

**Russian Bibliography of 2011-2012 Publications Linked to the Current NPAFC
Science Plan**

by

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Russian Bibliography of 2011-2012 Publications Linked to the Current NPAFC Science Plan

ABSTRACT

The bibliography lists original papers and documents published during 2011-2012 by Russian scientists and their collaborators relevant to the 2011-2015 NPAFC Science Plan. The bibliography lists 134 papers, corresponding to the five key research components of the NPAFC Science Plan.

INTRODUCTION

The Science Sub-Committee of the North Pacific Anadromous Fish Commission (NPAFC) developed a five-year Science Plan (2011-2015). The plan includes five components: 1) Migration and survival mechanisms of juvenile salmon in the ocean ecosystems; 2) Climate impacts on Pacific salmon production in the Bering Sea (BASIS) and adjacent waters; 3) Winter survival of Pacific salmon in the North Pacific Ocean; 4) Biological monitoring of key salmon populations; and 5) Development and application of stock identification methods and models for management of Pacific salmon.

The current bibliography lists original papers and documents published during 2011-2012 by Russian scientists and their collaborators relevant to the 2011-2015 NPAFC Science Plan. The bibliography lists 134 papers, corresponding to the five key research components of the NPAFC Science Plan. Each publication is listed under one research component, although some of them are relevant to several components. The references were given with abstracts if papers included abstracts in English. Otherwise, they listed without abstracts.

BIBLIOGRAGHY

COMPONENT 1: MIGRATION AND SURVIVAL MECHANISMS OF JUVENILE SALMON IN THE OCEAN ECOSYSTEMS

Koval, M.V. and V.V. Kolomeytsev. 2011. Specifics of hydrological conditions and juvenile salmon feeding in the waters off West Kamchatka in July 2011. Bulletin of Pacific salmon studies in the Russian Far East 6: 202–209 (In Russian).

Maznikova, O.A. 2012. Results of estimation of juvenile chum salmon abundance in the southern Okhotsk Sea in fall 2012. Bulletin of Pacific salmon studies in the Russian Far East 7: 225-227 (In Russian).

Yerokhin, V.G. and A.V. Klimov. 2011. On the relation between migrations of juvenile pink and chum salmon and physiological conditions of the fish. Bulletin of Pacific salmon studies in the Russian Far East 6: 271–274 (In Russian).

Yerokhin, V.G., A.V. Klimov, and A.P. Lozovoy. 2011. Results of trawl surveying autumn juvenile Pacific salmon abundance in the Okhotsk Sea waters adjacent Kamchatka in 2011. Bulletin of Pacific salmon studies in the Russian Far East 6: 118–120 (In Russian).

COMPONENT 2: CLIMATE IMPACTS OF PACIFIC SALMON PRODUCTION IN THE BERING SEA (BASIS) AND ADJACENT WATERS

Volkov, A.F. 2012. Mass development of *Themisto libellula* in the northern Bering Sea: invasion or bloom? *Izv. TINRO* 168: 142-151 (In Russian with English abstract).

Mass appearance of the large-sized hyperiid *Themisto libellula* is noted both in the western and eastern parts of the Bering Sea in 2007-2011 when it became dominant in the diet of salmon, pollock, herring, and some other nekton species. These years belonged to the relatively long (6 years) cold period with low water temperature and high values of ice cover, partially reasoned by weakening of water exchange with the Pacific and inflows of cold waters from the north. *Themisto libellula* is typical for cold-water areas and can penetrate with cold water streams far southward, where, being a short-span fast-growing species, it is able to grow rapidly in favorable environmental conditions and keep for a time its high abundance. This dynamics is usual for the species successively introduced into new habitats. After "worsening" the conditions, i.e. after restoration of water exchange between the Bering Sea and Pacific Ocean and water temperature heightening, the southern range of this species retreats back to the north and it disappears completely from south areas where it dominated recently. Taking into account some regularities of cold and warm periods interchange, known from observations in several last decades, the new warming in the Bering Sea could be expected in the next year or two. The water regime reconstructions influence on several mass zooplankton species in the Bering Sea, but the abundance of *T. libellula* has the most prominent fluctuations, so this species could be used as a biological indicator of climate changes in the Bering Sea.

Volkov, A.F. 2012. Results of zooplankton research in the Bering Sea under NPAFC program (expedition BASIS). Part 1. Eastern areas. *Izv. TINRO* 169: 45-66 (In Russian with English abstract).

Data on zooplankton in the eastern Bering Sea are presented. The samples were collected and

processed by planktonologists of Pacific Fish. Res. Center (TINRO) aboard the U.S.A. research vessels in the summer-autumn of 2003-2011. The period is divided on the basis of bottom temperature, SST, and sea ice cover to "warm" (2003-2006) and "cold" (2007-2011) years. The shift from warm to cold regime caused increasing of total zooplankton abundance, in particularly offshore where it became higher in more than three times, exclusively because of the large-sized faction growth which included mainly chaetognaths *Sagitta elegans* (49-52 % of its biomass), copepods *Calanus marshallae* (39 %) and *Eucalanus bungii* (26 %) Abundance of euphausiids, mysids, and hyperiid pteropods increased, as well, but the decapods (crabs and shrimps larvae) and coelenterates abundance decreased. Vast area with heightened biomass of the large-sized zooplankton, mostly chaetognaths and copepods, formed in the southern part of the shelf, including the coastal zone; besides, dense concentrations of euphausiids and amphipods were observed locally in the cold years. Biomass of the main large-sized species, as *Calanus marshallae*, *Neocalanus flemingeri*, *N. cristatus*, *Eucalanus bungii*, *Thysanoessa raschii*, *Themisto libellula*, *Limacina helicina*, *Sagitta elegans* increased significantly in the cold years, though this increasing went by different ways in different areas. However, abundance and spatial distribution of small-sized and medium-sized zooplankton almost had no changed between the warm and cold years, though some changes in its species structure occurred: the dominance of *Pseudocalanus newmani* changed for *Oithona similis* and abundance of neritic species (*Centropages abdominalis*, *Eurytemora herdmanni*, *Acartia longiremis*, cladocerans, and meroplankton: larvae of *Cirripedia*, *Bivalvia* and *Polychaeta*) became lower, down to almost disappearance in 2011. A new species -the hyperiid *Themisto libellula* appeared in the plankton of both eastern and western parts of the Bering Sea after the regime shift, with a certain lag: it penetrated to the eastern Bering Sea with cold waters from the north. It seems that this species reacts to new warming earlier than other ones: it vanishes immediately with stopping of the cold waters propagation, so it practically disappeared from the plankton and fish diet in 2011, although other cold-water species still did not had any visible changes. Apparently, the end of the cold period could be expected in 2012, but there is rather difficult to predict the changes in the plankton community.

Volkov, A.F. 2012. Results of the studies on zooplankton in the Bering Sea under NPAFC program (expedition BASIS). Part 2. Western areas. Izv. TINRO 170: 151-171 (In Russian with English abstract).

The data on zooplankton in the western Bering Sea obtained in 1986-2011, including the period of BASIS program (in total 3756 stations) are analyzed. Thermic conditions of each year are characterized by the values of ice cover. The species are revealed which abundance has been significantly different between "warm" and "cold" years. There are 12 heat-loving species and only 1 cold-loving one among the species of the small and middle size fractions; in the large-sized fraction there are 4 heat-loving species and 2 cold-loving species. Abundance of early stages and the species with a short life span (< 1 year) is more influenced by environments than abundance of long-living (> 1 year) species that are usually large-sized; that's why euphausiids and chaetognaths are absent among the environment-dependent species. Hyperiid *Themisto libellula* has the most noticeable changes of its abundance: it became abundant in "cold" years and disappeared in "warm" years with 4-5 years intervals, the same as in the eastern Bering Sea. The list of 20 major species in each fraction was constant during the whole studied period: the bulk of biomass (75 %) was formed by only 2 species in the small-sized fraction, by 3 species in the medium-sized fraction, and by 4 species in the large-sized fraction; in general, the first 10 species formed 94-100 % of the total zooplankton biomass. Both the total biomass and the biomass of size fractions increased in 1992-2001 and decrease recently, but the biomass of Amphipoda increases because of high abundance of the above-mentioned *T. libellula* in recent years. General state of zooplankton, as food base for planktivores, is estimated as stable and satisfactory.

Zavolokin, A.V. 2011. Comparative Characteristics of Food Supply of Pacific Salmon (*Oncorhynchus* spp.) in the Bering Sea from 2002 to 2006. *Journal of Ichthyology*. 51(3): 227-239. (In English).

Based on complex epipelagic surveys in the western Bering Sea, a comparative analysis of food supply of Pacific salmon (*Oncorhynchus* spp.) was conducted in summer and fall from 2002 to 2006. Nine indirect indices of food supply used in the study were as follows: feeding similarity, width of the feeding spectrum, diet feeding ration, diet feeding rhythms, fraction of accessory food in the ration, growth rate of the fish, abundance of food resources, and abundance of salmon. The food supply of salmon is lower in summer 2003 and fall 2006 in comparison to the food supply in other years of the study. However, well expressed feeding selectivity, consumption of prey items of certain type, and small proportion of accessory food (copepods and chaetognaths) prevailed in plankton, suggests the presence of sufficient food resources for Pacific salmon in the western Bering Sea.

Zavolokin, A.V., and G.V. Khen. 2012. Decreases in abundance of immature Pacific salmon in the western Bering Sea from 2002 to 2011: link to hydrological and forage conditions. NPAFC Doc. 1398. 20 pp. (Available at www.npafc.org).

Changes in abundance and distribution of immature chum, sockeye, and chinook salmon in the western Bering Sea in summer and fall of 2002-2011 were studied in relation to hydrological and forage conditions. From early 2000s to 2011, abundance of immature Pacific salmon in the surveyed area greatly decreased. The main causes of this decrease probably were (1) changes of current intensity resulted in weakening of water inflow from Pacific Ocean to the northwestern Bering Sea and (2) fluctuations of the total number of immature salmon in the North Pacific. Forage and temperature conditions were likely to have had relatively small impact on migration intensity of salmon.

COMPONENT 3: WINTER SURVIVAL OF PACIFIC SALMON IN THE NORTH PACIFIC OCEAN ECOSYSTEM

Glebov, I.I., S.V. Naydenko., N.A. Kuznetsova, E.V. Kurenkova, A.A. Khoruzhiy, R.G. Ovsyanikov, K.V. Padchenko, and S.P. Dudkov. 2011. Composition and structure of epipelagic nekton and plankton communities in the Western parts of Subarctic frontal zone in Winter-Spring 2011 (Result of 2011 Research Cruise of R/V «TINRO»). NPAFC Doc. 1331 (Rev. 1). 28 pp. (Available at www.npafc.org).

The results of trawl survey on R/V TINRO in the western part of Subarctic frontal zone in Winter-Spring 2011 are considered. The data on abundance and biomass of nekton and jellyfish were received for two epipelagic layers: 0–30 m (<30 m depth) and 31–60 m. Data on vertical distribution of Pacific salmon during the winter-spring period in a layer 0–120 m is obtained. In 0–30 m epipelagic layer the overall pink and chum salmon abundance was estimated as 81.2 and 47.9 million fish, in 31–60 m epipelagic layer — 81.2 and 7.79 million fish respectively. These studies confirm, that in the conditions of vertical isothermy the salmon (mainly pink and small size chum salmon) uses nearly the entire upper hundred-meter layer during the winter-spring period. The spatial distribution and biological state of salmon in two epipelagic layers is considered in detail. The data on the composition and structure of plankton communities for two epipelagic layers 0–50 and 0–200 m is presented. The zooplankton biomass in winter-spring 2011 was lower than in 2010, but was up to standard 2009. It can be connected with distinctions of oceanological conditions during the period from February till April in 2009, 2010 and 2011.

Glebov, I.I., E.V. Strezhneva, S.V. Naydenko, S.P. Dudkov, N.A. Kuznetsova, and A.A. Horuzhiy. 2011. Pacific salmon in the western part of subarctic front in February-April 2011. Bulletin of Pacific salmon studies in the Russian Far East 6: 77-87 (In Russian).

Naydenko, S.V. and N.A. Kuznetsova. 2011. Trophic relationships and food supply of salmon in western North Pacific Ocean in winter-spring 2009-2011. Bulletin of Pacific salmon studies in the Russian Far East 6: 210-215 (In Russian).

COMPONENT 4: BIOLOGICAL MONITORING OF KEY SALMON POPULATIONS

Antonov, A.A., and Kim Khe Yn. 2011. Nutrition and feeding relationships of juvenile salmon of the genus *Oncorhynchus* in the Kura River of Aniva Bay (Sakhalin Island). Water life biology, resources, status and condition of inhabitation in Sakhalin-Kuril region and adjoining water areas: Transactions of the Sakhalin Research institute of Fisheries and Oceanography. Yuzhno-Sakhalinsk: SakhNIRO 12: 3-15 (In Russian).

Feeding of juvenile salmon of the genus *Oncorhynchus*: pink (*O. gorbuscha*), chum (*O. keta*) and masu (*O. masou*) salmon has been studied during their downstream migrations, The results of study added the data on juvenile salmon feeding in small rivers of southern Sakhalin. Pink and chum salmon juveniles appeared to be closest by their diet spectrum. Masu under yearlings are not active competitors in feeding of juvenile salmon with a short freshwater cycle.

Baranov, S.B. and Y.N. Khokhlov 2012. The research and harvest of Anadyr chum in 2012. Bulletin of Pacific salmon studies in the Russian Far East 7: 60 - 65 (In Russian).

Bazarkina, L.A., V.F. Bugaev, G.V. Bazarkin, and V.D. Sviridenko. 2012. Dynamics of hydrobiological processes, determined conditions of foraging for juvenile sockeye salmon in the pelagic zone of Azabachye Lake in 2006–2010. Collection of scientific articles «Researches of aquatic biological resources of Kamchatka and Northwest Pacific Ocean» 24: 5–29 (In Russian with English abstract).

Hydrological and hydrochemical regimes, dynamics of stock abundance and biomass of plankters, including crustaceans, which are dominant component in juvenile sockeye salmon feeding, were characterized on the base of hydrobiological studies, carried out in pelagic zone of Azabachye Lake in 2006–2010. It was found that juvenile sockeye salmon had favorable conditions of feeding in 2006–2009, in the pelagic zone, and the indication of that is the highest for recent 15 years body weight of the juvenile migrants in 2007–2008. The rich stock of the forage plankters in the lake was result of sufficient food supply for the plankters and abundance decrease of juvenile sockeye salmon and its principle concurrent — residential threespine stickleback. It is suggested that an increase in the abundance of plankton-eating fishes in the pelagic zone since 2009 can cause decrease of the biomass of the plankton crustaceans and consequent decrease of juvenile sockeye salmon size and weight.

Bochkova, E.V. 2011. Comparative sensibility of four propagated fish cell lines to the IHNV-isolates, obtained from Kamchatkan sockeye salmon *Oncorhynchus nerka*. Urgent issues of veterinary biology 2(10). (In Russian).

Bugaev, A.V. and O.B. Tepnin. 2011. Assessment of the effects of some climatic factors on the abundance of Asian stocks of pink and chum salmon. Izv. TINRO 166: 67–87 (In Russian with English abstract).

Climatic factors influence on abundance of Asian pink and chum salmon is tested on the data about their catches from NPAFC statistics for 1925-2010. The atmospheric and oceanographic conditions are evaluated by standard indices AFI, ALPI, NP, PCI, GLB.Ts + dSST, N.HEMI, PDO, LOD, the number of Sun spots is also considered. The best links are found for the time series smoothed by 2-points moving average, both for catches and climatic indices. The salmon catches have the maximal correlation with the monthly indices of air temperature and SST averaged for the whole globe and Northern Hemisphere (GLB.Ts + dSST and N.HEMI); the correlation coefficients are 0.82-0.89 for chum salmon, 0.54-0.64 for pink salmon, and 0.74-0.78 for their summary catch. Other indices have lower relationship with the salmon catches; the correlation coefficients don't exceed ± 0.3 . So, there are no significant correlations between the pink and chum salmon catch dynamics and those climate indices. The multiple regression shows an indirect effects of the set of climatic variables (AFI, ALPI, GLB.Ts + dSST, N.HEMI, PDO) with the maximal correlation coefficients 0.88 for chum salmon, 0.61 for pink salmon, and 0.77 for their summary catch. These preliminary data could be used for further investigations of climate change influence on abundance of pacific salmon mass species with more detailed consideration of its effects on the ecosystems of the Bering Sea and North Pacific.

Bugaev, A.V. and O.B. Tepnin 2012. Estimation of the influence of some climatic factors on the abundance of Asian pink and chum salmon. NPAFC Technical Report 8: 103–106. (Available at www.npafc.org).

Bugaev, V.F. 2011. Asian Sockeye Salmon (fresh-water period of life, biological structure, population dynamics). Petropavlovsk-Kamchatsky: Publishing House «Kamchatpress», 292 pp. (In Russian).

Bugaev, V.F. 2011. Asian sockeye salmon-2 (biological structure and abundance dynamics of local stocks in the late XX - early XXI century). Petropavlovsk-Kamchatsky: Publishing house «Kamchatpress». 380 p. (In Russian).

Bugaev, V.F. 2012. Studies of stock abundance of salmonids in 1995–2011. Collection of scientific articles «Studies of aquatic biological resources of Kamchatka and Northwest Pacific Ocean» 25: 5–36 (In Russian with English abstract).

Retrospective review of research activities of the laboratory of stock abundance dynamics and forecast of salmon species, KamchatNIRO, for 1995–2011 is provided. Positive correlation between the catches of ñhinook salmon and coho salmon is demonstrated, including when averaging the data by periods of 3 or 5 years. A highly reliable positive correlation has been revealed between sockeye salmon and pink salmon, when averaging the data by periods of 3 years. From analysis of the data by periods of 5 years we have observed reliable negative correlations between the catches in the pairs sockeye salmon/ñhinook salmon and sockeye salmon/coho salmon. Dome-shaped correlations can be observed between sockeye and chum salmon and sockeye salmon and char by periods of 5 years: catches of both opponents in each pair go increasing to some level and than go decreasing. Positive reliable correlation revealed should be notified between generation abundances of ñhinook and coho salmon. It is also a notable fact that there is negative correlation between generation abundances of sockeye and ñhinook salmon: ñhinook salmon abundance decreases along the increase of sockeye salmon abundance. A stable positive correlation between generation abundances of sockeye and chum salmon is also found.

Chalov, S. 2011. River sediments as a salmon rivers ecosystems driver. Vladimir Ya. Levanidov's Biennial Memorial Meetings 5: 571-579 (In Russian).

Degtev, A.I., E.A. Shevlyakov, K.M. Malykh, and V.A. Dubynin 2012. An experience of assessment of juvenile and adult abundance of Pacific salmon by method of hydro-echosounding on freshwater migration ways. Izv. TINRO 170: 113–135 (In Russian with English abstract).

Data on sockeye salmon adults migration to the Ozernaya River and Lake Kurilskoye are used for regulation of fishery and provide its sustainability. Their run is monitored here since 1940, nowadays from a special fence with window-entrances for the salmon counting. These data were compared in 2010–2011 with hydroacoustic assessments of adults and juveniles obtained by means of the hydroacoustic complex NetCor developed by Promgidroakustika Ltd. During the mass run of salmon, intensity of their migration almost had no daily variation, but the bulk of migrants passed the control section in 01-04 a.m. in periods of poor migration. The estimations of the salmon number made by two methods were similar in general, with a small time lag in run dynamics determined by two methods that was caused by 3.5 km distance between the fence and the hydroacoustic complex.

Esin, E.B., V.V. Chebanova, Y.V. Sorokin, S.R. Chalov, and O.O. Koval. 2011. Comparison of biota thermal and cold streams that flow into the estuary Semlyachiksky. Izv. TINRO 167: 135-145 (In Russian with English abstract).

Two creeks in nearby valleys but with different water temperature are compared to understand the impact of volcanic thermal water on the ecosystem of a typical salmon stream. In the low-water period, water discharge in both flows was 0.5-0.6 m³/s, but water parameters differed between the thermal and cold ones: temperature was 17.4 and 7.5 oC, salinity 72.5 and 19.0 g/m³, turbidity 2.5 and 1.5 g/m³, respectively. The thermal stream was distinguished by tenfold higher autotrophic biomass, its net production was higher in 2.6 times, and the suspended detritus was lower in 6.3 times. Macrozoobenthos in the thermal stream was poorer (33 taxa, 2.5. 103 sp/m², 12 g/m²) than in the cold one (56 taxa, 11.7. 103 sp/m², 20 g/m²). Species composition of fish was identical in both streams (9 species), but fish density and biomass (except salmonid spawners) were lower in the thermal one (0.4 sp/m², 1.7 g/m²) than in the cold one (1.2 sp/m², 3.4 g/m²). Juvenile coho salmon and ninespine stickleback had similar abundance in the thermal stream (42 % and 51 % of catches, respectively), but coho dominated in the cold one (81 %). The sticklebacks, which fed on benthos only, had similar index of repletteness in both streams (on average 78 and 93 ‰).

Esin, E.B., V.V. Chebanova, and Y.V. Sorokin. 2011. Ecosystem of thermal stream with sea mouth (Kronocky biosphere reserve, Kamchatka). Vladimir Ya. Levanidov's Biennial Memorial Meetings 5: 150-157 (In Russian).

The data on abiotic conditions, proportion of trophic levels, structure of macrozoobenthos and fishes populations, and also fishes feeding composition have obtained in the ecosystem of constant thermal stream, running in Kronocky gulf.

Esin, E.B., Y.V. Sorokin, and V.N. Leman. 2011. Special traits of the ichthyofauna and extremal life conditions in the river delta of a volcanic region (the Fal'shivaya river, South-eastern Kamchatka). Journal of Ichthyology 51(1): 28-35 (In English).

Comparative characteristics are presented of hydrological conditions, toxicological situation (chemical composition by 35 elements and water biotesting), macrozoobenthos, and fish population in a salmon river at the impact zone of volcanic activity and in a pure tributary flowing in similar

natural conditions. It is shown that extremal life conditions for hydrobionts are formed under the influence of volcanic activity: excess of maximum admissible concentration of injurious substances for water bodies of fish cultural importance by five elements, turbidity up to 371.5 mg/l, and pH up to 5.3. Mean abundance of macrozoobenthos and spawning density of salmon on a polluted stretch in comparison with the pure_water tributary is lower by 15 and 20 times, respectively. In sticklebacks of the genus *Pungitius* living in the polluted stretch, the part of fish with asymmetry of gill rakers, of rays in pectoral fins, and of lateral scutes is significantly higher (by 2.5 times), as well as the part of asymmetric characters per specimen (by 3.7 times).

Esin, E.B. and Y.V. Sorokin. 2012. Residential Form of White_Spotted Char *Salvelinus leucomaenis* Inhabiting the Warm Stream Discharging into Semlyachikskii Firth (Kronotskii Natural Reserve, Kamchatka). *Journal of Ichthyology* 52(2): 172-179 (In English).

Residential form of white_spotted char *Salvelinus leucomaenis* appears in volcanic stream characterized by stable water and temperature regime. The maximal body length of fish is 285 mm and body mass is 245 g; the oldest specimen is 7 years old. The somatic growth does not relax, and the annual growth rate is 30–40 mm. The maturation begins at the age of 4 years after the fish reaches 175 mm length and 60 g in weight. The spawning takes place in autumn. Sex dimorphism and nuptial coloration are not observed, and the “spotted” coloration remains through the year. Vomer is toothless, or only one tooth is presented (in 15% of sampled specimens). Sagittal otoliths are characterized by deformation granular texture of ventral area, the layering is broken. The food spectra of a mature specimen comprises gammarids, large_size larvae, and imagoes of amphibiotic insects during the summer period.

Esin, E.B., V.N. Leman, Y.V. Sorokin, and S.R. Chalov 2012. Population Consequences of Mass Coming of Pink Salmon *Oncorhynchus gorbuscha* to the Northeastern Coast of Kamchatka in 2009. *Journal of Ichthyology* 52(6): 369-378 (In English).

During mass spawning of pink salmon *Oncorhynchus gorbuscha* in two rivers of central Karaginskii Bay (Kamchatka), the average coverage of the spawning hillock did not vary much (0.6–0.7 m²) even though the abundance of the spawning adults varied greatly. When the abundance of spawning females was less than 1.4 ind. per m² of spawning ground, the spawning hillocks did not interlock. When the abundance of spawning females varied from 1.7 to 1.8 ind./m², the spawning hillocks interlocked, and approximately 20–25% of them were re_excavated. When the abundance of spawning females was higher than 2.0 ind./m², all the early_deposited spawning hillocks were re_excavated. The re_excavation of the spawning hillocks increased the population mortality also by the mass pre_spawning death of the breeders and spawning outside the spawning grounds. Meanwhile, fish_kill of the eggs in the spawning hillocks was not observed, and the mortality of embryos and larvae did not depend on the spawning intensity. The ratio of live and dead embryos in the spawning hillocks before their hatching was approximately 60%, varying from 44 up to 92% in regard to the environment of the spawning ground (autumn low water, freezing, and siltation). Significant correlation was found between the survivability and grain_size composition of the spawning hillocks when the impact of small_size fraction was a limiting factor.

Gavruseva, T.V., N.V. Sergeenko, E.A. Ustimenko, T.V. Ryazanova, E.V. Bochkova, L.V. Ovcharenko, S.L. Rudakova, and E.A. Gritskikh 2012. Pathogens for hydrobionts of Kamchatka. Collection of scientific articles «Studies of aquatic biological resources of Kamchatka and Northwest Pacific Ocean» 25: 190–207 (In Russian with English abstract).

Results of complex researches (virological, bacteriological, parasitological and histological) of freshwater and marine hydrobionts of Kamchatka for the period from 2001 to 2011 have been demonstrated. Data on taxonomic composition and distribution of infective and invasive agents and

their effects on the health of hydrobionts have been generalized.

Gladyshev, M.I., E.V. Lepskaya, N.N. Sushchik, O.N. Makhutova, G.S. Kalachova, K.K. Malyshevskaya, and G.N. Markevich 2012. Comparison of polyunsaturated fatty acids content in filets of anadromous and resident sockeye salmon *Oncorhynchus nerka*. Journal of Food Science 77 (12): 1306–1310. (In English).

Fatty acid composition and content of 2 forms of sockeye salmon *Oncorhynchus nerka* from lakes in Kamchatka Peninsula (Russia) were compared. One form of sockeye salmon was anadromous (“marine”), that is, adult fish migrated in ocean to feed and grow and then return in the lake to breed. Fish of another form, kokanee, never migrate in the ocean. Per cent levels of the main indicators of nutritive value, eicosapentaenoic acid (EPA, 20:5n-3), and docosahexaenoic acid (DHA, 22:6n-3), were significantly higher in the landlocked *O. nerka*. However, concentrations of EPA and DHA per wet weight of filets were higher in the marine form, because of the relatively higher content of sum of fatty acids in their muscle tissue. As concluded, fish fed in marine environment had higher contents of long-chain n-3 fatty acids per wet weight than fish of the same species, fed in fresh waters. In general, both the anadromous sockeye salmon and the landlocked kokanee salmon can be recommended for human diet as a valuable product concerning contents of EPA and DHA.

Golub', E.V. and A.P. Golub'. 2011. Injuries gill covers as an indicator of sea fishing press. Bulletin of Pacific salmon studies in the Russian Far East 6: 88 – 92 (In Russian).

Golub', E.V. and A.P. Golub'. 2011. The research and harvest of the Pacific salmon in Chukotka in 2011. Bulletin of Pacific salmon studies in the Russian Far East 6: 33–40 (In Russian).

Golub', E.V. and A.P. Golub' 2012. The research and harvest of the Sockeye salmon in Chukotka in 2012. Bulletin of Pacific salmon studies in the Russian Far East 7: 52 - 59 (In Russian).

Golub', E.V. and A.P. Golub' 2012. Biology and feeding of juvenile Pink salmon from spawning in 2011. Bulletin of Pacific salmon studies in the Russian Far East 7: 143-147 (In Russian).

Golub', E.V. and A.P. Golub' 2012. Method of accounting of Pacific salmon in spawning ponds of the Meinypil'gyn Lake-River System, Chukotka. Bulletin of Pacific salmon studies in the Russian Far East 7: 143 - 147 (In Russian).

Gorin, S.L. and V.V. Chebanova. 2011. Salinization-related transformation of hydrological regime and benthos in the Nerpichye and Kultuchnoe lakes at the Kamchatka river estuary. Vladimir Ya. Levanidov's Biennial Memorial Meetings 5: 119-128 (In Russian).

The Nerpichye lake and the Kultuchnoe lake (which is often considered to be a part of the first one) form the largest lake system in Kamchatka. This system is of special interest as its hydrological conditions alter from the fresh water to the brackish water and vice versa. Changes of the hydrological regime evidently involve biota transformation. This article is based on the data collected from the authors' field studies and bibliographic sources. The research results reveal changes in the Nerpichye and Kultuchnoe lakes' ecosystem during the transition from the freshwater period, which was terminated in the beginning of XX century, to the one of the brackish water started from the 1920s through now.

Gorodovskaya, S.B. and I.V. Zhiganova. 2011. Characterization of biochemical parameters and rate of gametogenesis for juvenile sockeye salmon during early marine period of life in the Okhotsk Sea waters adjacent Kamchatka in 2005–2007. Collection of scientific articles «Studies of aquatic biological resources of Kamchatka and Northwest Pacific Ocean» 23: 26–32 (In Russian with English abstract).

Individual interannual differences in the concentration of chemical elements in juvenile body and in gonad development rate were studied on the base of analysis of gonad development data and of the dynamics of biochemical indexes of juvenile sockeye salmon muscles during the first year of life in the waters off West Kamchatka for 2005–2007. It was found that conditions of life in freshwater period were still influencing the biochemical indexes and the juvenile gametogenesis during early months at sea. Juvenile sockeye salmon, emerged from Kurilskoye Lake in 2006 and 2007, in the terms of more intense work of population factor and hence in the terms of less biomass of forage organisms demonstrated accelerated growth in the coastal zone, comparing to smolts, emerged in 2005. Metabolic processes, intensified at the expense of spending more energy, decreased lipid component in the protein-fat balance. That was accompanied with an increase of protein in the juvenile bodies. Gametogenesis was answering the transformations of the biochemical indexes. Marine juvenile sockeye salmon in 2006 and 2007 demonstrated later ovary development, comparing to female smolts in 2005. In July 2006 and 2007 the principle number of gametes of juvenile sockeye salmon was made up of oocytes at three early phases of previtellogenesis with dominance of the 3-rd phase. In 2005 we observed consequent transformation of some of the oocytes to the oocytes of the 4-th phase of cytoplasmatic growth along with parallel increasing the gamete sizes.

Gorodovskaya, S.B. and A.S. Sushkevitch. 2012. An assessment of the character of splitting the ages of maturation for Ozernaya River sockeye salmon on the rate of gametogenesis of juvenile downstream migrants. Collection of scientific articles «Studies of aquatic biological resources of Kamchatka and Northwest Pacific Ocean» 27: 41–49 (In Russian with English abstract).

The rational use of fish stocks implies strict regulation of commercial removal and level of sustainable production on the base of scientifically grounded forecast. Regular methods of forecasting salmon abundance not always succeed to provide sufficient accuracy, and this is why there are many attempts directed to improving the methods of forecasting sockeye salmon spawning stock and especially for the Ozernaya River sockeye salmon stock, which is one of principle stocks in Asia. Suggested method for estimation of the character of splitting the ages of maturation in generation and for assessment of the abundance of current and next generations requires further improving.

Gritsenko, O.F. 2012. Fishes of the Kuril Islands. Moscow: VNIRO Publ. 384 pp. (In Russian).

The monograph summarizes the results of the long-term investigations on fishes of the inland water bodies of the Kuril Islands, represented by 29 species from 7 families: lampreys Petromyzontidae, minnows Cyprinidae, smelts Osmeridae, salmons Salmonidae, sticklebacks Gasterosteidae, sculpins Cottidae, and gobies Gobiidae. The assessments of taxonomic and ecological diversity and representatives of ichthyofauna are given. The distribution of individual species within the Kuril Archipelago is shown. The data on biology and ecology are presented, and the external structure is described. The data on linear and weight growth and feeding are given also. The systematic, population structure and microevolution issues are studied in detail. For studying the systematic, both the traditional methods and methods of molecular genetics have been used. The regularities of

Pacific salmon reproduction and fishery are described in detail, and their spawning potential is assessed. The prospects of commercial and sport fishery development are shown.

The book is intended for scientists, students and lecturers of biological and geographical faculties, zoogeographers, specialists of fishery and environmental organizations, ecologists, specialists in the field of fisheries conservation, employees of fishery department and regional organizations.

The book size is 992 pages, including 209 illustrations and 166 tables. The reference list contains 636 titles.

Goryainov, A.A., N.I. Krupyanko, A.V. Lisenko, I.Z. Parpura, and A.V. Klimkin. 2012. Results of monitoring of chum and pink salmon in Primorskiy Region. Bulletin of Pacific salmon studies in the Russian Far East 7: 29-44 (In Russian).

Izergina, E.E., I.L. Izergin, and S.I. Kharchenkova. 2011. Comparative analysis of morphological pattern of blood of natural and hatchery raised juvenile salmon (*Oncorhynchus keta*) of some rivers of Magadan region. Bulletin of Pacific salmon studies in the Russian Far East 6: 254–258 (In Russian).

Indexes of morphological blood structure of natural and hatchery raised juvenile salmon are analyzed. Differences in relation of blood corpuscles of chum juveniles of different origin are determined. It is shown that hatchery raised salmon yield to natural in morphological indexes of blood.

Izergina, E.E. and I.L. Izergin. 2011. On osmotic resistance of the peripheral blood erythrocyte of chum juveniles (*Oncorhynchus keta*). Researches of aquatic bioresources of Kamchatka and the North-Western part of Pacific Ocean. Collection of scientific articles «Studies of aquatic biological resources of Kamchatka and Northwest Pacific Ocean» 23: 18-25 (In Russian with English abstract).

Osmotic resistance of the erythrocyte of chum juveniles inhabiting the rivers of the coastal areas of the sea of Okhotsk in Magadan region and chum juveniles inhabiting the estuary of the Ola river were detected. Osmotic resistance of nature juveniles from various rivers differs in a way and makes up OR-min 0,42; OR-max 0,26%. Osmotic resistance of the erythrocyte of juveniles taken from sea areas to hypothetical solutions of sodium chloride makes up OR-min 0,54; OR-max 0,42% of sodium chloride that is considerably lower than of juveniles taken from freshwater during downstream migration. Changes of osmotic resistance are adaptive traits and relate to erythrocyte changes, i.e. to old erythrocyte destruction and new one creation with membranes adapted to changed habitat. The studies on osmotic resistance of the erythrocyte of salmon are of interest for further estimation of successfulness of smoltification process during the early sea period.

Kaev, A.M. 2011. A forecast and actual development of pink salmon fishery in Sakhalin-Kuril region in 2011. Bulletin of Pacific salmon studies in the Russian Far East 6: 26–32 (In Russian).

Some particular features of pink salmon coastal approaches and fishery in its basic reproduction areas in the Sakhalin-Kuril region are described. A significant change in catches in 2011 on the western Sakhalin coast, in comparison with the previous cyclic year (decline on the coast of Tatar Strait and increase in the northwestern part of the coast), is related with the peculiarities of abundance formation for Japan and Pacific pink salmon stocks. A decline in catches was observed in the southern areas of the eastern Sakhalin and southern Kuril Islands and, in contrast, their increase in the northern areas, but this process was caused by the changes in abundance and ratio of Pacific pink salmon coastal approaches for different seasonal forms (early and late).

Kaev, A.M. 2011. About dynamics of pink salmon stock as an indicator of habitat processes. Bulletin of Pacific salmon studies in the Russian Far East 6: 196–201 (In Russian).

During the past 20 years the pink salmon in Sakhalin-Kuril region is characterized by the large sizes and great abundance caused mainly by the high survival in the sea life period. At the same time, changes in these characteristics are weakly related with the climatic indices. Besides, changes in pink salmon abundance, biological characteristics and timing of its coastal approaches may be corrected by the structural changes in the local stocks composing the early and late temporal forms. The changes in ratio between different forms in the pink salmon coastal approaches have the long-term trends. However, their directions coincide only in individual time periods for different fish stocks. Apparently, a simultaneous decline in the early form is a sign of the global deterioration in reproduction conditions that should be followed by the decrease in the total level of pink salmon stock abundance.

Kaev, A.M. 2011. Testing of forecasting and managing efficiency for pink salmon fishery in Sakhalin-Kuril region. Izv. TINRO 167: 32–53 (In Russian with English abstract).

Forecasting of pink salmon stock abundance is based on estimation of the ratio between the number of fry migrants and the number of returned adults from the corresponding year classes. A system of pink salmon monitoring includes the observations for dynamics of fish approaches to the coast and their biological parameters, number of spawners entered the rivers and the number of their fry migrants. The monitoring data are used for developing forecasts and operative recommendations for fishery management. The forecasting and factual data are compared for the South Sakhalin pink salmon which is characterized both by the high stock abundance and significant interannual variability. Special attention is paid to analysis of the forecast precision in the case of the abnormal changes in abundance that could be interpreted as a consequence of redistribution of the pink salmon stocks in its migratory flow. Almost for all cases, even for abnormally abrupt changes in abundance, the forecasts errors could be diminished if the primary data are correctly interpreted. The existing system of monitoring (trawl and drift-net surveys in the sea and observations for salmon approaches to the shore) allows us to estimate correctly the conditions of fishing and to make the reasonable decisions on fishery management, even in the cases of erroneous initial forecasts.

Kaev, A.M., A.A. Antonov, A.V. Zakharov, Khe Yun Kim, and V.A. Rudnev. 2011. Assessment of juvenile pink salmon migrants in the rivers of eastern Sakhalin and southern Kuril Islands. Bulletin of Pacific salmon studies in the Russian Far East 6: 112–117 (In Russian).

There are given some results (FSUE “SakhNIRO”) on the count of juvenile pink and chum salmon migrating from the spawning grounds downstream the rivers Kura, Dudinka, Orlovka (eastern coast of Sakhalin Island), and Rybatskaya (Iturup Island). These data and the numbers of counted migrants in some other rivers (FSU “Sakhalinrybvod”) were used to calculate the 2011 harvest of migrating juveniles for the basic territorial pink salmon groupings in the region. The analogous data for the previous years are corrected and the reasons for this correction are shown.

Kaev, A.M. 2012. Development of some tendencies in pink salmon stock dynamics in the eastern Sakhalin and southern Kuril Islands. Bulletin of Pacific salmon studies in the Russian Far East 7: 135-142 (In Russian).

The changes in abundance in early and late temporal forms are analyzed for pink salmon from the southern Kuril Islands and some areas of the eastern Sakhalin coast. It is shown that the decline in abundance for the early form was followed by the reduced numbers of returned adults of both (Kunashir Island and Aniva Bay in the southern part of Sakhalin Island) or one of the generative lines (Iturup Island). At the same time, in the southeastern Sakhalin coastal zone and Terpeniya Bay

in recent years, in contrast, the increase in abundance was recorded both for the early form and total pink salmon returns. A decrease in the 2011 brood survival in the freshwater period is suggested to be able to promote development of the same process in the northward areas of the eastern Sakhalin as occurred in Aniva Bay and southern Kuril Islands.

Kaev, A.M. 2012. Production Trends of Pink Salmon in the Sakhalin-Kuril Region from the Viewpoint of Run Timing. NPAFC Technical Report 8: 21–25. Available at www.npafc.org.

High abundance and large sizes were characteristic for pink salmon in the past 20 years. When studying the trends, we usually use indices that characterize the studied stock of pink salmon as a whole. However, a stock of pink salmon is not uniform. In the Eastern Sakhalin and Iturup Island, two forms of pink salmon, early and late, follow each other. The long-term trends of abundance of both forms in Aniva Bay and on Iturup Island are weakly agreed not only with changes in climatic indices, but also among themselves. Changes in the ratio of different forms of pink have the long-term trends and their directions in different areas coincide only for individual periods. The early form of pink is less resistant to environmental changes. Therefore, a synchronous decline in proportion of this form in different areas can be viewed as a warning of reducing the total abundance of pink salmon.

Kaev, A.M. 2012. Temporal structure and some features of stock dynamics of pink salmon *Oncorhynchus gorbuscha* (Salmonidae). J. Ichthyol. 52: 57–67 (In English).

Characteristics of early and late migrants of pink salmon *Oncorhynchus gorbuscha* that spawned in the rivers of the coast of Aniva Bay (southern Sakhalin) and Iturup Island (southern Kuril Islands) are described. Upstream migration of the late form is characterized by the presence of large exemplars, especially males, and increasing proportion of these fishes in the catches. Absolute fecundity of the females of the early and late forms can be similar (Iturup Island) or different (Aniva Bay), but relative fecundity is lower in the females of the late form in both regions. Production of a larger number of eggs by the females of the early form is associated with a larger level of mortality: the abundance of the early form is comparatively low, and substantial annual variation of the abundance is registered. Relative abundance of pink salmon from the temporal groups depends mainly on reproductive conditions during the freshwater part of their life cycle. Analysis of size composition of the fish conducted over many years shows a trend in the ratio between the body lengths of males and females: unfavorable foraging conditions (and slower growth rate) lead to the appearance of females that are larger than males. To take into account a positive correlation between the body length and fecundity of females, this feature is regarded as a compensatory reaction of the population directed to more intensive reproduction at poor foraging

Kaev, A.M. 2012. Wild and hatchery reproduction of pink and chum salmon and their catches in the Sakhalin-Kuril region, Russia. Environ. Biol. Fish 94: 207–218 (In English).

In the Sakhalin-Kuril region hatchery culture of pink and chum salmon is of great importance compared to other regions of the Russian Far East. During the last 30 years the number of hatcheries increased two-fold, and significant advances were made in hatchery technologies. As a result, chum salmon capture in regions where hatcheries operate (southwestern and eastern Sakhalin coasts, and Iturup Island) was 9 times as high during 2006-2010 than during 1986-1990, whereas wild chum salmon harvest markedly declined. Recent dynamics in pink salmon catch appear to track trends in natural spawning in monitored index rivers, suggesting natural-origin pink salmon play a dominant role in supporting the commercial fishery. It remains uncertain as to whether hatcheries have substantially supplemented commercial catch of pink salmon in this region, and I recommend continued research (including implementing mass marking and recovery programs) before decisions are made regarding increasing pink salmon hatchery production. Location of hatcheries in spawning

river basins poses problems for structuring a management system that treats hatchery and wild populations separately. Debate continues regarding the existence and importance of density-dependent processes operating in the ocean environment and the role hatcheries play in these processes. Loss of critical spawning habitat for chum salmon in the Sakhalin-Kuril region has led to significant declines in their abundance. I conclude by recommending increases in releases of hatchery chum salmon numbers in the region to help recover depressed wild populations and provide greater commercial fishing benefits in the region.

Kaev, A.M., and A.A. Koynov. 2012. Some results of study of the pink salmon scale structure from different areas of eastern Sakhalin and Iturup Island in 2011. Bulletin of Pacific salmon studies in the Russian Far East 7: 129-134 (In Russian).

The study was carried out because of the unpredicted changes in pink salmon catches in the northern part of the eastern Sakhalin (increase) and on Iturup Island (decline) that gives occasion to consider these changes as a result of re-distribution of this species between the areas of the migratory flow (hypothesis of a fluctuating stock). However, significant differences in the number of circuli in the first annual growth zone on the scales and in the character of scleritogram zone reflecting specific conditions for fish growth in different coastal feeding areas exclude the suggestion of “fall” in fish migrations to their spawning areas. At the same time, some essential changes have been found in fish growth during the joint habitat period for different stocks in the central part of the Sea of Okhotsk.

Kaev, A.M., A.A. Koynov, and L.V. Romasenko. 2012. Was there a re-distribution of the pink salmon migratory flow between different areas of Sakhalin-Kuril region in 2011? NPAFC Doc. 1399: 9 pp. (Available at www.npafc.org).

In 2011, pink salmon capture in the northern part of eastern Sakhalin was significantly higher and on Iturup Island, in contrast, lower than expected. This fact aroused discussion in favor of hypothesis of the fluctuating stock. To clarify the matter, we have studied a structure of fish scales. The statistically reliable differences in the number of circuli and consistent changes in width of the intercirculi distances in the first annual growth zone on the scales were found in fish sampled from different areas. These results were compared with the data obtained when studying pink salmon in the same areas in 1997. The new data obtained exclude the probability of mass relocation of fish in these years, particularly, fish of the south-Kuril origin, to the northern part of the eastern Sakhalin coast in 2011. At the same time, significant changes have been revealed in pink salmon returned in 2011 that occurred in their growth during the first year of life compared to fish returned in 1997–2000.

Kaev, A.M., A.A. Antonov, A.V. Zakharov, Khe Yun Kim, and V.A. Rudnev. 2012. Results of quantitative count of juvenile pink salmon migrants in rivers of the eastern Sakhalin coast and southern Kuril Islands in 2012 and their interpretation. Bulletin of Pacific salmon studies in the Russian Far East 7: 66-74 (In Russian).

There are given some results (SakhNIRO) on the count of juvenile pink salmon migrating from the spawning grounds downstream the rivers Kura, Voznesenka, Dudinka, Orlovka (eastern coast of Sakhalin Island), and Rybatskaya (Iturup Island). These data and the numbers of counted migrants in some other rivers (Sakhalinrybvod) were used to calculate the 2012 harvest of migrating juveniles for all territorial pink salmon groupings in the areas of eastern Sakhalin and southern Kuril Islands. A decline in pink salmon reproduction in the region is suggested to be caused by the strong floods occurred in the summer-autumn period both during the spawning process and after its completion.

Karpenko, V.I. and M.V. Koval. 2012. Feeding strategies and trends of pink and chum salmon

growth in the marine waters off Kamchatka. NPAFC Technical Report. 8: 82–86. (Available at www.npafc.org).

Klovach, N.V., A.N. El'nikov, and V.I. Roi. 2011. Characteristics of the Spawning Stock of Chinook Salmon *Oncorhynchus tshawytscha* from the Apuka River (Northeastern Kamchatka). *Journal of Ichthyology* 51(9): 758-768 (In English).

Biological features of chinook salmon *Oncorhynchus tshawytscha* from the Apuka River, the largest river of the northeastern Kamchatka inflowing Olyutorskii Bay of the Bering Sea, are studied. Chinook salmon from the Apuka River spend mainly a year in the river before downstream migration to the sea. The fish live in the sea for 1–4 years. The spawning migration of chinook salmon into the Apuka River begins in late May just after ice melting, and it continues until early August. The main part of the spawners enters the river during June. A hypothesis on the occurrence of two seasonal races in the Apuka River is proposed

Kolpakov, N.V., P.G. Milovankin, and E.V. Kolpakov. 2012. New data on biology of juvenile chum salmon *Oncorhynchus keta* in estuaries of Olga Bay (central Primorye). *Bulletin of Pacific salmon studies in the Russian Far East* 7: 167-173 (In Russian).

Krovnin, A. and N. Klovach. 2012. The association of long-term changes in West Kamchatka pink salmon catches with climate regime shifts in the Northern Hemisphere. NPAFC Technical Report 8: 126-129. (Available at www.npafc.org).

Long-term fluctuations of the Pacific salmon production reflect the dynamics of climatic and ecological conditions over the North Pacific.

The total Pacific salmon catches in the XX and early XXI century fluctuated in line with the PDO and ALPI dynamics: a clear maximum in the 1920-1940s was followed by a depression in the 1950-1970s and a new maximum in the 1990-2000s. The total Pacific salmon catch dynamics passed its maximum in the early 2000s, again in agreement with the dynamics of both PDO and ALPI indices. We have all reasons to expect that the next descending trend in PDO will likely to start in the 2010-2020s and be accompanied by the corresponding decline in the Pacific salmon.

Kuznetsova, N.A., J. Murphy, and J. Eiler. 2012. Feeding of salmon and other fish in the eastern Bering Sea in August-September 2012. *Bulletin of Pacific salmon studies in the Russian Far East* 7: 120-128 (In Russian).

Lepskaya, V.A. and A.A. Abramov. 2011. Pre-spawning migrations of Pacific salmon *Oncorhynchus* off the north Kuril Islands. Peculiarities of chum salmon *O. keta* and sockeye salmon *O. nerka* migrations. *Fisheries issues Journal* 12 (2): 224–248 (In Russian with English abstract).

Peculiarities of pre-spawning migrations of Pacific salmon *Oncorhynchus* through the northern Kuril Straits in 1997-2007 are considered. Temporary heterogeneity of migration flows of chum salmon *O. keta* and sockeye salmon *O. nerka* revealing waves in approaches to the northern Kuril Straits of different migration aggregations is established.

Lepskaya, V.A., E.V. Vedisheva, and A.A. Abramov. 2011. Pacific salmon off the north Kuril Islands waters. Moscow: VNIRO Publ. 95 pp. (In Russian).

This monograph is the final brief result of investigations conducted by VNIRO on the Northern Kuril Islands during 1996-2010. Until this period there was almost no any information in literature about the state of Pacific salmon stocks and possibilities of their commercial use on the Northern Kurils. Physical-geographical descriptions of the islands Paramushir and Shumshu is done,

characteristics of surface waters present condition is given, information about distribution of Pacific salmon in inner basins and coastal waters of the islands is submitted. Interannual features of salmon prespawning migrations through straits of the Kuril Islands are described and migrations periods of separate species are set. Temporal similarity of migratory streams with picking out of 'waves' depending on broods productivity of different stocks of the Sea of Okhotsk is shown. Long-term investigations allowed to estimate the possible exemption by commercial fishing as well as salmon, reproduced in the islands reservoirs, and also salmon of stocks of the Sea of Okhotsk, migrating through northern straits of the Kuril Islands. The book is for scientists, fishery personnel and fishery guards organizations.

Makarov, D.V. 2011. Dynamics of number and biological structure of North-Okhotomorsk coho populations in 2000–2010. Bulletin of Pacific salmon studies in the Russian Far East 6: 97–102 (In Russian).

The data on the dynamics of coho runnings into the rivers of the Tauai Bay, size and weight indexes change, age structure, absolute fertility of the main populations of the north Okhotomorsk coho are given.

Malykh, K.M., M.N. Kovalenko, and A.A. Adamov. 2011. Techniques and organization of haul seine fishing of Pacific salmon for commercial or scientific purposes. Petropavlovsk-Kamchatsky: KamchatGTU, 80 pp.

Markovtsev, V.G. 2012. Efficiency of chum salmon hatcheries in the Japan Sea. Bulletin of Pacific salmon studies in the Russian Far East 7: 159-166 (In Russian).

Metalnikova, K.V. 2011. Comparative characteristic of the gametogenesis of the hatcheries of juvenile chinook salmon before the release in natural environment in the three different years. The collection of articles Institute of the Fish Economy of National Agrarian Academy of sciences of Ukraine "Рибогосподарська наука України", Київ №3.

As a result of researches it has been proved, that it is impossible to change a temperature mode incubation chinook salmon. It will be in the future can have negative influence on development gonads at breeder chinook salmon. To feed smolt chinook salmon is necessary balanced on the structure foods.

Mironova, T.N. 2011. Biology and abundance of anadromous cherry salmon *Oncorhynchus masou (Brevoort)* in the Tumnin river (cjastal area of Tatar strait) in 2007-2008. Fisheries issues Journal 12 (1): 7–19 (In Russian with English abstract).

Data of 2007-2008 on spawning run time, particulars and intensity and on biological parameters of spring-summer form of cherry salmon from the Tumnin River - the centre of its reproduction are brought. Cherry salmon abundance is assessed. Current data allow to suggest that cherry salmon of northern Primorie restored its abundance and can be excluded from the list of Khabarovsk Territory Red Book. These data can be used to correct the catch forecast, for other fisheries assessment and also for hatchery purposes.

Morozova, A.V. 2011. Feeding by mass fish species in the coastal waters of East Kamchatka in August 2007 and 2010. Bulletin of Pacific salmon studies in the Russian Far East 6: 247–253 (In Russian).

Naydenko, S.V., A.A. Khoryzhiy, and A.V. Zavolokin. 2012. Food supply of pacific salmon in the North West Pacific in summer in 2000. Bulletin of Pacific salmon studies in the Russian

Far East 7: 152-158 (In Russian).

Ostrovsky, V.I. 2011. Factors controlling the pink salmon *Oncorhynchus gorbusha* juveniles abundance in the Iska River. *Izv. TINRO* 166: 73–87 (In Russian with English abstract).

Nonlinear multiplicative model is created that describes the pink salmon juveniles abundance in the Iska River (Okhotsk Sea basin) dependence on their parents abundance and some meteorological factors. The number of spawners is the most significant factor that explains 54 % of the juveniles abundance dispersion. Among the meteorological factors, air temperature during spawning migration and spawning correlates negatively with the juveniles abundance (14 % of dispersion), and air temperature in early winter (10 % of dispersion) and summer precipitation (4 % of dispersion) have positive correlation with the juveniles abundance. Totally these factors explain 82 % of the downstream migrants abundance variability. In the years with equal number of spawners, the maximal abundance of juveniles can be in 10 times higher than their minimal abundance because of meteorological factors influence.

Ostrovsky, V.I., and E.V. Podorozhnyuk. 2011. Spatio-temporal variability of spawning run dynamics for chum salmon (*Oncorhynchus keta*) in the rivers of Khabarovsk region. *Izv. TINRO* 165: 44–55 (In Russian with English abstract).

New method is proposed to describe the chum salmon spawning run dynamics that allows to obtain uniform parameters for comparing the dynamics in different areas. Using the method, dependence of the chum spawning run dynamics on latitude is found for all its groups in Khabarovsk region (both in the Okhotsk Sea and Tartar Strait) except of the summer chum in the Amur river and small rivers of the Amur estuary. Possible reasons of this dependence and formation of the Amur chum seasonal races are discussed.

Ostrovsky, V.I. 2012. Factors controlling the chum salmon *Oncorhynchus keta* juveniles abundance in the Iska River. *Izv. TINRO* 168: 115–130 (In Russian with English abstract).

Dependence of the chum salmon juveniles abundance in the Iska River (Okhotsk Sea basin) on their parents number and some meteorological factors is investigated. The number of spawners has the most significant influence; among meteorological factors, precipitation during anadromous migration correlates positively and air temperature in late winter and early spring (during downstream migration of juveniles) correlation negatively with the chum year-class strength. Model estimations of these factors contribution don't depend on the model structure. The results are compared with similar results on chum salmon in the Khor River and on pink salmon in the Iska River. All populations are characterized by strong dependence of the juveniles abundance on spawners number, and its correlations with meteorological factors are similar, too. However, contribution of a particular factor (power of influence) could be different for each particular species and spawning ground.

Pavlov, D. S., E.A. Kirillova, and P.I. Kirillov. 2011. Downstream migration in the juveniles of salmonids in the Utkholok River and in its tributaries (North-West Kamchatka). Paper 1. Downstream migration in the yong of the year. *Izv. TINRO* 163: 3 – 44 (In Russian with English abstract).

Downstream migration is an important part of the salmonids life cycle, as far as the most of them in Kamchatka rivers are anadromous species. Principal patterns of the downstream migration of their underyearlings are presented on the base of observations in the Utkholok and Kalkaveem rivers (North-West Kamchatka) during three years. Six salmonid species inhabit these rivers: *Oncorhynchus keta*, *O. gorbusha*, *O. kisutch*, *O. masou*, *Parasalmo mykiss*, *Salvelinus malma*, *S. leucomaenis*. Seasonal and daily dynamics of their migration were investigated with commonly

accepted methods (Покатная миграция..., 1981). Size, weight, and fatness of the migrating juveniles were measured, as well, their feeding habits were examined. The time of the migration beginning and the number of migrants in each particular year were determined by a complex of environmental factors. The most important abiotic factors were water temperature, water level in the river, stream velocity, and illumination. The most important biotic factor was the complex trophic factor that included food supply, competition for food, and feeding behavior. Abiotic factors play the leading role in realization of migration at early ontogenetic stages, but the role of biotic ones increases at the late stages. The observed patterns of the downstream migration allow to describe some mechanisms that control the process.

Pavlov, D.S., E.A. Kirillova, and P.I. Kirillov. 2011. Downstream migration in the juveniles of salmonids in the Utkholok River and in its tributaries (north-west Kamchatka). Part 2. Downstream migration in the second and subsequent years of life. Izv. TINRO 164: 27-73 (In Russian with English abstract).

Downstream migration of juvenile salmonids was observed in the Utkholok and Kalkaveem Rivers (north-west Kamchatka) during three years. The rivers are inhabited by seven species of salmonids: *Oncorhynchus keta*, *O. gorbusha*, *O. kisutch*, *O. masou*, *Parasalmo mykiss*, *Salvelinus malma*, and *S. leucomaenis*; five of them (except *O. gorbusha* and *O. keta*) have downstream migrations at the age 1+ and elder. Principal patterns and mechanisms of their downstream migration are considered with special attention to seasonal and diel dynamics. Starting time and duration of the migration as well as the number of migrants are determined by a complex of environmental factors, including abiotic (water temperature, water level, stream velocity, illumination) and biotic ones (food supply, competition for food, feeding behavior). The abiotic factors are more responsible for the downstream migration at early ontogenetic stages, but role of the biotic factors increases in late ontogenesis. Some mechanisms controlling the downstream migration are described taking into account size and weight parameters of migrants, their lipid content and feeding habits.

Pogodaev, E.G. and S.I. Kurenkov 2012. State of the ecosystem of Dalneye Lake, reconstruction of sockeye salmon dwarffish morph for the period of 60 years. Collection of scientific articles «Studies of aquatic biological resources of Kamchatka and Northwest Pacific Ocean» 27: 33–40 (In Russian with English abstract).

An attempt of making a long term reconstruction of stock abundance of dwarf sockeye salmon was made on the base of regular data about the dwarfs and condition of their forage base in the Dalneye Lake for the period 1938–1995. General methodical grounds used for estimation of the dwarfs until and after the 1970s have been analyzed. Analysis of archive and modern data on CPUE in spawning grounds of the lake has revealed periodic fluctuations of the stock and drivers of these fluctuations. There is correlation between stock abundance of the dwarfs and the biomass of forage zooplankton. Analysis of age structure of the dwarfs for the entire period of observations indicates that changes of the absolute abundance of the dwarfs were accompanied by changes of the relative number of age groups of the dwarfs.

Pogodaev, E.G., I.V. Shatilo, M.A. Kudzina, N.A. Chebanov, and S.V. Shubkin. 2012. Results of studying natural salmon freshwater bioresources and artificial rearing. Collection of scientific articles «Studies of aquatic biological resources of Kamchatka and Northwest Pacific Ocean» 25: 145–165 (In Russian with English abstract).

True contours for majority of sockeye salmon lakes of Kamchatka have been figured out and identified accurately in GPS, 3D simulations of lake hollows, bathymetric maps and basis geomorphologic characteristics have been provided as a result of geodesic and hydroacoustic researches. Echosounding of some plots in the lakes has revealed correlation levels between

structure of the water surface thermal parcels and morphological peculiarities of lake hollows, distribution of wind load within the parcels, and specifics in location of tributaries, intensity and temperature of flowing waters. Examination of otolith marking procedures in the course of hatchery cultivation of salmon in Kamchatka has revealed some obstacles, existed a long time and hindered successful marking, and has provided recommendations how to escape the obstacles. Principle scheme of complex measures to increase production of sockeye salmon in spawning-nursery lakes has been recommended. Researches in the field of recreational fishing have revealed formation of unfavorable ecological conditions, indicated by abrupt reduction of frequency of chinook salmon and rainbow trout — two principle and most attractive species and degradation of their biological structure as a result of spontaneous, almost not managed rate of sport fishing activity in several river systems, popular with sportsmen to have tours there. It is found that illegal amateur rope-gear ice fishing in the rivers of Kamchatsky krai can provide removal of smelt, saffron cod and lake herring of 1.5–2 thousand tons a season. Researches of fresh-water bioresources have revealed very high abundances of grayling and pike, status of low abundance and poor studying of whitefish representatives and the need in their further studying and effective protection.

Popova, T.A. 2012. Biological characterization of Chinook salmon in the rivers of the north-west coast of Kamchatka (Tigil'sky administrative district). Collection of scientific articles «Studies of aquatic biological resources of Kamchatka and Northwest Pacific Ocean» 26 (1): 101–113 (In Russian with English abstract).

Biological characterization is accomplished for Chinook salmon from the rivers Palana, Tigil' and Khairuzova for the period of observation from 1996 to 2011. Transformations in biological structure of Chinook salmon populations are revealed.

Radchenko, V.I. 2012. Abundance Dynamics of Pink Salmon, *Oncorhynchus gorbuscha*, as a Structured Process Determined by Many Factors. NPAFC Technical Report 8: 14–18. (Available at www.npafc.org).

Romasenko, L.V. 2012. Dynamics of pink salmon (*Oncorhynchus gorbuscha*) stocks in Kunashir. Izv. TINRO 168: 42–58 (In Russian with English abstract).

The materials have been collected during monitoring of pink salmon stock abundance on Kunashir Island (southernmost part of the Large Kuril Ridge) since 1994 using standard methods for counting downstream migrants, studying catch dynamics and biological characteristics of fish during the coastal fishery and spawning escapement. The occurrence of different temporal forms in pink salmon approaches is shown that determines, in particular, differences in catch dynamics in different years. A harvest of fry migrants was established to be dependent on the number of spawners; density-dependent factors were noted to be not affecting a spawning efficiency. At the same time, relationship between the number of fry migrants and returning adults is weaker that is related with the decline in fish survival during the downstream migration of abundant broods. The mentioned features of Kunashir pink salmon reproduction are, obviously, a reflection of specific habitat conditions nearby the margin of their spawning area.

Safronenkov, B.P., L.L. Khovanskaya, N.N. Ignatov, and I.K. Smilyanski. 2011. Artificial formation of local populations of Pacific salmon as a new perspective of fish culture development in Magadan region. Bulletin of Pacific salmon studies in the Russian Far East 6: 65–71 (In Russian).

Decrease in chum abundance in the basic rivers where salmon hatcheries are located and rivers-donors from which embryonate spawn was stored for incubation is stated. The authors consider that the solution of the problem could consist in enhancement of artificial reproduction as well as in

crating industrial uterine populations. Biotechnology of creation of artificial salmon populations in small watercourses within coastal areas of the northern part of the sea of Okhotsk has been developed. Cultivation of a number of such populations in small water basins within coastal areas of the northern part of the sea of Okhotsk will allow to get up to 1,0-1,5 thousands ton of extra salmon resources.

Safronenkov, B. and V. Volobuev. 2012. Salmon culture based on preservation of biological and ecological conditions of Aquatic communities. NPAFC Technical Report 8: 42-45 (Available at www.npafc.org).

Data on artificial chum population in a small watercourse, where it historically never existed, are given. It is shown that creation of populations of such kind on small watercourses of Magadan region may become an alternative to traditional salmon raising at hatcheries. The main coefficient of mature salmon returns of the created population is 0,7% and maximum coefficient is 1,9%. In perspective the distribution of biotechnology of industrial populations' creation on small watercourses of north Okhotomorsk coastal area will allow to create the chain of ecologically safe salmon populations which will give up to 1,5 thousand tons of salmon resources additionally in case if technical principles will be followed properly.

Shestakov, A.V., and S.I. Grunin 2012. The influence of the Chum salmon approaches number on the growth of food freshwater fishes in the Anadyr River (Chukotka). Bulletin of the North-East Scientific Center, Russia Academy of Sciences Far East Branch 3: 77-84 (In Russian with English abstract).

The paper presents the results of the early variability research of the round whitefish, vostryak whitefish, Siberian whitefish, inconnu, northern pike, and Kamchatka grayling growth rates reported from the Anadyr River. The biological data and the reversed calculation results for the fish linear growth have been thoroughly studied for the period between 1999 and 2010. The basic factor affecting the immature freshwater fishes growth variability is found to be the number of the Anadyr chum salmon approaches.

Shevlyakov, E.A. and A.V. Maslov. 2011. Rivers, determining Pacific salmon production in Kamchatka, as benchmarks to check occupation of spawning grounds. Izv. TINRO 164: 114–139 (In Russian with English abstract). Dynamics of spawning grounds filling by Pacific salmon is investigated for the main rivers of Kamchatka. Contribution of each river to production of salmon is estimated. Principles of extrapolation of the spawners assessments made on some typical rivers to other ones are discussed. The minimal flight time necessary for assessment of 5 species of Pacific salmon is estimated. A systematic approach to organize air observations under limited funding is proposed.

Shevlyakov, E.A., V.G. Yerokhin, and V.A. Dubynin. 2011. Characterization of the coastal fishery of Pacific salmon in Kamchatka region in 2011. Bulletin of Pacific salmon studies in the Russian Far East 6: 10–25 (In Russian).

Shevlyakov, E.A. and M.V. Koval. 2012. Forecast and production dynamics of pink salmon of Kamchatka. NPAFC Technical Report 8: 121–125. (Available at www.npafc.org).

Shevlyakov, E.A. and V.A. Dubynin 2012. Management plan for sockeye salmon fishery in the Ozernaya River. Voprosy rybolovstva. 13. № 1 (49): 157–165 (In Russian with English abstract).

In 2002-2010 fish processing facilities in vicinity of the Ozernaya River outlet demonstrated rapid

growth from production of 300-500 tons up to 3 000 tons a day. With that, in view of increasing runs of the Ozernaya River sockeye salmon stock, the number of trap nets increased on the coast between the rivers Yavinskaya and Ozernaya and caused disruption in dynamics of spawning migration to the Ozernaya River in 2009-2010. The problem of escapement quality and quantity support strictly calls for a deep careful reevaluation of fishery management strategy for main sockeye salmon stock in Asia.

Shuntov, V.P. 2011. Monography “Pacific salmon in marine and oceanic ecosystem”, V.2 and additional comments on carrying capacity of subarctic pelagic of the North Pacific for Pacific salmon. Bulletin of Pacific salmon studies in the Russian Far East 6: 240-246 (In Russian).

Shuntov, V.P. and O.S. Temnykh. 2011. Analysis of preconditions and results of salmon fishing season-2011. Bulletin of Pacific salmon studies in the Russian Far East 6: 3-9 (In Russian).

Shuntov, V.P. and O.S. Temnykh. 2011. Current changes in marine ecosystems in relation with climate changes: priority of global or regional factors? Bulletin of Pacific salmon studies in the Russian Far East 6: 49-64 (In Russian).

Shuntov, V.P., and O.S. Temnykh. 2011. Pacific salmon in marine and oceanic ecosystem. Vladivostok: TINRO-Centre. V.2. 473 pp. (In Russian with English abstract).

Detailed review of long-term studies on freshwater and estuarine life period of the Pacific salmon and their juveniles migration in the Far Eastern Seas and North Pacific is presented in the first volume of the monograph, published in 2008. In the second volume of the monograph, the wintering, feeding, and seasonal migration of immature and mature salmon is considered on wide basis of the data mostly obtained in more than 100 expeditions of Pacific Fisheries Research Center (TINRO) in 1980–2010. Marine autecology is described for each species from the genus *Oncorhynchus*, with special attention to composition and structure of nektonic communities, and analysis of role and place of the salmon in the trophic structure of pelagic communities. The conclusions on these issues change a view on carrying capacity of the North Pacific for salmon, as well as on factors limiting their abundance. The current status of Pacific salmon is estimated on the background of long-term trends in their abundance dynamics.

Shuntov, V.P. and O.S. Temnykh. 2012. Outcomes of salmon fishing season-2012. Bulletin of Pacific salmon studies in the Russian Far East 7: 3–9 (In Russian).

Smirnov, B.P., E.V. Mikodina, S.V. Pyanova, E.V. Ganja, E.D. Pavlov, and T.G. Tohilina. 2011. Gonad morphology and sex cells structure of mature pink salmon *Oncorhynchus gorbuscha* (Walbaum) males of different age and size. Vladimir Ya. Levanidov’s Biennial Memorial Meetings 5: 493-499 (In Russian).

The testis condition have been analyzed of underyearlings and yearlings of pink salmon from Far East water basin. There is testifying their untimely maturation. A cytological similarity is revealed in the gonad structure of underyearlings and yearlings of pink salmon. The gonads of studied fish are shown by cells of late stages of maturity – spermatocytes, spermatids and spermatozoa.

Temnykh, O.S., A.V. Zavolokin, E.A. Shevl’akov, L.O. Zavarina, V.V. Volobuev et al. 2011. Peculiarities of interannual variability of average sizes and age composition of Russian chum salmon stocks. Bulletin of Pacific salmon studies in the Russian Far East 6: 226–240 (In Russian).

The study provides comparative analysis of data on abundance dynamics, trends in body length and weight, the age of chum maturity of the main chum stocks being observed for the last 40-50 years. The analysis of the stated indexes is conducted taking into changes in abundance of the regional complexes of chum salmon.

Temnykh, O.S., A.V. Zavolokin, L.O. Zavarina, V.V. Volobuev, S.L. Marchenko, S.F. Zolotuhin, N.F. Kaplanova, E.V. Podorozhnyuk, A.A. Goryainov, A.V. Lysenko, A.M. Kaev, Yu.I. Ignat'ev, E.V. Denisenko, Yu.N. Khokhlov, and O.A. Rassadnikov. 2012. Interannual variability in size and age structure of Russian chum salmon stocks. NPAFC Doc. 1413 (Rev. 1). 20 pp. (Available at www.npafc.org).

Data on trends in abundance, size and age composition of chum salmon stocks from all major Russian stocks are considered for the last 40-50 years. Increase in the total abundance of chum salmon were accompanied by decrease in average size in most major reproduction areas from the 1970s to 2010s. Changes in size were accompanied by changes in age structure of chum salmon populations. The tendency of growth in average age of spawners due to an increase in the proportion of older chum salmon spawners was in most of examined areas (except Primorye chum salmon stocks). Statistically significant correlation coefficients between average sizes and total catches of chum salmon indicate that there is a close relation between chum salmon abundance and its production features. The reasons of the changes in the size-age structure of chum salmon stocks are discussed. Certain deficiency in food supply during marine life can negatively impact chum growth rate, but ocean food resources are not the limiting factor to the abundance of salmon.

Tokranov, A.M. and V.F. Bugaev. 2011. Where the salmon is bigger?: reference booklet. Petropavlovsk-Kamchatsky: Kamchatpress, 72 pp.

Ustimenko, E.A. and N.V. Sergeenko. 2011. Cause of furunculosis aeromonas salmonicida in spawning sockeye salmon *Oncorhynchus nerka* in Azabachye lake. Voprosy rybolovstva 12 (47): 576–586 (In Russian with English abstract).

The following are the results of a bacteriological investigation of spawning sockeye salmon from Azabachye lake in 2004-2009. Every year, except 2007, we isolated the causative agent of furunculosis - *Aeromonas salmonicida* in 6,7% to 33,3% of late-spawning fish only. During the testing of bacteria we exposed some differences between our isolates and the typical *A. salmonicida*. The *A. salmonicida* that we isolated in Azabachye lake shared some of the peculiarities inherent to the bacteria of this species isolated from fish in reservoirs of the Asian coast of the Pacific Ocean before. However, some of the characteristics of the bacteria we isolated from fish in Azabachye lake are unique to this lake. Pathogenesity of the isolated bacteria *A. salmonicida* shows their potential danger for salmon populations.

Ustimenko, E.A. 2012. Pacific salmon bacterial infections in artificial rearing in Kamchatka. Author's abstract of dissertation. Petropavlovsk-Kamchatsky, 23 pp.

Vetsler, N.M. and E.G. Pogodaev. 2011. Effects of trophic conditions in Dalneye Lake on the body weight and age structure of sockeye salmon smolts. Izv. TINRO 165: 272–282. (In Russian with English abstract).

Effects of trophic conditions in a spawning-feeding lake on biological parameters of sockeye salmon smolts are considered. Long series of forage zooplankton biomass for 1981-2006 (385 samples) are analyzed; the samples were collected 1-3 times per a month by vertical tows of Juday net with mouth diameter of 18 cm at a stationary point in the central part of Dalneye Lake. The data on body weight, age structure and abundance of sockeye salmon smolts were obtained in the same period, by

counting them visually from a fence and sampling from seine catches in the Dalnaya River (in total, 5360 individuals were sampled). Density of feeding juvenile sockeye salmon is estimated by division the total yearly number of escaped juveniles of certain age by the lake square. The juvenile escapement from Dalneye Lake has complicated age composition, varying by years. In the years with high abundance of spawners, the dominant age group of smolts was the yearlings, but the fresh-water period could be 2, 3, or and even 4 years if the spawners were few. The body weight of yearlings has positive correlation with the forage zooplankton biomass before migration, and the number of yearling smolts correlates negatively with this biomass. The harder trophic conditions before migration, the more yearlings in the age 1+ migrate from the lake. The body weight of two-yearlings depends on trophic conditions in both years of their fresh-water feeding, whereas the year of migration is more important. In the years with crustacean biomass 0.3-0.7 g/m³, 35-95 % of juveniles migrate in the age 2+, but in conditions of the higher biomass, the number of two-yearlings decreases and 3+ and 4+ smolts appear. The number of three-yearlings correlates poorly with zooplankton biomass before migration, because these 3+ smolts are mostly females, whereas males of this age demonstrate a dwarf-type development; however, the number of 3+ migrants is influenced by forage conditions in the first year of feeding (three years before migration). High zooplankton biomass (> 0.7 g/m³) promotes longer feeding of sockeye salmon juveniles in the lake and their dwarfification. In the case of joint feeding of several generations, the body weight of three-yearlings depends directly on crustacean biomass in two recent years, but it doesn't depend on trophic conditions in the lake if the abundance of feeding juveniles is low.

Vvedenskaya, T.L., O.O. Koval, A.R. Logachev, and A.V. Ulatov. 2012. Ecology-fisheries researches and assessment of the effects from various economic activities on the aquatic bioresources. Collection of scientific articles «Studies of aquatic biological resources of Kamchatka and Northwest Pacific Ocean» 25: 208–218 (In Russian with English abstract).

Scale of anthropogenous load on populations of hydrobionts and their environment are revealed and demonstrated. Effects of seismic oil exploration at sea on aquatic bioresources are estimated, and the last half of fall is advised as the time of minimal risk for the aquatic biota. Monitoring, provided for exploratory oil drilling on the West- Sukhanovsky parcel of shelf, has indicated a poor and short-time summary effect on marine environment, unable to bring any significant harm in populations of fish, marine mammals and invertebrates. In details description is given for typical ecological problems, arising in the course of building of gas-pipe or traffic infrastructure objects on West Kamchatka. Growth of poaching is shown as the most harmful consequence of the infrastructure as a factor of easy reaching up spawning rivers by cars Ecological state of some water bodies situated within Petropavlovsk-Yelizovo urban agglomeration and strongly affected by anthropogenous factors is estimated on the base of the hydrobiological monitoring. Whence in general the state can be reckoned as satisfactory, some plots have got the state “extremely misbalanced”. With that the streams have lost or extensively reduced the role of fish environment. Ecological and fisheries monitoring of the Falshivaya River results in the conclusion that the steam-water flow, emerging from geothermal power station to the river, strongly modifies physical and chemical conditions of water and affects aquatic biota in the upper stream of the Falshivaya R. An integrate assessment of ecological vulnerability and fisheries value of West Kamchatkan shelf is carried out, and major valuable parcels for fisheries are figured out from the results.

Vvedenskaya, T.L. and A.V. Ulatov. 2012. Results of monitoring for the streams in the system of the Avacha River, situated in the area of anthropogenic pressure. Collection of scientific articles «Studies of aquatic biological resources of Kamchatka and Northwest Pacific Ocean» 26 (1): 124–136 (In Russian with English abstract).

Hydrological, hydrochemical and hydrobiological characterization is given for small and mid rivers within the basin of Avacha River (the rivers Kolokolnikova, Krasnaya, Polovinka, Kanonersky Brook and a nameless tributary of the Pervaya Mutnaya River — all situated in the area of anthropogenic influence). Current ecological status of the rivers and causes of fish production reduce there for nowadays have been analyzed.

Volobuev, V.V. and S.L. Marchenko. 2011. Pacific salmon of the continental sea coast area of the Sea of Okhotsk (biology, population structure, number dynamics, commercial fishing). North-Eastern Scientific Center of the Far Eastern Branch of the Russian Academy of Science. 303 p. (In Russian).

The authors of the monography summarize the materials on different aspects of biology, distribution, number dynamics, intraspecific structure, commercial fishing, and formation of life strategies of four salmon species (chum, pink, coho, sockeye) inhabiting the water basins of the continental coastal area of the Sea of Okhotsk. The book includes the data of almost half a century monitoring of this fish group that allows to obtain full information on many studied questions of biology, conditions of natural and artificial production, morphologic aspect and stocks' dynamics of salmon inhabiting the part of the habitat with the length of 3,5 thousand km.

Volobuev, V.V., S.L. Marchenko, M.V. Volobuev, and D.V. Makarov. 2012. Pacific salmon in salmon rivers' ecosystems of the State reserved area «Magadanski». Collection of scientific articles «Studies of aquatic biological resources of Kamchatka and Northwest Pacific Ocean» 26: 75-89 (In Russian with English abstract).

The data on distribution, reproductive ecology, stocks, commercial fishing and biological structure of Pacific salmon of two main rivers of north Okhotomorsk coastal area which are the State reserved area «Magadanski» are presented.

Yarosh, N.V. and T.N. Travina. 2011. Feeding by size-ranged juvenile Dolly Varden *Salvelinus malma* (Walb.) in the lower part of the Bolshaya River (West Kamchatka). Collection of scientific articles «Studies of aquatic biological resources of Kamchatka and Northwest Pacific Ocean» 20: 52–57 (In Russian with English abstract).

Data on the feeding by juvenile malma trout *Salvelinus malma* (Walb.) individuals of different size in the low part of Bolshaya River have been demonstrated for three years. Demersal invertebrates were the principle food for juvenile malma trout. The character of their consumption in most cases is seasonal, and only larval caddis flies can be found stably and in a high number in the fish stomachs. Flying insects generally aren't principally important for juvenile malma trout's feeding. Findings of juvenile salmon or sticklebacks in stomach of juvenile malma trout are very rare.

Zaporozhets, G.V. and O.M. Zaporozhets. 2011. Dynamics of Pacific salmon stocks in the river systems of Avachinsky Gulf (East Kamchatka) in the late XX – early XXI century. Izv. TINRO 166: 3–38 (In Russian with English abstract).

State and structure of pacific salmon stocks and biological parameters of mature chum, sockeye, pink, coho, and chinook salmon are analyzed on the data of surveys, commercial fishery, and fish density accounting on spawning grounds in the river systems of the Avachinsky Bay. Effect of hatchery rearing on the biological parameters is evaluated. The salmon spawn mostly in the Avacha and Paratunka rivers, their main part is presented by pink and chum salmon. The stocks of other rivers (Nalycheva, Ostrovnaya, Vakhil') are in 10 times lower. Sockeye, coho, and chinook salmon are not numerous. Illegal fishing is significant, in particular in the Paratunka, Avacha, and Nalycheva.

Zaporozhets, G.V. and O.M. Zaporozhets. 2011. Salmon hatcheries of Far East in the North Pacific ecosystems. Petropavlovsk-Kamchatsky 268 pp.

Zaporozhets, G.V. and O.M. Zaporozhets. 2011. Salmon farming in the countries of the North Pacific region. Collection of scientific articles «Studies of aquatic biological resources of Kamchatka and Northwest Pacific Ocean» 22: 28–48. (In Russian with English abstract).

The article provides historical review about development of artificial culture of Pacific Salmon in the countries within the North Pacific region. Technological details and results of salmon hatchery cultivation in different countries are described. Principle attention is provided to priority of ecosystem approach in planning and accomplishing steps for salmon resource or stock abundance restoration has emphasized.

Zaporozhets, G.V., O.M. Zaporozhets, and Zh.Kh. Zorbidi. 2012. Production of chum and coho salmon in Viluysky salmon hatchery (South-East Kamchatka) Izv. TINRO 169: 162–175 (In Russian with English abstract).

Farming of salmon juveniles at the Viluysky Salmon Hatchery is investigated. Its efficiency is evaluated as low, so far as the mean coefficients of return and multiplicity in 1993-2004 were 0.04 % and 0.3 for the chum salmon and 0.11 % and 1.4 for the coho salmon. The returns depend negatively on the juveniles releases, possibly because of predators in Lake Bolshoi Viluy, more abundant in the periods of high releases. Both chum and coho salmon of artificial breeding return in younger age, as compared with the age at return for their wild populations.

Zaporozhets, O.M. and G.V. Zaporozhets. 2012. Some consequences of Pacific salmon hatchery production in Kamchatka: changes in the age structure and contribution to the natural spawning population. Environ. Biol. Fish 94(1): 219-230 (In English).

Aggregate hatchery production of Pacific salmon in the Kamchatka region of the Russian Federation is very low (< 0.5% of total harvest, with five hatcheries releasing approximately 41 M juvenile salmon annually), but contributions in certain rivers can be substantial. Enhancement programs in these rivers may strongly influence fitness and production of wild salmon. In this paper we document significant divergence in demographic traits in hatchery salmon populations in the Bolshaya River and we estimate the proportion of hatchery chum salmon in the total run in the Paratunka River to demonstrate the magnitude of enhancement in this system. We observed a reduction in the expression of life history types in hatchery populations (ranging from 1 to 9 types) compared to wild populations (17 types) of sockeye salmon in the Bolshaya River. We found similar trends in Chinook salmon in the same river system. This reduced life history diversity may make these fish less resilient to changes in habitat and climate. We estimate hatchery chum salmon currently contribute 17-45% to the natural spawning population in the Paratunka River. As hatchery fish increase in numbers at natural spawning sites, this hatchery production may affect wild salmon production. It is important to investigate the risk of introgression between hatchery and wild salmon that can lead to reduction in salmon fitness in Kamchatka rivers, as well as the potential of ecological interactions that can have consequences on status of wild salmon and overall salmon production in this region.

Zavarina, L.O. 2011. Biological structure and trends of changing stock abundance of chum salmon (*Oncorhynchus keta*) in the Bolshaya-Vorovskaya River system, West Kamchatka. Collection of scientific articles «Studies of aquatic biological resources of Kamchatka and Northwest Pacific Ocean» 23: 5–17 (In Russian with English abstract).

Long-term data (1991–2010) on the dynamics of chum salmon biological data in the Bolshaya Vorovskaya River are performed for the first time. Data on the dynamics of catches, density in

spawning grounds and runs of chum salmon in the basin of the river are provided. It is demonstrated that the dynamics of chum salmon generation abundance in this river depends on the abundance of pink salmon spawned in the year of chum salmon parental stock spawning.

Zavarina, L.O. and S.B. Gorodovskaya. 2011. Characterization of chum salmon (*Oncorhynchus keta*) juvenile escapement and some histological gonad indexes in the basin of the Khailulya River in 2002–2003 (the north-east coast of Kamchatka). Collection of scientific articles «Studies of aquatic biological resources of Kamchatka and Northwest Pacific Ocean» 22: 63–67 (In Russian with English abstract).

Data on juvenile chum salmon biological state, histological parameters of gonads and dynamics of down-stream migration have been demonstrated for 2002–2003. Stages of gonad maturation have been analyzed for juvenile chum salmon males and females, diameters of oocytes, oocyte nuclei and nuclei of spermatogonia have been measured.

Zavarina, L.O. 2012. Characterization of chum salmon *Oncorhynchus keta* spawning stock in the Zhupanova River, South-East Kamchatka. Collection of scientific articles «Studies of aquatic biological resources of Kamchatka and Northwest Pacific Ocean» 27: 24–32 (In Russian with English abstract).

Data about age composition, sex ratio and size-weight characteristics of chum salmon of Zhupanova River have been analyzed first time, and their dynamics has been demonstrated for the entire period of observation (1991, 1999–2011). Data on the dynamics of chum salmon catches, density of spawning and spawning runs in the basin of the river are provided. An increase in the abundance of chum salmon progeny generations with an increase of the biogenic mass of parental chum and pink salmon carcasses has been demonstrated for the even years 1996–2004. As for the odd years 1995–2005 of spawning, it can be observed only a trend to growth in the abundance of chum salmon progeny generations with an increase of the total biogenic mass of salmon carcasses.

Zavolokin, A.V., V.V. Kulik, and Y.N. Khokhlov. 2011. Changes in size, age, and intra-annual growth of Anadyr chum salmon (*Oncorhynchus keta*) from 1962-2010. NPAFC Doc. 1330. 11 pp. (Available at www.npafc.org).

Inter-annual changes in body size, age composition, and intra-annual changes in growth of Anadyr chum salmon collected in 1962-2010 were studied. From the 1960s to the 2000s, body size of Anadyr chum salmon significantly decreased and the average age of spawners slightly increased. Annual growth dynamics showed different patterns. Estimated from measuring intersclerite distances on scales, first-year growth of Anadyr chum salmon samples collected in 1962 to 2007 was enhanced. After the first year, growth was reduced. The greatest reduction occurred in the third (ages 0.3 and 0.4) and fourth (age 0.4) years. Intra-annual scale increments showed that growth reduction after the first year occurred both in over-wintering and foraging areas. This contrasts with the wide-spread suggestion that chum salmon size decreased due to a poor foraging conditions during the winter period. Based on published results and our data, it seems the growth of at least two salmon species (chum and pink salmon) changed similarly in recent decades. Hence there are some large-scale factors that influenced these species and had an effect in the vast areas of the North Pacific and marginal seas. Our results don't corroborate the decisive importance of density-dependent interactions for Pacific salmon productivity in the last 50 years. Negative correlations between some climatic indices (ocean surface temperature, ground air temperature, and heat content of North Pacific Ocean) and scale increments of Anadyr chum salmon in the second, third and fourth year zones suggest that warming of North Pacific may have adverse impact on chum salmon growth after the first year of life. Chum salmon growth reduction after the early marine period may be a mixture of increasing abundance of Pacific salmon combined with warming ocean.

Zavolokin, A.V., E.V. Farley, and E.C. Martinson. 2011. Feeding of Pacific salmon and other fish in the eastern Bering Sea in August-September 2011. Bulletin of Pacific salmon studies in the Russian Far East 6: 141-147 (In Russian).

Diets of Pacific salmon (pink, chum, sockeye, coho, chinook) and other nekton species (walleye pollock, cod, capelin, herring) were studied based on the data of pelagic survey in the southeastern Bering Sea in August-September 2011. Most fish fed on macrozooplankton. Pink, chum and sockeye salmon consumed primarily euphausiids, amphipods and pteropods. Stomach contents of pollock, cod and capelin consisted mostly of copepods. Coho and chinook salmon fed on small-sized fish and squids. In comparison with previous years (2008-2010), the role of hyperiid amphipod *Themisto libellula* in salmon diets greatly decreased.

Zavolokin, A.V., V.A. Degtyareva, and N.S. Kosenok. 2012. To the methods of fish diet analysis based on the samples from trawl catches. Bulletin of Pacific salmon studies in the Russian Far East 7: 107-111 (In Russian).

The conventional method of fish diet analysis based on the samples from trawl catches does not consider spatial inhomogeneity of fish distribution. We suggested using weighted means where weights were catches of fish species (or its size group). Suggested approach let us to get unbiased estimates of diet compositions and consumption rates.

Zavolokin, A.V., V.V. Kulik, I.I. Glebov, E.N. Dubovets, and Yu.N. Khokhlov. 2012. Dynamics of size, age, and intra-annual growth of Anadyr chum salmon in 1962-2010. Journal of Ichthyology. 52(3): 207-225. (In English).

Interannual variability of body length, body weight, age structure, and seasonal growth rate of Anadyr chum salmon *Oncorhynchus keta* was studied using the monitoring data obtained in 1962–2010 in Anadyr River and Anadyr Firth. Body size of spawning adults has decreased significantly for the decade of 1990–2000s compared to the period of 1960–1970s, and the ratio of elder specimens was higher. Annual growth dynamics showed different patterns. Estimated from measuring intersclerite distances on scales, firstyear growth of Anadyr chum salmon samples collected in 1962 to 2007 was enhanced. After the first year, growth was reduced. The greatest reduction occurred in the third and fourth years. Analysis of seasonal growth of scale evidences to the relaxation of the growth rates of Anadyr chum salmon after the first year of life preconditioned by both the overwintering and foraging period. These data are in contradiction with the widespread suggestion of decreasing of chum salmon body length during winter due to bad feeding conditions. According to the similarity of the dynamics of body length and growth rates of chum salmon and pink salmon *O. gorbuscha* observed for the last decades, we assume that this may be preconditioned by the same large-scale limiting factors that affect similarly these salmon species inhabiting vast areas. Our data do not support the idea about highdensity population of chum salmon as a main factor affecting the productivity characteristics of this species in the northern Pacific Ocean in the second half of the 20th–beginning of the 21st century. Reasons for decrease of chum salmon body length are discussed.

Zhivogljadov, A.A, V.A. Rudnev, A.A. Antonov, and O.A. Promashkova. 2011. Communities of resident fishes as markers of pink salmon (*Oncorhynchus gorbuscha* (Walbaum) reproductive sites on two rivers of Southern Sakhalin. Vladimir Ya. Levanidov's Biennial Memorial Meetings 5: 159-164 (In Russian).

The results of preliminary typification of river channel zones and fish communities of two typical salmon rivers (in the south of Sakhalin Island) have been presented. Distinctions in structure of communities of fishes-residents and differences in reproductive ability of *Oncorhynchus gorbuscha*

spawning areas of the investigated rivers are shown.

Zhivoglyadov, A.A., V.D. Nikitin, O.A. Promashkova, and A.P. Prokhorov. 2011. Some approaches to the study of species and spatial structure of fish communities from the plain zone of Poronai River. Water life biology, resources status and condition of inhabitation in Sakhalin-Kuril region and adjoining water areas: Transactions of the Sakhalin Research Institute of Fisheries and Oceanography. – Yuzhno-Sakhalinsk : SakhNIRO 12: 55–71 (In Russian).

There are presented the results of the Poronai River bed sampling at different sites in spring (April–May) and autumn (September) of 2005–2006. A seasonal variability of species composition in the Poronai River bed is shown based on the net, seine and fingerling trawl samplings (in total, 55 net stations and 14 active gear stations). There are given the principles of the river bed dividing into different zones and biotopes; based on them, the fish communities and their distribution within the plain zone of the river bed have been revealed. It is concluded that Cyprinidae are the dominants in spring and autumn.

Zhivoglyadov, A.A., V.A. Ul'chenko, and A.N. Kozlov. 2011. Dynamics of cenotic indices and distribution of freshwater fishes on Urup Island (Kuril Islands) in summer and autumn of 2000–2001. Water life biology, resources status and condition of inhabitation in Sakhalin-Kuril region and adjoining water areas: Transactions of the Sakhalin Research Institute of Fisheries and Oceanography. Yuzhno-Sakhalinsk : SakhNIRO 12: 72–93 (In Russian).

There are presented the results of ichthyofaunal study of freshwater bodies on Urup Island in 2000–2001. A structure of fish communities inhabiting different-type water bodies is analyzed, and some data on ichthyofaunal diversity of this island are given.

Zhivotovsky, L.A., L.K. Fedorova, G.A. Rubtsova, M.V. Shitova, T.A. Rakitskaya, V.D. Prokhorovskaya, B.P. Smirnov, A.M. Kaev, V.M. Chupakhin, V.G. Samarsky, V.P. Pogodin, S.I. Borzov, and K.I. Afanasiev. 2012. Rapid expansion of an enhanced stock of chum salmon and its impacts on wild population components. Environ. Biol. Fish 94: 249–258 (In English).

A harvested stock of chum salmon homing to Kurilskiy Bay, Iturup Island, consists of two genetically distinct river populations that reproduce in two rivers that drain into the bay and are characterized by limited gene flow. One of these is small and can be regarded as wild, whereas the other is much larger and, until recently, was composed of naturally reproducing components spawning in the river's mainstem and tributaries, with almost no hatchery reproduction during the past two decades. The only human impact on reproduction of the chum salmon stock was regulation of the escapement, with officially accepted limits to avoid 'over-escapement'. Recently the hatchery began to release a large amount of chum salmon juveniles. As confirmed by data on variation in both age composition and microsatellite DNA, first-generation hatchery-origin fish that returned from the first large releases occupied spawning grounds and presumably competed directly with, and potentially displaced wild fish. The most dramatic example is a genetically distinct beach-spawning form of chum salmon that was swamped by much more numerous hatchery-origin fish of the river-spawning form. In order to restore and support naturally reproduced population components, careful estimation of the carrying capacity of natural spawning grounds is necessary with efforts to increase escapement to these habitats. We also recommend concerted efforts to restore and conserve a unique beachspawning population of chum salmon. We further recommend development of a marking program for direct estimation of straying and evaluation of ecological and genetic impacts of hatchery fish on neighboring wild and natural populations.

Zorbidi, Zh.Kh. 2012. Fecundity and growth of coho salmon (*Oncorhynchus kisutch*) in

Kamchatka. Collection of scientific articles «Studies of aquatic biological resources of Kamchatka and Northwest Pacific Ocean» 26 (1): 90–100 (In Russian with English abstract).

Analysis of growth rate of coho salmon for 2005–2010 has demonstrated identical character of variations in dynamics of increments for coho salmon from the east and west coasts of Kamchatka in even and odd years. The growth rate of coho salmon has been reduced for recent six years during freshwater and marine periods of life comparing to the average annual growth rate for 1960–2002. Correlation between absolute fecundity and juvenile freshwater growth can be seen well depending on the body size of migrating two-yearlings under the term of a good growth in the year of spawning migration. The correlation coefficients in most cases are 0.62–0.64. Final fecundity depends on the factors, determining the character of the growth of coho salmon during marine period of life and the absolute individual fecundity formation. The higher the growth rate of fish of same one age at sea, the higher their fecundity, when all the other terms were same. The correlation coefficients vary almost in all cases in range 0.57–0.75.

COMPONENT 5: DEVELOPMENT AND APPLICATIONS OF STOCK IDENTIFICATION METHODS AND MODELS FOR MANAGEMENT OF PACIFIC SALMON

Akinicheva, E.G., A.O. Shubin, and M.Yu Stekolschikova. 2012. Current state of studies on marking and identification of hatchery-reared salmon in Sakhalin-Kuril region. Water life biology, resources status and condition of inhabitation in Sakhalin-Kuril region and adjoining water areas: Transactions of the Sakhalin Research Institute of Fisheries and Oceanography. Yuzhno-Sakhalinsk : SakhNIRO 13: 83–90 (In Russian).

The possibility to identify hatchery-reared fish perfectly is an actual problem for estimating numbers of returned salmon adults, artificial reproduction efficiency and fish survival, and for studying the marine life period. Since 2008, SakhNIRO and Sakhalinrybvod have realized a joint program of researches on the Pacific salmon otolith-marking. In 2010, the marked juveniles that composed more than 157 million individuals were released from 13 hatcheries in Sakhalin region. The studies on origin and numbers of returned hatchery pink salmon in Aniva Bay have been started. The first data on distribution and migratory ways of juvenile salmon from individual Sakhalin hatcheries in the early sea life period were obtained. The size-weight characteristics of juvenile pink and chum salmon were estimated in relation with their certain residence time in the sea.

Akinicheva, E.G., B.P. Safronkov, and E.A. Fomin. 2012. Pacific salmon marking at the Far East hatcheries. Bulletin of Pacific salmon studies in the Russian Far East 6: 83-90 (In Russian).

The juvenile salmon marked at different hatcheries of the same region are mixed after their migration to the sea, and the fish with hatchery marks of all mark-use countries (Russia, Japan, Korea, USA, and Canada) occur in the ocean feeding areas. In order to determine a true salmon origin from marks when studying a sea life period, they need to be different for each hatchery. Annually all these countries compose and correct their regional plans of marking for avoiding repetition of marks inside the country. Then the plans elaborated for each country are corrected at the international level, providing for unique marks used for marking juvenile salmon and in order to exclude their backup between countries. Most of the Far East hatcheries work on the river water, and that is why the well-distinctive marks on the otoliths of released juveniles are impossible to obtain without taking into account the particular features of the temperature regime while incubating and growing juveniles at each hatchery. In this paper the problems arising when marking salmon at hatcheries of the Russian Far East, and the main points for organizing the works to assure reliability of marks are considered.

Bugaev, A.V. 2011. Identification and commercial removal of Asian sockeye salmon *Oncorhynchus nerka* stocks within the EEZ of Russia. Izv. TINRO 167: 3–31 (In Russian with English abstract).

Commercial landings of sockeye salmon by Russian and Japanese drift-net fishery during prespawning migration (May-August) in 1995-2010 are assessed for four regions within the exclusive economic zone of Russia: southwestern Bering Sea (districts 61.01 and 61.02.1 by Russian nomenclature or district 1 by Japanese nomenclature); western part of the North-West Pacific (district 61.02.2); eastern part of the North-West Pacific (districts 61.03.1 and 61.04.1 or district 3a); and eastern Okhotsk Sea (districts 61.05.1, 61.05.3, and 61.05.4 or district 2a). Asian stocks of sockeye salmon are identified. The algorithm of local stocks identification is based on scale criteria, its examples for 2008 and 2010 are presented. Baselines of the local stocks are defined and their resolution ability is estimated. The ratio of mature and immature fish and age structure is determined for drift-net catches. Commercial landings are estimated for all identified stocks and stock complexes. Year-to-year dynamics of commercial pressure by Russian-Japanese drift-net fleet on the major Asian stocks of sockeye dwelling in the Kamchatka and Ozernaya Rivers is considered, and effect of the drift-net fishery on these stocks forming is demonstrated.

Bugaev, A.V., R.A. Shaporev, M.V. Koval, V.S. Ogorodnikov, A.O. Shubin, A.A. Koinov, Yu.N. Khokhlov, S.F. Zolotukhin, S.E. Kulbachniy, and E.V. Podorozhnyk. 2012. Distribution of regional complexes of Asian chum salmon *Oncorhynchus keta* stocks within the EEZ of Russia in the course of prespawning migrations. Izv. TINRO 171: 3–25 (In Russian with English abstract).

New phase of population studies of chum salmon on the base of phenotypical methods. Scale criteria are used as a basis for stocks differentiation. Six main regional complexes of stocks are revealed by analyzing the phenotypes of chum salmon scale from the samples obtained in 2010: 1) West Kamchatka, 2) East Kamchatka, 3) Sakhalin, 4) continental shore of the Okhotsk Sea, including the Amur, 5) Chukotka, and 6) Japan. The scale baseline is defined for the salmon of age 0.3 and 0.4. Resolution ability of the baseline model is estimated as 80 %. Using this model, the origin of chum salmon caught by drift nets in the period of their prespawning migration in May-August of 2010 and 2011 is identified, and spatial distribution of Asian stocks is determined for mature chum salmon within Russian EEZ in the Bering and Okhotsk Seas and the North Pacific. Stocks from Kamchatka and continental shore of the Okhotsk Sea dominated in aggregations of maturing chum salmon, whereas presence of Japanese stocks decreased. Year-to-year changes of proportions between the regional complexes of mature chum salmon are traced for 1997–2003. Dynamics of near-shore catches of mature chum salmon is compared with population structure of the maturing fish in prespawning migration, and the structure influence on formation of preanadromous aggregations is analyzed.

Bugaev, A.V., R.A. Shaporev, V.A. Savin, and A.I. Chistyakova. 2012. Results of phenotypic researches for Kamchatkan Pacific salmon *Oncorhynchus spp.* in 1990–2010. Collection of scientific articles «Studies of aquatic biological resources of Kamchatka and Northwest Pacific Ocean» 25: 37–57(In Russian with english abstract).

Results of phenotypical studies of Pacific salmon, accomplished by staff of KamchatNIRO in 1990–2010, are performed in several principal blocks. 1) Introduction and current use of the methods, based on scale criteria and practicing internationally in population biology. Working out new automatic methods for structural processing of scales and otoliths. 2) Carrying out extensive work to provide intraspecific differentiation and revealing main regional complexes of Pacific salmon stocks in Asia and North America from phenotypes of scale structure. Using results of the work as baseline

models. 3) Processing massive pool of scale images, obtained as a result of long-term drift-net surveys. Figuring out general trends in the ratio and spatial-temporal distribution of regional complexes of stocks of mature salmon on their prespawning routs within the EEZ of RF are figured out. 4) Preliminary data about intraspecific structure of Pacific salmon feeding aggregations in the Western Bering Sea in summer and autumn in the early 2000s are obtained. Abundance of Asian and American stocks in mentioned region is estimated. 5) Necessary prerequisites for further development of phenotypic researches in TINRO system are created.

Bugaev, A.V., N.Yu. Shpigalskaya, O.A. Pilganchuk, R.A. Shaporev, V.A. Savin, A.I. Chistyakova, U.O. Muravskaya, and O.N. Saravansky. 2012. Review of some results of Russian population studies of Pacific salmon in 2010 and 2011. NPAFC Doc. 1397. 18 pp. (Available at <http://www.npafc.org>).

The document demonstrates general directions of Russian population studies of Pacific Salmon in the system of fisheries institutes in Far East in 2010 and 2011. For today genetic and phenotypic methods are used to provide studying intraspecific structure of feeding and prespawning aggregations of salmon during marine period of life history. Issues of development of the studying attract a great interest as promising for commercial fishery practical solutions in the Exclusive Economic Zone of Russian Federation. Some results of provided and demonstrated work on identification were already used in forecasting abundance of salmon returns in the rivers of Kamchatka.

Chistyakova, A.I., R.A. Shaporev, and N.V. Varnavskaya 2012. Assessing the use of otolith microstructure for identification of regional stock complexes of juvenile chum salmon. NPAFC Technical Report 8: 71–73. (Available at <http://www.npafc.org>).

Fomin, E.A., S.N. Volkova, and S.I. Kharchenkova. 2011. Results of marking juvenile Pacific salmon at the hatcheries of Magadan region. Bulletin of Pacific salmon studies in the Russian Far East 6: 106–111 (In Russian).

Data on mass otolith marking of salmon at hatcheries of Magadan region are stated. The quality of salmon marking at hatcheries is discussed. Positive role of scientific support of marking and quality improvement of the marks being formed on the otoliths of hatcheries raised salmon are noted.

Ivankov, V.N. Intraspecific differentiation and the population organizing of pink salmon in different parts of its natural habitat. Izv. TINRO 167: 64-76 (In Russian with English abstract).

Ecological and temporal differentiation of the pink salmon populations is similar to chum salmon. Both species have two general strategies of reproduction. Seasonal races of pink salmon are distinguished by different spawning areas and habitat conditions of their embryonic-larval development, the same as chum salmon. Spreading of these sympatric ecological-and-temporal races of pink salmon is determined wider by their reproduction range than it was considered till recently.

Kul'bachnyi, S.E., and V.N. Ivankov. 2011. Temporal differentiation and conditions of reproduction of chum salmon *Oncorhynchus keta* (Salmoniformes, Salmonidae) from the Tugur River Basin (Khabarovsk Krai). Journal of Ichthyology 51 (1): 63–72 (In English).

Chum salmon *Oncorhynchus keta* from the Tugur River of Khabarovsk krai was studied. It was found that, in the river basin, chum salmon of two ecological groups reproduces: the first spawns at river sections with a pronounced underflow and the second spawns at river sections with a groundwater outlet. In the first anadromous migration, usually three maxima of the number of approaches of migrating fish are observed. The first in time maximum is represented by early (or

summer) chum salmon, the second includes migrants of early and late (or autumn) form, and the third is represented by chum salmon of only late form.

Forms of chum salmon from the Tugur River basin differ not only in the ecology of reproduction but also in biological indices. The later chum salmon is larger; its gonads at entry into the river for spawning are less mature as compared with early chum salmon. The autumn form of chum salmon reproducing at key spawning grounds is distributed more widely than the summer form. It is found along the Asian coast from Chukotka in the north to Japan and Korea in the south. Summer chum salmon occupies only part of the range of the autumn form.

Savin, V.A., R.A. Shaporev, E.V. Savenkova, and N.V. Varnavskaya. 2012. Differentiation of local pink salmon stocks on the basis of variations in their scale structure. NPAFC Technical Report 8: 67–70. (Available at www.npafc.org).

Shpigalskaya, N.Yu., Vl.A. Brykov, A.D. Kukhlevsky, O.N. Saravansky, A.V. Klimov, A.A. Chetvertak, and E.A. Shevlyakov. 2011. Regional identification for mixed oceanic aggregations of juvenile pink salmon (*Oncorhynchus gorbuscha Walbaum*) on the base of variety of mtDNA Cytb/D-loop. Izv. TINRO (165): 89–103 (In Russian with English abstract).

Genetic variety of pink salmon is determined for nine local populations from Kamchatka and eight ones from Sakhalin Island and the Amur collected in even years in the period from 2004 to 2010 (980 specimens) on the base of the mtDNA Cytb/D-loop restriction fragments polymorphism. Genetic differentiation of the populations is assessed by frequency distribution of 36 combined mtDNA haplotypes. Genetic distances are calculated and the populations are clustered by several statistic methods. Genetic diversity within the regions is poor, but the regions are statistically heterogeneous. Taking these results into consideration, regional composition of juvenile pink salmon mixed aggregations in the sea is analyzed for trawl catches collected by RV Professor Kaganovsky in autumn 2009 (595 specimens). The results of genetic identification correspond well with the data on catches and runs of pink salmon in the regions in 2010, in particular for the populations from East Kamchatka and Sakhalin. The estimated portion of the population from West Kamchatka differed from the real data in 5.7 %. The maximal identification error was for the Amur population where the factual catch and total run were much less than estimations done from genetic analysis of juveniles in the period of their feeding. This error was possibly caused by insufficient sample size from this area for the genetic baseline or by underestimation of the spawners number.

Shpigalskaya, N.Yu., U.O. Muravskaya, O.N. Saravansky, and E.A. Shevlyakov. 2011. Preliminary results of regional identification of juvenile pink salmon on the data of autumn trawl survey in the Sea of Okhotsk in 2010. Bulletin of Pacific salmon studies in the Russian Far East 6: 284–287 (In Russian).

Shpigalskaya N.Yu., Vl.A. Brykov, A.D. Kukhlevsky, A.A. Chetvertak. 2012. Polymorphism of mitochondrial DNA (mtDNA) of the Cytb/D-loop region in pink salmon populations. NPAFC Technical Report 8: 62-63. (Available at www.npafc.org).

Shpigalskaya, N.Yu., V.A. Brykov, A.D. Kukhlevsky, and E.A. Shevlyakov. 2012. Identification of pink salmon mixed-stock aggregations on the basis of mitochondrial DNA polymorphism. NPAFC Technical Report 8: 64-65. (Available at www.npafc.org).

Shpigalskaya, N.Yu., O.A. Pilganchuk, V.V. Savenkov, A.S. Kustova, U.O. Muravskaya, and O.N. Saravansky. 2012. Results of studying intraspecific structure of commercial fish species

by methods of population genetics. Collection of scientific articles «Studies of aquatic biological resources of Kamchatka and Northwest Pacific Ocean» 25: 69–97 (In Russian with English abstract).

Results of studies (2003–2011) on the base of modern methods of molecular genetics to assess population variation for commercial fish species, including pink salmon, sockeye salmon, chinook salmon, walleye pollock and pacific cod, have been demonstrated. Frequencies of polymorph genetic markers from fish of natural populations and foraging or spawning aggregations (more than five thousand individuals, about 100 samples) were used for the analysis.

Stekolschikova, M.Yu., E.G. Akinicheva, and A.M. Kaev. 2011. The first results of identification of the hatchery-origin pink salmon returned to Aniva Bay in 2010. Bulletin of Pacific salmon studies in the Russian Far East 6: 103–105 (In Russian).

A total of 514 marked fish (12.82 % of the total samples) were identified when analyzing the otolith microstructure. Of them, 480 fish had marks of the Anivsky Hatchery and 34 of the Taranaisky Hatchery. The marked fish from the other areas of Sakhalin and Iturup Islands were not found in the Aniva Bay samples. The hatchery-origin fish have increased in numbers from catches as far as pink salmon approaches intensified. As expected, most of the marked fish were represented in samples by the individuals from fish weirs of the Anivsky Hatchery (281 ind.) and Taranaisky Hatchery (67 ind.). Despite a wide presence of the marked fish in trap nets located far from the base rivers of the hatcheries, no fish with hatchery marks on their otoliths were found in the sample taken from the Kura River.