

Action #4 Information and monitoring

Action Goal: Demonstrate that relevant information is collected to support the harvest strategy

PI 1.2.3

The main goal of Pacific salmon fishing monitoring is to provide in-season information for making decisions that contribute to the optimal level of spawning escapement. To perform this, the number of salmon returns is determined; it consists of the catch volume and the number of counted salmon at the spawning grounds.

Visual counting during walking tours is carried out by fish biologists from SakhRybVod and scientists from SakhNIRO. They record the presence of live spawners of Pink and Chum Salmon, the number and location of spawning redds, the number of post-spawn fish (spawners that died after spawning), as well as the number of fish on the coastline eaten by wild animals and birds. Researchers assess the abundance of salmon runs and count spawners in spawning water bodies according to the "Methodological Recommendations for Pacific salmon research" developed by VNIRO specialists in 2017 (Glubokovsky et al., 2017).

For calculations and modeling, scientists use a set of main rivers where population dynamics are well studied, and then extrapolate these data to the entire area, thus they do not study all the rivers in the region. This is possible because the dynamics of salmon abundance are quite synchronous in rivers of the same area. A number of criteria are taken into account when selecting main rivers. First of all, they should represent the whole area well (to be "typical" rivers) and be convenient for regular examinations.

In the Sakhalin-Kuril Region, the "standard" or "optimum" values of river escapement proposed in 1969-1971 by Felix Rukhlov are used. They were calculated based on the area of the spawning redds. For Pink Salmon it is 2 fish/m² of spawning ground area, and for Chum Salmon it is 1.6 fish/m². The same standards were used to assess Kunashir Pink and Chum Salmon escapement to spawning grounds during the monitoring work.

Data on Pink Salmon escapement to spawning grounds, including Kunashir rivers, were posted on the website of the Ministry of Fisheries of the Sakhalin Region

https://fish.sakhalin.gov.ru/?page_id=19462

Catch statistics from each fishing parcel were collected daily. Fishing in the sea is controlled by border guards, and no fishing is carried out in rivers and lakes. Since Kunashir is a small island, all catches are included in the official statistics. Pacific salmon catch data are available on the website of the Association of Fishermen of Sakhalin Region (AFS)

<https://fish-sakh.ru/vyilov/tihookeanskije-lososi/2023-god/>

In 2023, the monitoring program for Kunashir's water bodies was expanded and additionally funded by the PCF Yuzhno-Kurilsky Ryibokombinat Co., Ltd. (hereinafter - YKRK). According to the data from tables 3.3.1.1. and 4.2.1 from Andrey Zhivoglyadov's report, in 2023:

- 16 watercourses were examined during the Pink Salmon run;
- six water bodies were examined during the Chum Salmon run.

The difference between the 2023 monitoring and previous years is that the work has been divided into 2 stages.

The first stage is the ongoing support of fishery. This is the first block of information required to analyze and revise the recommendations of the Pacific Salmon Fishery Strategy. The reports on spawning grounds examinations were submitted to SakhNIRO in the evening of the same day or in the next morning. Based on in-season data on spawning grounds escapement and catch statistics, SakhNIRO scientists developed recommendations for the Anadromous Fish Commission (hereinafter referred to as the Commission) to make operational decisions on fisheries. Due to the low Pink Salmon escapement to spawning rivers on Kunashir, the Commission decided to introduce a passing period from August 23 to September 10. This decision actually imposed a ban on Pink Salmon fishing on Kunashir.

The second is the data collection on the number of all groups of Pink and Chum Salmon from all periods of the fish run (early, mid and late) that entered the spawning grounds in the current

season. This work was carried out by Andrey Zhivoglyadov during two expeditions to Kunashir Island. Previously it was noted that some Pink Salmon enter the rivers of Kunashir in early October and Chum Salmon in early November. Therefore, there was a decision to shift the examination to later dates in order to account for both species. As a result, the examination of spawning grounds was carried out under the contract with YKRR during the periods:

- from October 04, 2023 to October 11, 2023 (first stage – Pink Salmon and river form of Chum Salmon); the spawning grounds of the following water bodies were examined: Lagunnoye Lake (with a tributary of the Pervukhina Stream), the Asina Stream, Filatova River (with the Bolysheva Tributary), Tyurina Stream, Serebryanka River, and Ilyushina River. Additionally, two rivers were examined: Andreevka River (south-eastern part of the island, it flows into the Pacific Ocean) and Sernovodka River (connecting the Peschanoye Lake with the South Kuril Strait).

- from November 15, 2023 to November 24, 2023 (second stage river and lake forms of Chum Salmon); the following water bodies were examined: Lagunnoye Lake with a tributary of the Pervukhina Stream, Peschanoye Lake, Serebryanoye Lake, and Ilyushina River.

Due to almost constant stormy weather and inaccessibility of some water bodies due to large amounts of precipitation in the fall of 2023 the examination of the Severyanka River, Valentiny Lake and Ilyinskoye Lake was not completed.

Poaching is controlled by employees of the local Fish Protection Department of the Sakhalin-Kuril Territorial Administration (SKTU), however, due to the extremely low number of Pink Salmon and Chum Salmon in the spawning grounds, there is currently no illegal large-scale fishing in Kunashir. During the fall FIP visit to Kunashir, this information was confirmed by all interviewed respondents, including the head of the local SKTU Fish Protection Department.

Scientists collect biological data on the size and weight of spawners, their fecundity and age structure in addition to spawning escapements and catch values. These data are presented in reports by Tatiana Tochilina and Andrey Zhivoglyadov and have been submitted to the fisheries institutes SakhNIRO and VNIRO. The information collected during the season will be used for formulating the main principles of future Strategies, as well as for developing fisheries management decisions in subsequent seasons.

Every year, at the end of the fishing season, a meeting of the Far Eastern Scientific & Fishery Council (DVNPS) is held, at which representatives of all regional institutions report the results of the fishing season, compare forecasts and actual catches. In 2023, such a meeting took place on November 23 in Petropavlovsk-Kamchatsky. The event was widely covered in the media and on the official website of the Federal Fisheries Agency (Rosrybolovstvo):

<https://fish.gov.ru/news/2023/11/24/na-dalnevostochnom-nauchno-promyslovom-sovete-pod-veli-itogi-lososevoj-putiny-i-obsudili-podgotovku-k-speczpromyslu-mintaya-v-2024-year/>

Scientific research based on monitoring data is published in a special journal “Bulletin: Study of Pacific Salmon in the Far East”. Thus, an analysis of the 2022 fishing season was published in issue No. 17 (2023).

A similar publication with a detailed analysis of the 2023 fishing season is expected in the next issue No, 18 in April - May 2024.

List of literature and Internet resources

Glubokovsky M.K., Marchenko S.L., Temnykh O.S., Shevlyakov E.A. Methodological recommendations for the Pacific salmon studies (Metodicheskie rekomendacii po issledovaniyu tikhoookeanskikh lososej). – M.: VNIRO Publishing House, 2017 (in Russian)

Zhivoglyadov A.A. Report to Contract Agreement No. 3/2023 dated April 27, 2023 “Conducting investigations on the habitat and escapement to spawning ground of Pink and Chum Salmon on Kunashir Island (Sakhalin Region)”. January, 2024

https://www.fishnet.ru/news/novosti_otrasli/zasedanie-dalnevostochnogo-nauchno-promyslovogo-soveta-na-kamchatke-foto-/

<https://fish.gov.ru/news/2023/11/24/na-dalnevostochnom-nauchno-promyslovom-sovete-podveli-itogi-lososevoj-putiny-i-obsudili-podgotovku-k-speczpromyslu-mintaya-v-2024-year/>

Pink Salmon Escapement as of Sept 04, 2023.

https://fish.sakhalin.gov.ru/?page_id=19462

In-season daily catch information (Association of Fishermen of Sakhalin Region, AFS)

<https://fish-sakh.ru/vyilov/tihookeanskie-lososi/2023-god/>

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February, 09 2024

Report

to Contract Agreement No. 3/2023 dated April 27, 2023

Conducting investigations on the habitat and escapement to spawning ground of
Pink and Chum Salmon on Kunashir Island (Sakhalin Region)

Responsible executor: Ph.D. A.A. Zhivoglyadov

Yuzhno-Sakhalinsk 2024

TABLE OF CONTENTS

ABSTRACT	2
1. INTRODUCTION	3
2 MATERIALS AND METHODS	4
3 Kunashir Pink Salmon	5
3.2 Biological parameters	7
3.3 Commercial stock status	8
3.3.1 Pink Salmon escapement to the main spawning rivers on Kunashir	8
3.4 Commercial fishing	9
4. Kunashir Chum Salmon	10
4.2 Commercial stock status	13
4.2.1 Chum Salmon escapement to the main spawning rivers on Kunashir	13
4.3 Commercial fishing	15
5 Assessment of the Pacific salmon spawning escapement (Pink and Chum Salmon) in rivers and lakes on Kunashir Island	18
CONCLUSION	34

ABSTRACT

Report 32 pp., 10 tables, 21 figures, 6 sources.

KUNASHIR ISLAND, SOUTH KURIL ISLANDS, PACIFIC SALMON, CHUM SALMON, PINK SALMON, REPRODUCTION ASSESSMENT, STOCK STATUS, COMMERCIAL FISHING, DISTRIBUTION, BIOLOGICAL PARAMETERS

Objects of research – Chum Salmon (*Oncorhynchus chain*) and Pink Salmon (*Oncorhynchus gorbuscha*), reproducing and feeding in the coastal and fresh waters of Kunashir Island (South Kuril Islands).

The aim of the research is to collect and analyze data on the qualitative and quantitative characteristics of the Pacific salmon spawners (Chum Salmon, Pink Salmon), reproducing in the water bodies of Kunashir Island (South Kuril Islands). Fisheries statistics, archival and holding data of the Sakhalin branch of the Federal State Budgetary Institution "VNIRO" ("SakhNIRO"), the Sakhalin branch of the Federal State Budgetary Institution "Glavrybvod" ("SakhRybVod") were analyzed during the study. In addition, biostatistical information was collected, and a number of spawning water bodies were examined on the island.

1. INTRODUCTION

The Southern Kuril Islands are one of the most important areas of Pacific salmon reproduction in the Sakhalin-Kuril region. In the modern period, salmon reproduction in the waters of Kunashir Island is relatively small (total spawning area 0.26 million m²). Historically, catches of up to 7.7 thousand tons of Pink Salmon and 3.2 thousand tons of Chum Salmon have been recorded, however, catches have declined dramatically in recent years and the island has lost much of its importance to the salmon farming industry.

Employees of “SakhNIRO” and “Glavrybvod” have been working on Kunashir Island since the 1970s. The first reports on the biology of Pink and Chum Salmon on Kunashir Island were presented by Ivankov (1967), detailed information is given in the monograph edited by Gritsenko (2012), then Kunashir salmon populations were considered by Kaev (2017). Regular monitoring of the Pacific salmon stocks on Kunashir Island was carried out from 1994 to 2010, but since 2013 field observations have been discontinued, and only data on pink and Chum Salmon entering the island's rivers are available.

Until recently, Kunashir Island remained one of the few areas in the Sakhalin Region where the stock of pink and Chum Salmon in the rivers of the island was formed solely due to natural reproduction. Recently, despite a significant decline in Pacific salmon catches and their importance for fisheries, Kunashir Island may be interesting in terms of large-scale artificial reproduction of Pacific salmon (two salmon hatcheries are already operating on the island), as well as for the relatively effective natural reproduction of salmon in the waters of the island.

Aims of the work:

1. Data collection to determine the quantitative and qualitative indicators of Pacific salmon (Pink Salmon, Chum Salmon) in the study area.

2. Examination to obtain information on the escapement to spawning grounds by Pink and Chum Salmon, on condition of spawning grounds and the level of reproduction of Pink and Chum Salmon in the following water bodies:

- Severyanka River, Asin River, Filatova River with the Bolysheva tributary, Ilyushina River, Serebryanaya River;

- Tyurina Stream, Pervukhina Stream, Pionersky Stream, Treugolny Stream, Luchevoi Stream;

- Valentiny Lake, Lagunnoye Lake, Ilyinskoye Lake, Serebryanoye Lake.

2 MATERIALS AND METHODS

The work is based on available materials and holding information from the Sakhalin branch of the Federal State Budgetary Institution “VNIRO” (SakhNIRO) and the Sakhalin branch of FSBI “Glavrybvod” (SakhRybVod) obtained during field surveys in 1977-2023 in coastal and inland waters of Kunashir Island, as well as data obtained during surveys on water bodies of Kunashir Island in 2020-2023.

When analyzing the dynamics of pink and Chum Salmon catches, we used fishery statistics from the Sakhalin-Kuril Territorial Administration of Rosrybolovstvo (SKTU) and data from the Ministry of Fishery of the Sakhalin Region.

Biological analyses and examination of Chum Salmon scale samples for age determination were carried out from September 29 to November 06, 2023 by Tatiana Tochilina, an employee of the central office of FSBSI “VNIRO”. The following parameters were measured according to generally accepted methods (Pravdin, 1966): fork length (FL), standard length (SL), total weight (TW), eviscerated weight (EW), weight of gonads (GW). If possible, scales were taken according to generally accepted methods (Sterligova, 2016) in a strictly defined place – from the second to fourth row above the lateral line between the dorsal and anal fins. The age was determined from scale samples using an MBS-10 binocular stereoscopic microscope. In total, 706 Chum Salmon specimens were analyzed and 806 scale samples were processed.

The number of Pink and Chum Salmon juveniles is given according to SakhNIRO holding and archival information on the basis of data obtained on the Ilyushina River.

The number of Pink and Chum Salmon spawners on spawning grounds was determined by visual counting during walking tours along rivers and inspections to the lakes using watercraft. The number of fish entering spawning grounds by the time of the examination was determined by total counting (for Chum Salmon) and selective counting (for Pink Salmon) (Shevlyakov et al. 2013). At the same time we performed visual determination of spawning ground condition and its description (bottom sediments, aquatic vegetation, depth), as well as photography of the examined areas. Flow velocity in rivers was measured using the float method. To measure cross-sectional area, the river channel measurements were carried out.

3 Kunashir Pink Salmon

The first reports on the biology of Kunashir Pink Salmon are represented by V.N. Ivankov (1967). This topic was further examined in detail by O.F. Gritsenko (2012) and Kaev (2017). Pink Salmon has historically been the most numerous species of the genus *Oncorhynchus* in the rivers of Kunashir Island, however, currently this species is in a depressed state; in 2023, in particular, not even single specimens entered some rivers.

3.1 Spawning run and spawning

The list of the main spawning water bodies on Kunashir Island includes about 60 rivers, streams, tributaries and seven lake-river systems. According to modern concepts, they provide up to 260 thousand m² of potential spawning grounds for Pacific salmon.

Pink and Chum Salmon entries to rivers almost everywhere, except for some water bodies (eg. Zolotaya River and some others). On the other hand, there is a situation when two rivers (Zolotaya and Severyanka) have approximately the same water quality and water volume, but Pacific salmon enter in significant numbers only in the Severyanka River and are absolutely absent in the Zolotaya River.

Talking about the absolute number of spawners, it should be noted that even-year generations dominated for a long time. After 2003-2007 dominance passed to odd-year generations; currently both forms are small in number (Figure 3.1)

Kunashir Pink Salmon are represented by two temporal forms. Unlike the Sakhalin rivers, the observed decrease of the relative fecundity of females on Kunashir Island was statistically insignificant after even and odd generations switch; both temporal forms are small in number and comparable in average size to each other (Kaev, Romasenko, 2017).

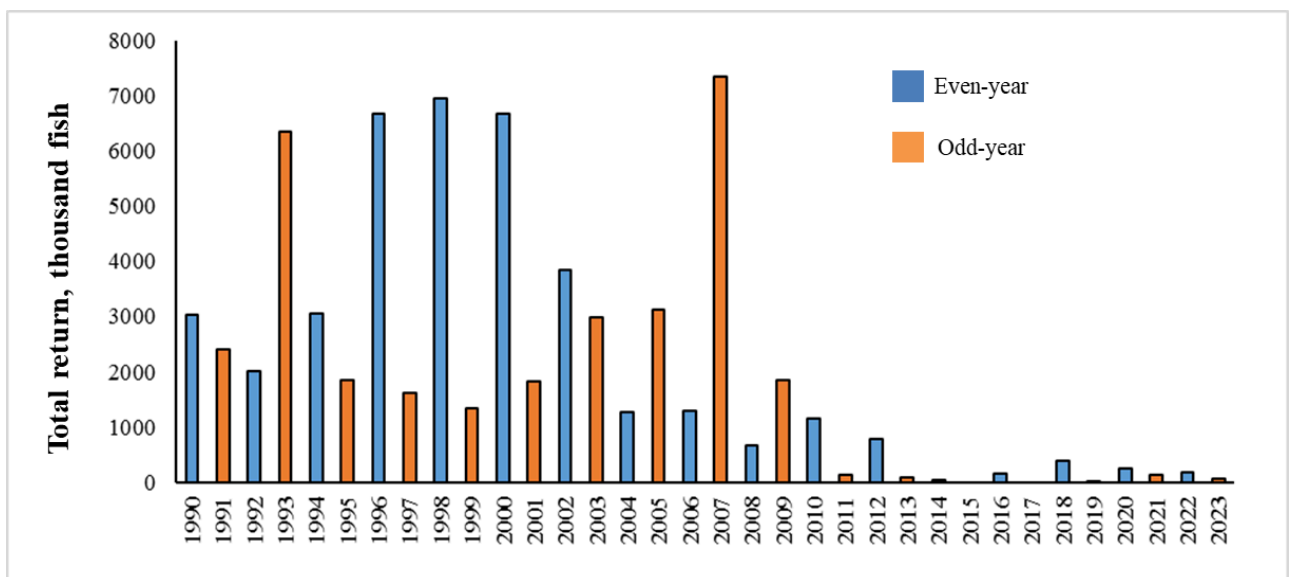


Figure 3.1 – Number of Pink Salmon returns on Kunashir Island for even and odd generations, 1990-2023

3.2 Biological parameters

Figure 3.2.1 demonstrates parameter dynamics of Pink Salmon from Kunashir Island in 2020-2022.

During this period, in 2020-2022 there was a decline in three parameters: in average fork length of even-year generations (51.2-49.9 cm), in body weight (1,363.0-1,522.1 g in 2020-2021), and absolute fecundity (1,483.7-1,427.7).

In 2023, biological analyzes of individuals were not carried out due to the low number of Pink Salmon.

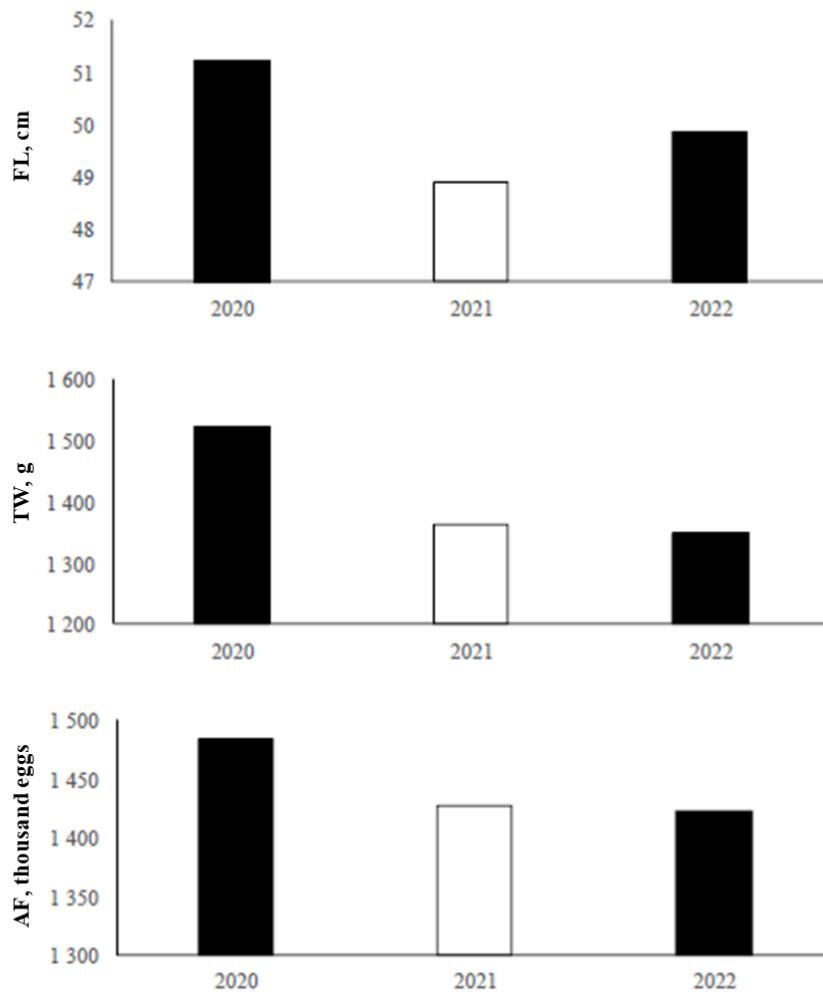


Figure 3.2.1 – Dynamics of the main biological parameters of Kunashir Pink Salmon in 2020-2022. Black color indicates even generations, whereas white color indicates odd generations of Pink Salmon (AF – absolute fecundity)

3.3 Commercial stock status

3.3.1 Pink Salmon escapement to the main spawning rivers on Kunashir

During the observation period from 1993 to 2013 the amount of Pink Salmon varied from 171 to 2,888 thousand fish with the average value of 1,344 thousand fish.

On average, fish density on the spawning grounds in the rivers of Kunashir Island was slightly lower than in the rivers of Iturup Island (1.89 and 2.44 fish/m² respectively) (Kaev, Romasenko, 2017).

The high-catch period for both generations occurred at the end of the last and in the beginning of the present centuries. As for the odd-year generation, the Pink Salmon stock reached a maximum in 2007 (7.4 million fish), and then sharply declined: in 2017, minimal entry of Pink Salmon into rivers was noted (Table 3.3.1.1).

Table 3.3.1.1 - Pink Salmon spawner escapement in Kunashir Island watercourses from 2016 to 2023, number of fish (data provided by SakhRybVod and SakhNIRO).

Watercourse	Spawning area, m ²	2016	2017	2018	2019	2020	2021	2022	2023
Date of examination		Sep 13	Aug 08	Sep 27	Sep 23	Oct 27	Sep 22	Jul 20- Nov 20	Sep 11
Severyanka River	13,000	-	-	5,300	4,100	-	1,640	4,650	-
Vodopadny Stream	no data	-	-	-	-	-	-	-	0
Belozerskaya River	1,440	-	-	-	-	-	-	-	0
Pionerskaya River	853	-	-	-	-	-	-	-	0
Treugolny Stream	1,033	-	-	-	-	-	-	-	0
Luchevoi Stream	4,294	-	-	-	0	-	370	1,054	100
Serebryanka River	13,000	-	-	-	-	5	630	-	10
Prozrachny Stream	816	600	single	3,200	250	7,800	120	2,400	28
Valentiny Stream	740	1,100	-	3,520	260	-	-	-	-
Vtoroi Dachny Stream	170	250	-	-	-	1,500	38	55	0
Asin River	5,000	5,300	single	9,700	520	8,200	220	8	single
Polynova River	3,760	-	-	15,200	-	19,200	270	1,426	-
Filatova River	9,820	2,000	-	14,500	2,800	23,000	1,470	4,500	1,000
Bolysheva River	2,020	-	-	-	-	-	-	606	20
Ilyushina River	21,000	9,870	single	13,800	2,150	20,400	840	12,300	2,500
Tretyakovka Stream	1,021	1,600	-	126	-	0	-	-	-
Saratovka River	30,000	-	-	-	20	-	-	-	-
Okunevka River	160	26	-	-	-	-	-	-	-
Pervukhina River	750	-	-	-	-	0	0	0	0
Zolotaya River	no data	-	-	-	-	0	0	0	-
Tyurina Stream	no data	-	-	-	-	-	-	150	50
Andreevka River	450	-	-	-	-	-	-	-	0

Watercourse	Spawning area, m ²	2016	2017	2018	2019	2020	2021	2022	2023
Date of examination		Sep 13	Aug 08	Sep 27	Sep 23	Oct 27	Sep 22	Jul 20- Nov 20	Sep 11
Sernovodka River	1,320	-	-	-	-	-	-	-	0

As for even-year generation, the minimal entry was noted in 2014. In 2016 and 2018 the number of spawners slightly increased, but escapement to spawning grounds was not at optimal value (about 2 million fish). During the period of satisfactory stock status the average number of Pink Salmon smolts was about 150 million fish (Kaev, Romasenko, 2017). Currently, counting juveniles during the migration period is not carried out.

Table 3.3.1.2 - Average density of Pink Salmon spawners from 2016 to 2023.

Year	2016	2017	2018	2019	2020	2021	2022	2023
Total examined spawning area, m ²	38,727	26,816	42,157	67,376	53,566	70,860	59,880	91,248
Total number of registered spawners, number of fish	20,962	single	65,346	10,100	80,105	5,598	26,999	3,708
Average density of spawners on spawning grounds, fish/m ²	0.54	-	1.55	0.15	1.50	0.08	0.45	0.04

3.4 Commercial fishing

Historically and in the modern period, Pink Salmon stock on Kunashir Island is formed exclusively due to natural reproduction. In 1990-2023 total number of Pink Salmon on the island varied from 0.04 to 6.9 thousand fish for odd generation (average 2.25 thousand fish) and from 0.02 to 7.35 thousand fish for even generation (average 2.07 thousand fish). The total number of Pink Salmon in 2023 was at an extremely low level and was estimated at 0.062 thousand fish (Figure 3.1).

Pink Salmon fishing on Kunashir Island is based exclusively on trap nets, and the main fishing area is the coastal area from the Sea of Okhotsk. Between 2013 and 2022 there were six trap nets in the Sea of Okhotsk coast, located from Stolbchaty Cape to Dokuchaev Cape with a total allowable catch of 100 tons. In 2023, four companies received fishing permits for 20 fishing gears.

Between 2009 and 2022, Pink Salmon catches ranged from 0.002 to 1.401 thousand tons, with an average of 0.289 thousand tons. Decrease in Pink Salmon catches on Kunashir Island began in 2004. In accordance with this, in the period from 2013 to 2021 restrictions on fishing were introduced annually, but they did not lead to the stock restoration. In 2023 a catch limit for this species was also introduced due to the low number of fish returns. In total, in 2023 there was 0.0008 thousand tons of Pink Salmon, i.e., the catch was practically absent.

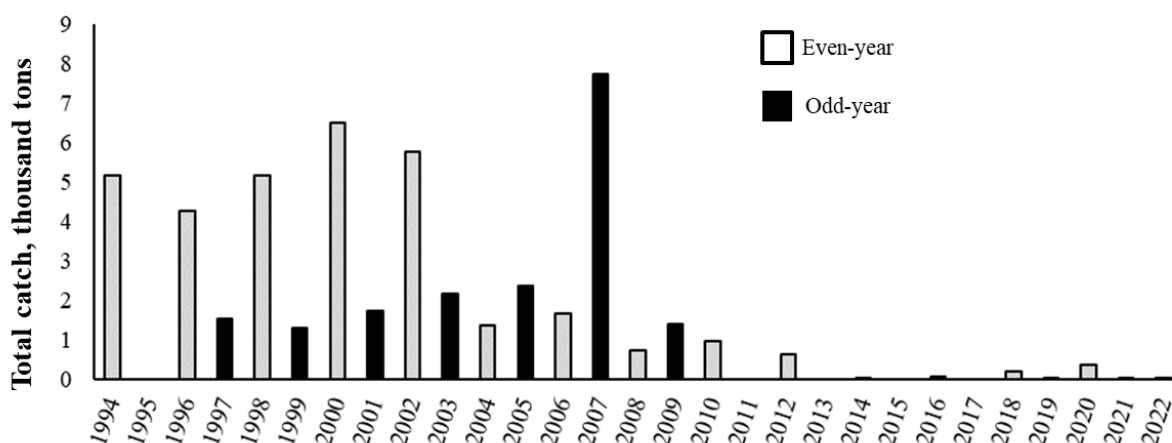


Figure 3.4.1 – Dynamics of Pink Salmon catches on Kunashir Island from 1994 to 2022.

4. Kunashir Chum Salmon

Kunashir Chum Salmon is represented by two forms: lake and small river form (“river” form). The number of Chum Salmon populations in the rivers and lake-river systems of the region is small.

4.1 Size, weight and age composition

In the period from 2000 to 2015 there were relatively small sizes and weights for Chum Salmon in the Ilyushina River, which is the control river. Fork length changed from 61.8 to 67.7 cm (on average 64.7 cm), total weight - from 2,486 to 3,573 g (on average 3,086 g), while males were slightly larger than females and the level of such dimorphism increased with the age of the fish. During fishing, the size of fish in returns, as a rule, decreases, and the proportion of males in catches falls (Kaev, Romasenko, 2017).

Table 4.1.1 demonstrates biological characteristics of Chum Salmon on Kunashir Island according to SakhRybVod in the period from 2001 to 2010.

Table 4.1.1 – Main biological parameters of Kunashir Chum Salmon from 2001 to 2010 (data obtained from SakhRybVod)

Year	FL, cm	Average weight, g	Average age, years
2001	61.3	3,349	3+
2002	63.5	3,491	3+
2003	63.4	3,573	3+
2004	61.4	3,023	4+
2005	59.0	2,915	3+

2006	60.8	3,026	3+
2007	61.2	2,897	3+
2008	61.5	3,021	4+
2009	60.5	3,088	3+
2010	60.6	2,931	3+

Main biological parameters of Kunashir Chum Salmon received in 2021-2023 are presented in table 4.1.2.

Table 4.1.2 – Main biological parameters of Kunashir Chum Salmon, 2021-2023

Date	Water body	FL, cm	Total weight, g	Absolute fecundity	Number of fish
2021					
September 12, 2021	coastal area	64.7	3,014.9	2,444	100
September 17, 2021	coastal area	63.6	2,983.7	2,481.7	100
September 23, 2021	coastal area	63.7	2,825.6	2,275.5	100
September 28, 2021	coastal area	65.1	2,864.1	2,337.8	50
November 09, 2021	Pervukhina River	61.8	2,195	-	37
Average		63,8	2,776.7	2,384.8	-
2022					
October 03, 2022	Golovnina Bay	60.9	2,446	2,325	99
October 09, 2022	Golovnina Bay	61.3	2,534	2,396	100
October 20, 2022	Pervukhina Bay	62.5	3,033	2,184	100
October 31, 2022	Pervukhina Bay	59.7	2,236	1,911	100
Average		61,1	2,562.3	2,204	-
2023					
October 12, 2023	Pervukhina Bay	63.0	2,731	2,303	100
October 30, 2023	Pervukhina Bay	59.2	2,282.5	2,260	100
October 20, 2023	Pervukhina River	65.1	2,733	2,004	100

November 03, 2023	Pervukhina River	63.7	2,349	1,833	100
October 05, 2023	Ricorda River	63.9	2,623	2,169	78
October 18, 2023	Ricorda River	62.4	2,453	1,911	50
November 05, 2023	Ricorda River	57.5	2,128	1,239	50
September 26, 2023	Ilyushina River	62.9	2,710.5	2,409	24
October 13, 2023	Ilyushina River	62.3	2,458.5	1,992	13
October 31, 2023	Ilyushina River	62.4	2,608.5	2,335	42
November 09, 2023	Sernovodka River	64.3	2,930.5	1,566	67
Average		62,4	2,546	2,002	-

In 2023 the average length of fish was 62.4 cm, weight – 2.55 kg, fecundity – 2,002 eggs. One can note a continuing trend towards a decrease in the average weight of Chum Salmon; in 2023, the average weight of Chum Salmon for all samples was lower (2.546 kg) than in 2022 (2.562 kg) and in 2021 (2.777 kg). The value of absolute fecundity also decreased, which is probably connected with a decrease in average body weight. However, the differences are small and any conclusions seem premature.

Age composition of Kunashir Chum Salmon in 1994-2010 usually consisted of four groups: from 2+ to 5+. Four- and five-year-old fish predominated in numbers; the shares of three- and six-year-old fish did not exceed 10% (Kaev, Romasenko, 2017).

At present time, six-year-old fish (5+) disappeared from the Kunashir Chum age composition. Thus, in 2022, a 5+ aged fish was found only in the Ilyushina River, and in 2023, 5+ aged fish were not recorded at all. In 2022-2023 four- and five-year-old fish predominated in numbers.

Table 4.1.3 - Kunashir Chum Salmon age composition (%) in 2022-2023

2022 year					
	2+	3+	4+	5+	Number of fish, %
Ilyushina River	15	73	10	2	100
Pervukhina River (salmon hatchery)	78	21.6	0.4	0	100
Pervukhina Bay	25.5	68	5.5	1	100
2023 year					
	2+	3+	4+	5+	Number of fish, %
Ilyushina River	10	72	18	0	100

Pervukhina River (salmon hatchery)	17	81.5	1.5	0	100
Pervukhina Bay	32	62	6	0	100

4.2 Commercial stock status

4.2.1 Chum Salmon escapement to the main spawning rivers on Kunashir

Chum Salmon are widespread throughout the island's water bodies. This is facilitated by deep circulation and intensive release of groundwater into the riverbeds and lakes. Chum Salmon do not breed only in rivers with an aggressive environment, but individual schools are observed during rain floods even in such water bodies.

Chum Salmon also enter very small streams, and in some of them the spawning grounds are located in the tidal zone.

A distinctive feature of Kunashir Island is the absence of relatively large watercourses. Only Tyatina River on the northeastern coast of the island is comparable in size to rivers on Iturup Island such as Slavnaya, Reidovaya, Kurilka and Kuibyshevka.

At the same time, Kunashir Island has relatively many lake-river systems (lakes Peschanoye, Serebryanoye, Lagunnoye, Ilyinskoye, Valentiny, Mikhailovskoye, and, according to some sources, Dlinnoye), where lake form of Chum Salmon spawn. In total, on Kunashir, spawning grounds in rivers occupy 44,383 m², whereas spawning grounds in lakes occupy 70,170 m².

Some Chum Salmon spawners appear in the rivers in September, but in most rivers mass salmon run occurs in the second half of October – early November. By the middle of November, spawner entry into the rivers sharply weakens. But in some southern rivers on the island, flowing into the Izmeny Bay, the main run of Chum Salmon occurs in November and continues until January, according to survey data from the local residents.

The number of Chum Salmon populations in the rivers and lake-river systems of the region is small. In 2000-2010 the number of spawners entering the Kunashir rivers varied from 12 to 79 thousand fish, and the number of migrated smolts were from 1.5 to 40.2 million, on average – 10 million fish. (Kaev, Romasenko, 2017). In recent years, Chum Salmon entry has decreased significantly, and works on counting smolts during the outmigration are not performed.

Until 2013, the forecast was based on the ratio between the number of smolts (annually counted in the Ilyushina River) and the number of adult fish in the return of the corresponding generations (according to fisheries statistics and counting in rivers).

At the same time, the return of Chum Salmon of local populations was calculated on the expert assumption of a 60% commercial extraction, which is based on the fact that the commercial extraction of Pink Salmon with approximately the same number of trap nets was 62.8% over the years of observation (Romasenko, 2018).

Currently, similar estimates have been adopted, since there is no new data.

Table 4.2.1. - Chum Salmon spawner escapement to the watercourses on Kunashir Island in 2011-2023, number of fish (according to SakhRybVod and SakhNIRO).

Water body	Spawning Area, m ²	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Ilyushina River	4,000	1,000	-	1,780	650	206	320	210	250	ind.	-	2,000
Tropinka Stream	375	50	-	500	280	26	-	-	-	-	-	-
Filatova River	700	370	-	900	442	38	236	46	142	500	300	-
Pervukhina River	240	-	-	-	-	18	-	-	-	0	0	0
Treugolny Stream	510	-	-	-	-	-	-	-	-	0	-	100
Prozrachny Stream	200	32	-	80	-	15	20	-	-	-	-	-
Luchevoi Stream	1,755	-	-	1,300	627	154	214	54	182	-	-	-
Severyanka River	2,000	-	-	2,050	-	-	1,400	-	-	50	150	-
Valentiny Lake	9,500	-	-	4,360	2,400	430	1,640	-	-	500	1,500	-
Polynova River	480	-	-	530	250	-	-	-	-	-	-	-
Ilyinskaya River	320	-	-	380	-	-	-	-	-	-	-	-
Ilyinskoye Lake	600	-	-	700	410	-	330	-	-	30	-	-
Lagunnoye Lake	25,000	-	-	-	-	-	-	-	-	214	550	600
Peschanoye Lake	30,000	-	-	-	-	-	-	-	-	0	-	500
Tyurina Stream	no data	-	-	-	-	-	-	-	-	-	-	150

Table 4.2.2 - Average density of Chum Salmon spawners on spawning grounds in 2011-2023.

Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Total number of examined spawning grounds, m ²	5,275	-	19,930	17,410	16,770	18,755	6,455	6,455	42,550	37,440	62,205
Total number	1,452	-	12,580	5,059	887	4,160	310	574	1,294	2,500	3,200

of spawners, number of fish											
Average number of spawners on spawning grounds, fish/m ²	0.28	-	0.63	0.29	0.05	0.22	0.05	0.09	0.03	0.06	0.05

4.3 Commercial fishing

The coastal Chum Salmon fishing on Kunashir Island is based on a mixed aggregation of local and “transit” fish. Between 1995 and 2017 fishermen caught from 0.3 to 3.4 thousand tons. In recent years, the share of the local Chum Salmon catch is less than 40% of the total catch (Kaev, Romasenko, 2017).

Salmon fishing on Kunashir Island differs from other areas of the Sakhalin Region, because until recently there was no catch of locally hatched Chum Salmon. Only in the last two years, it has been noted Chum Salmon returns to the Lagunnoye Lake Salmon Hatchery and the Ricorda River Salmon Hatchery.

Since 1990 (the year of the first observations), catches have varied from 0.031 to 3.244 thousand tons, and the number of spawners in the rivers has varied from 4 to 337 thousand fish.

The sharp increase in Chum Salmon catches since 2001 is associated with the beginning of mass bycatch of transit fish due to an increase in the length of trap nets. As a result, in these years, Chum Salmon catches were formed mainly due to the bycatch of transit Chum.

Moreover, unlike Pink Salmon fishing, for Chum Salmon fishing there was no correspondence between areas of intensive fishing and the location of large spawning water bodies (Kaev, Romasenko, 2017).

Starting from 1950, commercial catches of Chum Salmon varied from 0 in the absence of fishing in 1959-1966 up to 3.24 thousand tons in 2002 (Figure 4.3.1).

Since the 1990s fishing has been carried out mainly with trap nets. As a result, the main fishing period occurs in the second half of September – the first half of October.

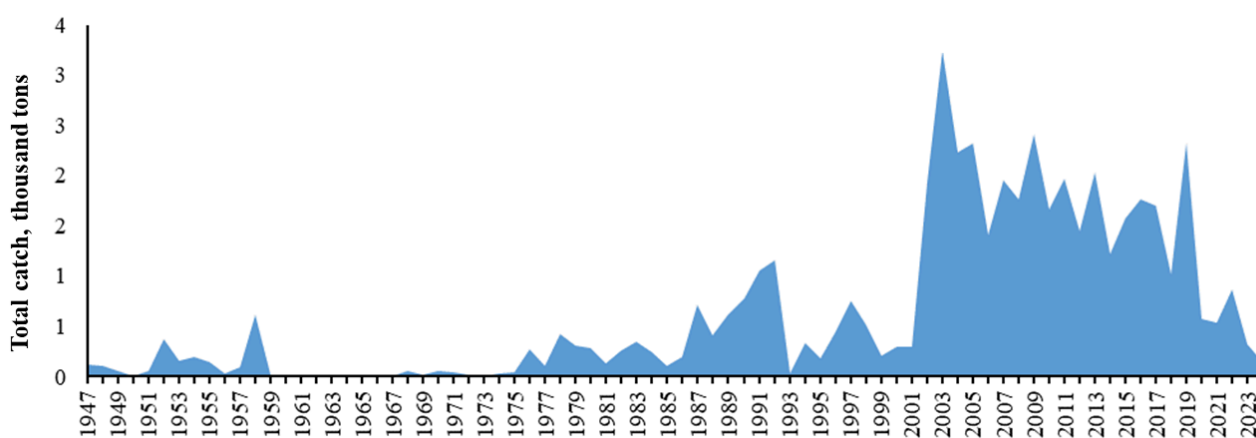


Figure 4.3.1 - Chum Salmon catches on Kunashir Island, thousand tons, 1946-2023

From 2010 to 2023 Chum Salmon catch in coastal trap nets ranged from 0.195 to 2.37 thousand tons, with an average of 1.334 thousand tons (Table 4.3.1).

Table 4.3.1 - Chum Salmon catches on Kunashir Island in 2010-2023, thousand tons.

Indicator	Years													
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Catch, thousand tons	1.96	1.45	2.03	1.214	1.57	1.76	1.705	1.269	2.374	0.587	0.54	0.86	0.32	0.195

As for Pink Salmon, the distribution of catches along the coast is uneven. In the southern part of the island (Izmeny Bay), the number of salmon is small and there is no fishing. On average, the largest catches and the number of set trap nets are observed on the Sea of Okhotsk coast.

As a rule, by the end of the first ten days of November, the last trap nets are removed, since their further operation is associated with the risk of destruction by strong fall storms. The abundance of the wild Chum Salmon population in the rivers of the island is small. The share of the local Chum Salmon in catches in recent years has been less than 40% of the total catch. Mainly catches consist of “transit” Chum Salmon, which do not reproduce in the rivers of Kunashir.

According to Kaev (2017), from 2001 to 2015, the volume of transit Chum Salmon harvest ranged from 342 to 803 thousand fish (Figure 4.3.2).

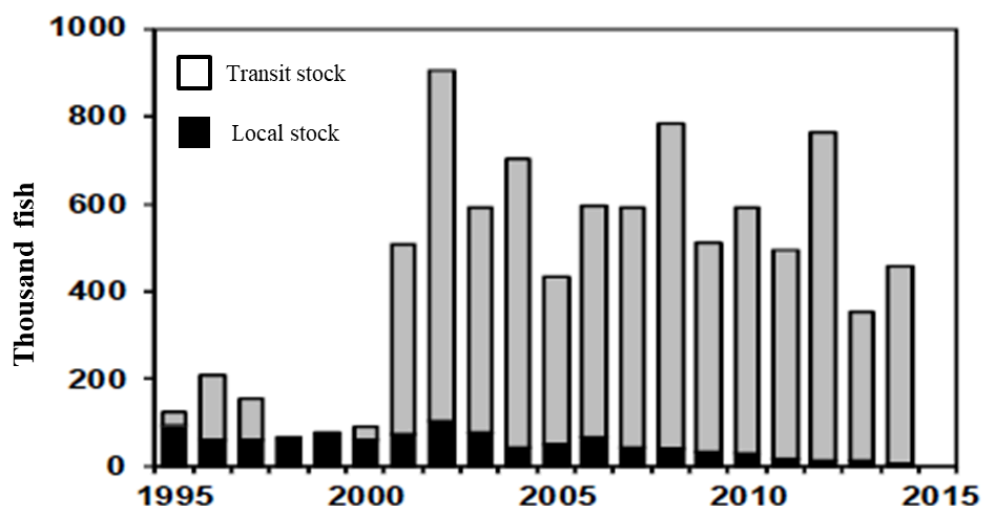


Figure 4.3.2 – The ratio between local and “transit” fish during Chum Salmon coastal fishing on Kunashir Island in 1995–2014 (Kaev, Romasenko, 2017)

Total catch of wild Chum Salmon is based on the assumption of 60% commercial extraction of fish return (Table 4.3.2). The number of Chum Salmon in the inland waters of

Kunashir is estimated by extrapolating data from fish counting at spawning grounds to all spawning grounds of the island (data from SakhRybVod).

Extremely weak entry of fish into the rivers is confirmed by the predominant catch of transit Chum Salmon in coastal waters due to the low number of fish of local populations.

Table 4.3.2 - Chum Salmon abundance in 2011–2022, thousand fish

Indicator	Year									
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Total catch, including	445.5	576.15	645.87	625.69	465.69	871.19	215.41	198.17	294.02	129.07
transit Chum	439.54	576.15	625.38	615.47	463.78	863.73	214.36	196.25	291.83	122.02
local Chum*	5.96	–	20.49	10.22	1.91	7.46	1.05	1.92	2.19	7.05
Spawners escapement*	3.97	–	13.66	6.81	1.27	4.97	0.70	1.28	1.46	4.70
Return of local stock*	9.93	–	34.15	17.03	3.18	12.43	1.75	3.20	3.65	11.75

Note: * Fish originated in the water bodies of Kunashir Island (40% - entry into rivers, 60% - catch in the coastal area)

In total, 0.195 thousand tons of Chum Salmon were caught in 2023, which is the minimum catch in recent years.

5 Assessment of the Pacific salmon spawning escapement (Pink and Chum Salmon) in rivers and lakes on Kunashir Island

Pink Salmon and Chum Salmon enter almost all water bodies on the island of Kunashir, with a few exceptions (Kaev, Strukov, 1999; Kaev, Romasenko, 2017). Pink Salmon spawn in almost all rivers and most tributaries of lakes. Reproduction of Chum Salmon (of river form) occurs in most rivers of the island, including very small ones (for example, Tyurina Stream). Relatively large rivers with regular reproduction of “river” form of Chum Salmon include the Tyatinka, Filatova, Ilyushina, and Severyanka rivers.

Regular spawning of Chum Salmon (of lake form) occurs in a number of lake-river systems on Kunashir Island (Lake Peschanoye, Lagunnoye, Ilyinskoye, Valentiny, Serebryanoye, Mikhailovskoye and, according to survey data, Lake Dlinnoye). Spawning of Chum Salmon in small quantities was observed in the tributary of the Serebryanoye Lake (Treugolny Stream).

During the 2023 field season, it was planned to examine the following water bodies (taking into account accessibility), which are the most significant for reproduction:

- Severyanka River, Asin River, Filatova River with their tributaries Bolysheva River, Ilyushina River, Serebryanaya River;
- Tyurina Stream, Pervukhina Stream, Pionersky Stream, Treugolny Stream, Luchevoi Stream;

- Valentiny Lake, Lagunnoye Lake, Ilyinskoye Lake, Serebryanoye Lake.

The study of the spawning stock was supposed to be carried out in two stages:

1. The first - in the period from the second half of September to October 2023. At this stage it was planned to examine mainly rivers, where both the potential spawning stock of Pink Salmon and the river form of Chum Salmon predominate;

2. The second - from the end of October to the beginning of November 2023. At this stage, it was planned to examine mainly water bodies where the reproduction of the lake form of Chum Salmon occurs.

In 2023, Pacific salmon spawning runs on Kunashir Island began relatively late. For this reason, during the work on the first stage, it was decided to shift dates of the second stage to a later period. It is known that Pink Salmon and Chum Salmon from the Southern Kuril Islands have relatively late migration periods; the fish run is extended and ends in November, and in some years – in December. The decision to postpone the second stage of our examination to a later period made it possible to monitor the intensity of the spawning run of Pacific salmon on Kunashir at the end of November and to count fish groups (mainly Chum Salmon) with the latest running period at the spawning grounds.

As a result, the examination of spawning grounds was carried out in the period from October 4, 2023 to October 11, 2023 (first stage, Pink Salmon and river form of Chum Salmon) and from November 15, 2023 to November 24, 2023 (second stage, river and lake form of Chum Salmon). All field works were carried out under the contract with the company PCF Yuzhno-Kurilsky Ryibokombinat Co., Ltd. (YKRK).

At the first stage, we observed spawning grounds of the Lagunnoye Lake (with a tributary of the Pervukhina Stream), the Asina Stream, Filatova River (with the Bolysheva Tributary), Tyurina Stream, Serebryanka River, and Ilyushina River. Additionally, two rivers were examined: Andreevka River (south-eastern part of the island, it flows into the Pacific Ocean) and Sernovodka River (connecting the Peschanoye Lake with the South Kuril Strait).

At the second stage, the following objects were examined: Lagunnoye Lake with Pervukhina Stream (Tributary), Peschanoye Lake, Serebryanoye Lake, and Ilyushina River.

Due to almost constant stormy weather and inaccessibility of some water bodies due to large amounts of precipitation in the fall of 2023 the examination of the Severyanka River, Valentiny Lake and Ilyinskoye Lake was not completed.

During the observation we recorded live spawners of Pink Salmon and Chum Salmon, noted the number and location of spawning redds, and counted dead spawners (post-spawn fish). This data was used to assess the intensity of spawning and its quantitative indicators.

Pervukhina Stream (tributary of the Lagunnoye Lake)

The examination was carried out on October 5 and November 16, 2023. Salmon spawning grounds begin from the mouth and continue to the 1.2 km mark, in some places accounting for up to 70% of the bottom area. The Pink Salmon spawning area in the Pervukhina River is 750 m², for Chum Salmon this value is 242 m². There is a salmon hatchery in the basin of the Pervukhina River, which releases Chum Salmon.

Potential Chum Salmon spawning grounds are located in the Pervukhina River at a distance of 700 m² from the mouth. In this section, the river channel approaches the left slope of the valley, and groundwater outlets are observed in this place. Potential Pink Salmon spawning grounds are distributed along the riverbed, up to 1.2 km from the mouth. There are no Pink and Chum Salmon spawning grounds above 1.2 km along the riverbed. It is noted that the spawning grounds are of good quality, and siltation is low. The bottom sediments consist mainly of rounded pebbles of various sizes (Fig. 5.1.).

Spawners and post-spawn Pink Salmon were not recorded at the spawning grounds. On the day of the examination(October 05, 2023), escapement to spawning grounds was 0%. There is a water intake dam 1.1 km from the river mouth; the main spawning areas are located downstream. During the examination of the first stage, enormous aggregations of Chum Salmon were noted in the estuarine space (obviously of hatchery origin, up to several thousand fish) (Fig. 5.2).

During re-examination of the Pervukhina River (November 16, 2023), the entry of Chum Salmon spawners was not detected. There were no signs of Pink and Chum Salmon spawning.



Figure 5.1 – Riverbed of the Pervukhina Stream



Figure 5.2 – Aggregation of Chum Salmon at the mouth of the Pervukhina Stream (Lagunnoye Lake, October 5, 2023)

Lagunnoye Lake

The examination was carried out on October 5, 2023 and November 16, 2023.

The lake is located in the central part of Kunashir Island, it is a residual fragment of the deepest part of the ancient strait, separated from the sea by bridges of marine and lagoonal sedimentary strata. The shape of the lake looks like an irregular oval with capes in the north, west and east. Maximum depth is 23.4 m. Lake length is 2.6 km, width is 1.5 km, water area is 3.5 km², catchment area is 20.4 km².

The lake is flowing and connects with the Sea of Okhotsk through a short channel. The Pervukhina Stream flows into the northern part of the lake, and two unnamed streams flow into the northwestern part.

The Chum Salmon spawning area amounts to 25.0 thousand m². Spawning grounds are concentrated in the coastal zone of 5-20 m width (on average 10 m), at depths of 0.3 - 1.5 m.

The main Chum Salmon spawning grounds (with an area of about 22.0 thousand m²) are located in the northeastern part of the lake. Smaller spawning areas (3.0 thousand m²) are noted in the northwestern part of the lake, extending into the land. Spawning grounds are confined to the places of groundwater outlets.

The number of Chum Salmon on lake spawning grounds is small; the total number of Chum Salmon spawners recorded at the time of the examination was up to 600 fish (October 05, 2023). In 2023, a massive Chum Salmon return to the mouth of the Pervukhina Stream was observed (Fig. 5.2).



Figure 5.3 – Post-spawn dead Chum Salmon on the spawning grounds of the Lagunnoye Lake (October 5, 2023)

Asin Stream

The total length of the watercourse is about 6 km, the catchment area is 8.0 km². The spawning area reaches 5,000 m², and Pink Salmon is reproduced in the watercourse.

The width of the riverbed varies from 3.7 m at the mouth to 2.4 m in the middle part. Current speeds vary from 0.2 to 0.8 m/s, depths are small and do not exceed 0.5 m. Spawning grounds are of good quality; no siltation was detected. The bottom sediments consist mainly of well-rounded pebbles of various sizes; in the upper part of the surveyed area the bottom is rocky in some places (Fig. 5.4.).

During the examination period (October 06, 2023), Pink Salmon spawning grounds were identified, and two spawning redds per 100 m² of spawning grounds were found. No live or dead fish were found. There are very few signs of spawning, which indicates an extremely low level of spawner entry in 2023.



Figure 5.4 – Riverbed of the Asin Stream

Filatova River (with Bolysheva tributary)

The total length of the river is 11.0 km, and the catchment area is 27.5 km²; Pink and Chum Salmon reproduction is observed in this river. The area of Pink Salmon spawning grounds is 7,800 m², and the area of Chum Salmon spawning grounds is 700 m². It has a Bolysheva tributary 6 km long, with a spawning area of 2,020 m².

There are no spawning grounds above 1.4 km along the riverbed; spawning is possible only in certain areas. The riverbed has a typical mountainous appearance, the bottom sediments composed mainly of boulders and rocks. On the riverbanks there are thickets of butterbur (*Petasites sp.*) and willow (*Salix sp.*), and the forest is predominantly deciduous (Fig. 5.5.).

During the examination period (**October 06, 2023**), places of mass Pink Salmon spawning were identified, and we counted 1 to 5 spawning redds per 100 m² of spawning grounds (with an average value of 0.1 – 1.0 spawning redds per 100 m²), there were also post-spawn fish. The estimated number of spawners is up to 1,000 fish, of which up to 20 fish were in the Bolysheva tributary. At the mouth of the Filatova River we noted the entry of Chum Salmon (small schools of 5-10 individuals).



Figure 5.5 – Riverbed of the Filatova River

Ilyushina River

The watercourse is located in the central part of the Pacific coastline. The length of the main river channel is 9.3 km, the catchment area is 29.5 km². Spawning area is 21 thousand m² for Pink Salmon and 4 thousand m² for Chum Salmon (Kaev, Strukov, 1999) (Fig. 5.6.).

The river escapement with Pink Salmon spawners this year (November 23, 2023) is estimated at 2.5 thousand fish. The average density of Chum Salmon spawners on spawning grounds was 0.5 fish/m², and the total number of Chum Salmon entering the Ilyushina River in 2023 can be estimated at 2.0 thousand fish.



Figure 5.6 – Ilyushina River

Treugolny Stream (tributary of the Serebryanoye Lake)

Length – 3.5 km, catchment area – 8 km². Spawning area – 1,033 m² (Pink Salmon) and 510 m² – Chum Salmon. During the examination (**November 22, 2023**) the presence of Pink Salmon spawners was not noted; there were no signs of spawning. It was revealed that Chum Salmon entered the limnocrone to spawn, which is approximately 500 m from the confluence of the Treugolny Stream and the Serebryanoye Lake (Fig. 5.7.). The total number of registered Chum Salmon spawners is about 100 fish.



Figure 5.7 – Limnocrene on the Treugolny Stream

Pionerskaya River (tributary of Lake Serebryanoye)

Length – 5.4 km, catchment area – 10.7 km². Spawning area is 853 m² (Pink Salmon) and 190 m² – Chum Salmon. The quality of spawning grounds is poor, the bottom sediments are silted and sandy (Fig. 5.8).

During examination (**November 22, 2023**) the presence of Pink Salmon and Chum Salmon spawners was not noted, there were no signs of spawning.



Figure 5.8 – Pionerskaya River

Serebryanka River (tributary of the Serebryanoye Lake)

The total length of the watercourse is 5.7 km, the catchment area is 47.8 km². The river is a tributary of the Serebryanoye Lake. The spawning area is 700 m² for Pink Salmon and 100 m² – for Chum Salmon.

Spawning grounds are of medium and low quality; in some areas there is high siltation. The bottom sediments consist mainly of medium and small pebbles. Spawning is possible only in certain sections of the riverbed with pebbly surface (Fig. 5.9). On the day of the examination (November 22, 2023), traces of anthropogenic impact were noted: in the riverbed there were fragments of metal structures, fuel and oil drums, and other items of unknown purpose. Single signs of Pink Salmon spawning were noted. There were no spawners of Chum Salmon.



Figure 5.9 – Serebryanka River

Luchevoi Stream (tributary of the Serebryanka River)

Length – 7 km, catchment area – 7.5 km². Spawning area – 4,294 m² (Pink Salmon) and 1,755 m² – Chum Salmon. The water in the channel has reddish-brown color, since the inspected section of the channel flows mainly through wetlands (Fig. 5.10). During examination (**November 22, 2023**) signs of spawning were noted in the middle part of the channel. About 50 spawning redds of Pink Salmon were recorded. The estimated number of spawners is at least 100 fish. There was no spawning of Chum Salmon in this watercourse.



Figure 5.10 – Luchevoi Stream

Serebryanoye Lake

Lake area – 0.8 km², catchment area – 24.4 km². Spawning area is estimated at 10,000 m². The lake is shallow, no more than 2.5 m deep, and densely overgrown with aquatic vegetation in some places. During examination (**November 22, 2023**) post-spawn Chum Salmon were recorded on the shores (Fig. 5.11). There was no mass spawning on these spawning grounds.



Figure 5.11 – Post-spawned Chum Salmon on the shore of Serebryanoye Lake

Tyurina Stream

The total length is 7 km. There is no data on the size of the spawning area. In the examined area, the stream has a width of 3.8-5.5 m. The banks are covered with tall grass. The water is very clear. There is a waterfall impassable for salmon approximately 200 meters from the estuary (Fig. 5.12). Spawning is possible only in certain sections of the riverbed with pebbly surface. The total spawning area is small and does not exceed 50 m².

Traces of anthropogenic impact were noted: in the riverbed and nearby there were fragments of metal structures, fuel and oil drums. Despite the small size of the watercourse, during the examination (**October 11, 2023**) up to 50 fish of Pink Salmon and 150 fish of Chum Salmon were counted. Both Pink and Chum Salmon were actively spawning.



Figure 5.12 – Tyurina Stream

Peschanoye Lake

It has a complex shape, stretches from northwest to southeast, and the coastline is highly winding. The lake depression largely forms the appearance of the Sernovodskiy Isthmus and the southern part of Kunashir Island. The lake is 4.35 km long, 2.4 km wide, and has an area of 7.4 km². The lake is flowing and has lagoon origin; maximum depth is 21.5 m. Catchment area is 35 km². (Fig. 5.13). The area of Chum Salmon spawning grounds is 30.0 thousand m². Spawning grounds are concentrated in the coastal zone with a width of 5 to 20 m (on average 10 m), at depths of 0.2 - 0.9 m. The bottom sediments predominantly consist of large pebbles with sand, there are thickets of aquatic rigid vegetation.

During the examination, mass spawning of Chum Salmon was noted in the apex of the lake (**November 21, 2023**). The total number of spawners was estimated at 500 fish.



Figure 5.13 – Peschanoye Lake

Sernovodka River (channel from Peschanoye Lake)

It flows out of the Peschanoye Lake and connects with the South Kuril Strait. The length of the Sernovodka River is 3 km, the catchment area is 6.5 km², and the spawning area is 1,320 m². The riverbed is composed of large pebbles and rocks, peaty and covered with aquatic vegetation in some places. The water is dark, because river banks are mostly swampy.

During the examination (October 11, 2023), the spawning run of Pacific salmon was not registered.



Figure 5.14 – Riverbed of the Sernovodka River

Andreevka River (southeast coast)

A typical mountain river with a length of 8 km and a spawning area of 450 m². It flows from the southern spurs of the Vorobyova Mountain, 20.5 km south of the Sernovodka River, and finally flows into the South Kuril Strait. The water is dark in color, the riverbed is composed of large pebbles. In a kilometer from the mouth there is Andreevsky waterfall, impassable for salmon. According to available information, it is a spawning river for Pink Salmon. During the examination (October 11, 2023), Chum Salmon entered in schools of 5-10 fish; there were no signs of Pink Salmon spawning.



Figure 5.15 – Riverbed of the Andreevka River

The list of water bodies examined during the field work, and the size of the examined spawning grounds are given in Table 5.1.

Table 5.1 – List of examined spawning water bodies on Kunashir Island. Total and examined spawning area, 2023

Water body	Date of examination	Number of counted fish		River length, km	Basin area, km ²	Spawning area, m ²	
		Pink Salmon	Chum Salmon			total	examined
Pervukhina River	October 05, 2023	0	0	2.2	6.5	992	992

Water body	Date of examination	Number of counted fish		River length, km	Basin area, km ²	Spawning area, m ²	
		Pink Salmon	Chum Salmon			total	examined
Asin Stream	October 06, 2023	single	-	6	8	5,000	5,000
Serebryanka River	November 22, 2023	10	-	5.7	n/d	800	300
Luchevoi Stream	November 22, 2023	100	-	7	7.5	4,294	2,000
Pionerskaya River	November 22, 2023	0	-	5.4	10.7	853	853
Treugolny Stream	November 22, 2023	0	100	3.5	8	1,033	1,033
Ilyushina River	November 23, 2023	2,500	2,000	9.3	29.5	25,000	10,000
Filatova River	October 06, 2023	1,000	-	11	27.5	8,500	4,000
Bolysheva tributary	October 06, 2023	20	-	6	no data	2,020	2,020
Tyurina Stream	October 11, 2023	50	150	no data	no data	no data	50
Lagunnoye Lake	October 05, 2023	-	600	-	20.4	25,000	25,000
Peschanoye Lake	November 21, 2023	-	500	-	35	30,000	30,000
Serebryanoye Lake	November 22, 2023	-	-	-	24.4	10,000	10000
Sernovodka River	October 11, 2023	-	-	3	6.5	1,320	1320
Andreevka River	October 11, 2023	-	single	8	-	450	450
Total						115,262	93,018
Total							

CONCLUSION

In the modern period, significant changes have occurred in the reproduction of Kunashir Pink and Chum Salmon.

The highest catches for both lines of Pink Salmon (even- and odd-years generations) occurred at the end of the 20th – beginning of the 21st centuries. After 2007, there was a decline in numbers for both even and odd generations of Pink Salmon. Due to the low return of this species, fishing restrictions are introduced almost every year. In 2023, passing days from August 23 to September 10 were applied by the regional Anadromous Fish Commission (AFC) because of the extremely low return of Pink Salmon. The total catch of Pink Salmon was 81 kg, which was extremely low compared to the small catches of previous years.

In general, there is a decrease in the density of even and odd generations of Pink Salmon together with the number of Chum Salmon that are reproduced in Kunashir rivers. In addition, escapement to spawning grounds is decreasing or staying at a low level. The average Pink Salmon spawner density was 0.04 fish/m², and 0.05 fish/m² for Chum Salmon.

The highest Chum Salmon catches were noted in 2002. In 2021-2022 there was a noticeable drop in the intensity of fishing and catches, and this situation continued in 2023. The total catch of Chum Salmon in sea waters in 2023 was 147 tons (Kunashir Island coast) .

In 2023, the absence of 5+ age groups of Chum Salmon was noted in the samples, and the trend towards a decrease in average body weight continued.

A slight increase in the number of Chum Salmon spawners (lake form) was noted; in particular, mass spawning of Chum Salmon was recorded in the Peschanoye Lake (southern part of Kunashir Island), where previously Chum Salmon were very rare.

During the monitoring of 2023 (apart from 2022), there were no factors impeding the passage of Pink Salmon and Chum Salmon to their spawning grounds: there were no congestions or blockages of riverbeds, no erosion of river mouths and channels. Also, there was no recent evidence of poaching in the examined water bodies.

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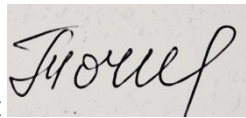
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REPORT

to the Contract Agreement dated April 20, 2023.

on the topic: **"Collection and analysis of biological and statistical information
for the reproduction of Pink and Chum Salmon on Kunashir Island"**

Responsible executor:



T.G. Tochilina

Moscow 2023

Contents

	Page
Introduction	3
Chapter 1. Purpose and initial data	3
Chapter 2. Materials and methods	4
Chapter 3. Research results	5
3.1. Inspection of water bodies	5
3.2. Inspection of fish hatcheries	7
Lagunnoye Lake Salmon Hatchery	8
Rikorda River Salmon Hatchery	10
Golovnina River Salmon Hatchery	11
Khlebnikova River Salmon Hatchery	12
Sennaya River	13
Chapter 4. Kunashir Pink and Chum Salmon stock status	14
4.1. Pink Salmon	14
4.2. Chum Salmon	15
Chapter 5. Pacific salmon fishing on Kunashir Island	20
5.1. Pink Salmon	21
5.2. Chum Salmon	23
Chapter 6. Fishing pressure and fishing efforts when catching Chum Salmon using trap nets	27
Conclusions	28
References	29

Introduction

The natural range of Pacific salmon occupies large areas in the North Pacific Ocean. They have colonized all habitats, including river basins, lakes, seas and the open ocean, and throughout their range, salmon play an important role in the ecology and economy of coastal regions. Unfortunately, due to various natural and anthropogenic factors, the majority of wild Pacific salmon populations are declining. In areas with high anthropogenic impact, artificial reproduction becomes a necessary element for preserving and increasing salmon numbers. However, it is extremely important that fish hatcheries are not used as an alternative to natural spawning grounds, but are developed taking into account the interests of wild salmon and the importance of preserving all their natural biodiversity.

For the Kuril Islands, the problems of preserving the natural reproduction and interaction of wild and hatchery salmon are currently becoming particularly acute and relevant, since the natural possibilities for a stable (and not episodic) increase in the population of valuable fish species in this region are very small. This is due to the limited spawning areas on the Kuril Islands and the migratory lifestyle of salmon fish species.

Further intensification of fishing solely through natural reproduction will inevitably lead to the depletion of valuable fish species. In the current situation, there is an obvious need to build a network of facilities for the salmon species reproduction (primarily for Pink and Chum Salmon) (V.V. Zinichev, V.N. Leman et al. 2012).

Artificial reproduction of Pacific salmon is an integral part of the development of fisheries complexes in the Northern Pacific countries, where their commercial stocks are formed. According to the international North Pacific Anadromous Fish Commission (NPAFC, www.npafc.org), the annual release of juveniles from salmon hatcheries in all countries (USA, Canada, Russia, Japan, Republic of Korea) reaches about 5 billion specimens. The total contribution of the Asia-Pacific region to the specified hatchery-produced salmon is about 60% (~ up to 3 billion specimens). Moreover, two countries (Japan and Russia) cover almost 100% of this hatchery production: the former releases approximately up to 2 billion juveniles and the latter — approximately up to 1 billion. In 2022, 99 salmon hatcheries operate within the Russian Far East: 71 in the Sakhalin Region, 15 in the Khabarovsk Territory, 4 in the Magadan Region, 5 in the Kamchatka Territory, 4 in the Primorsky Territory (A.V. Bugaev, A.I. Gerlits, 2023).

The number of salmon hatcheries in the Russian Far East is constantly increasing. In the near future, hatchery reproduction in Russia will grow, and it is extremely important that new and existing hatcheries are integrated into the existing system of natural reproduction with minimal losses for wild salmon. In this regard, ongoing scientific work on the state of wild and hatchery populations of Pink and Chum Salmon on Kunashir Island is extremely important, since the island has a significant role for the development of a fish hatcheries network. It is also important to determine the balance between economic efficiency and the ecological and biological capabilities of the area, as well as the rational consumption of water, land and biological resources.

1. Purpose and initial data

The main objective of the work is to collect and analyze biological and statistical information on wild and "hatched" populations of Pink and Chum Salmon to ensure sustainable exploitation of the commercial stock of Pacific salmon, to maintain the necessary level of their reproduction, and to preserve their habitat.

During the work, it was planned to collect information on the escapement of Pink and Chum Salmon into the water bodies on Kunashir Island, statistical data on the fishery, biological analyzes of Chum Salmon to determine the size and weight composition, fecundity, and collection of scale samples for age determination. The frequency of sampling depended on weather, fishing, organizational and other conditions.

It was planned to obtain the following data:

1) escapement to Kunashir spawning grounds with Pink Salmon spawners and Chum Salmon spawners;

2) the number of trap nets as well as Pink and Chum Salmon catches by types of fishing quotas on Kunashir Island over the past 15 - 20 years;

3) The age of Chum Salmon caught using coastal trap nets and at the egg collecting station of the Lagunnoye Lake Salmon Hatchery, as well as the age of Chum Salmon from the rivers and lakes on Kunashir Island.

2. Materials and methods

The work was carried out in accordance with the contract of the PCF Yuzhno-Kurilsky Ryibokombinat Co., Ltd. (hereinafter - YKRRK) on the topic: "Collection and analysis of biostatistical information on Pink and Chum Salmon fisheries on Kunashir Island"

Expeditions were carried out on Kunashir Island from September 29 to November 6, 2023. To collect statistical information, we used the data from the YKRRK trap nets and data from the South Kuril Department of the Federal State Budgetary Institution "Glavrybvod" (FSBI "Glavrybvod"). During the Chum Salmon analyzes biological data was collected from the different sites such as:

- trap nets at the YKRRK territory;
- egg collecting station on the Pervukhina River at the Lagunnoye Lake Salmon Hatchery;
- Ilyushina and Sernovodka Rivers within the territory of the South Kuril department of the Federal State Budgetary Institution "Glavrybvod";
- egg collecting station on the Rikorda River at the Rikorda River Salmon Hatchery.

We also visited other water bodies (Tyurina Stream, Serebryanoye Lake with a tributary) at the request of the YKRRK management to assess the prospects for construction of new salmon hatcheries.

According to generally accepted methods (Pravdin, 1966), the following parameters were measured (symbols used in further descriptions are given in parentheses): fork length (FL), standard length (SL), total weight (TW), eviscerated weight (EW), weight of gonads (GW). If possible, scales were taken in a strictly defined place in accordance with McLellan's methodological manual (McLellan...) – from the second to fourth row above the lateral line, between the dorsal and anal fins. All biological data collected during the work period were sent to the Sakhalin branch of the Federal State Budgetary Institution "VNIRO" (SakhNIRO), which is engaged in assessing the stock of Pacific salmon in the Sakhalin Region. After each bioassay the age was determined from scales using the stereoscopic microscope (binocular) MBS-10. In total, 706 scale samples were processed after bioassays and 100 scale samples were processed from the Pervukhina River (Lagunnoye Lake Salmon Hatchery) without bioassays (Table 1).

Table 1. – Number of Chum Salmon selected for bioassays in 2023.

Water body	Number of fish, fish		Number of scale samples, pcs.	
	♂	♀	♂	♀
Rikorda River	109	51	109	51
Pervukhina River	136	64	186	114
Ilyushina River	42	37	42	37
Sernovodka River	34	33	34	33
Pervukhina Bay	92	108	92	108
Total	413	293	463	343

In addition to our own data, the report uses fishery and other information obtained from YKRRK and the South Kuril Department of FSBI "Glavrybvod" (SakhRybVod).

The Contractor expresses gratitude to the management and employees of the YKRRK for funding, organization of accommodation, provision of transport, and timely provision of necessary information.

3. Research results

3.1. Inspection of water bodies

Tyurina Stream. Tyurina Stream was included in the list of water bodies where salmon hatcheries can be built after the research work (Extract from the minutes of the meeting of the Biological Section of the Scientific Council of FSBNU "VNIRO" No. 5 dated April 22, 2022).

Fishery characteristics of the Tyurina Stream are not available. According to preliminary data, the stream is 7 km long, and it flows into the South Kuril Strait. The stream has 2 waterfalls. The first is located 100 meters from the mouth, and can be surmounted by salmon. Spawning grounds are located on the areas before and after the first waterfall. The spawning area is about 100 m². The second waterfall is high. Pink and Chum Salmon enter the stream to spawn (Fig. 1)



A) Pre-mouth area with spawning grounds



B) Chum Salmon spawners in the area



B) Area with spawning grounds after the first waterfall
Figure 1. Tyurina Stream

Serebryanoye Lake with tributaries was included in the list of water bodies where salmon hatcheries can be built after the research work (Extract from the minutes of the meeting of the Biological Section of the Scientific Council of FSBNU "VNIRO" No. 5 dated Apr 22, 2022) (Fig. 2).



Figure 2. Serebryanoye Lake

The lake is located 2 km west of the Yuzhno-Kurilsk settlement. The area of its water surface is 0.82 km², catchment area – 24.4 km². The lake stretches from west to east, its shores are heavily indented. The length of the coastline is about 5 km. The lake is divided into two almost equal parts by the cape up to 20 m high, protruding far into the lake from the south. The length of the lake is 2 km, the width is 0.7 km. The average depth is about 1 m, the maximum is 1.7 m. According to the South Kuril Department of the FSBI “Glavrybvod”, Sakhalin taimen and Redfin spawn in the lake, and Chum Salmon spawning grounds are located along the southern shore near the cape.

Two streams flow into the lake – they are Treugolny and Pionersky, and the river Serebryanka flows out the lake.

Treugolny stream is 3.5 km long and flows into Serebryanoye Lake in its northeastern part. The total area of Pink and Chum Salmon spawning grounds in the stream is about 1,543 m², with 1,033 m² for Pink Salmon, and 510 m² for Chum Salmon. Basically, they are located downstream the main channel and in the left tributary. There is a limnocrene in the left tributary – it is a type of freshwater source, a small water body supplied by springs. Its area is about 380 m², the average depth is 65 cm, and the maximum depth is 80 cm (Fig. 3).



Figure 3. The limnocrene of the Treugolny stream. Potential spawning area for Chum Salmon

The channel connecting the limnocrene with the stream has the following parameters: its length does not exceed 10 m, the width does not exceed 1 m, and the depth does not exceed 30 cm.

In total, rivers and streams of the Serebryanoye Lake basin provide about 8,635 m² suitable areas for spawning. It is reasonable to use the watercourses of this basin as natural spawning grounds.

3.2. Inspection of fish hatcheries on Kunashir Island

The Southern Kuril Islands and, first of all, Iturup Island can be called as one of the most important areas for the Pacific salmon breeding not only in the Russian Far East, but throughout the northern Pacific. Currently, there are 22 salmon hatcheries: 19 of them are operating on Iturup Island, and other 3 are operating on Kunashir Island (Fig. 4).



Figure 4. Map of Kunashir Island, indicating the watercourses with possible location of the future salmon hatcheries. Red circles indicate the location of existing fish hatcheries

In 2023 the volume of release of grown juvenile salmon originating from the islands of Iturup and Kunashir amounted to 547.863 million fish, with 395.323 million of juvenile Chum Salmon and 152.54 million of juvenile Pink Salmon. Only 7.7% of this volume refers to Kunashir Island. At the same time, only Chum Salmon are released in Kunashir, which is 10.7% of the total release of this species from both islands. To compare the production of juveniles on these two neighboring islands, the data on juvenile release is summarized in Table 2 .

Table 2. Release of juvenile Pacific salmon from Iturup and Kunashir islands in 2023, million fish

Species	Iturup	Kunashir	Total
Pink Salmon	152.54	0.0	152.54
Chum Salmon	353.103	42.22	395.323
TOTAL	505.643	42.22	547.863

Table 3 represents the release of juveniles by salmon hatcheries into key rivers and other water bodies on Kunashir Island from 2018 to 2023.

Table 3. Release of juvenile Chum Salmon by the salmon hatcheries on Kunashir Island from 2018 to 2023, million fish

Name of the hatchery or water body	Release of juvenile Chum Salmon by year, million fish					
	2018	2019	2020	2021	2022	2023
Lagunnoye Lake Salmon Hatchery	1.5	3.4	10.4	18.5	12.5	19.8
Rikorda River Salmon Hatchery	0.0	0.0	14.2	14.6	14.1	17.9
Golovnina River	0.0	0.0	0.0	0.0	2.4	0.5
Khlebnikova River	0.0	0.0	0.0	0.0	0.0	1.0
Sennaya River	0.0	0.0	0.0	0.0	0.0	1.0
Tropinka River	0.0	0.0	0.0	0.0	0.5	2.0
TOTAL:	1.5	3.4	24.6	32.1	29.5	42.2

Lagunnoye Lake Salmon Hatchery

Lagunnoye Lake Salmon Hatchery is a complex of facilities intended for the reproduction of juvenile Pacific salmon and it is owned by the YKRK company. The hatchery area has (Figures 5 – 12):

- several sources of water supply (river and groundwater gravity conduits, and water pumping system with Lagunnoye Lake supply),
- three workshops (an incubator and two hangar-type nurseries), equipped with plastic incubators and pools (Japanese-made);
- a nursery of riverbed type with spring water supply,
- fish ladder and fishway for spawners;
- an egg collection point organized in one of the nurseries;
- round net cages for raising juveniles in the lake;
- other facilities providing the household needs.

In 2023, 29.1 million Chum Salmon eggs were incubated at the Lagunnoye Lake Salmon Hatchery. It is noteworthy that all eggs were collected from 2+ and 3+ years old spawners at our own salmon hatchery, that means that it was our own broodstock formed by juvenile releases in 2020 — 2021.



Figure 5. Workshops and fish ladder



Figure 6. A workshop with Japanese-made "Box" type incubation machines



Figure 7. Chum Salmon in the fishway before going to the egg collection point



Figure 8. Egg collection point



Figure 9. Chum Salmon spawners in front of the barrier weir and fish ladder into the fishway



Figure 10. Gravel-type (Japanese type) nursery



Figure 11. Round net cages in the Lagunnoye Lake, used for raising juveniles



Figure 12. Conducting bioassay of Chum Salmon inside the workshop of the Lagunnoye Lake Salmon Hatchery

There are three salmon hatcheries in the South of Kunashir Island: Rikorda River Salmon Hatchery, Golovnina River Salmon Hatchery and Khlebnikova River Salmon Hatchery. Noteworthy that juvenile Chum Salmon are transported from the Rikorda River Salmon Hatchery to the Sennaya River (Fig. 13).

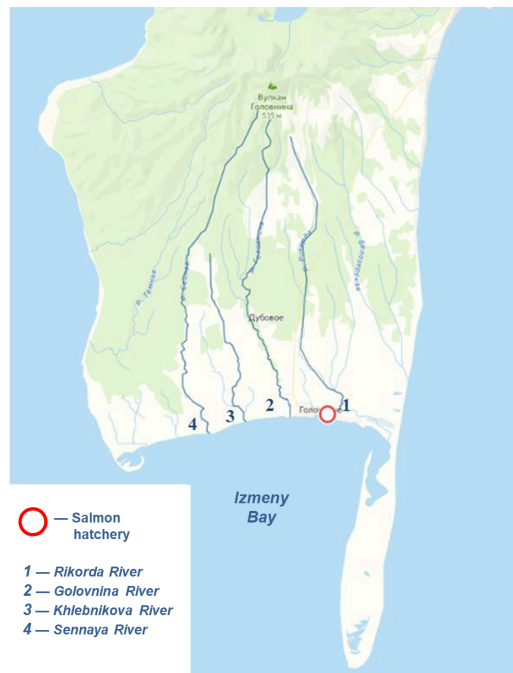


Figure 13. Location of the Rikorda River Salmon Hatchery, Golovnina River Salmon Hatchery, Khlebnikova River and Sennaya River

Rikorda River Salmon Hatchery

This hatchery was built almost simultaneously with the Lagunnoye Lake Salmon Hatchery. It has two workshops (Fig. 14 – 17):

- a nursery workshop with gravel-type equipment, in which eggs are incubated and pre-larval fish mature;

- a workshop for sorting and keeping spawners, which is also used for rearing juveniles.

The rearing workshop is connected to Rikorda River by a fish ladder, where Chum Salmon spawners go upstream in the fall, and the juveniles naturally migrate out of the hatchery and go downstream in the spring.

The release of juveniles from this hatchery began in 2020. In the fall of 2023, 16.5 million Chum Salmon eggs were planted for incubation at the Rikorda Salmon Hatchery. These eggs originated from its own broodstock, formed by juvenile releases in 2020–2021.



Figure 14. Rikorda River Salmon Hatchery, Izmeny Bay side

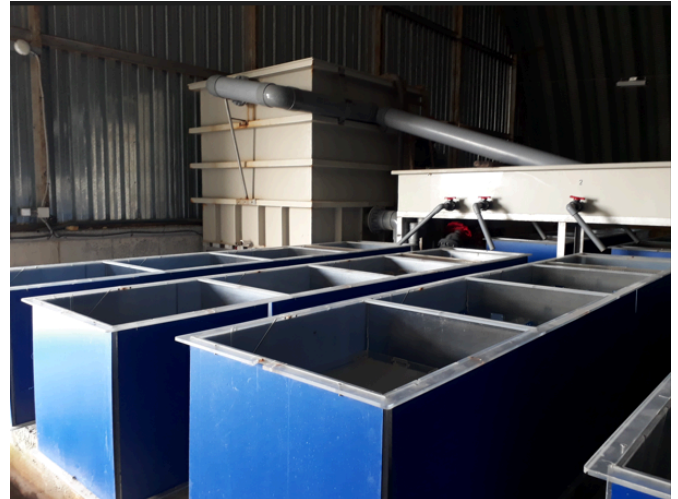


Figure 15. A nursery workshop with gravel-type equipment



Figure 16. The second workshop where staff sorts and keeps the broodstock in the fall, and raises juveniles in the spring



Figure 17. Fish ladder

Golovnina River Salmon Hatchery

The Golovnina River Salmon Hatchery was commissioned in the fall of 2022. It has one workshop with concrete fishways (Far Eastern type), which are traditional for salmon hatcheries in the

Sakhalin Region (Fig. 18 – 20). In the spring of 2022, a small amount of juvenile Chum Salmon was transported from the Rikorda River Salmon Hatchery and released directly into the Golovnina River. In 2023, 0.52 million of juvenile Chum Salmon were released into the Golovnina River from the hatchery workshop.



Figure 18. Golovnina River and the fish hatchery



Figure 19. Exterior view of the hatchery workshop



Figure 20. Interior view of the Golovnina River Salmon Hatchery workshop

Khlebnikova River Salmon Hatchery

The Khlebnikova River is located at the southern tip of Kunashir Island and flows into Izmeny Bay. Its length is 4.5 km, and catchment area is 3.9 km² (Fig. 21).

There is a limnocrene with an area of 360 m² in the midstream, approximately 3.5 km from the mouth of the river. It is connected to the river by a small channel. A spring flows into the limnocrene from the slope side. Chum Salmon spawners were swimming in the limnocrene at the time of the examination on October 25, 2023. The water temperature was 8.5°C in the limnocrene, and 9.0°C in the spring (Fig. 22).

The fish breeders from the Rikorda River Salmon Hatchery have placed a 20-ft. container with gravel type breeding apparatus on the shore of the limnocrene. In January 2023, Chum Salmon eggs were transferred from the Rikorda River Salmon Hatchery to these apparatus for incubation. In the spring of 2023, 1.0 million juvenile Chum Salmon were released there (Fig. 23).

Gravel-type apparatus (Fig. 24) ensure that Chum Salmon eggs, pre-larval fish, and larval Chum are kept in conditions that are similar to a natural spawning redd;

- the hatchery has no windows and is tightly enclosed, creating a complete blackout that simulates the presence of eggs and larval fish in a natural spawning redd;

- water supply to the apparatus is provided by pumping water from the stream flowing into the limnocrene;

- pre-larval fish are kept in an artificial plastic substrate that imitates gravel, allowing the larvae to spread according to their biological needs;

- juvenile rearing takes place in the same apparatus and is short-term (no more than 3 to 4 weeks);

- release of juveniles is carried out at night; smolts migrate out through the gutter into the limnocrene, with further independent outmigration into the Khebnikova River and into the coastal area.



Figure 21. Mouth of the Khebnikova River



Figure 22. Chum Salmon spawners in the limnocrene of the Khebnikova River

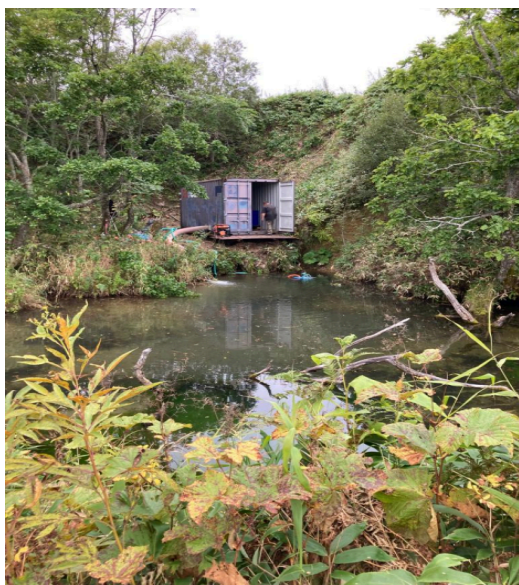


Figure 23. The limnocrene and fish hatchery on the limnocrene of the Khebnikova River



Figure 24. Gravel-type breeding apparatus in the hatchery

Sennaya River

The Sennaya River is located at the southern tip of Kunashir Island. It originates from the foot of Golovnina volcano and flows into Izmeny Bay.

The river flows through the valley with a clear direction from north to south in a single channel 14 km long with no tributaries. The river is 1.5 m wide downstream, but in some places the river goes under the shores for a distance of 0.5-0.8 meters. The river meanders strongly and can change direction sharply by 180°C. The average flow velocity in the river is 0.5-0.8 m/s, water discharge at the mouth is 0.15 m³/s.

At a distance of 3 km from the mouth, in the midstream (Fig. 25), there is the majority of spawning grounds for Chum and Pink Salmon. Flow velocity increases to 0.6-0.8 m/s. The quality of spawning habitat is improving, with fine gravels predominating. The area of Pink Salmon spawning grounds is 2,030 m² and Chum Salmon spawning grounds – 150 m². On the day of the examination (November 05, 2023) the temperature in the midstream of the river was 9.9°C

In the spring of 2023, 1.0 million juvenile Chum Salmon were transported from the Rikorda River Salmon Hatchery and released here.



Fig. 25. Midstream of the Sennaya River, where juvenile Chum Salmon were released in 2023

Reproduction of Chum salmon at the surveyed salmon hatcheries meets the ecological requirements for breeding this species. The production process at four hatcheries (on the Lagunnoye Lake, Rikorda River, Golovnina River and Khlebnikova River) takes into account biological cycles, because incubation of eggs, pre-larval fish rearing, stimulation of the fry's "swim up", feeding and release of juveniles take place within the same time frame as in the natural environment, in accordance with the typical temperature regime for the freshwater period of Chum Salmon development. The hatchery equipment simulates those spawning redd conditions that Pacific salmon use in natural water bodies and streams.

4. Kunashir Pink and Chum Salmon stock status

4.1. Pink Salmon

Pink Salmon runs to Kunashir Island in 2023 were extremely small. According to in-season monitoring studies, by mid-August the river escapement was almost zero. Taking this into account, the Anadromous Fish Commission on August 22 decided to introduce a passing period from August 22 to September 10. However, the situation has not improved; the escapement of the rivers of Kunashir Island with Pink Salmon spawners remained at an extremely low level (Table 4).

Table 4. Pink Salmon Escapement in the examined rivers of the Sakhalin-Kuril basin on September 04, 2023 (according to the standard of 2 fish/m²). Data provided by the Sakhalin branch of the FSBI “VNIRO” (SakhNIRO)

Water body	Spawning area, m ²	Number of spawners, number of fish	River escapement, %
Prozrachny Stream	8,160	28	0.2
Golovnina River	840	0	0.0
Belozerskaya River	1,440	0	0.0
Vodopadny Stream	620	8	0.6
Vtoroi Dachny Stream	170	0	0.0
Asin Stream	2,750	0	0.0
Ilyushina River	21,000	680	1.6
TOTAL:	34,980	716	1.02

There was no Pink Salmon fishing on Kunashir Island in 2023.

Fishing for scientific purposes and biological analyses was not conducted in 2023 due to the extremely low abundance of Pink Salmon.

It should be noted that the Pink Salmon fishing on Iturup Island was also extremely low. Total allowable catch was 10,927 tons for the South Kuril fishing zone, but only 1,889.9 tons were caught on Iturup Island, which was 17.3% of the forecast.

4.2. Chum Salmon

In the rivers of Kunashir Island, Chum Salmon is the second most abundant among *Oncorhynchus* salmon after Pink Salmon and is represented by two ecotypes: lake and river (small river ecotype). Chum Salmon populations in rivers and lake-river systems in the area are small. Chum Salmon are distributed almost everywhere. According to Kaev (2007), such distribution is probably facilitated by deep circulation and intensive groundwater outflow into the bed of rivers and lakes.

Chum Salmon also enter very small streams, and in some of them spawning grounds are located in the tidal zone (Kaev and Strukov 1999).

Fall Chum Salmon spawn in the Southern Kuril Islands, which, combined with the fact that Kunashir Island is located in the south of the spawning part of its range, determines the relatively late timing of its spawning migration. Individual Chum Salmon spawners appear in the rivers in September, but the main fish run occurs in the second half of October and early November. By mid-November, the intensity of fish entering the rivers decreases sharply. However, in some rivers at the southern tip of the island, flowing into Izmeny Bay, the main Chum Salmon run occurs in November and continues until January according to a survey of local residents. It is noteworthy that changes in the timing of the Pacific salmon run are also noted in other regions of the Russian Far East. In Bulletin No. 17, Barabanshchikov describes changes in the dynamics of the spawning run of Chum, Masu and Pink Salmon to the rivers in the northern part of Primorsky Territory from 1998 to 2022. The author also notes that the spawning runs of Chum, Masu and Pink Salmon have become longer (Barabanshchikov, 2023).

Most Chum Salmon enter rivers with developed spawning changes and gonads with IV, IV-V and even V maturity stages, which is due to the location of spawning grounds in the lower and middle reaches of the island's short rivers.

The area of Chum Salmon spawning grounds in rivers is 51 thousand m²; in lakes - 70 thousand m².

The total spawning area of Chum Salmon on Kunashir Island is 121 thousand m².

In 2023, spawner escapement in the water bodies of Kunashir Island remained weak (Table 5).

Table 5. Kunashir Chum Salmon Spawner Escapement in 2023 (according to the South Kuril department of the FSBI "Glavrybvod", and calculated according to the standard of 1.6 fish/m²)

Water body	Date of examination	Water temp. in the river, °C	Escapement, %	Spawning area, m ²	Number of spawners, number of fish	Note
Ilyushina River	October 31	10.0	10.4	4,000	648 - live 16 - dormant	mass spawning
Khlebnikova River	October 25	13.0	5.2	300	25	Mass spawning
Sennaya River	November 05	10.9	0	150	-	-
Golovnina River	October 19	10.6	2.5	755	30	spawning
Rikorda River	November 8	9.4	57.5	1,020	620 - live 318 - dormant	mass spawning
Peschanoye Lake	October 09	14.9	12.5	30,000	6,000	mass spawning
Lagunnoye Lake	November 17	7.0	9.75	25,000	3,500	mass spawning
Luchevoi Stream	September 29	14	1.75	1,755	50	Runs beginning
Filatova Stream	September 22	13.1	7.1	700	80	Runs beginning
TOTAL:			11.1	63,680	11,287	

To assess the biological condition of Chum Salmon spawners, we took:

- 2 samples from coastal trap nets,
- 2 samples from the Pervukhina River (Lagunnoye Lake Salmon Hatchery),
- 2 samples from the Rikorda River (Hatchery on the Rikorda River),
- 3 samples from the Ilyushina River
- 1 sample from the Sernovodka River (Table 6).

To carry out bioassays on the trap nets samples, the YKRRK company provided a workplace in the fish processing workshop.

Table 6. Main biological parameters of Kunashir Chum Salmon in 2023

Date	Water body	FL, cm		SL, cm		Weight, g		Gonado-somatic index		Absolute Fecundity	Number of fish	
		♂	♀	♂	♀	♂	♀	♂	♀	♀	♂	♀
Oct 12	Pervukhina Bay	63.0	62.9	58.0	59.1	2,760	2,702	4.5	18.8	2,303	46	54
Oct 30	Pervukhina Bay	59.1	59.2	55.5	55.5	2,246	2,319	5.3	23.6	2,260	46	54
Average values		61.1	61	56.8	57.3	2,503	2,510	4.9	21	2,282	92	108
Oct 20	Pervukhina River	65.4	64.7	61.6	60.6	2,694	2,772	3.1	24.0	2,004	76	24

Nov 03	Pervukhina River	64.9	62.4	61.2	58.5	2,349	2,349	3.0	24.6	1,833	61	39
<i>Average values</i>		65.2	64	61.4	59.5	2,522	2,561	3.1	24	1,919	137	63
Oct 05	Rikorda River	63.5	64.3	59.7	60.4	2,514	2,732	0	0	2,169	45	33
Oct 18	Rikorda River	63.0	61.8	59.1	57.9	2,461	2,445	3.0	19.6	1,911	33	17
Nov 05	Rikorda River	59.9	55.0	56.1	51.0	2,131	2,125	0	18	1,239	49	1
<i>Average values</i>		62.1	60	58.3	56.4	2,369	2,434	3	19	1,773	127	51
Sept 26	Ilyushina River	64.9	60.8	61	56.8	2,947	2,474	3.6	23	2,409	13	11
Oct 13	Ilyushina River	63.8	60.7	59.8	56.4	2,584	2,333	4.1	23.7	1,992	6	7
Oct 31	Ilyushina River	62.6	62.2	58.8	58.2	2,684	2,533	3.8	25.4	2,335	23	19
<i>Average values</i>		63.8	61.2	59.8	57.1	2,738	2,447	3.8	24	2,245	42	19
Oct 09	Sernovodka River	67.0	61.5	62.8	57.5	3,404	2,457	4	14.1	1,566	34	33

Table 7 summarizes biological analyses from various water bodies of Kunashir Island by sex and age. Based on this information, we see a decrease in body weight both in water bodies and coastal areas, where hatchery Chum Salmon are fished (Lagunoye Lake Salmon Hatchery and Ricorda River Salmon Hatchery), and in water bodies with exclusively wild reproduction of this species (Ilyushina and Sernovodka Rivers). The average weight of Chum Salmon from all water bodies on Kunashir Island falls below 3,000 g and is 2,537.6 g (range from 1,080 to 5,695 g). This value is lower than 10 years ago: according to Kaev, the average weight of Kunashir Chum Salmon in 1993 – 2013 was 3,086 g (range from 2,486 to 3,573 g) averaged for both sexes. No Chum Salmon weighing less than 2.0 kg were caught in those years, but there were also no Chum Salmon weighing more than 4.0 kg. In 2023 bioassays, 3+ years old fish had higher weight than 4+ years old specimens, with the maximum weight noted for an 3+ years old male caught in the Sernovodka River. It could be concluded that the 2020 generation of juveniles was in favorable feeding conditions in both coastal and oceanic waters. However, in the same age group, individuals with an average weight less than 2.0 kg and even 1.2 – 1.4 kg were found!

Table 7. Average weight and standard length for different age groups of Chum Salmon caught on Kunashir Islands in 2023, both for males and females

Rikorda River, males						
Age	Average weight, g	Weight range, g	Average standard length, cm	Standard length range, cm	Number of fish	%
2+	1,852	1,080-3,590	54.2	44-67	50	46
3+	2,738	1,380-4,500	61.1	58-74	58	54
Rikorda River, females						
2+	2,134	1,580-2,910	55.1	50-61	12	24
3+	2,767	1,680-3,770	60.7	51-67	39	76
Pervukhina Bay, males						

2+	1,880	1,200-2,470	52.8	45-57	34	37
3+	2,859	1,240-4,810	60	48-69.5	54	59
4+	2,925	2,360-3,390	61.5	60-63	4	4
Pervukhina Bay, females						
2+	1,970	1,440-2,670	53	49-57	30	28
3+	2,677	1,660-4,080	58.6	50.5-66	70	65
4+	3,076	2,370-3,520	61.9	56.5-66	8	7
Lagunnoye Lake Salmon Hatchery, Pervukhina River, males						
2+	2,161	1,425-3,165	56.5	51-64	27	19.6
3+	2,760	1,540-4,630	62.5	53-72	110	79.7
4+	3,700	0	67	0	1	0.7
Lagunnoye Lake Salmon Hatchery, Pervukhina River, females						
2+	1,917	1,280-2,620	55.3	49-60.5	11	17.5
3+	2,625	1,420-3,870	60.1	50.5-68.5	51	81
4+	3,145	0	61	0	1	1.6
Ilyushina River, males						
2+	2,247	1,630-3,615	56.3	51.5-66	5	12
3+	2,666	1,955-3,610	59.3	53-65.5	30	71
4+	3,476	2,285-5,105	63.6	57-70	7	17
Ilyushina River, females						
2+	2,313	1,895-2,980	54.7	51.5-59.5	3	8
3+	2,451	1,635-3,795	57.5	51-64.5	27	73
4+	2,651	2,105-3,445	59.3	54-64	7	19
Sernovodka River, males						
2+	1,858	1,400-2,315	51.7	48.5-55	2	6
3+	3,470	1,545-5,695	63.3	52-74	28	82
4+	3,710	2,330-5,280	64.7	58.5-72.5	4	12

Sernovodka river, females						
2+	2,215	1,770-2,660	53.2	50-56.5	2	6
3+	2,472	1,550-3,675	57.8	51.5-64.5	31	94

It is noteworthy that on the neighboring Iturup Island a decrease in the average weight of Chum Salmon was also noted. Bull. No. 17 Study of Pacific Salmon in the Far East published an article by Elnikov and Zelennikov, in which the authors, analyzing data for 2022, noted that the average weight of 3+ years old females and males was 2.27 and 2.57 kg respectively, and these values were lower compared to the Chum Salmon spawners studied during the previous eight years (Elnikov and Zelennikov 2023).

Tables 8 and 9 summarize the age composition of Chum Salmon caught in the coastal trap nets deployed in Pervukhina Bay (west of Kunashir Island, Sea of Okhotsk coast), as well as in the Ilyushina, Sernovodka, and Pervukhina rivers (Pervukhina is the base river of the Lagunnoye Lake Salmon Hatchery) and in the Rikorda River (the base river of the Rikorda River Salmon Hatchery).

Table 8. Kunashir Chum Salmon Age Composition in 2023, %

Date	Water body	2+		3+		4+		Number of fish	
		♀	♂	♀	♂	♀	♂	♀	♂
Sept 26, 2023	Ilyushina River	18	8	55	62	27	31	11	13
Oct 13, 2023	Ilyushina River	0	17	86	83	14	0	7	6
Oct 31, 2023	Ilyushina River	5	13	79	74	16	13	19	23
Oct 05, 2023	Rikorda River (salmon hatchery)	0	51	100	49	0	0	1	49
Oct 09, 2023	Pervukhina River (salmon hatchery)	4	20	92	78	4	2	50	50
Oct 12, 2023	Pervukhina Bay	17	28	74	67	9	4	54	46
Oct 18, 2023	Rikorda River (salmon hatchery)	41	48	58	52	0	0	17	33
Oct 20, 2023	Pervukhina River (salmon hatchery)	17	20	79	80	4	0	24	76
Oct 30, 2023	Pervukhina Bay	39	46	56	50	6	4	54	46
Nov 03, 2023	Pervukhina River (salmon hatchery)	18	20	82	78,3	0	1,7	39	60
Nov 05, 2023	Rikorda River (salmon hatchery)	0	51	1	49	0	0	1	49
Oct 09, 2023	Sernovodka River	6	6	94	82	0	12	33	34

The age composition of Chum Salmon (Kaev, Romasenko, 2017) on Kunashir Island usually has four groups – from 2+ to 5+. However, in 2022, an individual of 5+ years old was found only doing bioassay from the Ilyushina River, and in 2023, 5+ years old individuals were not encountered at all! Four- and three-year-olds fish dominate in numbers.

Table 9. Chum Salmon Age Composition (in%) in 2022-2023

2022					
	2+	3+	4+	5+	Number of fish, %
Ilyushina River	15	73	10	2	100
Pervukhina River (salmon hatchery)	78	21.6	0.4	0	100
Pervukhina Bay	25.5	68	5.5	1	100
2023					
	2+	3+	4+	5+	Number of fish, %
Ilyushina River	10	72	18	0	100
Pervukhina River (salmon hatchery)	17	81.5	1.5	0	100
Pervukhina Bay	32	62	6	0	100

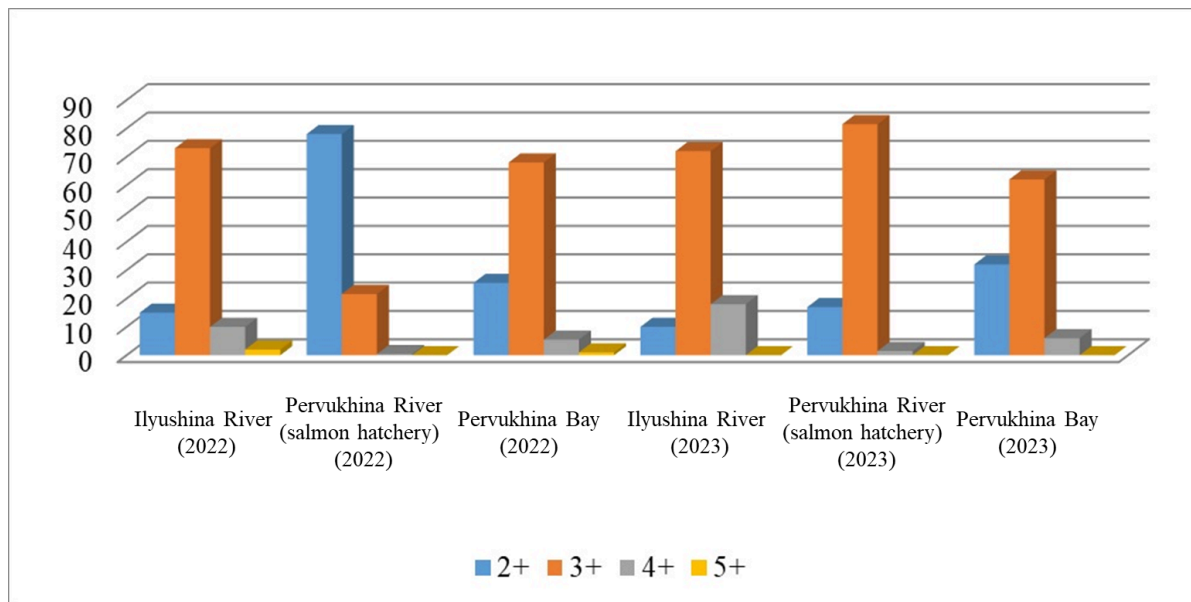


Figure 26. Change in the share of age groups (in %) in 2022-2023

Figure 26 shows that in 2020 there was a harvestable generation of Chum Salmon, because in 2022 and 2023 there was a high abundance of 2+ years old and 3+ years old individuals respectively. This is observed for both hatchery Chum Salmon (Lagunnoye Lake Salmon Hatchery) and wild Chum Salmon (Ilyushina River). It is likely that in 2020 the coastal waters of Kunashir Island had favorable

conditions for the feeding of juvenile Chum Salmon, both from the Sea of Okhotsk and the Pacific Ocean coastline. Obviously, the available data on the age composition of the Chum Salmon stock only for two years (2022 and 2023) do not yet allow any conclusions to be drawn. More detailed conclusions on generations survival will only be possible after longer observations.

5. Pacific salmon fishing on Kunashir Island

The salmon fishing of Kunashir Island differs from other areas of the Sakhalin Region in that, until 2021, the catch here was based only on wild populations. The map for 2006 demonstrates 36 fishing parcels registered on Kunashir Island (Fig. 27).

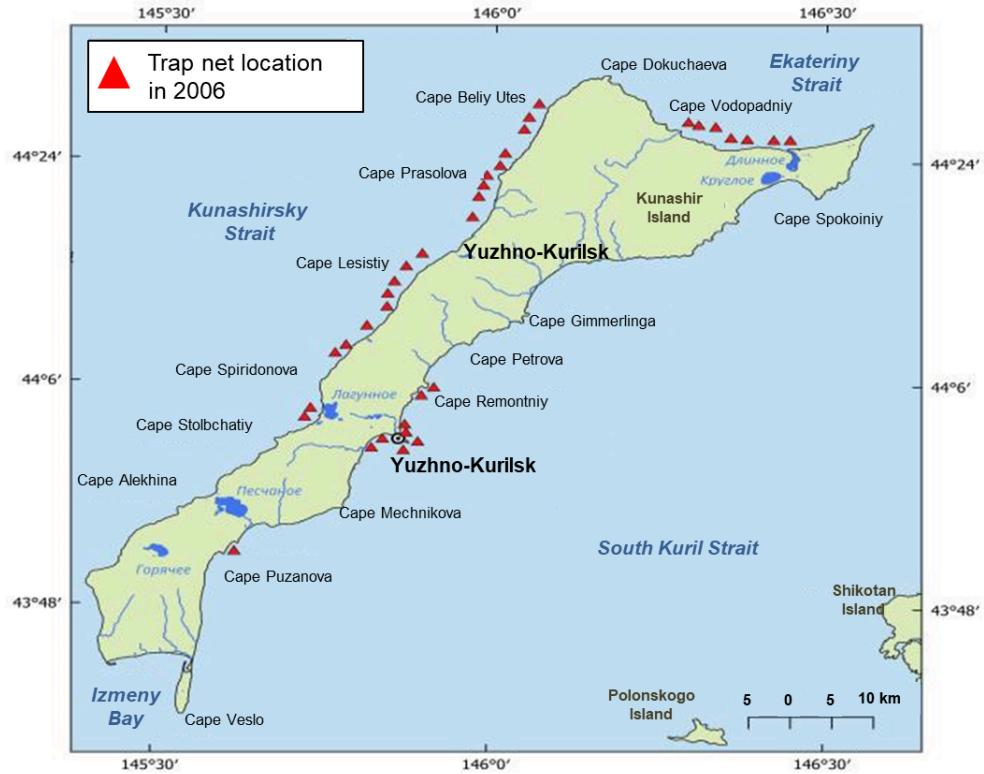


Figure 27. Fishing parcels location on Kunashir Island in 2006

According to data from the Ministry of Fisheries of the Sakhalin Region, in 2023, 21 fishing parcels belonging to 6 companies were registered on Kunashir Island (Fig. 28)

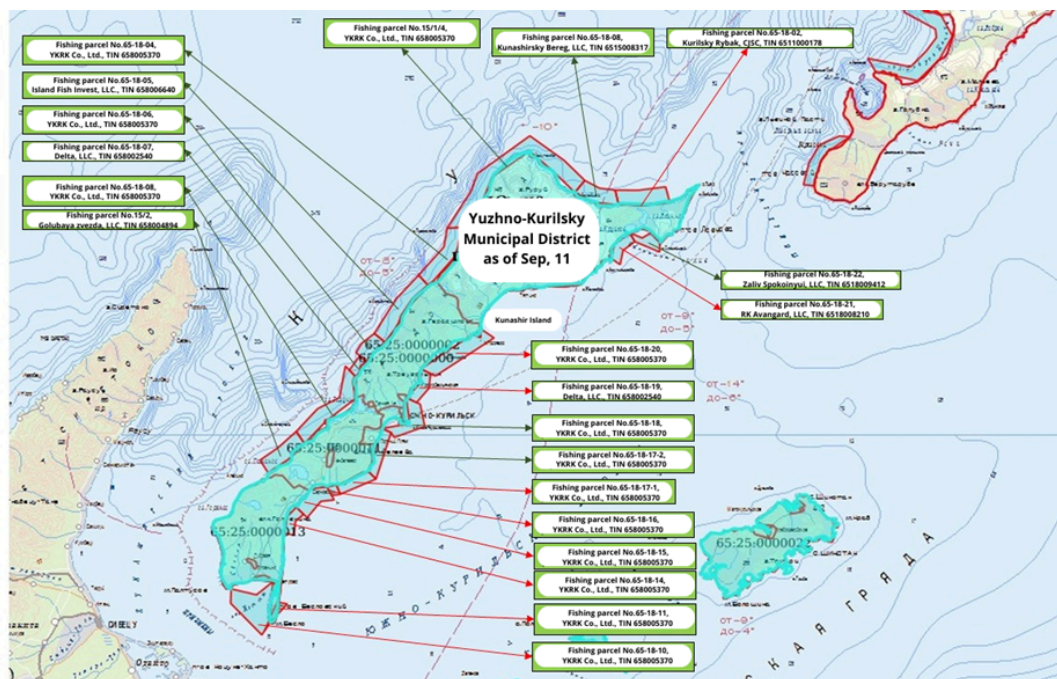


Figure 28. Fishing parcels location on Kunashir Island in 2023

In order to maintain a rational fishing for Pacific salmon, all branches of the VNIRO institute annually prepare Fishery Strategies, which include projected catch volumes, restrictive fishing measures for different areas, as well as recommendations on measures to ensure optimal spawning. SakhNIRO develops such a document for the Sakhalin Region. For the South Kuril fishing zone, which includes Kunashir Island, projected catch of Pacific salmon (Pink, Chum, Sockeye and Masu salmon) is 24,905 tons. Commercial fishing quotas for Pacific salmon were 1,200 tons for Pink Salmon and 3,650 tons for Chum Salmon. Quotas were allocated to four companies, of which YKRK has 1,000 tons of Pink Salmon and 3,000 tons of Chum Salmon.

Beginning and closing dates of commercial, traditional and recreational (amateur) fishing were:

- from August 01 to September 10 for Pink Salmon;
- from September 11 to November 30 for Chum Salmon.

Pink Salmon

The catch of Kunashir Pink Salmon with trap nets is currently extremely low. The period of the highest catches for both generative lines (even and odd years) occurred at the end of the 20th – beginning of the 21st centuries. In the line of odd years, the stock of Pink Salmon, having reached a maximum in 2007, sharply declined. At present, a decline is also noted for generations of even years.

However, there were no restrictions on fishing or recommendations to reduce the fishing pressure on Pink and Chum Salmon in Kunashir in the Fishery Strategy for 2023.

In-season data provided to SakhRybVod and SakhNIRO showed that until mid-August, the river escapement was extremely low, and only single Pink Salmon were recorded on spawning grounds. In mid-August, the management of YKRK company took the initiative to suspend Pink Salmon fishing on the island. The company specialists applied to SakhNIRO and the Association of Fishermen of Sakhalin Region (AFS) with a request to take measures to restrict fishing. They have thus initiated the process of approval and decision making. At the regular meeting on August 22, Anadromous Fish Commission (AFC) made a decision to introduce a period of passing spawners from 12 AM on August 23, 2023 to September 10, 2023 (Protocol No. 36). This decision actually imposed a ban on Pink Salmon fishing on Kunashir. However, the situation did not improve and there were no Pink Salmon in the catches in 2023.

Figure 29 presents data on Pink Salmon catch by all fishing companies on Kunashir Island for the period from 2001 to 2023, and Figure 30 presents data on the share of Pink Salmon caught by the YKRK. The share of the YKRK Pink Salmon fishery ranged from 50 to 100% in different years. In 2022, it was 96.3%.

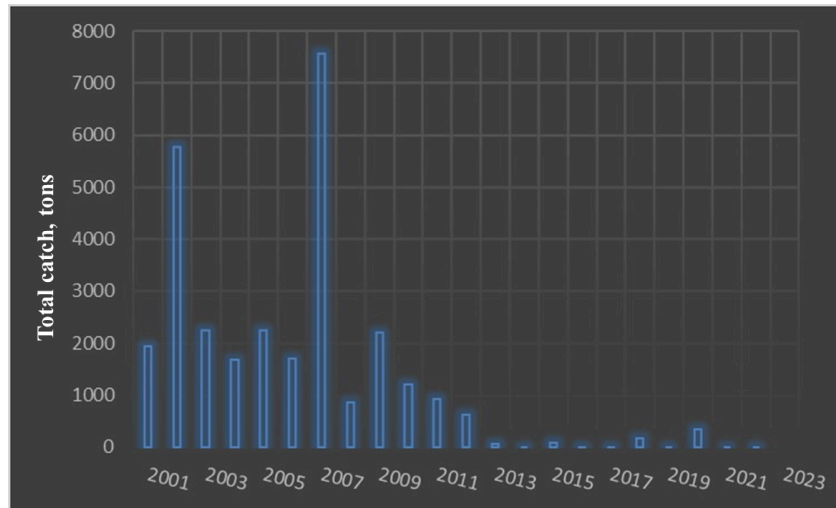


Figure 29. Dynamics of Pink Salmon catches by fishing companies on Kunashir Island from 2001 to 2023, tons

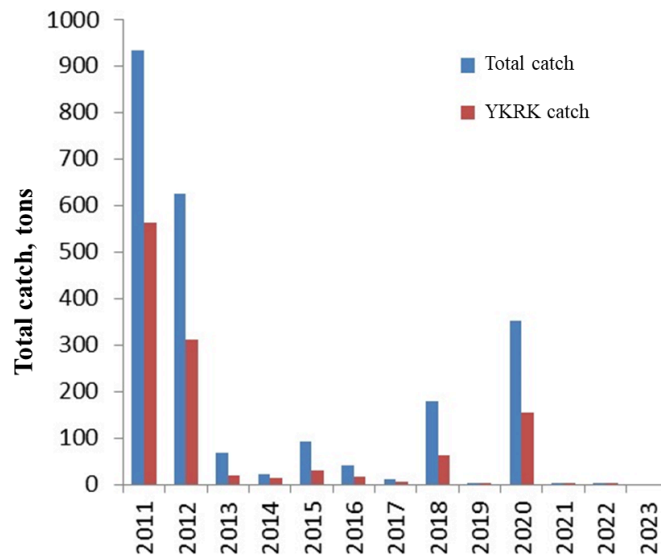


Figure 30. Pink Salmon caught by YKRK in the total volume of Pink Salmon caught on Kunashir Island from 2011 to 2023, tons

Chum Salmon

Chum Salmon in the coastal waters of Kunashir Island are currently caught by trap nets. The main part is caught in the second half of September - October. The distribution of catches along the coast is uneven. Most of the Chum Salmon are caught from the Sea of Okhotsk coast in the area of Pervukhina Bay. This is probably happening because the returning “hatchery” Chum Salmon appears in the catches.

In the southern part of the island (Izmeny Bay), the number of Chum Salmon is small; and coastal fishing in this part of the island is not yet carried out.

In 2023, the Anadromous Fish Commission (AFC) set a total catch quota of 3,650 tons for the Chum Salmon in the coastal area of Kunashir Island. YKRR's quota was 3,000 tons (Appendix No. 4 to Protocol No. 16 of the meeting of the Anadromous Fish Commission dated July 10, 2023). In fact, coastal total catch in 2023 was 206.091 tons, and 195.287 tons was caught by the YKRRK company.

In addition to fishing in the coastal area, two companies caught “hatchery” Chum Salmon at the egg collection points according to quotas for aquaculture and fish farming. In total, 164.188 tons were caught in this way, of which 109.399 tons were caught at the Lagunnoye Lake Salmon Hatchery.

Table 10. Chum Salmon catch on Kunashir Island in 2023, tons

Place of fishing	Fishing companies of Kunashir Island					TOTAL
	YKRRK / Lagunnoye Lake Salmon Hatchery	Muravyov Individual Entrepreneur / Rikorda River Salmon Hatchery	Island Fish LLC	Golubaya Zvezda LLC	Delta LLC	
Coastal trap nets	195.287	0	2.672	3.612	4.52	206.091
Salmon hatcheries (at the egg collection points)	109.399	54.789	0	0	0	164.188
TOTAL	304.682	54.789	2.672	3.612	4.52	370.275

The Chum Salmon runs were weak and intermittent. The situation was aggravated by abnormally high water temperatures in the coastal area. In the last days of October, the sea water temperature in the coastal area remained at 14-15°C. Fig. 31 shows data on water surface temperature, and we see that on October 30 (that is the end of the mass Chum Salmon running!) isotherms near Kunashir Island range from 12 to 16°C!

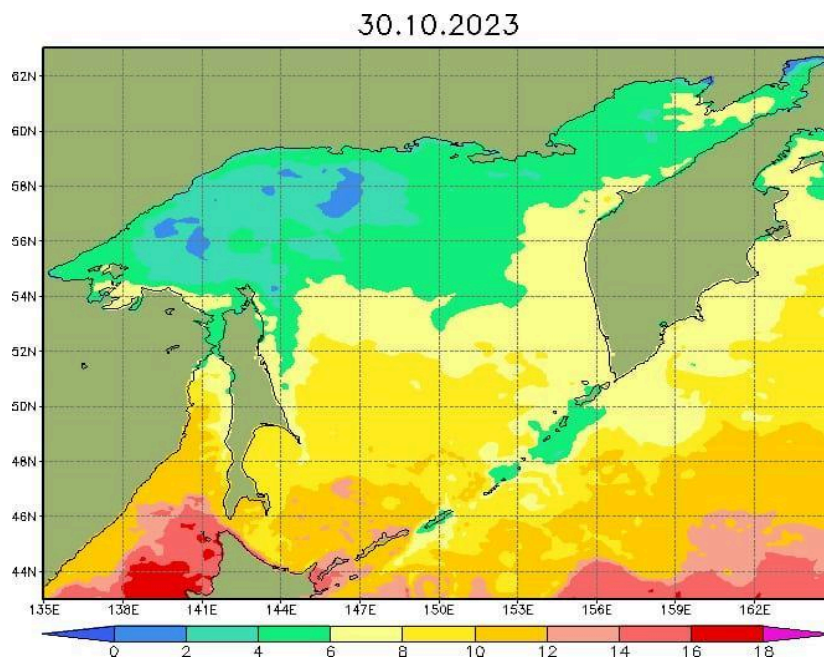


Figure 31. Water surface temperature in the coastal area of Kunashir Island at October 30, 2023 (according to the Unified State Information System for World Ocean conditions)

The decline in Chum Salmon catches is not as sharp as for Pink Salmon catches, but there is a clearly visible trend of annual decline in catches in the coastal area (Fig. 32).

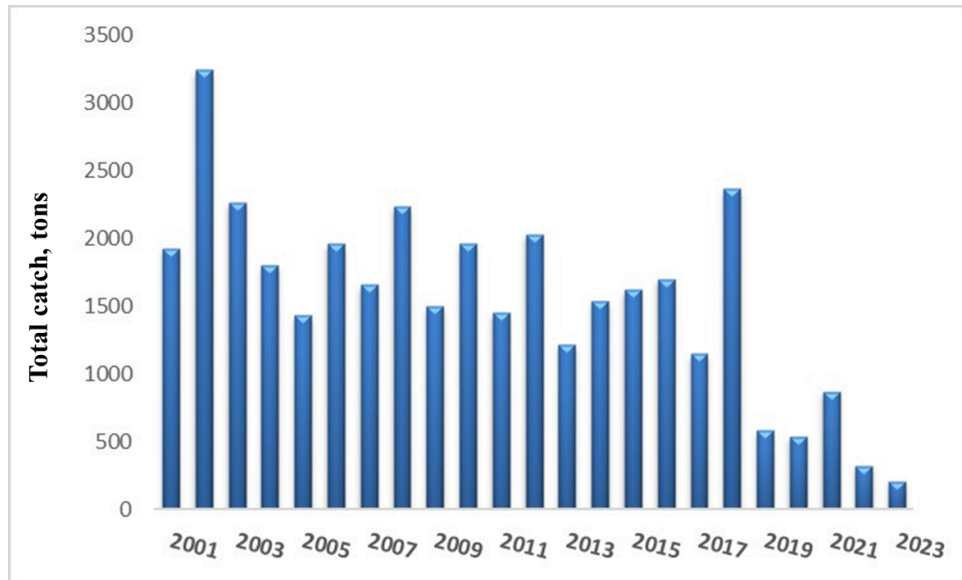


Figure 32. Dynamics of Chum Salmon catches by fishing companies on Kunashir Island from 2001 to 2023

Fig. 33 shows statistical data on Chum Salmon catches by the YKRK company relative to the total Chum Salmon catch on Kunashir Island (using coastal trap nets) for the period from 2011 to 2023.

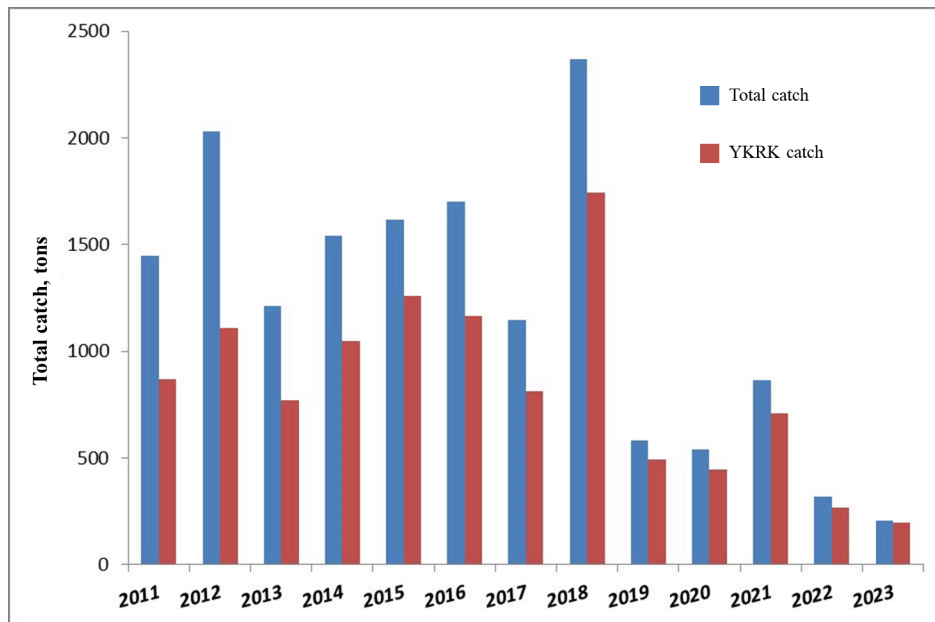


Figure 33. Chum Salmon catches by the YKRK company relative to the total Chum Salmon catch on Kunashir Island for the period from 2011 to 2023

The participation of YKRK company in the Chum Salmon fishery in different years ranged from 70 to 85%. In 2023, the share of this company in the total Chum Salmon harvest on Kunashir was 94.6%.

As a rule, the largest catches and the number of trap nets deployed occur on the Sea of Okhotsk coast. Usually, by the end of the first ten days of November, the last trap nets are removed, since their further operation is associated with the risk of destruction by strong fall storms.

In 2023, in order to use up its authorized quotas for Chum Salmon commercial fishing, the YKRK company set up 8 trap nets, 2 of them were located at the fishing parcel No. 65-18-18 within the Lesnaya River-Petrovka River boundaries (Golovnina Bay, Pacific coast), and other 6 trap nets were located at the fishing parcel No. 65-18-08 within 0.4 km northeast of Cape Spiridonov-Asin Stream (Pervukhina Bay, Sea of Okhotsk coast).

As for YKRK company trap nets, the first Chum Salmon was recorded on September 13 at fishing parcel No. 65-18-18 (Golovnina Bay) with a catch of 1,431 tons (Fig. 34). During the fishing month, 2 peaks of salmon runs were observed: the first was on September 13 and 14, and the second was on September 27-30 and October 9-10. Then the catches began to decline, and the company management decided to remove the first trap nets in this area on October 23.

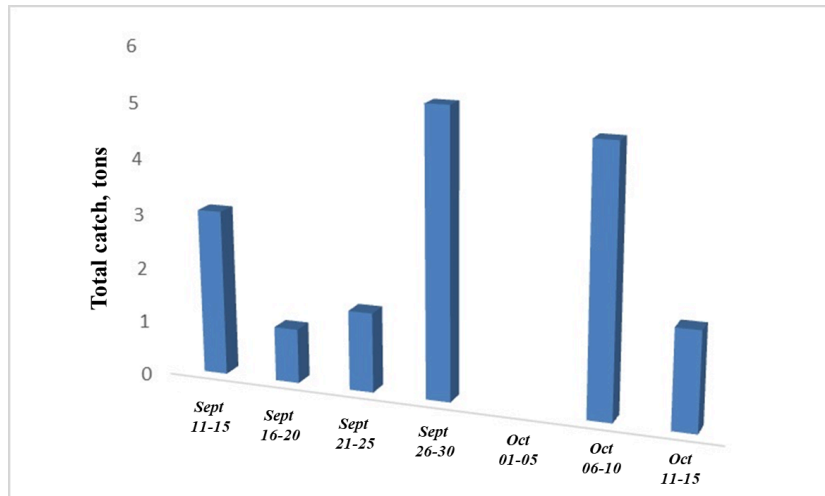


Figure 34. Dynamics of Chum Salmon catch (tons) at fishing parcel No. 65-18-18

The first catches at fishing parcel No. 65-18-08 (Pervukhina Bay) were recorded on September 24. The beginning of Chum Salmon runs was noted on September 29. Two peaks of runs were noted, apparently associated with the return of a mixed population (wild + hatchery) - from September 26 to October 15 and with the return of the hatchery population - on November 21-30. The late return of hatchery fish is probably connected with the release of juveniles from late planting of eggs brought from other areas in 2020 and 2021.

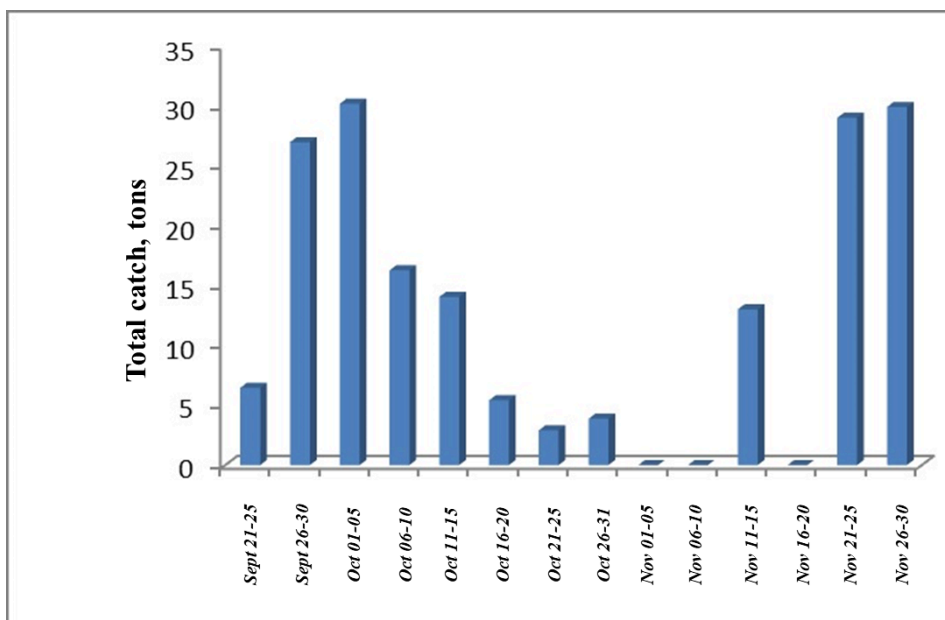


Figure 35. Dynamics of Chum Salmon catch (tons) at fishing parcel No. 65-18-08

In general, Chum Salmon fishing continued until November 28 inclusive (Table 11).

Table. 11. Chum Salmon catch in 2023 using trap nets

Five-day period	Chum Salmon catch using trap nets at coastalfishing parcels, tons	
	<i>No. 65-18-18</i>	<i>No. 65-18-08</i>
September 11-15	3.031	
September 16-20	1.00	
September 21-25	1.457	6.452
September 26-30	5.214	26.966
October 01-05		30.178
October 06-10	4.818	16.26
October 11-15	1.798	14.045
October 16-20	0	5.406
October 21-25	0	2.899
October 26-31	0	3.863
November 01-05	0	0
November 06-10	0	0

November 11-15	0	13.0
November 16-20	0	0
November 21-25	0	29.0
November 26-30	0	29.9
TOTAL From September 11 to November 28, 2023	17.318	177.969
Total catch	195.287	

In total, 195.287 tons were caught in fishing parcels, which amounted to 6.5% of the allocated fishing quotas.

6. Fishing pressure and fishing effort when catching Chum Salmon using trap nets

Due to the continuing decline in Chum Salmon catches at the YKRRK fishing parcel, we tried to analyze such indicators as fishing pressure and fishing effort in 2023.

The fishing pressure was calculated using the formula:

$$\text{Fishing pressure} = \frac{\text{Number of kilometers}}{\text{Number of trap nets}}$$

Fishing effort was calculated by the formula:

$$\text{Fishing effort} = \frac{\text{Number of fish}}{\text{Number of trap nets}}$$

Calculations for 2023 are shown in Table 12. The calculations took into account trap nets, where Chum Salmon were caught.

Table 12. Calculation of fishing pressure and fishing effort for Chum Salmon fishing in 2023

	Fishing parcel, No.	Number of trap nets	Length of coastline along the fishing parcel borders, km	Catch, tons	Fishing pressure	Fishing effort
				Chum Salmon		Chum Salmon
1	65-18-08	6	20.6	177.969	3.4	29.7
2	65-18-18	2	14.4	17.318	7.2	8.7
	TOTAL	8	35	195.287	4.4	24.4

Conclusions

1. No destruction or degradation of Pacific salmon spawning grounds was detected during the examination of water bodies on Kunashir Island between late September and early November.

2. Tyurina Stream is a water body for the potential construction of a salmon hatchery. The rivers and streams in the Serebryanoye Lake basin provide a total of about 8,635 m² of spawning grounds. It is reasonable to leave the watercourses of this basin for natural spawning.

3. Pink Salmon returns to Kunashir Island in 2023 were extremely small. An average river escapement rate was 1.0%. However, fish were observed only in three of the seven examined rivers. Passing days for Pink Salmon spawners were introduced on August 22 due to the low escapement to spawning rivers, which essentially imposed a ban on commercial fishing for this species. However, the situation did not improve until early September.

4. Anadromous Fish Commission (AFC) promptly introduced restrictions on Pink Salmon fishing in Kunashir, but this did not improve the situation regarding the escapement to spawning grounds.

5. In 2023 Chum Salmon spawner escapement in the main spawning rivers and lakes was higher than in 2022, but remains at a low level. In 2023, it was 11.1%, which was below the critical value of 30%.

6. Reproduction of Chum Salmon at the surveyed salmon hatcheries complies with the environmental requirements for breeding this species. The production process at four hatcheries (in the Lagunnoye Lake, Rikorda River, Golovnina River and Khlebnikova River) takes into account biological cycles, because incubation of eggs, pre-larval fish rearing, stimulation of the fry's "swim up", feeding and release of juveniles take place within the same time frame as in the natural environment, in accordance with the typical temperature regime for the freshwater period of Chum Salmon development.

7. In 2023, 29.1 million Chum Salmon eggs were incubated at the Lagunnoye Lake Salmon Hatchery from its own broodstock. Rikorda River Salmon Hatchery incubated 16.5 million Chum Salmon eggs (also from its own broodstock).

8. When analyzing the biometric characteristics, it was revealed that the average weight of Chum Salmon in 2023 was 2,537.6 g, which is lower than the average weight of Chum Salmon in the period from 1993 to 2013 (3,086 g) described by Kaev. A decrease in the body weight of Chum Salmon is observed both in water bodies and coastal areas, where hatchery Chum Salmon are fished (Lagunnoye Lake and Rikorda River Salmon Hatcheries), and in water bodies where exclusively wild reproduction of this species (Ilyushina and Sernovodka Rivers). A decrease in the weight of Chum Salmon is also observed on the neighboring Iturup Island.

9. The age composition of Chum Salmon (Kaev, Romasenko, 2017) on Kunashir Island usually has four groups – from 2+ to 5+. However, in 2022, an individual 5+ years old was found only in the Ilyushina River, and in 2023, 5+ years old individuals were not encountered at all! Four- and three-year-olds fish dominate in numbers.

10. Returns of Chum Salmon spawners to the Pervukhina River (Lagunnoye Lake Salmon Hatchery) are predominantly composed of 3+ years old fish with a small part of 2+ years old fish, which indicates the return from juvenile releases in 2020 – 2021. The return of adult fish from released juveniles continues to form.

11. High temperatures in the coastal area of Kunashir Island and frequent storms in 2023 negatively affected the coastal Chum Salmon fishing. Total catch in 2023 was 206.091 tons (5.9% of the allocated quotas for all companies), and 195.287 tons were caught by the YKRK company (6.5% of the allocated quotas for the company).

12. In 2023, in addition to coastal fishing, Chum Salmon were caught for aquaculture in the Pervukhina River (Lagunnoye Lake Salmon Hatchery) and in the Rikorda River (Rikorda River Salmon Hatchery). Total catch of hatchery fish was 164.188 tons, or 44.3% of the total Chum Salmon catch on Kunashir Island.

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