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SURVIVAL, GROWTH, AND FEED CONVERSION OF CHANNEL CATFISH AFTER ELECTRONARCOSIS

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ABSTRACT

Electrically narcotized and untreated lots of two-year-old channel catfish (*Ictalurus punctatus*) were held in divided cages in a pond to determine the effects of narcosis on their survival, growth, and feed conversion. Fish were narcotized by exposure to 1.5 votls/cm for 60 seconds duration with either 60 hertz alternating current, continuous direct current, or pulsed direct current of 15, 20, or 25 pulses/sec.

There was no significant difference in survival, growth, or feed conversion between the treated and untreated lots at the 0.01 probability level.

INTRODUCTION

The use of electricity in fisheries is a recognized research and management tool. The possibility of exposure to electrical parameters that affect the morphology and physiology of fish is of major concern to investigators in management, harvesting, and grading studies. Maxfield, et al. (1971) found that pulsed direct electrical current had no effect on the survival, growth, and fecun-

dity of yearling and young-of-the-year rainbow trout (*Salmo gairdneir*). McGrimmon and Bidgood (1965) reported that alternating current had no significant effect on vertebrae in rainbow trout, but that fish may be adversely affected in other ways. Another investigator, Hauck (1947), found that alternating current fractured vertebrae, ruptured arteries and veins, and caused hemorrhaging in rainbow trout. Adams, et al. (1972) suggested that the recovery time of common shiners (*Notropis cornutus* in a direct current electrical field was related to power density and that exposures to current for over 120 seconds resulted in high mortality due to the narcotic effect of direct current. Spencer (1967) found that bluegill (*Lepomis macrochirus*), channel catfish (*Ictalurus* punctatus), and largemouth bass (*Micropterus salmoides*) had broken, fractured, and dislocated vertebrae with hemorrhaging in that area after prolonged exposure to alternating or continuous direct current parameters.

Concern over the effects of electricity on catfish led to this study to compare the survival, growth, and feed conversion of channel catfish exposed to narcotic levels of electricity with those of untreated fish.

MATERIALS AND METHODS

Two-year-old channel catfish were used in this study. Test and control fish were given a prophylactic treatment for 12 hours in 25 ppm formalin and 3 hours in 50 ppm nitrofurazone, then held for three weeks prior to electroshocking.

Fish were exposed to selected electrical treatments, then placed into divided cages in a 1.6-ha pond. Each cage was divided in two with a control lot of catfish on one side, and experimental fish on the other. Equal numbers of fish were placed in each half-cage. The cages were 1.8 x 0.9 x 0.9-m-deep, and constructed of 4 mm square mesh aluminum wire attached to an aluminum frame.

Test fish were exposed in lots of 200 to one of five electrical treatments: 60 hertz alternating current, continuous direct current, and pulsed direct current of 1-millisecond duration of exponential shape at 15, 20, and 25 pulses/sec in an electrical test chamber. The test chamber was a fiberglass tank 1.0 x 0.6 x 0.4-m-deep containing 600 l of water at 22 C and a conductivity of 200 micromohos/cm. Aluminum electrodes were suspended from wooden blocks perpendicular to the long axis of the tank. Each experimental lot was placed in the chamber and immediately exposed to a voltage amplitude of 1.5 volts/cm for 60-seconds duration. This exposure period was longer than fish usually encounter in fishery survey studies with electrical shockers. All fish in each lot regained consciousness within two hours post-treatment. Each treatment was replicated. Ten treated groups, and 10 untreated control groups (an average weight of 14.0 g) were held in cages in a pond to check for delayed adverse effects. Fish were fed equal amounts of floating nutrionally--complete trout ration 112 times during a 133 day growing period (June 7 through October 17, 1972).

Fish were dipped from the cages after they were killed with rotenone, and allowed to harden in 10% formalin for four days, washed in water, and stored in 50% isopropyl alcohol prior to taking measurements. A subsample of 50 fish from each lot was measured to determine total length and individual weights. Total numbers and weights of the remaining fish were recorded. All measurements were completed within two weeks.

RESULTS AND DISCUSSION

Data on survival, growth, and feed conversion are summarized in Table 1. An analysis of treatment of the data comparing the variance within and among treatment and control lots demonstrated that there was no significant difference (P less than 0.01) in survival, growth, or feed conversion (Table 2).

Seventy-five to 100 percent of the fish in the treated lots survived, and from 77 to 100% of the fish in the untreated lots survived. Fish exposed to pulsed direct current at 25 pulses/sec had the lowest survival percentage (75%), but the corresponding control also had a low survival percentage (77%). Fish survival was affected by dense mats of *Pithophora* which restricted water exchange between cages and the open pond. In addition to reduced water exchange, fish were lost to snake predation and to turtles tearing holes in the wire mesh.

The average sizes of treated and untreated fish were similar. Treated fish ranged in weight from 205.6 to 312.5 g as compared to the range of 201.6 to 312.5 g for the untreated fish. The lowest average weight of 215.0 g occurred when pulsed direct current of 15 pulses/sec was used.

1.4 to 1.9 in the untreated lots. The better conversion rates (1.4 and 1.6) were in lots that had low survival. This was probably due to fewer fish per cage.

SUMMARY

Exposure of two-year-old catfish to 1.5 volts/cm for 60 seconds duration to either 60 hertz alternating current, continuous direct current, or pulsed direct current did not significantly affect their survival, growth, or feed conversion at the 0.01 probability level.

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Tabel 1. Effects of electronarcosis on variation in survival, growth, and feed conversion of channel catfish[1]

	Treatment 1 Continuous d.c.	Control	Treatment 2 Pulsed d.c. 25 Pulses/Sec	Control	Treatment 3 Pulsed d.c. 20 Pulses/Sec	Control
Number stocked	200	200	200	200	200	200
Average weight stocked (grams)	14.0	14.0	14.0	14.0	14.0	14.0
Kilograms harvested	40.0	39.8	44.2	49.7	37.7	35.9
Average weight harvested (grams)	210.4	209.5	294.6	312.5	207.1	201.6
Percent survival	96	95	75	77	91	89
Feed conversion	1.7	1.7	1.6	1.4	1.8	1.9

Table 1 (Cont'd)

	Treatment 4 Pulsed d.c. 15 Pulses/Sec	Control	Treatment 5 a.c.	Control
Number stocked	200	200	200	200
Average weight stocked (grams)	14.0	14.0	14.0	14.0
Kilograms harvested	41.0	42.0	40.0	37.3
Average weight harvested (grams)	205.0	210.0	210.5	207.2
Percent survival	100	100	95	90
Feed Conversion	1.7	1.7	1.7	1.9

[1]Treatments and controls are an average of two duplicated cages

Table 2. Analysis of variance for controlls and treatments using one-way classification.

Source of Variation			Kilograms Harvested				Average Weight			
			df		SS	F		df		SS	F
Control versus treatments			1		3.806	0.194		1		203.68	0.017
Error			12		234.525			12		31485.294	
Total			13	238.332				13		31688 977	
Treatments			3		9.481			3		4920.335	
Treatment 1 versus treatmensts 2, 3, 4, and 5	1			2.880		0.452	1		1507.072		0.747
Treatments 2, 3, and 4 versus treatments 1 and 5	1			5.401		0.921	1		2801.452		1.594
Treatment 5 versus treatments 1, 2, 3, and 4	1			1.200		0.179	1		611.811		0.278
Error			6		94.897			6		29845.765	
Total			9		104.124			9		34766.100	
Treatments			2		23.523					10544.862	
Treatment 2 versus treatments 3 and 4	1			23.522		8.608	1		7805.722		15.938
Treatment 4 versus treatments 2 and 3	1			0.001		0.000	1		2739.140		0.096
Error			3		41.838			3		15810.400	
Total			5		65.361			5		26355.562	

Source of Variation		Percent Survival				Feed Conversion			
		df		SS	F		df	SS	F
Controls versus treatments		1		1.785	0.017		1	0.002	0.109
Error		12		1199.428			12	0.314	
Total		13		1201.214			13	0.317	
Treatments		3		292.084			3		0.012
Treatment 1 versus treatments 2, 3, 4, and 5	1		93.728		0.816	1		0.007	1.060
Treatments 2, 3, and 4 versus treatments 1 and 5	1		165.761		1.652	1		0.005	0.853
Treatment 5 versus treatments 1, 2, 3, and 4	1		32.595		0.256	1		0.000	0.000
Error		6		1710.200			6		0.000
Total		9		2002.284			9		0.012
Treatments		2		680.333			2		0.023
Treatment 2 versus treatments 3 and 4	1		400.000		7.920	1		0.022	9.000
Treatment 4 versus treatments 2 and 3	1		280.333		2.540	1		0.001	0.062
Error		3		822.667			3		0.058
Total		5		1503.000			5		0.081

[1]Significant at 0.05