Water Problems Institute of RAS

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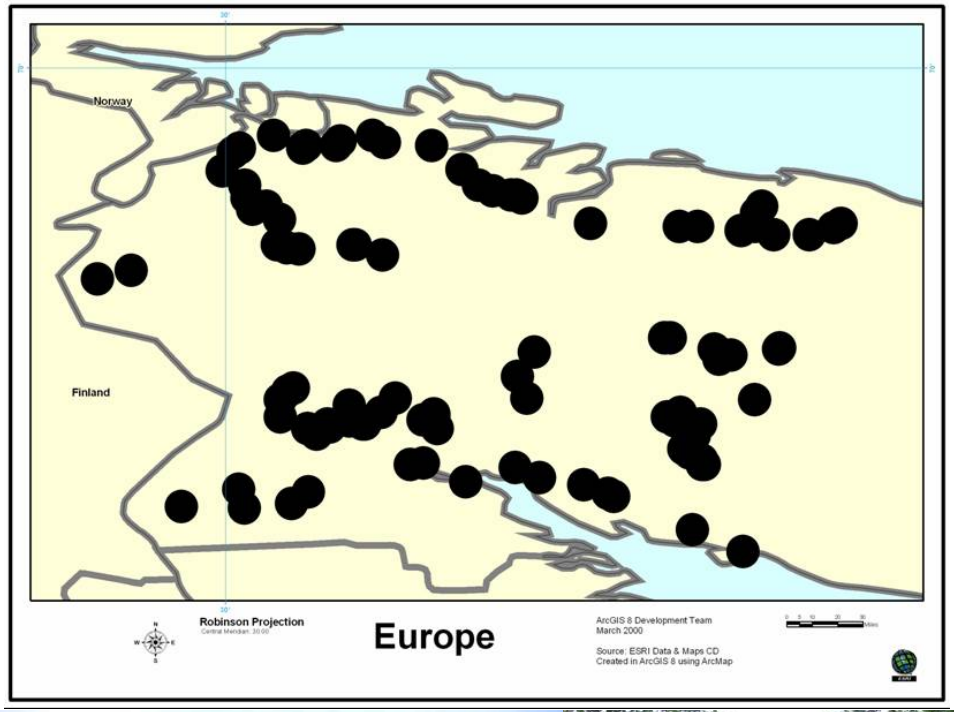
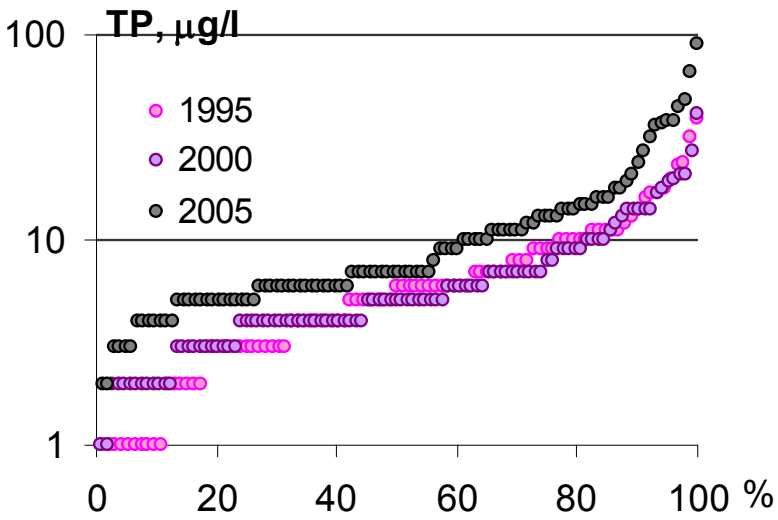
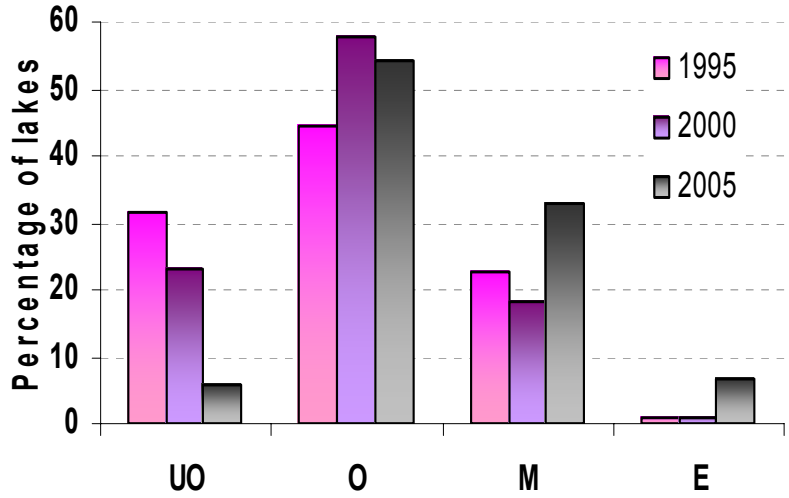
Change in C-N-P content in the Kola lakes through sueveys 1995-2005

Survey lakes 1995, 2000, 2005



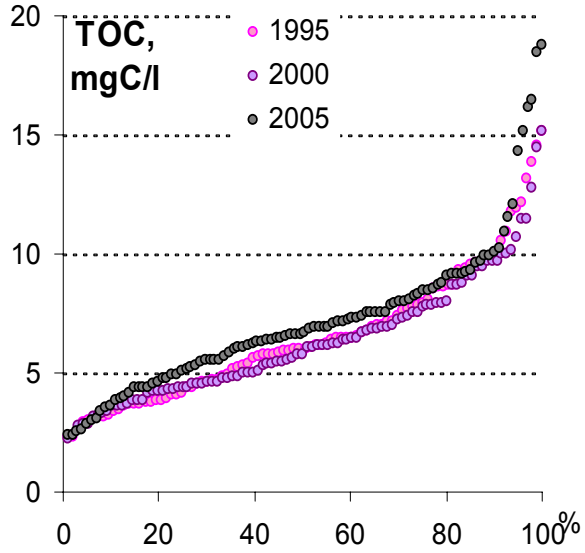
Distribution of total phosphorous and quantity of Kola lakes of different trophic state in 1995, 2000, 2005

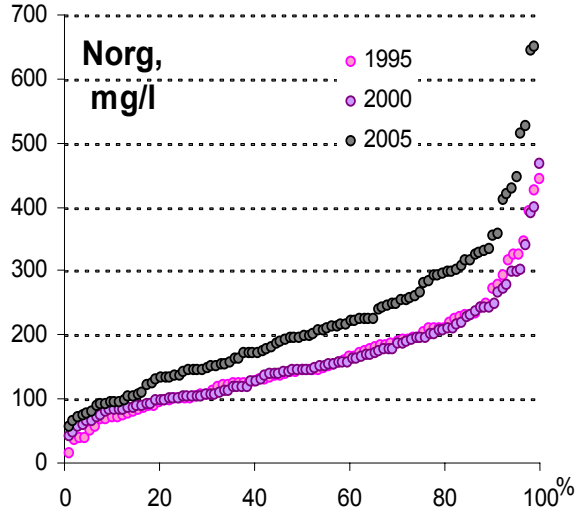


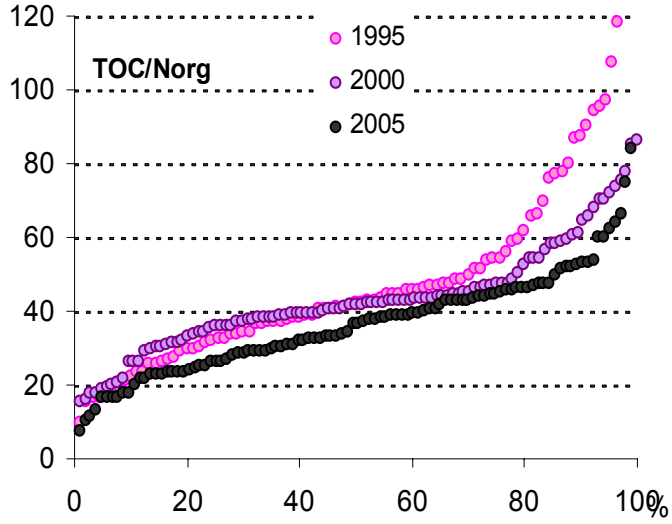


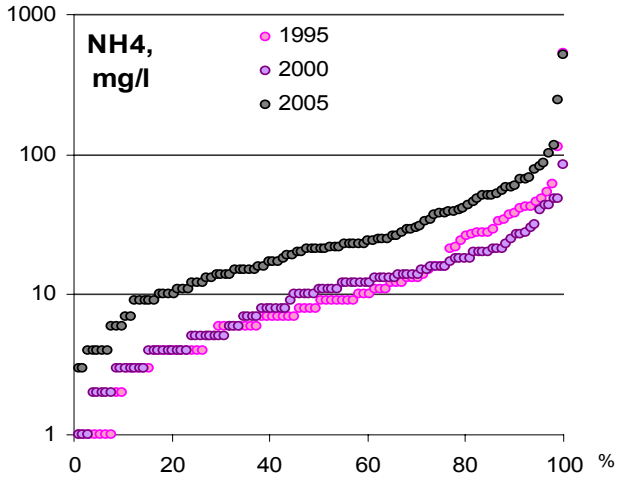
TP<4 μg/l – ultraoligotrophic lakes **UO**,
TP 4-10 μg/l – oligotrophic lakes **O**,
TP 10-35 μg/l – mesotrophic lakes **M**,
TP 35-100 μg/l – eutrophic lakes **E**,
(OECD, 1982; Vollenweider, 1979)

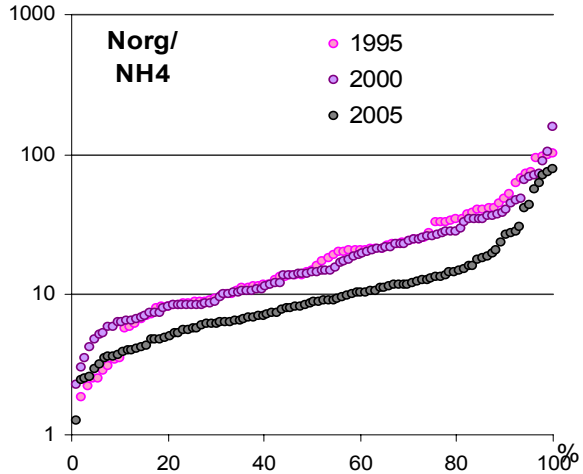
Distribution of the TOC and the parameters of nitrogen cycling in Kola lakes in 1995, 2000, 2005

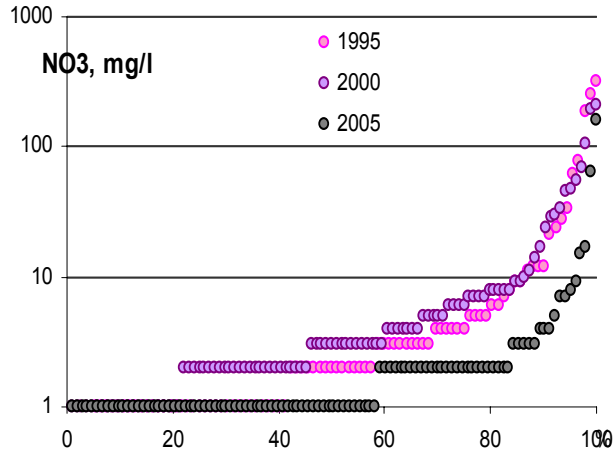




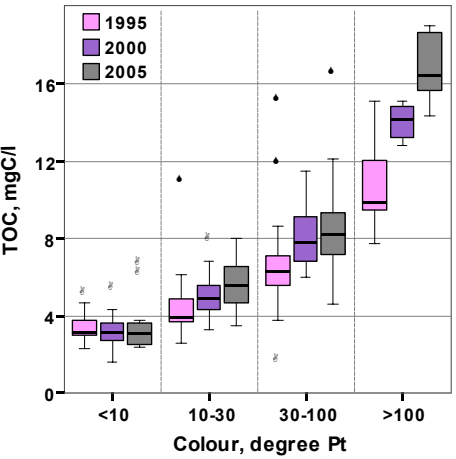


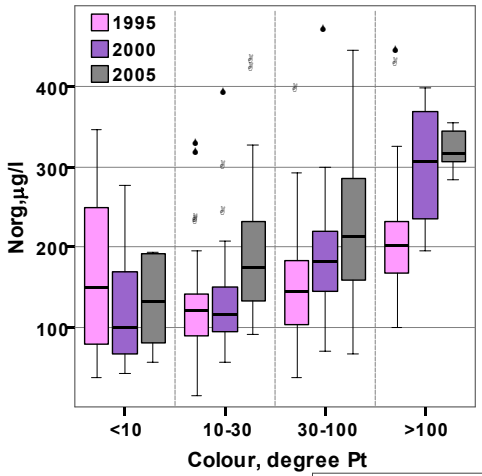


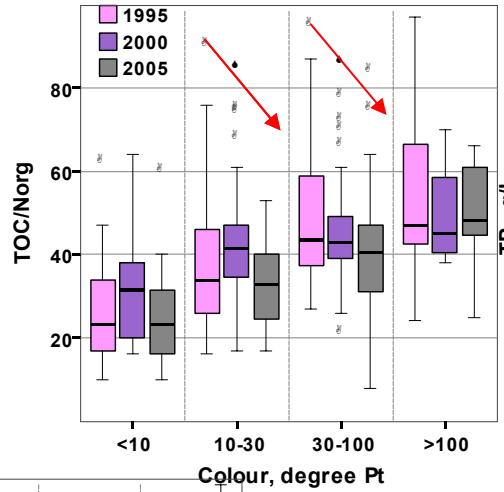


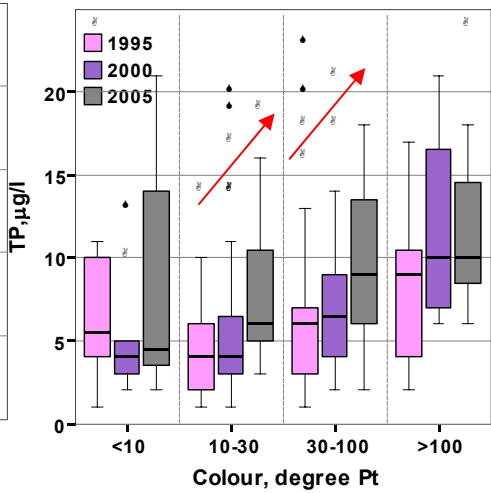


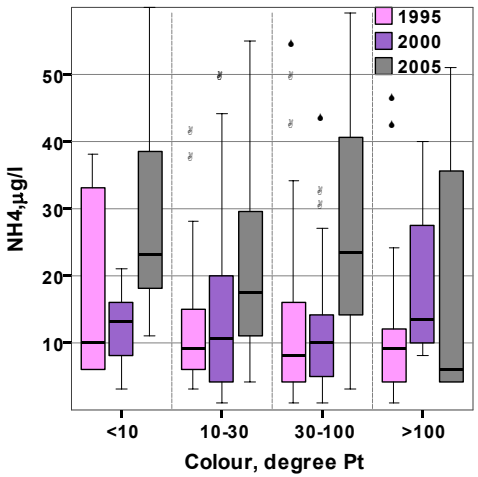
Effect of humic content on parameters under review

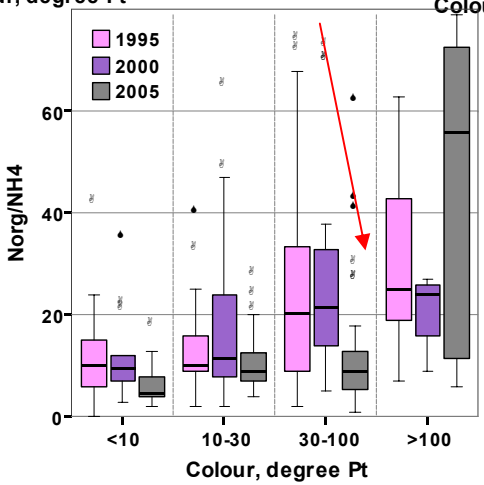


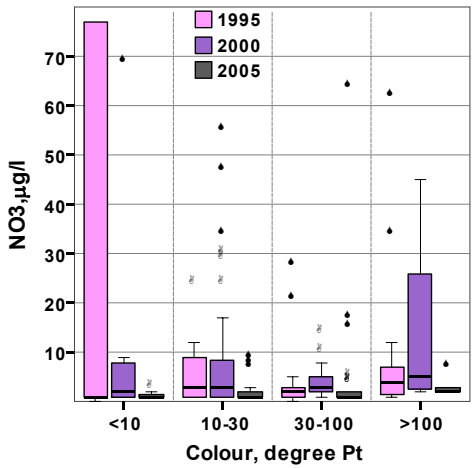


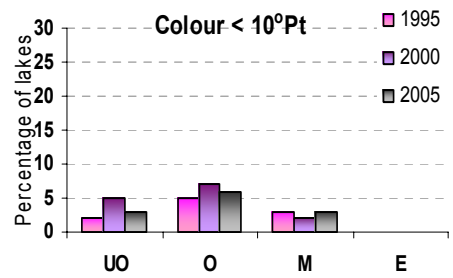


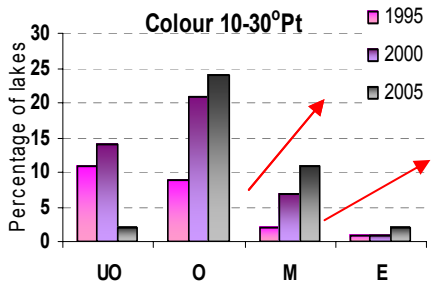


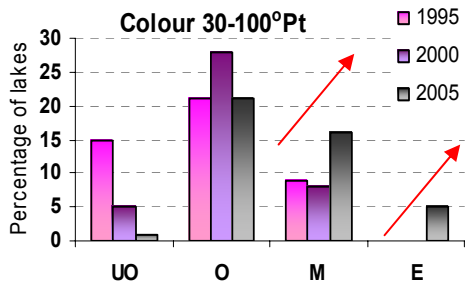


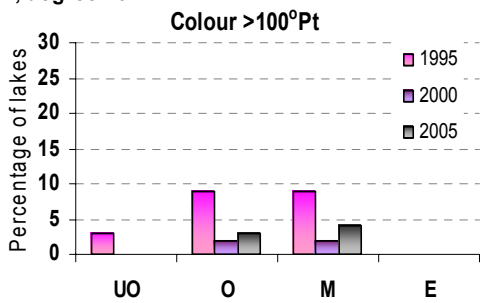




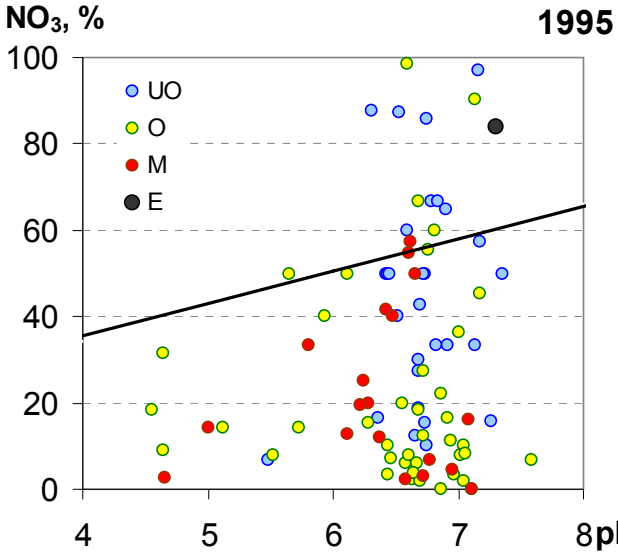


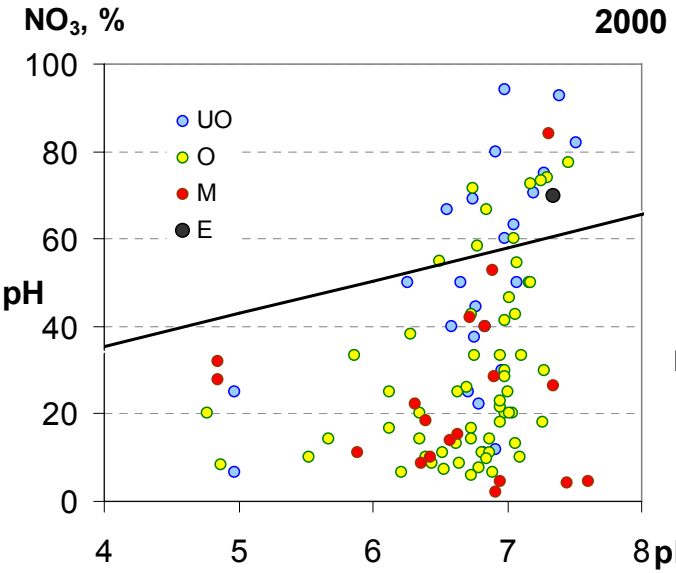


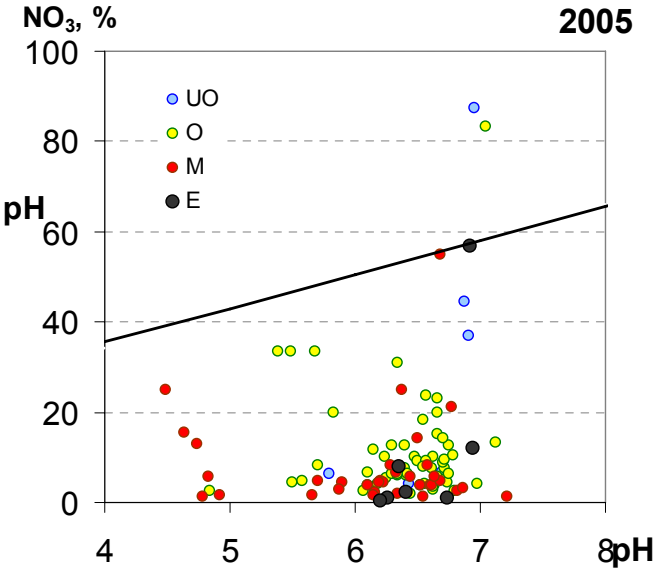




Distribution of percentage nitrate in the inorganic nitrogen concentration in Kola lakes in 1995, 2000, 2005





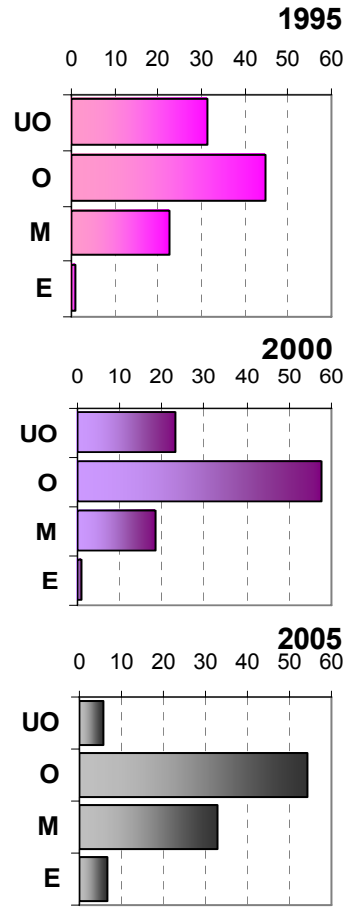


——— hypothetic relationship

(NO_3+NH_4=100%)

Distribution of percentage of the Kola lakes under different limitation level on phosphorus, nitrogen and silicon in 1995, 2000, 2005

		PO_4		N		Si	
		<10 µg/l	<1 µg/l	<300 µg/l (sum NH_4 and NO_3)	<7 µg/l (NO_3)	<0.5 mg/l	<0.1 mg/l
		1	**2**	**1**	**2**	**1**	**2**
1995	All lakes	**90**	**30**	**98**	**81**	**14**	**4**
	Ultaoligotrophic	100	45	100	69	3	3
	Oligotrophic	80	23	100	95	18	8
	Mesotrophic	100	25	100	75	25	0
2000	All lakes	**100**	**61**	**100**	**75**	**14**	**5**
	Ultaoligotrophic	100	75	100	75	8	8
	Oligotrophic	100	62	100	80	12	3
	Mesotrophic	100	42	100	63	32	5
2005	All lakes	**97**	**17**	**99**	**93**	**21**	**9**
	Ultaoligotrophic	100	**0**	100	60	20	20
	Oligotrophic	100	**20**	100	98	13	5
	Mesotrophic	100	**18**	100	94	35	15
	Eutrophic	**57**	**0**	**86**	71	14	0

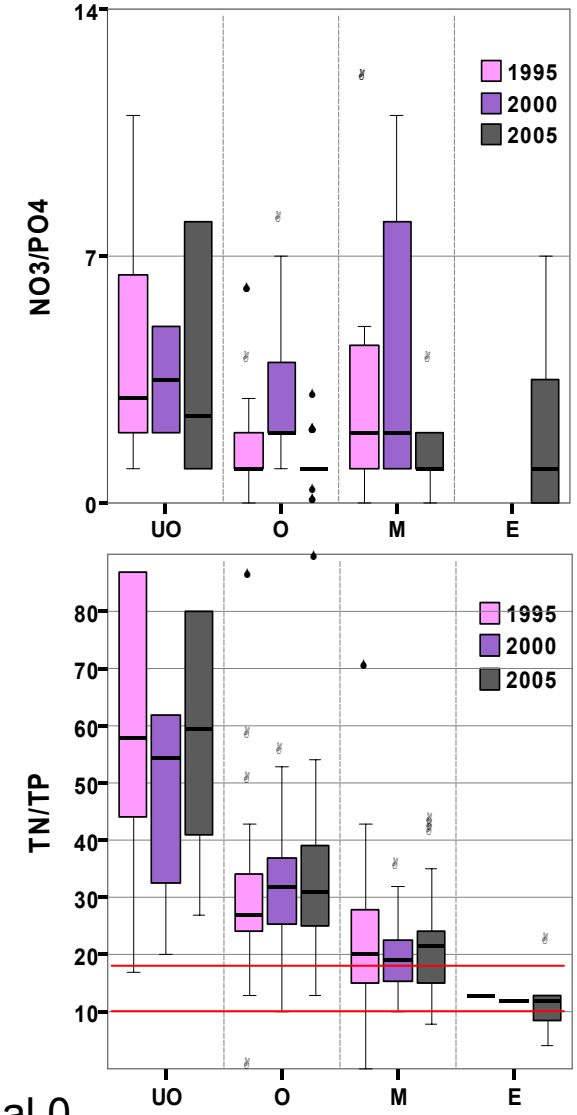


1 - limiting concentrations (low level of optimal condition) (Hutchinson, 1967)

2 - tentative concentration under which phytoplankton production cease

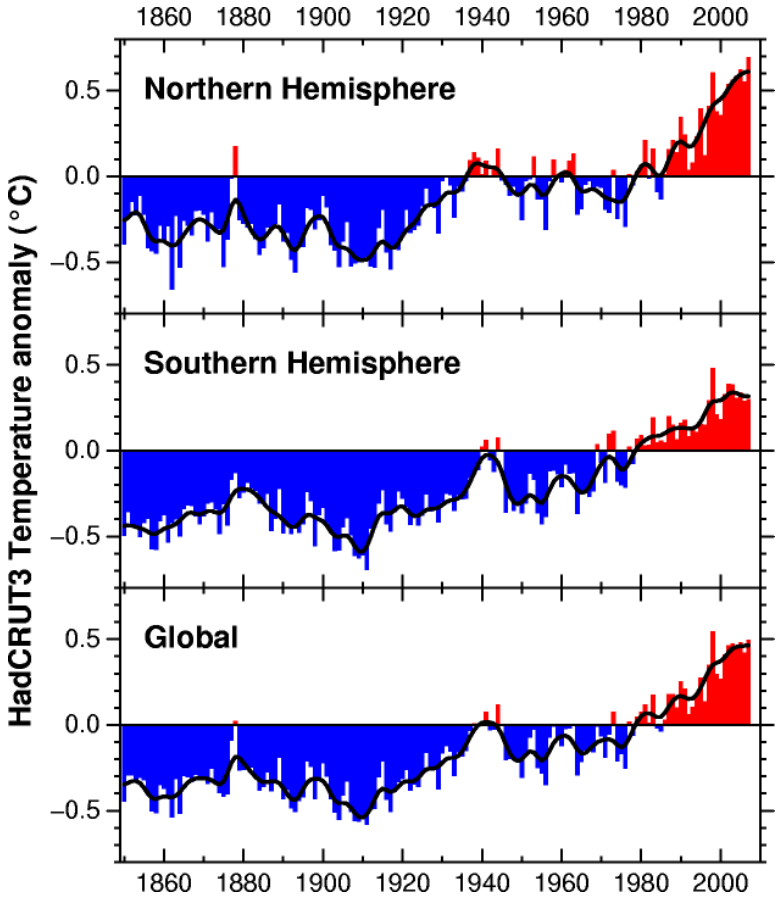
Distribution of percentage of the Kola lakes on NO_3/ PO_4 and TN/TP ratios in 1995, 2000, 2005

		NO_3/ PO_4		TN/TP		
		<7	>7	<10	10-17	>17
1995	All lakes	**59**	**11/30***	**1**	**11**	**88**
	Ultaoligotrophic	41	14/**45**	0	3	97
	Oligotrophic	73	5/22	0	8	92
	Mesotrophic	60	15/25	5	25	70
2000	All lakes	**30**	**9/61**	**0**	**11**	**89**
	Ultaoligotrophic	21	4/**75**	0	0	100
	Oligotrophic	33	5/62	0	7	93
	Mesotrophic	37	21/42	0	37	63
2005	All lakes	**79**	**4/17**	**4**	**14**	**82**
	Ultaoligotrophic	80	20/0	0	0	100
	Oligotrophic	79	2/19	0	4	96
	Mesotrophic	79	3/18	3	26	71
	Eutrophic	86	14/0	43	43	14



* - denominator – percent of lake with PO_4 concentration is equal 0

Climate stimulation ?



(Brohan et al., 2006)

Conclusions

By 2005 biogeochemical processes in Kola lake ecosystems had altered;
the symptoms are:
- increase of TOC and share of autochthonous organic matter judging from TOC to Norg ratio
- intensification of nutrients cycle judging from NH_4 concentration and Norg to NH_4 ratio as parameters of organic matter destruction
- increasing lake production judging from TP concentration as a parameter of eutrophication

Possible causes of rising lake production:
- climate stimulation
- increase of bioavailable form of nutrients due to intensification of their cycling

If in 1995 and 2000 the restrictive factor of lake production was phosphorus in association with nitrogen, whereas in 2005 that was nitrogen.

Thanks for your attention