CLIMATE FLUCTUATIONS AND WALLEYE POLLOCK BIOMASS DYNAMICS

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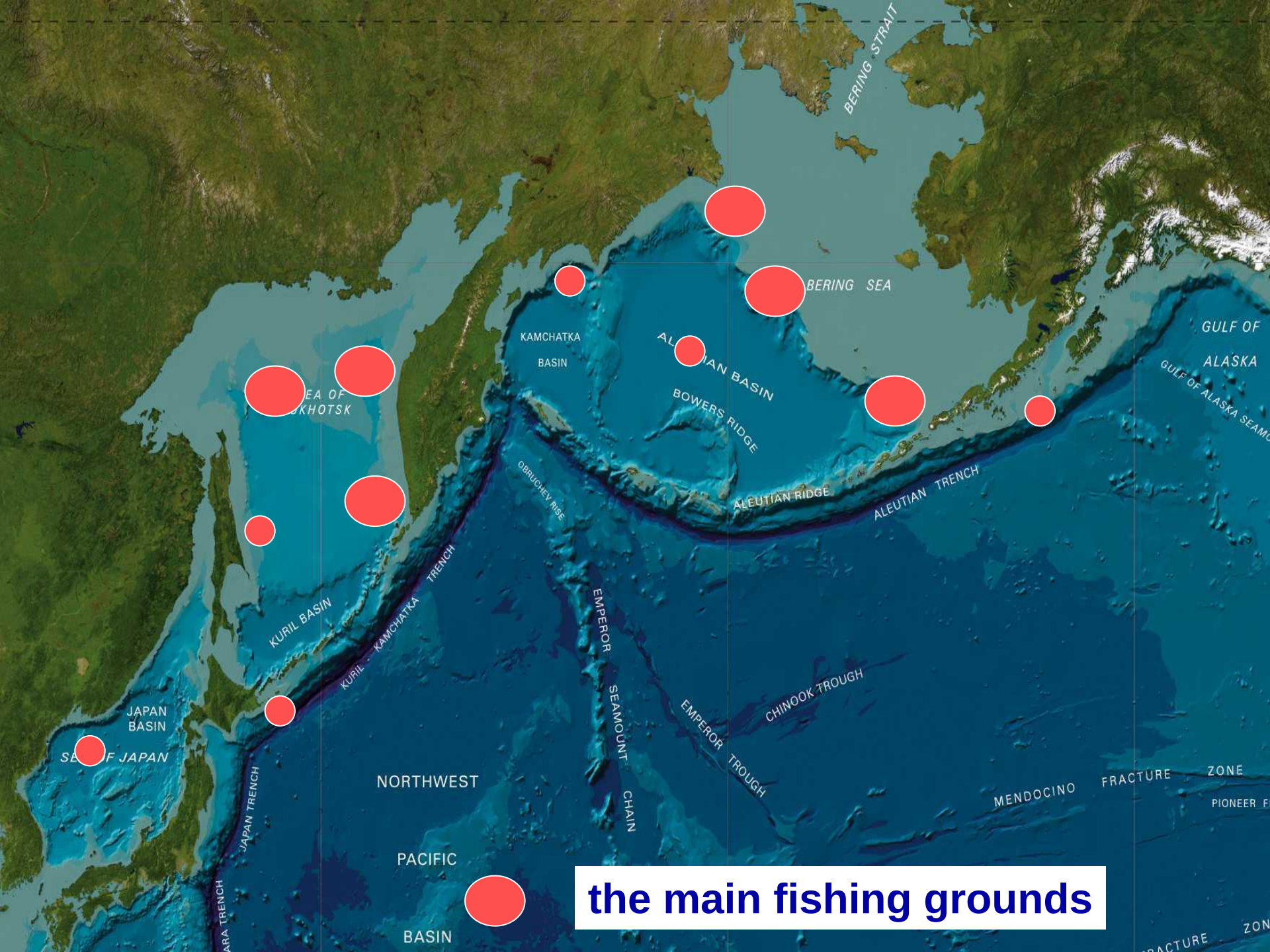
GOAL:

TO STUDY RELATIONSHIP BETWEEN

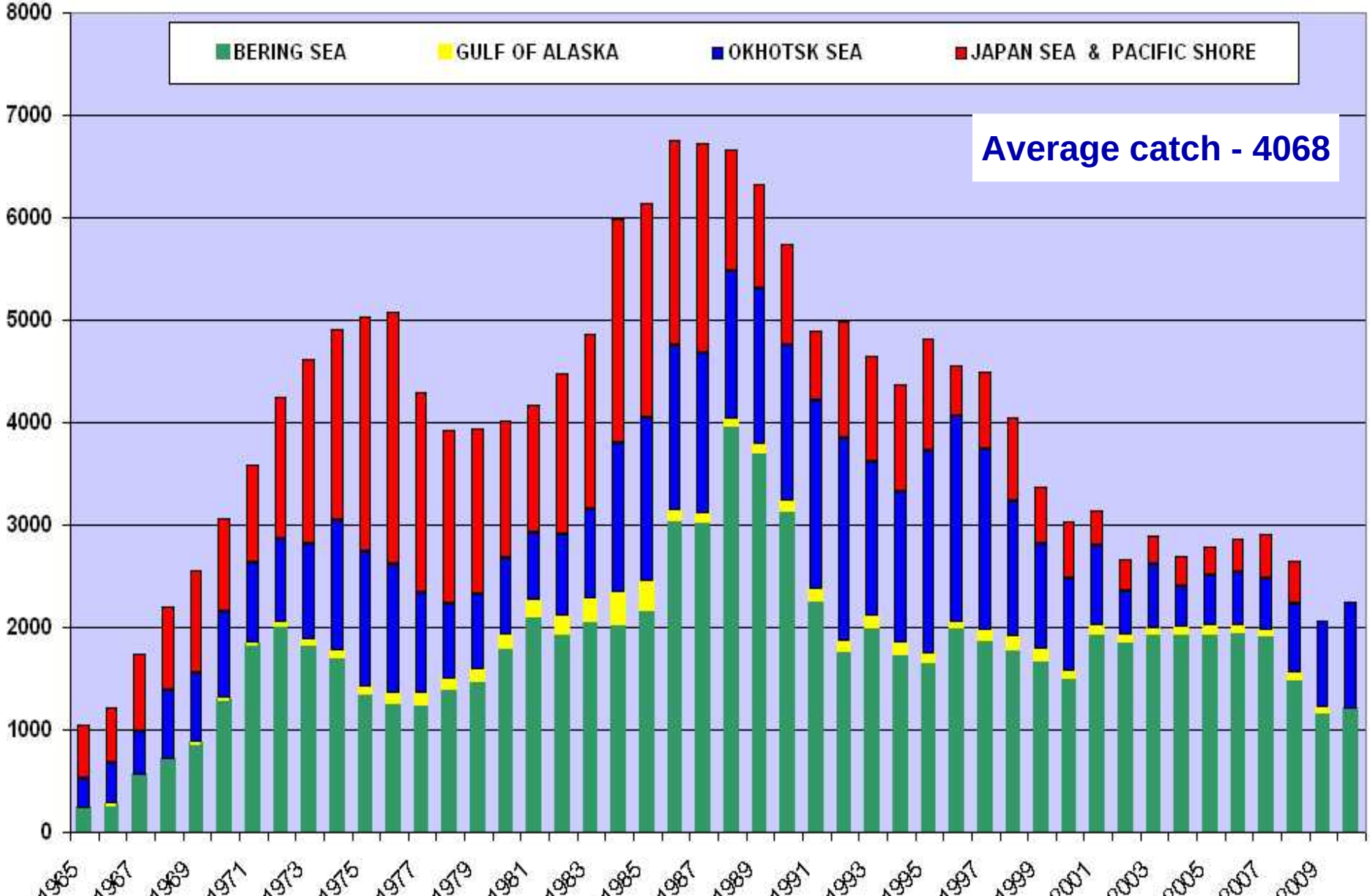
CLIMATE VARIATIONS AND DYNAMICS

OF WALLEYE POLLOCK BIOMASS

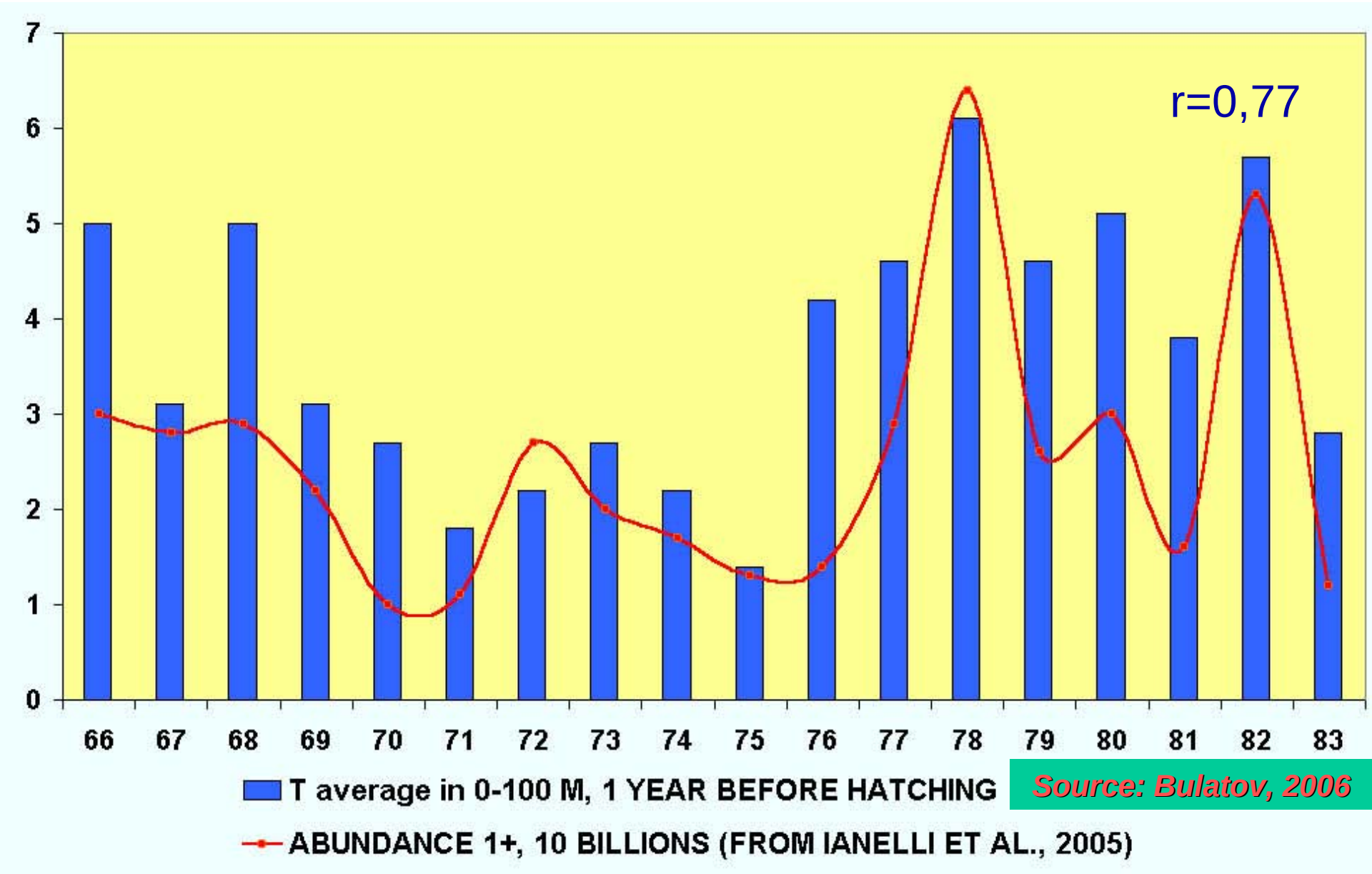


the main fishing grounds

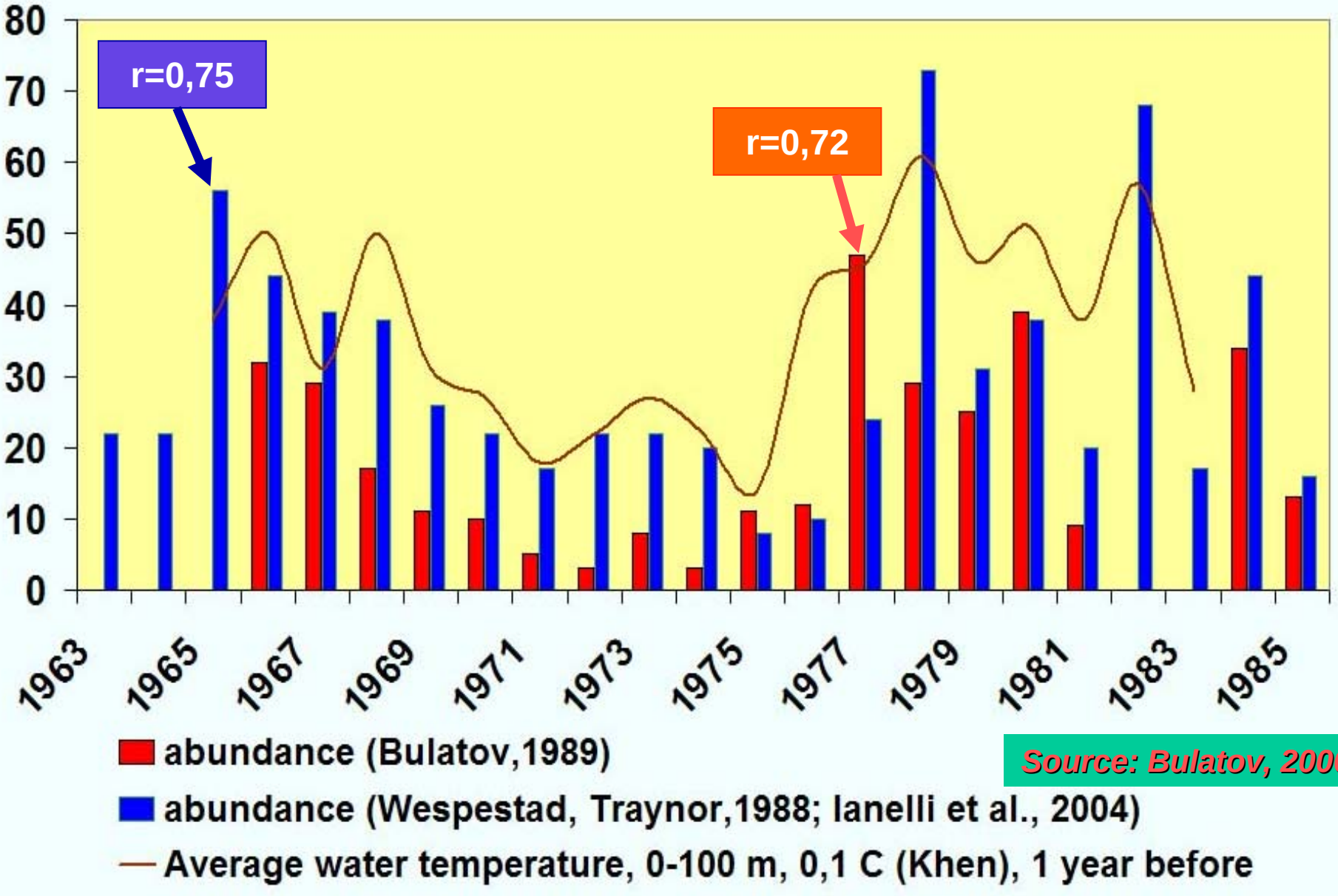
WORLD CATCH OF WALLEYE POLLOCK IN 1965-2010, thous.ton (2010 – TAC)



AVERAGE TEMPERATURE AND 1 YEAR ABUNDANCE IN THE EASTERN BERING SEA

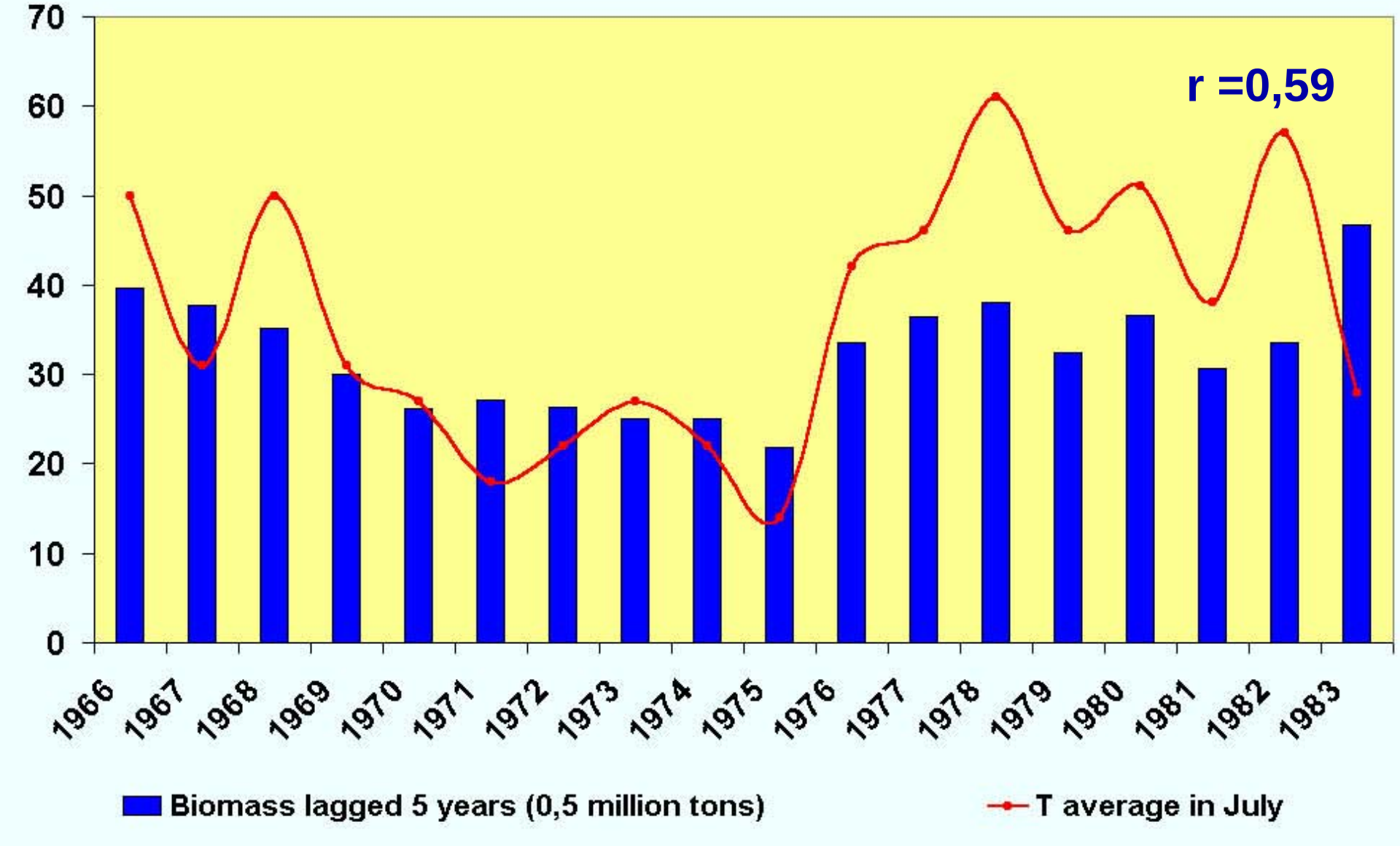


AVERAGE WATER TEMPERATURE AND ABUNDANCE OF POLLOCK GENERATIONS (5 YEARS, 100 MILLIONS)

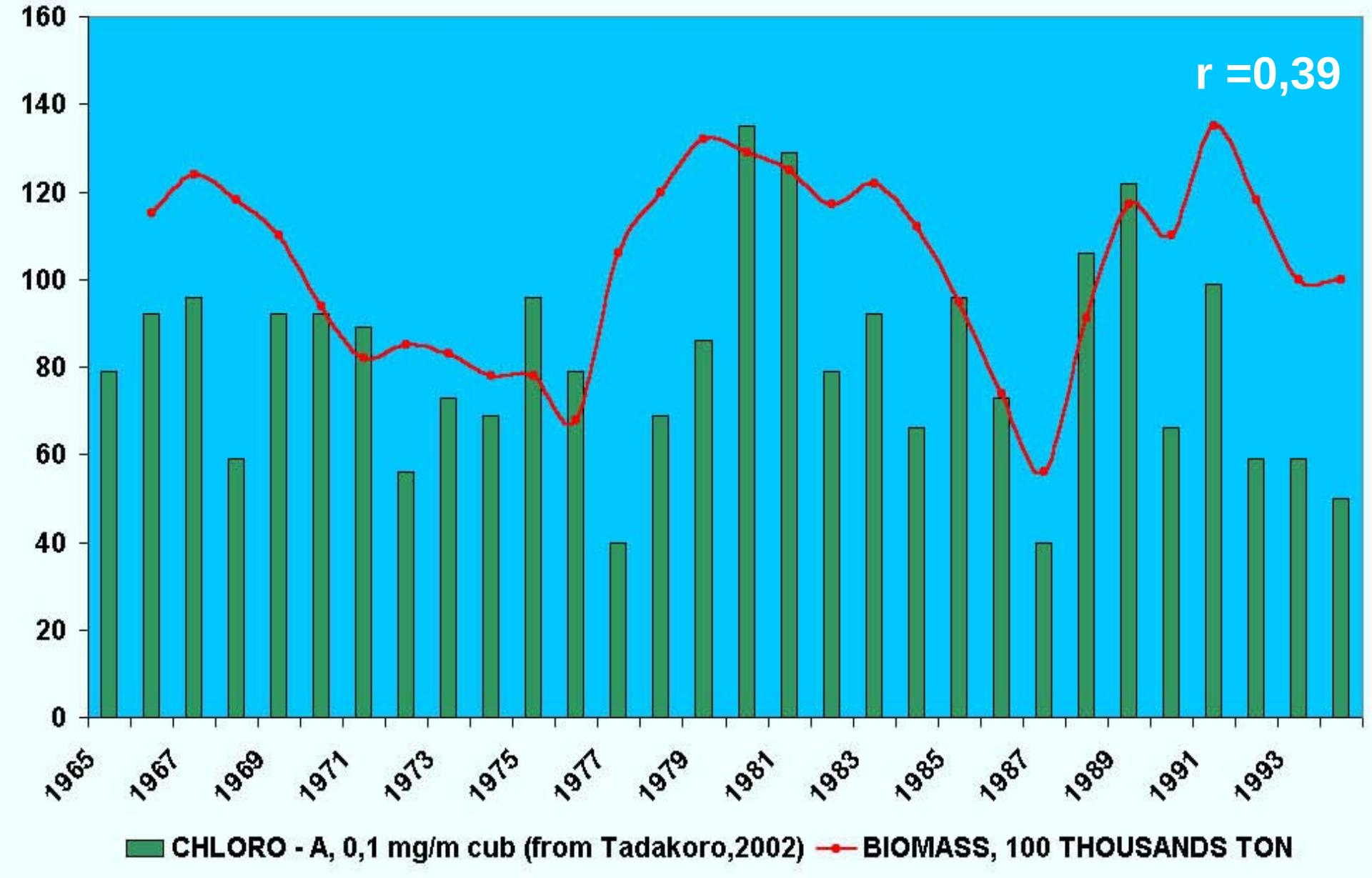


Source: Bulatov, 2006

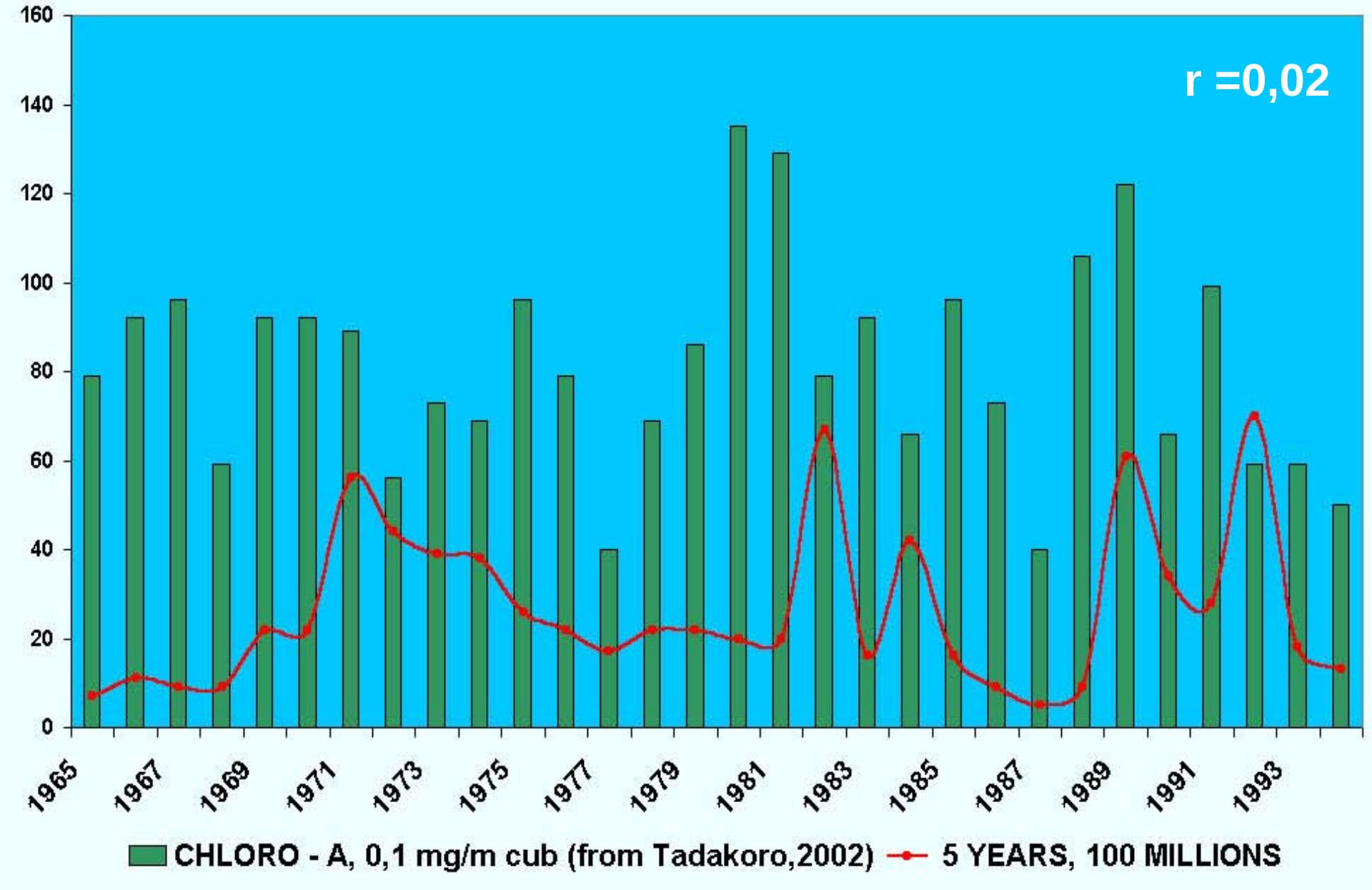
AVERAGE WATER TEMPERATURE (0,1 °C) IN JULY AND FISHABLE POLLOCK BIOMASS (LAGGED 5 YEARS) IN THE EASTERN BERING SEA



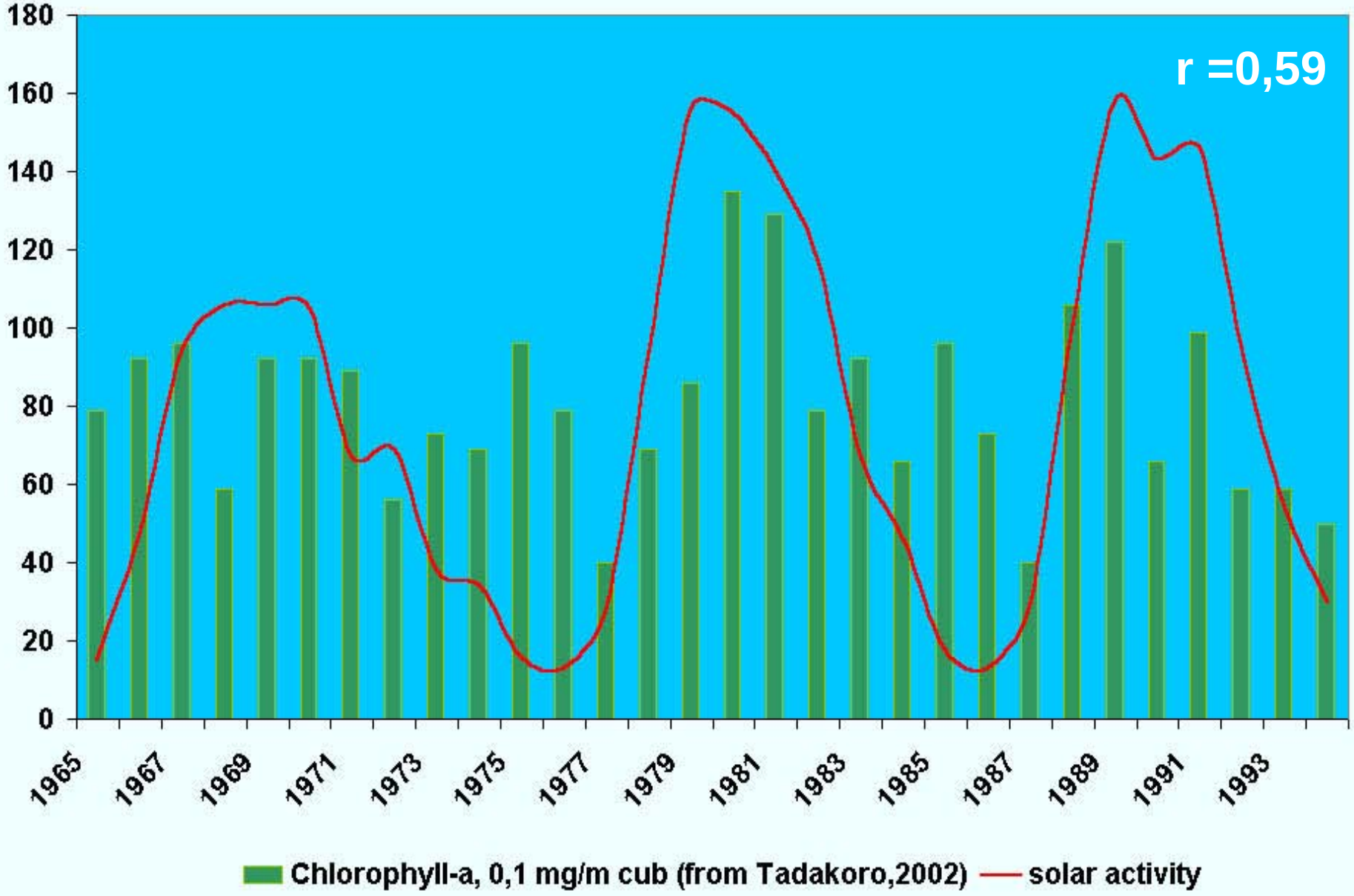
RELATIONSHIP BETWEEN CHLOROPHYLL - A CONCENTRATION AND POLLOCK BIOMASS (4 YEARS LAGGED) IN THE EASTERN BERING SEA



RELATIONSHIP BETWEEN CHLOROPHYLL - A CONCENTRATION AND NUMBERS OF 5 YEARS POLLOCK IN THE SOUTHEASTERN BERING SEA

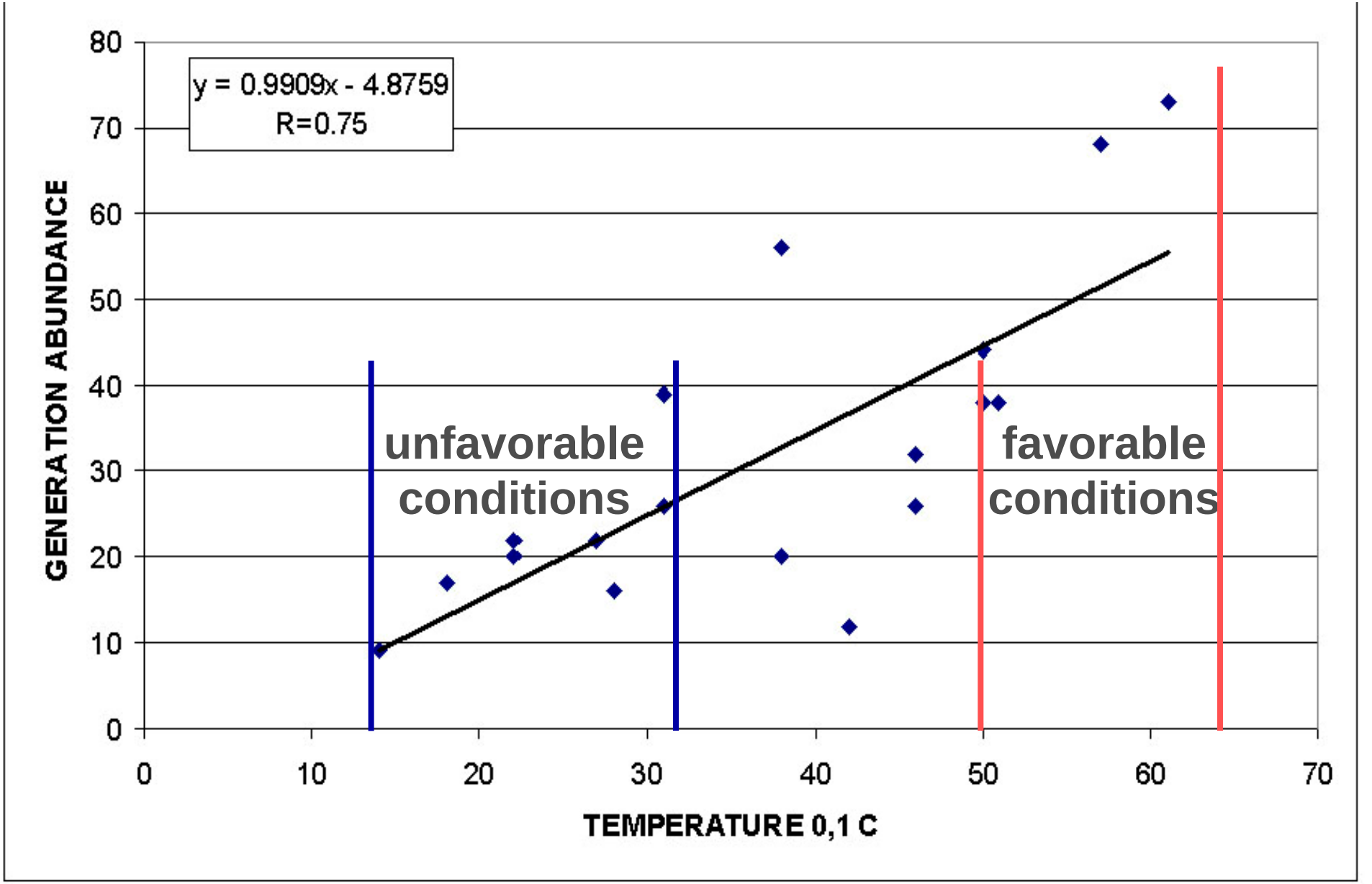


RELATIONSHIP BETWEEN SOLAR ACTIVITY AND CHLOROPHYLL A CONCENTRATION IN THE SOUTHEASTERN BERING SEA

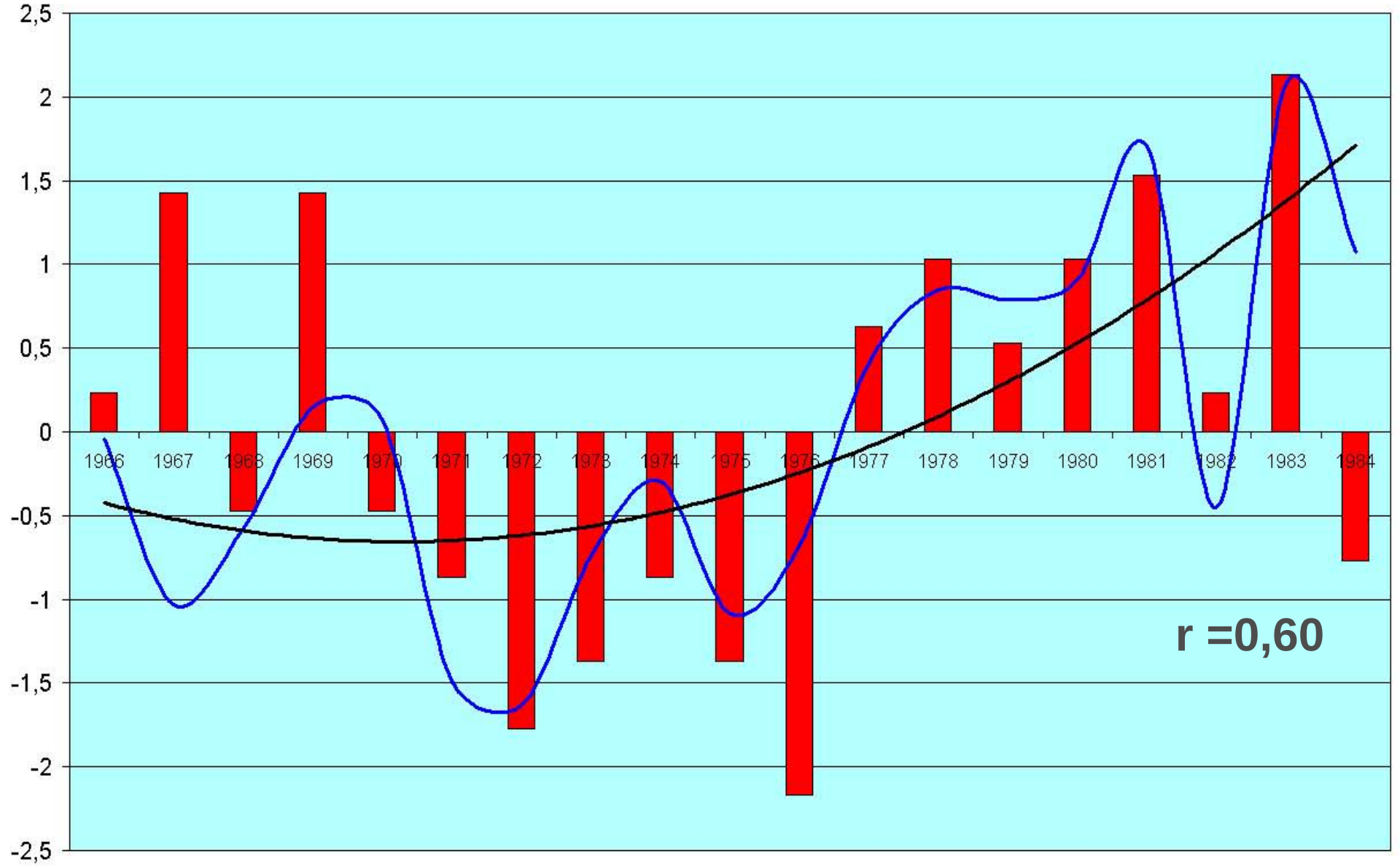


	BIOMASS	ABUNDANCE 1+	ABUNDANCE 5 YEARS	CHLORO. A
T SURFACE	**0,25** (1970-1998)	**0,06** (1970-2004)	**0,11** (1970-2000)	**-0,05** (1970-2004)
T BOTTOM	**0,12** (1982-2000)	**-0,23** (1982-2004)	**-0,15** (1982-2000)	**0,01** (1982-1994)
T IN 0-100M JULY	**0,59** (1966-1984)	**0,28** (1966-1984)	**0,36** (1966-1984)	**0,39** (1966-1984)
T IN 0-100 M JULY, 1 YEAR BEFORE HATCHIING	**0,60** (1965-1983)	**0,77** (1965-1983)	**0,75** (1965-1983)	**0,37** (1965-1983)
SOLAR ACTIVITY	**0,60** (1965-1993)	**0,41** (1965-1999)	**0,38** (1963-1999)	**0,59** (1964-1994)

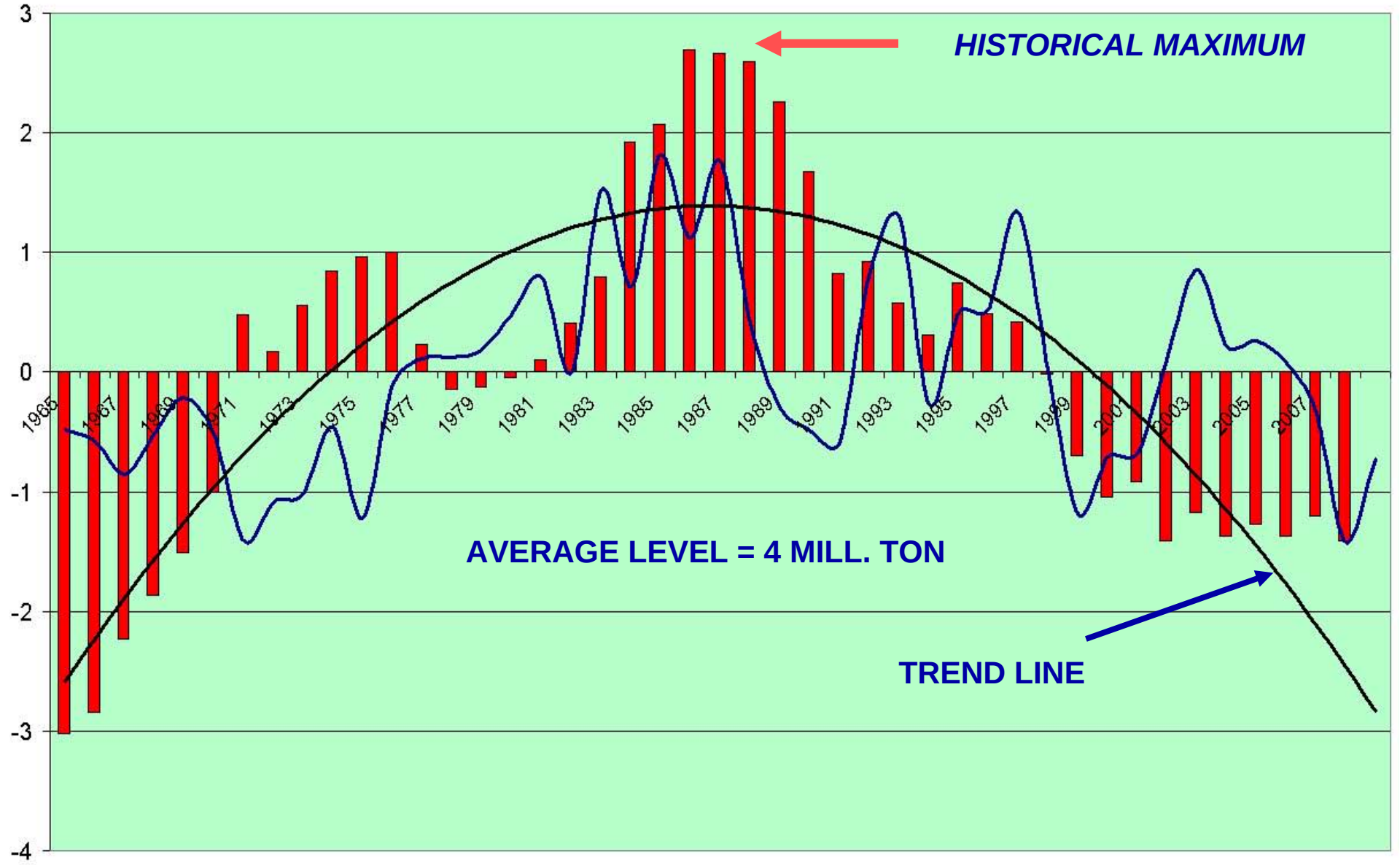
RELATIONSHIP BETWEEN AVERAGE WATER T IN 0-100 M LAYER AND NUMBERS OF 5 YEARS POLLOCK IN THE SOUTHEASTERN BERING SEA



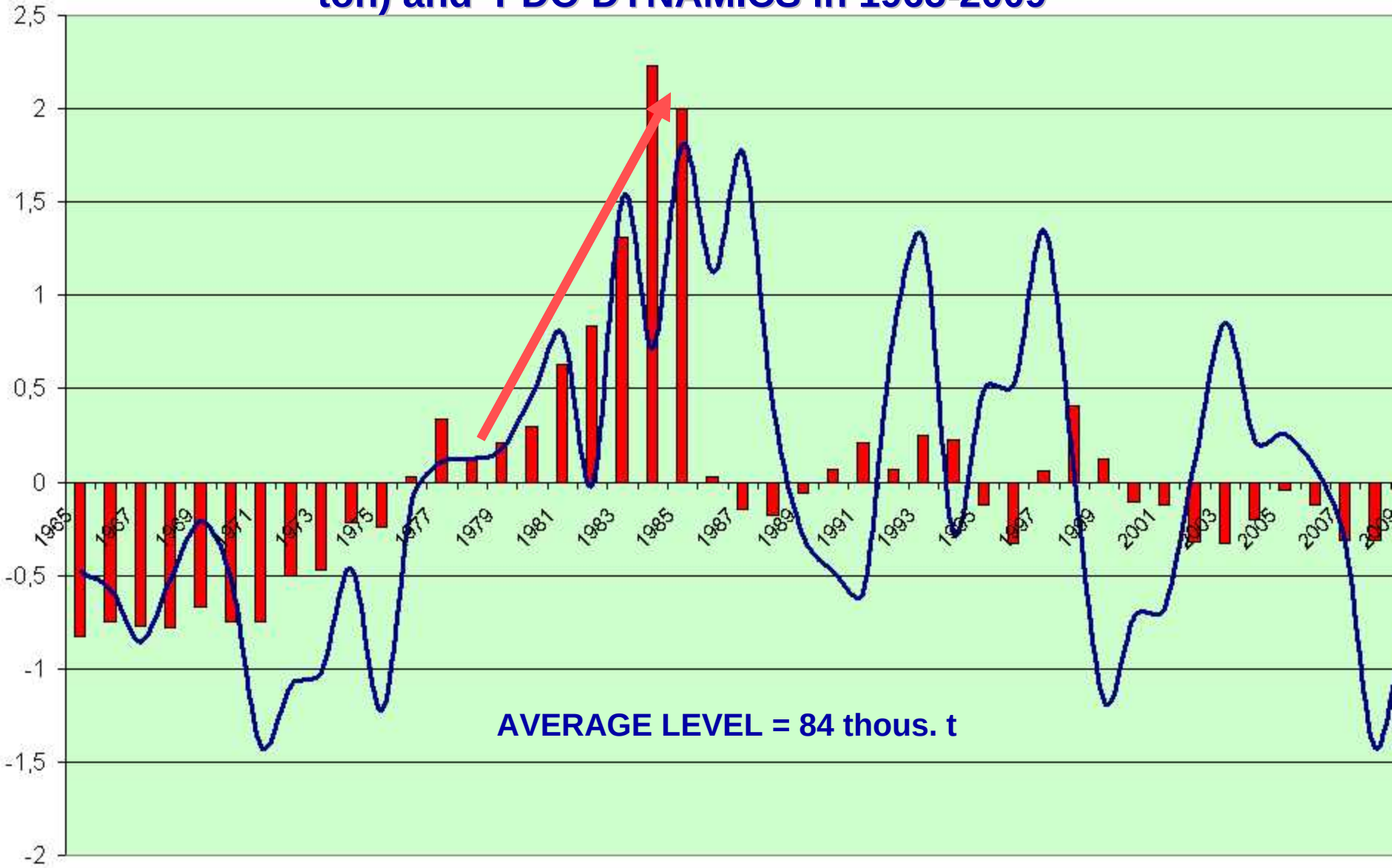
PDO IN APRIL-JUNE VS AVERAGE WATER T IN 0-100 M LAYER IN JULY SOUTHEASTERN BERING SEA, IN 1966-1984



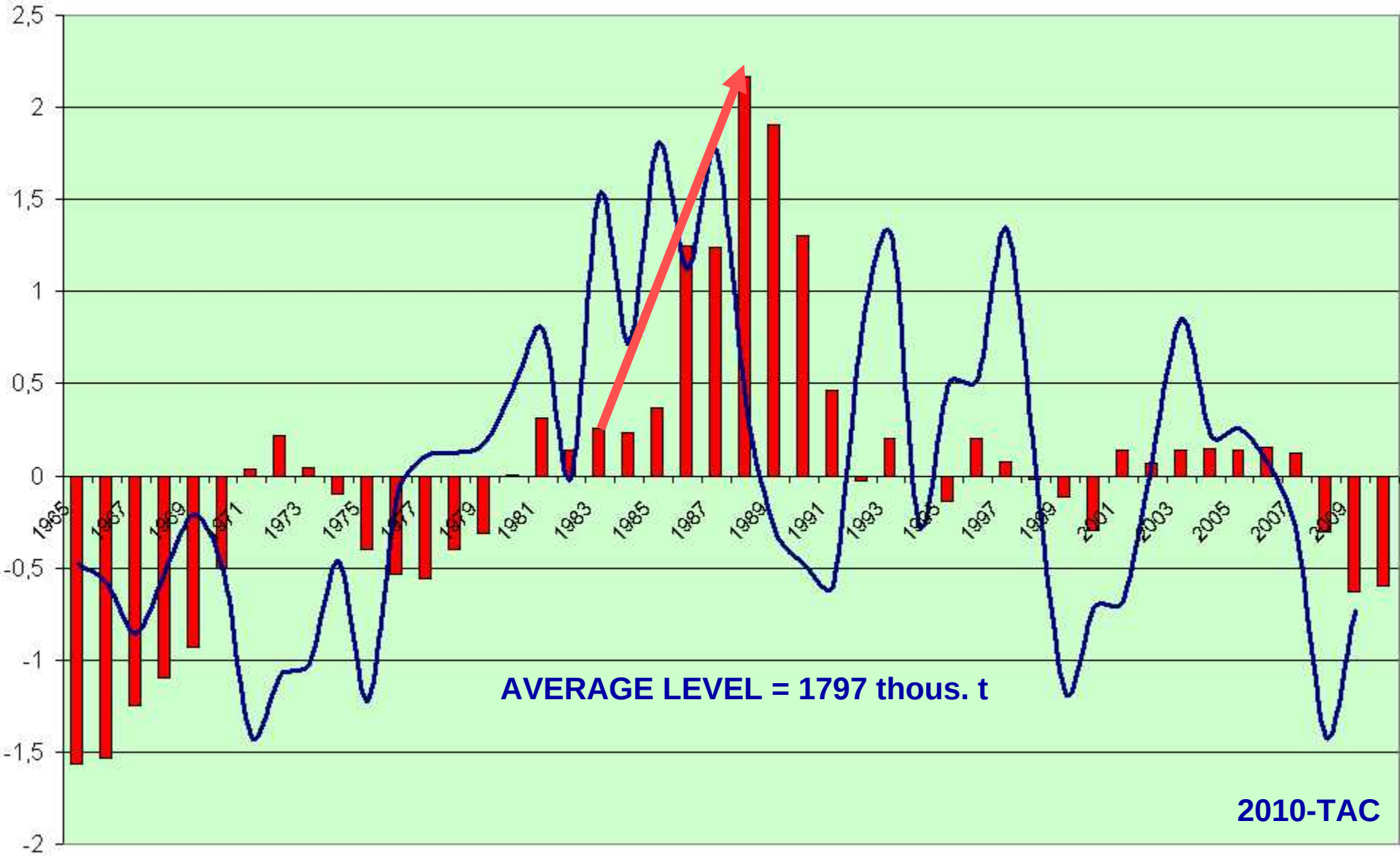
WORLD POLLOCK CATCH ANOMALIES (bars, mill. ton) and PDO DYNAMICS (LINE) IN 1965-2008



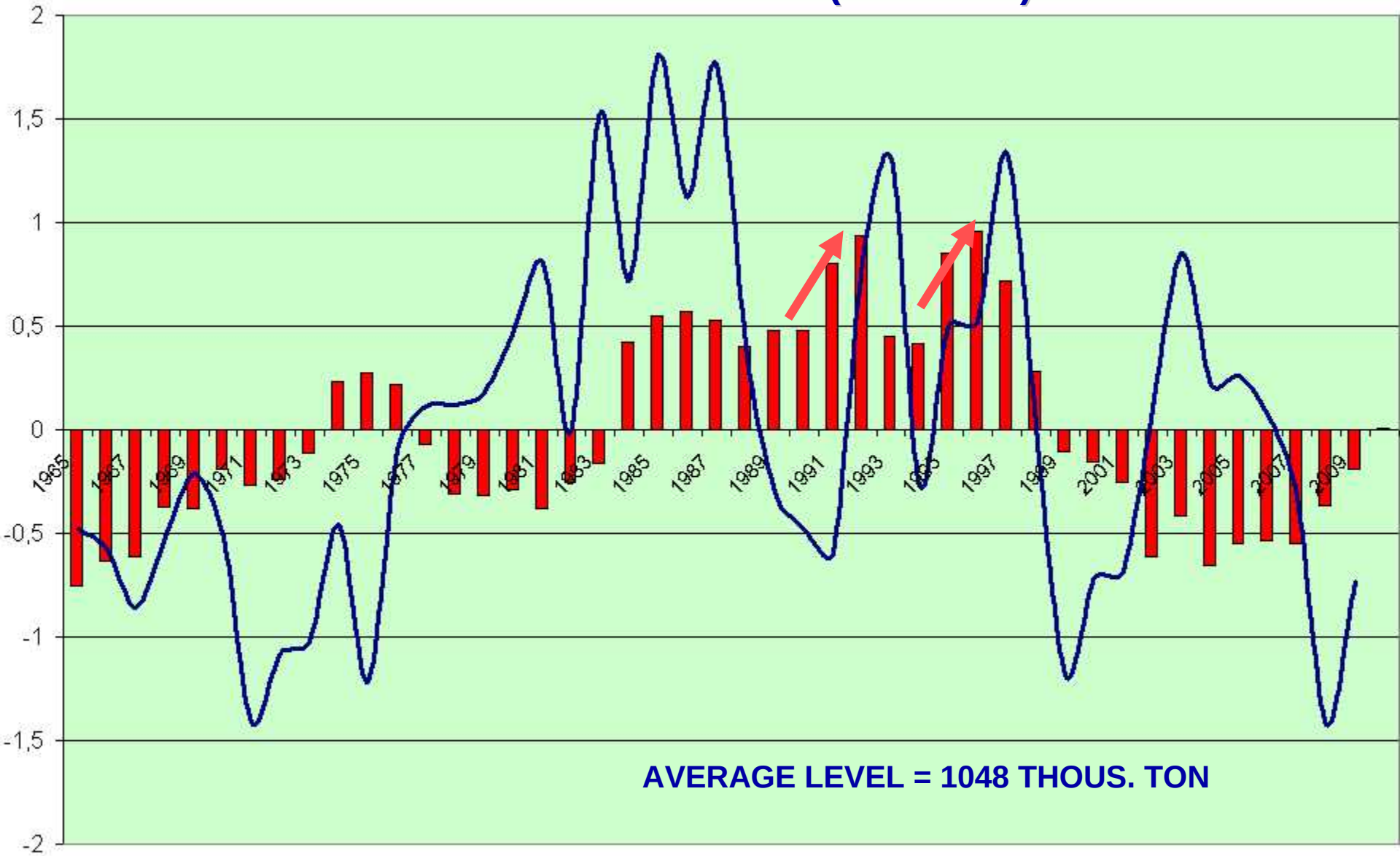
POLLOCK CATCH IN GULF OF ALASKA ANOMALIES (BARS, 100 thous. ton) and PDO DYNAMICS in 1965-2009



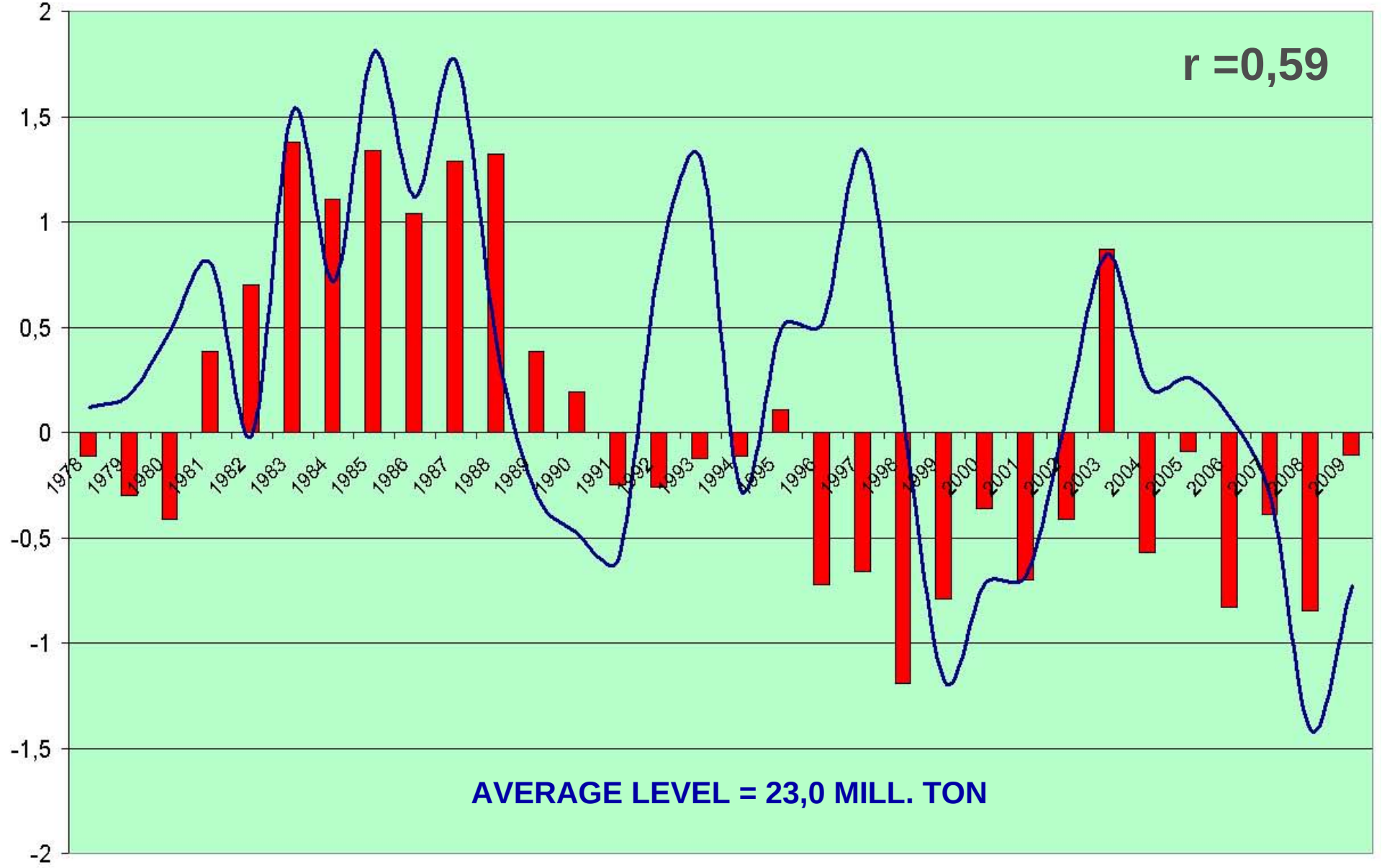
BERING SEA POLLOCK CATCH ANOMALIES (BARS, mill. ton) and PDO DYNAMICS in 1965-2010



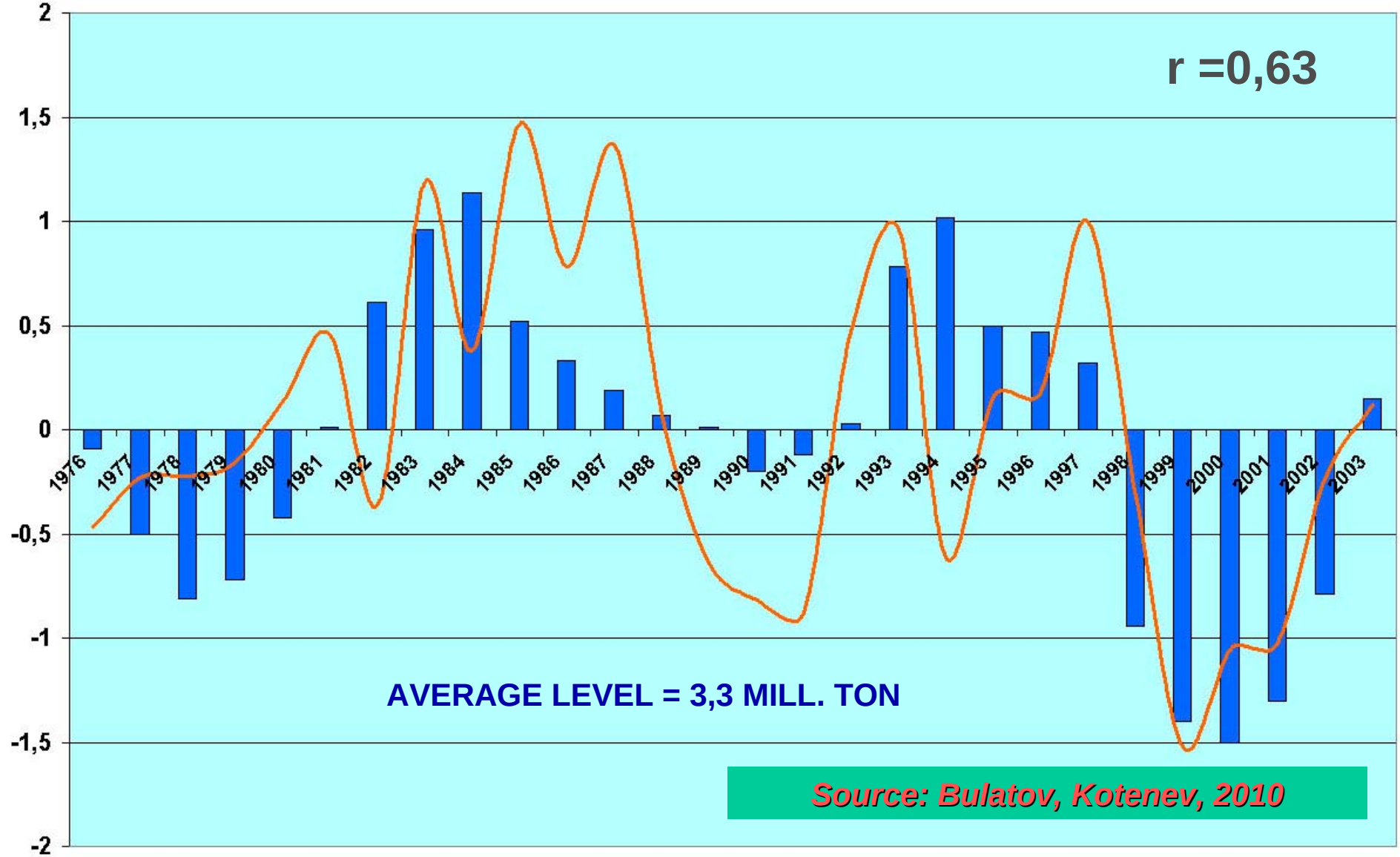
OKHOTSK SEA POLLOCK CATCH ANOMALIES (mill. ton) and PDO DYNAMICS in 1965-2010 (2010-TAC)

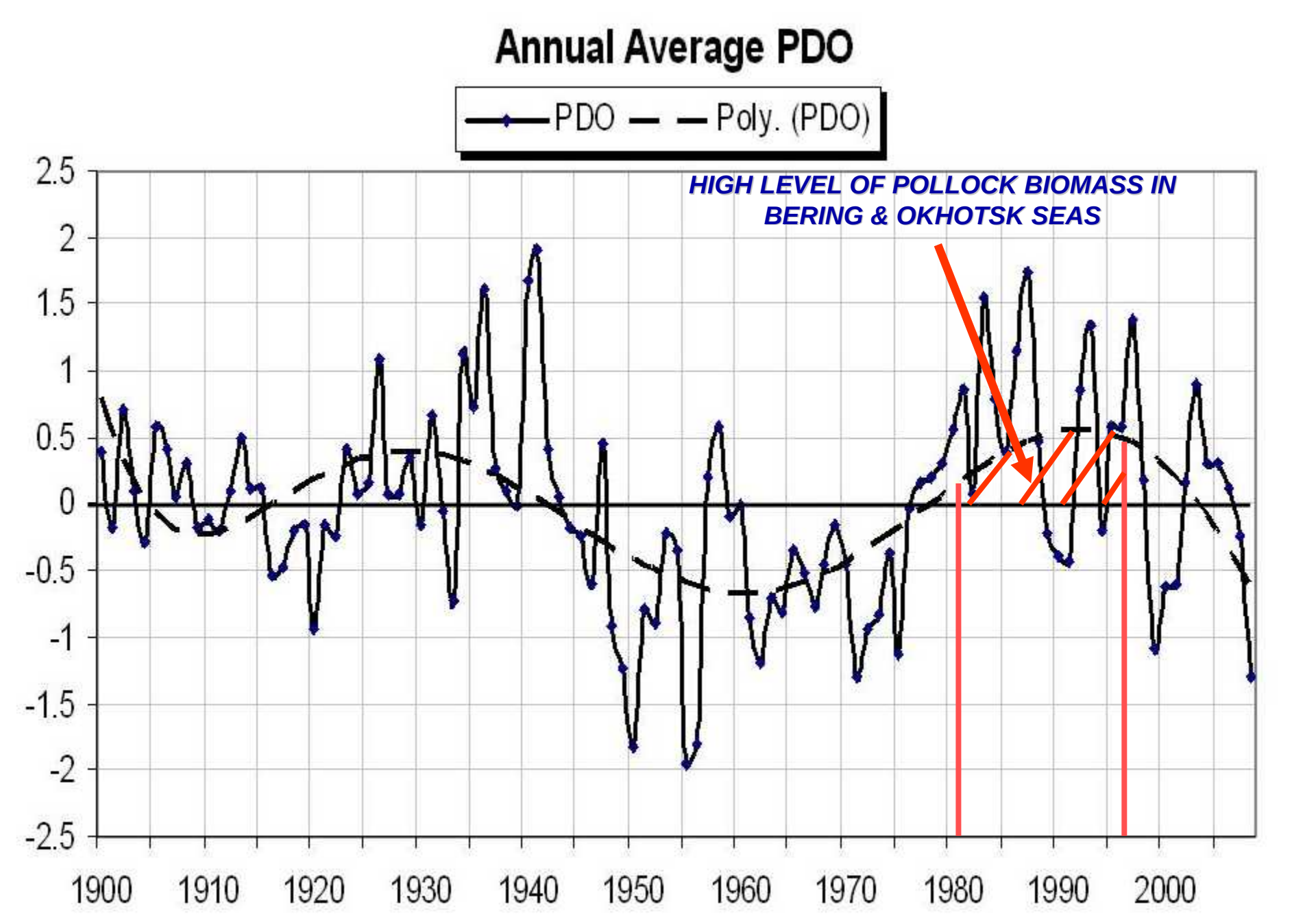


BERING SEA POLLOCK BIOMASS ANOMALIES (10 mill. ton) and PDO DYNAMICS in 1965-2009

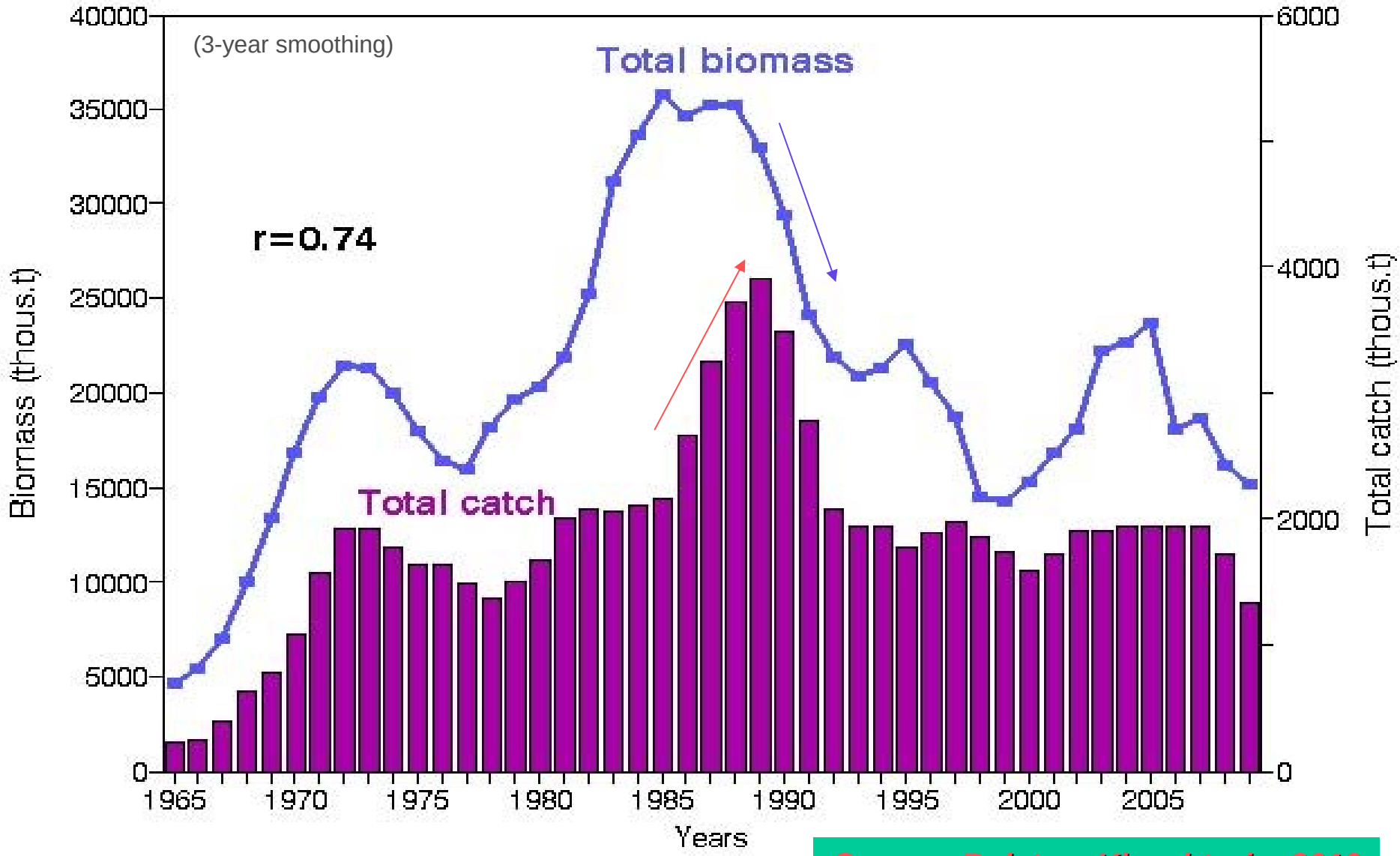


OKHOTSK SEA POLLOCK BIOMASS ANOMALIES (bars,mill. ton) and PDO DYNAMICS in 1976-2003



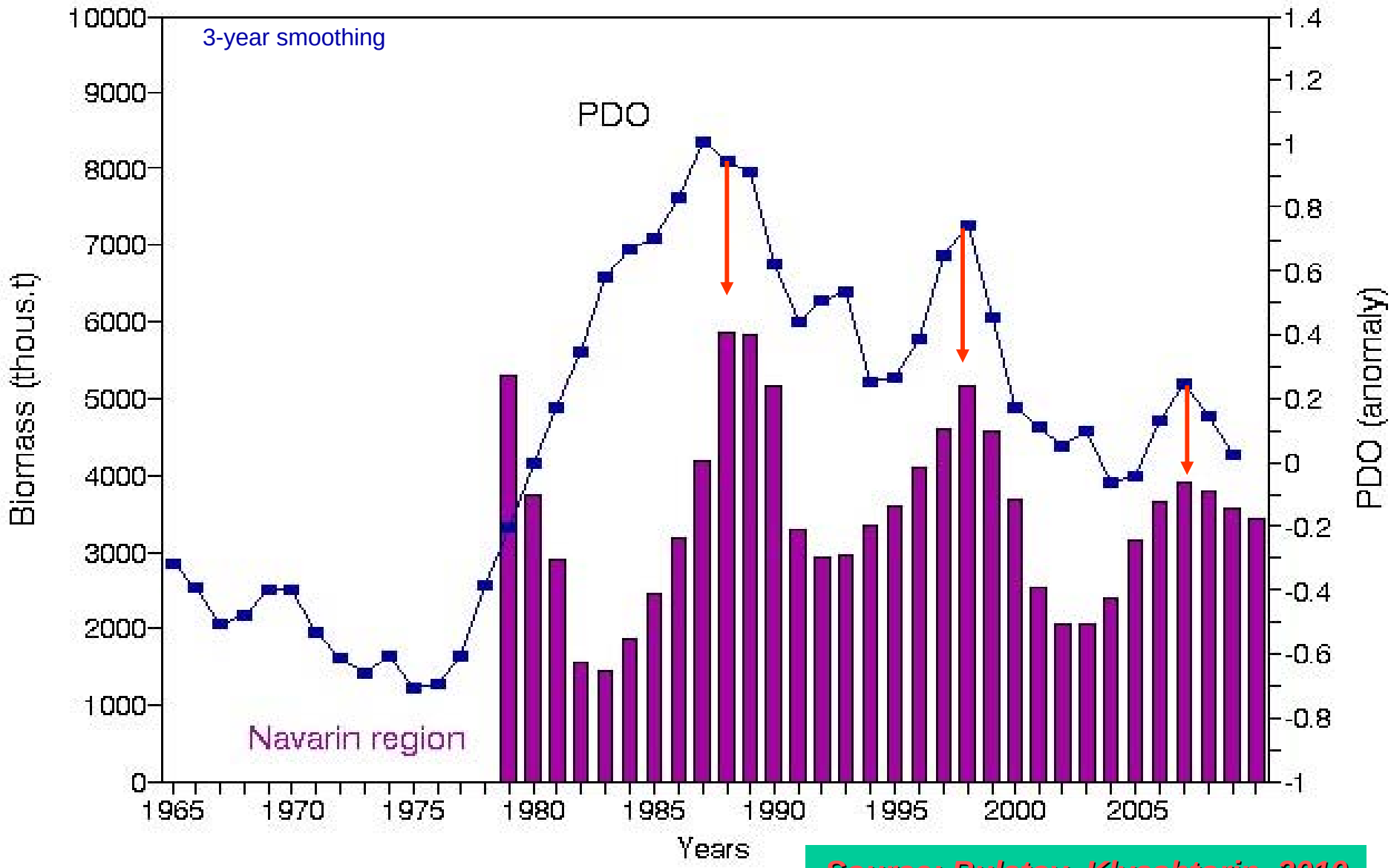

Annual Average PDO
PDO
Poly. (PDO)
HIGH LEVEL OF POLLOCK BIOMASS IN BERING & OKHOTSK SEAS
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000

Comparative dynamics of the Bering Sea walleye pollock total biomass and catch, 1965-2009



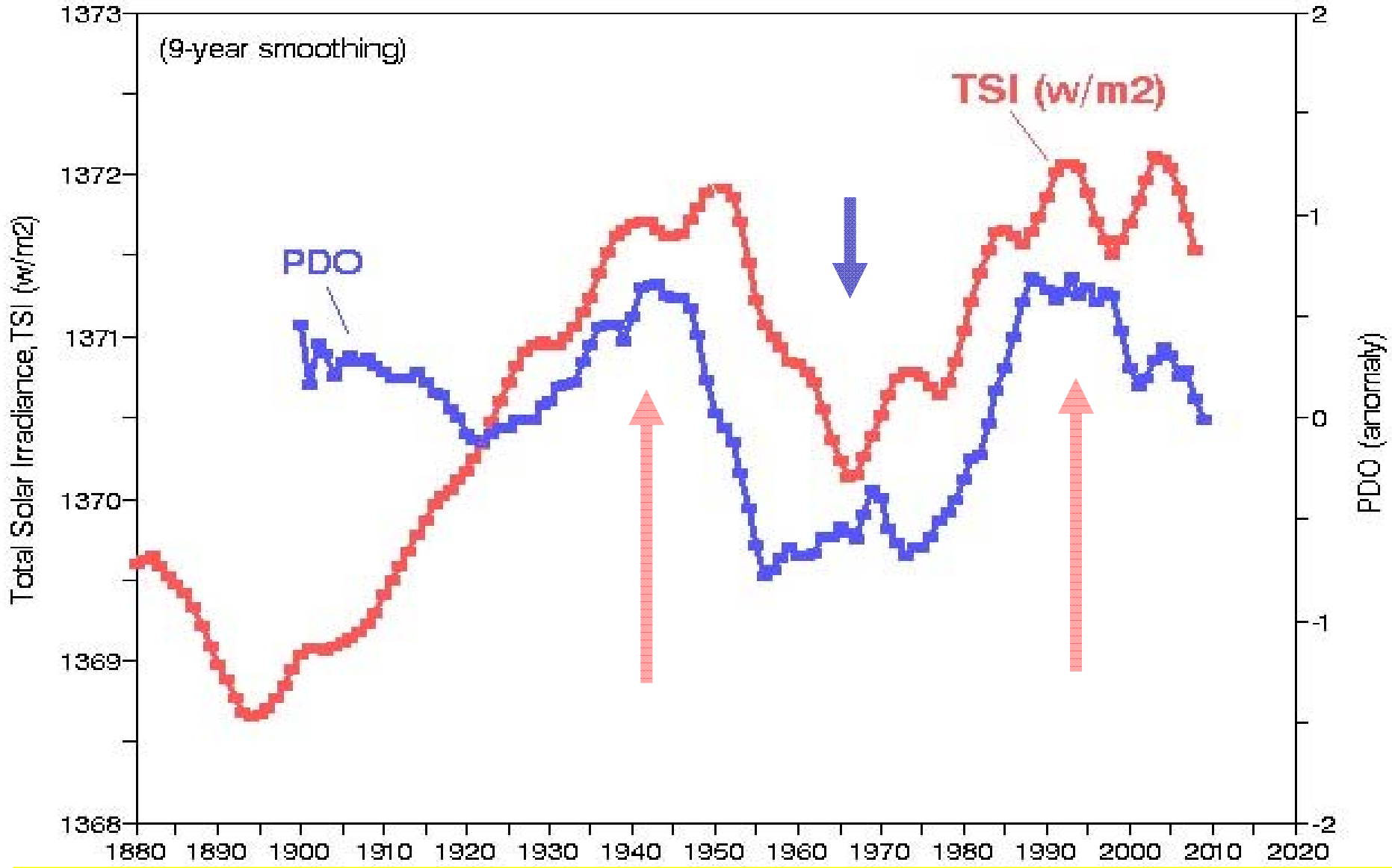
Source: Bulatov, Klyashtorin, 2010

Comparative dynamics of Pacific Decadal Oscillation (PDO) and pollock biomass in the Navarin region, 1979-2009



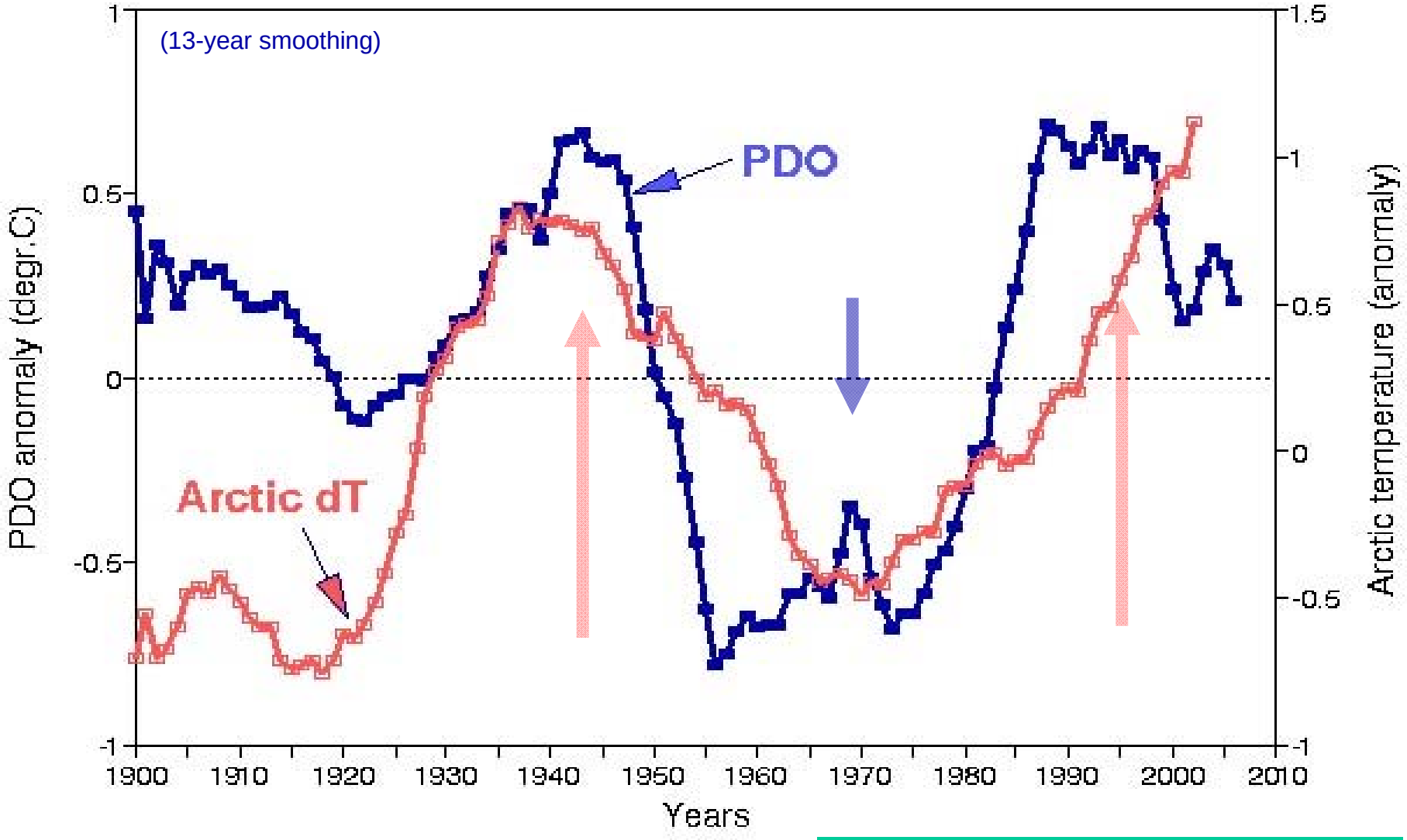
Source: Bulatov, Klyashtorin, 2010

Comparative dynamics of Pacific Decadal Oscillation (PDO) and Total Solar Irradiation (TSI), 1880-2008



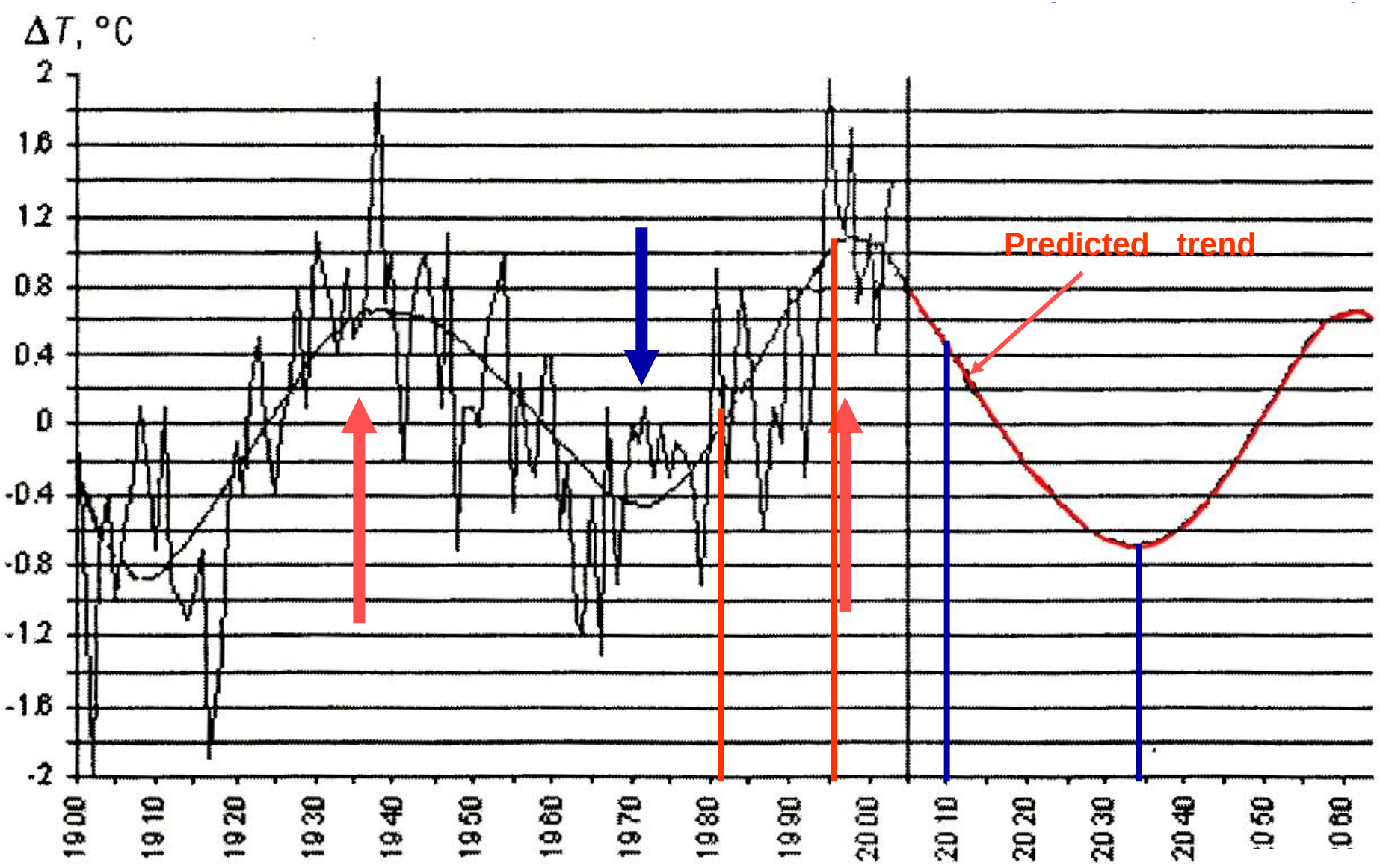
PDO-http://jisao.washington.edu/pdo/PDO.latest TSI - Hoyt/Willson

Comparative dynamics of the Arctic dT and PDO, 1900 - 2008



Source: Bulatov, Klyashtorin, 2010

Arctic air temperature in 1900-2005 and its probable long term trend according to Russian Arctic and Antarctic Institute forecast (AARI)



From: Frolov et al., 2009. "Climate Change in Eurasian Arctic Shelf Seas". Praxis Publishing Ltd, Chichester, UK, 164p.

Prof. Don J. Easterbrook suggest:
(4 th International Conference on Climate Change,
16-18 May 2010, Chicago, USA)

- Strong correlation between solar changes, the PDO, glacier advance and retreat, and global climate allow us to project a consistent pattern into the future.

- ***Projected cooling for the next several decades is based on past PDO patterns for the past century and temperature patterns for the past 500 years.***

  Three possible scenarios are shown:

  (1) global cooling similar to the cooling from 1945 to 1977,

  (2) global cooling similar to the cool period from 1880 to 1915, and

  (3) global cooling similar to the Dalton Minimum from 1790 to 1820.

WORKING HYPOTHESIS: POLLOCK BIOMASS DYNAMICS IN 2010-2050

REGION	2010-2035	2035-2050
GULF OF ALASKA	VERY LOW BIOMASS	SHARPLY INCREASING BIOMASS
EASTERN BERING SEA	DECREASING OF BIOMASS	SHARPLY INCREASING BIOMASS
NORTH & WEST BERING SEA	VERY LOW BIOMASS	SHARPLY INCREASING BIOMASS
EASTERN SEA OF OKHOTSK	DECREASING OF BIOMASS	SHARPLY INCREASING BIOMASS
NORTH & WEST SEA OF OKHOTSK	VERY LOW BIOMASS	SHARPLY INCREASING BIOMASS
SEA OF JAPAN & PACIFIC COAST	SHARPLY INCREASING BIOMASS	VERY LOW BIOMASS

CONCLUSIONS

- Variations in PDO, TSI and Arctic dT observed over the recent 100 years prove the existence of a ***~60 year regularity in climatic changes*** of the North Pacific and Arctic.

- At present the warming period is ending, and a cooling phase is beginning. Forecasts suggest that this ***cooling will result in a decrease in biomass of pollock stock*** in the Gulf of Alaska, Bering & Okhotsk Seas ***in the 2010-2035 and increasing in*** **Sea of Japan and Pacific waters**.

- The warming perion will begin from 2035 and biomass of pollock sharply increase in the Gulf of Alaska, Bering & Okhotsk Seas and decrease in Sea of Japan and Pacific waters.


THANK YOU
FOR YOUR ATTENTION