



Site Selection for a Aquaculture Business: A Cage Culture Model

REGIONAL TRAINING ON AQUACULTURE PRODUCTION
SYSTEMS INCLUDING CAGE CULTURE
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**"I AM RECEIVING A
-MONEY SMELL-
I WANT TO INVEST INTO
FISH CULTURE BUSINESS
IN NET CAGES..."**





✦ **The increasing popularity of cage culture world-wide can be attributed to the following advantages:**

- ✦ The applicability of cage culture is extremely varied. Rivers, backwaters, reservoirs, lakes, strip-mine lakes, irrigation canals etc., are all suitable for culture without any alteration in their state or function. - The production in small units (cages) as well as their quick and simple harvest render the method capable both for flexible adaptation to the actual market demands and for continuous supply.
- ✦ Cages are a convenient means of wintering, thus they save the vast investments for separate wintering ponds.
- ✦ Due to the high stocking density of enclosures, the direct observation of fish and immediate intervention, if necessary, are possible.
- ✦ Harvest is simple and quick, and the technological steps can be mechanized.
- ✦ Investment necessary to produce a unit of fish meat is 30-40 percent of that invested in a conventional fish pond system.
- ✦ Production of carnivorous fish, first of all sheatfish (*Silurus glanis*) in monoculture is also feasible.
- ✦ By producing seed for stocking natural waters in cages, building nursery ponds can be avoided.
- ✦ An indirect advantage is that by utilizing existing natural waters, land areas for fish ponds can be used for other rural activities.
- ✦ Cage culture can be well associated with sport fishing.
- ✦ The in situ construction of cages is quick and simple, so both the location and dimension of cages are easy to change.



The decision;

What will I produce in net cages, a cold water species or warm water species?

Cold water species like trout grow very well between 12-15°C water temperature;



Warm water species like carp like to live between 20-26°C water temperature.

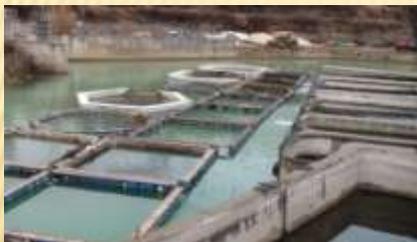


× SITE SELECTION

- × Many different sites may be adapted to cage culture. Potential sites include lakes, dam lakes, reservoirs, rivers, and streams. Each country may have specific laws governing the use of “public waters.” These laws may restrict private individuals from engaging in fish farming in public waters or may require permits for use of public waters. Check with the Department of Natural Resources, Department of Fish and Wildlife, or with the Cooperative Extension Service’s fisheries (or aquaculture) specialist in your state before using public waters for cage culture. Many ponds and quarries are not suitable for culturing fish in cages. The following are criteria that should be considered before attempting cage culture.

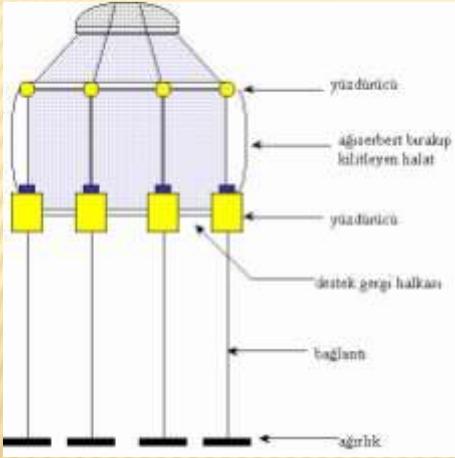


- × The surface area should be at least two acres and preferably it should be expansive when it was decided to increase the production volume.
- × The Bad...



The Good...





- ✘ According to the capacity, total depth of the water body should be at least two times longer than the net length of the cage (for instance if your net length is 8 m., the depth of the water should be minimum 16 m. or more).

- ✘ The reservoir/dam lake must have good water quality and should be located where prevailing winds blow across it. Although cage culture can be carried out successfully even in still water, some water current (10-20 cm/sec) has a good effect on the oxygen supply of fish, ensuring permanent water exchange between the water body inside and outside of the cage.
- ✘ The water current helps to remove the solid wastes from the cage quickly. However a high water velocity is disadvantageous for cage fish culture for the following reasons:
 - ✘ - a large part of the food can be washed away
 - ✘ - the fish is forced to swim causing energy waste
 - ✘ - the regular shape of the cage is deformed (the useful water volume is decreased by the current) According to some authors, water velocity in cage fish culture should not exceed 40 cm/sec.
- ✘ The prevailing wind has to be taken into account during site selection as well. It may have a good effect on the water exchange by generating surface water current, however if it is too strong the cages should be placed in a sheltered water area or have to be protected by breakwaters.



- ✘ The reservoir/dam lake must have good water quality and should be located where prevailing winds blow across it.
- ✘ The pond should not have direct access by livestock or large numbers of livestock in the watershed.
- ✘ The pond should not have a highly erodible watershed or one that allows the accumulation of large amounts of organic debris.
- ✘ The water level of the pond should not fluctuate greatly (2 to 3 feet) during the summer.
- ✘ The pond should not have chronic problems with aquatic weeds, over populations of wild fish, or oxygen depletion problems.



- ✘ The pond should have an all weather access road.





WATER QUALITY

- ✘ Water Temperature
- ✘ Oxygen Level of the Water
- ✘ pH, Ammonia and Nitrite
- ✘ Turbidity
- ✘ Water quality management is a key ingredient in a successful fish operation. Most periods of poor growth, disease and parasite outbreaks, and fish kills can be traced to water quality problems. Water quality management is undoubtedly one of the most difficult problems facing the fish farmer. Water quality problems are even more difficult to predict and to manage. A more thorough discussion of water quality problems and equipment needs can be found in other Extension aquaculture publications.



✘ Water Temperature

- ✘ If you have already decided on cold water / warm water species culture, you also should know the annual water temperature changes.
- ✘ National Meteorology Service can help you to provide exact changes in water body you have selected in a year.

What is the importance of annual water temperature changes in aquaculture?

Trout culture: The production period from egg to table fish (250 g) is 9-10 months. If the water temperature higher than the requirement of the fish, you can see lots of dead fish in your cages, if it is less the grow rate will reduce.

Carp culture: The production period from egg to market size (500 g and more) is 18-24 months. If the water temperature higher or lower than the requirement the grow rate will slightly reduce.

OPTIMUM IS BETTER

✘ Oxygen Level of the Water

- ✘ The minimum level of the oxygen should be 5 mg/l. It also depends on the environment, if there is an intensive aquatic plant population in the water, it consumes the oxygen mostly. In this case, especially after midnight the oxygen level can reduce until 1 mg/l that lethal level for the fish.

The bad...



The good...



✘ pH

- ✘ pH is a measure of the relative acidity of the water. The pH in a reservoir fluctuates daily due to uptake and release of CO_2 during photosynthesis and respiration. The pH is lowest at or near dawn and highest at mid-afternoon. The desirable range of early morning pH for fish production is from 6.5 to 9. The acid death point is a pH of approximately 4 and the alkaline death point is approximately pH 11. When the pH is outside the desirable range, fish growth is slowed, reproduction reduced, and susceptibility to disease increased.

Reservoirs with acidic bottom muds and soft water usually are not productive fish ponds. Lime can be added to these ponds to increase the pH and alkalinity (total concentration of bases). Limed ponds have fewer pH, dissolved oxygen, and other related problems. A total alkalinity of 20 mg/l is considered the minimum concentration for a pond used in fish production.



✘ Ammonia and Nitrite

- ✘ Ammonia is the primary nitrogenous waste produced by fish from protein digestion. Mammals produce urea, which is a complex of ammonia and carbon. Any nitrogenous waste from manure runoff into the pond, inorganic fertilizer, plant decomposition, and/or uneaten feed is transformed into ammonia by bacteria in the pond. Bacteria of the genus *Nitrosomonas* convert ammonia into nitrite. Both ammonia and nitrite are toxic to fish. The level of ammonia toxicity depends on the species of fish, water temperature, and pH. The level of nitrite toxicity depends on the species of fish and the chloride ion concentration in the pond water. Sub-lethal levels of ammonia are known to cause gill and tissue damage, poor growth, and increased susceptibility to disease. Nitrite at sub-lethal levels reduces oxygen transport into the fish, resulting in poor feed conversion, reduced growth, and increased susceptibility to disease. At stocking densities normally recommended for cage culture, neither ammonia or nitrite toxicity problems should be encountered. In ponds where higher density cage culture is attempted, where livestock manure can wash into the pond during rains, or where a plankton die-off has occurred, the level of ammonia (and later nitrite) may pose problems.



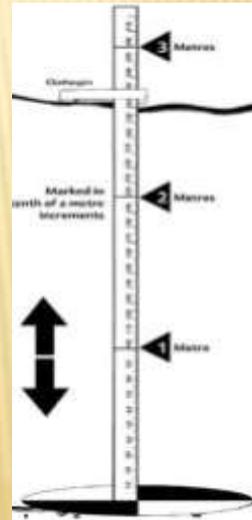
✘ Turbidity

- ✘ Turbidity is the degree to which light penetrates the water. Light penetration is blocked by suspended soil, organic material (detritus), and the plankton (floating or suspended microscopic plants and animals) of the pond. Turbidity caused by suspended soil and detritus (muddy color) may reduce photosynthesis and, therefore, oxygen production. Ponds which always have a moderate amount of suspended clay (i.e., muddy) may actually prevent wild fluctuations in oxygen levels. Large quantities of suspended soil particles washed into a pond during heavy rains, however, may cause irritation and clogging of the gills which can lead to secondary diseases. In general, high concentrations of suspended soil or detritus in a pond are not desirable.



- ✘ Since photosynthesis can occur only to the depth of light penetration into the pond, plankton turbidity is a measure or index of a healthy phytoplankton bloom (green color) in the pond. A healthy bloom will produce oxygen, reduce undesirable macrophytic plant growth, and reduce fish stress because of reduced visibility. Reduced visibility in ponds used for cage culture reduces stress on the fish caused by reactions to seeing people and possibly other animals in close proximity.

A healthy phytoplankton bloom (green water) is one with a Secchi disc visibility of 15 to 24 inches. Clear ponds with a visibility above 24 inches indicate a need for additional fertilization and possible liming (check with your Extension agent). Visibility of less than 12 inches indicates a plankton bloom which is too dense and may cause low dissolved oxygen problems.



✘ Interactions Between Other Farms in the Reservoir

- ✘ According to some country rules, the minimum distance between two cage farms should be more than 1 mile.
- ✘ That distance helps cage farms to get rid of the disease risk.
- ✘ The farms that was established in same reservoirs are also sharing the risks.
- ✘ Each fish farm should work as if the one.
- ✘ The capacity of the farms should be kept optimum.

