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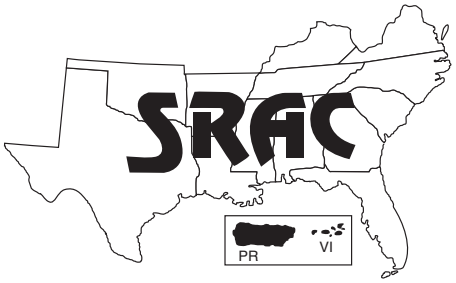

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Cage Culture Problems

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High density aquaculture has been described by the United States Department of Agriculture as the most intensive form of agriculture practiced on a large scale in this country. Cage culture is one of the most intensive forms of aquaculture. Because of this, there are inherent problems with cage culture that can prove challenging. This fact sheet addresses some of them. For additional information see SRAC Publication Nos. 160–166.

Signs of fish stress

Early signs of stress in fish are difficult to observe because ponds are usually turbid or murky and fish attempt to hide from people. Fish farmers, especially new ones, like to show off their fish to visitors, but unusual movements and sounds around the cages can cause stress in caged fish. Sampling fish to examine them may also cause stress or injury and can make fish vulnerable to diseases. For these reasons, it is critical to observe fish when they are being fed because this may be the only time they come readily to the surface.

Cages contain collections of individual fish that often behave differently, not unlike groups of people. Some caged fish will feed readily with people present, while others will wait until everyone is gone and all is quiet. It is important to watch closely and note the behavior of the fish during feeding so you will recognize behavioral changes. Changes in behavior are usually caused by changes in their environment (i.e., the pond water quality) or their health. These changes may be the first signs of stress. Learn to recognize the common signs of stress, which may include:

- eating less,
- eating less aggressively,
- not eating at all,
- gulping for air at the surface,
- swimming erratically,
- skin discolorations,
- dead or dying fish, and
- any other unusual behaviors.

If any of these signs appear, investigate immediately. A quick response is critical. Analyze the problem, then try to determine the reason for the stress symptoms and a solution to the problem.

There could be a number of reasons for stress symptoms you observe. Several are discussed in the sections that follow.

Reduced feeding

If fish are eating less it could signal a disease, a high parasite load, or a water quality problem such as low dissolved oxygen or high ammonia level. The presence of predators such as otters and raccoons also may cause the fish to decrease their feeding. Has there been unusual activity in or around the pond? Has the weather or water temperature changed? If it is a heavily overcast and windless day, it may simply be a temporarily low, but not critical, dissolved oxygen problem. Has the pond water color changed? Water color changes or the appearance of surface scum may also lead to low dissolved oxygen. A sudden halt to feeding usually suggests oxygen problems or disturbance. Diseases, parasites and other water quality problems usually affect fish over several days and are reflected by a gradual reduction of feed intake.

Gulping for air

If fish are at the surface gulping for air (most often observed at or before dawn), when the day before everything seemed fine, it is a sign that the fish aren't getting enough oxygen. (See the section on pond-induced stress.)

Skin discoloration, erratic swimming and death

Skin discolorations, open wounds or lesions, spots, fin erosion, and erratic swimming or other strange behaviors are usually signs of diseases or parasites. If that is the case, fish will be-

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gin dying soon. If you see a few dead fish each day, some type of slowly spreading disease or parasite problem is probably affecting the fish. But finding progressively more dead fish each day is a sign of a very serious disease problem. Dying fish or fish with suspected diseases or parasites should be diagnosed immediately. Take or ship a live sample of affected fish and a water sample to your nearest fish disease diagnostic lab. Many state fisheries, Extension aquaculture programs or state conservation fisheries departments offer disease diagnosis. Contact your county Extension office or state fisheries (or aquaculture) specialist for information on how to properly package, transport and ship fish samples (see SRAC Publication No. 472, *Submitting a Sample for Fish Kill Investigation*).

Any disease diagnostic lab will be able to tell you the best treatment alternatives for diseases or parasites. The most practical treatment for an internal bacterial disease is usually to offer a medicated feed, but medicated feed works only on fish willing and able to eat it. Purchase medicated feed only when you need it because antibiotics can loose their efficacy over time; it is illegal to use medicated feed as a prophylactic treatment.

If external bacteria or parasites are the problem, a therapeutic water treatment may be necessary. The diagnostic lab or other professional will base recommendations on the details you provide about fish behavior and recent pond management activities. Some diseases and parasites can be controlled only by treating the entire pond, while for others treating the water in and around the cage may be sufficient. Another option is to place a plastic bag around the cage and treat just the water and fish in the cage. Problems such as snails, which serve as intermediate hosts for a number of parasites, may be addressed by treating just the margins of the pond. During any therapeutic water treatment the dissolved oxygen level must be monitored closely so that supplemental aeration can be provided if necessary (see SRAC Publication No. 162, *Cage Culture: Cage Construction, Placement and Aeration*).

Pond-induced stress

Environmental conditions within ponds also can cause fish to be stressed. One problem is the accumulation of nutrients from run-off and/or from overfeeding (see SRAC Publication No. 161, *Cage Culture—Site Selection and Water Quality*, and SRAC Publication No. 164, *Cage Culture—Handling and Feeding Caged Fish*). Signs of nutrient accumulation are:

- excessive algal blooms (very dense, pea-green water color),
- surface scums,
- excessive aquatic macrophyte growth,
- strong odors, and
- a rapid change in water color.

These problems may show up in any pond as it ages (a process called eutrophication). In most aquaculture ponds nutrient accumulation is related to the quantity of feed fed rather than the number of fish in the pond. Excessive algal blooms (those measuring less than 12 inches visibility on a Secchi disk) and macrophytic growth can cause dissolved oxygen depletions at night or on heavily overcast days (see SRAC No. 466, *Algae Blooms in Commercial Fish Production Ponds*). Surface scums, such as those caused by blue-green algae, can shade out the rest of the algal population and cause dissolved oxygen depletions; this has been related to certain types of off-flavor issues. Changes in water color and the strong odors that often accompany decaying plant material—either algal or macrophytic—usually signal a pending dissolved oxygen depletion caused by the aerobic decomposition of organic matter. Rapid algal die-offs sometimes occur naturally and may be caused by the lack of an essential nutrient, environmental changes, or competition among species. As the algae die, the nutrients in their cells are returned to the water and stimulate the growth of a new algal population. Herbicide or algicide applications also can cause algal die-offs. Although it may be necessary to control plants chemically before they become excessive, always be careful when applying these chemicals (see SRAC Publication No. 360, *Aquatic Weed Management: Control Methods*). Supplemental aeration is almost always necessary to maintain the oxygen levels sufficient to sustain fish. At times of severe phytoplankton or macrophyte die-offs, even supplemental aeration may not maintain the proper oxygen level in the cage. In these cases it may be necessary to release the fish into the pond where they may find enough oxygen to survive. Other options are to move the fish to another pond or to harvest them.

It is better to learn to recognize situations that may cause oxygen depletion and take corrective measures promptly than to try to save the fish after the dissolved oxygen has dropped to dangerous levels. Remember that the stress caused by low dissolved oxygen is one of the major causes of disease outbreaks. Contact your county Extension agent or state fisheries (or aquaculture) specialist for information on diseases (see SRAC Publication Nos. 472–479B and 4700–4703) or to learn how to measure and predict dissolved oxygen levels in ponds (see SRAC Publication No. 162).

The human factor

A good record-keeping system is an invaluable management tool for the fish farmer. Records should include stocking dates, fish weights, and the number of fish stocked and harvested. The amount of feed fed daily and recorded observations of the feeding activity can help the manager identify trends, both positive and negative. The dates any treatments are applied or medicated feed is offered should be recorded so required withdrawal periods can be observed before fish are marketed. Financial information, such as the cost of inputs and the price received for fish at harvest, should

also be collected. And although profit may not be a person's sole motive for raising fish, knowing the actual cost of the activity is useful.

The skill of the manager or cage culturist has great influence on the success of the venture. Mismanagement can cause many of the problems encountered, including those water quality problems previously discussed. Other common errors in cage management include:

- choosing ponds with pre-existing problems,
- poor cage construction or location,
- stocking undersized or poor quality fingerlings,
- stocking too many or too few fish per cage,
- stocking too many fish per pond,
- feeding poor quality feed,
- overfeeding,
- disturbing the fish or handling them poorly, and
- failing to observe the fish closely.

These problems are very common, particularly with beginning cage culturists.

Other problems and observations

Biofouling, a common cage problem, is the growth of algae and/or bryozoans (soft-bodied, jelly-like animals) on the sides of the cage or the growth of aquatic macrophytes immediately around the cage. These restrict water flow through the cage and can cause localized dissolved oxygen problems. Periodically check the sides and bottom of the cage (without lifting it out of the water) and remove any biofouling organisms with a stiff brush or broom. Use slow movements when working around the cage to minimize fish stress. A few tilapia (if legal in your state) or Koi carp stocked along with the primary cage species may be helpful in controlling algae on the sides of the cage.

The use of smaller-than-necessary mesh size in the construction of the cage also can restrict water flow and cause water quality issues. It is important to use a mesh large enough to allow maximum water movement while retaining the fish and keeping predators and competitors out. A more detailed discussion on proper cage construction and a list of appropriate materials and mesh size can be found in SRAC Publication No. 162, *Cage Construction, Placement and Aeration*.

Vandalism, poaching and animal predation can be problems when culturing fish in cages. Cages located in either isolated areas or areas of easy access are prime targets for poachers. While some states place heavy fines on those caught stealing fish from a fish farm, the possibility of an easy meal may entice those willing to take the risk. To reduce predation and stress caused by otters, raccoons, snakes, turtles and fish-eating birds, locate cages where you can easily control them and fit them with effective tops.

Over-wintering fish in cages

Some species over-winter better than others, and an in-depth discussion of appropriate species for your area can be found in SRAC Publication No. 163. In general, a good management goal is to produce market-sized fish in a single growing season. Most fish feed less aggressively, if at all (depending on the species and water temperature), during the winter, but they will usually accept smaller rations offered less often. If you find it necessary to hold fish over the winter because they are too small for market or you lack marketing opportunities, try to feed them only on warm, sunny days when they are most likely to eat. Be prepared to use medicated feed if bacterial problems develop as the water warms and feeding increases in the spring. Carefully observe fish for signs of parasitic infestation or fungal growth during the winter. Monitoring the fish in the open pond may give you advance warning of these situations in cages. Winter feeding strategies can be found in SRAC Publication No. 164.

All fish farming, including cage culture, includes "crisis management." Visit the pond and observe the fish at least once daily. Plan ahead and be prepared for emergencies. If you are inexperienced and a problem arises, get help fast.

SRAC fact sheets are reviewed annually by the Publications, Videos and Computer Software Steering Committee. Fact sheets are revised as new knowledge becomes available. Fact sheets that have not been revised are considered to reflect the current state of knowledge.

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