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INSIGHT ON CAGE FISH CULTURE AT SELUD VILLAGE, TAPI DISTRICT, GUJARAT

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Abstract - *Cage aquaculture involves the growing of fishes in existing water resources while being enclosed in a net cage which allows the free flow of water. It is an aquaculture production system made of a floating system. The present study was carried out in the Tapi district in Selud village. Information was collected on cage culture. The right choice of site selection contributes significantly to the success of cage farming. Site selection is vitally important since it can greatly influence economic viability by determining. In cage culture species selection is an important criterion and cultured species were Tilapia, Catla, Rohu, Mrigal and Basa. Different Cage materials commonly used are bamboo, empty 200-litre steel drums, anchors, netlon, high-density propylene (HDPE), and galvanized iron Mainly caged fish should be fed a floating pellet feed. Species such as tilapia and carp can be successfully reared from cage culture to large-size fish food. All of the cage culture farmers managed cages properly. This case study also revealed that cage culture is a risky business, but farmers and workers still consider it a possible venture with high revenue.*

***Key Words*:** *cage, fish, profit, farming, Aquaculture*

1. INTRODUCTION

Aquaculture is an industrial process of raising aquatic organisms up to final commercial production within properly partitioned aquatic areas, controlling the environmental factors and administering the file history of the organism positively and it must be considered as an independent industry from the fisheries hitherto. Aquaculture plays an important role in the economy and livelihood. It is probably the fastest-growing food-producing sector and now accounts for 50 per cent of the world's fish that is used for food.

Fishes are good sources of proteins minerals and fatty materials including 3-omega fatty acids which are known for having anticancer properties. The nutrient values of fish however vary from one species and one individual to another depending on the age, sex, environment and season [1,2]. According to Yadav [3], fish is a rich source of protein, carbohydrates, vitamins (A, D and E), iron, calcium and other minerals for the human diet. It represents 14.6% of all animal protein on a global basis [4,5].

Cage culture is an aquaculture system in which fish are raised in floating net enclosures. This approach utilizes existing water bodies while containing fish, allowing for water exchange and waste dispersion into the surrounding environment. Cage culture can be applied to various finfish and shellfish species in freshwater, brackish, and marine environments. In freshwater, cages are commonly used for both the culture of food fish and rearing young fish from fry to fingerling stages. The origins of cage culture are somewhat unclear, though it is likely that early fishers used cages as temporary holding areas for their catch before taking it to market. The first fish production cages were developed in Southeast Asia around the late 19th century, constructed from materials like wood or bamboo, with fish fed on trash fish and food scraps. Modern cage culture practices began in the 1950s, appealing to small-scale or resource-limited farmers who sought alternatives to traditional agriculture [6].

Aquaculture has become a rapidly expanding industry, offering opportunities even on a small scale. Cage culture, in particular, allows farmers to utilize existing water bodies that might otherwise have limited uses. Effective site selection is crucial, as it directly impacts economic viability by affecting initial costs, operational expenses, production rates, and factors related to fish mortality.

The benefits of cage culture are often evaluated by comparing them to land-based fish farming methods, particularly in terms of construction technology, management ease, adaptability, fish quality, resource use, social impact, and economic outcomes. Cages are relatively easy to construct, whether traditional or modern. The enclosed setup simplifies monitoring of stock, which aids in feeding and daily management. Fish raised in cages tend to be superior in terms of condition, appearance, and taste. Additionally, cage culture maximizes the use of water bodies, creating income opportunities for community members, such as fishermen, who may have limited land access and whose livelihoods are impacted by fluctuations in the fishing sector. Cage farming requires less labor for harvesting and offers protection for fish from predators and competitors.

Over the past 50 years, the fishing industry has shifted from a localized, coastal trade to a global enterprise, resulting in worldwide declines in fish catches. This depletion has adversely impacted on the livelihoods and nutritional security of traditional rural fishing communities [7]. Currently, stocks of the top ten fish species, which contribute about 30 percent of the world's marine capture fisheries production, are fully exploited or overexploited, making it unlikely for these stocks to yield any

increase in the near future [8,9]. The capture fisheries sector has reached a plateau, with no further growth anticipated. Factors such as over-exploitation of near-shore waters, limited access to capture fisheries, and a need for diversification underscore the importance of mariculture as a viable alternative (Agricultural Research and Education for the Eleventh Five-Year Plan, 2007–2012). Consequently, the development of culture-based fisheries and aquaculture presents the most promising strategy to reinvigorate growth in the fisheries sector and related industries.

South Gujarat has a coastline of 300 km. which covers 19% of the coastline of Gujarat. South Gujarat has a lot of potential for fish production. Selud is a rural area situated on the upper side of the Ukai dam on the Tapi River, in Uchhal taluka, about 12 kilometres east of Uchhal taluka in the east of the city. The water level Ukai Dam is so high that people here mainly adopt cage culture fish farming. There has been plenty of water supply for many months. Fish are reared in large numbers in Selud cage culture. Therefore, the present study proposed to study the Cage culture going on in the Selud area.

2. STUDY AREA

Selud is a village in Uchchhal Taluka in the Surat district of Gujarat state, India. It is located 97 km East of the District headquarters Surat, 17 km from Uchchhal, and 292 km from the state capital Gandhinagar.

The present data were collected through key informal members, technicians and workers involved in cage culture farming.

Information was collected on land availability, cage shape and cage size, slope ratio of settlement reservoir, selection of species, food and feeding as per the pre-structured questionnaire.

3. OBSERVATION AND DISCUSSION

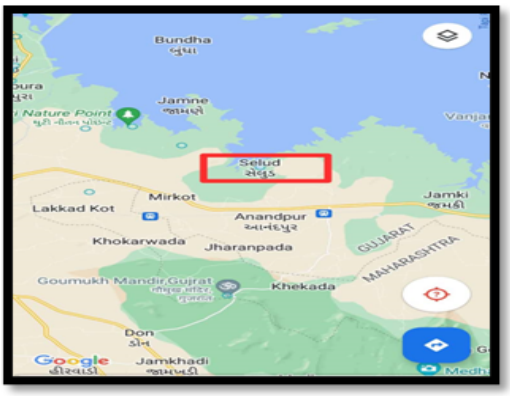

Fig. 1 Location of cage culture

3.1 Details of farmers

The farmers belonged to villages like Selud and Uchhal. The education level of workers and farmers was found in three groups: secondary level of education, higher secondary and graduation level. They had a minimum of four years' experience.

3.2 Site Selection and Depth

Site selection is a crucial aspect of cage culture, as choosing an appropriate location can mitigate many potential issues and reduce operational costs. The water depth should be adequate to keep the nets off the sediment, ensuring proper water exchange beneath them. Cage units must be constructed to endure the site's typical wind and wave conditions. Effective water circulation is essential to supply oxygen and carry away waste products. Ideally, there should be 30 to 60 cm of water below the cage bottom to facilitate waste removal. Cages should be positioned in areas with natural water flow to supply natural feed and effectively remove waste from the vicinity of the cage. Small ponds, ranging from 1 to 5 acres, can be used for cage culture, although emergency aeration may be necessary.

3.3 Shape of Cage and Materials to be Used

Cage size depends on the size of the area, the availability of aeration, and the method of harvesting. Small cages are more easily managed than large cages and usually provide a higher economic return per unit volume. A Cage of dimension $6m * 4m * 4m$ is considered a standard unit and additional units are attached as per requirement.

The cage consists of a hard frame as support and nylon netting as the cage body. Bamboo, mild steel (MS), galvanized iron (GI), poly-vinyl-chloride (PVC) and virgin-grade high-density polyethene (HDPE) are commonly used materials for cage frames. Knotless nylon nets are recommended for net cage fabrication. The cage frame can be constructed from wood, steel, iron and bamboo.

3.4 Selection of Species

The selection of fish species for culture should be based on Biological, physiological, and behavioral characteristics. Marketing criteria, for example, demand, price process and production for its trade should also be considered. Environmental criteria, for example, temperature, distribution and habitat for growth are also important aspects for the selection of species. The desired species characteristics for cage culture are a fast growth rate, in regional environmental conditions and tolerance for crowded conditions.

In the present study species selected for cage culture were catla, rohu, mrigal, Tilapia, and pangasius. These species were selected because of their fast growth rate, good market value, and good prices. Most commonly 10-20 mm seed sizes were used in cage culture

Catla and Rohu (Poly culture), Catla, mrigal and Basa monoculture as well as Catla, Rohu and Mrigal Poly culture were observed.

3.5 Water quality

The success of cage culture hinges on maintaining good water quality around the fish cages, making it essential for farmers to minimize environmental impacts. For effective cage culture practices, water bodies should ideally be oligotrophic or mesotrophic. Eutrophic reservoirs are strictly unsuitable for cage culture due to their high nutrient levels. The accumulation of uneaten feed and fish waste beneath the cages can lead to environmental issues; however, these problems can be mitigated by selecting sites with good water exchange for cage installation. Regular analysis of water quality is crucial to ensure optimal conditions are maintained for the fish.

3.6 Fish Health Monitoring

To maintain satisfactory fish health optimum stocking density and periodic cleaning of cages were taken into consideration.

Fish were examined periodically to see any signs of stress or injuries.

3.7 Cage maintenance

The cages installed were found painted with anti-corrosive paint to prevent rusting and increase their durability. Farmers cleaned the cages periodically to prevent any infections on the fish.

3.8 Feeding cage cultured fishes

Feeding is the most important managing practice that a fish farmer does each day. Improper feeding can adversely affect the culture species. The feed may comprise over 60% of variable costs. Fish feed must be nutritionally balanced, which has adequate protein and energy levels, is balanced in amino acids, and essential fatty acids, and is supplemented with a complete array of vitamins and minerals. Feeding fish twice daily at an adequate rate depending on water temperature, species, size, culture and density is recommended. Caged fish should be fed a floating pelleted feed. Floating feed is trapped inside the feeding ring and will allow the fish farmer the opportunity to observe the fish. Sinking feed will fall through the cage (unless the cage has a bottom) and not be eaten by the fish. More than one feeding is needed each day. Two types of feed are commonly used, Dry feeds and Non-dry feeds.

Fig.2 Cage materials

Fig 3 Full view of cage

Fig. 4 Installation of cage

Fig. 5 Feed

Lai et al., [10], in their study, revealed that suitable selection is one of the important criteria for floating cage culture. Good water quality, adequate water exchange and freedom from predators and natural hazards are important for cage culture. According to Das et al. [11], potential sites for culture vary according to the size and shape of the reservoir where cages are to be installed. One important study showed that species which respond to the use of prepared feed, market acceptance, easy availability, easy handling, fast growth good market value are selected for cage culture[12]. Study on pangas (*Pangasianodon hypophthalmus*) which is the most popular fish species for cage culture throughout India, Tilapia, IMC, are other fishes' cultures in a cage [13]. Adeparusi et al.,[14], in their study revealed that cage culture species selection is done on their ability to make use of available natural fish food in the water body.

Rehman et al.,[15] revealed that *Pangasianodon hypothalamus* is fast growing, highly popular as a food fish and a valuable species in Asian aquaculture and is a major candidate species for freshwater cage culture in India because of its fast growth. Fredriksson et al., in their study on a global scale, the decline of fish stocks has been the main reason for increased interest in aquaculture for a wider variety of species, especially the high-valued ones. Cage farming has an important role in meeting the global demand for fish products. A similar result was observed in the present study where the most appropriate species were tilapia and IMC fishes there are having high value in the market.

Glencross et al. [16] in their study focused on the determination of a feed ingredient is an important criterion in the evolution of that ingredient for fish. Fish feed pellets containing a larger proportion of plant-derived protein meal showed a lower specific hardness than the reference fish feed, which is likely concerning the longitudinal expansion which would generate larger lateral surfaces [17]. The texture would thus be more fragile, and less force to break the pellets. Important fish feed can float in water, fish feed quickly sinks into water and cannot be utilized optimally by fish. In the present study also, preference was given to floating feed.

3. CONCLUSION

In the present study it was found that for cage culture, site selection is the most important criterion. The depth should be sufficient to keep the nets clear of the sediments and wave conditions at the selected site. Small ponds (1 to 5 areas) can be used for cage culture.

In the present study species selected for cage culture were catla, rohu, mrigal, Tilapia, and pangasius. These species were selected because of the fast growth rate, good market value, and good prices. Most commonly 10-20 mm seed sizes were used in cage culture.

From the present study, it was observed that cage materials and cage size depend on the size of the area. Different materials used in the cage culture were bamboo, nylon, netting, anchors, (GI) Glazed Iron, and (HDPE) High-Density Polyethylene.

During the study, it was observed that the farmer purchased seeds from West Bengal and Pune. The size of food pellets is usually 20-30% of the mouth of the species. Different types of feed there have dry feed-non dry feed and natural food are plant, plankton and organic matters

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