

PINK SALMON AND INTERACTION WITH COMPETITIVE SPECIES, EPIDEMIOLOGY AND OTHER ASPECTS

The project for Pink Salmon introduction originally had a number of serious flaws:

- interaction between Pink Salmon and Atlantic Salmon was not studied.
- it was not taken into consideration that a less valuable species was being introduced that could behave rather aggressively in the course of adaptation;
- transmission of diseases was not taken into consideration;
- possible negative reaction by the neighboring countries was not discussed: if Pink Salmon comes in their rivers, and the attitude of international organizations.

Already late in XX century these issues were burning, and, currently, with its adaptation and distribution in the new habitat, are becoming especially urgent.

- The interest in the issue of interaction between Atlantic Salmon and Pink Salmon emerged in 1970's when the pre-spawning numbers of the odd year line of the introduced species reached 100 thousand individuals and more.

- Dedicated studies of this issue practically were not performed.
- Facts confirming competitive and sometimes antagonistic relations, as well as facts confirming negative impact by the introduced species on the inhabited environment have been accumulated in the course of studies of biology of Atlantic salmon and Pink Salmon.

Food competition:

- Chironomidae larvae and nymphs, gnat larvae dominate in the diet of Pink Salmon larvae and downstream migrants; to a lesser degree, nymphs of stone fly and may fly.

- Pink Salmon fry feed very actively, and their indices of stomach fullness are very high.

- Salmon juveniles and juveniles of other aboriginal fishes (brown trout, grayling, whitefish, burbot, minnow, stickleback) feed on the same species.

- The diet of Atlantic Salmon and Pink Salmon fry coincide by 52.9%, and that of downstream migrants – by 22.9%.

- In the tributaries of the Ponoy River (425km) Pink Salmon fry are found in late June- early July.

- The average weight and length of Pink Salmon fry is 25-45mm and 0.2-0.4g, respectively.

- - The average weight and length of Atlantic Salmon fry is 24-26 mm and 0.12-0.14, respectively.

- With the higher growth rate, Pink Salmon fry consume food more actively and in larger amounts than Atlantic Salmon fry.

- As a result of young Pink Salmon being more active in feeding and more numerous, weaker and smaller Atlantic Salmon fry in some sections are pushed out and are short of food.

Consequently, Pink Salmon fry is, without doubt, a food competitor to Atlantic Salmon fry.

Also, interaction between Atlantic Salmon and Pink Salmon breeders is not simple. Some authors believe that Pink Salmon is not able to occupy the ecological niche of Atlantic Salmon because they prefer different spawning grounds, Pink Salmon spawns earlier than Atlantic Salmon, and the former is not able to destroy spawning redds of the latter. However, observations on a number of the Barents and White Seas' rivers of the Kola Peninsula show that competitive relations between these two species do exist.

Competition between breeders:

Pink Salmon coming into a river occupies pits and scares away Atlantic Salmon that comes later.

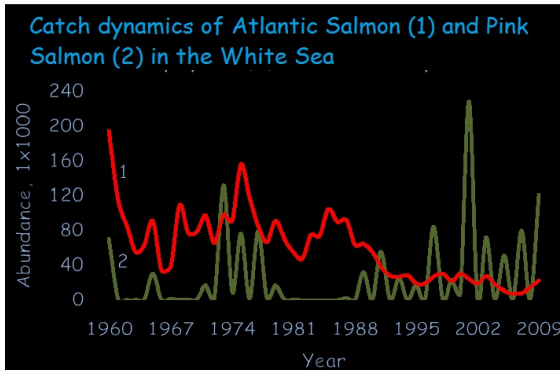
At the same spawning sites spawning redds of Atlantic Salmon and Pink Salmon have been found at a distance of 1-3 meters.

When opening spawning redds, eggs of both Atlantic Salmon and Pink Salmon were found in some of them.

In one of small White Sea rivers all spawning sites usually used by Atlantic Salmon were occupied by Pink Salmon.

Their number exceeded the number of Atlantic Salmon ca. 20 times, and several times exceeded the capacity of the spawning sites.

As a result, multiple use of the same spawning redds was observed. In the limited space conditions (in short and narrow rivers) when the numbers of spawning Pink Salmon exceeds the number of Atlantic Salmon breeders, spatial competition emerges for the best passages in rivers, for summer pits, and for spawning sites. Occupying sections of rivers that are required by both species, they protect their borders with more or less success depending on the numbers.



- Comparison of many-year catch dynamics of Atlantic Salmon and Pink Salmon in the White Sea shows that the fluctuations in the numbers, in general, coincide.

- The fluctuations have correlations with water temperature during the sea period of the both fishes' life cycles.

- In the years of Pink Salmon high numbers the competition increases and has an impact on the numbers of Atlantic Salmon.

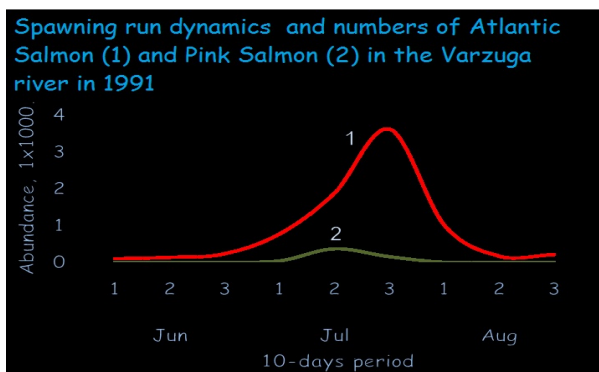
- Pink Salmon uses practically the whole river bed for spawning.

- The Pink Salmon domination areas are large riffles and shallow reaches.

- Numerous Pink Salmon stocks in odd years occupy spawning sites used by Atlantic Salmon and build their own spawning redds.

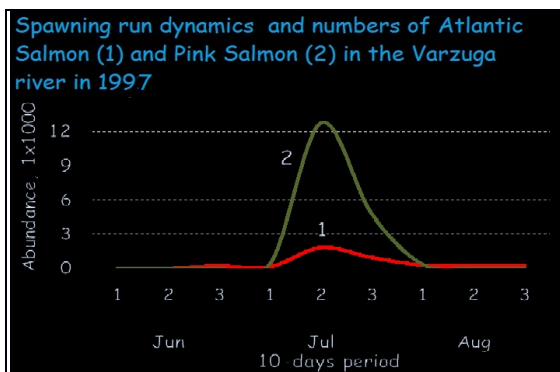
- Atlantic Salmon in many cases in their pre-spawning period avoid the areas occupied by Pink Salmon.

- Pink Salmon's behavior is more aggressive than that of Atlantic Salmon, and Pink Salmon usually win fights for territory.



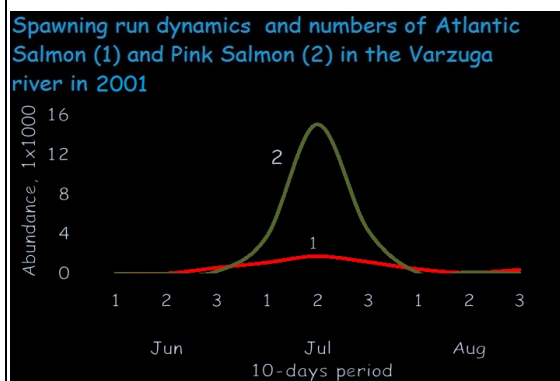
In large rivers of the Kola Peninsula such as the Varzuga until 1997 Pink Salmon was found in relatively small numbers. Atlantic Salmon dominated.

Spawning migration into the river by summer Atlantic Salmon starts in mid-July and lasts until late August. Annual average number of anadromous migrants amounted to over 10 thousand individuals.



- In 1997 for the first since 1956, over 18 thousand individuals came into the Varzuga; in 2001 – ca. 24 thousand.

- The number of summer Atlantic Salmon was more than twice as little as usual, without any preconditions for that.



- Such situation is observed in the recent odd years.

- Mass run by Pink Salmon has an impact on the numbers, dates, and dynamics of Atlantic Salmon migration.

In any case, in the years of mass Pink Salmon return the number of summer Atlantic Salmon is very low (fig). Last year (2017), by preliminary estimate, Pink Salmon amounted to 60 thousand individuals in the Varzuga. The number of summer Pink Salmon amounted to several hundred individuals. There are no facts to prove the correlation. But there is a concern that Pink Salmon may occupy the ecological niche that is being vacated, and it will have a detrimental effect on reproduction capacity of Atlantic Salmon. There are many similar examples.

Diseases

- In the course of introduction, a serious risk of transmitting diseases, especially viral ones, because in the native habitat such diseases as Viral erythrocytic necrosis VEN, Viral Haemorrhagic Septicaemia VHS, Infectious salmon anemia ISA etc. are found in Atlantic Salmon.

- In the new habitat mass epizootic outbreaks have not been observed in Pink Salmon juveniles and adults, but they have not been studied as possible hosts of infections.

- With growing numbers or ecological deterioration problems are possible. Also, diseases may be transmitted with eggs from infected breeders.

Yet another problem is related to Pink Salmon life cycle specifics.

Problem of breeders' mortality:

- After spawning semi-decomposed fish accumulate at the spawning sites: up to 12-15 individuals per 100m² and even more.

Decomposition of dead fish is slow due to low temperatures and low diversity of detritus feeders and vertebrate waste-eaters.

- Eutrophication of rivers takes place because of saturation of biogenic matter.

- Silting and eutrophication of water bodies' bottoms at Atlantic Salmon spawning sites

- Dead Pink Salmon attract bears and numerous flocks of birds to spawning sites.

- New routes emerge for infectious and parasitic invasions.

Problem of freshwater pearl mussel:

- The freshwater pearl mussel's life cycle is related to Atlantic Salmon.

- Pink Salmon is not a natural intermediary host for the mussel's glochidia.

- Replacement of Atlantic Salmon by Pink Salmon will definitely result in extinction of the freshwater pearl mussel which stocks are already undermined.

We believe that Pink Salmon coming to a number of North European countries have become a serious problem. Apparently, our meeting is a confirmation of that.

Problem of dissemination in the waters of NEA:

- As early as in 1960 occurrence of Pink Salmon outside the transplantation area showed the potential for its wider dissemination.

- Pink Salmon is using the same feeding areas as Atlantic Salmon, and has become its food competitor, as well as to many valuable commercial fish species which diet includes small fish, fry and large crustaceans.

- This was to be expected considering that the White Sea is covered with ice in winter, and in the center of the Barents Sea the mean monthly water temperature in winter decreases to 1.5-5.2°C.

The problem of transplantation and international law:

The UN documents (Clause 196 of UN Convention on the Law of the Sea, Clause 8 of the UN Convention on Biodiversity), FAO (Paragraph 8.2.6 of Code of Conduct for Responsible Fisheries), NASCO and other legal documents stipulate that states are to preserve genetic diversity of aquatic communities and ecosystems by way of reducing risks related to transplantation of non-aboriginal species, preventing transplantation, controlling and extermination of such alien species that pose a threat to ecosystems, habitats, or species.

Considering the above, one should reiterate that transplantation of Pink Salmon into the water bodies of Northern Russia has been a mistake, and all the above determines the need for radical measures to prevent Pink Salmon dissemination in the new habitat.