International Council for the Exploration of the Sea

ANACAT Fish Committee
CM 1995/M:39

SALMON RIVERS OF THE KOLA PENINSULA: SOME PECULIARITIES OF THE ATLANTIC SALMON SPAWNER MIGRATIONS TO THE KOLA AND TULOMA RIVERS

by

A.V.Zubchenko, Yu.A.Bochkov

Polar Research Institute of Marine Fisheries and Oceanography (PINRO), Murmansk, Russia

A.E.Bakulina, T.F.Mishukova

Murmansk Regional Directorate of Fish Conservation and Enhancement, Murmansk, Russia

Introduction

Undoubtedly, that various factors of enviroment have not only significant, but the decisive impact on terms and structure of the Atlantic salmon spawning migrations to rivers. However, it is difficult or completely impossiple to investigate this influence, due to the lack of precise data on the abundance of migrating salmon. At the same time, the data on structure of spawning migrations are of great practical importance, for instance, for estimating the fishing pressure.

The Kola and Tuloma Rivers fall into the Kola Bay of the Barents Sea. The mouths of these rivers are situated, practically, close to each other. The good conditions for salmon spawner accounting are noticed in the both rivers, since they pass through the special trap in the upper part of the fish ladder in the Tuloma River and are caught completely at the accounting fence in the Kola River. This makes it possible to observe the possible dependence of the dynamics of salmon spawning migrations on such factors of enviroment as the temperature and the level of water in the rivers, as well as on the variabilities of water temperature in the Barents Sea.

Material and methods

Ten-day period data on the abundance of salmon spawners, obtained from the results of accounting of spawning migrants at the accounting fence (the Kola River) and in the trap of the fish ladder (the Tuloma River) in 1980-1994, the data on temperature and the level of water in the Kola and Tuloma Rivers in the same period, the data on the water temperature at the depths of 0-200 m in the Main Branch of the Murman Current, and the data on temperature at the depths of 0-50 in the Coastal Branch of the Murman Current were used in the present paper.

Results and discussion

Some types of spawning migrations, distinguishing from each other by the different terms of starting the peaks of run, may be singled out in the Kola and Tuloma Rivers. Therefore, the years, similar in structure of run, are united into five groups (Fig.1,2).

The analysis of the season model: the dynamics of the spawning run - the temperature and the level of water in the rivers and the temperature of water in the Barents Sea, indicated, that the model is more informative and significant for the Tuloma River, than for the Kola River (the Fisher's criterion for the Tuloma River (F) was equal to 14.6 (the level of significance p = 0.0001, coefficient of determination (R-squared) - 0.76, for the Kola River F = 7.2 (p = 0.0036), R-squared = 0.61). The influence of the factors considered to the seasonal dynamics of salmon run was different for each river (the influence of the water level in the Tuloma River was 69.9%, of the water temperature in the river - 4,7%, of the water temperature in the sea - 0.8%; in the Kola River the influence of the water temperature in the river - 40.1%, of the water level - 12.7%, of the water temperature in the sea - 8%). The dynamics of the salmon run has the correlational relationship only with the temperature of water in the rivers (r = 0.63, p = 0.0048 - for the Kola River, r = 0.41, p = 0,088 - for the Tuloma River). This relationship is consistently explained, since the temperature of water grows during the spawning migration, however, the dependence of the seasonal changes in salmon abundance and water temperature is not always particularly pronounced (Fig.3-12). For example, the simultaneous reduction in temperature and abundance of spawning migrants was recorded in the Tuloma River in 1986 and 1992 (Fig.12). By contrast to, the decrease in temperature in the Kola River in 1980, 1981, 1986, 1987, 1989, 1990, 1993 and 1994 coincided with the peak of the spawning run (Fig.5,7). The connection between low temperature, as a rule, not more than 7-8°C, and the delay of the migration peak for the later term in comparison with mean-long-term data is well-observed in the Tuloma River (Fig.10-11). This connection is not noticed in the Kola River. The start of the salmon run in the mouths of rivers, under the temperature of close to 5°C, is common to the both rivers.

The level of water, in accordance with the data on the analysis, has not a pronounced impact on the pace of spawning migrations. It should be noticed, that in the Kola River the migration of salmon to spawning starts and takes place in the period of water level decline (Fig.13-17). The contrary picture is observed in the Tuloma River (Fig.18-22), that is explained by the Nizhnetulomskaya WPS location in the mouth of the river. Moreover, in the years of high floods the unexpected water removing, usually coinciding with the start of the salmon run, is noticed. The delay of the start of the spawning migration to the river, since the salmon run to the high-velocity jet, to the freshet canal, was observed in 1985, 1992, 1993 and 1994.

The conjugation (connection) of seasonal alterations of the migrating salmon abundance and the heat level of waters of the Murman Current in the Barents Sea. Besides, the significant influence of year-to-year fluctuations of water temperature at the depth of 0-50 m in the Coastal Branch of the Murman Current (May) on the year-to-year variations of migrating salmon abundance in the first ten-day period of June, as presented in Figs.23,24, is observed. In spring months, when the heat content of the atlantic waters is high*, significant increase in abundance of salmon prespawning specimens, migrating to the Kola and Tuloma Rivers, (in 5-10 times) is registered in the coastal zone of Murman. In spite of this, (compare Figs.1,2 and 23,24) the peak of spawning migrations in the warm years falls within the earlier terms. It is also interesting, that the peak of salmon run in the Kola and Tuloma Rivers always accounts for the period, when the water temperature at the depths of 0-200 m in the Main Branch of the Murman Current reaches 3°C (Figs.25-32). In this connection, we can draw the conclusion on the connection of these two factors.

---

* - mean water temperature at the depth of 0-50 m, at the "Kolsky meridian" Section in the flow of the Coastal Branch of the Murman Current in the period of 1980-1993 was 3.1°C.

Fig.1. Variants of salmon run dynamics in the Kola'River in 1980-1994

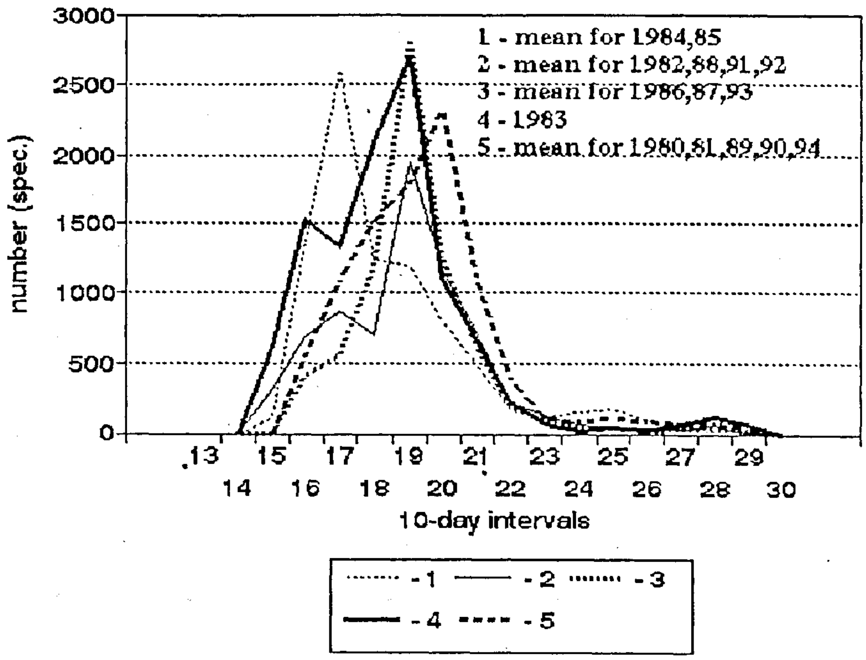

Fig.2. Variants of salmon run dynamics in the Tuloma'R. in 1980-1994

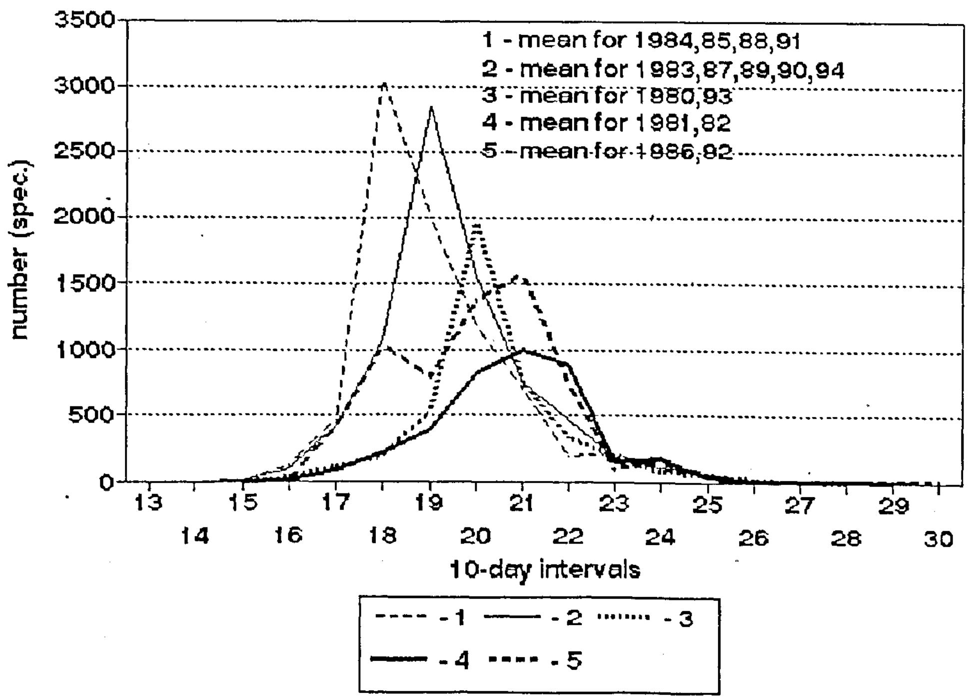

Fig.3. Dynamics of salmon run and water temperature in the Kola'R. in 1984,85

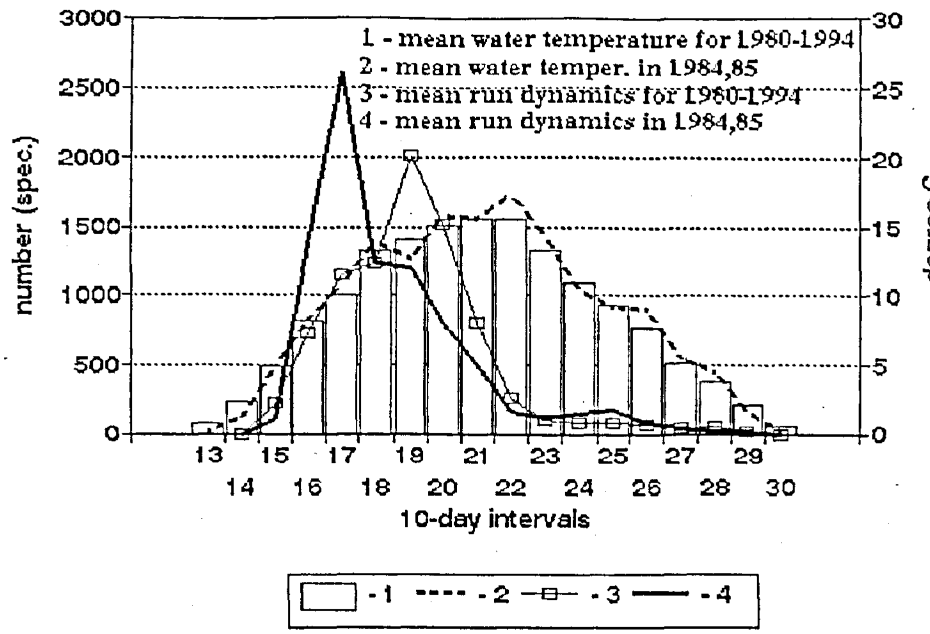

Fig.4. Dynamics of salmon run and water temperature in Kola in 1982,88,91,92

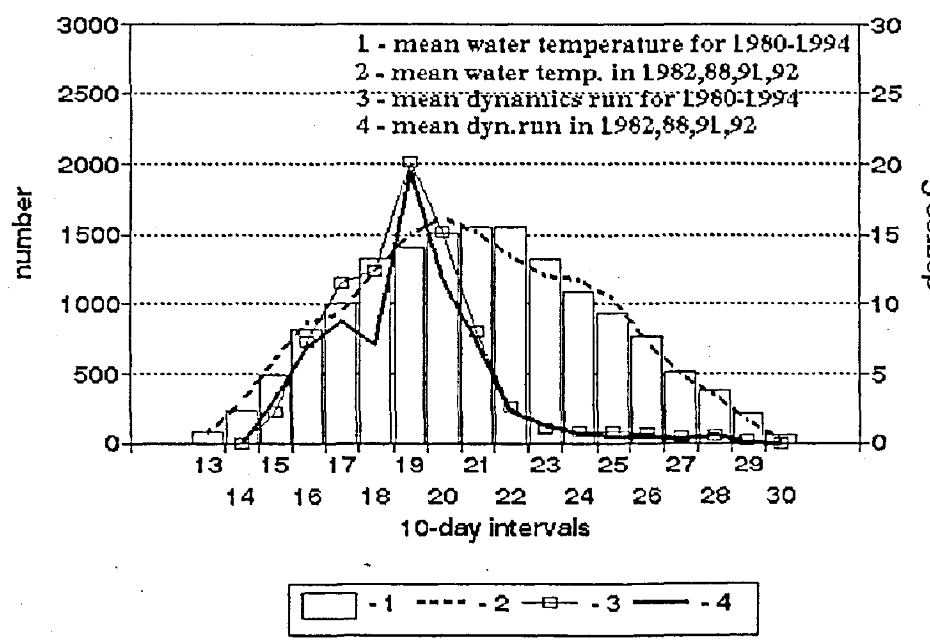

Fig.5. Dynamics of salmon run and water temperature in Kola'R. in 1986,87,93

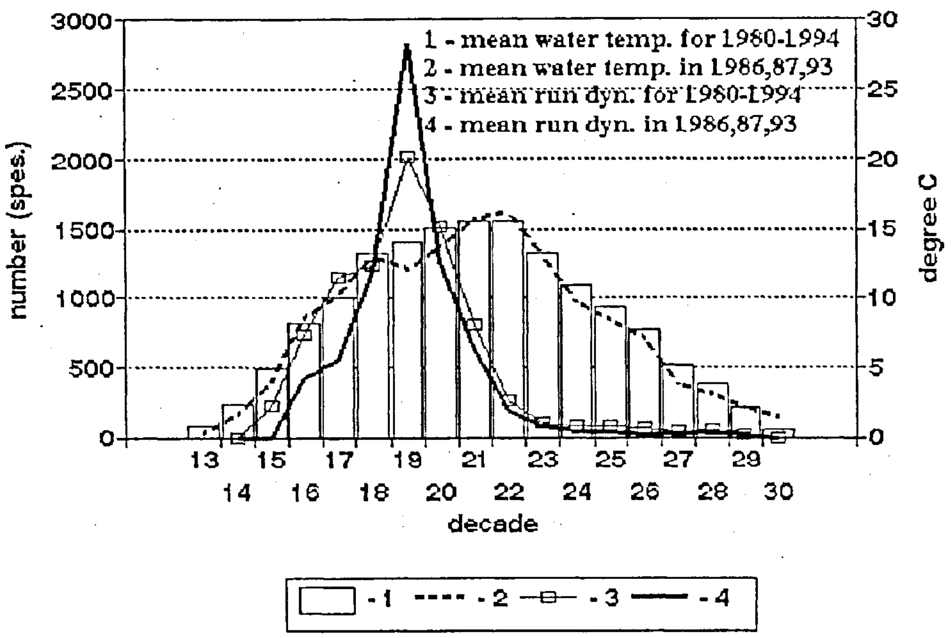

Fig.6. Dynamics of salmon run and water temperature in Kola'R. in 1983

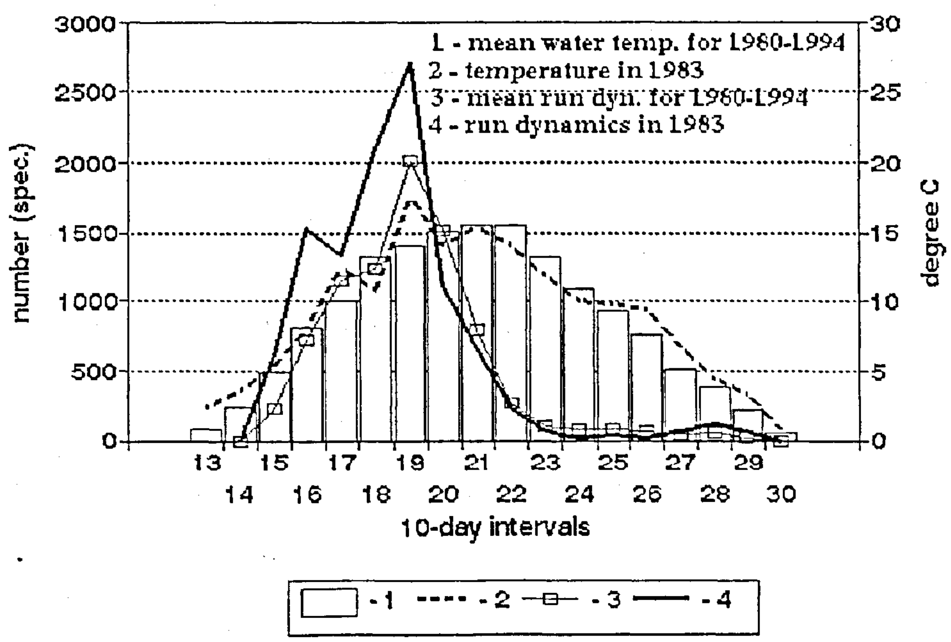

Fig.7. Dynamics of salmon run and water temperature in Kola in 1980,81,89,90,94

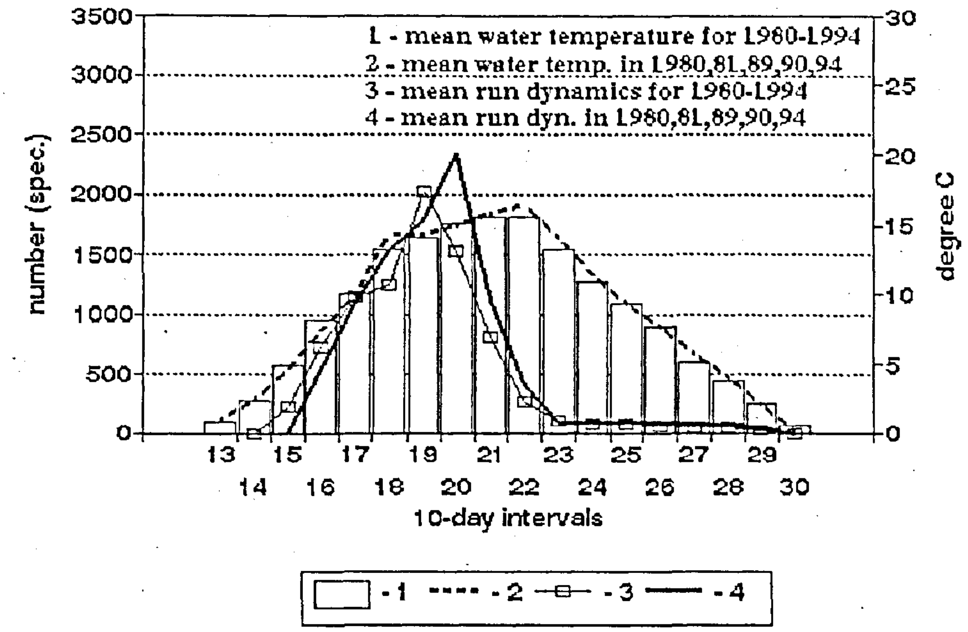

Fig.8. Dynamics of salmon run and water temperature in Tuloma in 1984,85,88,91

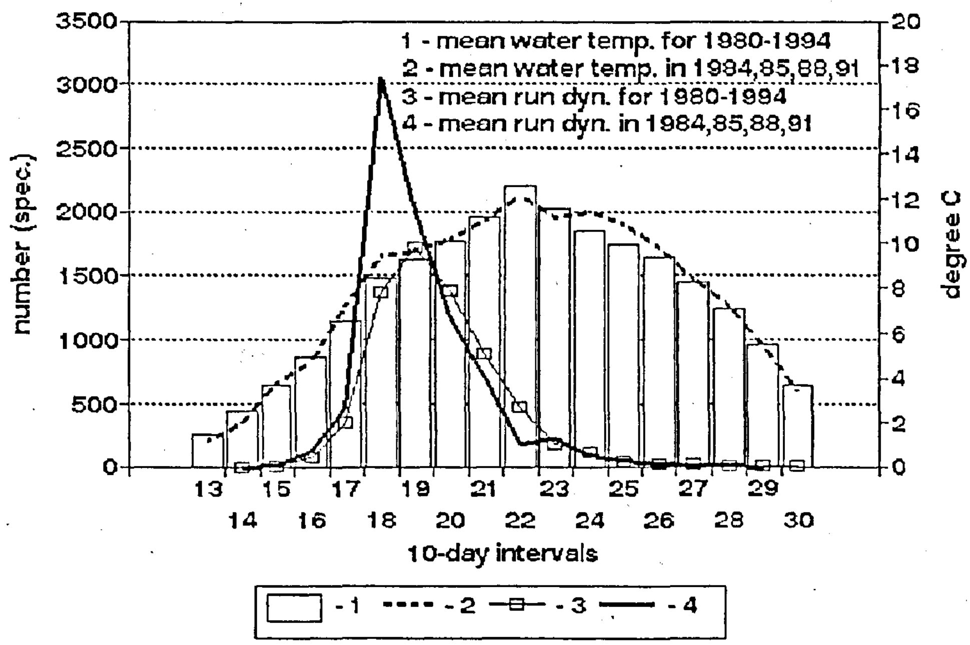

Fig. 9. Dynamics of salmon run and water temperature in Tuloma in 1983,87,89,90,94

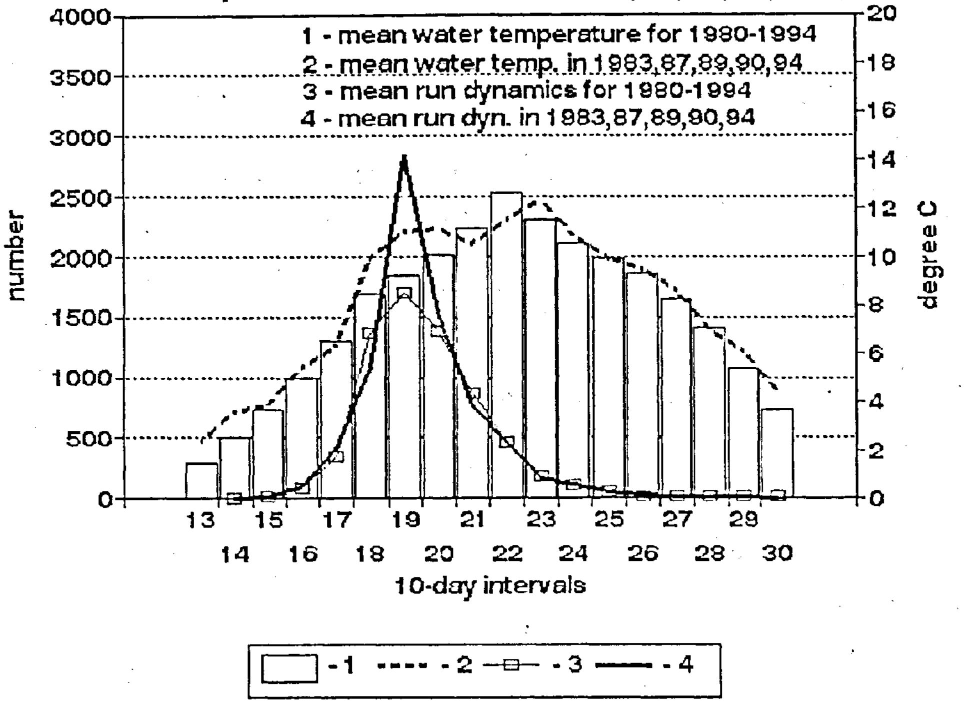

Fig.10.Dynamics of salmon run and water temperature in Tuloma'R. in 1980,93

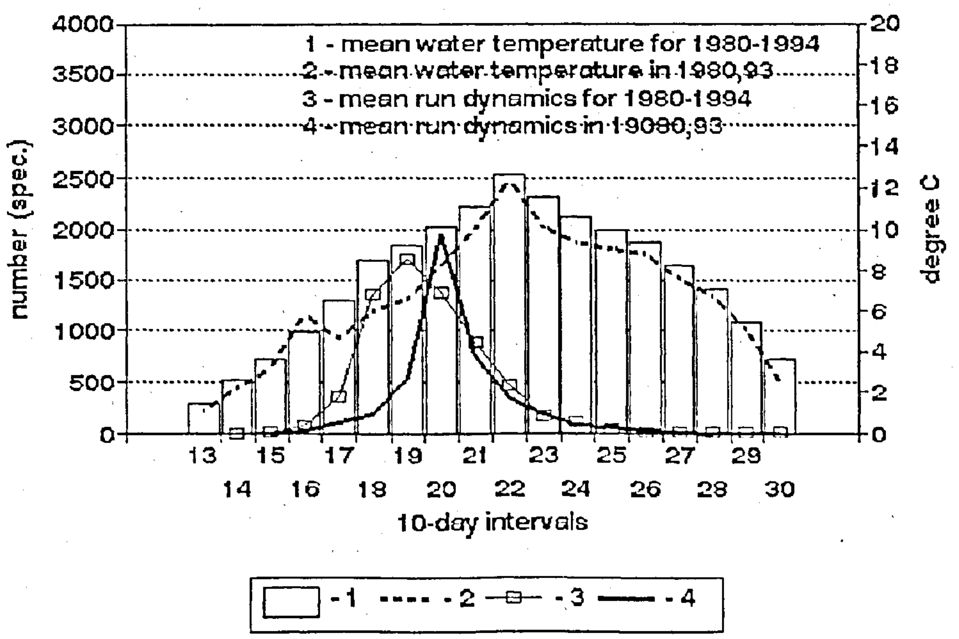

Fig.11.Dynamics of salmon run and water temperature in Tuloma'R. in 1981,82

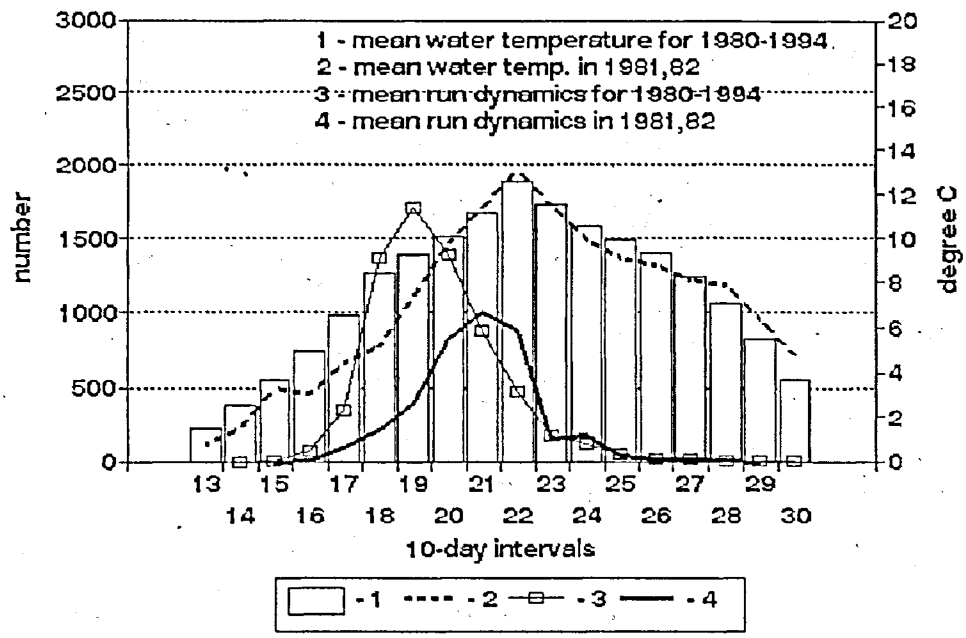

Fig.12.Dynamics of salmon run and water temperature in Tuloma'R. in 1986,92

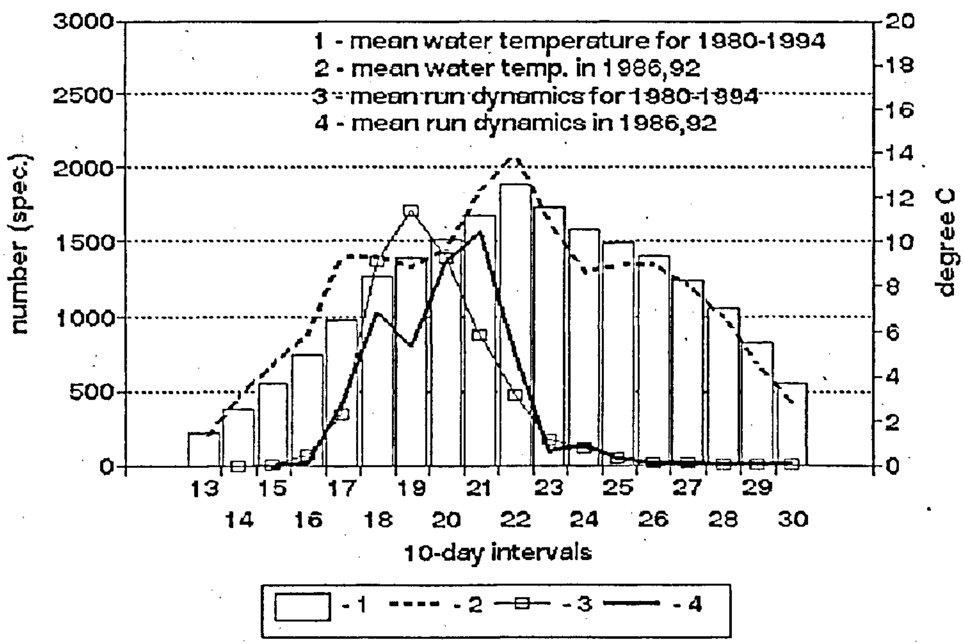

Fig.13.Dynamics of salmon run and water level in Kola'R. in 1984,85

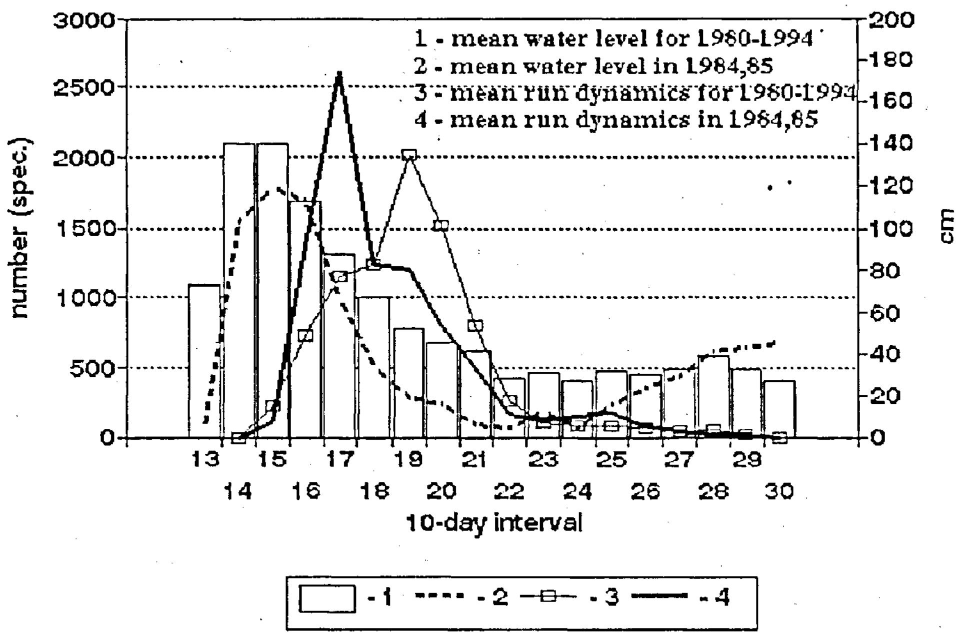

Fig.14.Dynamics of salmon run and water level in Kola'R. in 1982,88,91,92

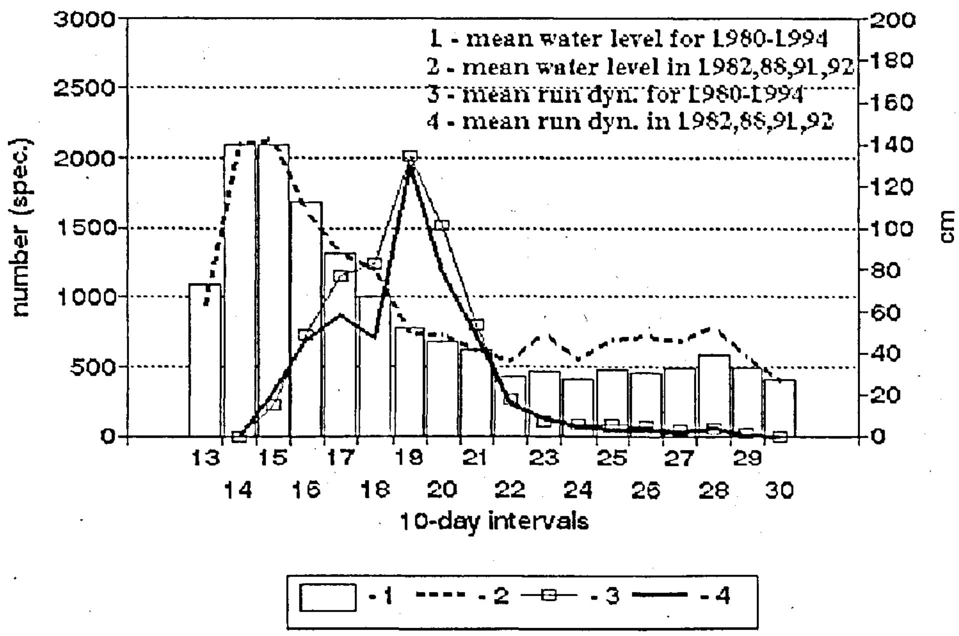

Fig.15.Dynamics of salmon run and water level in Kola'R. in 1986,87,93

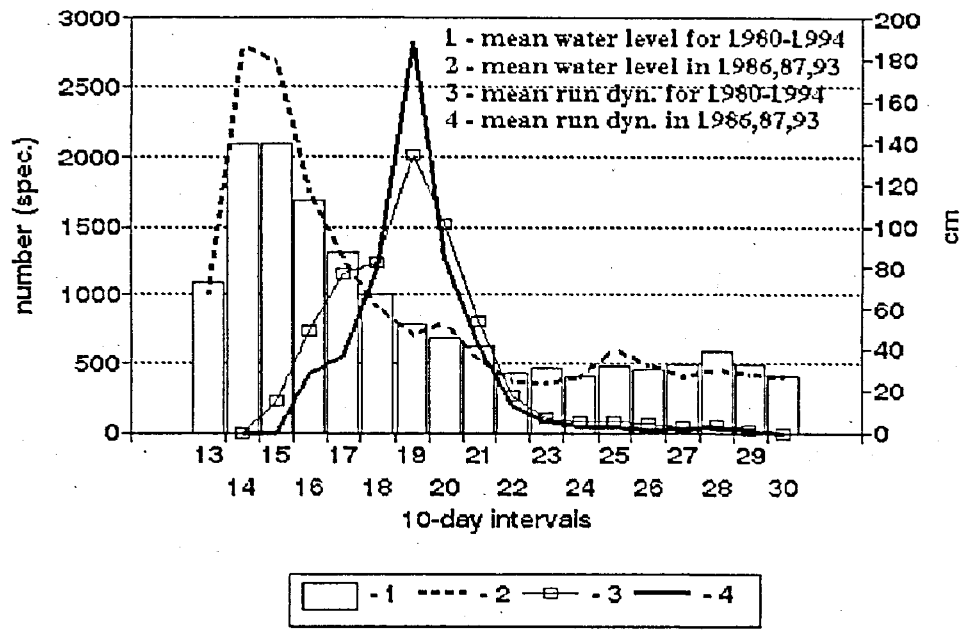

Fig.16.Dynamics of salmon run and water level in Kola'R. in 1983

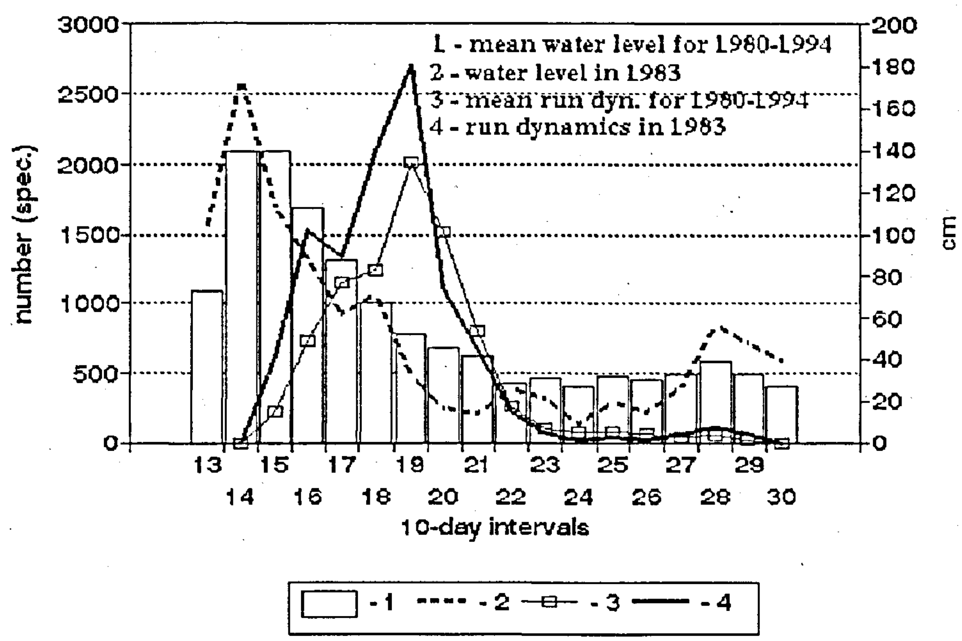

Fig.17.Dynamics of salmon run and water temperature in Kola in 1980,81,89,90,94

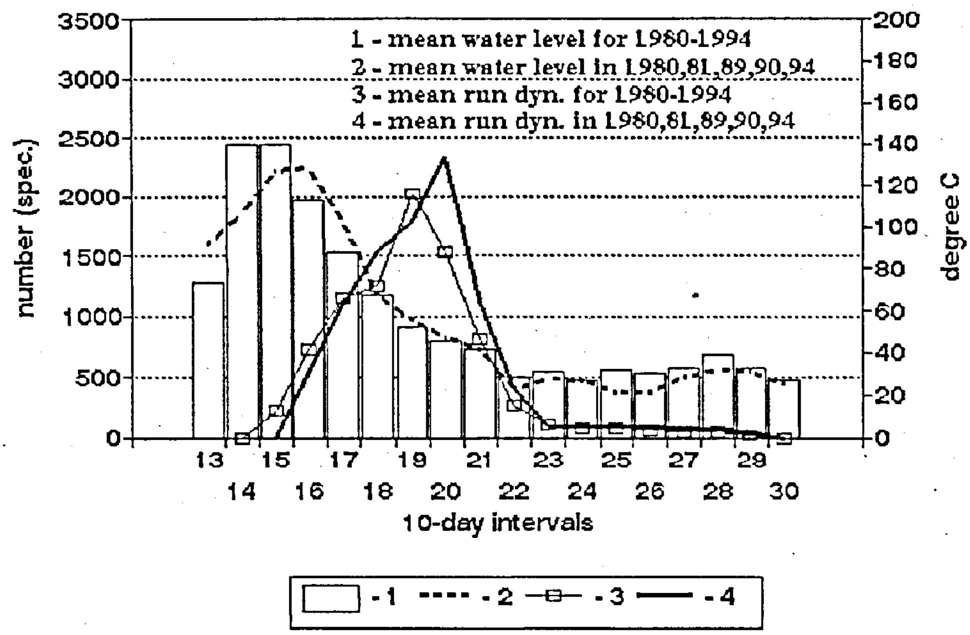

Fig.18.Dynamics of salmon run and water level in Tuloma'R. in 1984,85,88,91

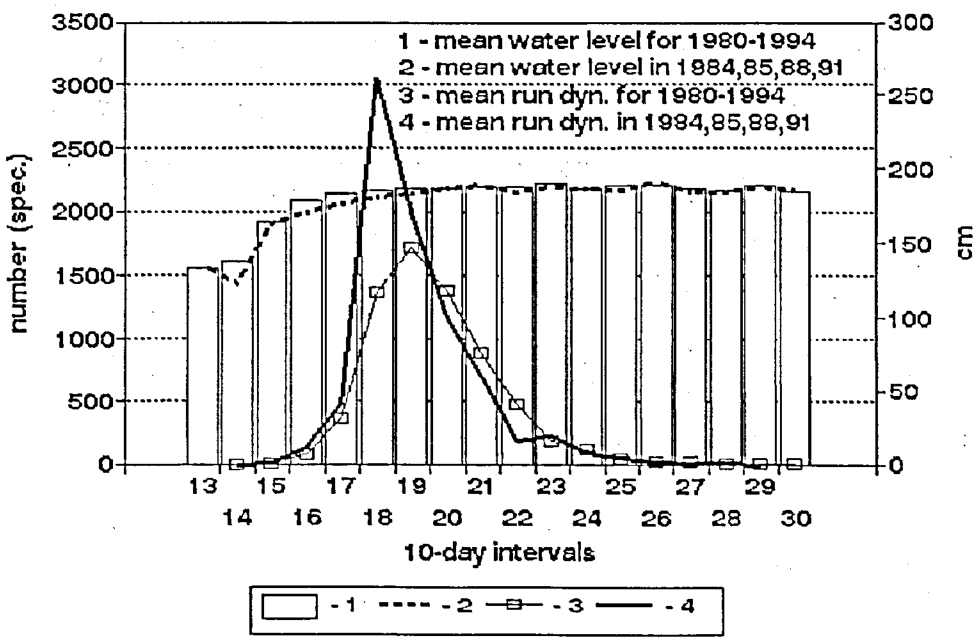

Fig.19. Dynamics of salmon run and water level in Tuloma'R. in 1983,87,89,90,94

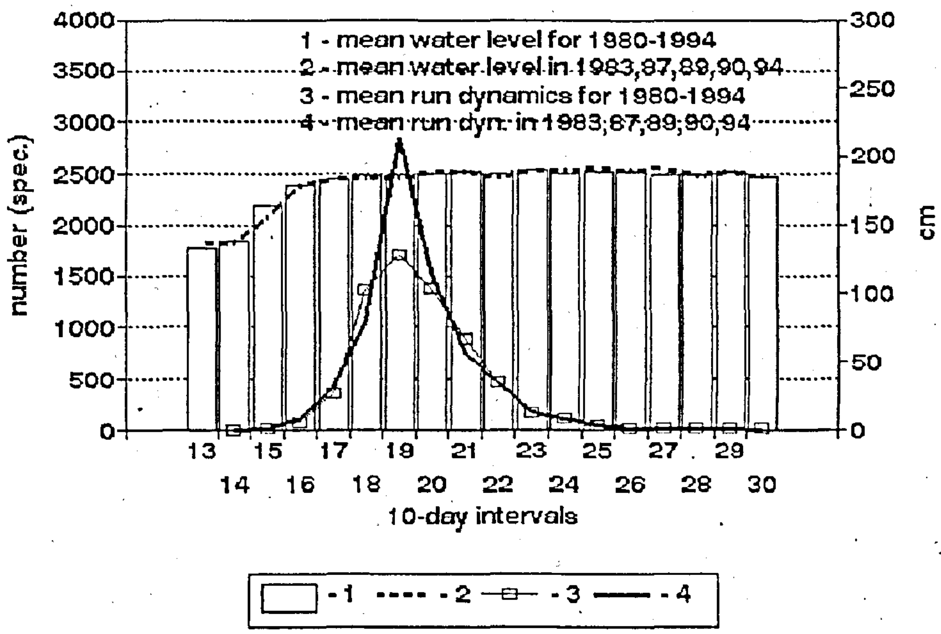

Fig.20. Dynamics of salmon run and water level in Tuloma'R. in 1980,93

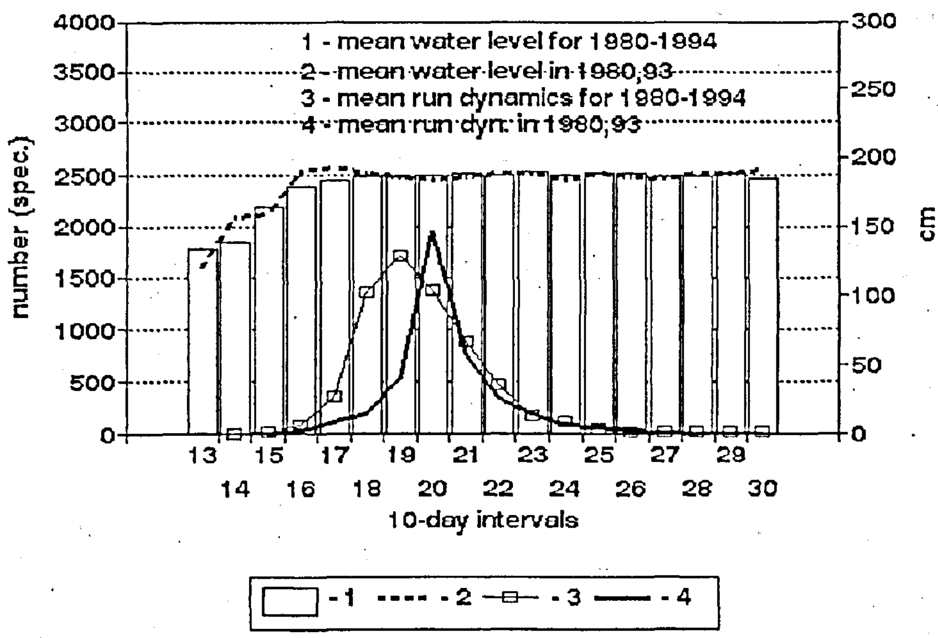

Fig.21.Dynamics of salmon run and water level in Tuloma'R. in 1981,82

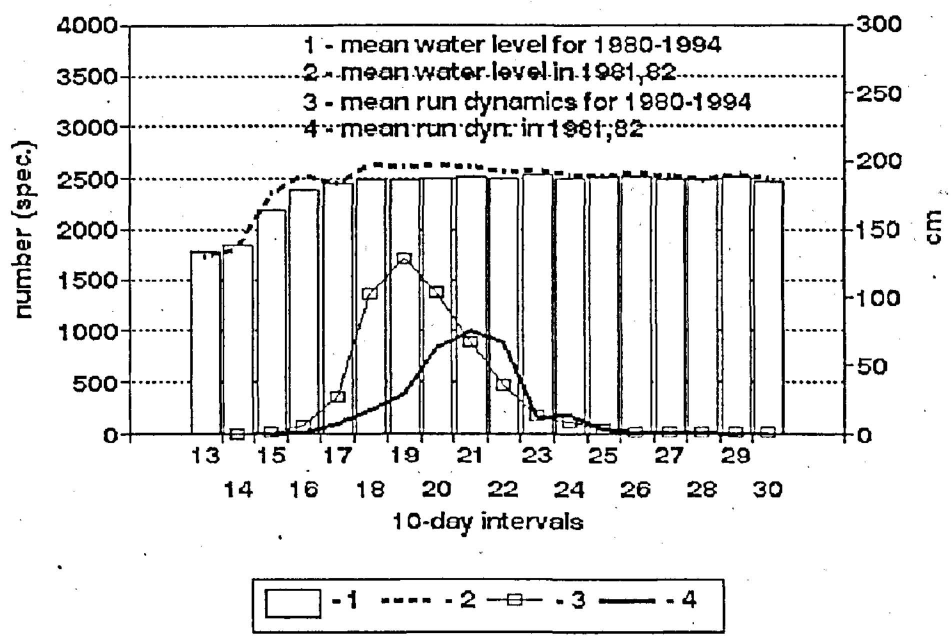

Fig.22.Dynamics of salmon run and water level in Tuloma'R. in 1986,92

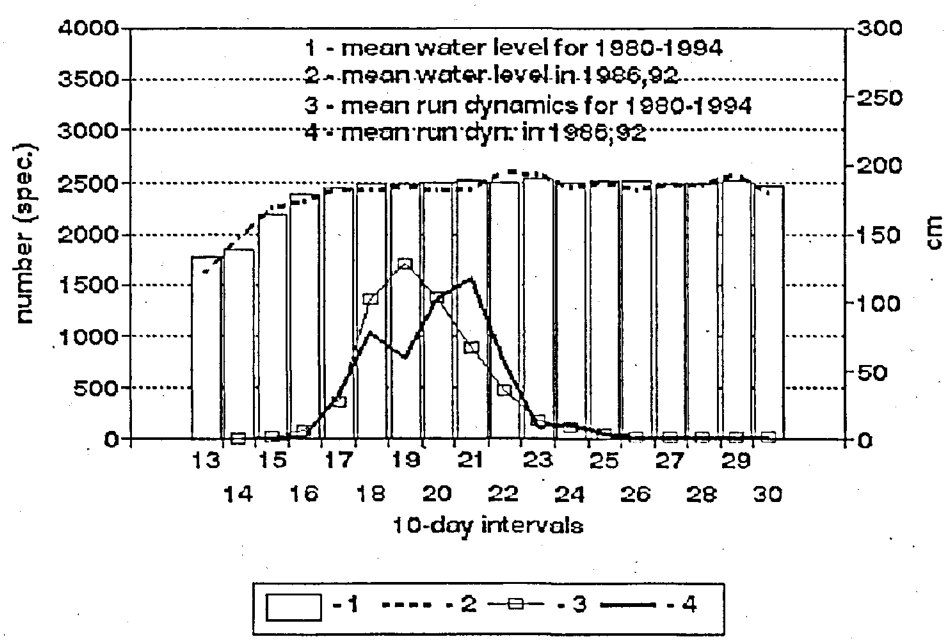

Fig. 23. Abundance of Atlantic salmon in Kola'R. in first 10-days of June versus water temperature in Barents Sea in May

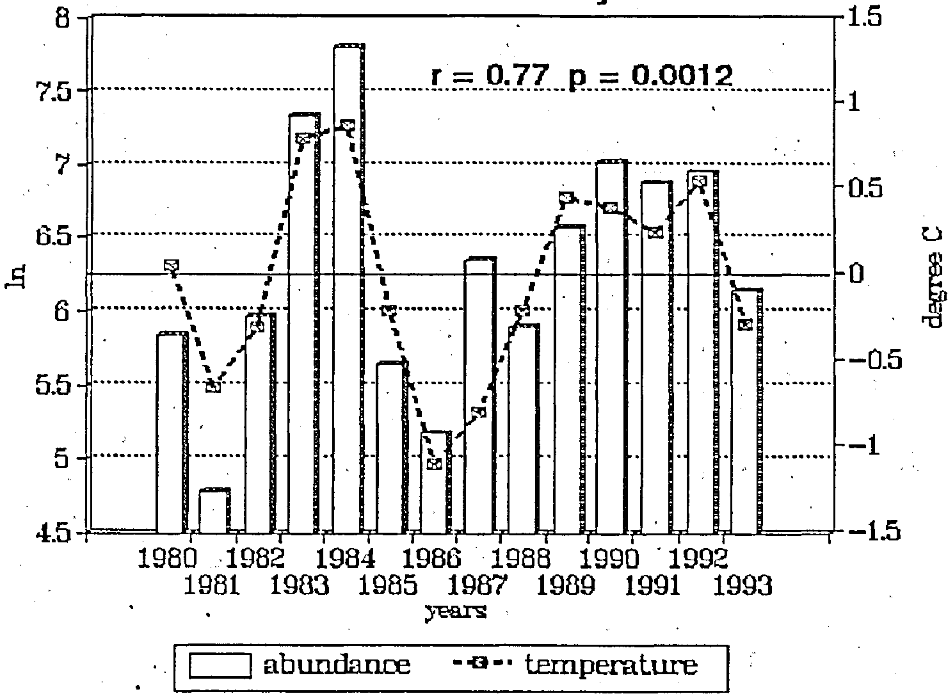

Fig. 24. Abundance of Atlantic salmon in Tuloma'R. in first 10-days of June versus water temperature in Barents Sea in May

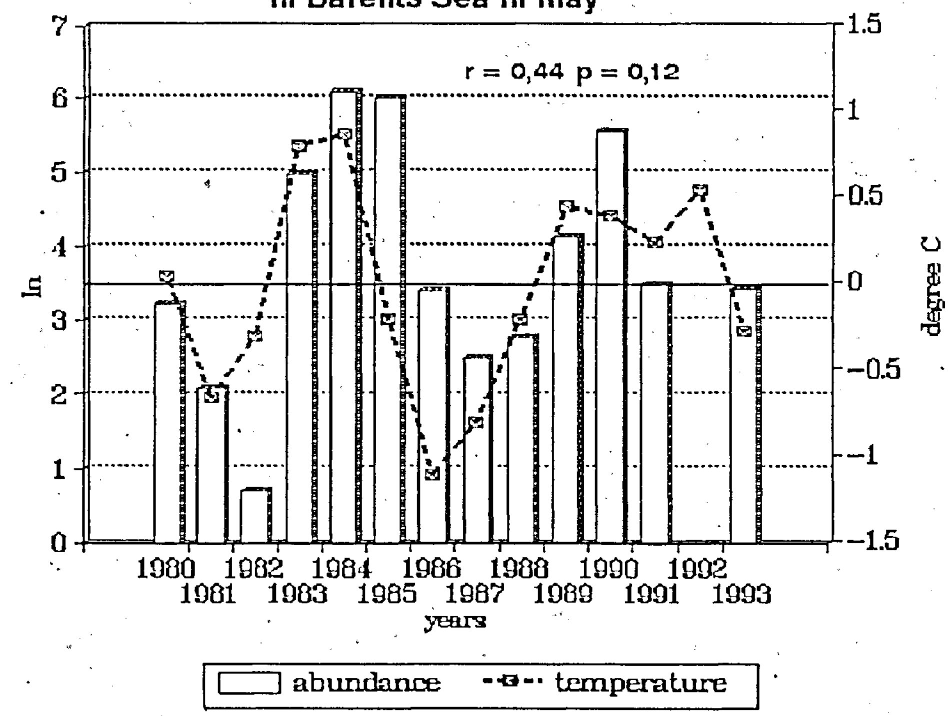

Fig.25.Dynamics of salmon run in Kola and Sea water temperature in 1980-1994

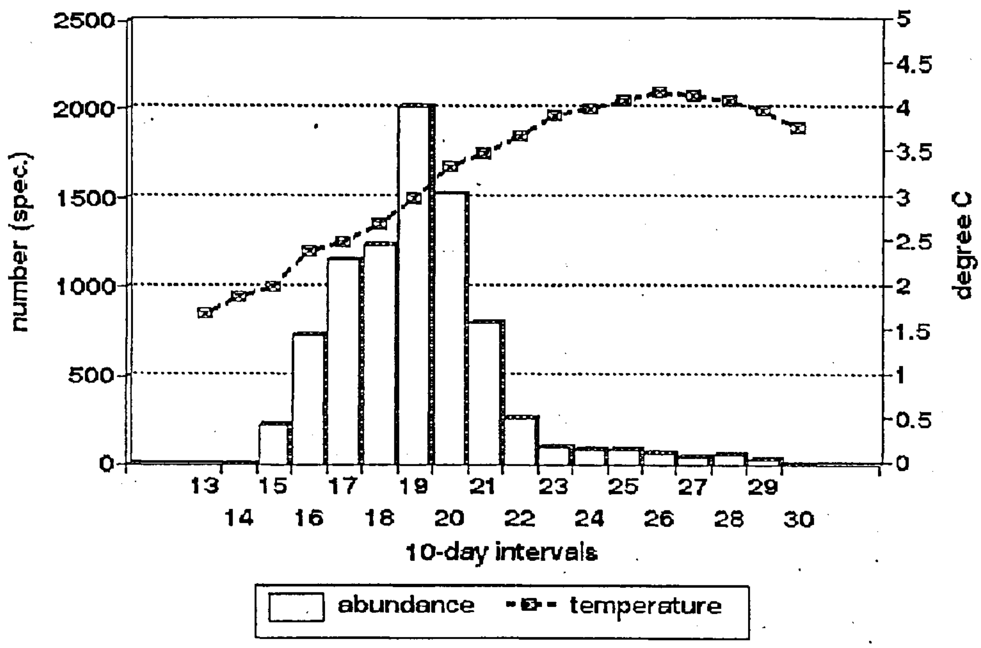

Fig.26. Dynamics of salmon run in Kola and Sea water temperature in 1980

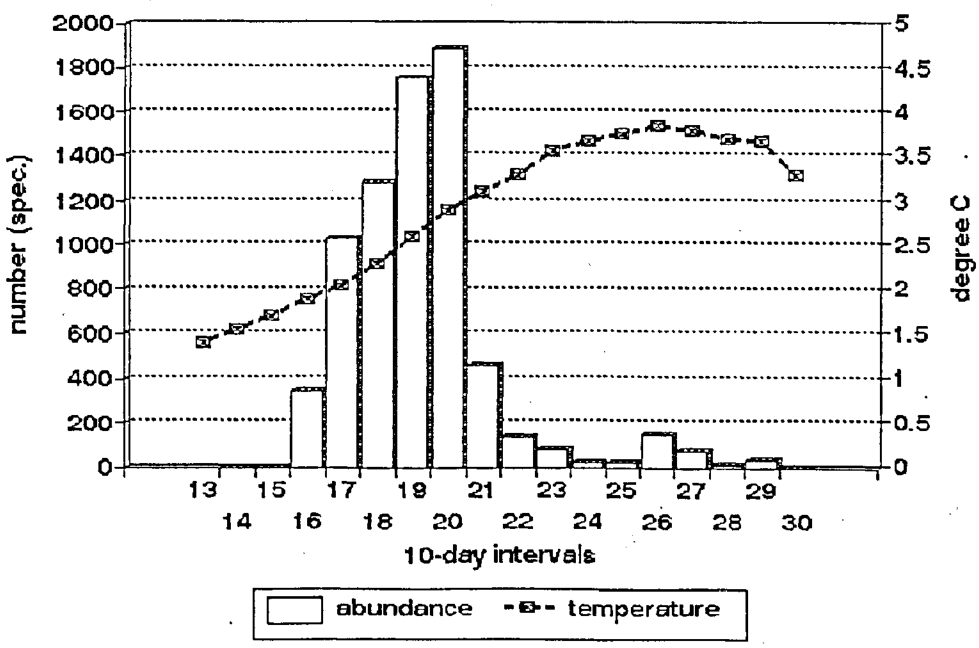

Fig.27. Dynamics of salmon run in Kola and Sea water temperature in 1984

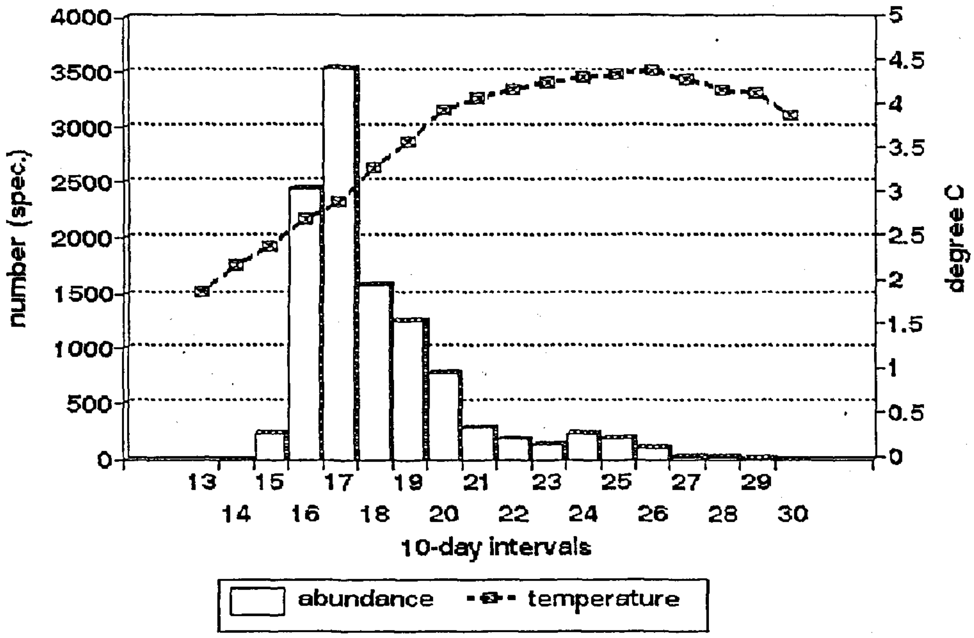

Fig.28. Dynamics of salmon run in Kola and Sea water temperature in 1993

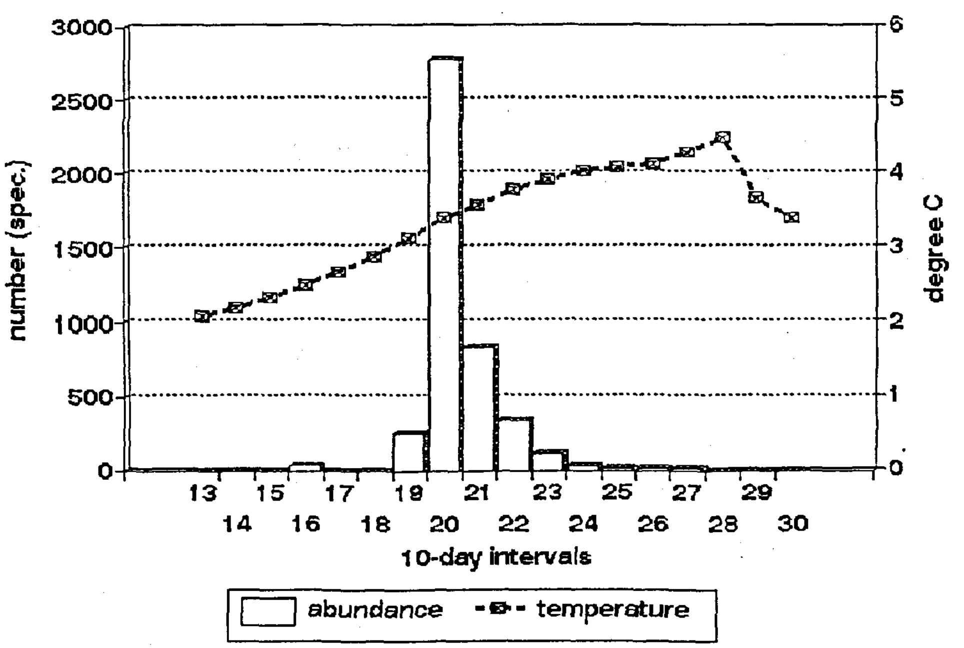

Fig.29. Dynamics of salmon run in Tuloma and Sea water temperature in 1980-1994

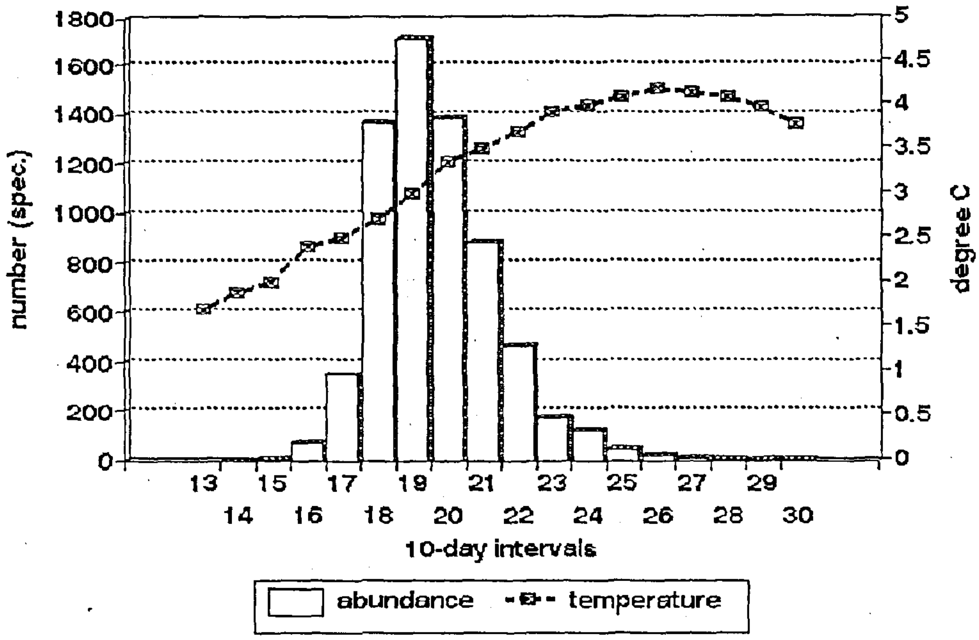

Fig.30. Dynamics of salmon run in Tuloma'R. and Sea water temperature in 1980

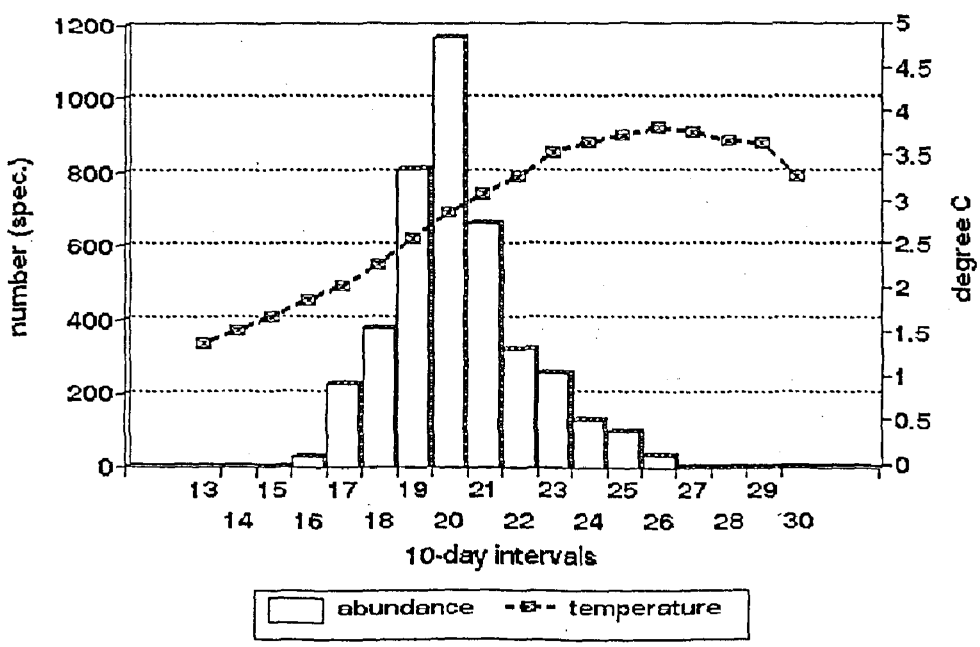

Fig.31.Dynamics of salmon run in Tuloma'R. and Sea water temperature in 1984

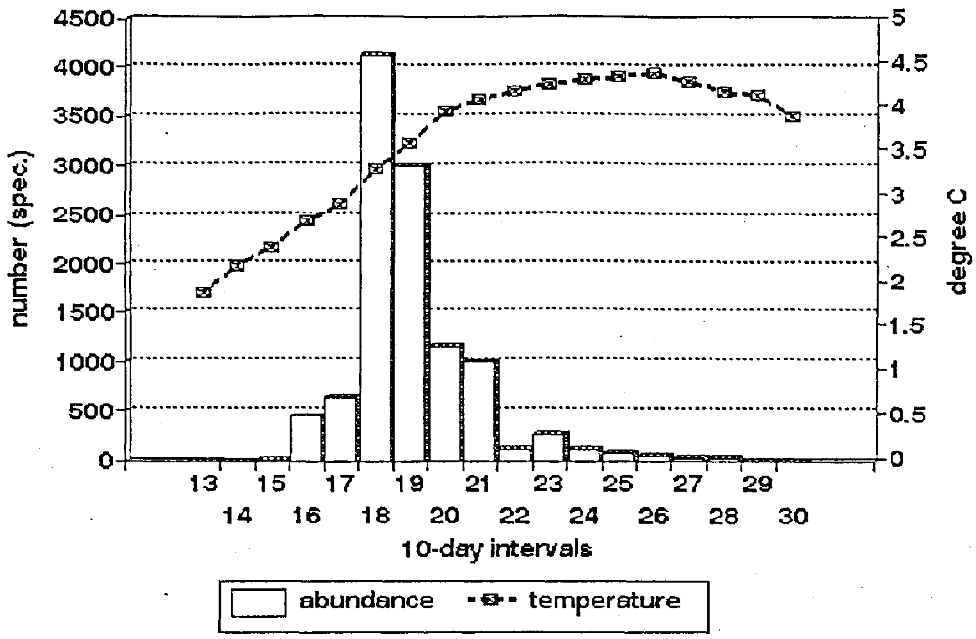

Fig.32.Dynamics of salmon run in Tuloma'R. and Sea water temperature in 1993