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Directed local changes of water temperature for the purpose of controlling the behaviour of fish are based on the knowledge of the characteristics of seasonal-age dynamics of their thermoadaptation possibilities (1,3). These possibilities are still inadequately studied (5), especially in relation to avoided temperatures.

By us the attempt was made to determine zones of avoided temperatures for the young of five species of fish (bream, roach, blue bream, perch, peled) in the summer period of the year, and also to assess the influence on them of additional factors, in particular mechanical driving. In parallel in two-fold repetition were conducted experiments on the determination of selected, shock and lethal temperatures of these fish.

The method of thermogradient investigation and the determination of shock and lethal temperatures were presented in detail earlier (3,4). The rate of heating up of fish in this case was 10-12 degrees/hour. As shock we took the temperature at which coordination of movement was disrupted, as lethal - the temperature at which movement of the gill covers ceased. Shock and lethal temperatures were determined as the mean of the values obtained for the different individuals. The final selected temperature was calculated as the mean selected in the last 3-4 days of a 10-day experiment. In each experiment 10 fish were used.

For the study of avoided temperatures was used a modified installation, described by Cherry et al (5). In two parallel troughs measuring 183 x 30 x 20 cm was set up a thermal gradient with a difference of temperature of 3-6 °C by means of an inflow of water of different temperatures from two tanks. The flow of water was brought about in the centre of the trough with the aid of polyvinyl tubes of 2.5 cm diameter. The level of the liquid in the installation was maintained at 2.5 - 6 cm depending on the dimensions of the experimental individuals. Fish to the number of 10-12 were placed in each trough of the installation, but after half an hour's accustoming them to the conditions of the experiment we changed the thermal regime up to the level at which avoidance reaction was observed. Measurements were made for two hours. Every five minutes with the aid of thermometers we noted the avoided temperatures and from these data calculated the mean avoided temperature. The experiments also were made in two-fold repetition.

The length and weight of the fish, caught in the littoral of the Rybinsk reservoir and acclimatized for 2-4 days to a temperature of 20-24 °C (peled was acclimatized to 16 °C), were as follows:-

bream - 3-4 cm, 0.3-0.7 g; blue bream - 4.6 cm, 1-3 g;
roach - 2-4 cm, 0.2-0.6 g; perch 3-5 cm, 0.3-1 g;
peled - 3-6 cm, 0.4-2 g.

The experiments were conducted in July-August 1975-1977.

As can be seen from the foregoing data (see table), the final selected temperatures of all species, excluding peled, occupied the range of temperatures 25-27 °C. The young of peled selected the colder parts of the gradient at a temperature of 16-17 °C.

The general zone of avoided temperature in all species lay at 5-11 °C above the

selected thermozone and equalled for two year blue bream and fingerling bream, roach and perch 32-35 °C, and for peled 26-28 °C.

The mean of the steady avoided temperature is at 10-13 °C above the temperature of acclimatization, that coincides with earlier obtained data on small bream of two months age (2).

Mechanical driving, as a rule, increases the value of avoided temperatures by 0.3-3 °C. The most distinctly on mechanical stimulation react the fingerling blue bream and bream, to the lowest degree this reaction appears in young perch (see table).

The range of avoided temperatures adjoins the zone of shock and lethal temperatures, i.e. avoidance originates with the intensification of the action of factors leading to the death of the fish. Lethal temperatures of fish for a long time acclimatized to 30 °C have still higher values.

Thus, the presented analysis of avoided, shock and lethal temperatures of young fish shows that these reactions appear by magnitude as a single series. Absolute values of any of these reactions can be used as initial data for the design of thermo-obstructing devices. In this case, as was shown by our experiments with mechanical driving, the presence of disturbing factors in the zone of avoided temperatures can somewhat displace the level of reaction of avoidance in young fish.

TABLE

Temperature reactions of young fish

Species	Temperature °C						
	Initial Selected	Avoided		Shock	Lethal	Extreme *	
		Natural	Heated			Shock	Lethal
Bream	26.6	33.3	34.7	33.5	34.3	37.2	38.3
Roach	25.3	32.8	34.2	32.0	33.6	36.1	37.1
Blue Bream	26.8	31.7	34.4	-	-	-	-
Perch	25.3	34.1	34.5	32.7	33.9	34.8	36.2
Peled	16.8	26.8	27.9	29.9	30.4	30.9	31.8

* Fish acclimatized for 10 days at 30 °C

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Notice

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