

## ANNOTATION

**of the dissertation work of Zamira Turarovna Bolatbekova  
on the topic "Cultivation technologies of live feed for effective growing of  
perspective aquaculture objects"  
presented for the degree of Doctor of Philosophy (PhD) on the specialty  
6D080200 - Technology for Production of Livestock Products**

### **Relevance of the research topic.**

The development of the fishing industry is one of the priority areas of agriculture in Kazakhstan. In his address, President of the Republic of Kazakhstan K. K. Tokayev "Kazakhstan in a new reality: time for action", dated September 1, 2020, noted the need to pay special attention to fisheries and agricultural development problems

In this regard, for the development of fisheries, the Government of the Republic of Kazakhstan takes comprehensive measures aimed at solving current problems of the industry, introducing economic incentives, removing administrative obstacles and improving legislation.

Today, according to the fisheries development program for 2021-2030, there is a potential to increase domestic production of fish and fish products from 6.9 thousand tons to 270 thousand tons, which allows increasing exports to neighboring countries and to world markets. Also, one of the Program's target indicators is to increase domestic consumption of fish products from 67 to 134 thousand tons per year by 2030.

In general, according to experts, the potential of the aquaculture industry in Kazakhstan is up to 270 thousand tons of marketable products, which allows to increase the level of consumption per capita to the volume recommended by the World Health Organization and is about 16 kg, and also allows to increase the volume of deep processing products with high added value, which, in turn, allows to increase the the tax base of the industry and its attractiveness to potential investors.

Breeding fish and other aquatic animals is in demand not only from the point of view of ensuring food security, but also from the point of view of freeing natural reservoirs from the anthropogenic load resulting from their excessive use. At the same time, over the past 5 years (2018-2022), although the limit was 272.3 thousand tons, the catch of fish resources and other aquatic animals amounted to 227 thousand tons. During the same period, only 55.7 thousand tons of commercial fish were grown in the fish farms of our republic.

The development of aquaculture will undoubtedly have a positive impact on the development of small and medium-sized businesses engaged in the agro-industrial complex, will create additional jobs, mainly in rural areas, and POPS will have a comprehensive effect in general, which will help solve a number of regional problems.

With such intensive development of domestic aquaculture, the need for fish feed will increase several times in the future. Currently, many technological

schemes include the use of live feed for growing juveniles of valuable fish species. Live feeds contain all the nutrients necessary for normal growth and development of fish, adding them to artificial feeds helps to increase the viability of young fish and improve the commercial qualities of fish.

Currently, in foreign countries, for example, in Germany, the Czech Republic, Denmark, India, etc., various technologies for growing live feed, which are mainly worms and crustaceans, have been developed in fish farming. Improving the technology of growing live feed will have a positive impact on the development of commercial fishing, expand the range of fish species grown, and ensure the availability of live feed for fish farmers, which will help reduce the cost of production. fish products and improving the efficiency of the fisheries sector of the Republic of Kazakhstan.

As part of the dissertation work, for the first time in Kazakhstan, the results of a study on the technology of cultivating live feed for the purpose of growing promising aquaculture objects were published.

**The purpose of the dissertation research.** Determination of the technology of growing live feed for efficient cultivation of aquaculture objects (clary catfish and tilapia).

**Purpose of the study:**

- to determine effective условия breeding conditions and technological modes of growing live fodder plants in cultivators;
- determine effective breeding conditions and technological regimes of live forage in swimming pools;
- assessment of fish-water-biological parameters of clary catfish grown using live feed;
- assessment of fish-breeding and biological indicators of tilapia grown with the use of live feed;
- determine the economic efficiency of breeding aquaculture objects-clary catfish and tilapia, using live feed;

**Research methods.**

Scientific research was conducted according to the scheme of research of the dissertation work. When conducting the research, the regulatory and technological framework and methodological guidelines that are generally recognized in fish farming were used.

The rearing of the larvae of the clary catfish was carried out in pools located in the incubation shop with a daily 2-time water change, heating system and aeration. Fish were weighed on analytical scales with CAS, and the larval body length was measured using calipers under an MBS10 binocular. The multiplicity of feeding, calculation of the daily ration of fish feeding in swimming pools and the feed ratio were carried out according to generally accepted methods in fish farming. (Chernomashentsev A. I., Ponomarev S. V., Kozlov V. I., Privezentsev Yu. A.).

The study and assessment of the growth rate of juveniles of the studied fish were carried out based on the results of control catches every 10 days and the final catch after 30 days. To carry out measurements, 25 pieces were selected from each fish tank individuals. To assess the viability of the studied fish at different stages of

cultivation in the pools, records of dead individuals were carried out daily and periodically, during sorting and final harvesting, using the direct accounting method, the feed consumption and eating behavior of fish were evaluated (Vlasov V.A., Ponomarev S.V., Kozlov V.I., Privezentsev Yu.A.).

The effectiveness of live feed was evaluated by fish-breeding and biological indicators: initial and final fish weight, absolute growth, relative growth, average daily growth, survival, feed costs per unit of growth. The absolute gain was calculated from the difference between the initial and final fish weight over the period. Survival rate is calculated as a percentage of the total number of observed fish (Vlasov V. A., Ponomarev S. V., Kozlov V. I., Privezentsev Yu. A.).

The dynamics of the temperature and oxygen conditions of water were monitored daily 3 times a day, the level of the hydrogen index-2 times a day. Water temperature, oxygen content, and pH were measured using термооксиметра a MARK-302E thermal oximeter.

Cultivation of live feed in cultivators and pools was carried out using the research of domestic and foreign authors (Bulavina N. B., Ivleva I. V., Lagutkina L. Yu., Moiseev N. N., Sevasteyev S. V.). Live feeds - dendrobena, staratel, acetic eel and white enkhitreya, were cultivated in cultivators, and other species - shrimp, mysids, daphnia and moina were cultivated in swimming pools, monoculture.

The determination of the chemical properties of live feed used on the NIRS TMDA1650 IR analyzer and moisture content on the EVLAS-2M device. The amino acid composition of live feeds was determined using a ЖИОМАХРОМ® liquid chromatograph. The temperature and humidity in the cultivators were determined using a TA-298 hygrometer.

**Basic rules (proven scientific hypotheses and other discoveries that are new knowledge).**

- effective breeding conditions and technological modes of growing live feed in cultivators have been determined;
- effective breeding conditions and technological modes of growing live feeds in swimming pools have been determined;
- the fish-breeding and biological indicators of the clary catfish grown using live feeds were evaluated;
- the fish-breeding and biological indicators of tilapia grown using live feed were evaluated;
- the economic efficiency of breeding aquaculture objects – clary catfish and tilapia, using live feeds, has been determined;

#### **Description of the main research results**

As a result of the studies conducted for the purpose of effective cultivation of aquaculture objects, the temperature regime of the medium in cultivators was at 21 °C, humidity at 88%, indicators of live feeds dendrobena - productivity of 17,2%, the average daily increase of 18,1% is higher than that of a live feed staratel ( $P \geq 95$ ).

The temperature regime of the water in the pools with live feeds was 23°C, pH 7,5 units, oxygen at 5,1 mg/l, the indicators of live shrimp feed compared to

mysida - the average daily increase was 35,4%, higher than that of live mysida feed ( $P \geq 95$ ), and productivity was 0,9% lower ( $P \leq 0.90$ ).

When comparing the fish-breeding and biological indicators of clary catfish and tilapia grown using live feed dendrobena, the nutrient coefficient of clary catfish was higher than that of tilapia by 0,88 units ( $P \geq 95$ ), survival rate by 0,40% ( $P \geq 95$ ).

When comparing the fish-breeding and biological indicators of clary catfish and tilapia grown using live dendrobena feed, the nutrient coefficient of clary catfish was higher than that of tilapia by 0,1 units ( $P \geq 95$ ), the survival rate was the same 91,5% ( $P \geq 95$ ).

Of the types of live food, the cost of Clary and tilapia grown using dendrobena is 36,8 and 121,9 tenge cheaper than using imported feed per piece. And when using crevette, it was shown that the cost of Clarice and tilapia is 19 and 9,2 tenge cheaper than using imported feed

The results of the research work of "Ak-Otau group" LLP and "Kapshagai spawning and exploration Farm-1973" LLP introduced and implemented technologies for cultivating dendrobena and shrimp in fish farms, four acts of implementation were obtained.

#### **Justification of the novelty and significance of the results obtained.**

For the first time, technologies for growing live feeds have been comprehensively studied in order to effectively grow aquaculture facilities. Effective methods for improving the cultivation of various types of live feed have been identified.

Effective breeding conditions and technological modes of live feeds in cultivators and swimming pools have been determined. The fish-breeding and biological indicators of aquaculture objects – clary catfish and tilapia, grown with the use of live feeds, were evaluated. The economic efficiency of breeding aquaculture objects – clary catfish and tilapia using live feeds has been determined.

The results of the work are presented to fish farmers for the purpose of growing live feeds and developing commercial fish farming.

**Areas of scientific development or compliance with state programs.** This work was carried out within the framework of the project "Development of formulations and technologies for the production of domestic starter competitive feeds, improvement of technologies for cultivating live feeds for valuable fish species and the introduction of developments at fish farms in Kazakhstan", registration number 0118RK01245, under the comprehensive scientific and technical program "Adaptation of advanced and improvement of existing technologies and promising fish farming facilities for the effective development of aquaculture, taking into account the regional conditions of Kazakhstan" (code O.0883) by order of the Ministry of Agriculture of the Republic of Kazakhstan. This work is also in line with the Fisheries Development Program until 2030, approved by the Decree of the Government of the Republic of Kazakhstan dated April 5, 2021, No. 208.

**Description of the doctoral student's contribution to the preparation of each publication.**

The doctoral student was directly involved in the preparation of scientific publications, design and presentation of them for publication in domestic and foreign publications.

Based on the results of research, 12 scientific papers were published, including 6 articles in scientific publications recommended by the Committee for Control in the Field of Education and Science of the Ministry of Education and Science of the Republic of Kazakhstan, 1 article-in a publication included in the international database Scopus, 2 articles – in collections of international conferences. The doctoral candidate also contributed to the writing of patents and is a co-author in them:

Utility model patent No. 4073 "Method for cultivating acetic eel (*Turbatrix aceti*) as a starter feed for juvenile fish", author's certificate No. 107570.

Utility model patent No. 5065 "Method for cultivating white enchytraeus (*Enchytraeus albidus*) as a live starter feed for juvenile fish", author's certificate No. 17570.

**Scope and structure of the dissertation.** The dissertation consists of an introduction, materials and methods of research, research results, a list of references and appendices. The total volume of the dissertation consists of 110 pages, 39 tables, 16 figures, 122 bibliographies and 4 appendices.