

Production economics of the emerging private fish farming industry in Bulgaria

Panagiotis Varvarigos

Vakakis International S.A., Agricultural Development Consultants, 9–11 Laodikias Street, Athens, GR-11528, Greece

The production economics of the emerging Bulgarian private carp and trout farming industry were assessed by surveying a representative sample of 20 private and state-controlled farms as well as visiting the National Fresh Water Fish Research Institute, the state-owned fish feed production plant and a fish processing plant.

The major constraints for the development of profitable fish farming were found to be the lack of capital and the insecurity of tenure, which nonetheless, do not serve to discourage new entrants into the industry. The expected gross margin per tonne of carp produced in reservoirs or earth ponds is USD 487, while a tonne of trout farmed in concrete raceways shows a gross margin figure of USD 525. State-owned trout farms are only available for outright purchase at auctions, whereas carp farms may be rented, but only for a short term.

Fish farmers could benefit from organizing themselves into producer groups in order to improve marketing and secure quality inputs. In particular, there is scope to source quality dry fish diets on both economic and environmental grounds.

An extension advisory service is needed to support inexperienced new entrants and researchers should urgently evaluate what seem to be the most cost-effective methods of production.

KEYWORDS: Private fish farming, Production economics, Bulgaria, Carp, Trout

INTRODUCTION

Bulgaria is currently undergoing an economic crisis due to a very large foreign debt and the disappearance of the traditional market for most of its production, which was formerly sold to other Eastern Block countries.

The national production of freshwater fish approximated 16 000 tonnes in 1989, the year of political change, comprising 12 000 tonnes of common carp (*Cyprinus carpio*), 1200 tonnes of rainbow trout (*Onchorynchus mykiss*) with the remainder made up by other carp species including bighead (*Aristichthys nobilis*), crucian (*Carassius carassius*), silver (*Hypophthalmichthys molitrix*) and grass carp (*Ctenopharyngodon idella*) (Staikov, 1993). Following a sharp fall in production to a total of less than 6000 t y⁻¹ coinciding with the events of 1989, production figures are only now gradually recovering and have reached about 8000 t y⁻¹ for carp and 500 t y⁻¹ for rainbow trout (European Parliament, DG for Research, 1992).

Prior to political reform, the initiative of workers and managers on the state and cooperative fish farms was not actively encouraged, but state employees tended to follow the instructions of the central authorities to feed, grow and harvest fish according to

production plans formulated elsewhere. State companies manufactured and supplied the feed and the state organization 'Fish and Fish Products' purchased the annual production with no real concept of competitive marketing or gross margin efficiency being applied.

Following political transformation, the state fish farms were left to cope with unreliable and costly input supplies, without guaranteed marketing channels and with high administration costs due to the excessively staffed, bureaucratic procedures. This resulted in an accumulation of debt and a reduction in production levels. Debt figures of 7 million leva (USD 250 000) are common amongst the state-owned farms and most of them remain dry or utilize only a fraction of the infrastructure available to them. Structures and equipment still stand derelict and are being cannibalized to repair others, while in order to pay some of the outstanding debts, part of the assets (tractors, lorries, machinery, nets and implements) are being auctioned off. Lack of security also results in considerable losses from poachers, which adds to an already precarious economic situation.

Recognizing the severe problems being faced by an otherwise promising industry, the Bulgarian Government decided to sell off or rent to private interests component parts or even state farms as a whole. Negotiations on the renting or sale of such farms are currently under way but are hindered by the slowness of the ongoing land restitution programme and by arbitrary farm valuations. Nevertheless, private investors drawn from the ranks of previous employees of state farms as well as new entrants to the industry are showing increasing interest in investing in fish farming.

This work attempted to research the geographical distribution of private fish farming activities, current production levels and intensity as well as to assess the production economics of the emerging private industry.

METHODS

In order to identify the inherent potential and the factors limiting private fish farm development, a random sample was taken of 20 private farms scattered in the predominantly carp (central-eastern) and trout producing regions (southern) (Fig. 1) and on-farm interviews with the farmers were conducted during October 1993. Among the farmers interviewed some operated retail fish shops in towns and one was exporting fish. In addition, visits were made to the State Research Institute for Fresh Water Fish in the town of Plovdiv, and to the sole state fish feed manufacturing plant and to the most modern fish processing installation, also state owned, both located in the Smoljan region of the Rhodope mountains. In all cases the directors and/or assistant directors were interviewed.

CARP FARMING SYSTEMS AND PRODUCTION ECONOMICS

The prevailing carp farming systems in Bulgaria today comprise:

- steel-framed net cages suspended in natural or artificial lakes using intensive stocking methods and the provision of pelletized dry feeds;
- earth ponds with the provision of supplementary feeding;
- culture-enhanced irrigation reservoirs with limited provision of feeding in the form of low-quality grains and agricultural by-products.

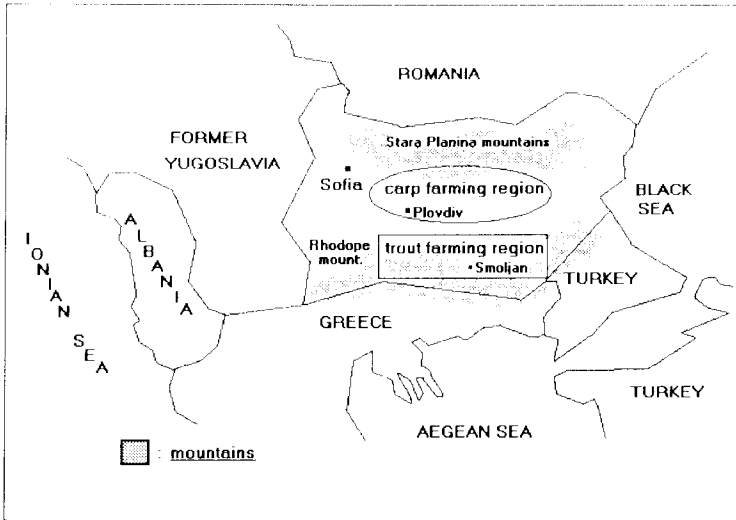


FIG. 1. Location of Bulgaria in the Balkan region and of the predominantly carp and trout farming areas within Bulgaria.

Carp farms are mainly situated in the plain bounded by the Stara Planina mountains in the North and the Rhodope mountains in the South (Fig. 1).

The levels of production achieved from the earth ponds and artificial lakes approximate 3 t ha^{-1} and 400 kg ha^{-1} , respectively, whereas the net cages produce about 30 kg m^{-3} . Carp are marketed from 0.8 kg and are on-grown to this size during only two summers with fingerlings achieving an average weight of 40 g during the first summer.

The most acute shortcomings that constrain carp farmers are:

- the incomplete land restitution programme, which seeks to return land to the pre-communist era owners, or their heirs;
- the lack of extension advice;
- the lack of adequate legislation securing business transactions against breach of contract.

These shortcomings hinder long-term investment, especially as the future of tenancies is uncertain. Tenancy agreements are only short term, commonly for one year, and rule joint ventures or distribution and marketing agreements with domestic or foreign partners who could inject capital in the businesses. The lack of finance is perpetuated also by the lack of loan collateral as contemporary carp farm tenants have no tangible assets apart from the growing stock, and frequently have no long-term investment programme.

With the occasional exception of steel-framed net cages, machinery, equipment and buildings are over 15–20 years old, are fully depreciated and often in a state of advanced deterioration. All are accounted for in the rent calculations for particular sites, but these rent approximations are arbitrary, regardless of the likely productivity of the enterprise. A rental figure of $40\,000 \text{ leva y}^{-1}$ is common for the scale of the typical carp farming activities under examination (in October 1993, USD 1 = 28 leva). In rare cases where the agreed tenancy extends beyond one year, the rent is inflation-indexed.

TABLE 1. Gross margins for carp farms in Bulgaria

	Ponds/reservoirs (leva t ⁻¹)	Net cages
Sale: 1 tonne of fish (α 26 leva kg ⁻¹)	26 000	26 000
Less fingerlings (α 2.5 leva fish ⁻¹)	3 475	3 288
OUTPUT	22 525	22 712
Feed	7 200	18 870
Veterinary and medical costs	200	250
Consumable materials	400	500
Transportation (mainly feed)	600	720
Energy (mainly for pumping)	500	0
VARIABLE COSTS	8 900	20 340
GROSS MARGIN	13 625	2 372

28 leva = USD 1

Labour is relatively cheap and four workers may be considered as the norm. The average salary of a fish farm worker, including charges for social security, is 35 000 leva y⁻¹ (equivalent to USD 97 per month) which is slightly above the national average for agricultural workers. Farmers find it easier and cheaper to hire labour rather than invest in mechanization.

Feeding pelletized rations formulated by the state factory is considered uneconomic due to the low quality of the feed which leads to excessive waste and water pollution. Fish pellets are not produced by extrusion and routine quality monitoring of the raw materials and the final product is not practised at the factory site. Consequently, feed conversion is poor with farmers even preferring to supply pig pellets which are cheaper despite the halving of the conversion efficiency and extending the growth cycle. Apart from pelletized rations, low quality grains and agricultural by-products are also provided to the fish in ponds and reservoirs.

Revenues are low and depress the gross margins. Farm-gate and wholesale prices of the fish are currently at 22–24 leva kg⁻¹ of live weight. These low prices are exacerbated by a seasonal peak in the supply of fish to the market in autumn during the main harvesting period of carp.

GROSS MARGIN DATA FOR CARP

The gross margin data, shown in Table 1, were obtained during the on-farm interviews and comprise modal values. Data from state farms were not included.

Mortality from the fingerling stage to market size is about 10% in earth ponds and 5% in net cages. The apparent feed conversion ratio (FCR) is 4:1 in ponds where carp are fed grain and agricultural by-products and can take additional advantage of the natural productivity of the pond. FCR is 4.5–5.0:1 in cages where carp are fed pig pellets and 2.5:1 in cages where carp are fed fish pellets bought from the Bulgarian state plant. Net cage operators usually provide a mix consisting of 65% fish pellets at 7.2 leva kg⁻¹ and 35% pig pellets at 4.6 leva kg⁻¹, resulting in an expenditure of 6.29 leva kg⁻¹ of mix achieving an

FCR of 3:1. In ponds and reservoirs a variety of feeds are combined and feed costs depend also upon natural productivity and stocking densities.

From the gross margin data it is clear that on a typical private carp farm producing 50 t y^{-1} (ponds) or 80 t y^{-1} (net cages), with an annual rental of 40 000 leva and labour costs of 110 000 leva (two workers/watchmen at 35 000 leva each and a foreman at 40 000 leva), a minimum break-even point of 11 t y^{-1} from ponds/reservoirs or 63 t y^{-1} from net cages needs to be achieved. Depreciation of cage structures, equipment and buildings is accounted for in the rent calculations.

Farming carp in net cages is apparently almost six times more expensive than in ponds, especially culture-enhanced reservoirs, because the fish cannot benefit from the natural productivity and are entirely dependent upon the provision of pelletized rations. With comparatively cheap feed, good harvests can be maintained from the latter. In addition, some reservoirs contain wild populations of carnivorous fish, such as sheat-fish (*Silurus glanis*) and pike-perch (*Lucioperca lucioperca*) with high quality flesh which add to the value of the harvest. Carp broodfish may also be harvested from these lakes in order to produce, with simple traditional technology, the necessary fingerlings to boost the fish populations.

Sensitivity analysis on feed costs shows that if the feeds as presently supplied to caged carp were substituted for extruded high-quality diets with a potential FCR of 1.4, then the present unit cost of feed could be more than doubled to about 13.5 leva kg^{-1} without changing the total feed cost figure.

TROUT FARMING SYSTEMS AND PRODUCTION ECONOMICS

Trout farming has been primarily developed in the Smoljan region of the Rhodope mountains where the state fish feed producing plant as well as the major trout processing unit are also located (Fig. 1). Trout are farmed in concrete raceways built alongside rivers or springs and equipped with pumping and aeration systems for water recycling. Operating the latter is necessary if the usually excessive structures are to be fully utilized. Many of these farms today remain dry awaiting buyers.

With a good water flow, production may reach 50 $kg m^{-3}$ of raceway and individual farm production may range from 50 to 250 t y^{-1} of market-size fish (180–280 g).

The state trout farms which remain in operation are managed with the advantage of feeds being available at cost and with state-directed marketing, whereas the emerging private trout farmers have to cope with costly feeds and must find the outlets for their products.

Auctioning off of former state-owned trout farms has been going on for a year and currently two private farms are in operation. Trout farms can only be purchased outright so considerable capital is tied up (approximately 1–3 million leva for a 50–80 t y^{-1} farm). This outlay has not only to be gradually recovered but also deprives the farmer of working and investment capital necessary to maintain and develop the farm. Nevertheless, on the two operating private trout farms some improvements were evidently under way, so additional depreciation costs will be incurred. Finance for these investments has come from private capital usually sourced from other agricultural activities. Cautious management prevails, so experienced stockmen are employed and the operation runs at about 30–40% of capacity. There are no marketing plans with the focus being concentrated on organizing production.

TABLE 2. Gross margins for trout farms in Bulgaria

	Concrete raceways (leva t ⁻¹)
Sale: 1 tonne of fish @ 60 leva kg ⁻¹	60 000
Less fry @ 1 leva per fish	5 850
OUTPUT	54 150
Feed	37 500
Veterinary and medical costs	250
Consumable materials	1 000
Transportation (mainly feed)	700
VARIABLE COSTS	39 450
GROSS MARGIN	14 700

Feed quality is of primary concern and the importation of improved feeds is under consideration. Environmental issues are a concern too. Water is not recycled because of pumping costs and the feed waste. Currently, Bulgarian trout feeds have FCRs of 2.3–2.5 compared with 1.2 which can be expected from imported feeds. Feed for on-growing trout is purchased at 15 leva kg⁻¹ excluding transportation.

Trout fingerlings produced by private or state farms cost 1 leva per fish at 1 g but it is expected that in future demand will concentrate on larger, 5 g fingerlings. Salaries are in line with those on carp farms with 35 000 leva y⁻¹ being the norm. Market prices are around 60–70 leva kg⁻¹ for fish in the round and about 80 leva kg⁻¹ for processed fish (gutted, headed and packaged).

GROSS MARGIN DATA FOR TROUT

Data were obtained during on-farm interviews. However, since only two farms have been privatized and started production to date, production data have also been obtained from state farms. Typical figures are shown in Table 2.

Fish mortality up to market size is expected to be 17%. At present there is no need to operate the pumps for water recycling because production is well below capacity.

A trout farm owner-occupier having invested about 2 million leva to acquire a 60–80 t y⁻¹ unit faces 200 000 leva annual depreciation for buildings, implements and structures. Salaries total about 110 000 leva y⁻¹ for two workers/watchmen and a stockman. Therefore, in order to reach a minimum break-even point covering fixed costs, some 21 t y⁻¹ of rainbow trout need to be produced. In fact, the two private farms in operation produce about 30 t y⁻¹ each, which is enough to cover both fixed costs and to realize a moderate profit.

If locally produced feeds were to be substituted for imported high-energy extruded diets with a resulting improvement in FCR from 2.5 to 1.2 then farmers could pay 31.5 leva kg⁻¹ of feed, representing more than a twofold increase in present unit feed costs without changing the demonstrated cost structure.

MARKETING, PROCESSING AND EXPORT OF CARP AND TROUT

Bulgarian-produced freshwater fish could be successfully marketed abroad due to competitive pricing. Carp in the round has already established a good export market in Northern Greece where large fish of at least 1.5 kg command prices of about 50 leva kg⁻¹, twice that achieved on the home market. Processed trout are also exported by state companies to Northern European countries where they fetch up to 90 leva kg⁻¹ of ready product.

Exporting and large-scale processing are, however, virtually impossible for the small-scale scattered producers and only one private carp farmer operating a relatively large-scale cage unit was found to export fish. The higher prices obtained were in this case necessary to keep the operator in business. Export marketing is controlled by vertically organized state companies where modern, automated processing facilities are available. These companies also incorporate fish and fingerling production. The emerging private farmers are still largely dependent upon the state organizations not only for marketing but also for sourcing most of their inputs and the formation of producer groups would be necessary prior to attempting independent export deals.

Within Bulgaria, fish are increasingly being marketed by private traders operating fish shops or renting stands in market halls. Shopkeepers purchase fish wholesale from growers in their region and transport them alive in insulated vans equipped with aerated holding tanks. They are able to bargain with the producers for the best prices and benefit from the lack of holding pens and the difficult financial position of the producers. At the point of retail the fish are transferred alive and kept in basins with water exchange and some aeration, allowing carp to stay alive for about a week. Retail shops may sell on average about 300 kg of carp week⁻¹, while from central market stands sales can be up to 200-300 kg of carp day⁻¹.

Renting a fish shop costs about 5 000 leva per month with additional power costs for refrigeration of about 1000 leva. Renting a market stand currently costs about 170 leva day⁻¹ but is re-auctioned every 3 months.

Carp are bought wholesale at 22–24 leva kg⁻¹ for 800 g fish, or 26 leva kg⁻¹ for 1.5 kg fish and are sold at about 35 leva kg⁻¹. Producers complain that they are being prohibited by law from selling their fish directly to the public at open markets. The producers argue that if they were allowed to retail their produce their income would increase but the price to the consumer would remain below current retail levels.

Nevertheless, there has been some integration of production and retailing through the renting of both fish shops and reservoirs. However, the shortage of private investment funds together with the short-term nature of tenures discourages the installation of holding pens at the lake sites. As a result supply cannot easily be regulated and hence remains seasonal while revenues are not greatly improved.

SOURCING OF FINANCE

Bulgarian fish growers are usually short of capital but borrowing is unrealistic either due to the inability to provide collateral and/or the very high interest rates, currently running at 58–70% p.a. This situation is worsened by the inexperienced banking sector being itself in the process of transformation.

The formation of joint venture companies with strong foreign participation is possible only for the trout producers who being owner-occupiers are able to offer strong equity.

Carp farmers are prevented from entering into joint ventures by the insecure tenures and the lack of true assets which typifies the industry.

Contract farming of fish on behalf of state-controlled enterprises, foreign processors or fish traders could provide working capital, quality feeds and technical advice as well as security against price fluctuations (Pillay, 1977). However, particularly amongst the private trout farmers, their insufficient relevant experience, their lack of contact with the industry abroad and the weak existing legislation to protect against the breach of contractual obligations hinder these intentions.

A more likely way forward is the sourcing of venture capital from affluent friends who have direct knowledge and confidence in the functions of the farm and who usually end up as partners in the enterprise. Due to strong ethical bonds, the lack of strict legislation on contractual obligations is not of decisive importance.

Insurance cover against risk would be an advantage when seeking finance or trying to arrange contractual deals; however, risk management as a concept is not well understood and it will take time before the insurance market develops and suitable policies to cover fish farming risks are made available.

RECOMMENDATIONS

1. A national strategy for the development of aquaculture must be established based on the overall economic development strategy for the country. The particular socio-economic and political realities existing in Bulgaria will determine Government policy (Pillay, 1977). If private initiatives in the farming of fish in inland waters are to be encouraged in the capital-short Bulgarian economy, it must be possible to conclude long-term, 10–15 y tenancy agreements for fish farm sites. The longer tenancies could be linked with the inflation index and based on professional opinion concerning the expected productivity of particular sites. However, while the continuing but slow land restitution programme prevents long-term tenancies of earth pond based sites, it is not well understood why, despite much official discussion on this subject, tenancies for reservoirs should not be secured for ten years or more. It is also not clear why state-owned trout farms should only be available for purchase through auctions without the alternative possibility of a long tenure being offered.
2. Vertically integrated state companies which currently control the production of most inputs (feeds, fingerlings) and undertake marketing (processing, exporting) should be strategically privatized in order to create a competitive and efficient environment for fish markets and input production and distribution. The private fish farmer must have freedom to select from a variety of inputs from different suppliers and sell fish according to individual marketing plans. Enhanced production technology is likely to evolve more readily where the decisions regarding input sourcing and output channelling are made under a free competitive market economy.
3. Processing and exporting must be considered as integral activities which should ultimately be in the hands of private investors or producer groups. Processing should develop in line with internationally acceptable technology standards and plant hygiene reinforced by regular inspections which should ensure that standards are maintained. Only a well-founded private industry is likely to effectively penetrate competitive export markets.

4. Institutional research facilities should be used to prove cost-effective technologies that may contribute to the profitability of existing production systems. Work should also focus on the development of stock health management measures.

Applied research should primarily concern:

- the construction and maintenance of holding ponds or net pens in large ponds or lakes for ready-to-market stock in order to facilitate selling during the off-peak season;
 - the incorporation of integrated technologies, such as raising carp fingerlings in wooden cages suspended in ongrowing ponds without the need to excavate special fingerling ponds;
 - the optimization of the carp pond rotation plans to make them available for stock grazing and cropping during dry periods;
 - maximization of the value of pond harvests by the application of polyculture of non-competitive species at the proper stocking densities, e.g. grass carp with bighead and common carp;
 - the assessment of the disease risks. Reservoirs are interconnected with each other and with rivers that supply earth ponds. Trout farms are located along connected river systems and often three or four farms operate along the same river. The risk of potential diseases spreading in these water systems needs to be identified, especially as production is expected to intensify in the future.
5. An extension service has to be organized for the provision of management advice to existing private farmers (AFRC/Phare, 1993). At present there is no institutional infrastructure offering advice. The most critical areas where private fish farmers are in need of support comprise:
- feed storage, feeding schedules and techniques;
 - optimum stocking densities for young and ongrowing fish;
 - production technologies for good-quality fingerlings;
 - disease identification and control through preventive measures.

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