SUPPLEMENTARY MATERIAL

Estimation of eutrophication in Paldang Reservoir using trophic state index deviation

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Table S1. Locations and information about the five study sites (P1–P5)

Name	Abbreviation	Site code	Latitude	Longitude
Paldang Dam 1	P1	1007B10	37.507700	127.429617
Paldang Dam 2	P2	1017B10	37.521394	127.283339
Paldang Dam 3	P3	1007B20	37.526428	127.367633
Paldang Dam 4	P4	1015B40	37.541233	127.310808
Paldang Dam 5	P5	1016B10	37.490589	127.296550

Source: own elaboration.

Table S2. Carlson's trophic state index (*TSI*) values and nitrogen to phosphorus ratio (N:P) of the five study sites (P1–P5) in the Paldang Reservoir (the monthly average of five years, 2018–2022)

Site	Month	*TSI*(*SD*)	*TSI*(TP)	*TSI*(Chl)	TN:TP	Equivalent
P1	Jan	52	43	48	114	*SD* > Chl > TP
	Feb	56	44	58	105	Chl = *SD* > TP
	Mar	57	45	62	77	Chl = *SD* > TP
	Apr	54	44	59	84	Chl = *SD* > TP
	May	54	45	59	59	Chl = *SD* > TP
	Jun	54	45	60	54	Chl = *SD* > TP
	Jul	53	47	55	31	*SD* > Chl > TP
	Aug	60	47	57	35	*SD* > Chl > TP
	Sep	53	47	51	42	*SD* > Chl > TP
	Oct	53	45	49	63	*SD* > Chl > TP
	Nov	46	44	41	95	*SD* > TP > Chl
	Dec	43	41	39	157	*SD* > TP > Chl

continue Tab. S2

Site	Month	*TSI*(*SD*)	*TSI*(TP)	*TSI*(Chl)	TN:TP	Equivalent
P2	Jan	52	40	51	130	*SD*> Chl >TP
	Feb	54	40	55	132	Chl = *SD* > TP
	Mar	54	43	59	90	Chl = *SD* > TP
	Apr	55	43	60	90	Chl = *SD* > TP
	May	49	43	54	75	Chl = *SD* > TP
	Jun	48	42	57	74	Chl = *SD* > TP
	Jul	46	46	57	39	Chl = *SD* > TP
	Aug	58	46	58	37	*SD* = Chl > TP
	Sep	57	46	57	40	*SD* = CHL > TP
	Oct	56	45	57	52	Chl > *SD* > TP
	Nov	52	43	51	90	*SD* > Chl > TP
	Dec	47	41	51	136	Chl > *SD* > TP
P3	Jan	52	45	50	87	*SD* > Chl > TP
	Feb	57	44	64	87	Chl > *SD* > TP
	Mar	59	45	62	77	Chl > *SD* > TP
	Apr	56	44	62	84	Chl > SD > TP
	May	52	45	58	65	Chl > *SD* > TP
	Jun	53	44	61	59	Chl > *SD* > TP
	Jul	54	47	59	32	Chl > *SD* > TP
	Aug	59	47	61	34	Chl > *SD* > TP
	Sep	55	47	56	38	Chl > *SD* > TP
	Oct	56	46	55	53	*SD* > Chl >TP
	Nov	50	44	47	83	*SD* > Chl >TP
	Dec	45	42	46	143	Chl > SD > TP
P4	Jan	50	41	55	130	Chl > *SD* > TP
	Feb	45	36	51	182	Chl > *SD* > TP
	Mar	47	38	52	147	Chl > *SD* > TP
	Apr	51	39	54	136	Chl > *SD* > TP
	May	48	41	53	92	Chl > *SD* > TP
	Jun	48	42	57	82	Chl > *SD* > TP
	Jul	47	43	57	64	Chl > *SD* > TP
	Aug	55	44	59	53	Chl > *SD* > TP
	Sep	54	44	57	56	Chl > *SD* > TP
	Oct	52	42	57	80	Chl > *SD* > TP
	Nov	48	40	50	111	Chl > *SD* > TP
	Dec	43	38	48	158	Chl > *SD* > TP

continue Tab. S2

Site	Month	*TSI*(*SD*)	*TSI*(TP)	*TSI*(Chl)	TN:TP	Equivalent
P5	Jan	54	45	55	108	Chl > *SD* > TP
	Feb	60	44	61	106	Chl > *SD* > TP
	Mar	67	47	64	54	*SD* > Chl > TP
	Apr	61	46	66	60	Chl > SD > TP
	May	55	46	61	52	Chl > *SD* > TP
	Jun	54	44	62	52	Chl > *SD* > TP
	Jul	55	45	63	51	Chl > *SD* > TP
	Aug	61	46	66	37	Chl > *SD* > TP
	Sep	60	46	68	48	Chl > *SD* > TP
	Oct	64	46	66	42	Chl > *SD* > TP
	Nov	58	45	62	61	Chl >*SD* > TP
	Dec	55	43	55	115	Chl = *SD* > TP

Explanations: P1–P5 = as in Tab. S1, *SD* – Secchi depth (m), Chl = concentrations of chlorophyll *a* (mg·m^{-3}), TP = total phosphorus.

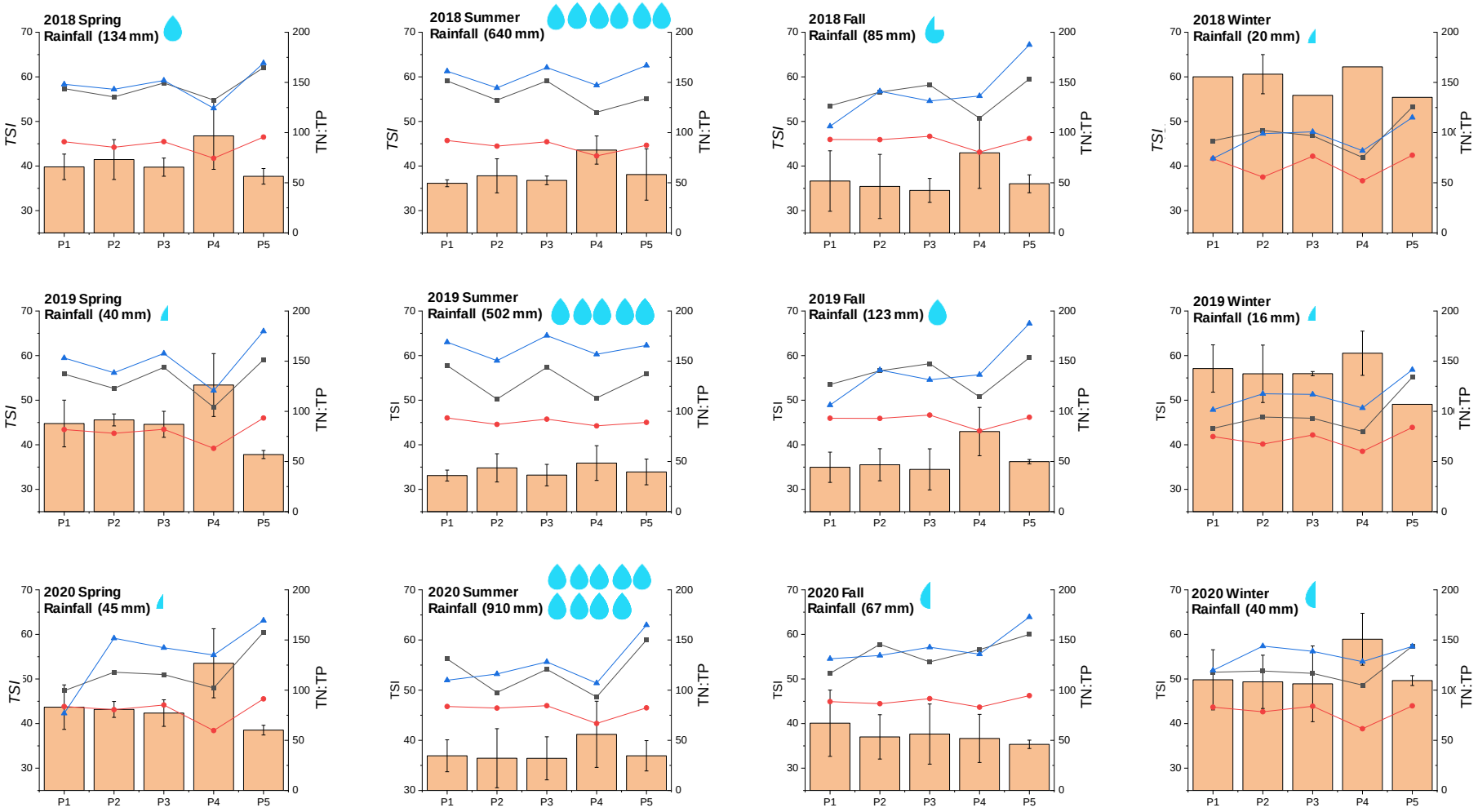
Source: own elaboration.

Table S3. Relationships between trophic state indices (*TSI*s) and the corresponding condition of the water system acc. to Carlson and Havens (2005)

***TSI*s chain**	**Condition**
***TSI*(Chl) = *TSI*(*SD*) – algae dominate light attenuation**	
TSI(*SD*) = *TSI*(Chl) ≥ *TSI*(TP)	dominance of algae attenuates light penetration, while algal biomass is limited by P
TSI(TP) > *TSI*(Chl) = *TSI*(*SD*)	algal growth is limited by factors (zooplankton grazing, N, etc.) other than P limits
***TSI*(Chl) < *TSI*(*SD*) – small particles, not necessarily related to algae, dominate light attenuation**	
TSI(TP) = *TSI*(*SD*) > *TSI*(Chl)	non-algal particles that containing P, dominate attenuate light penetration, hence, P and transparency correlate, but not with chlorophyll
TSI(SD) > *TSI*(Chl) = *TSI*(TP)	dissolved colour affect transparency, but not chlorophyll or P
TSI(TP) > *TSI*(*SD*) > *TSI*(Chl)	grazing by zooplankton reduces number of smaller particles, leaves larger ones, therefore, biomass reduces below level predicted from P level
***TSI*(Chl) > *TSI*(*SD*) – large phosphorus-containing particulates dominate**	
TSI(Chl) = *TSI*(TP) >> *TSI*(*SD*)	large chlorophyll-containing particulates dominate

Explanations: Chl, *SD* and TP as in Tab. S1.

Source: own study.


2018 Spring
Rainfall (134 mm)
2018 Summer
Rainfall (640 mm)
2018 Fall
Rainfall (85 mm)
2018 Winter
Rainfall (20 mm)
2019 Spring
Rainfall (40 mm)
2019 Summer
Rainfall (502 mm)
2019 Fall
Rainfall (123 mm)
2019 Winter
Rainfall (16 mm)
2020 Spring
Rainfall (45 mm)
2020 Summer
Rainfall (910 mm)
2020 Fall
Rainfall (67 mm)
2020 Winter
Rainfall (40 mm)
TSI
TN:TP
P1
P2
P3
P4
P5

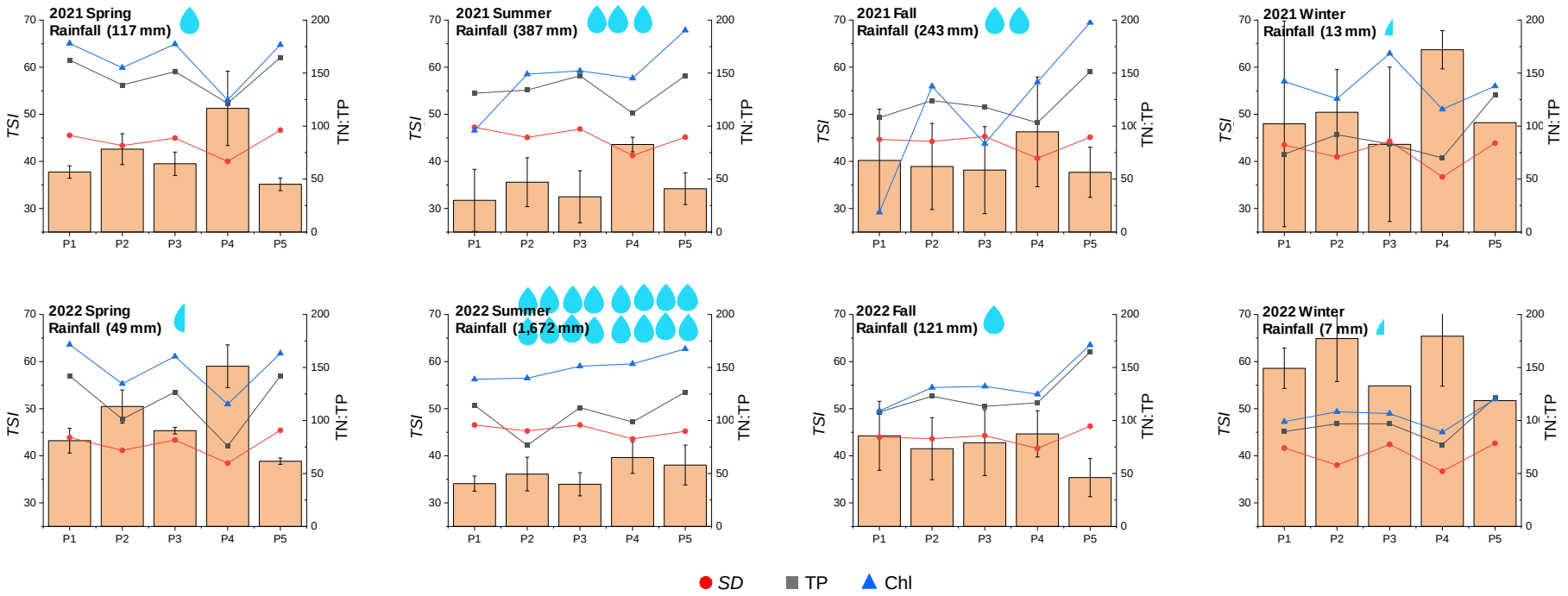
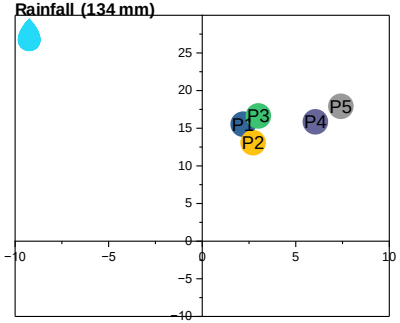
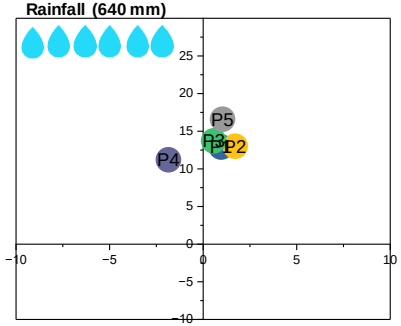


Fig. S1. Seasonal trophic state index (*TSI*) values for Secchi depth, total phosphorus, chlorophyll pigments, and N:P ratio (2018–2022, the five research sites); source: own study

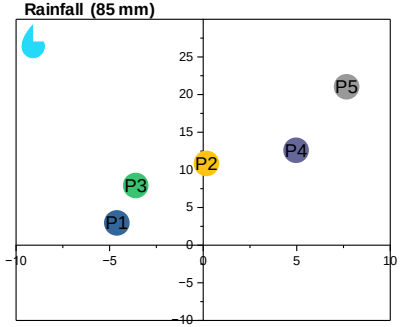
2018 Spring
Rainfall (134 mm)



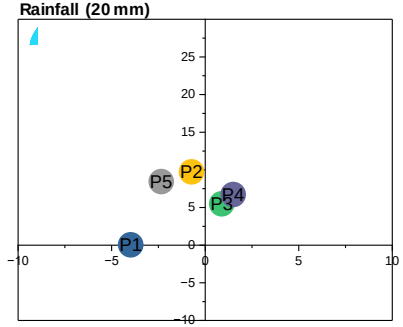
2018 Summer
Rainfall (640 mm)



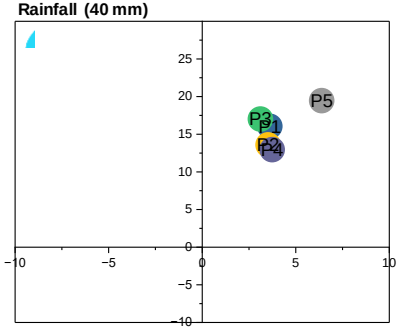
2018 Fall
Rainfall (85 mm)



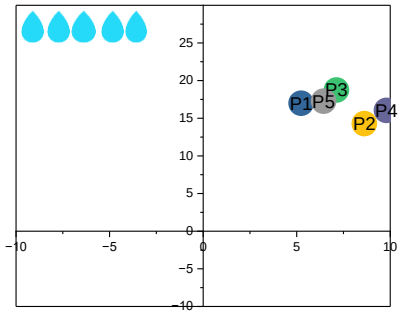
2018 Winter
Rainfall (20 mm)



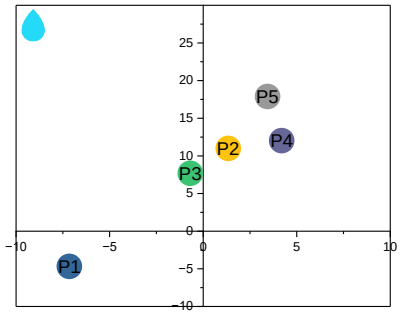
2019 Spring
Rainfall (40 mm)



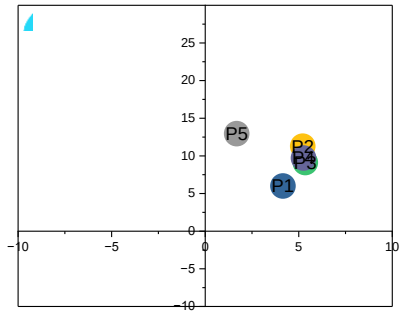
2019 Summer
Rainfall (502 mm)



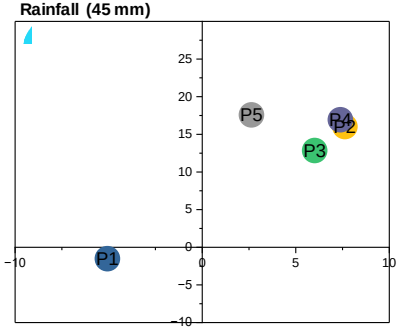
2019 Fall
Rainfall (123 mm)



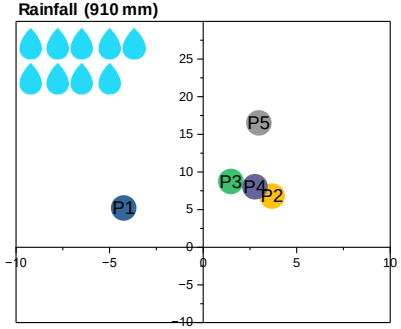
2019 Winter
Rainfall (16 mm)



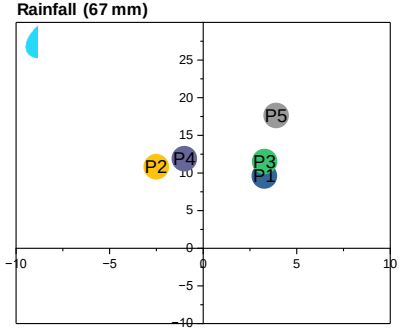
2020 Spring
Rainfall (45 mm)



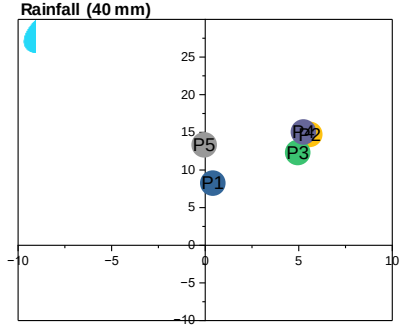
2020 Summer
Rainfall (910 mm)



2020 Fall
Rainfall (67 mm)



2020 Winter
Rainfall (40 mm)



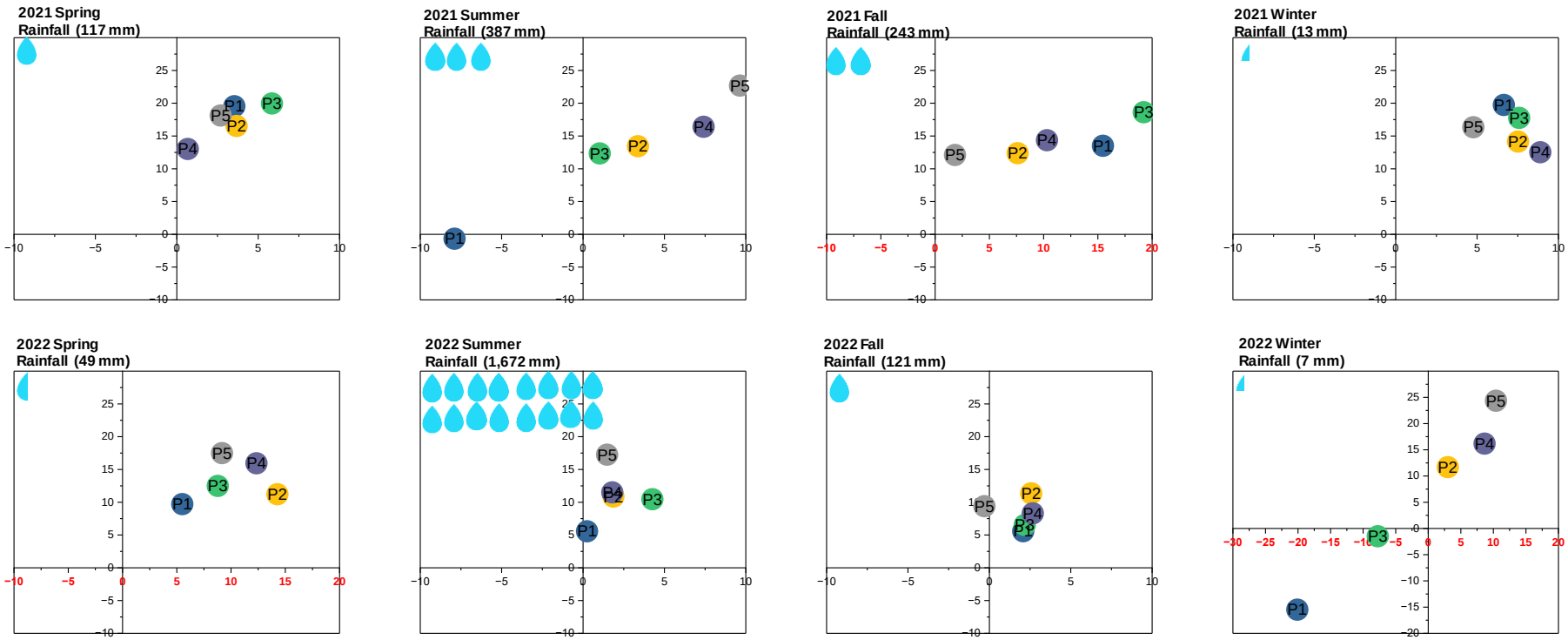


Fig. S2. Trophic state index deviations (*TSID*) following seasonal changes and rainfall from 2018 to 2022 of the five research sites (P1–P5); source: own study