**Bulletin 50**

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| УДК 502.3(571.63)  **K.Yu. Kirichenko, A.S. Kholodov, I.A. Vakhniuk, D.S. Gusev,  A.V. Kiryanov, V.A. Drozd, K.S. Golokhvast**  **RESEARCH OF AIR POLLUTION WITH FINE COAL DUST (NAKHODKA, PRIMORSKY KRAI)**  The study results of atmospheric air pollution with suspended coal dust particles in Nakhodka are discussed in the article. Using a combination of advanced analytical techniques the measurements of their quantitative and mass concentrations in the air basin were made. The coal dust particle size distribution in the snow samples selected in 2018 and 2019 from different parts of the town was detected and analyzed, and their morphological characteristics were investigated. On the basis of the study results, a map-scheme of coal dust distribution from the source of pollution was plotted. The obtained results indicate significant coal dust content in the atmospheric air of the territories adjacent to the coal terminals.  **Key words:** atmospheric suspensions, atmospheric air pollution, PM, coal dust, microparticles, Nakhodka, Prymorsky Krai.  *DOI: 10.17217/2079-0333-2019-50-6-13* |
| УДК 664.8.037.5  **V.D. Bogdanov, A.A. Simdiankin, A.V. Nazarenko**  **INVESTIGATION OF CRYOSCOPIC TEMPERATURES AND WATER FREEZING PROCESS IN COMMERCIAL HYDROBIONTS TISSUES**  The values of cryoscopic temperatures during the freezing processes research of commercial hydrobionts organs and tissues were determined. They were: −0,3ºC for cucumaria; −0,4ºC for Pacific herring milt; −1,0ºC for squid; −1,8ºC for octopus skin. It is established that the cryoscopic temperature depends on water content in the studied objects: the more water, the higher the temperature. The water freezing process in the studied tissues of hydrobionts is also associated with water content in them: the higher the content, the more intensively and deeply hydrobionts tissues are dehydrated during freezing. In addition, at initial stages this process depends on the cryoscopic temperature, the lower it is, the slower the freezing water process. During cryoprocessing the purpose of freezing is to prepare hydrobionts tissues to subsequent technological processes – the cryo-crushing and freeze-drying. Their efficiency increases when water is transferred from liquid to solid or crystalline state. In this regard, the rational freezing temperature can be a temperature of 25ºC below zero, when about 90% of the water contained in the studied hydrobionts tissues is frozen. The derived mathematical equations of temperature dependence on the freezing time and of frozen water amount on the temperature can be used to calculate the water raw materials cryoprocessing and hardware design.  **Key words:** milt, squid, octopus, cucumaria japonica, cryo-processing, freezing curves, cryoscopic temperature, frozen water.  *DOI: 10.17217/2079-0333-2019-50-14-21* |
| УДК [663.5:634.7+582.272.46](571.66) M.V. Blagonravova **DEVELOPMENT OF WATER-ALCOHOL EXTRACTS TECHNOLOGY FROM VEGETABLE RAW MATERIALS OF KAMCHATSKY KRAI**  The study data of water-alcohol extracts from plant raw materials of Kamchatsky Krai such as pine needles, wild berries, Ivan tea and brown algae are presented in the article. The results of determining the content of extracted substances in infusions obtained by using different concentrations of ethanol in water are discussed. It is shown that the optimal concentration of alcohol in infusions is 40%. It is established that the maximum extraction can be achieved with the use of hydromodule 1 : 4 during 7 days. The technological scheme of infusions preparation is developed. The results of determining vitamin C, iodine and mass concentration of organic acids content in the obtained water-alcohol extracts are presented. The high biological value of infusions is shown. The results of their organoleptic studies are presented.  **Key words:** water-alcohol extracts, extractives, extracts of Kamchatka berries, kelp extract, chemical indicators, extractives content, vitamin C, iodine, acids.  *DOI: 10.17217/2079-0333-2019-50-22-30* |
| УДК 664.649  **G.P. Lamazhapova, E.V. Syngeeva, E.B. Bitueva**  **EXPERIMENTAL EVALUATION OF HYPOLIPIDEMIC AND ANTIOXIDANT EFFECT  OF BREAD ENRICHED WITH OMEGA-3 ACIDS**  The bread enriched with omega-3 polyunsaturated fatty acids (PUFAs) by adding liposome formulations  to PUFA concentrate was developed. It was found that consumption of fortified bread by animals led to a normalization of the serum lipid profile (lowering total cholesterol, triglycerides, low and very low density lipoprotein cholesterol fractions and increasing high density lipoprotein cholesterol fraction) compared to those animals, which fed bread without additives, after alimentary dyslipidemia caused in both of them. When using a diet with enriched bread, the level of harmful oxidation products (diene conjugates and malondialdehyde) in blood plasma, erythrocytes and liver decreased. Based on the research results, it can be stated that bread enriched with omega-3 fatty acids is a functional product with a pronounced lipid-lowering effect.  **Key words:** omega-3 polyunsaturated fatty acids, bread, functional nutrition, lipid profile, alimentary dyslipidemia, antioxidant effect.  *DOI: 10.17217/2079-0333-2019-50-31-37* |
| УДК 664-4:634.11  **N.B. Eremeeva, N.V. Makarova, E.A. Eliseeva**  **ASSESSMENT OF ORGANOLEPTIC AND PHYSICAL AND CHEMICAL  PROPERTIES OF EDIBLE GLASSES BASED ON APPLE RAW MATERIALS WITH VARIOUS FILLERS: DRIED SNEPS, NUTS, SEEDS AND CEREAL FLAKES**  At present, edible films and edible coatings for food products, which are a natural biodegradable material, have gained popularity as barrier factors. Edible utensils are a way to reduce the waste of traditional packaging materials. The technology for the production of edible glasses with fillers such as dried squid, dried fish, crackers, pistachios, peanuts, pumpkin seeds, sunflower seeds, oat flakes, rice flakes, buckwheat flakes was developed. Edible glasses are obtained on the basis of one of the most common types of fruits – apples. A study of their organoleptic characteristics (appearance, color, taste, aroma, chewability), surface microstructure, packaging to water and other food-grade liquids, and their ability to absorb water showed that edible glasses based on apple raw materials are quite acceptable for practical use. Despite of the microcracks and voids found in their walls, they have high characteristics of resistance to the damaging effects of water, food liquids and high temperatures.  **Key words:** edible glasses, apples, fillers, moisture, stability, water absorption.  *DOI: 10.17217/2079-0333-2019-50-38-45* |
| УДК 528.272.46(265.53)  **T.A. Klochkova, A.V. Klimova, N.G. Klochkova**  **DISTRIBUTION OF *ALARIA ESCULENTA* (PHAEOPHYCEAE, LAMINARIALES)  IN THE SEA OF OKHOTSK**  This paper continues a series of our publications on the phylogeny of kelp species from the Russian Far East and discusses the molecular-phylogenetic data on *Alaria* species collected from the northern Sea of Okhotsk on its eastern and western coasts. Analysis of specimens from the Sea of Okhotsk showed their high genetic similarity with *Alaria* from the southeastern Kamchatka and with *Alaria esculenta*, which is widely distributed in the northern hemisphere, especially with its population from Spitsbergen. In our molecular-phylogenetic tree, species *Alaria crispa* positioned between the clades of Asian and Atlantic populations of *A. esculenta*; however its taxonomic status has not beed precisely determined. In this regard, until being clarified, *Alaria* representatives from the northern Sea of Okhotsk should be considered as *A. esculenta* s.l. Based on our molecular-phylogenetic data, species *Alaria marginata* seems to be absent from the northern Sea of Okhotsk and should be considered as a representative of the American marine flora. In Russian Far East, revision of the genus *Alaria* can be complete only after molecular survey of all species described in this region. Moreover, specimens collected from the type localities should be analysed, which are the Commander Islands for *Alaria praelonga, Alaria angusta* and *Alaria taeniata*, southeastern Sakhalin for *A. okhotensis*, and St. Lawrence Island for *A. crispa*. Without analyses of specimens from the type localities, it is not possible to understand the intraspecific differentiation of the genus *Alaria[[1]](#footnote-1)1***1**.  **Key words:** *Alaria esculenta* s.l., Laminariales, western Kamchatka, molecular phylogeny, northeast coast of the Sea of Okhotsk.  *DOI: 10.17217/2079-0333-2019-50-46-56* |
| УДК 574.587(265.54)  **S.G. Korostelev, E.A. Arkhipova, L.V. Romeyko, P.A. Fedotov, R.Y. Taganova**  **GROUND FAUNA FODDER BIOMASS AND ITS DISTRIBUTION ON THE SHELF OF SOUTHEASTERN KAMCHATKA AND THE NORTHERN PART OF THE AVACHA BAY**  The study results of species composition, spatial distribution, density of potential prey settlement for demersal fish species, crabs and craboids of southeastern Kamchatka shelf and the Northern part of the Avacha Bay in 2002. The total number of forage benthos on southeastern Kamchatka shelf amounted to 58 species of polychaetes (class Polychaeta), 28 species of molluscs (classes Gastropoda and Bivalvia), 23 species of crustaceans (mainly order of Amphipoda), 3 – echinoderms (classes Echinoidea and Ophiuroidea), and in the northern part of the Avacha Bay – 34 species of polychaete worms, 18 species of molluscs, 18 species of crustaceans, 3 – echinoderms. It is shown that the average forage biomass of the bottom fauna in southeastern Kamchatka shelf was 94,4 g/m2, the average density of the settlement was 256,5 g/m2, and in the northern part of the Avacha Bay, respectively, 112,0 g/m2 and 191,6 copies /m2.  **Key words:** southeastern Kamchatka, the Avacha Bay, fodder zoobenthos, shelf, Polychaeta, Mollusca, Crustacea, Echinodermata, density of the settlement, biomass.  *DOI: 10.17217/2079-0333-2019-50-57-72* |
| УДК 639.2"2003-2018"(265.5)  **P.M. Vasilets, D.A. Terentyev, A.A. Matveev**  **THE STRUCTURE OF CATCHES IN DIFFERENT TYPES OF FISHERY ACCORDING TO OFFICIAL STATISTICS AND RESEARCH WORKS IN KARAGINSKAYA SUBZONE IN 2003–2018**  The species structure of catches in the main types of fisheries (excluding salmon fishing) in Karaginskaya subzone was analyzed according to the sectoral monitoring system (OSM) of the Federal Agency for Fishery and according to scientific research in 2003–2018. It was found that with the exception of bottom trawling, the significant difference in the assessment of the qualitative and quantitative composition of catches according to OSM and scientific research in the study area is not observed. The tables of probable species extraction in different areas of crabs and fish catching are presented. Most amount of possible by-catch to the «main» types of fishing are supposed in conducting Danish seine and bottom trawling. The results of the analysis can be the base of fishing licensure, which include the whole complex of fish species presented in the catches of a certain fishing gear.  **Key words:** Karaginskaya subzone, fishery, Danish seine, variable-depth trawl, bottom trawl, ground line, demersal fish species, invertebrates, multi-species fishing.  *DOI: 10.17217/2079-0333-2019-50-73-88* |
| УДК [574.62:597.552.511](265.53)  **L.I. Izergin**  **JUVENILE CHUM SALMON DISTRIBUTION CHARACTERISTICS  IN THE MIXOGALIN OLA LAGOON (THE TAUI BAY, THE SEA OF OKHOTSK)**  The study results of Pacific salmon juveniles distribution in the estuary zone of the Ola River in summer 2004 are discussed. The material for the study was based on the data of a Pacific salmon juveniles quantitative distribution survey and on the data of hydrological and hydrochemical studies. The collection of ichthyological material was carried out by means of a fry Seine. Abiotic characteristics such as temperature, salinity, electrical conductivity and turbidity were determined on 20 sites of the Olsky lagoon. During comparative study of changes in environmental factors and quantitative accounting of fish the regularities of juvenile chum salmon distribution in the estuary zone of the Ola river were revealed. It is noted that the juvenile chum salmon distribution depends on the influence of abiotic factors, and for fish at different stages of stratification, different abiotic indicators are decisive. At the stage of presmolts chum salmon juveniles are quite sensitive to salinity, later – to temperature, causing a decrease in the amount of dissolved oxygen. Stratified juveniles prefer sea salinity and are no longer found at 25‰ and below.  **Key words:** Oncorhynchus keta, juvenile salmon, smoltification, early sea period, smolt habitat, the Ola lagoon, the Sea of Okhotsk.  *DOI: 10.17217/2079-0333-2019-50-89-97* |
| УДК 591.46:597.541  **N.P. Sergeeva, A.A. Bonk**  **SOME PATTERNS OF GONAD DEVELOPMENT OF KORF-KARAGIN IMMATURE HERRING**  The dynamics of the size and weight of the gonads, gonadosomatic index during the period of juvenile herring development inhabiting in the Korfo-Karaginsky region which is located near the eastern coast of Kamchatka is analyzed. The size structure and germ cells condition of immature females of different age groups are considered. The histological studies have shown that yearlings oocytes reach the first or the third stage of cytoplasmic growth, but two and three year old individuals – the fourth stage. It was shown that vitellogenic oocytes of the vacuolization phase are formed before maturation. After this, yolk granules begin to form in oocytes. The vacuolization phase of the cytoplasm of Korf-Karaginskaya herring lasts 8 months from October-November till May-June.  **Key words:** yearlings, immature individuals, gonads, biological indicators of herring, oocytes, diameter, development stage.  *DOI: 10.17217/2079-0333-2019-50-98-108* |
| УДК [591.3:639.2.03:597.551.2](282.256.86)  **Y.N. Chekaldin, A.A. Smirnov, S.I. Chebykin**  **FEATURES OF EMBRYONIC AND JUVENILE DEVELOPMENT OF RED-SIDED** **SUCKER (*CATOSTOMUS CATOSTOMUS ROSTRATUS*) IN THE KOLYMA RIVER.  EXPERIENCE OF RED-SIDED** **SUCKER CAVIAR ARTIFICIAL INCUBATION**  Siberian red-sided sucker (*Catostomus catostomus rostratus*) is widespread in the Kolyma River, has commercial value and is one of the promising objects of fishery. It also relates to the species which are perspective for the artificial breeding to trade and to compensate the damage to the fish resources, made during building of two HES on the Kolyma River. Basic experiences on improving the methods and ways of the red-sided sucker artificial breeding they were carried out from the 1st till the 30th of June 1994. The capture of breeders was realized by stationary nets and river-bed traps in the average flow of the Kolyma River lower than Seymchan Settlement at 230 km. In the course of this species studying it was established that the spawning occurs in the first decade of June with water temperature of 11–12ºС. The incubation period of caviar is 12–14 days. The transition of larvae to self-feeding begins at the age of 10–12 days. It is shown that red-sided sucker, in contrast to the whitefish and the grayling, passes the stage of the pigmentation of eyes, painting the regular elements of the blood, formation of jaws after hatching. The absence of pigmentation was the characteristic feature of the embryos of red-sided sucker. It appears on the seventh day the after the hatching larvae begin to feed independently.  **Key words:** red-sided sucker, Kolyma, spawning, roe, incubation, artificial breeding, temperature, pigmentation.  *DOI: 10.17217/2079-0333-2019-50-109-117* |
| УДК 556.555.8:591.524.11(470.56)  **A.A. Shayhutdinova**  **EVALUATION OF ECOLOGICAL STATE OF ZHETYKOL AND OBALYKOL LAKES  OF REGIONAL BIOLOGICAL RESERVE “SVETLINSKAYA” ON STRUCTURAL  AND FUNCTIONAL INDEXES OF MACROZOOBENTHOS**  Data of studying macrozoobenthos of reservoirs of regional biological reserve “Svetlinsky” (Svetlinsky district, Orenburgskaya oblast) on hydrobiological indicators are discussed. By spring 2019, the water level in Zhetykol and Obalykol was close to the minimum marks; Davlencol, Small Obalykol, Caracol Lakes completely dried up. Decomposition products of macrophytes (sulfate-anion, ammonium ion, phenol) and critically low concentration of dissolved oxygen (below 30% of saturation) were observed in the waters of Zhetykol and Obalykol Lakes. The fauna of lakes macrozoobenthos is represented by five species belonging to five genera and two families of the order Diptera. The reason for such low biodiversity is an acute shortage of oxygen, which oppresses the oxyphilic representatives of macrozoobenthos. The conducted studies show that euryoxide forms of chironomids such as larvae of *Chironomus riparius* and *Chironomus plumosus* dominate in these lakes. Their number can reach 54,2 and 81,1%, and biomass is 55,7 and 80,0%, respectively. Both species are able to inhabit all studied water bodies, including highly polluted ones with a low content of dissolved oxygen in the water. According to the results of water quality assessment with the help of Woodiwiss and Mayer biotic indices, the water in Zhetykol and Obalykol Lakes is characterized as highly polluted.  **Key words:** macrozoobenthos, biodiversity, *Chironomus riparius*, *Chironomus plumosus,*  eutrophication, Zhetykol Lake, Obalykol Lake, protected area.  *DOI: 10.17217/2079-0333-2019-50-118-122* |

1. 1 This study was supported by the grant from Russian Foundation for Basic Research (RFBR) (project № 19-04-00285 А). [↑](#footnote-ref-1)