

***PAST AND PRESENT SPECIES OF GENUS CARASSIUS  
OF THE MIDDLE VOLGA REGION***

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The results of the study of the historical and modern distribution of two species of the genus *Carassius* on the territory of the Tatarstan Republic and the Middle Volga region as a whole are presented. Materials on the osteological differentiation of three species of the genus *Carassius* are provided.

Keywords: Crucian carp, Prussian carp, Tatarstan Republic, the Middle Volga region, paleontological and archaeological sites, bone remains, distribution, osteological material.

***FISHING VALUE OF THE SMALL TRUEV RIVER VOLGA REGION AFTER  
CLEANING THE CHANNEL***

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On a typical small river Truev in the Penza region, a comparative analysis of the state of aquatic biological resources was carried out before clearing the channel and five years after its clearing. Five years after clearing, zooplankton biomass in natural sections of the river amounted to 5–19% of the primary, zoobenthos biomass – 3–29%, total fish productivity in the entire clearing area – 49%. Moreover, over the past five years, mainly due to rheophilous fish, the number of ichthyofauna and its biomass doubled. The fishery value of the river from the conditional, the ability to fish by amateur fishers, has moved into the category of real use of ichthyofauna, including as objects of food for people and animals. Therefore, the accepted recovery coefficient of ichthyomass in the Volga region, equal to the ripening time of the fish, is obviously worth considering as optimal. The existing practice of channeling all compensation funds to stocking large Volga reservoirs does not give practical results. Rehabilitation should be carried out on those water bodies and streams that have been damaged. Therefore, water bodies not assigned to protected areas, which include the Truev River, should be stocked up with valuable species of fish in order to ennoble the ichthyofauna and to increase fishery value.

Key words: Truev river, clearing of the channel, zooplankton, zoobenthos, ichthyofauna, fish productivity, fishery value.

***ASSESSMENT OF THE MAXIMUM SUSTAINABLE YIELD OF SEBASTES  
REDFISH USING THE CATCH PER RECRUIT FUNCTION***

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The object of the study is redfish species of the Flemish Cap Bank in NAFO Div.3M, the Northwest Atlantic statistical area. The aim this study is to determine the possible maximum sustainable yield and optimum fishing mortality value of redfish, using the catch per recruit function. Target reference points  $F_{max}$  and  $F_{0,1}$  for redfish stock banks on Flemish Cap have been evaluated and the resilience of these reference point have been investigated depending on the variation of parameters to the catch per recruit function. It is shown that the optimal average annual catch depends on the recruitment and can be obtained when the operation of the object for the fishing mortality of 0,08 to 0,2 and constitute 10–18 thousand t depending on the amount of recruitment. In this case, this reserve will be maintained at biologically secure scope (spawning biomass will be in the range of 20–40 thousand tons).

Key words: redfish species, stock, abundance, modelling, parameters, fishing mortality, fishery management.

## ***FISHING INTENSITY IN THE RUSSIAN PART OF VISTULA LAGOON***

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The article considers the results of a study of the intensity of fishing in the Russian part of the Vistula Lagoon (Kaliningrad Bay). There are several available sources of information about the fishery, which are typical for inland waters. These include data of fishing licenses (permissions), 5-day reports by fishermen and logbooks. The first allows you to determine the composition of fishing companies, fleet and the list of fishing gears, the second gives information about total catch; the third provides data about daily catch, types and number of gear, location of the fishery and landing. Reports and logbooks have low reliability in relation to volume of catch, however, data about type, number of fishing gears seem to be more correct. Using a combination of data from all sources, the magnitude of the fishing effort, the temporal dynamics of fishing intensity, the species composition of catches for the main types of gears. It is shown that the existing fishing effort does not exceed the production capabilities of aquatic bioresources. The maximum intensity of fishing was calculated to reach total usage of quotas. It is proposed to restore in the freshwater a new system of fishery monitoring, similar to the one that existed before 2004, and to introduce approaches to regulating fisheries through the regulation of fishing effort, which will ensure greater efficiency of control and management of aquatic bioresources.

Key words: Vistula lagoon, fishing intensity, effort catches, logbook, fisheries regulation.

## ***BY-CATCH AND DISCARD IN THE TRAWL AND SNURREVOD FISHERY IN THE FAR EAST FISHERY BASIN***

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Based on the databases of daily ship reports and scientific observations, a characteristic of the structure of catches in the fishery by pelagic and bottom trawls, as well as by snurrevaad in the Far Eastern Fisheries Basin, is given. It has been revealed that the fisheries regulation mechanisms in place during the study period did not fully solve the discards problem. On the one hand, there has been some improvement in the development of valuable species of

by-catch, and on the other, an increase in discards of low-value by-catch in these types of fisheries. Discards from these types of fisheries are more than 1 million tons per year.  
Keywords: trawling, snurrevaad, multi-species fisheries, by-catch, discards, Far Eastern seas

***THE LONG-TERM VARIABILITY OF THE BEGINNING  
OF THE YESSO SCALLOP (MIZUHOPECTEN YESSOENSIS) SPAWNING  
AND LARVAE SETTLEMENT IN MINONOSOK BAY  
(POSYET BAY, SEA OF JAPAN)***

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The long-term changes of the beginning of the Yesso scallop (*Mizuhopecten* (=Patinopecten) *yessoensis* Jay, 1857) spawning and larvae settlement in Minonosok Bay (Posyet Bay, Peter the Great Bay, East Sea/Sea of Japan) were analyzed in 1970–2011. The entropy of the processes was calculated, and on its basis the extent of data dispersion over years was studied. Key words: water temperature, interannual variability, phenological date, spawning, larvae settlement, spat, Yesso scallop; *Mizuhopecten* (=Patinopecten) *yessoensis* Jay, 1857, Minonosok Bay, Posyet Bay, Peter the Great Bay, East Sea/Sea of Japan.

***THE POLYCHAETES ROLE IN FOULING COMMUNITY  
ON THE MUSSEL-OYSTERS FARMS (CRIMEA, THE BLACK SEA)***

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Data on the taxonomic composition of polychaetes found on marine farms in the coastal waters of the Crimea were obtained. The material was collected in 2017–2019 from fouling of mussel collectors and oysters cages. 26 species of polychaetes belonging to 10 families were found. *Platynereis dumerilii* and *Nereis zonata* (Nereididae) dominated. *Polydora websteri* (Spionidae) and *Hydroides dianthus* (Serpulidae) may adversely affect the quality and quantity of expected product. Other species of polychaetes are typical representatives of the bottom fauna. They do not affect on cultured mussels and oysters. The obtained data should be taken into account when planning hydraulic works on the mussel and oyster farm. Key words: mariculture, mussel-oysters farm, Polychaeta, Crimea, the Black Sea.

***SOME TECHNOLOGICAL FEATURES OF THE PRODUCTION  
OF BIVALVES IN THE BLACK SEA***

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Mussel cultivation in the Black Sea is carried out in the water column, in suspended mariculture. This method of cultivation of mollusks has advantages (constant growth and nutrition of mussels, no sharp changes in external factors) and disadvantages (for example, weak muscle-closure valves). During transportation and storage of the Black Sea mussels,

there is a loss of intra-shell liquid, which results to the rapid death of mollusks. A new method for the preparation of commercial mussels has been developed, which combines the purification of live bivalves and the «training» of their muscle-closure. The basic principle of «training» is to simulate tidal phenomena with a 2 hours frequency for 1 day. The survival rate of «trained» mussels was more than 85% for 7 days. The proposed method can be recommended for use on industrial farms in the Black Sea region.

Key words: mariculture, mussels, Black Sea, cleaning, «training» of mollusks

## ***ASSESSMENT OF CARBOXAMIDE FUNGICIDES TOXICITY ON THE FRESHWATER CRUSTACEAN DAPHNIA MAGNA STRAUS***

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Materials are presented on the effect of two carboxamide fungicides, namely, bixafen and penflufen, on the zooplankton, in particular, *Daphnia magna* Straus. Penflufen is shown to be of middle toxicity while bixafen is highly toxic to the zooplankton. The action of carboxamides on biological parameters of cladocera was studied with the aim to quantify thresholds of sensitivity to fungicides. The survival rate, fecundity, abundance and biomass of daphnids are shown to decrease in the solutions with greater concentration of fungicides. Bixafen entering a fishery waterbody in concentrations exceeding 0,00005 mg/l may be more dangerous to the zooplankton than penflufen.

Keywords: daphnia, *Daphnia magna* Straus, fungicides, toxicity, survival, fecundity, abundance, biomass, age composition.

## ***THE CLARIFIED COHORT MODEL FOR THE BARENTS SEA COD STOCK ASSESSMENT***

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The SAM model is used for North-East Arctic cod stock assessment since 2017. The configuration for the model was agreed at the ICES special benchmark group. This configuration assumes the same properties of errors for all age groups within the same kind of surveys and in catch-at-age data. The results of the analysis show that for North-East arctic cod this assumption is not valid and for correct stock assessment a more detailed specification of variances is required. This is caused by significant change in age structure of the cod stock in recent years towards higher portion of elder age groups. The clarified model options described here had resulted in significant improvement of assessment diagnostics and more precise results of North-East Arctic cod stock assessment.

Keywords: stock assessment, North-East Arctic cod, SAM model, Akaike's information criterion, standard deviations of residuals.

***THE SNOW CRAB FISHERY STATISTICS IN THE RUSSIAN SEAS: ATTEMPT  
OF THE CORRECTED ASSESSMENT APPLICATION***

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Dynamics of the snow crab stocks from different Russian seas is given for the period 2013–2018. The stocks assessments were made by the original algorithm which allows to correct data of research surveys by fisheries statistics (corrected stock assessment). Algorithm application to cases of both fisheries in spatially isolated patches and years of missed research surveys are examined particularly. Generally the difference between the data of representative research surveys and corrected stock assessments are not great. If the yield exceed 40 percent from the available stock the last trends to reduce next year.

Keywords: fisheries, catch per effort (CPUE), stock assessment, snow crab, general linear models, traffic-light method, TAC