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Russian Bibliography of 2013 Publications Linked to the Current NPAFC Science Plan

by

A.V. Zavolokin[1], O.S. Temnykh[1], S.V. Naydenko[1], M.V. Koval[2], N.V. Klovach[3], V.V. Volobuev[4], A.M. Kaev[5], A.A. Zhivoglyadov[5], E.V. Golub'[6], V.I. Ostrovsky[7]

[1]TINRO-center, Vladivostok;

[2]KamchatNIRO, Petropavlovsk-Kamchatsky;

[3]VNIRO, Moscow;

[4]MagadanNIRO, Magadan;

[5]SakhNIRO, Yuzhno-Sakhalinsk;

[6]ChukotTINRO, Anadyr;

[7]KhfTINRO, Khabarovsk.

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Russian Bibliography of 2013 Publications Linked to the Current NPAFC Science Plan

ABSTRACT

The bibliography lists original papers and documents published in 2013 by Russian scientists and their collaborators relevant to the 2011-2015 NPAFC Science Plan. The bibliography lists 80 papers, corresponding to the five key research components of the NPAFC Science Plan.

Keywords: bibliography, migration, survival, climate impacts, BASIS, monitoring, stock identification, management

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 in 2013 by Russian scientists and their collaborators relevant to the 2011-2015 NPAFC Science Plan. The bibliography lists 80 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

Chebanova, V.V. 2013. Feeding of rainbow smolt, starry flounder, saffron cod, pacific herring and salmonids within the Kamchatka River estuary. Collection of scientific papers "The researches of the aquatic biological resources of Kamchatka and the north-west part of the Pacific ocean" 31: 98-105. (In Russian with English abstract).
Feeding characteristics for rainbow smelt (10–28 cm), starry flounder (11–29 cm), saffron cod (26–40 cm), Pacific herring (8–34 cm), char (18–62 cm), malma (17–36 cm), sockey salmon (11–16 cm) and coho salmon (11–27 cm) within the Kamchatka River estuary are given. Food composition peculiarities for some fish species in the vast area of the Nerpich'e and Kaltuchnoe Lakes as well as the features of their stomach fullness, arising from irregular distribution of food objects, are revealed.

Frenkel, S. E., B.P. Smirnov, and A.V. Presnyakov. 2013. Characteristics of zooplankton at the coast of Iturup Island in the time of salmon juveniles off-shore migration. Izv. TINRO 172: 89–195. (In Russian with English abstract).
Zooplankton of the superficial layer (upper 10 m) is characterized for the period of salmon juveniles feeding in the coastal zone of Iturup Island (during off-shore migration in August 2011). Data of two surveys conducted on the Okhotsk Sea side of the Island around Chirip Peninsula at the distance 200–1500 m from the coastline and retrospective data collected in May-July of 1980–1984 and 2010 are analyzed. In total, 36 taxa of zooplankton were identified. Both species composition and abundance became richer westward — so, in August 2011, the biomass was on average 160 mg/m 3 in Belavin Bay and 86 mg/m 3 in the Kurilsky Gulf at the western side of Chirip Peninsula but much lower eastward: 62 mg/m 3 in the Olya Bay, and 22 mg/m 3 in the Prostor Gulf. The maximum abundance (61 thousand ind./m 3, 1854 mg/m 3) was observed in the open coastal waters to the north of the Kitovy Gulf (also westward from Chirip) in late August in conditions of wind-induced upwelling. Pseudocalanus spp. was the most abundant species (both by number and biomass) westward from Chirip, but Oithona similis and Microsetella norvegica dominated eastward from this peninsula. Large-sized Calanidae species, being a preferred food for salmon juveniles, had the highest biomass in late August, when it reached 116 mg/m 3 in the northern Kitovy Gulf. Significantly lower biomass of zooplankton in August 2011 compared to July 1980–1984 and 2010 was induced by a sharp reduction in the number of Pseudocalanus spp. due to increase of water temperature. The zooplankton community succession is considered as a reason of the salmon juveniles off-shore migration.

Kalchenko, E.I., A.V. Klimov, V.G. Erokhin, V.I. Shershneva, A.V. Morozova, and M.I. Yureva. 2013. Dynamics of the composition of fatty acids of juvenile chum and pink salmon in the course of autumn-winter seaward and oceanic migrations. Collection of scientific papers "The researches of the aquatic biological resources of Kamchatka and the north–west part of the Pacific ocean" 30: 89–99. (In Russian with English abstract).
Analysis of the dynamics of juvenile pink and chum salmon's muscle tissue biochemical characteristics during autumn migrations to the Sea of Okhotsk and winter migrations to the north–western part of the Pacific Ocean has provided information about forage supply and seasonal energetic reversions in organism of the juvenile fsh in the course of the first year of life at sea. The principal role of the autumn feeding in the life history of Pacific salmon consists in providing a rapid growth and intense accumulation of lipids as general reserves of energy. In winter young chum and

pink salmon demonstrate intense spending of the lipids, accumulated in the muscle tissue for the autumn period, and transformation of the composition of their fatty acids towards a lower level of monounsaturated acids and a higher relative part of the ω–3 polyunsaturated fatty acids (especially of the docosahexaenoic acid). A poor content of lipids and changing profiles of fatty acids in salmon's muscle tissue in winter indicate of a high expenditure of accumulated energy required for adaptation to low water temperatures and worsening food supply.

Klimov, A.V., A.P. Lozovoy, and I.V. Zhiganova. 2013. Behavioral and Biochemical Adaptations of Juvenile Pacific Salmon in the Okhotsk Sea and Northwestern Pacific Ocean // NPAFC Technical Report 9: 131–135. (Available at www.npafc.org).

The aim of the work was to determine strategic behavioral and biochemical adaptations of juvenile pink, chum, and sockeye salmon in their first year in the ocean. Analysis was done on the basis of biochemical characteristics (lipid, protein, and calorie contents) of muscle tissue and the distribution of young salmon caught in trawl surveys in the Okhotsk Sea. We also analyzed feeding conditions and specifics of the seasonal metabolism of the fish. We analyzed the first ocean year in three periods: early marine period (adaptation period to live in sea water), intense foraging in autumn, and migration to the ocean (adaptations to live in the ocean). An important trait of these adaptive periods, and makes them different from other periods of salmon ontogenesis, is the proficiency–deficiency transit in the energy budget that is expressed by intense usage of deposited nutrient substances (mainly triacylglycerols). Based on our analysis, we now see two strategies used by juvenile salmon in exploration of marine feeding areas and strategies of biochemical adaptation. Pink and chum salmon firstly explore an extensive marine area and demonstrate intense foraging and then, as they migrate seaward, spend their accumulated energy. Whereas sockeye salmon forage within coastal waters and generally accumulate low levels of lipid from the time they enter sea water until when they move into offshore ocean waters.

Koval, M.V. and S.L. Gorin. 2013. Influence of the Conditions in the Hairuzova and Belogolovaya Estuaries (Western Kamchatka) on Total Pacific Salmon Abundance. NPAFC Technical Report 9: 222–227. (Available at www.npafc.org).

The Hairuzova and Belogolovaya rivers are some of the largest rivers in western Kamchatka. However, the total abundance of Pacific salmon in these rivers is much lower than in other Kamchatkan rivers of the same size, or even smaller. In July–August 2012 we conducted hydrological and ichthyological studies in these rivers and the adjacent waters of the Okhotsk Sea. Our studies have shown the following results. (1) The estuaries of the Hairuzova and Belogolovaya rivers share some of the same hydrographic characteristics. The zone of salt water intrusion and freshwater mixing in the estuaries during summer may be placed at about the same distance (15–30 km). (2) In the riverine parts of the estuaries, the bottom substrate is heavily silted from sedimentation of fluvial material, and silted gravel is not a good substrate for salmon spawning. (3) Species composition, abundance, and distribution of all types of juvenile fish in the estuaries have a daily variability that depends on tidal phases. (4) Because of the large dimensions of the estuaries and high flow speeds during tidal cycles, juvenile salmon probably do not have time to traverse the water mixing zones during a single low tidal period. Therefore, salmon juveniles are forced to inhabit the stressful conditions in the estuary for a long time period. (5) A high abundance of marine mammal salmon predators, such as beluga, *Delphinapterus leucas*, and spotted seal, *Phoca largha*, is observed in these estuaries throughout the summer. Outside of the Okhotsk Sea, high concentrations of marine mammals have been correlated with estuarine habitat characterized by a wide, deep seaward opening with many shallow places in the coastal zone where predators can effectively hunt for adult salmon. The Hiaruzova and Belogolovaya river–estuaries have the same type of habitats capable of supporting high levels of marine mammal salmon predators. In summary,

our results suggest that low abundance of salmon in the Hairuzova and Belogolovaya river–estuaries might be due to the following factors: (1) absence of spawning grounds in the lower reaches of the rivers as a result of heavily sited substrate, (2) high mortality of seaward migrating juvenile salmon caused by the large size and extremely strong hydrographic influences of tidal processes of the estuary, and (3) high mortality of adult salmon moving through the estuary from consumption by marine mammal predators.

Koval, M.V. and A.V. Morozova. 2013. Fish fauna, spatial distribution and interspecific food relations of abundant fish stocks in the epipelagial of the Kamchatka gulf during growth period of juvenile pacific salmons. Collection of scientific papers "The researches of the aquatic biological resources of Kamchatka and the north-west part of the Pacific ocean" 31: 106–121. (In Russian with English abstract).
Results of the registration trawl surveys made by Kamchatka Research Institute of Fisheries and Oceanography in the Kamchatka Gulf in August of 2007 and 2010 have been reported. Species compound of the catches, peculiarities of distribution and migration, feeding and interspecific food relations of young Pacific salmons and other abundant fish species are described. The obtained data shows that the fsh fauna of the epipelagial of the Kamchatka Gulf during the early period of sea feeding migration of juvenile salmons may include 25 fsh species, the most abundant of which are herring and Alaska pollock. These species are also the most probable rivals of juvenile salmon fish in food. The greatest catches of almost all fish species in August are observed in the northern Kamchatka Gulf — not far from the mouth of the Kamchatka River. After downstream migration from the Kamchatka River (up to the mid–August) there are favorable conditions for growing of young salmon in costal water as it has richer food abundance in comparison with the open water zone. The following factors (or their sum total) serve as the main reasons why young salmon fish remove from the shallow water to the deeper Kamchatka Gulf at the end of August: the average size of young fish reaches 10 cm and more; sharp interspecific rivalry in food caused by increasing abundance of herring on the shelf during its migration to the Nerpich'e Lake, coastal water temperature falls while in open water it rises up to the maximum level creating favorable environment for young fish.

Maznikova, O.A. 2013. Results of abundance estimation of juvenile chum salmon in the western Bering Sea in fall 2013. Bulletin of Pacific salmon studies in the Russian Far East 8: 194-196 (In Russian).

Maznikova, O.A. 2013. Distribution of chum salmon juveniles in the southern Sea of Okhotsk in the autumn 2012 **."Actual problems of water bioresources conservation" (First school of young scientists and experts in fish industry and ecology, dedicated to 100 years from the day of birth of professor P.A. Moiseev) Moscow: VNIRO Publ.: 377. (In Russian).**

Metalnikova, K.V. 2013. Neurohumoral way of trout secondary sexual characteristics determination under methyltestosterone effect. Trudy PINRO. PINRO Publ: 153-167. (In Russian).

Morozova, A.V. 2013. Feeding Interactions of Juvenile Pacific Salmon and Other Fish Species in the Coastal Epipelagic Zone of Kamchatka. NPAFC Technical Report 9: 127–130. (Available at www.npafc.org).
This research was based on data collected from trawl surveys conducted by the staff of KamchatNIRO in June–July 2005–2011 in the coastal waters of Southwest Kamchatka and August

2007 and 2010 in the Kamchatsky Gulf (East Kamchatka). There were 25 fish species caught in summer surveys of Southwest Kamchatka, and the common species were Pacific sand lance, capelin, sandfish, juvenile salmon, walley Pollock, and yellowfin sole.The most frequently caught species in surveys off East Kamchatka was Pacific herring. Trophological analysis has revealed maximum similarity in the diet of zoophagous species, including sandfish, and coho, Chinook, and masu salmon. Although these predators demonstrated different nektonic prey compositions, abundant aggregations of sandfish and young salmon were separated spatially. Planktophagous species included juvenile chum, pink, and sockeye salmon, sand lance, capelin, young sandfish, and pollock, and these species demonstrated low similarity in their diets. Some specific traits of juvenile salmon feeding on the two coasts of Kamchatka were revealed. In the coastal waters of Southwest Kamchatka, the fish component in the diet played an important role, not only for zoophagous salmon (coho and Chinook), but for planktophagous salmon (pink and chum), too. Organisms of the neritic complex dominated in the diet. In the coastal waters of East Kamchatka, the component of fish prey can be substituted by zooplankton in nekton–feeding fish. Oceanic zooplankton species often occur in the diet. Moreover, in the coastal waters of Southwest Kamchatka juvenile sockeye, Chinook, and coho salmon prefer to stay near shore until autumn (sockeye and Chinook salmon reside about 5–7 months, coho salmon about 2 months). In the Kamchatsky Gulf near shore feeding by juvenile salmon lasts about 2.5–3.0 months. We suggest that the difference is due to the different geomorphology of juvenile salmon habitats. The west coast of Kamchatka has a developed shelf and is highly productive. In summer the coastal habitat provides a favorable environment for mass emergence of various fish larvae and for their feeding during early ontogenesis. This characteristic can explain the presence of fish prey in the diet of all species of juvenile salmon. The forage resources in such habitats are more fully exploited, as the feeding period is longer. The Kamchatsky Gulf has a narrow shelf and less forage production as compared to the west coast. Moreover, in the last part of August a myriad of Pacific herring move into the gulf, and they have a diet that is very similar to that of juvenile salmon. Therefore, young salmon strive to become adapted to explore oceanic forage resources quickly and move out of the gulf relatively soon for ocean feeding areas.

Radchenko ,V.I., O.S. Temnykh, and A.V. Zavolokin. 2013. Review of Studies on Asian Juvenile Pacific Salmon Stocks, 2006-2012. NPAFC Technical Report 9: 1-10 (Available at www.npafc.org).

Studies of Asian juvenile Pacific salmon stocks have been conducted by the national research programs of Korea, Japan, and Russia towards achieving the objectives of the NPAFC Science Plan. Coastal research has primarily focused on juvenile salmon growth and survival, determining optimal marine conditions for release of hatchery fish, collecting data for stock assessment, and studying population dynamics. Offshore juvenile salmon surveys have examined the factors driving seasonal distribution, interannual changes in migration patterns, growth and survival rates, feeding habits and the role of salmon in epipelagic nekton communities, long-term variability in the food supply, and the carrying capacity of the North Pacific. Some offshore studies were conducted to investigate potential competition and prospects for further salmon hatchery program development, and juvenile salmon abundance was monitored annually with the aim of predicting the magnitude of adult salmon returns. Based on trawl survey results, the principal areas of juvenile salmon concentrations and the autumn migration patterns of various salmon species were identified in the Russian Exclusive Economic Zone and beyond. Previous understandings of juvenile salmon biology and ecology in winter were enhanced. It was shown that their vertical distribution during winter increased due to a more homogeneous structure of surface water masses during that season of year. Marine habitats of juvenile Pacific salmon were ranked by the level of biomass, species composition, and duration of residence. Due to increased pink salmon abundance of eastern Kamchatka stocks in recent years, the

amount of juvenile salmon has increased in western Bering Sea nekton communities since 1980-2006. The role of salmon in the trophic structure of epipelagic nekton communities has remained relatively low, even when there was a high abundance of juveniles. Food resources consumed by juvenile salmon were equal to 1-2% of the total macrozooplankton biomass. In the waters of the far-eastern seas and northwestern Pacific, the food supply for juvenile salmon and micronekton is much higher than the total food consumption by epipelagic nekton. Some changes in the prey spectra of juvenile Pacific salmon occurred in years of high salmon abundance, but this did not influence the growth and survival rates of juveniles. Changes in prey composition can be considered as an adaptation in response to variability in feeding conditions. Data collected during autumn juvenile pink salmon surveys in the offshore areas of the Okhotsk and Bering seas were utilized to make annual forecasts of mature salmon returning to Kamchatka and Sakhalin rivers. This fishery management procedure involves estimating the overall abundance of juvenile pink salmon and identifying the major regional groupings present in mixed-stock sample.

Safronenkov, B.P. and N.N. Ignatov. 2013. Number and qualitative condition evaluation of juvenile Pacific salmon (generation of 2011) reared at the hatcheries of the Magadan region. Proceedings of the 2nd international scientific conference "Reproduction of the natural populations of valuable fish species": 339–343. (In Russian).

41045.1 thousand roes of pink, chum and coho were gathered and incubated in 2011 which made up 106.1% from the planned quantity. After evaluating the number of juvenile salmon reared at the hatcheries of the Magadan region within the period of breeding 2011–2012 and their physiological condition we can conclude that general volume of juvenile salmon production remains at a rather low level (hatchery full capacity is 120 million of fish per year) in spite of good biological and physiological quality of hatchery reared juveniles. That is why in the near future we shall not expect big returns of spawners in all basic water basins of the Taui Bay of the Sea of Okhotsk. It determines the status of the hatcheries of the Magadan region as salmon fish hatcheries of ecological focus that is hatcheries supporting natural spawning at a certain level.

Zavolokin, A.V. 2013. Feeding habits, consumption rates, and growth of juvenile Pacific salmon in relation to fluctuations of the forage base and salmon abundance. NPAFC Technical Report 9: 97-100 (Available at www.npafc.org).

Total salmon abundance has increased over the last thirty years. In the 1990s, there was evidence of density-dependent effects in some salmon populations that led to conclusions about shortages of food resources and overpopulation of the North Pacific by salmon. Over the past decade, Pacific salmon abundance has continued to rise. This might cause the intensification of competitive interactions between and among salmon species. Based on several trophic features (daily ration, stomach fullness, diel feeding rhythm, trophic niche breadth, number of prey, diet overlap, share of minor food items), I suggest a food supply index (FSI) to estimate changes in food supply of juvenile salmon in relation to the biomass of zooplankton, salmon, and all nekton species in the Okhotsk and western Bering Sea in 2001-2010. The FSI correlated negatively ($r = -0.78$-0.56) with juvenile salmon biomass both in the Okhotsk and Bering seas. This means that increases in juvenile salmon biomass were accompanied by changes in feeding habits resulting in a switch to minor food items (copepods, chaetognaths), widening of trophic niche breadth, change in diet overlap, and/or decrease in feeding intensity. Consumption rates of juvenile salmon tended to decrease in years of relatively low food supply. Daily rations were lower by 7% in the Bering Sea and by 15% in the Okhotsk Sea, though these differences in daily rations between years of low and "normal" FSI were insignificant ($p = 0.05$). Changes in feeding habits and consumption rates seemed not to negatively affect juvenile salmon growth. Body size of juvenile salmon did not significantly correlate both to their abundance and relative biomass of the forage base. On the contrary, growth of juvenile chum

salmon, estimated by scale analysis, tended to be enhanced in years of high salmon abundance. Thus, despite increased salmon abundance there were no strong negative consequences for juvenile salmon in the Okhotsk Sea and western Bering Sea. Possible strengthening of competition among salmon populations was compensated by adaptive changes in their feeding habits.

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

Khen, G.V., E.O. Basyuk, N.S. Vanin, and V.I. Matveev. 2013. Hydrography and biological resources in the western Bering Sea. Deep-Sea Research II 94: 106-120.
The variability of temperature, salinity, dissolved oxygen and nutrients (phosphate and silicate) in the west Bering Sea in the Russian Exclusive Economic Zone (REZ) since 1950 and the influence of these factors on the distribution and dynamics of hydrobionts were studied. Since 1950, the sea surface temperature has been gradually increasing, although non-significant cooling occurred in the last decade. In contrast, in the 50–200 m depth range, the temperature has been cooling. During the last 60 years, the salinity decreased by 0.30, 0.06–0.10 and 0.04 at the sea surface, at the 100–200 m layer and at the depth of 500 m, respectively, resulting in a strengthening of the vertical stability and weakening of the vertical water exchange. As a consequence, the oxygen concentrations at depths down to 1000 m decreased during this period. Phosphate and silicate concentrations increased during the last 40 years. The water exchange with the North Pacific (based on the discharge through the Kamchatka Strait) from the mid-1960s to the early 1990s was 2-3-fold higher than in the 1950s or from the mid-1990s to 2010. During the periods of weakened water exchange, the herring population sharply increased, while during periods of strengthened water exchange, pollock biomass increased. The increase of codfishes, flounders and sculpin biomass at the sea shelf during the second half of the 20th century coincided with sea surface warming. Since 2007, the westward water transport from the Aleutian Basin was almost half that during 2002–06, while the northward stream from Near Strait noticeably increased. The populations of immature chum, sockeye and chinook in the REZ declined because of their weakened input from the US zone, and these species were distributed mainly in the northern and eastern Russian waters. Taking into account the cooling since the middle of the last decade, the change in the intensity and direction of the Aleutian Low and Siberian High trends, and the westward shift of the Aleutian Low, one can hypothesize the possible return of the Bering Sea climate to the conditions of the 1960–80s and the corresponding response observed in ichthyofauna.

Volkov, A.F. 2013. Relation of Pacific salmon feeding on the state of their forage base. Bulletin of Pacific salmon studies in the Russian Far East 8: 58-67 (In Russian).

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

Figurkin, A.L. and S.V. Naydenko. 2013. Spatial distribution of pink salmon in the Subarctic Front zone in winter-spring. Izv. TINRO 174: 69-84. (In Russian with English abstract).
Spatial distribution of pink salmon and the habitat conditions in the central and western parts of the Subarctic Front zone are considered on the data obtained in the winter-spring seasons of 1986–1992 and 2009–2011. The pink salmon spreads widely in the epipelagic layer of the mixing zone and adjacent waters, in the wide range of the sea surface salinity (32.7–34.9 ‰) and sea surface temperature (0.5–12.0 °C). Its distribution is determined by shape of the landscape zone favorable for its dwelling in winter-spring, so depends on the mode of the western Subarctic gyre in the North-

West Pacific, on the mode of the Subarctic Front, and on intensity of the ocean branches of the East-Kamchatka Current and Aleutian Current. Besides, the quantitative parameters of its distribution depend on fluctuations of the pink salmon abundance between odd and even years.

Naydenko, S.V. and N.A. Kuznetsova. 2013. Food Supply of Juvenile Pink Salmon in the Subarctic Frontal Zone of the Western North Pacific Ocean in the Winter and Spring. NPAFC Technical Report 9: 253-254 (Available at www.npafc.org).
The offshore waters of the North Pacific Ocean are the main areas inhabited by pink and other Pacific salmon in winter and spring. In 2009-2011 the Pacific Research Fisheries Center (TINRO, Russia) conducted complex research surveys of the marine habitat conditions of Pacific salmon in the Subarctic frontal zone of the western North Pacific Ocean. Data on total quantitative estimates of nekton biomass, stock of forage resources, and salmon and nekton feeding were analyzed to estimate the food supply of salmon (in particular juvenile pink salmon) in this area in the winter and spring. It was established that salmon, mezopelagic fish, squids, and subtropical fish (mainly Japanese anchovy in transitional subtropical waters) were the main consumers of forage resources in the upper epipelagic layer of the western Subarctic frontal zone. The total biomass of nekton was 193, 38, and 54 thousand tons in 2009, 2010, and 2011, respectively. Juvenile pink salmon comprised 30%, 8%, and 15% of the catch in those years. The basic trophic relationships between juvenile pink salmon (and other fish and squid) and major zooplankton groups were revealed and the daily consumption by nekton of forage resources in the upper epipelagic zone was estimated. Our results showed that the trophic links of juvenile pink salmon in winter were directed upon consumption of copepods, euphausiids, chaetognaths, hyperiids and pteropods (other prey groups had smaller values). The daily consumption of these zooplankton groups by juvenile pink salmon varied depending on pink salmon abundance and didn't exceed 2-14 thousand tons. The daily consumption of zooplankton by all nekton in the upper epipelagic zone was 5-20 thousand tons. Our estimates for the total biomass of zooplankton in the western Subarctic frontal zone in these years were 84-158 million tons, significantly higher than the consumption estimates. These estimates show the winter is not period of fasting when food resources are scarce. The feeding activity of juvenile pink salmon in this period wasn't low, the indices of stomach filling (ISF) changed from 5 to 460 o/ooo (averaging 54-140 o/ooo in different years), but the ISF in winter samples were lower than samples collected in fall. The lipid depletion in pink salmon in winter was also lower than in fall. We suppose this fact was not only a function of prey quality and quantity. The change in lipid signatures of juvenile pink salmon during fall and winter in the ocean could be due to physiological processes of salmon that occur during winter.

Zavolokin, A.V. and E.V. Strezhneva. 2013. Size-selective mortality of the Okhotsk Sea pink salmon during its winter-spring living in the ocean. Russian Journal of Marine Biology 39(7): 501-508 (In English).
The mortality of Sea of Okhotsk pink salmon in the winter and spring varies significantly from year to year, which complicates forecasts of its arrival in the following year based on data on the downstream migration of fry and surveys in the fall. The size-selective mortality of pink salmon was studied and the possibility of using the size and weight parameters of juveniles for predicting their return was evaluated through measurements of scale increments in juvenile pink salmon that were caught in the southern Sea of Okhotsk in the fall of 2007 and 2008 and in fish of these year classes that came back to spawn. In the 2007 year class, which had a low overwinter survival level in the ocean, the average scale increments for the first year of life were considerably smaller than those in adult fish that returned to the spawning grounds. In the pink salmon of 2008, which had a very high level of overwinter survival, the values of scale increments in juveniles and adults were similar. This confirms the hypothesis of a critical size and a critical period, according to which slowly growing

juveniles that do not accumulate enough energy reserves for summer are eliminated in the winter to a greater extent as compared to fast-growing fish. Correlation analysis revealed a significant negative relationship between the size and weight of juvenile pink salmon and their mortality in the ocean. After conducting further and more extensive studies this will allow using the size parameters of juvenile pink salmon as one of predictors of its return for the year following the fall surveys. These results emphasize how important it is to take the size and growth rate of juvenile salmon into account when forecasting their return.

COMPONENT 4: BIOLOGICAL MONITORING OF KEY SALMON POPULATIONS

Baranov, S.B. 2013. The population of Chum salmon *Oncorhynchus keta* in the Anadyr river basin – Chukotsky region, Russia. NPAFC Technical Report 9: 146–149. (Available at www.npafc.org).

We estimated the abundance dynamics of Anadyr chum salmon by interannual fluctuations of commercial fish catches that started a hundred years ago. The largest chum salmon stock on the Russian Northeast Asian coast spawns in the rivers of the Anadyr basin at Chukotka. The proportion of chum catches in the Anadyr basin is 75.3% in average to all catches of other Pacific salmons in Chukotka and is up to 12% by biomass of the total annual catch of chum salmon in the Russian Far East. The annual monitoring of Anadyr Chum salmon stock includes recording of commercial and non-commercial catches and biological data sampling from adult migrants. The harvest of Anadyr chum salmon has been going since 1910. It plays an important role in the traditional life of native population in Chukotka. The collected data are essential for accurate estimations of population size and quota limits for chum salmon. The Anadyr chum population plays an important role in gene pool preservation as a source stock of wild chum salmon in the North Pacific.

Baranov, S.B. and E.V. Golub. 2013. The status of stocks and forecasting Anadyr chum salmon. Bulletin of Pacific salmon studies in the Russian FarEast 8: 74–77. (In Russian).

Biological resource fishery in waters around the Kuril Ridge: modern structure, dynamics, and basic elements: collective monograph (Ed. A.V. Buslov). 2013. Yuzhno-Sakhalinsk: SakhNIRO: 264. (In Russian with English abstract).

The book is devoted to the modern multiaspect characteristic of the Russian fishery for different biological objects inhabiting the Pacific Ocean and Okhotsk Sea waters around the entire Kuril Ridge. Besides the general data on catches, it contains information on spatial distribution of fishing efforts when catching these or those objects and particular features of fisheries which use different gears. A large part of the book includes materials on revealing and analyzing the peculiarities of commercial exploitation based on the important biological features of the main commercial objects: saury, codfishes, flounders, Pacific salmon, crabs, shellfishes, urchins, and other marine hydrobionts. It is the first generalization on capture and marine biology aspects for this large fishery region of the Russian east seas. Much information obtained during the recent decades and its graphical presentation makes this book easily understood and attractive for the most diverse groups of readers. The book is assigned for scientists and specialists in the fisheries science in general and in the fishery complex of the Far East in particular, marine biologists, managers and economists, students and other persons who are interested in exploitation of marine biological resources.

Bugaev, V.F., and L.A. Bazarkina. 2013. Effects of volcanism on sockeye salmon *Oncorhynchus nerka* abundance in Kamchatka River. Collection of scientific papers "Conservation of biodiversity of Kamchatka and coastal waters": 52–66. (In Russian with English abstract).

Azabachye Lake is the most important sockeye salmon spawning and nursery ground within the system of Kamchatka River. There is information that sockeye salmon abundance in the lake notably increased as a result of the Lake fertilizing by volcanic ashes from eruptions of Bezymianny (1956), Plosky Tolbachik (1975) and Klyuchevskoy (1990) volcanoes. Eruption of Shiveluch Volcano on May 9–10, 2004 when the ash layer reached 15–18 mm caused signifcant growth of sockeye salmon abundance in Azabachye Lake in 2009–2012 that provided a great contribution to the total harvest and catch of sockeye salmon in Kamchatka River during this period.

Chebanova, V.V. 2013. Dynamics of distribution and abundance of macrozoobenthos in the lake system Nerpich'e–Kultuchnoe (the Kamchatka River estuary). Collection of scientific papers "The researches of the aquatic biological resources of Kamchatka and the north-west part of the Pacific ocean" 31: 89-97. (In Russian with English abstract).
Three areas in the lake system differing by composition and abundance of macrozoobenthos are distinguished. Benthos is shown to be more varied and abundant in the areas of intensive and moderate water replacement. Accumulation of hydrogen sulfide in the soil prevents benthic fauna growth in the area of poor water replacement (northern sector of the Nerpich'e Lake and the hollow of the Kultuchnoe Lake). Temporary improvement of ecological conditions as well as settling of chironomids in late summer is possible only for the northern sector of the Nerpich'e Lake where active wind shuffling reaches its bottom zone.

Frenkel, S.E. 2013. Pelagic zooplankton of estuarine water bodies of the Kamchatka River in 2009−2011. Collection of scientific papers "The researches of the aquatic biological resources of Kamchatka and the north-west part of the Pacific ocean" 31: 74-88. (In Russian with English abstract).
Species composition, seasonal variations in the structure and quantities of pelagic zooplankton of estuarine water bodies of the Kamchatka River in 2009–2011 have been studied. Neritic crustaceous species never observed here in the middle of the 20th century were found in the zooplankton despite no changes in the salinity of the water basins. Rotatoria constituted 60% of the total number of zooplankton. Only in winter and spring periods the abundance of crustaceous exceeded the abundance of Rotatoria in the sections with medium and strong replacement of water. The present research shows that in the years of cold summer a 1–1.5 month retardation of zooplankton's development happens. Average abundance of zooplankton in the Nerpich'e-Kultuchnoe lakes network in October of 2009, March, end of June and August of 2010 was 51, 4, 17 and 268 thousand units/m3, and the biomass was 107, 9, 47 and 321 mg/m3. At the end-August of 2011 — year of low temperatures there were 19 thousand units/m3 and 38 mg/m3. Since the years 1950−1960s of the XXth century the food supply of planktivorous fishes in the lakes network has not undergone changes.

Golub, E.V. and A.P. Golub. 2013. The research and harvest of the Sockeye salmon and Pink salmon in Chukotka in 2013. Bulletin of Pacific salmon studies in the Russian FarEast 8: 68–73. (In Russian).

Golub, E.V. 2013. The data on biology of the Coho salmon and Chinook salmon from basins of Chukotka. Bulletin of Pacific salmon studies in the Russian FarEast 8: 127–133. (In Russian).

Gorin, S.L. and E.A. Shevlyakov. 2013. On the problem of the area of responsibility discrimination between regulatory and supervisory fishing control authorities in river mouth areas. Fish industry (Rybnoe khozyajstvo) 1: 77-82. (In Russian with English abstract).
The paper considers major issues of currently plasticized fishery management and protection of

aquatic biological resources within river mouth areas. It is shown that the actual regulatory legal acts do not provide a strict definition of the boundary between land and sea waters in mentioned tidal areas. This situation generates frequent conflict situations between federal authorities and resource stakeholders and collisions between regulatory and supervisory federal organs in different departments (the Federal Security Service and the Federal Fisheries Agency). Authors suggest a possible solution and illustrate it for two river estuaries in West Kamchatka. Besides a discussion of the solution, the article also contains several general proposals for improvement of current legal and regulatory framework.

Gorin, S.L. 2013. Hydrological–Morphological Processes in the Estuary of the Bol'shoi Vilyui River (Eastern Kamchatka Coast). Water Resources. 40(1): 1–15. (In English).
The results of many-year field studies are used to discuss the issues of formation of the hydrological regime and the morphological pattern of the estuary of the Bol'shoi Vilyui R., belonging to the subtype of lagoon–lacustrine estuaries. A vast body of factual data, which characterize the estuary and the processes taking place in it, as well as the natural conditions under which it exists.

Gorin, S.L. 2013. Present-day morphological structure and hydrological conditions of the Kamchatka River estuary. Collection of scientific papers "The researches of the aquatic biological resources of Kamchatka and the north-west part of the Pacific ocean" 31: 6-26. (In Russian with English abstract).
Basing on the results of 2009–2010 field studies, detailed characteristics of morphological structure and hydrological conditions of the Kamchatka river Estuary (both the whole estuary and its water bodies — the Nerpich'e, Kultuchnoe Lakes, side channel Ozernaya and mouth lagoons) are discussed. In this connection a lot of facts describing the estuary with its active processeses and the estuary's environmental conditions are given.

Goryainov, A.A., N.I. Krupyanko, and T.A. Shatilina. 2013. Comparative analysis in catch dynamics of pink salmon from Amur River and Primorye. Bulletin of Pacific salmon studies in the Russian Far East 8: 106-118 (In Russian).

Gritsenko, A.V. and A.N. Elnikov. 2013. About assessment of the catch value of Pacific salmon by a yield of hard roes. Fish industry (Rybnoe khozyajstvo) 2: 65-70. (In Russian with English abstract).
The possibility of assessment of the catch value of Pacific salmon by a yield of hard roes using seasonal mean value of the yield of the roes is shown.

Gritsenko, O.F. and N.V. Klovach. 2013. Review of a book of V.V.Volobuev, S.L. Marchenko "Pacific salmon of the Okhotsk Sea continental coast (biology, population structure, abundance dynamics, fisheries)". Journal of Ichthyology 53(2): 251-253. (In Russian).

Kaev, A.M., and L.V. Romasenko. 2013. Characteristics of spawning run and downstream migration for pink salmon *Oncorhynchus gorbuscha* at Kunashir Island in relation to its temporal structure. Izv. TINRO 173: 67–76. (In Russian with English abstract).
Abundance and biological parameters of pink salmon, dynamics of their spawning migration and downstream migration of their juveniles are analyzed on the data collected at Kunashir Island (Kuril Islands) in 1990-2012. The species is represented there by two temporal forms: early and late ones, which replacement could be observed in spawning runs both at the island and in adjacent areas at Iturup Island and southern Sakhalin Island as variations of total catch and the large-sized males occurrence. However, relative fecundity of the females does not decline significantly when one form

replaces another at Kunashir Island, in contrast to the other areas, because of the following features of the pink salmon spawning related to location of Kunashir Island at the margin of its spawning area: i) relative fecundity of both temporal forms is similar at Kunashir; ii) both temporal forms are low-abundant at Kunashir, whereas the late form dominates at Iturup and south Sakhalin. Year-to-year changes of the temporal forms ratio are determined mainly by conditions of the freshwater period of the species life.

Kaev, A.M. 2013. Some results of pink salmon fishery at the eastern Sakhalin and southern Kuril Islands. Bulletin of Pacific salmon studies in the Russian Far East 8: 21–29. (In Russian).
The ratio of expected and factual approaches, daily catch dynamics and changes in size-sex fish composition, approximate ratio of different temporal pink salmon forms in their approaches have been studied in different pink salmon fishery areas in the eastern Sakhalin (northeastern and southeastern coasts, Terpeniya and Aniva bays) and southern Kuril Islands (Iturup and Kunashir). For lack of monitoring in northern Sakhalin resulted in data certainty on reproduction conditions, there is a large discrepancy between the catch and forecast estimates. One of the results of fishing season is large sizes of fish under their high abundance. The analysis of the long-term changes in size composition and returns of pink salmon (from local and total catches in the Okhotsk Sea) has revealed a relationship between these parameters, which does not agree with the view point indicating a prevalence of the density-dependent factors for pink stocks dynamics. The increase in catches at the completing stage of fishery is pointed as a peculiar feature of the past fishing season. This means a balance disturbance in male and female ratio at spawning grounds that may result in reproduction decline.

Kaev, A.M. and Yu.I. Ignatyev. 2013. Methodical aspects of the hatchery chum salmon abundance forecasting in Sakhalin region. Bulletin of Pacific salmon studies in the Russian Far East 8: 78–82. (In Russian).
There is shown that despite the increase in hatchery chum salmon survival in the recent years, its interannual fluctuations, along with the poly-age population structure, make a lag forecast based on the data of juveniles release and their following mean long-term survival. The calculation algorithm that allows us to minimize a lag effect is suggested, however, situations with the trends replacement in the long-term changes of broods' survival still remain a weak point.

Kaev, A.M., V.D. Nikitin, A.P.Prokhorov, A.A. Antonov, A.B. Metlenkov, and G.N. Dzen. 2013. Biological characteristics of cherry salmon in the rivers of southern Sakhalin. Bulletin of Pacific salmon studies in the Russian Far East 8: 141-146 (In Russian).
Presented study results of cherry salmon in rivers and coastal waters of southern Sakhalin in 2001, 2003-2006, 2012-2013. Displayed offset timing spawning on a later date in the direction from south to north, and the duration of the mass migration depending on the size rivers. Migration intensity increased during the second half of the day. Numerically at the beginning migrations dominate males. In general, in the population of spawning more females. Age composition is represented by two groups (1.1+ and 2.1+). In age groups, how and in general population of spawning, females are larger than males.

Karpenko, V.I., L.D. Andrievkaya, and M.V. Koval. 2013. The feeding and growth particularities of Pacific salmon in marine waters. Petropavlovsk-Kamchatsky: KamchatNIRO Publ.: 304. (In Russian).
The monograph represents of analysis of the long-term archival information of Laboratory of Marine Salmon Investigation of KamchatNIRO, and also results of own study of feeding and growth of Pacific salmon during the sea period of life. During the 50-year period of studying the uniform

technique of collection, processing and the trophological data analysis was used. In the monography described of habitat areas of Kamchatka salmon populations and the basic factors of environment influencing for their feeding and growth at sea. The structure of feeding and food requirements of five species of Pacific salmon (pink, chum, sockeye, coho and chinook) at different stages of the sea period of life was estimated. Long-term dynamics of weight growth of the adult Pacific salmon returns to Kamchatka coast was studied. Interspecific food relations of salmon at sea were investigated.

Khoruzhiy, A.A., A.V. Zavolokin, A.N. Starovoytov et al. 2013. Pacific salmons in the nekton community of the upper epipelagic layer in the North-West Pacific at Kuril Islands in early summer of 2012. Izv. TINRO 172: 65–82 (In Russian with English abstract).
Total abundance and density of nekton in the layer 0–50 m at the Pacific side of Kuril Islands estimated by the trawl survey conducted by RV TINRO in June 2 — August 8 of 2012 was the lowest for the last 9 years (1.5 t/km ^{2}). The bulk of its biomass was presented by pacific salmons (706.7 $\cdot 10^{3}$ t or 43.6 %), mainly pink salmon, which began its spawning migration (483.3 $\cdot 10^{3}$ t or 29.8 %, that is less than in the preceding odd year 2011 but more than in the previous even year 2010). Other mass species were chum salmon (192.7 $\cdot 10^{3}$ t or 11.9 % — the highest value, twice higher than in 2011) and walleye pollock (381.2 $\cdot 10^{3}$ t or 23.5 %). Mesopelagic fishes had the minimal abundance for the last 9 years (286.8 $\cdot 10^{3}$ t or 17.7 %), the total biomass of squids was also lower than in 2011 (225.3 $\cdot 10^{3}$ t or 13.9 %) because of the northern squid abundance decreasing.

Khovanskaya, L.L., B.P. Safronenkov, N.N. Ignatov. 2013. Results of comparative evaluation of salinity tolerance of wild and hatchery reared salmon. Proceedings of the 2nd international scientific conference "Reproduction of the natural populations of valuable fish species": 434–438. (In Russian).
Comparative analysis of the results of salinity tolerance of wild and hatchery reared juvenile chum conducted in 2012 allowed to determine physiological adequacy and their readiness for smoltification of fish reared at every operational hatchery of the Magadan region. Direct transferring of juvenile chum reared at Olskaya experimental production and acclimatization base (OEPAB) which are the generation of spawners of exploited and breeding population of Kulkuty river showed the survivability at the rate of 98% and of Lankovaya river — 100%. Juvenile chum reared at Yansky hatchery gave the survivability at the level of 96.8%. The lowest index of survivability (42%) in sea water belong to juveniles of chum reared at Armansky hatchery. Juveniles of wild chum from Ola and Taui rivers showed the highest rate of survivability in sea water — 100% (Ola juveniles) and 92% (Taui juveniles).

Klovach, N.V. 2013. Pacific salmon – a wonderful natural blessing."Actual problems of water bioresources conservation" (First school of young scientists and experts in fish industry and ecology, dedicated to 100 years from the day of birth of professor P.A. Moiseev) Moscow: VNIRO Publ.: 175-189. (In Russian).

Klovach, N.V. and A.N. El'nikov. 2013. Structure of spawning school of chum salmon Oncorhynchus keta from Olutorsky Bay of the Bering Sea (Northeastern Kamchatka). Journal of Ichthyology. 53(6): 707-717. (In English).
Results of studies of spawning chum salmon Oncorhynchus keta (Walbaum) in Olutorsky Bay and the Apuka River—the largest river in northeast Kamchatka—inflowing Olutorsky Bay of the Bering Sea are presented. It was established that the first individuals of the chum salmon enter the river together with early sockeye salmon and chinook salmon in the first ten-day period of June, and mass-spawning run takes place in July–August. Analysis of biological characteristics of chum

salmon caught in the Apuka River and Olutorsky Bay of the Bering Sea enabled us to reveal the inhomogeneity of its spawning school represented by two seasonal forms.

Klovach, N.V. and A.N. El'nikov. 2013. Structure of mature sockeye salmon stock (Oncorhynchus nerka) in Apuka River (Northeastern Kamchatka). Collection of scientific papers "The researches of the aquatic biological resources of Kamchatka and the north-west part of the Pacific ocean" 30: 40-43. (In Russian with English abstract).
The results of research of sockeye salmon Oncorhynchus nerka (Walbaum) p. Апука — the largest river of the North-East of Kamchatka, which flows into the Olyutorsky Bay of the Bering Sea. It is established that the herd of Apuka River presented migrants early period of the progress, spawning in Vatyt-Gytkhyn Lake, located in the lower part of the basin and of fish of the late timing of the implementation, spawning in the upper reaches of the river. Sockeye early period of the progress appears in the river with signs of spawning changes and a high value gonado-somatic index (GSI). Sockeye later term progress migrates into the river without signs of spawning changes and a relatively low-CIO. The size and age composition of the producers of sockeye salmon early and late period of the progress varies. (p. 39)

Klovach, N.V., A.N. Elnikov, and A.V. Gritsenko. 2013. Structure of spawning stocks of four Pacific salmon species of the Olutorsky Bay (Bering Sea, North-East Kamchatka). NPAFC Doc. 1488. 24 pp. (Available at www.npafc.org).
The paper describes data characterizing structure of spawning stocks of pink salmon O. gorbuscha, chum salmon O. keta, sockeye salmon O. nerka, and chinook salmon O. tshawytscha from the rivers inflowing the Olutorsky Bay of the Bering Sea (North-East Kamchatka). Intraspecific forms were revealed in chum, sockeye, and chinook salmon populations that are reproduced in the rivers inflowing the Olutorsky Bay. The existence of the forms helps to maintain high abundance of the species in changing environments and indicates the fact that the North-East of Kamchatka allocated in periphery of pacific salmon areal is an area of ecological optimum for chum, sockeye and chinook salmon.

Koval, M.V., E.V. Lepskaya, V.A. Dubynin, S.V. Shubkin, and S.A. Travin. 2013. Experience of hydroacoustic studies of Pacific salmons in the pelagial of some Kamchatka lakes. Bulletin of Pacific salmon studies in the Russian Far East 8: 207–225. (In Russian).

Makeyev, S.S., A.A. Zhivoglyadov, A.Yu. Semenchenko and P.S. Rand. 2013. Application experience of rotary screw smolt trap on the Sakhalin rivers. Transactions of the Sakhalin Research Institute of Fisheries and Oceanography «Water life biology, resources status and condition of inhabitation in Sakhalin-Kuril region and adjoining water areas» 14 (In Russian).
The main work results of rotary screw trap (RST) produced by EG Solution (USA) in two southern Sakhalin rivers in 2008 and 2010 years are presented. The recommendations for arrangement and application of trap for different objectives are given: accounting masu and commercial salmon species smolts, as well as study of migration activity of other fishes. Migration conditions of masu smolts are studied. The estimations of masu smolts total number in the Taranay River (2008) — 28520 samples and in Bystraya River (2010) — 43000 samples are quoted. A masu smolts distribution by length is showed. The opportunities for studying local migrations of resident fishes are demonstrated.

Marchenko, S.L., V.V. Volobuev, D.V. Makarov. 2013. Biological structure of Coho *Oncorhynchus kisutch* (Walbaum) of the continental sea-shore of the Sea of Okhotsk. Collection of scientific articles «Studies of aquatic biological resources of Kamchatka and

Northwest Pacific Ocean» 29: 70–83 (In Russian with English abstract).
Coho takes the third place in stock abundance of salmon in the water basins of the continental sea-shore of the Sea of Okhotsk. Analysis of the age structure of coho populations is conducted and geographical peculiarities of this index are revealed in the article. Size, weight structure and indexes of fertility of Okhotomorsk coho are studied. It is determined that all these indexes yield to Sakhalin coho. Okhotomorsk coho has a bigger value of fertility though average indexes of the character do not exceed the indexes of a number of Asian stocks.

Markovtsev, V.G. 2013. About making hatchery chum salmon stocks in the North Prymorye Rivers. Bulletin of Pacific salmon studies in the Russian Far East 8: 172-175 (In Russian).

Naydenko, S.V. and A.A. Khoruzhiy. 2013. Forage base and trophic structure of nekton communities in the upper epipelagic zone in the Pacific waters off Kuril Islands in summer of 2000s. Bulletin of Pacific salmon studies in the Russian Far East 8: 119-126 (In Russian).

Ostrovsky, V.I. 2013. Factors controlling the chum salmon (*Oncorhynchus keta*) juvenile abundance in the Mi Rive. Izv. TINRO 172: 94–105. (In Russian with English abstract).
Multiplicative model is developed on the basis of multiple nonlinear regression that describes the dependence of chum salmon juveniles abundance in the Mi River flowing to the Amur Liman on their parents number and some meteorological factors. The number of spawners is the main contribution. Other significant contributions are precipitation values in the spawning season (October) and in the time of downstream migration (May). Possible mechanisms of these correlations are discussed. Negative anomalies of the precipitation prevailed in the area of the Mi before 1974, and positive anomalies prevails since that time, so recent conditions are favorable for the chum salmon reproduction. The precipitation dynamics correlates positively with the dynamics of global air temperature with removed linear trend.

Pogodaev, E.G. 2013. Spatial distribution and stock abundance dynamics of sockeye salmon local stocks in the northern commercial fishery districts of Kamchatka region. Collection of scientific papers "The researches of the aquatic biological resources of Kamchatka and the north-west part of the Pacific ocean" 30: 28–38. (In Russian with English abstract).
Comparative characterization of some local stocks of sockeye salmon in the West Bering Sea zone, Karaginskaya and West Kamchatkan subzones is provided. Spatial distribution and contribution of particular watersheds in sockeye salmon general structure in the northern commercial fishery districts are estimated on the base of collected long–term data on the escapement density and catch. It is found that visible domination of sockeye salmon of the North East in major population parameters has provided not only a result of high local concentration of sockeye salmon watersheds, but rather due to a number of nursery sockeye salmon lakes in the systems.

Pospekhov, V.V. 2013. Helminthes and parasitic crayfish of the lake – Chukcha river system (water basin of the Taui river, the Sea of Okhotsk). Izv. TINRO 172: 165–172. (In Russian with English abstract).
Parasitologic study (helminthes, parasitic crayfish) of fish of the lake-river system Chukcha in the water basin of the Taui river (the Sea of Okhotsk) has been conducted. Our observation revealed 26 parasites at 8 fish species (3 of copepods and 23 of helminthes) which belong to 20 genera, 19 families, 12 orders, 6 classes and 4 types of animal kingdom. The biggest amount of species is represented by trematodes (11), cestodes (5), proboscis worms (4), nematodes and copepods (3 of each). Our research showed that helminthic fauna of grayling and kundscha of the lake–river system Chukcha is in many ways alike. Taking into consideration the content of these fish stomachs and

their infection rate by parasites we may conclude that graying of this lake–river system is a typical euryphag and kundscha is a predator.

Pospekhov, V.V., G.I. Atrashkevitch, O.M. Orlovskaya. 2013. Helminthes and parasitic crustaceans of diadromous chars (Salmonidae: *Salvelinus*) of the northern part of the Sea of Okhotsk. Izv. TINRO 174: 1–26. (In Russian with English abstract).
For the first time generalized data on helminthes and parasitic crustaceans of the three species of diadromous chars from the northern part of the Sea of Okhotsk — Dolly Varden char (*S. malma*), Levanidov's char (*S. levanidovi*) and whitespotted char (*S. leucomaenis*), have been represented. In general, 55 species of parasites are determined: 52 species of helminthes, referring to 43 genera, 30 families, 5 classes, 3 types — Plathelminthes, Nemathelminthes, Acanthocephales, and, besides, 3 species of parasitic copepods, of 2 genera, 2 families of Crustacea class, Arthropoda type. Trematodes are the most diverse — 22 species, 17 genera, 12 families. Number of cestodes (12 species, 9 genera, 8 families) and nematodes (12 species, 12 genera, 7 families) are practically the same. Number of acanthocephalans is considerably less (6 species, 5 genera, 3 family, 2 classes). According to ecological groups, parasites of diadromous chars are divided as follows: 29 species of the freshwater parasites (6 cestodes, 10 trematodes, 8 nematodes, 3 acanthocephalans and 2 copepoda) and 25 species of the marine parasites (5, 12, 4, 3 and 1, correspondingly), and one species (cestode *Diphyllobothrium luxi*) of indefinite ecological status. Helminthes of 11 species are noted to have medical and veterinary significance.

Rudakova, S.L. and E.V. Bochkova. 2013. The modern approach to monitoring of prevalence a infection haemopoetic necrosis virus (IHNV) in the Kamchatka populations of sockeye salmon *Oncorhynchus nerka* (Salmoniformes, Salmonidae). Voprosi Ribolovstva 14, №3(55): 496–509. (In Russian with English abstract).

Sergeenko N.V., T.V. Gavruseva, E.A. Ustimenko, E.V. Bochkova, L.V. Ovcharenko, S.L. Rudakova, and E.A. Gritskih. 2013. Composition and distribution frequency of pathogen species in sockeye salmon in spawning-nursery lakes of Kamchatka. Collection of scientific papers "The researches of the aquatic biological resources of Kamchatka and the north-west part of the Pacific ocean" 29: 137–147. (In Russian with English abstract).
This paper gives the results of comprehensive ichtio–pathological investigation of sockeye salmon (*Oncorhynchus nerka*) from the feeding–spawning lakes of Kamchatka (Nachikinskoye, Kurilskoe, Azabachie) conducted between2004 and 2010. The information on describes the species composition, the prevalence of infectious and parasitic agents, as well as their impact on the health of fish. The investigation identified reserves distressed by a particularly dangerous infections, that can affect the populations of sockeye salmon.

Sergeenko, N.V., and E.A. Ustimenko. 2013. Microflora of Pacific salmon and waters from graziery-spawning reservoirs of Kamchatka. Materials of KamchatNIRO reporting session "The results of research works in 2012": 317–323. (In Russian).

Shevlyakov, E.A. 2013. Structure and dynamics of coastal illegal fishing of Pacific salmon in Kamchatka nowadays. Ribnoye Hozyaistvo 2: 58–65. (In Russian).
Analysis of illegal fishing in Kamchatka today is provided. Structure of current illegal, unreported and unregulated (IUU) fishing is compared to the structure for previous period from 1990 to 2008. A positive trend (reduction) is noted in the share of the illegal catch in the total catch of Pacific salmon in Kamchatka. At the same time some other new forms of illegal exploiting salmon resource get revealed, including excessive (over the limits) catch of salmon by tribal communities or

representatives of associated indigenous people of the North, Siberia and Far East of the RF. Some directions in improvement of legal and regulatory framework, determining interactions in mentioned field, are proposed.

Shevlyakov, E.A., S.V. Shubkin, V.A. Dubynin, K.M. Malykh, E.V. Golub, E.P. Golub, A.M. Kaev, and M.V. Koval. 2013. Techniques of the accounts of Pacific salmon spawners on the spawning grounds and during anadromous migrations in the rivers. Bulletin of Pacific salmon studies in the Russian Far East 8: 36–57. (In Russian).

Shevlyakov, E.A., V.A. Dubynin, and V.G. Erokhin. 2013. The characteristic of the coastal catches of Pacific salmon in the Kamchatka region in 2013. Bulletin of Pacific salmon studies in the Russian Far East 8: 11–20. (In Russian).

Shevlyakov, E.A., V.A. Dubynin, Z.K. Zorbidi, L.A. Zavarina, T.A. Popova, N.B. Artuhina, S.L. Gorin, and O.O. Koval. 2013. Modern state of salmon complex in the Bolshaya River (West Kamchatka): reproduction, fishery, management. Izv. TINRO 174: 3–37. (In Russian with English abstract).
Commercial importance of the salmon fishery in the Bolshaya River has been reduced considerably, as compared with the period before 1950s. Biological parameters of the pacific salmons are considered and dynamics of their stocks are analyzed to find possible reasons of this reducing. Besides, dynamics of the salmons catch are analyzed in details for the last two decades, by types of fishing gears, with evaluation of each gear contribution to total landings from the Bolshaya. Anthropogenic impact is determined as the main factor of negative influence on salmon populations in the river. Complex of measures to restore and sustain the salmons resources in the Bolshaya River is proposed.

Shuntov, V. P. and O. S. Temnykh. 2013. Illusions and realities of the ecosystem approach to the study and management of marine and oceanic biological resources. Russian Journal of Marine Biology 39(7): 455-473 (In English).
The scientific and applied problem of the ecosystem approach to the management of marine biological resources arose during the last quarter of the 20th century as a component of the Rational Nature Use Concept. This occurred mostly because the existing fishery rules and concepts of the optimum yield theory, which were introduced in the practice of fishery regulations, have proven to be insufficiently effective to conserve biological resources and provide stability of the fishery resource base. The ecosystem approach to biological-resource management implies a change of the autecological studies of commercial stock units (populations) and the managerial single-species models for the sustainable-sized management, taking the impacts of the fishery on marine ecosystems into account, as well as those of marine ecosystems on the fishery. At present, the ecosystem-based biological-resource management includes a complex of ecological topics and issues, such as biodiversity conservation, effect of climate changes, sustainability of stocks and communities, interspecies relationships, multi-species fishery, conservation of rare species, protection of especially important water bodies and landscapes, biotope degradation, anti-pollution measures, invasive species, ranching aquaculture, genetic diversity, etc. The main current problem, besides insufficient knowledge of many of these issues, is how to practically integrate such a large number of parameters into the management system. Thus, the complicated and long-term problem of ecosystem management of marine biological resources should be solved step-by-step, following the progress in the technical capabilities and concepts of natural processes. As well, certain better-studied elements of the ecosystem approach should be implemented first in the practice of management, while taking the regional specifics into account.

Shuntov, V.P., O.S. Temnykh, and V.A. Shevlyakov. 2013. Salmon fishing season – 2013: good result, but there is a trend to decrease. Bulletin of Pacific salmon studies in the Russian Far East 8: 3-10 (In Russian).

Smilyanski, I.K., and A.V. Artyukhin. 2013. On the possibility of quickened coho breeding (*Oncorhynchus kisutch*) at cold-water hatcheries of the Magadan region. Proceedings of the 2nd international scientific conference "Reproduction of the natural populations of valuable fish species": 379–383. (In Russian).
A special line of closed type with the function of warming the water in hatchers and reservoirs was assembled at Olski hatchery in 2011 as an experiment. The aim of the experiment was to receive accelerated juveniles of coho with high size and weight indexes and to evaluate higher temperature influence on their growth and development. The results revealed that if to keep favorable for larvae and hutchlings constant temperature from the beginning of roe planting till their release into the water basins it is possible to obtain rather large and qualitative juveniles of coho even in the conditions of cold-water hatcheries.

Starovoytov, A.N., S.V. Naydenko, A.A. Khoruzhiy et al. 2013. Composition and structure of nekton communities in Russian waters of the Japan Sea in May 2013. Bulletin of Pacific salmon studies in the Russian Far East 8: 176-186 (In Russian).

Starovoytov, A.N., S.V. Naydenko, A.A. Khoruzhiy et al. 2013. Composition and structure of nekton and macroplankton communities in the upper epipelagic zone in the Northwestern Pacific Ocean in May-July 2013. Bulletin of Pacific salmon studies in the Russian Far East 8: 187-193 (In Russian).

Temnykh, O.S. 2013. Trends in pink salmon catches in the Northwestern Pacific Ocean based on the data of trawl surveys. Bulletin of Pacific salmon studies in the Russian Far East 8: 236-240 (In Russian).

Ulatov A.V. 2013. Ecology-fisheries estimation of influence of building, reconstruction and major overhaul of the main gas pipeline on locations of crossing with the salmon spawning rivers of high fisheries importance. General riches of human knowledge: the Collection of materials of XXX Krasheninnikovsky readings: 275–279. (In Russian).

Yarzhombek, A.A. 2013. Behavior of salmonid fishes (Salmoninae). Problems of fisheries. 14(3)(55): 387-405. (In Russian).
It was demonstrated in the article that agonistic and aggregating behavior appears in different species with varying degree. The behavior changes also in different ontogeny stages and depends on external affects and artificial conditions of housing.

Zakharova, O.A. and V.F. Bugaev. 2013. On duration of freshwater period of West Kamchatka masu salmon *Oncorhynchus masou.* Izv. TINRO 175: 110–126. (In Russian with English abstracts).
Scale structure of juvenile masu salmon from the rivers Bolshaya, Kikhchik, and Kol' (West Kamchatka) is investigated during "growth" and "no growth" periods in 2009–2012. The first scleritis bounding the central plate of their scale forms at the average body length 48 mm that is much larger than for other pacific salmon species. The scale growth resumes after wintering and annuli form in late May — early June. Any additional zones of close sclerites don't form during the

growth period. V.F. Bugaev (1978) hypothesis on two–year freshwater period of masu salmon at West Kamchatka is confirmed.

Zaporozhets, O.M. and G.V. Zaporozhets. 2013. Structure of sockeye salmon stocks in Bolshaya River basin (Western Kamchatka) in 1986–2012. Collection of scientific papers "Conservation of biodiversity of Kamchatka and coastal waters": 107–116. (In Russian with English abstract).

The structure of sockeye salmon stocks of Bolshaya River basin and biological characteristics of individuals of different ecological forms (lake and river) and races (early and late) in 1986–2012 are considered. It has been shown that the sizes and weight of adults in river form significantly more than lake, and early (spring) race – more small than late (summer) one. Sizes, weight and fecundity of sockeye salmon in both races decreased during the investi–gated period. The age of return for spawning in summer sockeye salmon has a negative trend, and this trend was not revealed for spring race; this indicator in sockeye salmon of Malkinsky SH is less than in sockeye salmon from SH «Ozerki» and in wild individuals of Bystraja River. Fresh-water age structure of adult sockeye salmon from samples of river and sea catches in estuary of Bolshaya River was compared with individuals of the Kuril Lake for the same years. The analysis has revealed that the share of «another's» individuals in sea nets does not exceed 15%. An abundance of sockeye salmon stock in Bolshaya River as a whole had a positive trend, at the same time commercial removal considerably exceeded an escapement for spawning that was an evidence of irrational use of this stocks.

Zaporozhets, O.M., G.V. Zaporozhets, and Zh.Kh. Zorbidi. 2013. Stock dynamics and biological parameters of pacific salmons in the Bolshaya River (West Kamchatka). Izvestiya TINRO 174: 38–68. (In Russian with English abstracts.

In the Bolshaya River basin, the runs of pink salmon spawning in even years are the most abundant, the runs of sockeye, chum, and coho salmons are lower, and the runs of chinook salmon are the lowest. Recently the catches of these species exceed strongly their escapement: the portion up to 96% of the runs to the river mouth is withdrawn. Body size of chum, sockeye, coho, and chinook salmons in the Bolshaya River decreased in the last two decades. Artificial salmon populations in the Bolshaya demonstrate reduction of their age spectra (visible in less number of the age classes) that means growing ecological risks.

Zhivoglyadov, A.A., A.A. Antonov, V.A. Rudnev and Kim Khe Yun. 2013. Variations of reproduction efficiency of pink salmon *Oncorhynchus gorbuscha* (Walbaum) and chum salmon *Oncorhynchus keta* (Walbaum) at spawning grounds of Sakhalin Island rivers. Problems of fisheries 14(2): 242–258. (In Russian).

The results of studying the efficiency of reproduction of pink salmon *Oncorhynchus gorbuscha* and chum salmon *Oncorhynchus keta* in the Southern Sakhalin in 2007-2011 are represented. Statistically authentic distinctions in efficiency of pink salmon and chum salmon reproduction on spawning grounds of different channel zones are revealed. It is shown that the lowest indicators of embryonic stages survival rate are dated for spawning areas of a flat rivers part.

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

Chistyakova, A.I., and A.V. Bugaev. 2013. A portion of the industrial pink and chum salmon juveniles during period of postkatadromous migrations in the Okhotsk Sea in 2012. Bulletin of Pacific salmon studies in the Russian Far East 8: 150–171. (In Russian).

Chistyakova, A.I., R.A. Shaporev, and A.V. Bugaev. 2013. Use of the otolith complex method for stock identification of juvenile pink and chum salmon in the offshore waters of the Okhotsk sea during postcatadromous migrations. NPAFC Technical Report 9: 54–58. (Available at www.npafc.org).

Differentiation of Pacific salmon mixed feeding or migrating aggregations into separate stocks within a species is always a challenge. Among the different methods for differentiating stocks, we selected a method based on otolith structure and applied it to separate mixed marine aggregations of juvenile pink and chum salmon in the Okhotsk Sea. As a result of the research, we obtained some baseline information of otolith microstructure phenotypes of pink and chum salmon from regions of the Okhotsk Sea, including West Kamchatka, Sakhalin, and the continental coast. The resolution ability of the baseline models was estimated by simulation. The average accuracy of estimation for a given pool of baselines was about 90% for pink salmon and 80% for chum salmon. These simulations indicated the baseline models we used were able to provide identification based on otolith structure of the regional origin of juvenile pink and chum salmon with a high level of resolution. Based on the baselines, we identified the regional stock complexes of postcatadromous pink andchum salmon collected during the trawl survey cruise of the R/V Professor Kaganovsky in autumn 2011.

Chistyakova, A.I. and A.V. Bugaev. 2013. Using the results of otolith marking for determination of origin and migration routes for hatchery juvenile pink and chum salmons in the Okhotsk Sea in autumn period. Izv. TINRO 174: 77–102 (In Russian with English abstract).

Structure of otholits is investigated for pink and chum salmons juveniles in the catches of trawl survey conducted by RV Professor Kaganovsky in the Okhotsk Sea in September–November 2011, in total 950 pairs of pink salmon otoliths and 1600 pairs of chum salmon otoliths. Among them, 30 individuals of pink salmon and 42 individuals of chum salmon were found with the code marks made in several Russian and Japanese hatcheries (pink salmons with the marks of 2 hatcheries in Sakhalin and 2 hatcheries in Iturup Island and chum salmons with the marks of 16 hatcheries, including 3 in Sakhalin, 1 in Iturup, 1 in the Amur River Basin, 1 in the northern Okhotsk Sea coast, 8 in Hokkaido, and 2 in Honshu). Schemes of the most likely migration routes are built. Juveniles from the group of hatcheries in the southern Okhotsk Sea (Sakhalin, Iturup, Hokkaido, and Honshu) have similar north–eastward migration to the coast of West Kamchatka up to 55–56 oN determined by water circulation. The otolith marking on hatcheries should be continued for identification of all salmons origin that gives reliable data about their stocks ratio necessary for fisheries forecasting.

Khrustaleva, A.M., O.F. Gritsenko, and N.V. Klovach. 2013. Single-nucleotide polymorphism in populations of sockeye salmon Oncorhynchus nerka from Kamchatka Peninsula. Russian Journal of Genetics 49(11): 1155-1167. (In English).

The genetic variability of 45 single-nucleotide polymorphism loci was examined in the four largest wild populations of sockeye salmon Oncorhynchus nerka from drainages of the Asian coast of the Pacific Ocean (Eastern and Western Kamchatka). It was demonstrated that sockeye salmon from the Palana River were considerably different from all other populations examined. The most probable explanation of the observed differences is the suggestion on possible demographic events in the history of this population associated with the decrease in its effective number. To study the origin, colonization patterns, and evolution of Asian sockeye salmon, as well as to resolve some of the applied tasks, like population assignment and genetic identification, a differential approach to SNP-marker selection was suggested. Adaptively important loci that evolve under the pressure of balancing (stabilizing) selection were identified, owing to this fact the number of loci that provide the baseline classification error rates in the population assignment tests was reduced to 30. It was demonstrated that SNPs located in the MHC2 and GPH genes were affected by diversifying

selection. Procedures for selecting single-nucleotide polymorphisms for phylogenetic studies of Asian sockeye salmon were suggested. Using principal-component analysis, 17 loci that adequately reproduce genetic differentiation within and among the regions of the origin of Kamchatka sockeye salmon were selected.

Pilganchuk, O.A., and N.Y. Shpigalskaya. 2013. Genetic differentiation of sockeye salmon *Oncorhynchus nerka* (Walbaum, 1792) populations of eastern Kamchatka. Russian Journal of Marine Biology 39(5): 371–379. (In Russian with English abstract).
The interpopulation differentiation of the sockeye salmon Oncorhynchus nerka (Walbaum) from the Olyutorskiy and Karaginskiy districts and from the Kamchatka River basin was examined based on the allelic variation at eight microsatellite loci (Ots107, Oki1a, Oki1b, One104, One109, OtsG68, OtsG85, and Oki6). The genetic diversity of samples from the northern rivers was lower, compared to samples from the Kamchatka River basin. Significant heterogeneity was found in the allele-frequency distribution at microsatellite loci of sockeye salmon from the investigated localities. The degree of genetic similarity of populations corresponded to their geographic closeness. The differences between population groups greatly exceeded the level of interpopulation differentiation. The analyzed samples formed four relatively separate groups: Lake Azabachye, Kamchatka River basin, Karaginskiy area (including the Navyrinvayam River in the south of the Olyutorskiy district), and northern Olyutorskiy area. The identification likelihood estimates of eastern Kamchatkan sockeye salmon in mixed aggregations at the level of population groups were fairly high (67.2–81.8%), greatly exceeding the accuracy of identification of individual populations.

Pilganchuk, O.A., N.Y. Shpigalskaya, V.V. Savenkov, O.N. Saravansky, G.V. Bazarkin, and A.N. Elnikov. 2013. Microsatellite DNA variation in sockeye salmon *Oncorhynchus nerka* (Walbaum, 1792) populations of eastern Kamchatka. Russian Journal of Marine Biology 39(4): 272–280. (In Russian with English abstract).
The interpopulation differentiation of the sockeye salmon Oncorhynchus nerka (Walbaum) from the Olyutorskiy and Karaginskiy districts and from the Kamchatka River basin was examined based on the allelic variability of eight microsatellite loci (Ots 107, Oki 1a, Oki 1b, One 104, One 109, OtsG 68, OtsG 85, and Oki 6). The genetic diversity of samples from the northern rivers was lower, compared to samples from the Kamchatka River basin. Significant heterogeneity was found in the allele frequency distribution of microsatellite loci of sockeye salmon from the investigated localities. The degree of genetic similarity of populations corresponded to their geographical closeness. The differences between population groups greatly exceeded the level of interpopulation differentiation. The analyzed samples formed four relatively separate clusters: Lake Azabachye, Kamchatka River basin, Karaginskiy area (including the Navyrinvayam River in the south of the Olyutorskiy district), and northern Olyutorskiy area. The estimates of the identification likelihood of eastern Kamchatkan sockeye salmon in mixed aggregations on the level of population groups were fairly high (67.2–81.8%), greatly exceeding the accuracy of identification of individual populations.

Rastjagaeva, N.A. 2013. Some results of identification of Pacific salmon of a various origin and definition of their age structure by different methods. Vestnik KamchatGTU 23: 72-77. (In Russian).

Shpigalskaya, N.Y., U.O. Muravskaya, A.I. Kositsina, and A.V. Klimov. 2013. Genetic identification of Okhotsk Sea juvenile pink salmon mixed-stock aggregations during the early marine period of life. NPAFC Technical Report 9: 45–48. (In English).
Pink salmon is the most abundant Pacific salmon species and one of the most important components of the North Pacific and Bering Sea ecosystems. Postcatadromous juvenile pink salmon leave

coastal waters for winter foraging in ocean areas after a short stay near the coast. Here we present results of juvenile pink salmon regional stock identification by RFL (restriction fragment length polymorphism) analysis of the mtDNA Cytb/D-loop region. Samples from 915 juvenile pink salmon were obtained from two autumn trawl surveys in 2011 (53ºN–56ºN, 148ºE–155ºE in September and 49ºN–54ºN, 145ºE–151ºE in October). The baseline data we used were the composite haplotype frequencies in samples of adult even–year broodlines of pink salmon from twenty–four rivers of the Okhotsk Sea basin (1500 individuals in total). Simulations using a 100% composition of each stock in four regions indicated high estimated identification accuracies, which averaged 83.7% for West Kamchatka, 83.2% for Sakhalin, 64.5% for Primorye, and 67.3% for northern Okhotsk Sea coast pink salmon. Grouping the northern pink salmon populations (West Kamchatka and northern Okhotsk Sea coast) and southern populations (Sakhalin and Primorye) increased accuracy to 91.1% and 86.2%, respectively. Results indicated the dominance (> 60% in mixed juvenile aggregations) of pink salmon populations originating from the southern part of the Okhotsk Sea basin were found in the northern part of study area in September. In October the portion of southern pink salmon populations in the mixture in this area had decreased to 45% (northern populations from West Kamchatka and northern Okhotsk Sea coast dominated in the mixture). These results can be used to determine the migration routes and timing of juvenile pink salmon originating from different regions and to provide abundance assessments for pink salmon stocks in mixed–stock marine aggregations.

Shubina, E.A., M.A. Nikitin, E.V. Ponomareva, D.V. Goryunov, and O.F. Gritsenko. 2013. Comparative study of genome divergence in salmonids with various rates of genetic isolation. International Journal of Genomics. (Available at http://www.hindawi.com/journals/ijg/).
The aim of the study is a comparative investigation of changes that certain genome parts undergo during speciation. The research was focused on divergence of coding and noncoding sequences in different groups of salmonid fishes of the Salmonidae (Salmo, Parasalmo, Oncorhynchus, and Salvelinus genera) and the Coregonidae families under different levels of reproductive isolation. Two basic approaches were used: (1) PCR-RAPD with a 20–22 nt primer design with subsequent cloning and sequencing of the products and (2) a modified endonuclease restriction analysis. The restriction fragments were shown with sequencing to represent satellite DNA. Effects of speciation are found in repetitive sequences. The revelation of expressed sequences in the majority of the employed anonymous loci allows for assuming the adaptive selection during allopatric speciation in isolated char forms.

Stekol'schikova, M.Yu., and E.G. Akinicheva. 2013. Some results of studying the returns of Aniva pink salmon marked at the hatcheries in 2009–2011. Bulletin of Pacific salmon studies in the Russian Far East 8: 134–140. (In Russian).
The results of identification of the marked fish in pink salmon returns to Sakhalin and Iturup islands in 2010–2012 showed that the meeting area for salmon released from the hatcheries "Aniva" and "Taranai" includes a southern part of the Terpeniya Bay coast and that of the total southern Sakhalin. In 2012, a proportion of hatchery fish from catches at different coastal sites was ascertained to be different: southern coast of Terpeniya Bay — 1.1 %, southeastern coast of Sakhalin Island — 6.5 %, eastern coast of Aniva Bay — 16,9 %, western coast of Aniva Bay and southwestern coast of Sakhalin Island — 5.2 %. In the course of spawning run, a temporal trend is traced in wild and hatchery pink salmon ratio dynamics: a proportion of hatchery fish increases. The hatchery fish straying to "wild" rivers within their entire distribution area is revealed (the marked fish percentage from samples varied between 0 and 13.5 %). The proportion of marked fish in samples taken from the monitoring hatchery rivers at the end of spawning migration reached 30%.