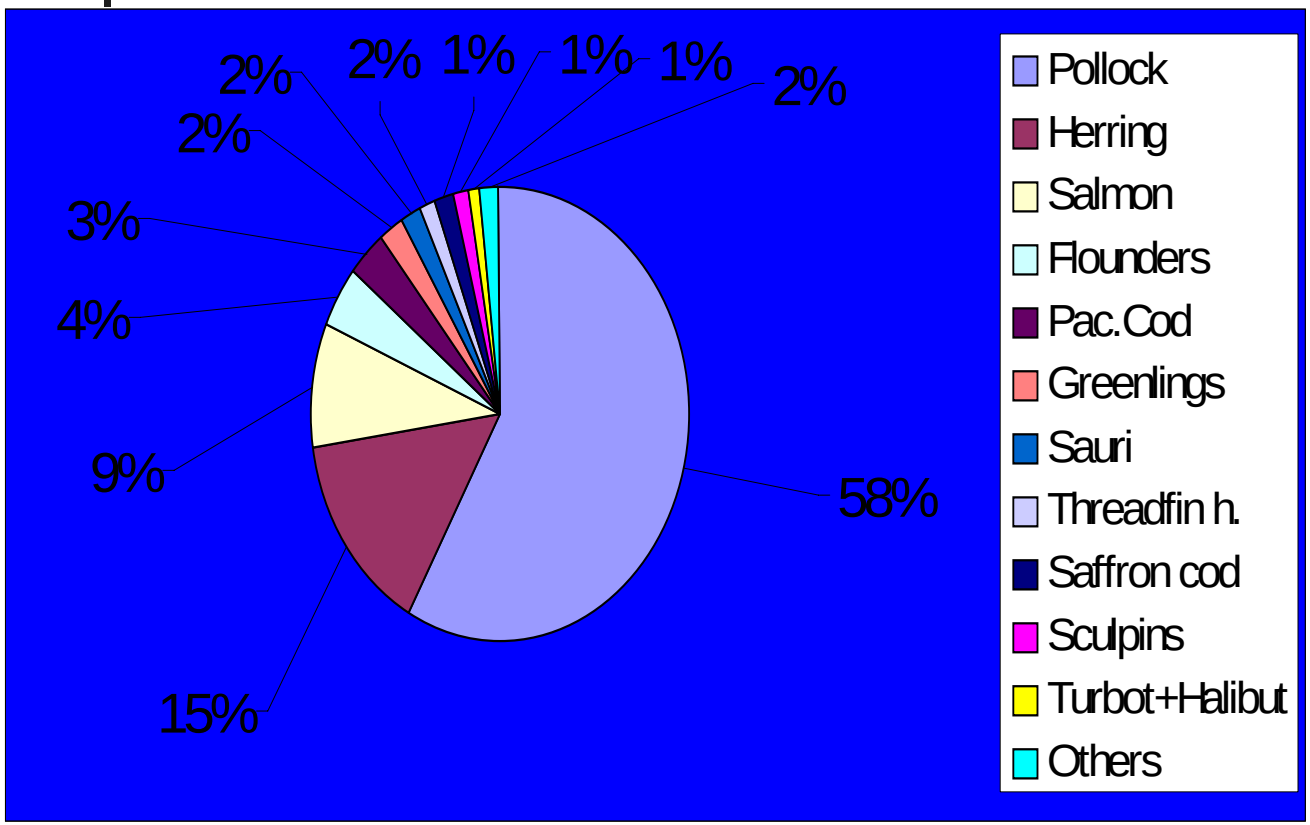
Parents-progeny relationships in the Okhotsk Sea walleye pollock

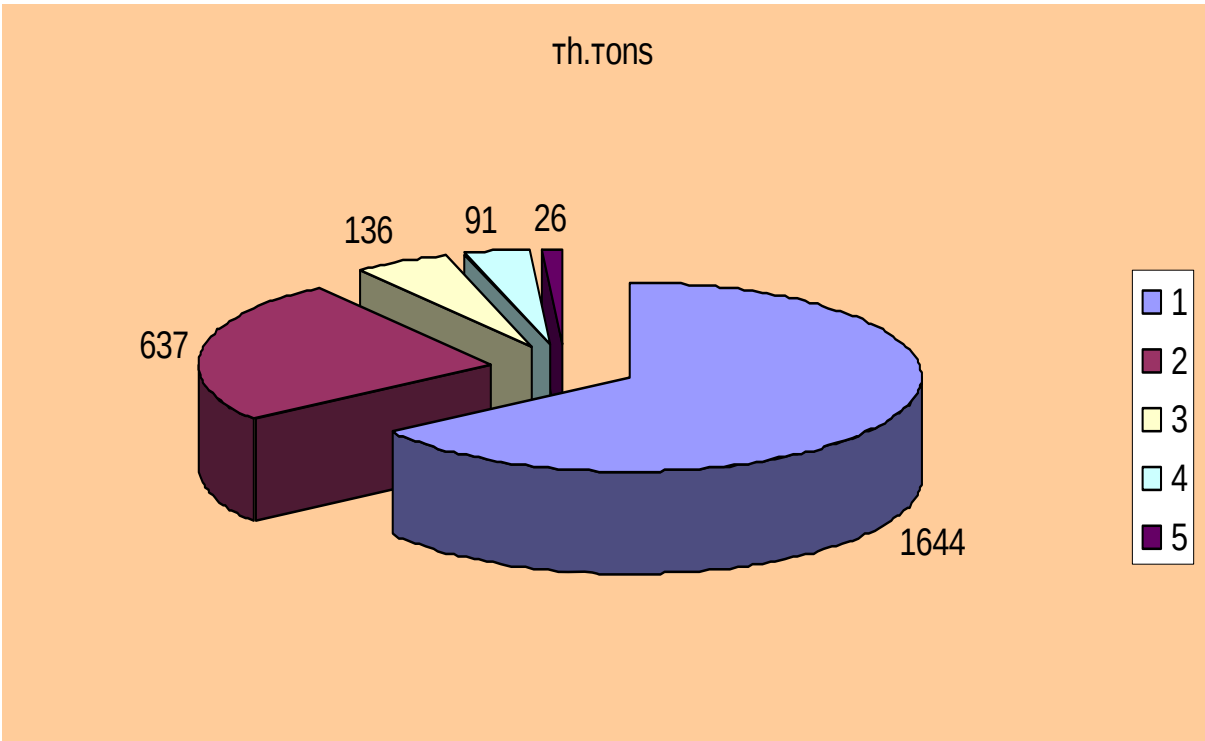
A.V. Smirnov (TINRO-Centre)

The share of walleye pollock in the mean annual fish catch in the Russian EEZ



Walleye pollock is the main target for commercial fishery in the Russian Far Eastern seas, and it accounts for about 60% of the total catch of fish and invertebrates in the Russian EEZ today.

Average annual catch of walleye pollock in different fishery areas in the Russian EEZ in the 1990s



1- Okhotsk Sea;

2- Bering Sea;

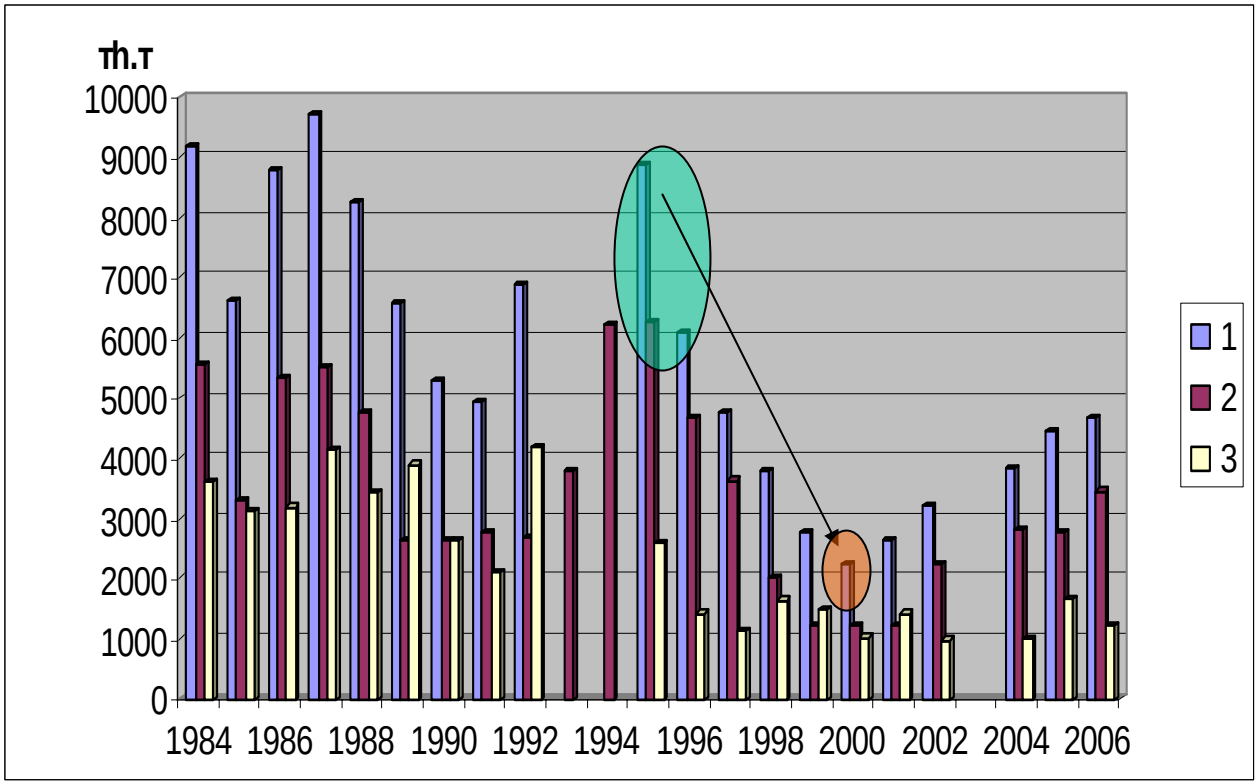
3- East Kamtchatka and North Kuril Islands;

4- South Kuril Islands;

5- Japan Sea

Dynamics of spawning stock biomass of walleye pollock in the northern Okhotsk Sea in 1984-2006

(1- entire Okhotsk Sea, 2- west Kamtchatka and Shelikhov Bay, 3- northwestern Okhotsk Sea. No survey has been conducted in 2003)



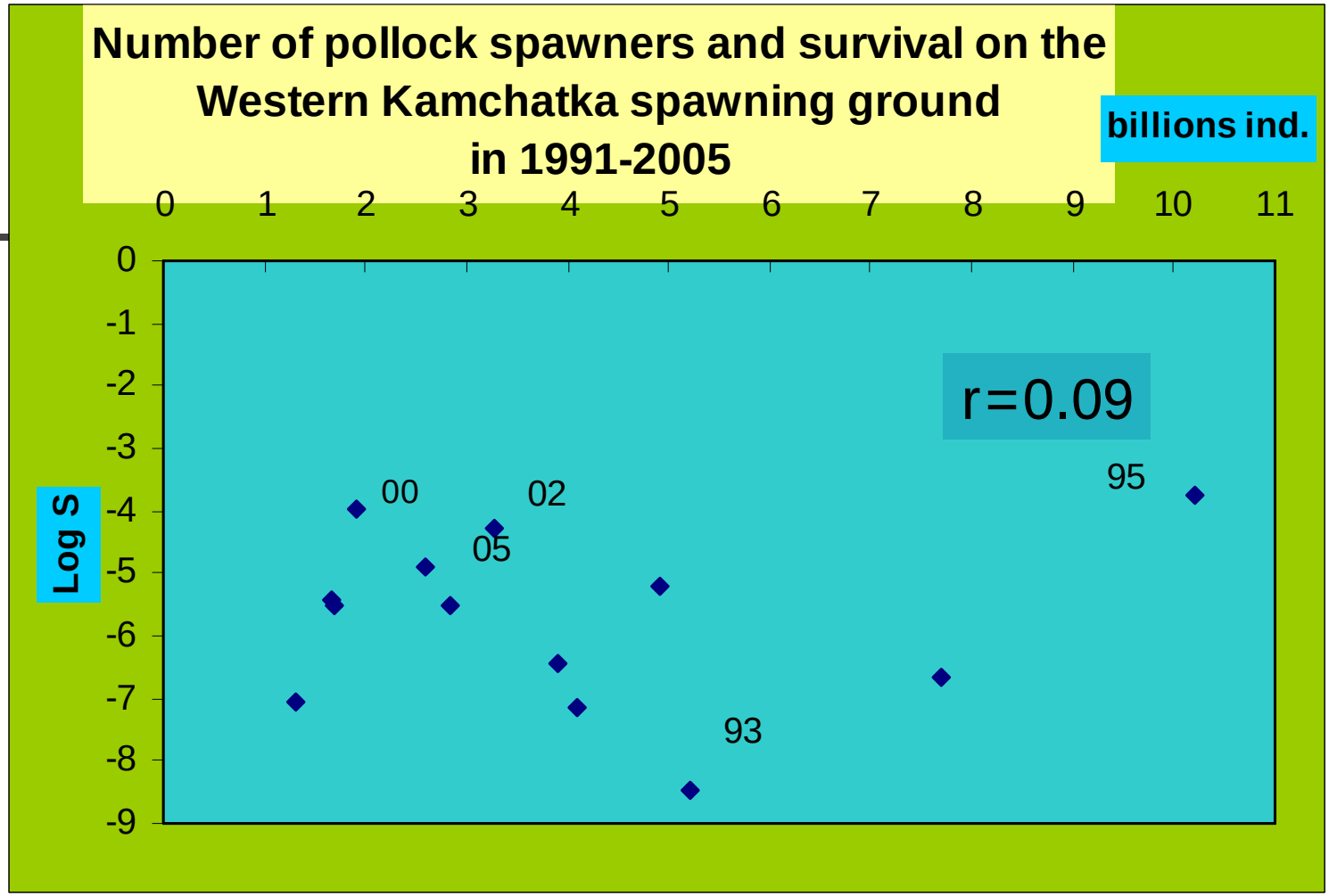
- A decrease in pollock catch in the Okhotsk Sea is related to a decline of its stock abundance. Pollock spawning biomass was estimated as 9.0 mln.t in 1995 and it reduced to 2.0 mln.t in 2000.

Main goals of the study were to determine:

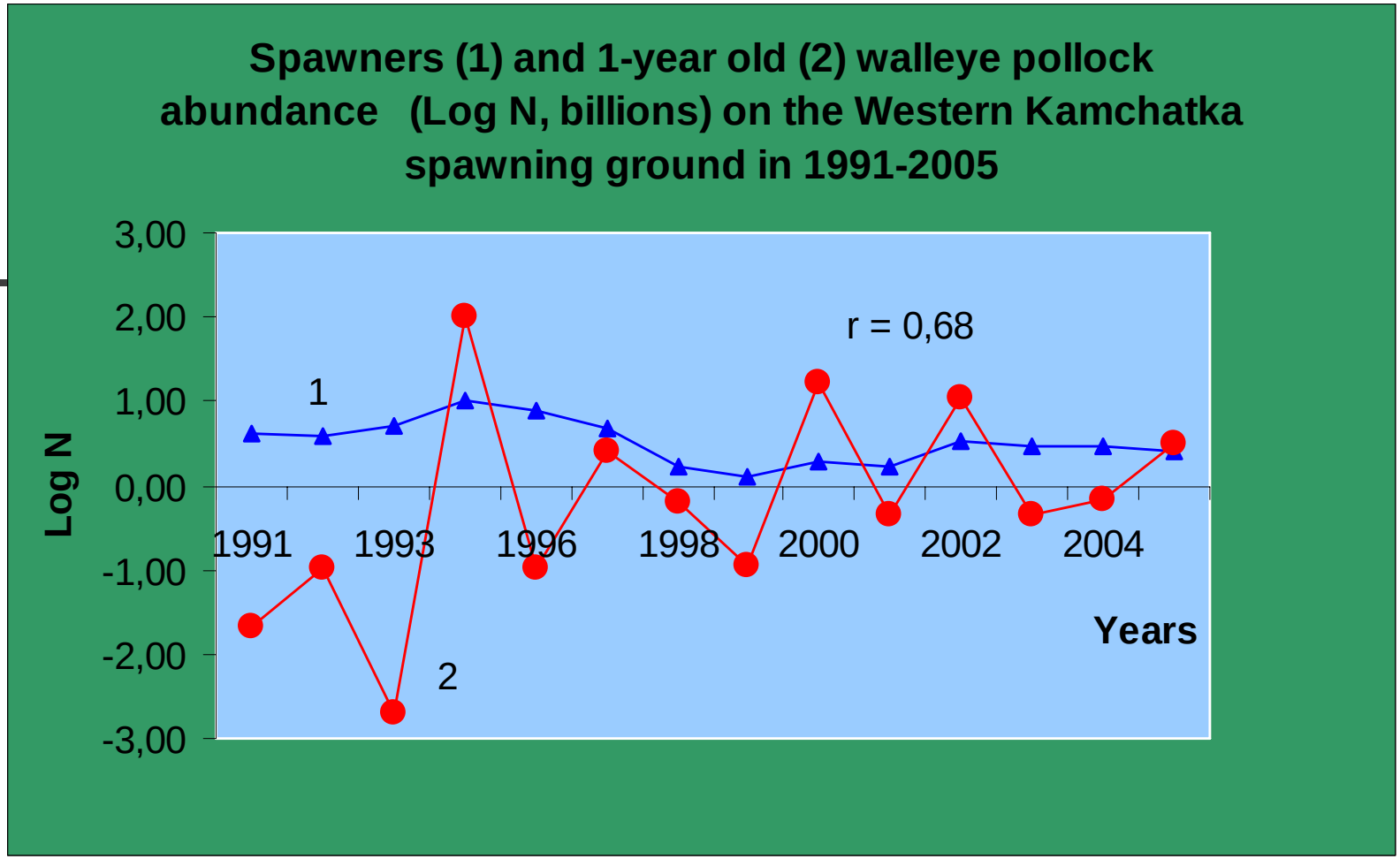
- 1. Is there a relationship between survival of pollock recruits and abundance of parental stock? What are the relationships between abundance of parental stock and recruits (or does the Ricker's model work?)
- 2. What biotic and abiotic factors have positive influence on pollock recruits' survival?

Data and methods

- TINRO-center conducts annual ichthyoplankton, trawl and zooplankton surveys in the Okhotsk Sea and estimates abundance of pollock eggs, spawning stock abundance, its age composition, biomass of plankton and oceanographic conditions in areas of pollock reproduction.
- “Reproduction index” in data analysis is a ratio between the number of yearlings and the number of eggs in one generation. Why do we take 1 year old fish for calculation of this index? Because by the age of 2-3 years, juvenile fish born on different spawning grounds occur together, and it is impossible to distinguish between them. Moreover, by the age of 1 year we are able to determine more or less precisely year class abundance.

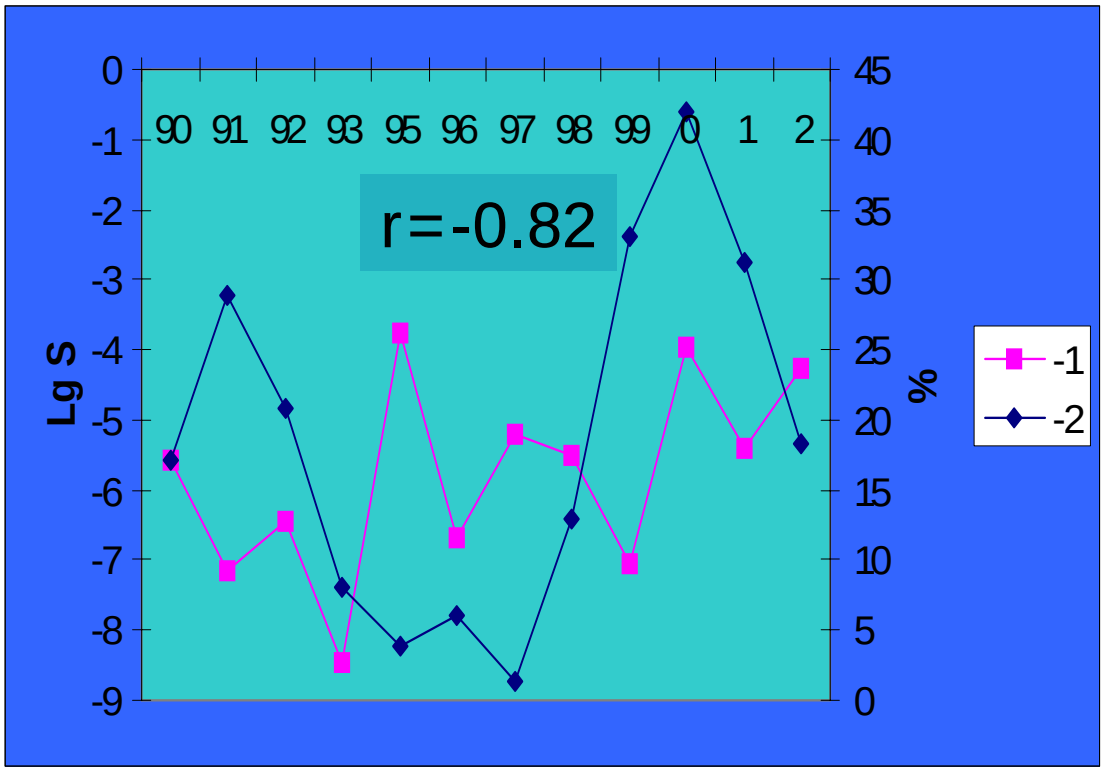


- It is obvious from this graph that recruits survival is not depended upon abundance of parental stock



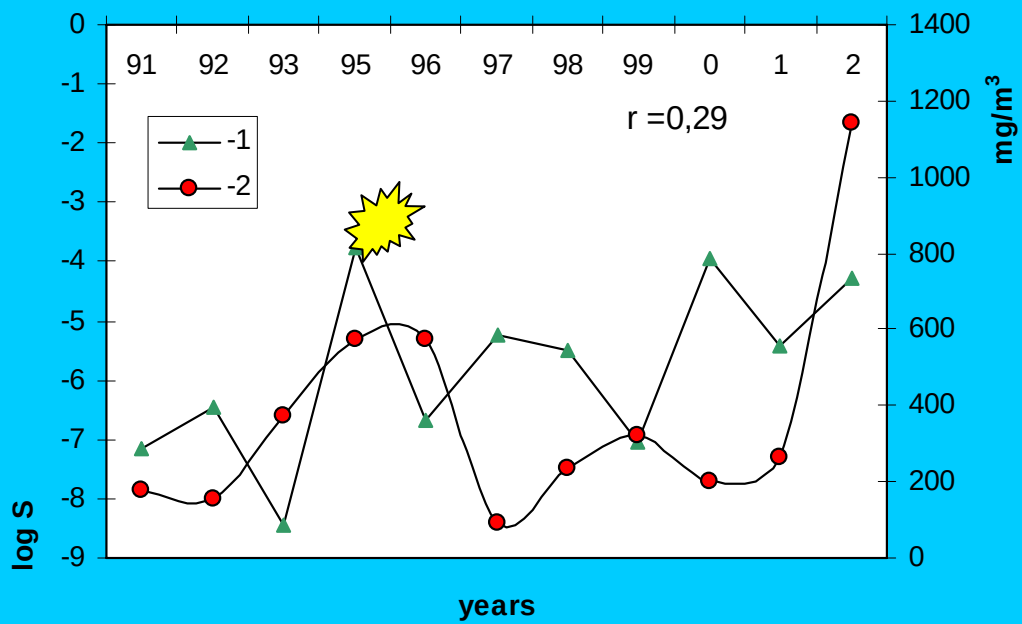
Correlation coefficient between pollock spawning stock and 1-year old fish abundance is 0.67, which means that the higher the number of parents participating in a spawning event, the higher the number of 1-year old fish.

Proportion of first spawning females and survival of recruits



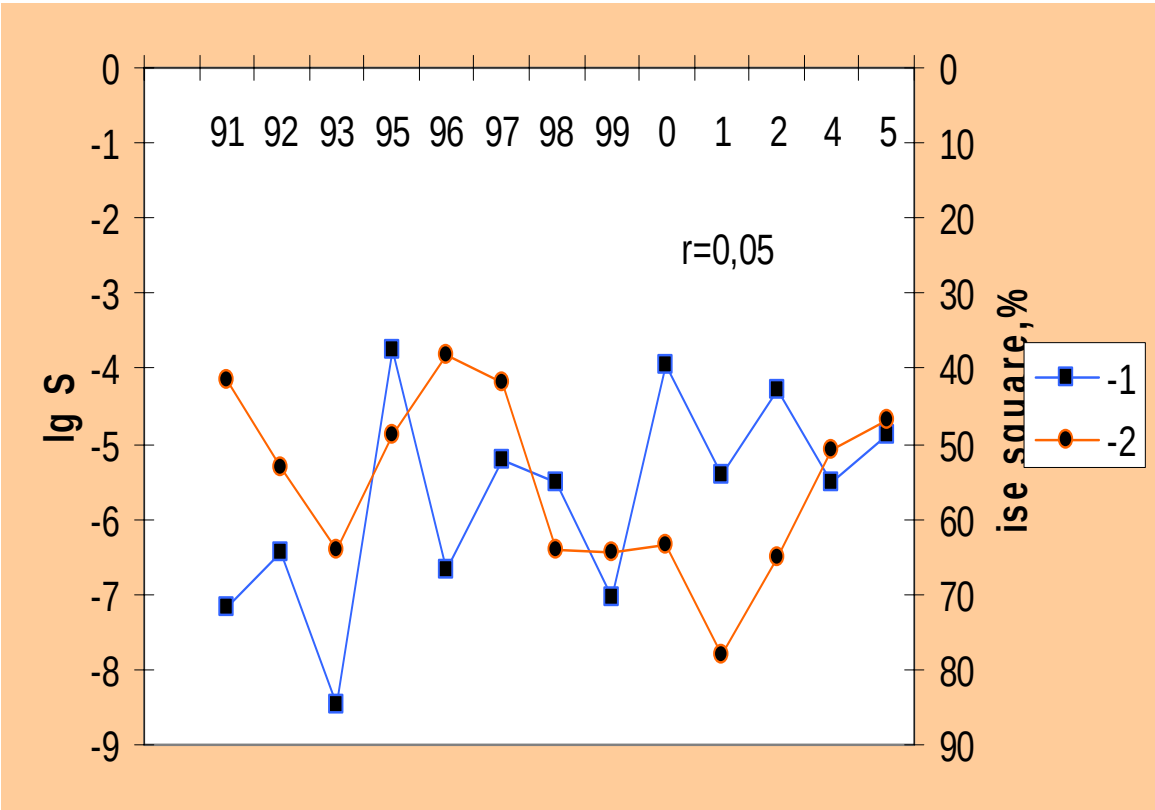
- Correlation coefficient between proportion of first spawning females and recruits' survival is -0.82. In some years good recruits survival was related to large spawning pollock individuals and their moderate age; however, long-term data did not confirm influence of these factors on pollock survival.

Walleye pollock survival (Log N_1/N_{eggs}) (1) and biomass of the Copepoda (2) on the Western Kamchatka spawning ground in 1991-2002



No significant relationship has been revealed between the abundance of forage organisms, for example, copepods, (and relative abundance of predatory and non-predatory plankton) and pollock progeny survival for long-term observations. However, in some years, for example in 1995, high biomass of copepods was associated with high survival of juveniles.

Ice cover (2) and survival of walleye pollock recruits (1)



- The ice extent could potentially influence pollock reproduction in the Okhotsk Sea. Our long-term data show that ice extent does not produce direct influence on pollock recruits' survival. Water temperature and direction of currents also did not show direct influence on the survival of eggs and larvae.

Conclusion

- Most important factors which have high influence on pollock recruits' survival and year classes abundance are the abundance of pollock spawning stock and its age composition. Low abundant pollock spawning stock does not provide high abundant year class because of low population fecundity, which was observed in the early 2000s, when, in spite of high recruits survival in 2000 and 2002, recovery of pollock stock was much slower than in the 1990s in the Okhotsk Sea.