DATA QUALITY AND SUMMARY STATISTICS

FLUME DATA

Annual Report 2018

This report complements the data available on the data portal and is designed to help users by giving an overview of the quality and key statistics of the flume data.

Data Version: 3

Release date: 14 November 2018

Report produced on: 13 October 2020

Compiled by: Jane Hawkins using R version 3.6.1 (2019-07-05)

BBSRC bioscience for the future

ROTHAMSTED RESEARCH

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1 15 MINUTE DATA

- Catchments arranged from largest to smallest across tables (left to right) for each farmlet.
- Where PLC switch = 0, this refers to timesteps when flume flow was <0.2 l/s (flow conditions not met) and so the pump is not activated to fill the by-pass flow cell. Therefore, flume data are considered invalid and are classified as missing values ('NA') in the quality control process.
- Where PLC switch = 1, flume flow is >0.2 l/s (flow conditions met) and so the pump is activated to fill the by-pass flow cell.
- For further explanation, refer to Sections 3.3 & 7.1.2 in the 'User Guide to 15 Minute Data' (FP_UG.Doc.002_15MinData) available on the Farm Platform website: http://resources.rothamsted.ac.uk/farm-platform-national-capability/data-portal-guides-and-information

1.1 Counts of PLC switch settings

	Catchment Number														
Variable	**Green**					**Blue**					**Red**				
	4	**5**	**6**	**12**	**13**	**9**	**8**	**7**	**11**	**14**	**2**	**3**	**1**	**10**	**15**
PLC Switch = NA (missing)	2563	58	1419	2029	2962	2024	1138	1151	1184	642	938	1140	2335	1385	600
PLC Switch = 0 (no flow)	15334	18583	20515	29000	26298	18292	18752	22251	25868	26878	18290	17470	15137	25046	23163
PLC Switch = 1 (flow)	17142	16398	13105	4010	5779	14723	15149	11637	7987	7519	15811	16429	17567	8608	11276

Table 1: Counts of PLC switch settings - missing data, no flow, flow

1.2 Zero values

		Catchment Number														
Variable		**Green**					**Blue**					**Red**				
	units	**4**	**5**	**6**	**12**	**13**	**9**	**8**	**7**	**11**	**14**	**2**	**3**	**1**	**10**	**15**
Flow	l/s	24582	28344	30527	32042	30863	27754	29301	31154	31973	32463	28509	28122	26403	32435	31656
Nitrate+nitrite	mg/l	3529	796	1717	1042	2418	1411	6140	1823	870	3232	2786	3278	1229	166	669
Ammonia	mg/l	17137	16398	13095	4008	5774	14715	15146	11634	7987	7518	15784	16419	17559	8606	11271
Ammonium	mg/l	17061	16373	13080	3768	5756	14525	14843	11613	7946	7498	14568	16057	17463	8578	11151
Conductivity	uS/cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dissolved oxygen	%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
pH	unitless	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Flow cell water temperature	°C	4	28	19	14	0	23	24	18	51	68	61	33	20	0	20
Turbidity	FNU	483	2	1	0	3	23	315	0	750	1	227	1	0	114	733
Total phosphorus	mg/l	NA	13088	NA	NA	NA	NA	10404	NA	NA	NA	10188	12922	NA	NA	NA
Dissolved organic matter	ug/l QSU	1	1	0	1	0	95	13	0	51	8	0	0	2	0	36
Ortho-phosphorus	mg/l	NA	13090	NA	NA	NA	NA	10404	NA	NA	NA	10195	12925	NA	NA	NA

Table 2: Number of zero values (out of 35039)

1.3 Missing values

1.3.1 Total number of missing values

Variable	Catchment Number														
	Green					Blue					Red				
	4	5	6	12	13	9	8	7	11	14	2	3	1	10	15
Flow	1442	1072	1038	2225	2886	2023	1137	1098	1673	575	1068	1140	2382	1394	600
Nitrate+nitrite	19100	18840	22593	31166	31602	20864	21532	24183	27482	28518	19469	19379	20788	26518	24272
Ammonia	17902	18641	21944	31031	29265	20324	19893	23405	27052	27521	19255	18620	17480	26433	23768
Ammonium	17903	18641	21944	31031	29265	20325	19895	23405	27052	27521	19255	18620	17480	26433	23771
Conductivity	17906	18641	22009	31087	29265	20326	20061	23405	27103	27521	19255	18620	17480	26433	23768
Dissolved oxygen	17902	18641	21944	31030	29265	20324	19893	23405	27103	27521	19255	18620	17480	26433	23771
pH	17903	18641	21945	31029	29265	20325	19894	23405	27103	27521	19255	18620	17480	26433	23771
Flow cell water temperature	17902	18641	21944	31086	29265	20324	19893	23405	27052	27521	19255	18620	17480	26433	23771
Turbidity	17903	18641	21944	31029	29266	20324	19893	23405	27052	27521	19255	18620	17482	26433	23768
Total phosphorus	35039	21949	35039	35039	35039	35039	24635	35039	35039	35039	24844	22114	35039	35039	35039
Dissolved organic matter	17902	18641	21944	31029	29265	20692	19945	23405	27052	27539	19255	18621	17483	26433	23792
Ortho-phosphorus	35039	21949	35039	35039	35039	35039	24635	35039	35039	35039	24844	22114	35039	35039	35039

Table 3: Total number of missing values (out of 35039)

1.3.2 Total number of missing values as a percentage

Variable	Catchment Number														
	Green					Blue					Red				
	4	5	6	12	13	9	8	7	11	14	2	3	1	10	15
Flow	4	3	3	6	8	6	3	3	5	2	3	3	7	4	2
PLC Switch	7	0	4	6	8	6	3	3	3	2	3	3	7	4	2
Nitrate+nitrite	55	54	64	89	90	60	61	69	78	81	56	55	59	76	69
Ammonia	51	53	63	89	84	58	57	67	77	79	55	53	50	75	68
Ammonium	51	53	63	89	84	58	57	67	77	79	55	53	50	75	68
Conductivity	51	53	63	89	84	58	57	67	77	79	55	53	50	75	68
Dissolved oxygen	51	53	63	89	84	58	57	67	77	79	55	53	50	75	68
pH	51	53	63	89	84	58	57	67	77	79	55	53	50	75	68
Flow cell water temperature	51	53	63	89	84	58	57	67	77	79	55	53	50	75	68
Turbidity	51	53	63	89	84	58	57	67	77	79	55	53	50	75	68
Total phosphorus	100	63	100	100	100	100	70	100	100	100	71	63	100	100	100
Dissolved organic matter	51	53	63	89	84	59	57	67	77	79	55	53	50	75	68
Ortho-phosphorus	100	63	100	100	100	100	70	100	100	100	71	63	100	100	100

Table 4: Total number of missing values as a percentage

1.3.3 Total number of missing values when PLC switch = 1

Variable	Catchment Number														
	Green					Blue					Red				
	4	5	6	12	13	9	8	7	11	14	2	3	1	10	15
Flow	0	0	0	0	0	0	0	0	0	0	19	0	0	7	0
Nitrate+nitrite	1203	199	659	137	2342	548	1642	781	430	998	241	769	3316	87	509
Ammonia	5	0	10	2	5	8	3	3	0	1	27	10	8	2	5
Ammonium	6	0	10	2	5	9	5	3	0	1	27	10	8	2	8
Conductivity	9	0	75	58	5	10	171	3	51	1	27	10	8	2	5
Dissolved oxygen	5	0	10	1	5	8	3	3	51	1	27	10	8	2	8
pH	6	0	11	0	5	9	4	3	51	1	27	10	8	2	8
Flow cell water temperature	5	0	10	57	5	8	3	3	0	1	27	10	8	2	8
Turbidity	6	0	10	0	6	8	3	3	0	1	27	10	10	2	5
Dissolved organic matter	5	0	10	0	5	376	55	3	0	19	27	11	11	2	29
Ortho-phosphorus	17142	3703	13105	4010	5779	14723	6225	11637	7987	7519	6432	3679	17567	8608	11276

Table 5: Total number of missing values when PLC switch = 1 (flow >0.2 l/s)

1.3.4 Total number of measured values in flume data as a percentage of possible values when PLC switch = 1

Variable	Catchment Number														
	Green					Blue					Red				
	4	5	6	12	13	9	8	7	11	14	2	3	1	10	15
Flow	196	207	259	818	556	224	224	292	418	458	215	206	186	391	305
Nitrate+nitrite	93	99	95	97	59	96	89	93	95	87	98	95	81	99	95
Ammonia	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Ammonium	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Conductivity	100	100	99	99	100	100	99	100	99	100	100	100	100	100	100
Dissolved oxygen	100	100	100	100	100	100	100	100	99	100	100	100	100	100	100
pH	100	100	100	100	100	100	100	100	99	100	100	100	100	100	100
Flow cell water temperature	100	100	100	99	100	100	100	100	100	100	100	100	100	100	100
Turbidity	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Dissolved organic matter	100	100	100	100	100	97	100	100	100	100	100	100	100	100	100
Ortho-phosphorus	0	80	0	0	0	0	69	0	0	0	64	79	0	0	0

Table 6: Total number of measured values in flume data as a percentage of possible values when PLC switch = 1 (flow >0.2 l/s)

1.3.5 Timesteps of missing 15 minute data when PLC switch = 1 (flow >0.2 l/s)

- Data are in farmlet/catchment/triplet order with catchments arranged from largest to smallest down the page.
- Colour bars represent missing 15 minute timestep water quality data for each farmlet when flow >0.2 l/s and may reflect data loss due to sensor downtime or where data failed the quality control process.
- NB. Total phosphorus, ortho-phosphorus and flume temperature not included as sampling and measurement are not influenced by the PLC switch values.

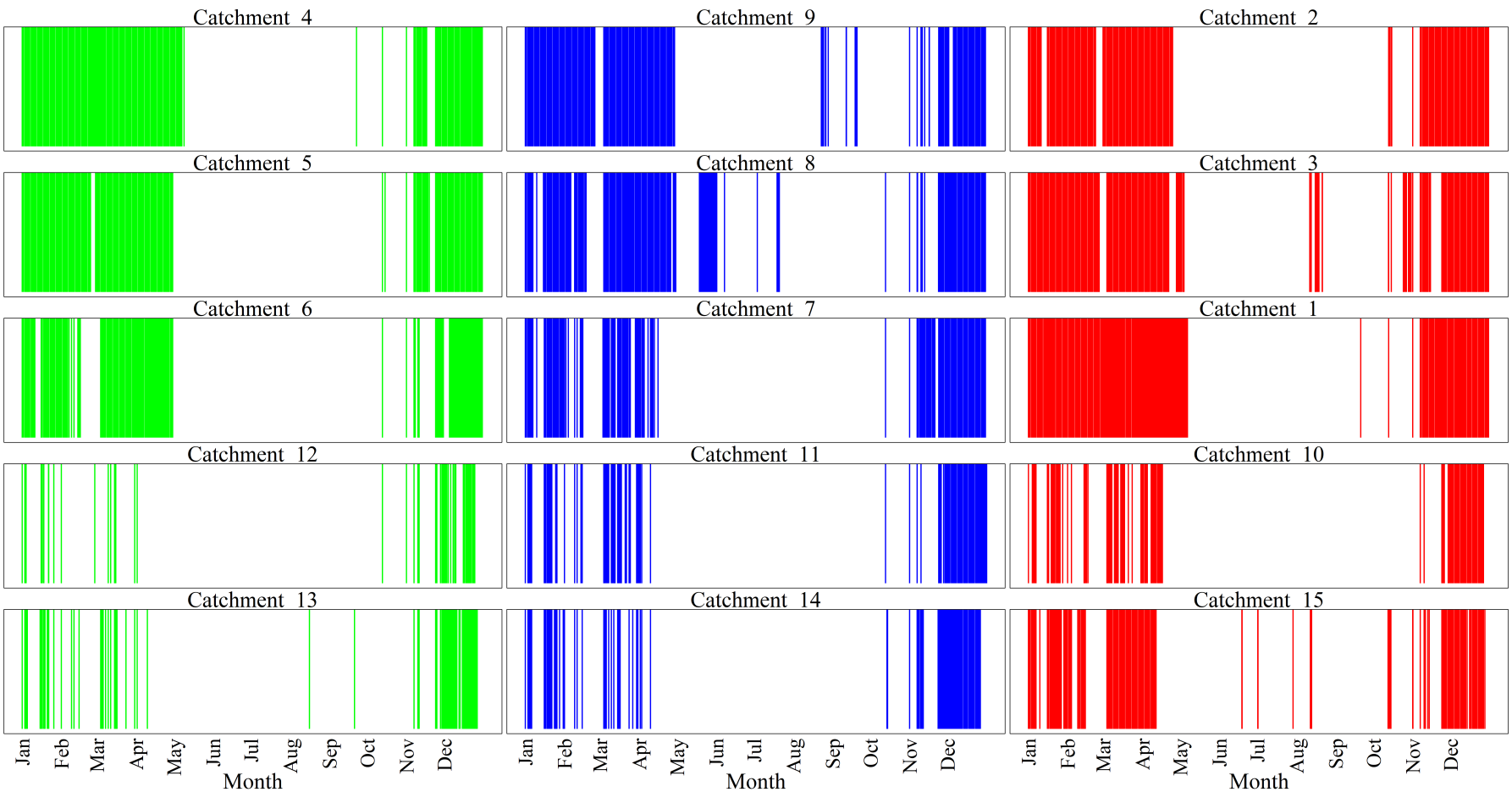

Figure 1: Timesteps of missing nitrate+nitrite data

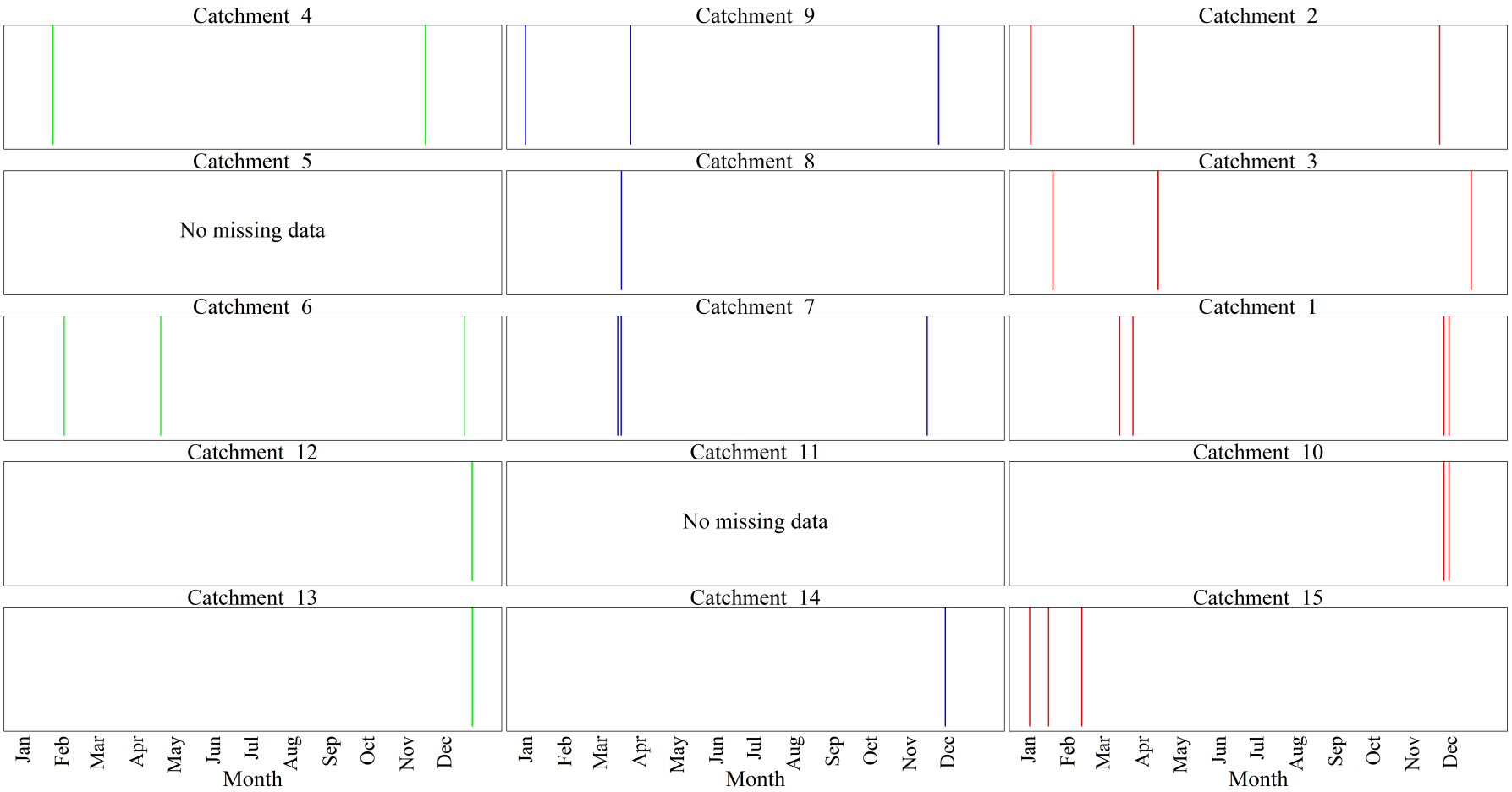

Figure 2: Timesteps of missing ammonia data

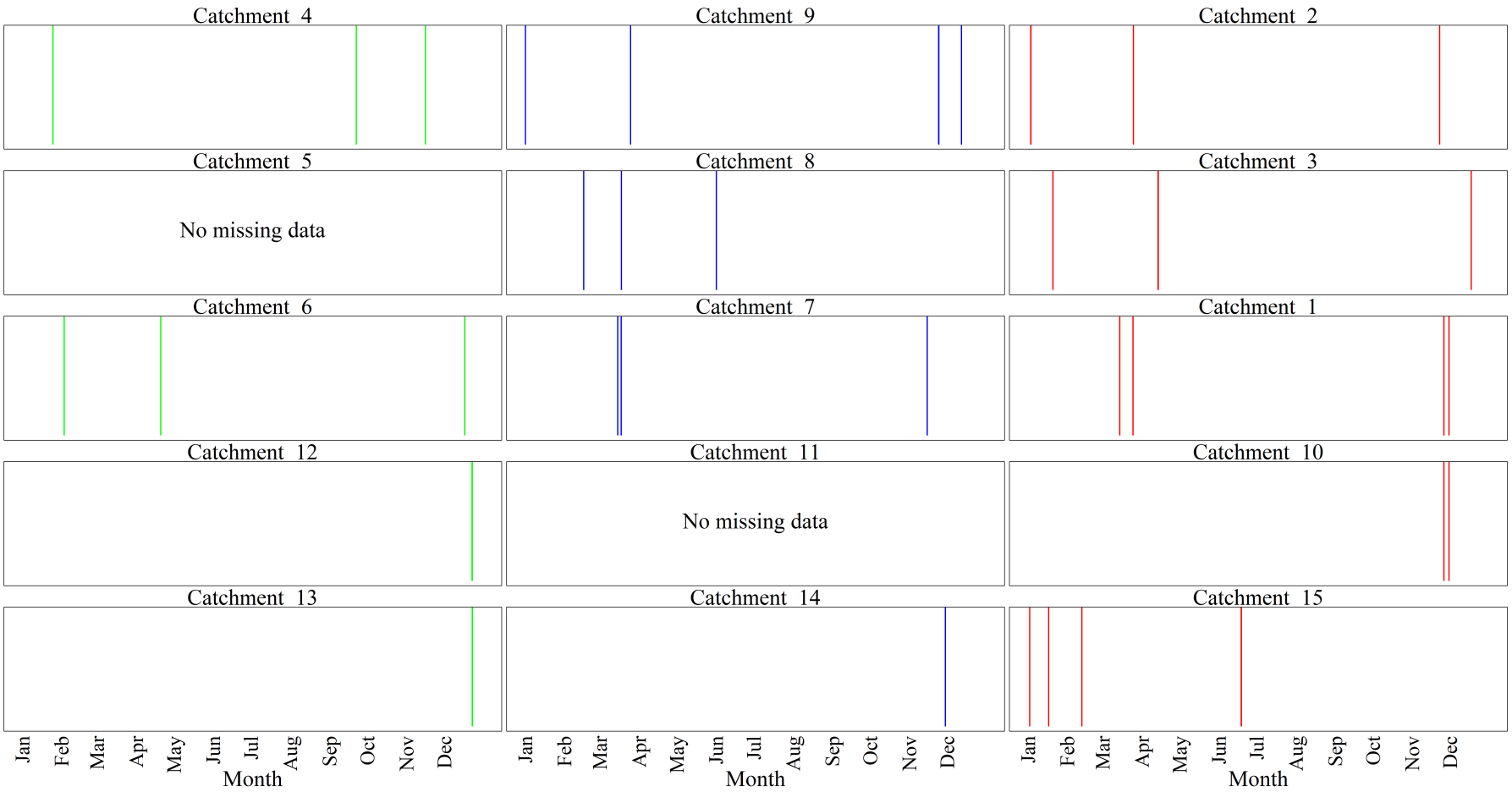

Figure 3: Timesteps of missing ammonium data

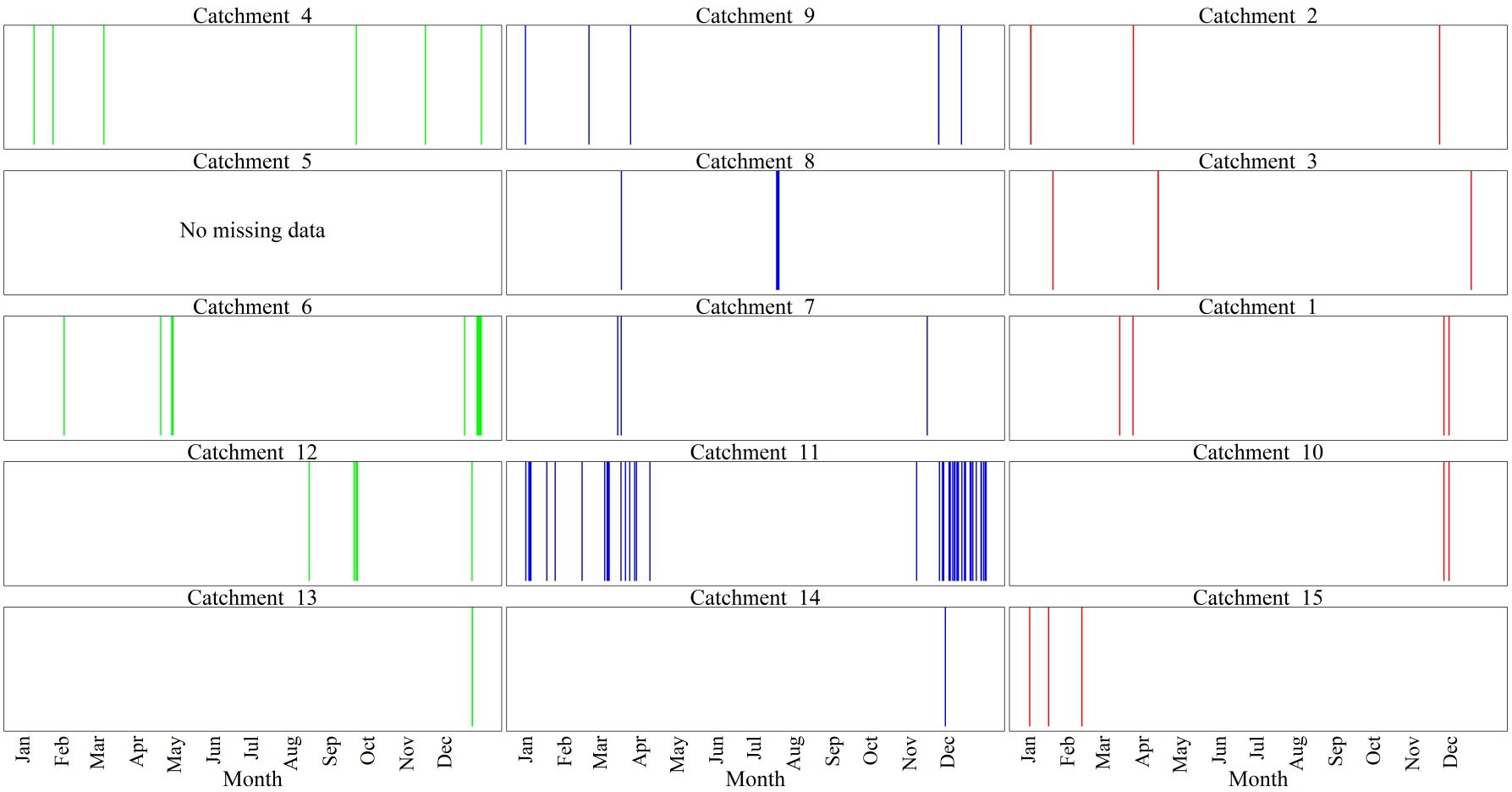

Figure 4: Timesteps of missing conductivity data

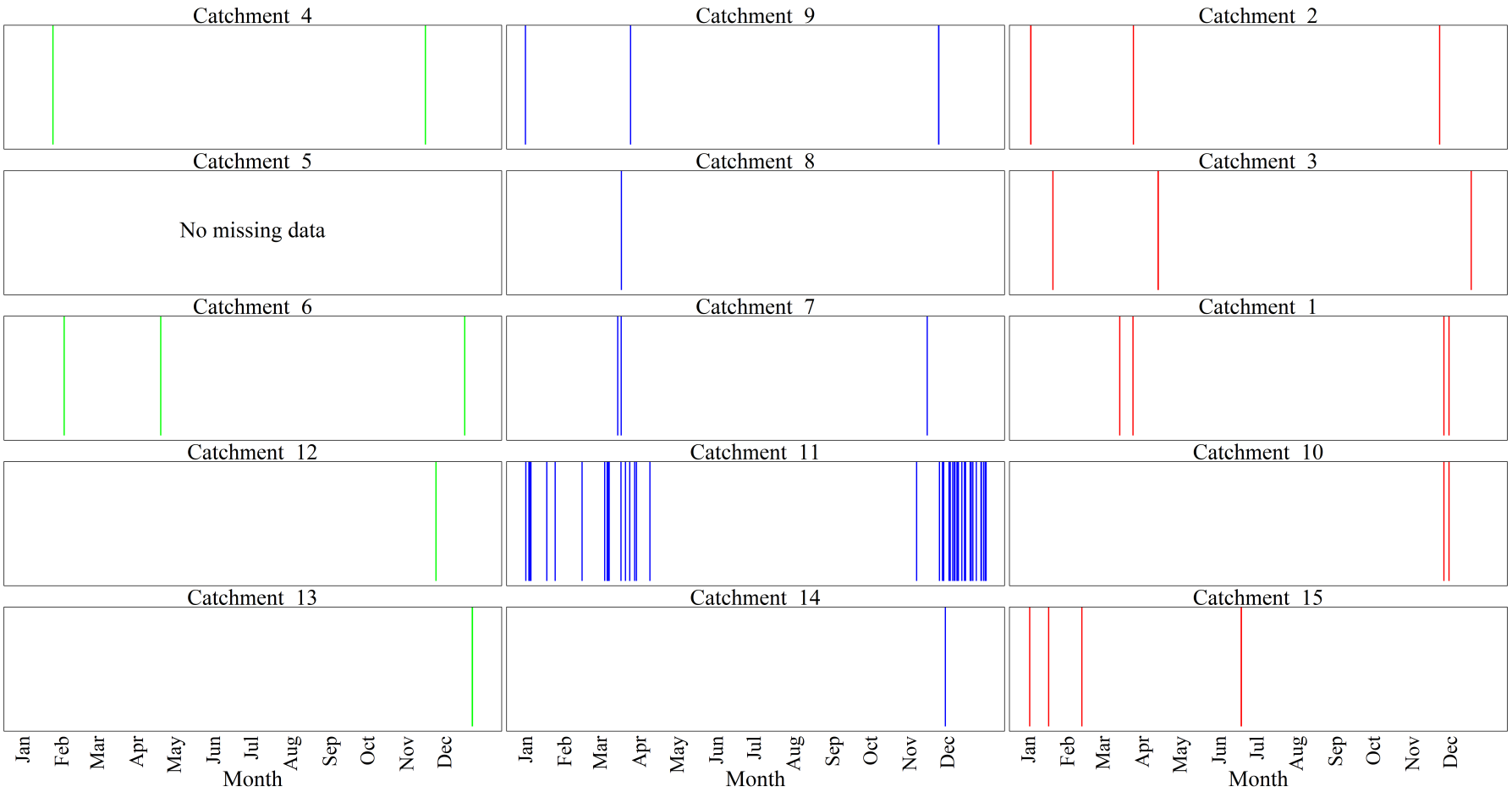

Figure 5: Timesteps of missing dissolved oxygen data

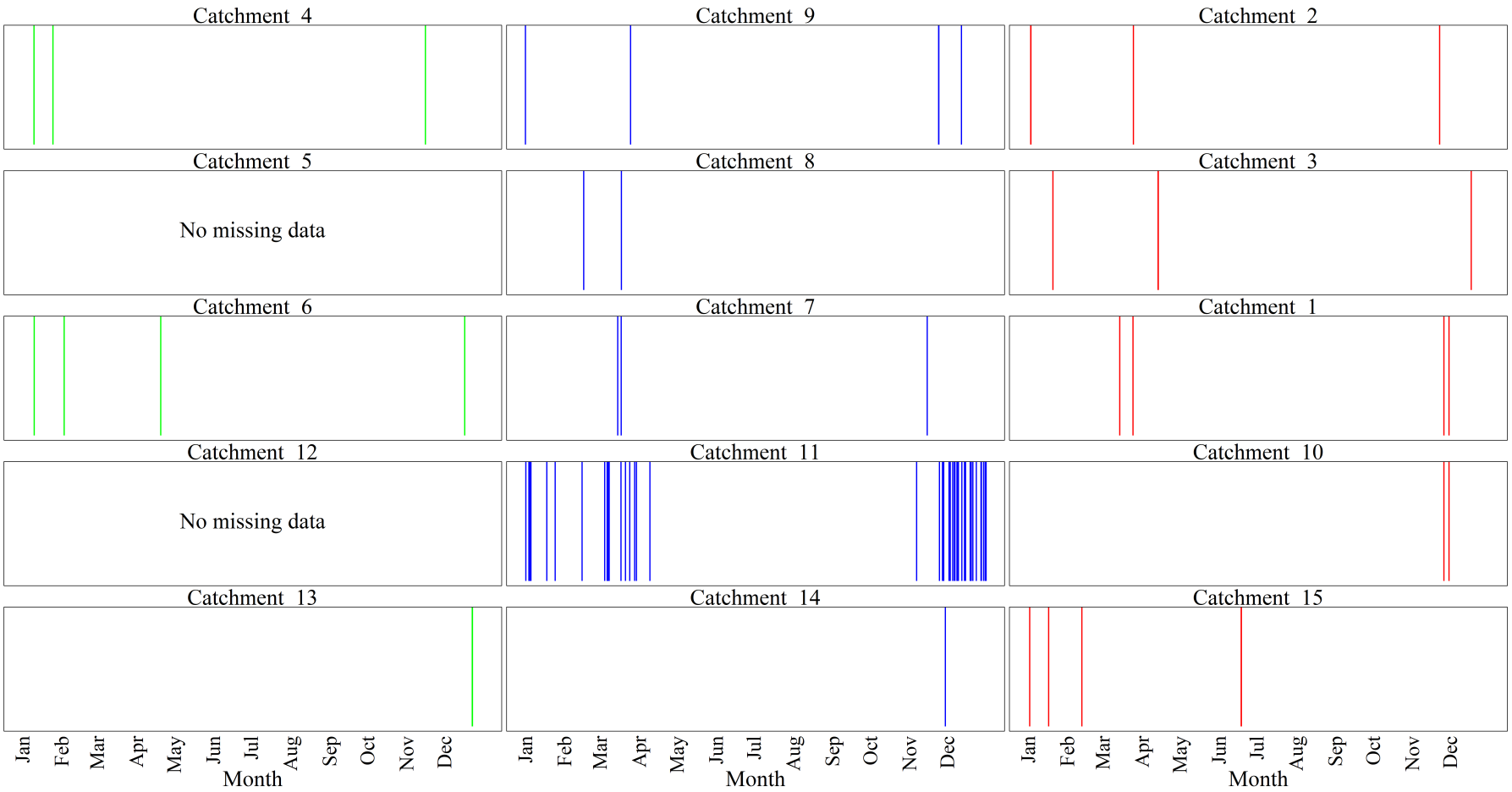

Figure 6: Timesteps of missing pH data

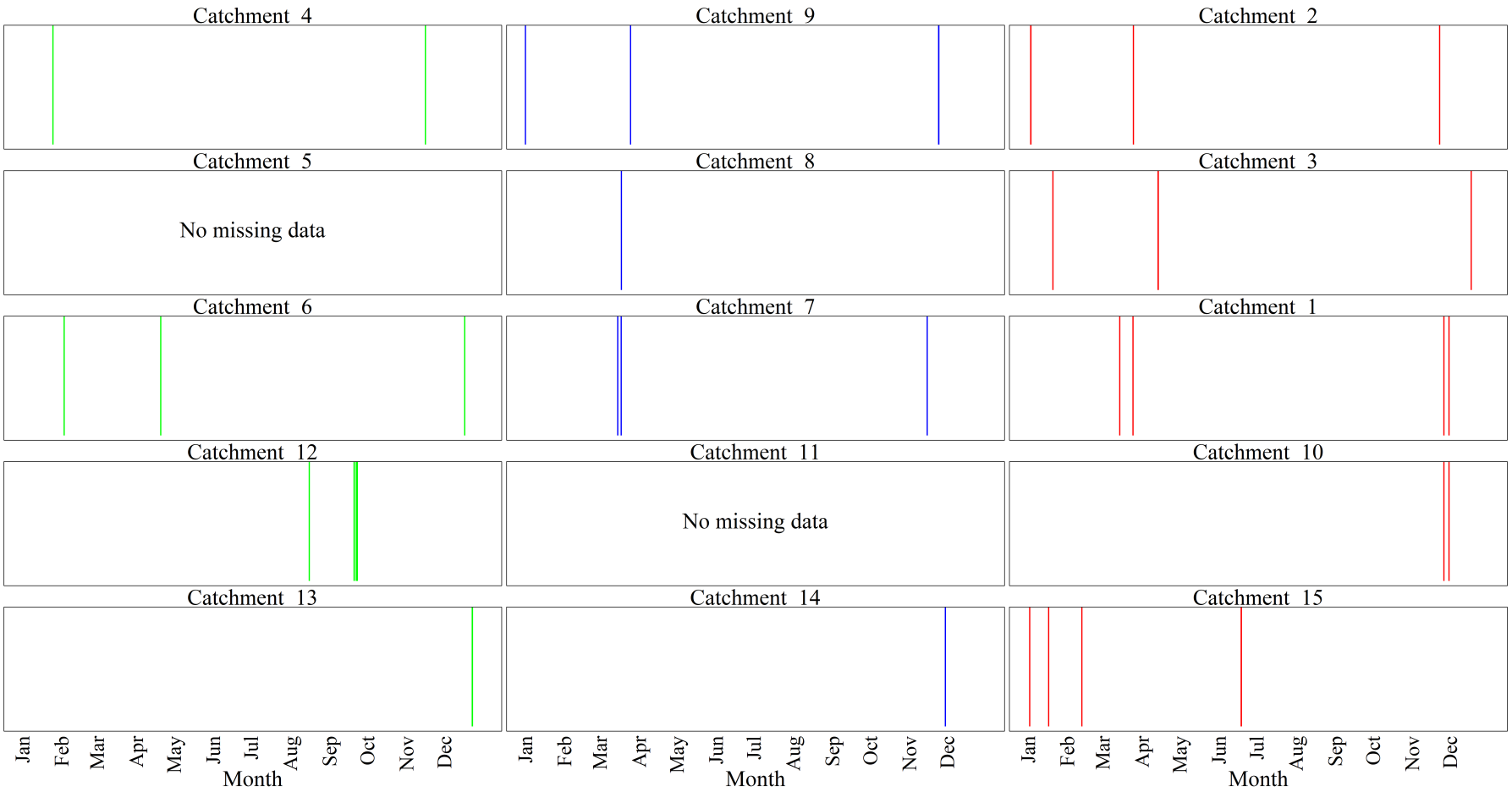

Figure 7: Timesteps of missing flow cell water temperature data

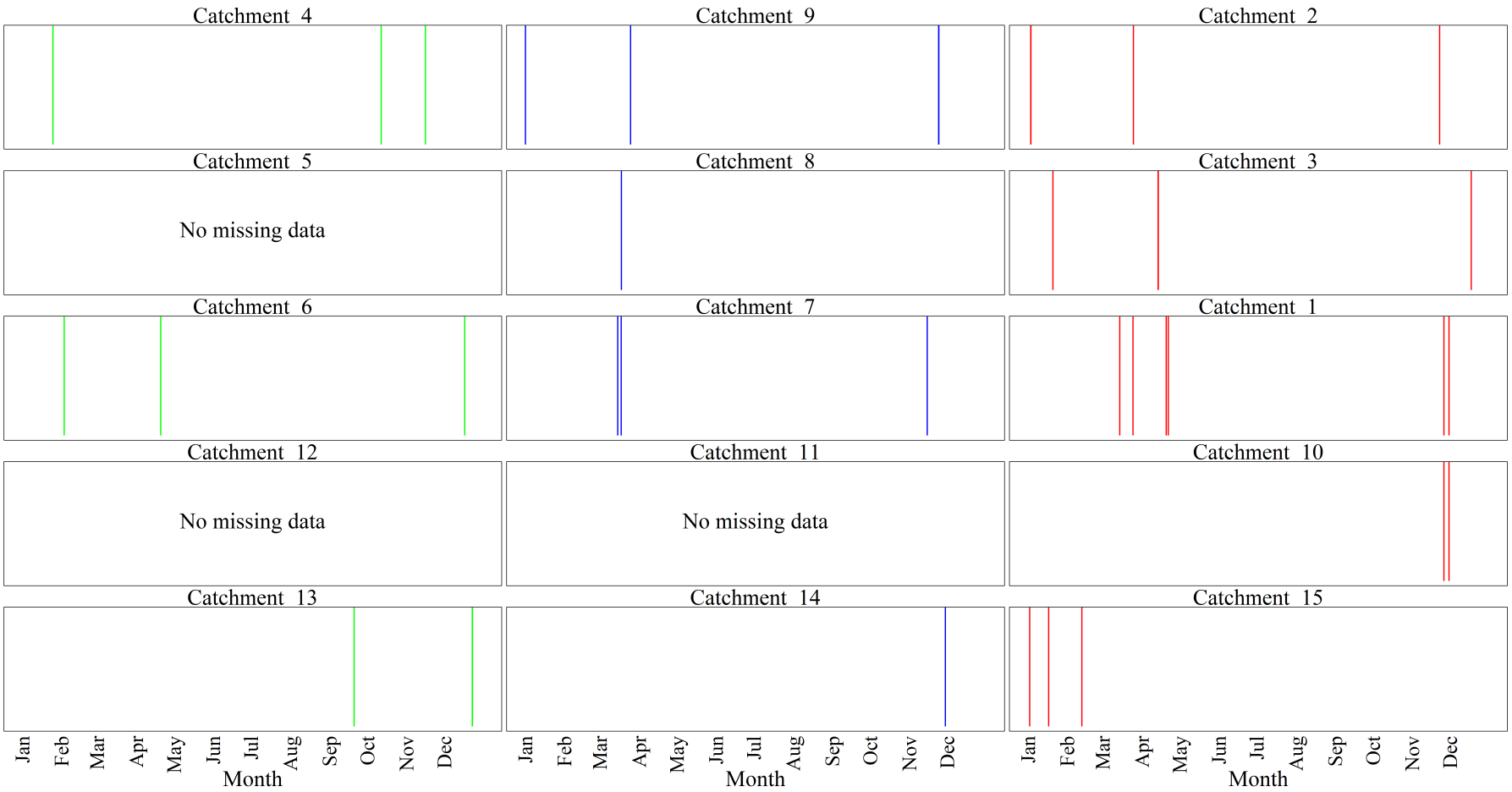

Figure 8: Timesteps of missing turbidity data

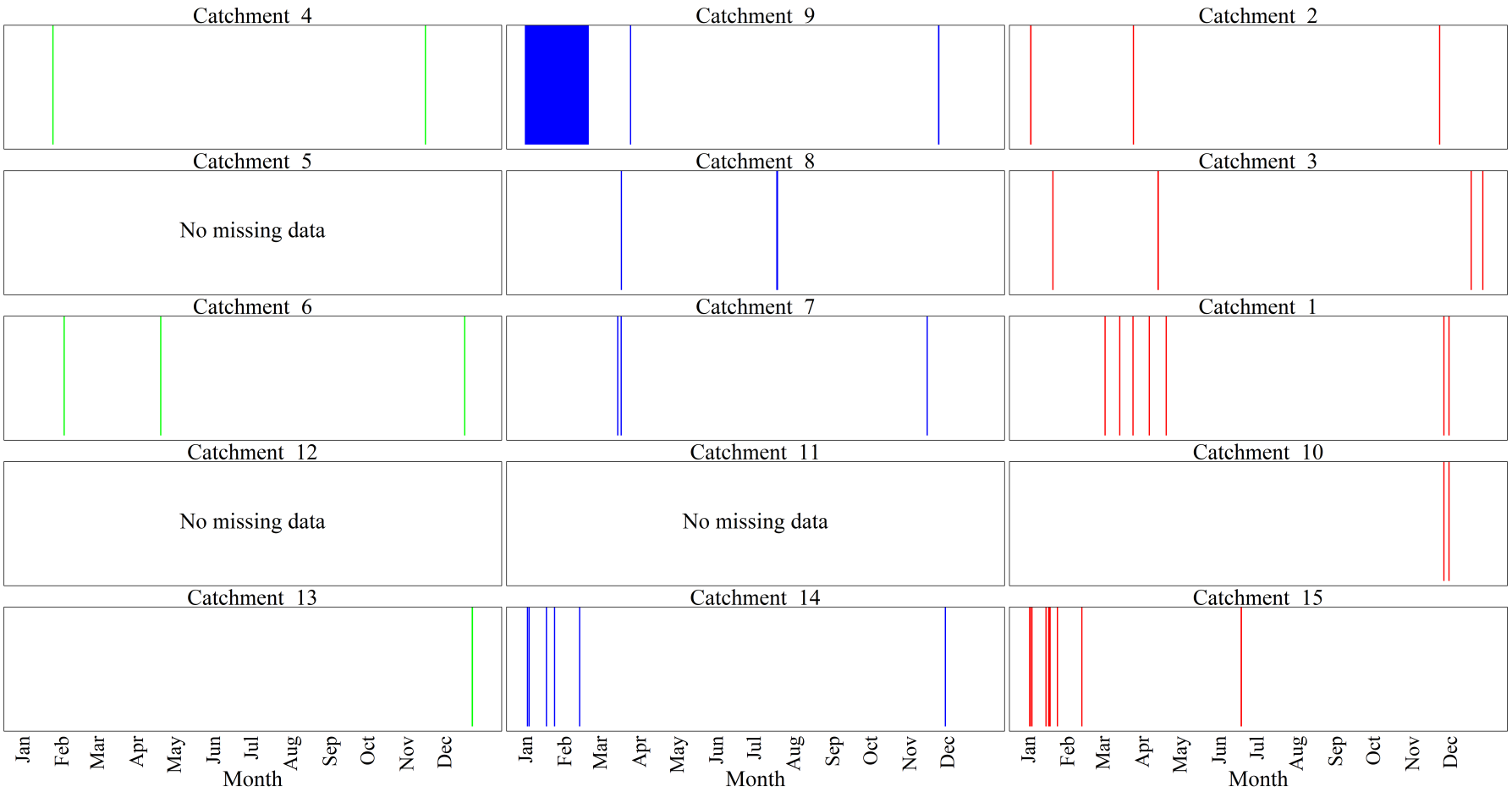

Figure 9: Timesteps of missing dissolved organic matter data

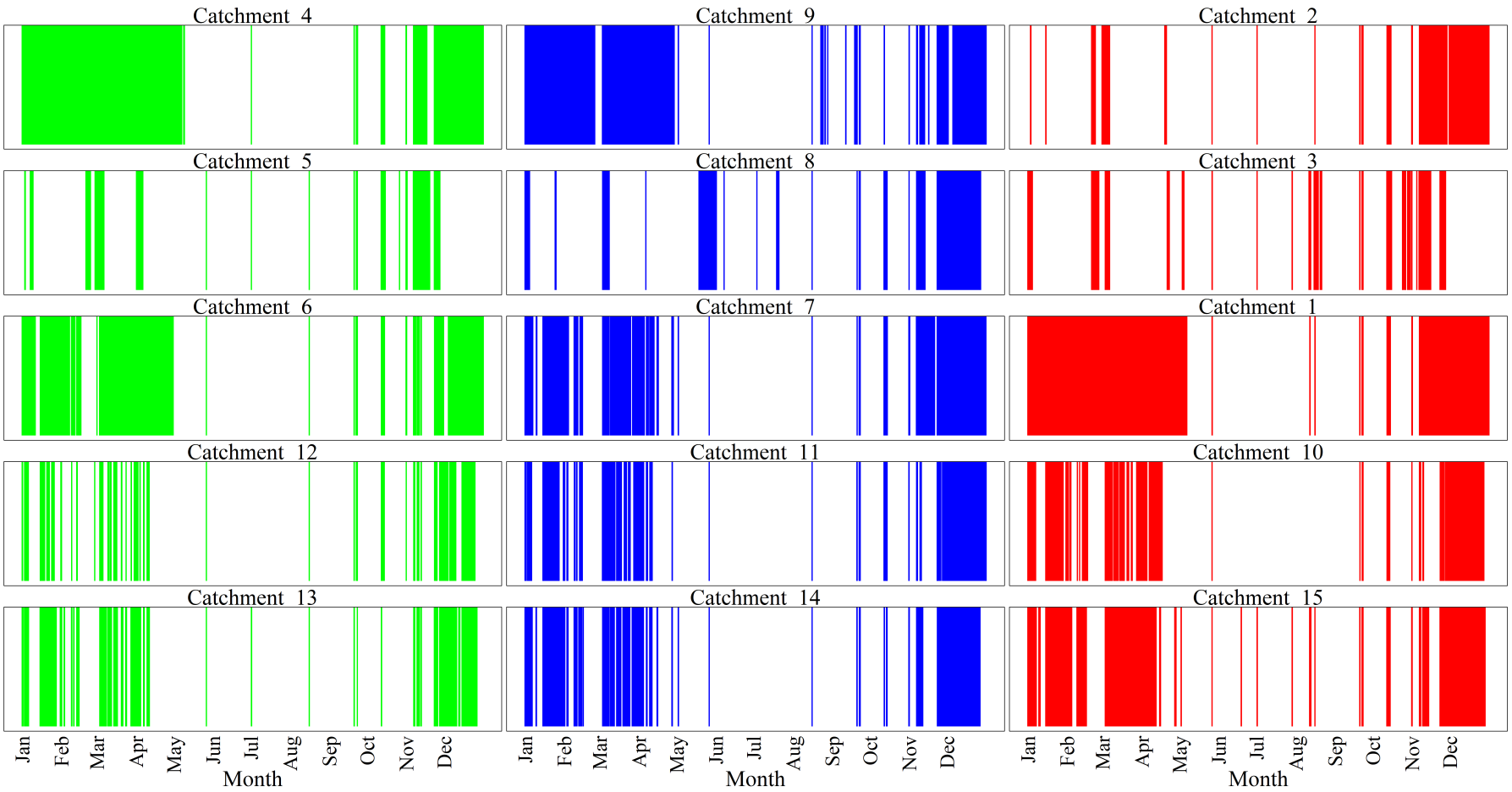

Figure 10: Timesteps of missing ortho-phosphorus data

1.4 Histograms of 15 minute data distribution

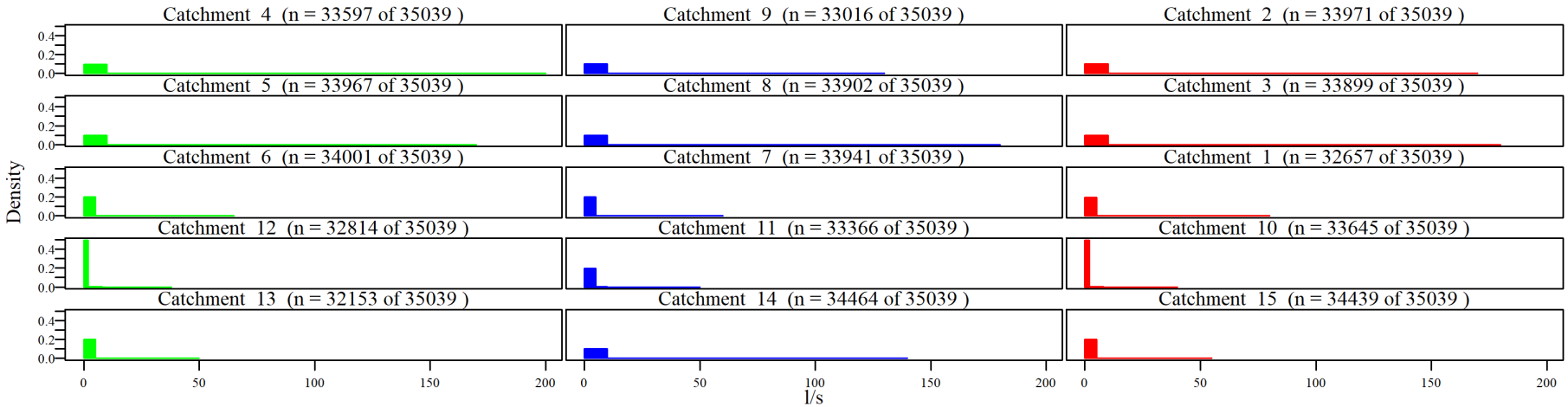

Figure 11: Distribution of data - flow

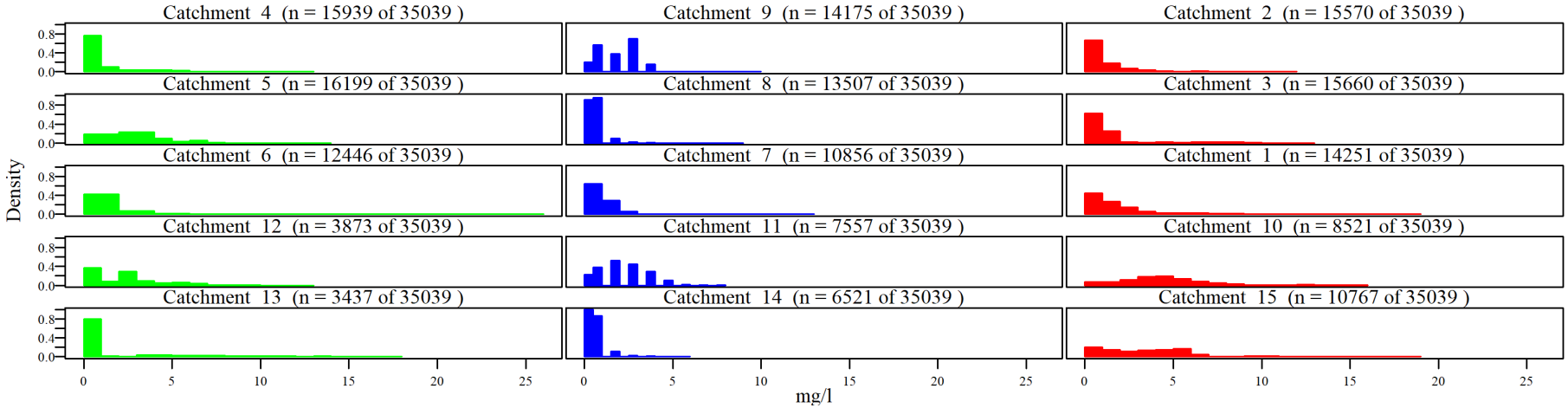

Figure 12: Distribution of data - nitrate+nitrite

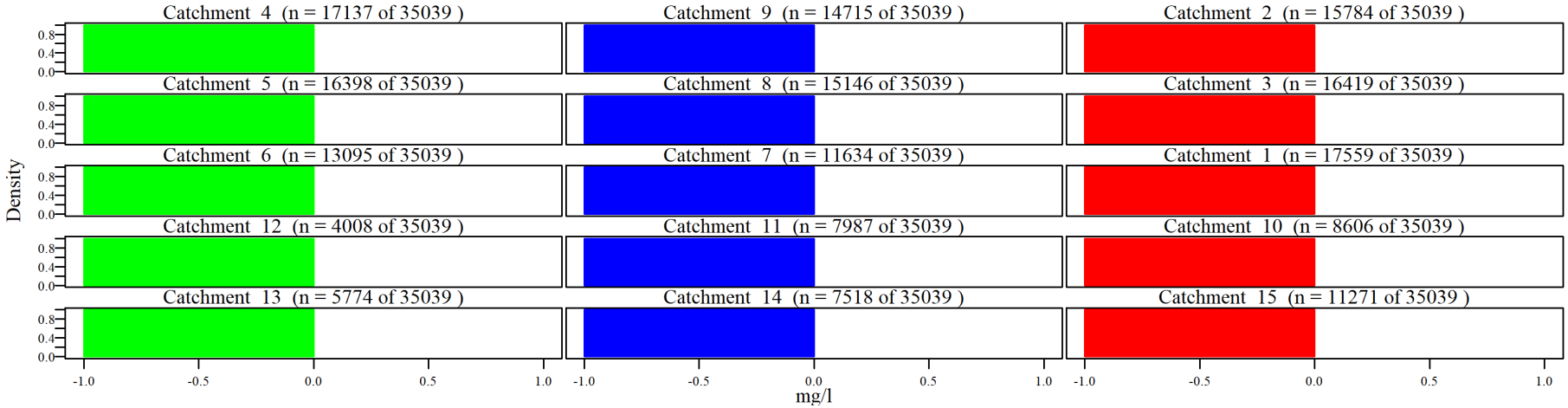

Figure 13: Distribution of data - ammonia

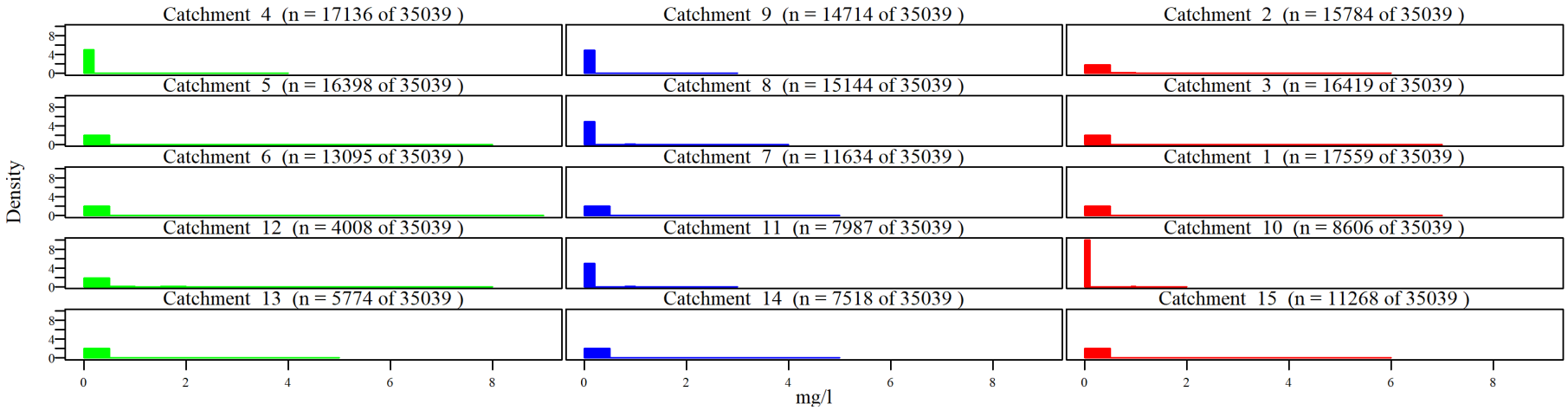

Figure 14: Distribution of data - ammonium

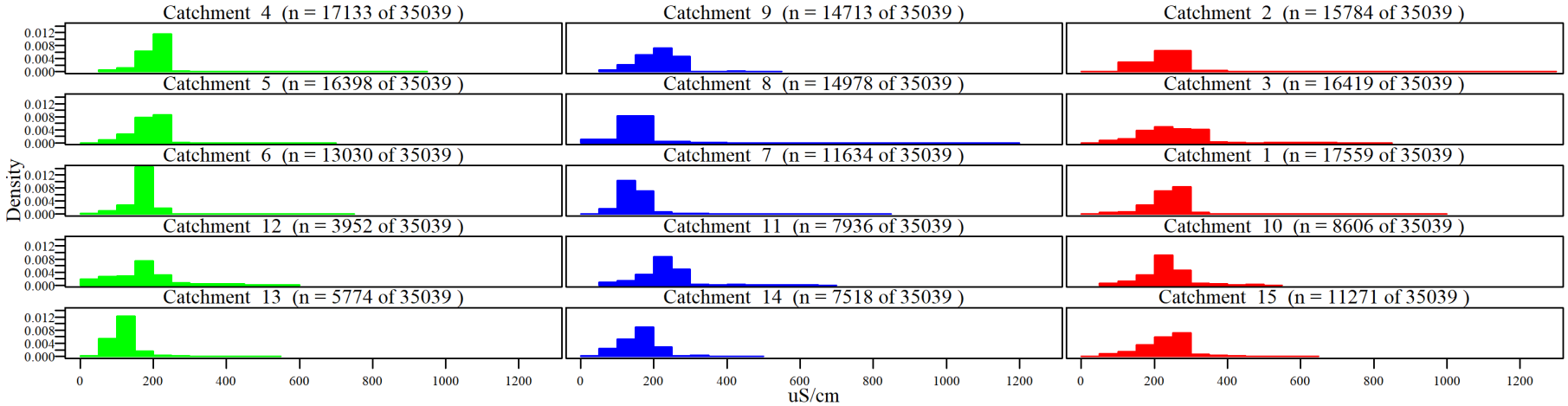

Figure 15: Distribution of data - conductivity

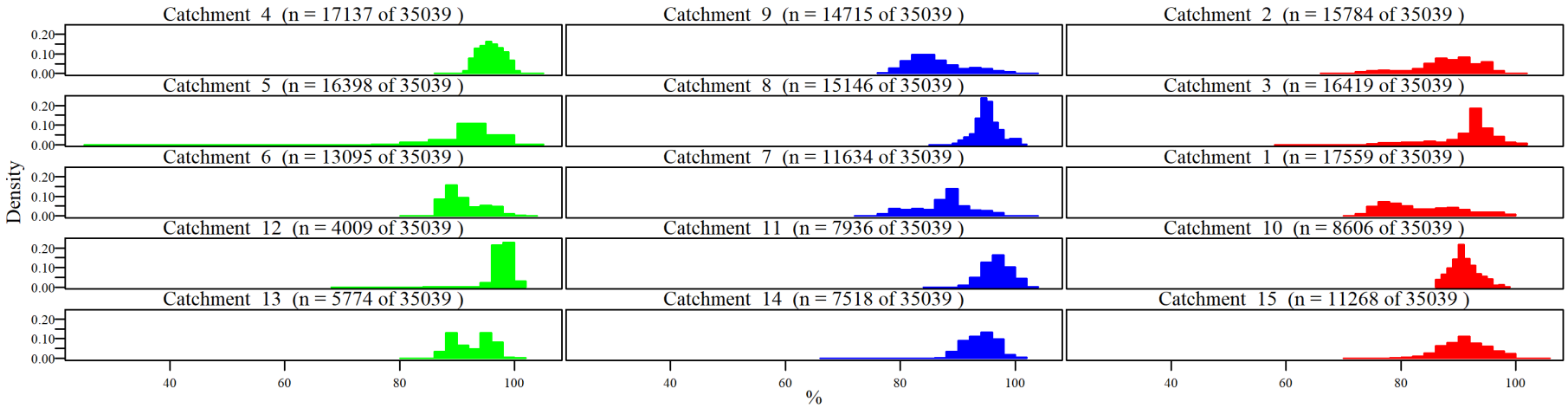

Figure 16: Distribution of data - dissolved oxygen

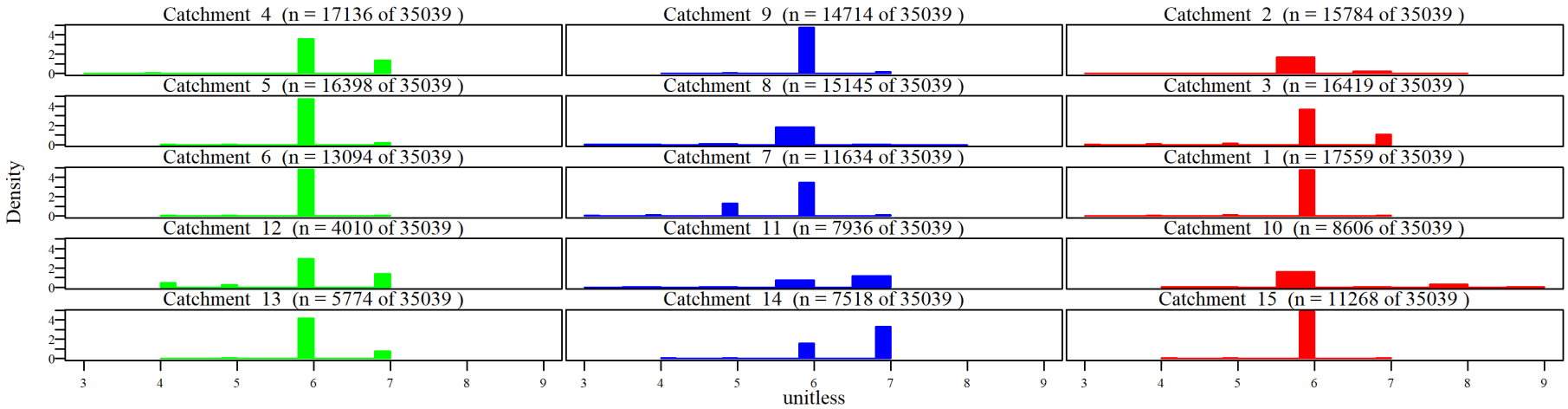

Figure 17: Distribution of data - pH

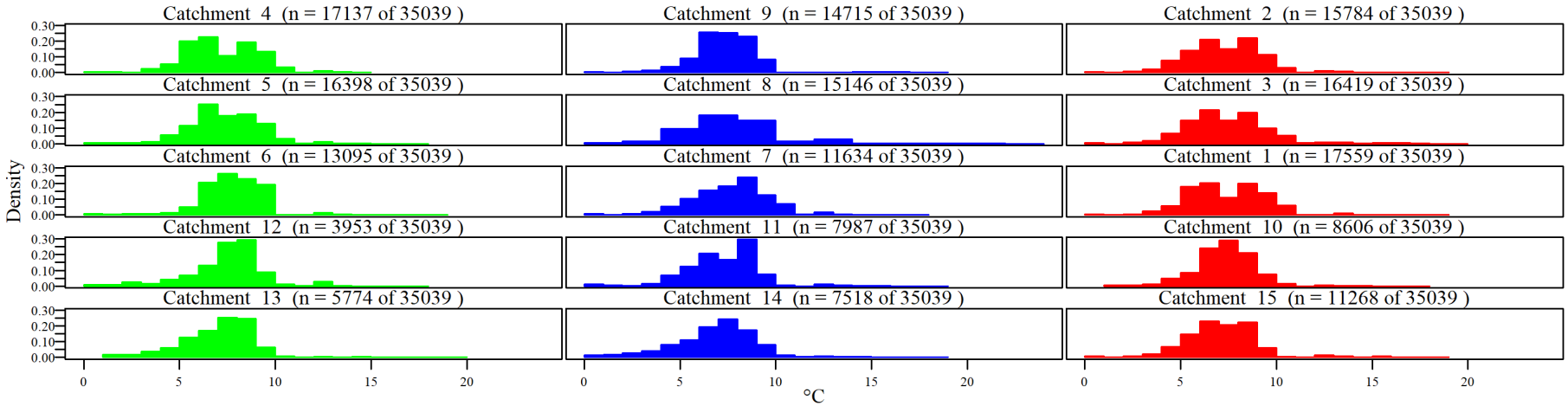

Figure 18: Distribution of data - flow cell water temperature

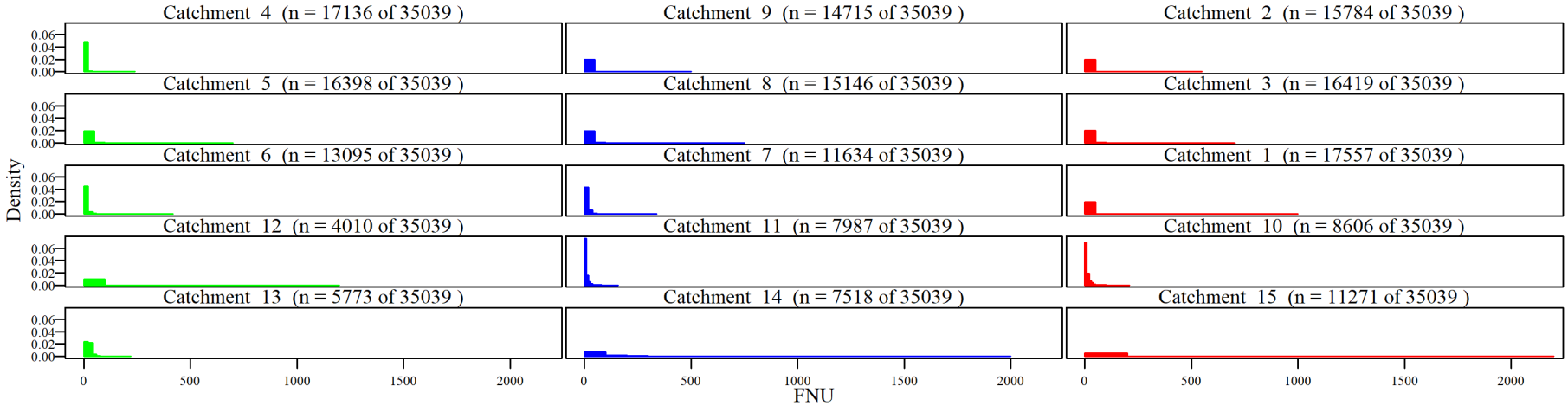

Figure 19: Distribution of data - turbidity

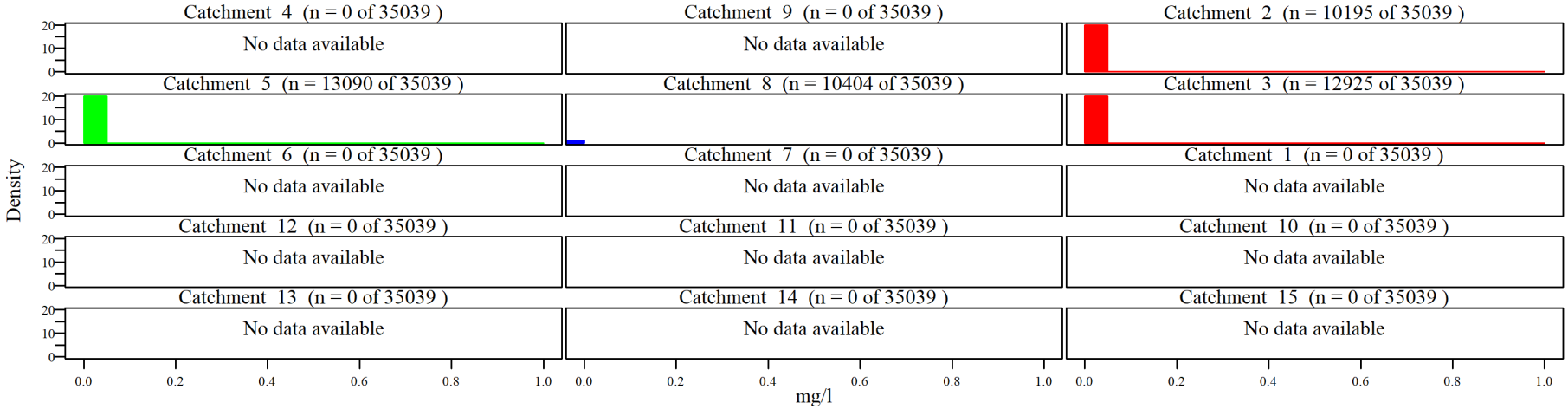

Figure 20: Distribution of data - total phosphorus

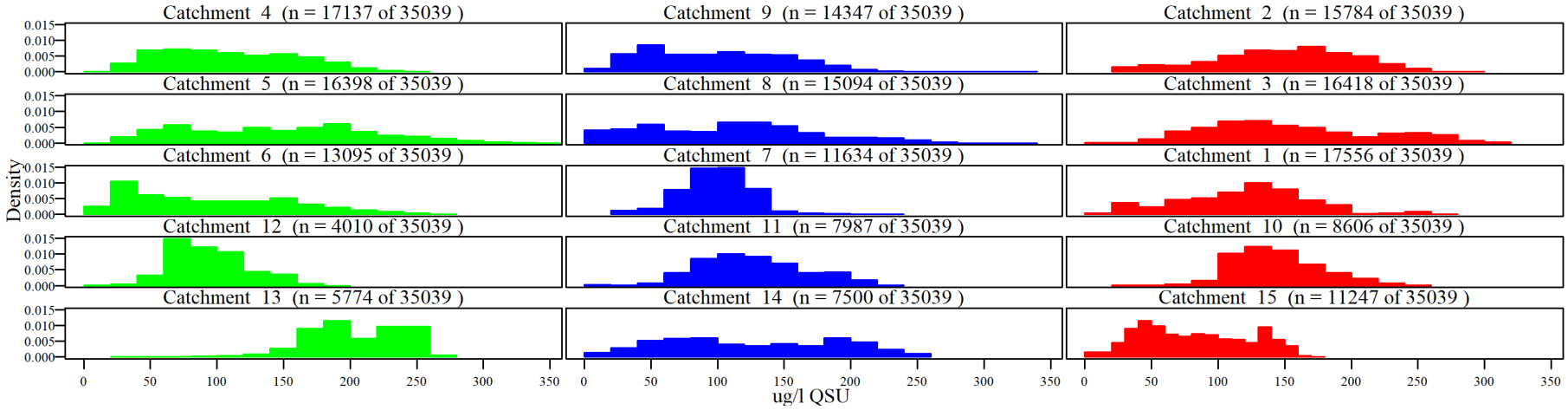

Figure 21: Distribution of data - dissolved organic matter

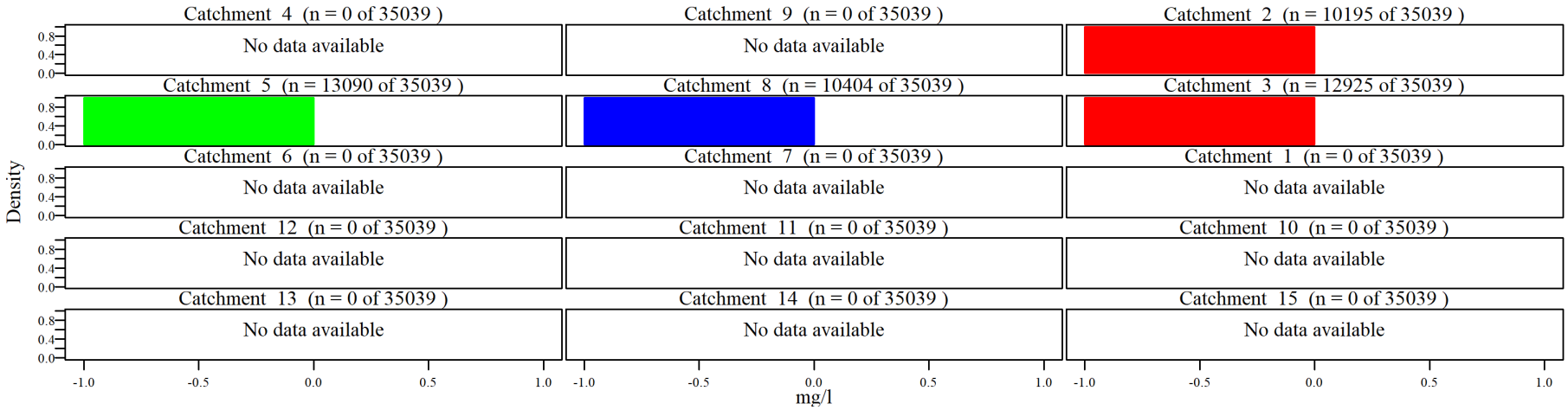

Figure 22: Distribution of data - ortho-phosphorus

1.5 Time series

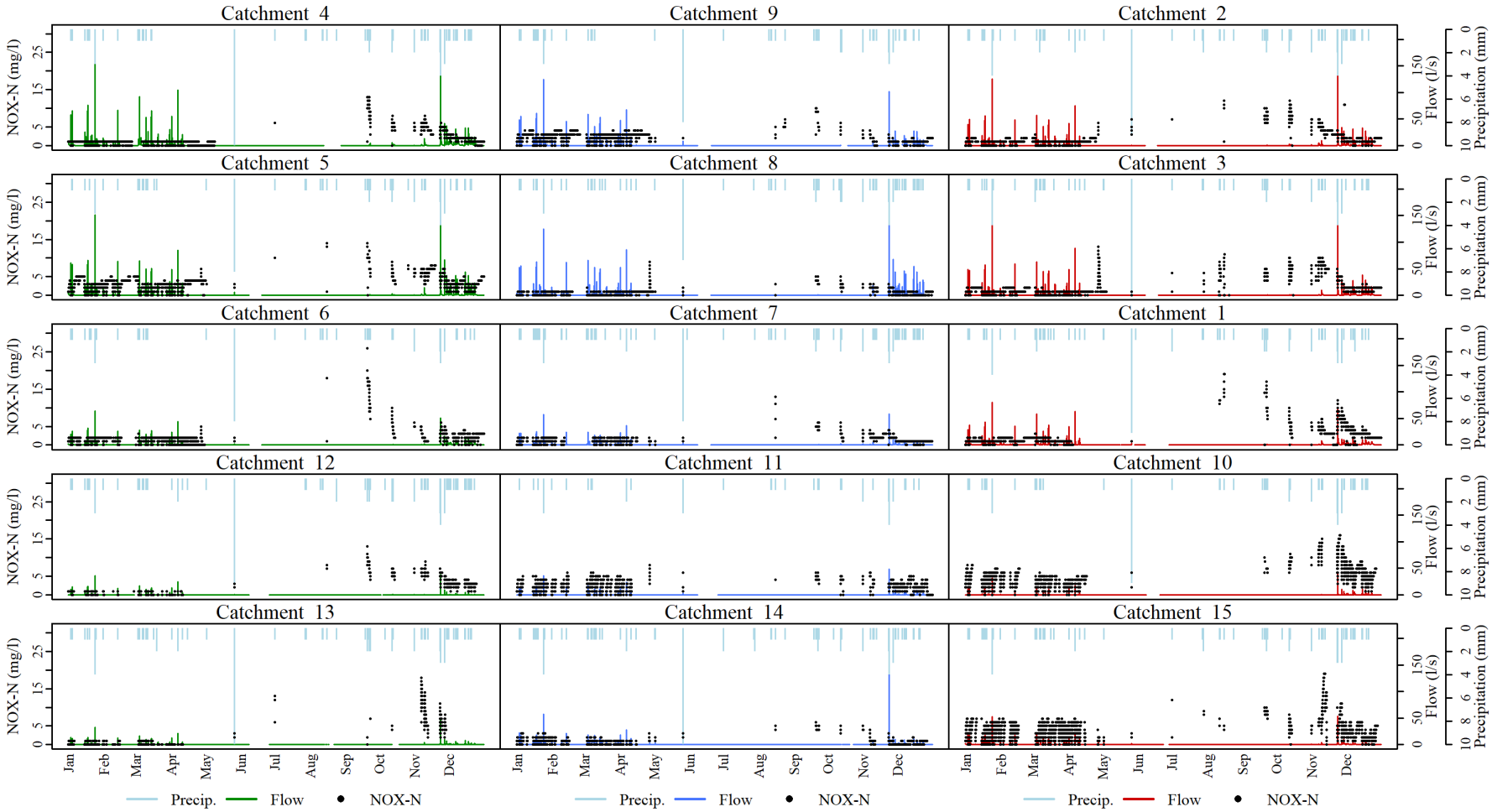

Figure 23: Time series of precipitation, flow and nitrate+nitrite (NOX-N)

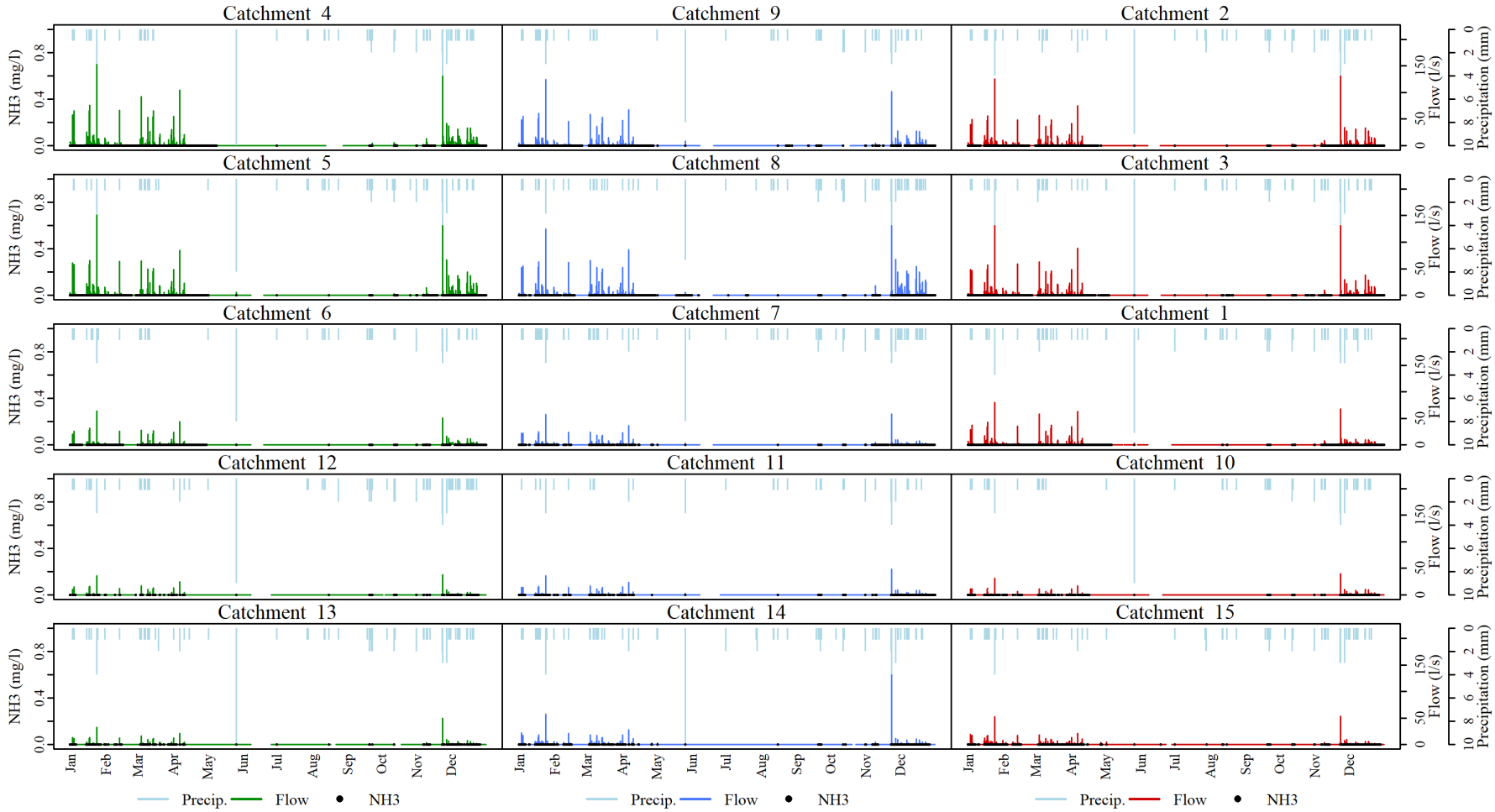

Figure 24: Time series of precipitation, flow and ammonia (NH3)

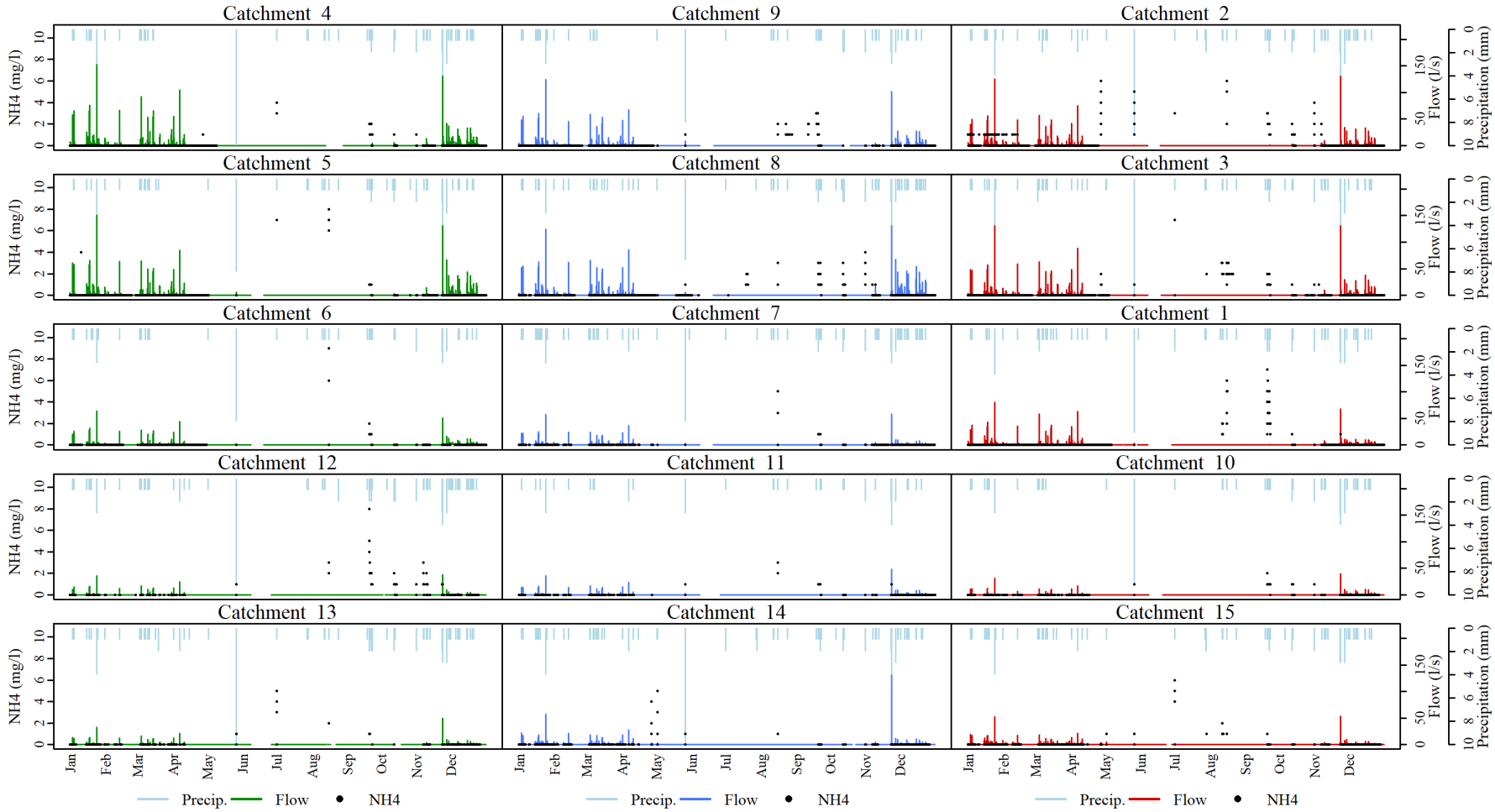

Figure 25: Time series of precipitation, flow and ammonium (NH4)

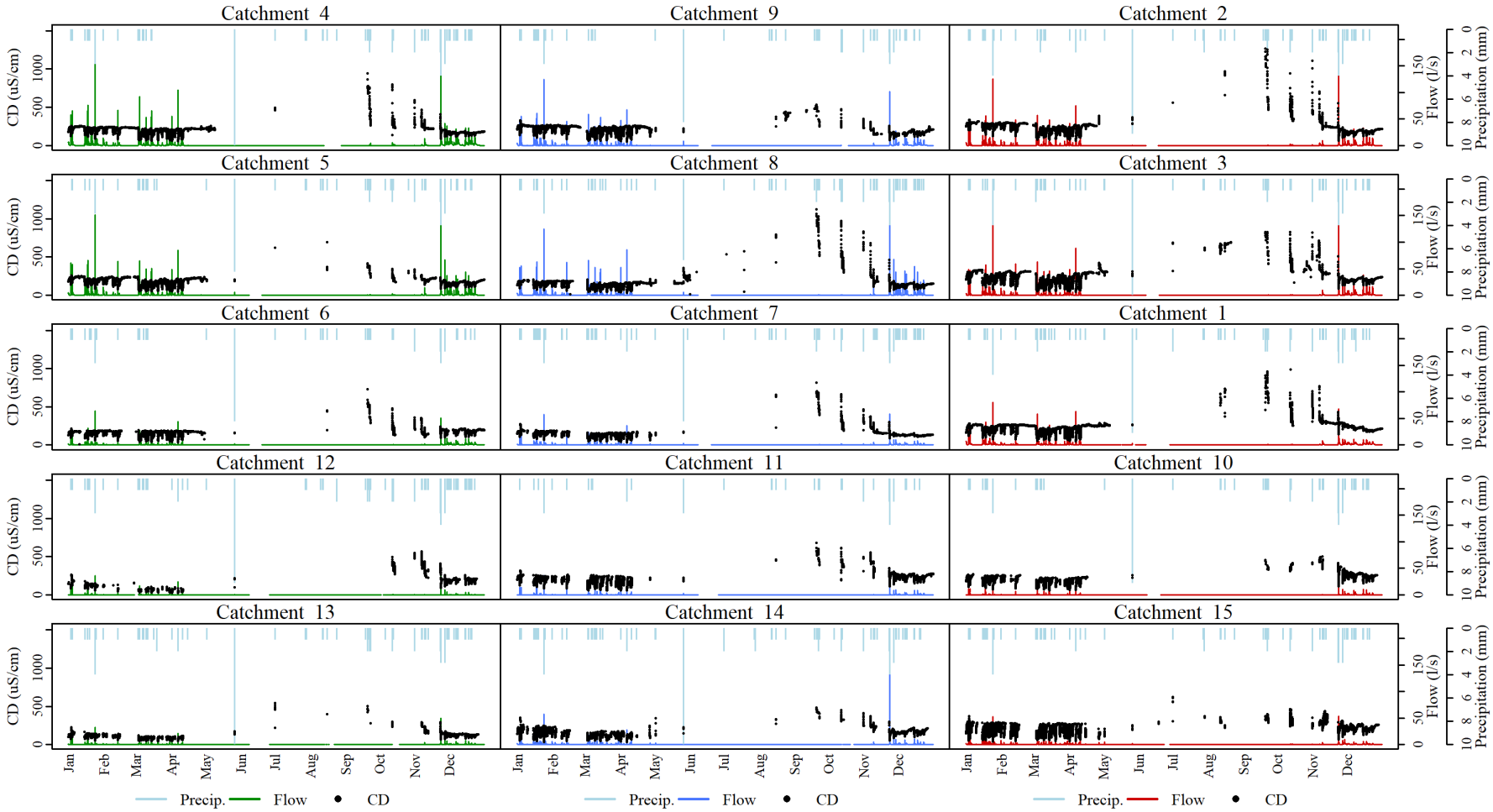

Figure 26: Time series of precipitation, flow and conductivity (CD)

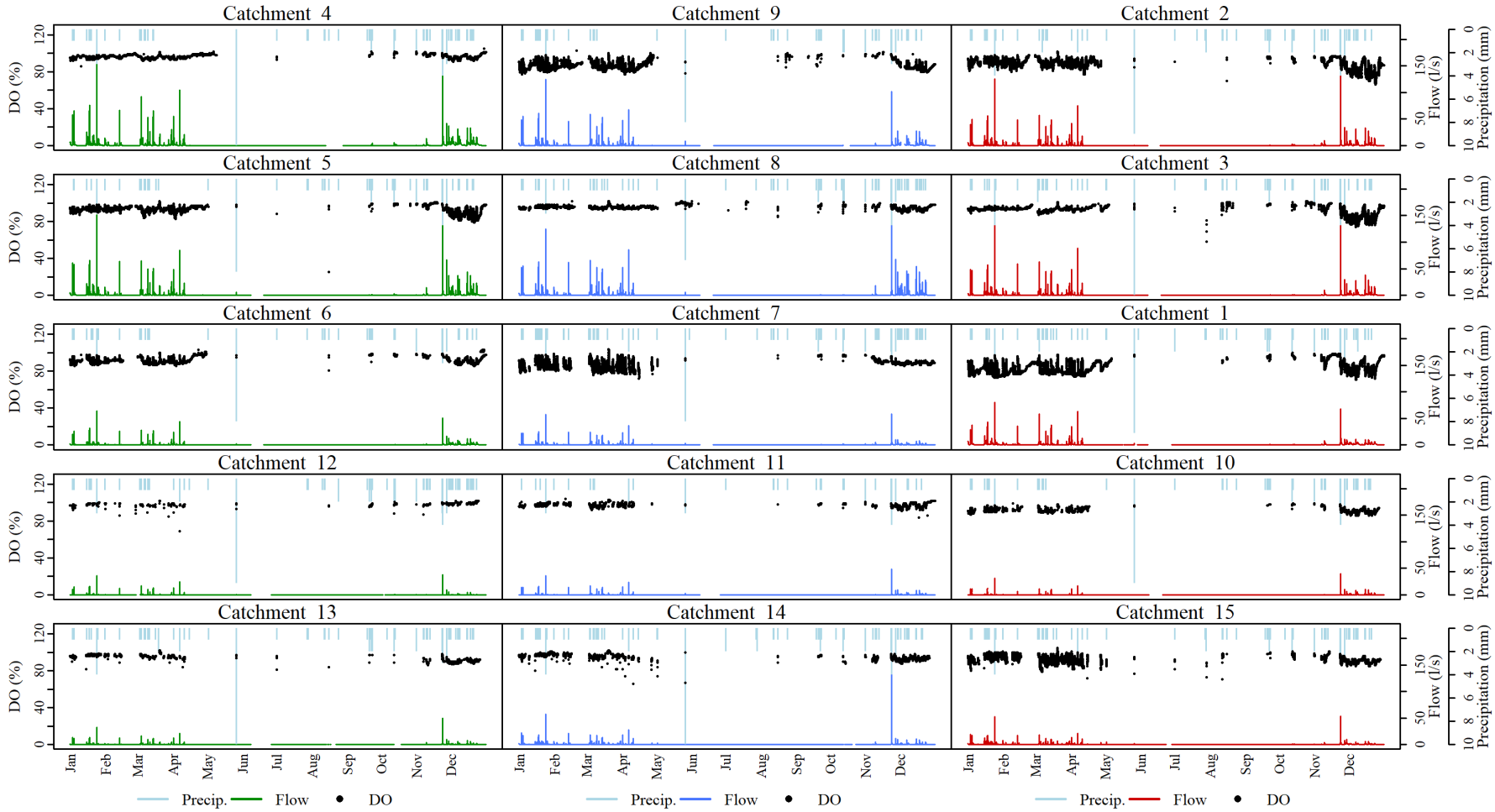

Figure 27: Time series of precipitation, flow and dissolved oxygen (DO)

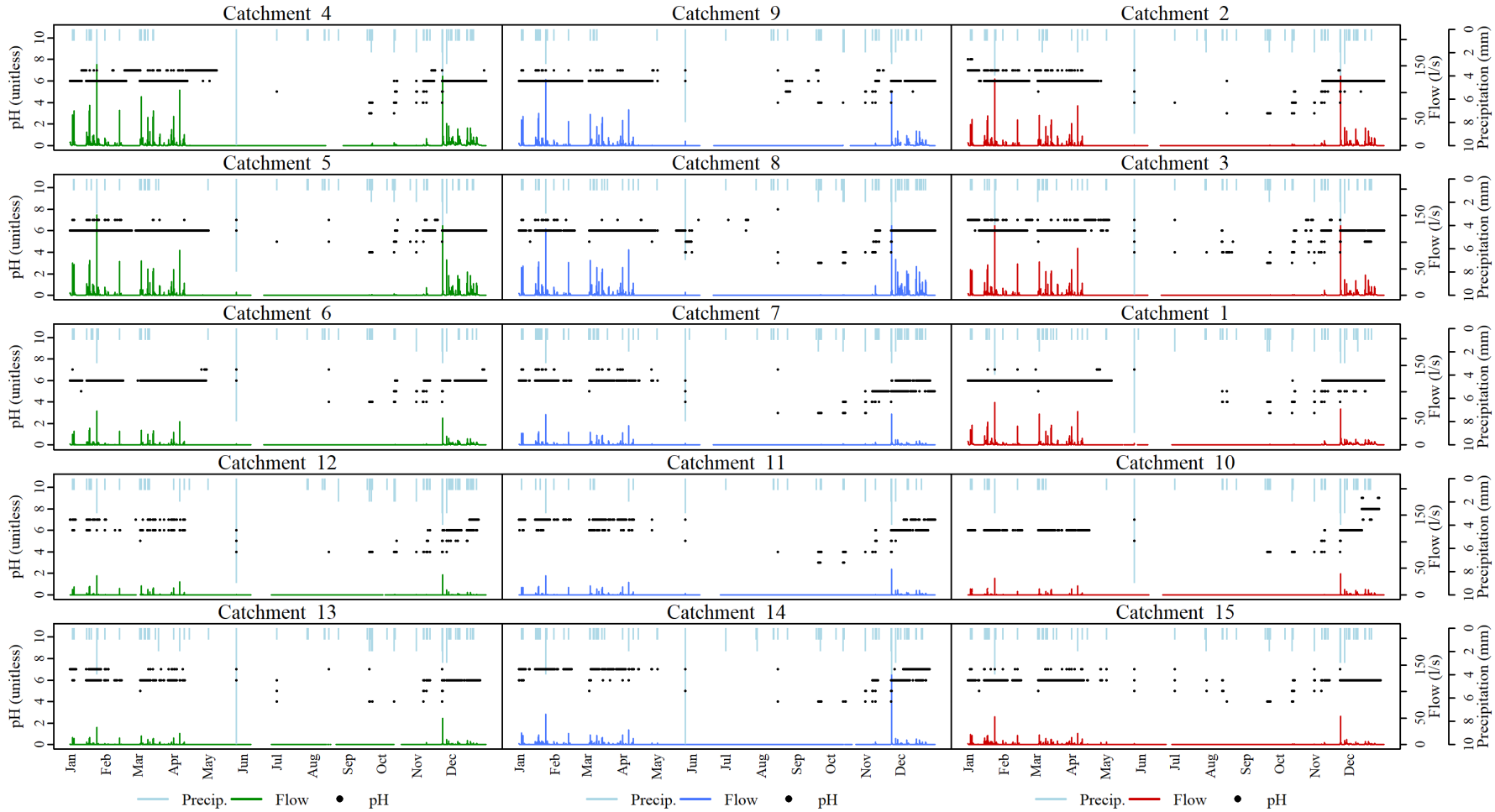

Figure 28: Time series of precipitation, flow and pH (pH)

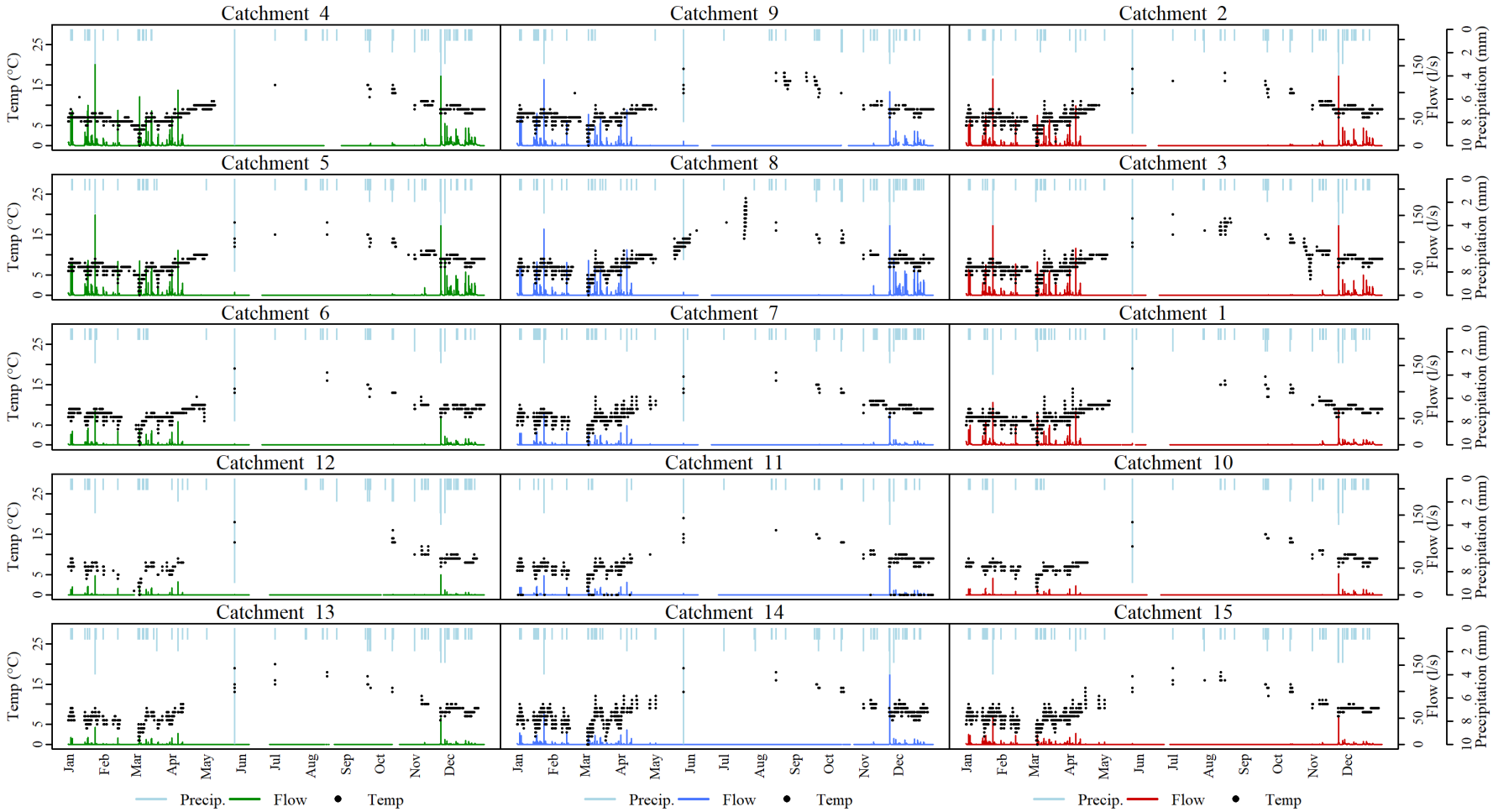

Figure 29: Time series of precipitation, flow and flow cell water temperature (Temp)

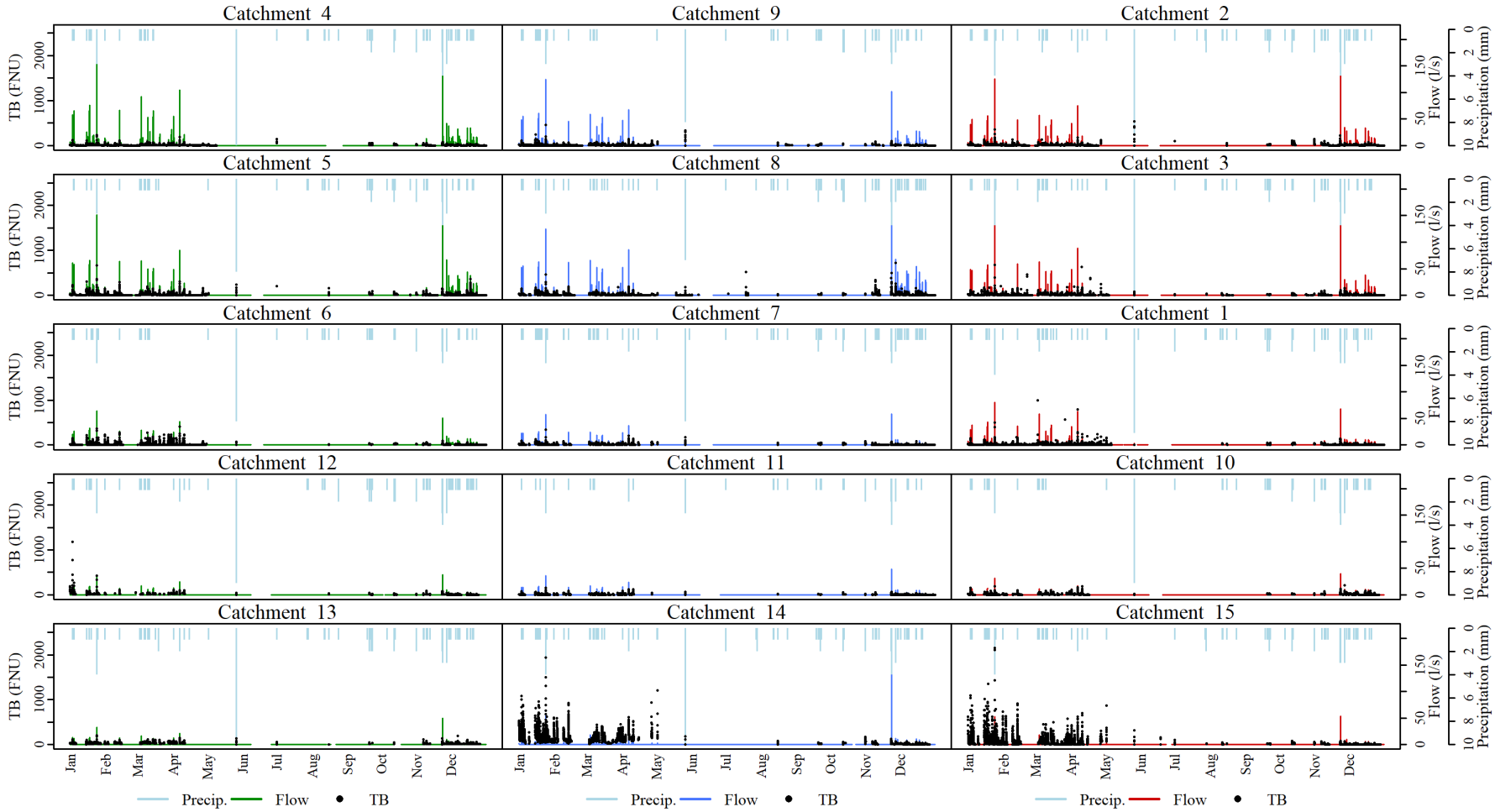

Figure 30: Time series of precipitation, flow and turbidity (TB)

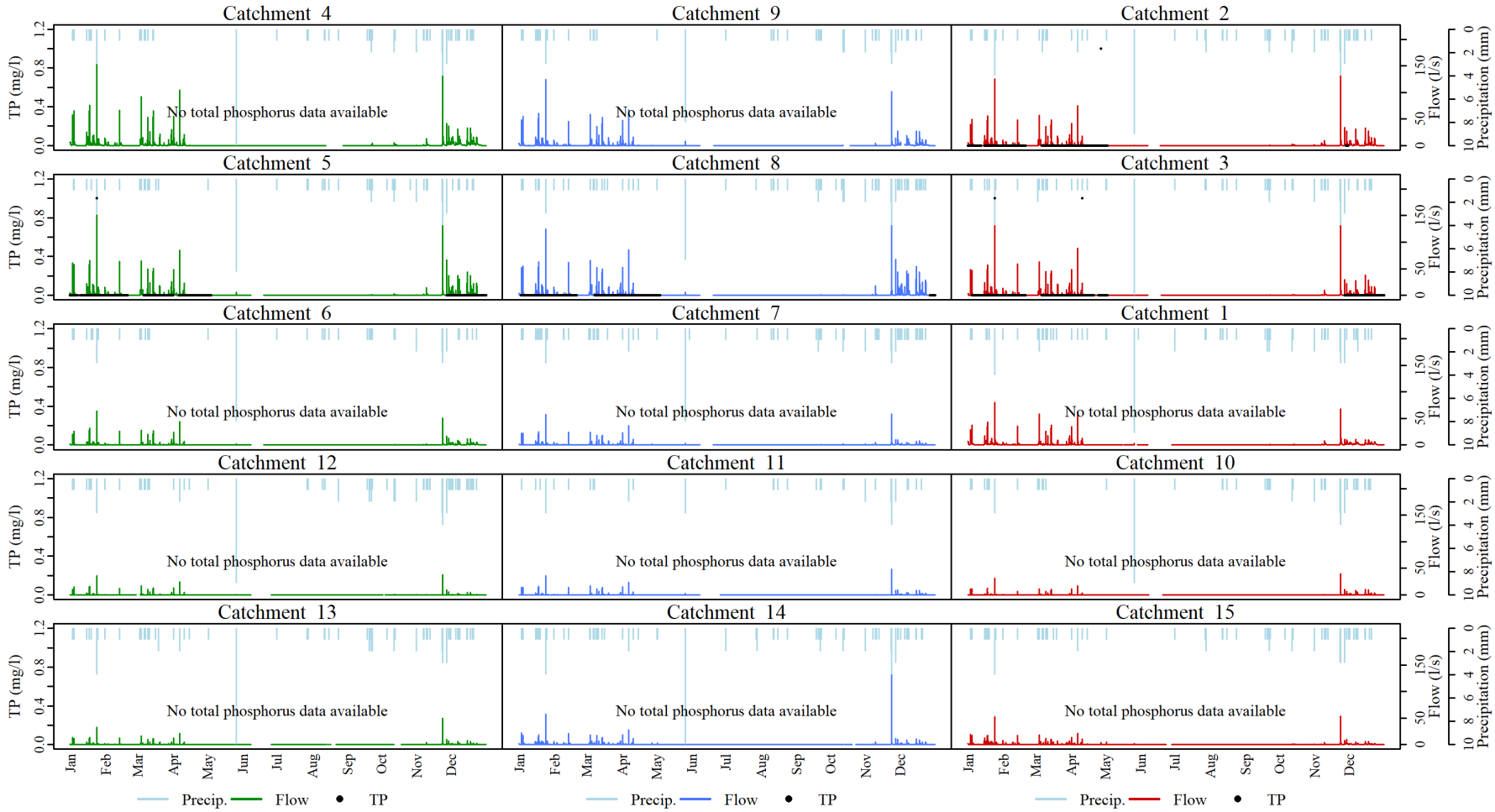

Figure 31: Time series of precipitation, flow and total phosphorus (TP)

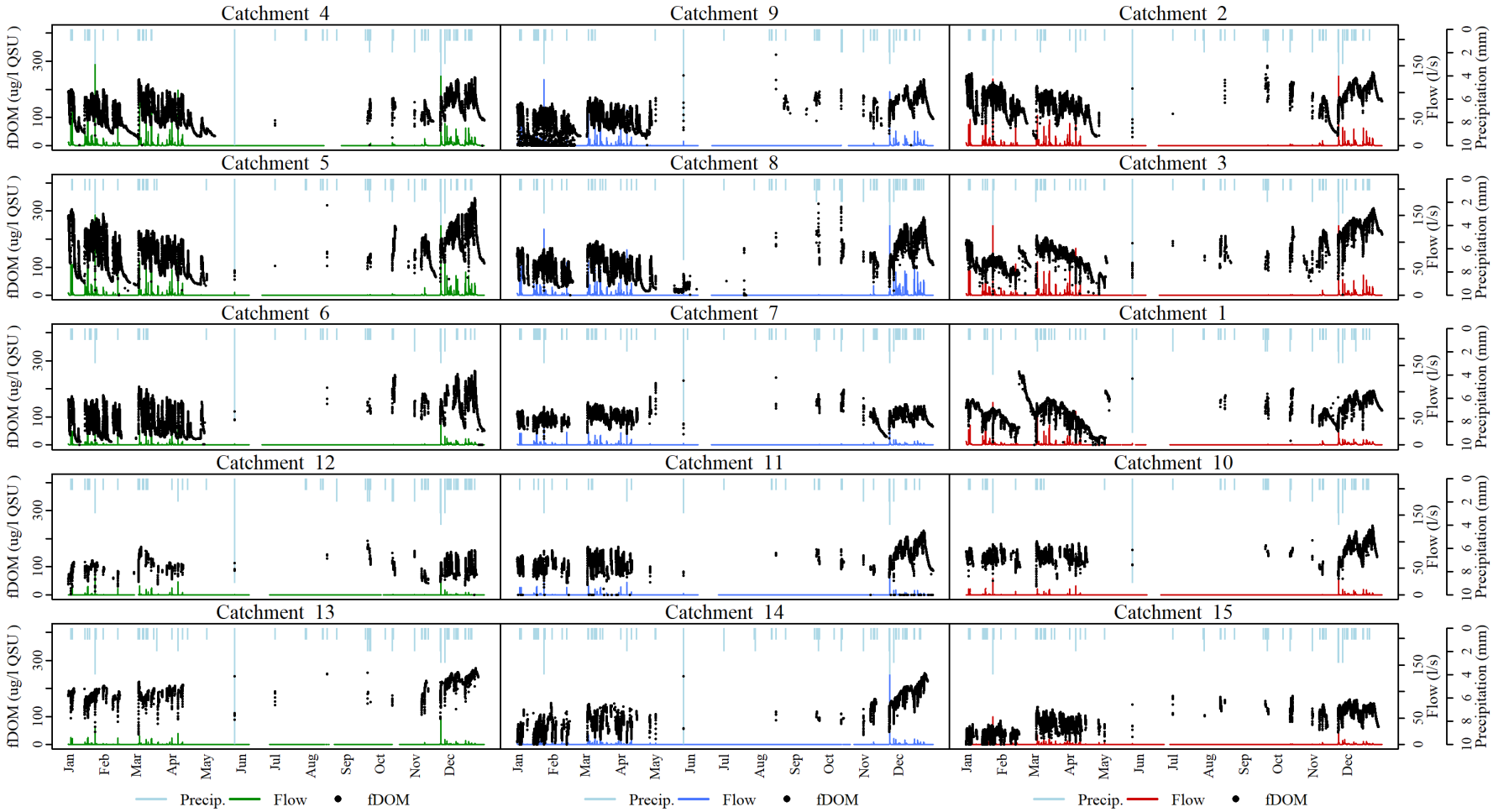

Figure 32: Time series of precipitation, flow and dissolved organic matter (fDOM)

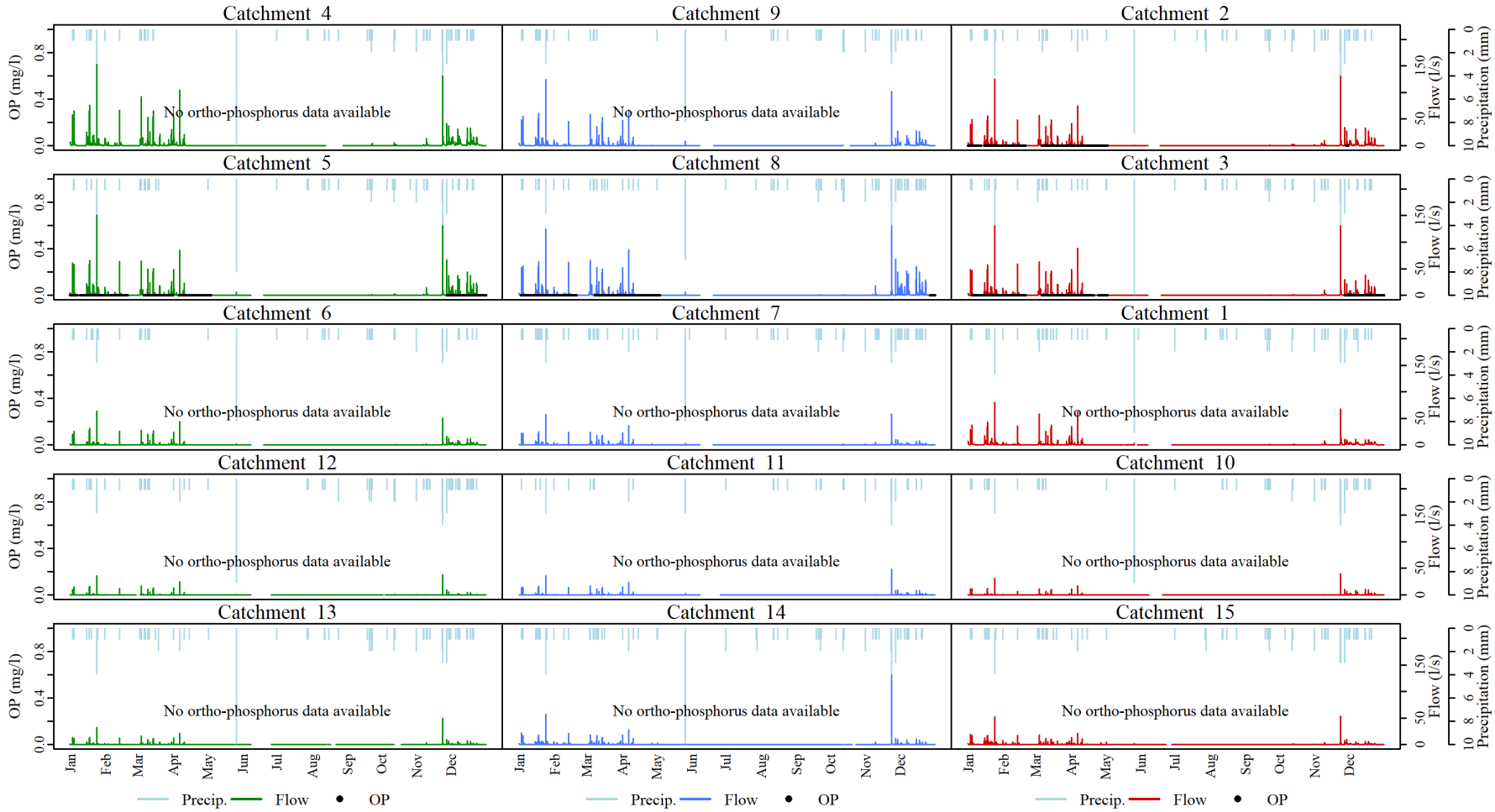

Figure 33: Time series of precipitation, flow and ortho-phosphorus (OP)

1.6 Correlations

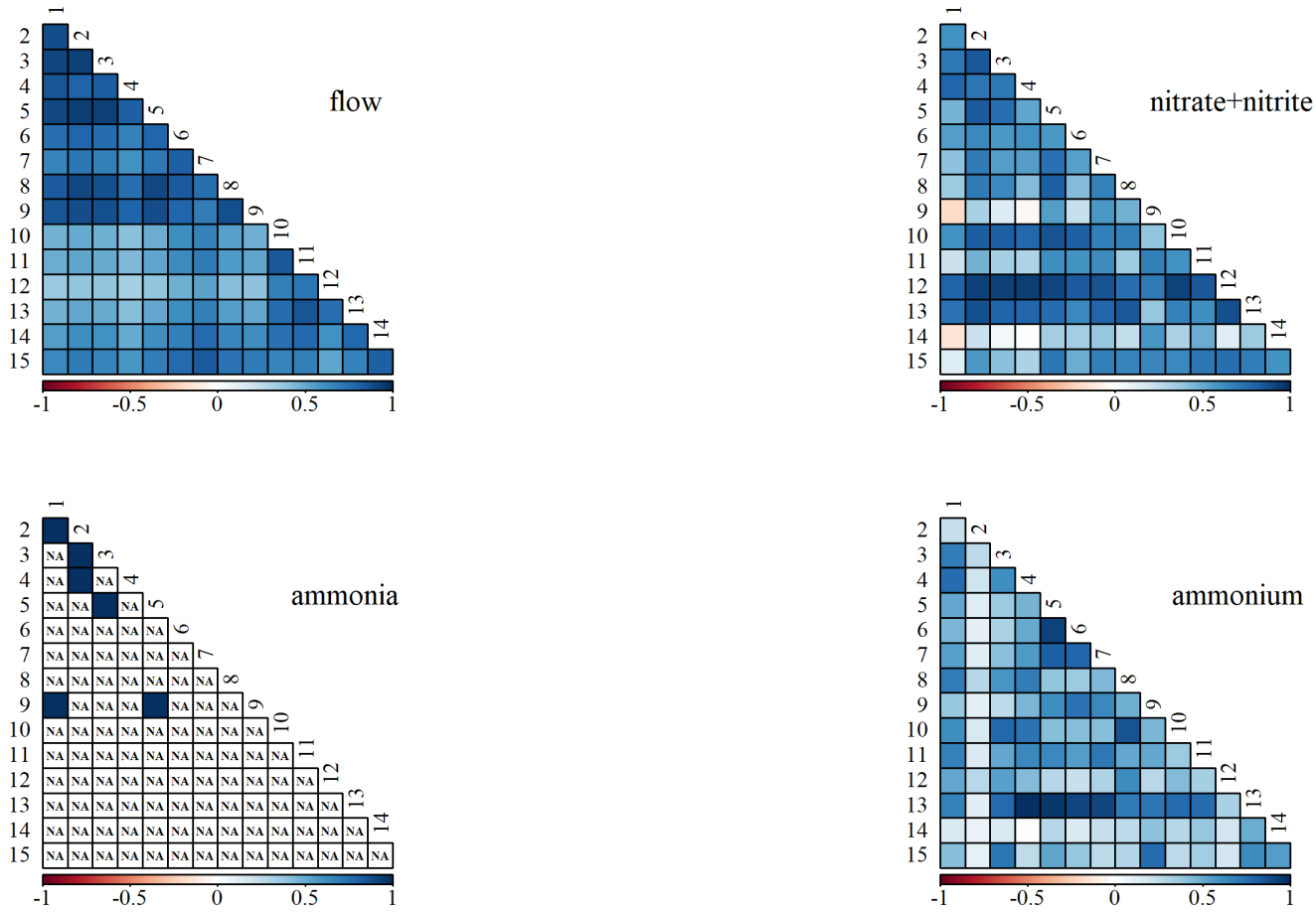

Figure 34: Correlations between catchments - flow, nitrate+nitrite, ammonia, ammonium

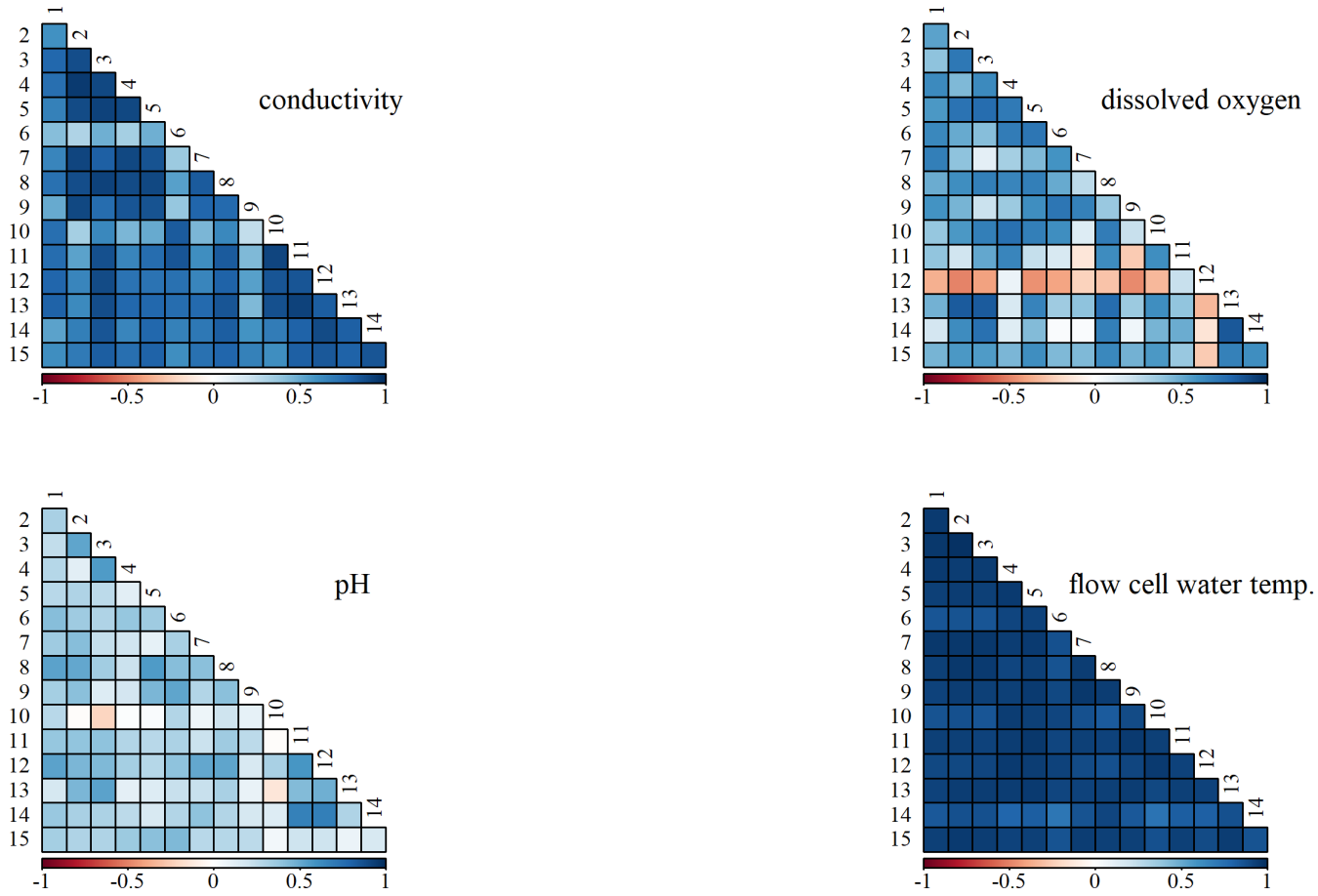

Figure 35: Correlations between catchments - conductivity, dissolved oxygen, pH, flow cell water temperature

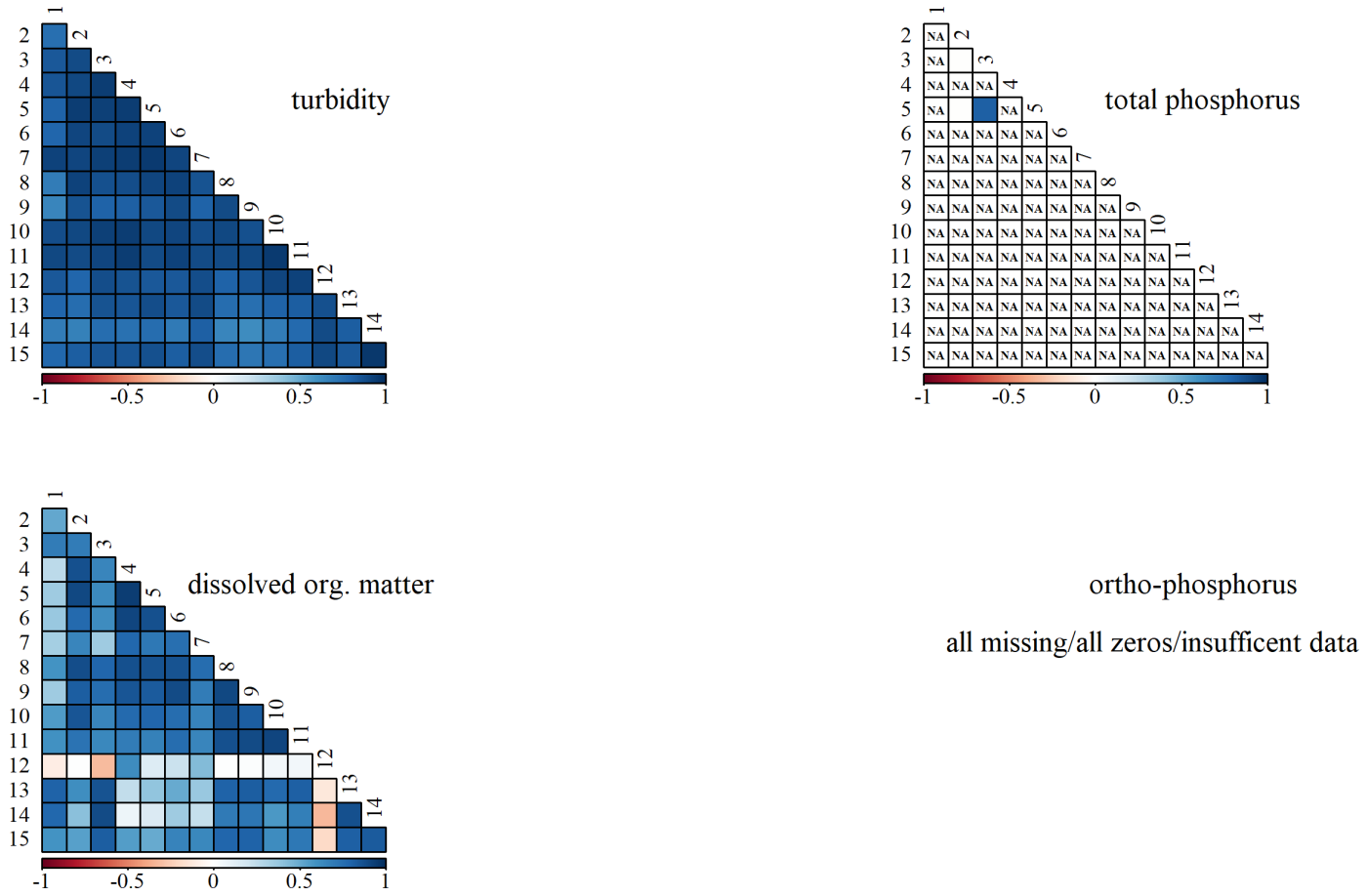

Figure 36: Correlations between catchments - turbidity, total phosphorus, dissolved organic matter, ortho-phosphorus

2 MONTHLY

2.1 Flow duration curves

Data are in triplet/catchment order with catchments arranged from largest to smallest across the page. NB. Data may include missing values.

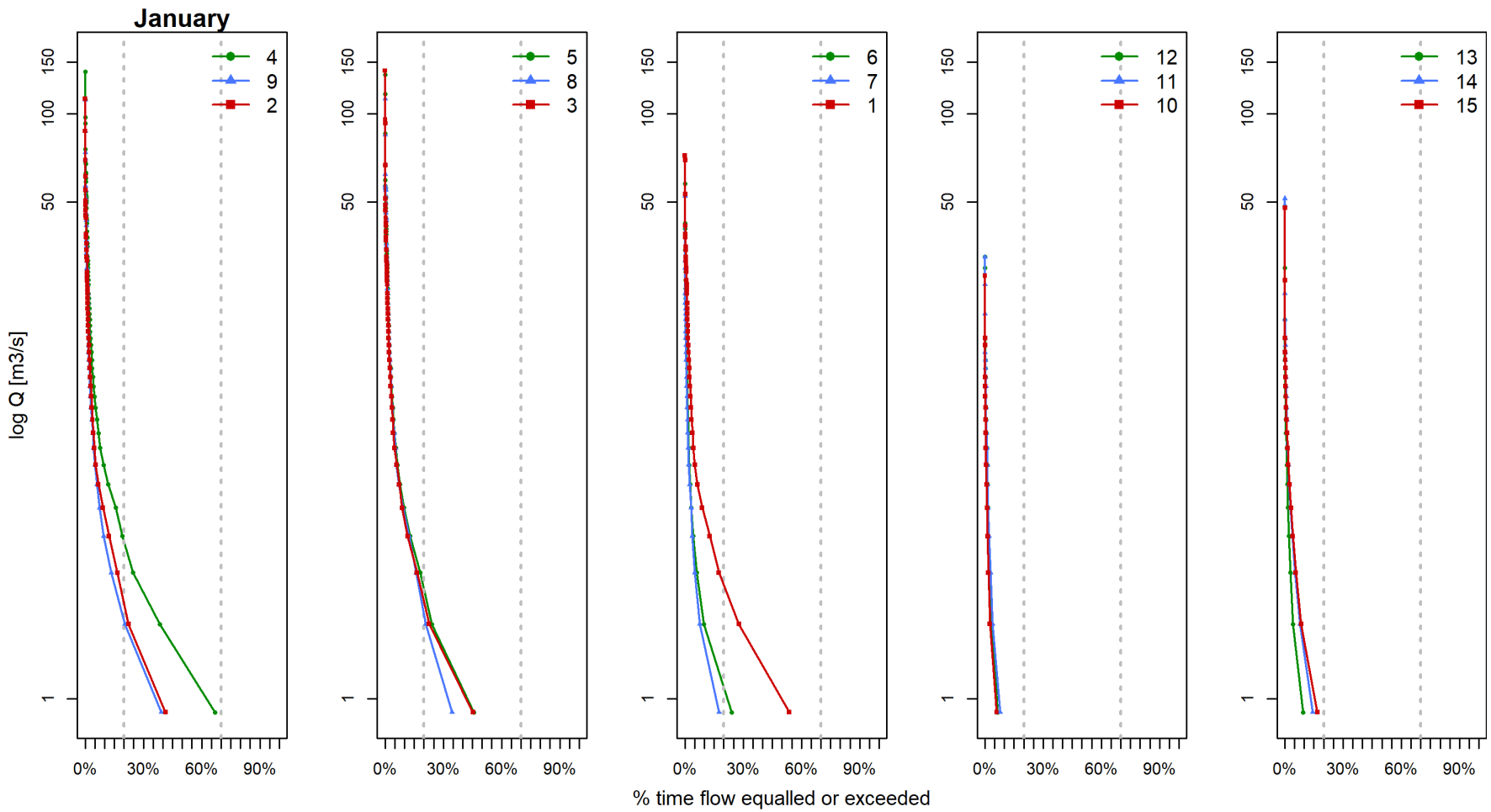

Figure 37: Flow duration curves for January

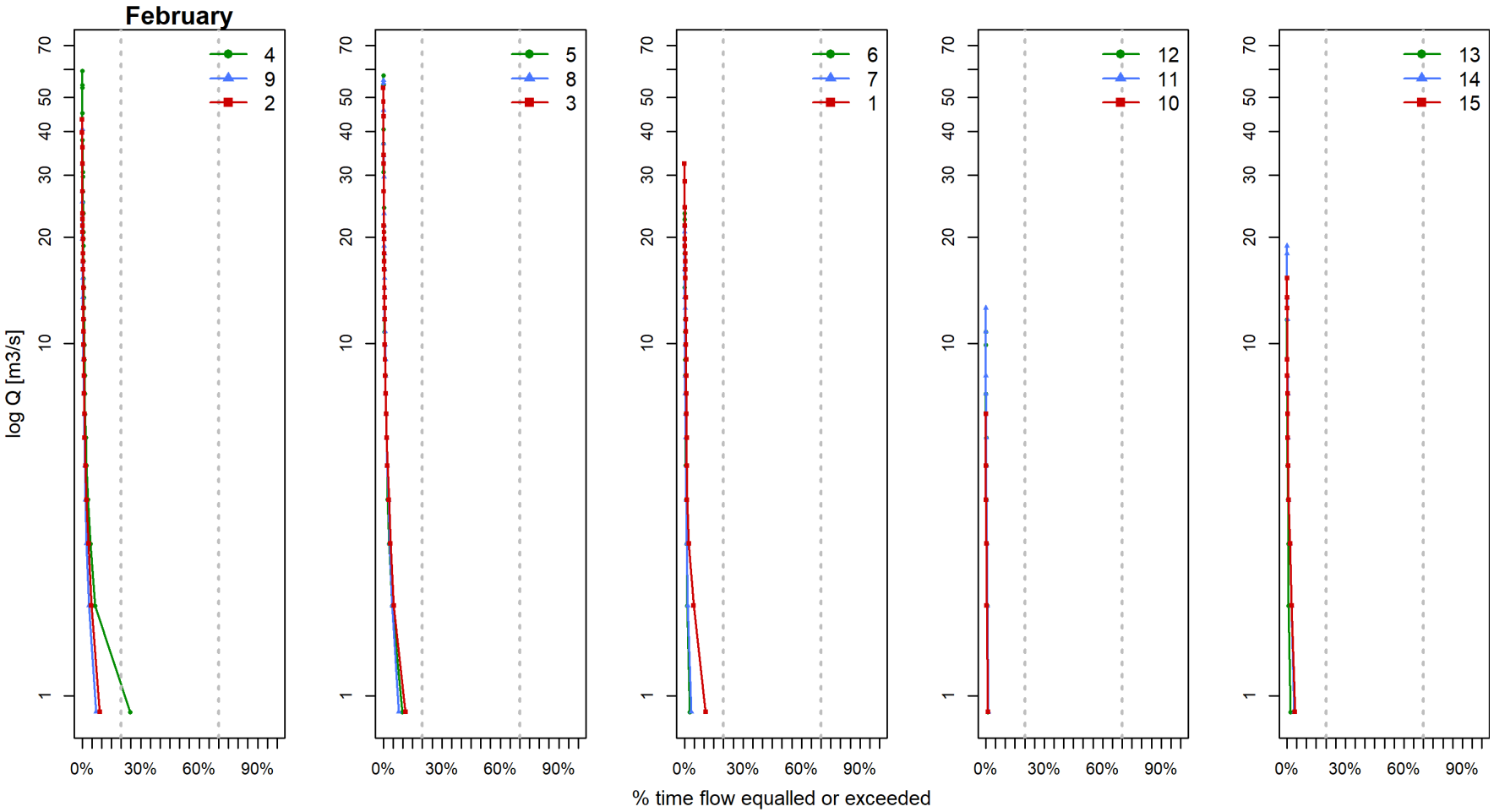

Figure 38: Flow duration curves for February

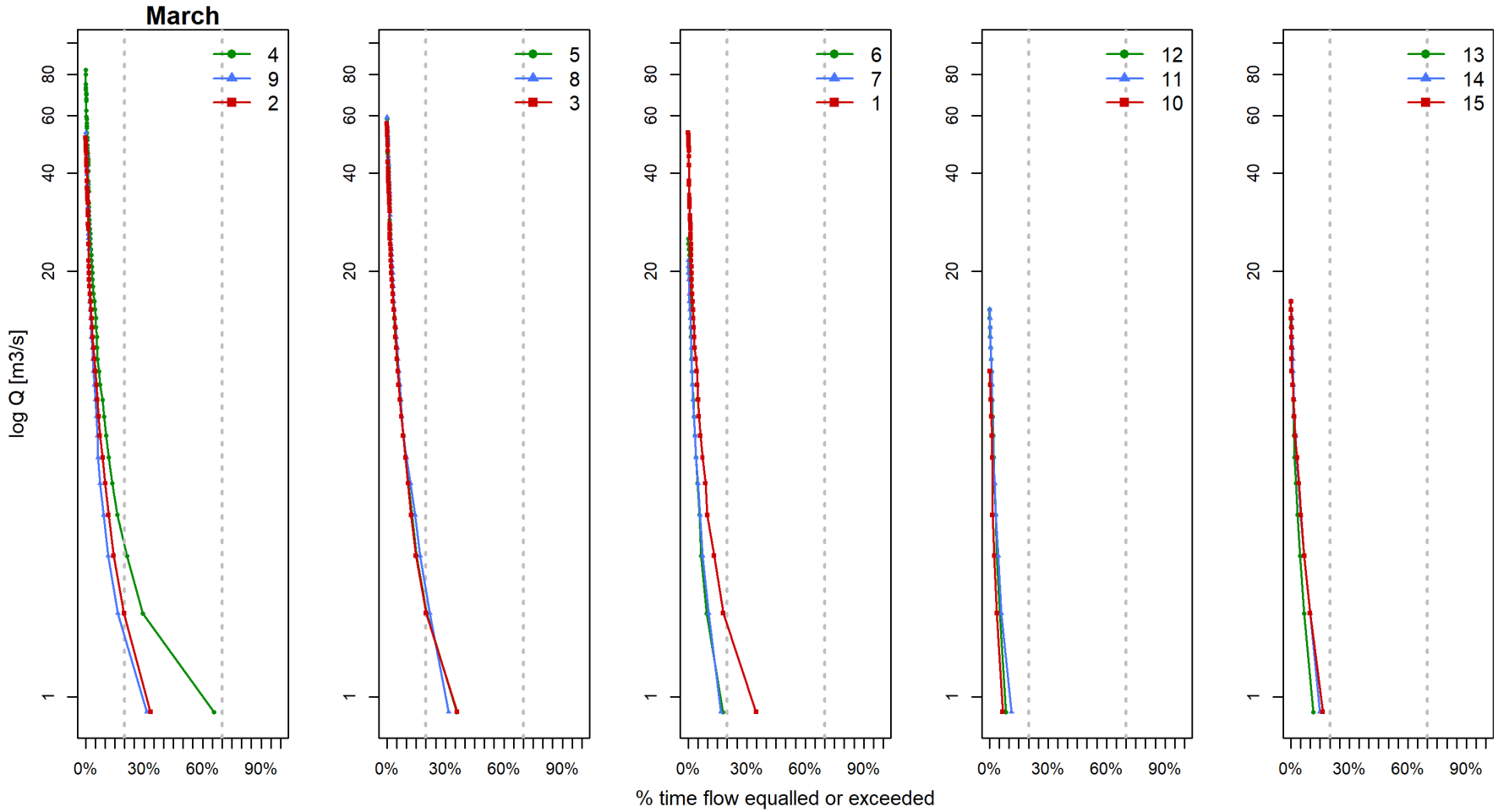

Figure 39: Flow duration curves for March

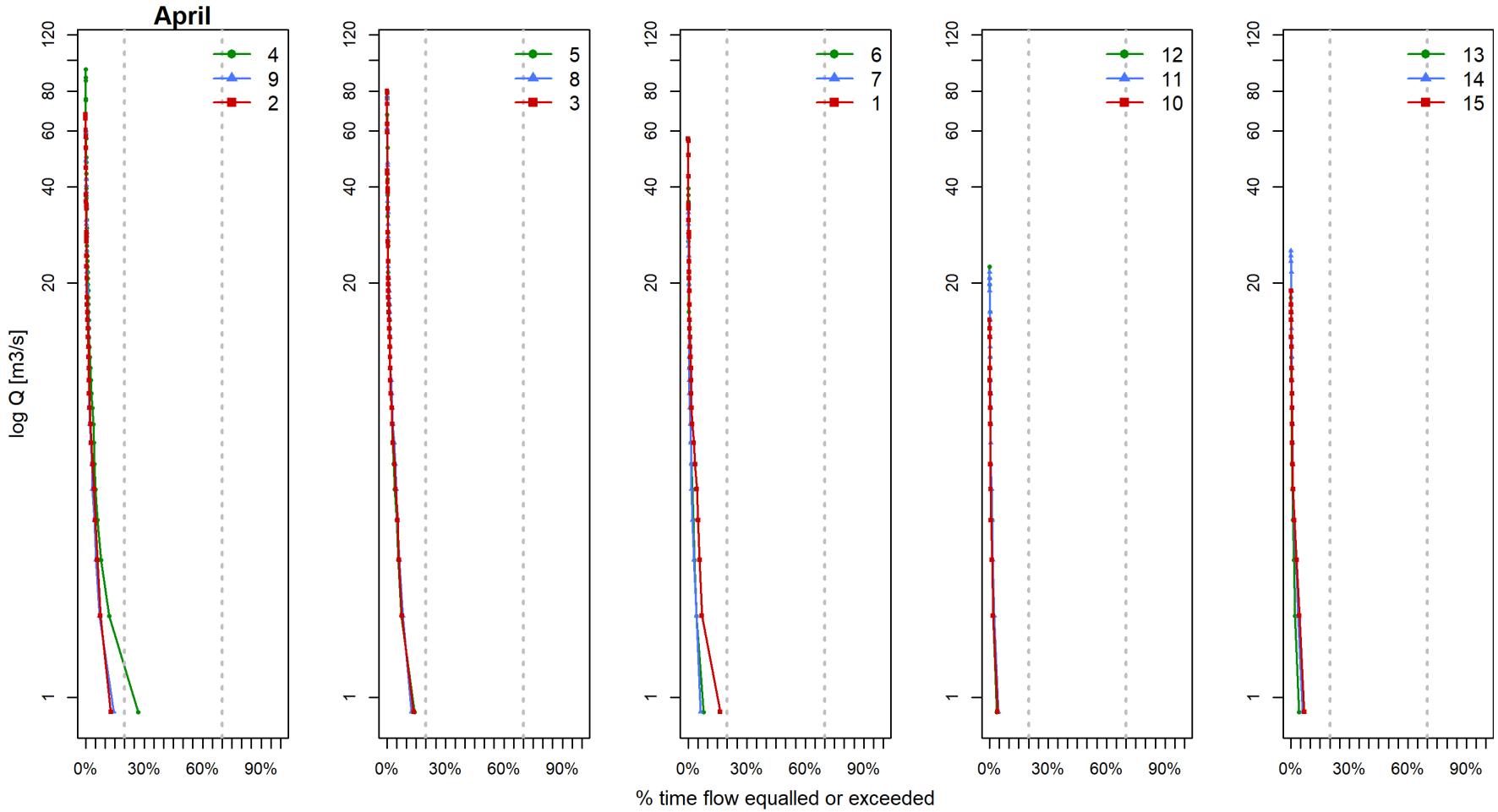

Figure 40: Flow duration curves for April

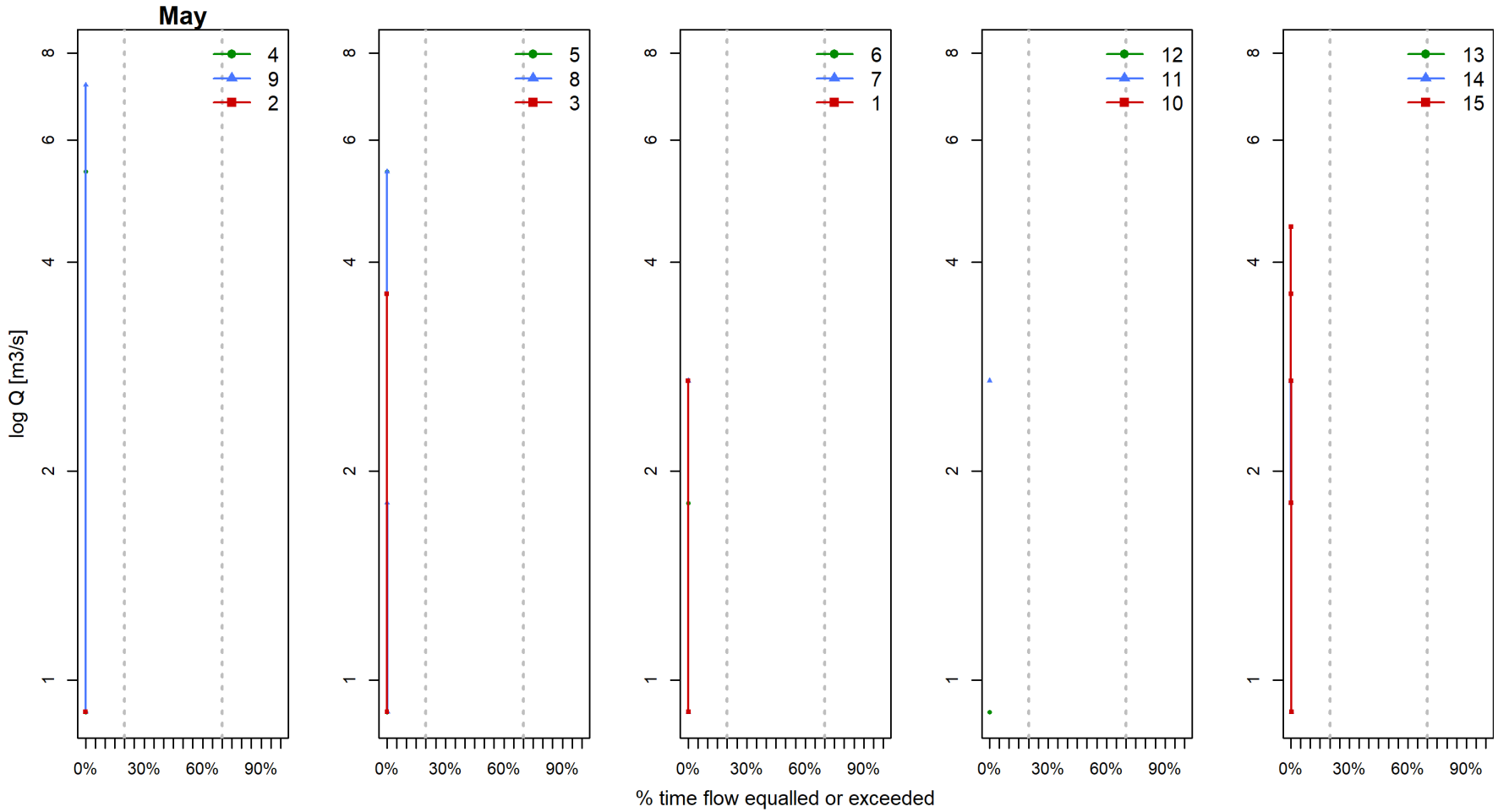

Figure 41: Flow duration curves for May

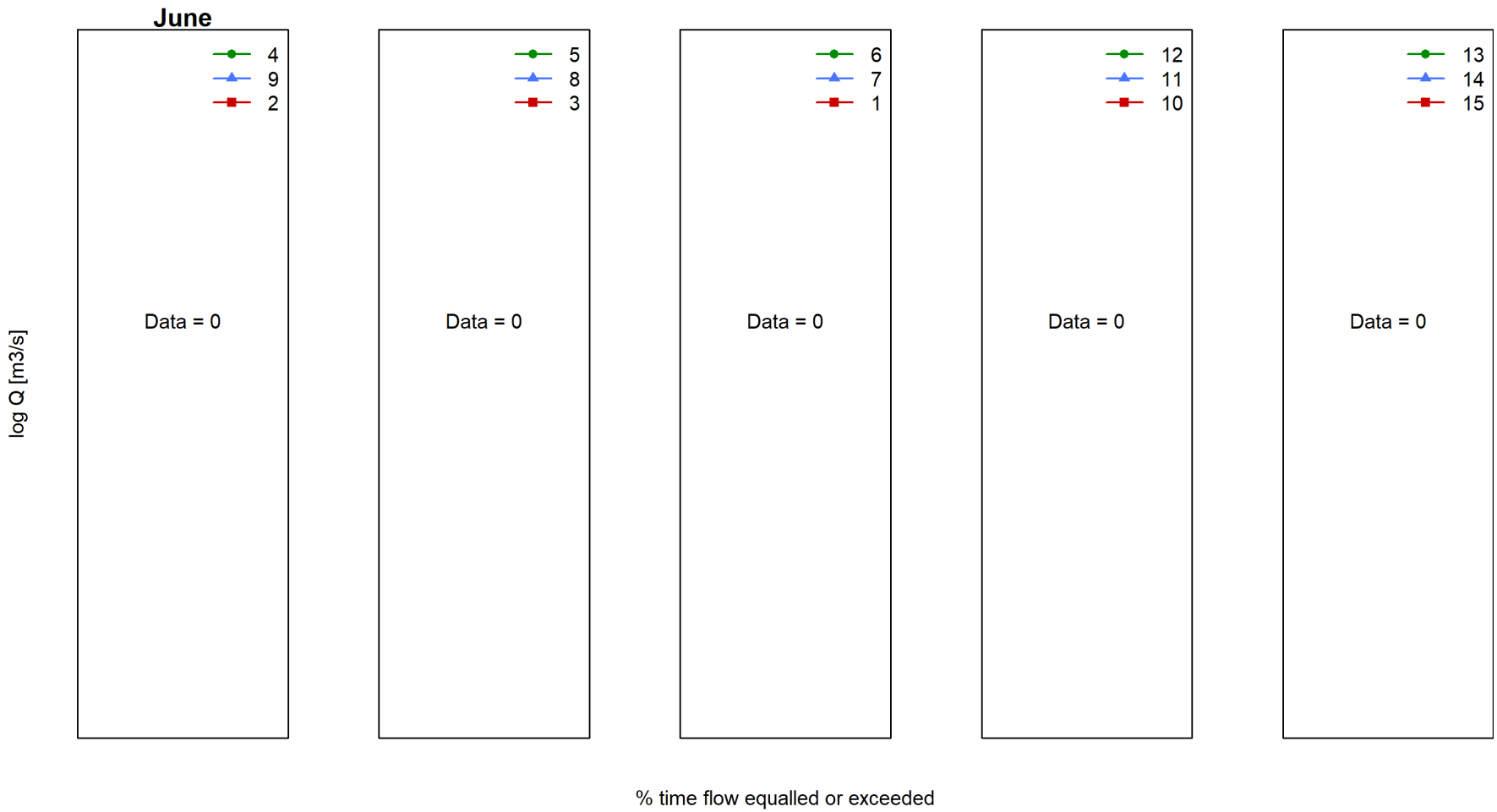

Figure 42: Flow duration curves for June

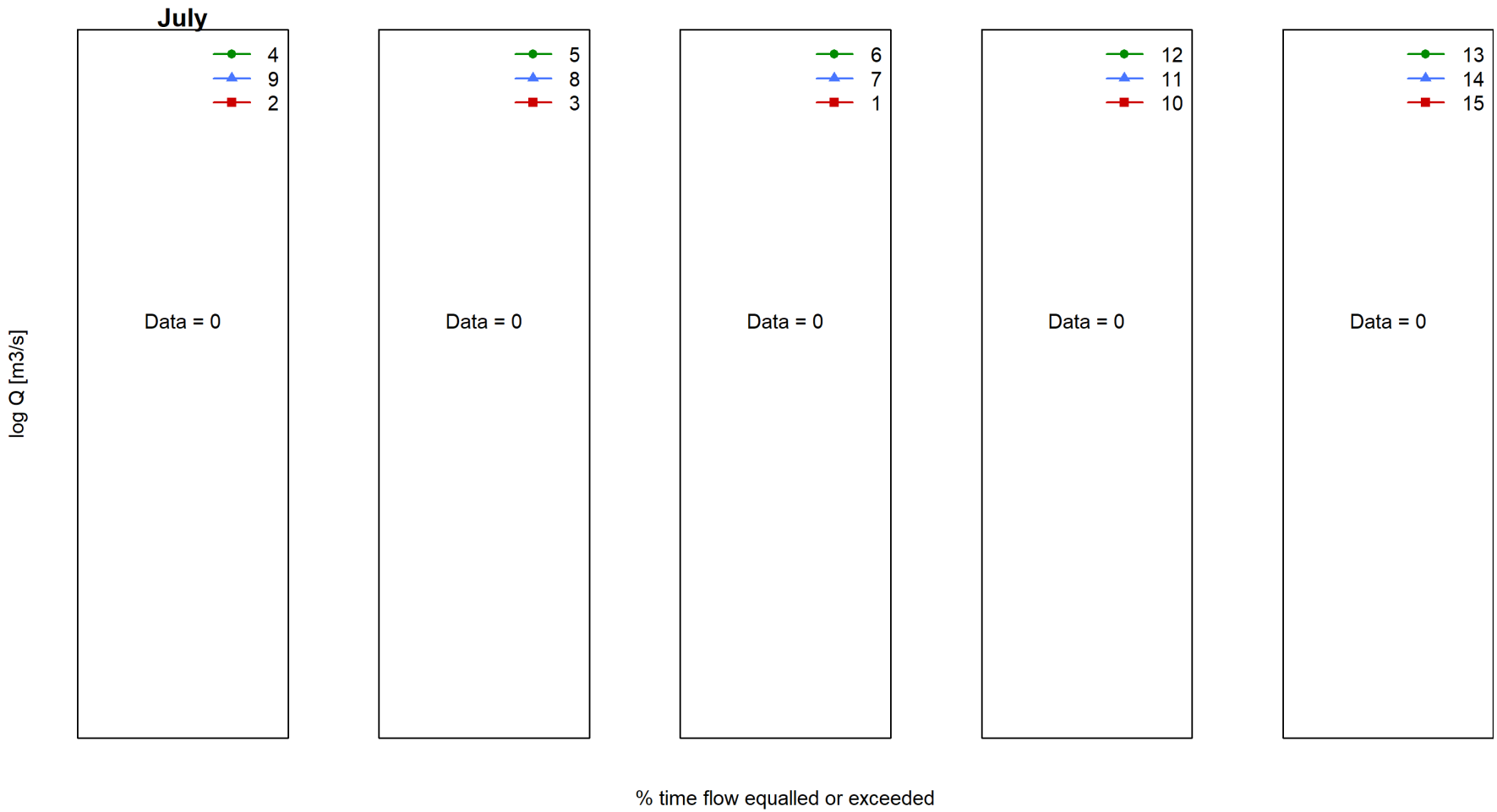

Figure 43: Flow duration curves for July

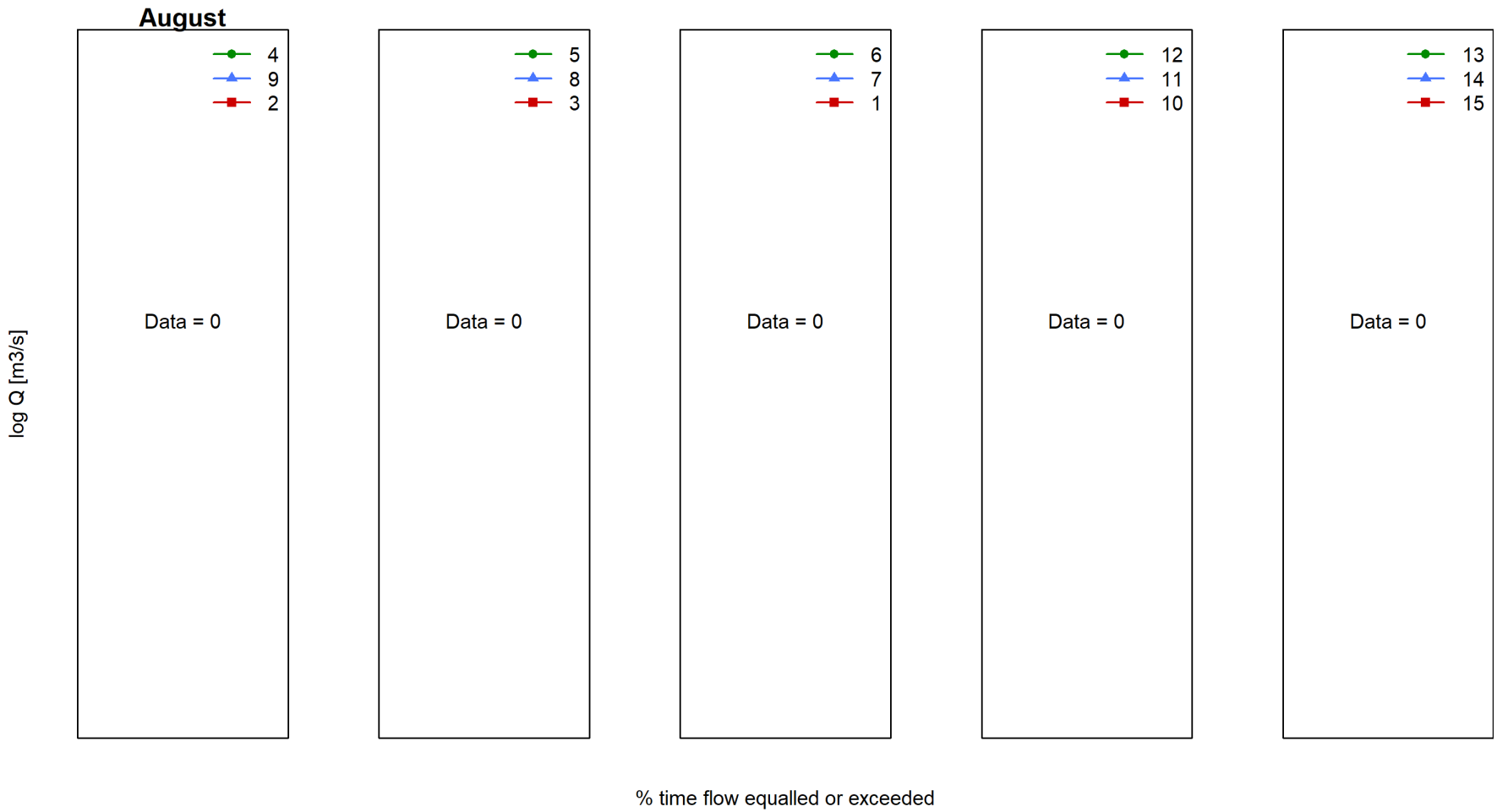

Figure 44: Flow duration curves for August

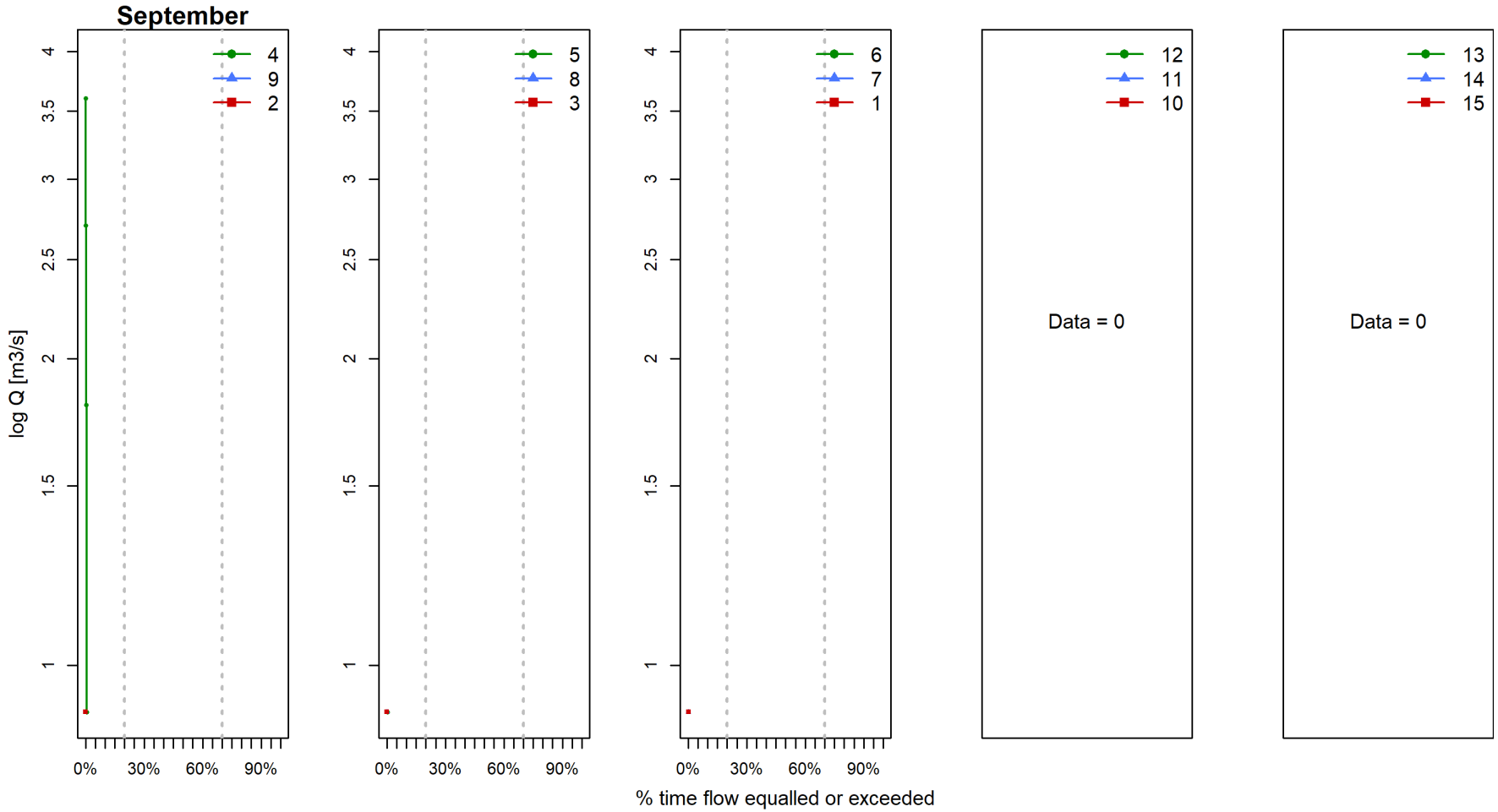

Figure 45: Flow duration curves for September

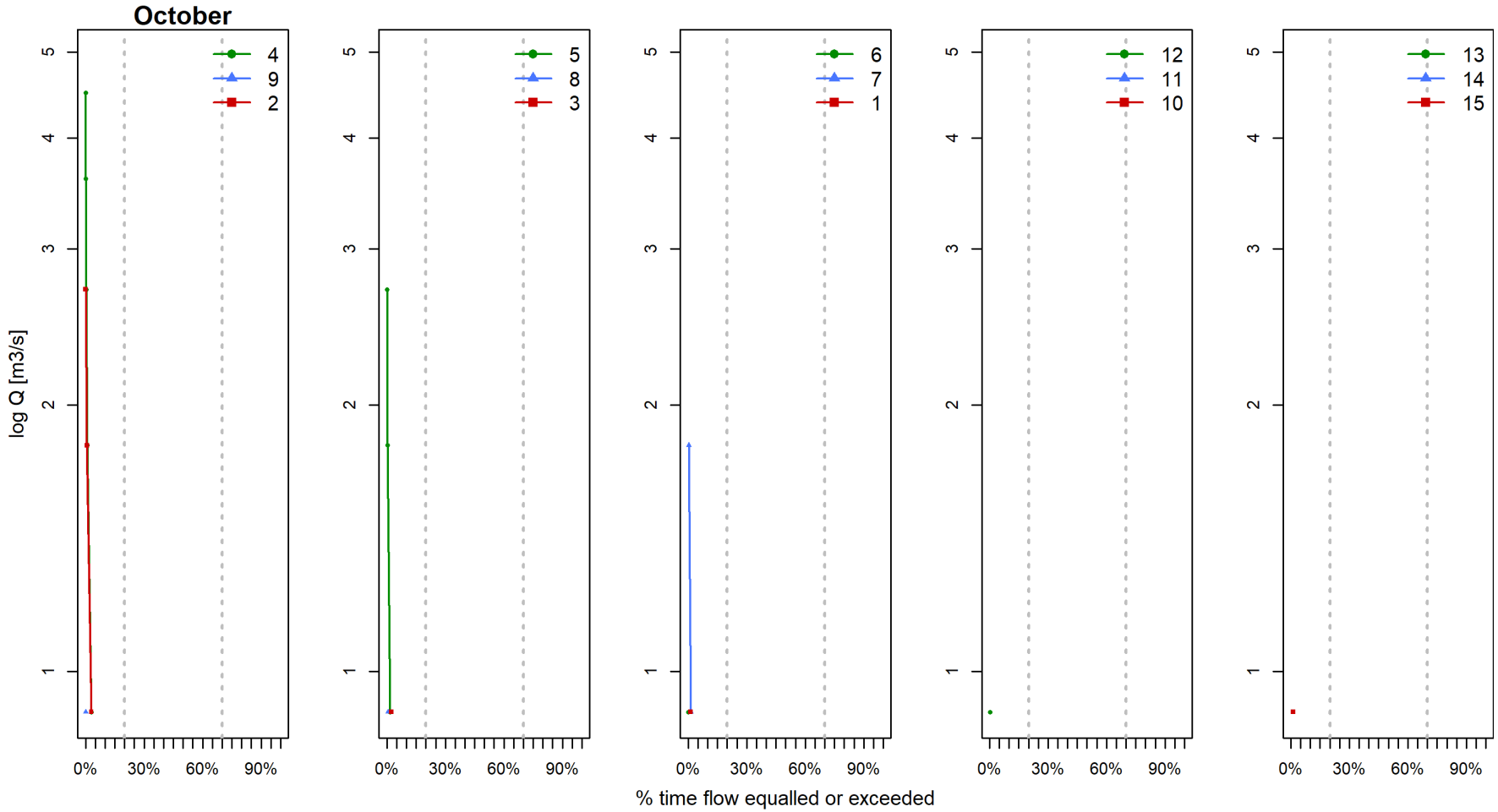

Figure 46: Flow duration curves for October

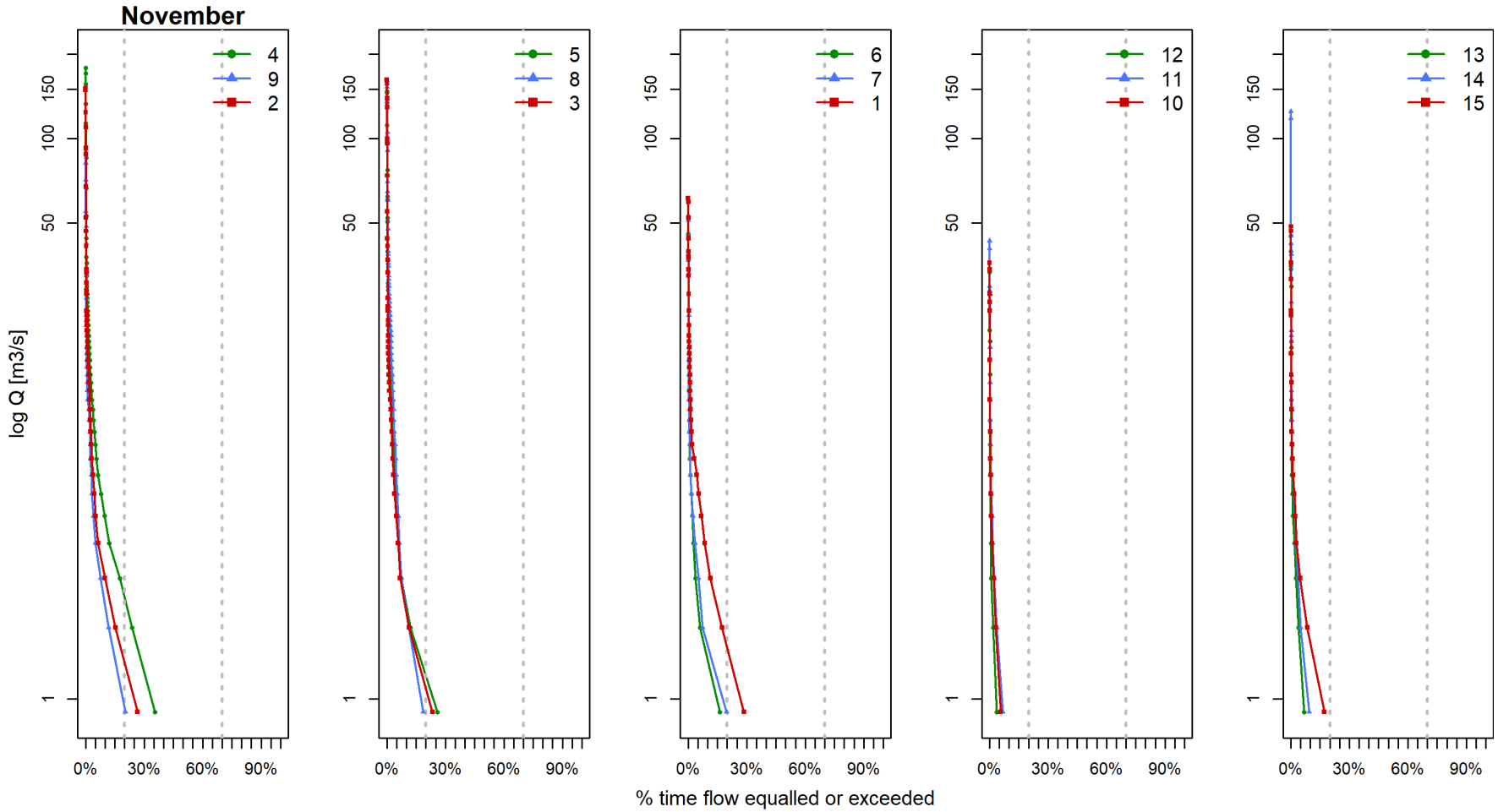

Figure 47: Flow duration curves for November

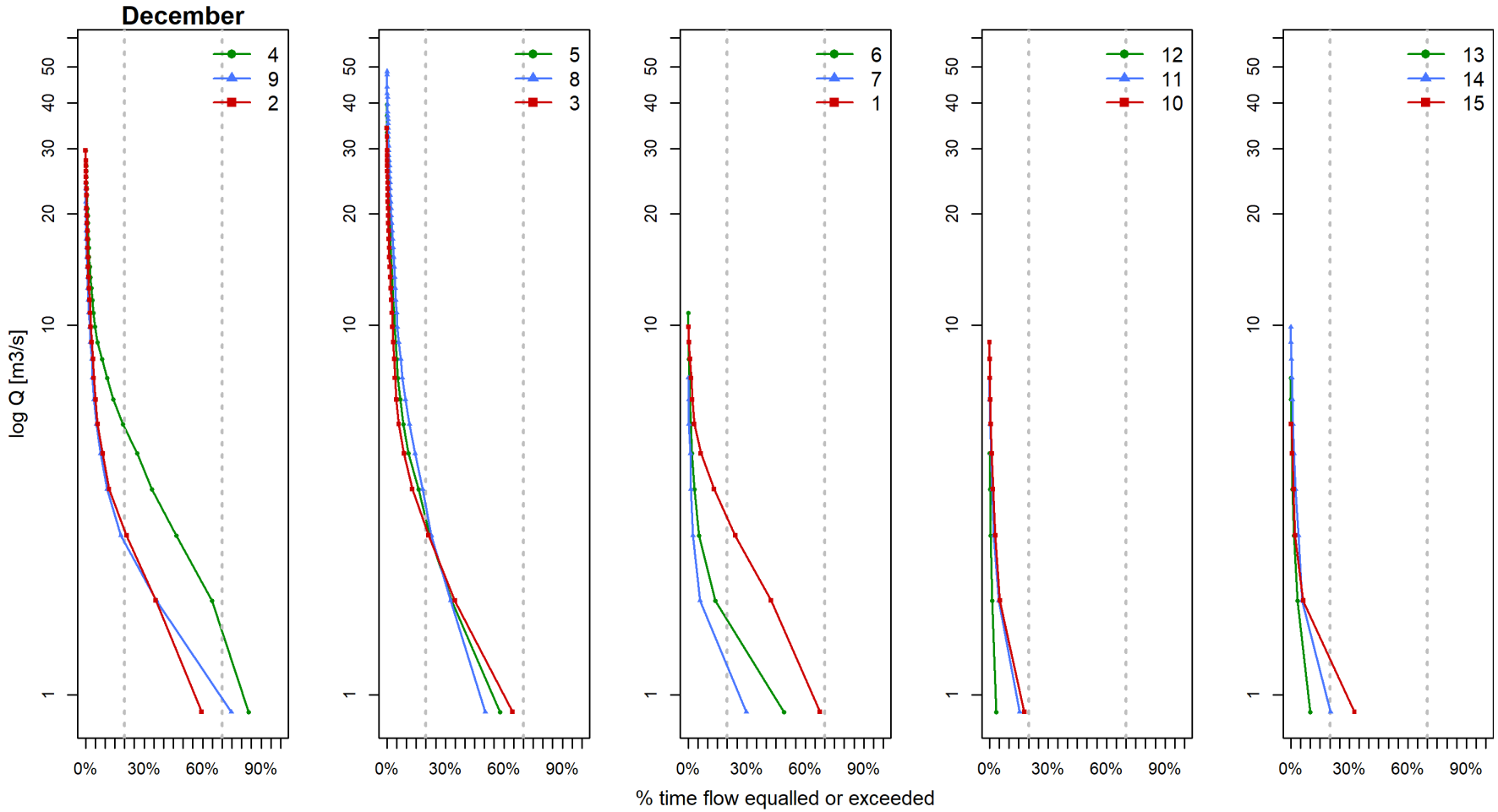

Figure 48: Flow duration curves for December

2.2 Means

Please be aware that the means are based on data that may contain missing values. Full data summaries are available on request.

Vertical lines = positive standard error of the mean. Values above bars = number of observations.

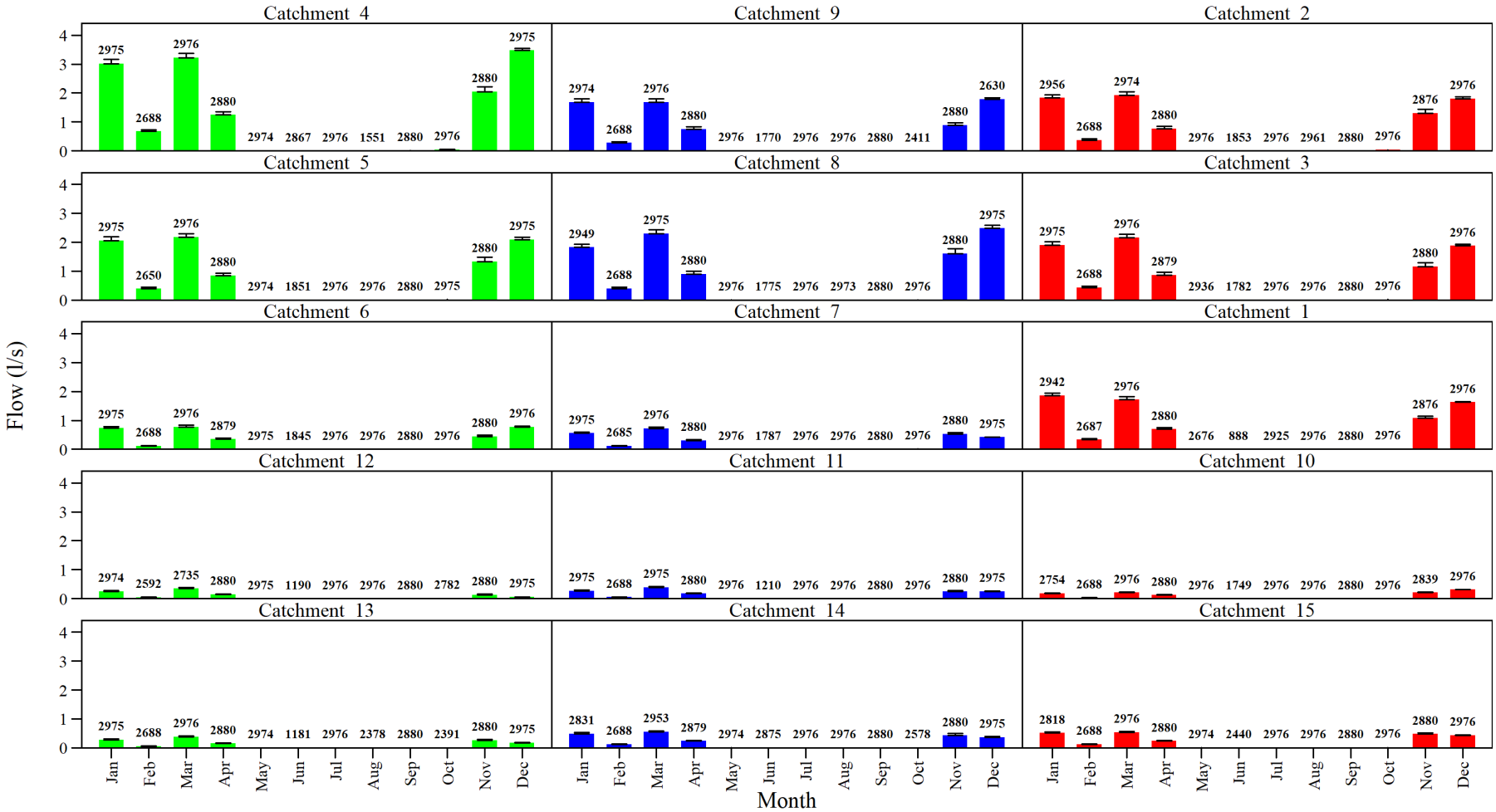

Figure 49: Monthly means for flow

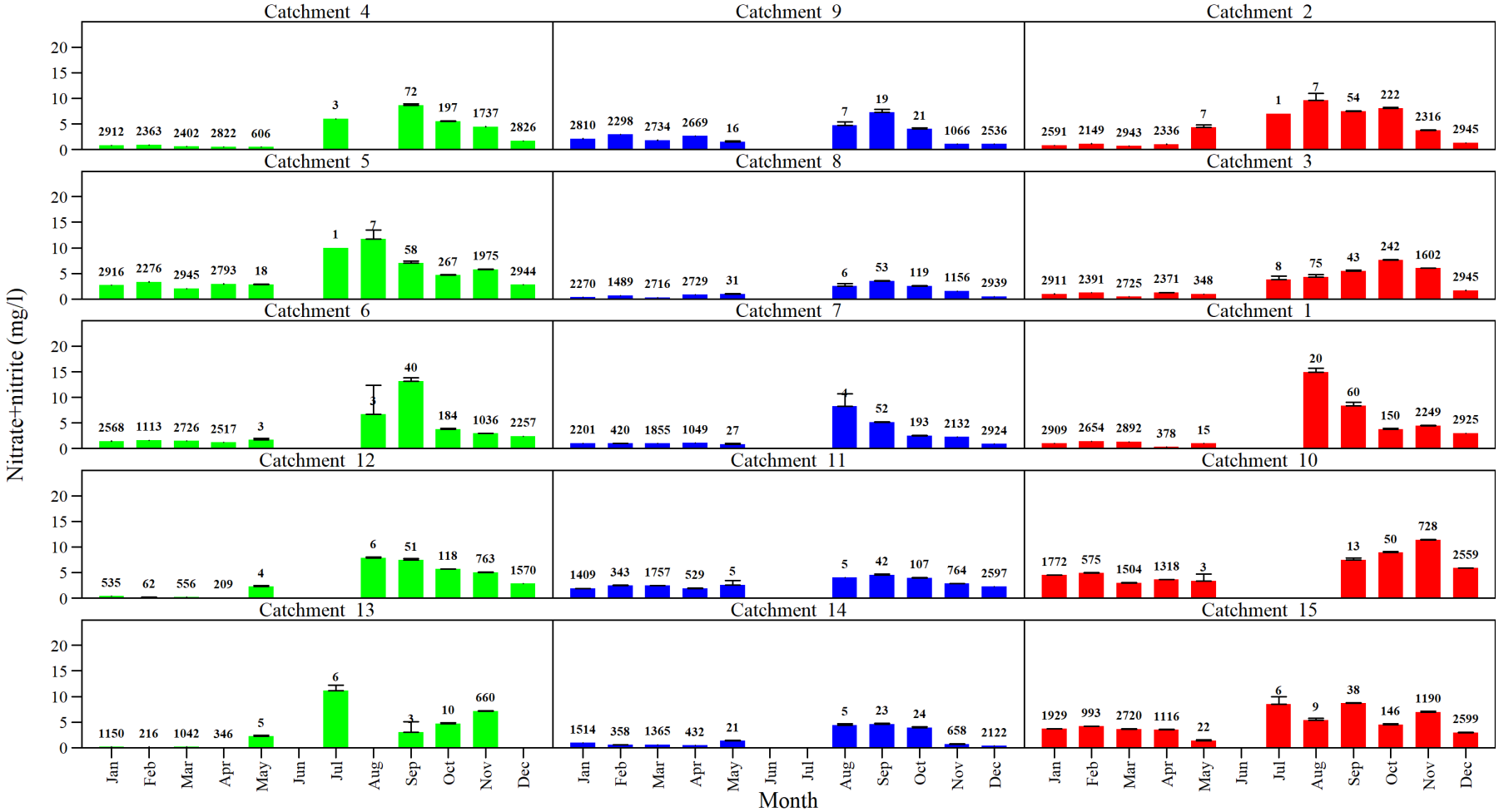

Figure 50: Monthly means for nitrate+nitrite

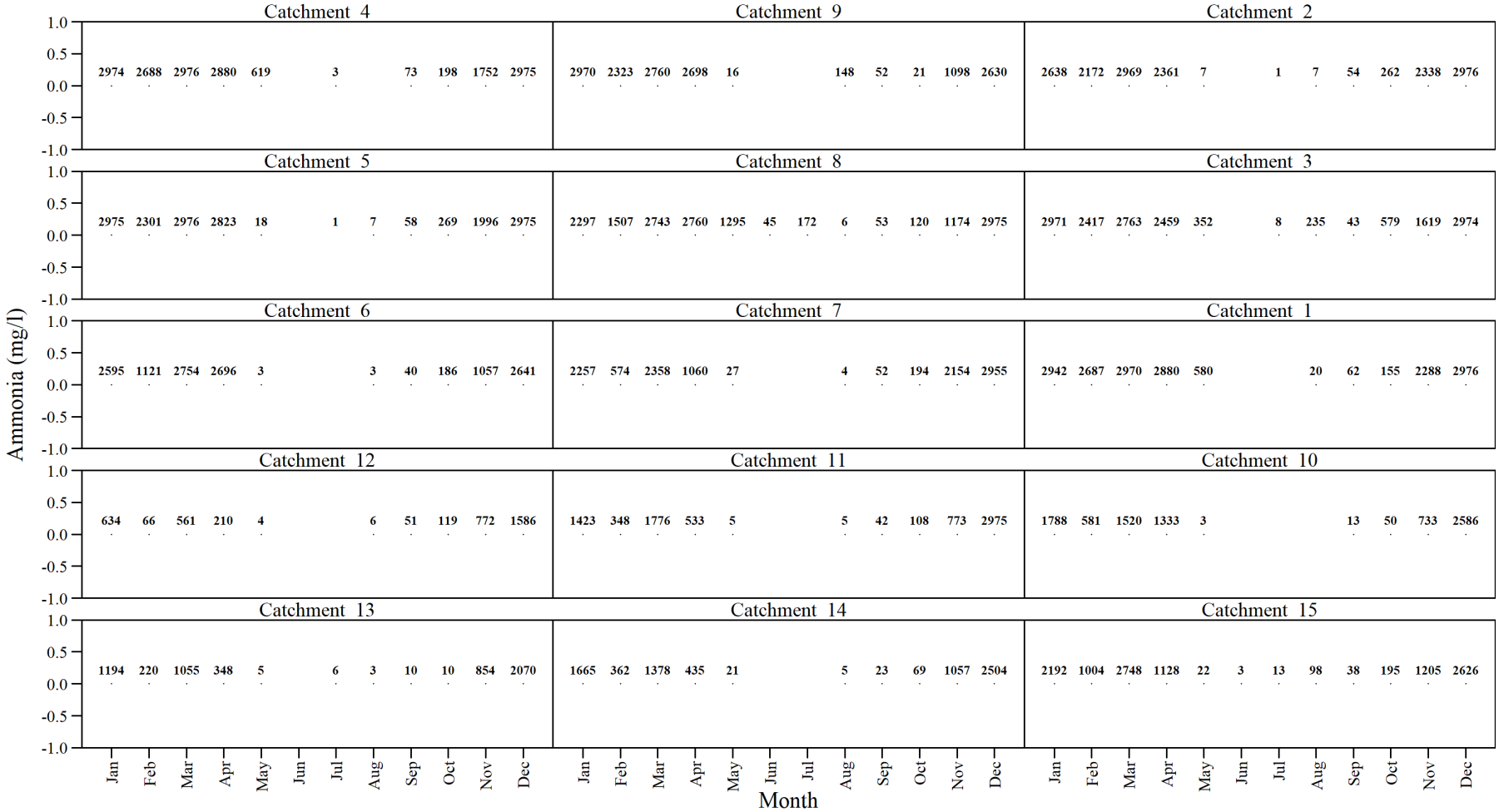

Figure 51: Monthly means for ammonia

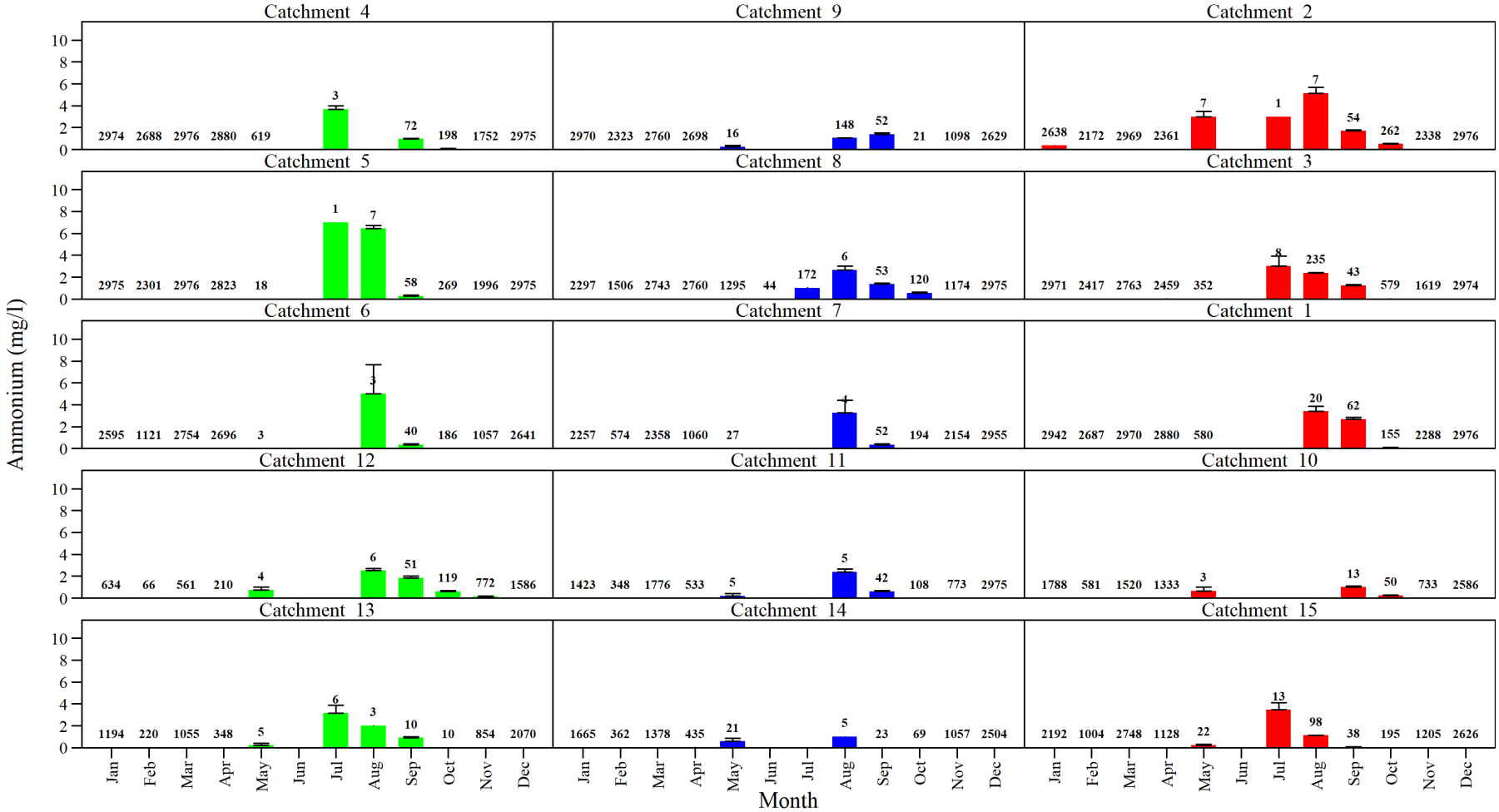

Figure 52: Monthly means for ammonium

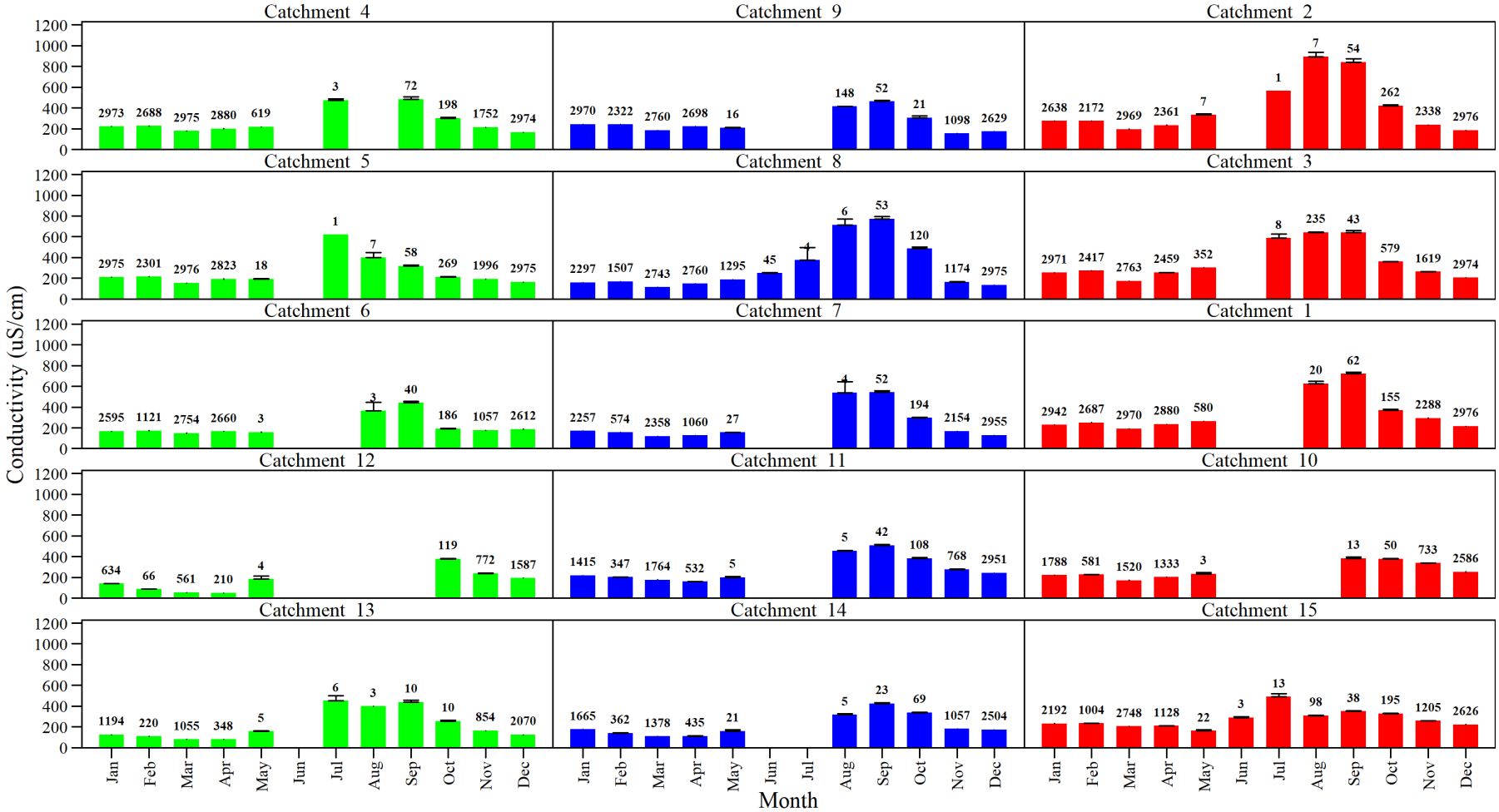

Figure 53: Monthly means for conductivity

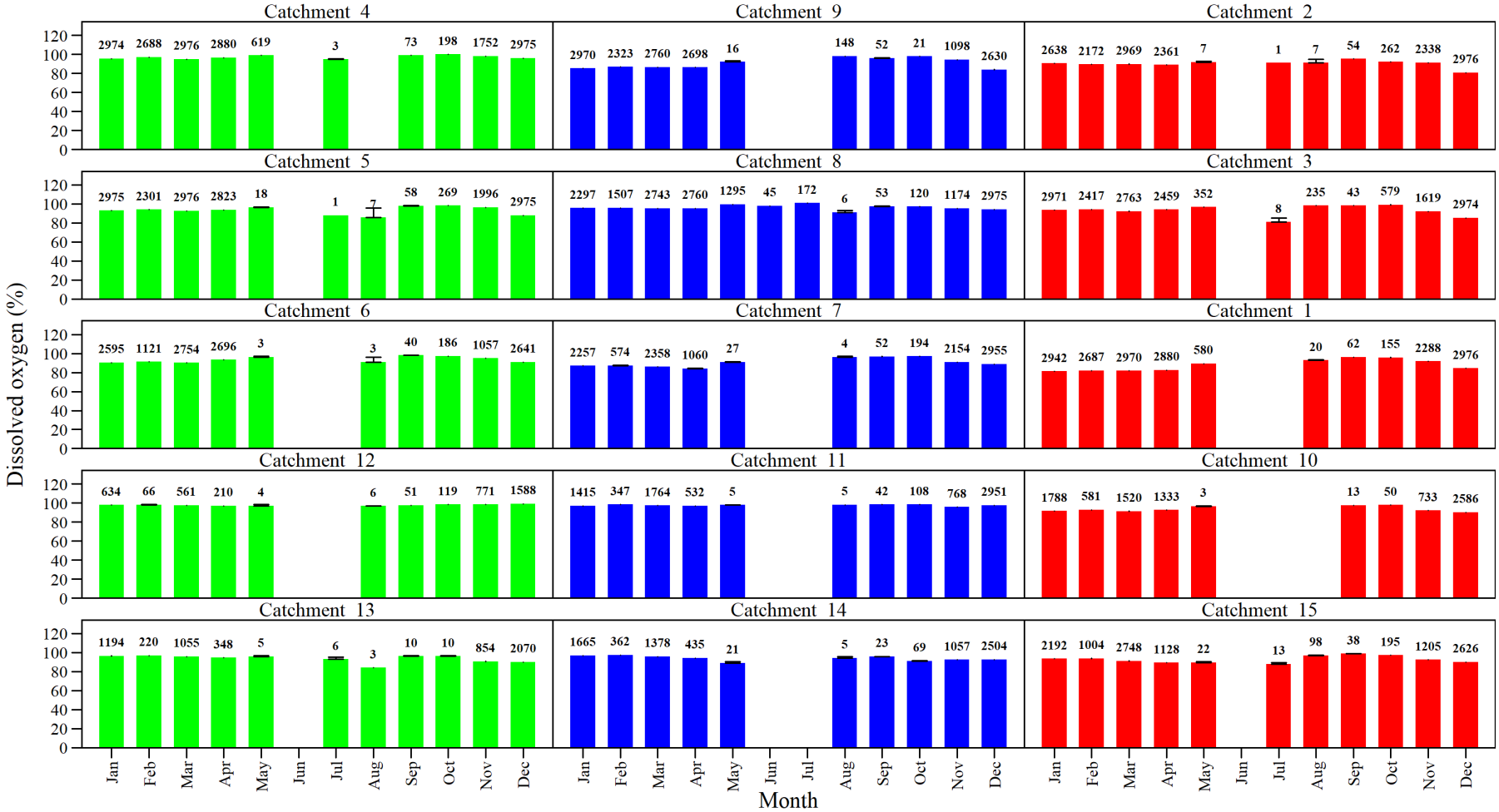

Figure 54: Monthly means for dissolved oxygen

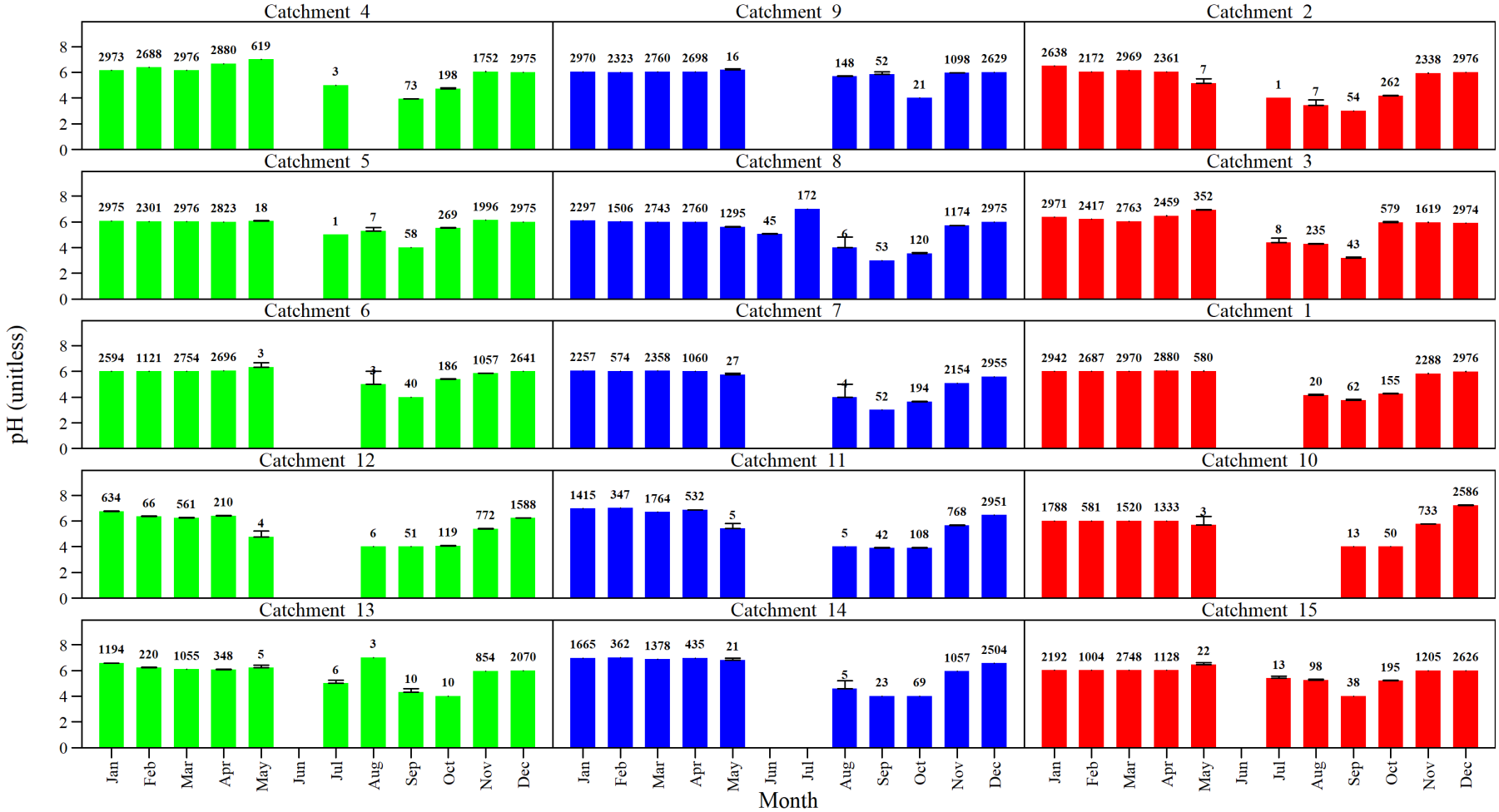

Figure 55: Monthly means for pH

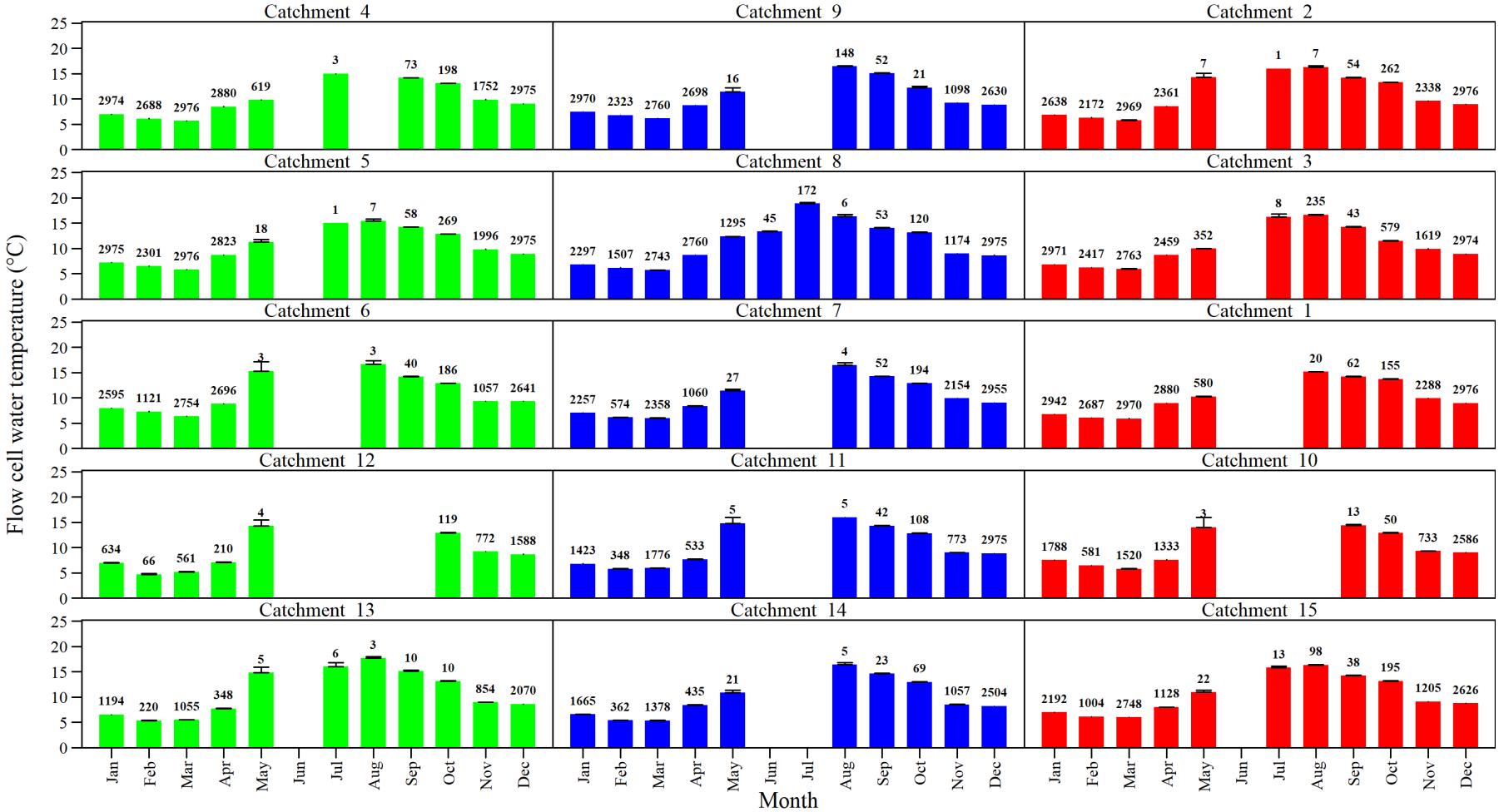

Figure 56: Monthly means for flow cell water temperature

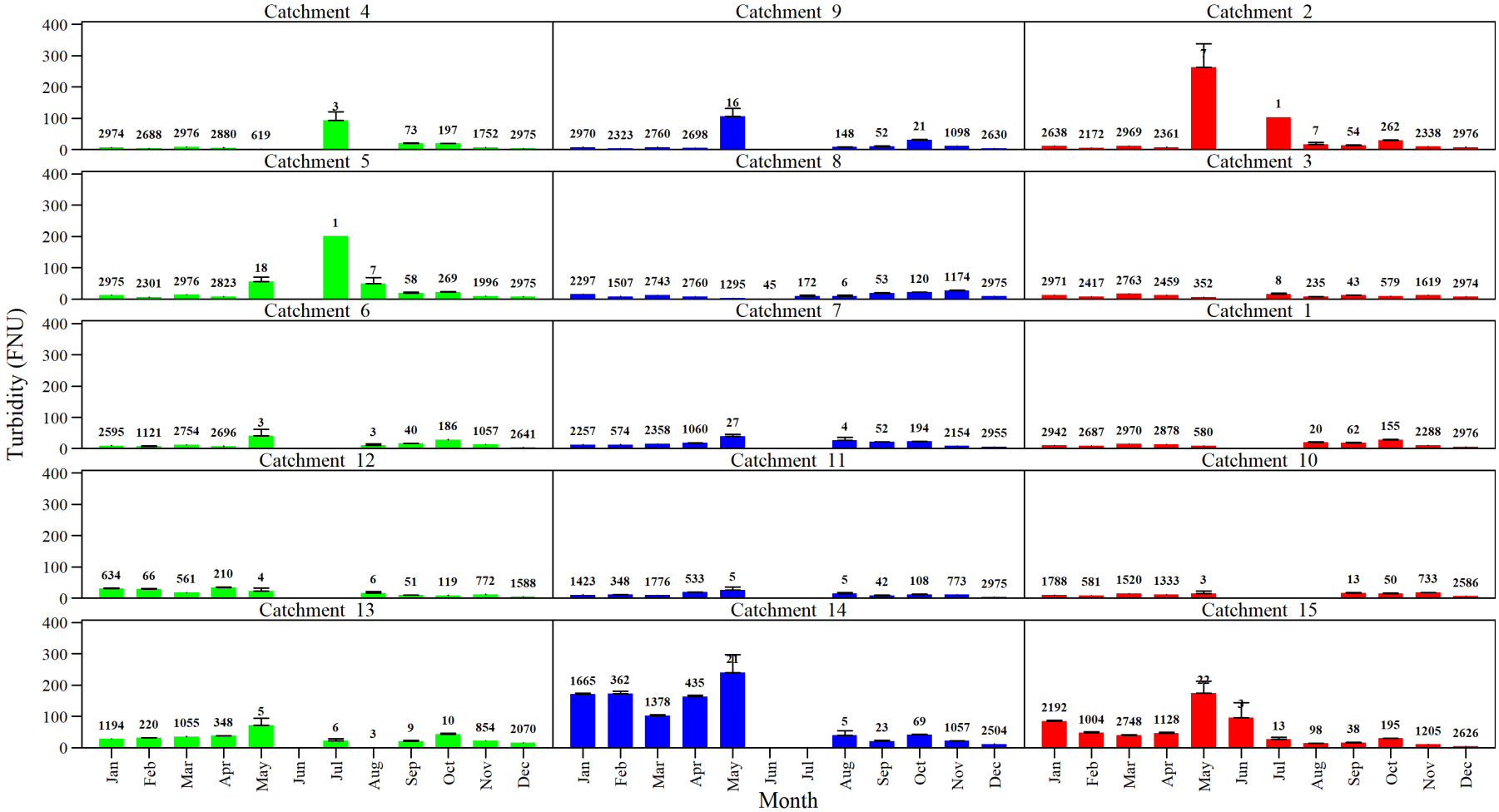

Figure 57: Monthly means for turbidity

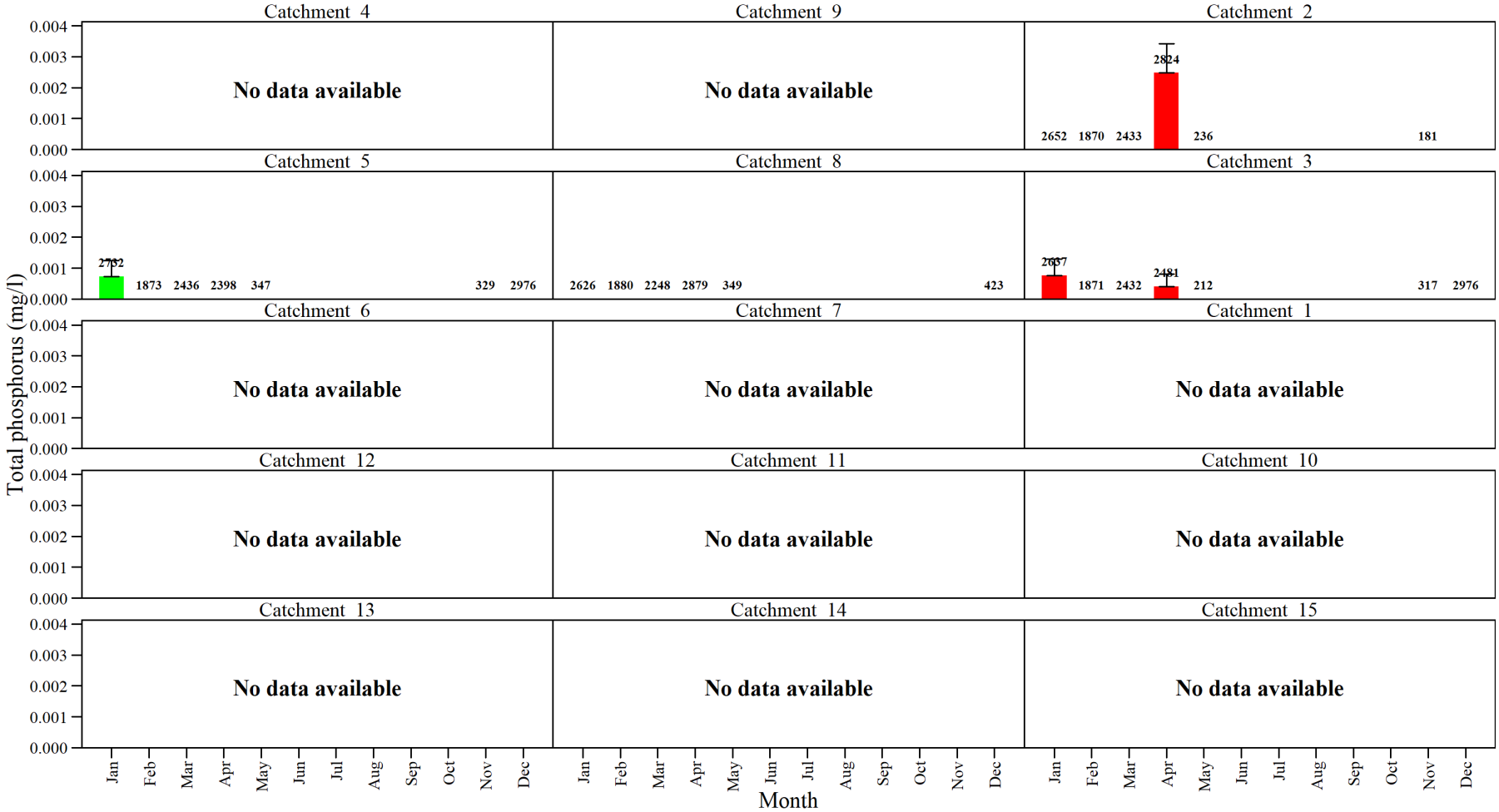

Figure 58: Monthly means for total phosphorus

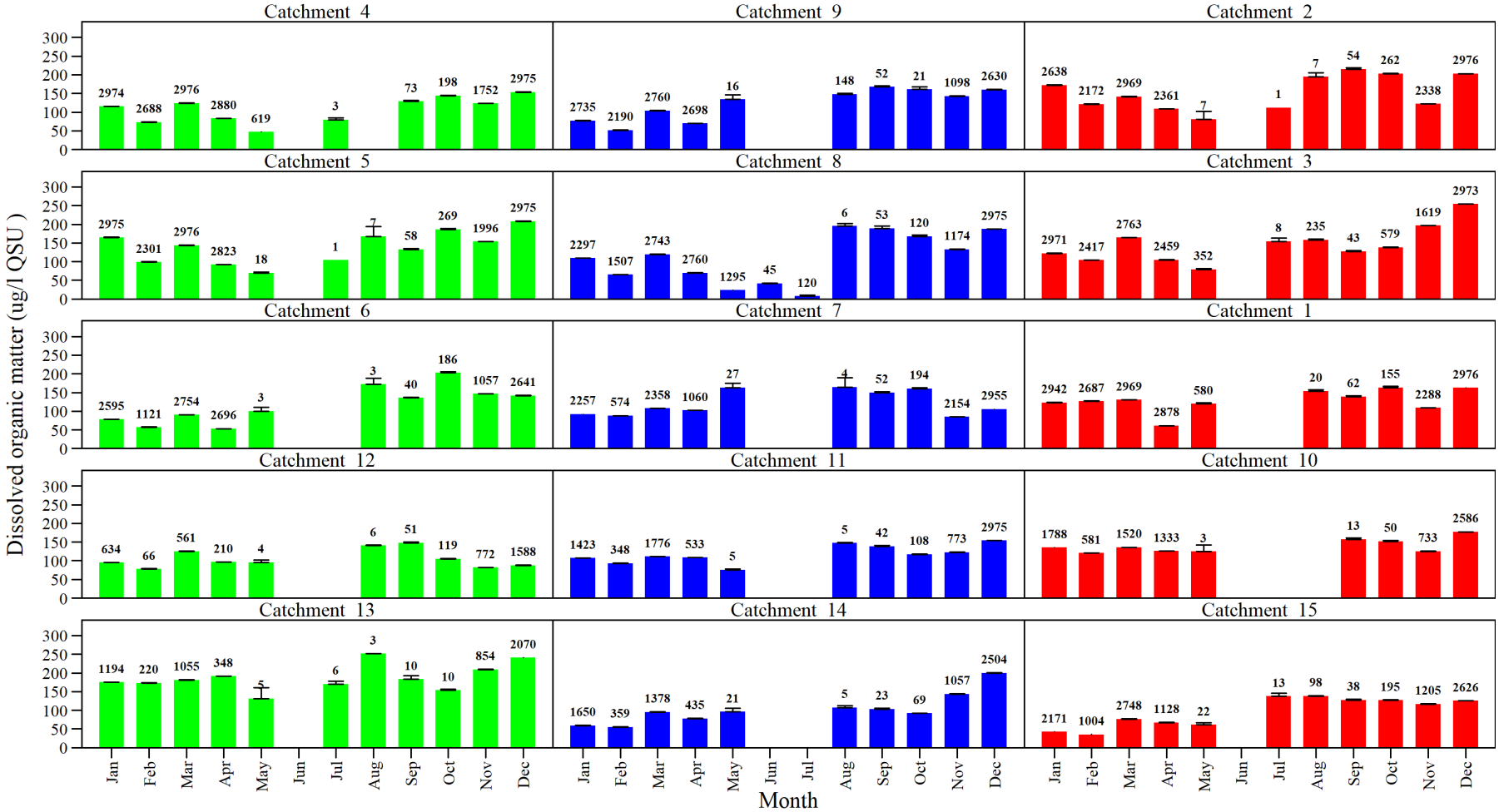

Figure 59: Monthly means for dissolved organic matter

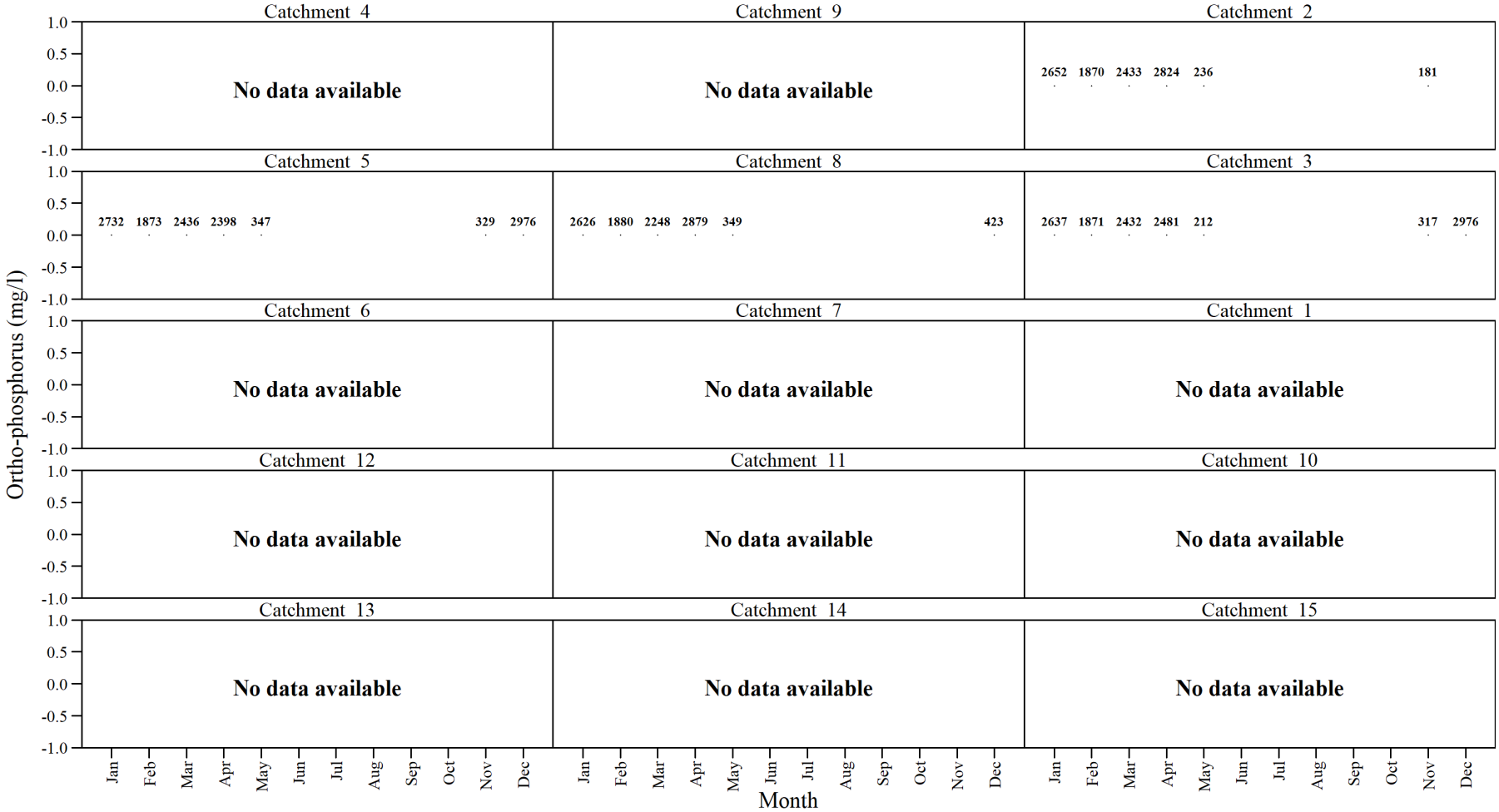

Figure 60: Monthly means for ortho-phosphorus

2.3 Chloropleth maps of means

Grey areas represent missing data

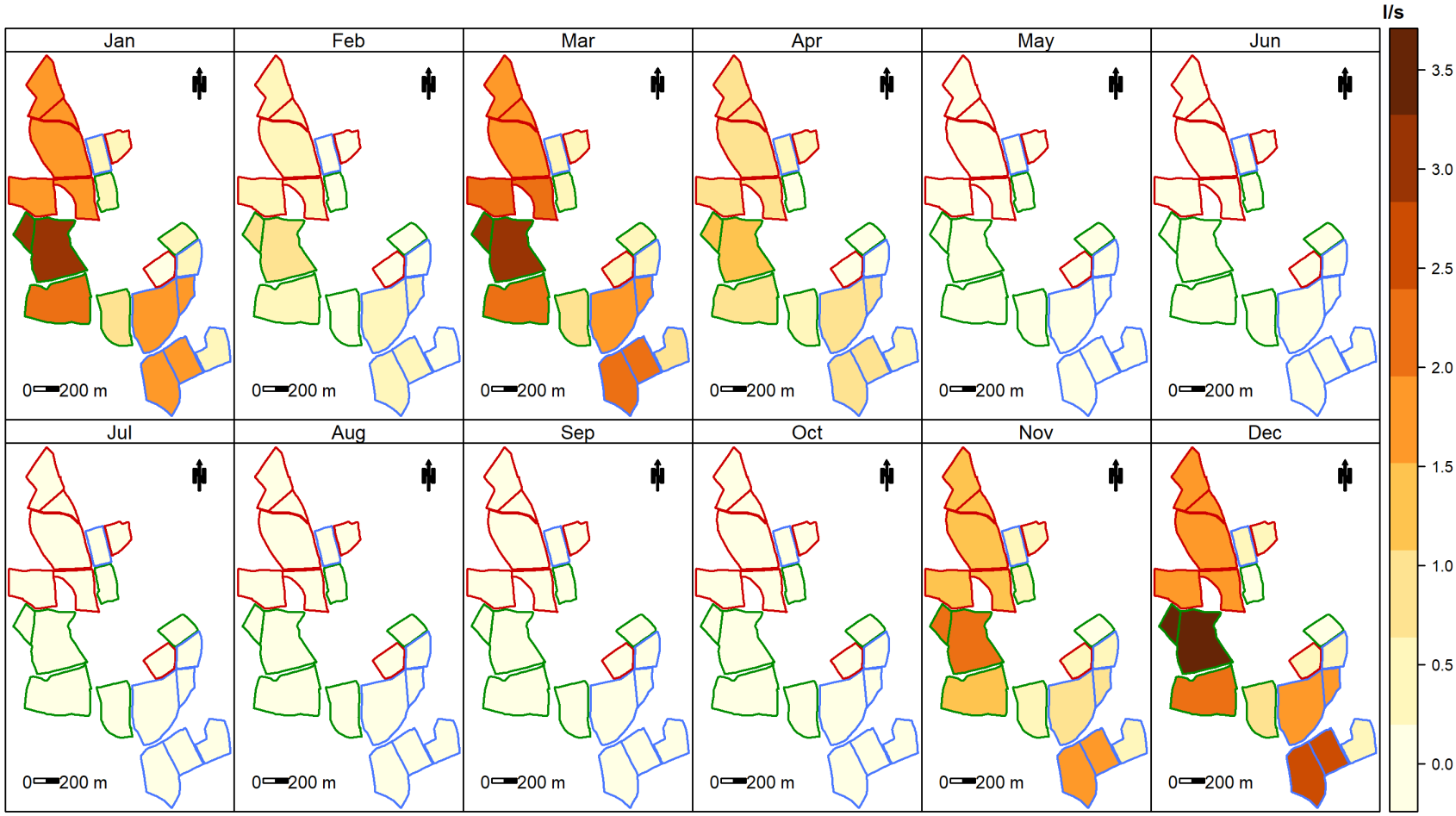

Figure 61: Mapped means for flow

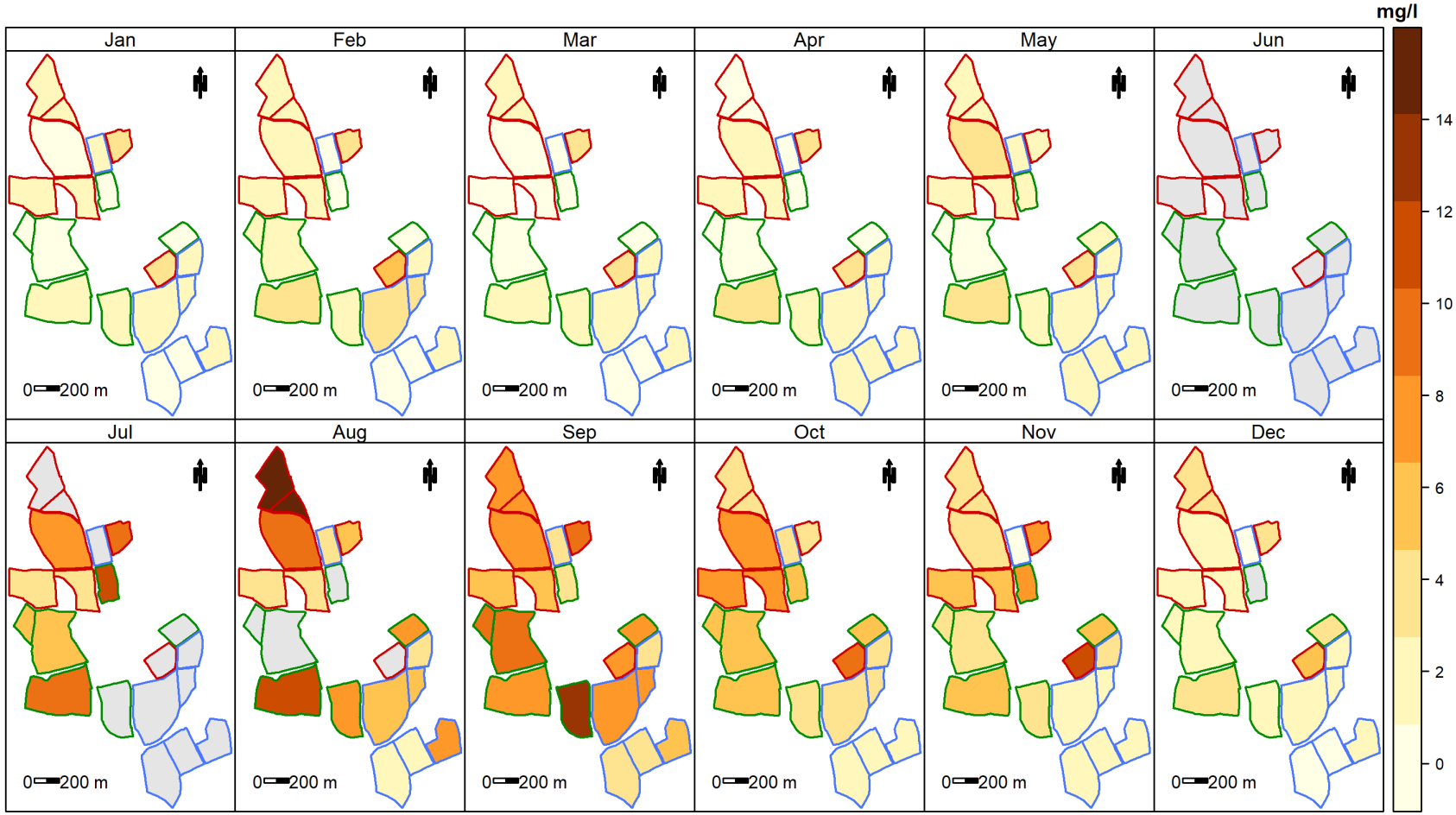

Figure 62: Mapped means for nitrate+nitrite

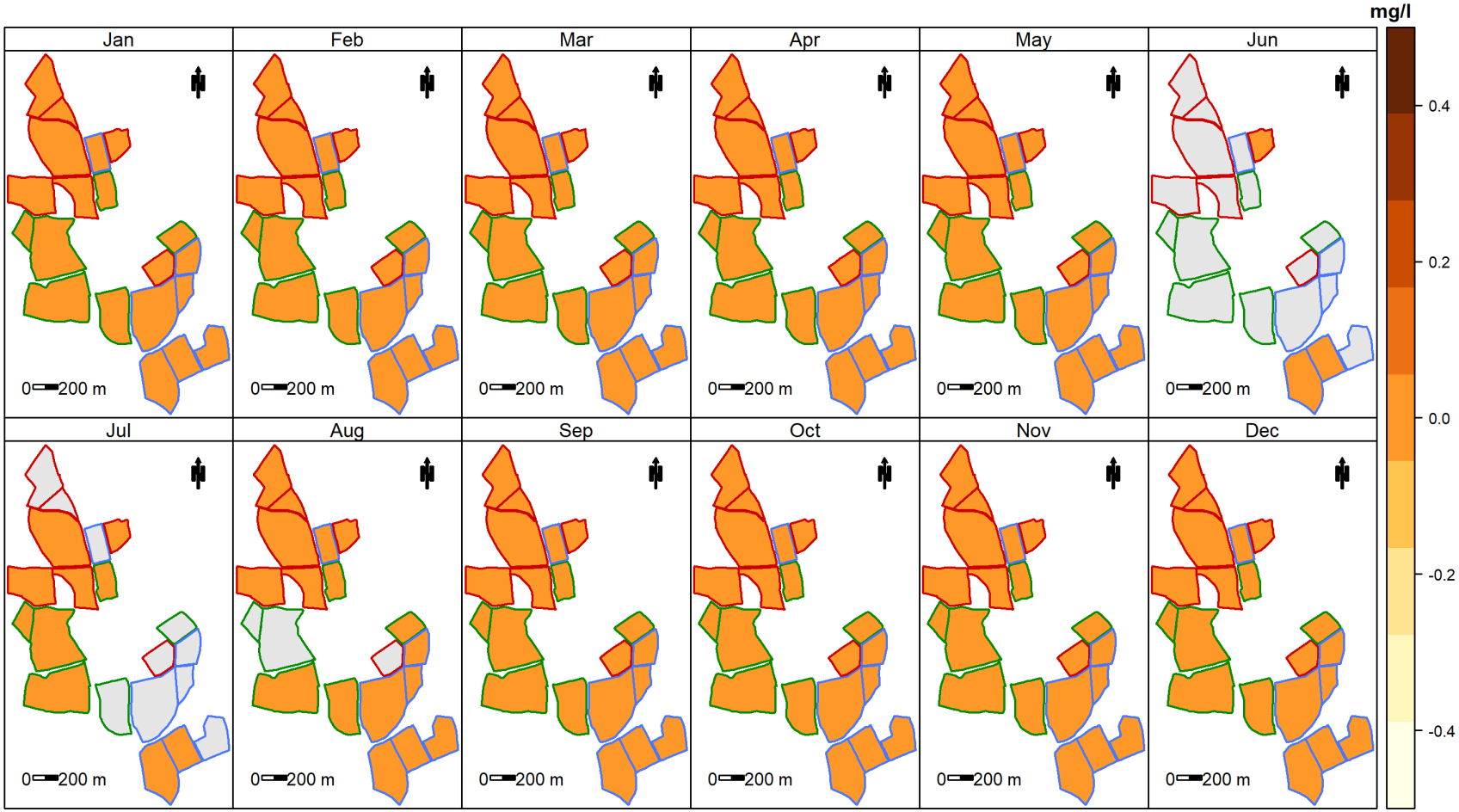

Figure 63: Mapped means for ammonia

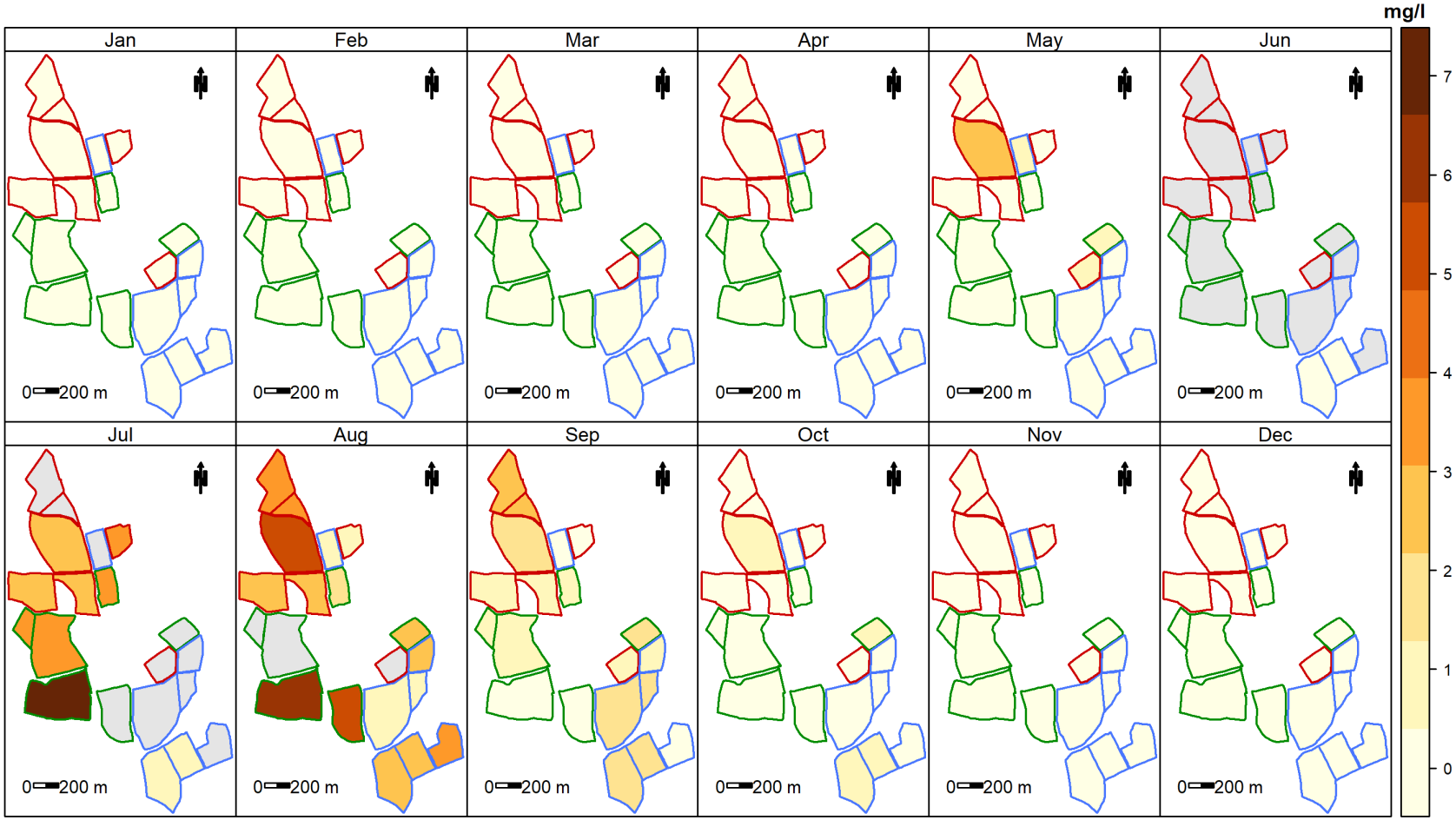

Figure 64: Mapped means for ammonium

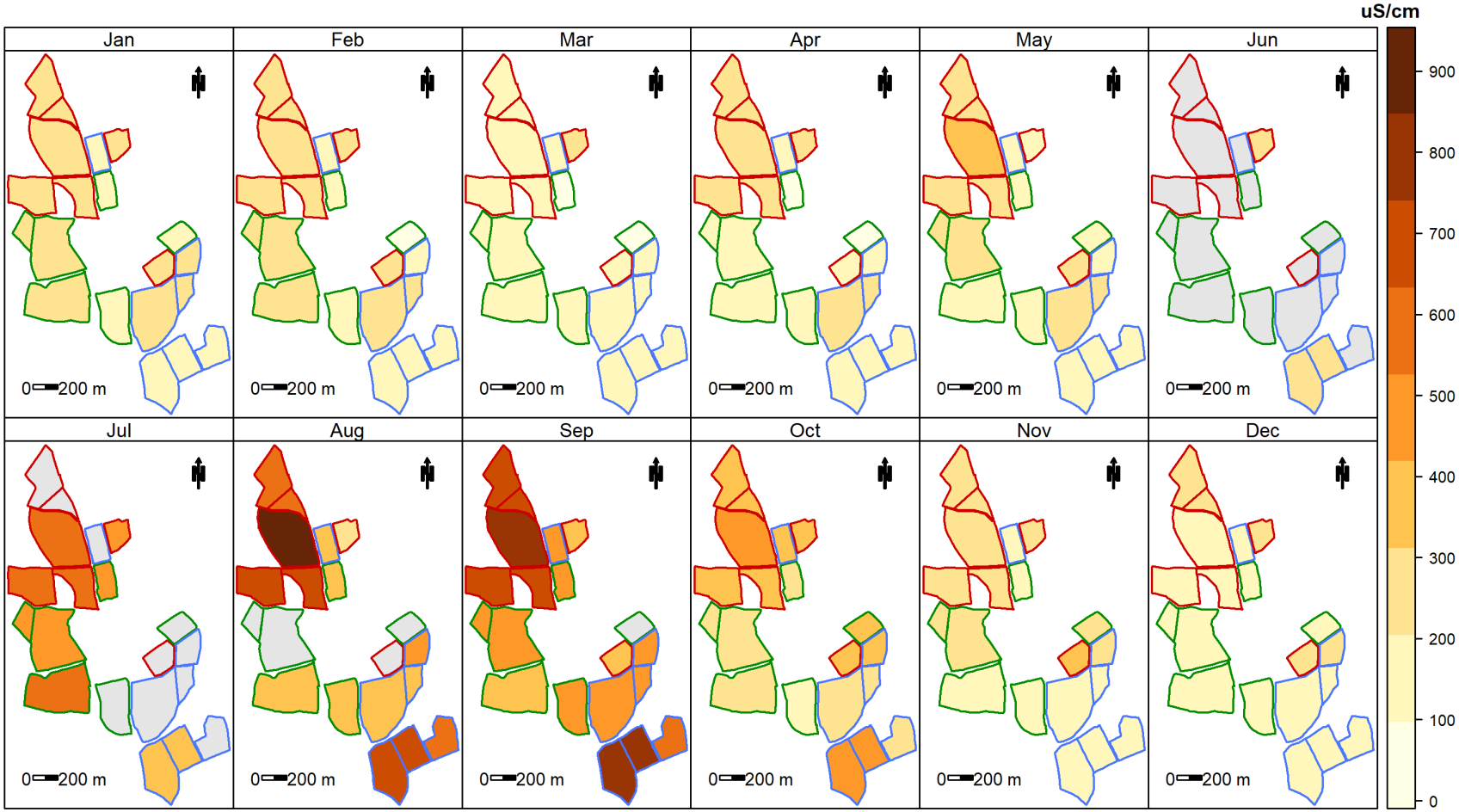

Figure 65: Mapped means for conductivity

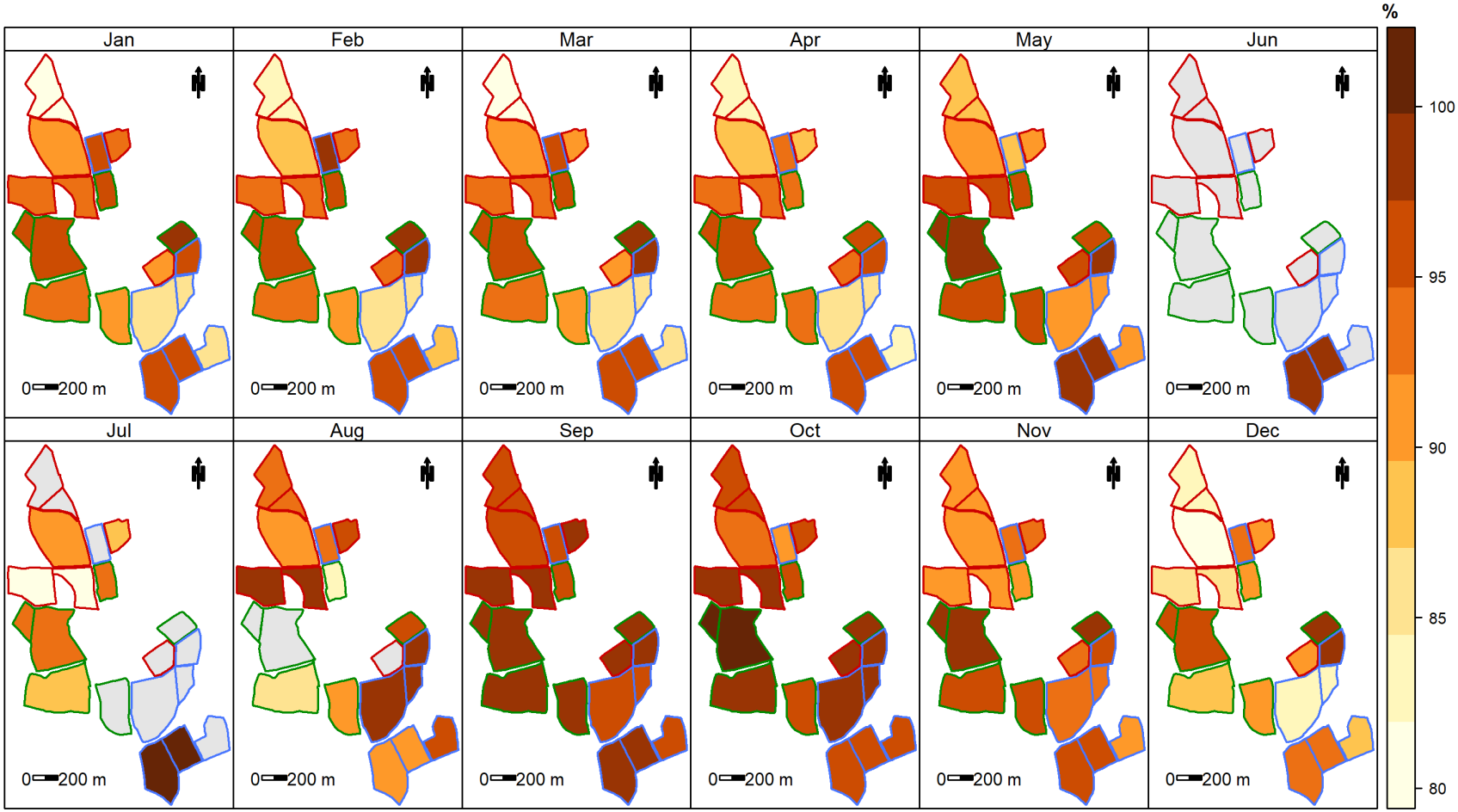

Figure 66: Mapped means for dissolved oxygen

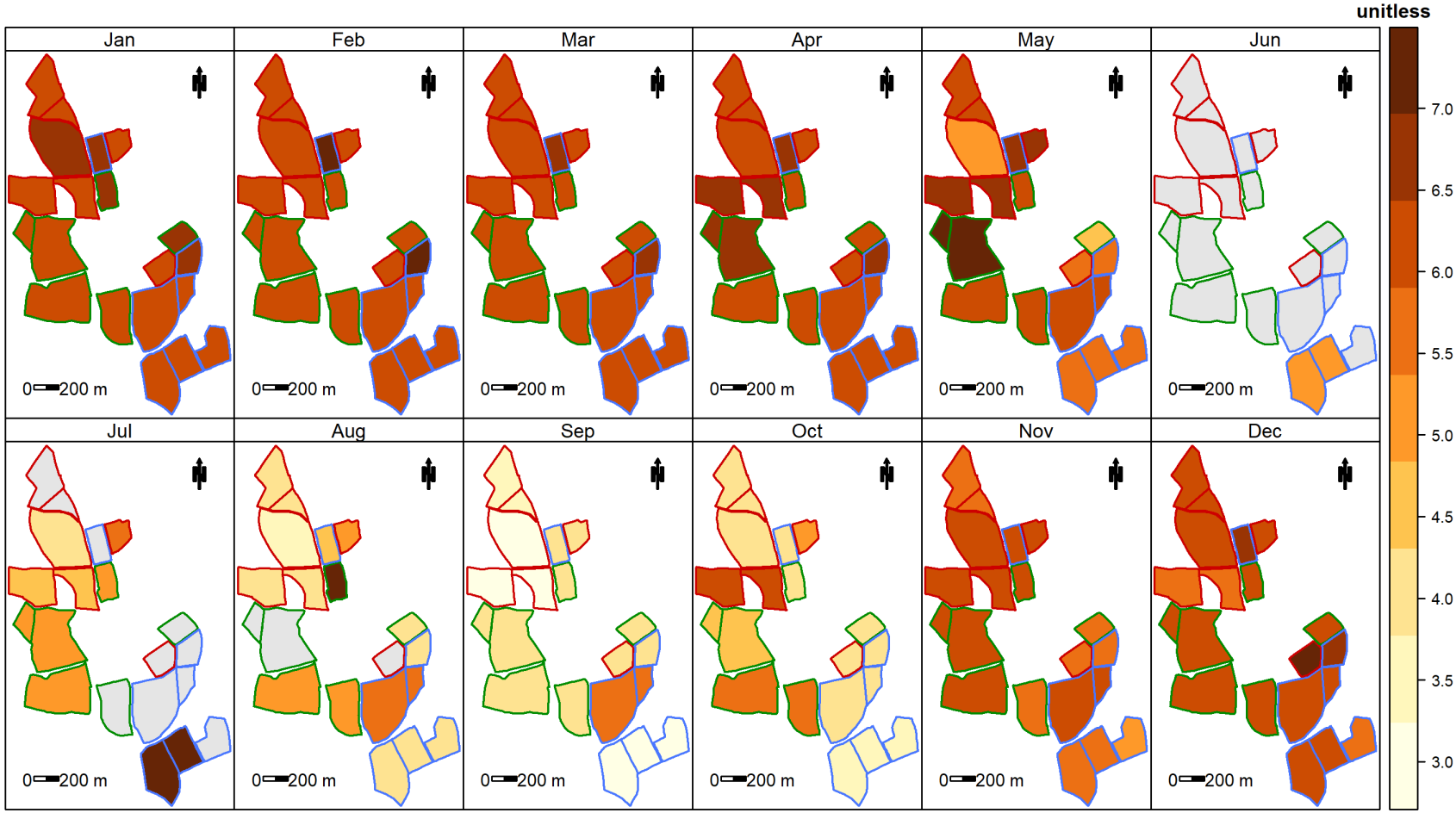

Figure 67: Mapped means for pH

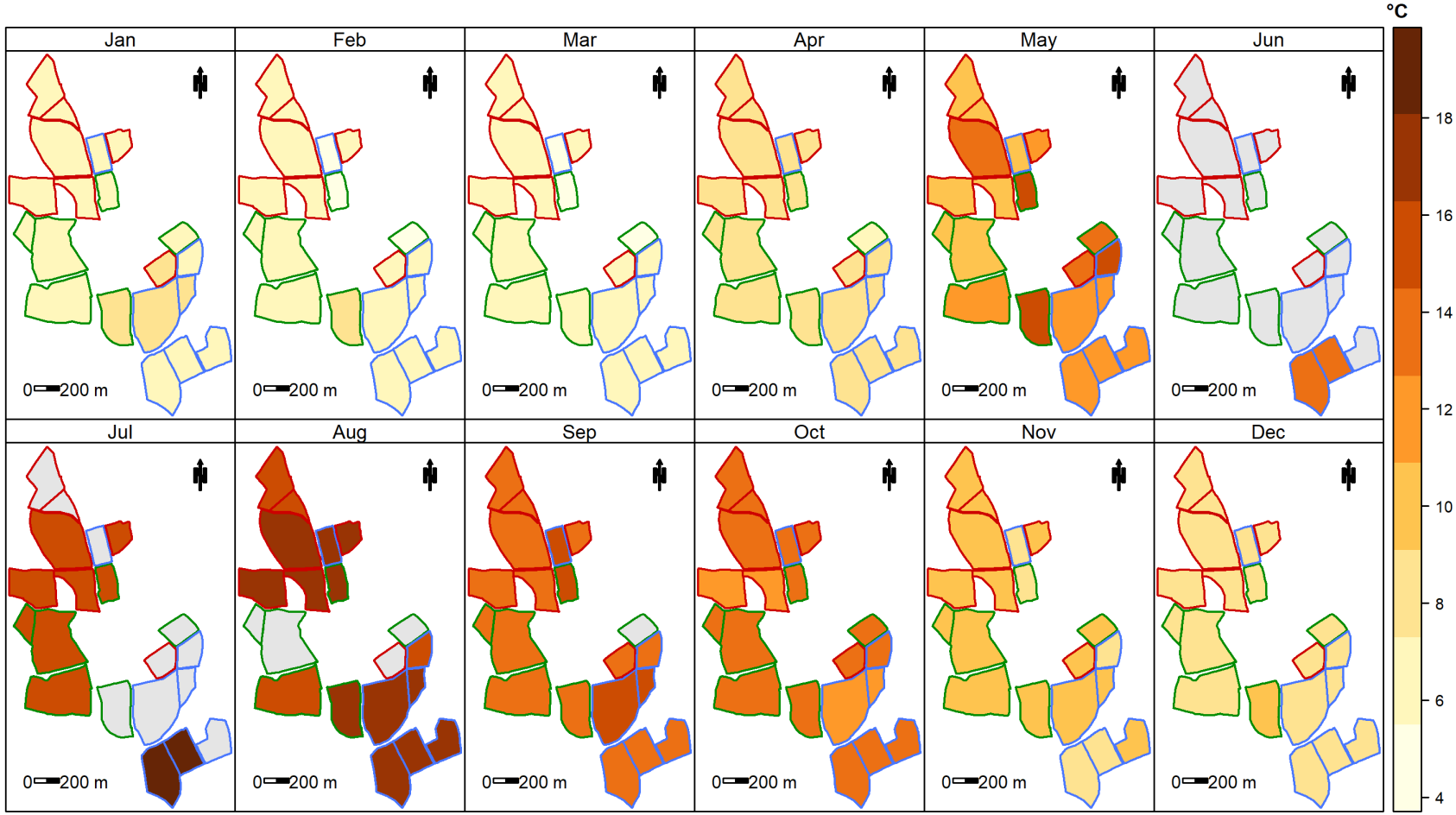

Figure 68: Mapped means for flow cell water temperature

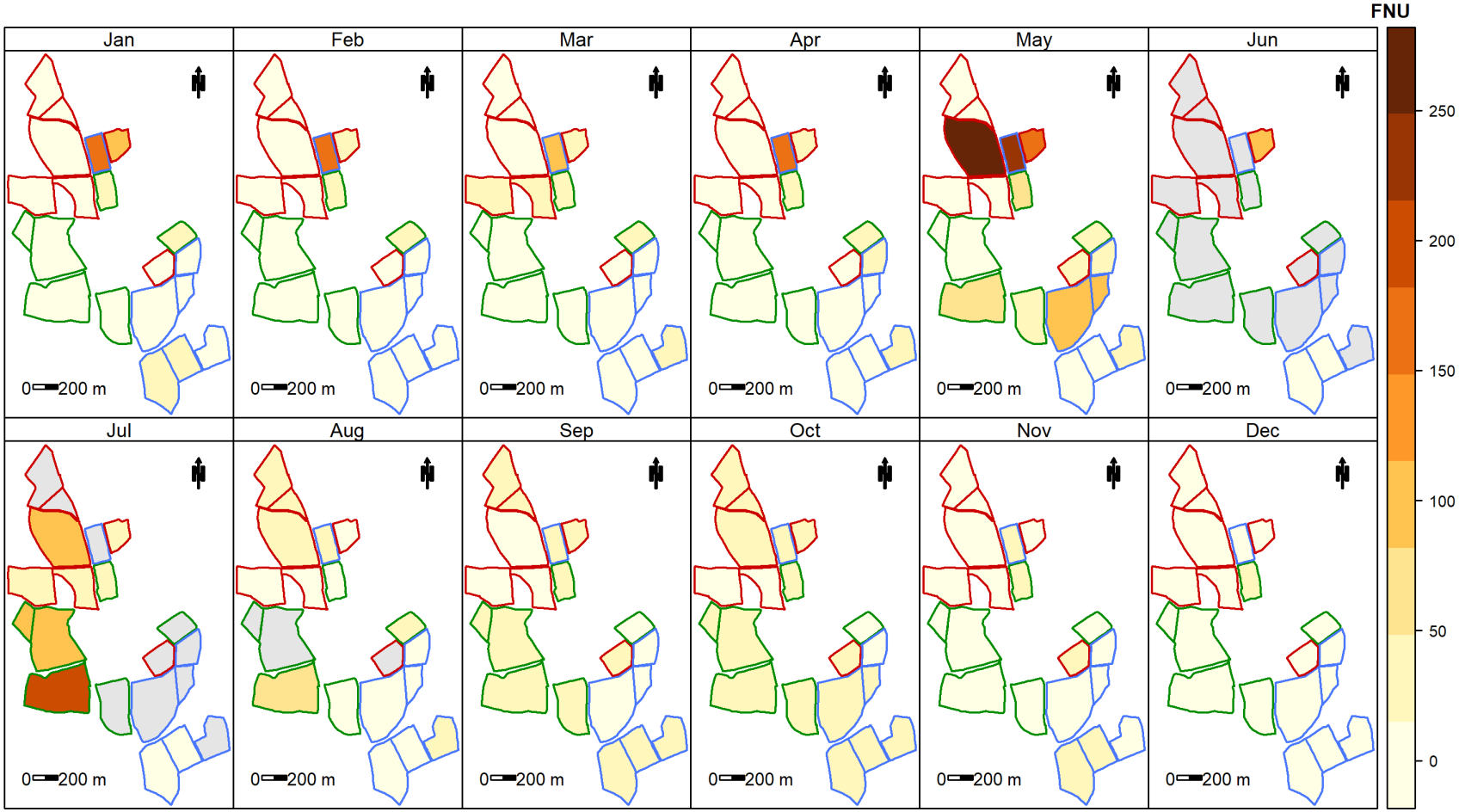

Figure 69: Mapped means for turbidity

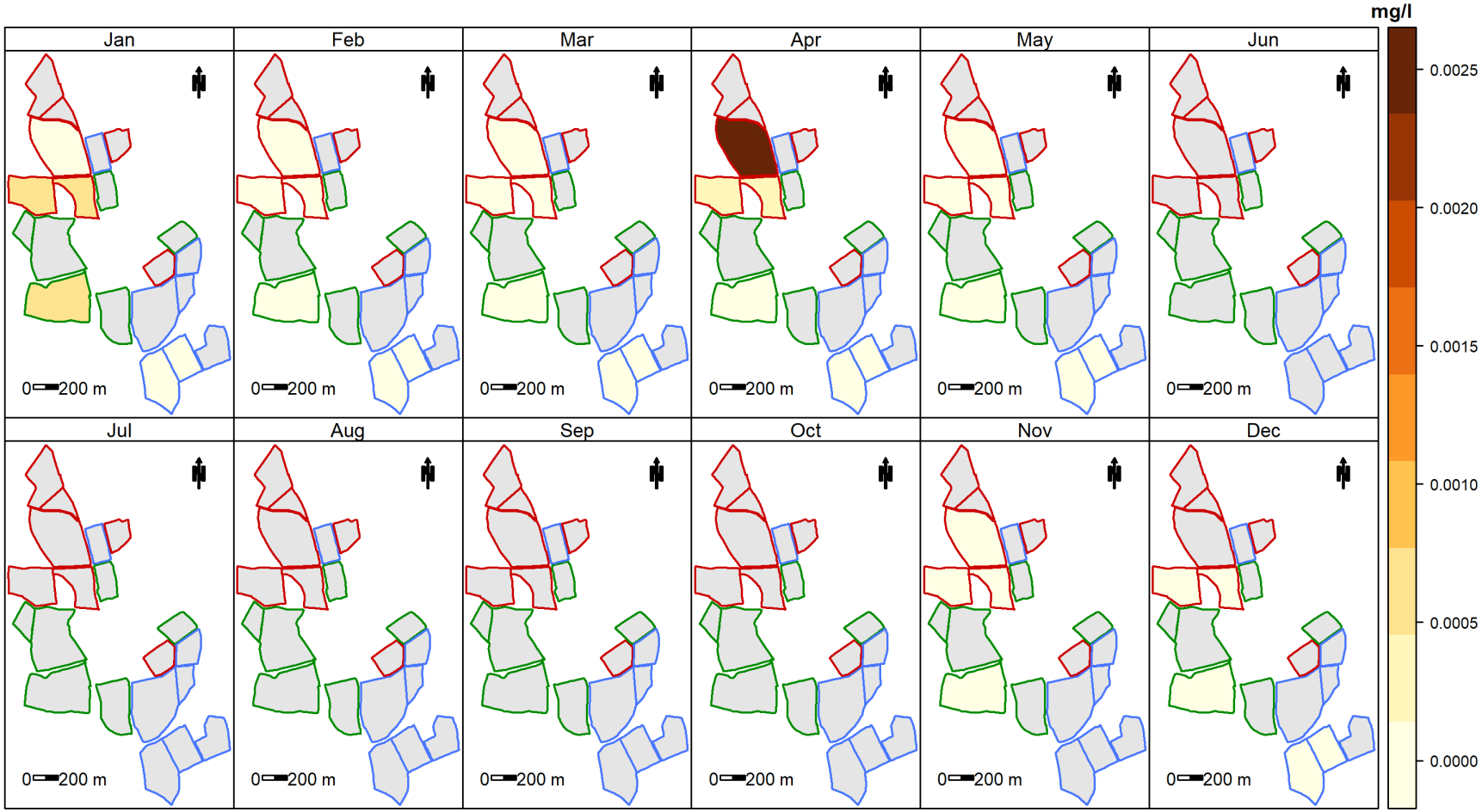

Figure 70: Mapped means for total phosphorus

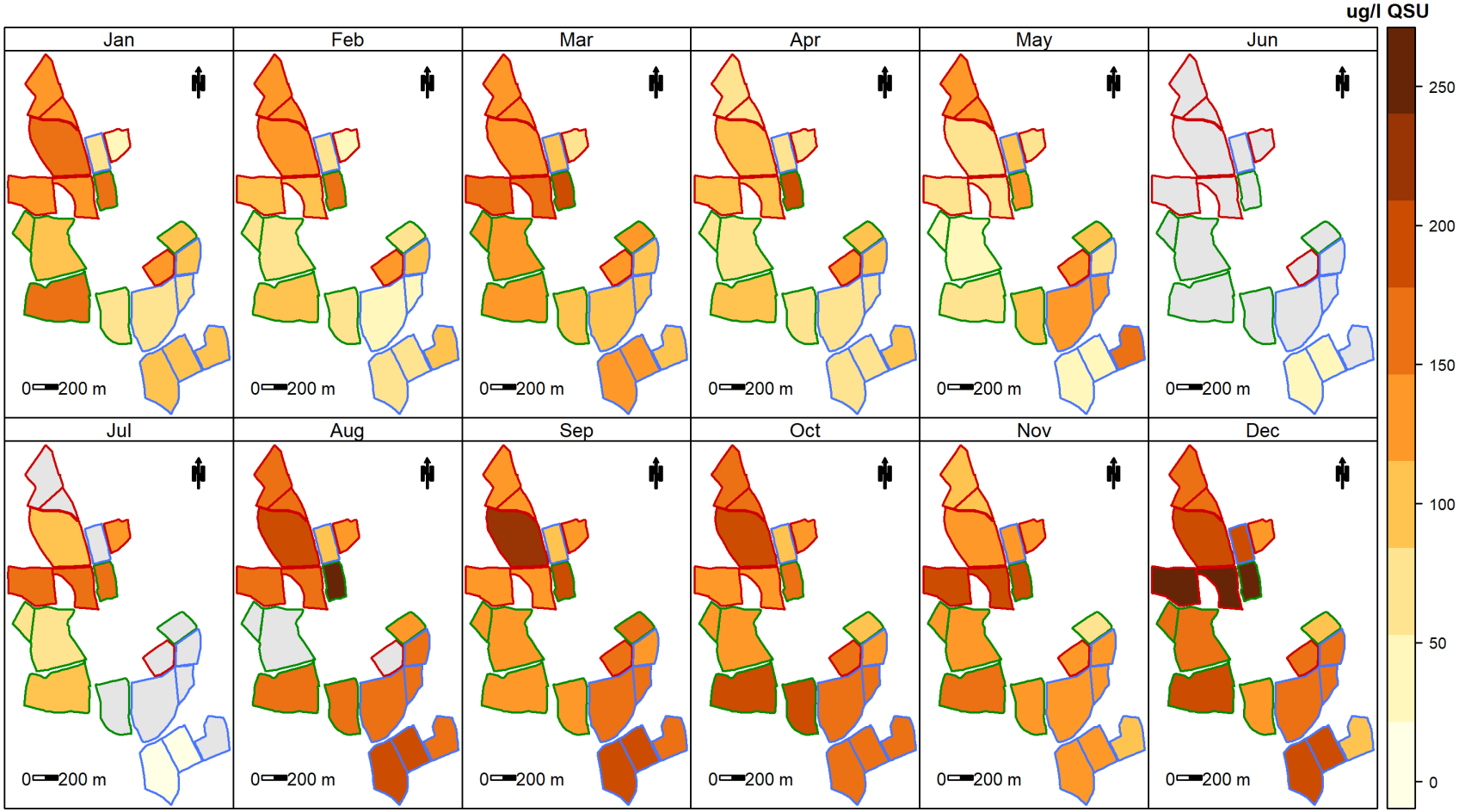

Figure 71: Mapped means for dissolved organic matter

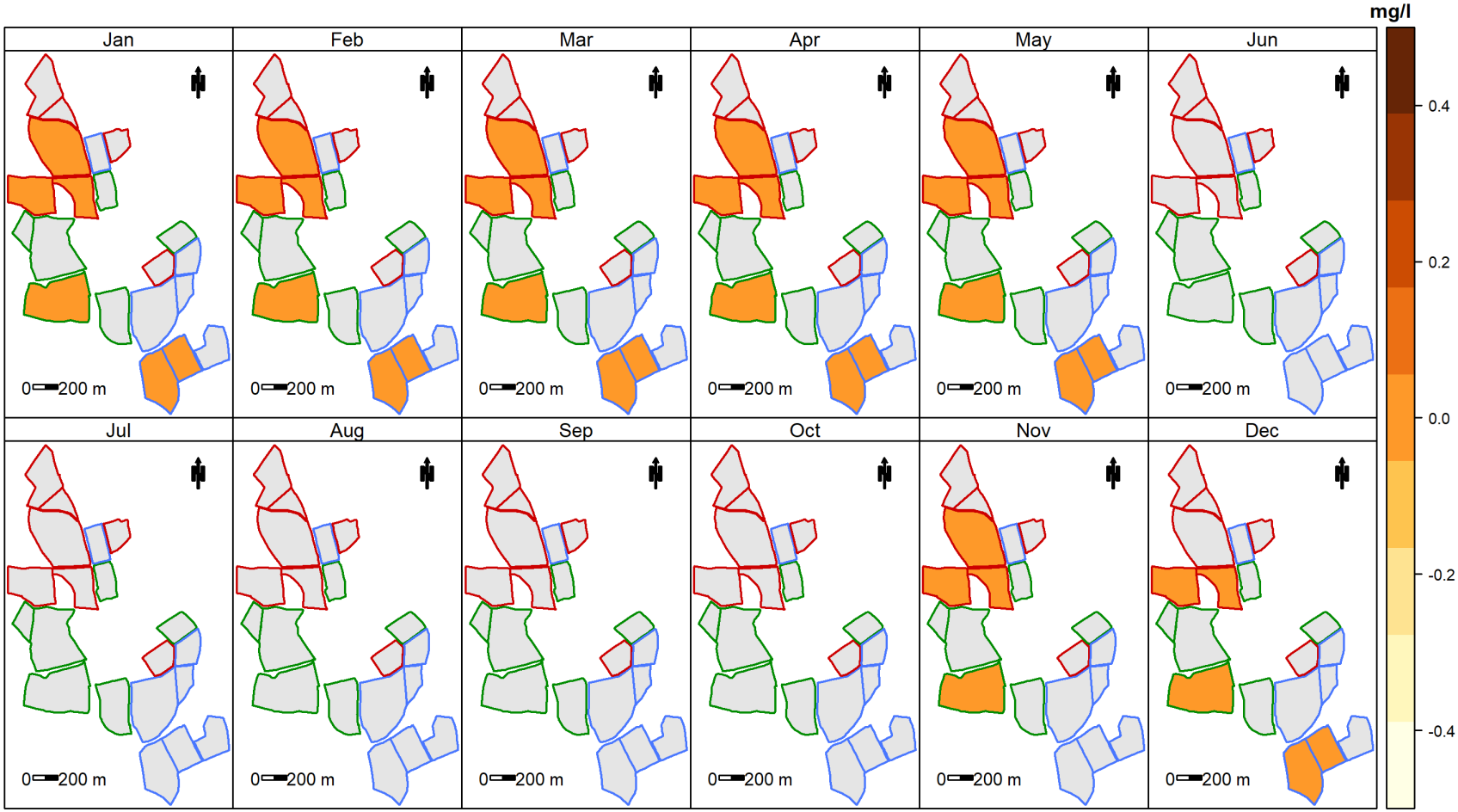

Figure 72: Mapped means for ortho-phosphorus

2.4 Chloropleth maps of standard deviations

Grey areas represent missing data

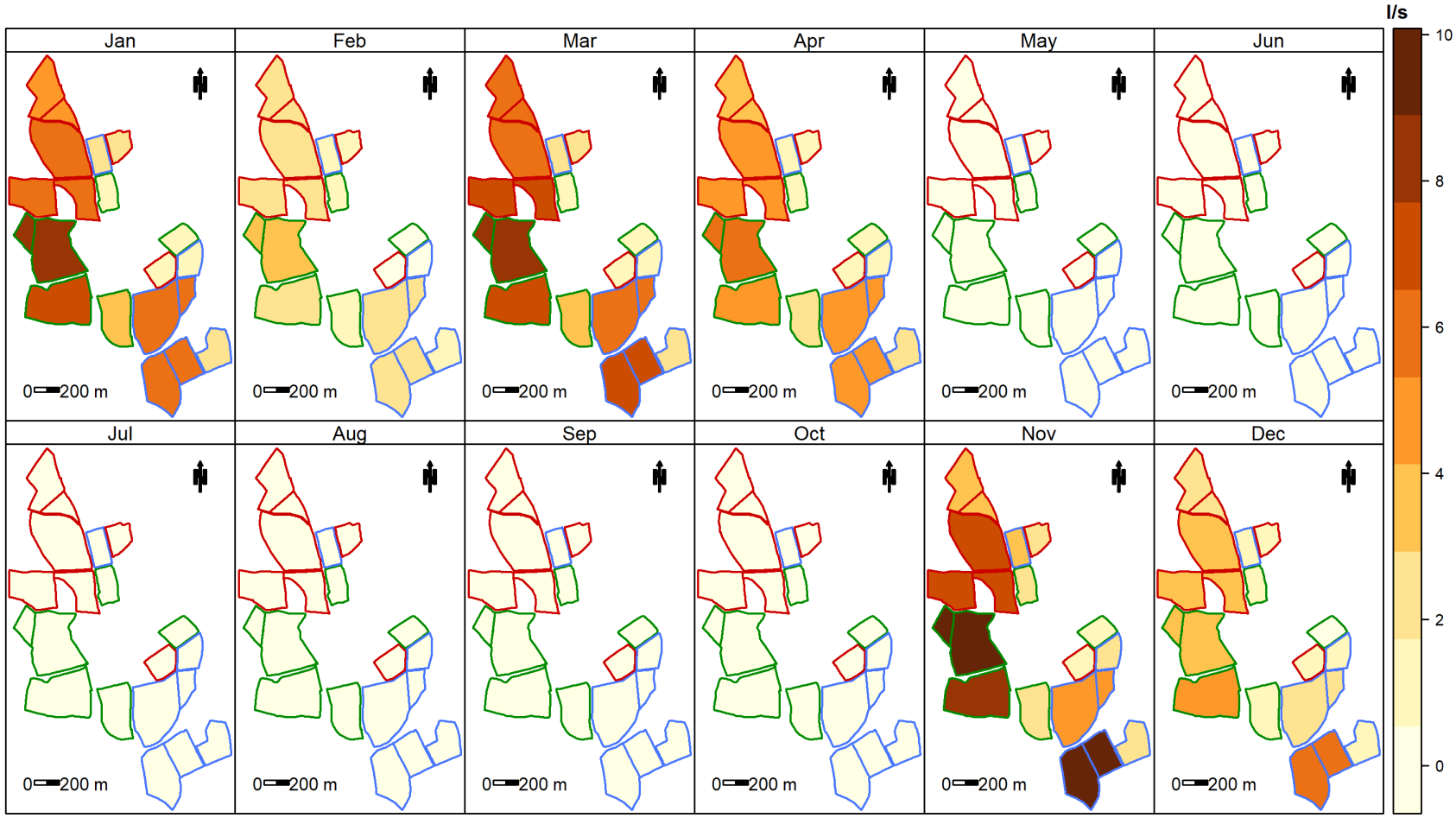

Figure 73: Mapped standard deviations for flow

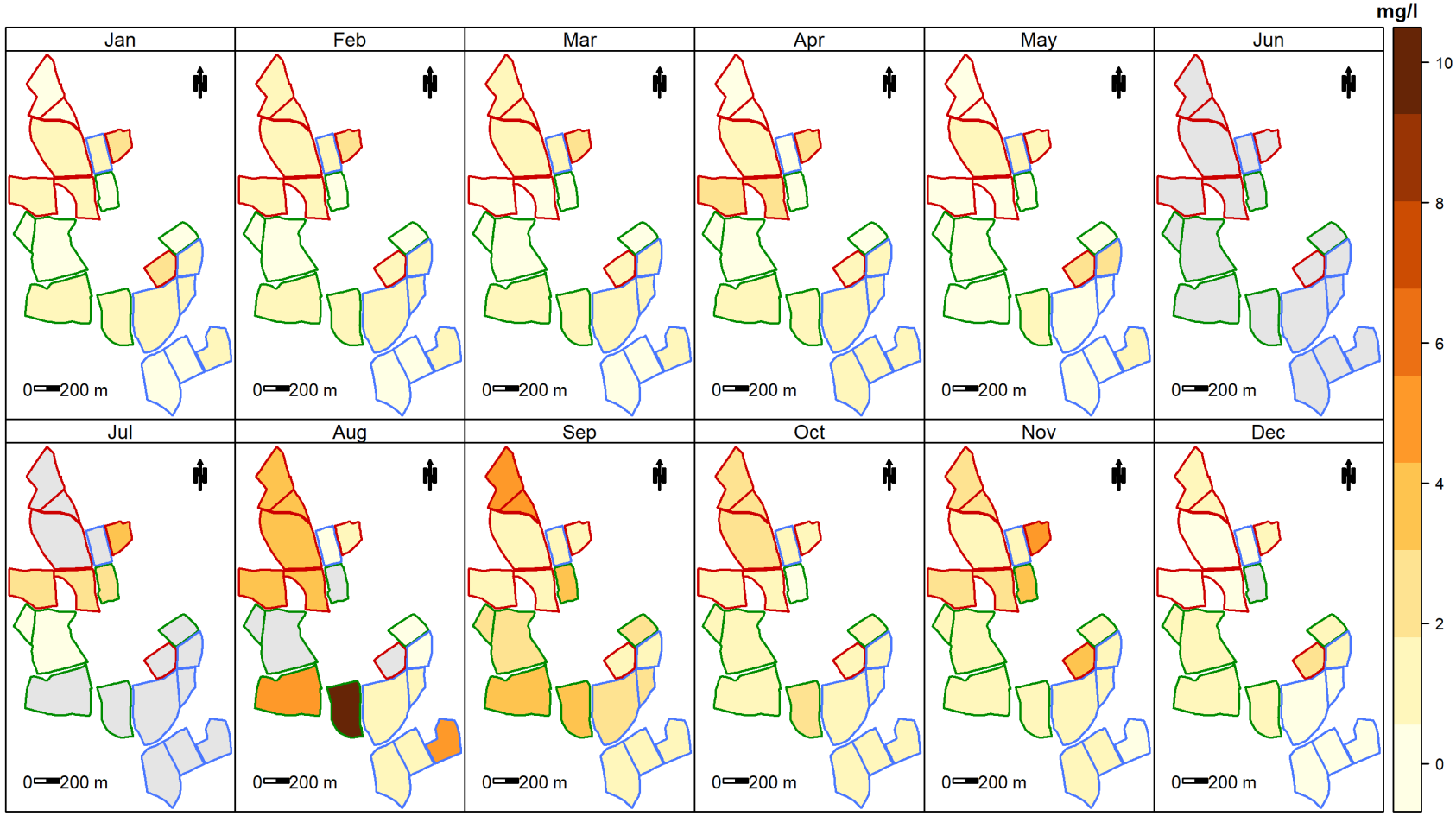

Figure 74: Mapped standard deviations for nitrate+nitrite

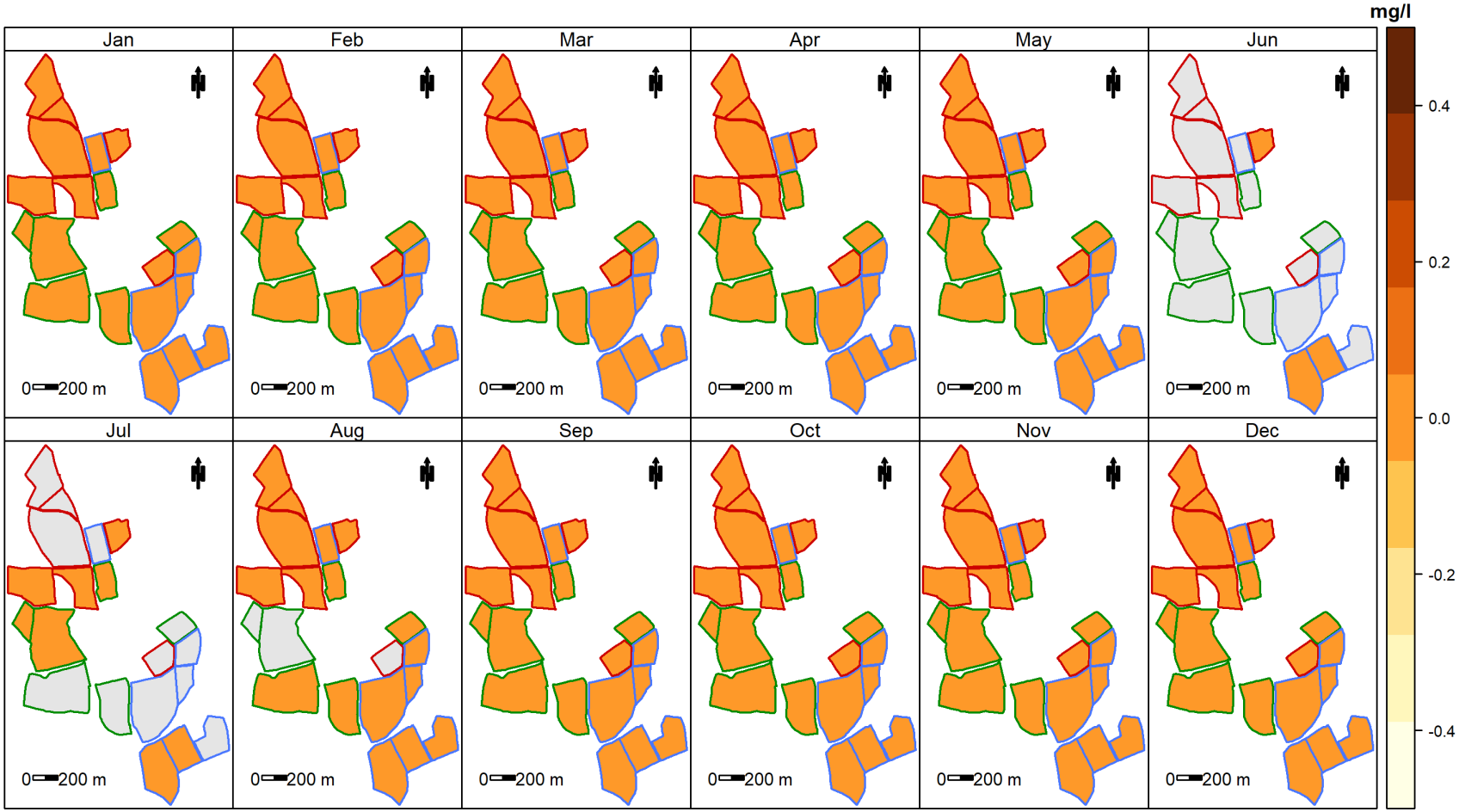

Figure 75: Mapped standard deviations for ammonia

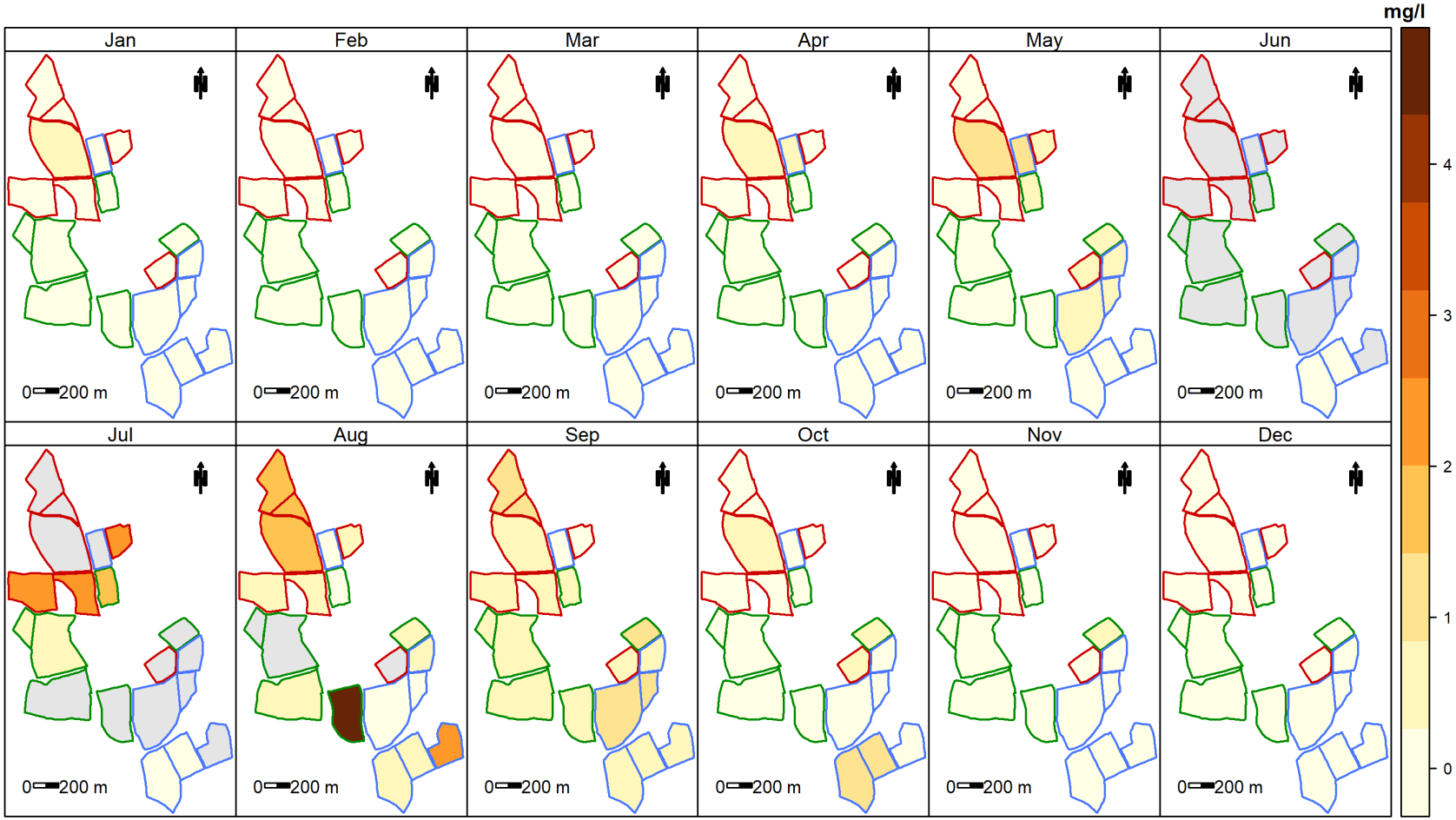

Figure 76: Mapped standard deviations for ammonium

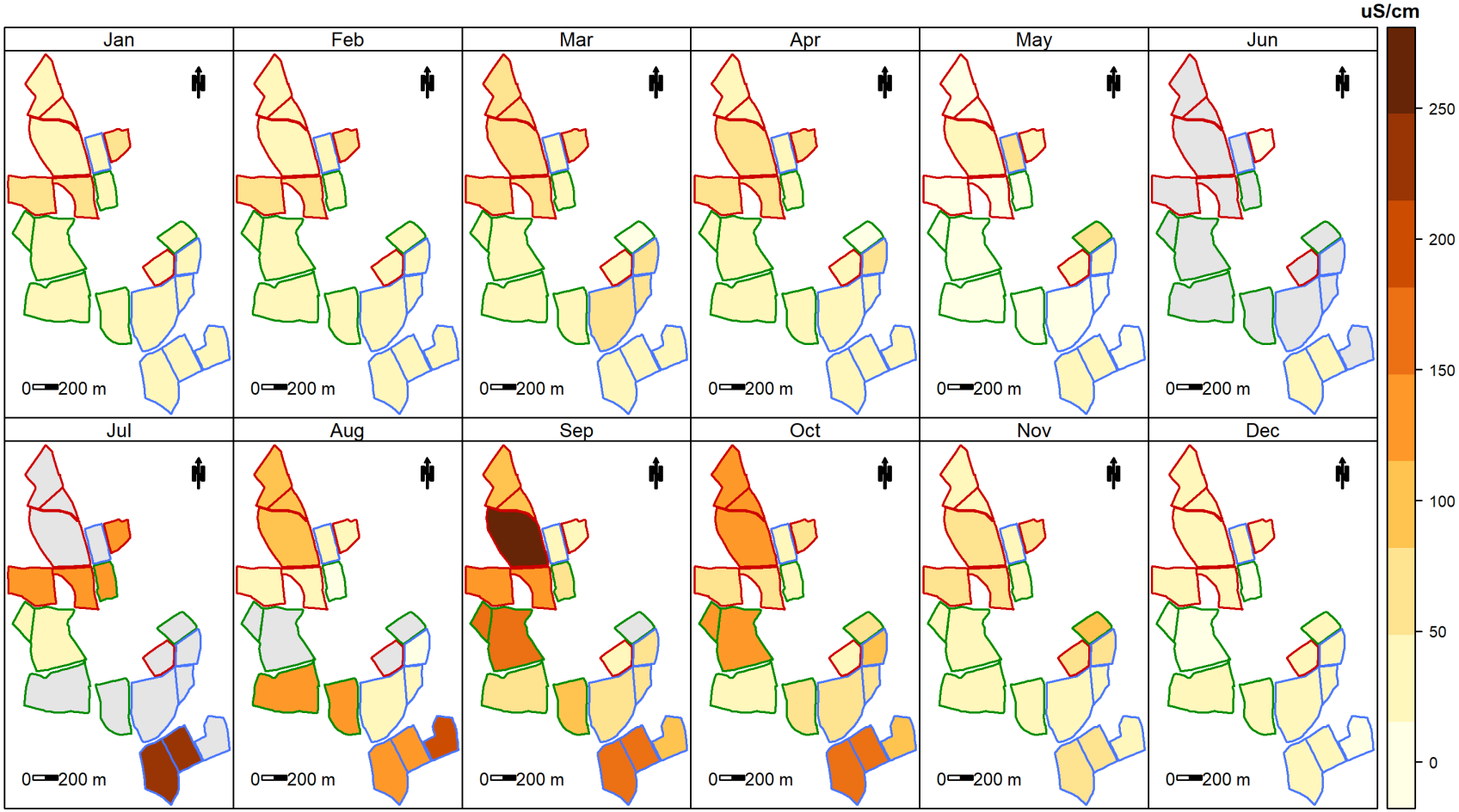

Figure 77: Mapped standard deviations for conductivity

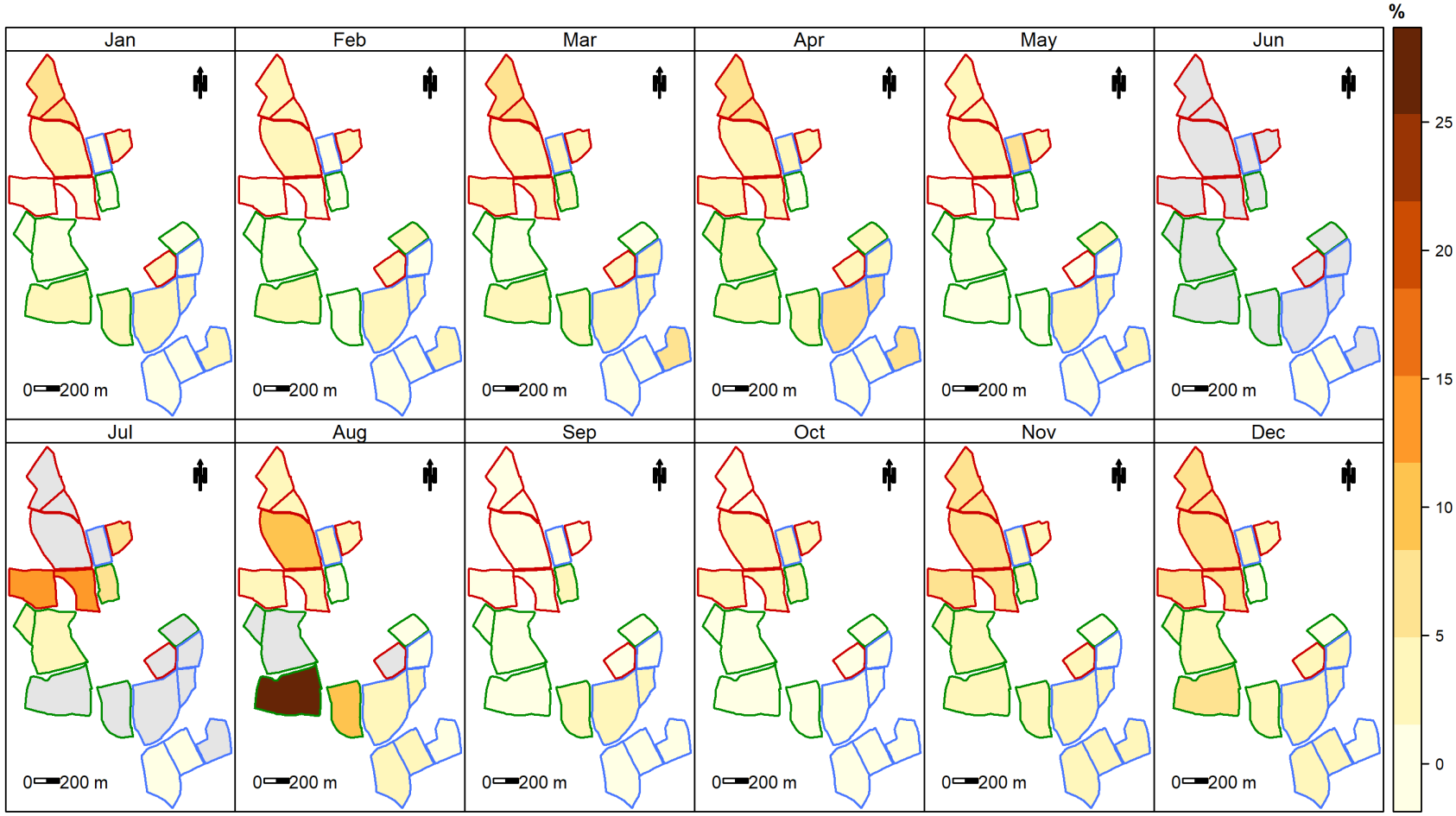

Figure 78: Mapped standard deviations for dissolved oxygen

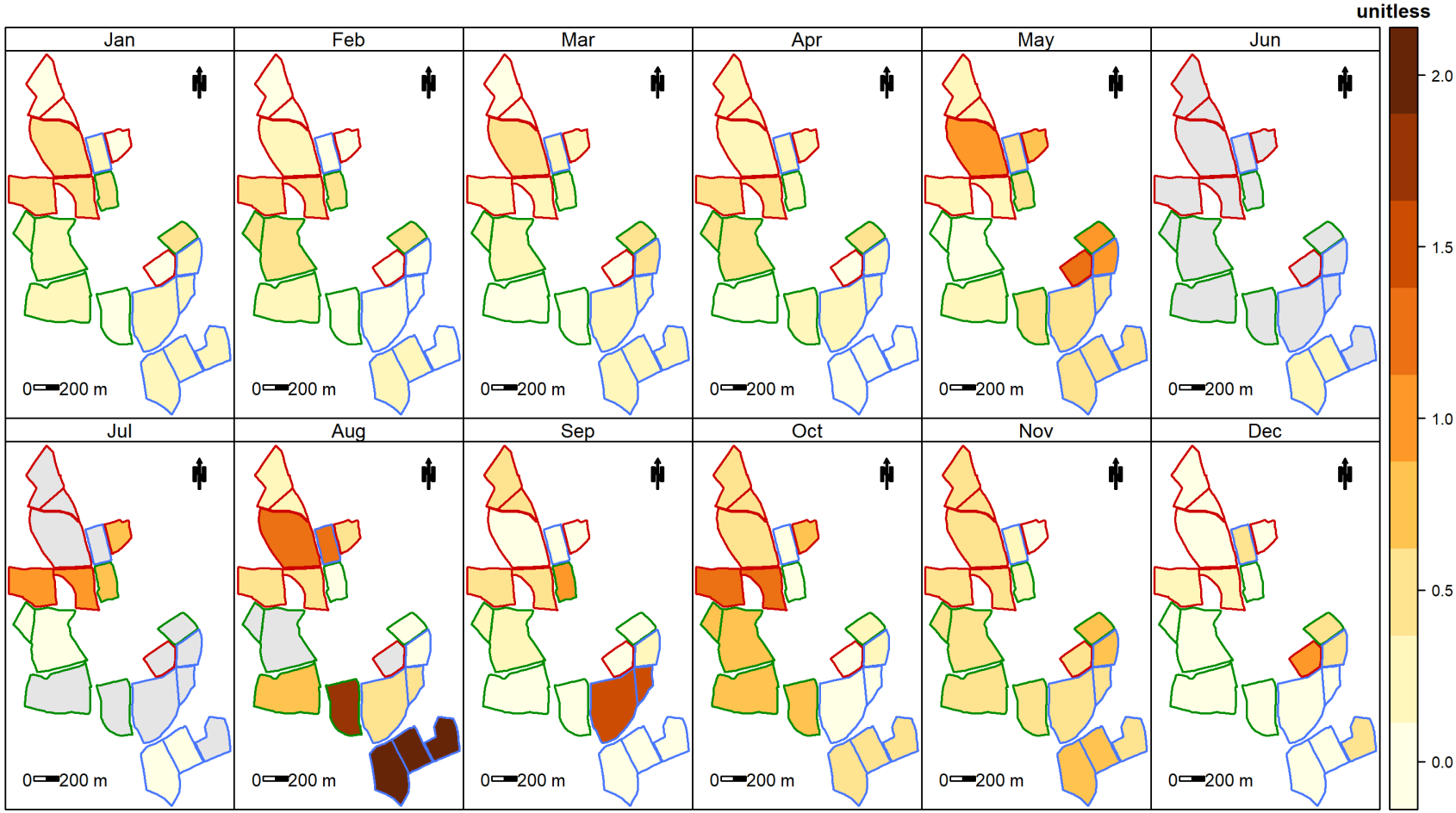

Figure 79: Mapped standard deviations for pH

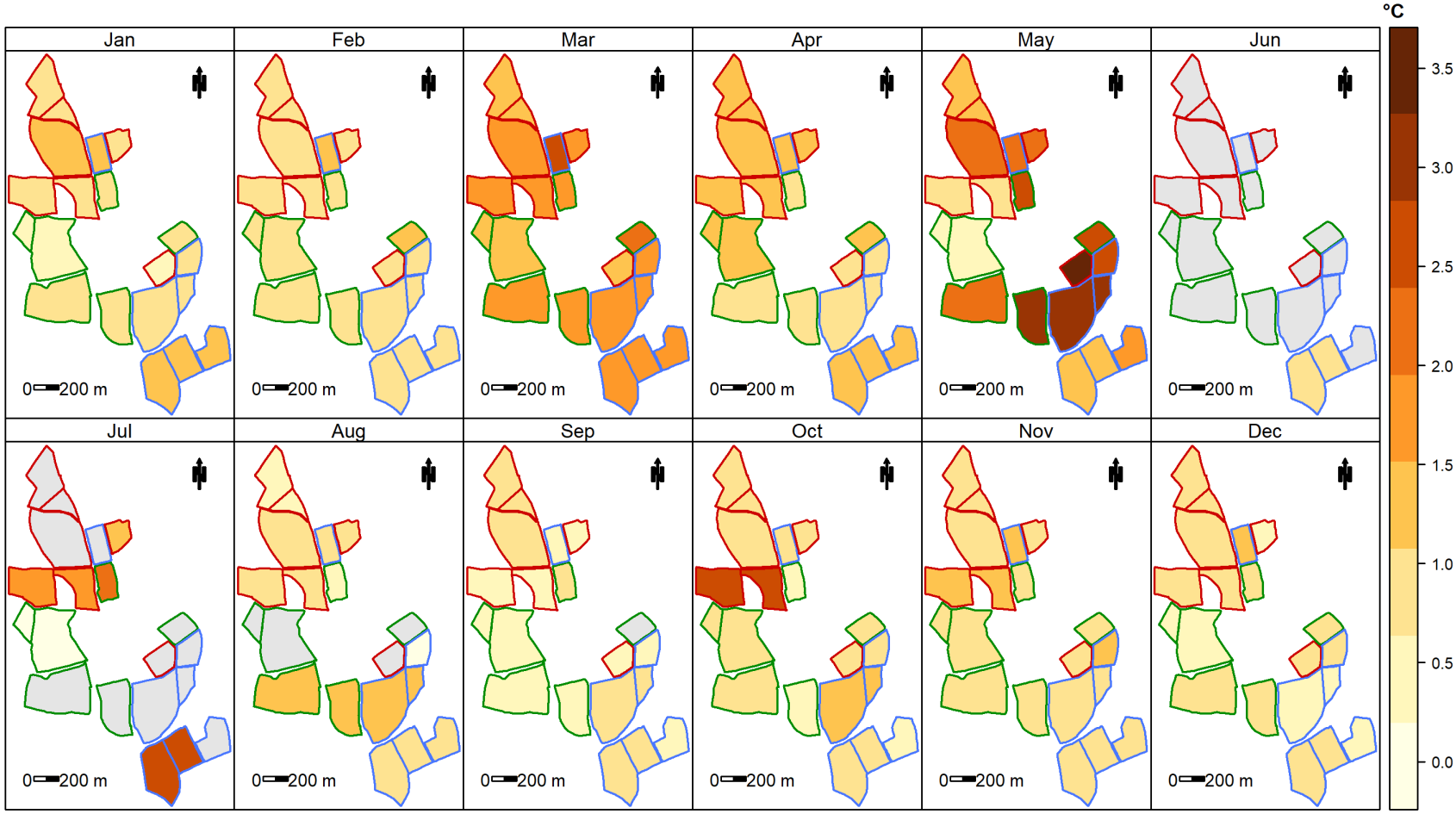

Figure 80: Mapped standard deviations for flow cell water temperature

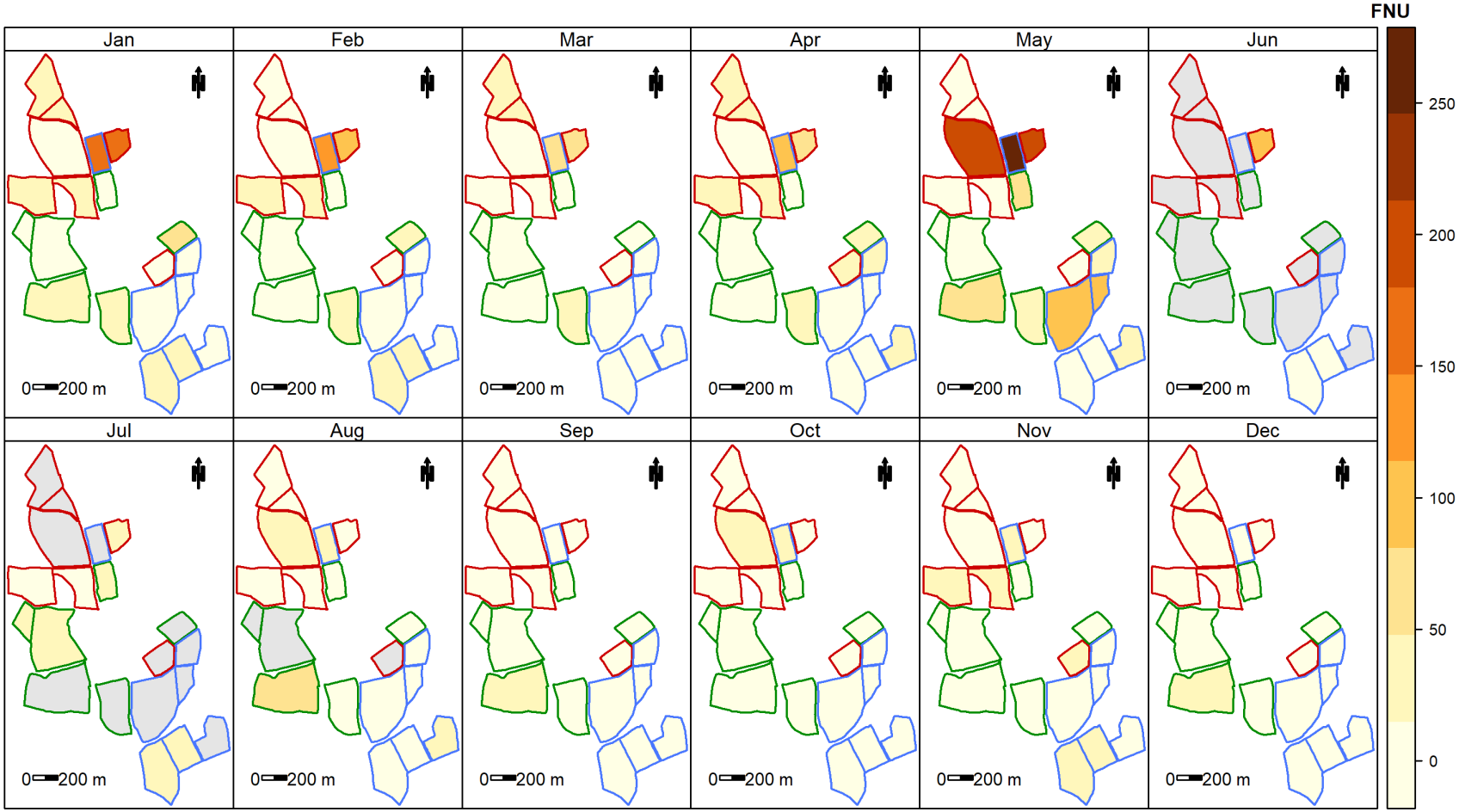

Figure 81: Mapped standard deviations for turbidity

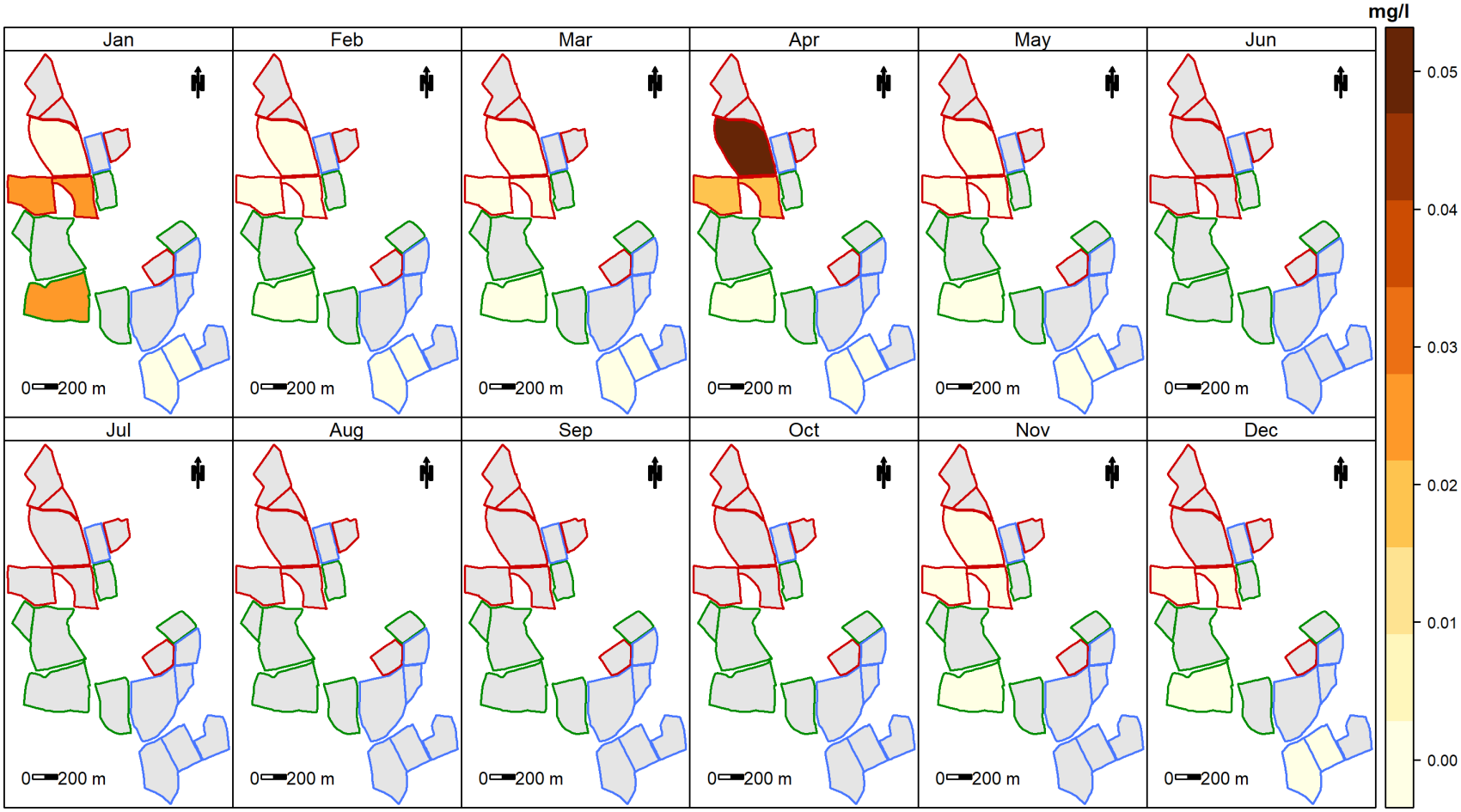

Figure 82: Mapped standard deviations for total phosphorus

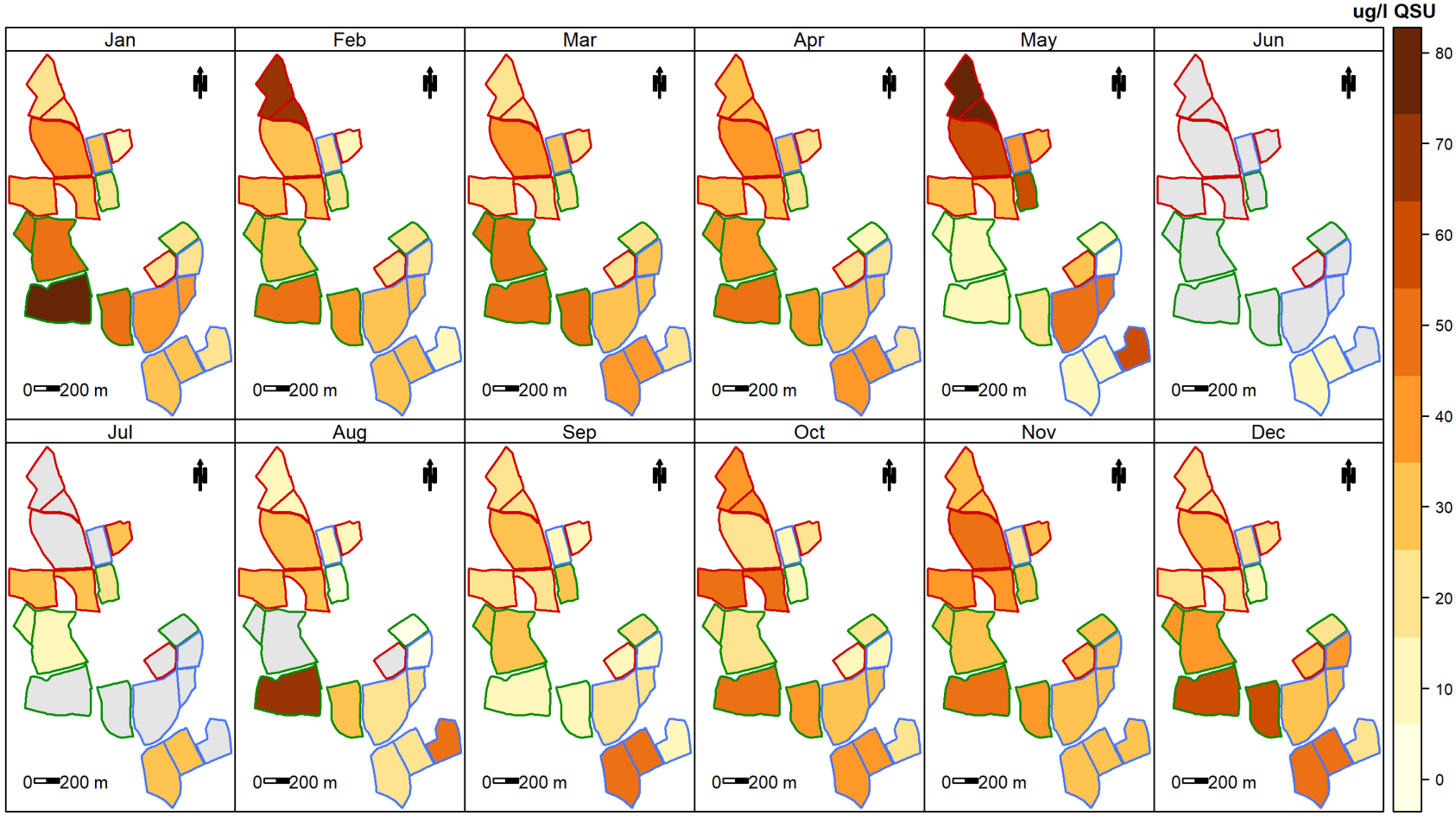

Figure 83: Mapped standard deviations for dissolved organic matter

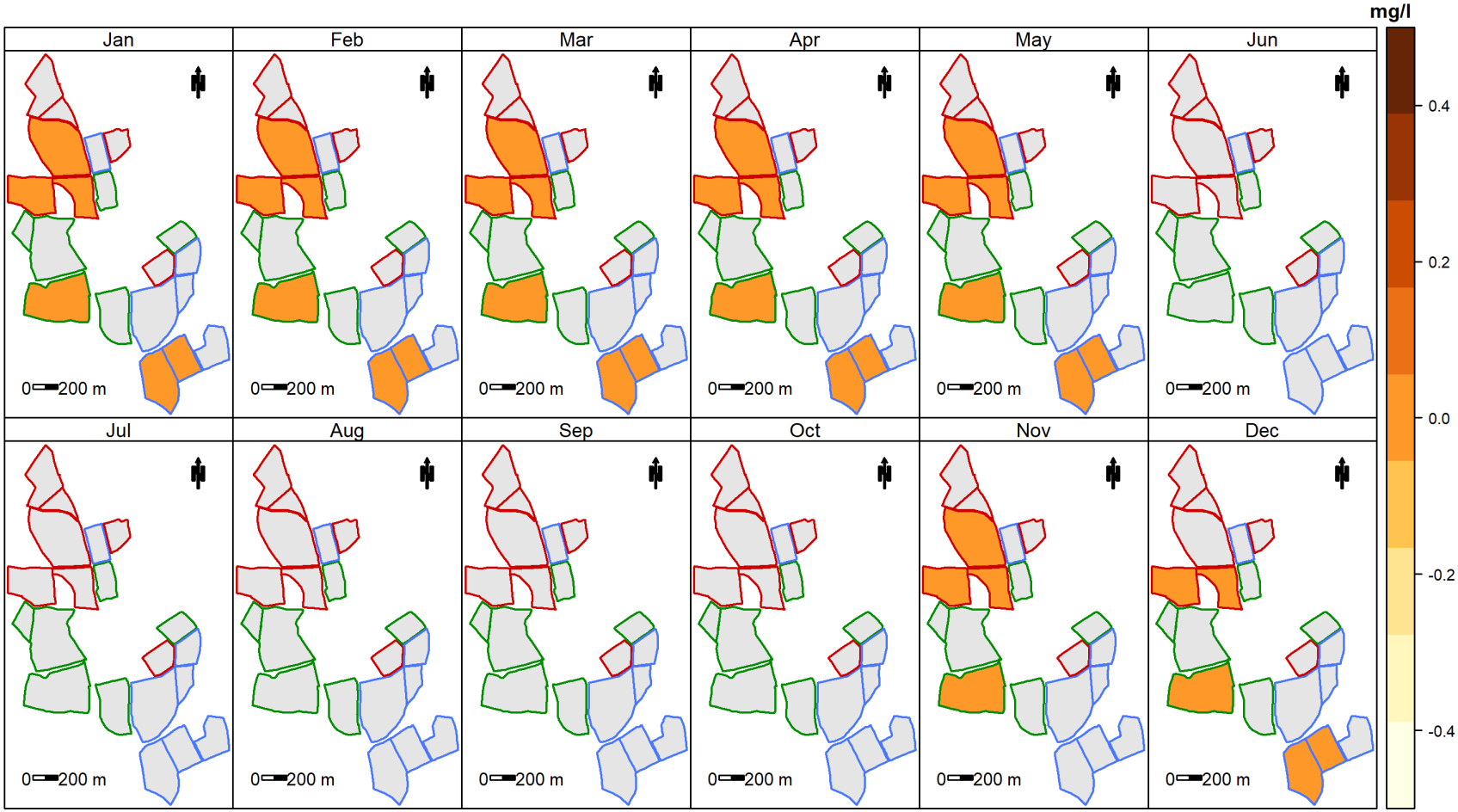

Figure 84: Mapped standard deviations for ortho-phosphorus

3 ANNUAL

3.1 Summary Statistics

Please be aware that statistics are based on data that may contain missing values. Full data summaries are available on request.

		Catchment Number														
Variable		**Green**					**Blue**					**Red**				
	units	**4**	**5**	**6**	**12**	**13**	**9**	**8**	**7**	**11**	**14**	**2**	**3**	**1**	**10**	**15**
Mean	l/s	1.2	0.8	0.3	0.1	0.1	0.6	0.8	0.2	0.1	0.2	0.7	0.7	0.7	0.1	0.2
Median	l/s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Standard deviation	l/s	5.1	4.3	1.7	0.9	1.0	3.4	4.7	1.5	1.0	1.6	3.8	4.1	2.9	0.8	1.2
Inter-quartile range	l/s	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Coefficient of variation	l/s	4.3	5.5	6.1	10.6	8.5	5.5	5.7	6.5	8.4	8.7	5.5	5.6	4.4	8.7	5.9
Minimum	l/s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maximum	l/s	199.0	164.0	64.0	38.0	50.0	124.0	179.0	59.0	48.0	139.0	168.0	180.0	80.0	40.0	54.0
Missing values	count	1442	1072	1038	2225	2886	2023	1137	1098	1673	575	1068	1140	2382	1394	600
Missing values as a %	%	4	3	3	6	8	6	3	3	5	2	3	3	7	4	2

Table 7: Annual summary statistics for flow

		Catchment Number														
Variable		**Green**					**Blue**					**Red**				
	units	**4**	**5**	**6**	**12**	**13**	**9**	**8**	**7**	**11**	**14**	**2**	**3**	**1**	**10**	**15**
Mean	mg/l	1.4	3.1	1.8	2.5	1.5	2.0	0.6	1.3	2.3	0.6	1.5	1.8	2.2	5.1	3.9
Median	mg/l	1.0	3.0	2.0	3.0	0.0	2.0	1.0	1.0	2.0	1.0	1.0	1.0	2.0	5.0	4.0
Standard deviation	mg/l	1.5	1.8	1.3	2.1	3.2	1.2	0.7	0.9	1.4	0.7	1.6	2.1	1.9	2.9	2.7
Inter-quartile range	mg/l	0.0	2.0	1.0	4.0	1.0	2.0	1.0	1.0	2.0	1.0	1.0	1.0	2.0	3.0	4.0
Coefficient of variation	mg/l	1.1	0.6	0.7	0.8	2.1	0.6	1.2	0.7	0.6	1.2	1.0	1.2	0.9	0.6	0.7
Minimum	mg/l	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maximum	mg/l	13.0	14.0	26.0	13.0	18.0	10.0	9.0	13.0	8.0	6.0	12.0	13.0	19.0	16.0	19.0
Missing values	count	19100	18840	22593	31166	31602	20864	21532	24183	27482	28518	19469	19379	20788	26518	24272
Missing values as a %	%	55	54	64	89	90	60	61	69	78	81	56	55	59	76	69

Table 8: Annual summary statistics for nitrate+nitrite

		Catchment Number														
Variable		**Green**					**Blue**					**Red**				
	units	**4**	**5**	**6**	**12**	**13**	**9**	**8**	**7**	**11**	**14**	**2**	**3**	**1**	**10**	**15**
Mean	mg/l	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
Median	mg/l	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Standard deviation	mg/l	0.1	0.2	0.1	0.4	0.1	0.1	0.2	0.1	0.1	0.1	0.3	0.3	0.2	0.1	0.2
Inter-quartile range	mg/l	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Coefficient of variation	mg/l	16.8	34.4	45.5	4.7	21.4	9.5	7.7	30.5	15.1	23.9	3.9	7.2	15.6	17.8	12.4
Minimum	mg/l	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maximum	mg/l	4.0	8.0	9.0	8.0	5.0	3.0	4.0	5.0	3.0	5.0	6.0	7.0	7.0	2.0	6.0
Missing values	count	17903	18641	21944	31031	29265	20325	19895	23405	27052	27521	19255	18620	17480	26433	23771
Missing values as a %	%	51	53	63	89	84	58	57	67	77	79	55	53	50	75	68

Table 9: Annual summary statistics for ammonium

		Catchment Number														
Variable		**Green**					**Blue**					**Red**				
	units	**4**	**5**	**6**	**12**	**13**	**9**	**8**	**7**	**11**	**14**	**2**	**3**	**1**	**10**	**15**
Mean	uS/cm	202.8	187.8	169.7	169.3	120.5	211.4	152.6	147.9	222.7	160.3	236.0	246.9	237.2	230.4	226.9
Median	uS/cm	214.0	194.0	177.0	183.0	123.0	223.0	151.0	138.0	229.0	161.0	239.0	238.0	248.0	231.0	237.0
Standard deviation	uS/cm	46.9	43.1	36.7	86.4	39.6	54.0	66.4	50.3	63.4	50.2	73.7	89.7	60.9	60.3	61.2
Inter-quartile range	uS/cm	54.0	60.0	25.0	86.2	39.0	80.0	42.0	36.0	60.2	57.0	82.0	106.0	54.0	52.0	73.0
Coefficient of variation	uS/cm	0.2	0.2	0.2	0.5	0.3	0.3	0.4	0.3	0.3	0.3	0.3	0.4	0.3	0.3	0.3
Minimum	uS/cm	55.0	45.0	10.0	29.0	46.0	50.0	11.0	38.0	56.0	35.0	62.0	45.0	49.0	62.0	42.0
Maximum	uS/cm	942.0	693.0	732.0	571.0	547.0	535.0	1127.0	816.0	677.0	487.0	1267.0	828.0	986.0	502.0	626.0
Missing values	count	17906	18641	22009	31087	29265	20326	20061	23405	27103	27521	19255	18620	17480	26433	23768
Missing values as a %	%	51	53	63	89	84	58	57	67	77	79	55	53	50	75	68

Table 10: Annual summary statistics for conductivity

		Catchment Number														
Variable		**Green**					**Blue**					**Red**				
	units	**4**	**5**	**6**	**12**	**13**	**9**	**8**	**7**	**11**	**14**	**2**	**3**	**1**	**10**	**15**
Mean	%	96.4	92.8	91.6	98.5	93.0	86.6	95.6	87.9	97.3	94.5	88.3	92.2	84.0	91.4	91.7
Median	%	96.0	93.0	91.0	99.0	94.0	86.0	95.0	89.0	97.0	95.0	89.0	93.0	83.0	91.0	92.0
Standard deviation	%	2.1	4.2	3.4	1.5	3.4	4.8	2.2	4.8	2.3	2.8	5.9	5.0	6.8	2.4	4.0
Inter-quartile range	%	3.0	5.0	5.0	1.0	6.0	6.0	3.0	5.0	3.0	4.0	6.0	4.0	11.0	3.0	6.0
Coefficient of variation	%	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.1	0.1	0.1	0.0	0.0
Minimum	%	86.0	25.0	81.0	69.0	81.0	77.0	85.0	72.0	84.0	66.0	66.0	58.0	71.0	86.0	71.0
Maximum	%	105.0	102.0	103.0	102.0	102.0	103.0	102.0	104.0	104.0	102.0	102.0	102.0	100.0	99.0	105.0
Missing values	count	17902	18641	21944	31030	29265	20324	19893	23405	27103	27521	19255	18620	17480	26433	23771
Missing values as a %	%	51	53	63	89	84	58	57	67	77	79	55	53	50	75	68

Table 11: Annual summary statistics for dissolved oxygen

		Catchment Number														
Variable		**Green**					**Blue**					**Red**				
	units	**4**	**5**	**6**	**12**	**13**	**9**	**8**	**7**	**11**	**14**	**2**	**3**	**1**	**10**	**15**
Mean	unitless	6.2	6.0	6.0	6.1	6.1	6.0	5.9	5.7	6.5	6.6	6.1	6.1	6.0	6.3	6.0
Median	unitless	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	7.0	7.0	6.0	6.0	6.0	6.0	6.0
Standard deviation	unitless	0.5	0.3	0.2	0.8	0.4	0.2	0.4	0.6	0.7	0.6	0.5	0.6	0.3	0.9	0.2
Inter-quartile range	unitless	1.0	0.0	0.0	1.0	0.0	0.0	0.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0
Coefficient of variation	unitless	0.1	0.0	0.0	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0
Minimum	unitless	3.0	4.0	4.0	4.0	4.0	4.0	3.0	3.0	3.0	4.0	3.0	3.0	3.0	4.0	4.0
Maximum	unitless	7.0	7.0	7.0	7.0	7.0	7.0	8.0	7.0	7.0	7.0	8.0	7.0	7.0	9.0	7.0
Missing values	count	17903	18641	21945	31029	29265	20325	19894	23405	27103	27521	19255	18620	17480	26433	23771
Missing values as a %	%	51	53	63	89	84	58	57	67	77	79	55	53	50	75	68

Table 12: Annual summary statistics for pH

		Catchment Number														
Variable		**Green**					**Blue**					**Red**				
	units	**4**	**5**	**6**	**12**	**13**	**9**	**8**	**7**	**11**	**14**	**2**	**3**	**1**	**10**	**15**
Mean	°C	7.7	7.8	8.2	8.0	7.5	7.8	8.1	8.1	7.7	7.3	7.7	7.9	7.9	7.8	7.6
Median	°C	7.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Standard deviation	°C	1.9	1.9	1.7	2.0	1.9	1.8	2.6	2.0	1.9	2.1	2.0	2.3	2.0	1.5	2.0
Inter-quartile range	°C	3.0	2.0	2.0	2.0	3.0	2.0	2.0	2.0	2.0	3.0	3.0	2.0	3.0	2.0	3.0
Coefficient of variation	°C	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.2	0.2	0.3	0.3	0.3	0.3	0.2	0.3
Minimum	°C	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0
Maximum	°C	15.0	18.0	19.0	18.0	20.0	19.0	24.0	18.0	19.0	19.0	19.0	20.0	19.0	18.0	19.0
Missing values	count	17902	18641	21944	31086	29265	20324	19893	23405	27052	27521	19255	18620	17480	26433	23771
Missing values as a %	%	51	53	63	89	84	58	57	67	77	79	55	53	50	75	68

Table 13: Annual summary statistics for flow cell water temperature

		Catchment Number														
Variable		**Green**					**Blue**					**Red**				
	units	**4**	**5**	**6**	**12**	**13**	**9**	**8**	**7**	**11**	**14**	**2**	**3**	**1**	**10**	**15**
Mean	FNU	5.9	10.0	8.9	14.1	24.8	5.8	11.3	11.3	8.1	82.3	9.5	11.2	10.7	10.4	38.3
Median	FNU	3.0	6.0	4.0	8.0	21.0	3.0	6.0	8.0	5.0	40.0	6.0	7.0	8.0	6.0	10.0
Standard deviation	FNU	7.7	17.4	17.5	29.7	13.7	10.7	19.1	10.9	9.8	111.4	13.3	16.4	16.0	12.4	87.9
Inter-quartile range	FNU	5.0	8.0	7.0	13.0	15.0	5.0	13.0	10.0	8.0	101.0	11.0	9.0	5.0	9.0	33.0
Coefficient of variation	FNU	1.3	1.7	2.0	2.1	0.6	1.8	1.7	1.0	1.2	1.4	1.4	1.5	1.5	1.2	2.3
Minimum	FNU	0.0	0.0	0.0	1.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
Maximum	FNU	234.0	668.0	406.0	1180.0	210.0	455.0	722.0	340.0	156.0	1933.0	531.0	674.0	997.0	209.0	2156.0
Missing values	count	17903	18641	21944	31029	29266	20324	19893	23405	27052	27521	19255	18620	17482	26433	23768
Missing values as a %	%	51	53	63	89	84	58	57	67	77	79	55	53	50	75	68

Table 14: Annual summary statistics for turbidity

		Catchment Number														
Variable		**Green**					**Blue**					**Red**				
	units	**4**	**5**	**6**	**12**	**13**	**9**	**8**	**7**	**11**	**14**	**2**	**3**	**1**	**10**	**15**
Mean	mg/l	NA	0.0	NA	NA	NA	NA	0.0	NA	NA	NA	0.0	0.0	NA	NA	NA
Median	mg/l	NA	0.0	NA	NA	NA	NA	0.0	NA	NA	NA	0.0	0.0	NA	NA	NA
Standard deviation	mg/l	NA	0.0	NA	NA	NA	NA	0.0	NA	NA	NA	0.0	0.0	NA	NA	NA
Inter-quartile range	mg/l	NA	0.0	NA	NA	NA	NA	0.0	NA	NA	NA	0.0	0.0	NA	NA	NA
Coefficient of variation	mg/l	NA	80.9	NA	NA	NA	NA	NA	NA	NA	NA	38.2	65.6	NA	NA	NA
Minimum	mg/l	NA	0.0	NA	NA	NA	NA	0.0	NA	NA	NA	0.0	0.0	NA	NA	NA
Maximum	mg/l	NA	1.0	NA	NA	NA	NA	0.0	NA	NA	NA	1.0	1.0	NA	NA	NA
Missing values	count	35039	21949	35039	35039	35039	35039	24635	35039	35039	35039	24844	22114	35039	35039	35039
Missing values as a %	%	100	63	100	100	100	100	70	100	100	100	71	63	100	100	100

Table 15: Annual summary statistics for total phosphorus

		Catchment Number														
Variable		**Green**					**Blue**					**Red**				
	units	**4**	**5**	**6**	**12**	**13**	**9**	**8**	**7**	**11**	**14**	**2**	**3**	**1**	**10**	**15**
Mean	ug/l QSU	109.9	145.4	93.8	94.5	205.4	98.3	109.1	99.3	126.5	126.0	148.4	155.3	119.7	144.6	82.5
Median	ug/l QSU	104.0	145.0	83.0	91.0	203.0	96.0	113.0	100.0	123.0	121.0	153.0	145.0	124.0	141.0	78.0
Standard deviation	ug/l QSU	49.1	68.6	59.9	27.4	34.4	50.4	62.4	25.6	38.9	64.0	51.7	62.5	48.5	32.0	40.4
Inter-quartile range	ug/l QSU	80.0	112.0	104.0	37.0	56.0	85.0	96.0	33.0	54.0	116.0	72.0	90.0	64.0	43.0	69.0
Coefficient of variation	ug/l QSU	0.4	0.5	0.6	0.3	0.2	0.5	0.6	0.3	0.3	0.5	0.3	0.4	0.4	0.2	0.5
Minimum	ug/l QSU	0.0	0.0	1.0	0.0	36.0	0.0	0.0	22.0	0.0	0.0	23.0	2.0	0.0	30.0	0.0
Maximum	ug/l QSU	242.0	345.0	263.0	193.0	273.0	324.0	326.0	240.0	229.0	255.0	283.0	309.0	262.0	247.0	174.0
Missing values	count	17902	18641	21944	31029	29265	20692	19945	23405	27052	27539	19255	18621	17483	26433	23792
Missing values as a %	%	51	53	63	89	84	59	57	67	77	79	55	53	50	75	68

Table 16: Annual summary statistics for dissolved organic matter

		Catchment Number														
Variable		**Green**					**Blue**					**Red**				
	units	**4**	**5**	**6**	**12**	**13**	**9**	**8**	**7**	**11**	**14**	**2**	**3**	**1**	**10**	**15**
Mean	mg/l	NA	0.0	NA	NA	NA	NA	0.0	NA	NA	NA	0.0	0.0	NA	NA	NA
Median	mg/l	NA	0.0	NA	NA	NA	NA	0.0	NA	NA	NA	0.0	0.0	NA	NA	NA
Standard deviation	mg/l	NA	0.0	NA	NA	NA	NA	0.0	NA	NA	NA	0.0	0.0	NA	NA	NA
Inter-quartile range	mg/l	NA	0.0	NA	NA	NA	NA	0.0	NA	NA	NA	0.0	0.0	NA	NA	NA
Coefficient of variation	mg/l	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Minimum	mg/l	NA	0.0	NA	NA	NA	NA	0.0	NA	NA	NA	0.0	0.0	NA	NA	NA
Maximum	mg/l	NA	0.0	NA	NA	NA	NA	0.0	NA	NA	NA	0.0	0.0	NA	NA	NA
Missing values	count	35039	21949	35039	35039	35039	35039	24635	35039	35039	35039	24844	22114	35039	35039	35039
Missing values as a %	%	100	63	100	100	100	100	70	100	100	100	71	63	100	100	100

Table 17: Annual summary statistics for ortho-phosphorus

4 APPENDIX

4.1 Hydrological areas - Catchments

	Catchment Number														
	Green					Blue					Red				
	4	5	6	12	13	9	8	7	11	14	2	3	1	10	15
pre-13/08/2013	11.6	6.7	4.0	1.9	1.8	7.9	7.3	2.7	1.8	1.8	6.8	6.8	5.0	1.9	1.6
post-13/08/2013	8.1	6.7	4.0	1.9	1.8	7.9	7.3	2.7	1.8	1.8	6.8	6.8	5.0	1.9	1.6

Table 18: Catchment hydrological areas (ha) pre- and post- change to area of Catchment 4 on 13th August 2013

4.2 Hydrological areas - Farmlets

	Green	Blue	Red
pre-13/08/2013	25.9	21.6	22.2
post-13/08/2013	22.4	21.6	22.2

Table 19: Farmlet hydrological areas (ha) pre- and post- change to area of Catchment 4 on 13th August 2013