SakhalinRybVod

REPORT

FOR 2nd HALF OF 2006

REYDOVO FISH HATCHERY

December 2006

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1. Introduction

The Reydovo Salmon Hatchery rears and releases the fry of pink and chum salmon, with particular emphasis on pink salmon. During its 45 year operational history, the Reydovo Salmon Hatchery has released 2226170 thousand pink salmon fry and 518492 thousand chum salmon fry.

Beginning in 2001, the number of released pink salmon fry stabilized and continues to remain at 40 million fry, with an average weight of the released fry between 250-340 mg. Analysis of spawner harvest (Table 16 of the Appendix) indicates a significant difference in the numbers of spawners by year – from 0.5 to 5.9 million (a 10-fold change in the number of spawners), with no discernable relationship between the numbers of returning spawners and the number and quality of fry. It appears that one factor that exerts a significant impact on the numbers of pink salmon spawners is its low homing factor (causing its regional redistribution). However, the southern Kuril Island region is one that is favorable for pink salmon, and because of this even a minimal number of returning spawners is enough to ensure that there will be enough eggs both collected for the incubators and to provide the needed density at the spawning sites.

Chum salmon, due to its rather high homing sense, is a species of Pacific Salmon that is more stable in its return than pink salmon. Beginning in 1999, chum salmon has been incubated, grown and released from the reconstructed hatchery using new technology. The returns of chum salmon spawners (Tables 14 and 15 of the Appendix) began to exceed 100 thousand spawners in 1993. Although the conditions under which the fry are reared in the new hatchery minimize the influence of external factors (floods, temperature changes, etc.) on the fry, the conditions in coastal waters during the release period are of great significance for their survivability, and, accordingly, on their numbers. If the numbers of released fry remain stable, the numbers of returning spawners can vary between 600 – 1200 thousand, i.e., by a factor of 2. In this case, the conditions in the coastal waters end up being the limiting factor on the abundance of the spawning population as it forms. A more in-depth study of the conditions of life for the chum salmon fry in the coastal water portion of the ocean will allow us to improve the stability of the returning population.

Work with masu salmon at the Reydovo Salmon Hatchery is of a conservational nature, to support the natural populations of masu in the Reydovaya River and the Krokhalinaya River, which are under intense pressure from poachers.

2. Utilization of hatchery capacity

Beginning in 2000 (the year that the hatchery achieved its design capacity), the numbers of pink and chum salmon eggs reached a level of stability (Table 1 of the Appendix) that varied between 70 – 74 million.

For collection of pink salmon eggs, two collection stations were used: the main station (collection station 1) and the flood station (collection station 2). During the season, 15300.9 thousand eggs were collected at station 1, and 29410.6 thousand eggs at station 2. Altogether, 44711.5 thousand eggs were collected, which represented 100.7 % of the target amount, which had been decreased in coordination with SakhalinRybVod FSE in order to rear the pink salmon fry at a standard density of 20 thousand/square meter.

Two collection stations were used to collect chum salmon eggs: collection station 1 and flood collection station 2. Altogether, a total of 28779.4 thousand chum salmon eggs were collected, which represented 100.3 % of the target amount. 26112.4 thousand eggs were collected at station 1, and 2667.0 thousand eggs were collected at station 2. Egg collection in the reporting year was carried out based on a figure of 10 thousand fry/square meter for incubation. The fry are grown at a density of 10 thousand/square meter until they grow to 0.8 g, after which the placement density is decreased to 8 thousand/square meter (fractional release of 20 % of the fry) and the remaining fry is grown to 1 g.

Masu spawners were harvested at collection station 2 and transferred into baths to hold to maturity. Altogether, 12 individual masu salmon entered the traps: 6 males and 6 females; 4 males and 4 females were utilized for egg extraction.

Altogether, 73497.1 thousand salmon young were collected (including the 6.174 thousand masu salmon). This met the planned target amount by 100.4 %.

3. Description of the fish spawning run

The weather conditions during the reporting period were characterized by a stabile hydrological regime in August - September and a significant amount of flooding in October - November (five floods with water levels being exceeded by more than 0.7 meters)

Two serious floods (over 1.0 meter in September - October) did not interfere with the planned release of pink salmon spawners into the river, while a powerful flood at the beginning of November led to flooding of the collection stations and the river mouth, and to the passage of chum salmon spawners into the river.

During the majority of **July**, clear and partly cloudy weather predominated, with moderate south east winds. No strong rainstorms were observed in July.

During the greater part of **August** predominated partly cloudy and overcast weather with brief drizzle and north west winds, as well as winds from the south east (from the ocean). A great number of pink salmon was observed at sea and beginning its run into the Reydovaya River.

September 2006 was characterized by predominantly partly cloudy and overcast weather with moderate south east winds.

During the month, three instances of significantly elevated water levels were noted: on 5, 8 and 19 SEP. During the night of 27 SEP, a cyclone passed through, bringing strong winds and heavy downpours which led to an elevation in the level of water in the river up to 1.85 meters, thereby flooding collection station 1. As a result of this flood, 6 thousand pink salmon spawners passed up the Reydovaya River to the spawning grounds. There was no damage.

During **October**, partly cloudy weather predominated, with periods of brief rainfall and south east winds. There were two floods during the month: on 08 and 09 OCT , leading to elevated water levels at collection station 1 by 1.5 and 1.8 meters, respectively. *As a result of the elevated water levels, spawners were observed passing above the collection stations (on the Krokhaliniy River and collection station 2).*

During **November** , overcast weather predominated with brief rain showers mixed with wet snow, and south easterly winds. The snow cover had still not been established by the end of the month. Hydrological conditions were unstable in the first and second 10-day periods, and three floods were noted: on 07, 12 and 14 NOV (2.0, 0.9 and 0.7 meters, respectively).

The hydrological situation in the river on the whole was variable, but the September and October floods did not interfere with the planned incubation of pink salmon eggs, while the extensive flooding in November led to an over-fill of the spawning grounds on the Reydovaya River with chum salmon spawners (165 %).

Pink salmon

The runs of spawners in the reporting year were characterized by great numbers and a long duration. Entry of spawners into the river mouth was observed in the second 10-day period of July.

The first spawners to reach the spawning areas on the Reydovaya River ("Runners") were noted on August 13, when the water temperature in the river was 12.6 degrees C.

The Reydovaya River was closed off at the river mouth with fish barriers on 17 AUG , from which day counting of spawner escapement began. In the area of collection station 2, the river was blocked off on 24 AUG, and at collection station 1 the river was blocked off on 15 AUG, with the escapement of pink salmon spawners above collection station 1 being controlled

using the water supply system. Spawners passed through to collection station 2, where they continued to mature in the channel below collection station 2. Collection of pink salmon eggs for incubation was begun on 18 SEP at collection station 2. Collection at collection station 1 was begun on 22 SEP.

On 12 SEP, analysis of pink salmon spawners was performed at collection station 1, yielding a ratio of ♀:♂= 20:80 (1:4). Collection at the beginning of the run started on 18 SEP and continued through 26 SEP at water temperatures in the river of 9.9 – 13.3 °C (in the area of collection station 1). The main run collection was begun on 27 SEP and continued through 02 OCT at temperatures of 9.4-13.1 °C and a ratio of ♀:♂= 36:64 (1:1.8) (analysis performed on 26 SEP). The end of the run collection was begun on 03 OCT and continued through 10 OCT at temperatures of 7.9 – 12.6 °C and a ratio of ♀:♂= 50:50 (1:1) (analysis performed on 04 OCT).

At the mouth of the Argunj and Reydovaya Rivers, 556.45 MT (430689 individuals) of pink salmon was harvested; 6904 MT (5343653 ind.) in fish traps outside the river mouth; and 108.262 MT (83738 ind.) at collection stations 1 and 2. The total number of pink salmon that entered the river for natural spawning (according to the Reydovo Control Station) was as follows: Reydovaya River - 43100 ind. (165 %). Table 16.

Chum salmon

The first chum salmon to enter the mouth of the Reydovaya River during the reporting year was observed during the third 10-day period of September. The time frame of the run corresponded to the multi-year average. For this year, spawners of ages 3+ and 4+ predominated (64.1% and 27.3%, respectively).

The first spawners of chum salmon were observed at the spawning sites on the Reydovaya River on 29 SEP at water temperatures in the river of 11.7 °C. The first spawners below collection station 1 were observed on 4 October at a water temperature of 11.6 °C. By 10 OCT, there were 800 individual spawners below the collection station, by 15 OCT there were 2500 individuals and the collection of reproductive materials was begun.

Collection from the beginning of the run was started on 15 OCT and continued through 24 OCT (in the area of collection station 1) at a water temperature in the river of 6.3 – 9.6 °C and a ratio of ♀:♂= 48:52 (1:1.08) (analysis performed on 14 OCT). The main run began on 25 OCT and continued through 02 NOV at water temperatures in the river of 5.1 – 8.4 °C and a ratio of ♀:♂= 51:49 (1:0.96) (analysis performed on 28 OCT). The end of the run was from 03 NOV through 10 NOV at water temperatures of 5.9 – 8.6 °C and a ratio of ♀:♂= 59:41 (1:0.7) (analysis performed on 09 NOV).

Chum salmon spawners were actively harvested in the area outside the river mouth. The following amounts were harvested: 1827.6 MT at the river mouth, and 1040.64 MT at sea, total 2868.24 MT (838667 individuals). 81.641 MT (23871 individuals) were caught at the collection stations (adding the weight of the eggs collected and delivered to the weight of dressed fish). 42.75 MT (12500 ind.) (122%) passed into the spawning areas of the Reydovaya River. The total number of chum salmon spawners in the Reydovaya River spawning population was 875038 individuals, or 2992.63 MT. Table 14.

4. Description of hatchery operations

Altogether, 83738 pink salmon spawners were harvested at the collection stations, including 83279 for reproduction purposes.

A total of 23871 chum salmon spawners were harvested at the collection stations, including 23102 utilized for reproduction purposes.

All of the harvested fish was sold to Gidrostroy LSC. The weight of the dressed fish on the average was as follows:

⇒ Pink salmon 1.209 kg.

⇒ Chum salmon 3.059 kg.

The first fish in the pink salmon and chum salmon runs were allowed through at collection station 2, before which spawners were held and eggs were collected for incubation. There was no need to feel or isolate the fish, since the maturity of the spawners at collection station 2 never dropped below 70 % .

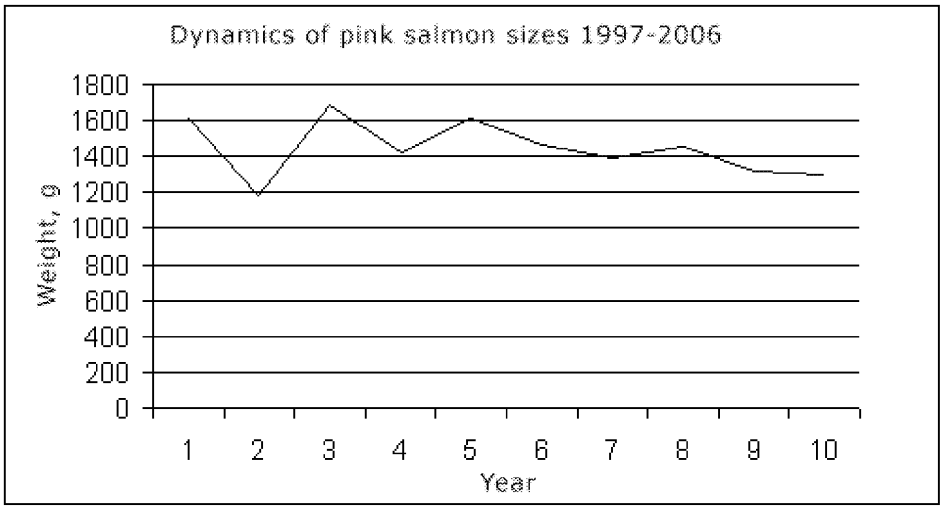
The morphometric characteristics of spawners during the season are presented in Table 6 of the Appendix. For pink salmon, the lower values for even years and greater values for odd years are easy to see. For chum salmon, a sharp decline in weight indicators (compared with previous years – Graph 2), which was related to the age composition – a significant number of 3+ and 4+ fish (Table 14 of the Appendix), and the dynamics of weight and length variation during the season is standard (decrease in sizes from the beginning to the end of collection).

In the Table are presented the size and weight indicators for spawners over 10 years.

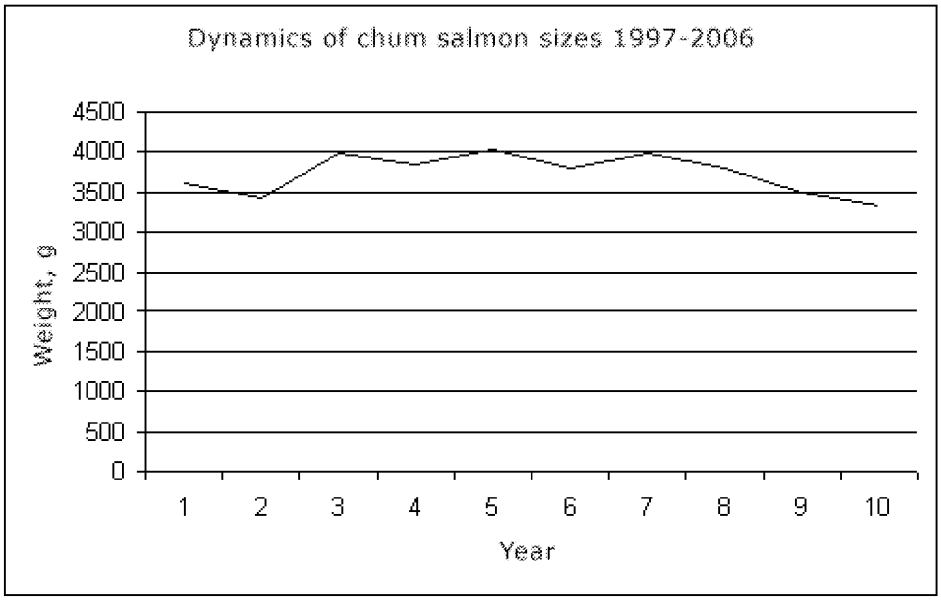
For pink salmon, a renewal of alternating weight depending on the harvest generation was noted (Graph 1), as well as a decrease in size differences between fish of contiguous years.

Year	Ratio of sexes		Length AC, cm.		Total weight, g.		Weight of skeins, g.	АИП, ind.
	♀	♂	♀	♂	♀	♂		
	Pink salmon							
1997	46	54	51.7	53.5	1579.4	1643.0	285.6	1613
1998	47	53	49.7	48.6	1177.3	1182.2	182.2	1240
1999	48	52	52.0	53.5	1626.7	1739.7	255.8	1545
2000	36	64	49.9	50.8	1400.6	1443.4	222.6	1472
2001	42	58	50.6	52.0	1591.7	1635.0	246.9	1568
2002	40	60	52.3	52.2	1518.4	1420.2	228.9	1651
2003	44	56	50.1	52.0	1336.9	1442.3	213.4	1484
2004	41	59	51.1	52.7	1418.0	1486.3	265.0	1665
2005	44	56	49.2	50.7	1314.7	1319.0	243.8	1472
2006	36	64	49.0	50.5	1288.0	1302.5	217.7	1410
	Chum salmon							
1997	51	49	66.8	69.4	3406.0	3821.6	653.5	2196
1998	46	54	68.2	65.6	3229.1	3604.3	572.7	2109
1999	41	59	69.9	72.8	3735.7	4232.0	697.3	2339
2000	46	54	70.9	74.1	3592.3	4094.8	708.0	2284
2001	44	56	69.9	71.9	3876.4	4198.0	727.6	2405
2002	45	55	69.4	71.3	3556.6	4066.4	658.8	2355
2003	50	50	70.4	73.1	3731.6	4248.7	657.5	2274
2004	48	52	70.8	71.6	3727.3	3854.7	594.3	2181
2005	39	61	67.0	69.2	3350.7	3637.0	614.4	2130
2006	52	48	66.4	68.3	3164.5	3539.6	597.1	2112

Graph 1



Graph 2



5. Egg collection

Egg collection for hatchery uses was done at two collection stations on the Reydovaya River. Station 1 was the main collection station, located at a distance of 0.8 km from the plant. Station 2 was used as a back-up (flood) collection station, located 0.02 km from the plant.

The equipment used at collection station 1 was imported: containers to be used for egg swelling and washing. Egg collection at collection station 2 was carried out in accordance with the methodologies developed for nurseries of the Far East type.

Eggs were placed in the incubators at the new plant. They were transported in FFU-type containers. Counting was done using the weight method. Dead eggs were not picked after transport. Prophylactic treatment was conducted on the second day using a formalin concentration of 1:800 for a 30 minute treatment time, and the eggs were preliminarily stirred by hand.

At collection station 2, the water was supplied at the same temperature as in the incubators.

If the temperature difference between the water at collection station 1 and the incubators exceeded 2 degrees C, the temperature was equalized in the transport container.

There were 15300.9 thousand pink salmon eggs and 26112.4 thousand chum salmon eggs collected at collection station 1, and 29410.6 thousand pink salmon eggs and 2667.0 thousand chum salmon eggs collected at collection station 2.

Altogether, 73490.9 thousand eggs were collected, which included 44711.5 thousand pink salmon eggs and 28779.4 thousand chum salmon eggs. The average number of pink salmon eggs in Atkins cells was 153.6 thousand (from 104.9 to 237.2 thousand), and in the box-type the average was 555.0 thousand (from 471.7 to 616.1 thousand); there were 8 Atkins type and 78 Box type incubators used. The average number of chum salmon eggs in the Atkins incubators was 114.2 thousand (40.8 to 125.3 thousand), and in the Box incubators was 416.8 thousand (371.4 to 465.0 thousand); there were 24 Atkins incubators and 62 Box incubators used.

Number of collected pink salmon eggs by date and lot size:

Lot #	Collection date	Number of eggs, thou-sand	Lot #	Collection date	Number of eggs, thou-sand	Lot #	Collection date	Number of eggs, thou-sand
1	18 SEP	365.2	10	27 SEP	3520.1	19	06 OCT	1249.7
2	19 SEP	474.4	11	28 SEP	1647.5	20	07 OCT	490.4
3	20 SEP	762.8	12	29 SEP	2594.4	21	08 OCT	524.1
4	21 SEP	1137.1	13	30 SEP	5013.0	22	09 OCT	2256.9
5	22 SEP	1576.8	14	01 OCT	5196.3	23	10 OCT	597.5
6	23 SEP	2112.0	15	02 OCT	3958.5	Total		44711.5
7	24 SEP	1769.5	16	03 OCT	2227.6			
8	25 SEP	2251.0	17	04 OCT	1128.4			
9	26 SEP	2710.8	18	05 OCT	1147.5			

Number of collected chum salmon eggs by date and lot size:

Lot #	Collection date	Number of eggs, thou-sand	Lot #	Collection date	Number of eggs, thou-sand	Lot #	Collection date	Number of eggs, thou-sand
1	15 OCT	402.6	11	25 OCT	1677.8	21	04 NOV	1755.5
2	16 OCT	382.2	12	26 OCT	1296.0	22	05 NOV	1277.8
3	17 OCT	824.4	13	27 OCT	1645.3	23	06 NOV	813.7
4	18 OCT	858.8	14	28 OCT	1152.5	24	08 NOV	783.3
5	19 OCT	803.6	15	29 OCT	2864.8	25	09 NOV	406.8
6	20 OCT	827.7	16	30 OCT	2241.7	26	10 NOV	692.1
7	21 OCT	860.0	17	31 OCT	1753.0	Total:		28779.4
8	22 OCT	819.6	18	01 NOV	797.0			
9	23 OCT	793.6	19	02 NOV	438.1			
10	24 OCT	1340.6	20	03 NOV	1270.9			

6. Egg incubation

Altogether in the reporting year, a total of 44711.5 thousand pink salmon eggs were placed into the incubators, 28779.4 thousand chum salmon eggs and, as an experiment, 6.174 thousand masu salmon eggs.

All of the eggs of pink salmon, chum salmon and masu salmon were collected on the base river, the Reydovaya River.

As of 10 DEC, dead eggs were picked in 23 lots of pink salmon eggs (100% of the eggs), comprising on the average 5.9 % and varying between 3.4 and 11.3 %. The percent of pink salmon eggs fertilized on the average comprised 95.5% and varied between 94 and 98%.

Picking of dead chum salmon eggs was begun, and as of 12 DEC two lots had been picked (2.7%). The dead eggs comprised on the average 6.4 %, varying between 6.0 and 6.8% . The percent of fertilized chum salmon eggs on the average was 95.2% and varied between 94 and 98%.

Dead eggs from incubation were picked using JX units at 350 – 420 deg. days. At 350 degree days, the eggs were stressed (broken up) by pouring. The pink and chum eggs were washed twice per week. The eggs that had reached the "eye-spot" stage were actively stirred by hand. The younger eggs (from 130 degree days) are carefully moved by hand and the water poured off. The remaining eggs are stirred passively by pouring the water from the boxes.

Prophylactic treatment of the eggs was done using the drip method as required. The first treatment of pink salmon and chum salmon was conducted on the second day after collection, using formalin in a concentration of 1:800, with a treatment time of 30 minutes. Secondary treatment of pink salmon was conducted in the period 11-29 NOV using a 1:800 concentration of formalin for 30 minutes. The second and third treatments of chum salmon using formalin were conducted on 22 NOV and 02 DEC.

Water supply was conducted as follows:

⇒ For pink salmon: at the beginning of incubation ground water was supplied at a temperature of 6.9 – 7.8 degrees C, and after the water temperatures equalized between the ground water supply and the infrabed supply (on 16 NOV) the supply was shifted to infrabed water. Water consumption for each row of boxes at the beginning of incubation was 50 liters/minute; after onset of the "eye-spot" stage was 60 liters/minute; and in the nurseries at hatching was 120 liters/minute.

⇒ For chum salmon: at the start of incubation, ground water was supplied at a temperature of 6.9 - 7.1 degrees C, and after the water temperatures equalized between the ground water supply and the infrabed supply. Water consumption for each row of boxes at the beginning of incubation was 50 liters/minute; after onset of the "eye-spot" stage was 60 liters/minute; and for each Atkins cell was 30 liters/minute.

As of 10 DEC all of the pink salmon (42074.5 thousand eggs) was set to hatch. Beginning of hatching was not noted. Density of placement for hatching for pink salmon was 19.7 thousand/meter^2 , and for chum salmon was 10.7 thousand/meter^2 .

Egg weight and size changes during incubation

#	Date of fertili-zation	Weight of individual eggs, mg.			Diameter, mm.		
		At placing	Eye-spot stage	Before hatching	At placing	Eye-spot stage	Before hatching
Pink salmon							
1	18 SEP	155	154	-	6.4	6.3	-
12	29 SEP	159	156	-	6.5	6.4	-
23	10 OCT	161	160	-	6.5	6.4	-
chum salmon							
1	14 OCT	308	298	-	8.2	7.8	-
14	28 OCT	305	297	-	8.2	7.8	-
23	09 NOV	292	-	-	8.0	-	-

Extent to which the main biological standards were met

#	Indicator	Units	Standard		Actual	
			Pink salmon	Chum salmon	Pink salmon	Chum salmon
1	Spawner death in dip-nets	%	1.5	1.5	-	-
2	Average mortality	ind.	1200	2500	1438	2116
3	Egg fertilization	%	96	97	95.5	95.2
4	Egg death in incubators (incl. transport)	%	11	10	-	-

7. Experimental hatchery operations

Year 2006 generation:

During the reporting period, a harvest of masu spawners was conducted. 6174 eggs were placed into incubators. One lot was collected: 25 SEP – 6174 eggs.

4 females and 4 males were used. Egg characteristics:

"swelling"

1. Diameter 6.4 mm., weight 155 mg.

"eye-spot"

27 OCT, day 33, 240.5 degree day.

All of the masu eggs were placed into a bath to hatch.

10 DEC — masu hatch noted on day 77 at 508.1 degree days. 6100 individuals hatched, egg death during incubation was 74, 1.2%.

Length AC = 20.3 mm., weight = 158.1 mg., yolk weight = 85.8 mg.

Individual taymen continue to be held in the incubation section. Taymen have been placed into a bath. Feeding done with live dolly varden. Total number of taymen held - 6 ind.

8 . Inventory of fish culture equipment

Information on amount and condition of imported equipment

#	Imported equipment	Units	Quantity	Condition
1	Egg collection station equipment Table for egg collection	pcs.		

	Fish cutting knife Container for egg swelling Container for egg washing		3 3 1 2	Good Good Good Good
2	Substrata for holding fry Length 1.95 м. Length 1.80 м.	m 2	 3380 1434	 Good Good
3	Hatching trays	pcs.	4814	Good
4	Collection kit (plates, nets, traps)	Set	1	Good
5	Insulated container SP type FFU type	pcs.	 28 30	 Good Good
6	Dead egg removal device Model SED Model JX	pcs.	 1 3	 not working Good
7	Water quality control instruments pH meters Thermograph Sigma-2, Model №S2-ES Salinometer OSK 2864 DO meter Oxygen measurer OXI 196 Thermometer with metal case Oxygen measurer YSI 57	pcs.	 1 1 1 1 1 1 1	 Good Good Good Good not working not working Good
8	Incubation equipment Box incubator, type 1 Box incubator, type 2 Trays for Box incubators Lids for Box incubators Atkins cell incubators Lids for Atkins cell incubators Trays for Atkins cell incubators Dripper, straight Ponds, rectangular	pcs.	 96 48 24 144 48 48 18 1 10	 Good Good Good Good Good Good Good Good Good
9	Feeders - Peleter Feeders - Maxi	Set	112 120	Good
10	Lab equipment Scales Sartorius LC 621 S Scales KF-S-30 Scales PM-3000	pcs.	 1 1 1	 Good Good Good
11	Pump equipment Sump 50DL5.75 Sump 100DL53.75 Diesel pump SB-6 Carburetor pump TED 100R Sump Amarex F 80, 3.15 KW	pcs.	 1 1 3 1 2	 Good Good Good Good Good
12	High pressure washer Diesel HD1050DE Electric HDS801E12	pcs.	 1 1	 Not working Good
13	Aerators: AGK 1914 AGK 191424 M-MH-MK	pcs.	 1 1 1	 Good Good Good

9. Effectiveness of hatchery operations

Pink salmon

During the 2006 season, 7460500 kg of pink salmon, or 5774342 individuals, were commercially harvested at the mouth of the river (in traps set up at the river mouth), and 108300 kg (83738 ind.) at the spawner stations. Escapement to natural spawning was 55700 kg (43100 ind.) (165%). Duration of pink salmon fishing (at the mouth and collection stations) was from 25 AUG through 21 OCT (56 days). The return coefficient was 11.4%. 44711.5 thousand pink salmon eggs were collected to incubate.

The reporting year was characterized by a large number of pink salmon. Calm weather allowed the main portion of pink salmon (97%) to be harvested at the approaches to the river mouth and in the river mouth itself. The rather calm hydrological conditions in the river allowed the necessary numbers of spawners to pass through to egg collection and natural spawning.

Chum salmon

The following numbers of chum were caught during the 2006 season: 1827600 kg in the river mouth, 10406.400 kg at sea, total 2868.24 MT. At the collection stations, 816.4100 kg were harvested (the weight of collected and delivered eggs was added to the weight of the dressed fish). 12500 individuals (122%), or 427.500 kg, entered the Reydovaya River to spawn. The total number of individuals in the spawning population of chum salmon in the Reydovaya River was 875038, or 29926.300 kg of chum salmon spawners (Table 14 of the Appendix). The duration of chum salmon fishing (in the river mouth and collection stations) was from 02 OCT through 30 NOV (60 days). In 2006, the core of the return was represented by spawners of age 3+ (64.1 %). The commercial take of chum salmon in the Reydovaya River and its tributaries was 98.5 %. The number of eggs collected for incubation was 28779.4 thousand

In the reporting year, the lowest average weight of chum salmon spawners for the past 10 years was noted – 3.3 kg. The November floods, which caused the egg collection stations to be flooded, led to too many chum salmon spawners arriving at the spawning grounds. The increased precipitation amounts made up the deficit in the river and allowed the chum to occupy all of the spawning areas.

Six hatchery specialists care for the 73490.9 thousand salmon eggs, which means that each worker is responsible for 12.25 million eggs.

10. Analysis of operations at the Reydovo Salmon Hatchery for the reporting period

The workers of the hatchery met the planned target amounts by collecting 73497.1 thousand salmon eggs, which included 44711.5 thousand pink salmon eggs, 28779.4 thousand chum salmon eggs and 6.174 thousand masu salmon eggs.

Spawners were collected by 16 workers at two collection stations. Retrieval of the spawners at station 1 is mechanized (using an electric hoist), while station 2 catches the fish by hand using dip-nets.

Spawner escapement is conducted at three fish control barriers, the first of which is situated at the common mouth of the Argunj and the Reydovaya Rivers, the second is at the mouth of the Argunj River, and the third is at the mouth of the Reydovaya River. Since significantly fewer spawners enter the Argunj River than the Reydovaya River, as a rule practically all of the fish enters the Reydovaya River. The surplus fish were harvested, after allowing the necessary escapement numbers to pass through.

The egg collection and spawner escapement processes were similar to those of the previous year, without any significant changes. The operational technology has been worked out well enough, and the hydrological conditions were good enough, to allow the planned numbers of pink and chum salmon eggs to be collected for the incubators, as well as to fill the natural spawning grounds.

Director, Reydovo Salmon Hatchery: T.P. Mizina

Chief Hatchery Specialist, Reydovo Salmon Hatchery: N.Yu. Remezovskaya

Appendix

Table 1 — Eggs placed in incubators over previous seven years

Year	Eggs placed in incubators, thousand			
	Total	Pink salmon	Chum salmon	Masu salmon
2000	70407.61	45059.0	25344.0	4.61
2001	74284.04	49024.0	25234.5	25.54
2002	71939.13	46543.7	25247.4	148.03
2003	73832.20	48021.3	25797.2	13.7
2004	71980.33	46107.2	25854.6	18.53
2005	70215.37	44209.2	25991.2	14.97
2006	73497.07	44711.5	28779.4	6.174

Table 2 — Utilization of hatchery capacity for egg incubation during the reporting period

Item #	Species of fish	Hatchery fry release capacity of fry in millions as of 01 JAN of the reporting year	Eggs placed based on norms, million	Eggs actually placed, million	% of hatchery capacity
1	Pink salmon	42.0	44.4	44.7	100.7
2	Chum salmon	21.7	28.7	28.8	100.8
3	Masu salmon	-	0.09	0.006	-
Total		63.7	73.19	73.497	100.4

Table 3 - Description of hatchery capacities

Item #	Description		Qty.	Sq. m.	Sizes, cm	Changes
1.	Far-East type incubators		-	-	-	Fully removed from use in 1999
2.	Box-type incubator units – "Box".		144	0.48	80/60	-
3.	Box-type incubator units – "Atkins"		12	1.08	30/3600	-
4.	Far-East type nursery		-	-	-	805.2 sq.m removed from use in 2000
5.	Nursery channels		62	2356	1900/200	Used for chum salmon
			54	2052	1900/200	Used for pink salmon
6.	Rearing ponds:	concrete	-	-	-	95 sq.m removed from use in 2000
		pit-type	-	-	-	273.0 sq.m removed from use in 2000
7.	Mesh spawner holding pen		4	24.0	200/300	-
8.	Ponds		10			

Table 4 — Salmon spawning run timing in the Reydovaya River

Body of water	Species of fish	Beginning of run				Mass portion of the run				End of run			
		10-dy per., mo.	Av. temp, °C		Ratio of sexes ♂:♀%	10-dy per., mo.	Av. temp, °C		Ratio of sexes ♂:♀%	10-dy per., mo.	Av. temp, °C		Ratio of sexes ♂:♀%
			River	Sea			River	Sea			River	Sea	
Reydovaya River	Pink salmon	1-2nd 10-dy pd of September	10.1-15.0	-	79:21	3rd 10-dy pd of September	9.9-13.1	-	64:39	1-2nd 10-dy pd of October	7.2-12.6	-	50:50
Reydovaya River	Chum salmon	1-2nd 10-dy pd of October	7.2-12.6	-	52:48	3rd 10-dy pd of October	5.1-8.4	-	49:51	1-2nd 10-dy pd of November	3.7-8.6	-	41:59

Table 5 — Harvest and sales of fish, eggs

Spawners harvested on base river, ind.			Spawners utilized, ind.			Fish sold, ind.				Roe sold, kg.	Written off, ind.
females	males	Total	females	males	Total	females	males	Total	X 100 kg		
Pink salmon											
34923	48815	83738	34756	48523	83279	34923	48815	83738	1082.6	-	-
Chum salmon											
13643	10228	23871	13375	9960	23335	13643	10228	23871	816.4	-	-

Table 6 — Bioanalysis of spawner salmon at Reydovo Salmon Hatchery collection station

Item #	Analysis date	Ratio of sexes		Length AC, cm.			Total weight, g.			Body weight ♀, kg.	Weight of skeins, g.	AIP, ind.	Working fecundity, ind.
		♀	♂	♀	♂	♂♀	♀	♂	♂♀				
		Pink salmon											
1	20 SEP 06	21	79	49.5	50.1	50.0	1373.3	1281.2	1300.8	1142.1	236.5	1477	1361
2	26 SEP 06	36	64	48.8	50.7	50.0	1258.5	1351.6	1318.1	1077.5	203.6	1352	1307
3	04 OCT 06	50	50	48.7	50.6	49.7	1232.2	1274.8	1253.5	1020.6	213.0	1400	1275
Total		*36*	*64*	*49.0*	*50.5*	*49.9*	*1288.0*	*1302.5*	*1290.8*	*1080.1*	*217.7*	*1410*	*1314*
		K E T A											
1	14 OCT 06	48	52	68.8	70.6	69.7	3535.1	3699.6	3621.0	2780.3	653.2	2246	2225
2	28 OCT 06	51	49	66.3	66.8	67.8	3103.7	3575.6	3333.8	2469.0	596.6	2143	2140
3	09 NOV 06	59	41	64.1	67.5	65.5	2854.7	3343.6	3055.2	2262.1	541.6	1948	1948
Total		*53*	*47*	*66.4*	*68.3*	*67.7*	*3164.5*	*3539.6*	*3336.7*	*2503.8*	*597.1*	*2112*	*2104*

Table 7 - Information on salmon egg collection by body of water

Egg collection station	Distance to plant, km.	Eggs collected		Transport mortality	Eggs transferred to other enterprises	Eggs accepted from other enterprises	Final number of eggs placed, thousand	From which portion of spawning population were eggs transferred or received
		Species of fish	Number of eggs, thousand					
Collection station 1, Reydovaya River	1.2	Pink salmon	15300.9	Not	-	-	15300.9	-
		Chum salmon	26112.4	Picked	-	-	26112.4	-
		Total:	41413.3		-	-	41413.3	
Collection station 2, Reydovaya River	0.1	Pink salmon	29410.6	Not	-	-	29410.6	-
		Chum salmon	2667.0	Picked	-	-	2667.0	-
		Total:	32077.6		-	-	32077.6	

Table 8 - Information on egg development by species

Item #	Date of fertilization	Eyespot appearance			Beginning of hatching			End of hatching		
		Date	Days	Deg. dy.	Date	Days	Deg. dy.	Date	Days	Deg. dy.
	Pink salmon									
1	18 SEP 06	19 OCT	32	236.5	-	-	-			
12	29 SEP 06	30 OCT	32	231.0	-	-	-			
23	10 OCT 06	12 NOV	34	239.4	-	-	-			
	Chum salmon									
1	15 OCT 06	18 NOV	35	245.2	-	-	-			
14	28 OCT 06	05 DEC	39	246.4	-	-	-			
26	10 NOV 06	-	-	-	-	-	-			

Table 9.1 - Temperature regime on the river

Mo., 10-dy per.	July	August	September	October	November	December
1	9.0	11.8	12.6	10.0	7.3	1.0
2	11.0	14.0	12.2	8.3	5.4	-
3	10.6	14.0	11.1	7.0	3.6	-
average	10.2	13.3	12.0	8.4	5.4	-

Table 9.2 - Temperature regime in pink salmon plant

Mo., 10-dy per.	July	August	September	October	November	December
1			-	7.4	7.0	2.6
2			7.6	7.1	6.5	-
3			7.6	7.0	5.5	-
average			7.6	7.2	6.3	-

Table 9.3 - Temperature regime in chum salmon plant

Mo., 10-dy per.	July	August	September	October	November	December
1					7.0	4.4
2				7.1	6.9	-
3				7.0	5.6	-
average				7.0	6.5	-

Table 9.4 - Temperature regime of the air

Mo., 10-dy per.	July	August	September	October	November	December
1	16.0	20.7	17.4	11.3	8.2	-2.6
2	17.1	21.1	17.6	9.2	4.5	-
3	15.4	20.7	14.1	7.4	2.6	-
average	16.1	20.8	16.4	9.3	5.1	-

Table 10 — Water consumption in plants (nurseries), lit./sec.

Mo., 10-dy per.	July	August	September	October	November	December
1			-	25.1	49.6	86.1
2			1.2	29.9	53.0	
3			9.1	38.5	59.7	

Table 11 - Oxygen content of water in nurseries

Mo., 10-dy per.	September				October				November				December			
	Inflow		Outflow		Inflow		Outflow		Inflow		Outflow		Inflow		Outflow	
	mg/lit.	%	mg/lit.	%	mg/lit.	%	mg/lit.	%	mg/lit.	%	mg/lit.	%	mg/lit.	%	mg/lit.	%
1	-	-	-	-	11.2	96	10.5	90	11.2	95	10.6	90	12.1	95	11.3	88
2	11.1	96	10.8	93	11.2	95	10.7	91	11.1	93	10.5	88	-	-	-	-
3	11.2	97	10.7	92	11.2	95	10.7	91	11.6	94	10.7	87	-	-	-	-

Table 12 - Water consumption by month over the calendar year

Mo., Water req., cub. m.	January	February	March	April	May	June	July	August	September	October	November	December
	481.4	419.57	312.57	355.88	652.90	378.17	0.52	0.54	8.68	84.012	140.746	-

Table 13 — Results of hatchery operations during the second half of the year

Number of spawners harvested				Spawner death in dip-nets, %	Numbers of females used for egg collection	Including females used for collection on other rivers	Working fecundity, ind.
Species of fish	Total	♀	♂				
Pink salmon	83738	34923	48815	-	34756	-	1286.4
Chum salmon	23871	13643	10228	-	13375	-	2151.7
Masu salmon	8	4	4	-	4	-	1543

Table 13 (cont.)

Species of fish	Eggs collected, thousand	Dead eggs from transport	Newly-collected eggs transferred to other hatcheries	Eggs transferred at eye-spot stage, thousand	Eggs received, thousand	Eggs placed in incubators, thousand	% fertilized	Incubation mortality	
								thousand	%
Pink salmon	44711.5	-	-	-	-	44711.5	95.5	2637.0	5.9
Chum salmon	28779.4	-		-	-	28779.4	95.2	-	-
Masu salmon	6.174	-	-	-	-	6.174	-	0.07	1.2
Total	73797.1	-		-	-	73797.1	95.4		

Table 14 — Age composition of spawning chum salmon population over the past 10 years

Harvest year	Age of return, ind., %								Total number in spawning pop.*
	2+		3+		4+		5+		
	ind.	%	ind.	%	ind.	%	ind.	%	
1994	1266	1.8	33205	47.2	33627	47.8	2251	3.2	70349
1995	8469	6.5	27888	21.4	85471	65.6	8469	6.5	130291
1996	4793	2.5	149007	77.0	22840	11.8	16683	8.7	193323
1997	3580	2.5	110967	76.4	30006	20.7	583	0.4	145136
1998	4276	2.8	96659	63.3	48559	31.8	3206	2.1	152700
1999	4584	1.7	183483	68.1	76246	28.3	5272	2.0	269584
2000	10310	4.2	121774	49.6	109097	44.4	4487	1.8	245668
2001	33082	11.6	163092	56.9	72843	25.4	17460	6.1	286477
2002	16686	2.2	671991	88.6	64469	8.5	5309	0.7	758455
2003	2364	0.2	704310	59.6	463237	39.2	11817	1.0	1181728
2004	2980	0.4	361360	48.5	368810	49.5	11921	1.6	745071
2005	37145	5.4	424419	61.7	195357	28.4	30955	4.5	687876
2006	62128	7.1	560899	64.1	238885	27.3	13126	1.5	875038

*Not counting spawners allowed through to natural spawning grounds

Table 15 — Commercial return of chum salmon to the Reydovo Salmon Hatchery (Reydovaya River)

Release year	Fry released, thousand	Av. weight of released fry, mg.	Age of return, ind.					Return percent
			2 +	3+	4+	5+	Total	
1988	-	-				243	243	
1989	9500	527.8			2480	2251	4731	
1990	-	-		12294	33627	8469	54390	
1991	9200	871.8	198	33205	85471	16683	135557	1.47
1992	10500	778.3	1266	27882	22840	506	52494	0.50
1993	2161	1220.5	8469	149007	27652	3206	188334	8.72
1994	20000	1206.3	4793	102937	48559	5272	161561	0.81
1995	11334	1229.5	3241	96659	76246	4487	180633	1.59
1996	10747	1131.6	4276	183483	109097	17460	314316	2.92
1997	10510	1039.7	4584	121774	72843	5309	204510	1.95
1998	8949	1003.5	10310	163092	64469	11817	249688	2.8
1999	15268	735.6	33082	671991	463237	11921	1180231	7.7
2000	23234	889.1	16686	704310	368810	30955	1120761	4.8
2001	22921.3	1134.2	2364	361360	195357	13126	572207	2.5
2002	22737.1	1160.6	2980	424419	238885			
2003	23118.2	1136.9	37145	560899				
2004	23304.1	1118.1	62128					
2005	23794.9	1148.1						
2006	23463.4	1086.0						

Table 16 - Efficiency of hatchery operations on pink salmon.

Release year of fry	Harvest year of spawners	Fry released, thousand	Weight of released fry, mg.	Commercially harvested at river mouth		No. of naturally spawning fish in the Reydovaya River		Spawners harvested at the base collection station		Total number in spawning pop.		Return percent
				ind.	X 100 kg*	ind.	X 100 kg	ind.	X 100 kg	ind.	X 100 kg	
1994	1995	*10200*	*483.5*	946067	14191	42532	638	42048	625	1030747	15454	10.1
1995	1996	*34811*	*403.4*	763484	9309	39380	473	140778	1718	943642	11500	2.7
1996	1997	*32539*	*305.0*	853688	13659	29580	477	34905	506	918173	14642	2.8
1997	1998	*24508*	*291.6*	1265583	15187	37960	456	124167	1490	1427710	17133	5.8
1998	1999	*20381*	*249.5*	404097	6805	47110	793	59754	934	510961	8532	2.5
1999	2000	*13278*	*232.2*	294730	4303	64670	944	100620	1350.5	460020	6597.5	3.5
2000	2001	*34695*	*237.3*	810625	12970	40300	645	229891	3347	1080816	16962	3.1
2001	2002	*42503*	*260.0*	2700882	37812	46800	655	128398	1880	2876080	40347	6.8
2002	2003	*45847*	*251.9*	400803	5491	31200	427	159489	2185	591492	8103	1.3
2003	2004	*42794*	*250.7*	1135175	16233	63400	907	60627	867	1259202	18007	2.9
2004	2005	*44171*	*292.1*	1366145	17896	48100	630	77045	1008	1491290	19534	3.4
2005	2006	*51692*	*274.9*	3850967	44754	43100	557	83738	1083	3977805	46394	8.0
2006	2007	*40656*	*342.7*									

** counting fishing gear set up in the river mouth and fish traps outside the river mouth*

Table 17 — Efficiency of hatchery operations on chum salmon.

Release year	Fry released, thousand	Commercially harvested at river mouth*		No. of naturally spawning fish		No. of spawners caught at collection stations		Total number in spawning pop.	
		ind.	X 100 kg	ind.	X 100 kg	ind.	X100kg	ind.	X 100 kg
2002-2003	-	862538	28682	12500	428	23871	816	875038	29926

***counting chum salmon harvested at sea**

For calculation of the number of spawners at sea and at the spawning grounds, the average measured weight was used from 3 analyses = 3.42 kg. (3 analyses by the Reydovo Salmon Hatchery).