DESIGN AND CONSTRUCTION OF FACILITIES FOR SHORT-TERM HANDLING OF FISHES

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Short-term handling include: holding tanks for fingerlings and food fish on fish farms; wholesale establishments for various sizes of food, bait, forage and ornamental species; and retail outlets for live fish such as market catfish and ornamentals. The practice of short-term handling is usually a form of intensive culture whereby the animals are contained at the maximum concentration that is expected to sustain a healthy state.

Design Of Facility

Intensive culture uses three basic approaches: open, closed, and recirculating. Closed systems are most commonly found in Texas at ornamental fish retail shops and in grocery stores where lobsters are marketed live. For these species temperature control is critical and small water volumes are maintained and conditioned. Because of the small volumes water may be replaced between lots. Recirculating systems that utilize larger volumes and biofilters are not practical for short- term handling because of the adverse effects of parasites and infectious microbes. The chance of exposure is too great where the same holding water is to be used repeatedly for different lots of animals. Intermittent dry out and restart to control disease agents is too laborious, and shut down time is too costly. Recirculating systems that draw and replace water from a nearby pond also increase the risk of parasitic disease. However, some fish farmers have used such systems temporarily until a well is drilled. Short-term handling facilities mainly utilize open systems. Their design will be the focus of this paper.

Water Supply

Water cost can be influential in determining the design. Open systems may utilize an exchange rate of 10 to 25 volumes per day. Water cost for a 1000-gallon tank with a flow rate of 15 volumes per day may be $30 per day for city water, whereas cost for ground water pumped from an onsite well could vary between 25 cents and $1.50 per day depending on well depth (50 to 250 ft). This, of course, presupposes ground water of useable quality. Surface water is also usable for open systems, but has the disadvantages of varying in quality and serving as a potential source for parasite introduction. Charcoal pretreatment may be needed in the case of chlorinated water. Canister style filters are available for this purpose, but homemade innovations such as charcoal packed drums or water softener units may also be used. Water availability, cost and quality are, consequently, important factors to consider when designing a holding facility.

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Tank Shape

Tanks are usually circular or rectangular, but some manufacturers round corners of rectangular tanks. A rectangular tank with dimensions of 10 X 4 X 2 feet will hold approximately 500 gallons of water. A 6-foot-diameter circular tank with 2- foot depth will contain approximately 450 gallons. There is usually a 3- to 6-inch freeboard above the water line.

Concentration/Separation Devices

Sometimes the ease of capturing fishes in round tanks is a concern. A fish concentrator can be helpful where a circular tank with center standpipe is used. Rectangular tank owners employ blocking screens to sort or crowd fishes. Screen slots are found on or in walls of some tanks, but most fish handlers prefer smooth walls where screens are merely wedged at any chosen point. A blocking screen is used in front of a standpipe drain in rectangular tanks to prevent obstruction of the drainpipe.

Enclosures

Enclosures can be of two types: open wall and closed wall. Open, uncovered holding systems are also used, but heat and direct light are detrimental to fish maintained in such systems. Owners of tanks built in the open will eventually cover them with plyboard or some other covering when it is realized that heat affects fish or causes them to crowd in the shade, which alters the tanks' carrying capacities. Open wall housing is an improvement over open systems and provides easy access to tanks from the outside. Closed wall housing sacrifices access but can be a great advantage in some circumstances, such as during the hot season when air conditioning can be used to stabilize water temperature at a favorable level.

This is not as important a factor at the fish farm as it is at the bait or food fish live market.

Electrical Supply

Electrical supply should be built overhead so as to be both handy and safe. Both outlets and lighting fixtures should be high enough to allow sufficient workspace. Because aeration is critical for the intense concentration of fish in short-term holding facilities, there should be an emergency back-up for the power supply. Generators that will self-start are available, but the less expensive and more common hand start models may be used in conjunction with inexpensive alarm devices. Compressed oxygen may also be used in cases of emergency.

Floors and supplemental Tanks

Attention should be given to floors. Slabs should be modified to allow drainage from tanks and routine cleaning procedures. Slabs should be of proper thickness and have adequate reinforcement for water weight. Standard 2-foot-deep tanks should have a 6-inch- thick layer of concrete formed immediately under the tank. Concrete should be reinforced with 3/8-inch diameter, number 3 reinforcement bars set at 9- to 10-inch spacings. Flooring around the tanks is adequately constructed with concrete of 4-inch thickness and welded wire reinforcement. Depressions for piping or free flow may be appropriately spaced. Removable false floors can be used to cover drains and piping. If walking surfaces are concrete, they should be left rough to prevent slipping.

A constant head tank is useful where water can benefit from aeration and mixing procedures. Where possible, it should be arranged to take advantage of gravity flow. A load-out unit is helpful in cases where multiple tanks are used. It frees other tanks for load-in and other handling uses. It is also advantageous to place a load-out tank where gravity will allow distribution of water plus the contained stock.

Net pens are made of cloth or netting. When used in tanks these versatile units will allow immediate transfer of sorted stocks to other tanks or ponds, and confinement of small fry without fear of loss through drains.

In some retail establishments a display tank is set aside from the primary holding tank. Here customers may select their live fish from a sample and thereby avoid a constant disturbance of the primary load. A shallow tank provides suitable visibility from the surface and ease of capture. A transparent wall will allow better viewing.

Materials Used In Tank Construction

Walls

Tank walls can be made of concrete, cinder blocks, fiberglass, wood, galvanized sheet metal or plastic liners held by frames. Concrete is mixed in the usual fashion using cement:sand:gravel in a 1:2:3 or 1:2:4 ratio. Oiling the inside frame facing will avoid sticking and improve smoothness. It is important that the tanks be fully cured before filling. New concrete tanks should be aged or seasoned by repeated fillings or rinses to remove leachable lime compounds that could affect fish. Use of 1pint of glacial acetic acid per 200 gallons of water will hasten the process by neutralizing alkalis.

Cinder blocks are handy and commonly used but are not as durable and have greater tendency to crack as compared to reinforced concrete, metal or fiberglass. Concrete may be be poured into the holes as a filler and reinforcement.

Fiberglass tanks are readily available and have the advantage of being movable. Fiberglass tanks should be finished on the inside with the smooth "gel" finish. Those sold as fish tanks have this surfacing.

Wood tanks are constructed with plyboard and suitable reinforcement. Brass screws are used. Wooden tanks are usually of less than 150-gallon capacity.

Tanks constructed with galvanized sheet metal may be used to contain fish, but they must be adequately aged to prevent zinc toxicity. The addition of certain chemicals to the water will also cause the release of zinc from the walls of even a well-aged galvanized tank. More rarely used for short-term handling tanks are framed liners of butyl synthetic rubber or laminated PVC sheeting containing nylon or terylene netting.

Coatings

Epoxy is the most common coating for tanks. Masonry latex is sometimes used, but it has a shorter life. Fiberglass has been used to coat wood with reasonable success.

The key to success with epoxy is a clean surface. Concrete surfaces may be prepared by sloshing on 1 part muriatic acid to 2 parts tap water with a long handled brush. Surfaces are ready when acid ceases to bubble. The concrete will have the consistency of fine sand paper. If cinder blocks are used the mortar should be allowed to cure and the blocks to dry completely. A block filler can then

be applied, and after it dries the blocks completely coated with epoxy. Epoxy will work well on clean, dry wood.

Pipes, Valves and Drains

Most facilities use plastic pipes. Plastic is easier to work with than metal, which tends to corrode at joints. Plastic pipes may be used for delivery of both water and air. Entry valves are available in a large variety. Plastic ball valves are commonly used, but specialized valves such as molasses valves have delivery features favored by some fish farmers. Stand pipes are the most popular drain control. They may be placed inside or outside of tanks. If outside, a coupling can be added to permit perpendicular fold down of the stand pipe. The advantage of outside drains is that there is no obstruction by an inside stand pipe. On the other hand, an inside standpipe may be made removable, and if fitted with a sleeve it can draw water from any depth. Tanks with floors that are recessed toward a bottom outlet have some advantage in removal of settled solids. Circular tanks have the advantage of permitting a circular flow that congregates solid waste material in the center of the tank floor. They thus have the potential for built-in cleaning when fitted with sleeved or subfloor center drain.

Aeration Equipment

Agitators are in common use at short-term handling facilities in spite of being less economical than other methods. Perhaps their popularity is associated with versatility. They are generally used at a rule-of-thumb rate of one per 100 pounds of fish. Air lifts, whereby air flows up a tube and moves water up and out in a directional manner, are considered an economical means of aeration. Air lifts are mostly used in recirculating or other growout units. Directed inflow methods utilize entry water to create a current. They are often used in circular tanks to create a circular flow. Blowers are frequently used in short term handling tanks and provide economical aeration. Air bubbles are supplied from the tank bottom. The delivery may be through spargers, airstones or perforated tubing. A false bottom is sometimes used. If no anchoring is possible for tubing methods, then the tubing must be weighted. Blowers are of various types. Noise is an important factor as is low air pressure. Low pressure air may be delivered through plastic pipes. Regenerative type blowers have gained much popularity in recent years.

Water Heating and Cooling

Seasonal temperature extremes and the thermal requirements of certain species may necessitate the chilling or heating of tank water. Even species that are native to Texas will sometimes benefit from the cooling of water that is contained outdoors in mid-summer.

Water can be chilled, within a range of room temperature to near freezing, with commercially available water chillers. A chiller equipped with at least a 1-horsepower compressor will be required to control volumes in the 500 to 1000-gallon range. Other forms of temperature control for cooling utilize evaporation and exchange. Open wall facilities may mist, spray or drip source water or reintroduced water into the tanks in order to chill water several degrees. Facilities supplied with ground water may be cooled during summer by the relatively cool sub-surface water. Aeration by agitators or air from blowers tends to equalize the temperature of the water with that of the air. Lower loads and limited aeration will lower temperature in open wall facilities. In closed wall buildings water temperature can be controlled by controlling the temperature of the room air. Heating water is usually more costly than cooling, because the magnitude of the required temperature change is usually greater. Nevertheless, water can may be warmed by heat exchangers or by blending heated water with cooler supply water. In some emergency cases, ground water that is suitably warmer than that contained in tanks may be used with advantage.

Net Pens

Net pens are sometimes used to confine fishes in an open system such as a pond, canal or other body of water that permits free exchange. Often they are placed beside a pier and provided with a lid if the contained species is a jumper. Net pens can be purchased from suppliers or constructed onsite. Plastic or plastic coated wire netting, framed or bound with hog rings, are commonly utilized materials, as is nylon netting. Framing tends to make net pens more durable for multiple handlings and permits better connection to overhead hoists. Hoists concentrate fishes for easier capture. Stock in net pens will benefit from mechanisms that cause circulation, such as agitators or pumps that direct water through the net pen.

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1988 TEXAS FISH FARMING CONFERENCE
HELD AT COLLEGE STATION, TEXAS
JANUARY 27-28, 1988