# A REVIEW OF ESSENTIAL CHECKLISTS FOR FISH CAGE CULTURE

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## ABSTRACT
Nigeria has potentials for high production of fish from her water bodies. Fishing is the predominant means of fish supply that needs to be increased by fish farming in different enclosures. Cage aquaculture is possible in several existing water bodies. The essential inputs for a successful fish cage farming therefore need to be considered. This would be an added wealth creation for job seekers/farmers hitherto involved in traditional fishing.

## INTRODUCTION
Nigeria is endowed with large bodies of fresh, estuarine and marine waters. Despite this availability of vast inland water and other influencing factors that can encourage fish production from cage aquaculture, its development still remained stagnant (Ita *et al*, 1985; Fagbenro, *et al* 2003). The first cages were probably been used by fishermen as temporary holding facilities for fish until enough quantities were caught or gathered for transportation to the market for sale. In some coastal areas like Ilaje Local Government (ILG) Area of Ondo State, local cage facilities have been used as temporary fish containers for several years. This storage facility avails the farmers the opportunity to take care of unsold fish till the next market day or when demand is made. This method could be exploited to take care of fish for longer period of time. Such that instead of regular fishing in the open waters, fish could be cultured and taken care of near homestead. The natural water is used as advantage over the conventional supply of water from boreholes to maintaining fish in tanks and ponds. The objectives of the paper are to raise the awareness of on basic requirements for setting up cage farming, point out the economic factors that could affect cage culture set up, alert on the possible risks associated with cage culture and provide a frame-work for assessing the cage culture business before take-off

### Opportunities in Fish Cage Farming
According to Otubusin, (2001) and Harrell, (2004) the opportunities and versatility of fish cage farming include opportunity to practise in existing water bodies: marine, brackish or freshwater, higher stocking density of fish compared to pond culture system, higher productivity than in the pond culture system considering the input and surface area involved, and a better control of fish population, such as in tilapia which is a prolific breeder. The fish cage system requires low initial capital than starting a pond culture operation. Fish harvesting is generally simplified because the entire cage can be taken from the water and the fish removed or simply scooped out with a net. It gives opportunity for a close observation and assessment of fish when being fed and thus their response, health conditions and growth. Also, there is easy and economical treatment of parasites and diseases. The system possess lesser risk of dangers compare to capture fisheries where there is incessant attack by sea pirates.

Water based aquaculture systems suffer in comparison to land-based operations in that there is less room to make mistakes in the choice of site. Since cage culture is done inside water bodies, it is extremely important to get the right site, where there is suitable water quality. Corroborating the same view, Chua and Elsie (2000) reported that at the onset any water based fisheries venture, it is important to have baseline data on water quality parameters and their seasonal variation, as such information is needed for planning and management of the enterprise successfully.

Under the right circumstances, fish production can be very profitable. Like other forms of farming, fish production involves substantial capital investment and many risks. Therefore, if one is considering fish farming using cages the following factors have to be considered. These considerations help to determine whether cage culture will be feasible for the situation available to the intending farmers.

## ESSENTIAL ECONOMIC FACTORS IN CAGE FISH CULTURE
### Managemaent
The following questions have to be honestly answered before a meaningful fish cage culture could be embarked on:

Do you have suitable site?

Would you be able to purchase or locally obtain necessary materials and expertise?
Do you have the necessary financial resources, both for initial take-off and maintenance?
Are you a member of any fisheries cooperatives societies?
Will the cultured fish attract demand that would make expected profit adequate and compensating for your labour, management and risk?
Is cage culture the best alternative for the site/water body available to you?
Are there other conflicting uses of the site/water body (e.g water transportation, logs transportation etc)?
Would you be able to absorb occasional losses?
Are you willing to devote the daily time and efforts required for the success of this business?

**Marketing**
Do you know/have an established market for your fish?
Do you have market for your fish at the time of the year when you would harvest your fish?
Would such period bring competitive price?
Do you have a suitable arrangement for harvesting your fish in terms of equipment and personnel?
Is the market accessible?
Are there suitable means of communication available?
Do you have storage/processing facilities for your product(s) now?
Is there any arrangement for advertising your product(s)?
If the need arises would you be willing to harvest during off-season?
Would you have alternative marketing strategies if the conventional fails e.g processing with addition of seasoning and marketing directly in offices?

**Physical factors**
Does the available water body allow for cage culture?
Is the site prone to strong waves/current?
Is water pollution rampant in the site?
Is the water of the required quality for the intended fish species?
Is the site protected against flooding/strong wind?
Is your residence close enough for regular inspection and emergencies?

**Production consideration**
Are quality feeds readily available at a competitive price?
Do you have a reliable source of drugs and chemicals when necessary?
Are fingerlings available in the locality?
Are there dependable external sources of fingerling?
Can you raise your own fingerlings with or without expert assistance?
Are materials for breeding available?
Is dependable labour (skilled and unskilled) available?
Do you have facilities for storing feed and other equipment?
Are dependable diagnostic services available (e.g nearby Fisheries Institution or expert at your beck and call?
Are you aware or connected to government agencies and trade associations that can provide you educational and technical services?
Is the road motorable or are there other sources of reliable transportation?

**Possible risks**
Are you equipped to handle the followings satisfactorily:
Poor water quality?
Off-flavour?
Pesticide contamination?
Poachers and vandals?
Personal stress resulting from risk management?
Predators?
Pollution?
Moving water weeds?

**Summary**

The above checklist does not cover all possibilities. Answering Yes or No to most questions may not guarantee immediate success or automatic failure. But to have a good success the answers must be mostly *yes* when the operation begins. More information may be looked for if the answers are mostly No, especially from experts and extension agents. The correct choice of site in any fish farming operation is vitally important, since it can greatly influence economic viability of the enterprise by determining capital outlay, and by affecting running costs, rate of production and mortality factors (Beveridge 1987). For open-water farms, such as cage culture, the most suitable and preferred areas continued to be sheltered bays, estuaries, lagoons, straits, lakes and reservoirs, protected from strong winds and rough seas. When selecting a site for cage aquaculture, the species optimum temperature, salinity, dissolved oxygen, pH and other water quality parameters should be considered. When these conditions are not met, the behaviour, feeding, food conversion and growth of the fish can be adversely affected (Pickering, 1981). Beveridge (1987) grouped the criteria for selection of suitable sites for cage fish culture into three categories. The first category is primarily concerned with physico-chemical conditions, which show whether a fish species can survive in an environment or not (temperature, salinity, oxygen, current, pollution, algal bloom water exchange). The second criterion lists the factors that should be considered in order to site a cage structure successfully (weather, shelter, depth, substrate), whilst the third category reveals those conditions which determine the possibilities of establishing a fish farm and the profitability of the project (in terms of legal aspects, accessibility, security, economic and social considerations).

**Criteria for site selection**

(1) Water current: While moderate currents and water flows are necessary to provide a continuous exchange of water, thereby helping to maintain oxygen level inside the cage and remove waste products generated by the fish as a result of feeding, sites with strong current, frequent storms and turbulent waters must be avoided. A water current of 10cm to 30cm/sec is adequate for fish production in cages. However, Otubusin, (1986) reported water current of 20cm to 50cm as suitable.

(2) Optimum oxygen concentration should be above 5ppm at all times for good result. Dissolved oxygen concentration can drop quickly if water exchange is inadequate.

(3) Temperature: The temperature of the water determines whether the species selected can be cultured on the site. This should not be too high. The ideal water temperature range for warm water fishes is 25°C to 30°C

(4) pH: Acid or alkaline waters are not ideal. The ideal water pH for the normal growth of fish is between 6 to 8 and values above or below this inhibit growth and reproduction. Too high concentrations of $Co_2$ will increase acidity, if the pH is below 4 the fish may start to die.

(5) Turbidity: High turbidity of water caused by suspended solid particles can affect productivity and fish life, because it decreases light penetration into the water and thus reduce primary and secondary productions.

(6) Salinity: Salinity and its variations affects the growth, reproduction and availability of any fish species found in a site. While some fish species have wide tolerance limits others do not. For example, the common carp (*Cyprinus carpio*) can grow well in salinity up to 5 ppt, but at 11.5 ppt the salinity becomes lethal. The salinity of freshwater is 0.02 to 0.12‰ , brackish 0.53 to 21.5‰,and seawater is 32 to 42‰ (Beveridge, 1987).

**Fish Species Selection for Cage Culture**

The choice of any fish species for culture in cages is a function of the site, water quality, construction costs, market outlets and legal requirements. Thus, to achieve good yield, fish species recommended for cage culture must have the following qualities:

Tolerance of over-crowding;
Fast growth;
Acceptance of supplementary feed;
Ability to make use of available natural fish food in the water body;
High resistance to disease;
Ease in breeding and
Good market value

## RECOMMENDATIONS

Ita (1993) gave a summary of 239 fish species belonging to 46 families, recorded in the major rivers of Nigeria. Of these fish species tilapia has been reported to be most important for culture in fresh water and in cages (Roderick, 2000). However, FAO (1999) reported that the Clariids, such as the African Catfish (*Clarias gariepinus*) have overtaken tilapia as major culture species in Nigeria. However, the culture of marine species is under-developed in Africa (Jamu and Ayinla, 2003). Hence, there is a need for research work geared towards investigating the possibilities of using marine species for culture in the Nigerian waters. Balogun *et al* (2008) noted that fishing activities in Ilaje Local Government Areas was 29.2 and 8.3 % in fresh water and brackish, respectively. This shows that fish species of interest abound in these water zones. Since cage culture is also possible in the same bodies of water, some of the idegenous fish species could equally be used. Tarpon, *Megalops atlanticus*, one the most cultured and popular fish species in all the Ilaje Local Government water zones could be a good candidate for cage culture (Balogun *et al*, 2008).

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