Analysis of the fisheries industry and the development of its feed supply, taking into account biologically active substances

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Abstract. The study presents the results of the assessment of the current state of the fisheries complex, the dynamics of extraction (catch) of aquatic biological resources, the state of the feed industry for certain types of feed. The study was conducted on the basis of relevant statistical, scientific, practical, and other materials in the field of activity of the fishery complex. The analysis was carried out in accordance with the key indicators identified. The State Program for the development of the fishery complex of the Russian Federation. A significant place in ensuring the positive dynamics of the development of the fishing industry is given to feed. Indicators of feed production are generally growing for older age and sex fish groups. Nevertheless, for the repair of young animals at the early stages of cultivation, to stimulate vitality and immunity, so-called starter, production and functional feeds containing specific ingredients and probiotics are required - biologically active substances that are not produced enough. As a result, a significant proportion of imported feed remains.

1 Introduction

The fisheries complex (hereinafter referred to as the FC) as part of the agro-industrial complex occupies a separate place and, as part of a diversified industrial and economic cluster of the economy, plays an important role in ensuring the country's food security, stability and socio-economic development of regions located near the water area of the water fund.

The provisions of the Food Security Doctrine establish that the volume of consumption of fish and fish products (in live weight) should be provided by 85 percent or more at the expense of domestic production. Proceeding from this, the priority tasks of the state policy in the field of development of the fisheries complex are [1, 2]:

"...stable provision of the country's population with safe, high-quality fish and other products of aquatic biological resources, and related industries (animal husbandry and poultry farming) with high-conversion feeds, as well as chemical and consumer industries with raw materials...";

"...increasing the export of competitive fish products with high added value...".

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To ensure the stability of fish production, the FC needs a positive dynamics of increasing the volume of extraction (catch) of aquatic biological resources (hereinafter referred to as ABR), the volume of fish and other products produced from aquatic biological resources and, as a result, the expansion of the resource base of the fisheries complex, including through the development of aquaculture, including mariculture, as well as modernization and construction infrastructure facilities of the fisheries complex.

In turn, the basis of increasing the resource base of the fisheries industry, increasing the productivity of livestock and the quality of the products obtained is mainly based on a strong and well-organized feed base, which in fact is a combination of various independent sub-sectors - feed production, feed preparation, and feed distribution.

For the normal growth and development of aqua and mariculture facilities, it is necessary not only a certain quantitative, but also mainly a qualitative ratio of the main nutrients, considering the gender and age characteristics of a particular object of cultivation that are part of artificial diets. It is on the rational organization of feed supply processes, especially in terms of meeting the current and future needs of the industry in the volume, assortment and quality of the feed produced, that the possibility of intensifying the increase in fish production depends.

The priority direction of the development of feed supply is currently focused on the maximum use of technological methods of maintenance and cultivation and biological factors to increase the productivity of feed, increase their energy and productive returns based on the expansion of the use of protein, fats, carbohydrates, minerals, vitamins, and biologically active substances (hereinafter – BAS), which should be in the feed in accordance with the physiological needs of the growing object.

As practice shows, the use of various methods (types) of BAS (processing of eggs, embryos, larvae, feeding as part of high-protein mixtures in the early stages of development) increases survival and reduces the natural waste of livestock, promotes the activation of digestive processes, increases the digestibility of feed, increases weight gain and stimulates the growth of hydrobionts, as a result of which an increase in fish productivity and the yield of marketable products of higher quality is provided [3].

It is also necessary to note the positive possibilities of BAS for improving the epizootic and ecological situation of water bodies (especially with an artificially created habitat) in terms of reducing the likelihood of highly resistant pathogens (infections, parasites) in the ecosystem in cases of refusal or a significant reduction in the use of synthetic antibiotics [4].

2 Materials and Methods

General scientific (analysis, synthesis, comparison, generalization) and special (system) methods of scientific cognition (clustering, monographic, comparison method) were used in the work. The methodological basis was the industry regulatory legal acts, the results of the work of specialized scientific and industrial organizations (institutions), as well as the published works of practitioners on the activities and management of the FC.

3 Results

According to Rosstat data [5] and the industry monitoring system of the Federal Agency for Fisheries [6, 7], the total volume of ABR production by all Russian users in all fishing areas of the world Ocean and in inland (freshwater) water bodies as of October 01, 2023 amounted to 4139.7 thousand tons, which is 433.6 thousand tons or 11.7% more than the same indicator last year (without withdrawal of commercial aquaculture). At the same time, the catch of

ABR in inland water bodies amounted to 64.2 thousand tons, which is 5.7% more than last year's value (Fig. 1 on the left).

An analysis of the dynamics of production in the context of basins shows that the main share of the country's ABR is formed in the Far Eastern Fisheries Basin – 3,461.26 thousand tons or 70.8% of the all-Russian catch, which is 1.1% less than the same indicator in 2022. The structure of production mainly includes cod (pollock, cod, halibut, etc.) – 53.8% or 1,845,81 thousand tons), salmon (Pacific) – 15.6% or 576.0 thousand tons, herring (herring, sardines, sprats) – 11.4% or 389.2 thousand tons, crustaceans – 2.2% or 64.5 thousand tons, and 16.9% or 611.7 thousand tons account for the catch of other fish species (Fig. 1 on the right).

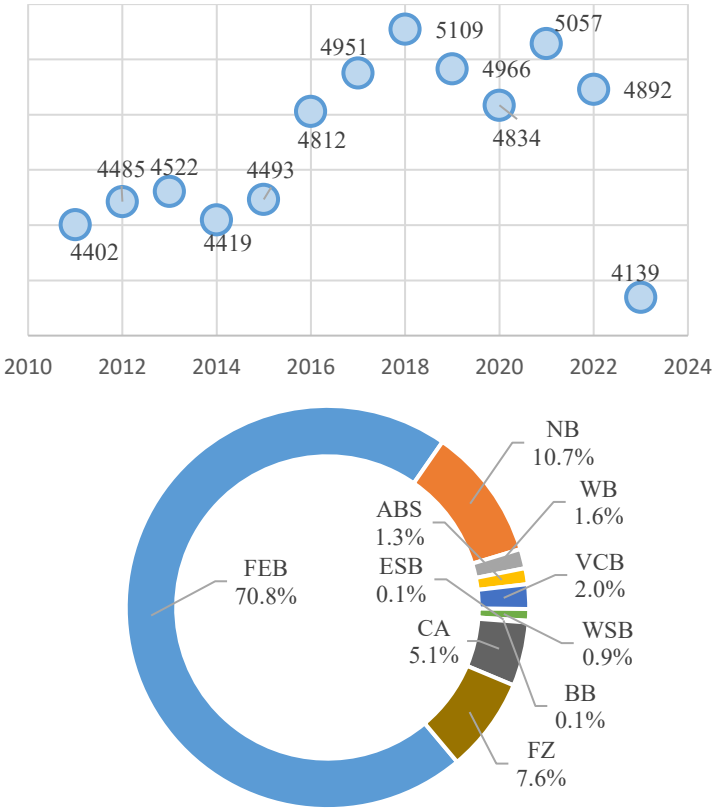


Fig. 1. Dynamics, thousand tons (on the left) and structure, % (on the right) of ABR production by fishery objects (basins). Compiled by the authors on the basis of sources [6, 7]. Symbols: FEB - Far Eastern Basin, NB - Northern Basin, WB - Western Basin, ABS - Azov-Black Sea basin, VCB - Volga-Caspian basin, WSB - West Siberian Basin, ESB - East Siberian Basin, BB - Baikal basin, CA - Conventional areas and open oceans, FZ - Foreign zones.

In the northern fishery basin, the volume of ABR production amounted to 10.9% of the all-Russian or more than 530 thousand tons, which is almost 6.6% more than the same indicator in 2022. The main commercial fish in this basin should be considered cod, haddock, and halibut – 449.6 thousand tons or 86.3% of the total catch in the basin, about five percent (25.5 thousand tons) falls on crustaceans and the total catch in freshwater reservoirs is about 11.8% (52.9 thousand tons).

In the waters of foreign states, as well as convention areas and the open part of the world ocean, about 13% of the all-Russian volume of ABR was extracted in total - 639.8 thousand

tons. Including 218.2 thousand tons (34.6% by volume) of mackerel, 159.8 thousand tons (26.5%) of northern whiting, horse mackerel - 53.1 thousand tons (8.4%), sardines 23.1 thousand tons (3.7%), and about 27.4% of other fish.

The least catchable are the Azov-Black Sea, Volga-Caspian, West Siberian, East Siberian, Baikal, and Western basins. The total volume of extraction (catch) of aquatic biological resources in these areas amounted to 290.4 thousand tons from 0.1 to 3.3%, which in total gave 5.7% of the catch in the country.

Separately, it is necessary to consider the indicators of commercial aquaculture. Aquaculture products are edible fish, non-edible fish, as well as other products from aquaculture facilities. Basically, aquaculture, including mariculture, includes commercial aquaculture (commercial fish farming) and artificial reproduction of aquatic biological resources aimed at growing planting material with subsequent release into water bodies of fishery significance.

Traditionally, aquaculture production is concentrated in the Northwestern, Southern, and Far Eastern Federal Districts. In the first half of 2023, the volume of fish and aquatic organisms production (including commercial products and planting material) amounted to 228.9 thousand tons, which is 2.8% more than the same indicators of the previous year for the year (Fig. 2).

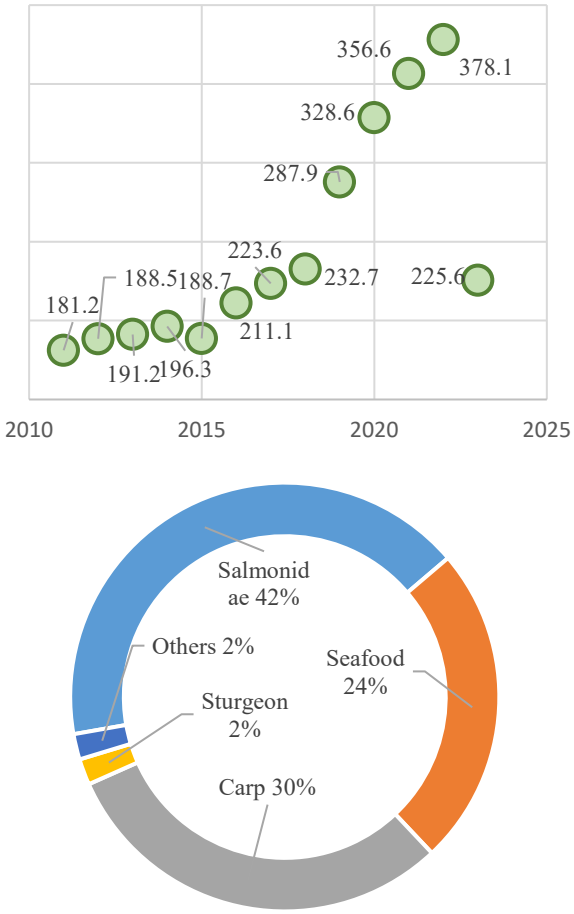


Fig. 2. Dynamics, thousand tons (left) and structure, % (right) of production by aquaculture types. Compiled by the authors on the basis of [6, 7].

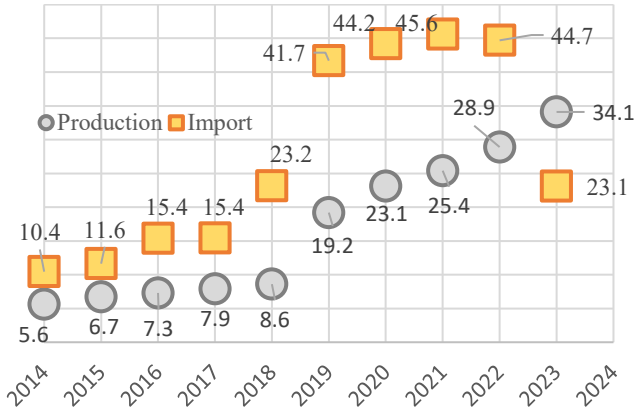
In the structure of production, the main species are salmon, carp, valuable hydrobionts (oysters, mussels, scallops and other mollusks and echinoderms), and sturgeon. Thus, 95 thousand tons of salmon (salmon and trout) is produced, carp - 69.5 thousand tons, seafood – 55.4 thousand tons, sturgeon – 4.45 thousand tons, other fish farming facilities – about 4.2 thousand tons.

Another source of food fish products entering the country is imports. Thus, in the first half of 2023, aquatic biological resources and fish processing products were imported in the amount of 238.1 thousand tons. The most imported commodity groups are frozen fish (cod, asparagus, moron, merluse) - 98.8 thousand tons, crustaceans (mussels, squid, octopus, shrimp) - 30.7 thousand tons, ready or canned fish - 15.8 thousand tons, fish fillets (trout, salmon) - 25.8 thousand tons, fresh fish (salmon, herring, mackerel) - 13.8 thousand tons. The main suppliers of ABR are the Faroes, Chile, China, Turkey [8].

4 Discussion

As the analysis showed, at present, the production indicators of the development of the agricultural complex (in physical terms) have a confident growth trend. The industry has a positive trend in the extraction of ABR and the production of aquaculture products. To meet the needs of the fast-growing aquaculture market, a stable feed base is required. The main part of any artificial feeding diet is usually a balanced composition of the feed mixture, which includes protein, fats, carbohydrates, minerals, vitamins, BAS. In form, artificial feeds are in different aggregate states – semi-liquid and solid (pressed). Most often, solid forms of combined feeds are used in the form of briquettes or pellets, which either do not sink at all, or sink very slowly.

Thus, for the first half of 2023, the production of all types of compound feeds for fish (starter, production, granular, extruded) amounted to 34.1 thousand tons, which is 2.6% more than the same indicator last year. The main producers of combined feeds are such enterprises as the AQUAREX Fish Feed Production Plant, Provimi LLC, Voronezh Experimental Feed Plant OJSC, Starooskolsky Bread Products Plant CJSC, and a number of others. The enterprises of the Central Federal District produced about three quarters of the total volume of fish feed in the country, processors of the North-Western Federal District produced about 15% and almost ten percent of the production of fish feed falls on the Southern Federal District. It is worth noting that most manufacturers are increasing not only production volumes, but also differentiating the product ranges of their products by composition (Fig. 3 on the left).



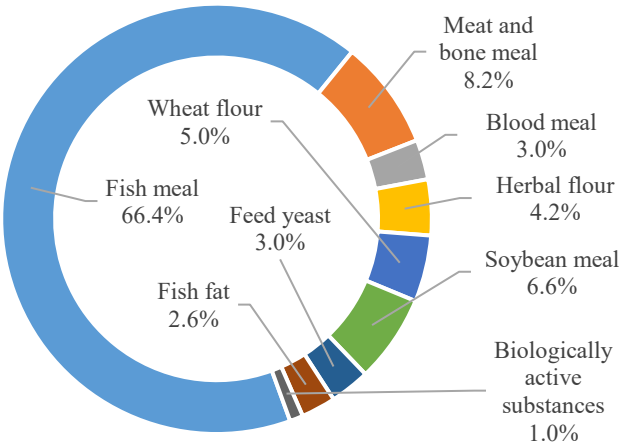


Fig. 3. Dynamics, thousand tons of combined feed production / import (left). The structure of the diet, % (right).

The basis of the feed produced is fish meal, which accounts for up to two thirds (66.4%) of the volume, meat and bone (blood) flour in the feed occupies 11.6%, wheat (grass) flour – 9.5%, soybean meal – 6.6%, and about 6.4% is occupied by other elements, including fish oil, BAS, etc. (fig. 3 on the right). The production of fishmeal in the Russian Federation in 2022 amounted to 148.3 thousand tons, an increase of 2.6% compared to the level of 2021.

Nevertheless, the current favorable production and economic situation nevertheless leads to the fact that the quantity and mainly the quality of feed produced domestically does not meet the needs of the industry, as a result of which there is an increase in imports of combined feed, especially for valuable fish species.

Thus, in the first half of the year, ready-made compound feeds were imported in the amount of 23.1 thousand tons, which is 3.6% more than the same indicator last year. At the same time, the majority of imported compound feed is intended for commercial fish (salmon, sturgeon, and trout), while domestic production is more focused on the production of feed for carp.

The main suppliers of imported fish feed are Western European producers of feed for aquaculture, such as the Danish "BioMar", the Norwegian "Skretting", and the German company "Alltech Coppens". In total, they supplied almost 90% of compound feeds for fish. It should also be noted that these companies also have so-called functional feeds in their product line, which, in addition to traditional ingredients of the highest quality, contain BAS that serve to maintain health and contribute to the rapid growth of livestock.

5 Conclusion

The analysis of the dynamics of the indicators of the development of the FC revealed both negative and positive trends. Thus during the analyzed period, there is an increase in ABR production (catch) in almost all product categories. A similar trend is typical for the aquaculture industry – indicators of the production of marketable products and planting material for the repair of the main livestock have also increased. There is also a slight increase in the share of imported ABR (mainly premium class) – salmon, shellfish in the form of fillets and chilled fish.

To meet the needs of the FC in feed, a significant increase in domestic production of both the compound feeds and the ingredients for them, including fish meal, meat and bone meal, blood and grass meal, various types of meal, fish oil, BAS, etc., has been ensured.

At the same time, there remains a serious dependence on imported products (compound feed), the share of which exceeds in some positions up to 80-90% (vitamins, BAS for salmon, sturgeon, whitefish, carp) from the domestic market resources.

The increased costs of imported feed from Russian producers of commercial aquaculture products caused by the weakening of the national currency will affect the increase in the cost of fish production, nevertheless, these additional costs will not provoke a significant rise in the cost of finished products, since now the level of consumption of fish and fish products due to domestic production has reached 152%.

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