

Algae Management and Off-flavor in U.S. Catfish Operations, 2009

The term off-flavor refers to undesirable flavors in fish. Off-flavor is caused by some algae and is a critical problem for the catfish industry because it can lead to delayed fish harvests. By forcing producers to keep fish in ponds longer, harvest delays may cause economic losses by creating an increased risk of fish loss due to disease problems, reduced feed efficiency, over-sized fish 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 Mississippi alone. In addition, flavor quality is important to the catfish industry's market share; if flavor is distasteful, consumers may purchase substitutes for catfish.

In January 2010, the USDA's National Animal Health Monitoring System conducted its third national study of the U.S. catfish industry, Catfish 2010. A total of 424 producers from 4 States participated in the study. These four States were divided into two regions. The East region was defined as Alabama and Eastern Mississippi; the West region was defined as Arkansas, Louisiana, and the Mississippi Delta. Results from the Catfish 2010 study related to off-flavor in catfish are presented here.

Algae management

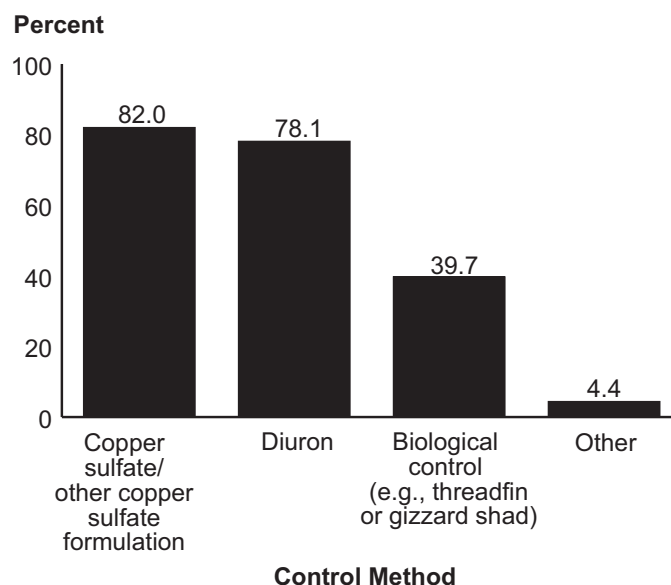
Overall, 40.9 percent of foodsize fish producers attempted to prevent algae overgrowth with a control program; 24.8 percent controlled blooms only in response to problems such as off-flavor; and 34.3 percent implemented no algae control treatments. A higher percentage of producers in the East region (54.8 percent) used an algae preventive program than producers in the West region (19.1 percent). Similarly, a higher percentage of operations in the West region (55.7 percent) had no algae control treatments compared with operations in the East region (20.7 percent).

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. Blue-green algae generally do not grow or produce MIB in water temperatures below 60°F, and off-flavor is mostly likely to occur from June through September. Of

producers that used preventive algae treatment programs, 89.8 percent began their program from March through June and 84.3 percent ended it from September through November.

Of producers that typically implemented an algae control program, most used a chemical or biological method to prevent and manage the growth of algae (fig. 1). Two algicides are currently approved for use in catfish ponds: copper sulfate or other copper-based products, and Diuron®, an herbicide known to have algicidal properties at low concentrations. While these algicides are used widely by the catfish industry, some producers also have tried a biological method (i.e., plankton-feeding fish) to reduce algae.

Figure 1. Percentage of operations that used algae control programs in 2009, by control method



Off-flavor occurrence and duration

In 2009, a higher percentage of catfish operations (80.7 percent) experienced delayed harvests due to off-flavor than operations in 2002 (69.6 percent) [table 1]. With the exception of operations in 2002, the percentages of operations and ponds that experienced harvest delays due to off-flavor problems were higher in the East region than in the West region.

Table 1. Percentage of operations and percentage of ponds from which foodsize fish were harvested that experienced harvest delays because of off-flavor problems in 2002 and 2009, by region

Harvest delay on...	East region	West region	All operations
Operations (2002)	68.7	70.6	69.6
Operations (2009)	86.8	72.0	80.7
Ponds (2002)	59.2	50.8	53.3
Ponds (2009)	56.6	43.9	48.1

While larger operations are still more likely to experience delayed harvests due to off-flavor, the percentage of smaller operations (fewer than 20 acres) that had any harvest delays because of off-flavor problems more than doubled from 2002 to 2009 (table 2).

Table 2. Percentage of operations and percentage of ponds from which foodsize fish were harvested that experienced any harvest delays because of off-flavor problems in 2002 and 2009, by size of operation

Harvest delay on...	Size of Operation (surface acres)			
	1–19	20–49	50–149	150 or more
Operations (2002)	21.7	61.9	78.0	86.3
Operations (2009)	55.3	75.2	83.0	88.6
Ponds (2002)	26.8	48.2	55.7	53.9
Ponds (2009)	34.9	68.9	54.4	45.8

Catfish absorb MIB and geosmin from the water almost immediately. Absorption continues as long as MIB and geosmin are in the water. On operations with harvest delays due to off-flavor in 2009, the average length of off-flavor episodes was 15 to 30 days on 37.9 percent of operations. Ongoing problems with off-flavor in ponds were reported by 21.1 percent of operations. More than 9 of 10 operations (96.2 percent) reported that their shortest off-flavor episode was at least 7 days.

Off-flavor treatment

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 the size and fat content of the fish.

Producers have several options when trying to purge fish of off-flavor. Some do nothing, knowing that blooms of blue-green algae are transient and will eventually disappear. Some move fish to another pond with fresh, clean water.

As in 2002, Diuron or a combination of Diuron and copper sulfate were the chemical treatments of choice for affected ponds in 2009 (table 3). The percentage of ponds that were treated only with copper sulfate decreased by half from 2002 to 2009. This decrease could be due to the substantial increase in the cost of copper sulfate from 2002 to 2009.

Table 3. Percentage of ponds that were treated with the following chemicals due to harvest delays because of off-flavor problems in 2002 and 2009

Chemical	Percent of Ponds*	
	2002	2009
Diuron only	27.2	23.7
Copper sulfate only	12.1	6.7
Both Diuron and copper sulfate	32.6	36.5
No treatment	28.1	33.1
Total	100.0	100.0

*For ponds with delayed harvests because of off-flavor problems.

From 2002 to 2009, there was a shift from doing no treatment to treating with Diuron alone or Diuron and copper sulfate combined in operations with fewer than 20 acres (table 4). For operations with 20 to 49 acres there was a shift from treating with both Diuron and copper sulfate combined to doing nothing.

From 2002 to 2009 there was a shift from doing no treatment or treating with Diuron alone to treating with Diuron and copper sulfate combined in operations with 50 to 149 acres. For operations with 150 or more acres there was a tendency to not treat instead of treating with copper sulfate alone.

Table 4. Percentage of operations that used the following treatment options for off-flavor

Treatment option	Percent Operations Size of Operation (surface acres)			
	1–19	20–49	50–149	150 or more
2002				
Diuron	1.9	6.9	17.9	31.0
Copper sulfate	14.8	17.2	15.8	10.9
Diuron and copper sulfate	19.0	64.8	39.8	29.1
None	64.3	11.1	26.5	29.0
2009				
Diuron	23.0	3.3	9.9	28.7
Copper sulfate	11.9	14.8	15.9	3.8
Diuron and copper sulfate	57.9	48.4	57.9	30.2
None	7.2	33.5	16.3	37.3

Conclusions

Off-flavor is an economically important problem for the catfish industry. Off-flavor occurs throughout the industry and continues to appear in a lower percentage of small operations. Chemically treating ponds is still the most widely practiced method for prevention and control of algae associated with off-flavor.

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