COMMON CARP (*CYPRINUS CARPIO* L.) PRODUCTION IN CYPRINID FISH BREEDING FACILITIES IN PELAGONIA (BITOLA, MACEDONIA)

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ABSTRACT

The most common fish that are grown in cyprinid fish breeding facilities is common carp (*Cyprinus carpio* L.). The aim of this study was to determine the production of common carp (*Cyprinus carpio* L.) in cyprinid fish breeding facilities in Pelagonia (Bitola, Macedonia) in a period of three years. Except main goal, other purposes are inevitably associated with carp production and these are determination of: food consumption for carp production in a period of three years for each fish pond separately; facilities for carp production that were used in each fish pond separately; fish stock material (one-year and two-year old carp) that was used for carp production in a period of three years for each fish pond separately. In order to investigate it, analysis of carp production were made in the two largest fish breeding facilities in Pelagonia (Bitola, Macedonia): fish pond Bel Kamen - Žabeni and fish pond Bukri. Investigations were carried out in a period of three years, from 2011 to 2013. Carp production in fish pond Bel Kamen - Žabeni is almost doubled (156.720 kg) compared with the fish pond Bukri (82.619 kg), which is normal, because of different ambient conditions and difference in capacity (ha) of these two ponds which is almost double. In fish pond Bel Kamen – Žabeni, food consumption (771.050 kg) is almost double compared to food consumed in fish pond Bukri (347.620 kg), during the examined period of three years.

Key words: common carp (Cyprinus carpio L.), cyprinid fish pond

INTRODUCTION

According FAO (2006), cyprinid fish are the predominant fish in world aquaculture with 54% of total fish production. Common carp (*Cyprinus carpio* L.) is the most common fish species in our country. It is a symbol of strength, fertility and longevity (Arts M. T., et al. 2001; Rasoarahona J. R. E, et al. 2004). It is omnivore fish and very effectively uses food. Ćirković M. et al. (2002) determined that fertility of carp is high and it ranges up to 1500.000 eggs per female. Carp is tolerant to large variations of quality of ambient conditions. This species is not susceptible to disease and is tolerant to handling.

Cyprinid (warm water) fish breeding facilities are facilities in which the water temperature ranges up to 30°C. They usually have an area of 10-100 ha, with water depth of 1-2 m. The optimal water temperature is 25°C, the amount of dissolved oxygen is 7-9 mg/l and the pH range from 7 - 8. The most common fish that are grown in cyprinid fish breeding facilities is common carp (*Cyprinus carpio* L.)(Stevanovski V., 2010).

The aim of this study was to determine the production of common carp (*Cyprinus carpio* L.) in cyprinid fish breeding facilities in Pelagonia (Bitola, Macedonia) in a period of three years. Investigations were carried out from 2011 to 2013.

Except main goal, other purposes are inevitably associated with carp production and these are determination of:

- fish stocking material (one-year and two-year old carp) that was used for carp production in a period of three years, for each fish pond separately.
- food consumption for carp production in a period of three years, for each fish pond separately;
- facilities for carp production that were used in each fish pond separately;

MATERIAL AND METHODS

In order to investigate it, analysis of carp production were made in the two largest fish breeding facilities in Pelagonia (Bitola, Macedonia): fish pond Bel Kamen - Žabeni and fish pond Bukri. Investigations were carried out in a period of three years, from 2011 to 2013.
Fish ponds Bel Kamen - Žabeni and Bukri are located in the southeastern part of Pelagonia (Bitola, Macedonia) and working within ZK "Pelagonija" - Bitola. They were built in 1960/61, with the enclosure of part of the Black River old bed with two embankments. Fish pond Bel Kamen - Žabeni occupies an area of 170 ha, while Bukri area of 55 ha. Land of the Black River old bed is very fruitful, contributing fish ponds to be very productive and rich in phyto and zoo plankton. Fertile soil and residual organic matter at the bottom of the ponds for years allow development of lush aquatic vegetation, which in certain conditions can adversely affect on water quality and on fish production.

Figure 1. Common carp (*Cyprinus carpio* L.) from fish ponds in Pelagonia (Bitola, Macedonia)

RESULTS

Cyprinid fish farming in Macedonia dating back to 1961 with the construction of fish ponds: Bel Kamen – Žabeni with an area of 170 ha and Bukri with an area of 55 ha, both in Pelagonia (Bitola, Macedonia). Ten years later a few cyprinid fish ponds were built such as: Dubrovo (140 ha) in Negotino, Ezerani (120 ha) in Resen and Sarandinovo (200 ha) in Prilep. Dubrovo and Ezerani fish ponds are not functional in the moment. The production of cyprinid fish species in these ponds in the period of 1986 - 1991 year ranged from 650 -1050 kg/ha fish. The total production of cyprinid fish species in 1986 amounted to 609.000 kg and in 1991, 758.000 kg. The period from 1991 - 1995 was a period of complete stagnation of cyprinid fish farming. In this period fish ponds Dubrovo, Ezerani and Sarandinovo were closed. Only fish ponds in Pelagonia (Bitola), Bel Kamen – Žabeni and Bukri remained in function but the fish production in these ponds showed a slight decrease. The period from 1995 - 2001 has the same production features, while only fish ponds in Pelagonia (Bitola) were in function. The period from 2001 - 2005 was characterized by occasional fish production in pond in Prilep and continuous working of fish ponds in Pelagonia (Program for fisheries and aquaculture development in Republic of Macedonia for a period of 12 years, 2011).
The stocking in fish ponds in Pelagonia is planned according to the condition of the pond and the quantity of offspring that are available. Fish ponds Bel Kamen - Žabeni and Bukri are very rich in algae and dense herbage. Therefore, it is necessary to enter herbivorous fish species which will control the herbage within normal limits and will provide better conditions for carp breeding as the most abundant species in these ponds. Best results are achieved with polyculture fish breeding. This provides breeding of more fish species which do not competitive

eating, using different foods and occupies different living space. The best way for stocking is represented by 70% carp, 10 % grass carp and 20% bighead carp, although this relationship may change.
Table 1 and 2 shown fish stocking material of one and two year old carp (kg) that was used for stocking in fish ponds Bel Kamen - Žabeni and Bukri in Pelagonia (Bitola).

Table 1. Fish stocking material (kg) in fish pond Bel Kamen – **Žabeni**

FISH POND BEL KAMEN - **ŽABENI**			
Year	2011	2012	2013
One – year old carp	2.000	2.500	4.000
Two – year old carp	8.740	31.000	8.000
TOTAL (kg)	10.740	33.500	12.285

Table 2. Fish stocking material (kg) in fish pond Bukri

FISH POND BUKRI			
Year	2011	2012	2013
One – year old carp	/	/	2.180
Two – year old carp	/	/	1.560
TOTAL (kg)	/	/	3.740

Table 3 shown carp production in cyprinid fish breeding facilities in Pelagonia (Bitola, Macedonia) in a period of three years.
In 2011, there were 51.000 kg carp production in fish pond Bel Kamen - Žabeni, while 18.578 kg in fish pond Bukri.
In 2012, there were 68.720 kg carp production in fish pond Bel Kamen - Žabeni, while 33.720 kg in fish pond Bukri.
In 2013, there were 37.000 kg carp production in fish pond Bel Kamen - Žabeni, while 30.321 kg in fish pond Bukri.

Table 3. Carp production in cyprinid fish breeding facilities in Pelagonia (Bitola, Macedonia)

Year / Fish pond	FISH POND BEL KAMEN - **ŽABENI**	FISH POND BUKRI
	Carp production (kg)	
2011	51.000	18.578
2012	68.720	33.720
2013	37.000	30.321
TOTAL	156.720	82.619

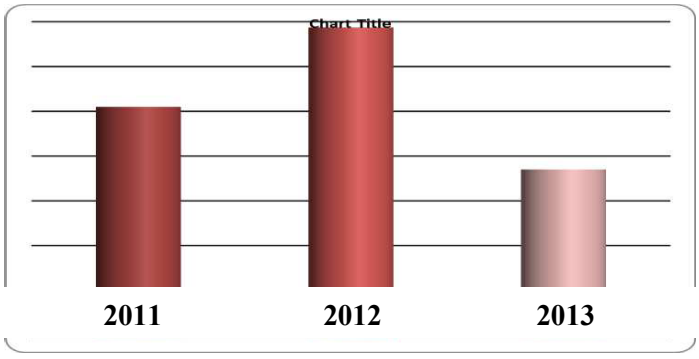

Figure 2. Carp production (kg) in fish pond Bel Kamen - **Žabeni** from 2011 to 2013

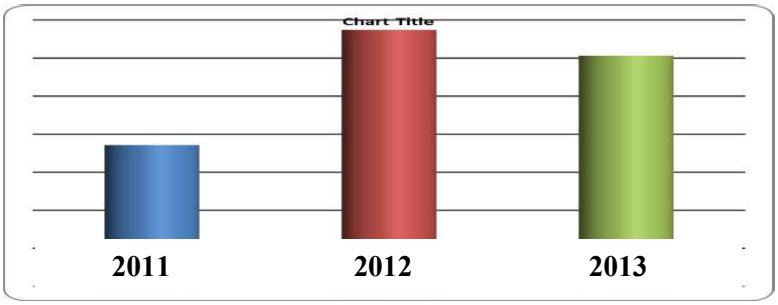

Figure 3. Carp production (kg) in fish pond Bukri from 2011 to 2013

Taking into account the quantities of carp (kg) of a period of three years respectively (2011, 2012 and 2013), it can be noted that the carp production in fish pond Bel Kamen - Žabeni is almost double (156.720 kg) compared with the fish pond Bukri (82.619 kg). This situation is normal because of different ambient conditions and difference in capacity (ha) of these two fish ponds which are almost double.

Table 4. Food consumption (kg) for carp production in cyprinid fish breeding facilities in Pelagonia (Bitola, Macedonia)

Year / Fish pond	FISH POND BEL KAMEN - **ŽABENI**	FISH POND BUKRI
	Food consumption (kg)	
2011	278.850	86.800
2012	310.000	154.820
2013	182.200	106.000
TOTAL	771.050	347.620

As a result of larger carp production in fish pond Bel Kamen – Žabeni, food consumption (771.050 kg) is almost double compared to food consumed in fish pond Bukri (347.620 kg), during the examined period of three years.

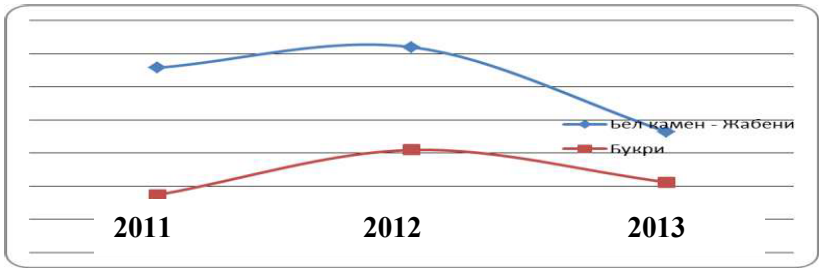

Figure 4. Food consumption (kg) for carp production in fish ponds **Bel Kamen – Žabeni** and Bukri in 2011, 2012 and 2013

Table 5. Total area (ha) of used facilities in fish pond **Bel Kamen – Žabeni**

FISH POND BEL KAMEN - **ŽABENI**			
YEAR	2011	2012	2013
Hatchery	16	16	16
Growing center	32	/	/
Installation for juvenile fish	1	1	1
Winter center	1	1	1
Nursery for commercial fish	110	110	110
TOTAL (ha)	160	128	128

Table 6. Total area (ha) of used facilities in fish pond **Bukri**

FISH POND BUKRI			
YEAR	2011	2012	2013
Nursery for commercial fish	50	50	50
Hatchery	5	5	5
TOTAL (ha)	55	55	55

Tables 5 and 6 shown a total area (ha) of used facilities in both fish ponds in Pelagonia for a period of three years, in which can be seen that fish pond Bel Kamen - Žabeni had hatchery, growing center, installation for juvenile fish, winter center and nursery for commercial fish with a total capacity of 160 ha in 2011, while 128 ha in 2012 and 2013. Compared with it, the fish pond Bukri had only nursery for commercial fish and hatchery with a total capacity of 55 ha in 2011, 2012 and 2013. Spawning in these fish ponds is natural and uncontrolled and it is necessary to put a greater number of female fish in order to provide a sufficient number of offspring for stocking. In practice, there is ratio of 1: 3 (one female and three males) in area of 1 ha. Spawning begins in late April and early May, when the water temperature reaches 20°C. The fish hunting is in October or November next year, with a total duration of the production process from 18-19 months and getting fish with consumption weight of 1500 g. For carp feeding grains such as wheat, corn, barley and peas are used. About 70% of the diet is with natural food and 30% is additional food. The amount of natural food in the fish ponds depends on their productivity. Feeding with additional food starts with increasing water temperature of 17-18°C and it is usually the end of April and beginning of May. Feeding begins with small amounts, depending on the offspring size and its density. Initially, the amount of food is less, but with water temperature increase and fish weight, the quantity of food is also increased. Feeding is done in the morning, no later than 10 pm. Food is given in the places that are previously marked.

Table 7. Daily ration for carp feeding

Month	% of food for body weight (biomass)
March	0,2 - 0,5
April	0,5 - 1,5
May	1,5 - 2,0
June	2,0 - 3,0
July	3,0 - 4,0
August	3,0 - 4,0
September	2,5 - 3,0
October	1,0 - 1,5
November	0,5 - 1,0

Growth control has been performed every 15 days with hunting a certain number of samples (70-100), and include not only weight measures, but control of fish health. Also, twice a month food treated with drugs as a preventive measure against certain diseases is given to fish. Depending on the amount of natural food in fish ponds, for 1 kg fish growth, 2,2 - 3,2 kg additional food is spent. The average consumption is 2,7 kg food for 1 kg growth. The highest food consumption is in July and August. There is the greatest growth in this period. In October water temperature decrease, fish are less active and eat less food.
Around the second half of October fish feeding stopped and the water is discharged into the fish pond.
Carp hunting begins in early November and lasts 10-12 days.

Figure 5. Preparing for carp hunting

Figure 6. Carp hunting

Figure 7. Carp selection

CONCLUSIONS

Cyprinid fish farming in Macedonia dating back to 1961 with the construction of fish ponds in Pelagonia (Bitola, Macedonia): Bel Kamen – Žabeni with an area of 170 ha and Bukri with an area of 55 ha.
In 2011, there were 51.000 kg carp production in fish pond Bel Kamen - Žabeni, while 18.578 kg in fish pond Bukri.
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As a result of larger carp production in fish pond Bel Kamen – Žabeni, food consumption (771.050 kg) is almost double compared to food consumed in fish pond Bukri (347.620 kg), during the examined period of three years.
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REFERENCES

Arts, M. T., Ackman, R. G., Holub, B. J., 2001. Essential fatty acids" in aquatic ecosystems: a crucial link between diet and human health and evolution. Canadian Journal of Fisheries and Aquatic Sciences, 58, 1, p. 122–137;
Ćirković, M., Jovanović, B., Maletin, S., 2002. Ribarstvo. Univerzitet u Novom Sadu. Poljoprivredni fakultet;
FAO, 2006. Food and Agriculture Organization of the United Nations. Fisheries and Aquaculture Department.http:// www.fao.org/fishery/culturedspecies/Cyprinus_carpio/en;
Program for fishery and aquaculture development in Republic of Macedonia for a period of 12 years (2011), University "St. Cyril and Methodius", Institute of animal science, Fishery department. Skopje, Macedonia;
Rasoarahona, J. R. E., Barnathan, G., Bianchini, J. P., Gaydou, E. M., 2004. Annual evolution of fatty acid profile from muscle lipids of the common carp (Cyprinus carpio) in Madagascar inland waters. Journal of Agriculture and Food Chemistry, 52, p. 7339–7344;
Stevanovski V. (2010): Freshwater fishery. Faculty of biotechnical sciences. Bitola, Macedonia;