was then collected into a 25 ml. specimen bottle and neutral formalin was added to make a 5 percent solution. Collection sites and time intervals were the same as for the bottom samples given above. In the laboratory, three quantitative determination were made on the plankton samples. A gravimetric determination was made by drying a 5 ml. aliquot of the concentrated sample in a 60°C. oven until all water was evaporated. The dried sample weight was then determined and the value was reported as wet weight per liter of sample (Lagler 1956). A quantitative determination was also made and reported as field count. The

field count was obtained by use of a Whipple ocular disc and a Sedgwick-Rafter counting cell. The total number of organisms observed in 10 Whipple disc fields using the 10X objective of an AO microscope was recorded. From this, the total number of organisms was calculated as indicated in Standard Methods (Anon. 1965) and reported as the number of organisms per liter of water sampled. A differential strip count was also made and the zooplankton and phytoplankton were reported by type and number per liter of sample.

E. *Radiological Survey.* Samples of fish, bottom sediment, and water are to be taken for radiological tests (beta and gamma radiation counts). Water and sediment samples are also to be tested for radiation (beta and gamma from sources such as tritium, strontium 90, etc.). A mussel cage was planted at Site number 5 and mussels are to be recovered at 6 month intervals for beta and gamma radiological examinations. The required samples are to be obtained by L. R. U. personnel and the determinations are to be made by the Radiological Health Division of the Arkansas State Department of Health.

III. Summary.

Firm conclusions cannot be reached from the limited amount of data collected to date. However, the following generalizations are possible at this time.

1. Water temperatures one foot below the surface ranged from a high of 84.2° F. in July to a low of 41° F. in January. Bottom temperatures for the same sites ranged from a high of 82.4° F. in July to a low of 32.9° F. in January. Temperatures extremes at any one site have been quite small and no true thermal stratification has been detected.

2. Dissolved oxygen minima ranged from a low of 6.2 ppm in September to a high of 9.6 ppm in January one foot below the surface, and from a low of 4.0 ppm in September to a high of 9.1 ppm in January on the bottom. A possible oxygen stratification was detected during September in the deep water sites in the Arkansas river channel, but was not found elsewhere.

3. Fish population studies during October netted 263 fish including 8 species, and for December netted 65 fish from 7 species. Bottom samples contained 27 organisms per square foot from 6 taxa in October, and 70 organisms per square foot from 7 taxa in December. Field counts of plankton in October were 21,501 organisms per liter of water, and for December were 3620 organisms per liter of water.

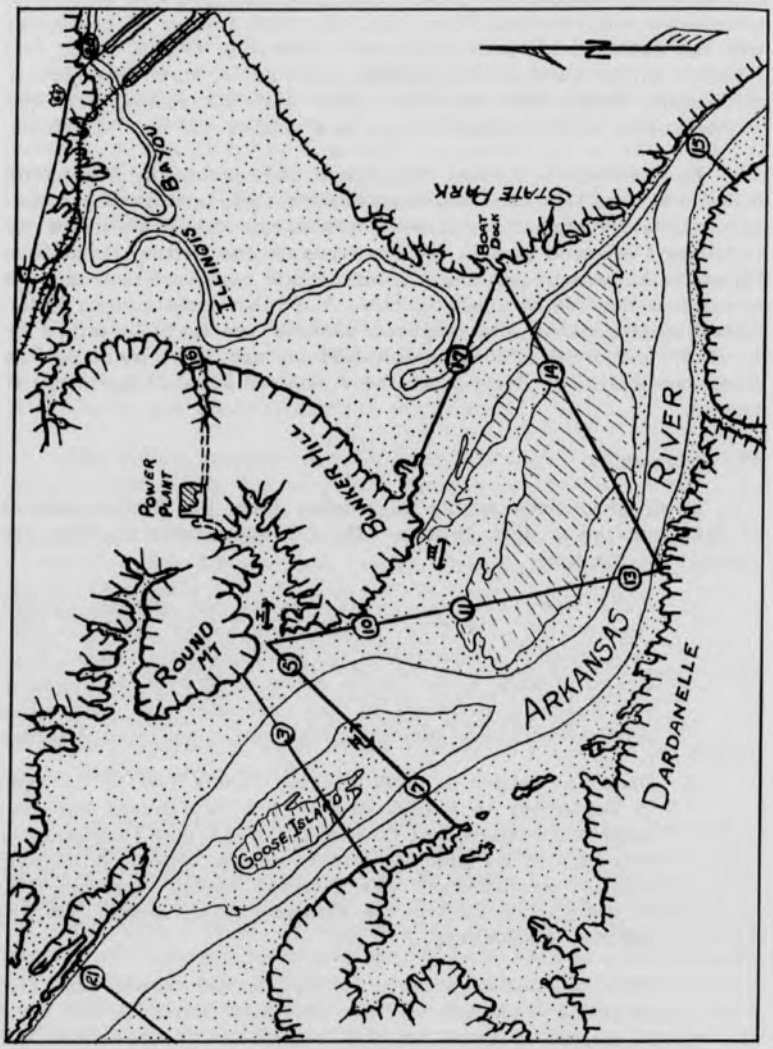

Figure 1. Map of Dardanelle Reservoir Area.

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