Review of Feeding Practices for Channel Catfish Production

William A. Wurts, Ph.D.
State Specialist for Aquaculture
Kentucky State University CEP at UK Research and Education Center
P.O. Box 469, Princeton, KY 42445
www.ca.uky.edu/wkrec/Wurtspage.htm

Feeding can account for as much as 50 percent of the cost of commercial channel catfish production. Offering too little feed at the beginning of the production season (April to June) can result in fish not reaching market size by autumn. However, feeding too much toward the end of summer can cause poor water quality, which can reduce growth and increase expense because of poor food conversion ratios (FCRs). The following guidelines for good feeding practices can improve catfish performance and increase farmers' profits.

There are several general rules for feeding catfish. However, there are always exceptions to the rules. For example, the percent of body weight (percent BW) fed and the FCR change as fish size increases. But before discussing exceptions, it is important to summarize and review the basic feeding practices.

Having the Right Feed

It is important to purchase a 28-32 percent protein, 100 percent nutritionally-complete pelleted feed. At water temperatures above 65º F it should be presented in the form of a floating pellet, and the feeding response should be observed. Between 60 and 65º F it is preferable to mix a slow-sinking feed with a floating feed, and below 60º F a sinking feed is needed. The feed should be distributed as evenly as possible over the entire pond surface, and with the prevailing wind. No more feed should be purchased than can be used during a 60 to 90 day period beyond the manufacturing date.

Feeding to Satiation

The practice of satiation feeding always provides the correct amount of feed (percent BW) for water temperatures above 60º F. When feeding to satiation the fish should be offered only what they will eat (clean up) in 20 to 25 minutes once a day. However, no more than 100 lb/ac with aeration and no more than 30 lb/ac without aeration should be offered. This applies equally to body weight feeding (see below).

Body Weight Feeding (percent BW)

This practice is most commonly used when the farmer has an accurate estimate of total fish weight in the pond. The daily feed is provided as a percent of total weight. For feed calculations, the percent is in decimal form (e.g. 3 percent = 3/100 = 0.03).

Water temperatures are again influential. In general, for spring and autumn feeding (cool weather) water temperatures in large local reservoirs are good indicators of pond water temperatures. Pond temperatures are colder in winter and warmer in summer than those in local reservoirs.

At 50-60º F, feed 0.5-1.0 percent BW (or 5-10 lb feed/1000 lb fish, daily) using sinking feed;

At 60-70º F, feed 2.0 percent BW (or 20 lb feed/1000 lb fish, daily);

At 70-86º F, feed 3.0 percent BW (or 30 lb feed/1000 lb fish, daily);

At 90-95º F, feed 0.5-1.0 percent BW daily;

Above 95º F, feed no more than 0.5 percent BW every three days.

Note also that the percent BW fed changes with fish size.

Timing of Feeding

Dissolved oxygen levels must be higher than 3.0 ppm (mg/1), preferably 5.0 ppm. For fish under intensive production (>2000 lb/ac) the feed should be offered between 10:00 am and 1:00 pm. Under extensive production (<2000 lb/ac) the fish will feed more aggressively if food is offered between 4:00 and 7:00 pm.

Growth and Conversion - Catch Them Young

As channel catfish grow their feed intake as percent BW decreases (Table 1). But the FCR increases; that is, the amount of feed it takes to produce a pound of fish increases. When water temperatures are between 75 and 85º F, catfish fry will consume feed at 10 percent BW daily, and 15-inch food fish will eat at a rate of 1.5 percent BW daily. FCRs for 6-inch fish and 15-inch fish will be 1.1 and 1.9, respectively. This means that it takes 1.1 lb of feed to produce a 1.0-lb gain in 6-inch catfish, and 1.9 lb of feed for a 1.0-lb gain in 15-inch fish, or 73 percent more feed for the same amount of growth. Because fingerlings and juvenile channel catfish (fish less than 0.5 lb each) are growing much faster, require more feed, and convert food to weight gain more efficiently; producers should do their best job of feeding when fish are young.

Table 1. Food conversion ratios (FCR) and percent body weight (percent BW) consumed at various sizes and optimum water temperature conditions (adapted from Robinson et. al. 1998)

Fish Size (lbs/1000 fish)	FCR	Daily Percent BW
60	1.1	4.5
100	1.3	3.75
600	1.7	2.5
1000	1.9	1.4
2000	2.1	1.1

How Much Protein, 28 or 32 Percent?

Commercial catfish farmers must use feeds that are 100 percent nutritionally complete. Statistically, research has shown that catfish fed complete diets containing 32 percent protein do not grow significantly better than those receiving feed with only 28 percent protein content. Because fingerlings and juvenile catfish are growing much faster than larger fish, it is better to use feeds with 32 percent protein for young catfish. However, as fish get larger (greater than 0.5 lb each), complete feeds containing 28-30 percent protein might be a more practical choice.

To ensure good growth, a catfish farmer should use a 32 percent protein diet for the first two months after stocking fingerlings. A 30 percent protein feed could be fed for the second two months, then 28 percent protein for the last two months before harvest and restocking. The 28 percent protein diet could be used as a low-cost finishing feed at a time in the production season when the greatest amount of food is used per acre. This reduces the cost of feeding large quantities (80 to 100 lb feed/acre daily), and lowers the levels of nitrogen wastes – ammonia and nitrite – in the water.

Protein contains approximately 16 percent nitrogen. The protein in feed is the source of nitrogen wastes in fish production ponds. Decreasing the protein content from 32 percent to 28 percent will reduce nitrogen wastes by 12.5 percent. This also helps lower the risk of ammonia and nitrite toxicity during the last two months of

production, when these wastes are at their highest concentrations.

Under-stocking or Multiple Batch Feeding Practices

Producers can closely estimate how many catfish are put into their ponds because they purchase and stock fingerlings by weight. One thousand, 6-8 inch catfish fingerlings weigh approximately 100 lb. If a farmer stocks 500 lb of 6-8 inch fingerlings in a 1.0-ac pond the stock density is some 5,000 fish/ac. Because the weight of fingerlings stocked in each pond is recorded, the most effective way to start feeding fingerlings is by the percent BW method. However, if there are already larger fish in the pond when fingerlings are stocked, a practice called "under-stocking" or "multiple batch production," feeding becomes more complicated. For example, assuming the producer stocks a new pond with 500 lb of 6-8 inch fingerlings for the first time, it is easy to calculate the amount of food needed. This size fingerling will consume a quantity of feed as high as 4.0 percent BW daily when temperatures are between 75 and 85º F, equivalent to 20 lb of feed. But if the 1.0-ac pond already contains 5,000 catfish each weighing 1.3 lb and consuming a total of 86.5 lb of feed daily, then the addition of 20 lb more food for the fingerlings brings the total to slightly more than 106 lb of feed per day.

At this new level, the farmer will exceed the maximum daily feeding rate of 100 lb/ac. But a daily rate of 100 lb/ac will not provide enough food for the fingerlings, and especially as the food-size fish are larger and more aggressive. So, with 100 lb/ac of floating feed and 6,500 lb of larger fish crowding out the smaller fingerlings at mealtime, the fingerlings are not likely to perform well in terms of either growth or survival. Furthermore, exceeding the 100 lb/ac limit may cause deterioration of water quality to the detriment of all the fish.

But there are some practical alternatives for "multiple batch production" or "under-stocking." First, selectively harvest fish weighing over 1.0-1.25 lb before stocking the next batch of fingerlings. This will reduce the number of larger fish present and lower the total amount of feed needed, and allow the farmer to provide enough additional food for the new fingerlings without exceeding the maximum daily limit. Second, to help fingerlings find feed while the big fish are in a frenzy to get the floating pellets, a smaller size sinking pellet containing 32 percent protein can be fed together with the floating feed. This practice can be continued for one to two months after the new fingerlings are released. Accurate feeding of "multiple batch" fingerlings can be achieved with the help of a feeding table (Table 2) which adjusts feeding rates on a weekly basis. And using a floating feed for the larger catfish, which were not removed, will enable easy adaptation to satiation rates as the fish continue to grow.

Table 2. Feeding table for 1000 channel catfish fingerlings in "multiple batch" production, at water temperatures of 70 to 86°F (adapted from Wurts and Wynne 1995).

Fish Size (lbs)	Time (days)	Total Weight (lbs)	Daily Feed Ration (lbs)
0.1	0	100	4
0.12	7	120	4.6
0.15	14	150	5.4
0.19	21	190	6.6
0.23	28	230	7.5
0.29	35	290	8.9
0.35	42	350	10.2
0.43	49	430	11.9
0.53	56	530	14

When practicing this continuous production method, it is important to keep good records about stocking, harvest, and feeding. These data can be used to estimate fish size, total weight of fish in a pond, feeding rates, FCR, and overall survival. Record the number of pounds stocked and harvested, average individual weights of the fingerlings stocked and food fish harvested (weight per 1000 fish) and the total amount of feed fed to each pond. This information is every farmer's personal scorecard and provides information on profitability of the farm.

Seasonal Adjustments of Feeding Rates

Channel catfish are cold-blooded animals (ectotherms). As water temperature increases and decreases so does the feeding activity of the catfish. To prevent excessive and underfeeding, rates must be adjusted as temperature changes. As long as water temperatures are above 60º F, satiation feeding will provide the correct amount of food (percent BW) required by channel catfish. When water temperatures drop below 60º F, channel catfish are reluctant to feed at the surface, and satiation feeding is no longer a reliable practice. It is difficult to observe feeding activity when the food sinks and the fish do not come up to feed. This is true whether it is autumn or spring.

Catfish will still consume floating feed when water temperature is between 60 and 65º F. But when the temperature falls below 60º F, a sinking pellet should be used.

Mixing a slow-sinking feed with floating feed during this transitional period (60-65º F) allows fish to become accustomed to sinking feed when water temperatures are falling in autumn, and floating feed when temperatures rise again in spring.

The simplest way to adjust feeding when water temperature is between 50 and 60º F is to reduce by half the amount of feed consumed when the temperatures are 60 to 70º F. That is, if average daily feed consumption is 66 lb/ac when temperatures are 60 to 70º F, the daily feeding rate is reduced to 33 lb/ac when temperatures are between 50 and 60º F. In this same example, if water temperatures drop below 50º F, the standard recommendation is to feed 33 lb/ac every other day or every third day. When ice begins to form around the edges of ponds, feeding should be halted.

Because feed is the largest single operational cost of any intensive farm, feeding accurately can make the difference between profit and loss in commercial channel catfish farming. Knowing the general rules and understanding the exceptions are powerful management tools. The producer who takes a little extra time to observe feeding activity and adjust rates, to keep and maintain accurate records and even to create custom feeding tables, has a much better chance of owning the farm rather than betting it.

References

Robinson, E.H., M.H. Li, and M.W. Brunson. 1998. Feeding catfish in commercial ponds. Southern Regional Aquaculture Cente*r,* Publication No. 181, Southern Regional Aquaculture Center, Stoneville, Mississippi USA. 6pp.

Wurts, W.A., and F. Wynne. 1995. Sustainable channel catfish farming: Low management production through modified stocking and feeding practices. World Aquaculture, 26(3)54-59.