Trend coincidence of Pink salmon catch dynamics among the odd-years and even-years populations: regional and basin scale views

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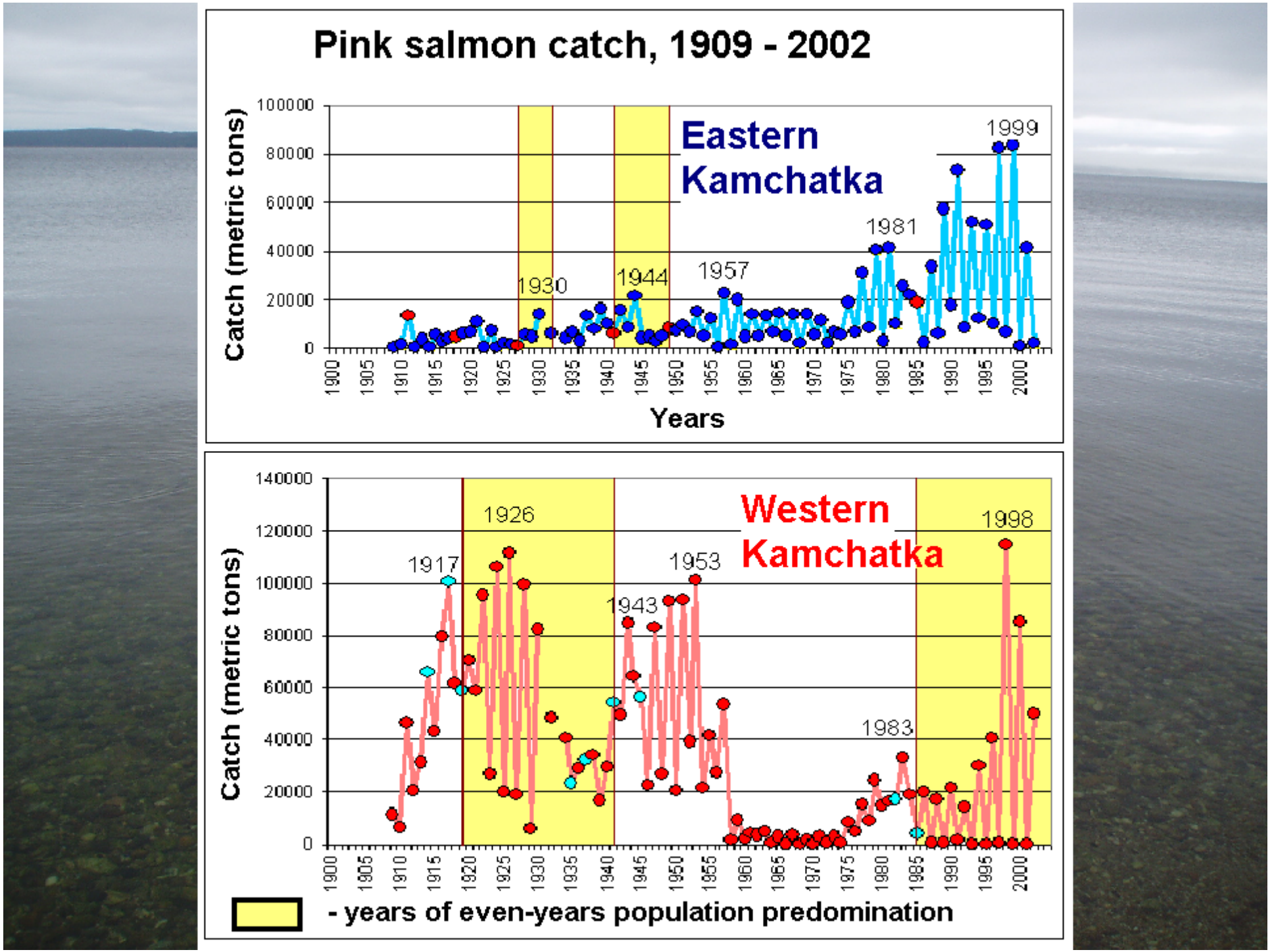
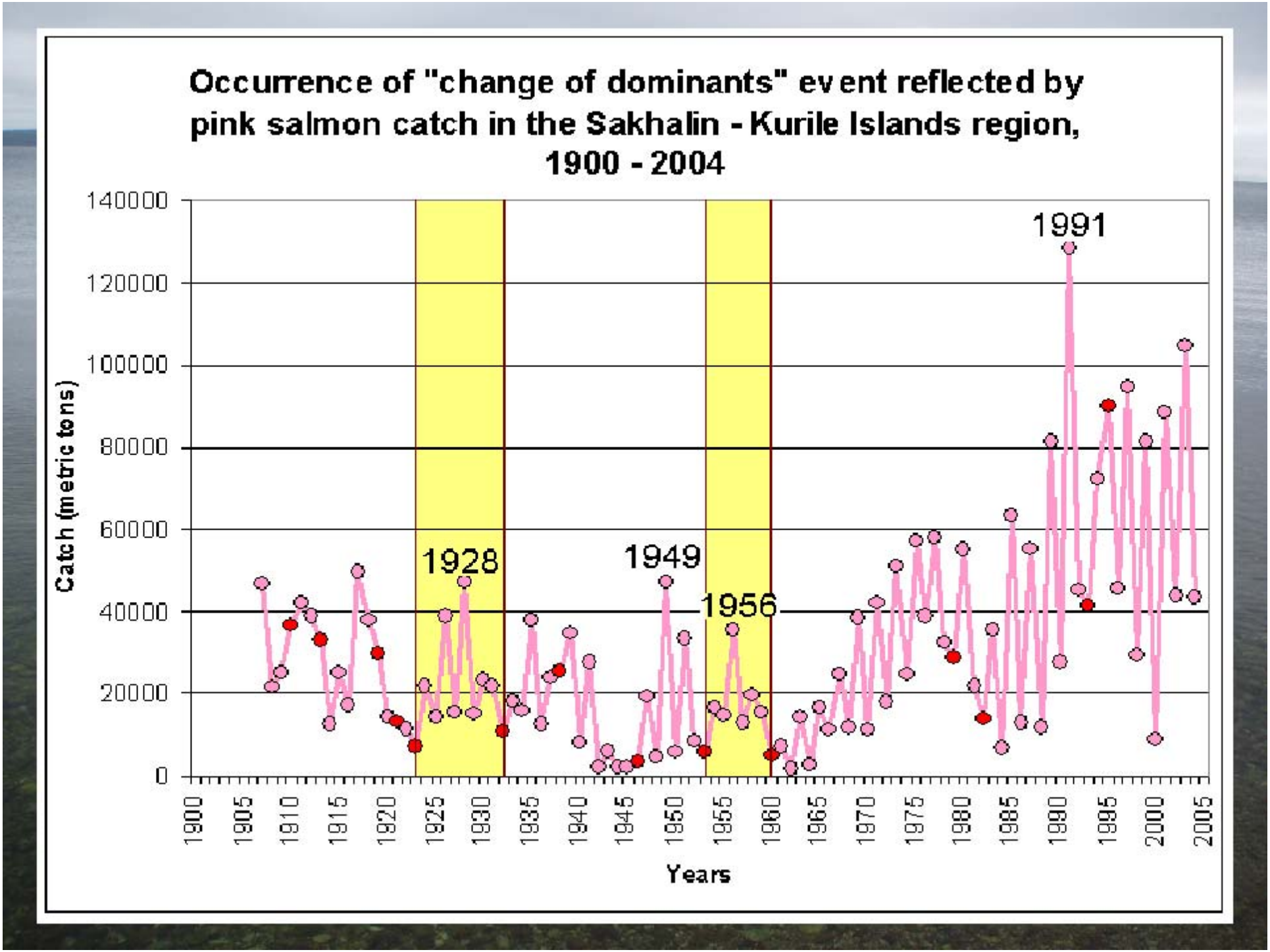
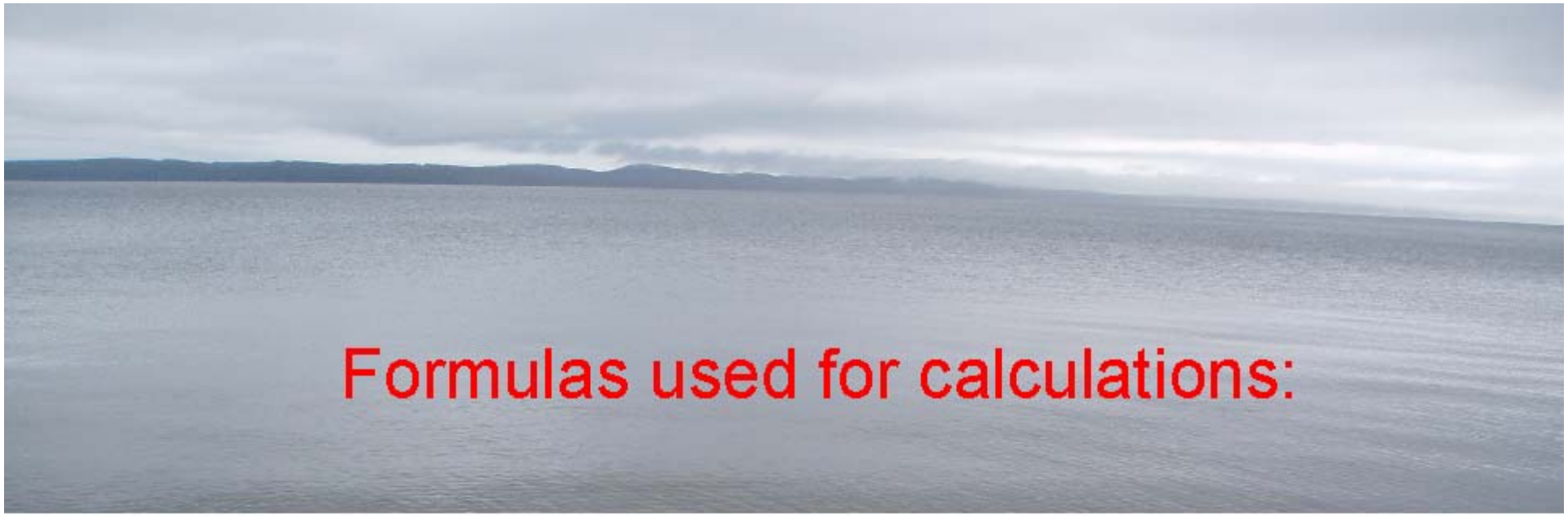

Pink salmon catch, 1909 - 2002
Catch (metric tons)
Years
Eastern Kamchatka
1930
1944
1957
1981
1999
Western Kamchatka
1917
1926
1943
1953
1983
1998
- years of even-years population predomination


Occurrence of "change of dominants" event reflected by pink salmon catch in the Sakhalin - Kurile Islands region, 1900 - 2004
Catch (metric tons)
140000
120000
100000
80000
60000
40000
20000
0
1928
1949
1956
1991
1900
1905
1910
1915
1920
1925
1930
1935
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
Years



Formulas used for calculations:

$$C_{exp\ 2004} = (C_{fact\ 1996} + C_{fact\ 1998} + C_{fact\ 2000} + C_{fact\ 2002})/4$$

$$D_{2004} = C_{fact\ 2004} - C_{exp\ 2004}$$

Where $C_{exp\ i}$ is expected catch for corresponding year; $C_{fact\ i}$ is **factual** catch for corresponding year; D is deviation of factual catch from the expected catch in the corresponding year

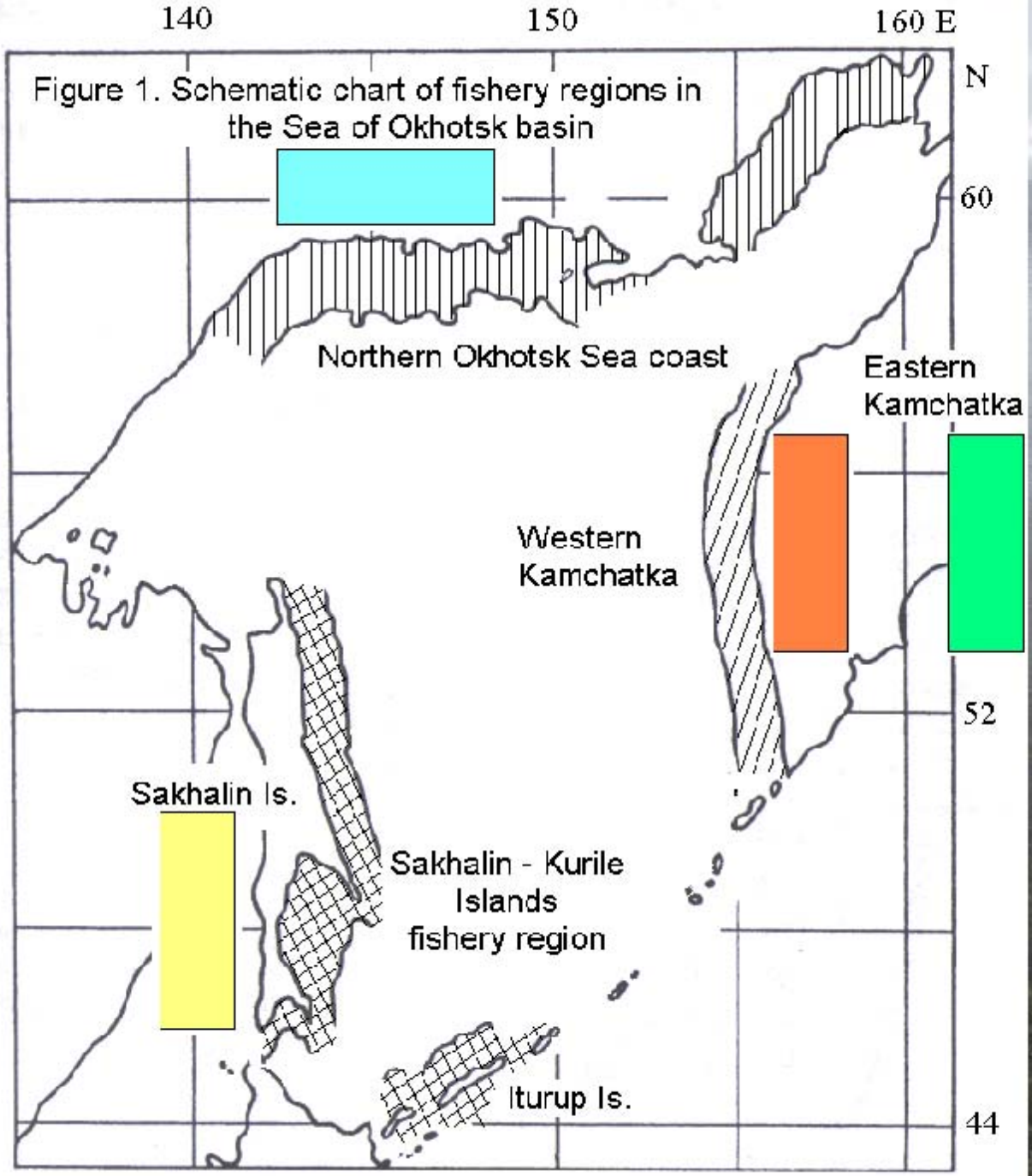
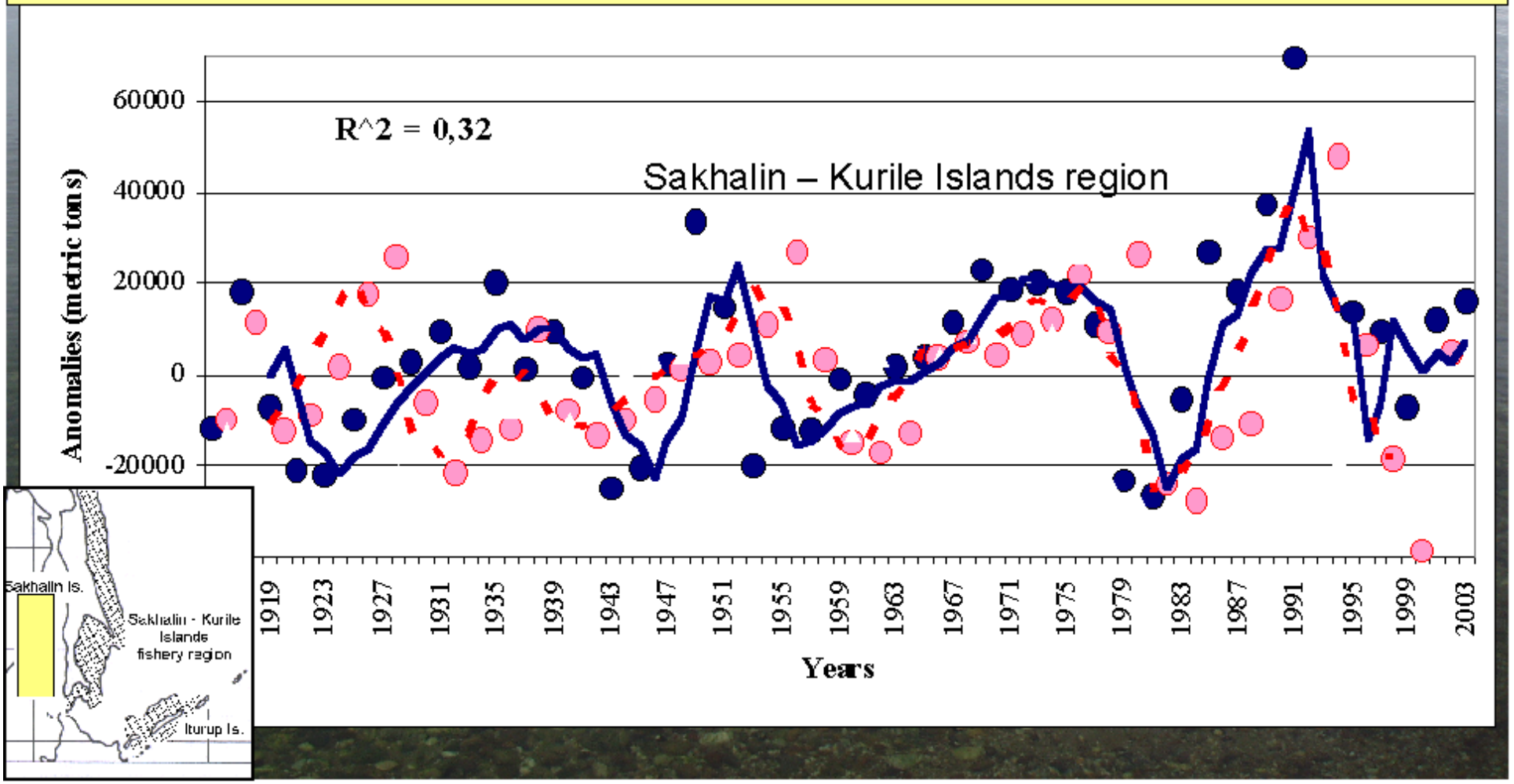


Figure 1. Schematic chart of fishery regions in the Sea of Okhotsk basin

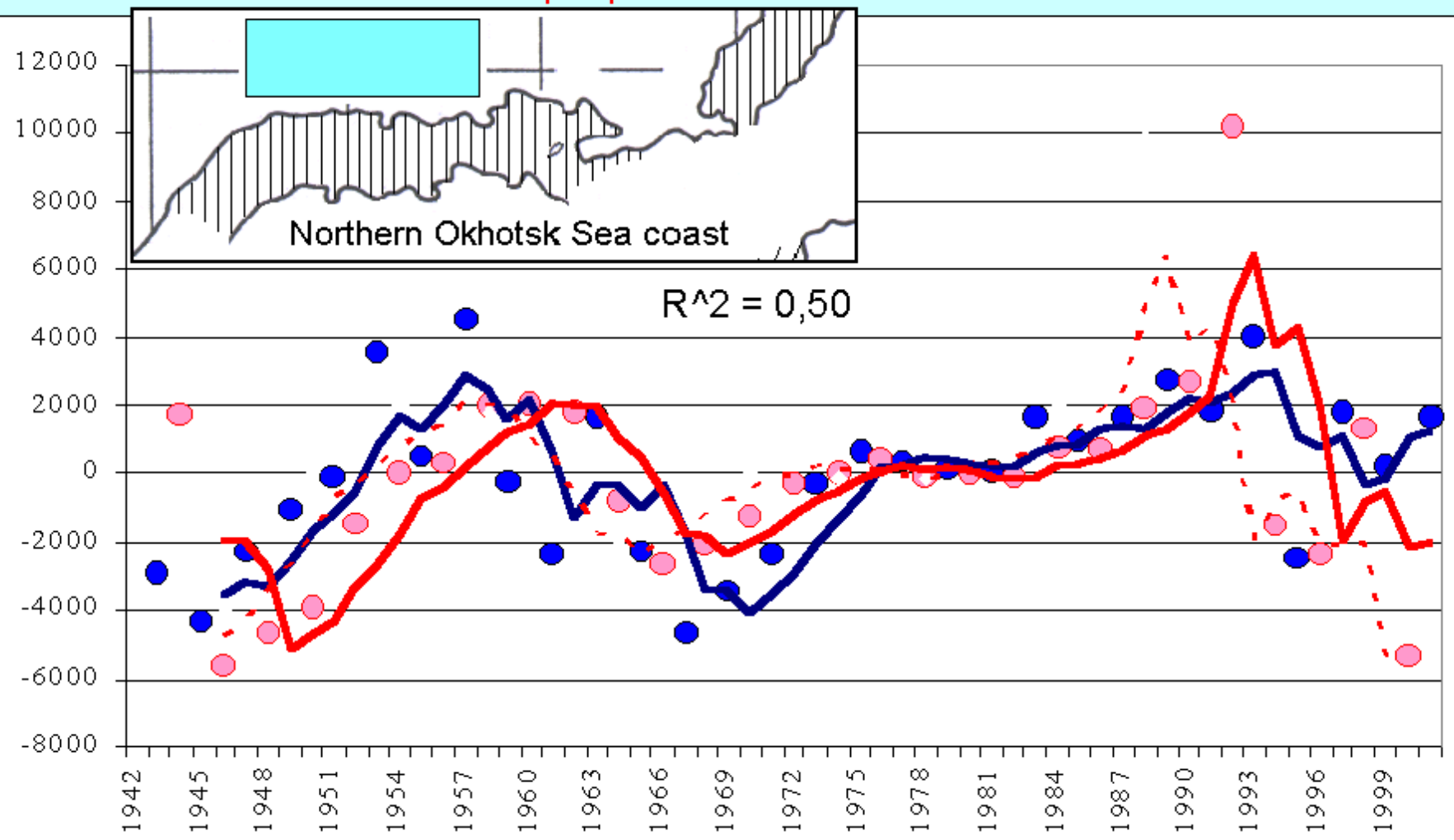
Remark:

Rectangle colors near the fishery regions are the same as on slides with the pink salmon catch dynamics for indicated regions or their parts.

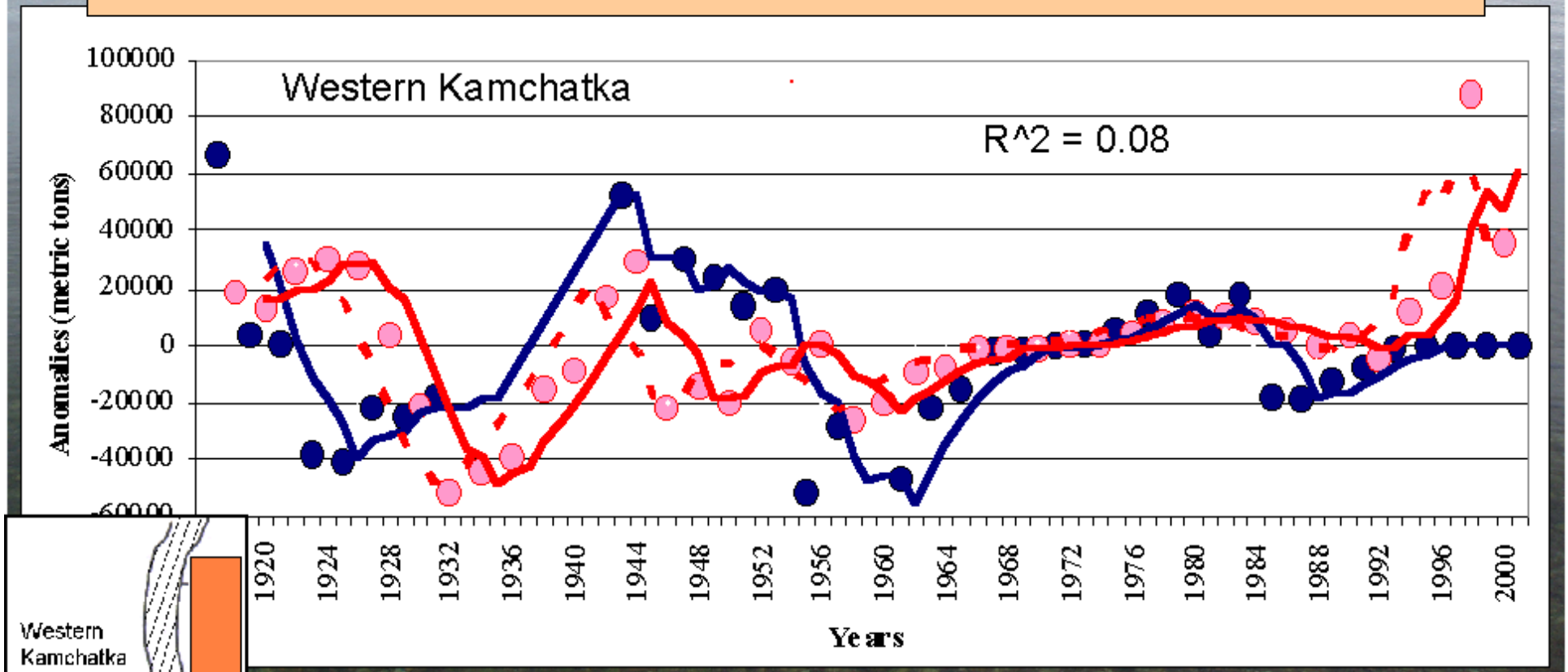
Anomalies of expected pink salmon catch value in the Sakhalin – Kurile Islands region, 1915 – 2003. Coincidence coefficient of trend curves for the odd-years (blue line, dark circles) and even-years (red line, open circles) populations is given. Trend curve for even-years population (dotted line) was moved back on two steps (four years) for the purposes of illustration



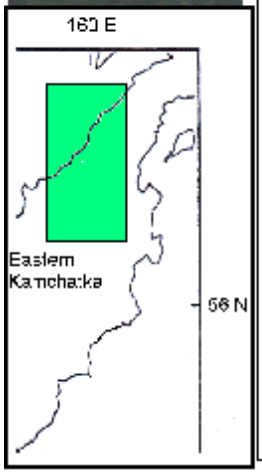
Anomalies of expected pink salmon catch value on the nothern Okhotsk Sea coast, 1942 – 2001. Coincidence coefficient of trend curves for the odd-years (blue line, dark circles) and even-years (red line, open circles) populations is given. Trend curve for even-years population (dotted line) was moved back on two steps (four years) for the purposes of illustration

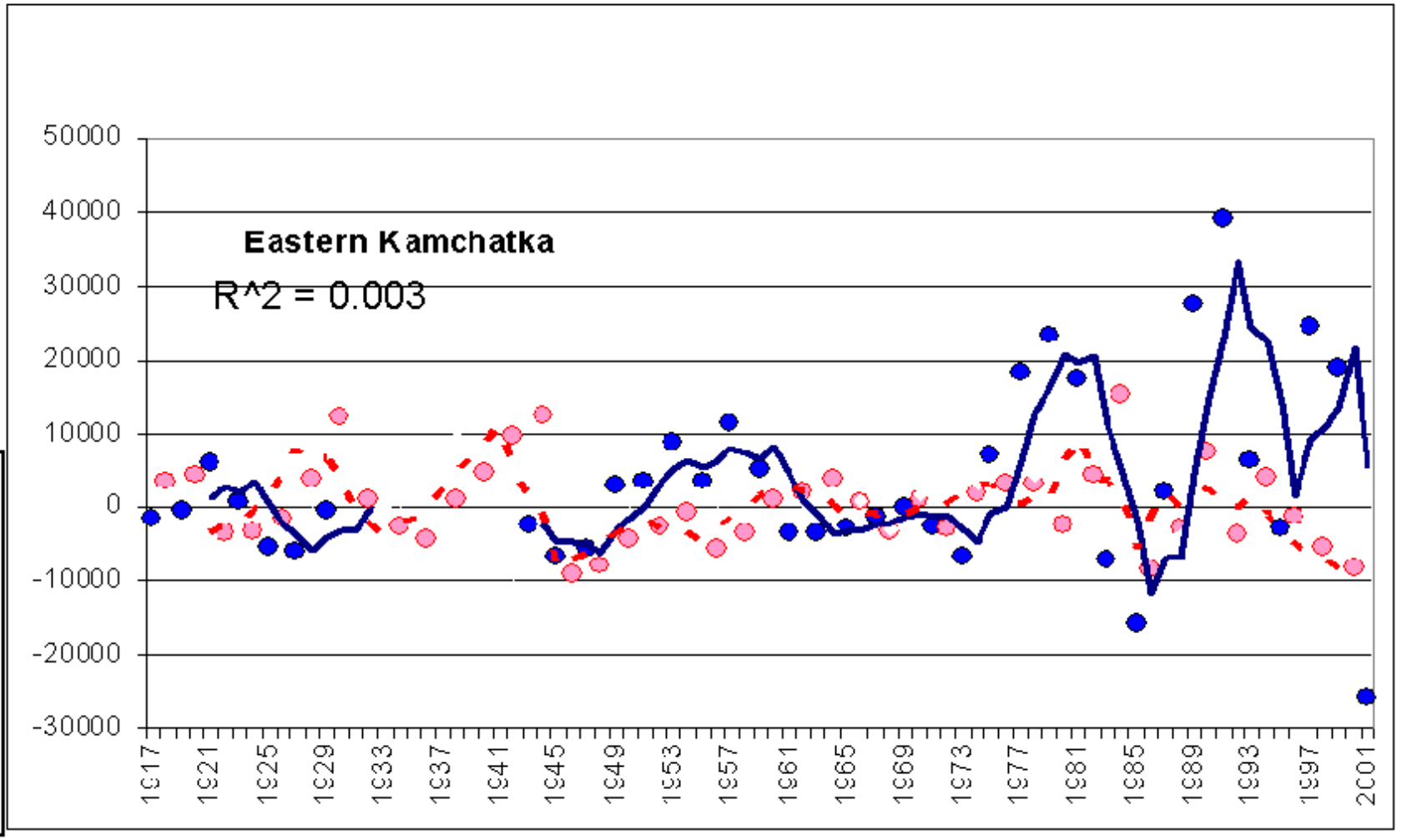


Anomalies of expected pink salmon catch value on the western Kamchatka coast, 1916 – 2001. Coincidence coefficient of trend curves for the odd-years (blue line, dark circles) and even-years (red line, open circles) populations is given. Trend curve for even-years population (dotted line) was moved back on two steps (four years) for the purposes of illustration



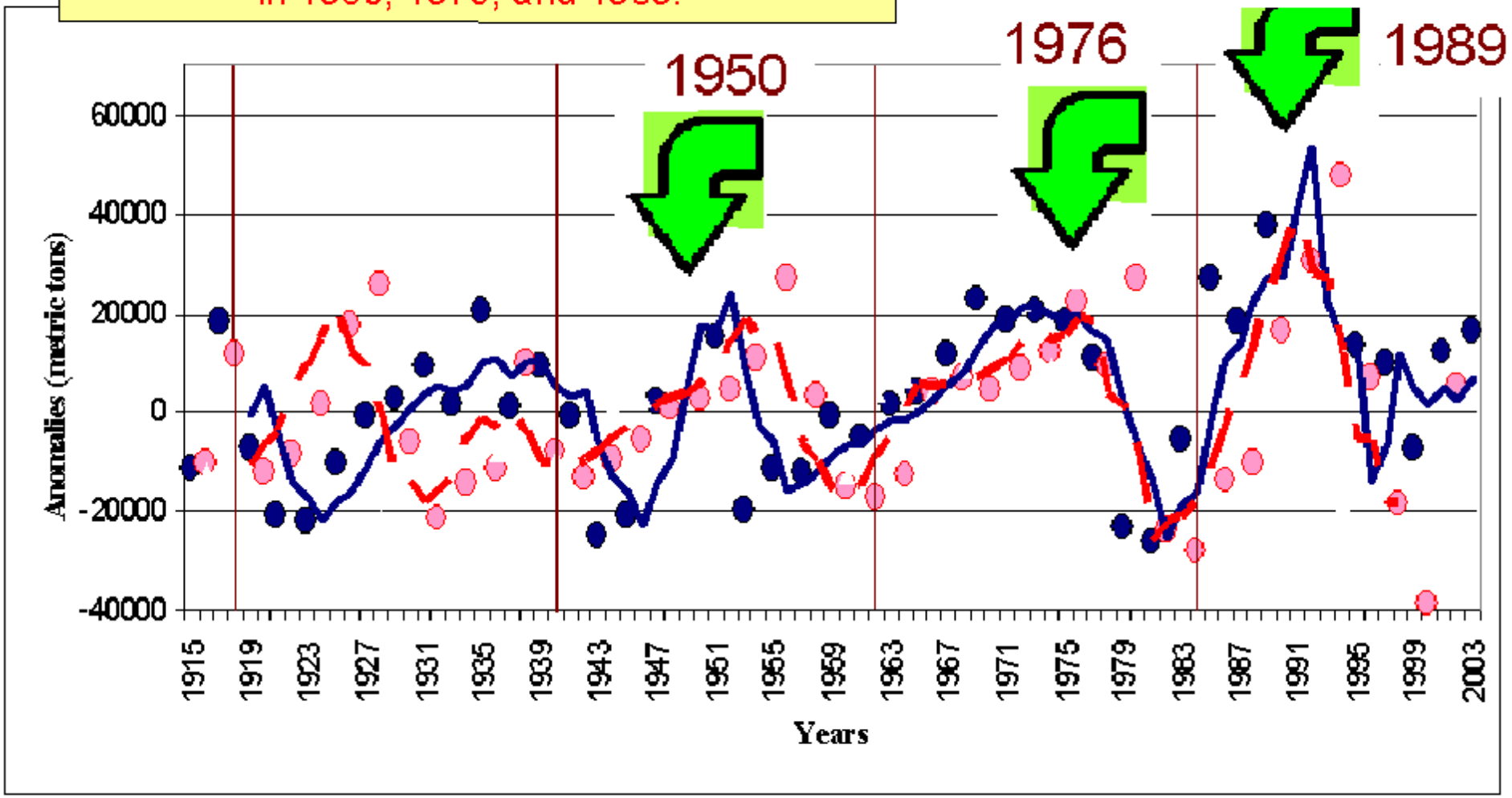
Anomalies of expected pink salmon catch value on the eastern Kamchatka coast, 1917 – 2001. Coincidence coefficient of trend curves for the odd-years (blue line, dark circles) and even-years (red line, open circles) populations is given. Trend curve for even-years population (dotted line) was moved back on two steps (four years) for the purposes of illustration



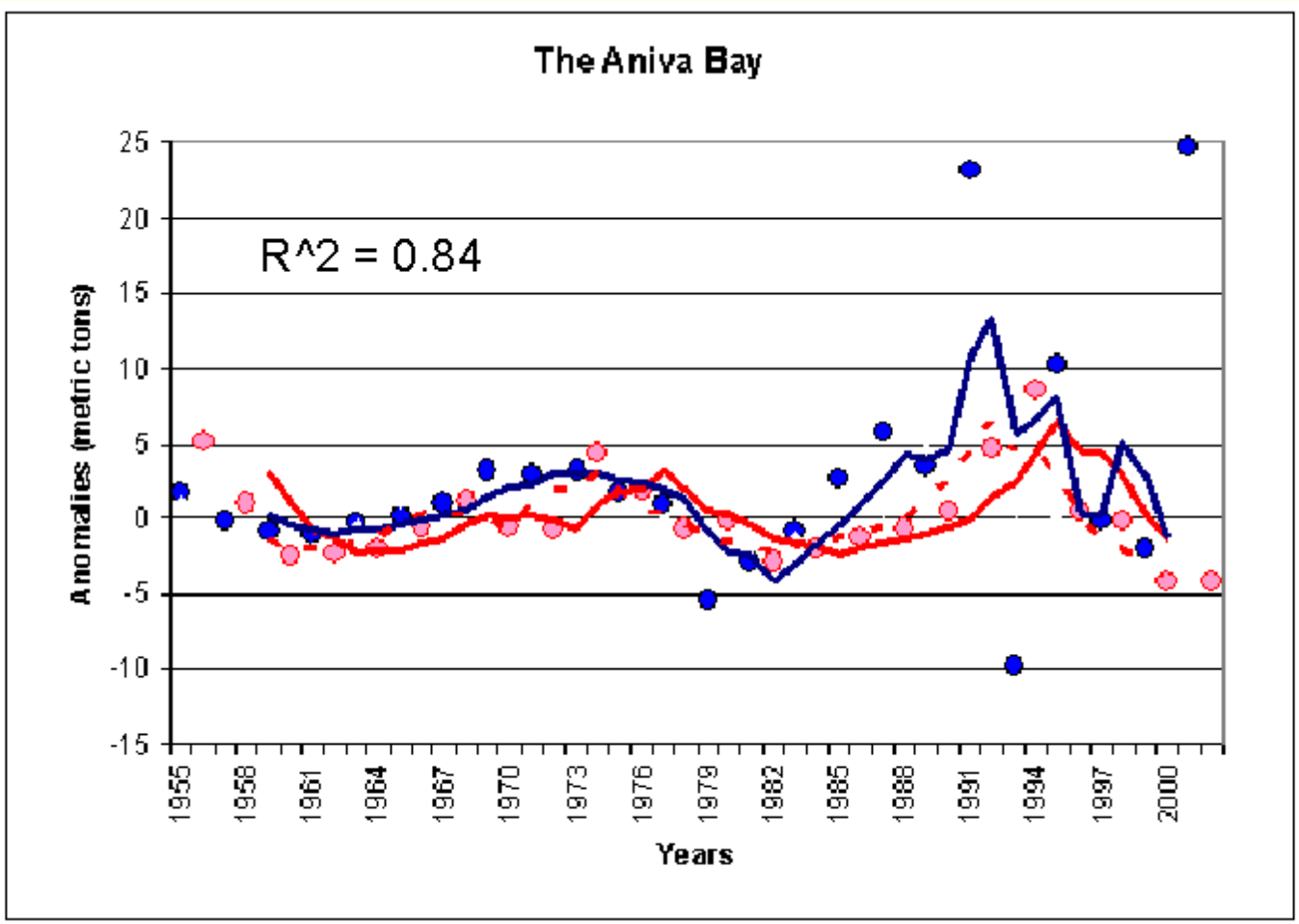


In the Sakhalin – Kurile Islands region, uptrend and downtrend alternation roughly coincided with 22-years (double solar) cycle. Rough coincidence of peaks of the odd-years trend curve occurred with the generally recognized years of climate-oceanological «regime shifts» in 1950, 1976, and 1989.

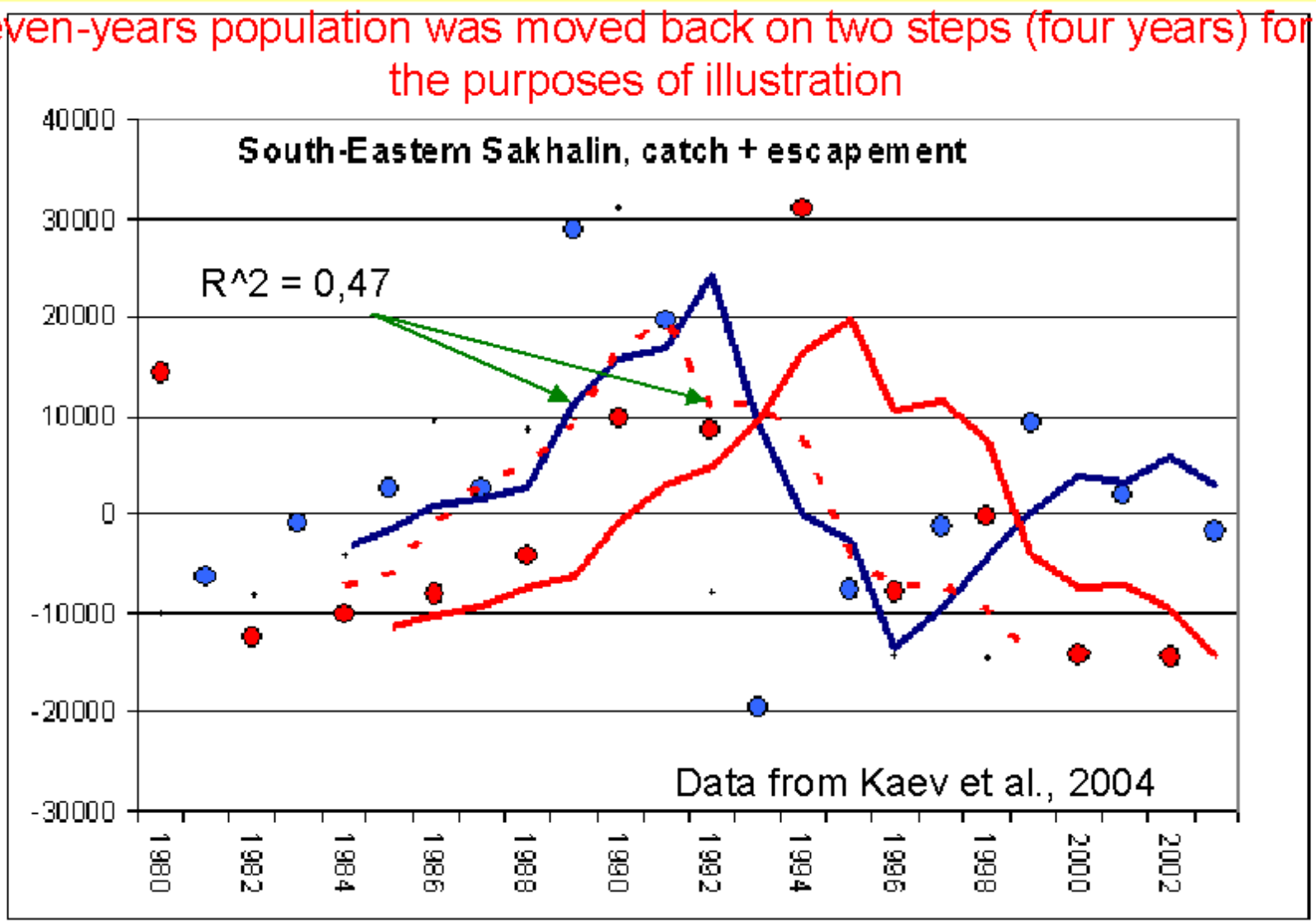
2 x



Anomalies of expected pink salmon catch value in the Aniva Bay (part of the Sakhalin – Kurile Islands region), 1955 – 2002. Coincidence coefficient of trend curves for the odd-years (blue line, dark circles) and even-years (red line, open circles) populations is given. Trend curve for even-years population (dotted line) was moved back on two steps (four years) for the purposes of illustration



Anomalies of expected pink salmon abundance (catch + escapement) on the south-eastern Sakhalin Island coast, 1980 – 2003. Trend curves for the odd-years (solid line, dark circles) and even-years (dotted line, open circles) populations are given. Dotted trend curve for even-years population was moved back on two steps (four years) for the purposes of illustration



Key point of discussion:

V. Sukhanov (1997) notes that the temporary dynamics of the effecting factor, as the main thing from which he selected food supply, is the fluctuations of sinusoid curve. Population maximally effectively uses its food supply, if its abundance changes synchronously with the fluctuations of its feed availability.

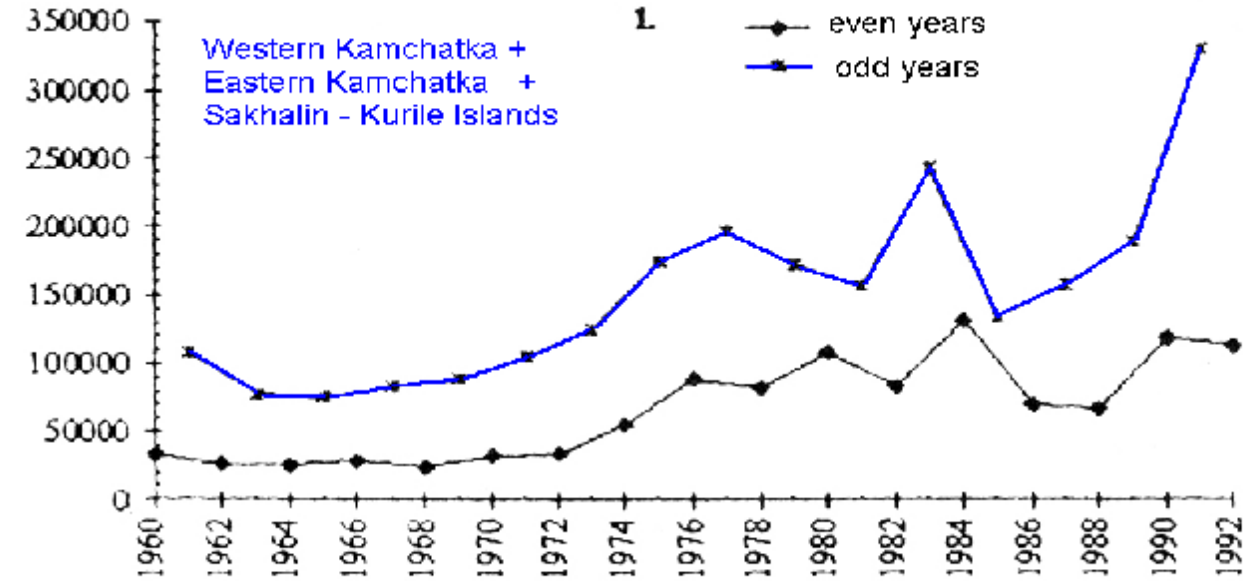
This hypothesis must be correct for any of the factors (complex of factors), which determine the complex of conditions and resources of the living environment of population. From this point of view, the synchronization of a change in the pink salmon populations' abundance can be explained completely, since they dwell same rivers, coastal sections, and oceanic regions during the life cycle.

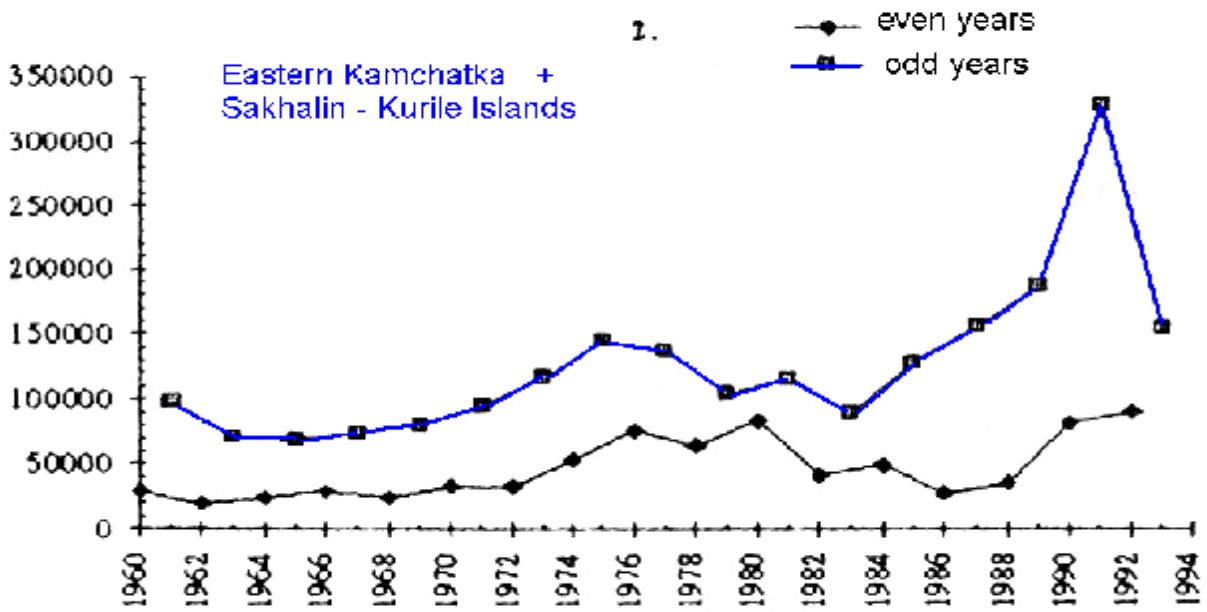
V. Sukhanov (1997) writes about the natural selection of populations according to the sign of the more complete utilization of the "fluctuating feed availability".

Such populations possess the properties of conservative system, which is located in the region of its ecological optimum, if we will consider such optimum as the maximal possibility of resources utilization and benefits from the ambient environmental conditions, and, therefore, the abundance maximum averaged in the time.

If this hypothesis is accurate, the pink salmon populations of the southern part of the Sakhalin Island, reproducing in rivers of the southeastern coast and the Aniva Bay, are distributed closer to the "region of ecological optimum" than other in a life cycle.

Does fishery statistics properly reflect the abundance dynamics?





Pink salmon abundance dynamics (catch + escapement) in some large fishery regions of the Russian Far East, 1960 - 1994, after Varnavskaya et al. 1995

Conclusions:

- Odd-years and even-years populations of pink salmon in different regions of the Sea of Okhotsk coast demonstrate coincidence of catch dynamics through the whole existing catch series.

- That supposes an existence of the strictly determined internal response of salmon generative lines to the periodic dynamics of global factors, which effecting environmental conditions of salmon reproduction and survival.

- However, salmon dynamics trends obtain own regional features determined by local factors as natural, as anthropogenic ones.

- Pink salmon populations of the south-eastern side of Sakhalin Island and the Aniva Bay are functioning in environmental conditions, which are the closest to optimal ones for this salmon species. Therefore, the abundance trends of odd-years and even-years populations coincide there in the most degree.

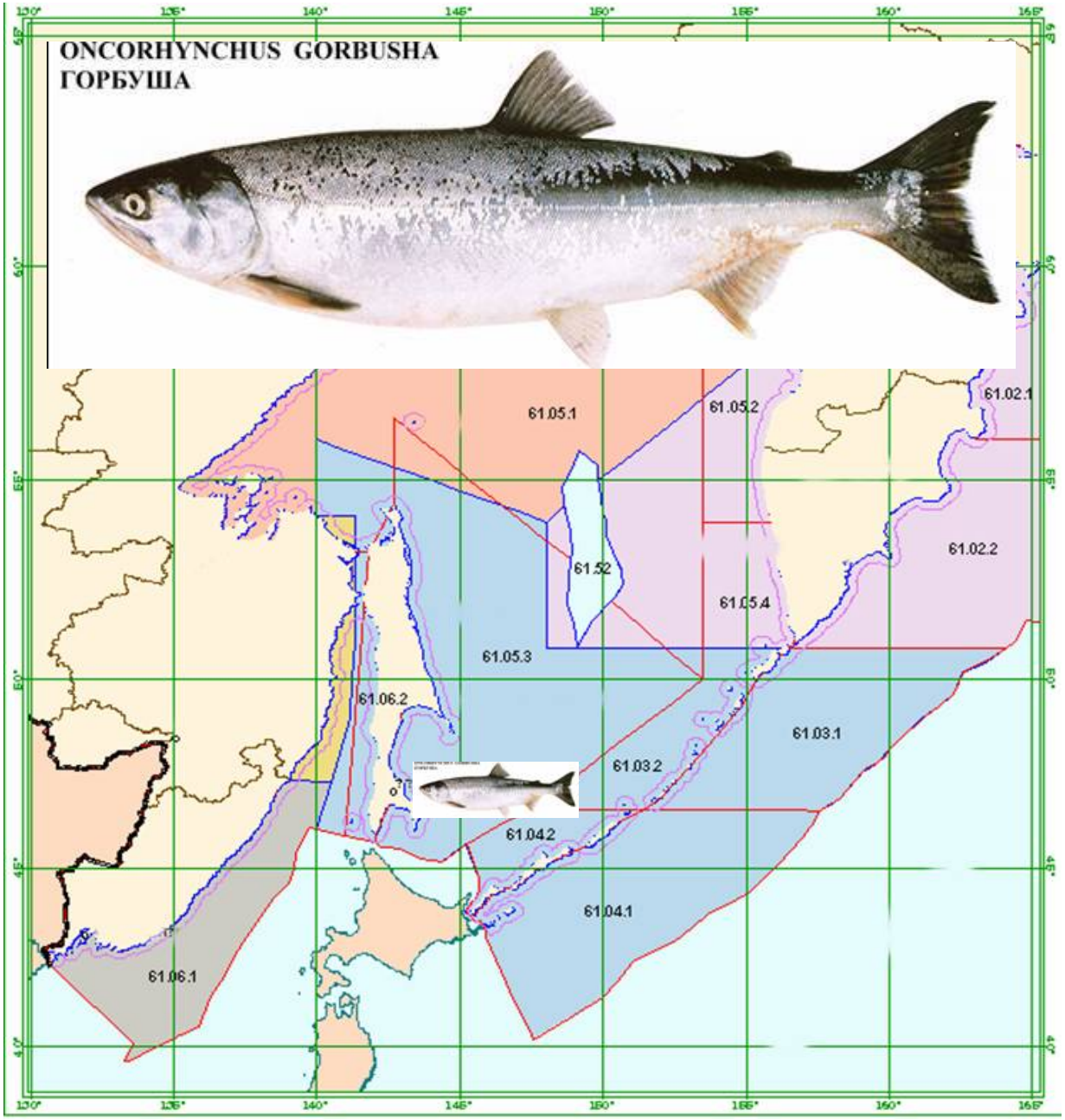
Can we forecast pink salmon catch from the found dependence ?

Routine calculations give estimation of pink salmon harvest for the Aniva Bay and the south-eastern Sakhalin coast at 12,630 metric tons in 2004

Factual catch totaled 12,800 metric tons!

Great success?

A pure fluke !!!



Likely, it could be used for tuning of forecast developed by traditional method

However, it is obvious that the time of new revisions approaches in a process of studying the climatic and oceanological factors effects on Pacific salmon abundance dynamics. The optimal size of regional group should be defined, which should be considered as a separate unit in the study of interaction between the environmental factors and abundance dynamics. The data generalization by the traditionally established fishery or statistical regions can introduce additional inaccuracies.