Water quality changes trends of the main rivers of Uzbekistan and their role in present ecological situation in the Aral Sea basin

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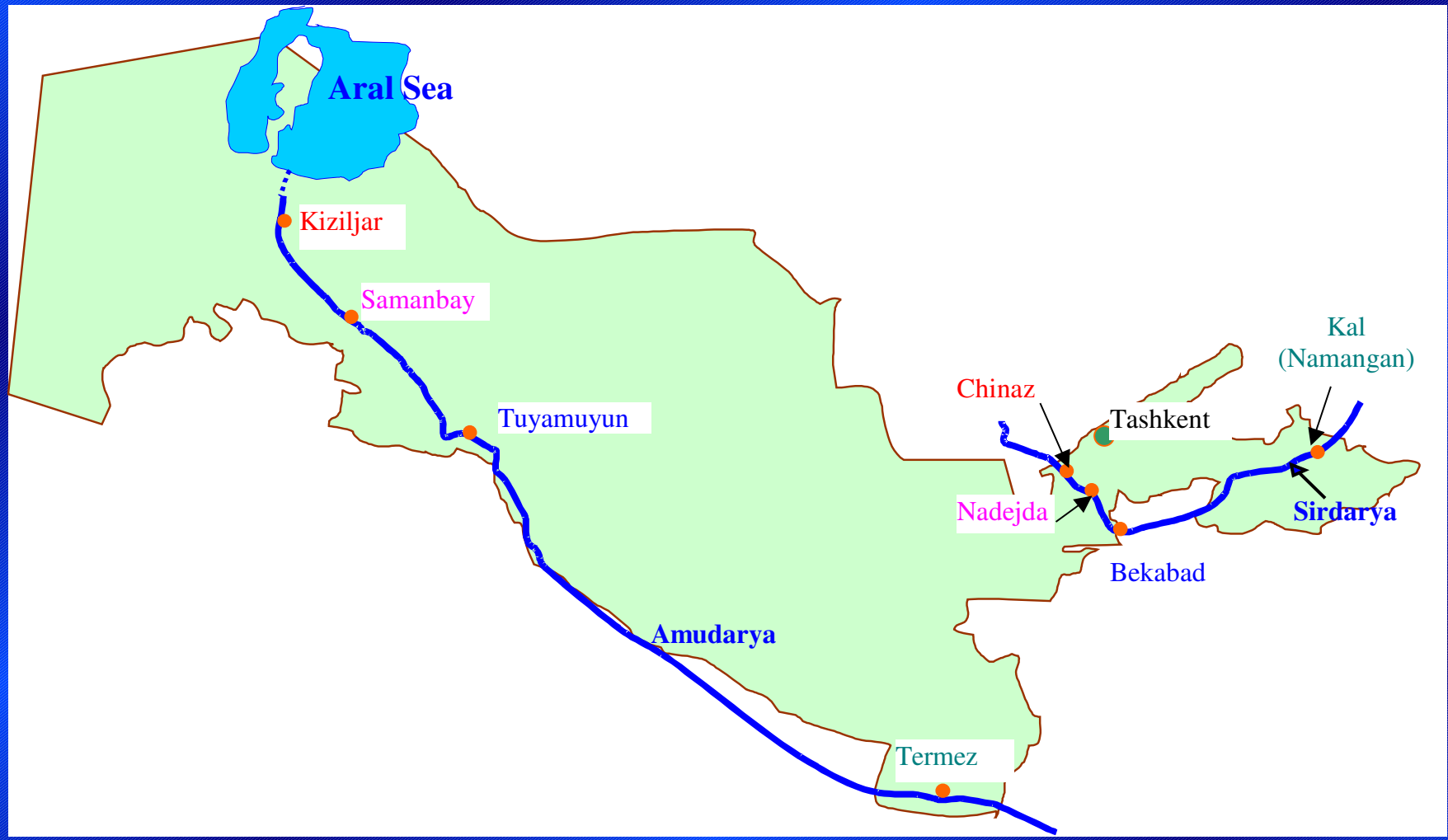
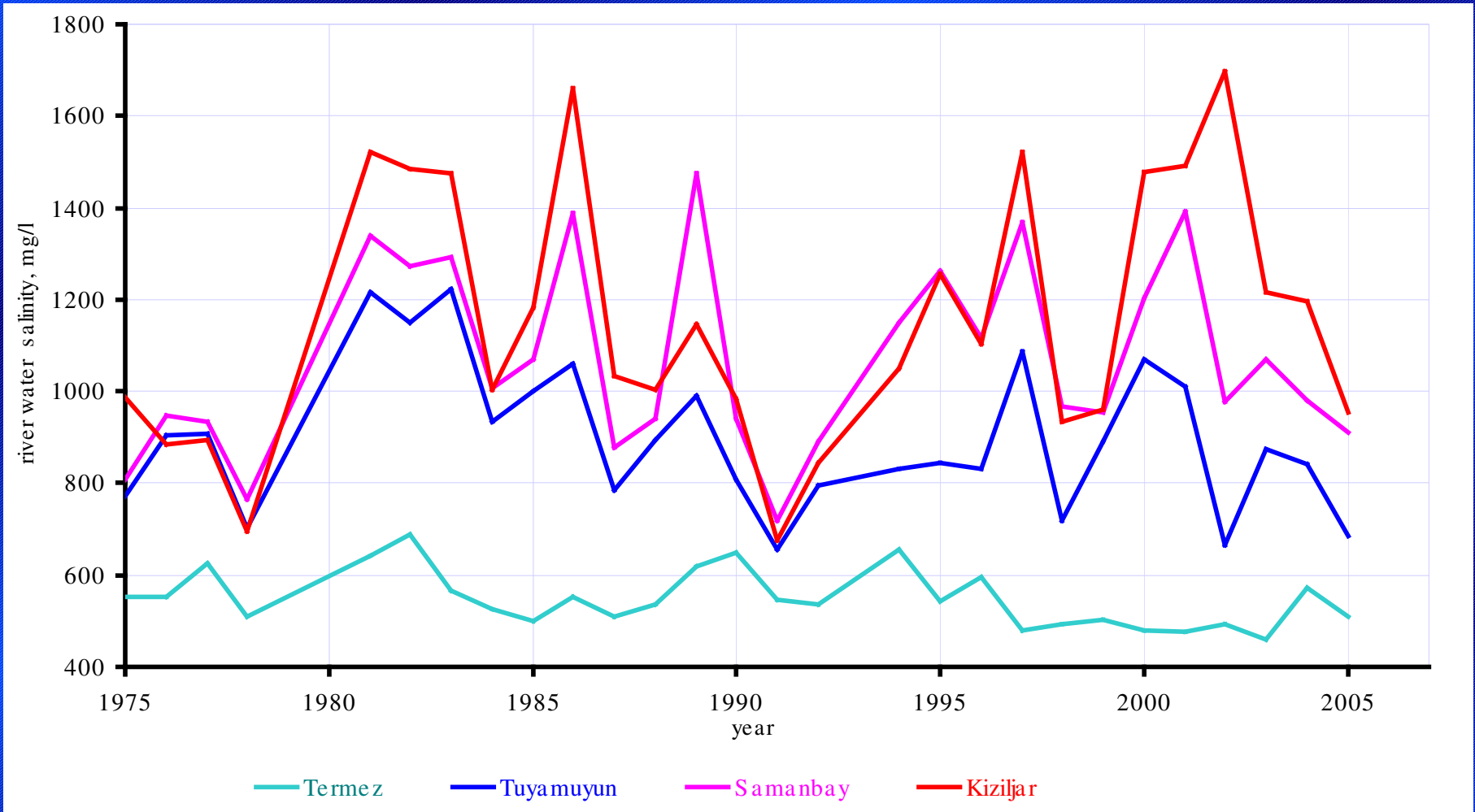
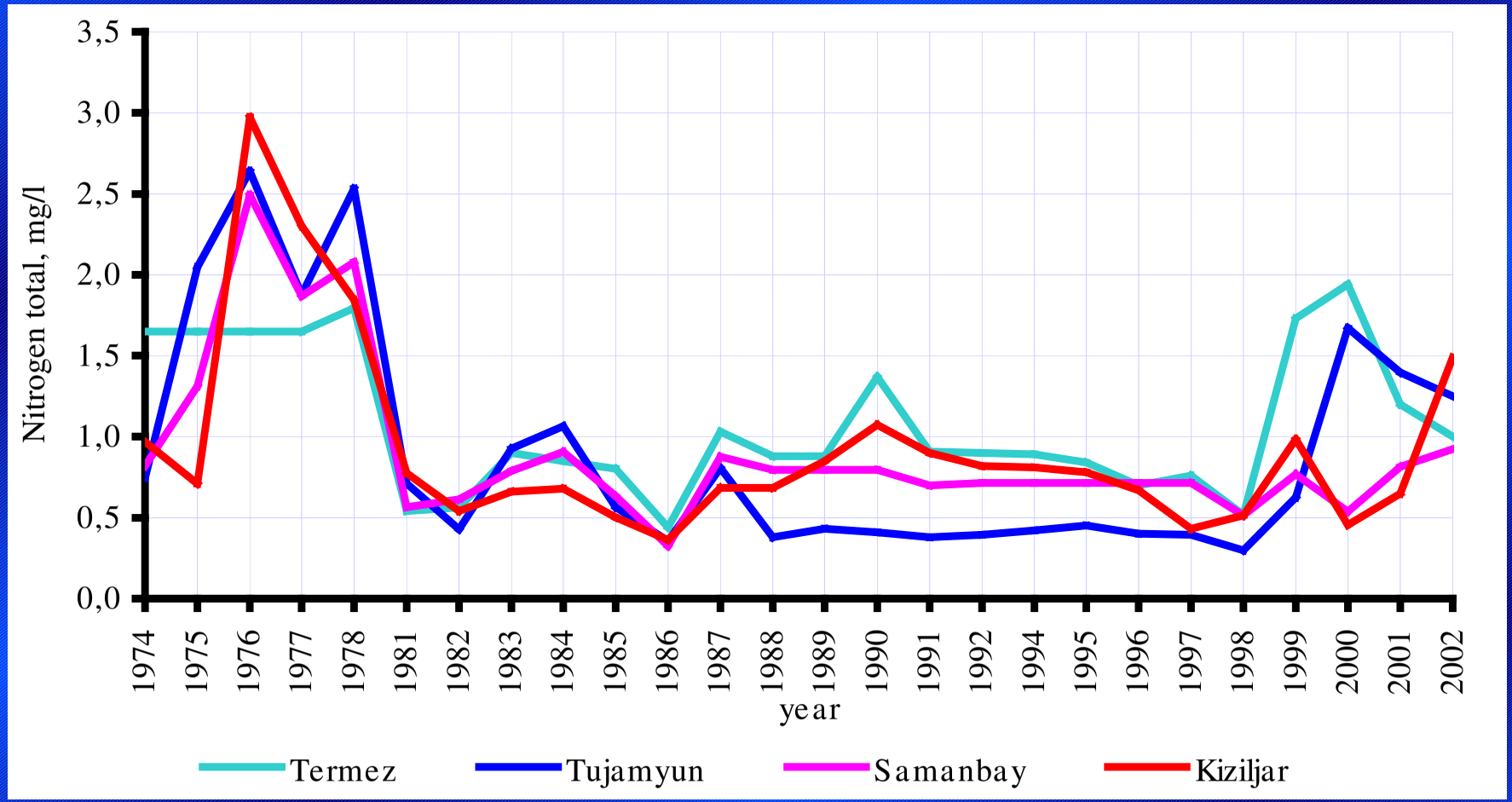
Water quality control stations



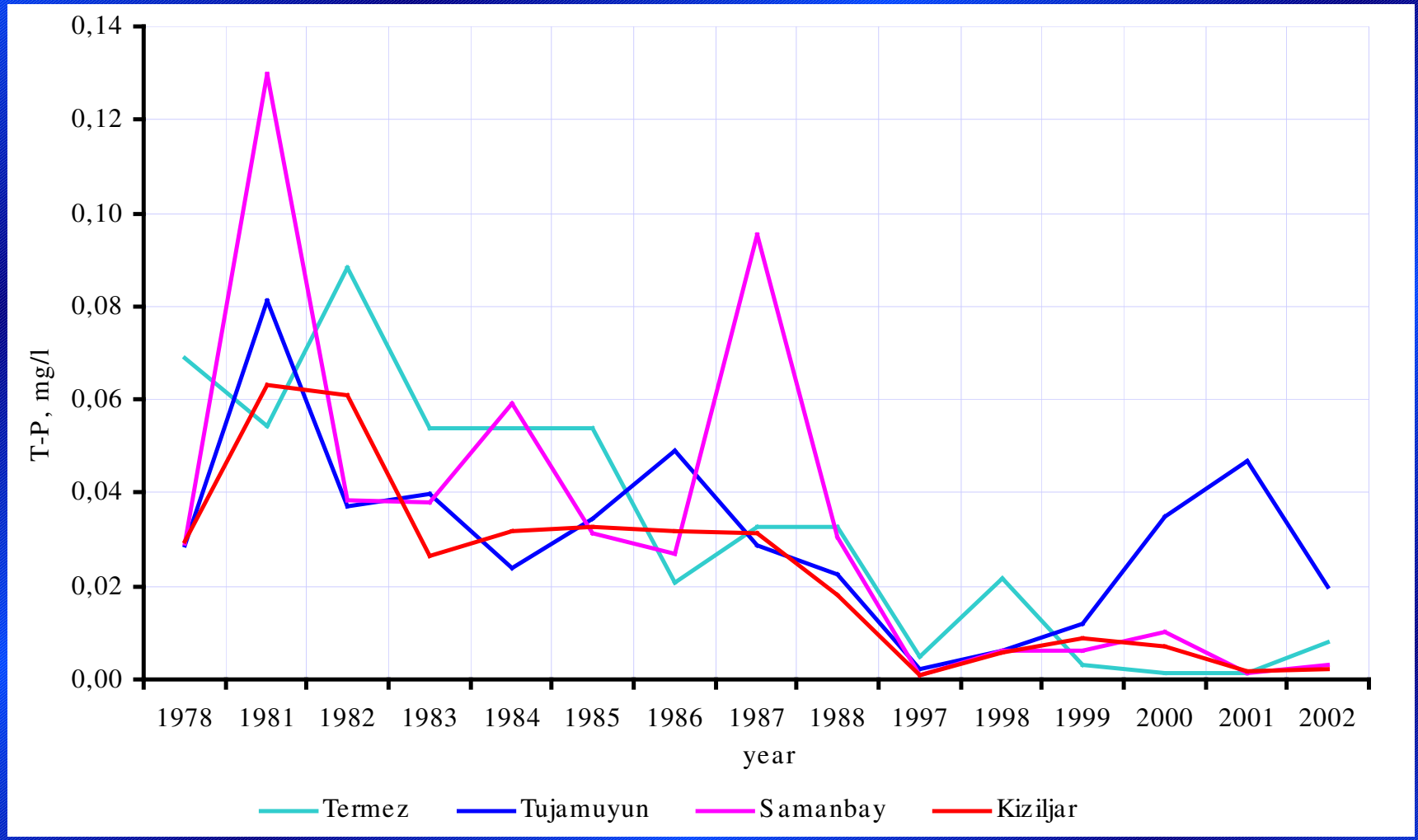
Amudarya River water salinity



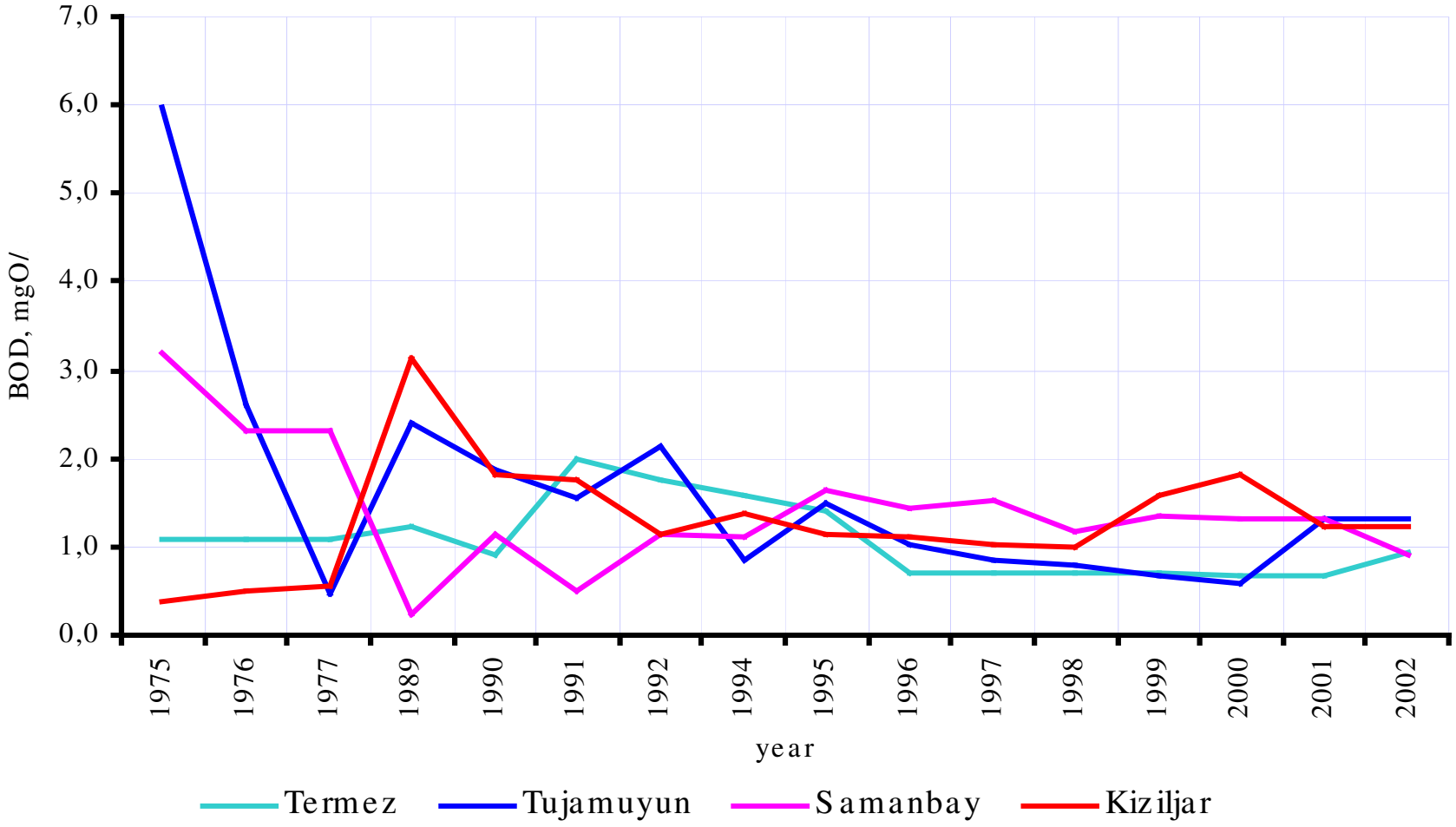
Changes of T-N in Amudarya River water



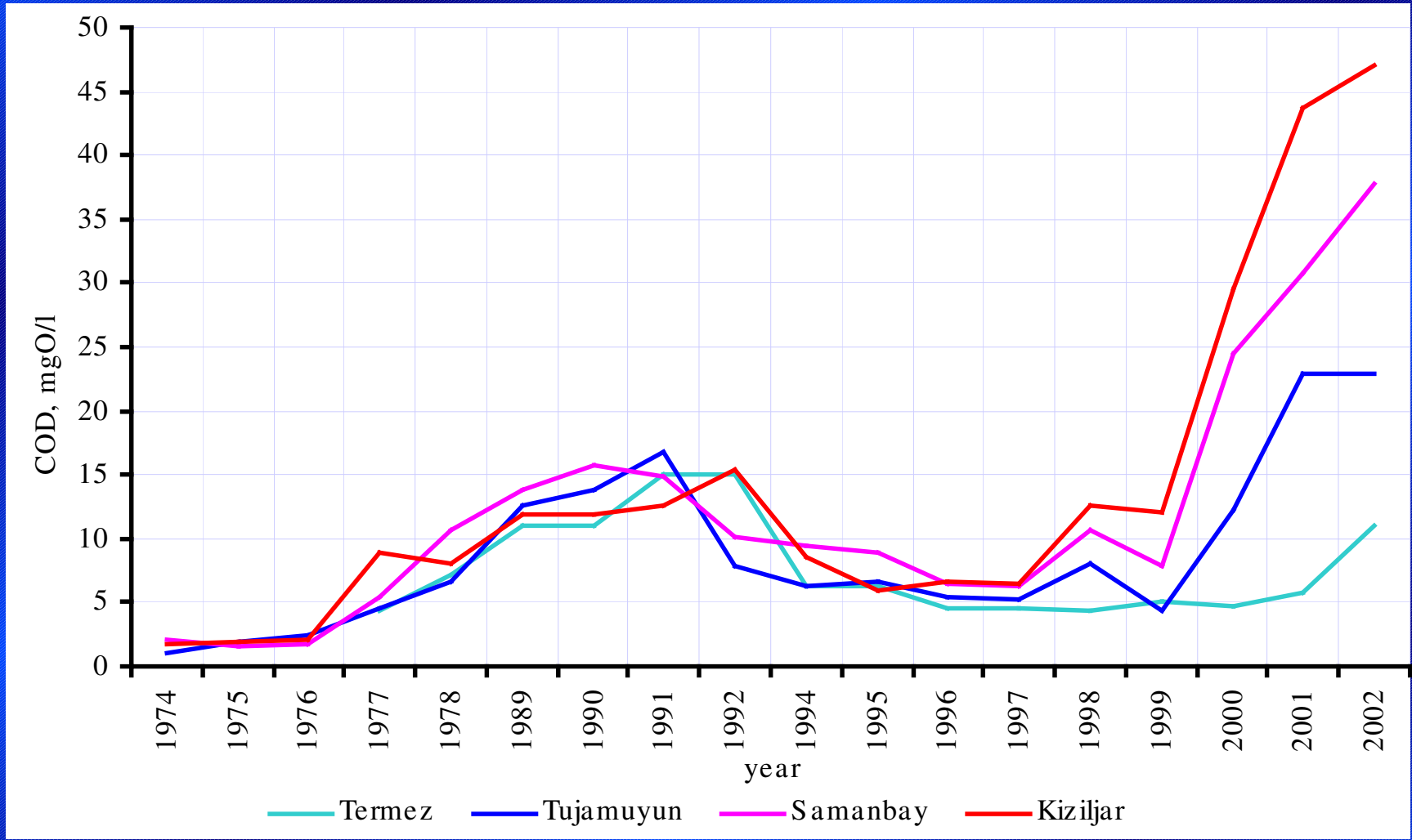
Changes of T-P in Amudarya River water



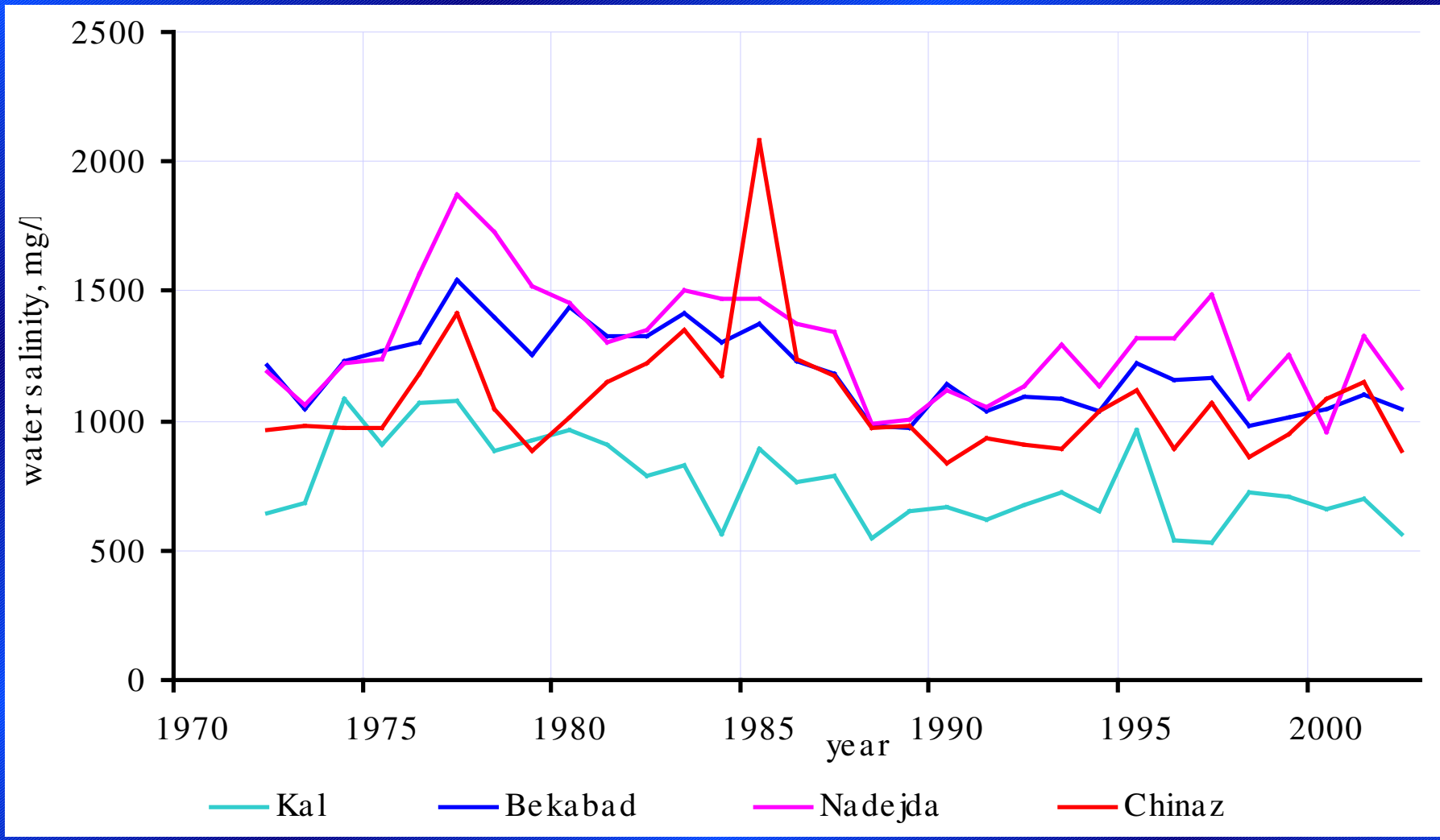
Changes of BOD in Amudarya River water



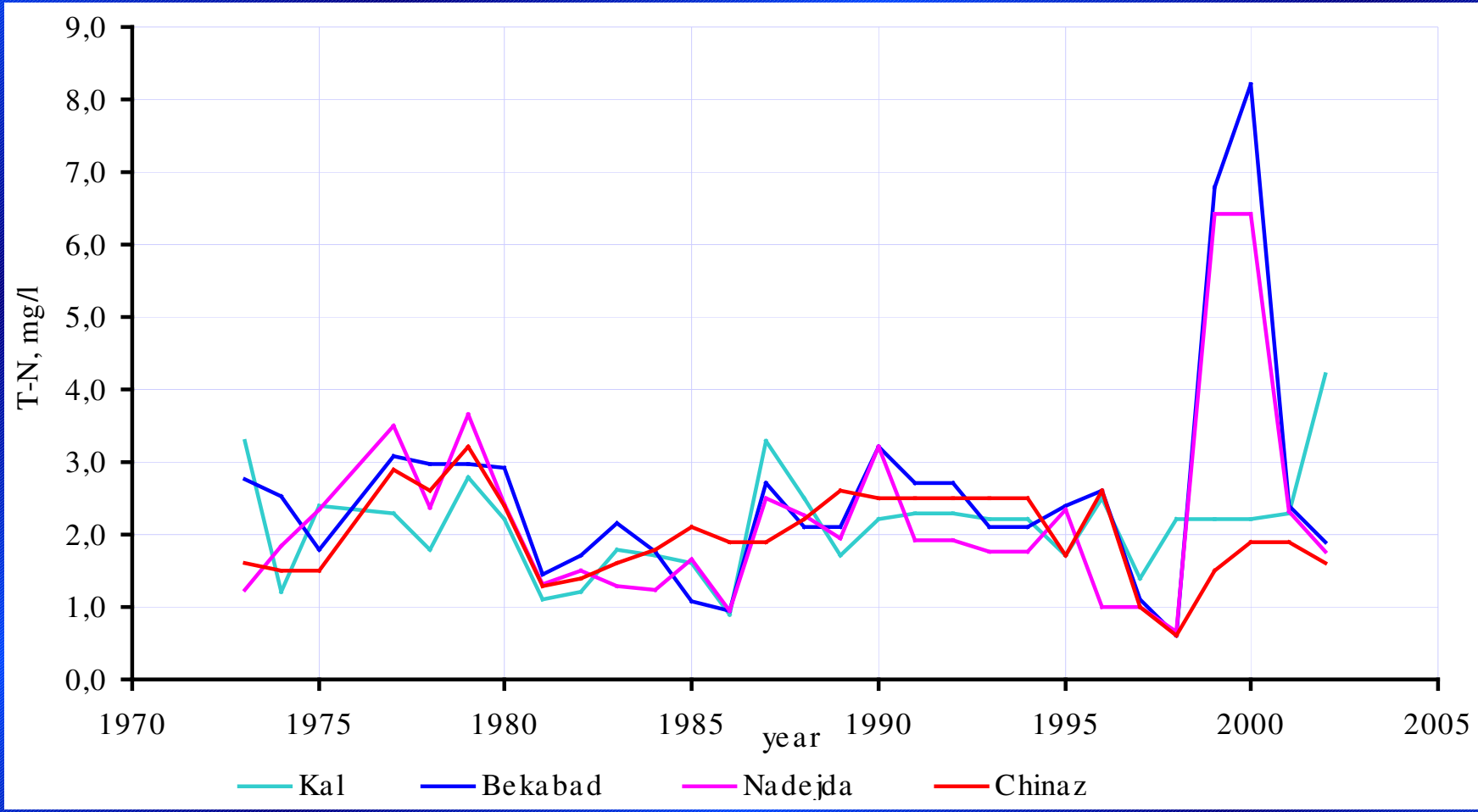
Changes of COD in Amudarya River water



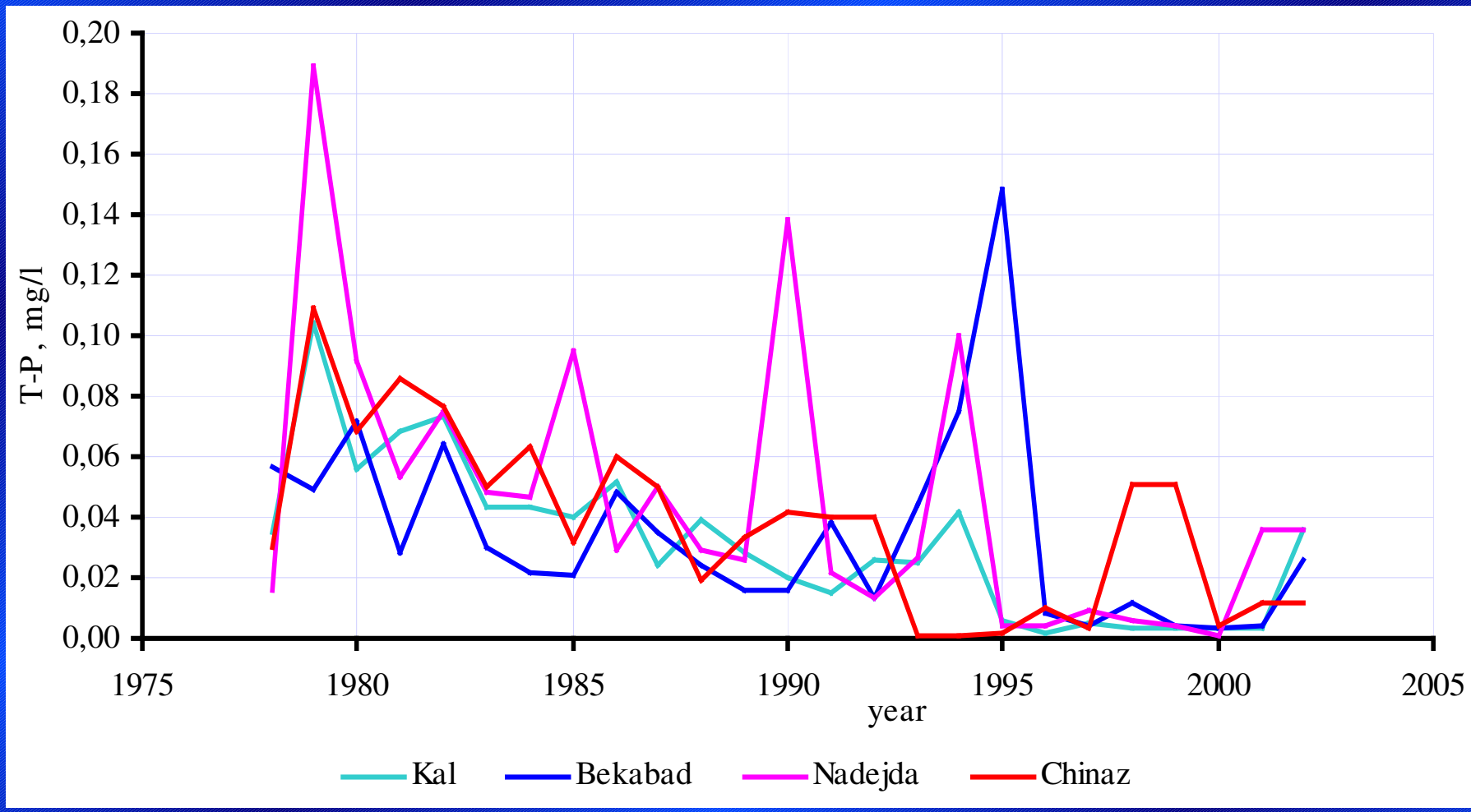
Sirdarya River water salinity



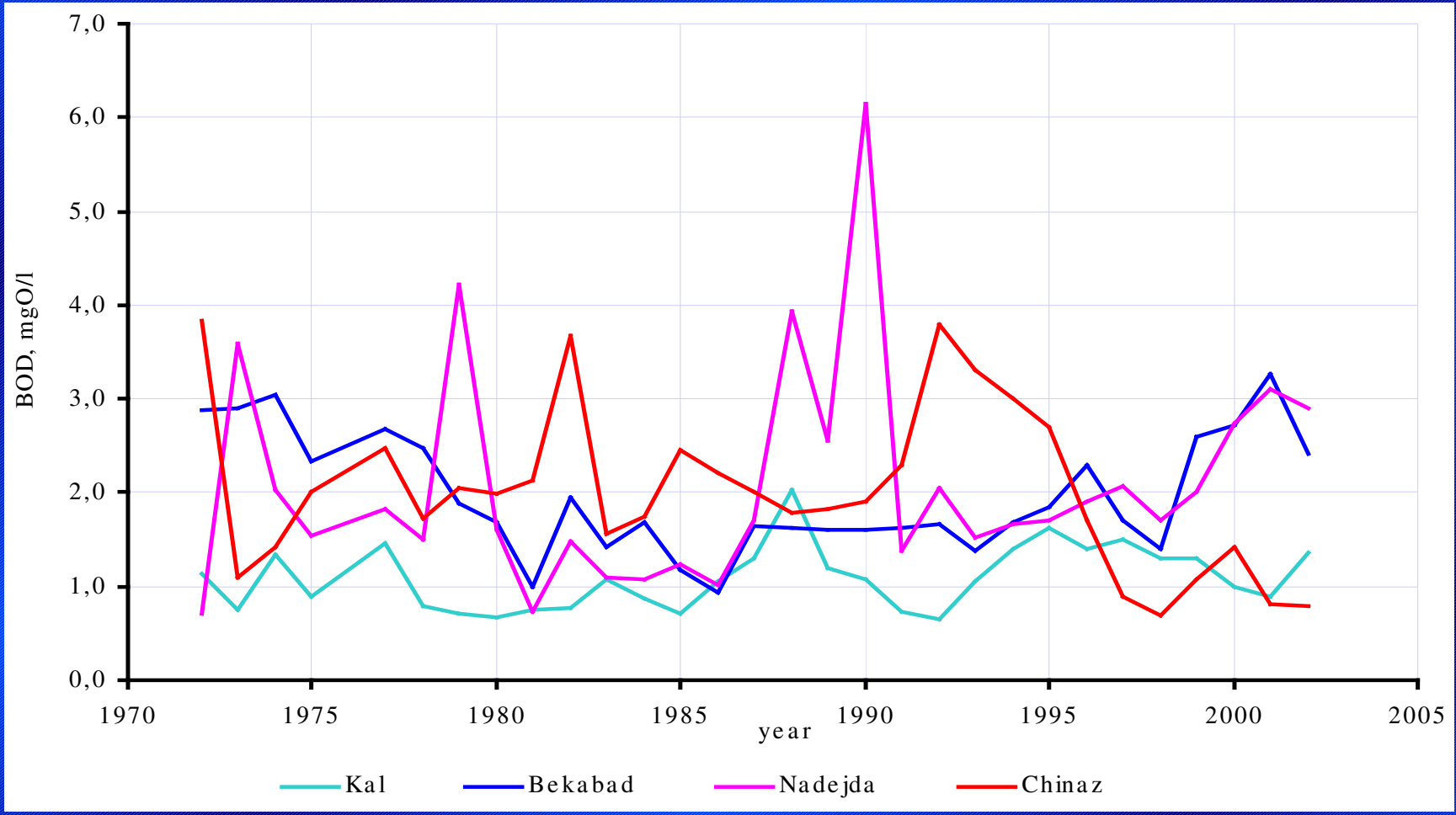
Changes of T-N in Sirdarya River water



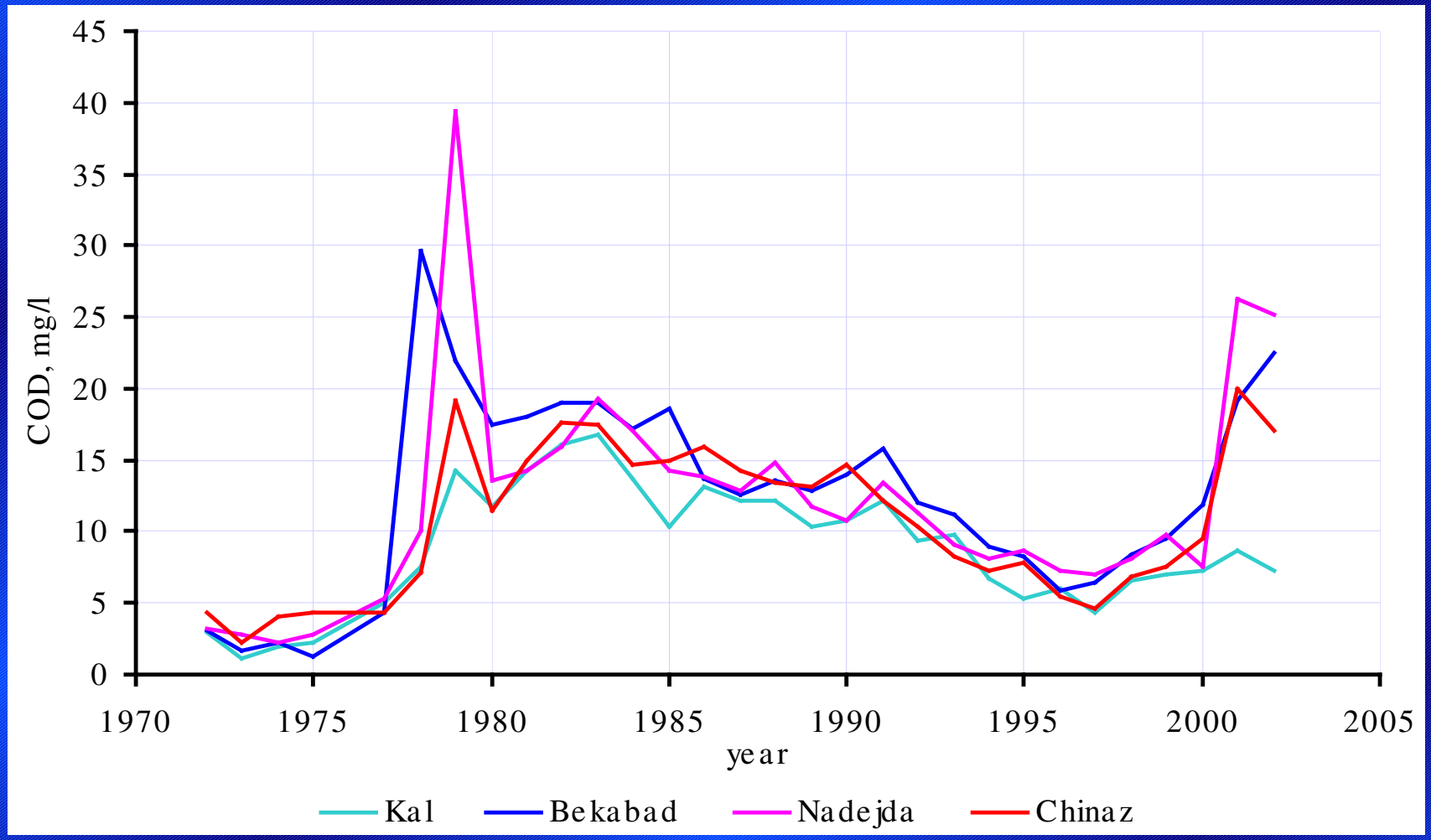
Changes of T-P in Sirdarya River water



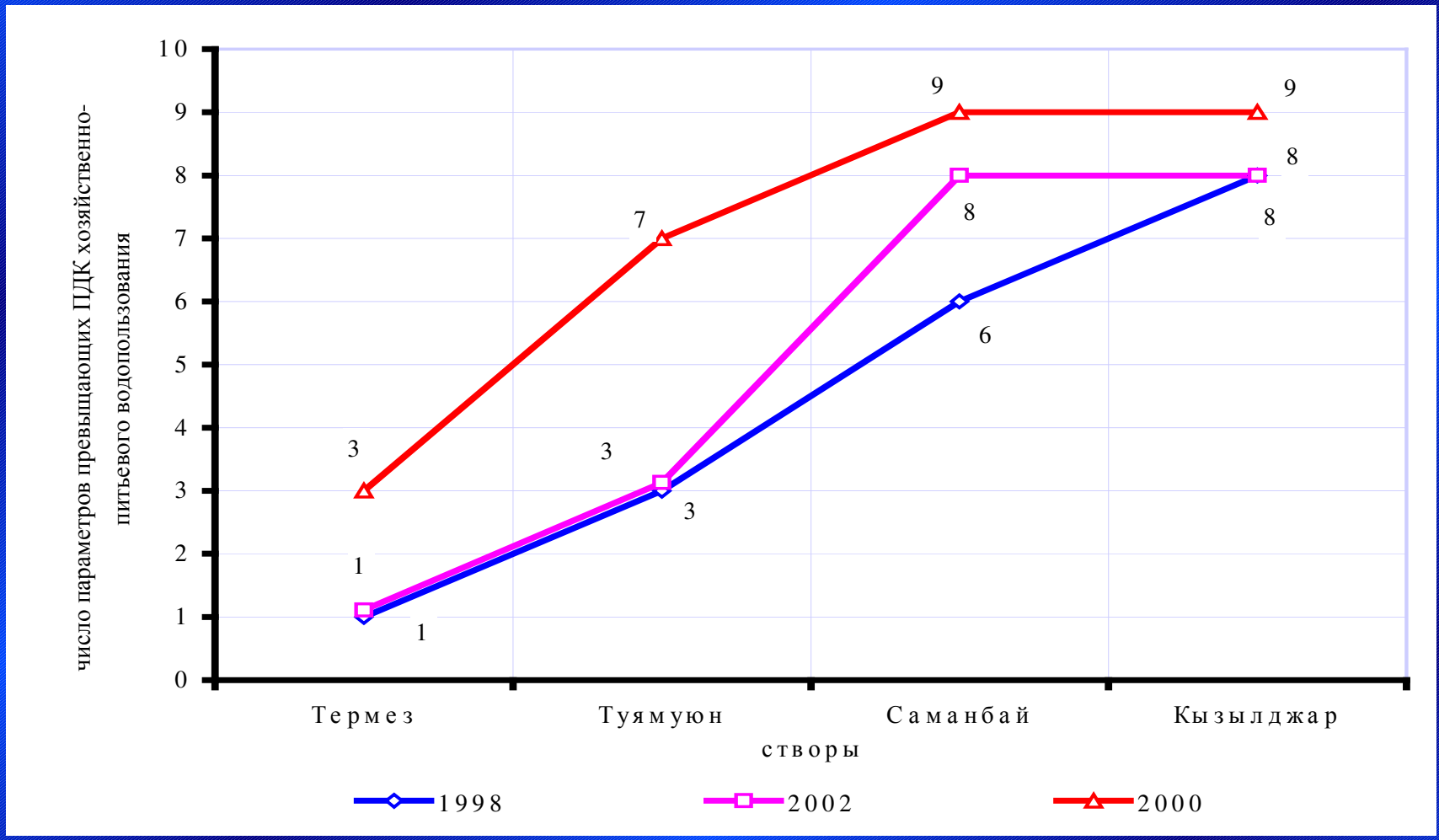
Changes of BOD in Sirdarya River water



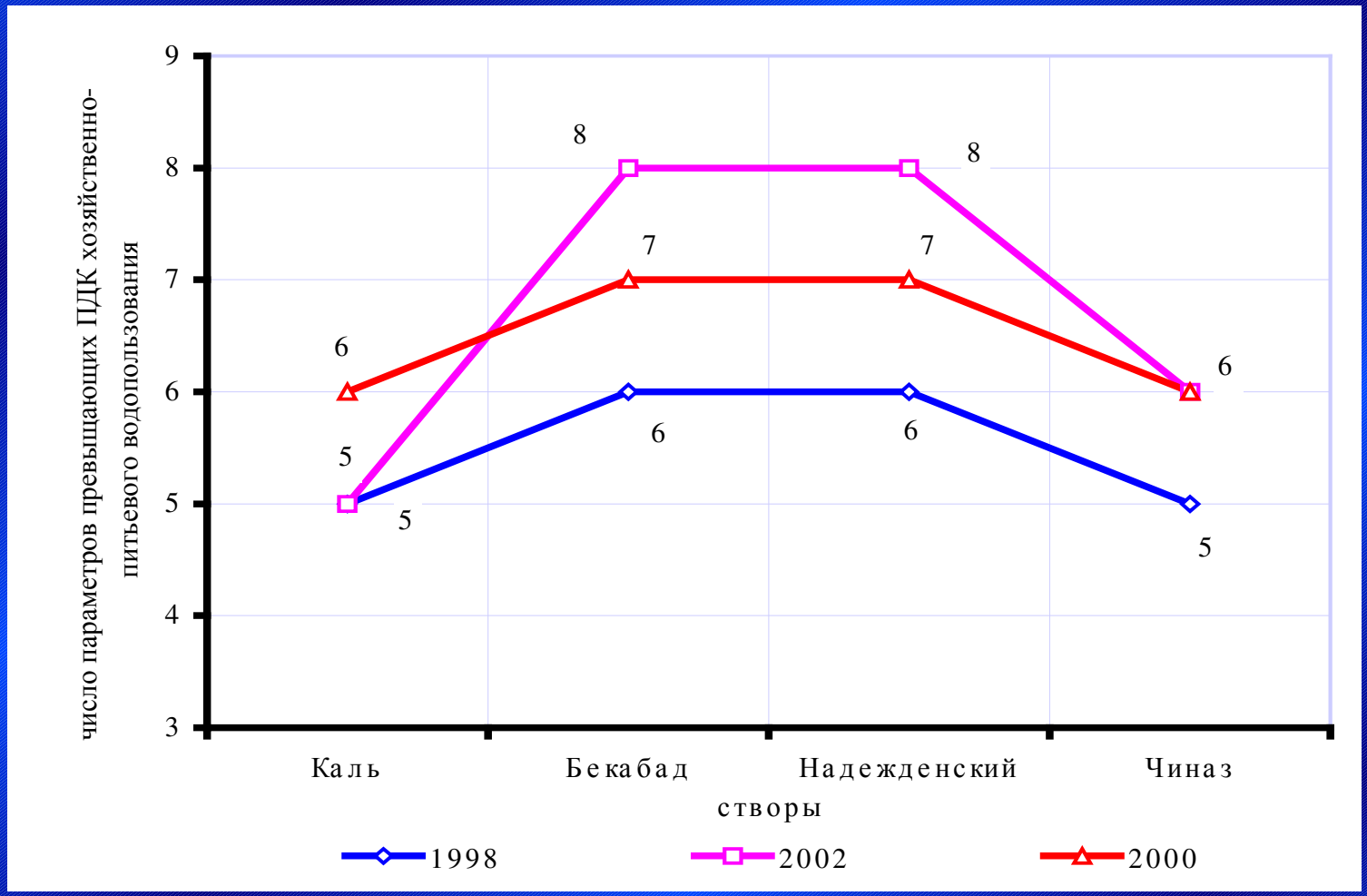
Changes of COD in Sirdarya River water



Changes of Amudarya River water quality result of anthropogenic impact



Changes of Sirdarya River water quality result of anthropogenic impact



River water for irrigation (quality assessment)

- **Salinization risk**

$$K_s = M * 0,03 / (Ca^{2+}+Mg^{2+})$$

- **Natrium alkalinization risk**

$$K_{Na} = (Na^{+}+Ca^{2+}+Mg^{2+}) / Ca^{2+}+Mg^{2+}$$

- **Magnesium alkalinization risk**

$$K_{Mg} = Mg^{2+}*100\%/(Ca^{2+}+Mg^{2+})$$

- **Chloride salinization risk**

$$K_{Cl} = Cl^{-} + 0,5*SO_4^{2-}$$

Irrigation quality of the Amudarya River water

1998 year (high water)

Station	Months	Salinization risk		natrium alkalinization risk		magnesium alkalinization risk		chloride salinization risk	
		Calculation	Estimation	Calculation	Estimation	Calculation	Estimation	Calculation	Estimation
Tuyamujun	III-IX	3,3	<4	1,5	<3	39,3	<50	9,9	<15
Samanbay	I-II, IV-XII	3,9	<4	1,8	<3	45,3	<50	10,8	<15
	III	3,4	<4	1,5	<3	50	>50	10,6	<15
Kizildjar	II-III, VI-VII, IX-XI	3,6	<4	1,6	<3	49,4	<50	10,0	<15
	IV	3,3	<4	1,6	<3	47,9	<50	16,9	>15

Irrigation quality of the Amudarya River water

2000 year (low water)

Station	Months	Salinization risk		natrium alkalinization risk		magnesium alkalinization risk		chloride salinization risk	
		Calculation	Estimation	Calculation	Estimation	Calculation	Estimation	Calculation	Estimation
Termez	I-XII	3,9	<4	1,8	<3	35,7	<50	6,1	<15
Tuyamujun	VI, X, XI	3,8	<4	1,7	<3	45,7	<50	11,6	<15
	III	3,7	<4	1,7	<3	45,8	<50	16,5	>15
	V	4,4	>4	1,9	<3	49,3	<50	11,6	<15
Samanbay	I-III, VII-X	3,8	<4	1,8	<3	48,3	<50	13,5	<15
	IV	3,8	<4	1,7	<3	50,8	>50	16,2	>15
	V	4,1	>4	1,8	<3	43,4	<50	16,5	>15
	XI-XII	3,4	<4	1,7	<3	52,6	>50	12,6	<15
Kizildjar	II,III, VI-XI	3,9	<4	1,8	<3	49,2	<50	13,6	<15
	IV	5,3	>5	2,3	<3	55,1	>50	26,0	>15

Irrigation quality of the Amudarya River water

2002 year (medium water)

Station	Months	Salinization risk		natrium alkalinization risk		magnesium alkalinization risk		chloride salinization risk	
		Calculation	Estimation	Calculation	Estimation	Calculation	Estimation	Calculation	Estimation
Tuyamujun	V, VI	3,3	<4	1,7	<3	32,6	<50	3,3	<15
Samanbay	I, III, VI-VIII	3,7	<4	2,1	<3	46,9	<50	10,6	<15
	II	3,7	<4	2,0	<3	**53,6**	**>50**	9,0	<15
	IV	3,5	<4	1,9	<3	**54,6**	**>50**	13,6	<15
	V	4,0	<4	2,1	<3	**54,9**	**>50**	9,9	<15
Kizildjar	VI	2,8	<4	1,4	<3	37,6	<50	4,3	<15
	III	3,8	<4	2,1	<3	**53,7**	**>50**	12,3	<15
	IV	**4,7**	**>4**	2,5	<3	**56,3**	**>50**	**28,7**	**<15**

Irrigation quality of the Sirdarya River water

1998 year (high water)

Station	Months	Salinization risk		natrium alkalinization risk		magnesium alkalinization risk		chloride salinization risk	
		Calculation	Estimation	Calculation	Estimation	Calculation	Estimation	Calculation	Estimation
Kal (Namangan)	I-XII	2,9	<4	1,4	<3	49,9	<50	6,5	<15
Bekabad	I-VII, IX-XII	2,9	<4	1,4	<3	48,9	<50	8,1	<15
	VIII	2,5	<4	1,3	<3	**50,1**	**>50**	5,3	<15
Nadejda	I-VII, IX-XII	3,0	<4	1,5	<3	49,2	<50	9,2	<15
	VIII	2,6	<4	1,3	<3	**52,1**	**>50**	8,7	<15
Chinaz	I-VII, X-XII	3,3	<4	1,5	<3	47,8	<50	6,8	<15
	VIII	2,7	<4	1,4	<3	**51,0**	**>50**	6,4	<15
	IX	2,8	<4	1,4	<3	**51,4**	**>50**	6,3	<15

Irrigation quality of the Sirdarya River water

2000 year (low water)

Station	Months	Salinization risk		natrium alkalinization risk		magnesium alkalinization risk		chloride salinization risk	
		Calculation	Estimation	Calculation	Estimation	Calculation	Estimation	Calculation	Estimation
Bekabad	I-VII, IX,XIXII	3,3	<4	1,7	<3	49,0	<50	9,0	<15
	VIII	3,0	<4	1,5	<3	50,1	>50	8,2	<15
	X	2,9	<4	1,5	<3	50,5	>50	9,0	<15
Nadejda	I-VI, IX-XII	3,5	<4	1,7	<3	45,4	<50	7,9	<15
	VII	3,1	<4	1,5	<3	51,5	>50	6,8	<15
	VIII	3,0	<4	1,5	<3	52,0	>50	6,3	<15
Chinaz	I-V, VII,XI,XII	3,3	<4	2,4	<3	47,7	<50	9,1	<15
	VI	3,2	<4	1,6	<3	50,8	>50	8,8	<15
	VII	6,54	>6	2,49	<3	51,2	>50	9,1	<15
	IX	3,1	<4	1,6	<3	50,1	>50	8,7	<15
	X	3,0	<4	1,6	<3	58,8	>50	6,8	<15

Irrigation quality of the Sirdarya River water

2002 year (medium water)

Station	Months	Salinization risk		natrium alkalinization risk		magnesium alkalinization risk		chloride salinization risk	
		Calculation	Estimation	Calculation	Estimation	Calculation	Estimation	Calculation	Estimation
Kal (Namangan)	VIII	2,3	<4	1,1	<3	46,6	<50	2,7	<15
	IX	2,9	<4	1,4	<3	**50,0**	**>50**	1,7	<15
Bekabad	I-III, V, VIII, XI, XII	3,5	<4	1,8	<3	49,6	<50	9,9	<15
	IV	2,5	<4	1,3	<3	**50,1**	**>50**	5,2	<15
	VI	2,6	<4	1,3	<3	**50,9**	**>50**	6,8	<15
	VII	2,6	<4	1,3	<3	**52,7**	**>50**	6,2	<15
	IX	2,6	<4	1,3	<3	**53,7**	**>50**	8,5	<15
	X	2,4	<4	1,3	<3	**52,7**	**>50**	7,3	<15
Nadejda	I-V, X-XII	3,4	<4	1,7	<3	48,1	<50	10,4	<15
	VI	3,4	<4	1,7	<3	**52,2**	**>50**	10,4	<15
	VII	3,3	<4	1,8	<3	**54,3**	**>50**	10,2	<15
	VIII	2,4	<4	1,3	<3	**53,4**	**>50**	7,0	<15
	IX	2,6	<4	1,4	<3	**50,8**	**>50**	7,2	<15
Chinaz	I-VII, X-XII	3,7	<4	1,9	<3	47,1	<50	10,2	<15
	VIII	3,0	<4	1,5	<3	**51,0**	**>50**	6,1	<15
	IX	2,8	<4	1,3	<3	**52,4**	**>50**	6,0	<15

Conclusions and recommendations

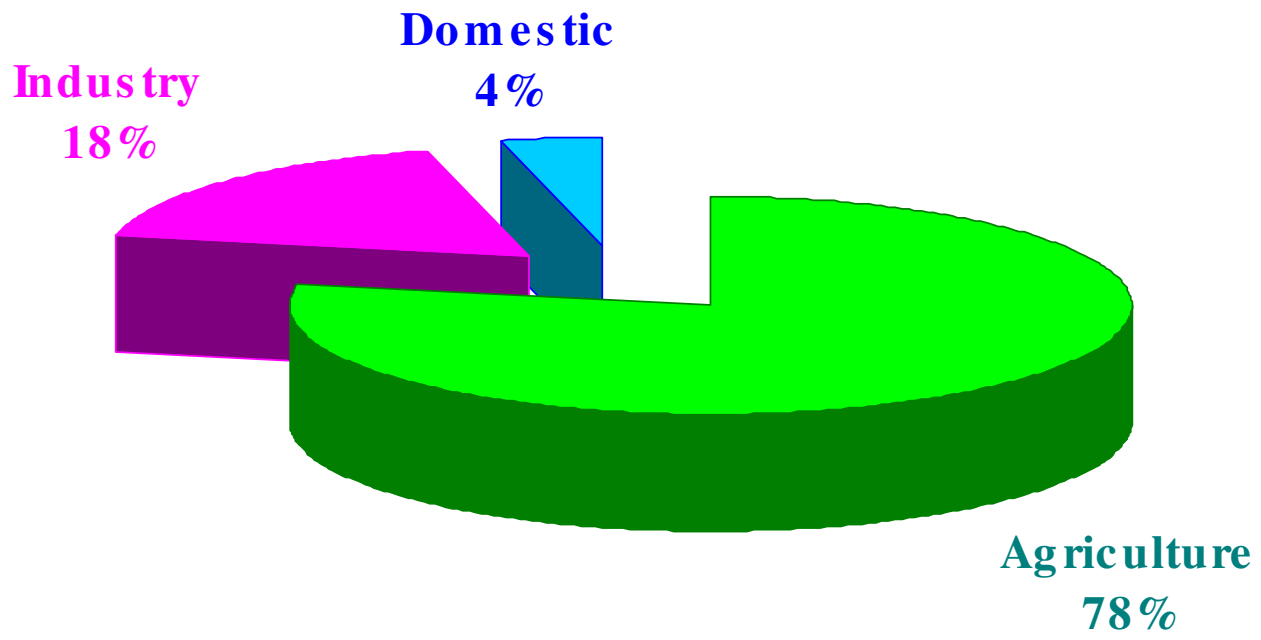
Amudarya River

- At spring periods of the year (the shallow years) necessary to provide the measures on prevention of the accumulation in ground of the toxic salts (particularly magnesium and chlorine).

Sirdarya River

- At the summer (July August - a September) period of year farmers must take measures on prevention of the accumulation in irrigated ground of the toxic salts magnesium

Agriculture is a main source of contamination of water resources



Examples of our work for mitigation of agricultural (drainage water) impact to the environment

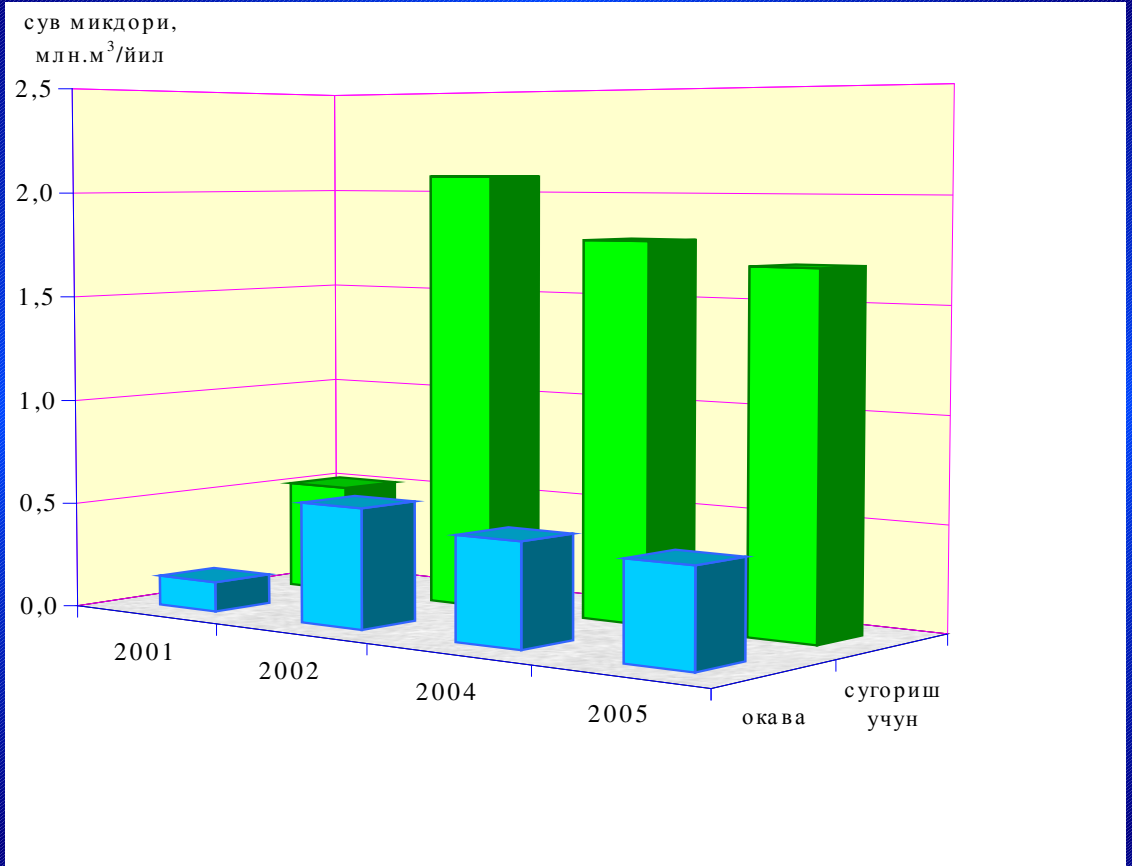
Drainage water use for irrigation at sloppy areas

Installation of building for drain water intake for irrigation

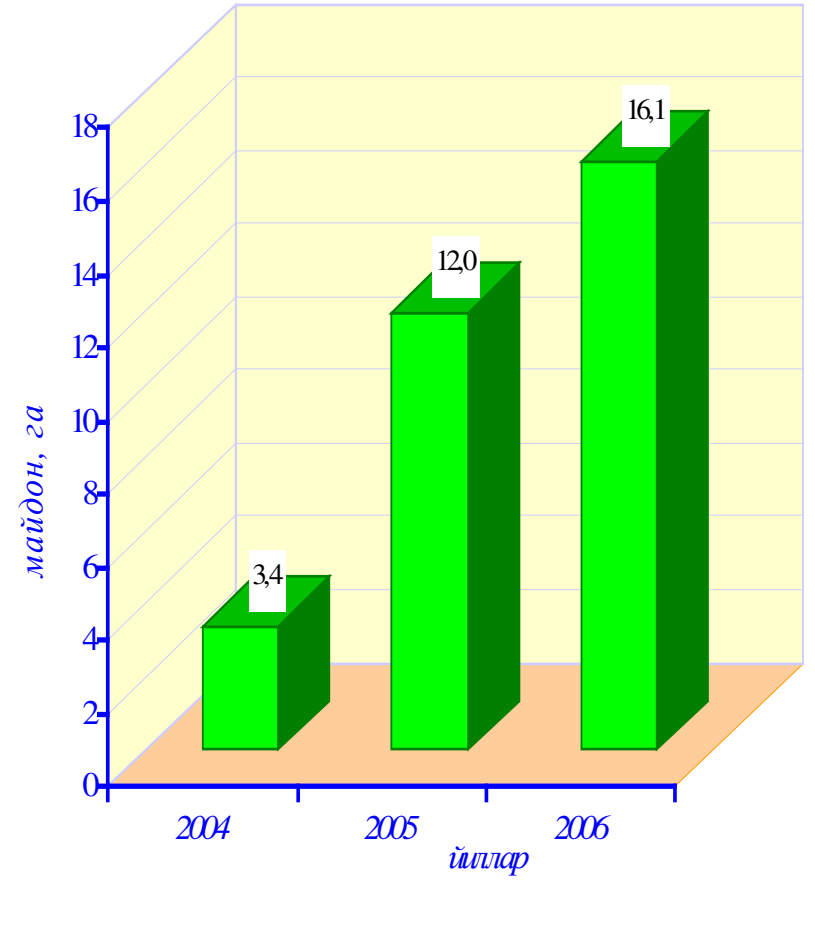
Farmers day

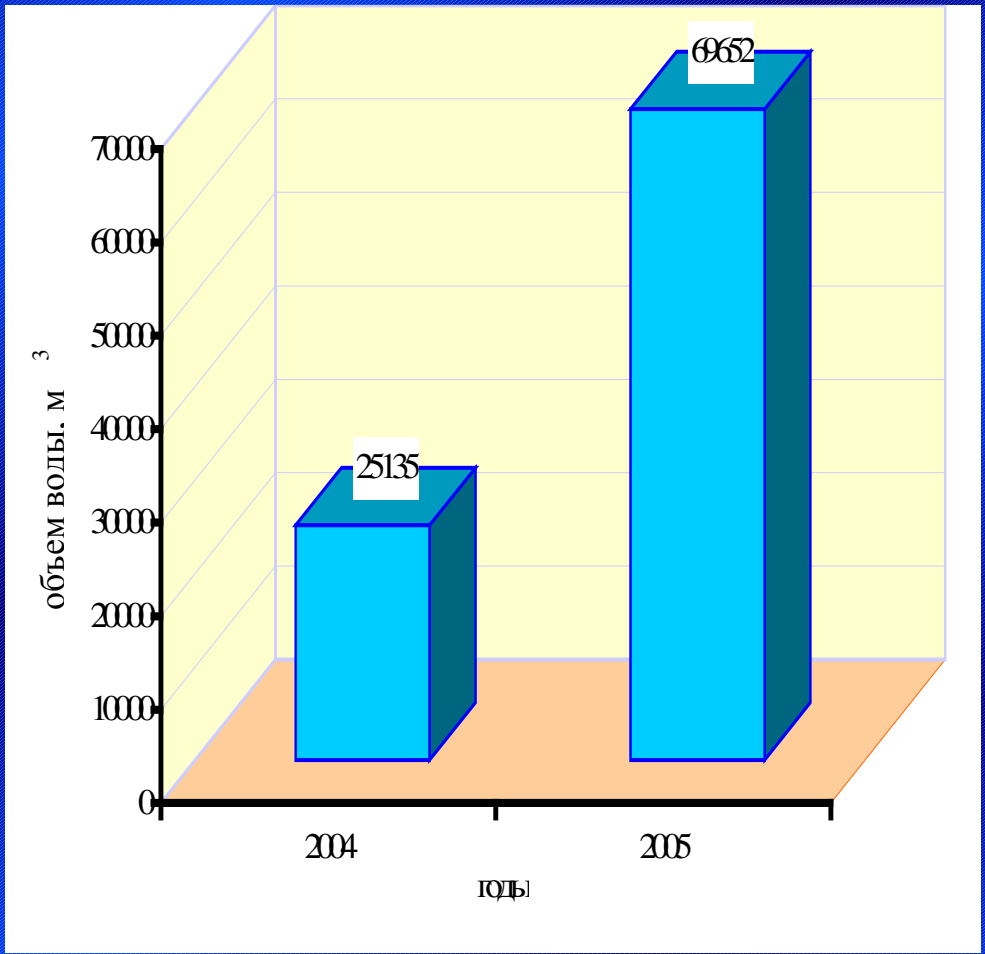
Boykozon farm, Tashkent region

Drainage water use for crop irrigation at sloppy areas (quantity of drainage water)



Drainage water use for crop irrigation at sloppy areas (results)





Drainage water use for crop irrigation at sloppy areas

Drainage water using for irrigation at flat areas

Kushmanata farm, Sirdarya region

Drainage water use for crop irrigation

Crops	Type of water	Number of irrigation	Irrigation rate, m^3/ha	Contribution of drainage water in irrigation water, %
Wheat	river	2-3	2222	0
	blended	2-3	2226	32
	drainage	2-3	2557	68
Sunflower	river	2	1944	0
	blended	2	1978	35
	drainage	2	2016	71
Maize	river	2-4	2856	0
	blended	2-4	3156	39
	drainage	2-4	3243	77

Drainage water use for crop irrigation (crop yields, t/ha)

Crops	Type of water	year		
		2003	2004	2005
Wheat	river	4,05	3,94	4,26
	blended	3,78	3,63	4,13
	drainage	3,48	3,23	3,92
Sunflower	river	-	1,27	1,50
	blended		1,27	1,49
	drainage		1,25	1,47
Maize	river	9,91	16,20	15,37
	blended	9,61	15,85	15,37
	drainage	9,53	15,51	15,56

Drainage water use for crop irrigation

THANK YOU