

## DOCTORAL THESIS ABSTRACT

*Keywords: carp, breeding technologies, health, feeding, processing*

Aquaculture is one of the branches of Agriculture that can provide good quality protein at low cost. Due to this fact, Aquaculture has registered the fastest evolution worldwide among all branches of agriculture.

The first action of the formation of the Moldova Podu Iloaiei carp population consisted in the crossing of the female carp of culture with scales, belonging to the Nucet Fish Research Station, with males of wild carp of Siutghiol, in 1953. The descent obtained in 1957 reaches maturity, presenting a higher growth rate and prolificacy to the parents, it can be stated that the objective was achieved, the new form of carp being more resistant to dropsy by 50%, compared to cultured carp.

At the same time, the plan of the subsequent crosses was elaborated, the first generation breeders were subjected to absorption and alternating crosses with indigenous carp of Cefa and Nucet, as well as with carp imported from Hungary and Ukraine, obtaining, in 1963, the generation of the third carp, the population of Moldova Podu Iloaiei.

In 1988, within the Iași Fisheries Research Station, a selection was made in the breeding and remontant carp batches of the resort, belonging to the new population "Moldova Podu Iloaiei" targeting specimens with as few scales as possible. Numerically reduced batches were thus obtained, which were artificially reproduced.

### *The purpose of the paper*

The research carried out had the role of bringing edifying scientific elements regarding the exploitation of carp belonging to the population of Moldova Podu Iloaiei in different fish farms, from different areas, with different environmental conditions. In the study we monitored the influence of growth technologies on production performance and health of the carp population studied.

About 4 million tons of carp are produced worldwide and about 100,000 tons are caught in the wild (Ecology and Evolution, 2020).

Most fish farmers in Moldova and beyond have a major interest in carp breeding as well as in the development of new breeds, more resistant to disease and with a higher yield of growth and development during the active season.

In order to carry out the research that was the basis of the doctoral thesis, I carried out specialized studies in three fishing units in the NE region of Moldova, in the counties of Iași and Bacău, as well as in the Faculty of Animal Husbandry in Iași, respectively, in some laboratories. specialized research belonging to the University of Life Sciences "Ion Ionescu de la Brad" in Iasi.

Specifically, the research studies focused on three fish farms with different

geoclimatic conditions, respectively: Valea-Ursului fish Farm in Iași County, Răcăciuni fish Farm in Bacău County and the Research Station for Aquaculture and Aquatic Ecology Ezăreni, Iași, and analysis within the Faculty of Animal Husbandry within the University of Life Sciences from Iași.

#### *The biological material studied*

The species taken in the study of the doctoral thesis is represented by the carp (*Cyprinus carpio*) population of Moldova Podu Iloaiei, which is a variety obtained for the purpose of populating the fish basins in the NE area of the country.

During the experiments, the physico-chemical parameters of the water were monitored daily, both in the morning and in the evening. This control was performed by monitoring three important parameters, namely dissolved oxygen in water, pH and temperature.

#### *Morphometric and weight determinations*

Through these morphological determinations, in the studied carp population, the aim was to highlight a specific increase in length and weight depending on the period of growth of the fish material. Finding data on fish material is possible through body measurements, weighing fish and processing and interpreting the resulting data.

#### *Fish diet*

In the feeding of the fish material, during the experiments, a range of granulated feeds was used, taking into account the age of the exploited fish, respectively, from summer I, II and III, made in the host fish farms of our experiments.

All granular feed administered during the research included fishmeal, bloodmeal, sunflower and soybean meal, cereals, vitamins and minerals.

#### *Calculation of biotechnological indicators*

The control fishery was carried out twice a month, to estimate the growth rate, weighing each time between 20 and 100 carp, calculating the following growth parameters, respectively:

- Ichthyomas gain [FBG-Fish Biomass Gain]
- Individual weight gain [IWG-Individual Weight Gain]
- Daily Growth Rate [GR-Growth Rate]
- Feed conversion factor [FCR-Feed Conversion Ratio]
- Protein efficiency ratio [PER-Protein Efficiency Ratio]
- Frequency of planktonic and benthic species in the ponds studied
- Carp breeding biotechnologies in summer I, II and III

The research was carried out in three fish farms, the growth systems being semi-intensive and super-intensive. The fish material was raised in monoculture for a wider observation, in terms of growth rate and feed consumption.

#### *Water quality characterization*

Oxygen dissolved in water had average values between a minimum of 5.3 mg / l in August and a maximum of 9.2 mg / l in October.

The water temperature was another factor that I monitored, this having a minimum of 12<sup>0</sup> C at the end of October, in the pond in Valea Ursului and a maximum of 26.4<sup>0</sup> C in August, in the Răcăciuni farm, but within within the limits of normal growth and development of carp.

Regarding the pH of the water, the minimum value recorded was 7.09 pH units, in July, and the maximum value of 8.80 pH units, in August, also values close to the optimal ones.

The physico-chemical parameters of the water were within normal limits without disturbing the growth rate of the biological material.

### **Biotechnology for summer carp breeding, the population of Moldova Podu Iloaiei**

The experiments were performed in two ponds, one belonging to the Valea Ursului fish farm, and the other located in the Răcăciuni fish farm. The experimental period was extended over 4 months (July-October), in 2017.

The population of the ponds was made with carp fry by the population of Moldova Podu Iloaiei, with an average weight of 5g / specimen, and the control fishing was done bimonthly, until October 30th.

The carp specimens registered a very good growth rate, reaching at the end of the experimental period an average weight per specimen, in the fish farm Valea Ursului (L1) of 121g / exp, and in the Răcăciuni farm, respectively lot L2, of 146g / exp.

Regarding the percentage of survival of the fish material studied, it turned out that in the group L1 (Valea Ursului) a rate of 55% was evaluated, while in the group L2 related to the pond HC2 (Răcăciuni) there was a survival of 46%.

The fish productivity recorded in group L1 was at the end of October about 1,659 kg of carp, on an area of 1.3 ha, while in the pond HC2 was produced a production of 3,417 kg of carp, on an area of 2, 6ha, with an average of 1,314 kg per ha.

### **Biotechnology for carp breeding in the second summer, the population of Moldova Podu Iloaiei**

Carp rearing in the second summer was adequate, with a good increase in growth, starting from an average initial weight of 69g / exp, reaching an average weight at the end of the experiment, between 1024g and 1117g in ponds intended for experiments.

The feeds used met the requirements for growth and development of cyprinids, at the end of the experimental period the body weights of the fish were recorded above the average in the literature.

Feeding the carp population of Moldova Podu Iloaiei with granular fodder is an efficient solution in the growth, development and profitability of a cyprinid unit.

### **Biotechnology for growing and fattening carp in the third summer**

The biological material studied, according to the biotechnology for growing carp in the third summer, had a good increase in growth, reaching the end of the experimental period at average weights between 3,750g-3900g/specimen.

The conversion of granulated feed administered in ponds for fish farming was between 2.2 and 3.2 kg for 1 kg weight gain.

According to the analyzes performed, in the two production farms, we can say that their water is part of the second quality category, according to Order 1146/2002, on the basis of which surface waters are classified.

The population of Moldova Podu Iloaie, Carp survival had an average percentage of 95% in group L5 group raised in Valea Ursului farm and 94% in group L6 from Răcăciuni farm.

Production costs for 1kg of fish amounted to values between 5.25 and 7.88 lei, and the net profit was between 6.09-6.41 lei for 1kg of fish.

According to the results of the recirculating system, the main technological desideratum to be achieved in a recirculating system in aquaculture is to ensure medial conditions that correspond, as much as possible, to the ecophysiological characteristics of the crop species.

The studies carried out in the halls of the Research Station for Aquaculture and Aquatic Ecology, were carried out on four distinct lots, with four different types of granulated feed, obtained from specialized companies, such as Aller classic, Soprofish, Nutra and Aqua Garant .

Of these four batches studied, the highest growth rate was recorded in batch B2, and as administered feed the best conversion was recorded in extruded food from the company Aller classic, where for 1 kg of fish were administered 1.2 kg of feed.

In detail, as the carp population Moldova Podu Iloaiei has not been subjected to growth experiments in recirculating system, we present the results obtained, lots:

Lot B1 consisted of a number of 114 specimens, with a total weight of 10.8 kg, in the experimental interval 21.11.2015- 01.03.2016 obtaining a total weight of 27.4 kg, resulting in an average weight of carp of 95 g, and a final weight, at the end of the research, of 240 g. The total food consumption, during the whole administration period in basin B1 was 19.92 kg of administered feed, with a conversion of 1.2 kg / 1kg fish increase.

Lot B2, at the beginning of the experimental period had a herd of 121 specimens, with a total weight of 5 kg, at the end of the experimental period a total weight of 20.8 kg was obtained resulting in an average carp weight of 44g / exp, and a final weight, at the end of the research, of 171g / exp. The feed consumption was 22.1 kg, with a feed conversion of 1.4 kg / 1 kg of fish.

Lot B3 had a number of 57 specimens, recording a total weight of 10 kg, during the study a total weight of 27.6 kg was obtained, resulting in an average carp weight of 175 g / exp, final weight, at the end of the research , being 484 g / exp. The total consumption of Nutra feed was 28.16 kg, with a feed conversion of 1.6 kg / 1 kg of fish.

Lot B4 which was composed of a number of 71 specimens, having a total weight of 10 kg, in the experimental interval 21.11.2015- 01.03.2016 registering a total weight of 26.8 kg, resulting in an average weight of carp of 140 g, at a final weight, at the end of the research, of 377 g. The total feed consumption of Aqua Garant was 25.2 kg, with a feed conversion of 1.5 kg / 1 kg of fish.

The permanent monitoring of the health of the fish material and the technical conditions of exploitation in a super-intensive recirculation system meant that at the end of the research there were no mortality.

In semi-intensive and extensive growing systems, it has been shown that the trophic potential of the ponds studied can support the growth and development of cypinids, with outstanding productive results, along with additional feed with feed that has a protein content appropriate to the age category of carp.

Hydrobiological analyzes and determinations highlighted the following:

The zoobentos was represented by the Tubificidea family, with the species *Tubifex tubifex*, *Tubifex costatus* and *Pelosclex benedeni*, also called mud worms, these having a high frequency, of over 82%, in the ponds studied.

Zooplankton, represented by several families, had a maximum development in June, when 1480 exp./l were registered, with a biomass dynamics of 52g / m<sup>3</sup>.

Phytoplankton, as it has been shown, is an essential indicator of productive health for aquaculture basins, representing the primary producers that influence the other trophic cycles, for a sustained development and growth, the zooplankton feeding on phytoplankton.

The trophic potential of the ponds influenced the growth and development of the studied fish material, bringing an added value to the quality and quantity of fish produced in each pond studied.

It is important to note that a good feeding of the fish material and a hygiene of the ponds exclude the possibility of certain diseases in cyprinids.

Prophylaxis in a fish unit is essential in preventing the exploitation of exploited fish material, regardless of the densities and categories of fish raised.

In addition, the technologist must know the primary signs of diseases occurring in the fish farm and must act quickly to remove them, as in fish farming, the transmission of diseases is pandemic.

The quality of the water and the aquatic environment must be closely linked to the requirements for the growth and development of cyprinids.

Due to the feeding with granulated food, when necessary, the inoculation of drugs and antibiotics necessary to remove diseases was relatively easy.

Basically, the administration of antibiotics was done by spraying them on granulated feed, as well as directly by embedding in the food allocated to fish.

Throughout the experimental period, isolated cases of disease have appeared, which indicates that a good quality feed and a water quality suitable for growing cyprinids can significantly reduce the occurrence and pandemic manifestation of pests in ponds.

#### *Health monitoring*

Early recognition and treatment of diseases occurring in breeding systems can strictly reduce the level of mortality of fish, so the Aquaculture specialist must have a record of health status depending on the species or species exploited.

For the analysis of the health condition of the studied fish material, several ichthyopathological examinations were performed, consisting of clinical examination, necropsy examination, parasitological examination, bacteriological examination and hematological examination.

#### *Application of conservation methods*

Fish meat is the complete and complex functional food through which man maintains or regains his health. Technologically speaking, however, the main problem in terms of capitalizing on meat from aquatic organisms is the preservation of the initial quality, given its poor shelf life.

The method used to assess the quality of fish meat stored in refrigerated conditions is called the Quality Index Method and is a method based on evaluating a large number of parameters, in a scoring system from 0 to 3, in a decreasing regime.

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In order to assess the freshness of the fish under study, they were cleaned of impurities but without washing them, then their heads, viscera and caudal fin were removed.

At the end of the storage period in refrigeration conditions (7 days), the values of the easily hydrolyzable nitrogen content indicated a meat unfit for human consumption, the constants of this parameter being between 36.33 mg / 100g, in the carp population of Moldova Podu Iloaiei compared to 37 , 17 mg / 100g, for indigenous trout, the two categories of meat being the most consumed in Romania.

The coefficient of variability recorded for the yield in the form of a trunk was less than 10%, which indicates a uniformity of the analyzed samples.

Analyzing the two types of superior recovery of fish (trunk, fillé,), we found that the most efficient way of recovery was recorded when cutting under

trunk form, where an average yield of over 87.00% was registered, while when capitalizing in the form of fillé it proved to be the least efficient because an average yield of only 49.30% was registered.

In the economic idea of increasing the benefits obtained by fish farmers by delivering fish and in forms other than live carp (by semi-processing on the farm), we also presented elements of cutting, threading and temporary storage by refrigeration of fish meat.

*Capitalization in the form of fillé*

In the case of this type of cutting, the losses were much higher than in the trunk. The yield recorded when cutting the carp population of Moldova Podu Iloaiei in the form of fillet was about 49.30%.