



ROMANIA

ACADEMY OF AGRICULTURAL AND FORESTRY SCIENCES, „GHEORGHE IONESCU ȘIȘEȘTI”
RESEARCH AND DEVELOPMENT STATION FOR FISHERIES NUCET

A wide-angle photograph of a calm lake at dusk or dawn. Several people are wading in the water, pulling long fishing nets. The foreground is filled with tall, dry grass. The sky is overcast with soft light from the low sun.

**BIORESONANCE TREATMENT ON GROWTH PERFORMANCE AND
HEALTH STATUS OF SILVER CARP (*HYPOPHthalmichthys molitrix*)
AND BIGHEAD CARP (*HYPOPHthalmichthys nobilis*)**

Nucet– 2026



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The Research and Development Station for Fisheries NUCET is a public institution subordinated to the Academy of Agricultural and Forestry Sciences, founded in 1941. In its over 80 years of existence, the institution has made an essential contribution to the development of fish farming in Romania.



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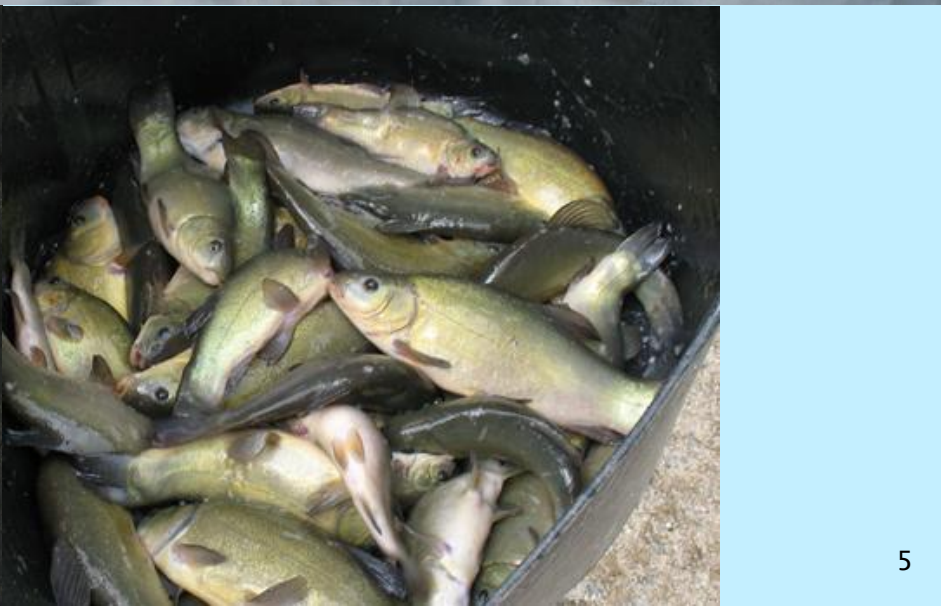


The experimental research is carried out in 5 experimental bases (ponds) with an area of 110 hectares, with about 90 fish ponds and in the 3 pilot stations for artificial reproduction and intensive growth.

FISH SPECIES THAT ARE THE OBJECT OF GROWING AND REPRODUCTION TECHNOLOGIES AT S.C.D.P. NUCET- CHART 1



FISH SPECIES THAT ARE THE OBJECT OF GROWING AND REPRODUCTION TECHNOLOGIES AT S.C.D.P. NUCET- CHART 2



The present scientific research programs refer to:

- Genetic improvement, protection and conservation of living resources in inland waters and aquaculture;
- Conservation of fresh-water fish “Genetical collection”;
- Optimization of artificial reproduction technologies for cultured fish;
- Development of sustainable fish production technologies, sustainable intensification of it through integrated multitrophic aquaculture, intensive, extensive, combined systems;
- Elaborate of artificial reproduction and growth technologies for valuable species of freshwater fish;
- Diversification of aquaculture production by introducing new species and developing breeding technologies;
- Applied aquatic ecology;
- Animal welfare in aquaculture systems;
- Biosafety;
- Climate change studies.

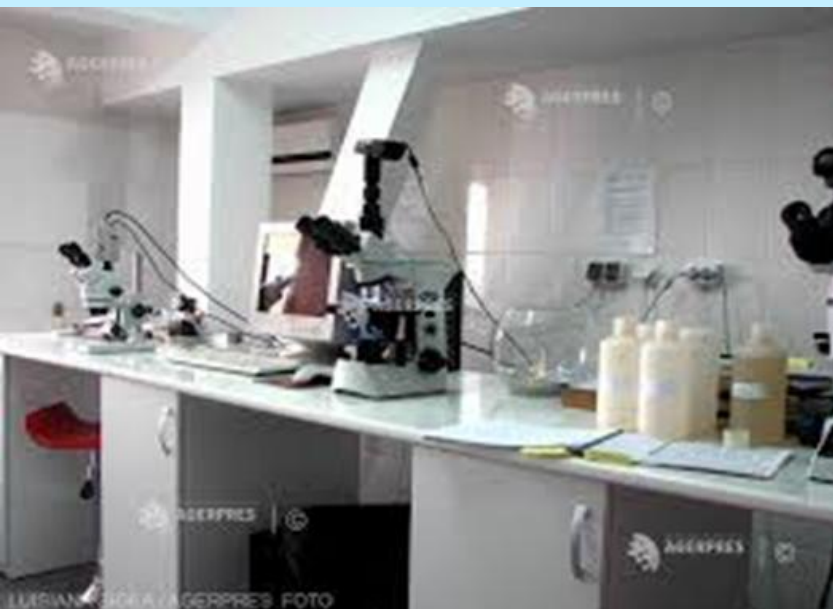
The most important achievements in Romanian fish farming (acclimatization of new species, artificial reproduction technologies, growth technologies in polyculture, creation of industrial and carp breeds, genetic manipulation), were made at Nucet Station.

One of the achievements after 1990 is the establishment and development of the collection of species and breeds of freshwater fish, which contains 30 genetic entities, represented by almost 90 different age groups, being by far the most important in the country and in Europe.



The research activity is carried out in the laboratories of:

- 1. Experimental laboratory for reproduction, selection, improvement and production of stocking material;**
- 2. Laboratory for applied aquatic ecology;**
- 3. Laboratory of aquaculture and fishing in inland waters;**
- 4. Laboratory for fish health and well-being;**
- 5. Laboratory for the improvement, protection and conservation of genetic resources from inland waters.**



PILOT STATIONS FOR ARTIFICIAL BREEDING OF FARMED FISH SPECIES



PILOT STATIONS FOR ARTIFICIAL BREEDING OF FARMED FISH SPECIES



PILOT STATION FOR CULTURE OF FARMED FISH SPECIES



PILOT STATION FOR ARTIFICIAL BREEDING AND CULTURE OF FARMED FISH SPECIES



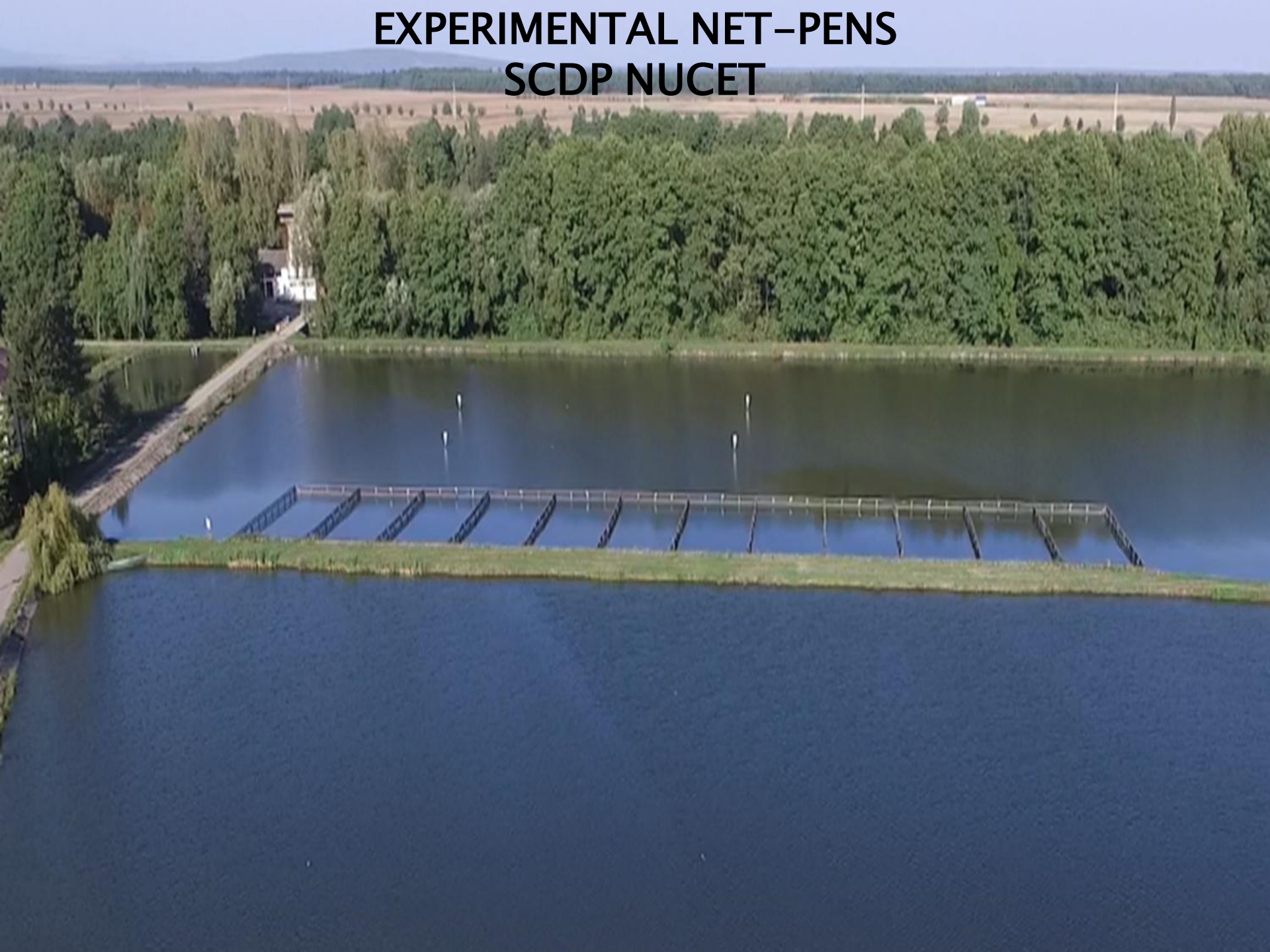


**EXPERIMENTAL EARTHEN PONDS FOR GROWTH IN
POLYCULTURE AT SCDP NUCET**

EXPERIMENTAL FLOATING CAGES SCDP NUCET

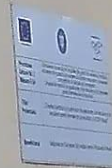


EXPERIMENTAL NET-PENS SCDP NUCET



COUNSELING CENTER FOR AQUACULTURE FARMS, SCDP NUCET

CENTRUL DE CONSILIERE
PENTRU ACVACULTURĂ NUCET



- In 2018, was created at SCDP Nucet the Counseling Center For Aquaculture Farms, co-financed by the European Fund for Fisheries and Maritime Affairs through the Operational Program for Fisheries and Maritime Affairs
- The general objective of the Center is to provide counseling services both for aquaculture farms in Romania and for potential aquaculture beneficiaries through different programs.

APPLIED TECHNOLOGIES IN ROMANIA

- 74.40% are traditional farms, with growth in polyculture, in earth ponds;
- 17.95% of farms apply the technology of growth in concrete tanks;
- 2.22% apply the technology of growing in cages or net-pens;
- 2.22% of farms raise fish in recirculating systems;
- 3.21% in other growth systems.

BIORESONANCE TREATMENT ON GROWTH PERFORMANCE AND HEALTH STATUS OF SILVER CARP (*HYPOPHTHALMICHTHYS MOLITRIX*) AND BIGHEAD CARP (*HYPOPHTHALMICHTHYS NOBILIS*)

The present study analyzes the influence of the treatment applied during the embryonic development period on the growth performance of the Asian cyprinid species *Hypophthalmichthys molitrix* (silver carp) and *Hypophthalmichthys nobilis* (bighead carp), under culture conditions in summer I.

These are two planktonic species of the Cyprinidae family, with a major importance in world aquaculture and in maintaining the ecological balance of aquatic ecosystems. Originally from East Asia, they have been widely introduced in Europe, including Romania, where they are successfully used in polyculture systems.



Silver carp is predominantly phytoplankton-feeding, utilizing algal biomass through filtration, which reduces trophic competition with other species and contributes to the control of eutrophication. It is characterized by a rapid growth rate, reaching 3–5 kg in four years, and prefers warm, well-oxygenated waters. Natural reproduction occurs in rivers with strong currents, but in aquaculture it is achieved artificially by hormonal induction.

Silver carp growth performance

Summer I		Summer II		Summer III		Summer IV	
average	weight	average	weight	average	weight	average	weight
(g/ex.)		(g/ex.)		(g/ex.)		(g/ex.)	
30 – 150		250 – 800		1.200 – 2.500		3.000 – 5.000	



Bighead carp closely related to the silver carp, has a diet dominated by zooplankton, but also includes other organic components. It has a superior growth potential, being able to exceed 6 kg in four years, and a high prolificacy. The integration of the two species in polyculture, together with common carp and grass carp, allows for the efficient use of trophic resources (phytoplankton, zooplankton, benthos and vegetation), leading to increased fish productivity and the stabilization of aquatic ecosystems. Thus, both the silver carp and the bighead carp have a double value: economic, through fish production, and ecological, through their role in regulating water quality.

Bighead carp growth performance

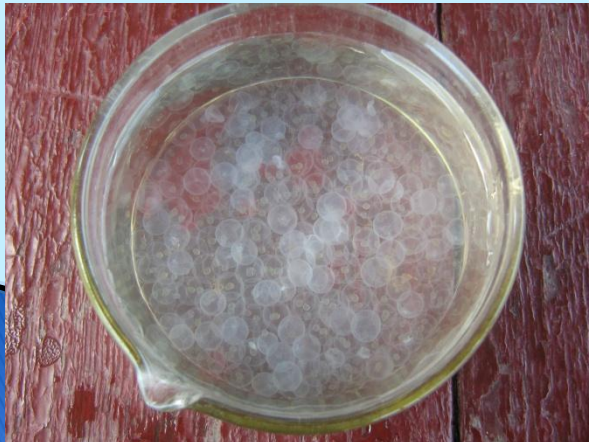
Summer I		Summer II		Summer III		Summer IV	
average	weight	average	weight	average	weight	average	weight
(g/ex.)		(g/ex.)		(g/ex.)		(g/ex.)	
20 – 70		350 – 1000		1.000 – 3.000		3.000 – 6.000	



OBTAINING STOCKING MATERIAL

The 3–5 day old larvae necessary for stocking the experimental ponds were obtained by artificial reproduction. The work involved the following technological stages:

- fishing of the breeders from the prematurity ponds, injection with the hormone triggering maturation and ovulation and their introduction into the maturation ponds;
- collecting and fertilization of the eggs, which takes place at an interval of 10–16 hours from the second injection, depending on the water temperature, introduction of the fertilized eggs into the incubation devices;
- applying bioresonance treatment to a batch of 200,000 eggs from each species (silver carp and bighead carp);
- monitoring of the eggs during the incubation period;
- collecting the 3–5 days old larvae from the incubation devices and stocking them in the experimental ponds.



MATERIALS AND METHODS

1. Experimental design: for the experiments, were used 2 earthen ponds with an area of 2 ha/pond, with an average depth of 1.5 m and a total water volume of approximately $\approx 30,000$ mc/pond. The cumulative area of the experimental basins was approximately 4 ha.

The experimental basins were provided with:

- individual supply/discharge system for technological water;
- filters for the ponds water supply;

2. Experimental protocol

The experiments were carried out on the growth of silver carp and bighead carp in the first summer in a polyculture system.

The applied technology involved the successive completion of the following stages:

- Preparation of the ponds;
- Stocking the fish material;
- Feeding;
- Monitoring of environmental conditions;
- Evaluation of growth parameters;
- Evaluation of health status;
- Harvest fishing and evaluation of results.



STAGES OF POND PREPARATION AND STOCKING WITH BIOLOGICAL MATERIAL

Before flooding the experimental ponds with water, the dams and embankments were reviewed and repaired, special attention was paid to the construction and repair of water filtration installations (1 mm mesh screen) which have the role of preventing the entry of embryonated eggs or larvae of wild fish into the experimental ponds at the time of flooding. Before flooding, all experimental ponds were treated with hydrated lime (150 kg/pond). In order to stimulate the natural productivity of the ponds (phytoplankton and zooplankton) at all trophic levels, fertilizers and amendments were administered.

The two batches were raised under identical environmental and technological conditions, in 2 ha ponds each, stocked with larvae in equal proportions (50,000 ex./ha/species). During the growth period, standard feeding and water quality monitoring technologies were applied, monitoring essential physicochemical parameters (temperature, dissolved oxygen, pH, nutrients) and planktonic biomass dynamics.

Stocking rate 50 000 ex/ha	B exp. 1 (2 ha)	B exp. 2 (2 ha)
Silver carp	100 000	100 000
Bighead carp	100 000	100 000
TOTAL	200 000	200 000

FEEDING FISH MATERIAL

Combined feed was used for feeding the fish material. In the first three weeks, Prestarter type meals, feed milk powder, fish meal, feed yeast, rice bran were administered.

After the end of the predevelopment (21 days), feeding was carried out with concentrates of plant origin (wheat, barley, corn) and industrial residues (sunflower meal) supplemented with animal origin meals, the mixture having a protein content of at least 24%. This type of feed is recommended for cyprinid growing systems.

At the beginning of the growth experiment, the feed administration was distributed in 6 meals/day, until the fish material reached the size of 1–2 g/ex. Later, as the fish material grew, the number of administrations was reduced to 3 meals/day. The feed conversion rate (FCR), calculated based on growth rate, was 3.4 kg feed/kg fish growth.



MONITORING ENVIRONMENTAL CONDITIONS IN EXPERIMENTAL PONDS AND ESTABLISHING TECHNOLOGICAL INTERVENTIONS

- monitoring water quality to maintain the main physico-chemical and hydrobiological parameters within the optimal range;
- controlling the excessive development of aquatic vegetation;
- preventing and combating the phenomenon of "water bloom";
- ensuring a maintenance flow of approx. 8 – 12 l/sec/ha;
- daily recording of water and air temperature;
- monthly control fishing was carried out to assess the health status and establish food rations.



EVOLUTION OF SILVER CARP AND BIGHEAD CARP GROWTH IN EXPERIMENTAL PONDS

During the growth cycle, monthly control fishing was carried out to determine the growth rate in order to establish the daily food ration and assess the health status.

At the end of the growth season, the average weight recorded was:

- 127 g/ex for treated fish;
- 88.5 g/ex for fish in the control pond.

Data on the evolution of the growth of fish material in the experimental ponds are presented in the table below.

Experimental pond	Specie	June	July	August	September	October
		g/ex				
B. Exp. 1 (treated)	silver carp (T)	2	35	77	101	126
	big head carp (T)	3	37	79	109	128
B. Exp. 2 (control)	silver carp (C)	1	25	49	70	87
	big head carp (C)	1	22	45	72	90

EXPERIMENTAL RESULTS

The results of the experiment suggest that the technology of rearing silver carp (*Hypophthalmichthys molitrix*) and bighead carp (*Hypophthalmichthys nobilis*) in the first year of life can significantly improve survival rates and growth performances, achieving productions of:

≈2.5 t/ha for treated fish;

≈1.8 t/ha for fish from the control pond;

Experimental pond	Specie	Age	Surface (ha)	Stocking larvae (ex)	Production obtained				
					S (%)	Exemplars	g/ex	Quantity (kg/ha)	Quantity (kg/pond)
B. Exp. 1 (treated)	silver carp	0→0 +	2	100000	39,18	39181	126	2488	4976
	big head carp			100000			128		
B. Exp. 2 (control)	silver carp		2	100000	40,77	40768	87	1804	3608
	big head carp			100000			90		
TOTAL			4 ha	400.000					8584



CONCLUSIONS

The preliminary results obtained in the experiment highlight the significant impact of the treatment applied at the embryonic stage on the bioproductive performances of the analyzed species. There are indications of possible positive effects under identical technological and environmental conditions. The fish material originating from the treated larvae demonstrated superiority over the control batch, reflected by an accelerated growth rate, a higher average individual weight and an increased efficiency in the utilization of available trophic resources.

The treated fish material presented a good physiological state, characterized by an increased resilience to fluctuations in the physico-chemical parameters of the aquatic environment, as well as by a greater uniformity of the population, an essential aspect for optimizing technological management.

Compared to the control batch (Bexp. 2), the fish material from the treated larvae (Bexp. 1) presented, throughout the entire growth period, a higher yield, expressed through a faster growth rate, a higher average individual weight in the control fishing and a better adaptation to the environmental conditions specific to intensive growth in summer I. These differences can be correlated with a better utilization of natural trophic resources (phytoplankton and zooplankton), as well as with an increased efficiency of the conversion of the administered feed.

THANK YOU !

