Methodological instructions for the control of the escapement of Pacific Salmon spawners into the rivers of the Sakhalin Oblast through fish counting barriers

The present methodological instructions have been developed in order to organize the regulated escapement of Pacific Salmon spawners into rivers where Salmon fish hatcheries operate. In coordination with SakhalinRybVod and SakhNIRO, these instructions may also be utilized for organizing such operations on the other rivers of Sakhalin Oblast as well.

Regulation of Pacific Salmon escapement into the rivers presupposes the restriction of the numbers entering the river each day.

For these purposes, a fish counting barrier is erected so as to control the passage of fish and to permit a partial harvest of the surplus spawners, the temporary detainment of spawners and a daily counting of the number of fish allowed to enter the river.

The fish counting barrier is erected at the mouth of a river or tributary in coordination with and compliance with current law.

The regulation of salmon escapement into the rivers accomplishes the following goals:

- it allows the spawning sites to be filled with the optimal number of spawners;
- it provides for the harvest of the fish needed for purposes of artificial reproduction;
- it optimizes the conditions of the spawning run, preventing mass pre-spawning salmon mortality;
- it preserves the genetic diversity of the populations.

Control over the escapement of salmon is exercised by a fishing brigade working for the salmon hatchery, or by another fishing organization. The organization responsible for control of the escapement of spawners into the river appoints a manager for the project. All operations are conducted under the auspices of specialists from SakhalinRybVod.

Escapement control is conducted under a spawner escapement schedule developed on the basis of information on the presence of spawning areas for the respective salmon species and the salmon hatchery's need for spawners, and approved by SakhalinRybVod and SakhNIRO.

The salmon spawner reproduction escapement schedule

The total number of spawners for escapement is determined from the sum of the number of spawners needed for artificial and natural reproduction using the following formula:

$$N = N_e + N_i ,$$

where N_e is the number of salmon spawners needed for natural spawning (individuals);
and N_i is the number of salmon spawners needed for hatchery reproduction (individuals).

The number of salmon needed for natural spawning is determined by multiplying the spawning area of the river basin by the normal (recommended) number of spawners per square meter for the particular species.

$$N_e = S * n ,$$

where **S** is the area of the spawning site in square meters;
and **n** is the optimum number of salmon spawners needed to fill the spawning areas (individuals/square meter).

The spawning area of the river is taken from data presented in the documentation for the spawning waters, as approved by the organization responsible for listing the spawning waters.

The value for the optimum number of salmon spawners to fill the spawning areas is unique for each salmon species and individual bodies of water, and is determined in coordination with SakhalinRybVod and SakhNIRO.

Upon coordination of the spawner escapement schedule, the cover letter must show the calculated values used and the methodology for the calculations.

The number of spawners for artificial reproduction is calculated on the basis of the volume of the respective quotas (in the order for reproduction quotas allocated to the salmon hatchery for the

current year) and the applicable biological standards, where the average weight of spawners is indicated.

The numbers of spawners needed for natural and artificial reproduction obtained from the completed calculations are increased by 10% in order to compensate for pre-spawning mortality during the period of fish migration from the salmon hatchery to the roe collection station and the spawning grounds. If special circumstances occur that impact the pre-spawning survivability for a particular body of water, then the respective values for calculation that compensate for this are applied in coordination with SakhalinRybVod and SakhNIRO.

The total number of spawners needed for escapement into the river are distributed in proportion to the anticipated dynamics of the spawning run in five-day or ten-day periods.

Adjustments to the escapement schedule

During the course of the spawning run, the numbers of fish allowed through per day may be adjusted based on the results of the field study of the river by the SakhalinRybVod specialists to ensure an optimal number of fish at the spawning sites and rapid response to the hydrological situation. The total number of fish designated for escapement is not subject to change, except in extreme circumstances, such as the loss of spawning grounds or unfavorable hydrological conditions. In such cases, changes to the existing escapement schedule are made in the same manner and with the same type of coordination as in compiling a new escapement schedule.

Escapement schedules may be adjusted in the following cases:

- [*garbled words*] critical hydrological conditions in the lower reaches of the river and a danger of massive pre-spawning mortality. In this case, the fish escapement may be shifted within the time frame of the run, thereby preserving the genetic variability of the local population to the maximum possible extent and providing the necessary escapement numbers;
- the actual time frame of the run differs from the planned (average over many years);
- if a large discrepancy has been identified during the field study of the river between the escapement numbers and the actual amount of fish in the fiver (due to poaching, mass mortality, catastrophic escapement from flood).

The methodology of fish escapement for reproduction

The regulation of escapement for reproduction is carried out at the river mouth or at the roe collection station (if the river has a salmon hatchery in operation), in which case the nets at the roe collection station will take the place of a fish counting barrier. At the hatchery's roe collection station (salmon weir), the escapement schedule for spawners to pass through to the upriver spawning grounds must be kept on hand. This type of schedule is compiled in accordance with the rules and coordinated as stipulated in the present instructions.

The construction of the fish counting barrier must provide complete closure of the water stream from bank to bank, and must not lead to gilling of the fish (when mesh barriers are used). In construction, the fish counting barrier may be a simple mesh net for temporary accumulation of the fish, which has been rigged in such a way as to allow for the escapement of the spawner fish.

Before escapement, the counter, with the assistance of the fishermen of the fishing brigade, prepares a location for the escapement to occur. The web and trap barrier is then unfastened, or the floating panel is sunk with rocks or the pipes are pulled out of it, the pipes are pulled out of the belly of the trap, opening a passage for the fish in the fish counting barrier that is 0.5-1.0 meters in width and preferably no more than 0.5-0.7 meters deep. The optimal size of the opening for the fish and its location in the river are found experimentally. During the escapement, the time of passage through the barrier must also be considered. Usually, escapement is begun on an incoming tide or by visual observation of the fish approaching the fish counting barrier and striving to pass through it.

Depending on the volumes of escapement and the type of fish counting barrier, the following

methods can be used to count the fish escapement.

Full individual piece count

The counter counts all of the escapement fish. This method is used when the numbers of fish for escapement are small, or the spawners are striving with some intensity to move upstream. For convenience, it is expedient to use push-button hand counters, with each digit representing tens or hundreds of fish. If no push-button counters are available, then the "dot square" method of counting may be used, using each dot to also represent tens or hundreds of fish.

Temporal count

This method is used when the fish run is less intensive, but occurs evenly over time.

First, all of the fish are counted individually over a selected interval of time, usually 5-10 minutes. Then the time needed to allow the daily escapement amount is calculated. During the escapement, several more checks are made (full counts, usually three measurements per hour) over the same amount of time. All of the measurements are added together, and the average per unit of time is found, and the calculation is made for the entire period.

Example:
Today we need to allow an escapement of 5,000 fish.

1. *In 5 minutes, 100 fish passed through.*
   *Time needed is 5,000/100 * 5 minutes = 250 minutes*
   Number of measurements over 250 minutes - 12
2. *In 5 minutes, 88 fish passed through.*
3. *In 5 minutes, 72 fish passed through.*
4. *In 5 minutes, 104 fish passed through.*
5. *In 5 minutes, 111 fish passed through.*
6. *In 5 minutes, 92 fish passed through.*
7. *In 5 minutes, 98 fish passed through.*
8. *In 5 minutes, 100 fish passed through.*
9. *In 5 minutes, 84 fish passed through.*
10. *In 5 minutes, 98 fish passed through.*
11. *In 5 minutes, 98 fish passed through.*
12. *In 5 minutes, 78 fish passed through.*

Total: 1123 fish / 12 = 93 fish in 5 minutes.
To find the total escapement amount -
*250 minutes / 5 minutes * 93 fish = 4650 fish.*

Control over escapement

All calculations and data on the amount of daily fish escapement must be entered into a special log with sewn and numbered sheets. This log must bear a name indicating the fish counting barrier to which it refers, and must be registered in the fish conservation agency [RyboOkhrana].

During the spawning run, the SakhalinRybVod specialists are to monitor the numbers of fish at the spawning sites and the correspondence of the data in the log on fish escapement and its actual presence at the spawning sites. After each check, a notation to that effect is made in the log.

Upon completion of the spawning run, a report is compiled on the work completed on escapement of spawners. This report must indicate the location where the work was done (the name of the body of water, name of the fish hatchery to which the fish counting barrier belongs), the names of the persons who participated in the escapement work, the duration of the work, and the total number of spawners allowed through. If for any objective reason the numbers of fish allowed through does not correspond to the planned schedule, then this fact must also be reflected in the report and indication

made as to the reasons for this. This report must then be forwarded to SakhalinRybVod.

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