

**FEDERAL AGENCY FOR FISHERY**  
**Federal State Budgetary Scientific Institution**  
**“Kamchatka Research Institute of Fisheries and Oceanography”**  
**(FSBSI “KamchatNIRO”)**

November 14, 2018 # 13-03/ 3378

On cooperation in aerovisual monitoring

To “Vityaz-Avto Co., LTD”  
Director General,

A.E. Ramanauskas

Dear Aleksas Edmundo!

FSBSI “KamchatNIRO” appreciates all of your help in organizing aerovisual monitoring and is sending the Scientific Report on Pacific Salmon Spawners Stock Assessment in Opala, Kol and Vorovskaya rivers in 2018.

Attachment: Report, 18 pages.

Director

N.Yu. Shpigalskaya

**Federal Agency for Fishery**

Federal State Budgetary Scientific Institution  
“Kamchatka Research Institute of Fisheries and Oceanography”  
(FSBSI “KamchatNIRO”)

**“SEEN AND AGREED”**

Director of “KAMCHATNIRO”,  
PhD, Biology  
N.Yu. Shpigalskaya  
[signature]  
01 November 2018

## **REPORT**

### SCIENTIFIC RESEARCH RESULT

**“Scientific Report on Pacific Salmon Spawners Stock Assessment in Opala, Kol and Vorovskaya rivers” (contract №25/18 NIR dated 06.06.2018, “Vityaz-Avto Co., LTD)**

Petropavlovsk-Kamchatskiy, 2018

## **TEAM LIST**

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The Pacific Salmon is one of the most valuable fisheries in the world. Salmon fishery improvements and scientific research require specific and reliable data on salmon spawners stock. Based on this data we can assess salmon stock in various river basins, estimate fishery influence on this stock, forecast salmon reproduction few years ahead. Aerovisual monitoring allows rationalizing, speeding up and reducing the price for research on salmon escapement in vast water territories. Quantitative assessment of salmon escapement greatly defines Pacific salmon run forecast and commercial catch estimation. Salmon stock has been aerovisually monitored since 1957 and there is still no alternative method available that could cover large territories.

The goal of this research is a Pacific salmon distribution and stock examination in Opala, Vorovskaya, Kol rivers.

Tasks:

- Quantitative assessment of Pacific salmon spawners in Opala, Vorovskaya, Kol rivers.
- Assessment of spawners escapement and distribution in Opala, Vorovskaya, Kol rivers.

## **1. RESEARCH RESULTS**

Operational monitoring of spawning grounds in West Kamchatka rivers (Opala, Vorovskaya, Kol rivers) was performed during the fishing season 2018 (by contract 25/18-NIR dated 06.06.2018 “Scientific Report on Pacific Salmon Spawners Stock Assessment in Opala, Kol and Votovskaya rivers”). Eurocopter AS355N was used for aerovisual monitoring. The flight hours – 12 hours, 2 025 km were covered.

## **1.1 Opala river**

Total number of aerovisual monitorings in Opala river – 4. On 20 July 2018 Chum and Red salmon spawners stock was assessed in the tributary of Opala-Savan rivers and its tributaries, Praviy and Leviiy Savan.

The second monitoring was done on 04 September 2018 to assess Pink salmon spawners stock. Main river bed and its tributaries were monitored.

On 08 September one additional monitoring was performed to correct previously obtained data.

On 08 October 2018 Silver salmon was assessed in Opala river. The tributary of Opala river and its tributary, Savan river with its own tributaries, were monitored.

Hydrological regime in Opala river basin during the aerovisual monitoring was favorable

### **1.1.1 King salmon**

King salmon stock in Opala river basin is not experiencing such a pressure as its population in Bolshaya river. However, yearly fluctuations in population are rather significant. From 2001 to 2018 spawners escapement ranged between 170 spawners and 18 000 spawners, in average - 5 400. A long-term average level of King salmon spawners escapement in Opala river was within the average level and equals to 4 400 spawners. It should be noted that King salmon was monitored in relatively late dates, and highly probable that already spawned fishes were not counted.

### **1.1.2 Red salmon**

Red salmon spawning population in Opala river is exposed to strong yearly fluctuations. However, recently Red salmon stock has been growing. This year its stock is assessed as 25 000 spawners that from 2001 year is the second biggest result after its maximum in 2006 (35 500 spawners); a long term average level is about 5 200 spawners. Main spawning grounds are located in the left tributary of Opala-Savan rivers, and partially in its tributaries. Some Red salmon was found in clusters with Chum salmon, however, due to the distinctive spawning coloring it was easy to identify it.

### **1.1.3 Chum salmon**

Chum salmon along with Pink salmon are dominant species in Opala river. Some years have seen up to 200 000 spawners coming to spawn in the river, at long term average level of about 35 600 of Chum salmon spawners. In general, in 2018 Chum salmon was seen in Savan river (92 000 spawners) – left tributary of Opala river and in the second-order tributary of Leviy Savan river (28 500 spawners). Chum salmon was distributed in the middle of the riverbed as well as along both river sides, sometimes together with Red salmon. However, dense clusters were not found, but rather it was even distributed along the riverbed. Chum salmon spawning escapement (in total 133 000 spawners) in Opala river basin in 2018 is assessed as optimal.

### **1.1.4 Pink salmon**

Pink salmon run in Opala river basin in 2018 was at rather high level for this river. However, the first aerovisual monitoring (04 September) recorded only 90 000 spawners in the spawning grounds. Pink salmon was distributed in the middle of the river flow; only small clusters were found in liman and in the lower flow. Sea seines installed near the riverbed were monitored too. Most of seines were filled with fish. That is why in 4 days (08 September) one additional flight was performed in the lower and middle flows and in river tributaries. This aerovisual monitoring recorded more than 350 000 Pink salmon spawners. However, for Opala river this number is lower than its long term average level for even number year (2,3 million spawners from 1984). Some undercount is possible, as Opala river in the lower flow has some characteristics that make assessment difficult (depth, bottom color, vegetation), but that is not an indication that aerovisual monitoring results were underestimated.

### **1.1.5 Silver salmon**

Silver salmon spawners in Opala river were monitored on 08 October 2018. Most of Silver salmon spawners were found in the river, where about 6 500 spawners were counted, in its tributaries Silver salmon was sparse, in all main tributaries about 600 spawners were found. Total counted number is 7 100 spawners, which is significantly lower than the long-term average level (14 500 spawners for the whole period of monitoring). Some undercount is possible due to late and prolonged spawning season that makes it difficult to count.

## **1.2 Kol river**

Total 3 aerovisual flights were performed to explore Kol river spawning ground. The first flight was performed on 07 August 2018 that counted 120 000 King salmon spawners, 350 000 Red salmon spawners, 39 000 Chum salmon spawners and 4 350 000 Pink salmon spawners. King salmon and Red salmon were undercounted as there was no specialized flight for King salmon and its spawning period by the beginning of August had finished. Red salmon assessment was complicated due to the extremely high Pink salmon run, plus historically only a small amount of Red salmon spawn in Kol river.

The second aerovisual flight was done on 30 August 2018; tributaries, Kol Levaya and Kol Pravaya, were explored. 350 000 Red salmon spawners, 15 000 Chum salmon spawners (9 000 spawners in Kol river and 6 000 spawners in Levaya Kol), 9 300 000 Pink salmon spawners in Kol river, 1 400 000 Pink salmon spawners in Levaya Kol river, 400 000 in Pravaya Kol river and 85 000 in lower tributary of Kol river were counted.

Chum salmon was counted in the period optimal for it, and its run to Kol river was at the sufficient level.

Pink salmon run in summer-fall 2018 in Kol river basin was very high, that has not been seen in other years. Pink salmon run exceeded the optimum in few times.

During the transit flight from Kikhchik river to Vorovskaya river on 27 September 2018 Silver salmon run was assessed in Kol riverbed. However, only Pink salmon was seen. Silver salmon was seen only in liman. Liman shore was covered with dead Pink salmon with unspawned roe and milt. A big aggregation of thousands of dead Pink salmon spawners were seen in the north of liman (Pic.1)

### **Pic.1. Dead Pink salmon in the estuary of Kol river**

The third flight was performed on 11 October 2018 to count Silver salmon in spawning grounds of Kol river as well as to assess the conditions of fish and spawning grounds in extremely high Pink salmon run. 12 500 Silver salmon spawners in Kol river and 350 000 in Levaya Kol river were counted. During the monitoring some clusters of dead Pink salmon including female spawners with unspawned roe was seen along the river sides.

## **1.3 Vorovskaya river**



Total 3 monitoring flights were performed to explore Vorovskaya river spawning grounds. The first flight was on 01 September 2018 to count Chum, Pink and Red salmon. Vorovskaya river and its first-order tributary – Srednyaya Vorovskaya were explored.

The second flight was on 27 September 2018 that explored all Vorovskaya river to assess salmon and spawning ground conditions in extremely high Pink salmon run in the West Kamchatka rivers and Vorovskaya river in particular.

The third flight was done on 11 October 2018 to assess Silver salmon spawners in spawning grounds of Vorovskaya river.

Total flight time is 5 hours.

Hydrological regime in Vorovskaya river basin during the monitoring was favorable.

### **1.3.1 Red salmon**

Red salmon spawning population in Vorovskaya river is exposed to significant yearly fluctuations, but in general is within a low level. Long term average escapement level from 2001 until now is about 13 000 spawners, maximum - 58 000 spawners. In 2018 extremely high Pink salmon run made it difficult to fully assess Red salmon as in dense clusters of Pink salmon it was difficult to identify Red salmon. The only place, upper flows of Srednyaya Vorovskaya river, 200 000 Red salmon spawners were counted.

### **1.3.2 Chum salmon**

Chum salmon is the second largest in stock in Vorovskaya river after Pink salmon. Chum salmon catch for the last 30 years reached 2 450 MT during the fishing season, but recently its catch has decreased. Long term average escapement from 2001 until now accounts for 36 000 spawners within the range between 1 000 to 83 000 Chum salmon spawners. In 2018 Chum salmon escapement reached 100 000 spawners and is estimated as high. However, during monitoring flights in October for Silver salmon, some dead Chum salmon that failed to spawn was found. That is why it is complicated to assess spawning quality and real Chum salmon escapement level. Extremely high Pink salmon run could possible effect spawning of Chum salmon.

### **1.3.3 Pink salmon**

Pink salmon run in summer-fall 2018 in Vorovskaya river basin was very high that has not been seen in other years. Pink salmon filled all the river from the lower flow where it formed large and thick clusters with 70-100 000 spawners up to upper flows where its clusters were sparse. In the left tributary, Srednaya Vorovskaya river, the density of Pink salmon clusters were lower, but here the total number of salmon was significant; a few clusters of Pink salmon were seen near the waterfall which is a serious obstacle for Pink salmon, in the upper flows of the river. Total 16,5 million Pink salmon spawners were counted in Vorovskaya river which is almost thrice bigger than of the previous record (6,83 million) in 1983, and in 6 times exceeded long term average level for even number year – 2,7 million.

Salmon run lasted till the beginning of October. During the monitoring flights conducted on 27 October 2018 a few stops were made on the riverbank to explore Pink salmon spawning grounds. In some parts the number of dead fish reached up to 50-70 000 spawners (Pic 1.)

***Pic.1 Cluster of dead unspawned Pink salmon in the middle flow of Vorovskaya river.***

A large number of dead females with unspawned roe was seen. On the ground along the river sides and in the water, spawned but washed off roe was found.

In general, spawning grounds were overpopulated in the lower and middle flows of the river that can have a negative effect not only on Pink salmon population but also on other Pacific salmon spawning in the river. On the other hand, relatively low density of Pink salmon population in upper flow of Vorovskaya river and partially in Srednaya Vorovskaya river gives hope for a quality salmon spawning in these spawning grounds without drastic negative effect on the future stock.

#### **1.3.4 Silver salmon**

Spawning run of Silver salmon in Vorovskaya river with extremely high Pink salmon run began later than usual. Only 3 500 spawners were counted which is lower than long term average level (26 500 spawners). In the upper flow of Vorovskaya river and its main tributaries Silver salmon was seen sparse or with small clusters 5-10 spawners. Main clusters were seen in the lower flow in place where Bolshaya and Srednyaya Vorovskaya rivers merge. In this place the river branches out for many tributaries and Silver salmon unevenly get distributed there in small clusters. It should be noted that space distribution in the river during the monitorings showed that salmon just started to come to the river and regardless the optimum period of monitoring significant undercount could take place in spawning grounds of Vorovskaya river.

## CONSLUSION

Opala, Kol and Vorovskaya rivers are important for spawning. 6 Pacific salmon species spawn in the basins of these rivers. Monitored river basins belong to the area where dominant spawning species spawn: Pink and Chum salmon.

In long term assessment it should be noted that in 2018 Chum salmon was counted 3 times more, Red salmon – 4 times more than long term average level. In general, spawning of these species in Opala river can be assessed as close to optimal. Silver salmon was counted less than expected (including high run of Silver salmon in the West Kamchatka) but some undercount is possible too.

The aerovisual monitoring in Opala river counted **2 445 King salmon, 133 310 Chum salmon, 352 250 Pink salmon, 25 000 Red salmon, 12 850 Silver salmon** (see table 1).

In Vorovskaya river in 2018 Pink salmon run and escapement level was characterized as extremely and abnormally high. Salmon spawned in all the river, up to the upper flows and in all tributaries. Chum salmon spawners in this river can be assessed as optimal. However, it is possible that not all salmon could spawn due to the shortage of space in spawning grounds occupied by Pink salmon. Special monitorings for Pink salmon were not conducted. Pink salmon run was assessed during spawning migration of Pink and Chum salmon which do not correspond to optimal periods for Red salmon assessment. As far as Silver salmon is concerned, it should be noted that despite the optimal period for monitoring some undercount is possible.

Aerovisual monitorings in Vorovskaya river counted **100 000 Chum salmon, 16 400 Pink salmon, 200 000 Red salmon, 3 500 Silver salmon** (see table 2).

In Kol river in 2018 Pink salmon run and escapement level are characterized as extremely and abnormally high. Salmon spawned in all the river, up to upper flow and in all tributaries.

Chum salmon population in Kol river can be characterized as optimal. But it is possible that not all salmon participated in spawning due to the shortage of space in spawning grounds occupied by Pink salmon.

Special monitorings for Red salmon were not conducted. The number of its run was assessed during the spawning migration of Pink and Chum salmon that do not correspond to optimal periods for Red salmon assessment.

Silver salmon assessment in Kol river was done in the optimal period. Spawning escapement was estimated as good.

Aerovisual monitoring counted **1 000 King salmon, 54 000 Chum salmon, 11 185 000 Pink salmon, 700 000 Red salmon, 12 850 Silver salmon** (see table 3).

<b>date</b>	<b>river</b>	<b>Tributary 1</b>	<b>Tributary 2</b>	<b>Tributary 3</b>	<b>King salmon</b>	<b>Red salmon</b>
20.07.18						
	Opala				25	150
		Savan			2 400	23 000
			Leviy Savan		20	1 750
			Praviy Savan			55
04.09.18	Opala					
		Savan				
08.09.18	Opala					
		Savan				
08.10.18	Opala					
				Sr. Opala		
				Levaya Opala		
				Levaya Opala		
		Savan				
<b>TOTAL</b>					<b>2 445</b>	<b>24 995</b>

**Table 1. Counted Pacific salmon spawners in Opala river basin in 2018, thousand**

<b>date</b>	<b>river</b>	<b>Tributary 1</b>	<b>Red salmon</b>	<b>Chum salmon</b>	<b>Pink salmon</b>
01.09.18					
	Vorovskaya			100000	1 4500 000
		Srednyaya Vorovskaya	200		1 900 000
27.09.18	Vorovskaya			flight	
11.10.18					
	Vorovskaya				
<b>TOTAL</b>			<b>200</b>	<b>100 000</b>	<b>1 6400 000</b>

**Table 2. Counted Pacific Salmon spawners in Vorovskaya river in 2018, thousand**

**Table 3. Counted Pacific Salmon spawners in Kol river in 2018, thousand**

<b>date</b>	<b>river</b>	<b>Tributary 1</b>	<b>King salmon</b>	<b>Red salmon</b>	<b>Chum salmon</b>	<b>Pink salmon</b>	<b>Si</b>
07.08.18	Kol		120	350	39 000	435 000 (preliminary data)	
30.08.18	Kol			100	9000	9 385 000	
		Levaya Kol		250	6000	1 400 000	
		Pravaya Kol				400 000	
15.10.18	Kol						
		Levaya Kol					
<b>TOTAL</b>			<b>120</b>	<b>700</b>	<b>54000</b>	<b>11 185 000</b>	