# Carp and Pond Fish Culture

## Second Edition

### Including Chinese Herbivorous Species, Pike, Tench, Zander, Wels Catfish, Goldfish, African Catfish and Sterlet

**László Horváth**, MSc, PhD
*Head of the Fishery Department, Szent István University, and Doctor of Science, Hungarian Academy of Science*

**Gizella Tamás** (Horváth), PhD
*Carp farm director, Fishery Scientist and author*

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# The Authors

*László Horváth*
As a postgraduate László Horváth studied at two world famous establishments in Hungary: at the Fish Culture Research Institute, Szarvas (with Professor Woynarovich) and at the Warmwater Fish Hatchery, Szazhalombatta, where he eventually became Director of Research. Whilst there he was also involved in research and development for the Hungarian state fish farming industry as well as acting as a consultant in many developing countries.

Following a post as professor at the Agriculture University, Gödöllö, he established the Fishery Department at the newly named Szent István University in 1991 as its Head. He is also a Doctor of Science at the Hungarian Academy of Science.

László Horváth has published over 100 scientific papers and written several books on fish culture.

*Gizella Tamás*
Gizella Tamás also studied for her PhD at Szarvas. Married to László Horváth, she also worked at the Warmwater Fish Hatchery, Szazhalombatta, where she became Director of Production and a recognised expert on the technology of cyprinid fry rearing and the mass cultivation of zooplankton. After undertaking a managerial role for the Hungarian Federation of Fish Producers, she is now the director of a large carp farm in Hungary and the joint author of several books.

*Chris Seagrave*
After studying applied biology at Brunel University, Chris Seagrave left to carry out research into fish diseases at the Ministry of Agriculture, Fisheries and Food, Weymouth.

In 1980 he left to take up a teaching post as Sparsholt College as Senior Lecturer in the Department of Fish Farming and Fishery Management. He is still there!

In 1985 he developed a carp and ornamental fish farming business, which is currently one of the largest producers of pond fish in the UK. Chris Seagrave is also the author of textbooks on fish farming and fishery management.

# Preface

The Hungarian fish farming industry is respected throughout the world for its expertise and innovations, especially in the spawning technology of fish, and the name of László Horváth is well known to all concerned with the farming of carp.

During 1980 László Horváth and his wife, Gizella Tamás, published two books on the culture of the common carp and other important fish farmed in Eastern Europe. The information in these books was originally aimed at technicians within the large Hungarian fish farming industry. The books sold well, and were regarded by many as essential texts for both farmers and students of fish farming alike.

During a visit to Hungary in 1988 we agreed that the books should be translated and published in English, as a text on the principles and practices of pond culture at this level was not readily available in the English language. The two books have been amalgamated here into one text, though some additions have also been made to make the book more relevant to a worldwide readership.

The final chapter has been enlarged to include a section on goldfish to cater for the increasing demand for information on ornamental species, although it should be emphasised that the culture of the common carp acts as a model for the majority of pond species.

I hope that, with the inclusion of a large number of original drawings painstakingly produced by L. Horváth senior, the book retains much of its Hungarian character.

Chris Seagrave
Editor

# Preface to the Second Edition

The first edition of this book was produced in 1992. During the following decade the carp and pond farming industry has continued to grow at a pace, particularly in the Far East. As a food fish the carp continues to be extremely important but perhaps less so in Europe, as the major political changes experienced in the former Eastern Bloc countries have caused a wide range of social and economic changes.

In the UK the sport fishing industry has developed beyond all recognition, with the carp as the angler's main quarry. Intensively managed, densely stocked waters are now widely available for the pleasure angler. For the specimen hunter, fish as large as 20 kg (45 lb) are not uncommon.

The variety of species grown in ponds also continues to increase, for both the table market and the increasingly important ornamental fish trade. Technologically few major changes have been witnessed with the exception of the new 'synthetic' hormones now in common use in hatcheries around the world.

The first edition of this book was well received by the industry. It is hoped that this edition enjoys a similar reception.

# Acknowledgements

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In addition, the authors would particularly like to thank Ildy Horváth for providing a number of additional illustrations in the style of her grandfather's originals.

Cover photograph reproduced courtesy of Mick Rouse of the *Angling Times*.

# Chapter 1
# Introduction

## 1.1 Characteristics of carp farming

In most countries of Europe and Asia, and in some areas of Central America, the common carp (*Cyprinus carpio*) is the most important cultured fish. Less importance is attached to this species in the Americas or Australasia.

Carp is one of a few species of fish that can be considered as domesticated, but there is a considerable difference between the domesticated form and its wild relation (from which it was originally bred) with respect to reproduction capacity, growth, utilisation of feeds, etc. The wild form is covered with scales and grows slowly while the 'noble' ones (i.e. domesticated forms of both scaly and mirror varieties) utilise artificially fed cereals and natural food well, giving rapid growth. Yields per unit area vary greatly, depending on the environment and rearing methods used. Using 'extensive' methods, about 0.5 tonnes/ha can generally be achieved whilst with the application of the most advanced technologies 2–3 tonnes/ha may be produced even in temperate climates. In the tropics where the growing season is longer, yields can be even higher still. Carp are highly resistant to handling, during harvesting, grading, transportation, etc., and to changes in water temperature and oxygen levels.

The palatability of carp is high, and the fish still enjoys considerable demand in the marketplace in most east European countries, in near and far east Asia and also among immigrant communities in the UK, USA and other western countries. It is extremely advantageous that as a farmed animal 50–60 per cent of the feed requirements of carp can be satisfied with cereals, the other 40–50 per cent being made up from small animals living in the ponds (inferior crustaceans, larvae of insects, molluscs, etc.). The reproduction capacity is extremely high and, during one season, 0.5–1 million fry may be produced from one female.

## 1.2 Historical background of carp husbandry

To understand and appraise appropriate methods of fish propagation and fry rearing it is necessary first to appreciate the historical background to fish culture and describe the 'simpler' methods of propagating carp. Early fish husbandry started in two centres – the ancient Chinese and Roman empires. Deliberate breeding practices created the basis for the development of successful propagation methods.

The earliest information regarding carp propagation comes from the ancient Chinese. The spawning of common carp stocked in ponds was observed and described as early as 451 BC, but for the Chinese carp early technology involved the collecting of eggs and fry from natural waters and then stocking them in fish ponds to be reared up to market size.

The first full account of European methods was documented in Europe in the sixteenth century by Dubravius, who described the principles of fish propagation and husbandry in fish ponds. In the eighteenth century a new phase of fish culture was initiated by Jakobi, who first fertilised trout eggs artificially. This work was a scientific curiosity in its time but was soon forgotten. The method was discovered again by Remi and Gehin a century later, and applied to fish farms. In 1851 the first fish 'seed' production farm was established in France. Propagation of salmonids was relatively easy due to the biological features of the species (the eggs are not sticky and they are also highly resistant to handling because of their thick shells), hence trout farms were established in several parts of the world. Garlick in the USA, as well as Nikolskiy and Vranskiy in Russia, developed the principles of trout husbandry and the results and experiences achieved were indirectly influential in the development of carp husbandry technology. In the nineteenth century Dubich and co-workers from Silesia in Eastern Europe, as well as their successors, performed outstanding work in developing carp farming methods, enabling the safe rearing and thus economic farming of carp to be possible. Dubich also observed that the natural production potential of fish ponds is closely related to the soil conditions, and he described the basic factors that influence the growth of carp in fish ponds. His method of carp propagation was the only one used for several decades in regions where sophisticated hatchery propagation techniques had not

been introduced, and even today it is still the main method of seed production across the globe.

Detailed studies of the propagation and reproductive physiology of fish started in the 1930s. Gerbilskiy and co-workers from Russia studied the endocrinal processes which regulate reproduction in fish (basing their work on that of Ihering in Brazil) and then elaborated a practical method for inducing ovulation. The principle of the method involves the use of the hypophysis (pituitary gland) which is transplanted to receptor fish, where exogenous gonadotrophic hormones released from the donor gland will trigger the ovulation process. With this method fish can be propagated to a preplanned schedule. This method enables mass propagation and scheduled production of seed stocks. The method known as 'hypophysation' was originally worked out for the propagation of sturgeonids, but it soon became evident that it can be applied successfully in the propagation of other fish species as well.

The hypophysation technique was used somewhat late for the propagation of carp (during the early 1940s). As the egg shells of carp contain chemicals that enable them to stick to vegetation in water, this 'stickiness' prevented carp eggs from floating freely in incubation jars, and hence made incubation in the hatchery impracticable. Therefore the hypophysation technique was used only to promote natural spawning in ponds, which is not a reliable method of producing seed.

A prerequisite for propagation in the hatchery was therefore to eliminate the stickiness of carp eggs. Several techniques were worked out for this at the end of the 1950s but the simple and efficient Hungarian method became the most widespread. This technique, the salt-carbamide (urea) treatment of eggs developed by Woynarovich from Hungary, is now applied all over the world. In recent years the traditional carp-orientated fish farming in Europe has been supplemented. Chinese practices, using several fish species together which better utilise the natural biocoenosis of fish ponds than achieved in monoculture, result in higher fish yields.

These additional species are: the grass carp or amur (*Ctenopharyngodon idella*), the silver carp (*Hypophthalmichthys molitrix*), and the bighead carp (*Aristichthys nobilis*). These are called (not really justifiably) 'herbivorous' fish and have been cultured for many centuries in China with fairly high yields. The seed stock for these species was collected from natural waters as they cannot propagate in conventional fish ponds. A