Carp culture in Iran

Hassan Salehi

Assistant Prof. of Iranian Fisheries Research Institute and the Vice President of Fisheries, Iran, No.250, West Fatemi, Tehran, Iran. Email h-salehi@iranfisheries.net

Carp culture is the most important fisheries subsector. This article provides a comprehensive overview of the industry, its structure, operations and economics

Kiosk for wholesale of fishery products and other agricultural produce, near Shilat, Tehran.

The culture of carp is an ancient activity, using a mixture of four species with different feeding habits: Plankton-consuming, herbivorous, malacivorous, and benthivorous. Carp is widely sold fresh, whole and in a range of value added forms. In Iran, warm-water fish farming is based on Chinese carps, namely common, silver, grass, and bighead carp. These carps are easy to breed in hatcheries in large numbers at little cost, and are distributed to farmers to grow out in ponds or open waters. The common carp and the three Chinese ones are often reared in polyculture. Since the 1970s carp farming has spread along the Caspian coast, with total carp production peaking at almost 54,000 tonnes in 2001. The structure of fish consumption has also changed resulting in expanded markets and growth in fish demand.

Iran is large and rapidly developing and its pattern of supply and demand may be expected to change markedly over coming years. The carp culture industry is currently the most important sub-sector of fisheries in Iran and its rapid development has attracted considerable attention in recent years. Iran covers an area of about 1.6 million square kilometres[1] and had a population of more than 66 million in 2003[2]. Since the end of the Iran-Iraq war in 1988, Iran has undergone a process of economic transition, changing from a government controlled military economy towards a more liberal and market oriented economic structure. Key factors contributing to the government's decision making have been the large population growth, unemployment rate, as well as the attempt to optimise management of the economy by privatisation. Other key social developments have been rapid urbanisation leading to more job opportunities, better living standards, higher literacy levels, growth of student numbers in universities, growth in the role of women in society (eg. the female literacy rate, 35% in 1979, has risen to 75% in 1995, and the number of female students in universities had increased to more than 55% by 2002) and better facilities in urban areas However, all of these key factors have also improved more recently in rural areas.

The characteristics of the carp farming industry in the four main fish farming provinces, Gilan, Mazandran, Golestan and Khuzestan are different. For almost 20 years, carp has been considered a subsistence food, particularly in Gilan, but also in Mazandran and Golestan, and is a preferred food item by a majority of people in these provinces. Carp culture initially developed in the Caspian area, with more than 95 % of farms, in Gilan 67% of farms are less than 1 ha and 95% are less than 5 ha, while in Mazandran and Golestan 59% of farms are less than 1 ha and 86% of farms less than 5 ha, and only 1% of farms in the Caspian Sea littoral are larger than 20 ha. In Khuzestan, more than 90% of farms are larger than 5 ha and 33% larger than 20 ha

Table1: Percentage share of number of farms in provinces and categories.

Province	<1 ha		1 to 5 ha		5 to 20 ha		20< ha		Total
	% p	% c	% p	% c	% p	% c	% p	% c	
Gilan	80	**67**	77	**28**	41	**4**	24	**1**	75
Mazandran and Golestan	20	**59**	22	**27**	32	**11**	26	**3**	22
Khuzestan	0	**0**	1	**9**	27	**58**	50	**33**	more than 3
Total	63		27		7		almost 3		100
% p: as % in province, % c: as % in categories, Sources: Salehi[3,8].									

Table 2: Carp farming production in Iran, 1991-2000 (tonnes)

Year	1991	1993	1995	1997	1999	2000	% growth 1990-2000
CC	5502	4206	6561	5435	4600	7000	**27**
BhC	983	1052	1269	1360	1150	1500	**53**
SC	10019	12619	15228	16310	13800	17000	**70**
GC	3143	3155	3942	4078	3450	2000	**-36**
Total	19647	21032	27000	27183	23000	27500	**40**

CC: Common carp, BhC: Bighead carp, SC: Silver carp, GC: Grass carp

Source: FAO[9].

According to stocking density, carp systems can be distinguished, as:

- Extensive fish farming, where stocking density is generally low; with no supplementary feeding,
- Semi-intensive fish farming, where stocking density is higher, with better management and supplements of daily feed.

Carp culture

In 1970, Shilat (the fisheries organization of Iran) established a carp culture research station in Gilan province, while the first commercial facility for carp culture was established in 1969, supported by Romanian experts[3]. Since 1985 aquaculture has been developed mostly by private entrepreneurs and co-operatives. Small-scale trials are also being conducted by Shilat in cages and pens in the Anzali lagoon[4] and Dez reservoir. Iran has recently directed considerable effort to developing freshwater aquaculture and enhancing fish stocks in inland water-bodies[5]. In 2001, there were some 3,065 registered carp culture farms, with a total pond area of almost 9,493 ha. Warm-water fish production now includes several cyprinid species, raised either in monoculture or polyculture in earthen ponds or in open water bodies. Annual production figures for carp show large changes from year to year, although the trend over the last decade has been positive.

Hatchery production

Hatchery production is the main source of seed for both carp farming and culture-based fisheries. Production of carp fingerlings increased to 90 million pieces by 2001, of which only 15% is produced by Shilat. Hatchery production of carp species was started by Shilat, but Government policy encouraged the role of the private sector and in 2001, some 20 private hatcheries produced more than 85% of the carp seed. It is expected that eventually all hatchery production of carp fingerling will come from co-operatives and private farms.

Production systems and practices

Traditional fish farming in Iran was based on the European system and this was expanded in 1970 with the introduction of the Chinese carps, namely the grass, silver and bighead carp. The common carp and the Chinese carps are often reared in polyculture, although some farmers prefer to keep common carp in monoculture. After hatching, larvae are transferred to tanks and fed with diets of powdered yolk and powdered milk. When the larvae are about 8 days of age they are transferred from the hatchery to nursery ponds where they feed on natural food. Fry of 10 g size are usually transported for release into water-bodies, or grown to market size on fish farms. Recently, both public and private hatchery operators have been testing the traditional Chinese technique. This avoids all handling of the spawning adults until the eggs are ready for transfer to the hatchery or, in some cases, the eggs hatch and the larvae remain in the tanks until transfer to nursery ponds[3].

Table 3: Production in open water-bodies (culture-based fisheries) in key provinces, 1991-2001 (tonnes)

Year	1991	1993	1995	1997	1999	2001	% share in 1995	% share in 2001
Khuzestan	9119	6019	2830	12000	4309	200	11	0.8
Gilan	6689	2164	1445	1360	1029	1270	6	4.8
Mazandran and Golestan	1958	3813	8975	10060	9518	15700	36	60.9
Sistan-B.	4353	3000	4600	4200	11307	0	19	0
Fars	216	2657	1320	1450	743	400	5	1.5
W.Azarbiajan	875	1065	1633	1800	1905	2350	7	9
Others	1693	3539	4036	3915	5007	5865	16	23
Total	**24903**	**22257**	**24836**	**34785**	**33818**	**25785**	**100**	**100**

Sources: Salehi[3] and Aquaculture Department[10].

FAO[4] and Salehi[3] concluded that carp farming in Iran was economically attractive. In Khuzestan, carp farming was profitable but farmers claimed that the cost of construction of ponds had drastically increased, possibly making carp farming a risky investment. In Gilan, Mazandran and Golestan, where carp farming is mainly an artisanal activity carried out by small farmers as a sole or a part-time activity, carp farming is another income-generating venture. There are about 15,800 non-governmental persons active in carp farming[6]. The majority of these people will also have another employment, either seasonal or non-seasonal activity.

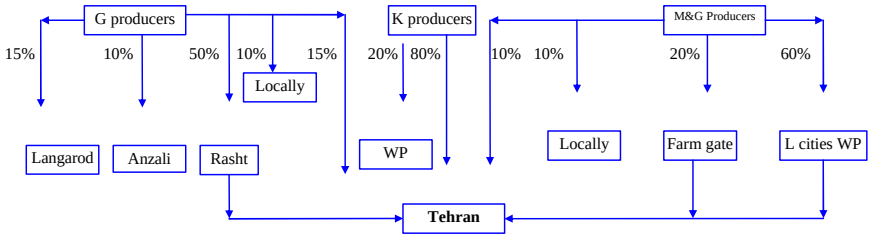
Production systems and practices in the culture-based fisheries

There are about 1,900 natural, semi-natural and artificial water-bodies and 150 earth dams, 235 barrage dams and 1,500 irrigation reservoirs[3] in Iran. The total water surface is estimated at 558,000 ha. These are distributed through all the provinces and can be used for fresh fish culture. The composition of carp species used to stock these water-bodies depends on the availability of fingerlings from the Shilat or other hatcheries, but is usually (28-32%) common carp, (40-50%) silver carp, and (5-10%) bighead carp, the rest being grass carp. Carp production in open water-bodies in the key provinces is shown in Table 3.

Harvests of carp and other warm-water species from the water-bodies, whether natural, semi-natural or artificial, are difficult to measure. Incomplete production data prepared by the aquaculture department indicate average yields of 43 kg ha^{-1} in 1993, and 40 kg ha^{-1} in 1994, increasing to 49 kg ha^{-1} in 1995.

The agriculture sector contributes 21% to the GDP so that there is considerable emphasis on water conservation and management. As part of this national effort, there are thousands of small artificial reservoirs, earthen ponds, and tanks constructed as integral parts of irrigation schemes for valuable agriculture land. These small units, many of which are seasonal, are used as focal points for village fish farms, in which villagers, working as a co-operative, take up fish farming as a part-time activity. In the first year, the units are stocked with fingerlings while certain operational needs are provided by Shilat free of charge, after which the co-operative has to provide fingerlings and other required facilities. Typically, fingerlings are 30 g in weight, and are stocked at a density of 2,500 ha^{-1}. With growth possible only during the warm months of the year, this type of extensive production differs by region. With suitable farming practices but without mechanical aeration and possibly without additional water, the yields range from 300-500 kg ha^{-1}, though yields have improved over recent years. In Mazandran province it had reached 1,300 kg ha^{-1} by 1997 and 1,540 kg ha^{-1} by 2001 with some 13,400 t total production[3,7].

Figure 1: Carp marketing outlets in main provinces.



WP: Within province, L cities WP: Large cities within province, G: Gilan province, M&G: Mazandran and Golestan provinces, and K: Khuzestan province, Sources: Completed from FAO, 1992, op.cit *and Salehi, 1999 & 2003$_b$* op.cit.

Carp harvesting and marketing

Carp farmers use different marketing channels depending on the quantity of fish they have for sale, the distance to their intended market, the availability of transport and the credit they may receive for production. In general, small carp producers sell to local markets, dealers or wholesalers within the same province, whereas large producers would ship directly to the capital or other large provincial fish markets, or auction at the farm gate.

The marketing channels for carp differ between provinces. In Gilan, Mazandran and Golestan harvest starts in September, but in Khuzestan it may be two or three months later. The standard market size for carp is about 1 kg. Some farmers may delay their harvesting up to November, or even December to obtain larger fish and potentially better prices. However, this delay is constrained by additional cost, and most farmers, except a few with large farms and high capital investments, are unable to do so. Harvesting is by draining water from the pond or by using a net, and usually carried out by the farmers. Buyers are usually responsible for transporting the fish to the market. The majority of farmers harvest a pond only once a year, or even once per farm, but very large ponds or farms may require more than one harvest.

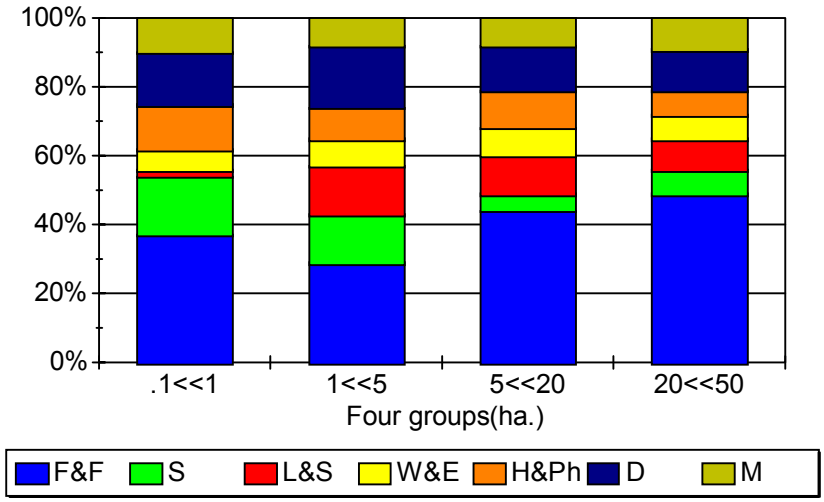
A variety of market outlet ranges from local fish markets, wholesalers within each province, and the co-operatives or wholesalers at Tehran. Wholesalers in Gilan, Mazandran and Golestan, often provide credit to the farmers[3]. As Figure 1 shows, in Gilan province, 50% of carp production is sold to wholesalers in Rasht city, the centre of Gilan province, 15% to the Langarod fish market, 10% to the Anzali fish market and the balance is sold to local market, co-operatives or shipped to Tehran. The wholesalers at Rasht transport and sell some 50% of their carp to wholesalers in Tehran.

In Mazandran and Golestan, more than 60% of cultured carp is sold to wholesalers in the large cities of the province, though small farmers may sell their fish in the local market, and 20% of cultured carp is auctioned at the farm gate. A small amount of the fish sold by auction to wholesalers or at the farm gate is transported to Tehran. In Khuzestan province more than 80% of carp production is sold to wholesalers from Tehran, less than 20% sold at Ahvaz city, the centre of the province, and the balance is sold in local markets.

Carp prices

In Iran, the prices of carp are low relative to prices of red meat and chicken, and these have fallen in real

Figure 2: Contribution of costs per ha of carp farms production in four categories[3].



F&F: Feed and fertiliser, S: Seed, H&Ph: Harvesting and post harvest, W&E: Water and energy, L&S: Labour and Salaries, D: Depreciation, and M: Miscellaneous.

terms. Grass carp usually has the highest price followed by silver carp, while common carp is the cheapest. The price of bighead is between silver and common carp. In 2003, wholesale prices of grass, silver and common carps were US$ 1.60, 1.15 and 1.12 respectively in Tehran.

Cost structure and profitability of carp farming

The various producer locations, categories and cultured systems have different cost structures and consequently different profitability, depending on availability and quality of inputs, farm management, climate, area of farms, location of production, selling price and other factors. On average, farmers in all locations and categories made a profit (gross revenue minus total costs). However, this aggregate picture includes notable variations as profits of farms of less than 5 ha, and farms in Gilan, Mazandran and Golestan. Special case farms such as those obtaining additional income from seed sales were more profitable than other systems.

Considering only farms in Khuzestan, on the basis of costs per kg of production, total cost declined as farm size increased, though economies of scale for this province may be relevant. In the Caspian region it may also be relevant to conduct comparisons between farms of 1-5 ha with farms of 5-20 ha as economies of scale may also be relevant.

In the Caspian littoral the history of cultured carp is longer and farms of less than 1 ha water surface are only found in this area. Smallholder carp culture, in some cases integrated with agricultural activity, is seen as a simple and low cost source of income in this area. Carp farming does not appear to be a particularly attractive investment in West-Azarbiajan, but in Kerman it may be. Factors such as feed and fertilizer, seed, water and energy, labor and salary costs all influence yield and profitability, but farm management, location, production system and size of farms also influence this. In the Caspian region, a wide range of plant materials, and other organic by-products are used to improve pond productivity and carp growth, either directly as feed or indirectly as fertilizer. This practice reduces total operating costs and consequently increases profitability. Some farmers in Gilan, based on the price of fish and the price of rice have reported shifting from aquaculture to rice farming. However, in the present situation, carp farming would bring considerably higher operating returns than the principal crop (rice).

In many cases, especially in Gilan, Mazandran and Golestan, family labor may be used during the off-agricultural season, in which case there would be minimal costs for pond preparation. It appears that farmers in Gilan and especially small farmers were more profitable because they can take advantage of management with reduced cost of inputs especially feed and fertilizer. The break-even production point averaged 2.3 t ha^{-1}, ranging from 1.5 t ha-1 in Mazandran and Golestan to 3.2 t ha^{-1} in Khuzestan. On average, the benefit-cost ratio and the rate of farm income were closely related to location. This suggests that Gilan farmers practice more efficiently and have better conditions, resulting in higher farm income per ha followed by Mazandran.

Future development

Applied research, market-oriented strategy, extension services and the training of core personnel for development may need to be given particular attention, considering existing technology, the transfer, adaptation and development of new technology for hatching, farming, harvesting, handling, processing and marketing. Considering the lack of information services for producers, distributors and marketing agencies, as well as development institutions, the establishment of an information network needs to be given attention. This would draw support from organisations like NACA and INFOFISH. The absence of a legal basis for the sector as a whole and affiliated sub-sector is also a critical need to be addressed. The Shilat law provides a framework for this sector, but additional and specific legislation for aquaculture is required.

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