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Overview of Fish Farming Using Floating Cages along the Shatt al-Arab River in Basrah Province, Southern Iraq

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ABSTRACT

The current study was carried out during the period of September 2018–March 2019 aiming at providing an overview of fish farming projects using floating cages in Basrah province, southern Iraq. The primary strategy for data collection was through a questionnaire. The study showed that the first cage farm was established in Abul-Khaseeb district in 2008, and the number of certified farms is 37 with a total number of 466 cages. Cultivated carp fish were obtained from local hatchers in Basrah and Babylon. Fish farms are similar in the quality of feed used, cages' design, and raw materials involved in their manufacture. The results also showed that fish farmers are educated, and more than 40% of them are university graduates. In Basrah, women have a vital role in the operation, maintenance, and management of fish farms as well. The total production of certified farms in the province amounted to 544 tons per season. The survey results showed that cage farming in Shatt al-Arab is profitable in the absence of the saltwater intrusion phenomenon.

KEYWORDS: Cage culture, fish production, carp, Shatt al-Arab

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1. Introduction

Fish is a vital component of human food and a source of high-quality animal protein. Due to growing communities and an increased demand for fish products, there has been a need to pay attention to fish farming projects. Fish culture is an effective means of providing a source of income, ensuring food security, and creating significant investment opportunities worldwide (FAO, 2018; Endalew et al., 2020). Cage technology is one of the prevailing systems in culturing multiple freshwater and marine fish species due to the high level of productivity in the unit area (Al-Shemmari et al., 2018).

Cages are systems that keep cultured species in a specific area and at high density while excluding unwanted animals from the water bodies. Cages rely on water movement to supply farmed fish with the quality of water required to achieve sustainable growth and remove metabolic waste that causes health problems for the farmed fish (Masser et al., 2012).

Fish farming by cages is widespread in Thi-Qar governorate. The efforts exerted in the culture have been less, as this method requires only providing feed and monitoring the health of the cultivated fish. Therefore, it does not require a large labor force, and the farm can be managed by its owner or family members with a small number of working hours (Jedran et al., 2015; Abbood et al., 2017).

Cage projects have achieved significant profits for fish farmers in Babylon governorate, which has attained social welfare for the segment working in this field (Jabor, 2012). The previous researcher suggested that cage culture is the best compared to the earthen ponds in terms of final weight, cost reduction, maximized cash flow, and minimized mortality rates. It was also noted that monitoring and treating diseases in the cages is easier.

Floating cages are a preferred system in Basrah province and have been widespread along the Shatt al-Arab River (Ahmed et al., 2020). However, the information available on cage fish farming in Basrah is minimal.

The current study aims to provide a comprehensive idea of fish farming projects by floating cages along the Shatt al-Arab River in terms of the size of farms and their productivity, type of farmed fish and their source, type of feed, administration, marketig, and work constraints.

2. Material and Methods

Information was collected through field visits to 37 licensed fish farms that adopt the floating cage system in six different locations of the province spread along the Shatt al-Arab River, Southern Iraq. The process of data collection took six months, from September 2018 to March 2019, with 3-4 visits to each of the study sites. Figure 1 shows a map of the study locations along the Shatt al-Arab River.

Various data collection methods were used in this study. The primary strategy was through the questionnaire shown in Table 1. Data was also derived through direct communication with the farmers from the visited farms.

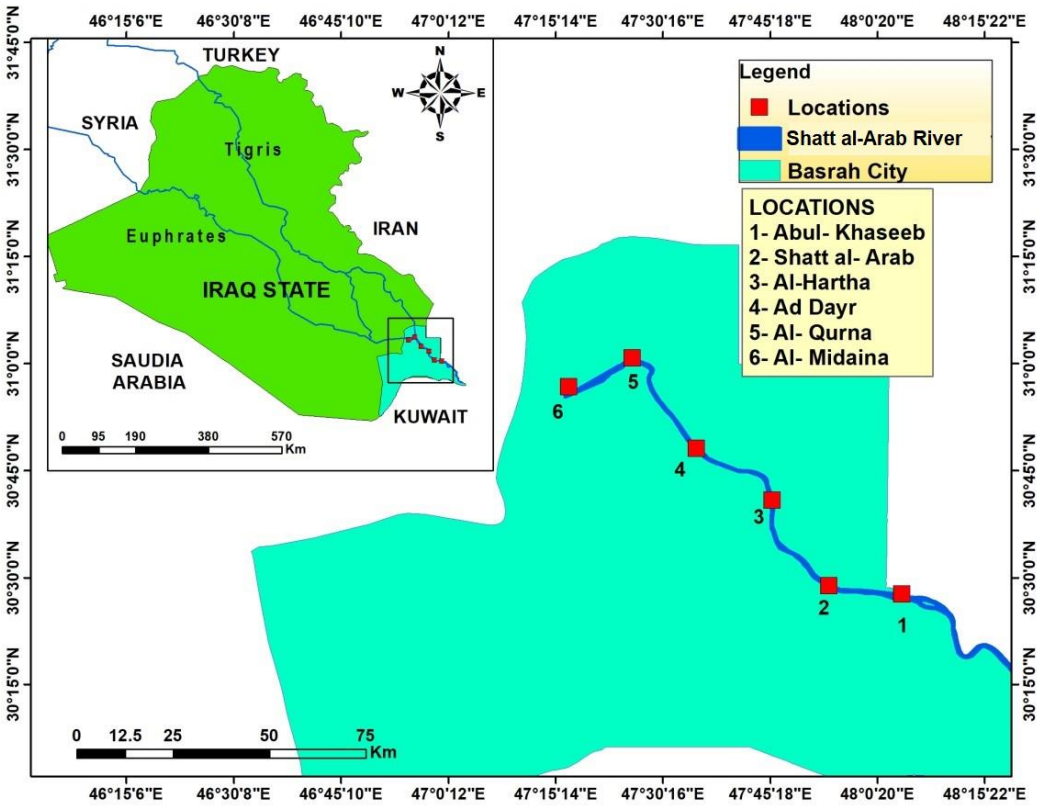

Figure 1: Locations of fish farming projects along the Shatt al-Arab River

Table 1: The form used to collect information from each farm

General information about the farm	Farm number Farm location Farm area Establishment date Personal property, rented, other
Cages	Number of cages/farm Cage dimensions Cage manufacturing materials The average cost of establishing one cage
Farmed fish	Type of farmed fish Source of farmed fish The average initial weight of fish The cost of purchasing the farmed fish The number of farmed fish in each cage Breeding period
Fish feed	Feed type (floating, sinking, mixed) Source of feed (imported, local, made on the farm) The purchase price per ton Feeding method (calculated quantities, satiation limit)
Information about the farmer	Age of the farmer Educational level Does the farmer have a profession other than farming?

Administration	Is the farm managed by the farmer himself or by labor force? Do women have a role in the farm management? Are there documentation notebooks for the farm input and output?
Production and marketing	What is the market fish size? Selling price per kilo Productivity achieved at the end of the season How marketing is done (wholesale, individual, restaurants, local markets) Is fish farming a profitable business?

3. Results

Table 2 represents the number of farms in each location, establishment date, cost and number of cages, and cage dimensions.

Table 2: The number of farms, establishment date, cost and number of cages, and cage dimensions

Location	No. of farms	Establishment date	Average of the water area (m^2)	No. of cages in each farm	Total no. of cages in each region	The average cost of cage establishment (Iraqi Dinar)
Abul-Khaseeb	6	Between 2008 and 2015	282 ± 80.2	12 ± 3	67	750.000 ±116
Shatt al-Arab	5	2011 and 2013	240 ± 0.00	12 ± 0	59	680.000 ± 75
Al-Hartha	7	=	288.5 ± 81.5	14 ± 3	91	700.000 ± 88
Ad-Dayer	6	=	282 ± 141.3	12 ± 4	72	605.000 ± 97
Al-Qurna	5	2009 and 2013	332 ± 105.2	13 ± 2	64	750.000 ±160
Al-Midaina	8	2011 and 2014	300 ± 93.1	14 ± 3	113	618.000 ± 97

The current study included 37 floating cage farms approved by the Basrah Directorate of Agriculture. The total number of cages only 466 cages. The results revealed that the first licensed farm was established in the district of Abul-Khaseeb in 2008. The results indicated that the largest number of cage farms is located

in the Al-Midaina district. All cages have been set up in Shatt al-Arab in the water areas opposite to farmers' land, and there are no payments for rent. The survey results also showed that cage farming is profitable in the absence of environmental problems limiting production.

Table 3: Farms locations, farmed fish type, size, and density in each cage, and rearing period

Location	Type of farmed fish	Fish source	Average initial weight (g)	Cost of the individual fish (ID)	No. of fish in each cage	Rearing period (month)
Abul-Khaseeb	C. and silver carp	Babylon hatchery	100–125	500	1000–1200	3–6
Shatt al-Arab	C. carp	Babylon hatchery	100–125	500	1000-1200	3–6
Hartha	C. and silver carp	50% Babylon hatchery and 50% Basrah University hatchery	10–25	200–250	1200-2000	6–11
Ad-Dayer	C. and silver carp and herbi	90% Babylon hatchery and 10% Basrah Uuniversity hatchery	50% (10–25), 50% (100–125)	250 ID for cat. A and 500 ID for cat. B	900/cage for cat. A and 1200/cage for cat. B	8 months for cat. A and 6 months for cat. B
Al-Qurna	C. carp	90% Babylon hatchery and 10% Basrah University hatchery	50% (10–25), 50% (100–125)	300 ID for cat. A and 500 ID for cat. B	700–99/cage for cat. A and 1200/cage for cat. B	9 months for cat. A and 6 months for cat. B
Al-Midaina	C. and silver carp and herbi	Babylon hatchery	10–25	150–200	1200–1500	6–11

Note: Category A refers to fish size 10–25 g; Category B refers to fish size 100–125 g.

The results indicate that farmed fish are common carp (Cyprinus carpio), grass carp (Ctenopharyngodon idella), and silver carp (Hypophthalmichthys molitrix). Fish were obtained from two sources, namely, the University of Basrah hatchery and the hatchery of Babylon governorate. The breeding period is between 3 and 11 months, depending on the farmed fish's initial size.

Feed and feeding

There is a remarkable similarity in terms of feed quality used in all fish farms, which is a mixture between imported floating pellets (priced at 925,000 Iraqi dinars/ton) and locally made sinking pellets (priced at 650,000 Iraqi dinars/ton). Leftover is used to fill the shortage when needed. Fish are fed manually two times a day to the satiation limit.

Farmers' information

Figure 2 shows farmers' educational level, which indicates that most farm owners are university degree holders (various disciplines outside the fish farming sector) with an average age of 45. Their experiences of fish farming are an outcome of information exchanged between them.

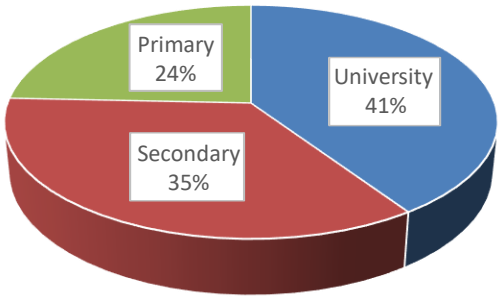

Figure 2: Farmers' educational level (%)

The study showed that farm owners have occupations other than fish farming. 13.51% of the total number work as a public servant (the license to practice fish farming has been granted to a non-employee family member), 21.60% work in agriculture and animal husbandry such as livestock, and 15.11% have other occupations outside the agriculture and aquaculture sector.

Management information

The results showed that fish farmers rely on themselves and family members to manage and maintain their farms (manufacture of cages, cage maintenance, feeding fish, fish sorting, fishing, sale, etc.). Fees are only paid to a veterinary consultation when needed.

The current study shows that women have a significant role in fish culture projects in 26 out of 37 farms included in the current investigation. The role of women includes feeding fish, household fodder manufacturing, and financial management. The study also showed that all licensed farms have notebooks to document the farm's inputs and outputs.

Production and marketing

The highest production is recorded in Al-Hartha and the lowest production is in Abul-Khaseeb farms. The total output of licensed farms in the province amounted to 544 tons/season. The results indicate that the marketing is done on-demand from consumers (individuals, restaurants, local markets, or mobile vehicles). Fish are marketed in different sizes and throughout the year. The price of a kilo of fish is 4500 ± 500 Iraqi dinars, while the wholesale price is 2000 ± 500 Iraqi dinars per kilo.

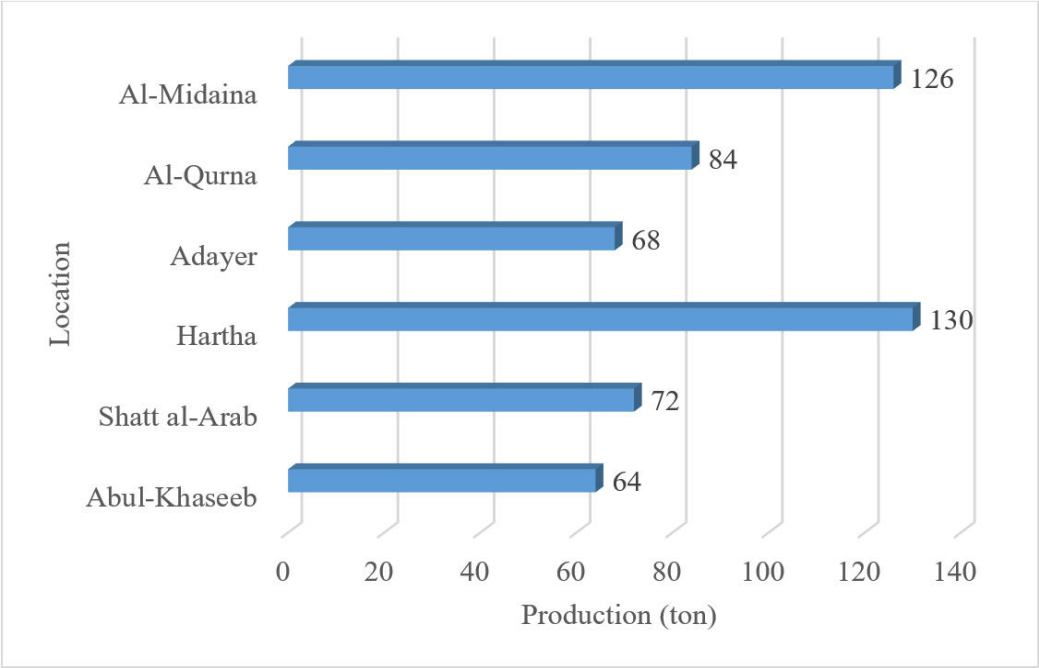

Figure 3: Farms' total production (ton) for one season

4. Discussion

Fishing is an ancient practice for the rural and marshland population in Basrah province, while fish farming is relatively recent (Ahmed et al., 2020). The current study included 37 floating cage farms established between 2008 and 2015 along the Shatt al-Arab River. Abbood et al. (2017) reported that fish farmers resorted to floating cages instead of earthen ponds due to the decrease in the amount of water reaching the Shatt al-Arab from tributaries and the difficulty of obtaining sufficient amounts of water to fill the earthen ponds and change the water when needed. Besides, farmers own agricultural land with waterfronts on the Shatt al-Arab River which makes it suitable for breeding cages without having to pay rent. Therefore, the floating cage system is the best economically compared to the earthen ponds.

Regardless of location, there is a remarkable similarity in cages' design, dimensions, and raw materials. This may be because all farms are licensed by the Directorate of Agriculture, which allows farmers to benefit from the services of the Directorate scientifically and practically, unlike the unauthorized farms where it was noted that the design of the farm depends on the personal experience of farmers (Ahmed et al., 2020). The similarity also applies to the number of fish farmed in each cage, the feed used, and their source. According to the results of the current study, the cost of purchasing feed is higher compared to other inputs (the cost of raw materials for cage construction and buying fish fingerlings from local hatcheries), and this is one of the obstacles to fish farming in general (Rana et al., 2009).

The diversity of sources of income for fish farmers in Basrah governorate is imperative due to the risk of the saltwater intrusion coming from the Arabian Gulf, which can cause fish mortality and capital loss in some seasons (Ahmed and Al-Zewar, 2020). The current study revealed that many fish farmers, regardless of their educational level, practice other occupations to achieve their families' economic security. Ezzit et al. (2017) reported that cage farming activity in Egypt depends mainly on family members and neighbors' assistance. Similarly, the current study showed that fish farming is a profitable enterprise if farmers can squeeze the expenses represented by the wages of

the cage manufacturing and its maintenance, feeding fish, fish sorting, general administration, and marketing, where the farmer depends on himself and his family members in the performance of tasks.

The Food and Agriculture Organization (FAO) reported that women have an active contribution to fish farming worldwide and sometimes play a more vital role than men (FAO, 2013). Women make up to 80% of the workforce in fish culture projects in Tanzania (Luomba, 2013); in Thailand, approximately 46% of cage fish farmers are female (Lebel et al., 2013). In Indonesia, women's participation in aquaculture activities is estimated at 1.5–1.7 times that of men (Sari et al., 2017). Similarly, the current study shows that women have a significant role in fish culture projects in 26 out of 37 farms included in the current investigation. Empowering women by granting them a license to practice fish farming, providing infrastructure, modern technology, and training will improve livelihoods and provide economic security for low-income families.

Although Abul-Khaseeb farms are the oldest in terms of foundation, they are the least productive compared to other sites, according to the current study results. The proximity of the Abul-Khaseeb district to the estuary and its susceptibility to the saltwater coming from the Arabian Gulf may have caused a reduction in fish production (Ahmed and Abdulrasool, 2020). Also, Shatt al-Arab water becomes more polluted as we head south due to agricultural, industrial, and domestic pollutants, making it less suitable for various uses (Moyel and Hussain, 2015; Lateef et al., 2020), while the highest production is in the Hartha district north of Basrah.

The survey results indicated that cage farming projects are profitable in the seasons where saltwater intrusion, one of the biggest problems and constraints for aquaculture projects, does not occur. In a recent study on carp farming in Basrah, farmers were unable to make acceptable profits due to the presence of fish imported from neighboring countries at low prices (Ahmed et al., 2020). Still, the international ban on the movement of goods between countries due to the Coronavirus pandemic helped small fish farms by reducing competition with imported fish, according to FAO (2020).

5. Conclusion

The current study concluded that fish farming by cages in Basrah is a relatively recent practice. The annual production amount is modest compared to the province that has 2,985,073 people (CSO, 2019). The result revealed that women have a significant role in the operation and maintenance of fish farms. The high prices of feed and the phenomenon of frequent saltwater intrusion are determinants of production and the main problems of fish culture in the province. Further studies are needed to highlight the importance of fish culture enterprises to support the rural community in the province.

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