

**Results of the “Identification of tagged Chum salmon in returns to "Kurilsky" and "Reidovy" Hatcheries in 2013”.**

The project on the contract No. 04-658/2014-NIR with JSC Hidrostroy of August 06, 2014 on the subject of "Identification of tagged Chum salmon in returns to "Kurilsky" and "Reidovy" hatcheries in 2013" is completed.

The main objective of research was identification of hatchery chum salmon with otolith tags in returns to "Kurilsky" and "Reidovy" hatcheries.

Results of tags identification are presented in the table (tab. 1).

Table 1 – Material and results of identification of tagged chum salmon in returns to “Kurilsky” and “Reidovy” hatcheries in 2013.

Collection date	Collection location	Sample size	Release 2011	Release 2010	Release 2009
“Kurilsky” hatchery					
11.10.13	Kurilka river mouth	90	1	3	9
14.10.13	broodstock site of “Kurilsky”	94	2	5	8
21.10.13	Kurilka river mouth	98	3	3	5
24.10.13	broodstock site of “Kurilsky”	100	1	4	9
30.10.13	broodstock site of “Kurilsky”	100	3	7	1
31.10.13	Kurilka river mouth	100	7	2	0
07.11.13	Kurilka spawning grounds	50	1	6	3
Total # of otoliths from the “Kurilsky” area – 83		632	18	30	35
Lebedinoe lake					
18.10.13	Besimianny creek	48	1	0	0
30.10.13	before Zmeyka river	46	1	1	1
10.11.13	lake spawning grounds	6	0	0	0
13.11.13	Oziorny creek	10	9	0	0
Total # of otolithes from Lebedinoe Lake area -13		110	11	1	1
“Reidovy” hatchery					
08.10.13	broodsock site of “Reidovy”	98	9	41	31
18.10.13	broodsock site of “Reidovy”	98	10	43	35
23.10.13	Reidova river mouth	99	5	49	31
05.11.13	broodsock site of “Reidovy”	97	18	51	15
07.11.13	Krokhaliny creek	49	1	10	30
Total # of otolithes in “Reidovy” area – 379		441	43	194	142
Overall – 475 otoliths.		1183	72	225	178

## Short discussion of results

**Characteristic of material.** Otoliths were sampled from the catches of chum salmon at the broodstock sampling sites of “Kurilsky and “Reidovy” hatcheries and in the mouths of the hatcheries base rivers. Some samples are collected on spawning grounds of Kurilka river, Krokhalinaya river (tributary of Reidova river) and Lebedinoe Lake, located in vicinities of “Kurilsky” hatchery (fig. 1).

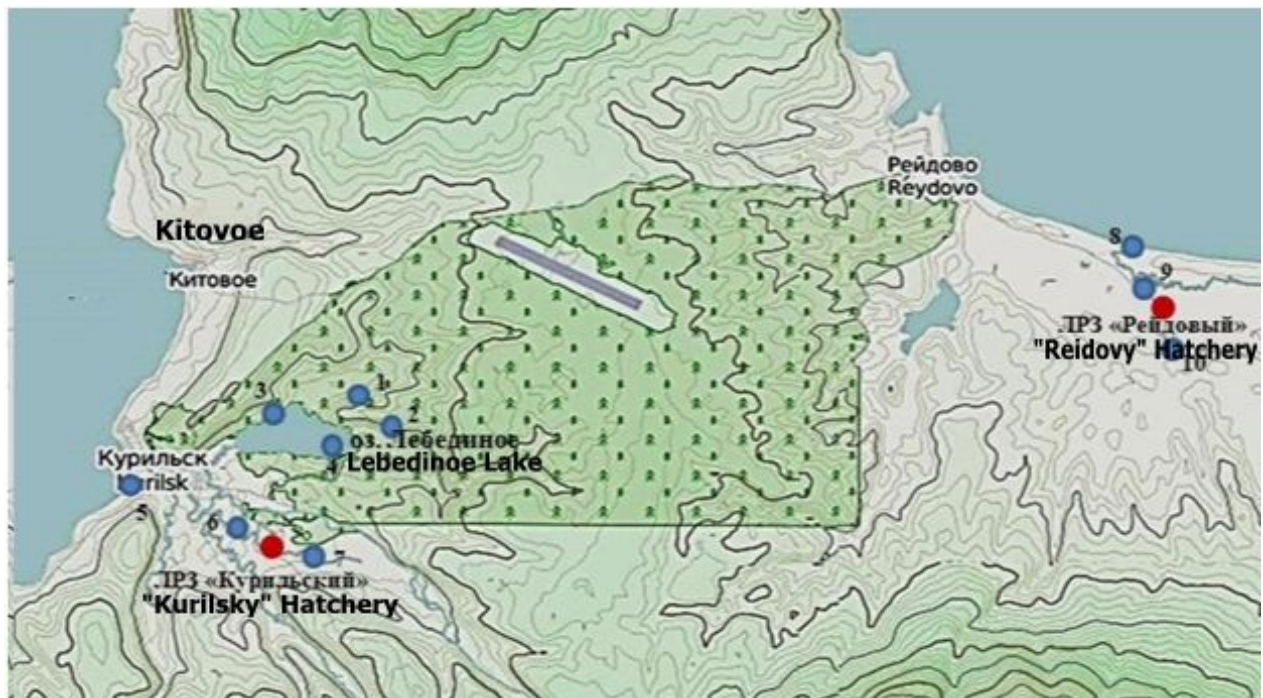


Fig. 1 - The scheme of "Kurilsky" and "Reidovy" locations and chum salmon otoliths sampling sites in 2013: 1 – Bezimianny creek; 2 – Oziorny creek; 3 – spawning grounds before Zmeka river; 4 - spawning grounds before Bezimianny creek ; 5 – Kurilka river mouth; 6 – broodstock sampling site of “Kurilsky” hatchery; 7 - spawning grounds of Kurilka river; 8 – Reidova river mouth; 9 – broodstock sampling site “Redovy” hatchery; 10 – Krokhaliny creek.

Overall 1216 otolith samples were collected. Some otoliths had aberrant center or crumbled at storage and the subsequent transportation, thus only 1183 samples were usable for analysis.

Tagged chum salmon expected in return of 2013 to Kurilsky and Reidovy bays could be presented by age groups 2+, 3+ and 4+ from release of “Kurilsky” and “Reidovy hatcheries. The tags used for chum salmon from generations of 2008-2010 on "Kurilsky" hatchery are presented in figure 2.

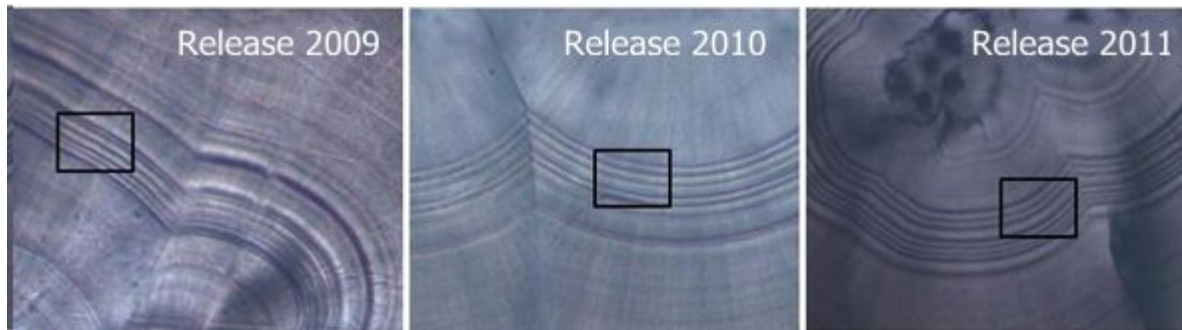


Fig. 2 – Otolith tags in “Kurilsky” hatchery release in 2009-2011.

The tags used for chum salmon from generations of 2008-2010 on "Reidovy" hatchery are presented in figure 3.

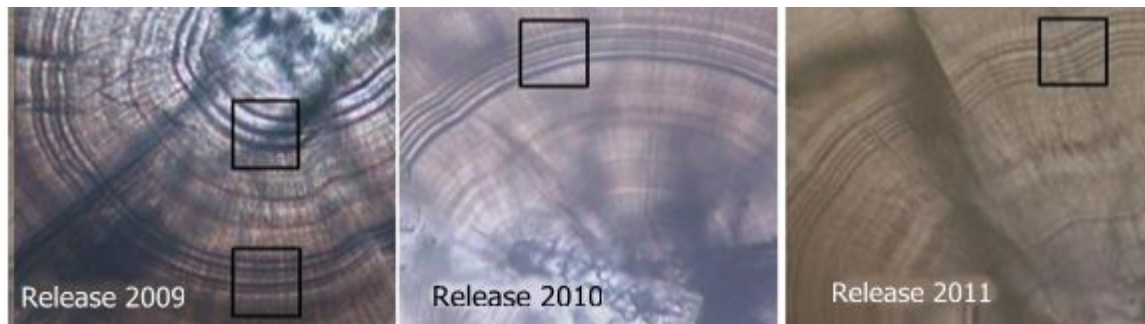


Fig. 3 – Otolith tags in “Reidovy” hatchery release in 2009-2011.

First tags from “Kitovy” hatchery, which is located in close proximity to the bay were found in return of 2013 (age group 2+). Tagging was done at “Kurilsky” hatchery then fries were transported to "Kitovy" hatchery. Despite the fact that all fries had the same tag, tags from the different hatcheries had noticeable otoliths microstructure difference because of the different hydrological conditions in the period of an incubation and feeding (fig. 4).

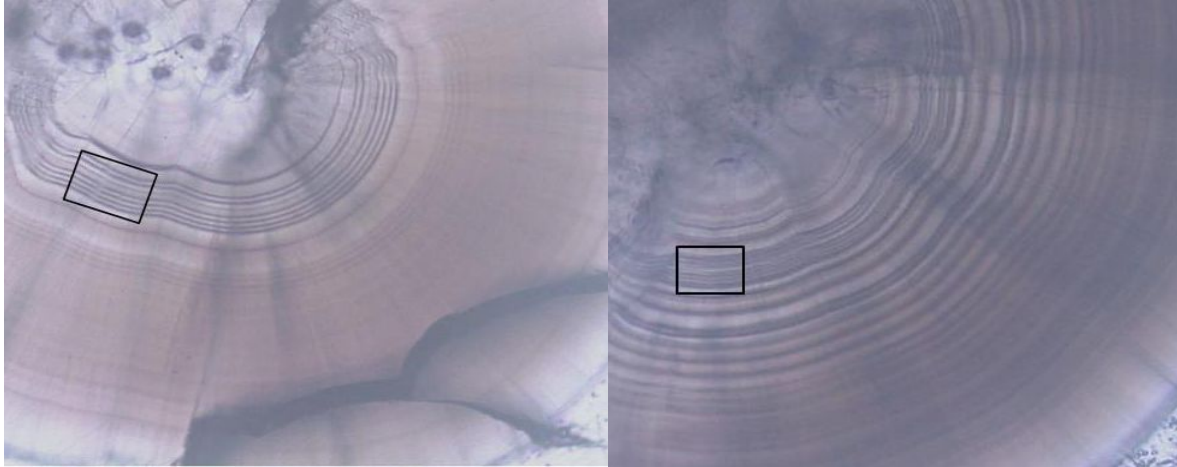


Fig. 4 – Tags on fry otoliths from “Kurilsky” (at the left) and Kitovy” (on the right) hatcheries in release of 2011.

Along with "Kurilsky", "Reidovy" and “Kitovy” hatcheries tags, 2011 tags from "Bukhta Olia” hatchery (located in Prostor Bay) could be present in chum salmon returns in 2013 (fig. 5).

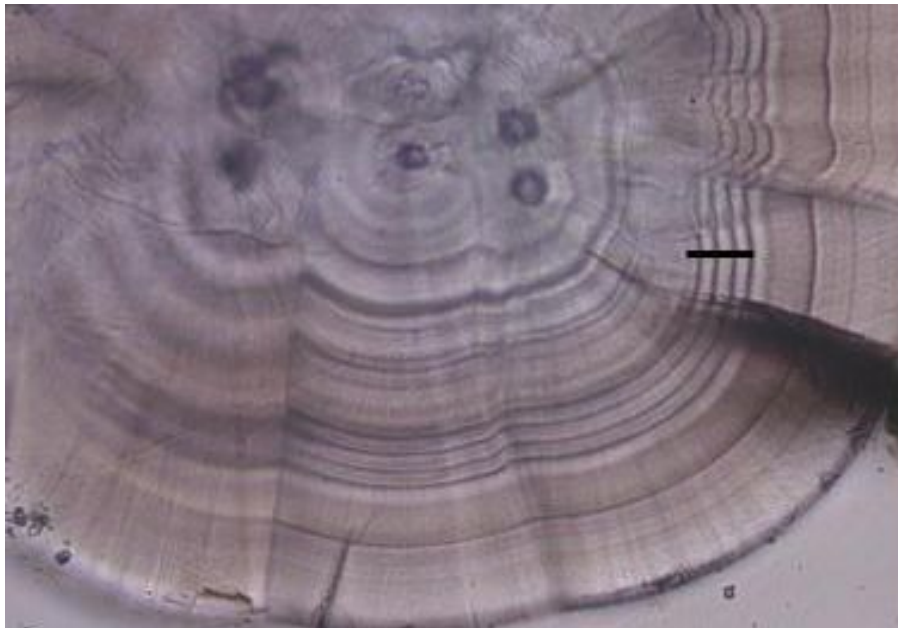


Fig. 5 – Tags on fry otoliths from “Bukhta Olia” hatchery in release of 2011.

**Age structure.** The otoliths samples were taken mainly from chum salmon of age 3+ and 4+ (47 and 41%, respectively) (fig. 6). Age group 2+ made 10%, 5+ age group made only 2% of the total number of samples.

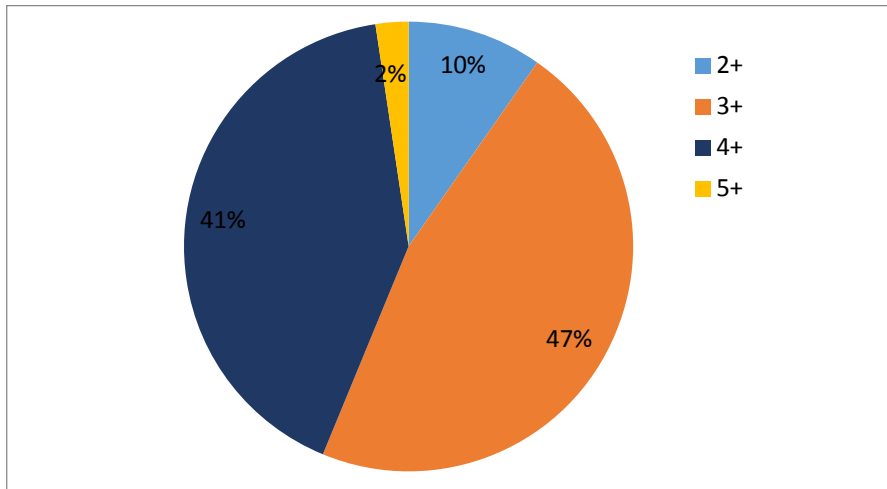


Fig. 6 - Age structure of chum salmon in return of 2013 in "Kurilsky" and "Reidovy" hatcheries area.

There was only slight difference in age structure of the samples from this hatcheries and from Lebedinoe Lake spawning grounds (fig. 7).

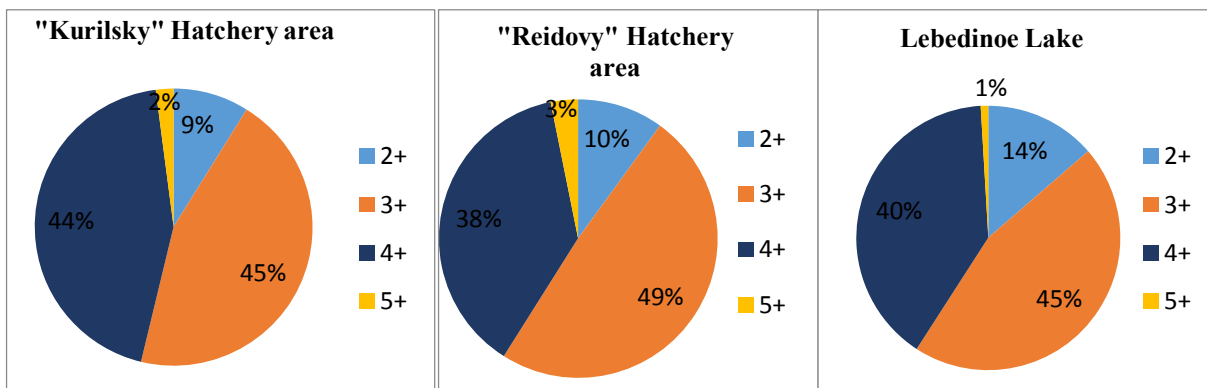


Fig. 7 – Share of different age groups in the samples from return of 2013 to "Kurilsky", "Reidovy" hatcheries and Lebedinoe Lake.

Dynamics of a ratio of chum salmon age groups during the sampling period in different areas also had the general character – the gradual increase in number of younger groups was noticed (fig. 8, 9).

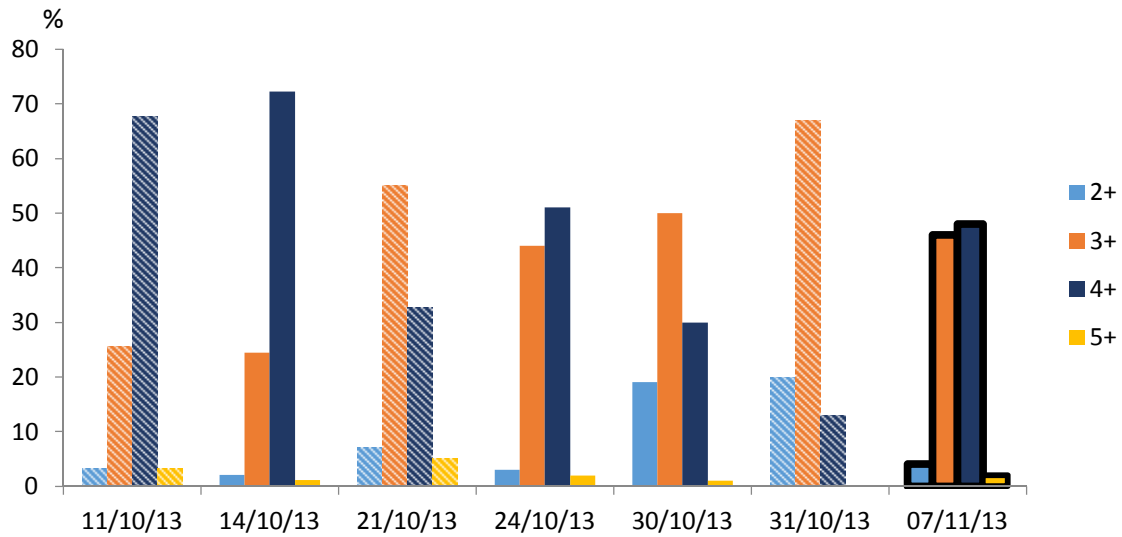


Fig. 8 – Age structure of chum salmon in return to "Kurilsky" hatchery in 2013: samples from the mouth of Kurilka river are shaded; samples from the hatchery broodstock take site are not shaded; the black bordered samples are from the spawning grounds of Kurilka river.

Age group 5+ was present in the samples but in low numbers up to 5,1%.

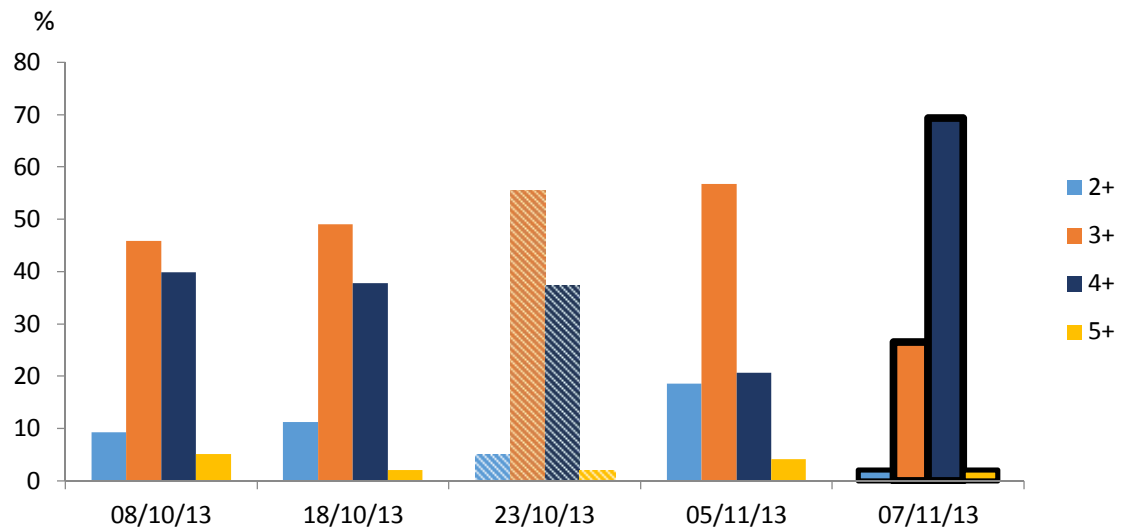


Fig. 9 – Age structure of chum salmon in return to "Reidovy" hatchery in 2013: samples from the mouth of Reidova river are shaded; samples from broodstock take site of the hatchery are not shaded; the black bordered samples are from the spawning grounds of Krokhaliny creek.



Age groups composition in the samples from Lebedinoe Lake is different - age group 4+ was gradually increasing in numbers, age group 3+ was gradually decreasing (fig. 10). The younger age group (2+) in this area was in general presented by a small number (fig. 7) and made 90% in the latest, small sample (10 otoliths) from the spawning grounds of Oziorny creek.

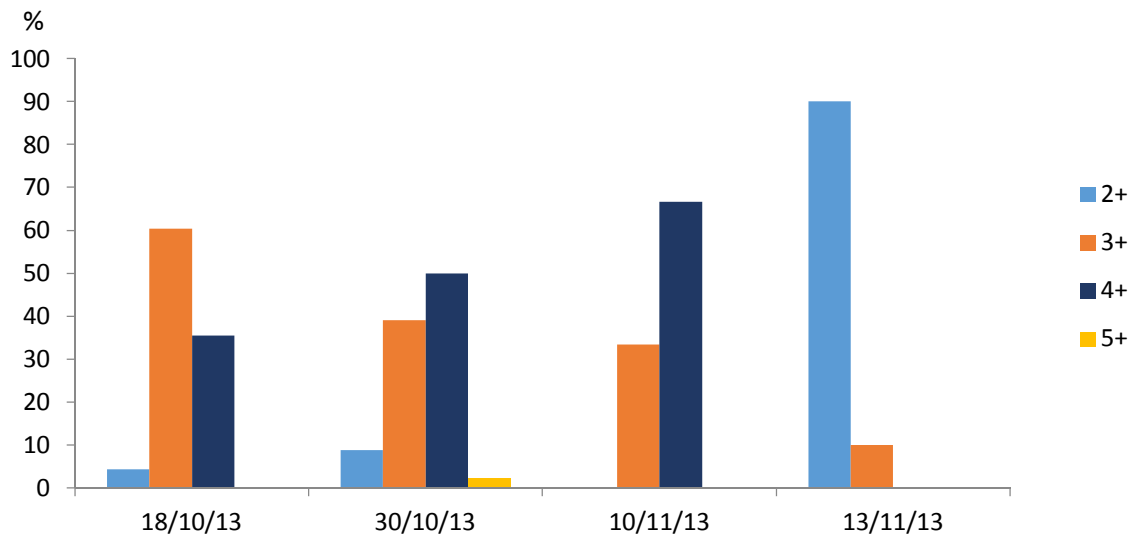


Fig. 10 – Age structure of chum salmon in the samples from the Lebedinoe Lake spawning grounds in 2013.

### Assessment of chum salmon origins

As a result of the analysis of 1183 otoliths microstructure of chum salmon 475 tagged otoliths were found, 96 – in “Kurilsky” hatchery area and 379 – in “Reidovy” hatchery area (tab. 1). Majority of the tags originated from "Kurilsky" and "Reidovy" hatcheries, 6 otoliths had a tag of "Kitovy" hatchery. One otolith from the mouth of Kurilka river had Japanese tag (age 3+). No tags of "Bukhta Olia" hatchery were found in returns to "Kurilsky" and "Reidovy" hatcheries.

All tags from the return to "Reidovy" hatchery originated from this hatchery.

Only one tag (2010 release) belonging to “Reidovy” hatchery found in the samples from “Kurilsly” hatchery area.

Considering 100 % annual tagging at the "Reidovy" hatchery we can assume minimal straying of chum salmon released from this hatchery. At the "Kurilsky" hatchery only 12-20% of release is tagged, thus absence of "Kurilsky" tags among a small number of the analyzed otoliths sampled in the Prostor Bay does not allow to estimate straying intensity. This question demands further research.

**"Reidovy" hatchery.** Total of 379 tags originated from this hatchery were identified, more than a half of which were presented by age group 3+, the share of five-year-old group was a little smaller - 38% (fig. 11). The smallest was youngest age group (11% from release 2011).

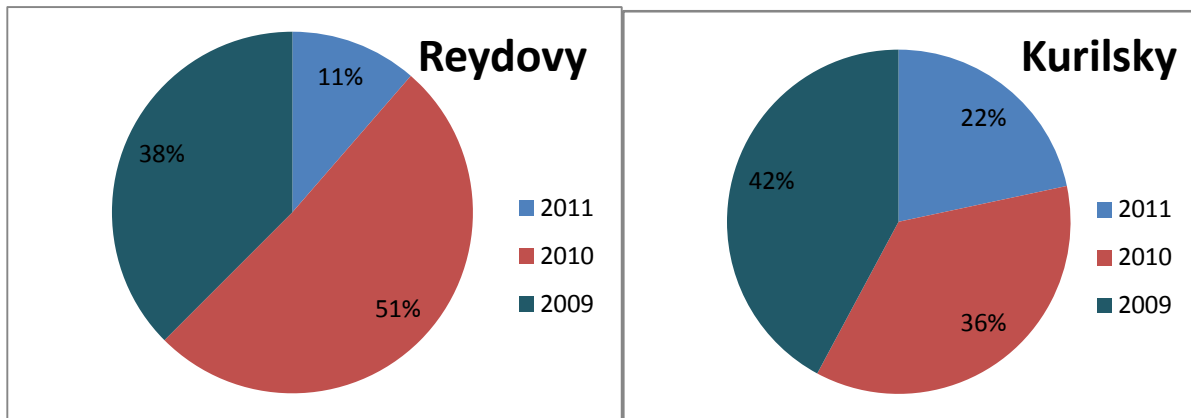


Fig. 11 - Share of different age groups in the samples of chum salmon in return of 2013 to "Reidovy" (at the left) and "Kurilsky" hatcheries (on the right).

The share of the hatchery origin chum salmon was high during spawning run and made 82,7 to 89,8% both on a broodstock take site, and in the mouth of the river (tab. 2). Approximately the same number of tagged chums was found on a spawning grounds of Krokholiny creek, tributary of the base river of the hatchery.



Table 2 – Share of different age groups of tagged chum salmon in 2013 return to “Kurilsky” and “Reidovy” hatcheries.

Collection date	Collection location	Tags, %	Tags by age groups, %			
			2+	3+	4+	5+
“Kurilsky” hatchery						
11.10.13	Kurilka river mouth	13,4	33,3	13	14,8	0
14.10.13	broodstock site of “Kutilsky”	15,3	100	21,7	11,8	0
21.10.13	Kurilka river mouth	11,2	42,9	5,6	15,6	0
24.10.13	broodstock site of “Kutilsky”	14	33,3	9,1	17,6	0
30.10.13	broodstock site of “Kutilsky”	11,1	15,8	14	3,3	0
31.10.13	Kurilka river mouth	9,1	35	3	0	0
07.11.13	spawning grounds of Kurilka river	20	50	26,1	12,5	0
Lebedinoe Lake						
18.10.13	Bezimianny creek	2,1	50	0	0	0
30.10.13	before Zmeyka river	6,5	25	5,6	4,3	0
10.11.13	lake spawning grounds	0	0	0	0	0
13.11.13	Oziorny creek	90	100	0	0	0
“Reidovy” hatchery						
08.10.13	broodstock site of “Reidovy”	82,7	100	91,1	79,5	0
18.10.13	broodstock site of “Reidovy”	89,8	90,9	89,6	94,6	0
23.10.13	Reidova river mouth	85,9	100	89,1	83,8	0
05.11.13	broodstock site of “Reidovy”	86,6	100	92,7	75	0
07.11.13	Krokhliny creek	83,7	100	76,9	88,2	0

In the age group 4+ share of hatchery chum made 75 to 94,6%, age group 3+ contained mostly hatchery chum as well (from 76,9 to 92,7%). About 100% of the youngest age group (2+) was chum salmon of the hatchery origin. The origin of chum salmon in small age group 5+ was impossible to determine because the generation of 2007 was not tagged.

**“Kurilsky” hatchery.** Total of 83 tagged otoliths of chum salmon were found. Mainly from age groups of 3+ and 4+. Their share was equal and together they made near 90% (fig. 11). The share of tags in younger age group (2+) was higher than on “Reidovy” hatchery and made 22%.

Throughout the spawning run the share of “Kurilsky” hatchery tagged chum salmon changed from 9,1 to 15,3% (tab. 2).

On the spawning grounds of Kurilka river, where we sampled only once, 20% of otoliths had tags. Considering that “Kurilsky” hatchery annual release of tagged chum is pretty low (12 to 20%), it is possible to assume that at high survival level the main part of returns to "Kurilsky" hatchery is of a hatchery origin. More exact conclusions can be made based on the further research directed towards an assessment of return numbers and survival assessment of "Kurilsky" hatchery chum salmon.

**Lebedinoe Lake.** Low number of tagged chum salmon was found in the samples from spawning grounds of the lake. Total 23 tags from different age groups: 4 – release of 2009, 7 – release 2010 and 12 – release 2011.

The share of tags in the lake samples did not exceed 6,5%, except for the sample of 10 otoliths collected in the middle of November in Oziorny creek, 90% of them had a tag type 3.4H and were of age 2+ (tab. 2).

Comparison of the otoliths microstructure of these group against releases 2011 from “Kurilsky” and “Kitovy” hatcheries showed that 6 tags belonged to ”Kitovy” hatchery (fig. 4). The rest 3 tags were identified to be of "Kurilsky" hatchery origin.

To explain the presence of such considerable number of tagged chum from the single age group in a single small sample from the lake tributary spawning grounds more precise sampling is required. It is necessary to mention that the most of the discovered tags were of “Kitovy" hatchery origin. Part of chum release 2010 was incubated and tagged at “Kurilsky” hatchery, but fed and released at "Kitovy" hatchery, which could lead to decrease in a homing ability of spawners.

### **Conclusion**

1. Returns of chum salmon to the base rivers of “Kurilsky” and “Reidovy” hatcheries are mostly of the hatchery origin. Share of the hatchery chum salmon in Reidova river returns makes 80 to 90%. To estimate the size of hatchery chum return in Kurilka river assessment of survival rate of "Kurilsky" hatchery chum salmon is necessary.

2. Based on resulting data we can conclude that there is no exchange of spawners between “Kurilsky” and “Reidovy hatcheries.
3. Straing of “Kurilsky” hatchery chum salmon to the different basins in the hatchery area exists. For more exact assessment it is necessary to expand research on the basins which are not part of the base river systems of "Kurilsky" and "Reidovy" hatcheries.
4. To estimate the size of hatchery chum salmon return it is necessary to assess the share of hatchery chum in catches.