

STUDY REGARDING THE INTENSIVE AND SUPER-INTENSIVE GROWTH SYSTEMS OF SALMONIDS

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Abstract

Diversified development of the national economy has provided new conditions of operation of the trout artificial breeding, by setting up new areas and by improving the growth technology as a result of scientific research amplification. The present paper will refer to growth systems of salmonids that are based on information from both farms in Romania and other countries with tradition in salmonid breeding. In the traditional systems of farming, basins vary in shape and size, depending on the purpose, the nature of the terrain and species considered for artificial culture in the trout farm. Raceway culture systems are based on the presence of a strong water current, with several growth basins placed on its course. Numerous models of very durable and easy to maintain floating nurseries have been created with the apparition and diversification of synthetic materials. The principle of super-intensive systems is to better exploit the biological potential of a species, to obtain a maximum yield of fish per m³ of water. Flow-through systems are based on the use of warm water from different sources and are basically running one-time water passes through these pools. A recirculating system must include the fish breeding basins and several installations allowing adequate conditions for species biological requirements. Even if it has a number of disadvantages, intensive conventional farming systems of trout produce 90% of the trout existing on the market for consumption, and will remain the main Romanian salmonid breeding system.

Keywords: breeding system, salmonids, floating nurseries, recirculating system

1. INTRODUCTION

Romania has many hills and mountain waters with adequate flows, suitable for trout farming activity. Diversified development of the national economy has provided new operation conditions of the artificial breeding of trout, by setting up new areas and by improving breeding technology as a result of amplification of scientific research. The causes which led to the transition to artificial growth in salmonid fish are growing demands in both domestic and foreign markets, and the requirement in restocking mountain waters, to meet the demands of a growing number of fishermen. The national program of conservation and development of forests provides, among others, a rapid increase in production of trout for consumption and the possibility for people to spend their leisure time by practicing sport fishing. In the conception of modern fish breeding, the salmonids fish can be grown in cement tanks of various shapes and sizes, suspended tanks in water mass, and tanks placed on the river courses. In this context, a salmonid farm can be placed in a natural unpolluted watercourse, characterized by a summer temperature that does not exceed 20 °C. Water flow is also important, but modern technology allows high salmonid production at a low flow of fresh water. The solution is the reuse of water by turning it into system and removal of organic suspensions.

Salmonids can also be grown in recirculating systems.

The salmonid farm units are more profitable than the cyprinid units because of smaller areas that are used, the fact that they can more easily be monitored and, their production of a much appreciated food by consumers of all ages, namely trout.

2. MATERIAL AND METHOD

The present paper will refer to the growth systems of salmonids based on existing information from both farms in Romania and other countries with tradition in salmonid growth.

Salmonid farming area is quite low, ranging between 0.1 and 1.5 ha, much of the surface being allotted to the basins and access roads and a small amount to the buildings.

Salmonid growth systems are intensive and super-intensive farming systems.

Within these systems, the most important were analyzed as follows: traditional systems of growth, Raceway type growth system, floating nurseries system, the flow through system and recirculating system.

3. RESULTS AND DISCUSSIONS

In the **traditional systems of farming**, basins vary in shape and size, depending on the purpose, the nature of the terrain and species considered for artificial culture in the trout farm. (Figure 1).

A salmonid farm comprise several types of pools, each of which is destined for a certain fish age. Thus, it exists:

- Pools for juveniles;
- Pools for youth;
- trout for consumption ponds;
- replace pools;
- Breeding ponds;
- Quarantine basins;
- Experimental basins.

Each of these basins are sized according to the requirements of the biological material: density of growth, dissolved oxygen level, specimen size, degree of feeding etc.



Figure 1. Traditional farming system of trout

From the point of view of basin form, they can be rectangular, circular, or oval, rectangular ones are the most used in trout farms because they are easy to operate and maintain, but presents the disadvantage of a poor balance between water consumption and obtained production.

However, good results are obtained in circular and oval pools with perimeter water supply and central discharge. They have the advantage of creating a circular current throughout their area, which facilitates the cleaning of the residues that gathers on the bottom in center.

Conventional intensive farming systems are currently the most common trout farms in Romania, but they have some disadvantages that must be addressed:

- occupation of relatively large land areas;
- high water consumption;
- a numerous staff that serves technological processes, the direct effect are increased costs;
- risk of exposure to contaminated

water supply sources [6]; - dependence on climatic factors (drought, heat, cold, frost) that directly affect the growth rate of trout.

Even if it has some disadvantages, such as those described above, these trout farms produced 90% of the trout for consumption, and until the apparition of investments in other growth systems will remain the base of the Romanian salmonid growth system.

Raceway culture systems are rare in Romania (Figure 2).

They are based on a strong current of water, with several growth basins placed on its course. Basically, a portion of a watercourse is transformed into a fish growth basin. Growth density of fish is strictly dependent on the volume of water that traverse through the system and on its speed.



Figure 2. Raceway growth system of trout

Raceway-type systems have the advantage of lower land development costs compared to other farming systems, and the obtaining of high yields, due to strong current of water, which promotes high fish density growth.

The disadvantages of these systems are:

- Dependence on climatic and seasonal conditions;
- Difficulties in feed administration due to the water current;
- High risk of transmission for specific diseases from one basin to another and the impossibility of making proper treatments;
- Exposing the fish on various limiting factors (mammals, birds, existing fish in the watercourse);
- Danger of exposure to natural disasters that may compromise production (flood, floods, basin breaking);
- Requirements for additional aeration systems where the flow rate of water decreases.

Floating nurseries: The method consists of keeping fish in cages floating in the water due to surface floats or they can be attached to the substrate of the water basin [7].

Many models of very durable and easy to maintain floating nurseries have been created with the apparition and diversification of synthetic materials (Fig.3). Pelleted feed that have become increasingly accessible, was also a factor that led to the development of such fish farming methods in many countries [5].



Figure 3. Floating nurseries system

Floating nurseries have numerous advantages:

- Keeping fish in cages can be practiced in rivers or various water bodies (ponds, lakes, etc.).
- Nurseries construction can be achieved with low costs;
- Technological flow links can be easily monitored;
- Fishing is easily done.

Practicing the method of salmonids growth in floating cages should be taken into account the following aspects: - physico-chemical factors of water as the trout is a cold-water fish and in cages the growth is directly influenced by seasonal fluctuations of temperature and the dissolved oxygen content; - nurseries correct placement; - standards and norms of salmonids feeding and some aspects of fishing and valorization of trout [1].

In our country, such salmonid farms exist in Bicaz Mountain (Potoci trout farm) and Bradisor (Vâlcea) [3].

Super-intensive systems: These growth systems – are relatively new in our country - are used to obtain productions of over 200 kg of fish per m³ of water. The growth and development of fish are realized in strictly controlled environmental conditions using high densities of fish.

The principle of super-intensive systems is to better exploit the biological potential of a species, to obtain a maximum yield of fish per m³ of water [2]. Fish growing in the super-intensive system can be made by:

- Flow-through systems;
- Recirculating systems

Flow-through systems use pools, which may be made of different materials such as concrete, metal, fiberglass, tilt, placed on racks that can be placed in warehouses, production halls or even outdoor. These farming systems rely on warm water use from different sources and basically water pass just one-time through these pools.

Countries with a developed economy use these systems for species of fish that have affinity for high temperatures, but by mixing hot and cold water the system may be used also for other species.

In salmonid breeding, these systems are less used, but there are cases, such as trout in the Mediterranean region, where variations in temperature throughout the year are insignificant, and these systems successfully operate. Advantages of such systems relate to: high yields obtained on the volume and time in strictly controlled environmental conditions, reduced number of staff employed; ongoing monitoring of growth environment parameters, offering safe products in terms of food and health, ensure high production of fish throughout the year, reducing spending on storage and disposal of fish.

Before using this system of super-intensive growth must take into account the fact that for high output operation is required a large amount of water.

Recirculating system

These systems are frequently used in U.E. countries, because they presents several advantages such as location of such systems in areas without a water course, conservation of water resources by recirculation; getting fresh products throughout the whole year; monitoring the growth environment of fishes throughout the year; elimination of transportation costs by locating these systems close to the markets.



Figure 4. Recirculating system

A recirculating system must include the fish breeding basins and several installations allowing adequate conditions for species biological requirements (fig. 4). Considering these aspects the components of a recirculating system can be divided into:

Essential components: water supply, mechanical filtration, biological filtration, the elements of disease prevention, growth tanks, pumps, piping, environmental control, gases regulating elements backup generator.

Infrastructure and auxiliary equipment: room which houses the entire system, water quality monitoring equipment, feeding system, control systems.

Additional systems: quarantine tanks, washing and feeding systems, automatic control and monitoring systems.

Although it has many advantages, these systems are developing with difficulty mainly due to large investments requirements, advanced technology and high energy consumption during the operation. By finding solutions to overcome these impediments, production results can be spectacular, and investment return can be done in a very short time [4].

4. CONCLUSIONS

Even if it has a number of disadvantages, intensive conventional trout farming systems produce 90% trout for consumption, and will remain the main Romanian salmonid breeding system.

Raceway culture systems are rare in Romania and are based on the presence of a strong water current, with several growth basins placed on its course.

Trout can be raised in floating nurseries. They must be located in well-oxygenated water, the most indicated being the mountain lakes.

In salmonid culture, flow through systems are less used, but there are instances where productions are significant, as are trout in the Mediterranean region, where variations of water temperature on the mountain streams during a year are not significant (12-16°C), and systems successfully operate.

Romania has a potential for fish culture and salmonid culture, but without an effort and next generation technologies we will not be able to compete on European and world markets.

5. REFERENCES

- [1] Boaru A., Voda R.M., Cerbu G., Contribution for obtaining of some production performances in consumable trout, breed in floatable fish pounds. *Lucrări științifice Zootehnie și Biotehnologii*, vol. XXXVII, Timișoara. ISSN: 1221-5287, 2004.
- [2] Boaru A., Voda R.M., Vladau V.V., Piscicultura superintensivă – o variantă economică de creștere a peștilor. *Lucrări științifice seria Zootehnie vol.48*, Ed. „Ion Ionescu de la Brad”, Iași. ISSN: 1454-7368, 2005.
- [3] Bud I., Ionescu O., Vladau V.V., Pop S.N., Peștii din apele reci. *Păstrăvii*. Ed. Risoprint, Cluj-Napoca, 2007.
- [4] Cocan D., Sisteme superintensive în piscicultură. Sesiunea de comunicări științifice studențești, USAMV Cluj-Napoca, 2006.
- [5] Cocan D., Creșterea pastravului curcubeu în sistem recirculant și condiții controlate de mediu, Ed. Bioflux Cluj-Napoca ISBN: 978-973-88929-5-8, 2008.
- [6] Oprea L., Georgescu R., Nutriția și alimentația peștilor. Ed. Tehnică, București, 2004.
- [7] Voda R.M., Boaru A., Contribution and new principles in salmonid breeding in floatable fish pounds. *Lucrări științifice Zootehnie și Biotehnologii*, vol. XXXVII Timișoara. P. 334-338. ISSN: 1221-5287, 2004.

<http://www.sterlet.ro>

<http://www.growfish.com.au>

<http://www.umass.edu/aquaculture>

<http://aquanic.org/systems/raceways/photos.php>