Conservation of aquatic living resources under conditions of large-scale development of oil and gas resources on the Pacific continental shelf (the Sea of Okhotsk)

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According to Food and Agriculture Organization projections, high growth rates of the global human population may result in an increase in food shortages, especially in protein food products in the near future. Non-renewable energy sources are dwindling and will tend to rise in price on the world market. The use of living resources is also approaching the maximum sustainable limit. Fierce competition for securing access to biological and hydrocarbon resources is increasing among nations. Often, only the economic benefits are sought, and the conservation of natural resources and environment for future generations is relegated to environmental movements. However, effective and rational use of natural resources is the only guarantee for the well-being of humankind. It should be based on the complex estimation of natural resources and socioeconomic conditions, including regional specific features.

All over the world modernization of economies related to natural resource use, with a simultaneous increase in withdrawal of natural raw material, occurs. It is unlikely that there will be a nation that does not face problems arising from the contradicting interests of ministries and agencies, regions and economic entities whereby each side tries to gain its own benefits while ignoring the interests of society at large.

The fishing industry is, in its own way, unique. Its whole activity is based on exploitation of renewable aquatic bioresources. Thus, their sustainable existence and reproduction of bioresources in all natural water basins is a basic necessary condition without which the stable operation and development of the fisheries are impossible. The state of aquatic bioresources is directly related to the ecological situation which is formed under the influence of numerous natural and anthropogenic factors, such as climate variations, fisheries, hydro construction, engineering, navigation, mining operations, and pollution. Year by year, the anthropogenic impact becomes more and more substantial. With these conditions in mind, regular access to reliable information on the ecological status of water basins and their aquatic bioresources becomes necessary. The data on the types and scale of impacts on aquatic biota should be the basis for decision making and regulatory, legal, organizational and economical measures aimed at minimization or elimination of environmental damage caused by the anthropogenic activities.

In 1972 UNESCO formulated preliminary proposals on the establishment of the Global Environment Monitoring System. However, this system has not been created until now because of disagreements regarding the methods of monitoring, allocation of responsibilities among the existing academic and sector observational systems. The absence of progress in the organization of a system of ecological monitoring is an international problem.

The establishment of a comprehensive ecological monitoring system has become especially necessary because the extraction rate of natural resources has approached an unsustainable level. Recently, coastal regions have faced a conflict of interests between oil and gas development and fisheries on the continental shelf.

When considering the mutual influence of the oil and gas industry and fishery on the environment, the competitive aspects of this interaction are considered. The fact that hydrocarbon resource development at all stages, and even after its completion, may negatively affect aquatic resources and their habitats, is considered foremost. However, besides the direct antagonistic relationships between the oil and fishery industries, there is their indirect interaction occurring in the socioeconomic sphere.

In many coastal regions the oil and fishery industries are the most significant, and often the only components, of the economy that form the basis regional development and employment. However, both industries are based on the use of natural resources and have a number of similar economic features that should be considered when developing a long-term strategy of coastal region development.

The oil industry uses a non-renewable natural resource. To ensure the stable development of oil-producing regions in the long-term, some benefit from hydrocarbon resource extraction should be invested in the development of infrastructure, industries and agriculture in these regions to ensure the dynamic development of the region after hydrocarbon resources are depleted.

Bioresource sustainability is an erroneous notion when thinking of the possibility of stable development and maintenance of socioeconomic infrastructure of coastal regions in the long-term. However, an overview of coastal regions around the world, whose economies are based on fisheries (mainly coastal fisheries) provides evidence on the increase of socioeconomic crises. Employment in fisheries and related industries is continuously decreasing, and governments of many countries are forced to take measures to support the fishermen while making serious efforts to reduce of the number of fishing vessels.

The decrease in the abundance of commercial bioresource species due to overfishing, bycatch, illegal fisheries, disturbance of habitats, and expansion of large-tonnage expedition fleets, is considered to be one of the main reasons leading to this situation. There is no doubt that all these events exist. However, even their complete elimination, and recovery of stocks to optimal levels, do not guarantee the stable development of fishery-dependent regions.

The fishery industry is different from other industries, in which the increase in labor productivity is reached due to the introduction of innovative technologies, high-productive equipment, use of improved materials, *etc*. The increase in production for the fishery industry means only the increase in catch per fisherman. However, the volume and cost of the natural bioresource base, even renewable and maintained at an optimal level, are limited.

In most coastal regions of most developed countries, the fishery industry has failed to provide the financial benefits necessary to fully develop the regional economy and proper resource-saving production. This is because the fisheries on most abundant species are not super-profitable, and the most in-demand and high-value species of aquatic resources are now utilized to the full extent.

The development of the richest shelf oil and gas fields that make large profits should provide the source of investment necessary to ensure the future development of coastal areas. For this to happen, it is necessary to develop a mechanism for withholding some part of the profit by governments in the form of natural rent, to be saved in specialized funds for regional development. It may also be possible to exempt part of the profit from taxation on condition that it be invested in the development of regional economy.

Reasonable planning of oil and fishery industry development should be based on the principle of a balanced management of coastal zones, providing for common interests of users of different resources in both economic and environment protection areas. Making a profit should not be a top priority. For example, in the case of hydrocarbon development on the West Kamchatka shelf, it is necessary to take into account the natural uniqueness of this region and to ban, by law, the exploration and development of resources in the area.

In a balanced approach to natural resource exploitation, the oil and gas industry damage done to the fishery may ironically favor its conservation by creation of alternative employment sources for populations living in coastal regions through the gradual decrease in fishing pressure on aquatic bioresources, and by investing revenue received from the oil and gas industry into environment-oriented projects, including monitoring and protection of aquatic bioresources.

Regarding the organization of efficient ecologic–fishery monitoring, an absence of basic ecological data prevents the reliable identification of anthropogenic components, among other factors, that cause changes in the environment and degradation of aquatic ecosystems. As a result, instead of the harmonious development of natural resources, inter-sectoral disputes emerge resulting in economical and social crises and unavoidable losses for all competing sides.

Debates regarding the causes and amount of damage to living resources determine that the causal relationship between committed actions and the following adverse consequences, or appearance of substantial damage to the environment and human health, is of great importance. It is necessary to find out if these adverse consequences are caused by other factors, including natural factors, and if they occur independently of industrial operations and states of crisis.

Planned sustainable use of natural resources should be made in a stepwise manner. It should include a definition of the purpose of living and non-living resource exploitation, taking into account local specific ecological features, and provide a selection of optimal alternatives and suggest the possibility of planned improvement. The need becomes obvious for developed ecological management within oil and gas producing companies not only during exploratory surveys, planning and designing of industrial complexes, but for the lifetime of the operations until resource depletion.

The initiative and activities of industry, rather than a system of strict governmental management, control and supervision, are the most effective conditions for mutually profitable non-crisis development of the oil and gas producing industry, and fisheries. Fishery companies aiming at long-term development and promotion of urban development should also be interested in maintaining their good reputation by allowing them to obtain cheap credit at banks, *i.e.*, strengthen their positions under the fierce competition. Thus, the participation in a system of ecological monitoring should become necessary for both oil workers and fishermen.

Figure 1 shows the organization of ecologic and fishery monitoring. To obtain reliable information about the status of aquatic bioresources and their habitats, and industrial processes affecting the environment, the free exchange of information, extensive discussions of emerging issues and joint managerial decision making are necessary.

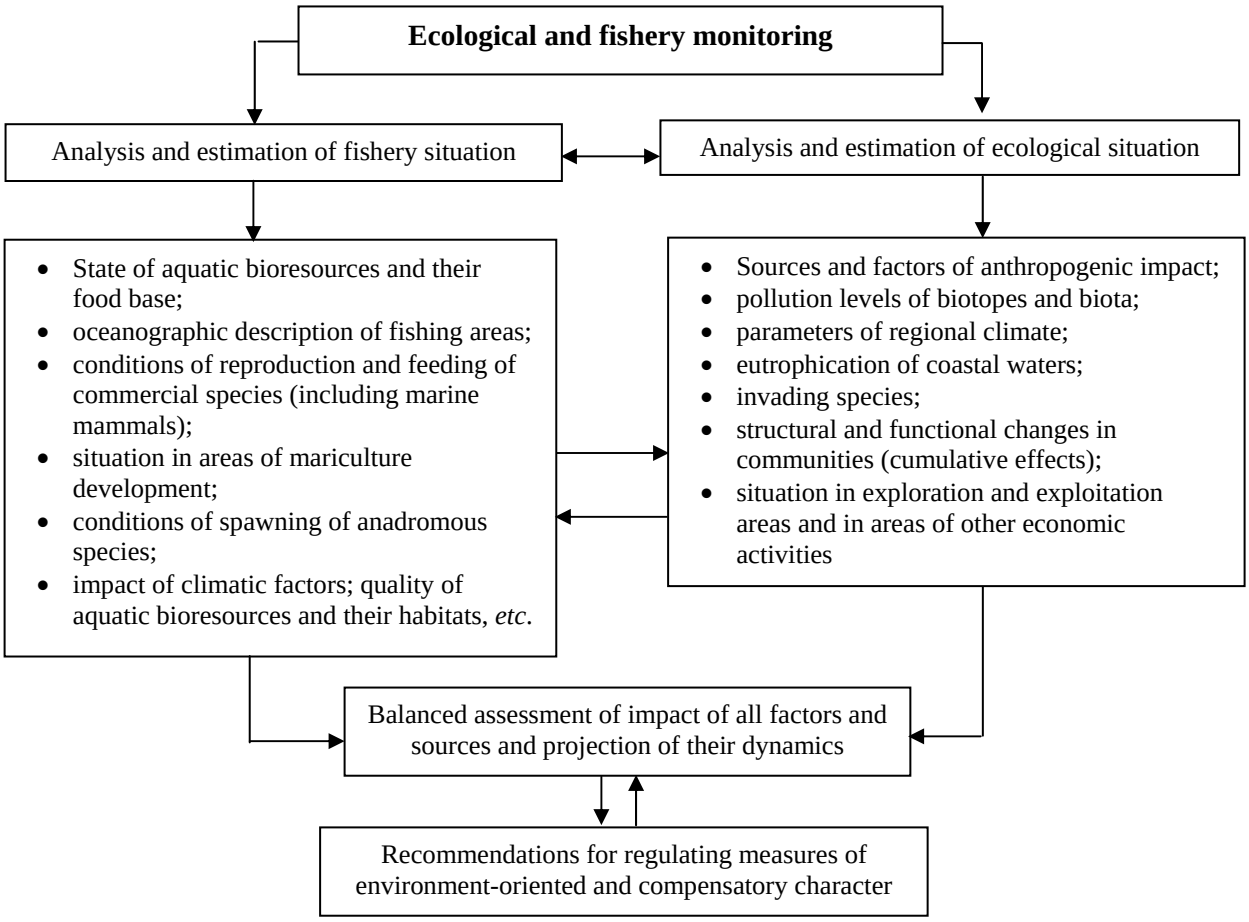

Fig. 1 Scheme of organization of ecological and fishery monitoring.

A stable environment and successful development of the fishery industry as a specific sector of the national economy plays an important role in guaranteeing a secure food supply, and the development and maintenance of a socioeconomic infrastructure in coastal regions. Hence, the strategy of effective resource-conserving natural management is needed, taking into account the conservation of aquatic biological resources and their habitats. Minimization of the growing anthropogenic impact to the marine ecosystem is actual recently and should be managed at the governmental level. For this to happen, it would be expedient to establish consultative bodies which would include representatives of legislative and executive powers, industrial companies, and scientific organizations to ensure the operation of the specific sectors of economy and environment-oriented organizations.

Understanding the danger of taking an antagonistic approach to resource development by nature-oriented structures results from the fact that the stability of environment, natural-resource potential and guaranteed right of future generations to clean environment would otherwise be jeopardized.

Only by the formulation of a common purpose and through the consolidation of efforts by the whole world community are we able to guarantee the diminishing negative anthropogenic impact on marine ecosystems and bioresources, and development of effective exploitation of natural resources.