

Development of water protection of Lake Onega

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Presentation outline:

- General information
- Classification of Lake Onega waters
- Present total P loading on Lake Onega and its "hot spots"
- Effect of TP loading reduction on TP concentration in lake waters
- Conclusions

Drainage area

Lake surface area

Water volume

Max depth

Mean depth

Retention time

Lake Onega

66 200 km²

9 900 km²

291 km³

120 m

30 m

15 years

Lake Ladoga

260 000 km²

17 200 km²

900 km³

230 m

47 m

11 years

Joensuu

Kondopoga

Petrozavodsk

Lake Onega

Svir

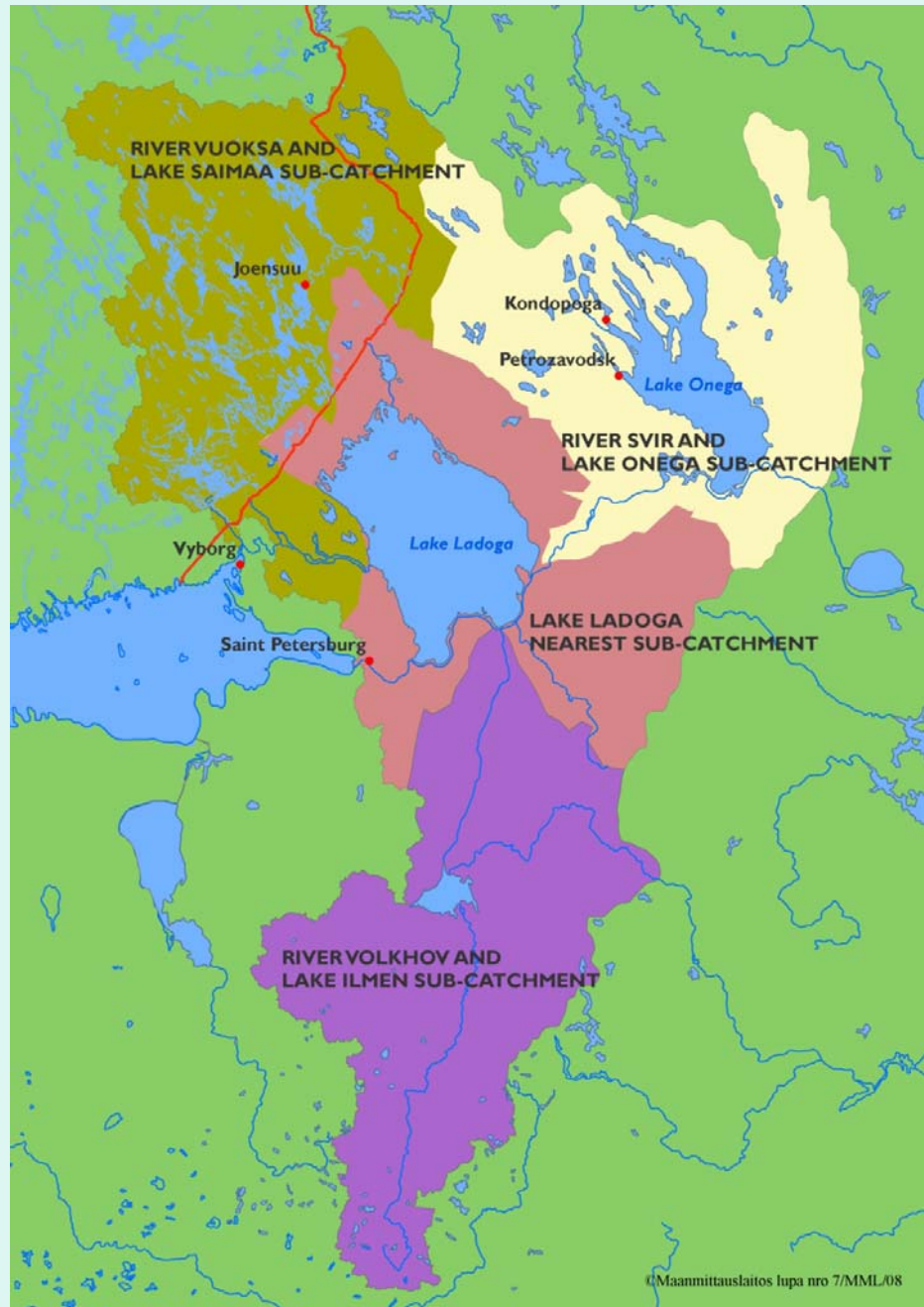
Lake Ladoga

Vyborg

Saint Petersburg

Neva



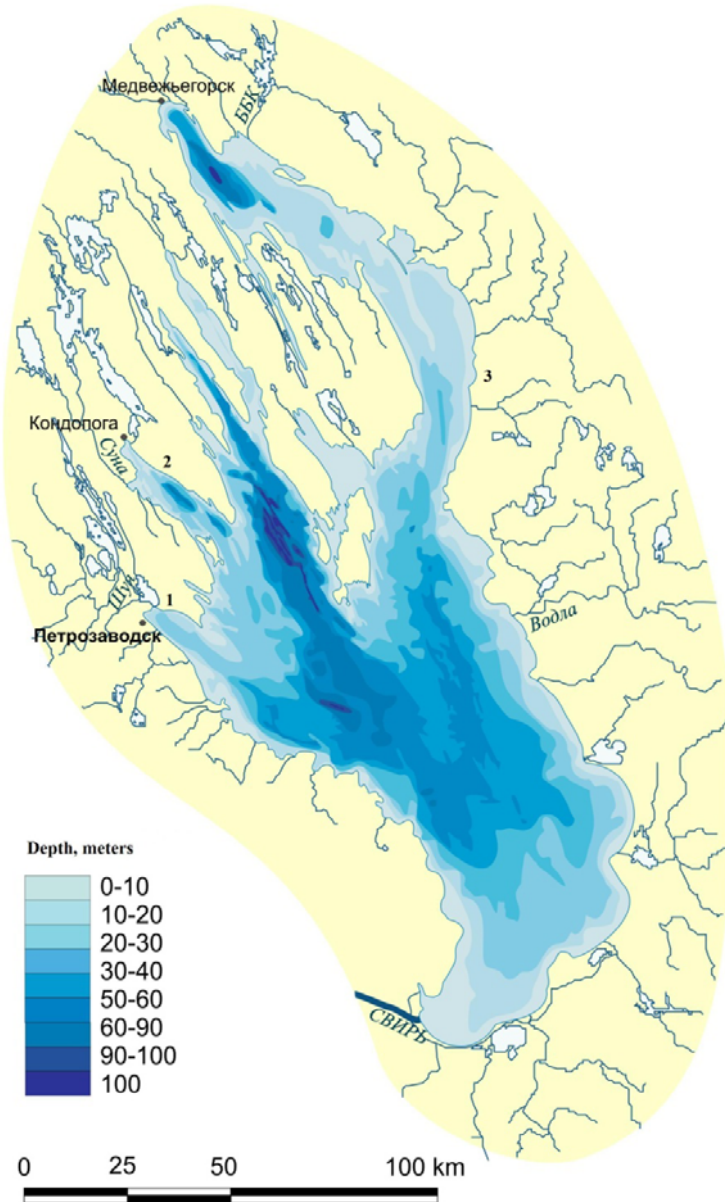


Map of Lake Ladoga catchment

- (1 – Lake Ladoga immediate sub-catchment,
2 – River Svir and Lake Onega sub-catchment,
3 – River Vuoksa and Lake Saimaa sub-catchment,
4 - River Volkhov and Lake Ilmen sub-catchment).

Catchment area of Lake Onega with sub-catchments





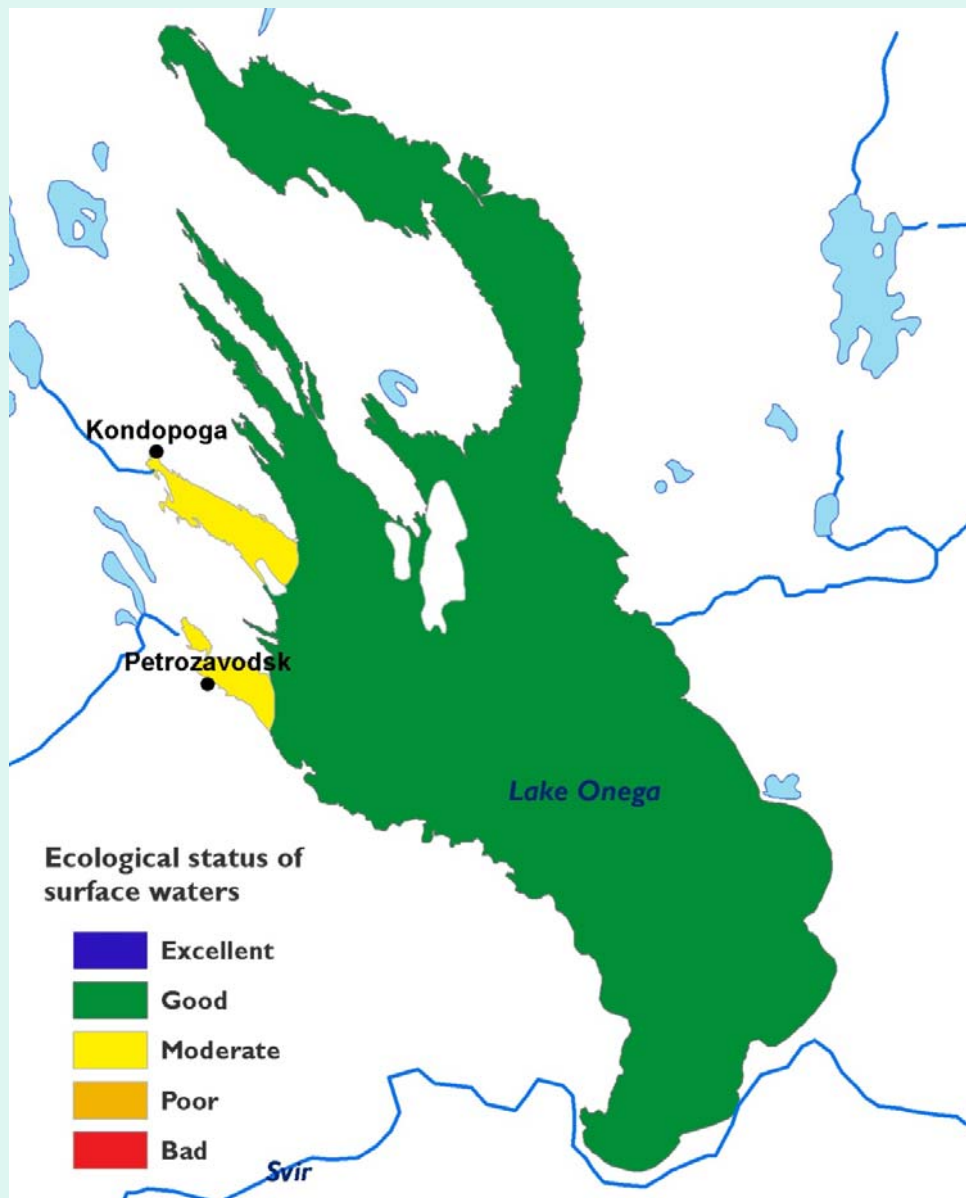
Bathymetric map of Lake Onega (source: Northern Water Problems Institute, KRC RAS, Petrozavodsk, Russia).

1 - Petrozavodsk bay, 2 – Kondopoga bay,
3 – Bolshaya bay

Limit nutrients concentrations of the new Finnish classification scheme
for the large slightly humic lake.

Ecological status	Excellent	Good	Moderate	Poor	Bad
Total phosphorus concentration, $\mu\text{g/l}$	< 10	10 - 18	18 - 35	35 - 70	> 70
Total nitrogen concentration, $\mu\text{g/l}$	< 400	400 - 500	500 - 700	700 - 900	> 900

Ecological classification of Lake Onega (new Finnish scheme)



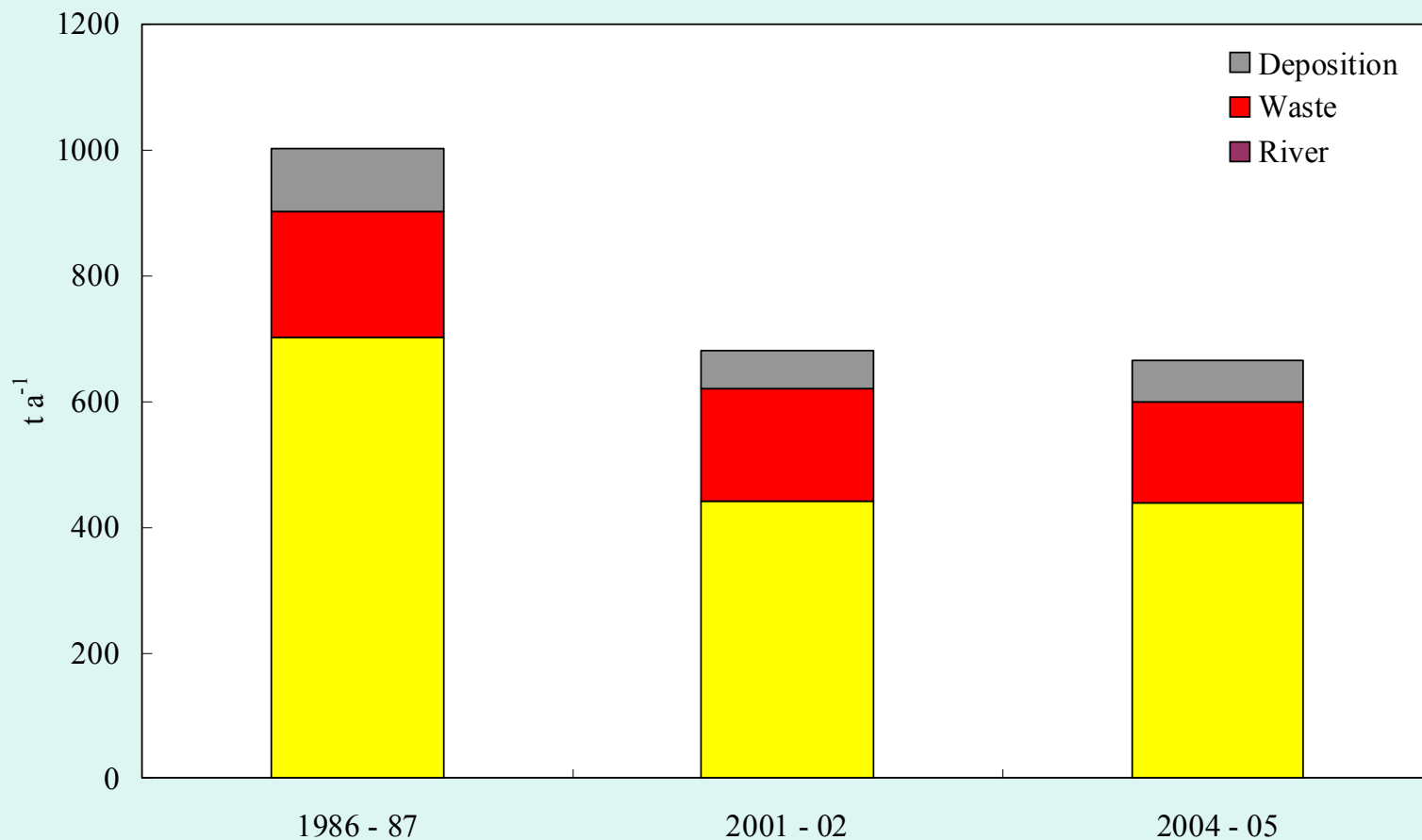
Dynamics of population in the coastal area (from Filatov et al., Lake Onega. Ecological Problems, 1999)

Population	1976		1989		1995	
	Thousands, people	%	Thousands, people	%	Thousands, people	%
Total	312,3	100	358,0	100	371,2	100
Urban	289,9	92,8	342,4	95,6	355,4	95,7
Rural	22,4	7,2	15,6	4,4	16,0	4,3

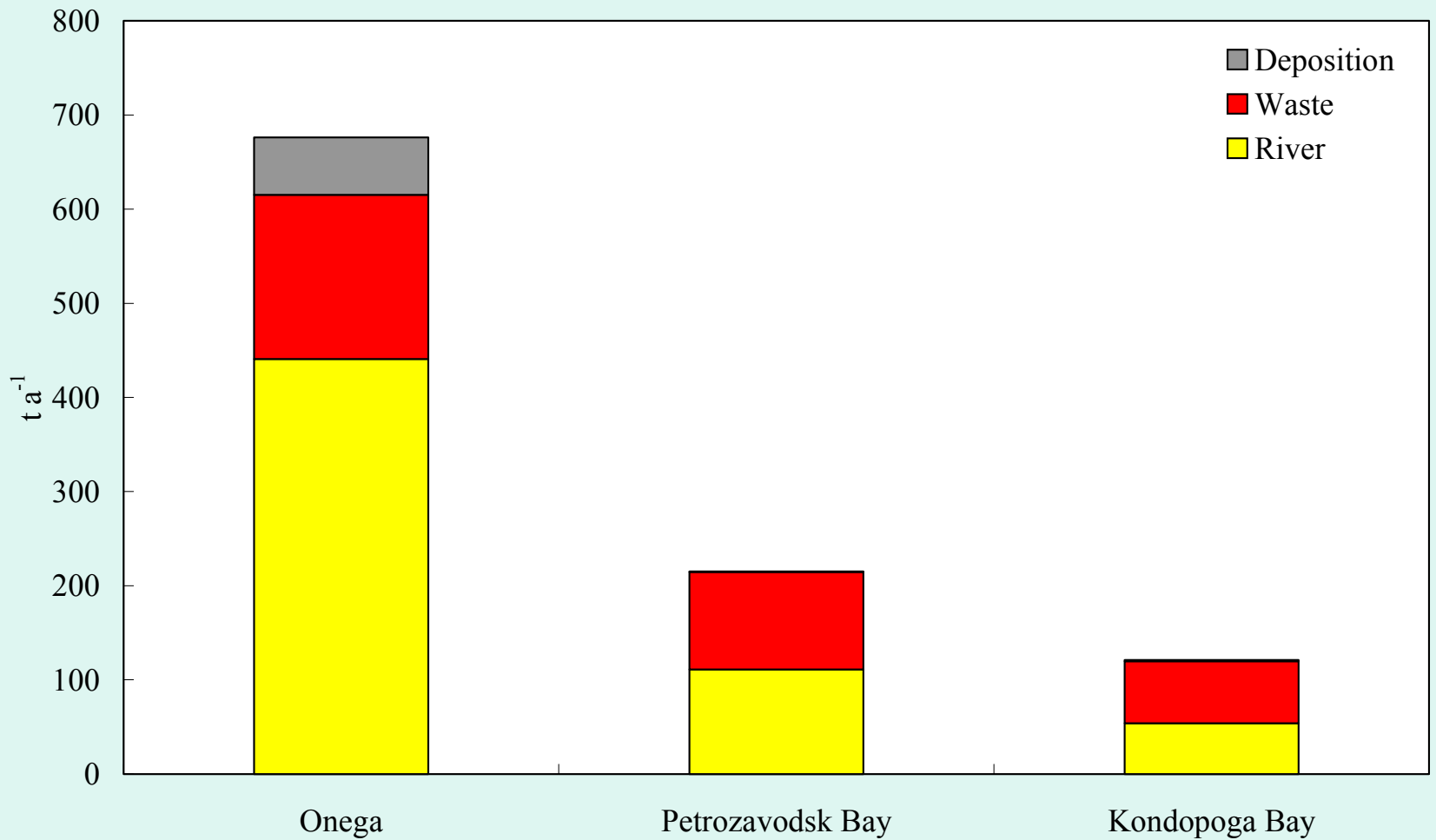
Gradation of settlements in the coastal area (from Filatov et al., Lake Onega. Ecological Problems, 1999)

Number of persons	Number of settlements		
	1976	1989	1995
< 10	19	12	14
11 – 50	10	10	11
51 – 100	9	7	6
101 – 500	13	7	7
501 – 1000	8	4	5
1001 - 5000	7	10	10
> 5000	4	4	4
Total	70	54	57

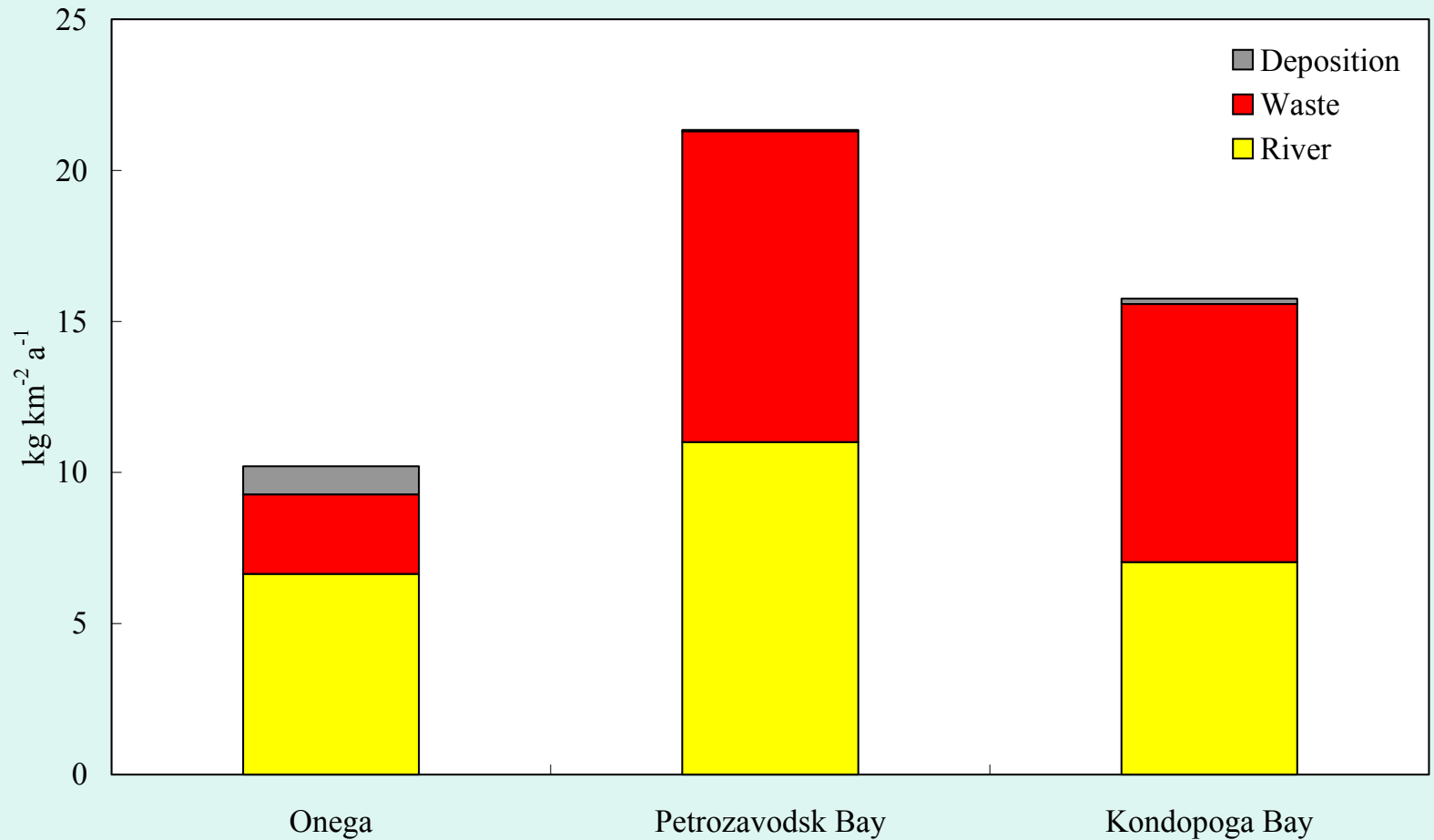
Temporal development of total phosphorus loading to Lake Onega



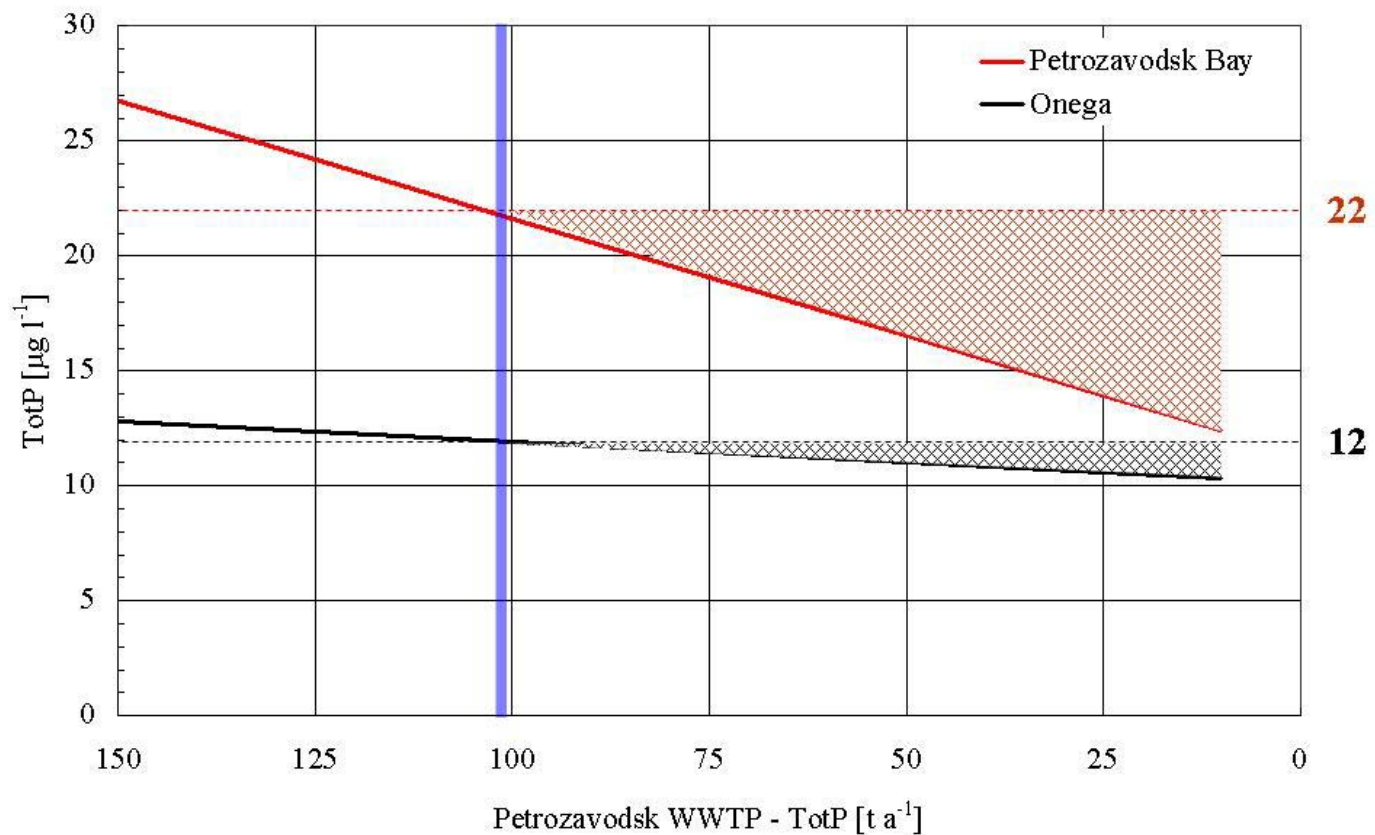
Present total phosphorus loading to Lake Onega and to two hotspots: Petrozavodsk Bay and Kondopoga Bay



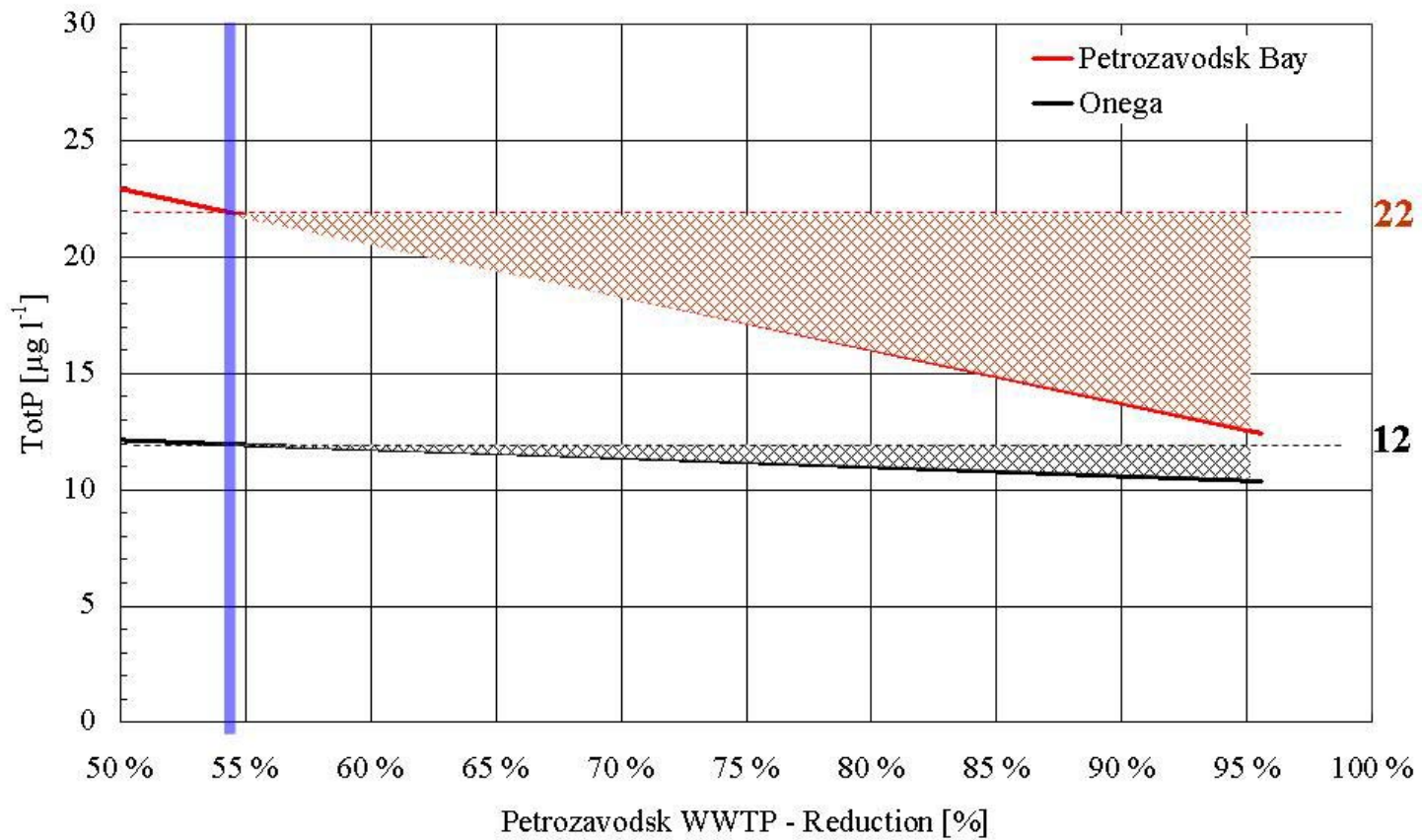
Present relative total phosphorus loading to Lake Onega and to two hotspots: Petrozavodsk Bay and Kondopoga Bay



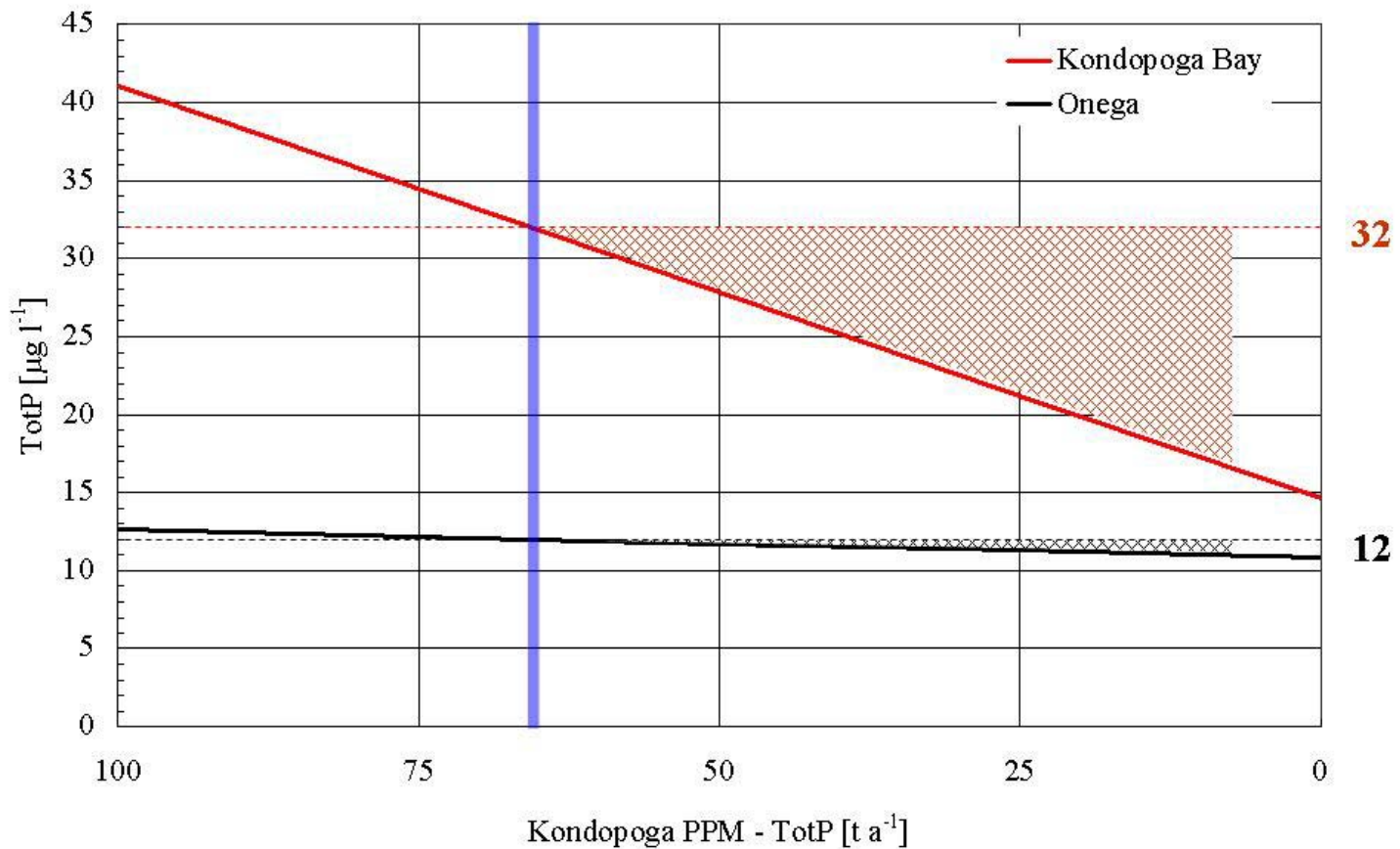
Effect of total P load reduction on TP concentration in Lake Onega and Petrozavodsk Bay (mass-balance estimates)



Relative effect of total P load reduction on TP concentration in Lake Onega and Petrozavodsk Bay (mass-balance estimates)



Effect of total P load reduction on TP concentration in Lake Onega and Kondopoga Bay (mass-balance estimates)



Conclusions:

- While Lake Onega preserves a good status of water as a whole, the problems with pollution and eutrophication exist in Petrozavodsk and Kondopoga Bays where anthropogenic loading is more pronounced.
- Petrozavodsk Bay has better exchange with open central part of the lake, but in winter time and during thermal bar period (late spring – early summer and autumn) water quality can deteriorate, when Shuya flood waters are locked in the bay.
- Kondopoga Bay is more isolated from the central part of the lake. Here anthropogenic impact is most severe, the pollution is heaviest at the head of the bay throughout the year, where Kondopoga PPM withdraws wastewaters for nearly 80 years (40 years without treatment).
- As a consequence of human impact on Lake Onega is a rise in its nutrient status. The Petrozavodsk industrial centre is the main eutrophying agent for the central part of the lake, whereas Kondopoga pulp-and-paper mill wastewaters are more localized within the bay.
- The excessive phosphorus loading with Petrozavodsk wastewaters should be reduced considerably to prevent further eutrophication of Lake Onega. The existing treatment removes about 55-60% of total phosphorus from Petrozavodsk wastewaters. Modern technology permits to increase this figure up to 95%.
- To improve environmental conditions in Kondopoga Bay the effectiveness of wastewater treatment process at Kondopoga PPM has to be enhanced and phosphorus loading has to be reduced

Thank you for your attention !

