

## **FISHERY DEVELOPMENT PROSPECTS IN THE LAKE KRONOTSKOE BASIN, KAMCHATKA PENINSULA**

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Worldwide experience of fish ladders construction as well as juveniles' downstream migration through dangerous river sections is discussed in respect for artificial *Oncorhynchus nerka* stock creation for Lake Kronotskoe basin. Basic dimensional parameters of fish ladder were estimated for the Lake Kronotskoe basin according to the recent experience in salmonid ladder building and operation. The assessed parameters are distant to previously proposed ones by TINRO, LenHydroProject, HyproPromRiba. No similar scaled project were realized anywhere in the World. The wide ranges of the complicate issues which are doubt to realize in the current project are determined consequently rising a necessity of the long-term investigations. Ecosystem transformation predictions define the degradation of unique fish fauna after the anadromous Pacific Salmon introduction. The basic ground for the contemporary endemic fauna usage without the anthropogenic impact is suggested in conclusion.

*Keywords:* fish ladder, hydro-engineering, sockeye salmon, *Oncorhynchus nerka*, charrs, *Salvelinus*, biodiversity, Kamchatka.

## **STATE OF FISH COMMUNITY IN ILMEN LAKE UNDER INTENSIVE FISHERY PRESSURE**

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Data on the current commercial catches of Ilmen Lake are presented. It is found that fishery significantly effect on the formation of the fish community core. At present blue bream is the main commercial species in Ilmen Lake. Rejuvenation of the commercial stock of pikeperch is found. In the catches, the share of young pike (2–3 years old) increases. Nevertheless, there is a steady tendency to increase the annual catch mainly due to minor commercial species (blue bream, roach, sabre fish, silver bream). In the current market conditions fishery, first of all, is aimed to extract the most valuable species in the fish community, such as pikeperch and pike. It results in these species number decrease. These problems are based on the lack of a clear management in fishery industry and effective control over the use of fish resources.

Unsettled relations, absence of operational control mechanisms, and controversial nature of norms do not contribute to the conservation and reproduction of aquatic biological resources. It results in braking in the development of the fishing industry, forcing fishing organizations to violate a law that initially designed to protect the interests of fishermen.

*Keywords:* fish community, fishing pressure, number of commercial stock, rational use, Ilmen.

**SEASONAL VARIABILITY OF BIOLOGICAL AND HEMATOLOGICAL  
CHARACTERISTICS OF MATURE INDIVIDUALS OF THE BLACK SEA  
SHEMAYA *ALBURNUS MENTO* (CYPRINIDAE) FROM THE DON PART  
OF THE POPULATION**

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The results of multi-annual research studies of the pre-spawning biological and hematological characteristics of mature individuals of the Black Sea shemaya *Alburnus mento*, which perform anadromous migrations to the Don River in the autumn season, are presented. This species is valuable in the Azov ichthyofauna and is in the Red List of Threatened Species of the Russian Federation and the Rostov Region. Average fecundity rate of the shemaya females in the autumn anadromous migration in the pre-spawning period (22,2 thousand pcs) and the content of first-generation oocytes (31,1%) were found out. It is shown that, in the pre-spawning period, the average body weight was 125,9 and 101,9 g. body length was 21,1 and 19,5 cm, and the gonadosomatic index (GSI) was 6,3 and 3,3% for females and males respectively; it means that this species exhibits sexual dimorphism in terms of some characteristics. Relation between females fecundity and their length and weight has been estimated. Variability of the biological and hematological characteristics of individuals from the period of autumn anadromous migration to the pre-spawning period has been analyzed; verifiable increase in the gonad mass, GSI, the number of first-generation oocytes, and female fecundity has been recorded, as well as decrease in the overall body weight of the individuals of both sexes. The conclusion was made that the seasonal variability of biological and hematological characteristics gives evidence of the process of reproductive products formation and of the preparation of mature individuals to spawning, despite long period of retention (5–6 month) in the pond environment of rheophilic fish farms, which differs from the natural environment. It indicates high adaptive capacity of the individuals of this species, as well as the possibility to use shemaya individuals from autumn migration for the purposes of artificial reproduction.

*Keywords:* the Black Sea shemaya *Alburnus mento*, the Azov and Don Region, anadromous

migration, weight, length, gonadosomatic index, oocytes of different generations, fecundity, sexual dimorphism, hematological characteristics.

## **STATUS OF FOOD RESOURCES FOR BENTHOPHAGOUS FISH IN THE SEA OF AZOV**

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The paper considers the quantitative and qualitative characteristics of benthic food and its distribution in the Sea of Azov in 2015. In the sea proper, the bulk of available food is comprised of mollusks, mainly, *Cerastoderma glaucum*, *Mytilaster lineatus*, *Abra abra segmentum*, small hydrobiids and polychaetes *Alitta succinea* and *Hedister diversicolor*. In the central and eastern parts of the Taganrog Bay the community of *Nereidae* and the intruder *Marenzelleria* sp. has formed a highly productive zone for the feeding of benthophagous fishes and their young. At the present time, out of benthic fish species only round goby stocks are of commercial value. The increase in the salinity of the Azov Sea waters has caused a reduction in the habitat area of semi-migratory fish (in particular, bream and roach). All sturgeon species do not represent commercial targets. Efficient use of feed resources is directly dependent on their availability. Given the low amounts of commercial stocks of benthophagous fishes and their poor natural reproduction, we can say that there has been sufficient food for the young and mature fish of main commercial species.

*Keywords:* Sea of Azov, zoobenthos, food biomass, bivalve mollusks, polychaetes, invasive species, distribution of benthos-eating fish.

## **PRACTICE OF RESEARCH AND FORECASTING OF BIOMASS OF SNOW CRAB *CHIONOECETES OPILIO* OF THE SOUTHERN PART OF PRIMORYE SUBZONE**

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In this paper, the current state of the snow crab *Chionoecetes opilio* stocks in the Primorye subzone to the south of Cape Zolotoj is described and its research methodology is given. Abundance restoration dynamics of functional groups during the fisheries ban period is considered. Commercial stock is estimated at a level of 45 million individuals, which is the historical maximum for this subzone.

*Keywords:* snow crab, sub-zone of Primorye, terminal moulting, stock, fishery.

**ON THE MINIMUM COMMERCIAL COD SIZE *GADUS MORHUA CALLARIAS*  
IN THE BALTIC SEA**

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The paper discusses the need to reduce the minimum commercial size of cod (*Gadus morhua callarias*) caught in the exclusive economic zone and territorial sea of Russia in the ICES Subdivision 26 of the Baltic Sea in connection with the structural changes in the population of the Eastern Baltic cod in the recent years. The analysis of the size-by-age composition of the stock and the physiological condition of cod for the period 1992–2016 was conducted. Based on the values of the parameters of life expectancy and body size, as well as the parameters of the growth model of Bertalanffy, the natural mortality of cod by periods is estimated by different methods. The dominance in the stock of mature small-sized individuals is determined. It is recommended to reduce the minimum commercial size of cod from 38 cm to 35 cm.

*Keywords:* Baltic Sea, cod, minimum commercial size, maturation, natural mortality.

**ON THE QUESTION OF THE USAGE OF THE MULTI-PURPOSE RESERVOIRS  
IN THE UPPER OKA RIVER BASIN FOR THE PURPOSES OF AQUACULTURE**

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The article presents the results of the cadastral fishery survey of the group of instream ponds and lakes of various origin, located within the boundaries of individual municipal districts of Moscow, Tula and Ryazan regions in summer, 2017. The comparative fishery characteristics of the water bodies based on the complex of morphometric, hydrochemical, hydrobiological and ichthyological indicators are provided. The potential usage of this group of water bodies for the purposes of pasturable aquaculture, based on the results of the appraising by the series of fish-кyфкшпn parameters is discussed.

*Keywords:* bodies of water of complex purpose, instream ponds, floodplain lakes, grazing, aquaculture, bonitirovka rating.

**STRUCTURE OF PHYTO- AND MEROPLANKTON IN THE MARINE FARM  
AREA ON THE BACKGROUND OF DIFFERENT HYDROLOGICAL AND  
HYDROCHEMICAL CONDITIONS (THE BLACK SEA, SOUTH COAST OF  
CRIMEA, BLUE BAY)**

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The complex of monthly environmental studies was carried out in the period from March 2010 to March 2012 in the area of mussel-oyster farm (Blue Bay, South Coast of Crimea). Features of the interannual and seasonal variability of hydrological and hydrochemical characteristics were examined and their effect on the state of phyto- and meroplankton was revealed.

Extremely high values of water temperature observed in the 2010. Summer period of 2011 was distinguished by the intensification of coastal upwelling. The hydrochemical regime was characterized by a good aeration of the water column, the absence of suffocation phenomena and a low content of biogenic elements. During the observation period, 168 species and varieties of microalgae belonging to 9 divisions, 85 genera were found; larvae of 49 species of benthic invertebrates were identified. It was concluded that the studied parameters were optimal for the development of aquaculture of bivalves.

*Keywords:* mussel-oyster farm, thermohaline structure, dissolved oxygen, biogenic elements, phytoplankton, meroplankton.

## **ON APPLICATION OF THE DEPLETION MODELS FOR THE COMMERCIAL CRABS STOCKS ASSESSMENT**

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The daily commercial catches in the four tanner crab (*Chionoecetes bairdi*) populations were used for initial stock assessment by the Leslie's method. It was shown that estimated stock indexes depended on the observations number. To overcome this uncertainty the new algorithm is suggested. It includes data standardization with account of the "ship factor", use of polynomial of the 3d degree for objective choose of the basic observations number with consequent calculation of regression coefficients, removing of doubtful variants at all stages of the calculations. The results of the estimations are compared with the data received both by surveys and by previously published algorithms. The concept of an available commercial stock is discussed.

*Keywords:* *Chionoecetes bairdi*, Sea of Ohotsk, Leslie model, stock assessment.

## **THE INJECTION OF OMEGA 3 FATTY ACID INTO MUKSUN LARVAE FEED**

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Here you can find the results of our research about mucksun larvae growing on artificial feed which

included Docosahexaenoic acid (DHA) and Eicosapentaenoic acid (EPA). It is shown, that additional injection of DHA and EPA into feed significantly rises levels of DHA and EPA in fatty acid compositions of neutral lipids and phospholipids of larvae. Young muksuns, which got rich in fatty acids feed, finally had 3,5 higher DHA level and 7 times higher EPA level in neutral lipids, and also 2 times higher DHA level and 3 times higher EPA level in phospholipids of larvae in comparison with larvae which consumed control feed.

*Keywords:* artificial feed, fatty acids, DHA, EPA, Omega 3 fatty acid, larvae, muksun.

**IN MEMORY OF BORIS NIKOLAEVICH KOTENEV**

**(05.10.1939–26.10.2018)**

An outstanding Russian scientist, Dr. Boris N. Kotenev died on 26 October 2018.

A kind and bright man passed away. He was a dedicated scientist and leader, and a modest worker with giant merits in national and world fisheries science.