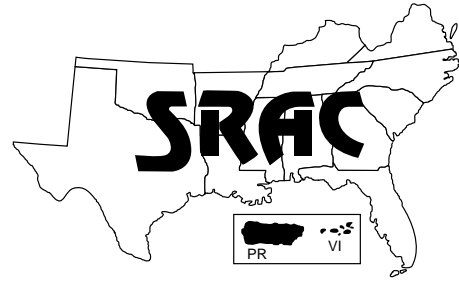


**Southern
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Bighead Carp

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In worldwide aquaculture, bighead carp (*Hypophthalmichthys nobilis*) ranks fourth in production (2.8 billion pounds in 1995). Bighead were introduced into the southern United States from China (the largest producer) in the early 1970s. Because the word “carp” has a negative connotation to some consumers, alternative names proposed for bighead include “noble fish,” “speckled amur” and “lake fish.”

In the United States, bighead are polycultured with channel catfish in approximately 5,100 acres of earthen ponds, including an estimated 4,000 acres in Arkansas, 500 in Mississippi, and 600 in Alabama. Bighead are an important source of additional income that, at times of low catfish prices, has kept some fish farmers in business. The primary market is to live-haulers who sell to specialty markets in large cities. The current U.S. market is limited and easily saturated. Wide fluctuations in price and unique marketing requirements for bighead have prompted farmers to seek alternative markets.

Bighead have a pleasant, mild tasting flesh, but are too bony for most U.S. consumers. The poten-

tial for canned and surimi (minced, formed fish) products is being studied.

Producing bighead with catfish requires that the bighead be hand-sorted from catfish each time a pond is seined, or seined separately with a large mesh seine before catfish are harvested. This is a significant disadvantage in multiple-batch catfish production. Other disadvantages of polyculture are that bighead consume pelleted feed intended for catfish, compete for aerated water, and may be vectors of fish parasites.

Biology

The bighead is aptly named, as this fish has a large head with a protruding lower jaw and eyes that “look down” (Fig.1). They are deep-bodied fish with tiny scales and gray to black blotches on the body, which gives them a speckled appearance. While bighead can reach 60 pounds or more and 4-year-old fish may weigh 20 to 25 pounds, the primary market is for 6- to 12-pound fish. Bighead can survive in a wide range of temperatures, but in one study their preferred temperature was 78 °F



Figure 1. Bighead carp.

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and the thermal death point was 100 to 102 °F.

The natural food of the bighead is zooplankton, along with larger phytoplankton. Bighead are filter feeders and use their fine, comb-like gill rakers to strain tiny animals and large algae from the water. If zooplankton are scarce, bighead may feed on detritus (organic matter and associated bacteria that accumulate on the pond bottom). Pond bottom organisms are not a normal food item; in one study, bighead were not found to have a significant impact on the benthic (pond bottom) community.

Under favorable conditions, bighead grow rapidly. After reaching 1 to 1¹/₂ pounds they can gain 1 pound or more per month. Growth is largely dependent on the fertility of the water and the stocking density. Market size fish (6 to 12 pounds) are usually 2 to 3 years old.

Bighead are native to large rivers and will not spawn in still waters or small streams. Although fish do mature in ponds and can be induced to spawn with hormone injections, they do not spawn naturally in still water. In large rivers, spawning typically occurs when spring rains flood the river and water temperature reaches 77 to 86 °F. Eggs are slightly heavier than water and settle out in still water. In rivers, eggs are suspended by turbulence and carried downstream.

Bighead have become established in the Mississippi River system and reportedly spawn in the Mississippi, Missouri and Illinois Rivers. Larval bighead have been collected from the lower Missouri River in late June and early July. There is some concern that bighead compete with native species such as the paddlefish and bigmouth buffalo, which have similar food habits and distribution. Many states prohibit the introduction of bighead or require a special permit for a bio-secure facility. Triploid bighead (apparently sterile) have been produced and could be raised for market, although a limited study showed

that they grow more slowly than normal (diploid) fish.

Culture

As with the other Chinese carps, techniques for reproducing bighead by induced spawning have been perfected by fish farmers and researchers (for additional information, see Rottmann and Shireman, 1992). Brood fish reach maturity at 3 to 4 years of age, with males maturing earlier than females. Fish can be induced to spawn with hormones (see SRAC publications 421-427). Optimum water temperature for induced spawning is 72 to 78 °F. For fingerling production, newly hatched fry are stocked into prepared nursery ponds (see SRAC publications 469 and 700) at rates of 100,000 to 500,000 per acre.

Bighead are typically raised to market size in polyculture with channel catfish, although they can be raised alone in fertilized ponds. In either case, farmers stock 300 to 400 small fingerlings per acre or 100 to 150 larger fish (stockers, typically ¹/₄ to ¹/₂ pound) per acre. The higher stocking rate for small fingerlings is based on anticipated low survival rates. Stocking rate is also adjusted according to the required market size at harvest. If stocking density is too low, bighead may grow beyond the desirable market size before the producer is able to market them. Although bighead do not grow well on pelleted feeds alone, they will consume catfish feed, especially when stocked at higher densities. Data from experimental ponds indicate that when stocked at recommended rates, bighead do not significantly affect catfish production or food conversion ratios.

Bighead will grow during the winter months in the southern U.S., but much more slowly than in the summer. Yields depend on fish size, pond fertility and culture period, and typically range from 500 to 800 pounds per acre.

Before stocking bighead into catfish ponds, it is critical to check fish health and treat for parasites if necessary. *Lernaea* (anchor

worm) is rarely seen in catfish production, but there have been several major catfish losses from this parasite after bighead were introduced into catfish ponds. There is no legal treatment for this parasite in food fish ponds.

Bighead are thought to improve pond water by continually cropping plankton to make the pond plankton community more stable and less prone to die-offs. There is no convincing evidence of this. In reducing concentrations of zooplankters (that feed on phytoplankton) and large phytoplankters, bighead no doubt influence the composition and size structure of the plankton community. However, this does not necessarily lead to improved water quality or reduced off-flavor.

Harvesting and marketing

The preferred market size for bighead is 6 to 12 pounds. Larger or smaller fish bring much lower prices.

Bighead are gentle and relatively easy to capture with a seine. They must be separated from catfish by hand at harvest, unless a very large mesh net is used. Where pond seining is done by crews from a catfish processor, stocking of bighead is discouraged because the sorting process slows the catfish harvest. Some producers have learned the art of "swimming off" bighead. This involves using an aerator to create a current through the net containing the bighead and catfish. A 10- to 15-foot section of the float line of the live car (sock) is then submerged slightly (6 to 8 inches) so that the bighead will swim against the current and out of the live car, thus separating themselves from the catfish. New advances in grading technology designed to select only market-size fish from multiple-batch catfish ponds may speed sorting of bighead as well.

Fish are transported in 10,000- to 20,000-pound loads. Shrinkage (loss in individual fish weight) during shipping can be as much as 8 to 15 percent in the summer and 2 to 5 percent in winter. Regardless of season, the changes

in water chemistry and temperature during transit and holding stress fish and can cause losses.

Successful marketing of any product requires a basic understanding of the perceptions and desires of the end user. The primary consumers of bighead in North America are persons of various Asian cultures in major metropolitan areas such as Chicago, Boston, Toronto and New York. Live, high quality fish are critical for this market. The typical consumer will buy only enough fish for the current day's meal and will pay top dollar only for live fish. Fish that die in retail markets are sold cheaply, at about 20 percent of the live price.

Most live bighead are sold from small street markets clustered within a particular area (Fig. 2). Competition is fierce and the typical vendor might sell only 100 to 500 pounds of bighead each day. Because space is limited and the value of dead fish is so low, retailers buy only what they can sell in a day or two. The typical markets are not accessible to large transport trucks, so fish must be warehoused and distributed to individual fish markets by smaller trucks (Fig. 3). Another difficulty is that retailers often want to see the quality of the fish before they buy.

Bighead are not easy to keep alive in small tanks, especially at market size. If a wholesaler is unable to market fish within a few days of receiving them, they are likely to die. Therefore, it is critical for producers, haulers, wholesalers and retailers to understand the importance of minimizing stress on the fish at each point of han-



Figure 2. Dressed bighead carp in a Chinese market.



Figure 3. Unloading live bighead on a crowded city street.

dling. Rough handling and rapid temperature and water quality shifts during hauling and holding are the largest logistical hurdles to overcome, especially in the summer. Transport tanks should be insulated, white fiberglass to stay as cool as possible. Salts are often useful to minimize stress and large blocks of chlorine-free ice can help keep fish cool during transit.

Bighead competes in the marketplace with other fish species sold live, and species that substitute for bighead affect the market price. For example, if there is an oversupply of tilapia, bighead prices will drop.

Grass carp, also polycultured with catfish, are more in demand and sell for a higher price than bighead. So, a farmer who also supplies grass carp has an advantage, in that they can be used as inducements to buy bighead as well.

Economics

Annual costs and returns for bighead raised in polyculture with channel catfish or alone in fertilized ponds were estimated from studies conducted at the University of Arkansas at Pine Bluff. A 15-acre pond with or without catfish was used as a basis for estimating costs and returns. In polyculture with catfish, bighead carp provided additional revenues of \$95 to \$391 per acre at market prices of \$0.25 to \$0.70 per pound, respectively. An average farm-gate price of \$0.40 per pound would yield an additional \$194 per acre. For bighead raised alone, the break-even prices above variable and total costs were estimated at \$0.28 and \$0.52 per pound, respectively. Thus, raising bighead alone is unlikely to be profitable at current prices. However, farmers with insufficient operating capital to produce catfish in all their ponds should be able to cover variable costs (and keep ponds in water) by raising bighead alone in the unused ponds. In addition, grass carp are commonly stocked at 10 to 30 fish per acre in ponds and represent additional income not considered in these estimates.

Product development

Bighead are currently sold whole. The large head is not a disadvantage but, in fact, is especially desirable prepared as soup. For processed products, however, the large head contributes to relatively poor dress-out rates, as do the strips of red meat along the lateral line that must be removed for all white meat products. Dress-out percentages for whole-dressed, steak, shank fillet and white meat shank fillet are approximately 68, 66, 31 and 27 percent, respectively. Fish weight does not significantly affect dress-out, although fish raised at higher densities have lower dress-out percentages.

Ultimately, price stability and expansion of the market for bighead depend on the development of new processed products (Fig. 4). Pilot studies have demonstrat-



Figure 4. Canned bighead carp.

ed that canned bighead is well accepted by consumers, as the canning process softens and eliminates bones. In one study, more than 60 percent of the taste test panelists felt that products made with bighead were equal to or better than canned tuna, and said they would pay a similar price. Processed meat is bland, light in color, low fat (less than 1 percent crude lipids), and relatively soft. Texture could be improved by

making the meat firmer. Despite its potential, yields of white meat suitable for canning are low, which should increase the market price. Developing markets for new products is difficult, and many new fish products do not gain national acceptance.

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