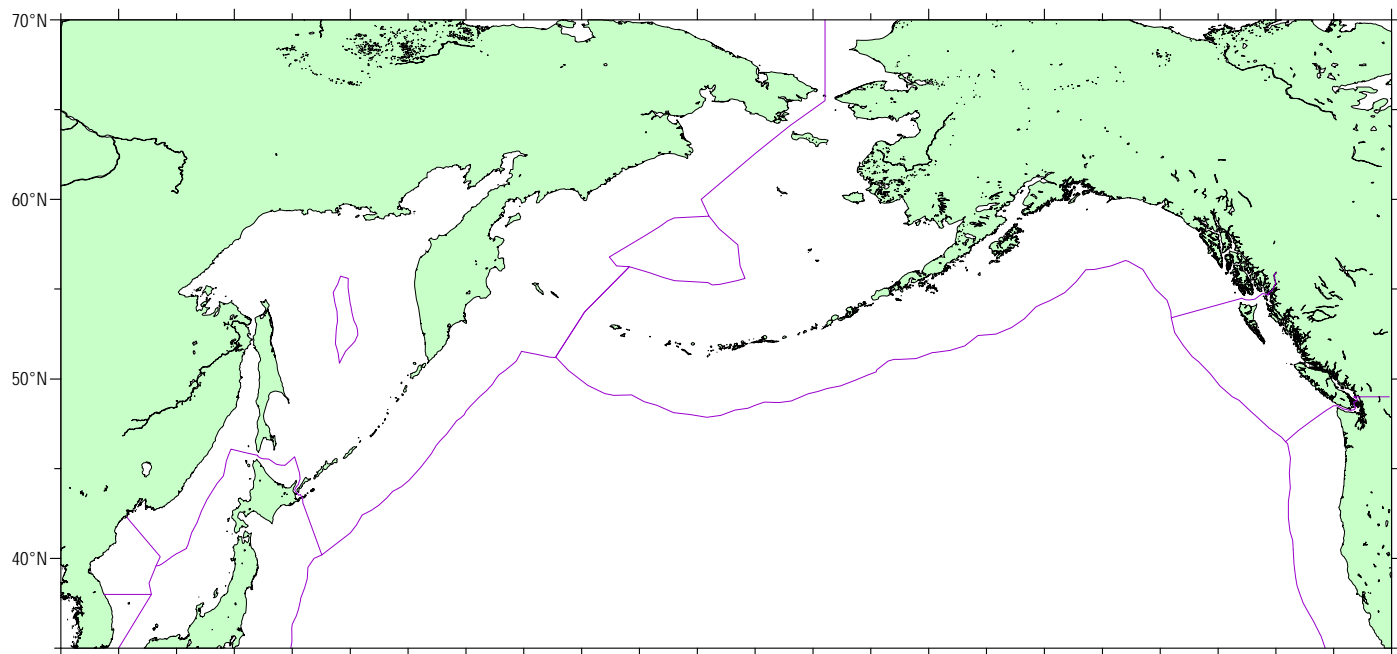


# Global and regional elements of ecological capacity of the Pacific salmon habitat

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## **Outlines**

**The presence of organisms in the sea available for Pacific salmon feeding essentially exceeds their needs. But the parameters of salmon stock population depends on the density factor.**

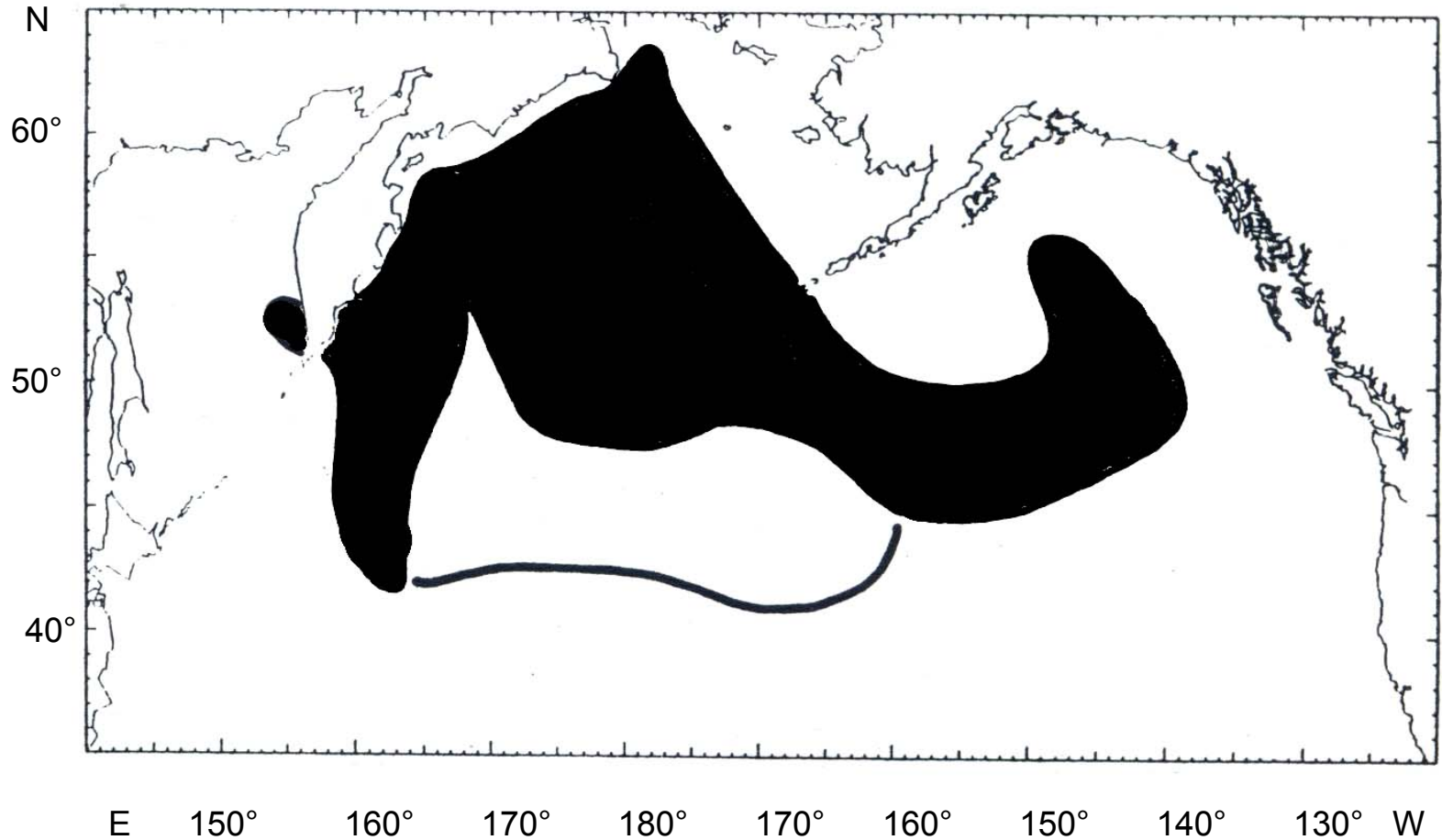
**The carrying capacity of ocean in winter in relation to Pacific salmon determines their abundance in the following spring-summer period in North Pacific in whole.**

**The upper abundance limit of each specific stock is determined by the carrying capacity at the ontogeny stage on which their abundance is maximally restricted.**

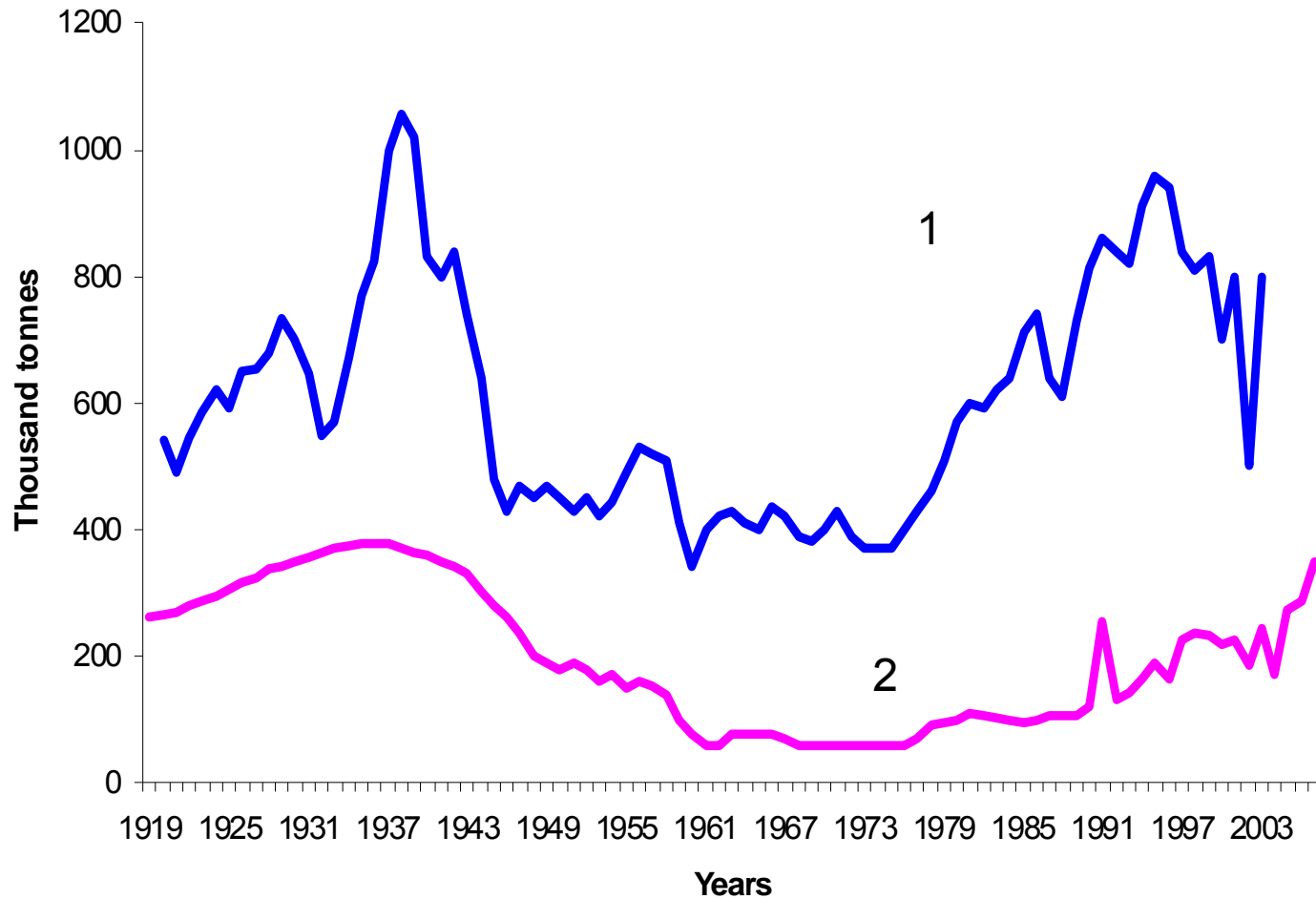
## **Data**

- 1. The data received during the VNIRO expeditions and cruises conducted in 1994-2005.**
- 2. The Russian and NPAFC statistics of Pacific salmon catches for 1920-2006.**
- 3. Data of the Russian satellite and ship monitoring on the SST;**
- 4. The NASA data on chlorofill "a" in the surface layer in the wintering habitat of salmons;**
- 5. The publised data of the Russian and Foreign authors**

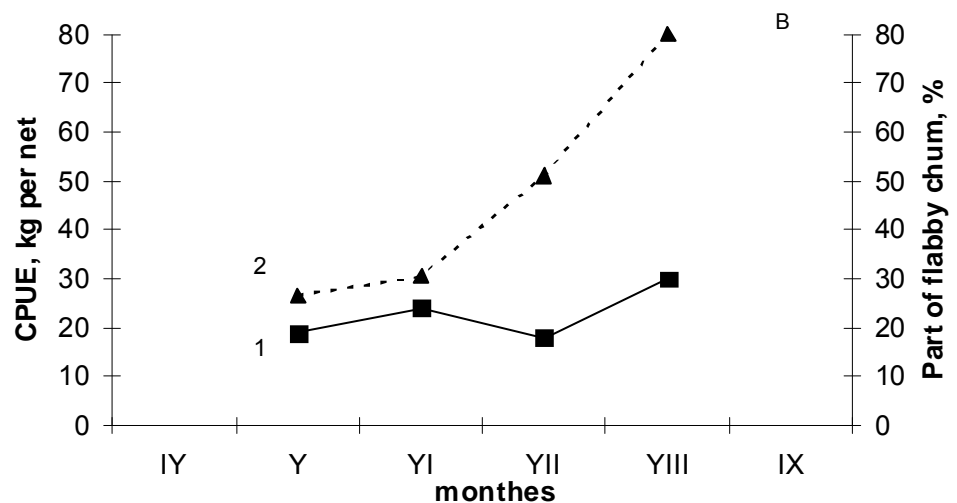
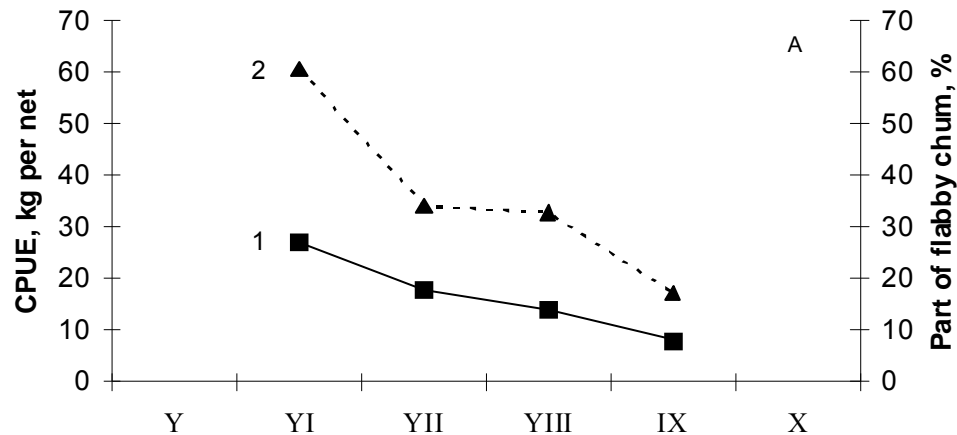
**Feeding area of Japanese chum salmon: □ - before 1971; ■ + □ - after 1971 (by Ogura,1994)**



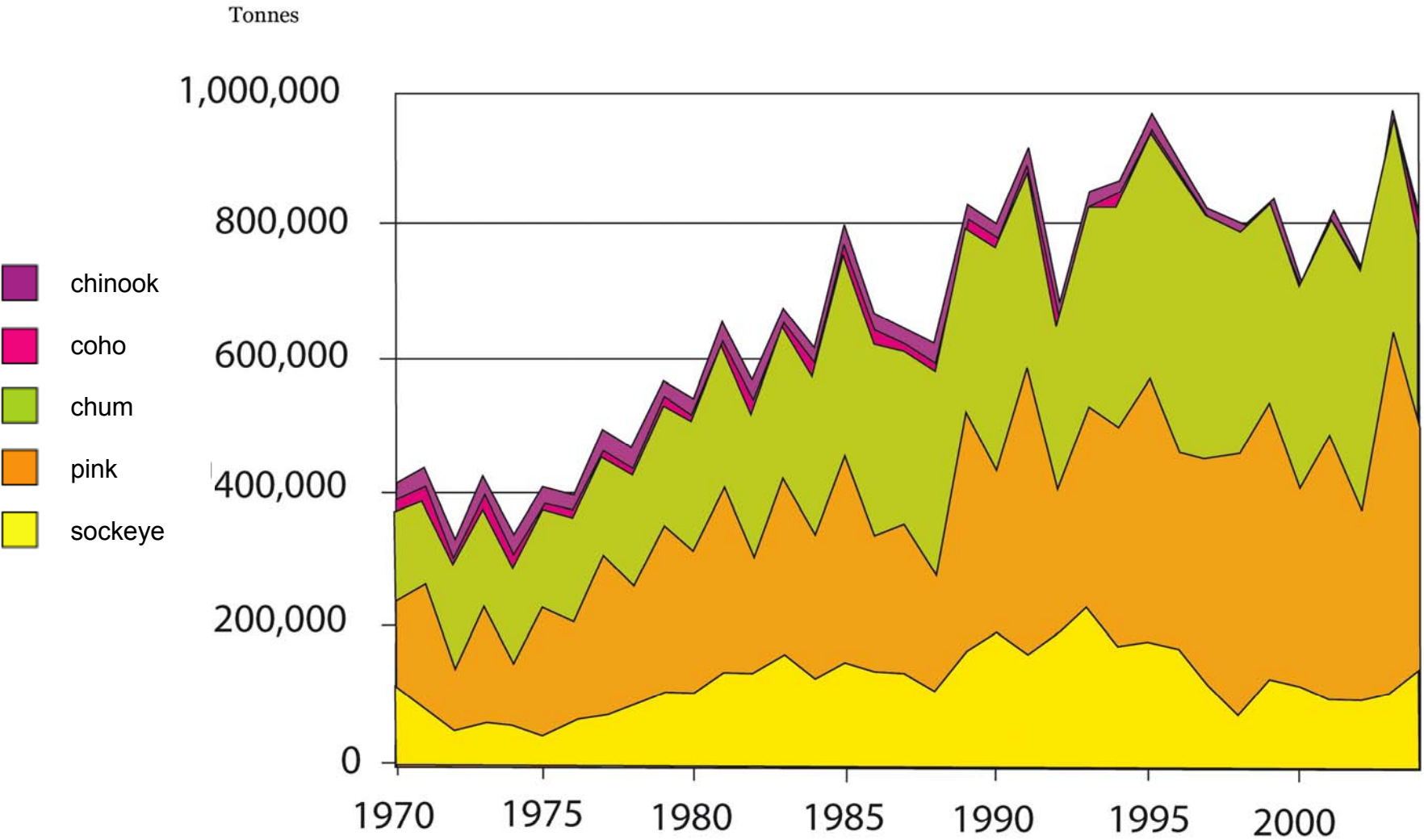
# Total Pacific salmon catch (all species) in the North Pacific (1) and in the Far East Waters of the Russian Federation (2) in 1920-2006



**The catches of chum salmon per unit effort (1) and share of chum salmon with flabby sceleton muscles (flabby chum ) (2) in 1996: A – The Bering Sea; B – Pacific waters off the Kamchatka Peninsula (Gritsenko et al., 1995 ; Klovach, Gritsenko, 1998, Klovach, 2000, 2003)**



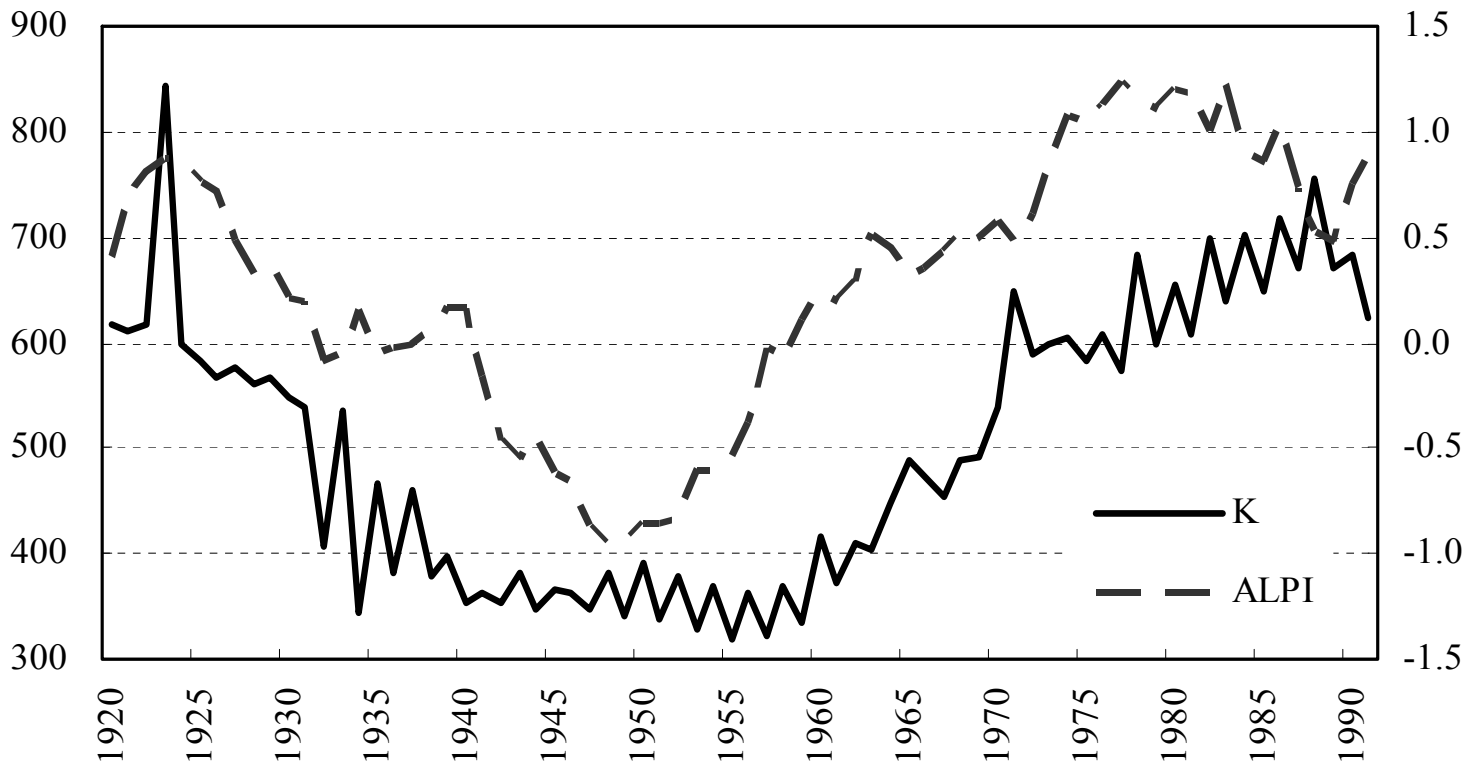
# Total Pacific Salmon catch in Asia and North America (in tons)



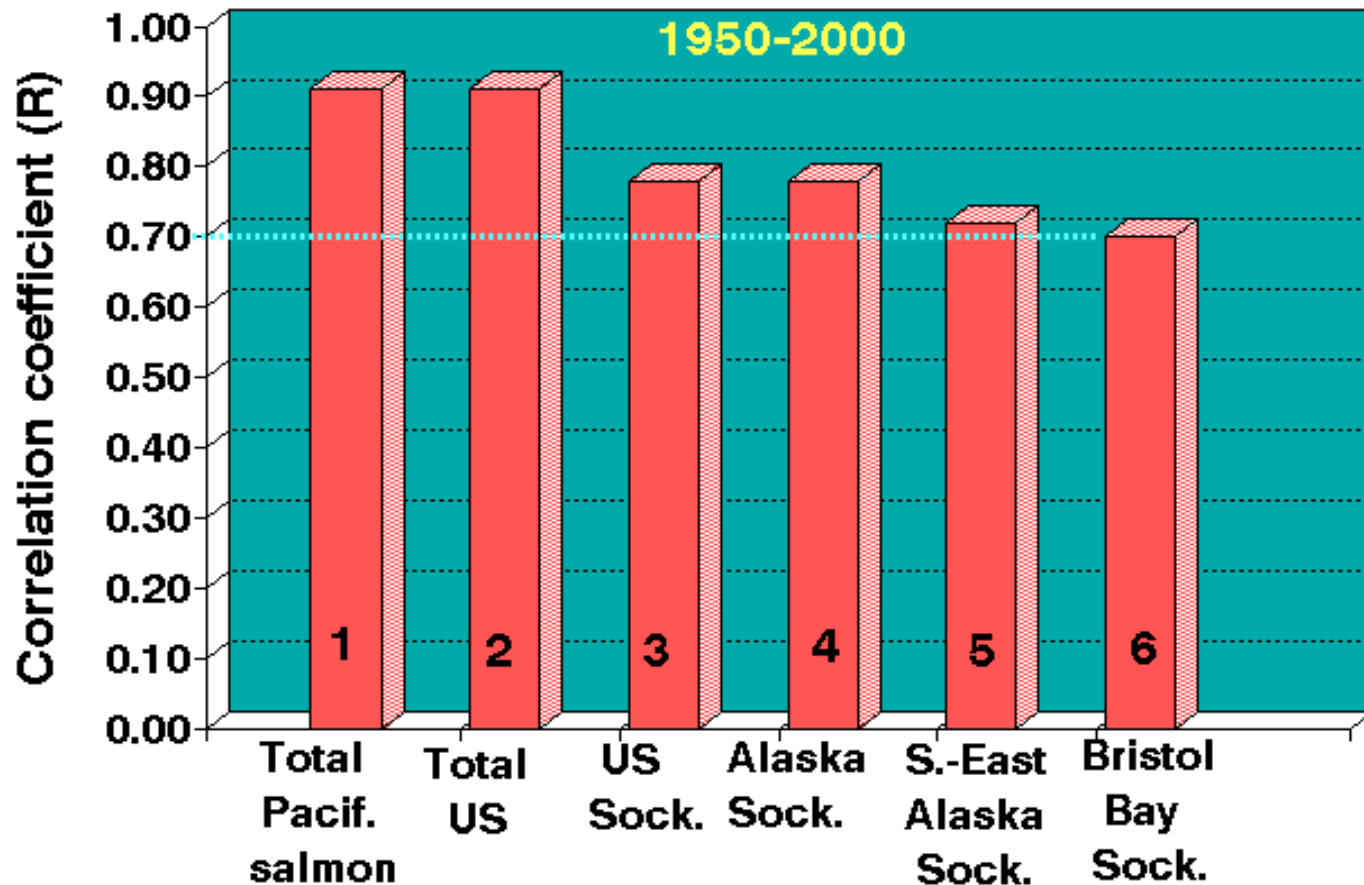
**Because the food availability during the winter season is minimal, the carrying capacity in winter determines the amount of salmon approaches in the following spring-summer period (Beamish et al., 1998). The survival (mortality) of salmon in winter is one of indicators of changes in carrying capacity. Thus, in the 1990's acceleration of natural mortality was observed for pink salmon during the winter feeding period. The minimal observed survival (7.3%) was observed for Okhotsk pink salmon stocks in 2000. In the following years their survival increased and reached 20.8% in 2004 (Radchenko, 2007).**

# Dynamics of Aleutian Low Pressure Index (ALPI) and Total Numbers of Sockeye, Chum and Pink Salmon (K, mln.sp.)

(by Kaeriyama, 2004)

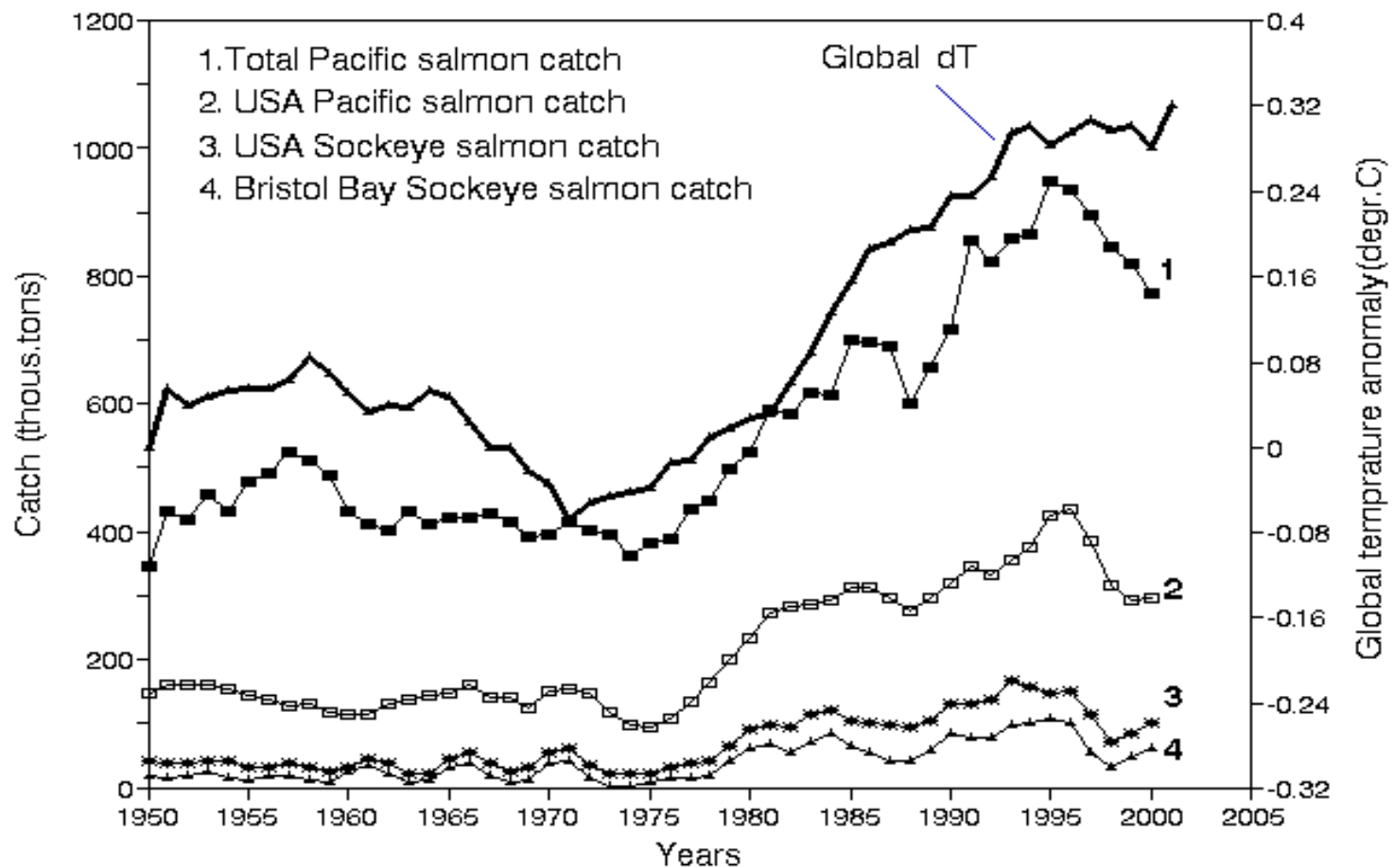


**Correlation between dynamics of Global Temperature Anomaly (dT) and catch of different Sockeye salmon stocks ,1950-2000**

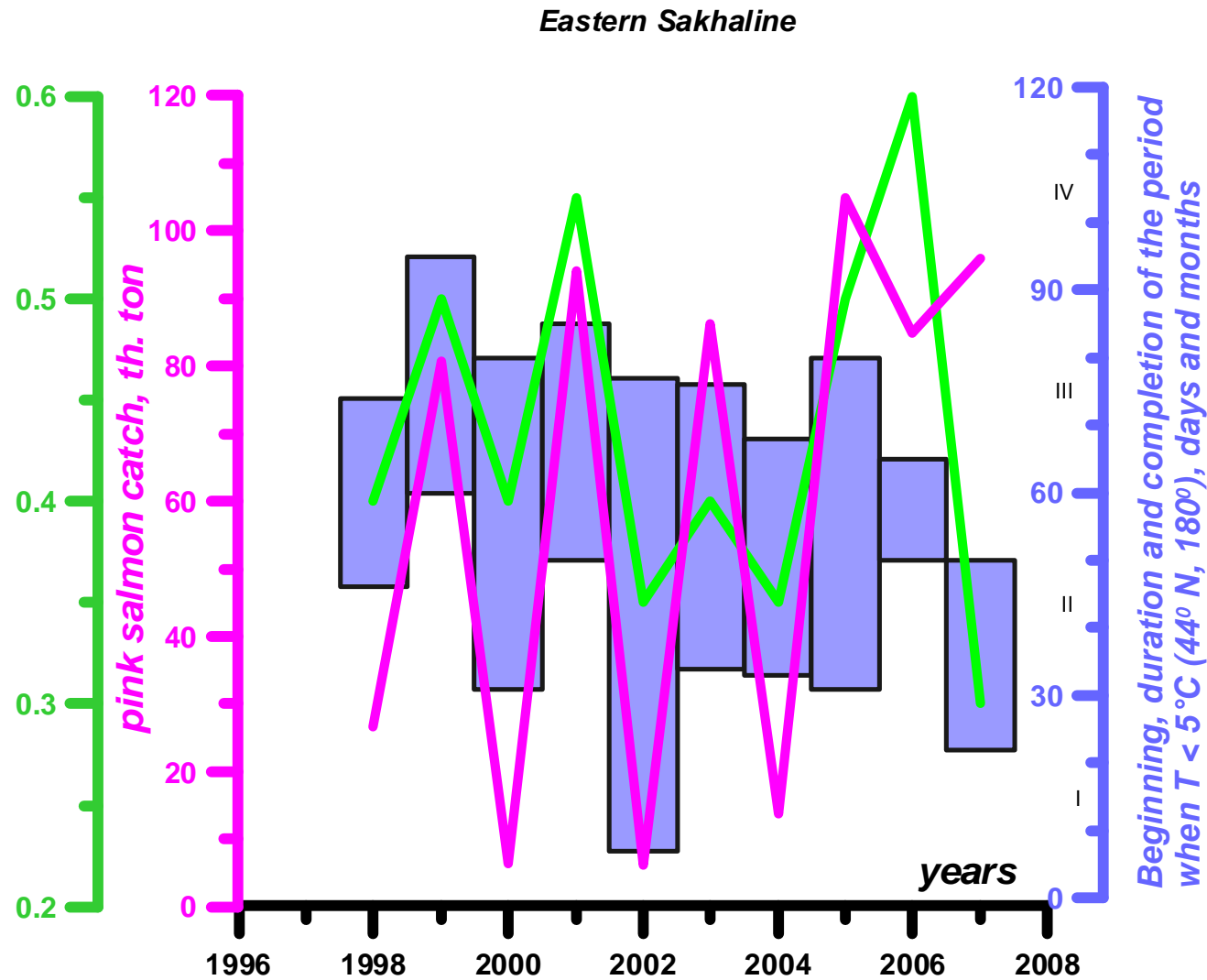


**(by Klyashtorin and Lyubushin, 2005)**

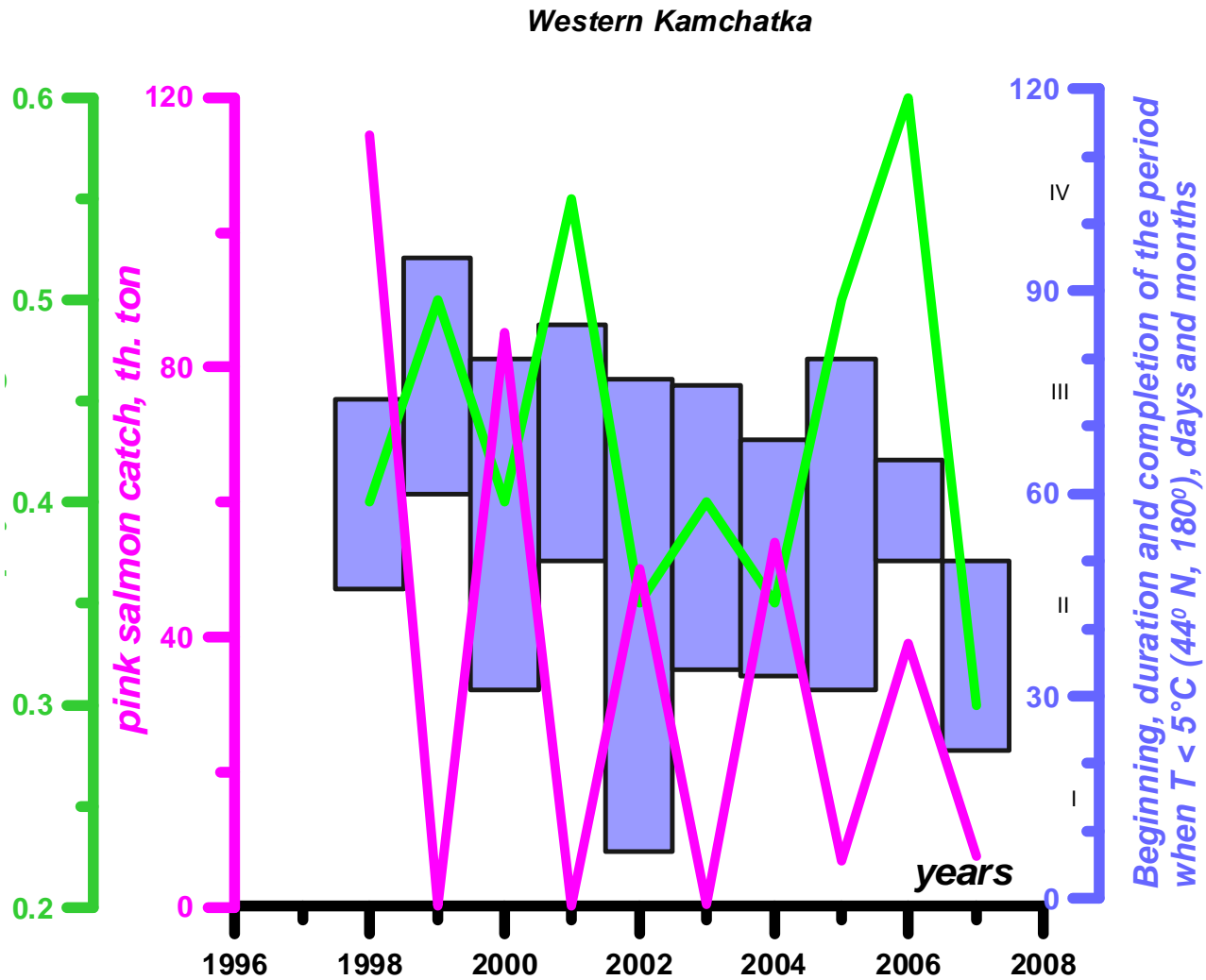
**Comparative dynamics of Global dT and salmon catch in the different North Pacific regions, 1950-2000: 1 – Total Pacific salmon catch; 2 - Total salmon catch of USA; 3 – Sockeye salmon catch of USA; 4 - Catch of Bristol Bay sockeye salmon (by Klyashtorin and Lyubushin, 2005)**



**Duration of the period when  $T < 5^{\circ}\text{C}$  at  $44^{\circ}\text{N}$ ,  $180^{\circ}\text{E}$ , corresponding content of chlorophyll A in winter at the same location and pink salmon catch at East Sakhalin in summer**



**Duration of the period when  $T < 5^{\circ}\text{C}$  at  $44^{\circ}\text{N}$ ,  $180^{\circ}\text{E}$ , corresponding content of chlorophyll A in winter at the same location and pink salmon catch at West Kamchatka in summer**



**Commonly, it may be concluded that the upper boundary of abundance of each specific population is determined by the carrying capacity at the stage of ontogenesis on which their number is very limited.**

**The catches of chinook salmon in the Kamchatka River exceed the registered official catches by 40%, at least.**

**The catches of sockeye salmon in the same river exceed the official ones by two times as minimum (Klovach, 2005; Gritsenko et al., 2006).**

**The illegal annual Pacific salmon catch in Kamchatka rivers during 2002-2006 was 54 thousand tons that constituted about half of the officially registered catch (Zaporozhets et al., 2007).**

## **Conclusions**

**The carrying capacity is not constant. Its variability taking into account the size of the North Pacific make it impossible to accurate determination of the carrying capacity. Our assumption regarding the changes in the carrying capacity for Pacific salmons imply the catch statistics or another assotiated factors, for example, the flabbing of salmon skeleton muscles.**

**The reasons of prominent changes in the carrying capacity of the North Pacific in relation on salmon populations with tendency to it increase are not clear. This problem requires the further investigations. Our specialists continue to trace both the climatic situation in the ocean and also with the state of various salmon stocks.**

**Thank you for your attention !**