Ponds in drought

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Watershed or runoff ponds must be constructed with the proper amount of watershed to fill them under normal weather conditions. Average annual rainfall, soil types, land slope, vegetative cover and climate are some of the factors that will determine how much watershed will be required to provide approximately 1,223,500 L of water. The watershed must be able to provide enough water volume to fill the capacity of the pond basin.

Watershed ponds are affected by drought in a number of ways. The loss of water volume and diminished pond depth during extended drought is most obvious. Deep watershed ponds (3.6 m maximum depth, or greater) may be built to contain extra water capacity to compensate for anticipated water loss during hot, dry weather. Relative to surface area, many runoff ponds contain inherently large water volumes and are deep because of the hilly topography.

Most warmwater fish production occurs in the 1.2 to 1.8 m of water located near the surface. Under normal conditions, ponds with a maximum depth of more than 2.4 m offer little benefit to fish production. However, extra water volume may be desirable where ponds are exposed to prolonged dry weather. Ponds located in arid lands may be constructed to maximum depths of 3.6 to 4.2 m (Mattinson and Glasscock 1997). During drought, shallow ponds may dry up or fish may die from compromised water quality. Shallow ponds that can be readily topped off with ground or surface water may not need the extra capacity. The capacity of irrigation, livestock, hydrants and some reservoirs may be maximized relative to the pond's surface area to supply large amounts of water during dry conditions.

Seepage and Evaporative Water Loss

Many ponds leak small volumes of water either constantly or periodically. Excessive pond seepage may result when ponds are constructed in inadequate or poor locations or they are improperly built. Poor subsoils containing too much sand, gravel, silt, rock formations or too little clay may allow for excessive seepage under normal weather conditions. Water may seep through the basin of ponds where the clay barrier is not adequate to provide water retention. Some pond dams are constructed without adequate topsoil removal, which prevents proper sealing and compaction at the base. Water may leak from under the dam and, in severe cases, may cause a collapse. Some soil types require the construction of a core trench to anchor the dam into the sub soils. Quality clay soil is compacted into the trench and core of the dam to prevent seepage and possible dam failure. Ponds may lose water around plumbing structures, such as drain and overflow pipes installed in the dam. Anti-seep collars should be placed on all drain pipes and other plumbing built into dams. These barriers prevent water movement along the outside of pipes, which may compromise dams integrity. Large trees and shrubs growing on dams may cause seepage by the piping of water along root structures and may eventually weaken the embankment. Woody vegetation growth should be prevented on dams.

During some years, evaporative water loss may be compensated largely by direct rainfall into the pond in humid environments (Boyd 1990). However, dry season water loss may not be replenished with direct rainfall until months later. Ultimately, watershed runoff must supply the most timely water replacement during the warm season and the majority of the volume throughout the year.

Physical and Biological Effects of Low Water Levels

Pond shorelines exposed by receding water levels during drought may create a number of pond management problems along with a few opportunities for pond managers. With large portions of the pond basin exposed, the clay basin liner may develop deep cracks. Marginal clay barriers may become damaged and seep upon re-flooding or seepage problems in ponds that already leak may become more severe. Low pool levels offer some opportunities to renovate dams and remove some silt and debris when the basin can support heavy equipment. Care should be taken to avoid damaging the clay liner during such renovations. Properly repair any damaged areas of the basin with compacted blankets of quality clay soil.

Water quality should be carefully monitored during low water conditions to maintain fish populations. Dissolved oxygen depletions may become more frequent and more severe because of the elevated temperature of shallow water and as organic material, such as plants, decompose. Aeration devices may be required to maintain adequate dissolved oxygen concentrations (>5 mg/L) particularly in ponds where fish are heavily stocked and fed (>1,000 kg/ha). Increased water temperature, pH and reduced water volume may lead to elevated concentrations of toxic un-ionized ammonia gas (NH_3). Feeding may be restricted and supplemental water added to the pond, if available, in an effort to reduce un-ionized ammonia concentrations.

Low water levels may reduce or eliminate shallow water nursery habitat used by young game and forage fish species. Concentrated predation by larger fish may positively or negatively affect future sport fish population balance in a pond or lake. Beneficial predation may occur when carnivorous fish are reduced over abundant forage. However, excessive predation of young game and forage fish could limit food availability to larger fish and delay their recruitment into the fishery. Predators, such as water snakes, fish eating birds and river otter may prey more readily on concentrated fish populations confined in shallow water.

Aquatic plants and filamentous algae may have more shallow water habitat, less than 1 m in depth, to extend their growth and increase density during low water levels. Increased vegetation growth in shallow water may interfere with fish feeding, seining and sport fishing activities. Ponds filled with aquatic plant and algae growth may increase the habitat in which small game and forage fish species hide and avoid predation by larger fish. Such conditions could contribute to an overabundance of small fish and cause a future imbalance in pond fish populations. Lake managers may struggle to control aquatic vegetation growth in shallow waters. Contact herbicides and algaecides should be used with care to prevent chemical toxicity to fish and to avoid oxygen depletions.

Note

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Pearl Culture

(Continued from page 60)

thys molitrix), bighead carp (*Aristichthys noblis*), mandarin fish (*Siniperca chuatsi*) or freshwater shrimp (*Macrobrachium nipponense*). The mussel mainly grazes on plankton for food; the more plankton in the water, the more rapid growth of the mussel and production of better freshwater pearls. So, pearl ponds need to be fertilized to increase plankton blooms. However, fertilization leads to eutrophication. Chinese freshwater pearl culture needs to improve pearl quality and reduce water pollution resulting from the manuring practiced in pearl culture. A bio-promoter containing calcium and other mineral elements is used to promote mussels to secrete nacre to gain good quality pearls.

Pearls are divided into nucleus pearls and non-nucleus pearls. Almost all of marine pearls are nucleus pearls. Freshwater pearls are mainly non-nucleus pearls, which account for more than 90 percent of all freshwater pearls. Non-nucleus pearls are formed by inserting cell slices manufactured by the out membrane of the mussel. Generally, it takes 3-5 years to produce a marketable pearl. The sizes of freshwater pearls are unequal and the small size pearls accounts for the greater part of production. This affects the total average price of the freshwater pearl. Actually, the high quality freshwater pearls are equal to the saltwater pearl. In the last few years, as the output of freshwater pearls increased, the nucleus pearl has developed more quickly.

Nucleus pearls are formed by inserting the nucleus manufactured from the shell of the mussel or other stiff materials. It takes 1-2 years. Because the freshwater mussels are larger, the types of nucleus pearls are many, for example, button pearls, cross pearls, Buddha pearls and men pearls. The most important factor that limits freshwater nucleus pearls is high mortality of the mussel after inserting the nucleus into the mussel. To improve the quality of the mussel and change the method of insertion are two ways to solve this problem.

The primary color of freshwater pearls is white and those account for more than 60 percent of all output. Other colors include orange, red, green, black and purple. Pearl color relates to the host mussel, the cell slices inserted and the minerals in the water.

Many companies that manage freshwater pearl culture, process and trade in China. The main companies include Shanxiahu Group, Ruanshi Company, Qidazhou Company, Shanshui company and Suzhou United Pearl Company. Most of the pearls on the mainland were exported through Hong Kong 10 years ago. Now, more and more pearls are exported directly to other countries. Many Chinese pearl companies have their own pearl culture sources. They play an important role in the development of pearl culture by solving the problem of disease, the improvement of water quality and the extension of good strain of mussels.

Notes

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