JOB COMPLETION REPORT

As Required By

FEDERAL AID IN FISHERIES RESTORATION ACT

TEXAS

Federal Aid Project No. F-2-R-19

Region 2-B Fisheries Studies

Job No. E-8: Productivity Study of the Fishery of the Guadalupe River

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Job Completion Report

State of Texas

Project No. F-2-R Name: Region 2-B Fisheries Studies

Job No. E-8 Title: Productivity Study of the Fishery of the Guadalupe River

Period Covered: February 1, 1968 to January 31, 1972

P. S. Objective: To determine production in a Central Texas River.

Procedures:

This study was initiated in 1968 and during this year, the electrofishing gear was purchased, tested and necessary modification were made.

In 1969 potential study sites were electrofished in an effort to determine the maximum efficiency of the electrofishing gear and to check for suitable study sites. Twelve sites were tested during this segment. The sites tested were subjected to a total of 28.45 hours of electrofishing which produced 5,553 fish, representing 14 species. The data for these collections are presented in Table 1. During these tests, valuable electrofishing experience was gained and possibly the best electrofishing techniques were developed.

During the 1970 segment, potential study sites were sampled with the electrofishing gear and one study site on the San Gabriel River in Williamson County and two study sites on the Guadalupe River in Comal County were chosen. From a literature review of population estimate methods, two methods (Petersen and Schnabel) were determined to be applicable to the needs of this study.

During the 1971 segment, no field work was done on this project because the chemical renovation of Lake Lyndon B. Johnson required most of Project F-2-R's time and manpower. However, Federal Aid documents, job progress reports, and other literature pertinent to this job were reviewed during this period.

Findings and Discussion:

Many obstacles prevented the accomplishment of the project objective. These varied from lack of equipment to lack of manpower to lack of time. This job was terminated in 1972 because it was determined that the construction of weirs, which were necessary for this study, was economically infeasible. Although the project objective was not accomplished, valuable information was obtained.

This project progressed as far as the development of devices and techniques which would aid in the accomplishment of its objectives. However, the device (an electrofishing boat) and the development of the techniques necessary for the successful use of it are extremely important. This device makes possible the sampling of many areas which cannot be sampled with other sampling devices. It is not selective toward a given fish size and it is only slightly selective toward certain fish species. Since the major accomplishment of this job was the development of the electrofishing boat, an explanation of its design and operation are included in this report.

In 1969, 12 sites on four rivers were electrofished. A total of 28.45 hours was spent electrofishing and 5,553 fish were collected. Data concerning each collecting trip made during this period are shown in Table 1. The number of fish caught during night samples exceeds that of daytime samples by approximately 50 per cent for each hour of electrofishing.

The water with the lowest conductance (310 micromhos) was the most productive. It is very difficult to successfully electrofish in water with a high conductivity and impossible if the conductivity is exeedingly high. The amperage appears to affect the success of the electrofishing operation. The higher the amperage the greater the tendency of the fish to be "knocked to the bottom". The fish dive directly to the bottom and are difficult for the netters to pick up. The ideal situation is to set the voltage and amperage so that the fish will be stunned and brought to the surface within the electrical field. Note that at 2.5 amperes and 150 volts in water with a conductance of 310 micromhos, there were twice as many fish collected per hour of electrofishing time as there was with 3.0 amperes. There were also approximately twice as many fish collected with 150 volts and 2.5 amperes as there was with 150 volts and 4.0 amperes in water having a conductance of 335 micromhos. With the electrofishing unit tested during this period, it appears that settings of 100-150 volts and 2.5-3.0 amperes in waters having a conductance between 300 and 700 micromhos produce the best results. Insufficient data have been collected to indicate optimum voltage and amperage settings for waters with high conductivity (700).

Design and Operation of an Electrofishing Boat

During 1968 Project F-2 constructed an electrofishing boat to be used as the primary fish sampling device for a productivity study of a stream fishery. Using trial and error methods and drawing heavily from published literature, the shocker and its operation has been modified so that the end result is an electrical fish sampling tool that works effectively under most stream conditions found in Region 2-B. It has also proven useful in a limited number of reservoir tests.

Equipment and Design

The two most important components of the shocking equipment are a Model III-C Variable Voltage Pulsator designed and manufactured by Coffelt Electronics Company of Denver, Colorado, and a 115-230 volt, 3,000 watt McCulloch alternating-current Mark III generator. These two components can provide output voltages for electrofishing that can be varied continuously from 0-300 volts D. C., 0-300 volts pulsed D.C., and 0-280 volts A.C., 60 cycles per second. The pulse output from the Coffelt unit is a square wave voltage with a 50 per cent duty cycle and can be varied from 10-200 pulses per second.

The V.V.P. and generator are mounted in a 16 foot, flatbottomed boat equipped with a custom made guardrail around the bow, a 60 gallon live well under the middle seat, remote controls and powered by an 18 horsepower outboard motor (Figure 1).

Electrodes for the device are made from 5/8 inch, lead filled, copper tubing. The positive electrode consists of six, 40 inch lengths of tubing connected to an eight foot piece of three inch plastic conduit which is mounted perpendicular to and at the end of a 12 foot section of 2 X 4 by means of a single ten inch carriage bolt and two screendoor springs (Figure 2-Inset 1). This arrangement allows the conduit crossmember to swivel and return to its normal position when rigid objects are encountered during operations. Springs also form the junction between the conduit and the lengths of tubing so that the electrodes will pass over or around under-

water debris and return to their normal position.[1]

The base of the boom is attached to the boat by means of a large, loosefitting U-bolt attached to the rear of the front deck. At its mid-point the boom is supported by a stand constructed of 2 X 4 boards in such a manner that the height of the boom can be adjusted (Figure 2-Inset 2). This arrangement makes possible limited adjustments to depth and width of the electrical field by moving the boom in or out and up or down.

The negative electrode consists of a single 20 inch piece of tubing suspended from the bow of the boat by means of a harness snap.

Size 16 AWG, 600 volt insulated wire is used as the conductor for the electrode circuit. That portion of the circuit located inside the boat is permanently housed in ½-inch electrical conduit with outlets at the stern near the V.V.P. and at the rear of the foredeck. The permanent outlets, particularly the forward outlet, should be female twist-lock types to prevent the possibility of crew members being accidentally shocked. The circuit then runs from the forward outlet through an Allen-Bradley, 600 volt A.C - D.C., treadle switch at the bow of the boat to the electrodes. This wiring arrangement allows the circuit to be controlled from both the front and rear of the boat. All components of electrofishing equipment must be connected to a common ground to eliminate any electrical potentials that might exist. This is accomplished by a ground wire that runs from the base of the generator to the side of the boat. (See Figure 3 for a wiring diagram)

Night shocking has been found to be roughly twice as productive as day shocking; therefore, a permanent lighting system was mounted on the bow of the boat. It consists of two, all weather, floodlight receptacles with yellow, 100 watt, 115-125 volt bulbs to reduce light reflection from the water and to inhibit insect attraction.

Numerous types of commercially manufactured dipnets were used in conjunction with the electrofishing operation. They were too weak to withstand the weight of the large number of fish that were often netted. Much stronger dipnets were obtained from a private source through Project F-9-R personnel and have been found to be very adequate for electrofishing.

Miscellaneous Equipment

Two pieces of auxilliary equipment are a volt-ohm meter and a portable conductivity meter. There are many junctions and splices necessary in the wiring system of the electrofishing boat and each is a potential trouble spot for shorts. Occasional malfunctions of the V.V.P., the generator and the footswitch are also encountered and with a volt-ohm meter, these malfunctions can usually be located rapidly and repaired in the field with a minimum of time lost. Without the volt-ohm meter, the simplest short may take hours to locate and repair.

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[1]Basic design of the positive electrode was patterned after the electrode arrangement of a device built by Mr. Billy D. Cooper.

The degree of electrofishing success depends primarily on the conductivity of the water in which it is used; therefore, a portable conductivity meter is very useful to determine roughly how efficient the shocker will work in an area.

Operation

A minimum of three men are needed to operate the electrofishing equipment efficiently and a fourth man, although not absolutely necessary, is a definite asset to the operation. One man positioned in the rear controls the boat and the master controls on the V.V.P. and generator. Two men are positioned at the bow and it is the job of one of these to operate the footswitch which controls the circuit to the electrodes. He and the second man are also primary netters. The fourth man, when used, is a utility man. He is positioned immediately behind the foredeck and in front of the livewell. He acts as a secondary netter, empties the dipnets of the primary netters and is relief man for the primary netters.

Best results have been obtained when the boat is driven slowly (about trolling speed or less) upstream in a zig-zag pattern from bank to bank with the circuit to the electrodes being alternately broken and reestablished on approximately 10 second intervals by the footswitch operator. When the switch is depressed, fish in the field are immobilized; and those on the weak outer perimeter of the field are driven upstream by the zig-zag pattern. When the circuit is interrupted, some fish will attempt to turn back and are collected when the circuit is reestablished. This method has proven very successful for narrow streams. In wide streams many fish can elude the field and escape downstream. But good success can be obtained by using the zig-zag method from one bank to midstream and back to the bank and then repeating the procedure on the opposite side on the return trip downstream.

In many instances those fish that run upstream just in front of the electrical field can be herded into gravel bars, log jams, dead-end sloughs and other natural barriers. When this can be accomplished large numbers of fish may be stunned at one time.

In unusually fast moving water, upstream movement of the boat has been found undesirable, because fish are swept away by the current as soon as they are stunned. Allowing the boat to free-float with the current using the outboard only to keep the boat aligned has been found to be the most productive method for swift water.

Limiting Factors

Some factors that adversely affect the efficiency of the electrofishing boat are: high water-conductivity, extreme turbidity and deep water. Conductivities in excess of 1,000 microhms/cm. severely limit the intensity of the electrical field and may inhibit the electrofishing operation entirely. Turbidity does not limit the effectiveness of the machine itself, but rather inhibits the visability of the netters. Many fish that are stunned cannot be seen and consequently are not netted. Maximum depth-penetration of the electrical field appears to be 6-8 feet, but this will vary with water conductivity. In waters where the field fails to penetrate to the bottom, fish have been consistently observed escaping under the field.

From tests conducted over a two-year period, optimum conditions for peak efficiency of this unit seems to be a clear (6-8 ft. secchi), shallow (6-8 feet deep), stream which exhibits a conductivity between 300-700 micromhos with operations conducted at night, but adequate results have been obtained under all stream conditions,

TABLE 1
SUMMARY OF ELECTROFISHING OPERATIONS

Date	Day or Night	River System	County	Generation Time (Hours)	Conductance (micromhos)	Voltage	Amperage	Pulses/second	Spotted Gar	Longnose Gar	Shad	Trout	River Carpsucker	Gray Redhorse Sucker	Spotted Sucker	Carp	Channel Catfish	Bullhead Catfish	Flathead Catfish	Spotted Bass	Largemouth Bass	Sunfish	Total
4/2 69	D	Llano	Kimble	1.75	400	150	3	15	1	-	34	-	-	16	10	7	-	-	-	-	31	60	159
4/2 69	N	Llano	Kimble	1.25	400	150	3	15	-	6	122	-	9	30	9	3	4	-	-	-	36	49	268
4/3 69	D	Maynard Creek	Kimble	1.5	450	150	3	10	-	-	-	-	-	-	-	-	2	-	-	-	44	186	232
4/3 69	N	Maynard Creek	Kimble	1.5	450	150	3	10	-	-	-	-	-	-	-	-	1	-	-	-	38	292	331
4/28 69	D	Guadalupe	Comal	2.5	310	150	3	20	-	4	35	6	6	305	-	-	-	-	-	2	15	43	416
4/28 69	D	Guadalupe	Comal	1.0	310	150	3	20	-	-	34	14	-	207	-	-	-	-	1	-	2	20	278
4/28 69	N	Guadalupe	Comal	1.5	310	150	3	20	-	8	295	4	4	433	-	-	2	-	-	-	12	50	808
5/6 69	N	Guadalupe	Comal	1.3	310	150	3	20	-	-	38	13	1	276	-	-	-	-	-	1	-	-	329
5/12 69	D	Lampasas	Lampasas	.66	550	100	4	20	-	3	31	-	-	6	-	15	4	-	-	-	27	14	100
5/12 69	N	Lampasas	Lampasas	1.0	550	100	4	20	-	11	29	-	8	5	-	-	7	-	1	-	12	19	92
5/13 69	D	Lampasas	Lampasas	.5	975	75	3	20	-	-	-	-	-	-	-	1	-	-	-	-	2	-	3
5/13 69	D	Lampasas	Lampasas	.66	550	125	4	20	-	-	-	-	1	-	-	3	1	6	-	-	11	91	113
5/19 69	D	Guadalupe	Comal	1.5	310	150	2.5	20	-	20	25	-	-	630	-	1	7	-	-	3	4	37	727
5/19	N	Guadalupe	Comal	1.5	310	150	3	20	-	27	275	-	-	198	-	-	1	-	1	-	-	29	531

TABLE 1 (Cont.)
SUMMARY OF ELECTROFISHING OPERATIONS

Date	Day or Night	River System	County	Generation Time (Hours)	Conductance (micromhos)	Voltage	Amperage	Pulses/second	Spotted Gar	Longnose Gar	Shad	Trout	River Carpsucker	Gray Redhorse Sucker	Spotted Sucker	Carp	Channel Catfish	Bullhead Catfish	Flathead Catfish	Spotted Bass	Largemouth Bass	Sunfish	Total
6/6 69	D	Guadalupe	Comal	2.5	310	150	3	20	-	2	54	3	1	158	-	-	1	-	-	10	2	139	370
5/6 69	D	Guadalupe	Comal	1.33	310	150	3	20	-	11	29	13	8	5	-	-	7	-	1	-	12	19	105
9/23 69	N	Guadalupe	Kerr	1.00	390	140	6	15	-	-	72	-	1	11	-	-	-	-	2	-	-	-	86
9/24 69	D	Guadalupe	Kerr	1.5	335	150	2.5	20	-	-	146	-	-	16	-	-	-	-	-	1	2	52	217
12/16 69	D	Guadalupe	Comal	2.0	335	150	4	16	-	-	45	-	-	14	-	-	-	-	-	2	7	24	92
12/16 69	N	Guadalupe	Comal	1.0	335	175	3	14	-	11	33	-	3	110	-	-	-	-	-	-	5	19	181
12/17 69	D	Guadalupe	Comal	1.0	335	150	4	20	-	-	89	-	-	24	-	-	-	-	-	-	-	2	115
			TOTAL	28.45					1	103	1386	53	42	2444	19	30	37	6	6	19	262	1145	5553

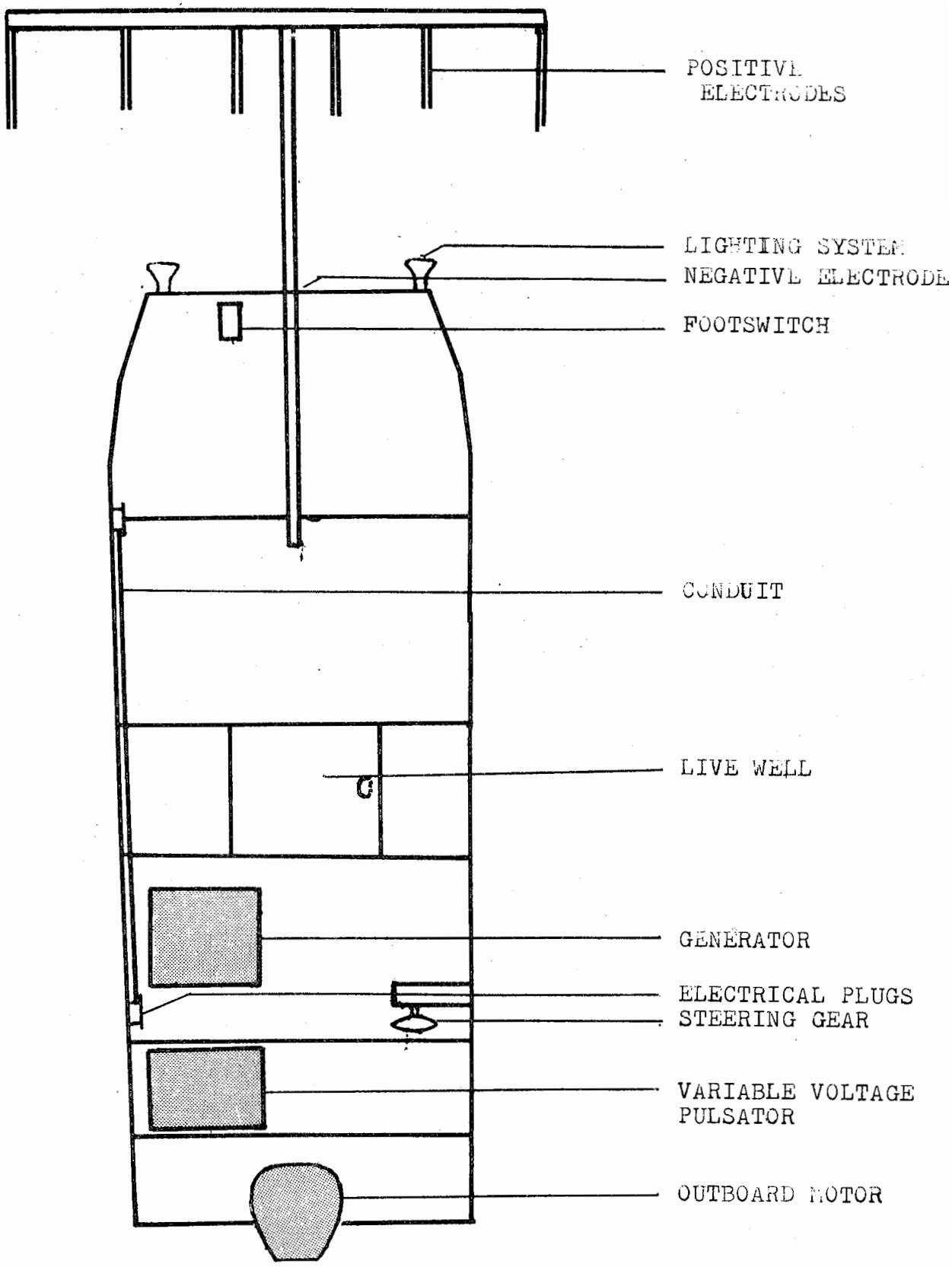

FIGURE 1 - TOP VIEW OF ELECTROFISHING BOAT WITH COMPONENTS

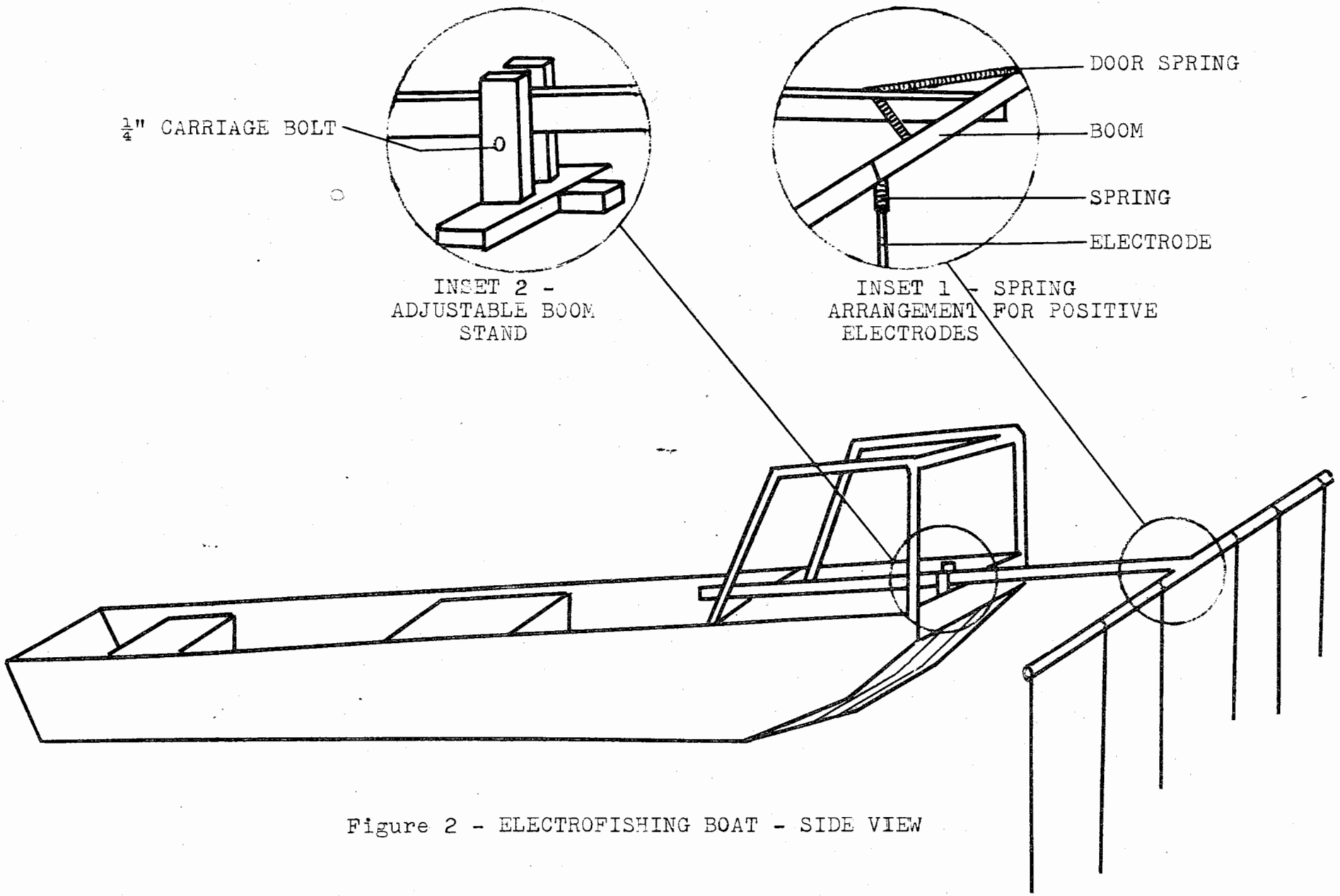

Figure 2 - ELECTROFISHING BOAT - SIDE VIEW

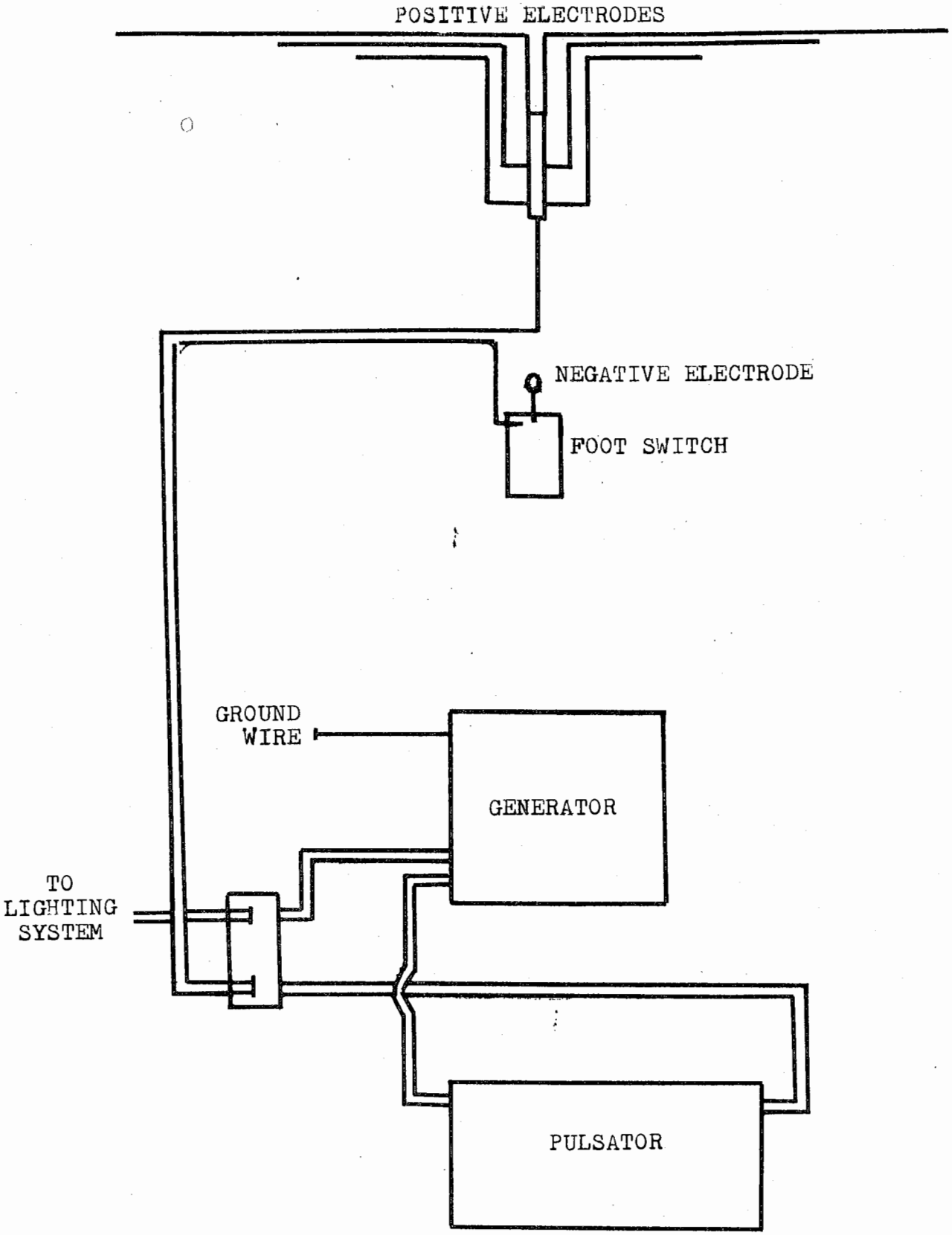

Figure 3 - DIAGRAM OF ELECTROFISHING BOAT CIRCUITS

both day and night, so long as stream conductivity remained below 1000 micromhos/cm.

Safety

As with all high voltage devices, safety procedures should be followed when working with electrofishing equipment. The following list of precautions should be included as part of each electrofishing operation:

1. Approved lifejackets, rubber gloves and non-conductive foot wear should be worn by all crew members.

2. All crew memebers should have a thorough knowledge of electrofishing operation.

3. All electrical circuits should be checked for shorts before operating.

4. Make sure all electrical wires are out of the way.

5. Use dipnets with non-conductive handles.

6. Have fire extinguisher and first aid kit and know how to use them.

7. Never work for long periods. Take frequent rest breaks.

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Date: August 9, 1973

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