Factors of the Current Sustainable Development of the Fisheries Complex in the Kamchatka Krai

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Abstract. Based on a comprehensive analysis of statistical data, we investigate the state of fisheries in the Kamchatka Krai, the dynamics of catching and exporting the aquatic biological resources, and the existing production structure. We indicated the problems in the development of the fishing industry (aging of the fleet, the spread of poaching, the disposal of “non-target” fishing objects, low processing of export products, etc.). Moreover, we studied the functional specificity of the fishing industry. The paper identifies and analyzes the main factors of sustainable development in the fishing industry. It also reveals the organizational and economic mechanism of regulation and stimulation of the fishing industry. We analyzed the activities of federal and regional authorities in the context of fishery development in the Kamchatka Krai. We studied the technical base of fishing enterprises. The study reveals the mechanisms of renewal and modernization of the fishing fleet. It also analyzes the main innovative directions in fisheries. We conducted a quantitative analysis of staffing in the fishing industry. Based on the performed analysis, we made conclusions on several positive trends in the Kamchatka Krai fishing industry. The paper summarizes the approaches to the formation of factors of sustainable development in the Russian fishery complex. We outlined the requirements for further fishery development in the Kamchatka Krai.

Keywords: Aquatic biological resources · Fisheries · Fisheries complex · Export · Organizational and economic mechanism · Material and technical base · Innovation · Staffing

1. Introduction

The fishing industry is the most important economic activity in the Kamchatka Krai due to its geographical position. The fishery complex [FC] occupies a special place in the Kamchatka Krai; the processes taking place in it are directly reflected in all aspects of the regional economic, social, and political life. The industry accounts for more than 20% of the gross regional product [GRP], more than 50% of industrial production, and about 90% of export volume [18].

Moreover, the Kamchatkan fishery complex plays an essential role in the Russian fishing industry. In the total number of catches, Kamchatkan fish enterprises account for at least 30% [18].

At the current stage of social development, state regulation of fisheries is integral to its functioning, especially in Russia. The primary task of the state is forming the economic, legal, and other prerequisites for its sustainable development.

The role of state regulation in the fishing industry of the Russian Federation is reflected in the works of O. V. Korneiko and A. G. Stolbov [15, 19]. The analysis of the existing approaches and
experience of the Soviet period to the regulation of the fishing industry can be seen in the works of O. V. Akulich [1].

Several scientific works analyze the development of the Russian fishing industry [22, 17, 20]. The analysis of state programs for the development of the fishing industry can be found in the works of M. Yu. Dyakov and E. G. Mikhailov [5].

State regulations of the fishing industry in countries where this industry plays a significant role are of particular interest to the development of Russian state regulations [11].

Global trends in the development of fisheries are reflected in the works of R. Arlinghaus, S. J. Cooke, and W. Potts [2].

E. E. Kvashnina [16], E. I. Denisevich, and S. Yu. Rakutko [4] analyzed the factors of sustainable development of the fishery complex. A. A. Kokov, Kh. Kh. Takaeva, and Kh. B. Ezhiiev studied the aspects of sustainable development of the agro-industrial complex [14].

Modern methods of control over fisheries are analyzed by D. Bradley, M. Merrifield, K. M. Miller, S. Lomonico, J. R. Wilson, and M. Gleason [3].

Despite the close attention paid to the development of the fishery sector in the modern Russian secondary literature, the factors for its further development are underresearched. Thus, this study aims to identify the factors contributing to the sustainable development of the fishing industry in Russia and the Kamchatka Krai, substantiate their significance, and assess their completion in the fishery complex of the Kamchatka Krai.

2. Materials and Methods
We employed general scientific and special research methods – analysis, synthesis, integrated system approach, comparison, generalization, and methods of retrospective and logical analysis.

The methodological basis of this study is formed by the normative acts on the fishery complex in the Russian Federation.

The conceptual basis was formed by the national policy outlined in the Doctrine of Food Security of the Russian Federation, the State Program of the Russian Federation “Development of the Fisheries Industry” (April 12, 2014 No. 314, as amended March 27, 2019) [9], and “Strategy for the development of the Russian fishery complex up to 2030” (November 26, 2019 No. 2798-r) [10].

The factual data on the development of the fishery complex, the state of the fishing fleet, and the efficiency of using aquatic biological resources was supplied by the statistical materials of the Federal State Statistics Service, state authorities, etc.

3. Results
In the Kamchatka Krai, over 500 enterprises are engaged in year-round and seasonal fishing, more than 200 of which fish for aquatic biological resources. Recently, the extraction of marine bioresources has been increasing (see table 1).

In 2018, salmon production was the highest in the entire post-Soviet period.

The specific nature of aquatic biological resources is determined primarily by such features as mobility and renewability, which significantly distinguishes them from other natural resources [16]. Concerning the fishery complex, sustainable development must deal with a different prioritization of tasks and factors compared to other production areas.

One of the main tasks of the fishery sector is ensuring the food security of the country. However, despite the growth in caught volumes, reflected in table 1, the export volume also increased, which indicates that the fishery complex of the Kamchatka Krai is still focused on foreign sales markets. Moreover, the Government of Kamchatka Krai plans to increase the export of fishing products to $1.234 million by 2024 [18].

Thus, one can state that the federal task of ensuring Russian food security and the priorities of regional authorities in the Kamchatka Krai do not coincide. This is caused by several factors, mainly the difference in domestic and foreign seafood prices. The traditional sales markets for Kamchatka fishing enterprises are the markets of China, Japan, and South Korea, where seafood prices are
nominated in US dollars, which increases the profits of these enterprises. Another important reason is the logistic difficulties of supplying seafood to the European part of Russia. Despite the development of logistics services in the Primorsky Krai, the activation of Russian Railways, and the Northern Sea Route development, the actual supply of seafood to the Russian domestic market did not grow. The dynamics of aquatic bioresource export in the Russian Federation are shown in Table 2.

### Table 1. The dynamics of production of aquatic biological resources by enterprises of the Kamchatka Krai, 2012–2019.

| Year | The total catch of aquatic biological resources, thousand tons | including Pacific salmon, thousand tons | including sea fish, invertebrates, thousand tons | export, million USD |
|------|-------------------------------------------------------------|----------------------------------------|-----------------------------------------------|-------------------|
| 2012 | 1,048                                                      | 253                                    | 795                                           | 640               |
| 2013 | 873                                                        | 132.5                                  | 740.5                                         | 580               |
| 2014 | 895                                                        | 143.6                                  | 751.4                                         | 491               |
| 2015 | 982                                                        | 192.7                                  | 789.3                                         | 514               |
| 2016 | 1,066                                                      | 234.3                                  | 831.7                                         | 516               |
| 2017 | 1,203                                                      | 243.4                                  | 959.6                                         | 647               |
| 2018 | 1,563                                                      | 498.9                                  | 1,064.1                                       | 789               |
| 2019 | 1,554                                                      | 378                                    | 1,176                                         | 837               |

*Source: Compiled by the authors based on [12, 18].*

### Table 2. The dynamics of export of aquatic biological resources of the Russian Federation, 2017–2019.

| Product | 2017 | 2018 | 2019 |
|---------|------|------|------|
| Fish, crustaceans, mollusks, and other aquatic invertebrates | 4,347,796 | 5,098,911 | 5,290,515 |
| Including: | | | |
| living fish | 0.1 | 361.1 | 0.3 | 361.4 | 0.9 | 1,562.0 |
| fresh or chilled fish | 2.7 | 3,566.0 | 5.1 | 5,558.0 | 8.0 | 7,497.0 |
| frozen fish | 1,875.8 | 2,637,135.9 | 1,956.5 | 3,249,376.3 | 1,810.5 | 3,020,740.5 |
| fish fillet | 117.7 | 527,294.6 | 124.1 | 503,063.0 | 104.9 | 486,217.6 |
| dried fish, salted | 5.6 | 27,228.6 | 4.8 | 20,402.6 | 5.0 | 22,043.7 |
| crustaceans | 87.3 | 1,054,403.8 | 85.3 | 1,198,996.6 | 95.1 | 1,587,814.5 |
| shellfish | 21.6 | 72,450.3 | 29.3 | 90,720.3 | 42.5 | 129,323.2 |
| aquatic invertebrates | 11.2 | 25,355.5 | 11.8 | 30,432.6 | 11.4 | 35,316.4 |

*Source: Compiled by the authors based on [6].*
The fishing industry operates mainly through the use of renewable biological resources. Therefore, ensuring a high return rate of bioresources and fair pricing in the final product according to the investment costs is a top priority. The main products of Kamchatkan enterprises are non-processed products, mainly frozen fish (table 3).

**Table 3.** The structure of the production of aquatic biological resources in the Kamchatka Krai in 2017–2018.

|                               | 2017       | 2018       |
|-------------------------------|------------|------------|
| Processed and canned fish, crustaceans, and mollusks | 892,544.7  | 1,003,771.7|
| of them:                       |            |            |
| frozen fish fillet            | 27,872.7   | 38,415.3   |
| frozen fish                   | 742,680.9  | 830,971.4  |
| dried fish                    | 31.5       | 25.1       |
| cold-smoked fish and fish fillets | 232.4    | 277.8      |
| frozen fish liver and milt    | 4,474.2    | 5,858.3    |
| caviar                        | 20,983.4   | 26,704.3   |
| frozen crustaceans            | 4,718.3    | 3,903.4    |
| frozen, dried, salted, brined, or smoked shellfish | 33,474.9  | 40,503.6   |
| flour and coarse meal and pellets from fish, crustaceans, mollusks, and other aquatic invertebrates not suitable for consumption | 29,384.8  | 33,123.9   |
| canned fish, natural (thousand conventional cans) | 7,622.7    | 5,837.2    |
| canned fish in tomato sauce (thousand conditional cans) | 306.1      | 461.1      |

*Source:* [13].

Since the fishery complex of the Kamchatka Krai is highly seasonal (especially for the extraction and processing of salmon fish), the sustainability of its development, in this case, is determined by natural and climatic seasonal factors. Therefore, further development is largely determined by the ability of these factors to positively influence the fishery complex.

Based on the preceding, ensuring sustainable development of the FC is only possible via a systematic approach that provides a comprehensive study of the prerequisites and development factors in their mutual connection.

The prerequisites for the development of the FC must be correctly established since it will allow developing an effective strategy for the development of the fishing industry in the Kamchatka Krai. The prerequisites must become a starting point for future development and its factors. The prerequisites consist of the sustainable development principles, which reflect the tasks of FC, the interests of the authorities, and the producers in solving these tasks, the natural and economic conditions of production, and the initial state of the fishing industry. The factors and conditions for FC development are shown in Figure 1.

**Figure 1.** Factors and conditions for FC development. *Source:* Compiled by the authors.
The above factors formed at different times in the FC development, with different dynamics and influence directions.

Reforming the fish industry management system in the late 1990s – early 2000s led to the emergence of new negative consequence and the aggravation of old ones:

- the growth of poaching;
- the by-catch and discarding of non-target fishing objects, small and low-value fish;
- the depletion of aquatic biological resources;
- the decrease in the total catch of marine natural resources;
- the physical and moral deterioration of the fishing fleet;
- the export of non-processed (raw) products.

To overcome the aforementioned negative trends, the state authorities started formulating the prerequisites and development factors.

To renew the fishing fleet, the government increased the quota periods for catching aquatic bioresources from ten to fifteen years and allocated “state support quotas” in the amount of 20% for investment purposes.

Kamchatka fishery enterprises became actively involved in the “investment campaigns” conducted by the Federal Agency for Fishery. In 2019, several agreements were signed to construct:

- eight fish processing plants;
- three modern fishing medium-tonnage seiner-trawlers;
- four large processor trawlers [18].

In 2020, fishing enterprises, to which the state has assigned shares of quotas for investment purposes, received the right to develop these resources.

One of two 50-meter seiner trawlers – “Leninets” – built-in 2019 at the “Yantar” shipyard in Kaliningrad received quota support. The collective fishing farm named after V. I. Lenin is the first fishing enterprise in the Russian Federation, which successfully presented to the commission a vessel built in Russia under the “investment quotas” program.

Thus, the total volume of investment quotas of enterprises in the Kamchatka Krai amounted to 23.7 thousand tons of pollock, 3.6 thousand tons of Pacific herring, and other fishing objects in the total volume of 33 thousand tons.

During the implementation of sectoral programs in the Kamchatka Krai, fishing enterprises invested more than 45 billion rubles in the construction (modernization) of coastal fish processing plants and the modernization of the fleet (17 billion of which came from regional budgetary support).

In 2014, Kamchatka Krai implemented a state program that compensates fisheries for a part of the costs incurred for the payment of interest on investment loans, advances, and lease payments.

In 2019, fifteen investment projects were reimbursed for a part of their implementation costs from the regional budget. The volume of state support amounted to 182 million rubles.

In 2019, measures to implement four investment projects for the construction and modernization of onshore plants were completed (three of them on the coast of the peninsula and one in the city of Petropavlovsk-Kamchatsky).

During the implementation of projects by the Kamchatka Krai fisheries, more than 3 billion rubles were invested in the development of coastal fish processing plants.

Three out of four enterprises are residents of the territory of advanced social and economic development “Kamchatka” and receive additional state preferences and support.

In general, one should note that the advanced special economic zones [ASEZ] and the free port of Vladivostok [FPV] are in demand among the enterprises of the fishery complex. Currently, 14 fisheries with investment projects totaling more than 8 billion rubles have received the status of ASEZ residents. They are successfully implementing their development plans, mainly for the construction and modernization of onshore processing facilities. Another resident implements a related project to organize a regular line to deliver frozen fish from Kamchatka to the ports of the Far East.
Two enterprises, being residents of FPV, with the support of the Ministry for the Development of the Far East and the Arctic and the Government of the Kamchatka Krai, are implementing an investment program to create a port hub in Petropavlovsk-Kamchatsky for integrated servicing of fishing vessels and the organization of transshipment of refrigerated and dry container cargo worth more than 3 billion rubles.

In general, over the past 11 years, Kamchatka fishing enterprises invested more than 40 billion rubles in the fishing industry’s development. In total, 25 modern factories were built in the region. During the same period, the fishing enterprises built, purchased, and modernized 18 fishing vessels.

At the current development stage, innovations in the development of the fishing industry are becoming increasingly important.

One of the innovative solutions in the field of the fishing industry was the introduction in 2018 of a system of mandatory electronic veterinary certification by the Federal State Information System “Mercury” [FSIS “Mercury”]. A similar approach is used in many countries and is proven to be effective [3].

The state authorities that initiated the launch of the FSIS “Mercury” assumed that it would guarantee the quality of products and ensure control over its movement.

The goals of creating FSIS “Mercury” include:

- avoiding paper waste and reducing costs for certification;
- minimizing time costs and providing a convenient mechanism for the operation of enterprises;
- fighting corruption among supervisory authorities;
- fighting poaching;
- suppressing supplies to the market of substandard and illegal products.

Another area of innovation development is the modernization of onshore processing facilities for integrated fish waste processing. In 2019, amendments were made to the state program of the Kamchatka Krai “Development of the fishery complex of the Kamchatka Krai” with creating conditions for the integrated processing of fish waste and the introduction of innovative technologies for processing fish products, excluding the formation of unprocessed fish waste [18].

The fishing vessels with RSW-tanks, in which water is continually circulating, and the air is supplied, were introduced by Kamchatkan fishing enterprises. Thus, the harvested seafood is delivered live to the processing enterprises, which directly affects the quality of products.

Despite several positive trends, the innovative development of the Kamchatkan fisheries is currently only at the initial stages of development. It does not reach the development level of the leading fishing powers (Norway, Japan, etc.). For further actions must include the intensification of using existing innovative technologies (technologies for more in-depth processing of seafood, the use of biodegradable fishing gear, fleet renewal with the help of RSW-tanks technology, etc.) and increase the innovative activity of scientific institutions in the Kamchatka Krai.

The Kamchatka Krai is traditionally considered a fishing land. Currently, the number of people employed in the fishing industry of the region is growing. According to official data, in 2018, the average number of workers in the fishing industry was 15.8 thousand people. In 2019, it saw an increase of 104.4% and amounted to 16.5 thousand people. The average monthly salary of fishers in the region is also growing at a faster rate – in January–October 2019, it amounted to 132 thousand rubles (118% to the level of 2018), fish processors – 118 thousand rubles (110%) [21].

Nevertheless, despite these tendencies, the fisheries in Kamchatka Krai lack personnel. This applies to low-skilled workers (sailors, fish handlers) and highly qualified specialists (navigators, radio specialists, engineers, etc.). One could surmise that the lack of low-skilled personnel can be solved by labor migration. However, the lack of qualified personnel must be solved intra-regionally.

There are three secondary vocational schools and one higher educational institution (Kamchatka State Technical University) focused on training personnel for the fishing industry. However, for some objective and subjective reasons, graduates of these educational institutions cannot fully satisfy...
personnel needs. This is especially true for those positions that require higher education. The most significant factors determining this trend are currently:

- the declining number of secondary school graduates;
- the orientation of graduates of the Kamchatka Krai schools to educational institutions in the European part of Russia (mainly Moscow and St. Petersburg universities);
- problems with training in the general education schools of the Kamchatka Krai in “Physics,” which leads to a refusal to take the Unified State Exam in this discipline, and, as a consequence, the impossibility to enroll in a university for technical (engineering) specialties;
- low prestige of maritime professions.

To develop the human resources of the fishing industry, changes were made within the framework of the regional state program “Development of the fishery complex” of the Kamchatka Krai in 2019. These changes included (1) compensation for targeted training costs, (2) creation of training and production centers, (3) modernization of the educational and laboratory facilities of educational institutions, (4) the organization of production practices of cadets and students, and (5) activities to increase the prestige of maritime professions among young people.

4. Discussion

The analysis of various works focusing on the prospects for sustainable development of the Russian fishing industry shows no unity of view among the authors on the prerequisites and factors determining the fishing industry’s growth. The range of opinions is wide enough, namely:

- The return of elements of a planned (socialist) nature to the fishing industry’s economic mechanism and more active public-private partnership mechanisms [15].
- The formation of fishery clusters in coastal regions, where the fishery complex plays a significant role [20].
- The formation of vertically integrated fishery enterprises, including in the form of fishery clusters [22].
- The implementation of the bioeconomic concept of rational use of aquatic biological resources, the essence of which is a physical and economic sense, boils down to preserving marine natural resources and obtaining the maximum yield of finished products with a high share of added value [19].

Without entering into polemics with the above authors, we would like to emphasize that, in our opinion, the fundamental prerequisite for the sustainable development of the fishery complex is the stability of the conditions for fishing industry economic activities. Among the researched factors, the more active introduction of the latest technologies in the extraction and processing of aquatic bioresources and staffing problems are the most important. Simultaneously, as the study showed, innovative technologies will further reduce personnel problems due to increased labor efficiency, automation of production, and labor mechanization.

5. Conclusion

Despite significant technical and economic problems, fishing industry in Kamchatka Krai overcame several crises and received an impetus for progressive, sustainable development. The analysis showed that the main factors of sustainable development are already formed in the Kamchatka Krai. However, most of the studied factors are in the initial stages of their formation. Therefore, to create a trend for the sustainable development of the fishery complex, a relatively comprehensive and complex work in a single direction of all the participants (state and municipal authorities; small, medium, and large businesses in the fishing industry; public organizations; educational and scientific institutions, etc.) is necessary. The set of measures should include technical means, regulatory actions, including law enforcement and control, training, communication, and regulatory and cognitive elements of compliance [11].
Thus, the most significant factors of the sustainable development of the fishery complex are:

- the state of the material and technical base of fishery enterprises;
- organizational and economic mechanisms for regulating and stimulating the fishing industry;
- the introduction of innovative technologies, both directly in the production sector and in the regulation of the fishery complex;
- the system of personnel support for the activities of fishing enterprises.

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