



## Off-flavor in U.S. Catfish Operations

Off-flavor is the development of undesirable flavors in fish that render them temporarily unmarketable. Off-flavor is a critical problem for the catfish industry because it can lead to delayed fish harvests. Harvest delays may cause economic losses by forcing producers to keep fish in ponds longer, creating an increased risk of loss due to disease problems, loss of sales at processing plants, reduced feed efficiency, and delays in stocking the next crop of catfish. At the producer level, off-flavor adds an estimated \$15 to \$23 million annually to catfish production costs. In addition, flavor quality is important to the catfish industry's market share; if flavor is poor, consumers may purchase other foods in place of catfish.

The most common off-flavors are caused by metabolites produced by blue-green algae. These off-flavors are referred to as "musty" -- from 2-methylisoborneol (MIB), and "muddy" -- from geosmin.

In January 2003, the USDA's National Animal Health Monitoring System (NAHMS) conducted its second national study of America's catfish industry, Catfish 2003. There were 739 participating producers from four States. These four States were divided into two regions. The East region was defined as Alabama and Eastern Mississippi, the West region as Arkansas, Louisiana, and Western Mississippi. Results from Catfish 2003 related to off-flavor in catfish are presented here.

### Off-flavor Occurrence and Duration

According to Catfish 2003, 69.6 percent of catfish operations and 53.3 percent of catfish ponds experienced delayed harvests due to off-flavor in 2002. Delayed harvests due to off-flavor were more likely to occur on larger operations and occurred on about an equal percentage of farms in the East and West regions (Table 1).

Catfish absorb MIB and geosmin from the water almost immediately. Absorption continues as long as MIB and geosmin are in the water. Purging off-flavor from fish does not occur until the water is free

of MIB and geosmin, which may take anywhere from a few days to several weeks. Purging rate is affected by the initial level of MIB and geosmin in the fish, water temperature, and size and fat content of the fish.

**Table 1. Percentage of Operations (and Percentage of Ponds on These Operations Where Foodsize Fish were Harvested) that Experienced Any Harvest Delays in 2002 Because of Off-flavor Problems, by Size of Operation and by Region:**

Harvest Delay on...	Percent Operations					Region	
	Size of Operation (Surface Acres)					East	West
	1-19	20-49	50-149	150 or More	All Ops.		
Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	
Operations	21.7	61.9	78.0	86.3	69.6	68.7	70.6
Ponds	26.8	48.2	55.7	53.9	53.3	59.2	50.8

On operations with harvest delays due to off-flavor in 2002, the average length of off-flavor episodes was 15 to 30 days on 40.1 percent of operations. Ongoing problems with off-flavor in ponds were reported by 26.9 percent of operations. More than 9 in 10 operations (91.8 percent) reported that their shortest off-flavor episode was at least 7 days long.

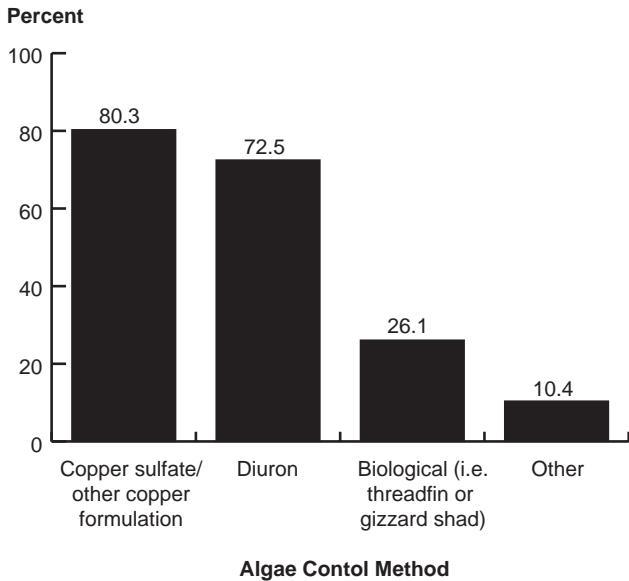
### Algae Management and Off-flavor Treatment

Overall, 37.8 percent of producers attempted to prevent algae overgrowth with a control program; 34.1 percent controlled blooms only in response to problems such as off-flavor; and 28.1 percent implemented no algae control treatments. A higher percentage of producers in the East region (50.1 percent) used a preventive program than producers in the West region (23.7 percent). Similarly, a higher percentage of operations in the West region (38.9 percent) had no algae control treatments compared to operations in the East region (18.6 percent).

Previous reports indicate off-flavor is most likely to occur from June through September. Blue-green algae generally do not grow or produce MIB in water temperatures below 60 degrees Fahrenheit. Of producers using preventive algae treatment programs, 89.7 percent began their program between March and June and 86.1 percent ended it between September and November.

Two algicides are currently approved for use in catfish ponds: copper sulfate (CuSO<sub>4</sub>) or other copper-based products, and Diuron<sup>®</sup>, an herbicide known to have algicidal properties at low concentrations. These two algicides are used widely by the catfish industry. Some producers also have tried a biological method, using plankton feeding fish in their ponds to reduce algae (Figure 1).

**Figure 1. For Operations that Used Algae Control Programs, Percent of Operations by Control Method**



After delayed harvest due to an off-flavor problem occurs, producers have several options when trying to purge fish of off-flavor. Some do nothing, knowing that blooms of blue-green algae are sporadic and eventually disappear. Some move fish to another pond with fresh, clean water. Many producers use one of the methods followed for preventing and managing the growth of algae.

Catfish 2003 showed that on operations with less than 20 surface acres about two-thirds (64.3 percent) of ponds with delayed harvests received no treatment. Affected ponds on larger operations were more likely to be treated with Diuron, CuSO<sub>4</sub>, or a combination of the two (Table 2).

**Table 2. For Ponds that Had Delayed Harvests, Percentage of Ponds that Were Treated with the Following Chemicals, by Size of Operation:**

Chemical	Percent Ponds				
	Size of Operation (Surface Acres)				
	1-19	20-49	50-149	150 or More	All Ops.
	Pct.	Pct.	Pct.	Pct.	Pct.
Diuron	1.9	6.9	17.9	31.0	27.2
CuSO <sub>4</sub>	14.8	17.2	15.8	10.9	12.1
Diuron and CuSO <sub>4</sub>	19.0	64.8	39.8	29.1	32.6
None	64.3	11.1	26.5	29.0	28.1
Total	100.0	100.0	100.0	100.0	100.0

## Conclusion

Off-flavor is an economically important problem for the catfish industry. Off-flavor occurs throughout the industry, although it appears in a lower percentage of smaller operations. Currently, chemically treating ponds is the most widely practiced method for prevention and control of algae associated with off-flavor.

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