

AGENCY FOR INTERNATIONAL DEVELOPMENT WASHINGTON, D. C. 20523 BIBLIOGRAPHIC INPUT SHEET	FOR AID USE ONLY
---	-------------------------

1. SUBJECT CLASSIFICATION	A. PRIMARY Agriculture
	B. SECONDARY Fisheries

2. TITLE AND SUBTITLE
Fish feeds and nutrition; cool weather feeding of channel catfish

3. AUTHOR(S)
Lovell, R.T.

4. DOCUMENT DATE 1975	5. NUMBER OF PAGES 3 p.	6. ARC NUMBER ARC
---------------------------------	-----------------------------------	-----------------------------

7. REFERENCE ORGANIZATION NAME AND ADDRESS
Department of Fisheries and Allied Aquaculture, Auburn University, Auburn, Alabama 36830

8. SUPPLEMENTARY NOTES (*Sponsoring Organization, Publishers, Availability*)
(In Commercial fish farmer and aquaculture news, May/June 1975, p. 28-29)

9. ABSTRACT

In fish whose body temperature varies with water temperature, digestion and metabolism also are very much affected by water temperature. Fish feed less consistently during cool weather, and nutrient requirements, the ability to assimilate some types of food, and the deposition of body fat and protein in warm water fish all are affected by change in water temperature. Although there has been relatively little research directly related to cool weather feeding of farm-raised channel catfish, the following nutrition-water temperature interrelationships have been demonstrated with warm water fish: 1) Food moves through the gut more slowly at low temperatures; 2) Catfish will feed when hungry, or the gut is empty, even at very low water temperatures. However, at low temperatures, the gut empties more slowly and the fish may not become hungry as quickly as at higher temperatures; 3) Percentage digestibility and/or metabolism of starch and vegetable proteins is poorer at lower water temperatures; 4) Fish respond to higher percentages of protein at higher water temperatures; 5) Water temperature affects deposition of fat and protein in the body of intensively-fed channel catfish. A winter-feeding experiment to measure changes in weight and body composition (fat and protein) of channel catfish concluded that winter feeding was much more profitable than not feeding and that the fed fish contained more protein and less fat than the non-fed fish. The fed fish also had higher percentages of protein than fall-harvested catfish.

10. CONTROL NUMBER PN-AAC-044	11. PRICE OF DOCUMENT
---	-----------------------

12. DESCRIPTORS Catfishes Feeding stuffs Channel catfishes? Seasonal variations Environments Temperature perception Feeding Habits	13. PROJECT NUMBER
	14. CONTRACT NUMBER CSD-2780 211(d)
	15. TYPE OF DOCUMENT

COOL WEATHER FEEDING OF CHANNEL CATFISH
R. T. Lovell 1974, 2 p

Several nutrition-water temperature interrelationships have been demonstrated with warmwater fish. These include: food moves through the gut more slowly at low temperature; catfish will feed at low water temperatures; metabolism of starch and vegetable proteins is poor at low water temperatures; fish's response to high percentage protein in feed is greater at higher water temperatures; and that water temperature affects deposition of fat and protein in the body of intensively-fed channel catfish.

In experiments at Auburn University during the winter of 1973-74 it was found that by feeding fish at 1 percent of fish weight every other day an increase in fish weight of 23% could be obtained. In terms of economic benefit \$116/acre would be gained.

FISH FEEDS AND NUTRITION

Cool Weather Feeding of Channel Catfish



**By Tom Lovell
Department of Fisheries and Allied Aquaculture
Auburn University**

Fish Feeds and Nutrition

By Tom Lovell, Professor, Auburn University

Cool Weather Feeding of Channel Catfish

Editor's Note: Tom Lovell, Ph.D., is professor of fisheries and allied aquacultures at Auburn University, Auburn, Alabama, and chairman of the Research Committee of the Catfish Farmers of America.



External temperature affects feeding habits and feed utilization in a manner very much unlike that of land animals.

Variations in temperature may cause livestock and poultry to eat more or less, but digestion and metabolism in these animals is pretty much unaffected because of the constant body temperature.

In fish, where body temperature varies with water temperature, digestion and metabolism are very much affected by the temperature of the water. As every catfish farmer knows, fish feed less consistently during cool weather. In addition, the nutrient requirements, the ability to assimilate some types of food and the deposition of body fat and protein in warmwater fish are all affected by change in water temperature.

The Interrelationships

Although there has been relatively little research directly related to cool weather feeding of farm-raised channel catfish, the following nutrition-water temperature interrelationships have been demonstrated with warmwater fish:

1. Food moves through the gut more slowly at low temperature, as found by researchers at Kansas State University. The slower passage is due to slower solubilization of the food by digestive enzymes and reduced propulsion of food by the intestines (peristalsis).

In extended cold weather, food has been found in the gut of channel catfish seven days after feeding.

2. Catfish will feed when hungry, or the gut is empty, even at very low water temperature. However, at low temperatures, the gut empties slower, and the fish may not become hungry as quickly as at higher temperatures.

3. Percentage digestibility and/or metabolism of starch and vegetable proteins is poorer at lower water temperatures. Raw starch (as in corn) is only about 25 percent digested by channel catfish in warm water and is even lower in cold water. Work at the Southeastern Fish Cultural Station at Marion, Alabama, showed that channel catfish utilized

animal sources of protein about as well at 69 degrees F. as at 76 degrees F., but plant sources of protein were not utilized as well at the lower temperature as at the higher temperature.

4. Fish respond to higher percentages of protein at higher water temperatures. This has been demonstrated in coldwater and warmwater fish. This is perhaps related, to a large degree, to the fish's daily protein need which is higher at warmer temperatures.

Research at the Fish Farming Experimental Station at Stuttgart, Arkansas, indicated that feeding 25 percent protein feed to channel catfish during the spring and fall when water temperature was below 75 degrees F. — 30 percent protein feed when temperature was between 75 degrees F. and 80 degrees F. — and 35 percent protein feed when temperature was above 80 degrees F. — produced as much fish gain as feeding 35 percent protein feed all season, and more gain than feeding 30 percent protein feed all season. The effect of water temperature on ratio of protein to energy (of various sources) in catfish feeds has not been established.

5. Water temperature affects deposition of fat and protein in the body of intensively-fed channel catfish. It was found at the Georgia Agricultural Experiment Sta-

tion at Skidaway Island that the fat level in channel catfish increased with increasing temperature from 68 degrees F. to 86 degrees F. This agrees with a pond-feeding study at Auburn University (discussed below) which indicated that a higher percentage of the weight gain in channel catfish was protein in winter than in summer, although food conversion was poorer in winter.

The Auburn Study

A study was conducted at Auburn University during the winter of 1973-74 to measure the changes in weight and body composition (fat and protein) of channel catfish weighing near 1 pound that were held overwinter in ponds at densities of 2,000 fish per acre and fed under one of the following feeding regimes:

1. No feed.
2. An allowance of 1 percent of fish weight every other day.
3. An allowance of 1 percent of fish weight only on "warm" days or when water temperature at 3 feet was above 54 degrees F. (average winter water temperature in Alabama).

Percentage weight change, feed conversion and economic benefit (costs other than feed not included) of winter feeding were as follows:

Treatment	Days Fed	Weight Change	Feed Conversion	Benefit Of Winter Feeding
No Feed	0	- 9%	—	—
Fed Alternate Days	51	+ 23%	2.8	\$116/acre
Fed Warm Days	52	+ 18%	3.5	\$109/acre

Dressing percentage and protein and fat content of the dressed fish were as follows:

Treatment	Dressing Percentage	Dressed Fish % Protein	Composition % Fat
No Feed	60	15.7	10.1
Fed Alternate Days	61	18.0	8.2
Fed Warm Days	61	17.2	9.0

The experiment showed that winter feeding was much more profitable than not feeding, and that at this relatively low rate of feeding, the fish would eat every other day regardless of temperature. Also, the fed fish contained more protein and less fat than the fish that lost weight. The fed fish had higher percentages of protein than fall-harvested catfish.

In reviewing the above results, consider that catfish may respond differently in large ponds (those in the experiment were 1/10 acre), when fed higher allowances, with different feeds, or under colder winter temperature conditions.

Conference On Feeds

On April 24, a group of catfish farmers, feed manufacturers and researchers met on the Mississippi State University campus to exchange recent information on productive catfish rations and particularly cool weather feeds. The following suggestions were made:

1. For warm water (80-90 degrees F.) feeds, 36 percent total protein with at least 1/6 of the protein from high quality animal sources and the remaining protein from mixed plant sources but limiting the amount of cottonseed meal to 10 percent of the formula. (Available energy level should be 1,100-1,200 cal/pound; raw corn is a poor energy source for fish — and fat, rice bran, wheat and wheat byproducts (except bran) are good sources.

2. For cool water (less than 75 degrees F.), in comparison with warm water feeds, lower total protein level, perhaps 25 percent; higher fraction of animal protein, perhaps 1/2 of total protein; higher level of available energy in proportion to protein content of the feed, with more energy supplied by fats (preferably low-melting fats).

3. A satisfactory winter feeding schedule for channel catfish in ponds, until more definitive data is available, is an allowance of 1 percent of fish weight fed on alternate days.

●