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9. ABSTRACT

Hatchery-reared largemouth bass fed either Oregon Moist Pellet (OMP) or natural food organisms were compared for their organoleptic quality. Fish were held a minimum of 24 hours prior to slaughter and were dressed by removing the head, skin, and viscera. They then were washed and frozen. Fillets baked without seasoning were evaluated by a panel of eight judges. A difference in flavor readily was distinguished between the fish receiving the OMP diet and those receiving natural organisms. The greatest objection to the taste of the OMP-fed fish was a "fish-oil" flavor. Texture and appearance were essentially the same in all the fish. This research indicates that other formulations of artificial foods for largemouth bass should be investigated with emphasis on their effects of the organoleptic quality of the bass. If a ration formula such as the OMP is necessary for feeding bass man-made diets, it should be replaced a few days or weeks before the fish is to be consumed, perhaps with forage fish.

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COMPARISON OF ORGANOLEPTIC QUALITY OF LARGEMOUTH BASS FED NATURAL AND ARTIFICIAL DIETS

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DEVELOPMENTS IN FEEDING LARGEMOUTH BASS (*Micropterus salmoides*) to adult size as reported by Snow [3] suggest that ultimately artificial rations may be employed to grow and maintain adult largemouth bass for catchout pond fishing or as a food fish. In such an event, the effect of the diet on the flavor of the meat which will be consumed as food is a matter of interest.

To date the Oregon Moist Pellet (OMP) [1] has proven to be the most effective feed for largemouth bass although other formulations have been fed with a lesser degree of success [4, 5]. Feed conversions (lb feed/lb gain) of 1.5 for OMP the first year of growth and 2.75 the second year suggest that the largemouth bass may possibly be cultured as a food fish on artificial diets.

During the spring of 1973 largemouth bass from the Warm-Water Development Center that were reared on forage fish were compared with others that were fed for varying periods of time on the OMP in order to evaluate the effects of the artificial diet on the characteristic flavor of the largemouth bass.

METHODS

Hatchery reared largemouth bass of the Marion Reference Strain, age classes 2, 3, and 4, that had been fed only the OMP (table 1) from a size of approximately 5 centimeters were used in the study.

The fish were reared in earthen ponds without access to forage fish and were in good condition and feeding actively at the time they were collected for organoleptic evaluation. Other bass of the same breeding, in age classes 1, 2, 3, and 5, had been reared on natural pond food and forage fish, primarily gold fish and Tilapia, without any artificial food. These fish also were in good condition and were consuming appreciable quantities of forage fish at the time of collection, as indicated by growth rate and stomach analyses.

*Table 1.—Composition of Oregon Moist Pellet
(Hublou [1])*

Ingredient	Percent of diet
Dry mix:	
Herring meal	28
Cottonseed meal	15
Dried whey product	5
Wheat germ meal	4
Shrimp or crab meal	4
Corn distillers' dried solubles	4
Vitamin premix	1.5
Wet mix:	
Wet fish and fish parts	30
Kelp meal	2
Herring or soy oil	6
Choline chloride	0.5

All fish were removed from the rearing ponds and held in a holding house for 24 to 48 hours before being slaughtered, except the age class 4 OMP fed fish which were held for 96 hours. A minimum of five fish per age class from each feeding regime were randomly selected for the evaluation, except in age classes 3 and 5 of the fish fed forage fish where only two fish per class were available.

After removing the fish from the holding tank, they were quickly stunned by a sharp blow to the head. Growth and gonad measurements were made on the fish as part of a companion study. The fish were subsequently dressed for organoleptic evaluation by removing the skin, head, and viscera. The dressed carcass was washed, weighed for determination of dressing percentage, and placed in a labeled 2-mil plastic bag for freezing. The fish were frozen at 0°F within 1 hour following slaughter and stored at this temperature in a 3-mil overwrap for approximately 10 days before being transported to Auburn University for evaluation. Following an additional 10 days storage at 0°F, the fish were thawed in running tapwater in the Nutrition and Technology Laboratory of the Department of Fisheries and Allied Aquacultures.

Fillets were removed from each side of each fish, wrapped in aluminum foil, and cooked without the addition of salt or seasoning for 20 minutes in an oven at 400°F. Two evaluations were made: the first was a triangle test conducted according to the method described by Larmond [2], which was used to determine whether or not a significant difference existed in sensory quality among age classes or between diets; then, where a distinguishable difference was established, a 10-point hedonic rating test was used to evaluate the intensity of difference in flavor, texture, or appearance among the fish.

The judges were trained personnel who had experience in evaluating fish for abnormal flavors. Eight evaluators participated in the triangle test. For each comparison the judge was given three unknown samples, two alike and one different, and asked to select the odd sample. To test differences between diets for young fish and for older fish and between ages within a feeding regime the following comparisons were made: age class 2 forage fish versus age class 2 OMP; age class 5 forage fish versus age class 4 OMP; age class 2 OMP versus age class 4 OMP; and age class 2 forage fish versus age class 5 forage fish. Ten panelists participated in the hedonic evaluation which followed the difference test by approximately 2 hours.

RESULTS AND DISCUSSION

The average dressing percentage for all fish was 47.6 with no significant difference between the two diet groups. Females had a lower dressing percentage, possibly because of removal of heavily developed gonads in dressing. The overall average condition factor, K_{TL} , was 1.75 indicating better than average weight for the fish in relation to length. There was no significant difference in condition between fish fed forage fish or OMP. However, the bass fed forage fish were considerably larger than those fed OMP, especially in class 2 when the forage fish group gained 2.3 times as much as the OMP fed bass. Size of fish ranged from an average of 481 grams for class 2 OMP to an overall of 1,492 grams for class 5 forage fed fish. All fish were attractive in appearance and well proportioned in spite of size differences.

The judges readily distinguished flavor differences between fish fed the two diets as indicated in table 2. In all eight evaluations, the judges made correct identification of the odd sample. They were not able to distinguish between age classes within a diet treatment.

Table 2.—Flavor difference tests between large-mouth bass fed OMP or forage fish and between fish in young and older age classes

Comparison	Number of evaluations	Number correct	Statistical significance
Age 2 OMP vs. Age 2 forage	8	8	$P < 0.001$
Age 4 OMP vs. Age 5 forage	8	8	$P < 0.001$
Age 2 OMP vs. Age 4 OMP	8	5	NS
Age 2 forage vs. Age 5 forage	8	3	NS

In the 10-point hedonic rating test the evaluators gave higher scores to all of the bass that had been fed forage fish, as table 3 indicates. Fish in age classes 1, 2, and 5 had significantly higher flavor scores than the other samples. Two of the three OMP fed samples had flavor scores near 6 which indicated marginal acceptability. Texture was not significantly different among the samples. Appearance was essentially the same for all fish. The age 4 OMP fish were slightly darker than most of the others.

The judges, when asked for comments on organoleptic qualities of the fish, listed a "fish-oil"

Table 3.—Average organoleptic scores for largemouth bass of various age classes fed OMP or forage fish

[Scoring schedule: 10 = excellent, 8 = good, 6 = moderate, 4 = poor, 2 = very poor, 0 = unacceptable]

Age class and diet	Number of evaluators	Average score ¹		
		Flavor	Texture	Appearance
1 Forage fish	10	7.7 _a	8.6 _a	8.1 _a
2 Forage fish	10	8.3 _a	8.6 _a	8.8 _a
3 Forage fish	10	7.1 _b	8.0 _a	7.9 _{a,c}
5 Forage fish	10	8.1 _a	8.6 _a	8.2 _a
2 OMP	10	7.0 _b	8.2 _a	8.3 _a
3 OMP	10	6.2 _{b,c}	7.5 _a	7.9 _{a,c}
4 OMP	10	6.2 _{b,c}	7.8 _a	7.4 _{b,c}

¹Means with the same subscript were not significantly different at $P < 0.05$.

flavor as the most important objection to the OMP fed bass, along with "strong" and "pond-like". Comments on flavor for the forage fed bass were usually "mild", "sweet", and "typical good bass flavor".

The cause of the undesirable flavor in the fish fed the artificial diet was probably related to the large amount of marine fish oils in the OMP formula. Marine fish oil in channel catfish feeds produced objectionable "cod-liver-oil" flavor in the fish consuming the feeds¹. It is unlikely that consumers in

¹Fisheries Research Annual Report, Volume I, Part X, Processing and Marketing Technology of Commercially Cultured Catfish. Auburn Agricultural Experimental Station, Auburn, Alabama. 1972.

the Southeastern United States would find the marine-fish-oil type flavor desirable in bass or catfish.

This research indicates that other formulations of artificial foods for largemouth bass should be investigated with emphasis on their effects on the organoleptic quality of the bass. If a ration formula such as the OMP is necessary for feeding bass man-made diets, it should be replaced a few days or weeks before the fish is to be consumed, perhaps with forage fish.

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