DESIGN OF EXPERIMENTAL AQUACULTURE RECIRCULATION SYSTEM FOR REPRODUCTIVE BIOTECHNOLOGY OF INDUSTRIAL HYDROBIONTS

O. MALYSHEVA, ***research associate,*** **V. SPYRYDONOV,** ***PhD,***

S. MELNYCHUK, ***PhD,*** **V. KOVALENKO,** ***PhD,***

K. KHURTA, ***magistr***

National university of life and environmental sciences of Ukraine

It was designed the experimental recirculation mini-system for the implementation and improvement of artificial reproduction technology and production of the viable quality of fries of the commercial fish species using the modern molecular genetic methods.

Keywords: *recirculation setting, aquaculture, molecular genetic research methods, fisheries calculations.*

Intensive human activities related to industrial development, water transport and hydro-tech building led to a drastic reduction in fish stocks. Almost all of the checkpoints and semi-checkpoints fish species affected by changes in the hydrological and hydro-chemical regimes of places of existence, worsening conditions for foraging and natural reproduction. In such circumstances, the development of the modern world fisheries focused on the transition from hunting fish and other aquatic organisms in natural waters to their domestication and reproduction in aquaculture conditions [3, 4].

In modern conditions of aquaculture are important breeding and cultivation of fish and aquatic invertebrates in artificial controlled conditions with a high level of mechanization and automation of technological processes - namely in fishing systems with recirculation of water (RS) [2, 6]. The principle of the modern RS is based on repeated use of water in the system, with the clearance of metabolic waste

products and the ability to control temperature, gas- and chemical regimes. Rational exploitation of RS allows aquaculture by significantly increasing the level of intensification of production to obtain a high yield per unit area or volume of water in the system regardless of the season, and minimize the cost of water and human labor [9].

The majority of modern fish-breeding RS is designed for productivity 30-100 tons of fish per year. However, recently more and more private farms, given their own financial and commercial opportunities, used mini-RS, production capacity can be only 500-1000 kg of fish per year. These mini-RS through small size is easy to operate [5, 10].

The most common and promising objects that are grown in RS is African catfish, *Tilapia species*, sturgeons and their hybrids, *Salmo* and *Coregonus species*. Attracted particular interest from the sturgeon family and their hybrid forms that are desirable objects in industrial and commercially as producers deli meat and caviar [7, 11].

At the same time, before aquaculture arises the task of maintaining the genetic diversity of fish species. To ensure the effectiveness of artificial reproduction, control and conservation of fish species diversity is more urgent use of modern methods of molecular genetic studies using microsatellite and mitochondrial DNA markers. With these research methods can be estimated intraspecific genetic polymorphism of populations, to determine species identity, make the genetic passports and form heterogeneous uterine herd sires fish [8].

The combination of modern scientific and technological developments in the field of aquaculture and molecular genetic studies of testing in the experimental conditions and further integration into production would increase profitability of modern fish-breeding farms through rational use of genetically been certified stud sires valuable fish species, obtaining viable offspring quality and increase demand for competitive products.

Purpose of research. Drafting an experimental mini-RS and justification of its commissioning to improve the technology of artificial reproduction of fish species,

including sturgeon, using molecular genetic methods of research in the scientific and research laboratory reproductive biotechnology industrial aquatic Ukrainian Laboratory of Quality and Safety of Agricultural Products (ULQSAP).

Materials and methods of research. Special studies were carried out at the department of molecular diagnostic tests ULQSAP. To organize and conduct research with valuable species of fish and ease of observation was established research laboratory reproductive biotechnology industrial aquatic organisms. For research under controlled conditions of the aquatic environment was created mini-installation of closed water supply. The necessary hydraulic calculations to the mini-RS were carried out with the latest requirements for the effective operation of RS [2, 9]. In fisheries calculations used commonly regulations of sturgeon fish farming [1, 12].

Results of research. At this stage of research work in the laboratory of reproductive biotechnology industrial aquatic studies on improved methods of cultivation of fish farming facilities in a fully controlled conditions of water environment using the latest molecular genetic research.

In March 2014 was commissioned an experimental mini-RS for examination in the laboratory scientific developments focused on improving the technology of reproduction and growth of promising aquaculture facilities, their genetic certification, obtaining female same-sex offspring and vitality fish planting material, testing and the practical application of scientific developments.

The project in the list of process equipment includes mini-RS capacity for prespawning keeping of broodstock fish, hatching machines of Weiss with independent water supply, tanks for rearing of young fish. The total volume of water in the mini-RS is 8 m^3, 6 m^3 of which accounts for the experimental tanks for growing of fingerling and tanks for prespawning keeping of broodstock fish (Figure).

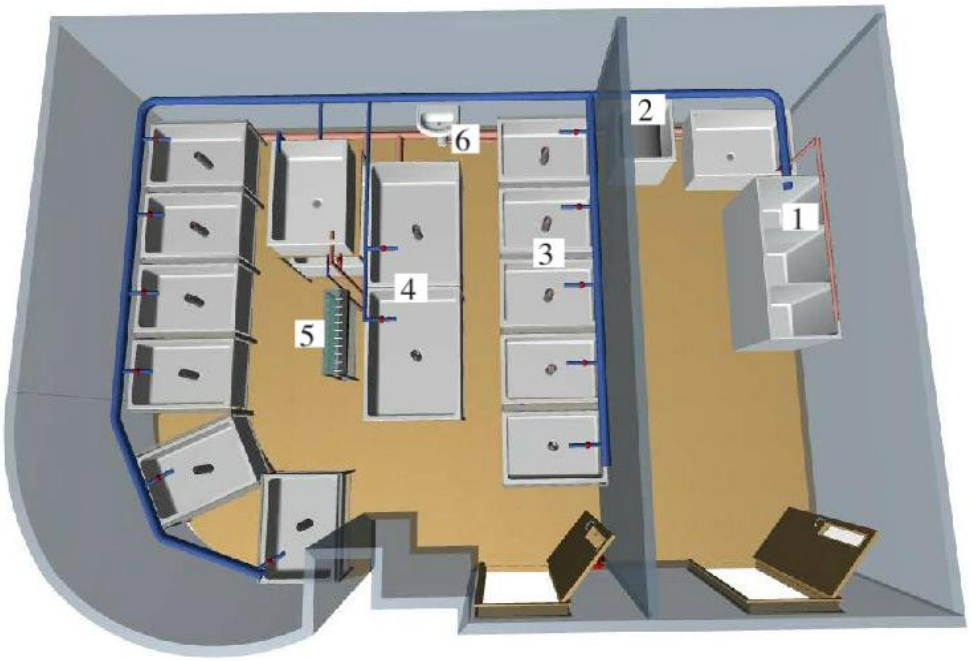

Fig. - Scheme of the mini-RS equipment in the lab room

1 - biofilter; 2 - mechanical filter; 3 - experimental tanks; 4 – tanks for prespawning keeping of broodstock fish; 5 - hatching machines of Weiss; 6 – draining

Research mini-RS consists 11 tanks for growing of fish planting material with working volume of 0.34 m^3 for each and two tanks ffor prespawning keeping of broodstock fish with working volume to 0.97 m^3, biological filter with capacity of 2 m^3, mechanical filter and mini-incubation installation of devices Weiss.

The working capacity of the experimental tanks designed for sturgeon fry (weighing 3 g) rearing (table).

Thus, the total area of the experimental rearing tanks is 10.56 m^2 with maximum operating power of getting sturgeon fry (weight of 3g) scheduled at 11 thousand copies by cycle.

Currently, based on established research laboratory reproductive biotechnology industry and aquatic put into operation a mini-RS conducted work on selecting and combining the best pairs of broodstock sturgeon fish species by remote allelic variants using microsatellite DNA markers.

Calculation of the capacity of the research mini-RS for sturgeon fry rearing

Index	Norm	Amount
Total area of rearing tanks: m^2	-	10,56
Survival of free embryos (prelarvae): %	65	-
thousand copies	-	22,629
Survival of larvae: %	70	-
thousand copies	-	15,840
The stocking density of larvae: thousand copies/m^2	1,5	-
Survival of fry (weight of 3 g): %	70	-
thousand copies	-	11,088

On the basis of the selection of pairs of broodstock fish started research and development of effective and receipt of crossing these fish-viable unisexual female progeny. Along with these studies, conducted the development of species identification of fish species and work on assembly of individual genetic passport which will allow to determine the origin of each of the individuals and to assess the purity of mother steps in fish-breeding farms in Ukraine. Scientific development of this direction focused on the rational use of sires of fish species and increasing the efficiency of fish culture in today's driving aquaculture.

Conclusions

Research in the field of fish culture in combination with modern biotechnology techniques represent a significant perspective both from scientific and practical points of view.

The experimental mini-RS with controlled conditions of the aquatic environment, based on which laboratory reproductive biotechnology industrial

aquatic ULQSAP will conduct research on improved methods of cultivation of aquatic organisms on the basis of new molecular genetic developments and implement them in production.

REFERENCES

1. *Алимов С. І.* Індустріальне рибництво. Підручник. / *С. І. Алимов, А. І. Андрющенко* – Севастополь: Видавництво УМІ, 2010. – 552 с.

2. *Брайнбалле Я.* Руководство по аквакультуре в установках замкнутого водоснабжения. Введение в новые экологические и высокопродуктивные замкнутые рыбоводные системы / *Я. Брайнбалле* – Копенгаген. – 2010. – 70 с.

3. *Григорьев С. С.* Индустриальное рыбоводство. Часть 1. Биологические основы и основные направления разведения рыбы индустриальными методами: Учебное пособие. / *С. С. Григорьев, Н. А. Седова* – Петропавловск Камчатский: КамчатГТУ, 2008. – 186 с.

4. *Грициняк І. І.* Історичні аспекти, стан та перспективи розвитку рибогосподарської діяльності на внутрішніх водоймах України / *Грициняк І. І., Третяк О. М., Колос О. М.* // Вісник Сумського національного аграрного університету: Серія «Тваринництво». – 2014. – Вип.2/1 (24). – С.22-29.

5. Опыт выращивания осетровых рыб в условиях замкнутой системы водообеспечения для фермерских хозяйств. / *Матишов Г. Г, Матишов Д. Г., Пономарева Е. Н. и др.* – Ростов-на-Дону: Изд-во ЮНЦ РАН. – 2006. – 72 с.

6. *Пономарёв С.В.* Индустриальное рыбоводство. / *С. В. Пономарёв, Ю. Н. Грозеску., А. А. Бахарева* – Санкт-Петербург: Изд-во Лань. – 2013. – 420 с.

7. *Пономарёв С. В.* Осетроводство на интенсивной основе. / *С. В., Пономарёв, Д. И. Иванов* – М.: Колос. – 2009. – 312 с.

8. Применение молекулярно-генетических исследований в аквакультуре осетровых рыб / *Козлова Н. В., Базелюк Н. Н., Файзулина Д. Р, Стоногина Е. В.* // Вестник АГТУ. Серия: Рыбное хазяйство – 2013. – №3. – С.113-117.

9. *Проскуренко И. В.* Замкнутые рыбоводные установки. / *И. В. Проскуренко* – М.: Изд.-во ВНИРО, 2003. – 152 с.

10. *Проскуренко И. В.* Фермерское рыбоводное хозяйство. / *И. В. Проскуренко* – Санкт-Петербург: Изд-во Гипрорыбфлот, 2000. – 226 с.

11. Стан запасів осетрових риб та розвиток осетрової аквакультури в Україні / [*Третяк О. М., Ганкевич Б. О., Колос О. М., Яковлєва Т. В.]* // Рибогосподарська наука України. – 2010. – №4. – С. 4-22.

12. *Чебанов М. С.* Руководство по искусственному воспроизводству осетровых рыб / *М. С Чебано, Е. В. Галич* // Продовольственная и сельскохозяйственная организация ООН. – Анкара, 2013. – 328 с.

ПРОЕКТУВАННЯ ЕКСПЕРИМЕНТАЛЬНОЇ РИБНИЦЬКОЇ УСТАНОВКИ ЗАМКНЕНОГО ВОДОПОСТАЧАННЯ ДЛЯ РЕПРОДУКТИВНОЇ БІОТЕХНОЛОГІЇ ПРОМИСЛОВИХ ГІДРОБІОНТІВ

О. О. МАЛИШЕВА, В. Г. СПИРИДОНОВ, С. Д. МЕЛЬНИЧУК, В. О. КОВАЛЕНКО, Х. М. КУРТА,

Розглянуто перспективи проектування та застосування експериментальної міні-установки замкненого водопостачання для удосконалення технології штучного відтворення і отримання якісного життєстійкого посадкового матеріалу цінних промислових видів риб з використанням новітніх методів молекулярно-генетичних досліджень.

Ключові слова: *установка замкненого водопостачання, аквакультура, молекулярно-генетичні методи досліджень, рибогосподарські розрахунки*

ПРОЕКТИРОВАНИЕ ЭКСПЕРИМЕНТАЛЬНОЙ РЫБОВОДНОЙ УСТАНОВКИ ЗАМКНУТОГО ВОДОСНАБЖЕНИЯ ДЛЯ РЕПРОДУКТИВНОЙ БИОТЕХНОЛОГИИ ПРОМЫСЛОВЫХ ГИДРОБИОНТОВ

О. А. Малышева, В. Г. Спиридонов, С. Д. Мельничук, В. А. Коваленко, К. Н. Курта

Рассмотрены перспективы проектирования и применения экспериментальной мини-установки замкнутого водоснабжения для усовершенствования технологии искусственного воспроизводства и получения качественного жизнестойкого посадочного материала ценных промысловых видов рыб с использованием новейших методов молекулярно-генетических исследований.

Ключевые слова: *установка замкнутого водоснабжения, аквакультура, молекулярно-генетические методы исследований, рыбохозяйственные расчёты*