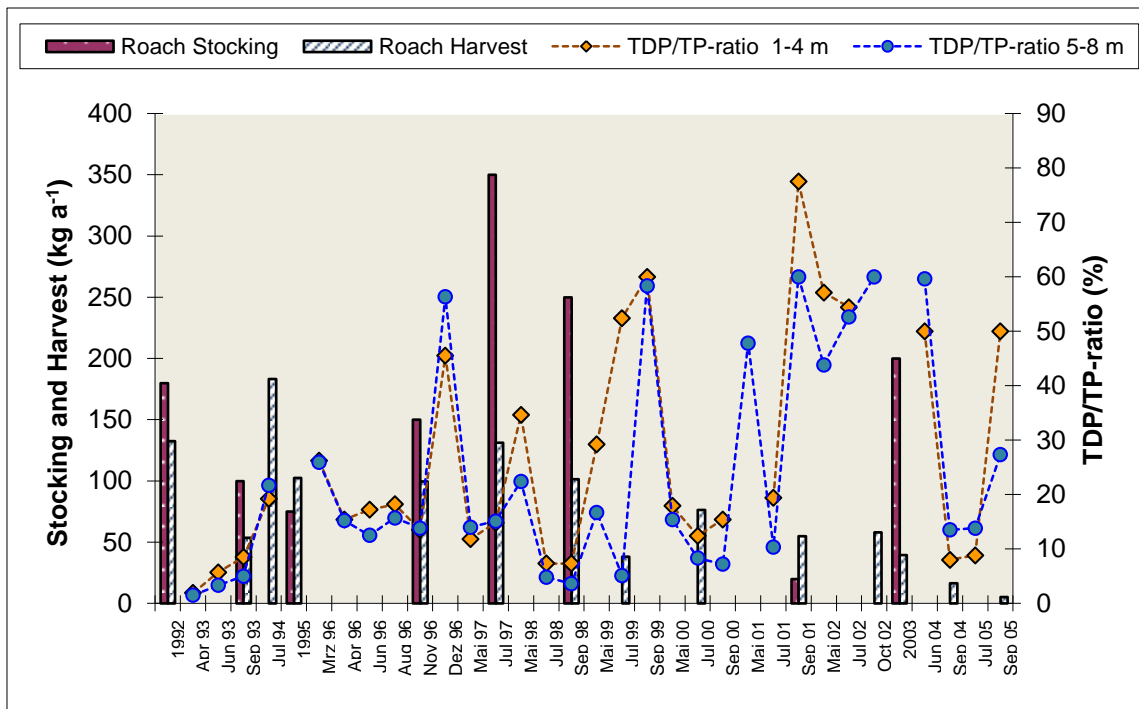


Year	Roach Stocking (kg)	Roach Harvest (kg)
1980	250	159,31
1981	288	331,73
1982	500	192,3
1983	1150	87,1
1984	1060	403,85
1985	345	202,73
1986	156	406,28
1987	300	95,74
1988	250	116,77
1989	200	158,76
1990	100	90,65
1991	250	126,12
1992	180	132,49
1993	100	53,55
1994	0	183,27
1995	75	102,59
1996	150	99,64
1997	350	131,12
1998	250	101,39
1999	0	38,05
2000	0	76,265
2001	20	54,98
2002	0	58,08
2003	200	39,48
2004	0	16,57
2005	0	5,15

In the time series, I present them together with the TDP/TP-ratio.

	Roach Stocking (kg a ⁻¹)	Roach Harvest (kg a ⁻¹)	TDP/TP- ratio 1-4 m (%)	TDP/TP- ratio 5-8 m (%)
1992	180			
Apr 93			1,9	1,5
Jun 93			5,7	3,3

Sep 93	100	53,55	8,5	5
Jul 94		183,27	20	21,7
1995	75	102,59	-	-
Mrz 96			26,2	25,9
Apr 96			15,4	15,2
Jun 96			17,2	12,5
Aug 96			18,2	15,7
Nov 96	150	99,64	13,5	13,8
Dez 96			45,5	56,25
Mai 97			11,8	14
Jul 97	350	131,12	14,8	15,1
Mai 98			34,6	18,3
Jul 98			7,3	4,8
Sep 98	250	101,39	7,3	3,6
Mai 99			29,2	16,7
Jul 99			52,4	5,1
Sep 99		38,05	60	58,3
Mai 00			17,9	15,4
Jul 00			12,4	8,25
Sep 00		76,265	15,4	7,2
Mai 01			0	47,8
Jul 01			19,35	10,3
Sep 01	20	54,98	77,5	60
Mai 02			57,1	56,25
Jul 02			54,4	52,6
Oct 02		58,08	0	60
2003	200	39,48	-	-
Jun 04			50	59,6
Sep 04		16,57		13,5
Jul 05			8,8	13,8
Sep 05		5,15	50	27,3



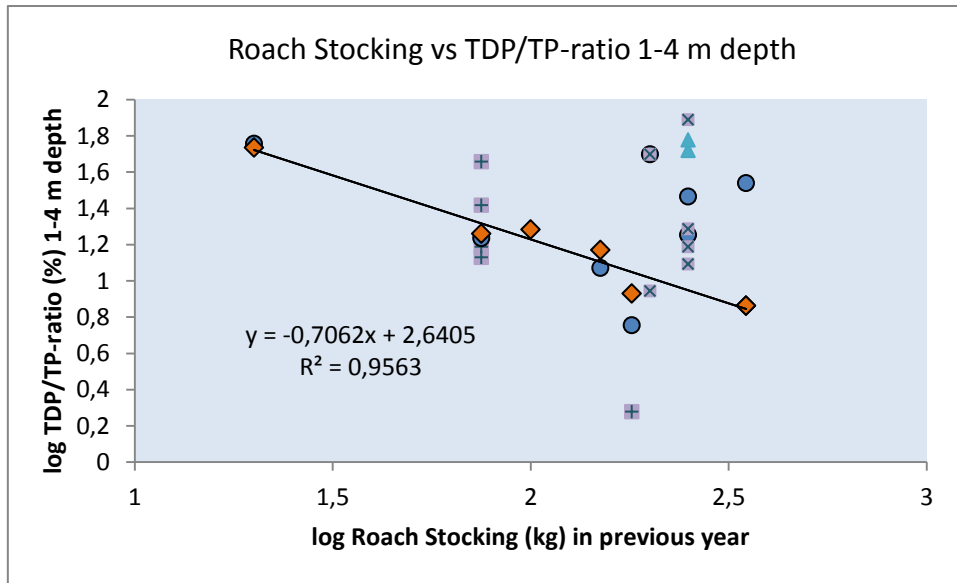
For convenience, fish stocking is made in the autumn when temperature is low and the stocked fish can accustom to the lake during winter time before a new growing season will start next spring. I assume that during winter feeding activities are low because of the temperature.

For computation, I had to compare the stocking numbers with the nutrient data from the growing season after the stocking event and so I displaced the stocking figures one year forward as below.

Year	Roach
After	Stocking
Stocking	(kg)
1993	180
1994	100
1995	0
1996	75
1997	150
1998	350
1999	250
2000	0
2001	0
2002	20
2003	0
2004	200
2005	0

The principal question is linking the planktivore stocking with the TDP/TP-ratio as outlined above. For an exhausting analysis, I had to use all the available ratios and classed them with the stocking numbers.

Month and year of water sampling	Roach Stocking in previous year (kg)	TDP/TP- ratio 1-4 m (%)	log roach stocking (kg)	log TDP/TP- ratio 1-4 m (%)	period	Symbol in the Diagram
Apr 93	180	1,9	2,25527251	0,2787536	Nov_ April	+
Mrz 96	75	26,2	1,87506126	1,41830129	Nov_ April	+
Apr 96	75	15,4	1,87506126	1,18752072	Nov_ April	+
Nov 96	75	13,5	1,87506126	1,13033377	Nov_ April	+
Dez 96	75	45,5	1,87506126	1,6580114	Nov_ April	+
Jun 93	180	5,7	2,25527251	0,75587486	May + June	o
Jun 96	75	17,2	1,87506126	1,23552845	May + June	o
Mai 97	150	11,8	2,17609126	1,07188201	May + June	o
Mai 98	350	34,6	2,54406804	1,5390761	May + June	o
Mai 99	250	29,2	2,39794001	1,46538285	May + June	o
Mai 00	250	17,9	2,39794001	1,25285303	May + June	o
Mai 02	20	57,1	1,30103	1,75663611	May + June	o
Jun 04	200	50	2,30103	1,69897	May + June	o
Sep 93	180	8,5	2,25527251	0,92941893	July - Oct	◇
July 94	100	19,2	2	1,28330123	July - Oct	◇
Aug 96	75	18,2	1,87506126	1,26007139	July - Oct	◇
Jul 97	150	14,8	2,17609126	1,17026172	July - Oct	◇
Jul 98	350	7,3	2,54406804	0,86332286	July - Oct	◇
Sep 98	350	7,3	2,54406804	0,86332286	July - Oct	◇
Jul 02	20	54,4	1,30103	1,7355989	July - Oct	◇
Jul 00	250	12,4	2,39794001	1,09342169	2 yrs after	x
Sep 00	250	15,4	2,39794001	1,18752072	2 yrs after	x
Jul 01	250	19,4	2,39794001	1,28780173	3 yrs after	x
Sep 01	250	77,5	2,39794001	1,8893017	3 yrs after	x
Jul 05	200	8,8	2,30103	0,94448267	2 yrs after	x
Sep 05	200	50	2,30103	1,69897	2 yrs after	x
Jul 99	250	52,4	2,39794001	1,71933129	1999	Δ
Sep 99	250	60	2,39794001	1,77815125	1999	Δ



Explanations:

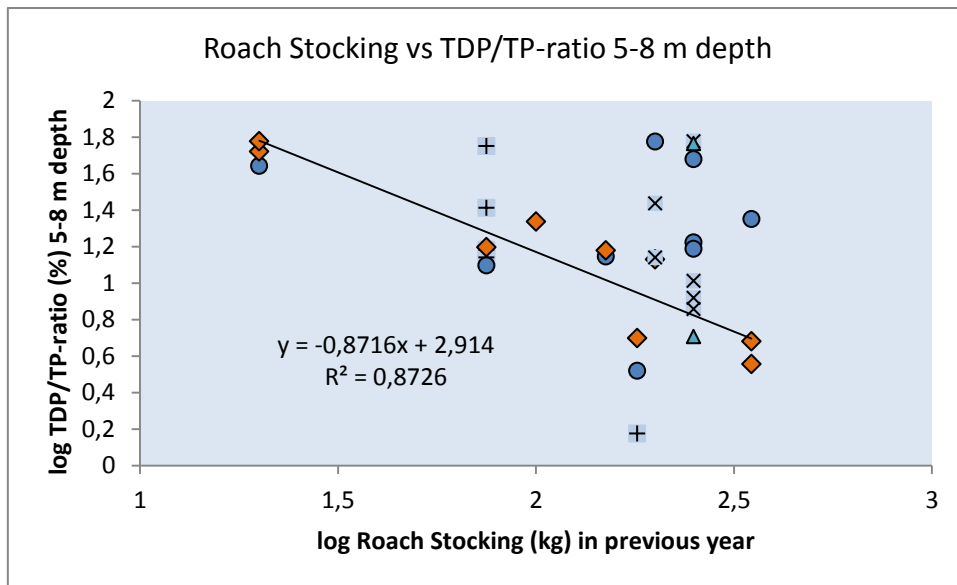
November to April is the cold season and roach shows a reduced activity including feeding.

May and June concerns the spring bloom.

Periods with two or three years after the stocking event show a retarded return to an earlier state and the year 1999 is the first year of cormorant invasion which occurred for Lake Buchtzig.

I do not use this regression, because for the year 1998 two data points are used.

Month and year of water sampling	Roach in previous year (kg)	TDP/TP-ratio (5-8 m) (%)	log roach stocking (kg)	log TDP/TP-ratio (5-8 m) (%)	Period	Symbol in the Diagram
Apr 93	180	1,5	2,25527251	0,17609126	Nov - April	+
Mrz 96	75	25,9	1,87506126	1,41329976	Nov - April	+
Apr 96	75	15,2	1,87506126	1,18184359	Nov - April	+
Nov 96	75	13,8	1,87506126	1,13987909	Nov - April	+
Dez 96	75	56,3	1,87506126	1,75050839	Nov - April	+
Jun 93	180	3,3	2,25527251	0,51851394	May + June	o
Jun 96	75	12,5	1,87506126	1,09691001	May + June	o
Mai 97	150	14	2,17609126	1,14612804	May + June	o
Mai 98	350	22,4	2,54406804	1,35024802	May + June	o
Mai 99	250	16,7	2,39794001	1,22271647	May + June	o
Mai 00	250	15,4	2,39794001	1,18752072	May + June	o
Mai 01	250	47,8	2,39794001	1,6794279	May + June	o
Mai 02	20	43,8	1,30103	1,64147411	May + June	o
Jun 04	200	59,6	2,30103	1,77524626	May + June	o
Sep 93	180	5	2,25527251	0,69897	July - Oct	◇
July 94	100	21,7	2	1,33645973	July - Oct	◇
Aug 96	75	15,7	1,87506126	1,19589965	July - Oct	◇
Jul 97	150	15,1	2,17609126	1,17897695	July - Oct	◇
Jul 98	350	4,8	2,54406804	0,68124124	July - Oct	◇
Sep 98	350	3,6	2,54406804	0,5563025	July - Oct	◇
Jul 02	20	52,6	1,30103	1,72098574	July - Oct	◇
Oct 02	20	60	1,30103	1,77815125	July - Oct	◇
Sep 04	200	13,5	2,30103	1,13033377	July - Oct	◇
Jul 00	250	8,3	2,39794001	0,91907809	2 yrs after	x
Sep 00	250	7,2	2,39794001	0,8573325	2 yrs after	x
Jul 01	250	10,3	2,39794001	1,01283722	3 yrs after	x
Sep 01	250	60	2,39794001	1,77815125	3 yrs after	x
Jul 05	200	13,8	2,30103	1,13987909	2 yrs after	x
Sep 05	200	27,3	2,30103	1,43616265	2 yrs after	x
Jul 99	250	5,1	2,39794001	0,70757018	1999	Δ
Sep 99	250	58,3	2,39794001	1,76566855	1999	Δ



This is just to imagine the available data for 5-8 m depth range. Of course, an objection will be that for each stocking event only one data point can be used.

For the year 1999, it should be noticed that the TDP/TP-ratios show a remarkable difference in July. I attribute this difference to the first invasion of cormorants in Lake Buchzig. Observations by Weick (pers. Communication) and by myself during echosounding showed that fish displaced into the layer below the thermocline in the first year of cormorant invasion. Such observations in context with cormorant invasions were made also at lakes near to Cologne as Rutschke (1998) cited a personal communication by Neumann on page 76, "Verhalten der Fische bei starker Nachstellung durch Kormorane".

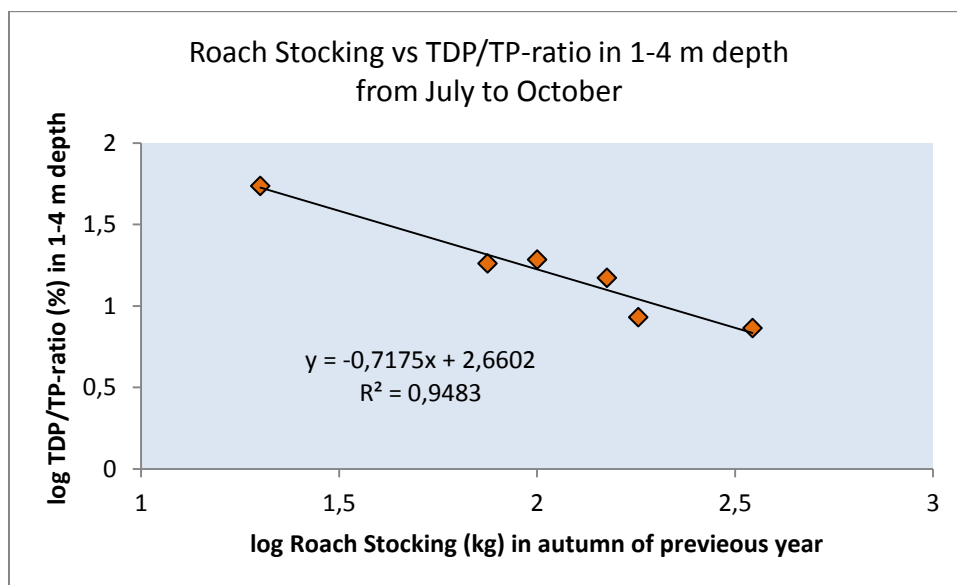
The very low TDP/TP-ratio of 5.1 % at July 1999 in 5-8 m depth may be due to the presence of planktivorous fish on contrary to the TDP/TP-ratio of 58.3 % in 1-4 m depth. The measurements in September were at 60 resp. 58.3 % meaning that the planktivores were not existing more, probably eaten up by the cormorants. This just for hypothesis.

Erich Rutschke. 1998. Der Kormoran. Biologie, Ökologie, Schadabwehr. Parey Buchverlag Berlin.

Year of Roach Stocking	Roach Stocking in previous Year	TDP/TP- ratio 1-4 m	log Roach Stocking	log TDP/TP- ratio 1-4 m	Month and Year of Zooplankton Sample
	(kg)	(%)	(kg)	(%)	
1992	180	8,5	2,25527251	0,92941893	Sep 93
1993	100	19,2	2	1,28330123	Jul 94
1995	75	18,2	1,87506126	1,26007139	Aug 96
1996	150	14,8	2,17609126	1,17026172	Jul 97
1997	350	7,3	2,54406804	0,86332286	Sep 98
2001	20	54,4	1,30103	1,7355989	Jul 02

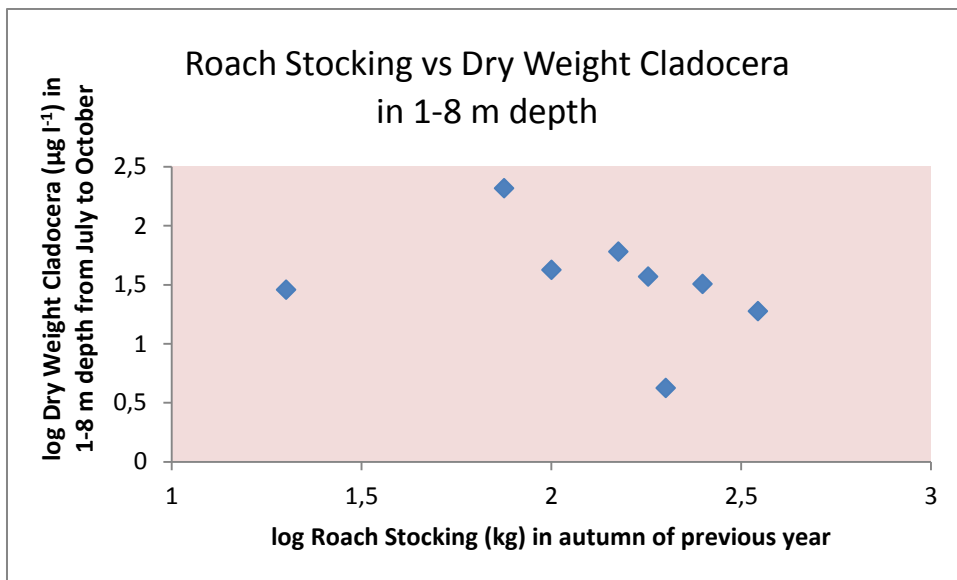
For each stocking event, only one data point is used, preferably from September, if available.

The regression is significant at the 0.1 % level.



It may be interesting to compare the correlation Roach stocking to TDP/TP-ratio with the relationship Roach stocking to Cladocera biomass.

Year of	Roach	Dry Weight	log	log	Month and
Roach	Stocking	Cladocera	Roach	Dry Weight	Year of
Stocking	in Previous	1-8 m depth	Stocking	Cladocera	Zooplankton
				1-8 m depth	Samples
	(kg)	($\mu\text{g l}^{-1}$)	(kg)	($\mu\text{g l}^{-1}$)	
1992	180	36,9	2,25527251	1,56702637	Sep 93
1993	100	42,1	2	1,6242821	Jul 94
1995	75	207	1,87506126	2,31597035	Aug 96
1996	150	60,1	2,17609126	1,77887447	Jul 97
1997	350	18,9	2,54406804	1,2764618	Sep 98
1998	250	32	2,39794001	1,50514998	Sep 99
2001	20	28,6	1,30103	1,45636603	Jul 02
2003	200	4,2	2,30103	0,62324929	Sep 04



One outlier for ten data sets may be allowed - I could read in a textbook for statistics. Therefore, I consider the dispersion and do not calculate a regression.