

## SEMIINTENSIVE CAPR (*Cyprinus carpio*, L.) PRODUCTION – TYPE OF SUSTAINABLE FISHERY

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*ABSTRACT: Semiintensive carp production is based on two sources of food for fish: proteins that are present in live food and carbohydrates that are provided from additional feeds. By consumption of secondary producers (zooplankton and bottom fauna) nutrients, main causer of water ecosystem eutrophication (phosphorus and nitrogen) is utilized. Unused nutrients (inorganic or organic compounds) are settled at the pond's bottom and through application of agrotechnical measures (natural drainage, winter killing, disking) fertility of the pond's bottom is increased. Semiintensive carp production based on live food as the main protein source fits into the concept of sustainable agriculture.*

**Key words:** semiintensive system of carp production, sustainable fishery.

### INTRODUCTION

During the two last decades global fish capture is in stagnation and decreases while aquaculture has a constant rising trend (over 9% per year), so one can say that every 4<sup>th</sup> kilo of fish consumed is obtained from aquaculture.

Aquaculture in Europe compared to the world's trend has a slower growth. During the last decades there are positive trends in aquaculture development in EC and Northern European countries and negative trends in Eastern European countries. In countries with positive trends intensive production of carnivorous fish species is dominant (trout, salmon), but semiintensive one of fresh water – warm water fish, mainly cyprinid fish such as *Cyprinus carpio* – common carp is traditionally present in Eastern European countries (MITROVIĆ-TUTUNDŽIĆ, BALTIC, 2000).

Oposite to an intensive production followed usually by the problems as environmental pollution, diseases of breded animals, high production expenses etc. semi-intensive and even exstensive production during last years got more and more supporters. Such production will be an advantage in future, since it is economic and fits to the concept of sustainable agriculture.

### SEMIINTENSIVE SYSTEM – SUSTAINABLE FISHERY

Differing from an extensive system, being almost abandoned in fish ponds and intensive system being sporadically present, mainly in fry production and cage systems,

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semi-intensive system presents a dominant form of carp production in Serbia. Semi-intensive system is based on a protein food component for carp on the account of natural food while the energetic needs mainly are fulfilled by usage of carbohydrates (maize, barley, wheat...).

This type of production enable yield that is a several hundred kilos up to over 3 tones per hectare of production water surface (MARKOVIĆ, MITROVIĆ-TUTUNDŽIĆ, 2000). The scale of production depends on the type of fish pond, fish stock, productivity of the fish pond, water quality, quality and quantity of food added, as well as agrotechnical and technological applied. (MITROVIĆ, 1968).

Growth dynamics of reared carp is primarily dependent on the quantity of constitutive components – proteins in food that fish consume. As in semiintensive breeding system natural food is the main source of protein, so the growth of carp depends on the level of development of natural food and to a lesser extent on the amount of added carbohydrates.

In warm water fish ponds live food consists of zooplankton and bottom fauna. Zooplankton is the main live food for carp fry (and other species that are reared in carp fish farms), but together with bottom fauna, live food is a source of nutrients for market fish as well. Zooplankton in fish ponds and other still and slow flowing water ecosystems has a distinctive seasonal dynamics, with a minimum and maximum of secondary production (MARKOVIĆ *et al.* 1998, MARKOVIĆ, 2003).

Bottom fauna is very important in the fish diet (except the youngest fish categories, 3-4 month old), as well as zooplankton. Mainly, bottom fauna in fish ponds consists of Diptera larvae, i.e. the family Chironomidae and Oligochaeta. Similar to zooplankton, bottom fauna has a seasonal dynamics.

Live food in fish ponds develops due to the amounts of available nutrients in water (basically elements that are often in deficit, ortophosphates and nitrates). However, consumption of nutrients (phosphorus and nitrogen) by primary producers through food chains leads to development of secondary producers, live food for reared carp, mainly zooplankton.

With regard to the fact that the origin of nutrients are mainly brought from natural water sources (rivers, lakes) or man made water ecosystems – canals (less from the bottom sediments or from applying agrotechnical measures – fertilization) nutrients are the main cause of water ecosystem eutrophication. During the process of fish production a part of nutrients is used which decreases the pollution of natural and man made water ecosystems. Nutrients that are introduced in fish ponds are transferred to reared fish through food chains. The quality of water that is used for fish production is poor and can not be used for any other purpose so that the reserves of high quality water and animal protein feed are not wasted. A high quality fish meat is produced as a result of this type of production (BAUER, 1982; MITROVIĆ-TUTUNDŽIĆ, MARKOVIĆ, 2000).

A part of nutrients is settled on the ponds bottom which increases the fertility of the sediment for next year production cycle.

Together with water flow with nutrients into fish pond are also brought suspended matters of inorganic and organic origin. In carp fish ponds that are still waters a big part of these nutrients are deposited in the ponds sediment. The fish ponds are emptied at the end of the production cycle (in October/November), the surface left to dry out and in winter to freeze. These measures are necessary because they increase the process of mineralization which in return increases the quality of the pond sediment.

However, carp fish farms are built on unfertile soil. Using this type of soil for fish production, in the long run, has a positive effect on its quality.

Except carp as the main fish species that is reared in semiintensive system in warmwater fish farms there are other accompanied fish species, not less important. These fish species are well known as Asian complex: white grasscarp, white and gray bighead. Rearing carp in polyculture (together with accompanied species) can increase the production up to 30% more than in monoculture. Production per area unit is increased and the natural potentials of the fish farms use to be maximal.

White grasscarp and bighead are herbivores. Grasscarp consumes macrophytes (*Phragmites communis*, *Tipha latifolia*, *Lemna minor*, *Ceratophyllum demersum*) white bighead feeds on algae that additionally helps utilization of primary producers as food for reared fish. Same as carp, gray bighead feeds on zooplankton, secondary producers.

Unskilled stocking of Asian complex fish can decrease production of common carp on the cost of better production of gray bighead (direct competitor of carp) or white bighead (by decreasing the amount of planktonic algae that are food for zooplankton). Inadequate estimation in stocking can additionally lead to bigger conversion index. In the absence of live food Asian complex fish start feeding on additional food (they need more additional food for growth than common carp).

### **PERSPECTIVES IN SERBIA FOR SEMIINTENSIVE SYSTEM OF CARP PRODUCTION**

Fish production in Serbia is carried out mainly in warmwater – carp and coldwater trout fish farms. Production of fish in cages and in enclosed or partitioned natural or man made waters is of much lesser scale (MARKOVIĆ, MITROVIĆ-TUTUNDŽIĆ, 2003).

There is almost no reliable information on the amount of market size fish produced at fish farms (mainly common carp and trout, to a lesser degree white and gray bighead, white grasscarp, wells, pikeperch, northern pike). However, the amount of produced fish together with the amount of cached fish (commercial fishery and sport fishing) could be estimated on 6000 – 8000 tones, which is about 30 to 40 % of domestic market demand. Every year a lot of currency is spent on import of additional quantities of fish (MIŠ-ČEVIĆ, 2003). With better standard of living and nutritional culture development the demand for fish becomes even bigger. This require an effort as to look after possibilities of increase of fish production at fish farms and generally development of this branch of agriculture. With regard that Carp is the most consumed fresh water fish on our market by all means most logical direction of fishery development is in increasing production on existing fish farms and construction of new ones. The present areas under warmwater fish farms in Serbia are about 11 000 hectares. In Vojvodina, possibilities for building new fish farms are almost unlimited. Under a free estimation on the territory of Banat there are over 100 000 hectares of unfertile and low fertile land in vicinity of rivers and canals that are not used or occasionally used for cattle grasing, that are suitable for construction of carp fish ponds. Perspectives for development of this type of production in Serbia are obvious, especially because semiintensive system of warmwater fish rearing is compatible with the modern concept of sustainable agriculture and economical production.

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