Partial Identification Results of Tagged Pink Salmon Returning to Iturup Island in the Years 2010-2011.

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Tagging of salmon at the hatcheries of ZAO "Gidrostroy" has been carried out within the scope of fishery certification requirements. The purpose of the work was to evaluate the proportion between natural and hatchery fish reproduction at the approaches to hatcheries during commercial catches, to estimate the proportion of hatchery-origin salmon passing to spawning grounds.

As we consider the results of pink salmon return identification within the years 2010-2011, we shall also be evaluating the release of tagged juveniles in the years of 2009 and 2010.

Fig. 2. Release volume of tagged pink salmon juveniles in 2009 composed: at "Reidovoy" hatchery was 100% of the release; at the "Kurilskiy" hatchery it was 10.8 %.

In 2010 equaled the same 100% tagging in "Reidovoy" hatchery but 84.3% of the pink salmon juveniles released at "Kurilskiy" hatchery.

All tags were sufficiently observable to provide correct determination of pink salmon origin in the return. Figs. 3 – 6.

Fig.3. Dry method of tagging was implemented in "Kurilskiy" hatchery, as it was impossible to use a thermal method there at the time. Tags on pink salmon otoliths are very thin but very distinct, as there were just a small number of structural elements on the otoliths, and they were mainly formed after tagging.

Fig.4. Based on the results of the first year, in the second year of work we chose a mode that is more appropriate to the hydrologic characteristics of the hatchery. Tags on chum salmon otoliths are always more distinct than on pink salmon due to the peculiarities of the otoliths structure. They came out perfectly well from the very beginning of the project.

The only issue that may arise when tagging in this hatchery is the insufficient clearness of one of the tag strips on some embryos. It may be connected to the un-careful mixing of roe after the subsequent drainage of the incubator. It may also be the individual response of a particular fish to the tagging factor. As a rule, such tagging error does not disturb the overall picture and does not question the correctness of determination of salmon origin. A collection of otoliths of every group is being formed annually and kept in SakhNIRO. When needed we can always compare otoliths of spawners with the collection of otoliths of juveniles.

Fig. 5. Tagging at "Reidovoy" Fish Hatchery is being carried out thermally. The tags turned out to be observable perfectly well, but there was also a challenge. Within the first year of work we have been changing water temperature to form a thermal tag for all fish breeding production (both for pink salmon and chum salmon). We raised the temperature for chum salmon, reducing it at the same time for pink salmon. Warm water discharge is a very efficient option for tagging. The problem was that all fish for tagging had to reach not less than 320 grams/day. Roe cannot be disturbed prior to this, as otoliths have

not appropriately been formed yet. When the last groups of chum salmon are ready for tagging, the first groups of pink salmon have already hatched. Under variation of temperature within 3 degrees, the tags are hardly visible on the otoliths of such adult fish. A much greater gradient is necessary, which in turn, may have a negative impact on the development of juveniles.

Fig.6. To provide a better quality of tags in 2010, we marked first 10 batches of pink salmon roe using dry tagging in order to clearly recognize them.

Henceforward, fish breeders in "Reidovoy" fish hatchery found the way to tag chum salmon and pink salmon separately; in this case warm water works well.

The process of tagging itself is labor-intensive and a time consuming process. Tagging of one species lasts 3 to 4 weeks. Fish breeders in "Kitoviy" and "Olya Bay" hatcheries permanently carry out dry tagging during the whole of January, including weekends and holidays; daily draining water, filling in water and mixing roe in devices. In "Kurilskiy" and "Reidovoy" fish hatcheries, where they have two species, this process lasts twice longer – about two months. All this work is carried out due mostly to fish breeders enthusiasm, since they do not receive any extra payment. My efforts to provide bonuses for their work failed numerous times.

In 2010 we obtained our first results: The return of the pink salmon breed of 2008 took place, and allowed us to start the research connected with the determination of fish origin.

Fig.7. Points of material collection are shown in the diagram.

The concept of collection was stipulated by the certification requirements: Samplings were performed at points of collection of roe in salmon hatcheries, in base rivers, in tributaries of base rivers and in the basins which are not included in the watercourse systems of hatcheries. Additionally, salmon otoliths were selected from fixed sea nets in the areas of Prostor and Kurilskiy Bays, where "Reidovoy" and "Kurilskiy" salmon hatcheries are located.

The samplings were selected as pink salmon was approaching the research area: Beginning from the first 10 days of July until the last 10 days of September. At first they collected material in the fixed nets and during the period when pink salmon were moving into the rivers, they continued to collect the material from catches of coastal fishing, made selection of otoliths in the mouths of base rivers, and then in the approaches to salmon hatcheries and spawning grounds.

Fig.8. In 2010 tagged individuals were observed **in Prostor Bay** in the first 10 days of August; their maximum was registered in the second half of September in the point of roe collection in the salmon hatchery, where their numbers reached 98%.

Within this period of time the number of hatchery-origin specimen in the mouth of the base river progressively grew but did not exceed 50%. At the fish registration barrier in the mouth of the base river it was equal to 90% in the last 10 days of September. At this point, in the analysis, dated September 22, up to 22% of the specimen tagged at Kurilskiy hatchery were registered.

Fig.9. In **Kurilskiy Bay** the first tagged specimen were registered at the end of August, although in July samplings were absent. In the middle of September their portion was equal to 98-100% both in the nearest nets to the river and in the distant part of the Bay.

At the same time, 74% of hatchery-origin fish was registered in a river mouth net and in the roe collection point, the registered portion of such fish did not exceed 20%.

Solitary specimens of spawners from Reidovoy Salmon Hatchery were also found in the catches of fixed nets at Kurilskiy Bay.

Fig.10. In the spawning grounds at the outskirts of Reidovoy hatchery, no Kuril fish were noticed; specimens from Reidovoy hatchery were observed among pink salmon which dropped in the Olya River.

Fig.11. Tagged pink salmon specimen from Reidovoy hatchery were also found in the vicinity of the Kurilskiy Salmon Hatchery, in Rybatskaya River. Kurilskiy pink salmon were observed only in the spawning grounds of the main riverbed of the base river of Kurilskiy Salmon Hatchery.

Thus, almost 100% of hatchery-origin pink salmon that approached the roe collection point and fish registration barrier of Reidovoy Hatchery were marked; and from 24 to 68% in the nets of Prostor Bay were registered at different times.

And a rather strange situation may be observed in the approaches to Kurilskiy Hatchery: The more distant from the hatchery the higher portion of hatchery-origin pink salmon were found.

There was noticed an insignificant straying of pink salmon from the Reidovoy Hatchery and also from Kurilskiy pink salmon to the base river spawning grounds.

The key results of the data obtained after the first year of recording are the determination of points for material collection and sampling intervals. That allowed the carrying out of our work in 2011 at a higher level.

Fig.12. The research area was increased in 2011. Material was collected in the roe collection points of hatcheries, combined with the collection in catches in separate fixed nets in Prostor and Kurilskiy Bays and added material collected from the main path of migration in the northern part of Iturup, around the Cape of Friz area and from both sides of the Cape.

Unfortunately, only single samplings took place in the spawning grounds as occurred in the previous year. This was connected not only with sampling complexity but with low approaches of pink salmon in 2011 also.

Fig.13. The portion of hatchery-origin pink salmon in net catches **in the north** was high (about 45% at the average in samples) and it was observed in all samplings within the whole period.

Two peaks of increase of hatchery-origin fish portion were recorded. It will be clarified later whether it is connected with the increase of quantity of hatchery-origin pink salmon or with population dynamics of the portion of the wild fish return.

Within the whole period of fishing, pink salmon from both Reidovoy and Kurilskiy salmon hatcheries was registered. Portions of pink salmon from the Reidovoy salmon hatchery were noticeably

reduced toward the end of the fishing period while at the same time the portion of pink salmon from the Kurilskiy salmon hatchery continued to remain substantial. In the catches at the Northern part of Iturup, two specimens released from Taranaiskiy and Sokolovskiy hatcheries (Sakhalin) were registered.

Fig.14. Net catches of fish in **Prostor Bay** contained a large degree of hatchery-origin pink salmon (about 70% by the end of August). Specimens from Reidovoy Salmon Hatchery dominated here at this time. Their portion significantly decreased as far as they were entering the river. The portion of the Kurilskiy Salmon Hatchery was high, especially by the middle of August (more than 40%).

Fig. *(not numbered)* Only hatchery spawners were registered in the small roe collection point #2 of Reidovoy Salmon Hatchery. More than 50% of wild fish and pink salmon from Kurilskiy Salmon Hatchery were observed in roe collection point #1 located in the migratory riverbed.

Fig. *(not numbered)* The **Kurilskiy Bay** tagged specimens were not noticed in July catches; hatchery-origin pink salmon began appearing from the middle of August, but by the end of the month net catches were almost 80% of hatchery-origin pink salmon. The major portion of the tagged specimens originated from Kurilskiy Salmon Hatchery.

The portion of the pink salmon from Reidovoy Salmon Hatchery found in the nets remote from the mouth of the base river (the diagram above) was more than 12%; at the same time, pink salmon were found only close to the mouth of Kurilka River (the diagram below). The portion of wild spawners increased in the first ten days of September.

Fig. 17. A number of brief but rather regular observations in the nets at the mouth of Kurilka River showed a gradual decrease of hatchery-origin fish, mostly pink salmon, from Kurilskiy hatchery, and specimens from Reidovoy Salmon Hatchery at the mouth of Kurilka River were registered sporadically.

Further collection of material took place in the roe collection point of the hatchery where the portion of the hatchery-origin pink salmon was high, and gradually reached 100% toward the end of September. All tagged specimens were of “Kurilskiy” Salmon Hatchery origin. Pink salmon from Reidovoy Hatchery were not registered in the river.

Fig. *(not numbered)* Samples taken from spawning grounds in 2011 revealed the presence of a considerable portion of hatchery pink salmon. Basically these were fish from Kurilskiy Hatchery being registered in all basins, except for Rybatskaya River, where material managed to be collected.

Therefore, in the roe collection point in Reidovoy Hatchery only one specimen from Kurilskiy Hatchery had been registered. But on the other hand, all other basins, including Reidovaya River, were visited by some pink salmon from Kurilskiy Hatchery.

Pink salmon from Reidovoy Hatchery demonstrated straying to a lesser extent, but still some specimens were registered in Slavnaya River and Krokholiniy Creek. Thereupon, having passed the hatchery of their origin, pink salmon visited Olya River and even reached Rybatskaya River. Such straying was registered in 2010. Pink salmon from Reidovoy Hatchery was not registered in the basic river of Kurilskiy hatchery.

The purpose of the work at this stage was not to determine the number of returns, but it should be still noted that the material obtained in 2011 allowed the first calculations to be carried out upon the analysis of the biological parameters of hatchery-origin and wild salmon in returns, as well as the statistics of fish catches in 2011.

Conclusions

1. As a result of the tagged pink salmon identification in the return of the years 2010-2011, data was obtained about the proportion between wild and hatchery-origin pink salmon in the areas of Reidovoy and Kurilskiy salmon hatcheries; in Prostor and Kurilskiy Bays; as well as the ways of migration to the spawning grounds of the Northern part of Iturup Island.
2. A significant portion of hatchery-origin pink salmon was registered in approaches to the basic rivers of hatcheries.
3. A significant part of catches in the year of 2011 was provided by the hatcheries activities.
4. In 2011 the straying portion for pink salmon from Kurilskiy Salmon Hatchery was larger than for the pink salmon from Reidovoy Salmon Hatchery; it may be connected with the longer period of spawning migration along the Iturup Island coast.
5. The initial data provides a supposition that a significant portion of hatchery-origin pink salmon migrate through the Friz Strait. At the same time, the registered presence of spawners with tags from Reidovoy Salmon Hatchery in net catches in Kurilskiy Bay, without visiting Kurilka River, can be explained by straying in the rivers of the Bay, or by the existence of other paths of migration.
6. The obtained data will become a basis for the development of calculation methods for counting quantity of the return of hatchery-origin pink salmon to Iturup Island.