Water quality measures were not related to fish production even though the unfertilized pools were lowest in both.

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HEAT TOLERANCE OF ALBINO VS. NORMAL CHANNEL CATFISH

Ictalurus punctatus

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ABSTRACT

Two lots of the Arkansas strain of channel catfish, *Ictalurus punctatus,* containing both albino and normal fish, were acclimated in the laboratory at a constant temperature of 30.0°C. Samples of albino and normal fish were exposed to a lethal temperature of 39.0°C. The albinos from both lots had the highest mean survival time, but the differences were not statistically significant.

INTRODUCTION

There has been a considerable amount of interest shown in the "albino" channel catfish, *Ictalurus punctatus,* and the question of their relative survival and growth in ponds has been raised.

Nelson (1958) noted no significant differences in the growth or survival of albino and normal catfish in hatchery ponds. Prather (1961) obtained similar growth rates in ponds but the survival of the albinos was less. It was suspected this was due to increased susceptibility to predators.

Albinism is generally considered to be selected against. Is this due to ecological factors such as predation or to physiological weaknesses? The purpose of this experiment was to compare the heat tolerance of albino and normal colored channel catfish.

The strain of fish exhibiting this mutation originated in the Arkansas state fish hatcheries where they have been propagated for approximately 26 years (Brady, et. al., 1965). These fish have accumulated many of the characteristics of domestication including color mutations. The "albinistic" condition in these fish was first reported by Nelson (1957) and is now common. These fish have a yellowish-white color and pink eyes. Solid black and pied individuals have also been noted (Brady, et. al. 1965).

Instances of albinistic wild channel catfish are rare but have been reported by Aitken (1937) and Menzel (1944). Albinistic catfish of other species have been reported by McLane (1950) and Atz (1953).

The lack of pigmentation in hatchery and aquarium fishes is quite common. A number of conditions seem to be involved. Xanthism or yellowness is often reported. Whitish fish are less often noted. Haskins and Haskins (1948) working with *Lebistes*

[1]A portion of this research was conducted at the University of Arkansas and was supported financially by the Arkansas Game and Fish Commission.

reticulatus, noted three non-allelic color conditions, all of which were recessive to the normal wild color. These they called golden; blond and albino. In addition, a cross between golden and blond yielded a "cream" phenotype. The albino trait was semi-lethal and characterized by poor reproduction, short life, and less resistance to variations in acidity and temperature.

Allen and Strawn (1967) found that heat death of channel catfish may be due to several physiological failures, or "lethal effects". The acclimation temperature and test temperature determine which lethal effect (or effects) result in death. At the higher test temperatures the fish appeared to die from a nervous or shock effect. This was referred to as lethal effect I. If the fish were tested at lower temperatures they lived longer and exhibited some of the characteristics of asphyxia. This was referred to as lethal effect II. At still lower or slowly lethal temperatures there were indications of other lethal effects.

The acclimation temperature of 30.0°C and test temperature of 39.0°C were chosen for the present study because it was felt that under these conditions the fish would die from lethal effect II. In the work by Allen and Strawn (1968), this was a major "effect", accounting for approximately 69% of the deaths of channel catfish killed at a wide range of lethal temperatures.

MATERIALS AND METHODS

Two lots of fish were used in this study. On June 29, 1966 approximately 4,000 two day old fry were obtained from the Centerton State Fish Hatchery, Centerton, Arkansas and reared in the laboratory at the Department of Zoology, University of Arkansas. Approximately 25 albinos found among them were reared in a tank along with approximately 300 of the normal fish at a constant temperature of 30.0°C (± 1.0°C).

The second lot consisted of nine albino and nine normal fingerlings obtained from a fish farmer, Mr. J. G. Walker of Malvern, Arkansas. The fish were obtained June 25, 1968 and were approximately 24 days old. These were maintained in an aquarium in the fishery laboratory at Louisiana State University. The temperature was maintained constant at 30.0°C (± 1.0°C). Both lots of fish were held under near-constant light conditions.

Seventeen surviving albinos and 30 normal fish from the Centerton fish were tested together in a lethal bath on October 12, 1966. These fish were 108 days old and ranged in length from 24 to 52 mm.

The Malvern fish were tested on July 8, 1968. They were approximately 37 days old and had been acclimated to 30.0°C for 13 days. These fish ranged in length from 31 to 45 mm.

The individual death times of the fish were analyzed statistically using the F-test (Snedecor, 1959) to determine if the variances of the albino and normal fish from each lot were the same. The appropriate t-test (Snedecor, 1959) was then utilized to compare the differences in death times of the albino and normal fish of the same lot.

RESULTS

The survival times (time to death) of the Centerton fish is shown in Table 1 and the Malvern fish in Table 2. The longer survival time of the older Centerton fish was to be expected, as Allen and Strawn (1968) showed that at higher lethal temperatures survival was longer for older fish. Within lots, there was no apparent correlation between length of fish and time of death.

All of the fish appeared to die from lethal effect II, except the first Centerton albino (7.7 minutes) and the first Malvern albino (4.0 minutes). These two fish exhibited the characteristics of lethal effect I, both in time of death and manner of death.

The F-test indicated the variance of the two samples of Centerton fish was significantly different ($P < .05$) with the death time for the first albino (7.7 minutes) included. However, with this time (7.7 minutes) excluded, the difference was non-significant. The variance was similar between the two samples of Malvern fish,

TABLE 1

Survival time in minutes of Centerton albino and normal channel catfish at a lethal temperature of 39°C.

Fish No.	*Survival Time*	*Fish No.*	*Survival Time*
1	7.7 a	25	56.4
2	28.4	26	57.5
3	29.3	27	58.2
4	36.7	28	58.4 a
5	36.8	29	58.9 a
6	38.2	30	59.8
7	40.1 a	31	60.1 a
8	44.4	32	61.0
9	45.1	33	61.5
10	45.7	34	62.7
11	45.9	35	63.2
12	46.5 a	36	63.2
13	49.5 a	37	63.8 a
14	50.1	38	64.9
15	50.3 a	39	64.9
16	51.0	40	68.4 a
17	51.7 a	41	69.7
18	52.4	42	70.2 a
19	53.0	43	70.5 a
20	53.9	44	72.2 a
21	54.1	45	76.5
22	54.5	46	84.8 a
23	55.2	47	90.2 a
24	55.9 a		

a = albino

TABLE 2

Survival time in minutes of Malvern albino and normal channel catfish at a lethal temperature of 39°C.

Fish No.	*Survival Time*	*Fish No.*	*Survival Time*
1	4.0 a	10	24.8
2	10.7	11	25.0 a
3	14.1	12	26.5 a
4	18.6	13	27.3
5	19.9 a	14	27.9 a
6	20.6 a	15	28.3 a
7	20.6	16	28.4
8	23.9	17	32.6
9	24.7 a	18	33.1 a

a = albino

with and without the first albino (4.0 minutes). The sample, however, was quite small for statistical analysis.

The Centerton albinos had a mean of 58.78 minutes with the death time for the first fish (7.7 minutes) included and 61.97 without it. The mean of the normal fish was 53.14. The Malvern albinos had a mean of 23.33 with the time of the first fish (4.0 minutes) included and 25.75 without it. The normal fish had a mean of 22.33.

Utilizing t-tests, the survival times of each lot of albinos were compared with their normal counterparts. the tests were performed with and without the times of the first albino of each lot. In all cases the differences in survival times between the albino and normal fish were non-significant at the .05 level of probability.

DISCUSSION

There is a slight indication from the results of these heat tolerance tests that albino channel catfish are more resistant to lethal effect II. However, the differences were not statistically significant. It can be stated that the albinos were not less resistant to lethal effect II. This experiment did not determine the relative resistance of albinos to other lethal effects of high temperatures.

Even under natural conditions the lack of pigmentation is not always a disadvantage, as evidenced by the extinction of melanine pigmentations in cave fishes, particularly in *Anoptichthys* (Şadoglu, 1957). If there are no physiological weaknesses linked to the mutation in question here, it may not be a disadvantage in those situations in which predation is controlled by man.

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A NOTE ON PHOSPHORUS CHANGES IN POND SOILS

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ABSTRACT

Nitrogen content of fertilizer formulations influenced the amount of organic and inorganic phosphorus found in the bottom soil of fish ponds flooded with water of medium hardness and alkalinity.

INTRODUCTION

Phytoplankton, a natural fish food, is dependent on soluble inorganic phosphorus for growth. The use of phosphorus in pond fertilization programs attempts to supplement that amount already present. The continuing need for phosphorus applications (Swingle, et al. 1963) suggests that phosphorus is rapidly utilized or that large portions quickly become unavailable. Phosphorus becomes