DATA QUALITY AND SUMMARY STATISTICS

FLUME DATA

Annual Report 2013

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

Table of Contents

List of Tables

List of Figures

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)	624	313	285	593	0	285	3850	285	0	0	36	0	0	0	0
PLC Switch = 0 (no flow)	15377	21727	24555	31829	31204	23729	20054	25809	30284	28842	23259	22127	20208	28880	25003
PLC Switch = 1 (flow)	19038	12999	10199	2617	3835	11025	11135	8945	4755	6197	11744	12912	14831	6159	10036

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	25564	30407	32654	33858	34119	31739	30007	33337	34131	33477	29182	30656	29297	33494	32777
Nitrate+nitrite	mg/l	5613	990	1680	997	1361	1469	3406	1649	723	1082	2472	3021	8413	456	949
Ammonia	mg/l	18212	9211	9805	2462	3715	10793	10695	8912	4724	5320	11114	11114	13102	6151	9863
Ammonium	mg/l	16746	9813	9744	2324	3654	10697	8230	8796	4634	5233	6263	10725	11249	5925	9264
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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Turbidity	FNU	6877	672	3616	111	2	267	47	437	2	142	699	911	1208	562	1360
Total phosphorus	mg/l	NA	4708	NA	NA	NA	NA	3656	NA	NA	NA	4789	NA	NA	NA	NA
Dissolved organic matter	ug/l QSU	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ortho-phosphorus	mg/l	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	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	624	313	0	593	0	0	0	0	0	0	36	0	0	0	0
Nitrate+nitrite	16402	23430	25218	32627	31276	24586	25112	27756	30332	30221	24446	22935	21895	29056	25394
Ammonia	16827	25828	25234	32577	31324	24246	24344	26127	30315	29719	23815	23925	21894	28888	25176
Ammonium	18114	24641	25234	32577	31323	24246	25457	26131	30315	29719	25054	23925	23272	28888	25176
Conductivity	16830	24643	25234	32577	31323	24246	24348	26128	30316	29719	24035	23930	22068	28888	25177
Dissolved oxygen	16827	25828	25234	32577	31324	24246	24344	26127	30315	29719	23480	23925	21892	28888	25176
pH	16827	24641	25234	32577	31323	24246	24344	26127	30315	29719	23480	23925	21892	28888	25176
Flow cell water temperature	16827	24641	25234	32577	31323	24246	24344	26127	30315	29719	23480	23925	21892	28888	25176
Turbidity	19149	24900	26052	33258	31325	25766	24356	26346	30315	29843	25558	23928	23249	29138	26618
Total phosphorus	35039	30331	35039	35039	35039	35039	31378	35039	35039	35039	30250	35039	35039	35039	35039
Dissolved organic matter	35039	35039	35039	35039	35039	35039	35039	35039	35039	35039	35039	35039	35039	35039	35039
Ortho-phosphorus	35039	35039	35039	35039	35039	35039	35039	35039	35039	35039	35039	35039	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	2	1	0	2	0	0	0	0	0	0	0	0	0	0	0
PLC Switch	2	1	1	2	0	1	11	1	0	0	0	0	0	0	0
Nitrate+nitrite	47	67	72	93	89	70	72	79	87	86	70	65	62	83	72
Ammonia	48	74	72	93	89	69	69	75	87	85	68	68	62	82	72
Ammonium	52	70	72	93	89	69	73	75	87	85	72	68	66	82	72
Conductivity	48	70	72	93	89	69	69	75	87	85	69	68	63	82	72
Dissolved oxygen	48	74	72	93	89	69	69	75	87	85	67	68	62	82	72
pH	48	70	72	93	89	69	69	75	87	85	67	68	62	82	72
Flow cell water temperature	48	70	72	93	89	69	69	75	87	85	67	68	62	82	72
Turbidity	55	71	74	95	89	74	70	75	87	85	73	68	66	83	76
Total phosphorus	100	87	100	100	100	100	90	100	100	100	86	100	100	100	100
Dissolved organic matter	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Ortho-phosphorus	100	100	100	100	100	100	100	100	100	100	100	100	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	0	0	0	0	0
Nitrate+nitrite	401	1390	378	205	72	572	1208	1662	48	1379	1151	808	1687	176	391
Ammonia	826	3788	394	155	120	232	440	33	31	877	520	1798	1686	8	173
Ammonium	2113	2601	394	155	119	232	1553	37	31	877	1759	1798	3064	8	173
Conductivity	829	2603	394	155	119	232	444	34	32	877	740	1803	1860	8	174
Dissolved oxygen	826	3788	394	155	120	232	440	33	31	877	185	1798	1684	8	173
pH	826	2601	394	155	119	232	440	33	31	877	185	1798	1684	8	173
Flow cell water temperature	826	2601	394	155	119	232	440	33	31	877	185	1798	1684	8	173
Turbidity	3148	2860	1212	836	121	1752	452	252	31	1001	2263	1801	3041	258	1615
Dissolved organic matter	19038	12999	10199	2617	3835	11025	11135	8945	4755	6197	11744	12912	14831	6159	10036
Ortho-phosphorus	19038	12999	10199	2617	3835	11025	11135	8945	4755	6197	11744	12912	14831	6159	10036

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	181	267	344	1316	914	318	315	392	737	565	298	271	236	569	349
Nitrate+nitrite	98	89	96	92	98	95	89	81	99	78	90	94	89	97	96
Ammonia	96	71	96	94	97	98	96	100	99	86	96	86	89	100	98
Ammonium	89	80	96	94	97	98	86	100	99	86	85	86	79	100	98
Conductivity	96	80	96	94	97	98	96	100	99	86	94	86	87	100	98
Dissolved oxygen	96	71	96	94	97	98	96	100	99	86	98	86	89	100	98
pH	96	80	96	94	97	98	96	100	99	86	98	86	89	100	98
Flow cell water temperature	96	80	96	94	97	98	96	100	99	86	98	86	89	100	98
Turbidity	83	78	88	68	97	84	96	97	99	84	81	86	79	96	84
Dissolved organic matter	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ortho-phosphorus	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

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.

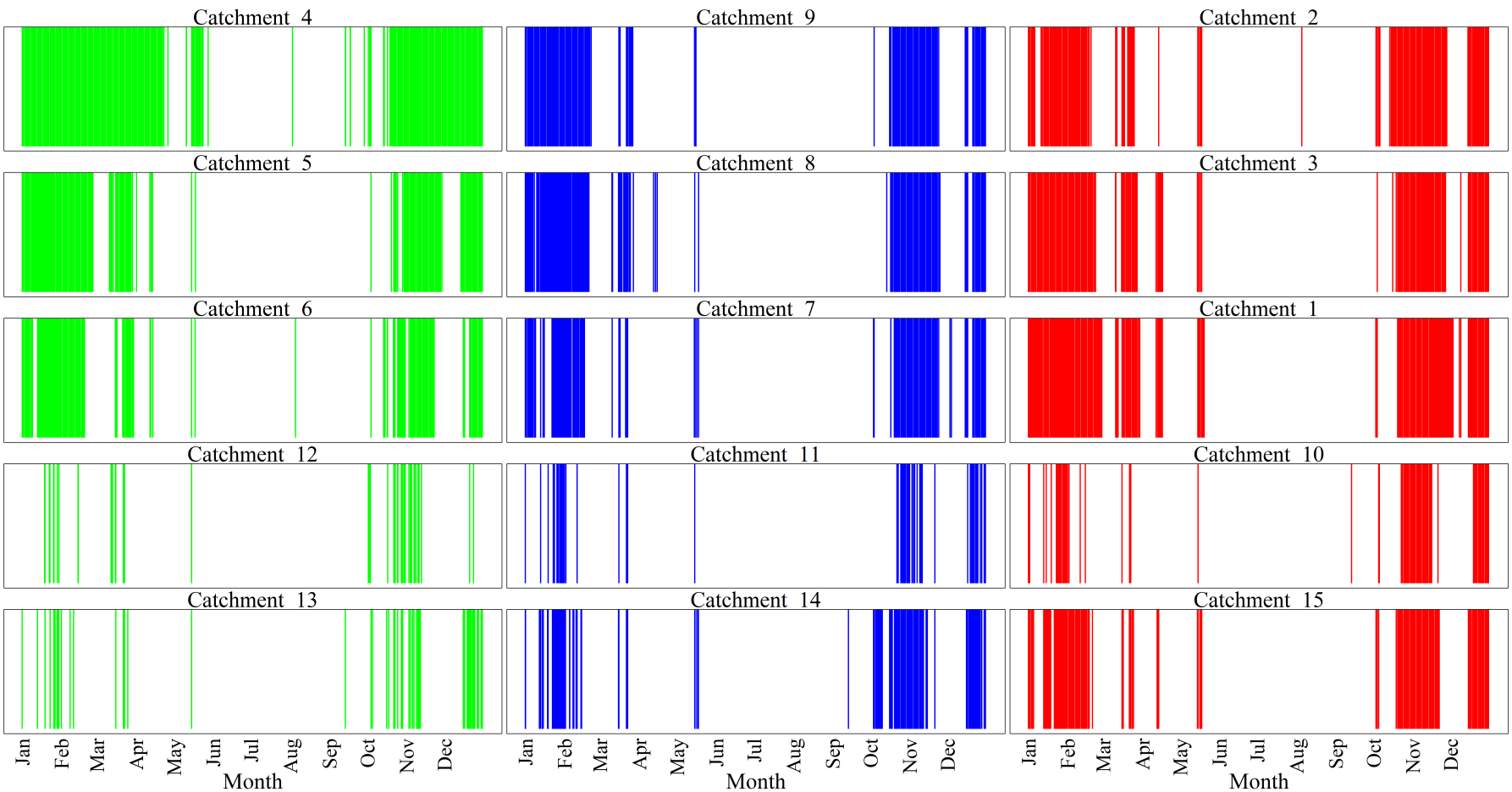


Figure 1: Timesteps of missing nitrate+nitrite data

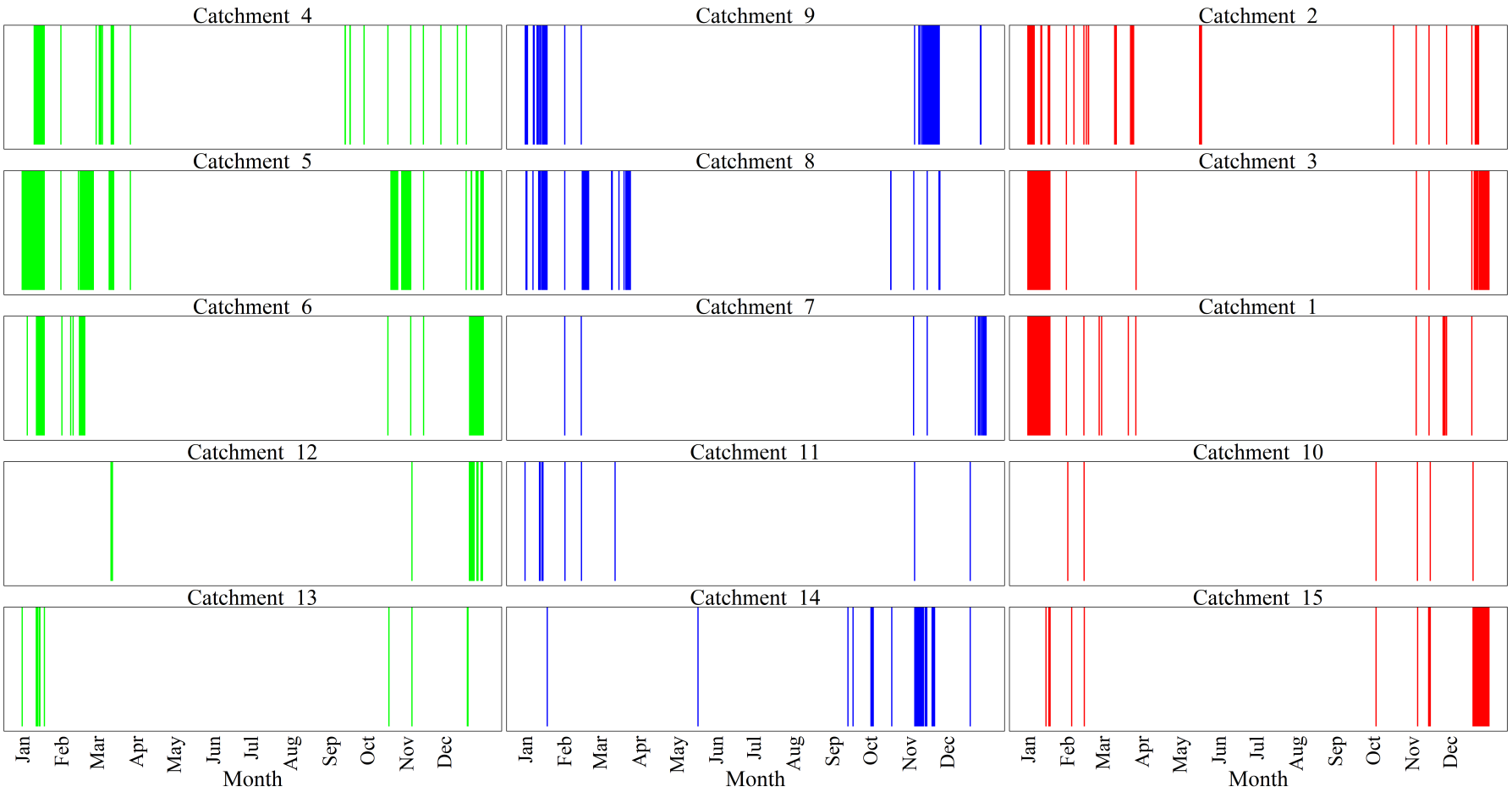


Figure 2: Timesteps of missing ammonia data

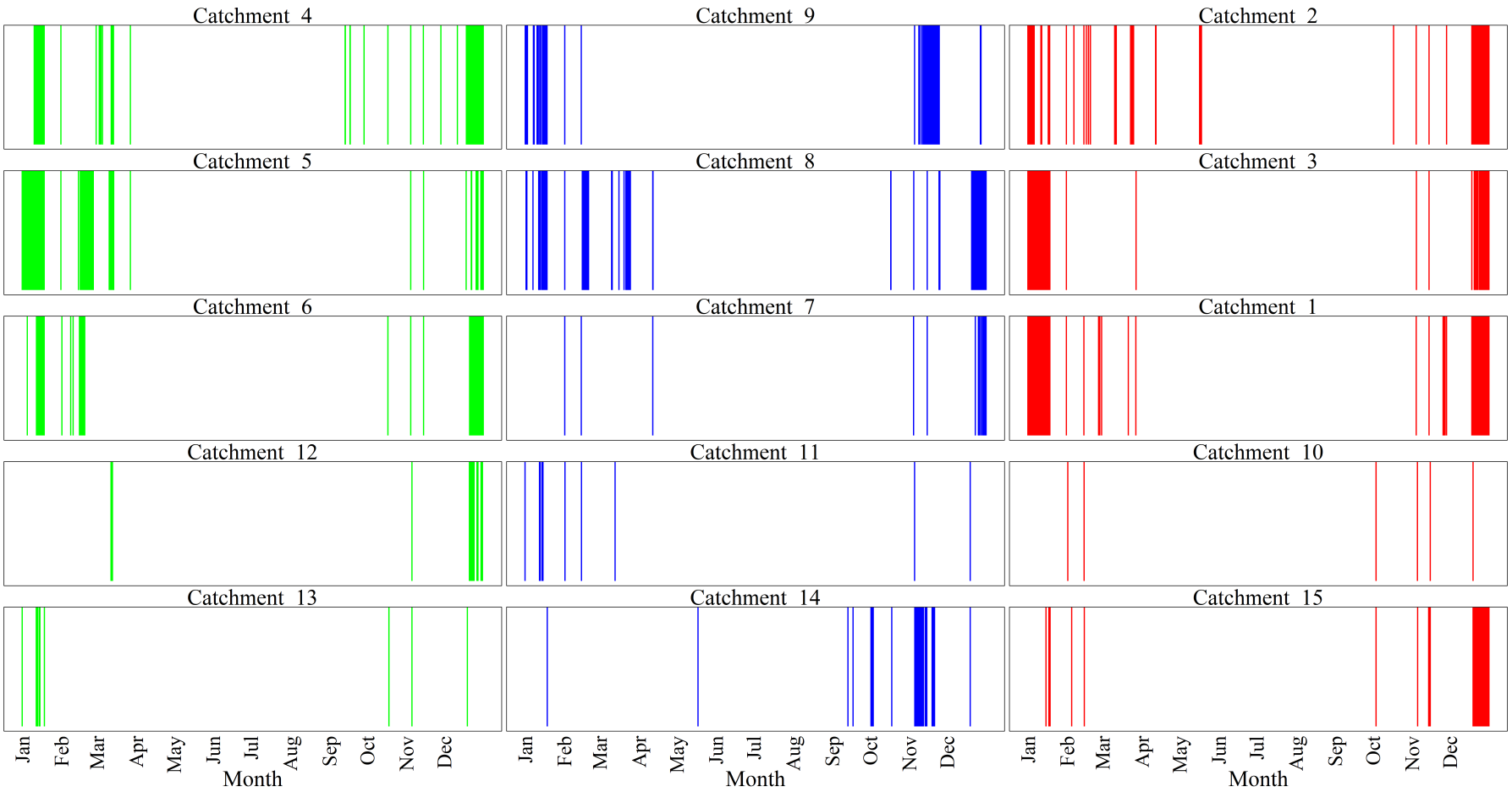


Figure 3: Timesteps of missing ammonium data

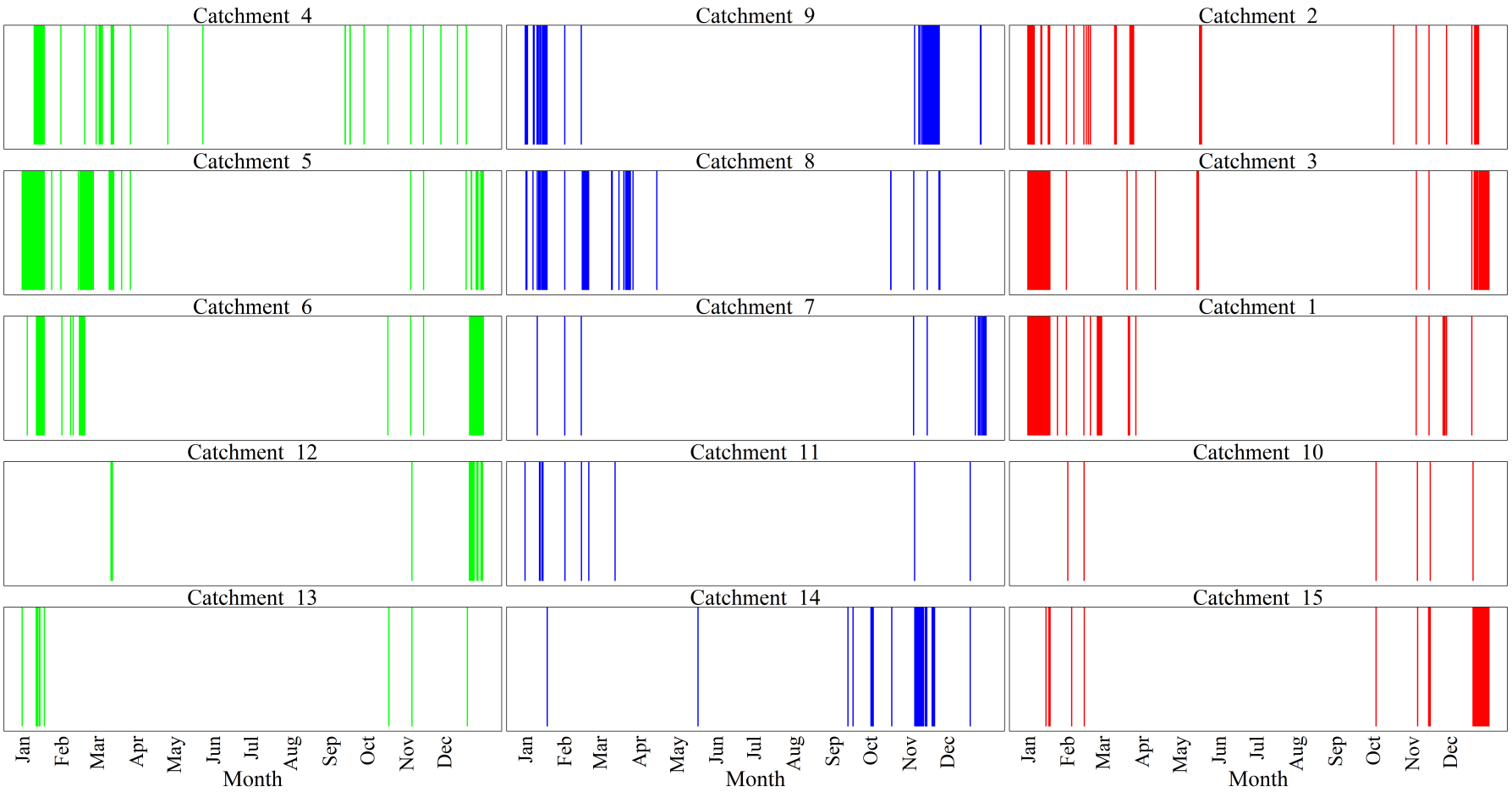


Figure 4: Timesteps of missing conductivity data

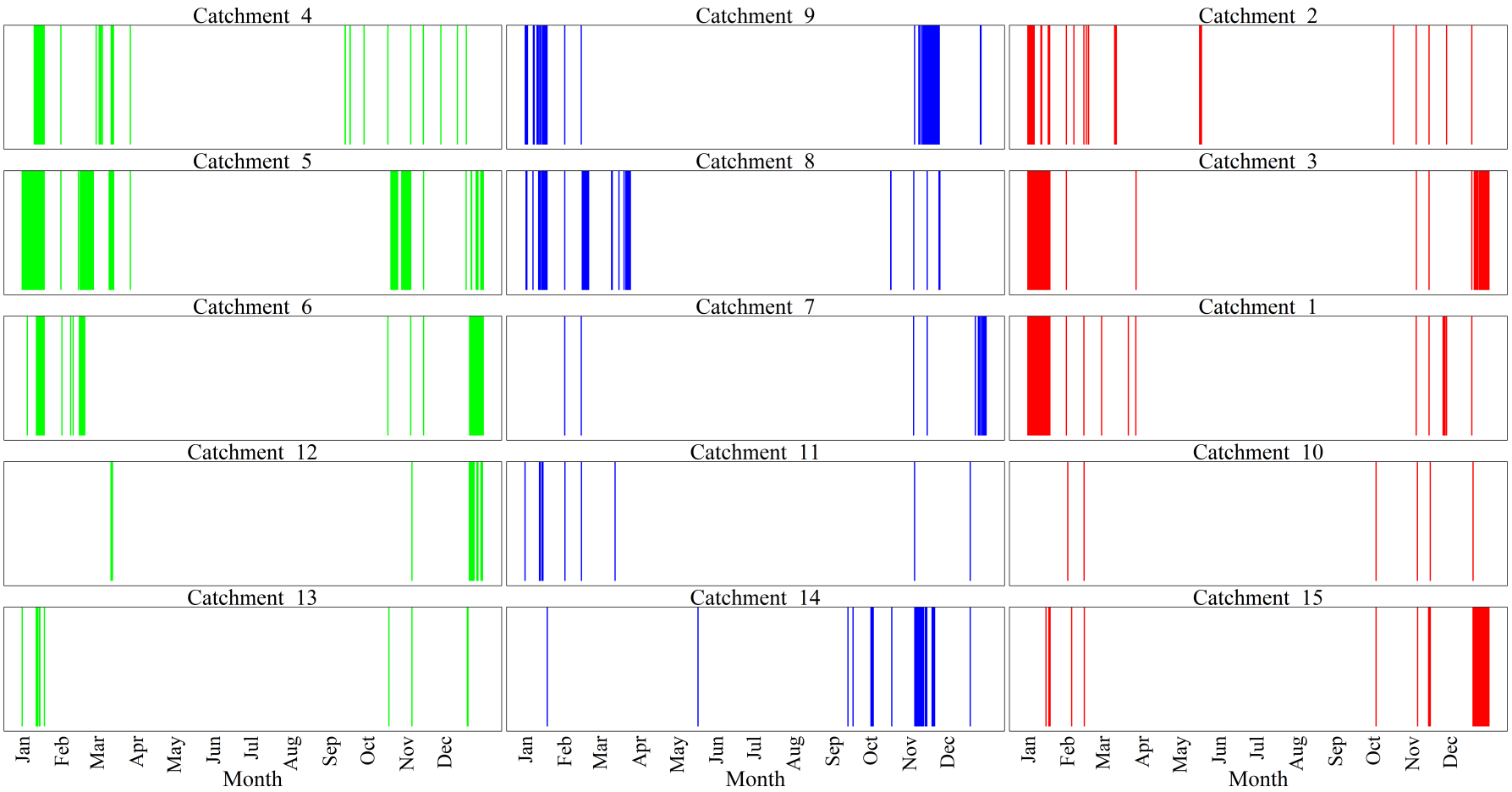


Figure 5: Timesteps of missing dissolved oxygen data

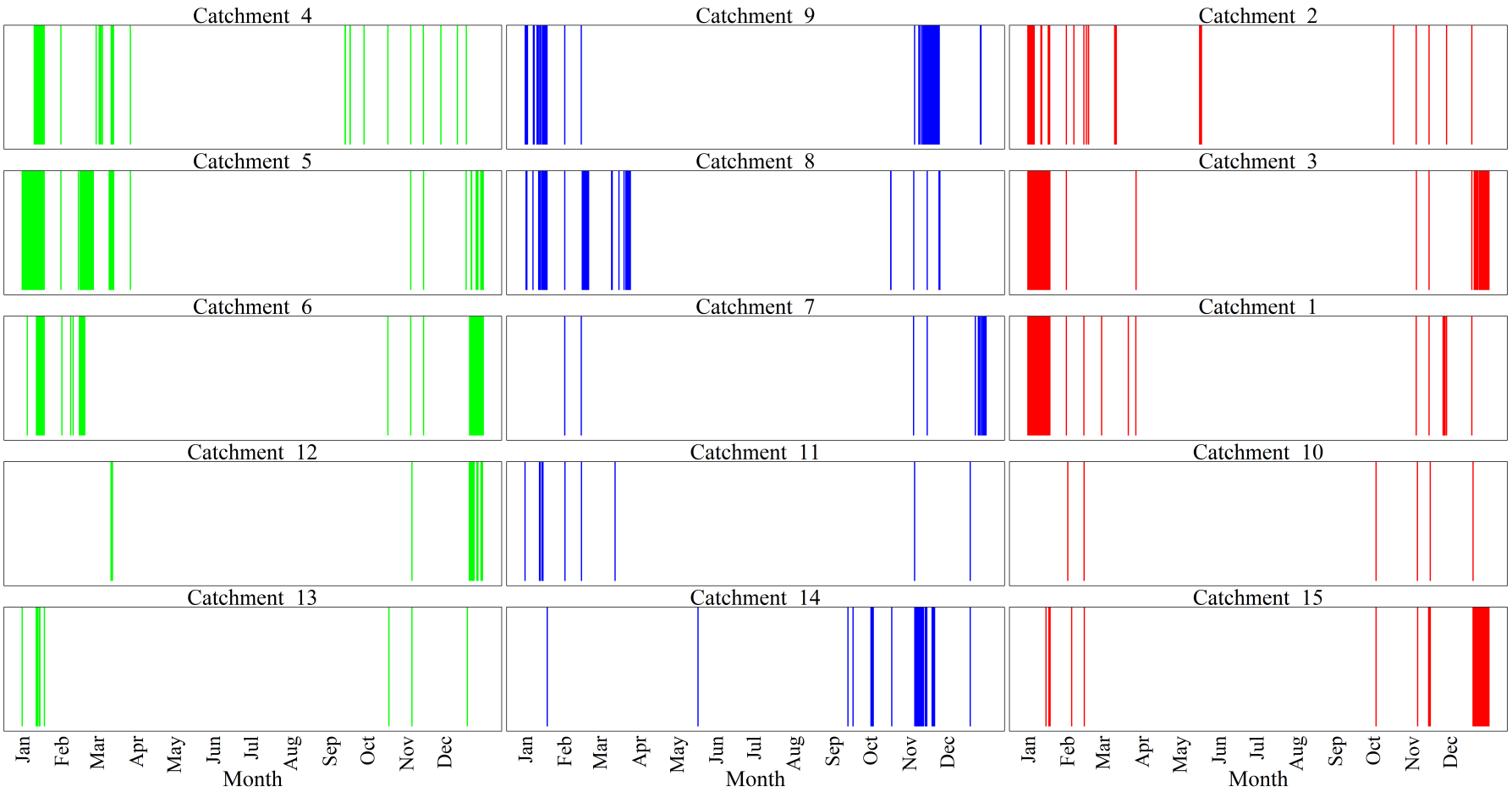


Figure 6: Timesteps of missing pH data

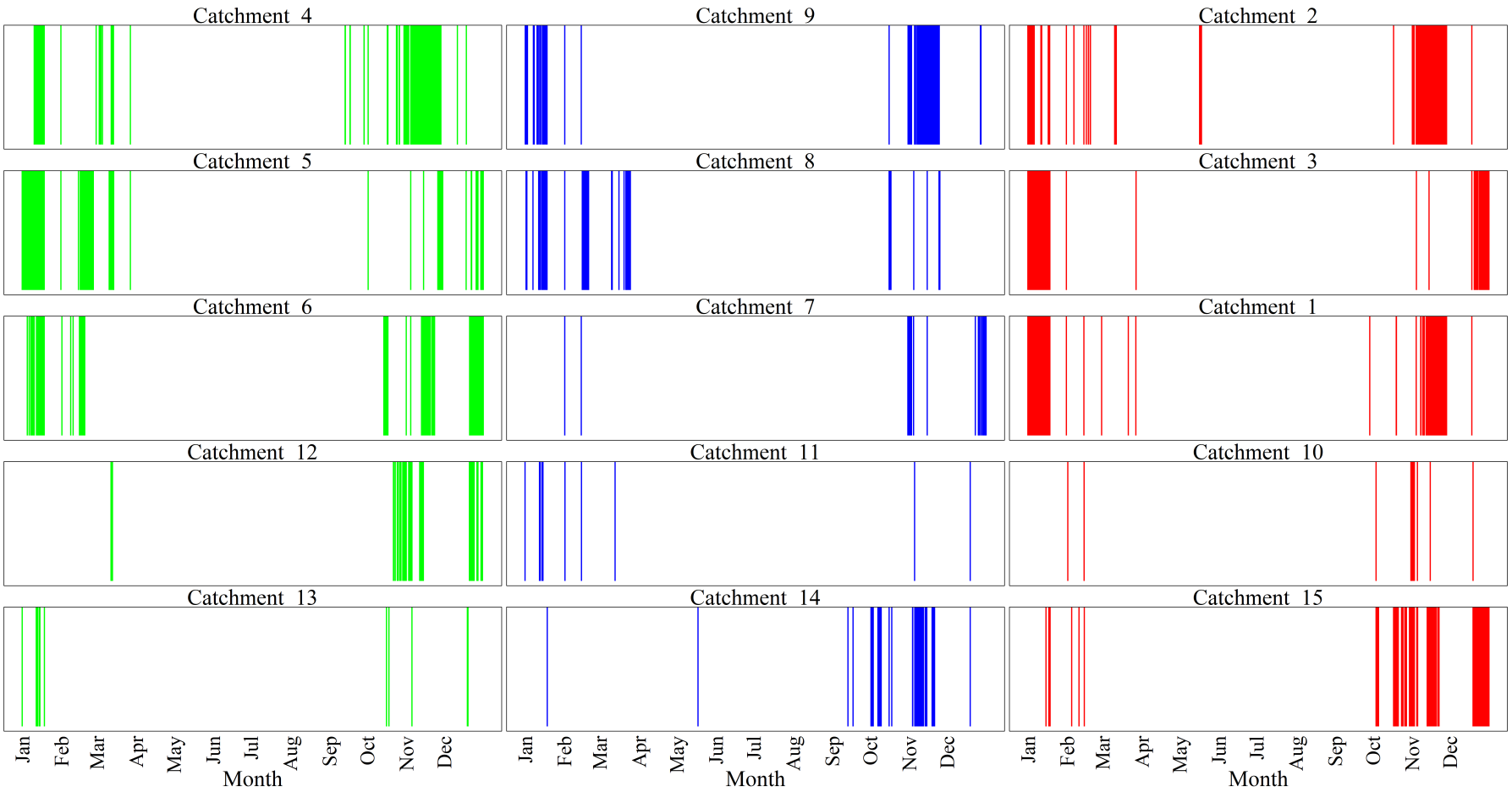


Figure 7: Timesteps of missing flow cell water temperature data

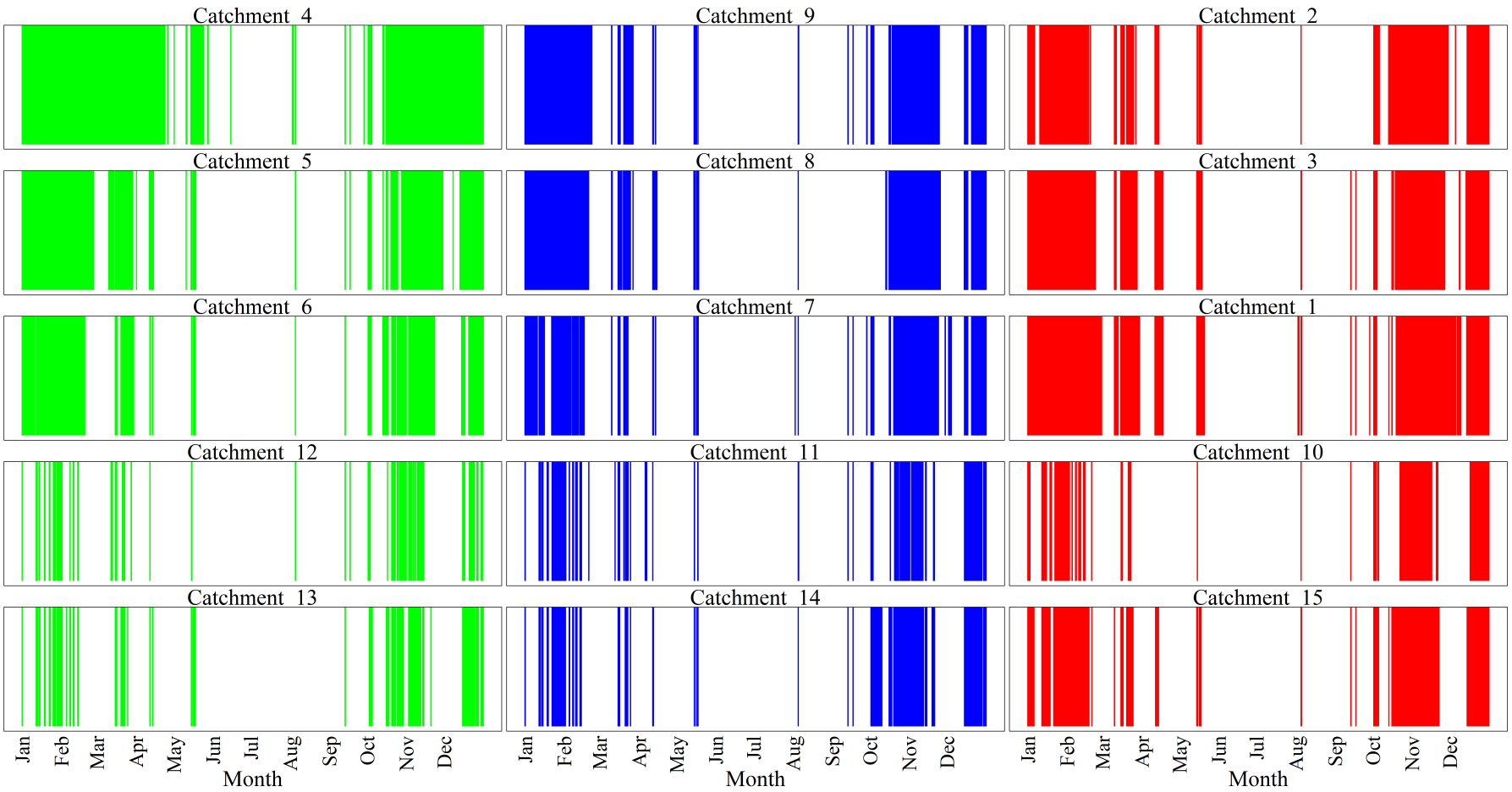


Figure 8: Timesteps of missing turbidity data

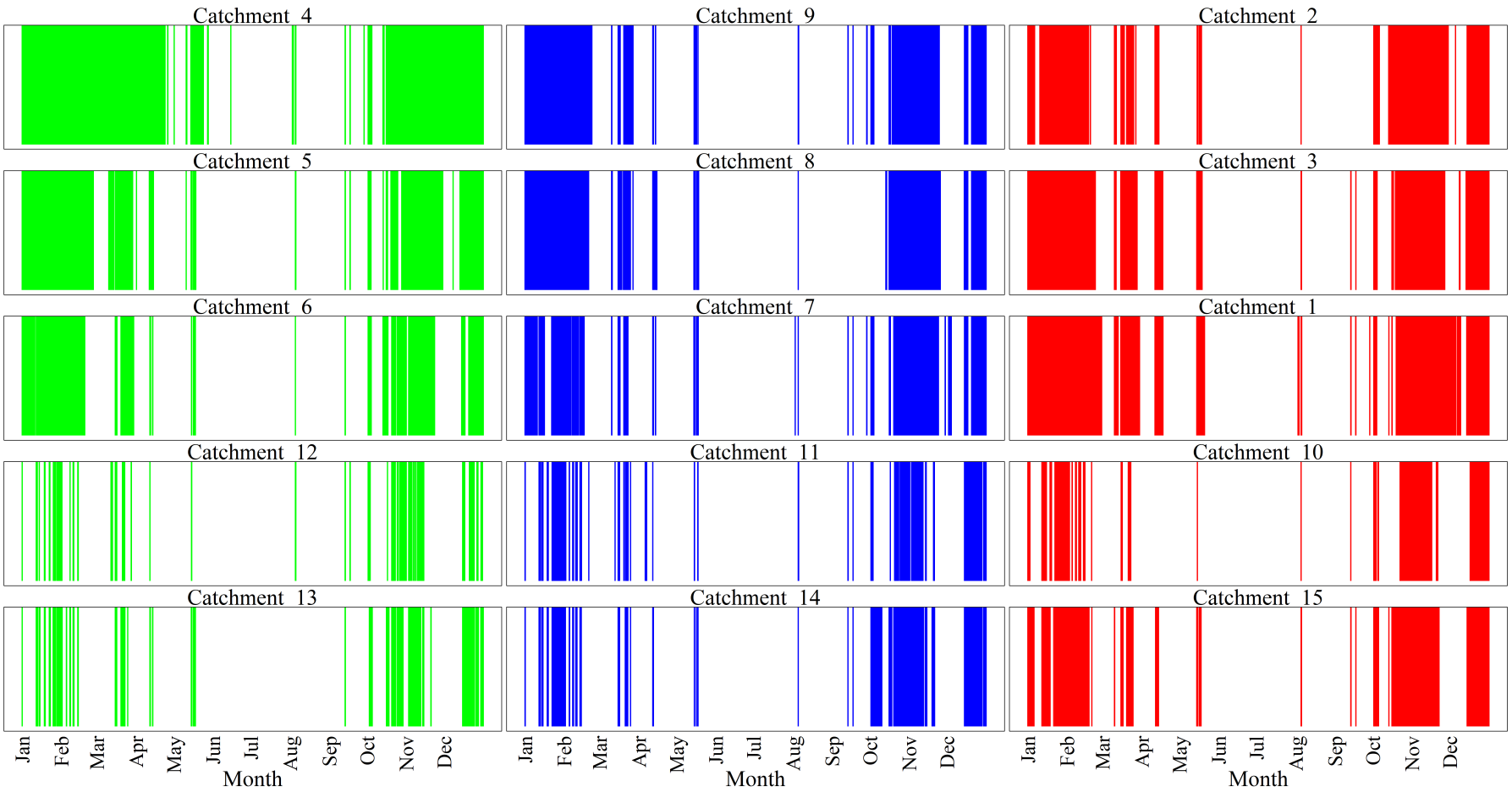


Figure 9: Timesteps of missing dissolved organic matter data

1.4 Histograms of 15 minute data distribution

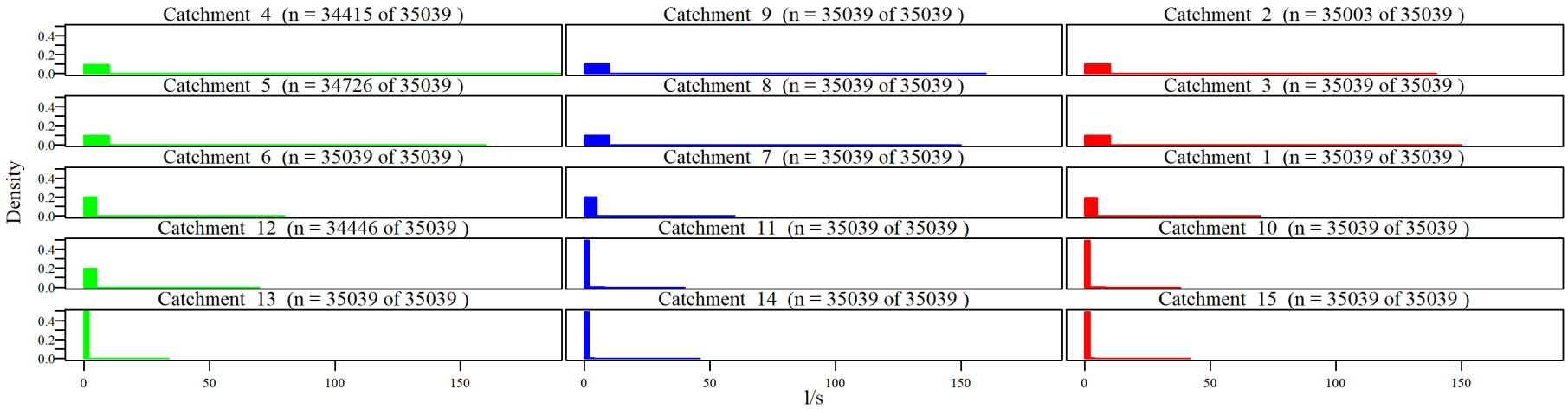


Figure 10: Distribution of data - flow

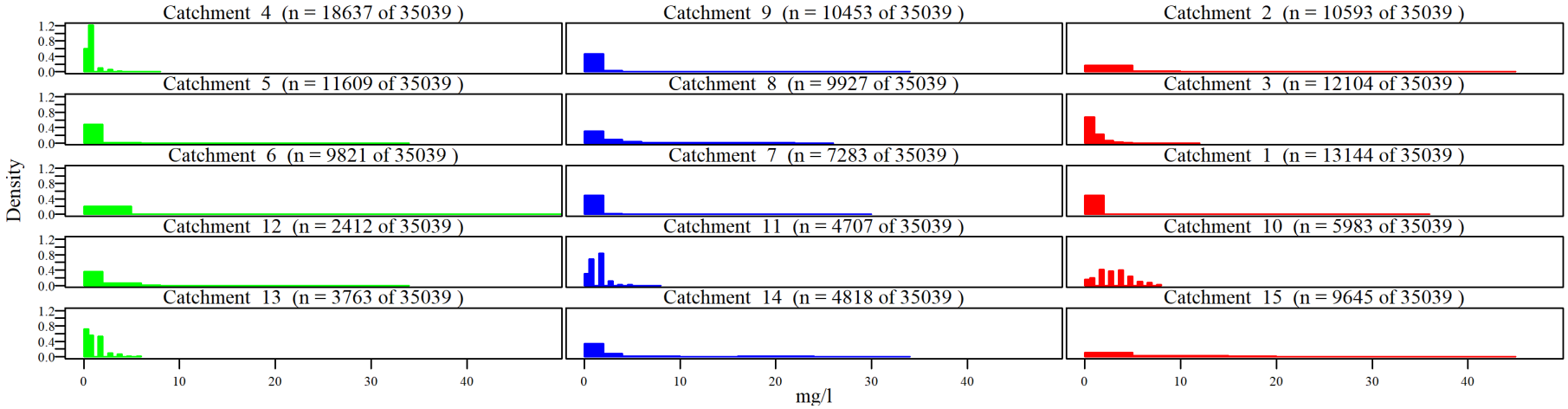


Figure 11: Distribution of data - nitrate+nitrite

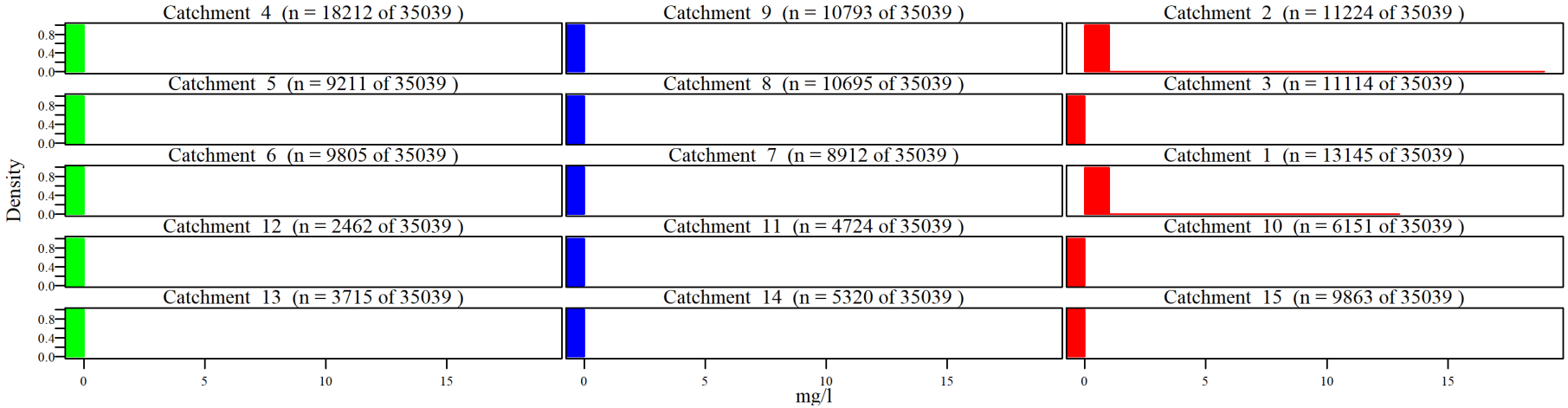


Figure 12: Distribution of data - ammonia

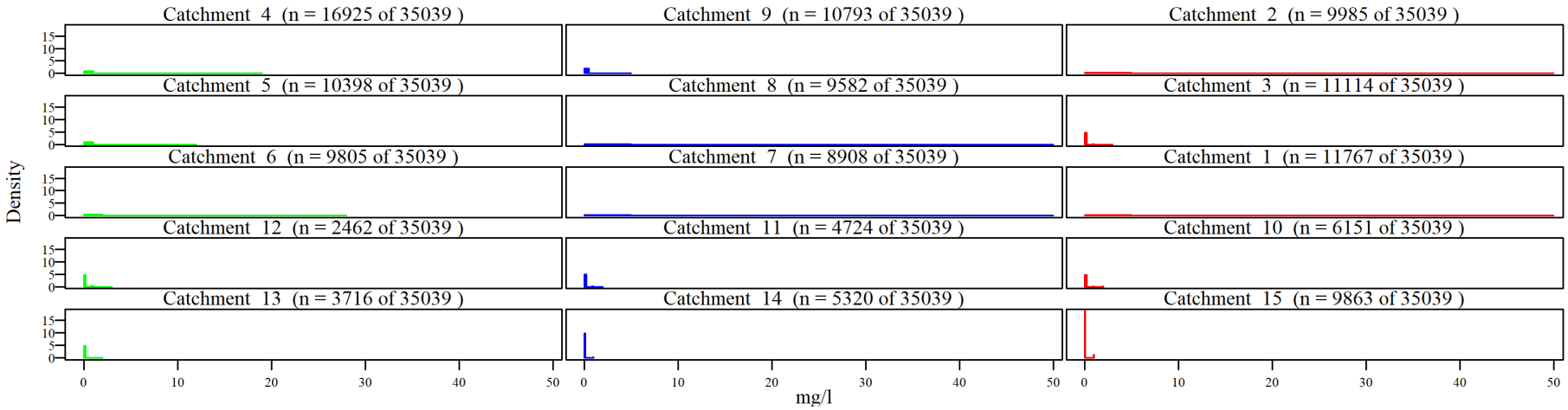


Figure 13: Distribution of data - ammonium

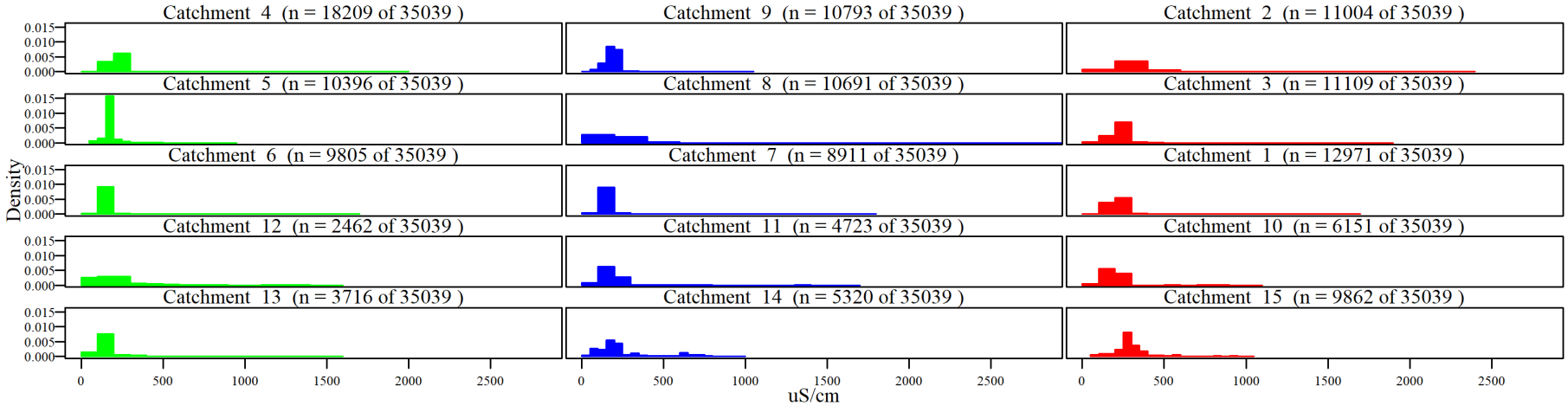


Figure 14: Distribution of data - conductivity

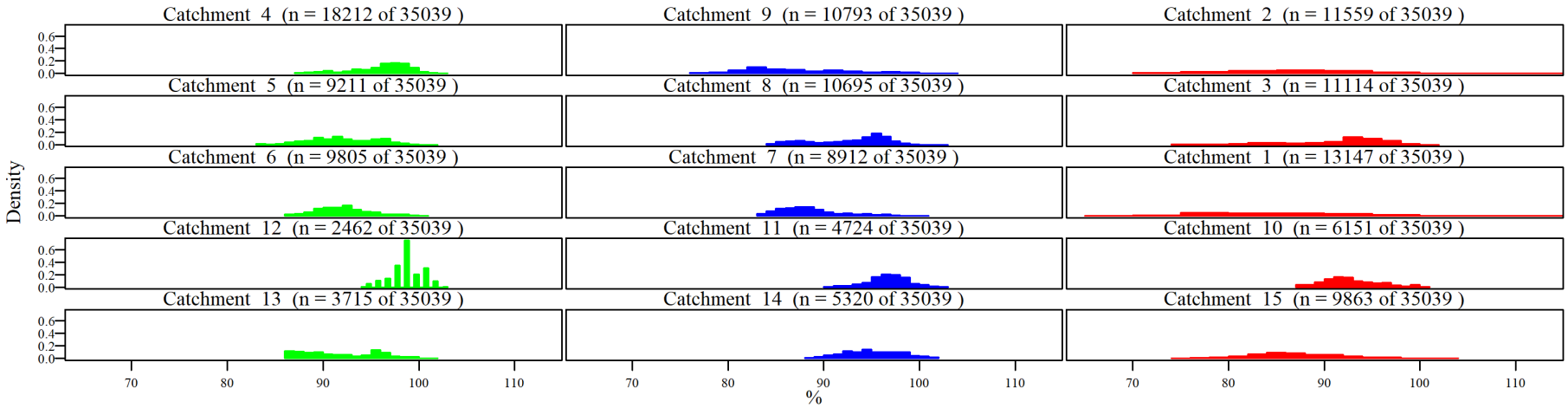


Figure 15: Distribution of data - dissolved oxygen

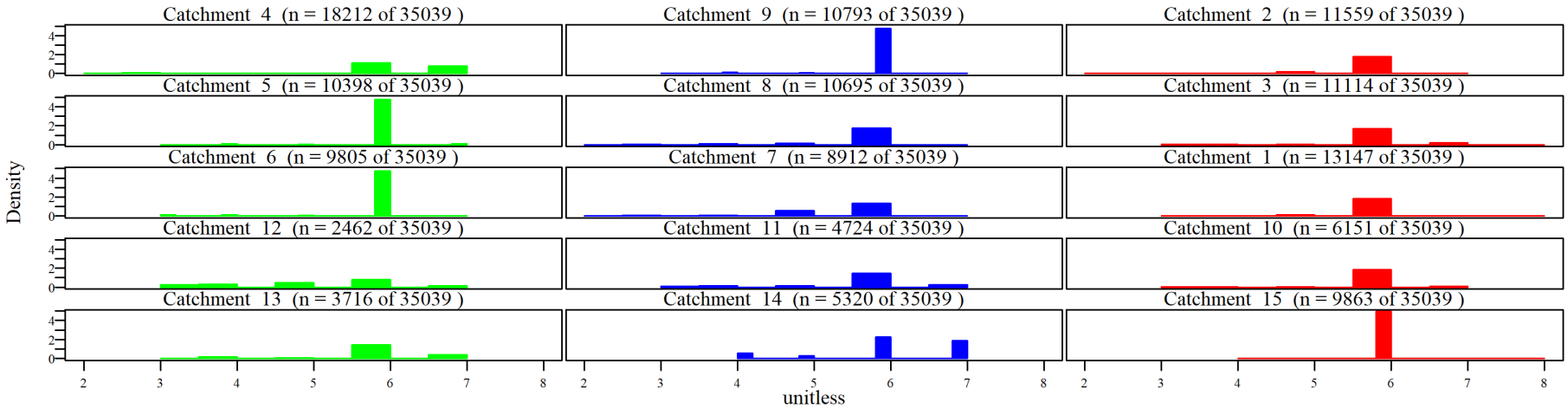


Figure 16: Distribution of data - pH

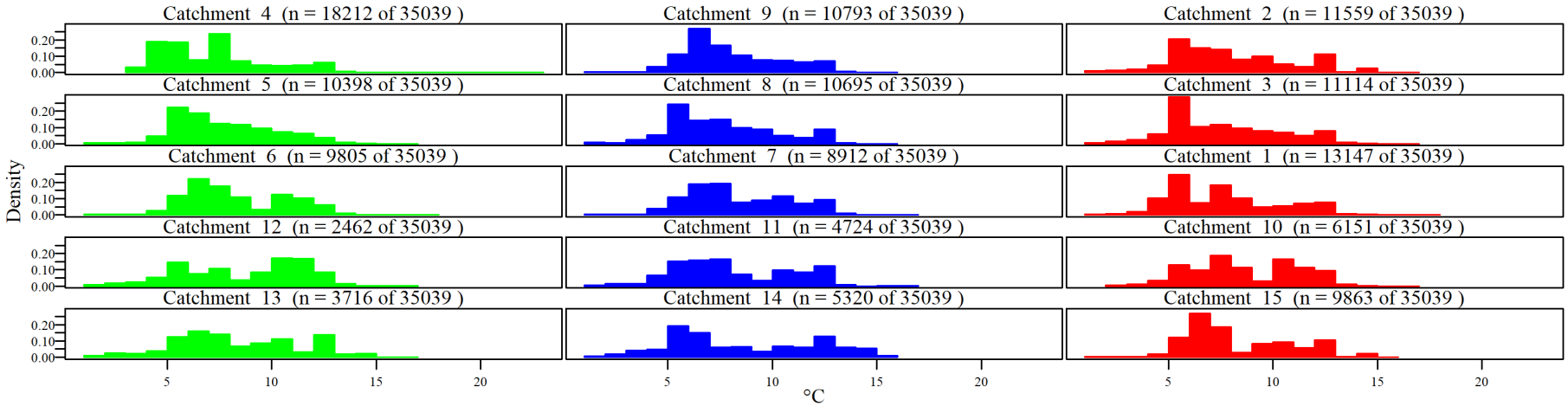


Figure 17: Distribution of data - flow cell water temperature

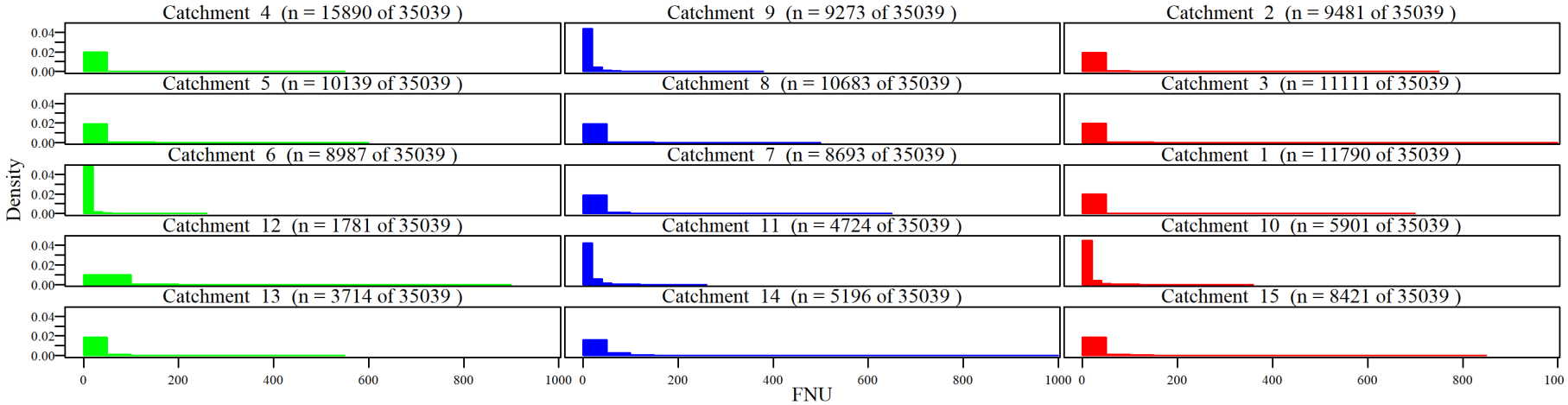


Figure 18: Distribution of data - turbidity

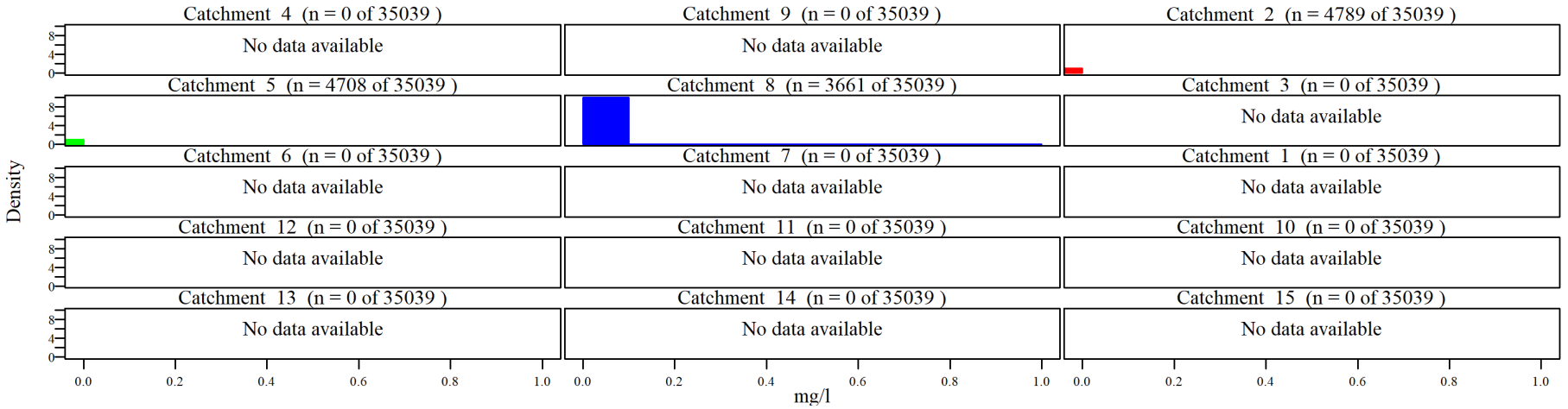


Figure 19: Distribution of data - total phosphorus

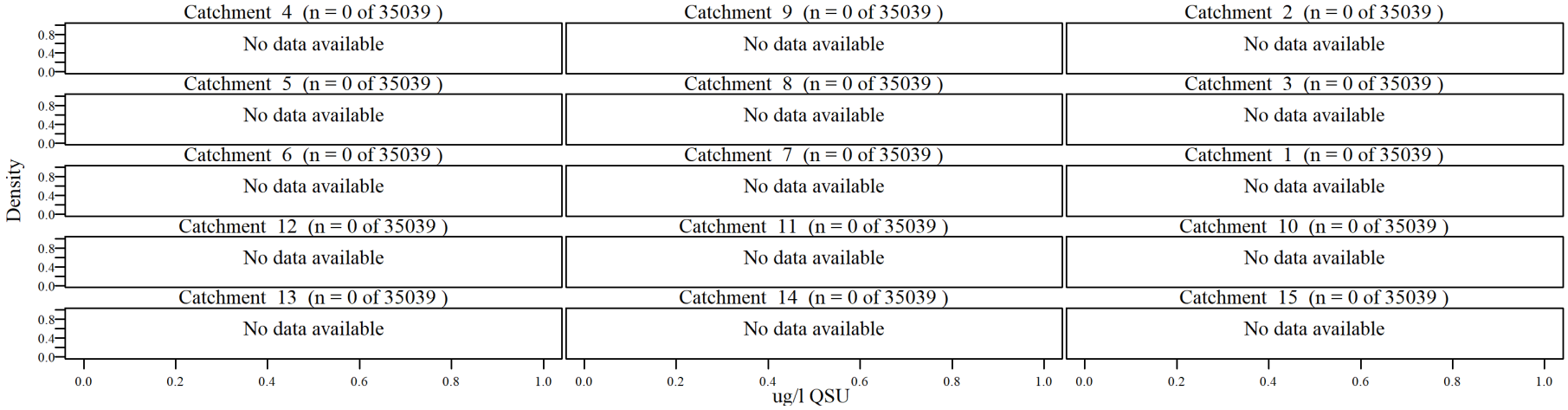


Figure 20: Distribution of data - dissolved organic matter

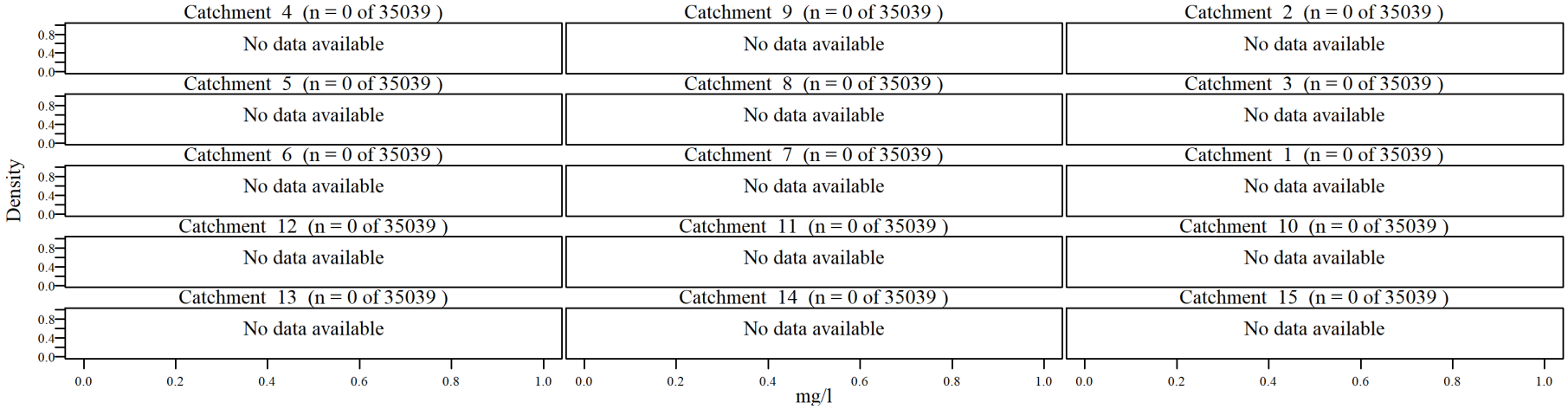


Figure 21: Distribution of data - ortho-phosphorus

1.5 Time series

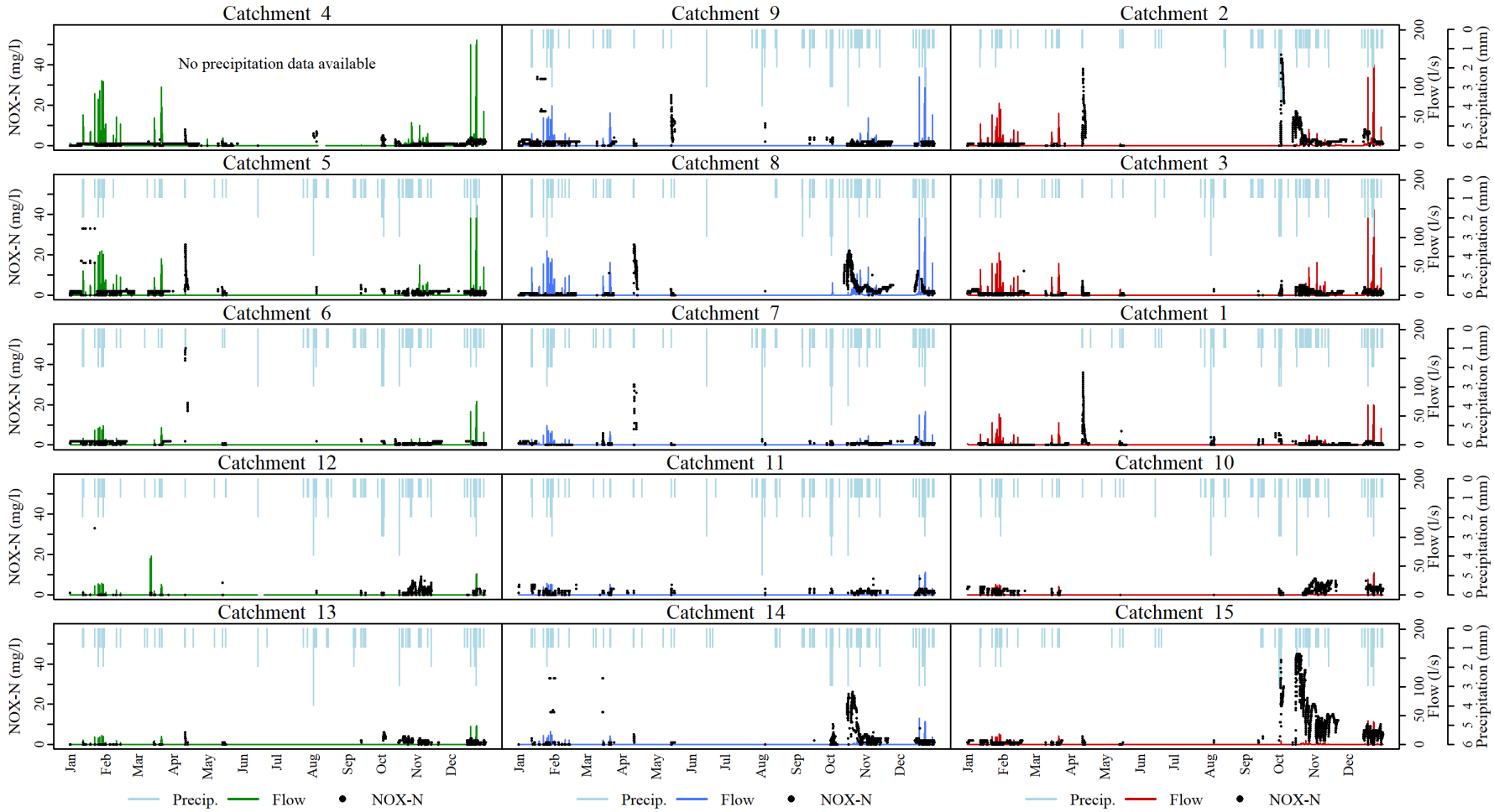


Figure 22: Time series of precipitation, flow and nitrate+nitrite (NOX-N)

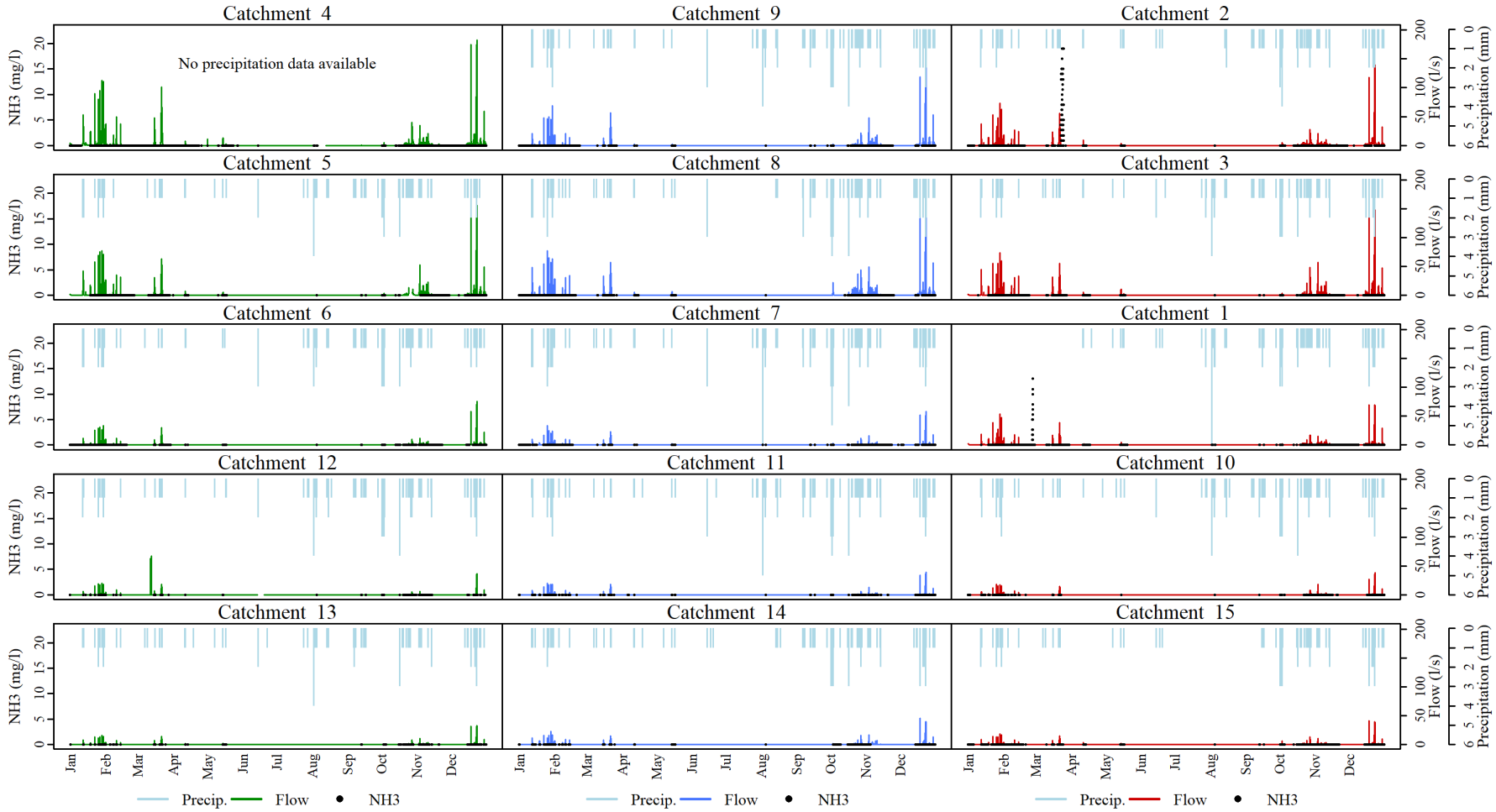


Figure 23: Time series of precipitation, flow and ammonia (NH3)

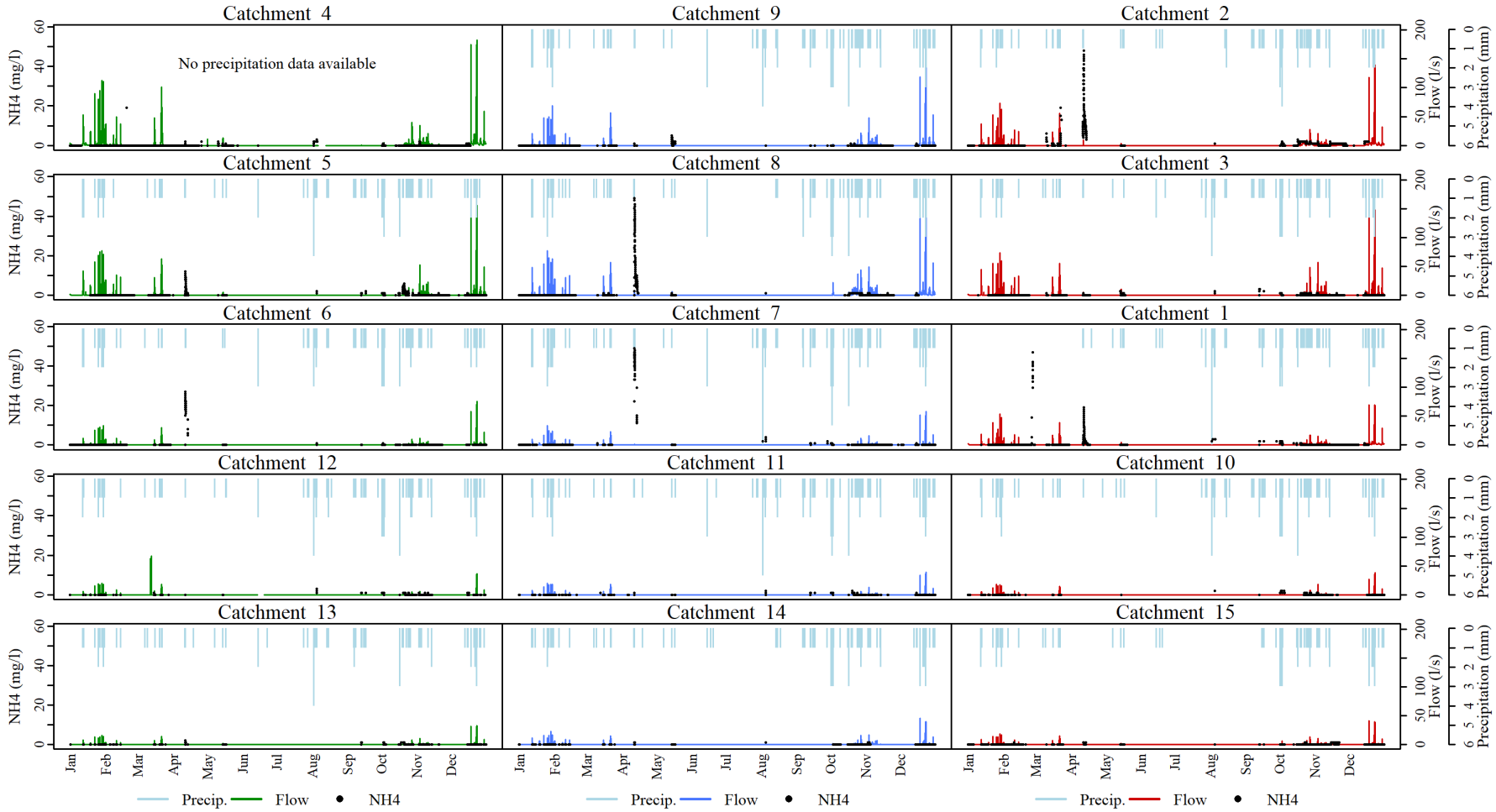


Figure 24: Time series of precipitation, flow and ammonium (NH4)

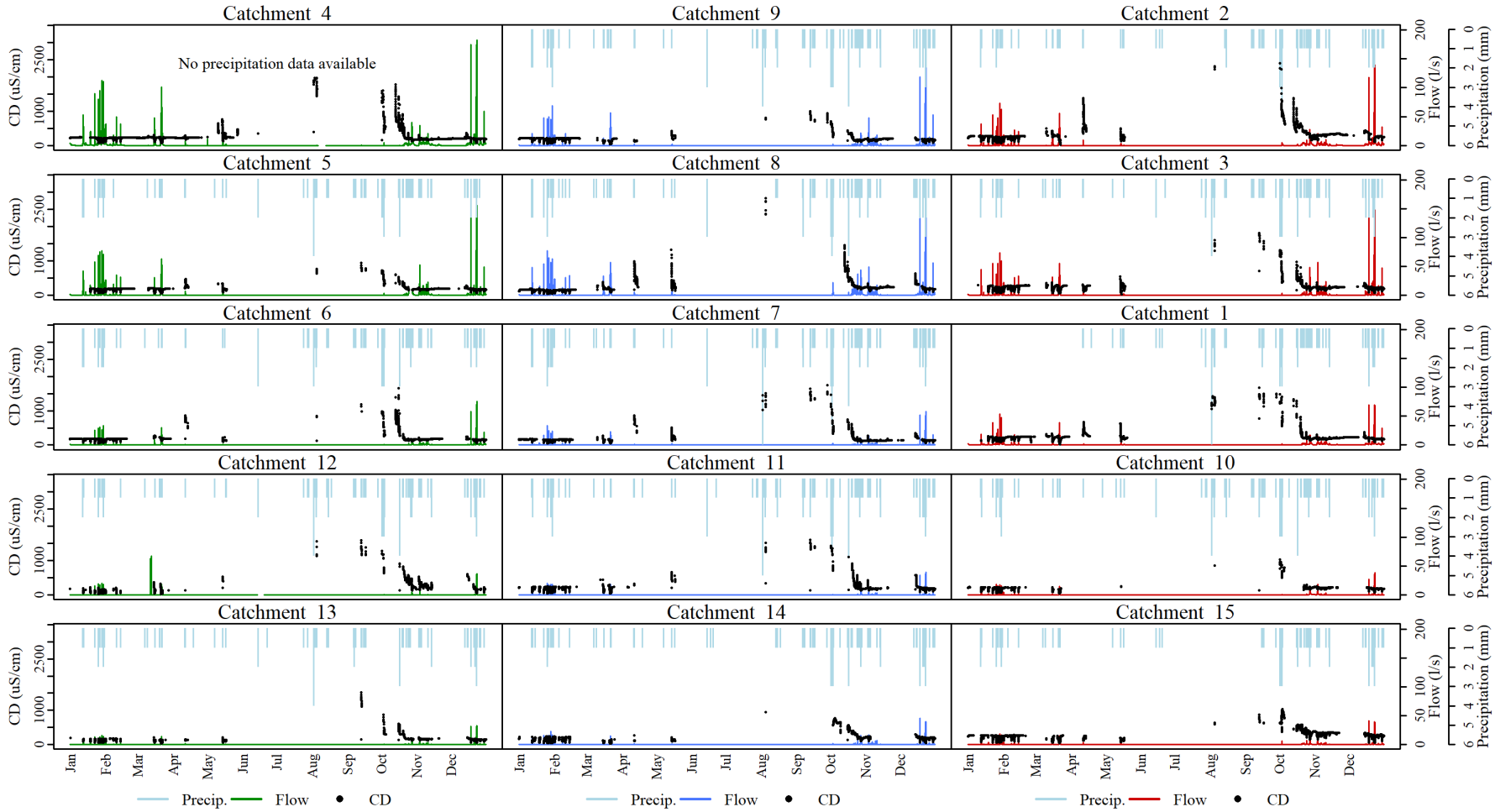


Figure 25: Time series of precipitation, flow and conductivity (CD)

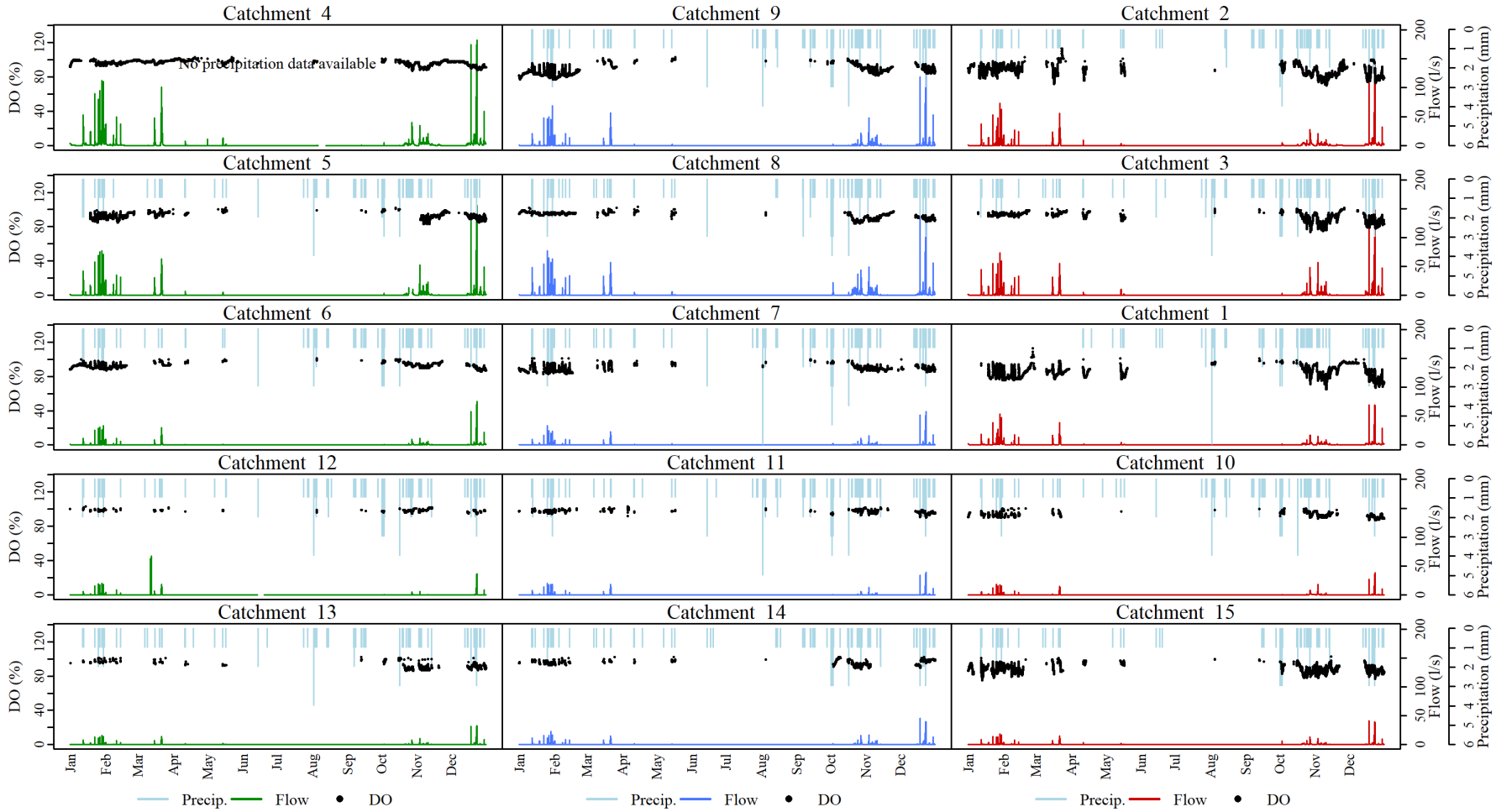


Figure 26: Time series of precipitation, flow and dissolved oxygen (DO)

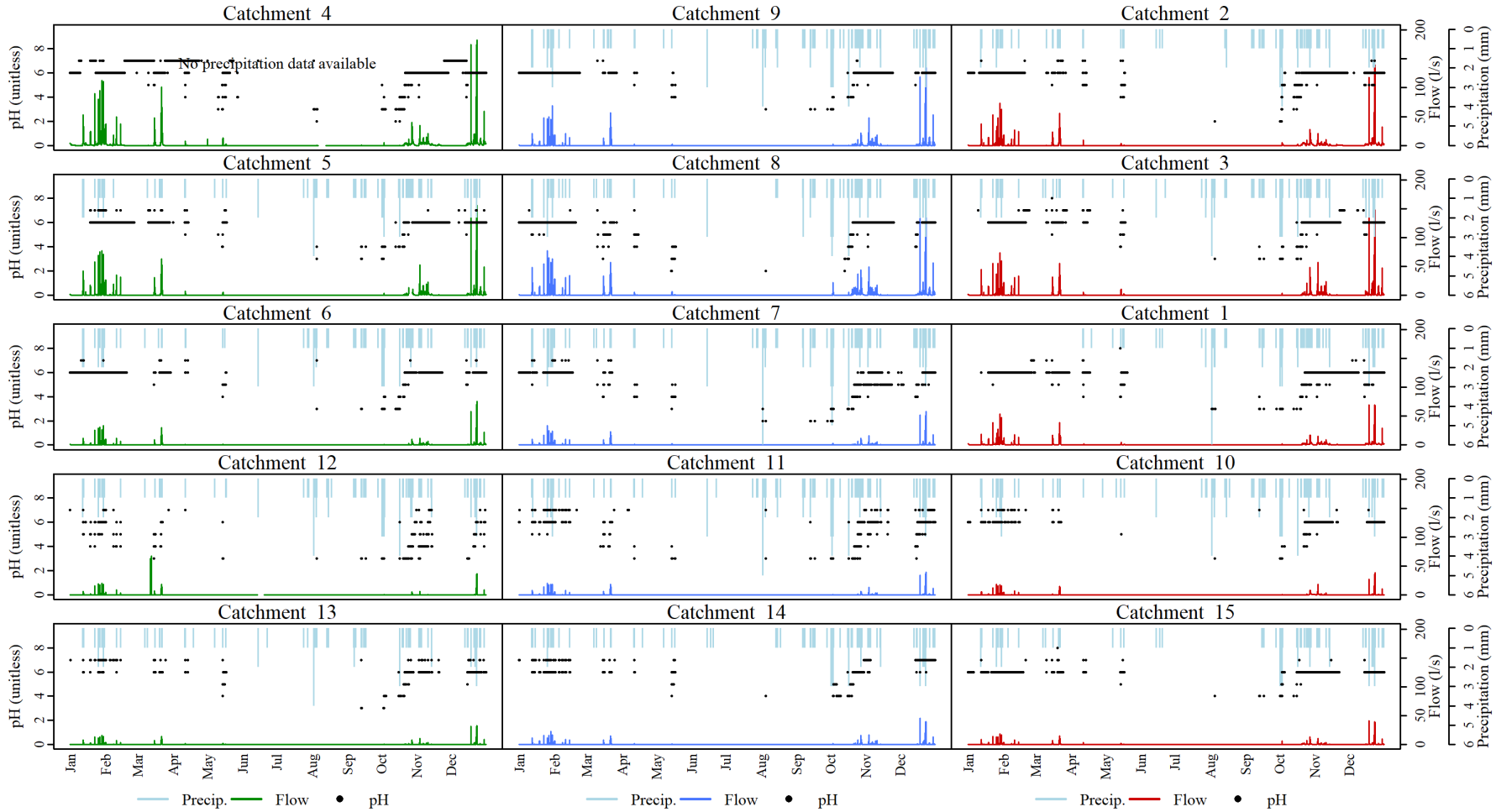


Figure 27: Time series of precipitation, flow and pH (pH)

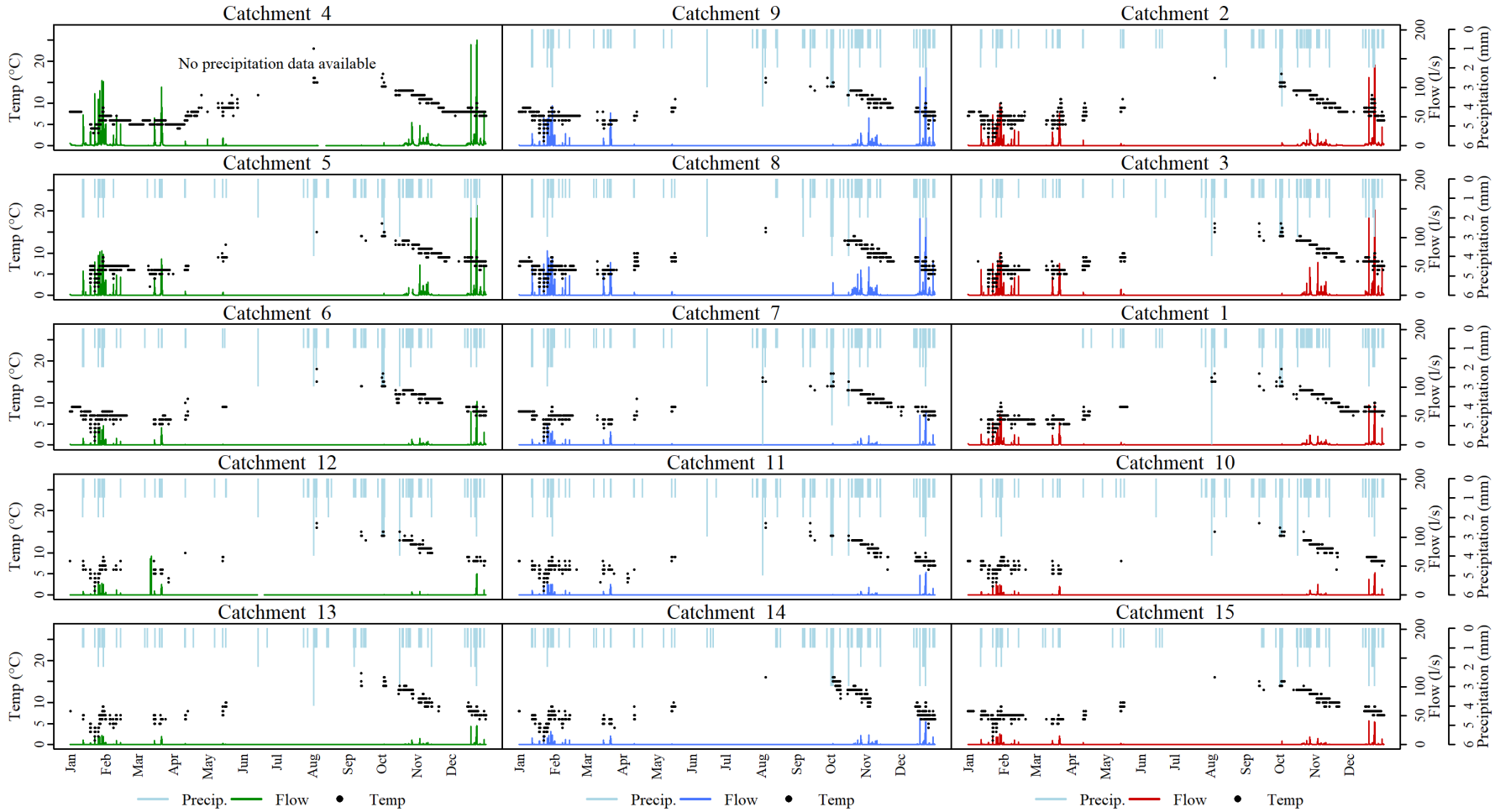


Figure 28: Time series of precipitation, flow and flow cell water temperature (Temp)

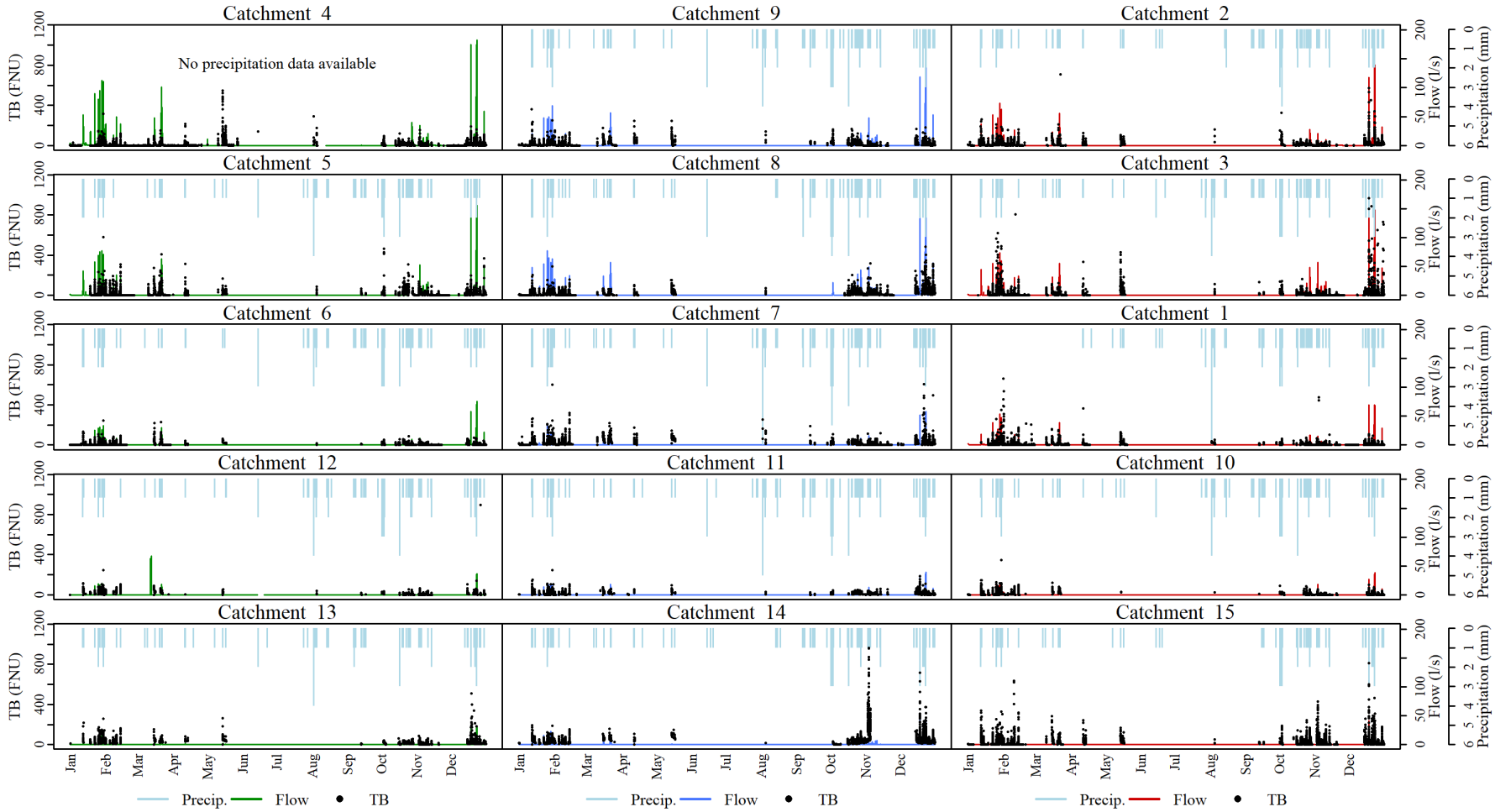


Figure 29: Time series of precipitation, flow and turbidity (TB)

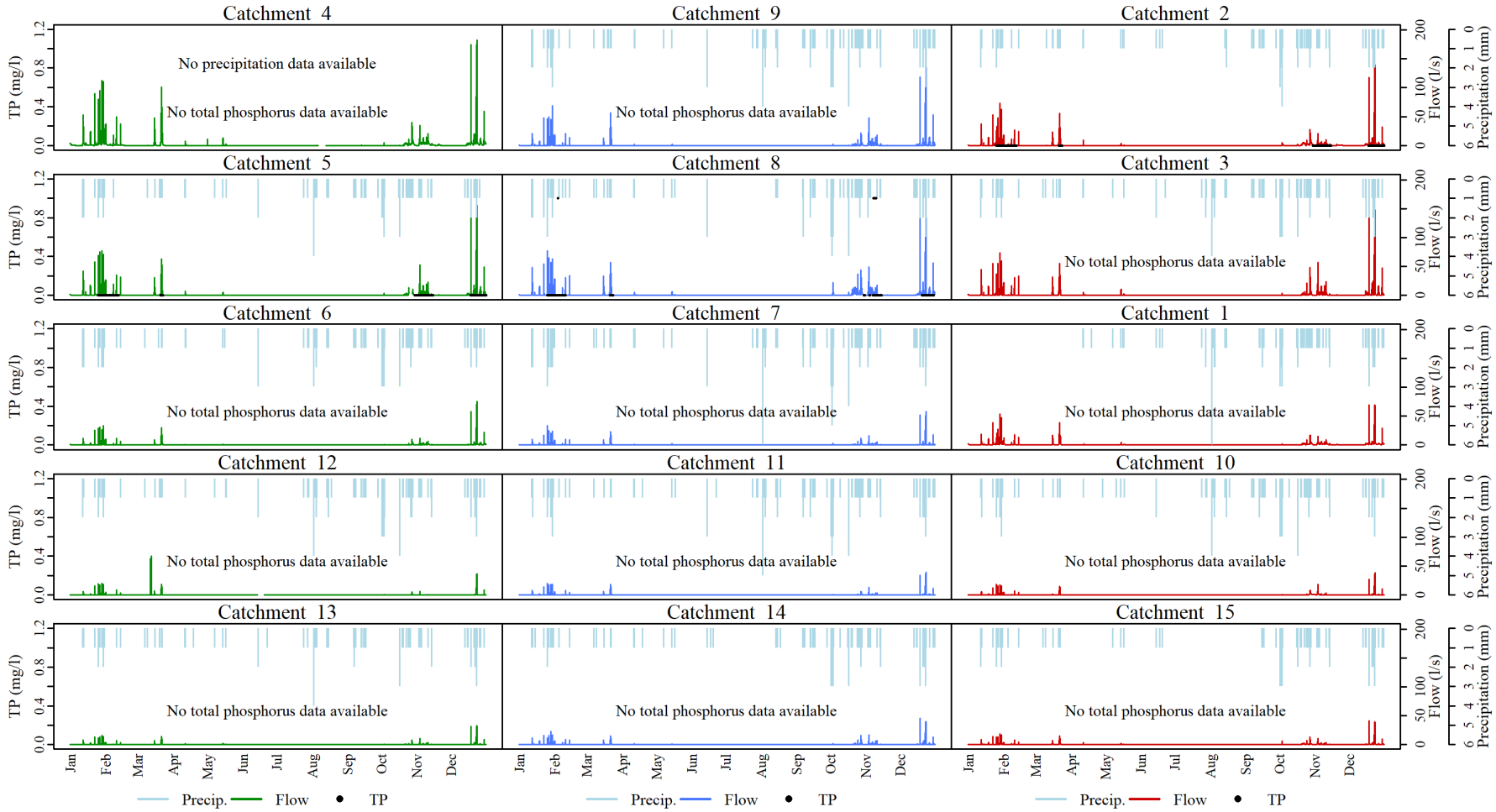


Figure 30: Time series of precipitation, flow and total phosphorus (TP)

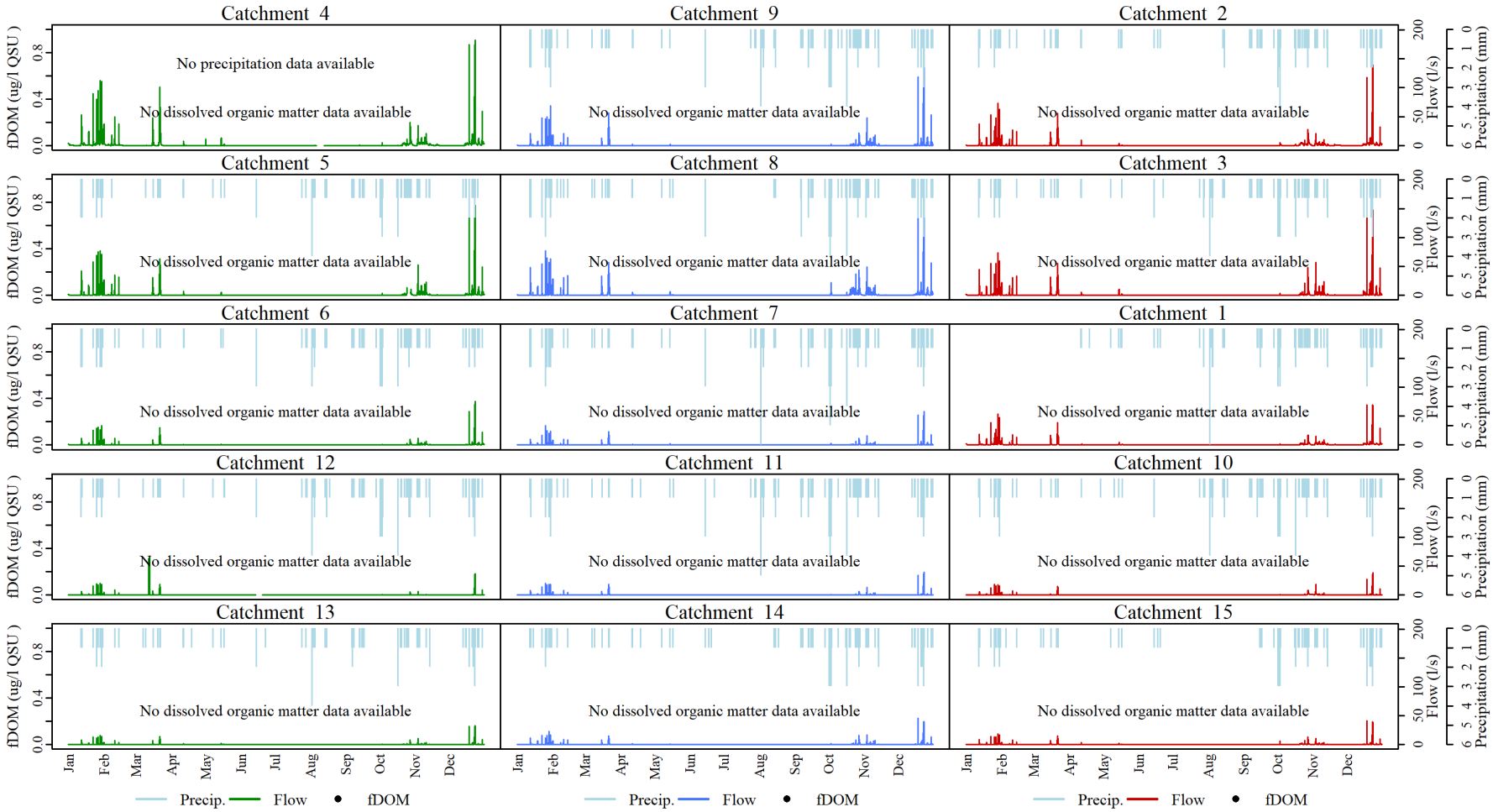


Figure 31: Time series of precipitation, flow and dissolved organic matter (fDOM)

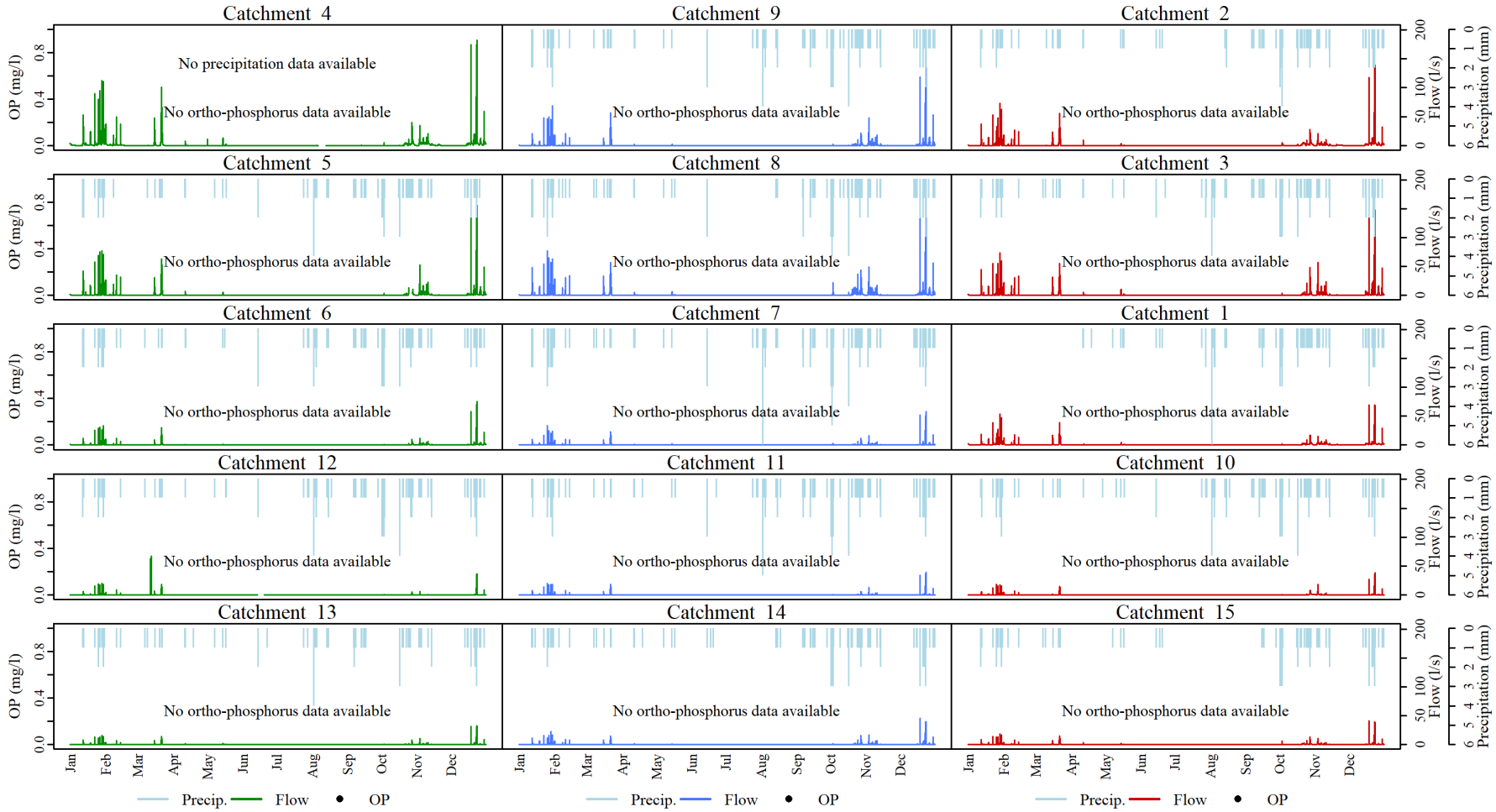


Figure 32: Time series of precipitation, flow and ortho-phosphorus (OP)

1.6 Correlations

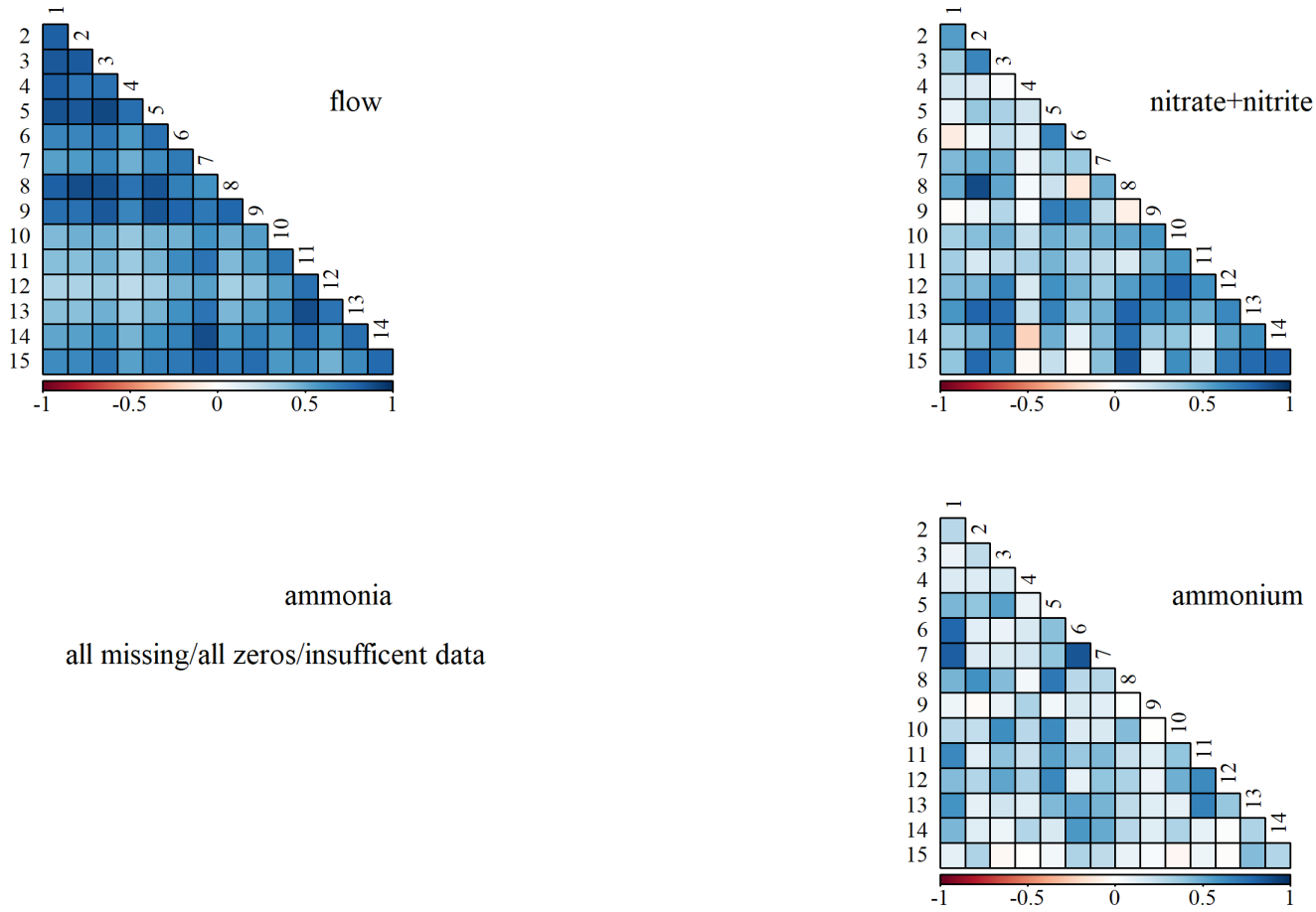


Figure 33: Correlations between catchments - flow, nitrate+nitrite, ammonia, ammonium

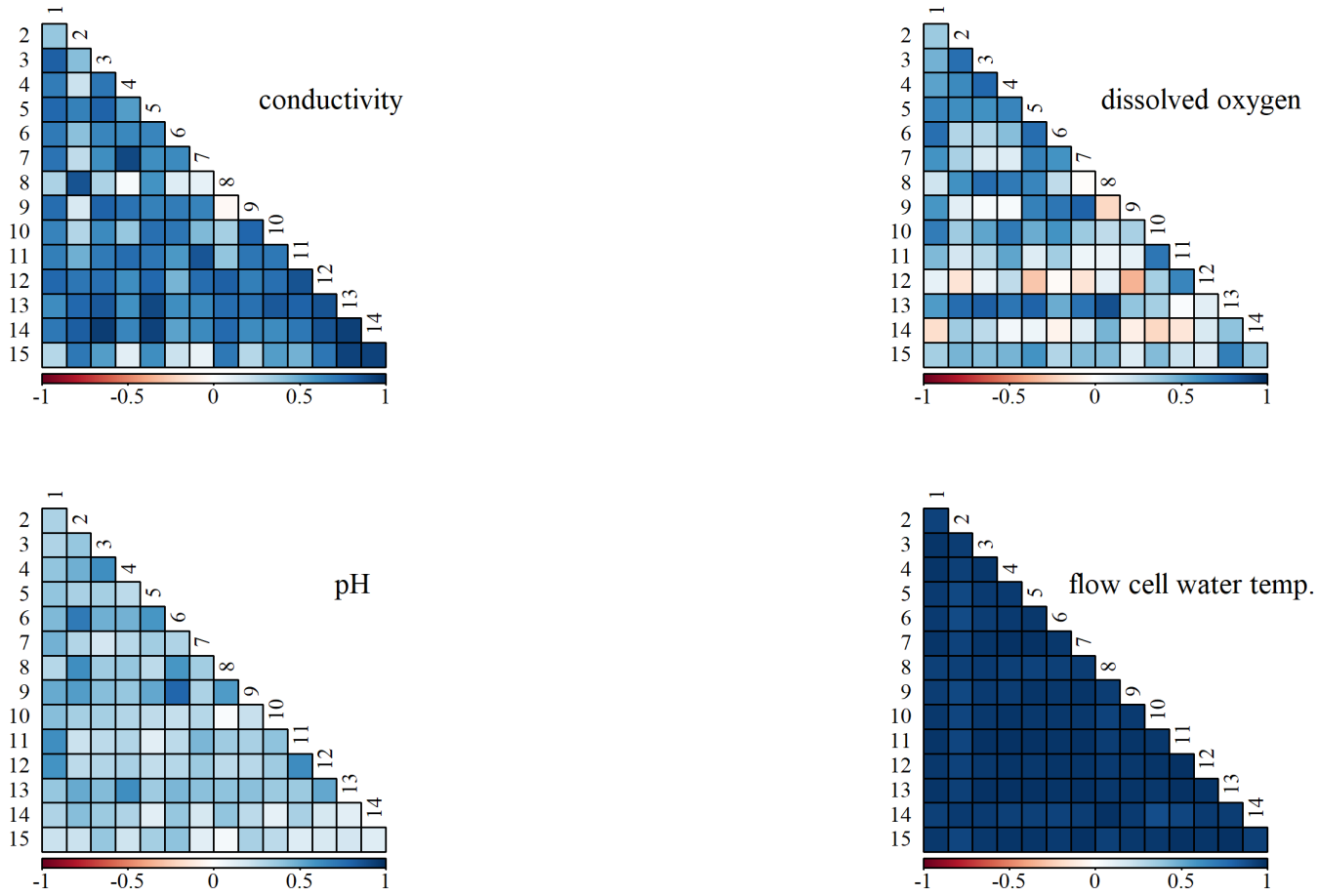
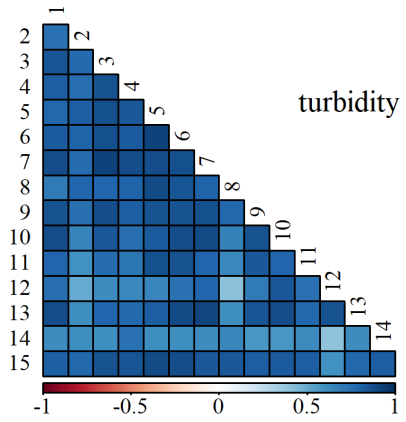


Figure 34: Correlations between catchments - conductivity, dissolved oxygen, pH, flow cell water temperature



total phosphorus

all missing/all zeros/insufficent data

dissolved org. matter

all missing/all zeros/insufficent data

ortho-phosphorus

all missing/all zeros/insufficent data

Figure 35: 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.

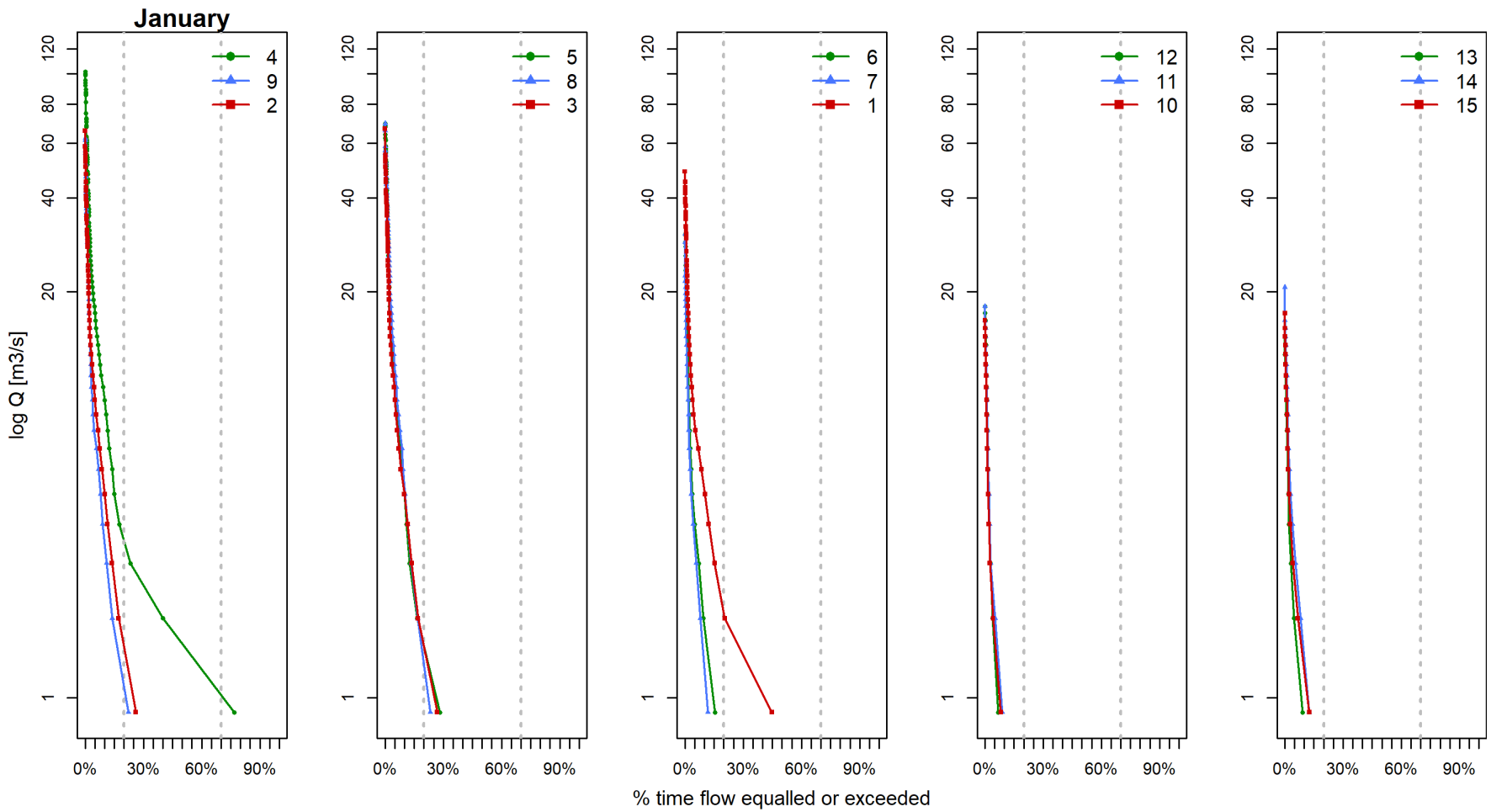


Figure 36: Flow duration curves for January

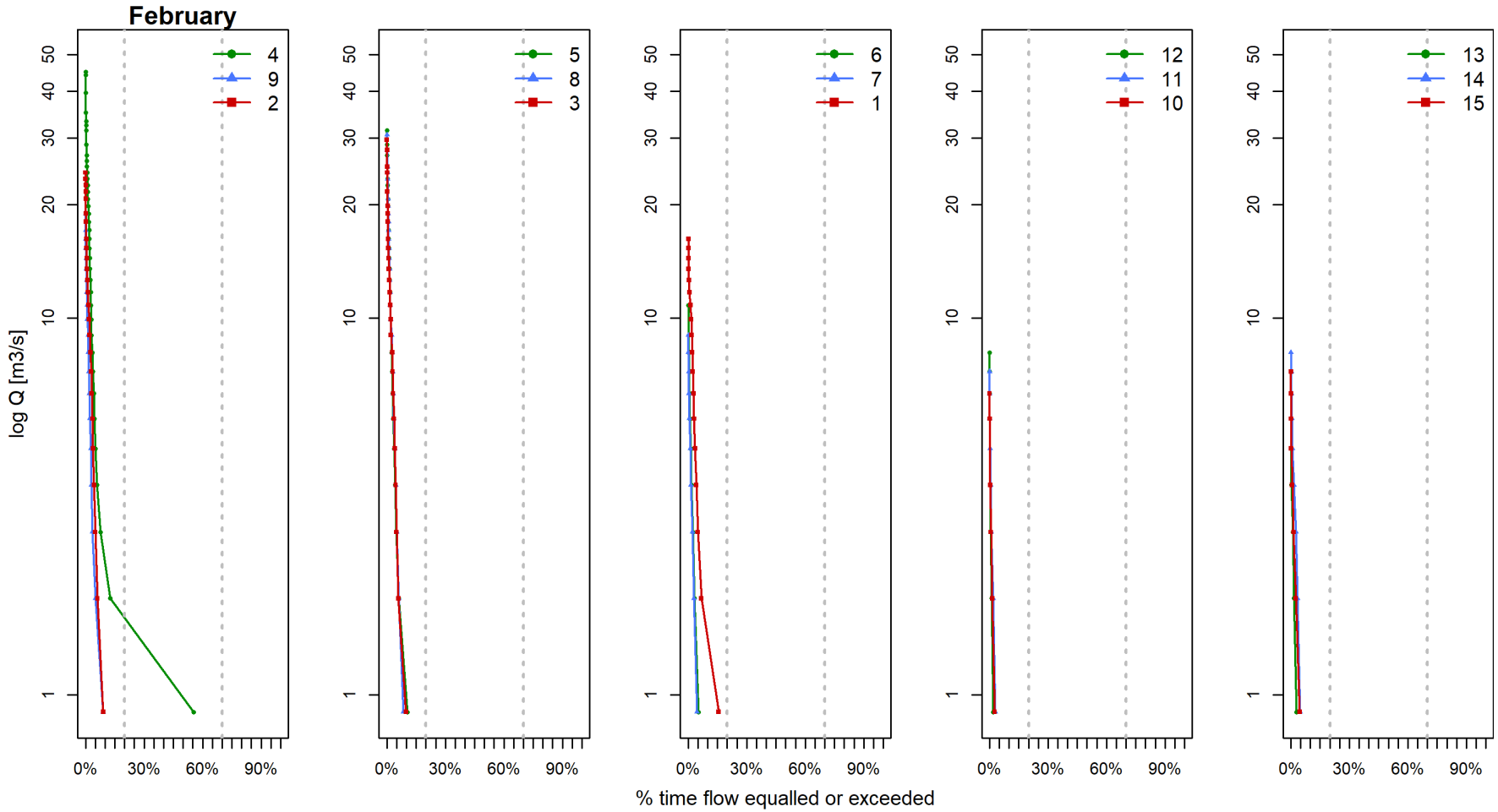


Figure 37: Flow duration curves for February

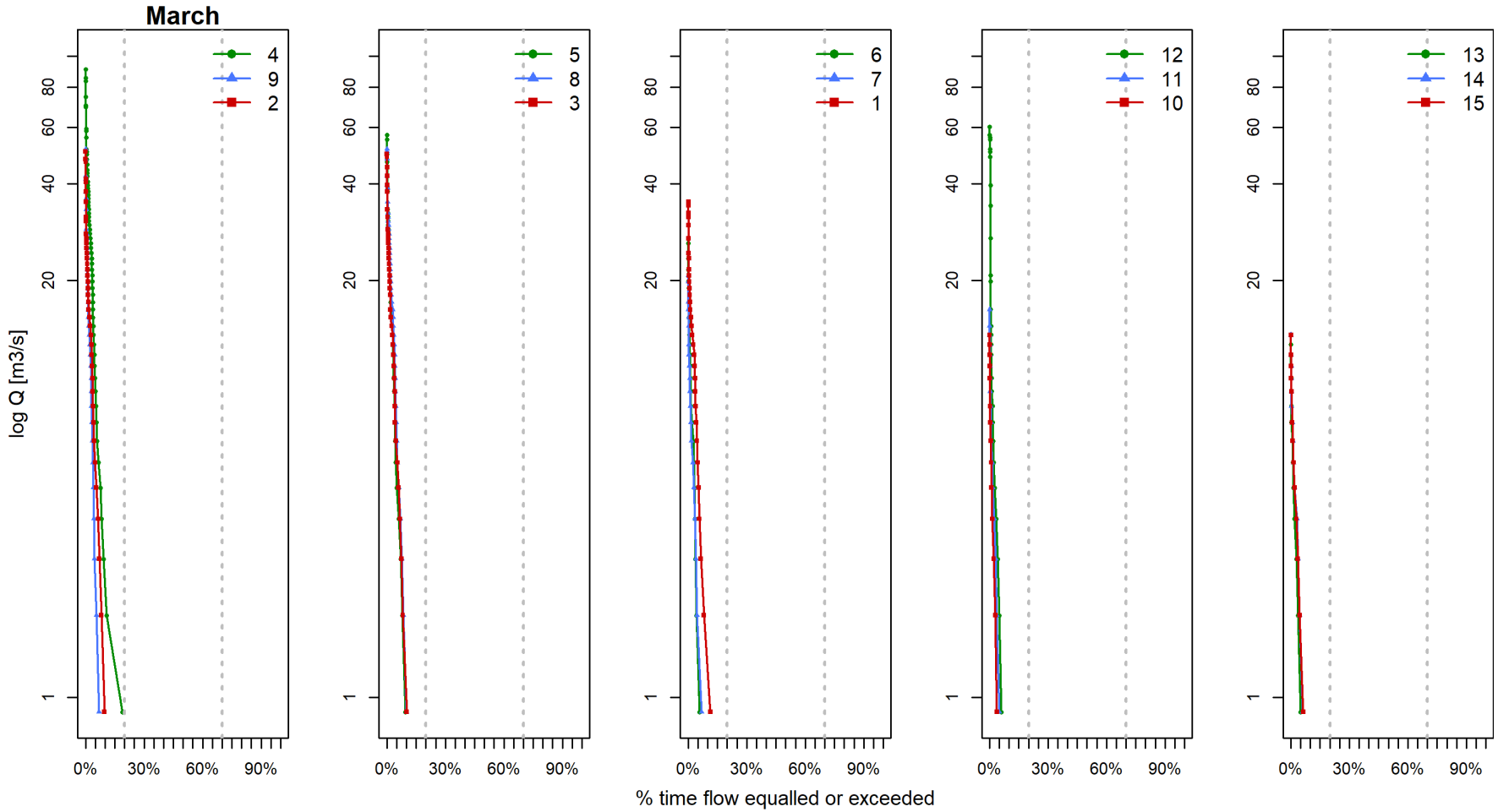


Figure 38: Flow duration curves for March

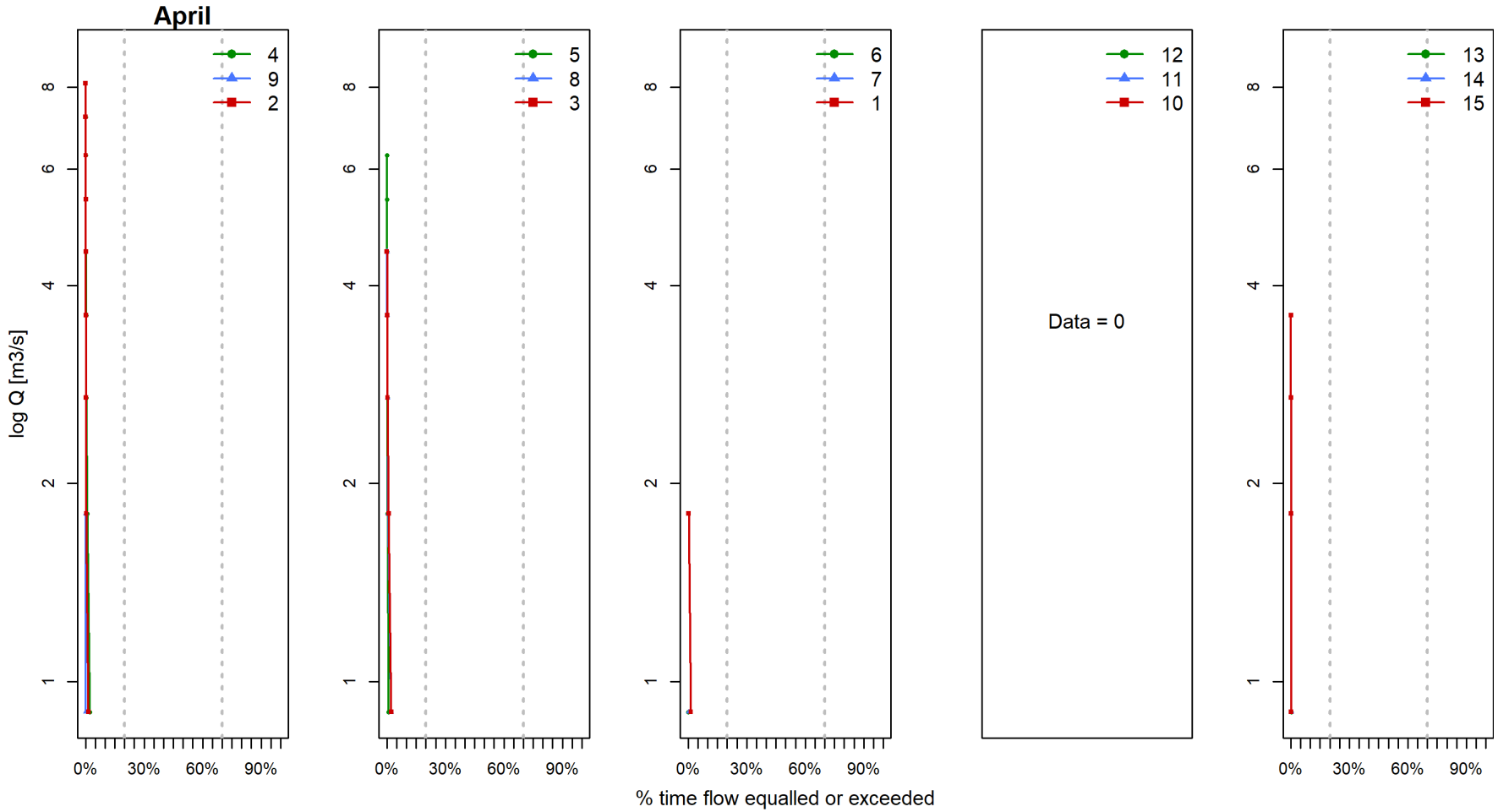


Figure 39: Flow duration curves for April

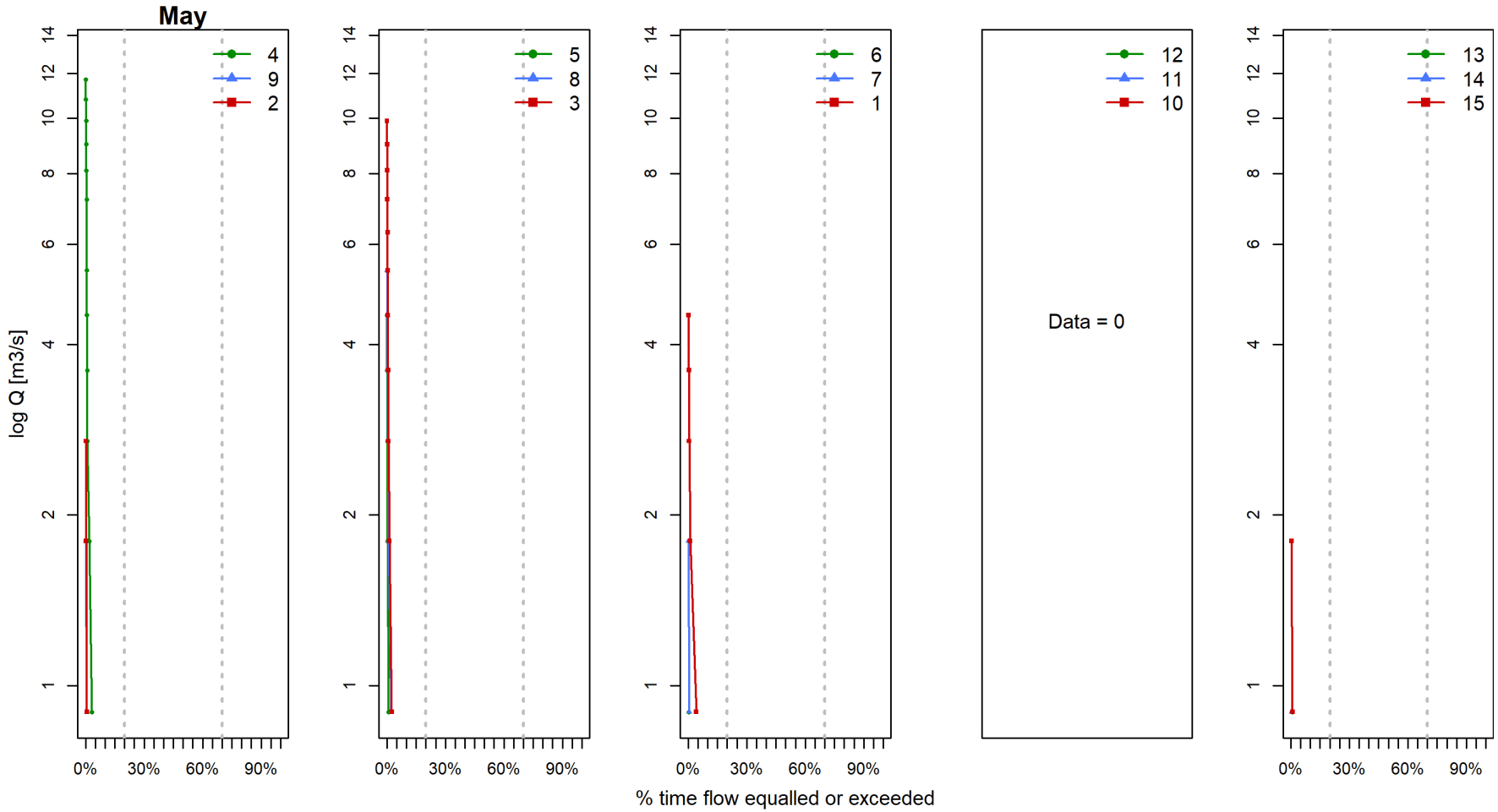


Figure 40: Flow duration curves for May

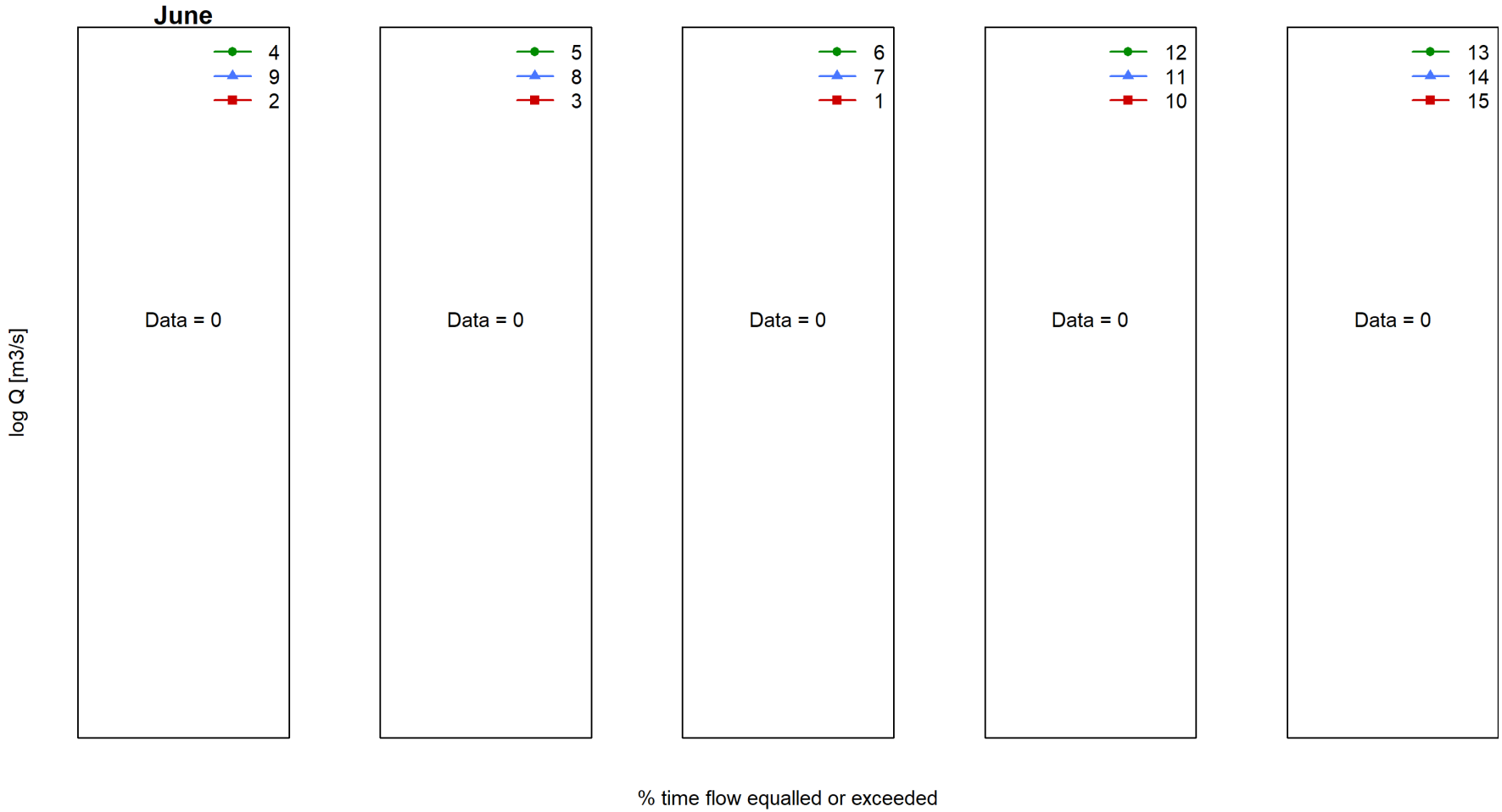


Figure 41: Flow duration curves for June

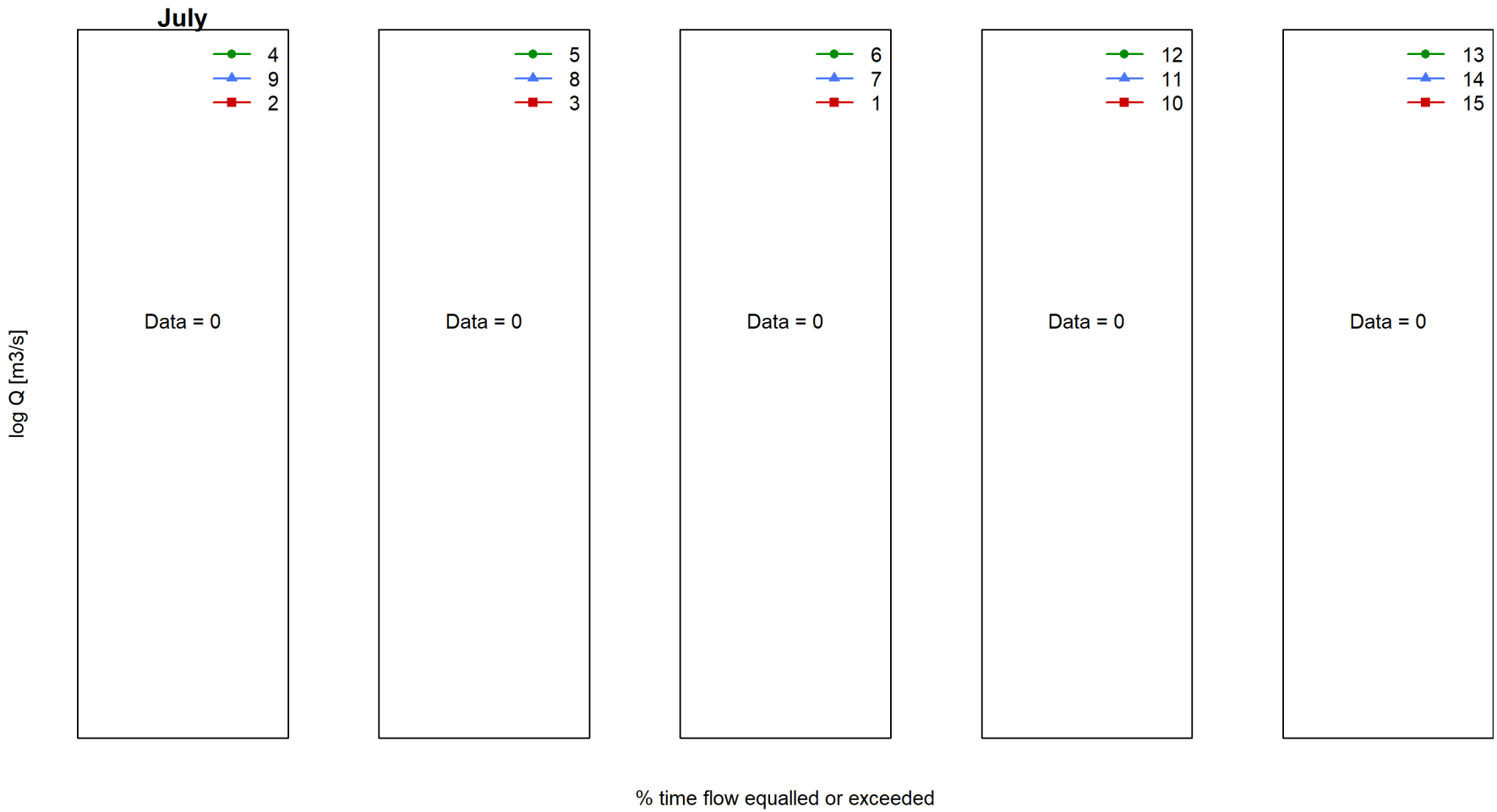


Figure 42: Flow duration curves for July

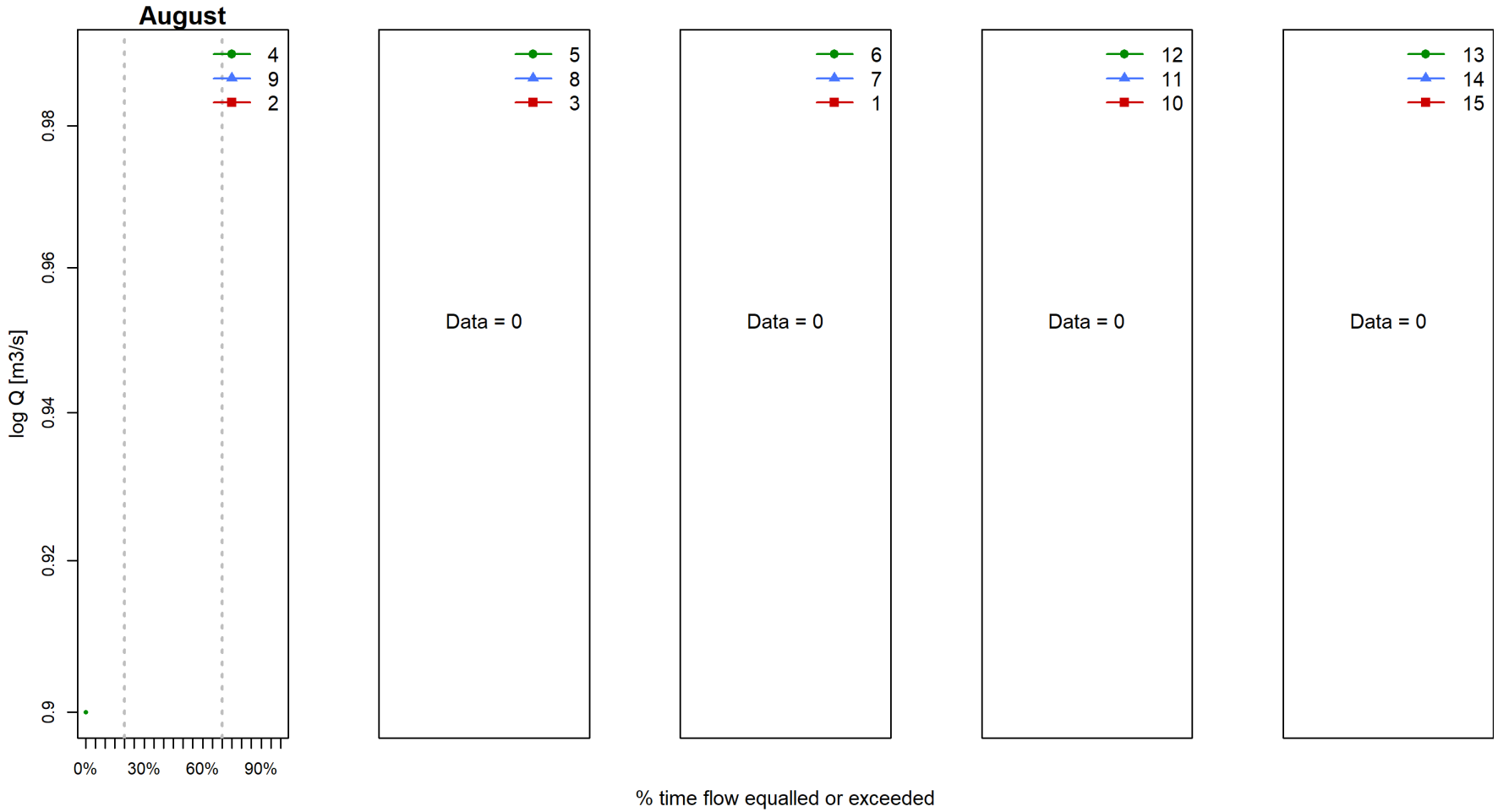


Figure 43: Flow duration curves for August

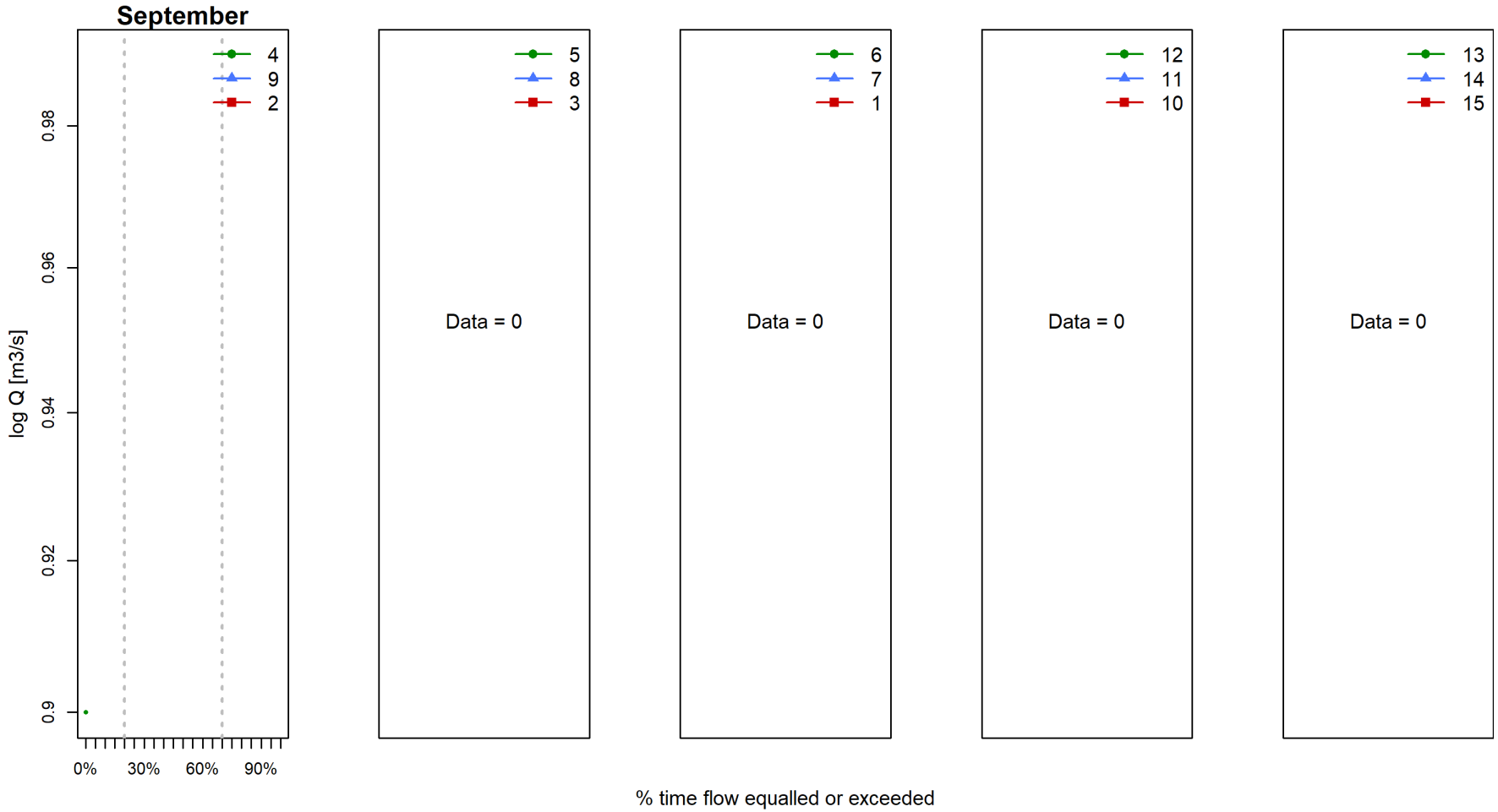


Figure 44: Flow duration curves for September

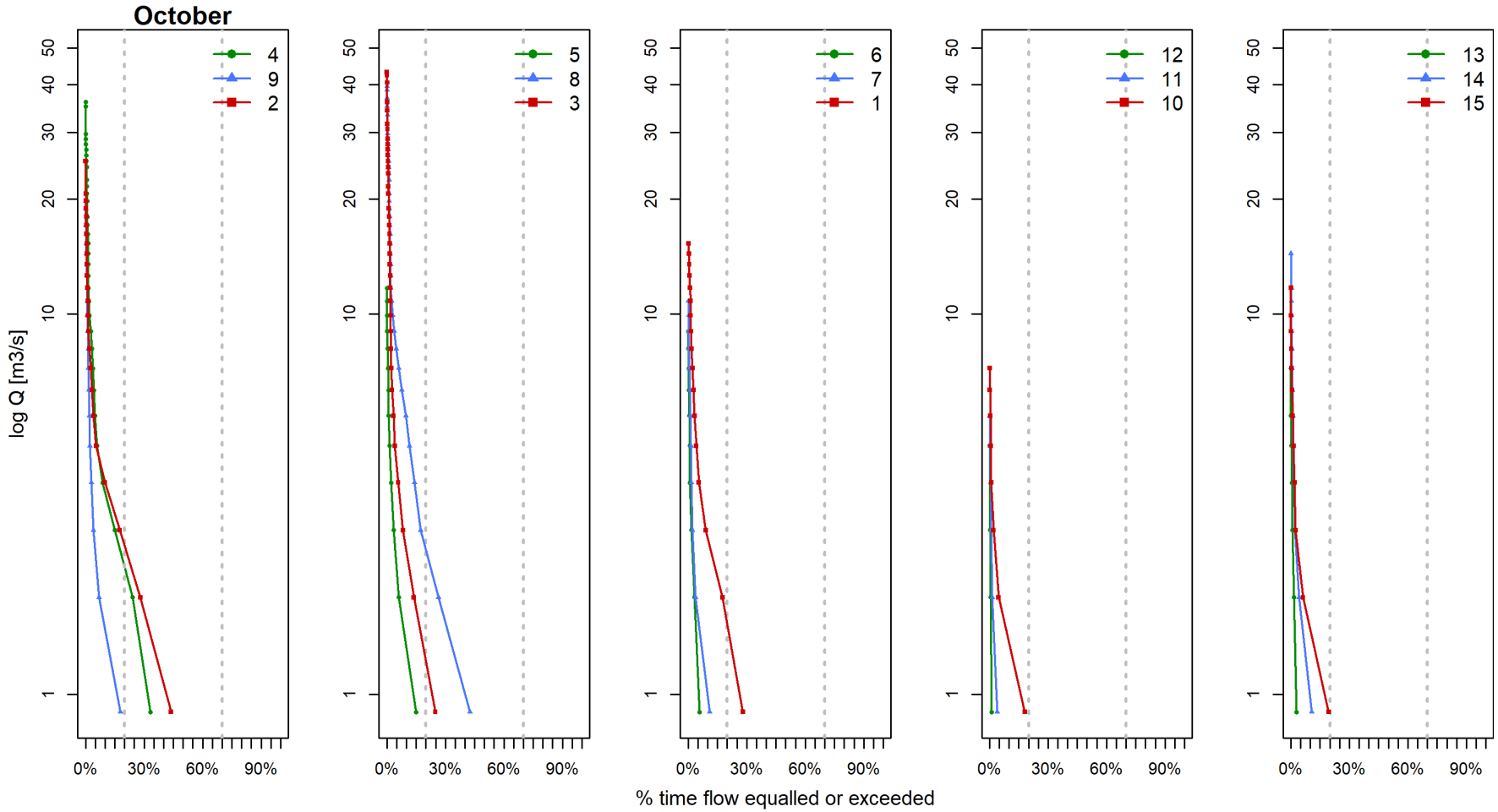


Figure 45: Flow duration curves for October

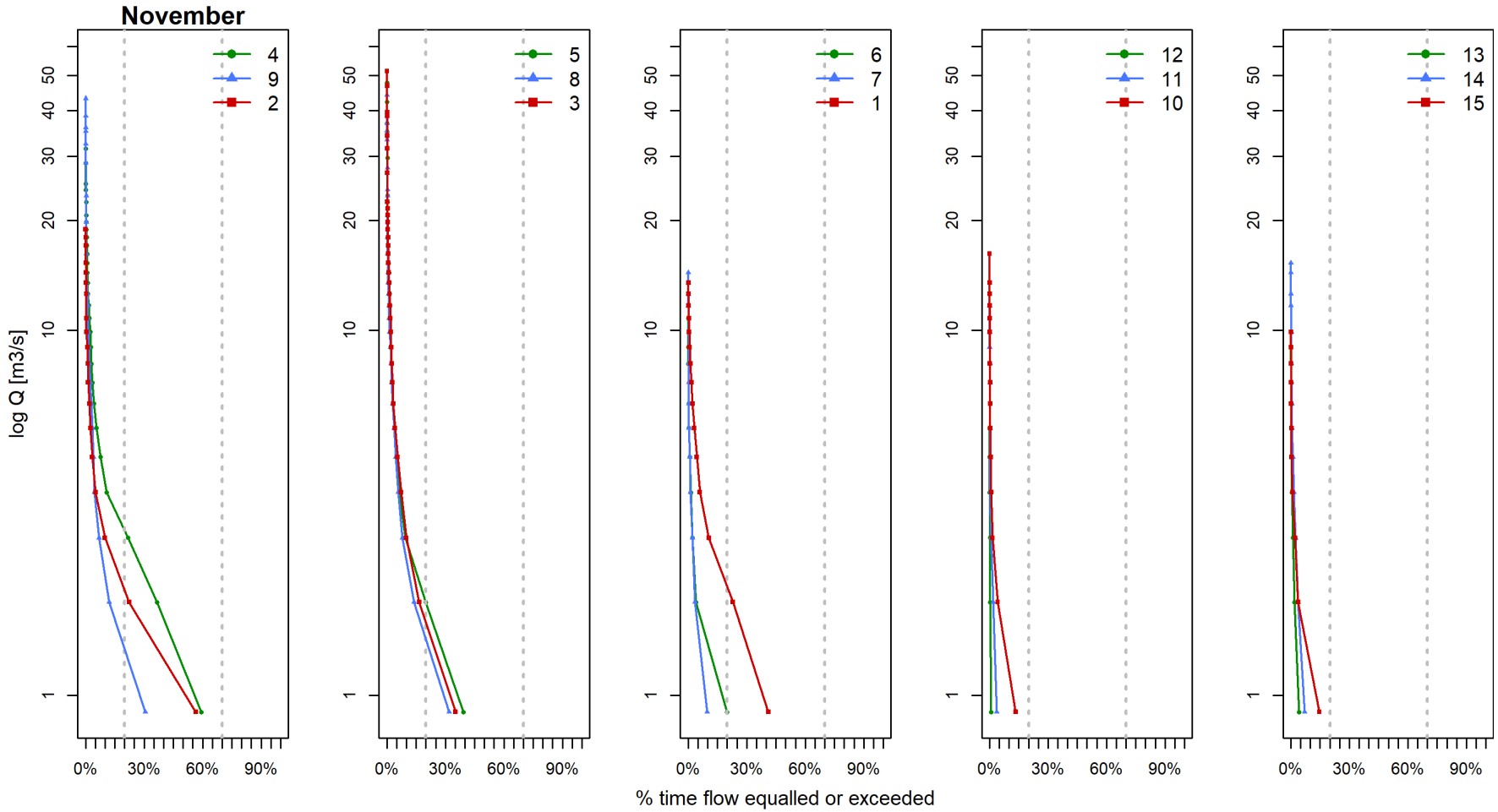


Figure 46: Flow duration curves for November

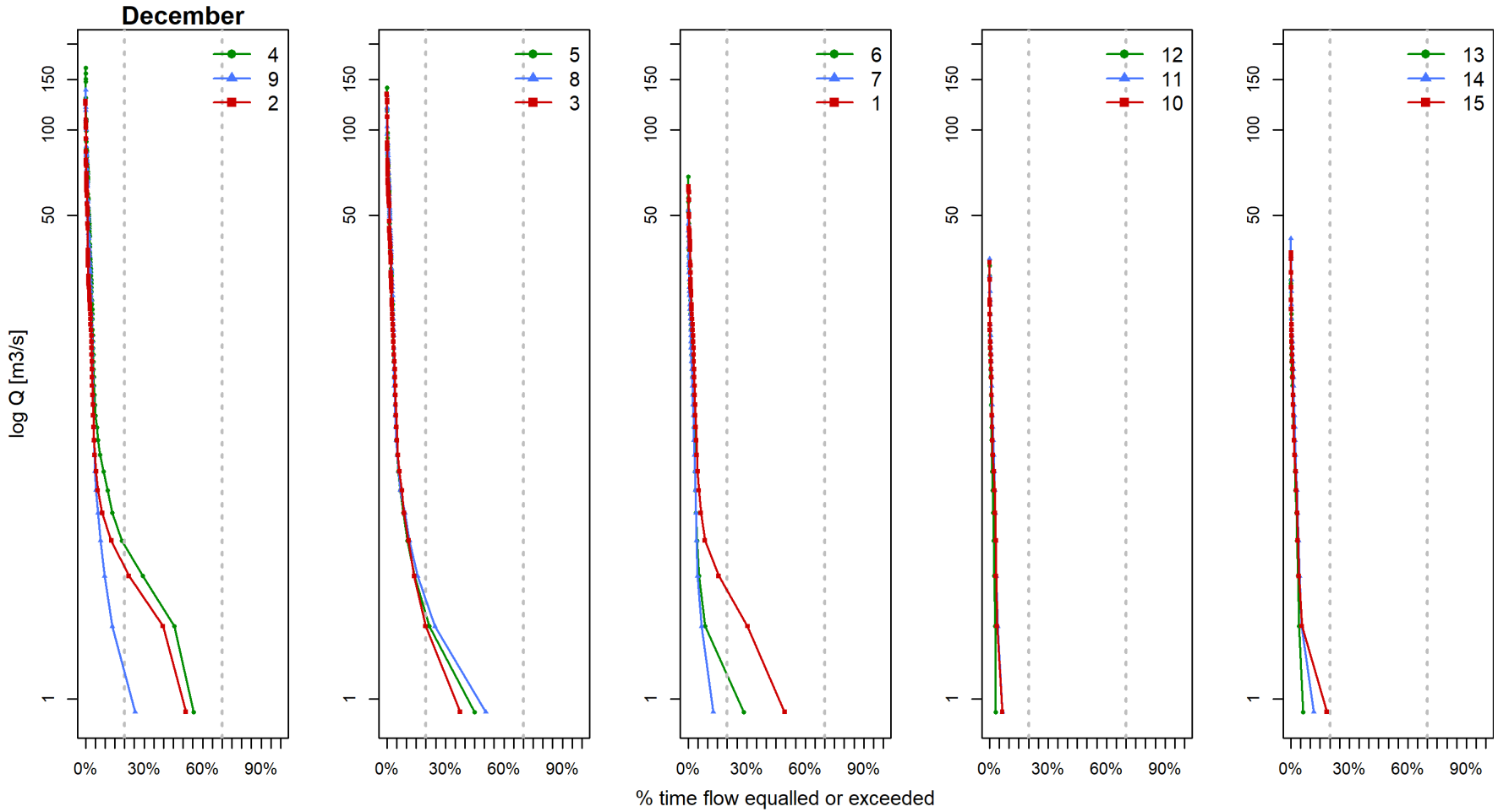


Figure 47: Flow duration curves for December

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.

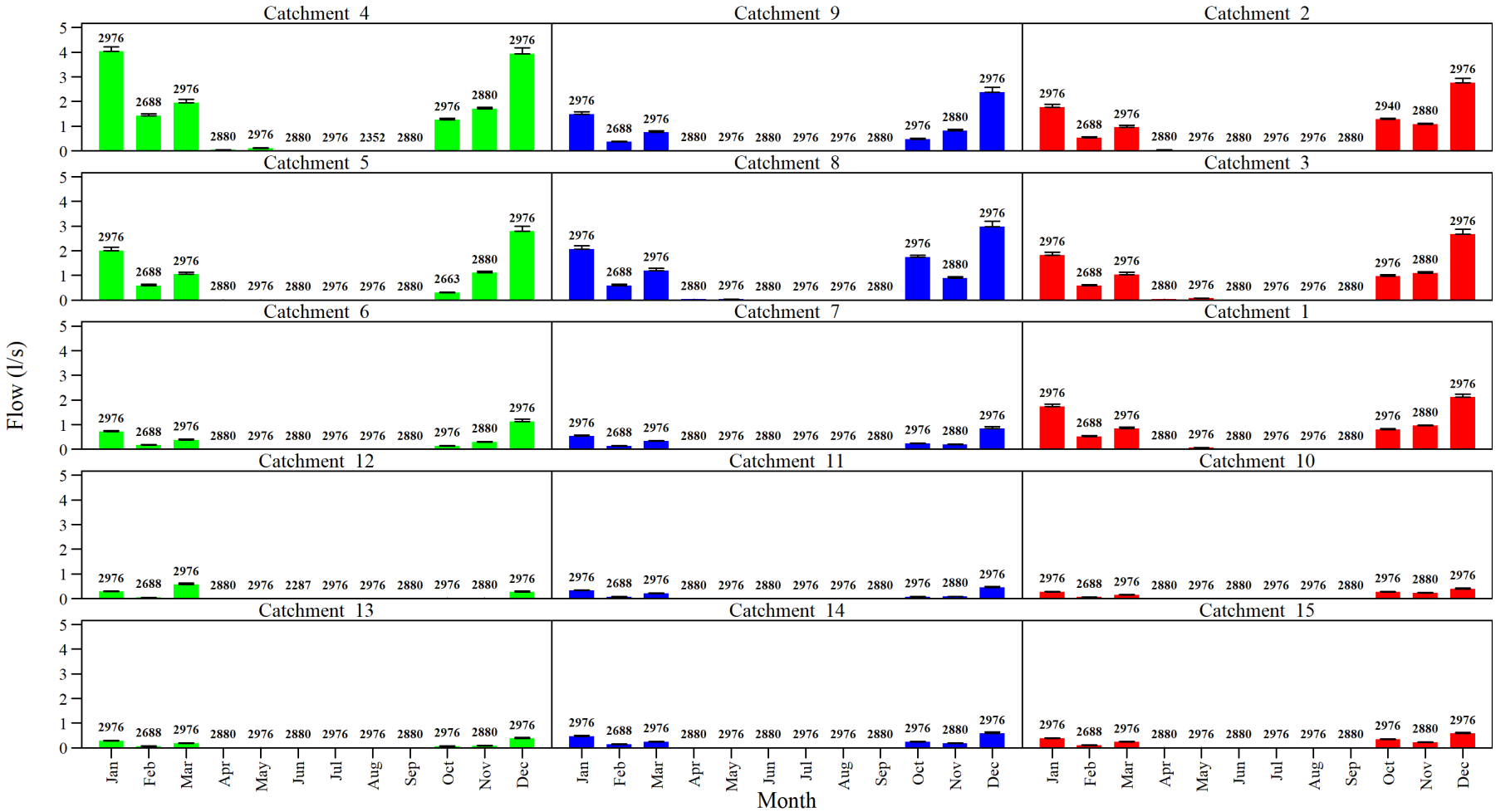


Figure 48: Monthly means for flow

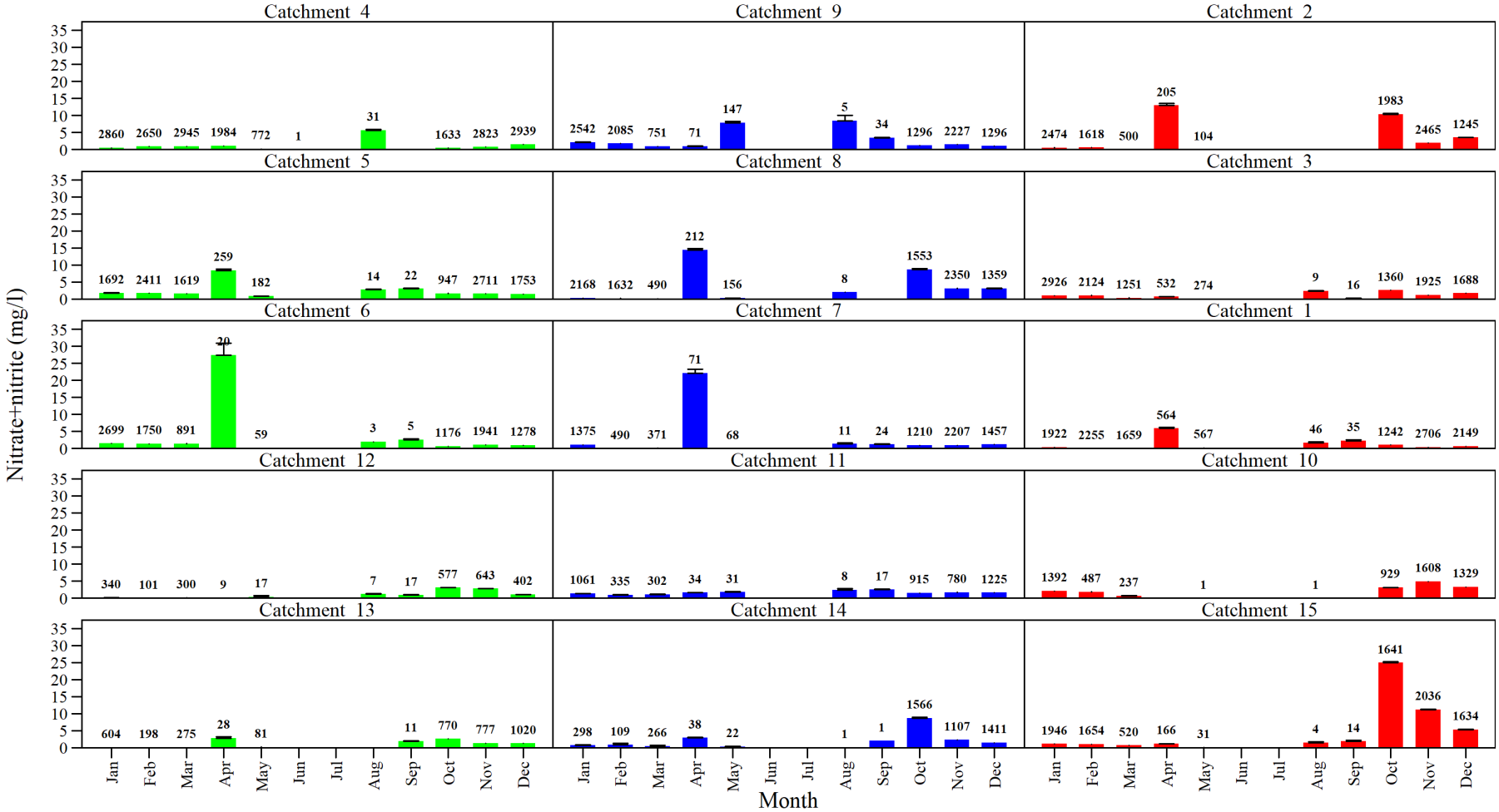


Figure 49: Monthly means for nitrate+nitrite

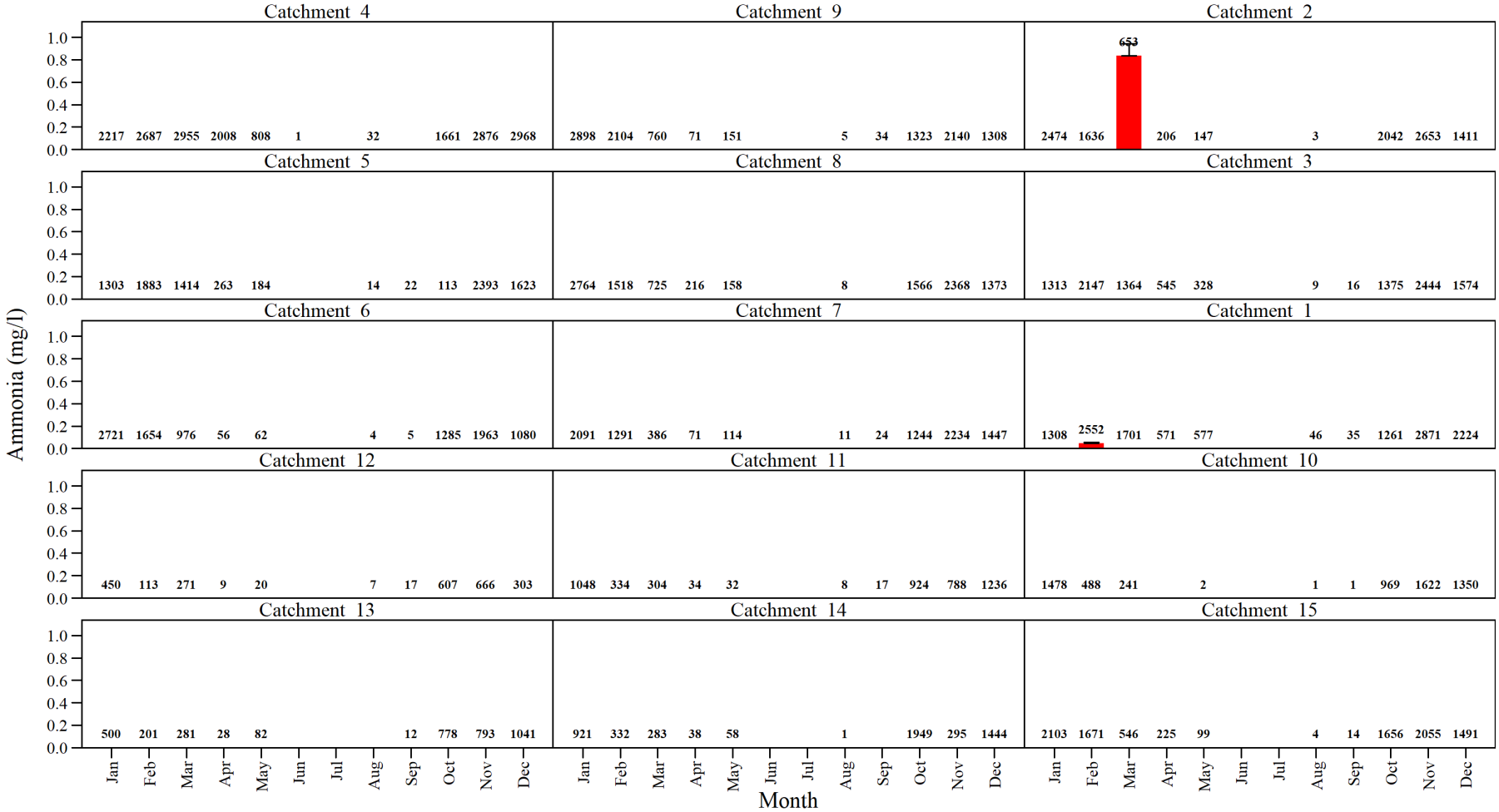


Figure 50: Monthly means for ammonia

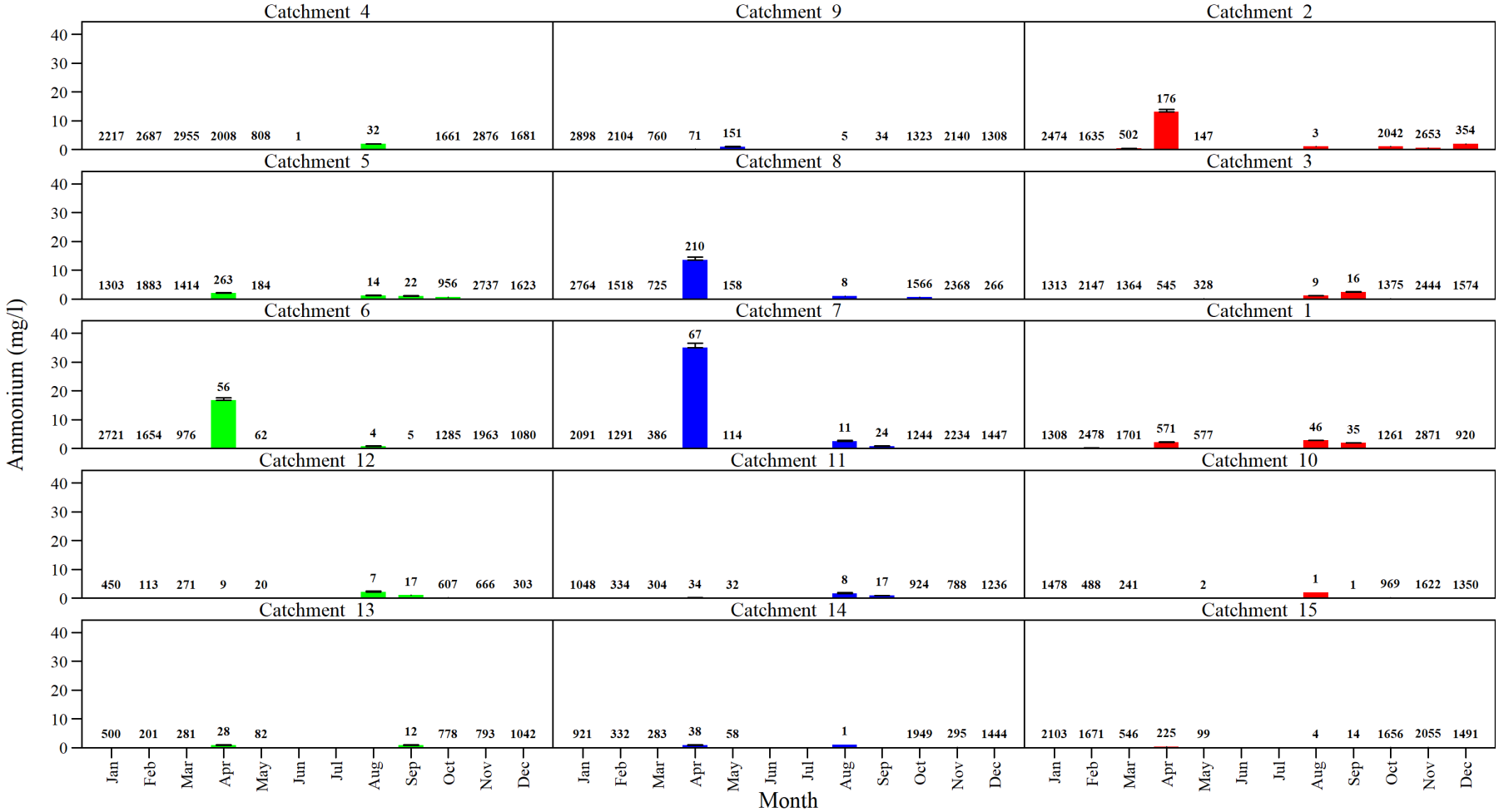


Figure 51: Monthly means for ammonium

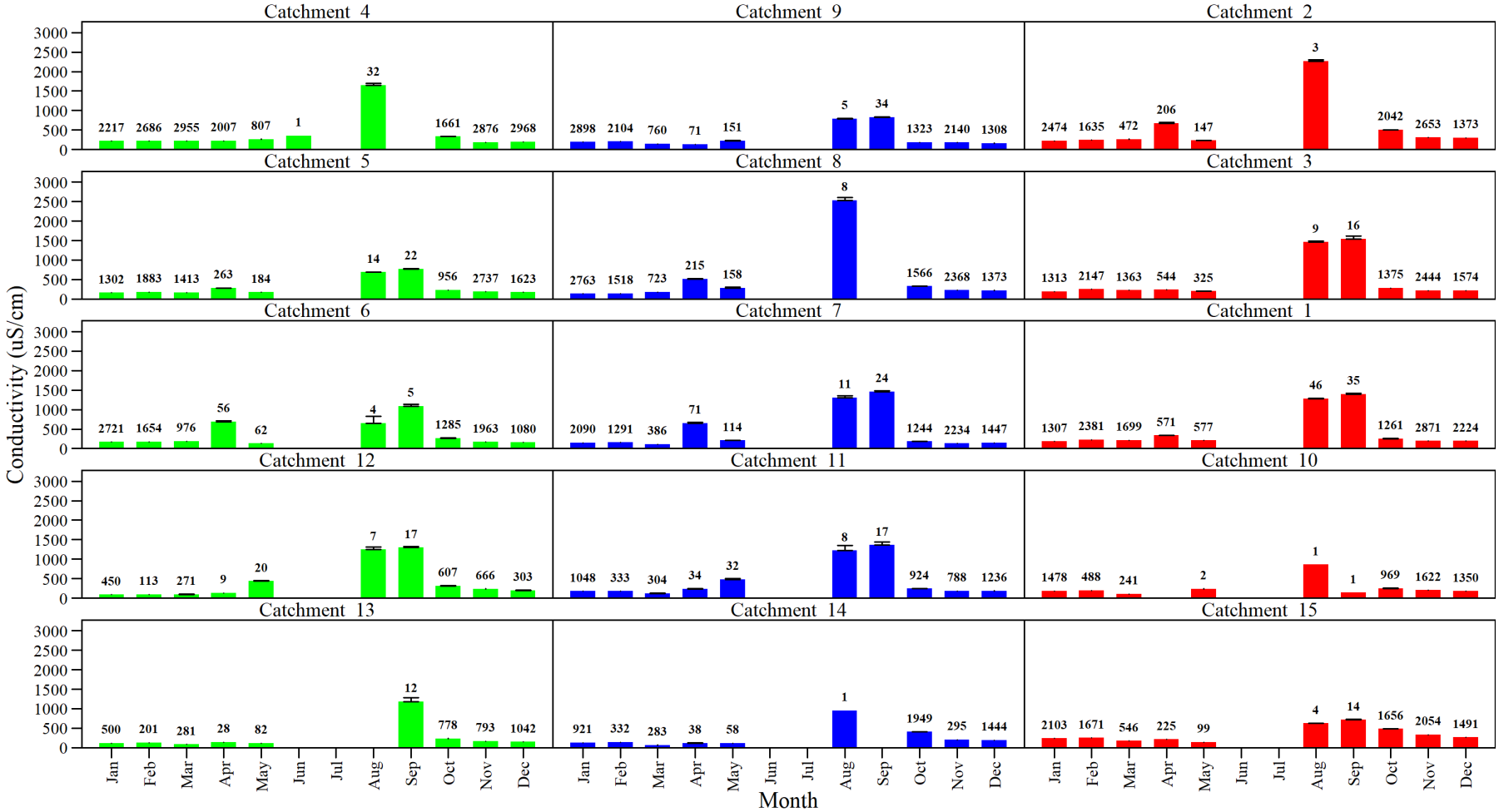


Figure 52: Monthly means for conductivity

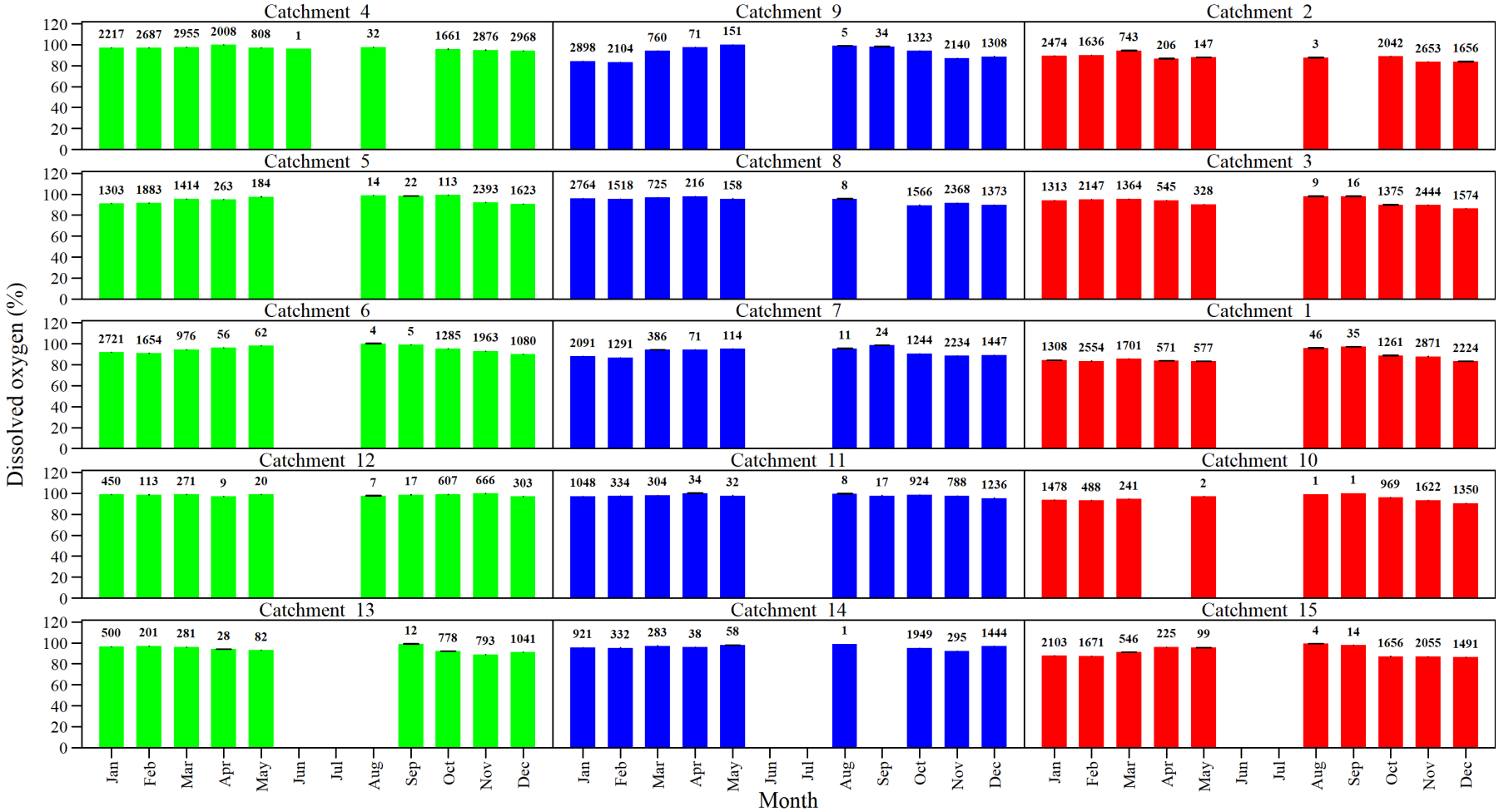


Figure 53: Monthly means for dissolved oxygen

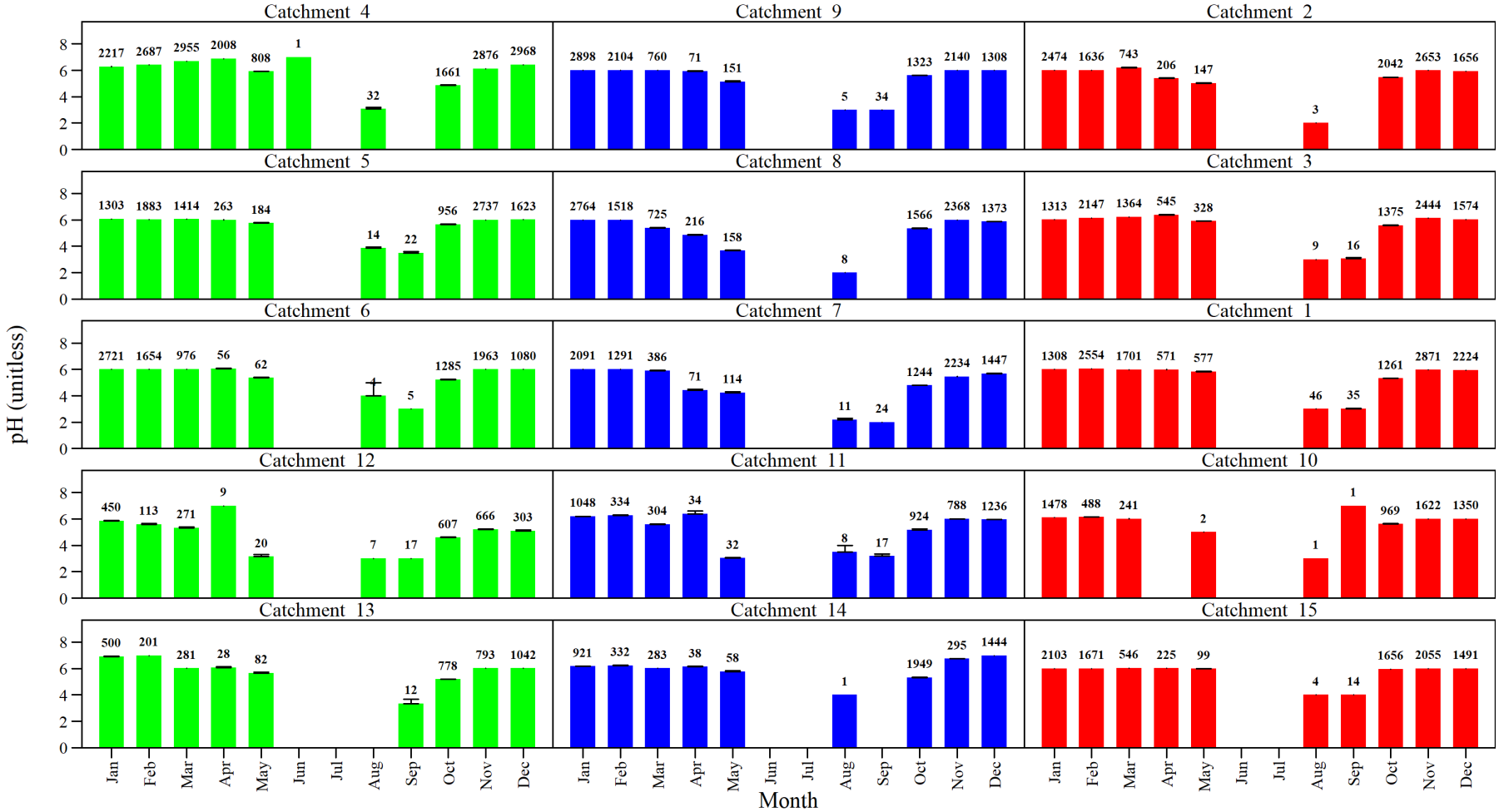


Figure 54: Monthly means for pH

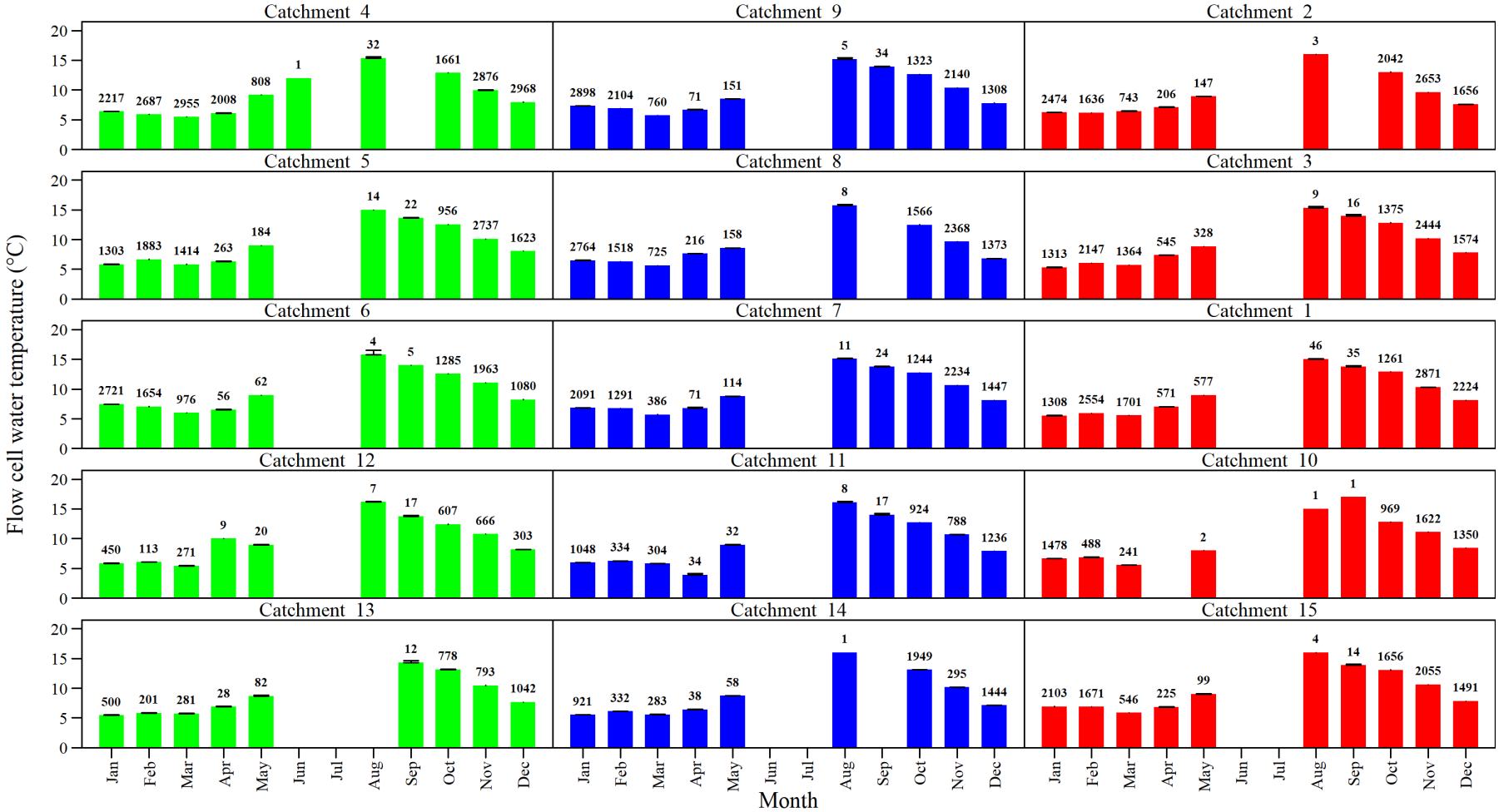


Figure 55: Monthly means for flow cell water temperature

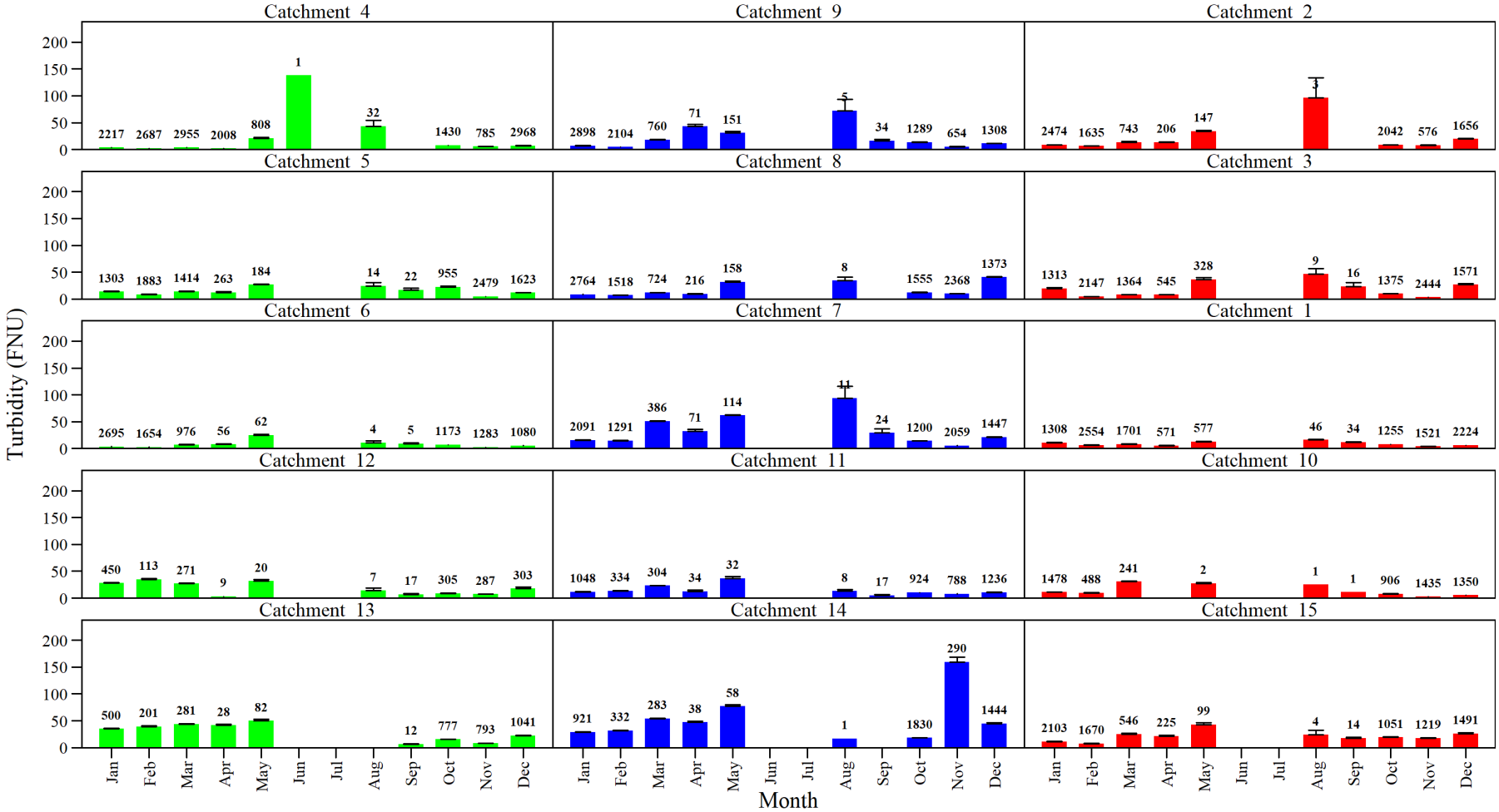


Figure 56: Monthly means for turbidity

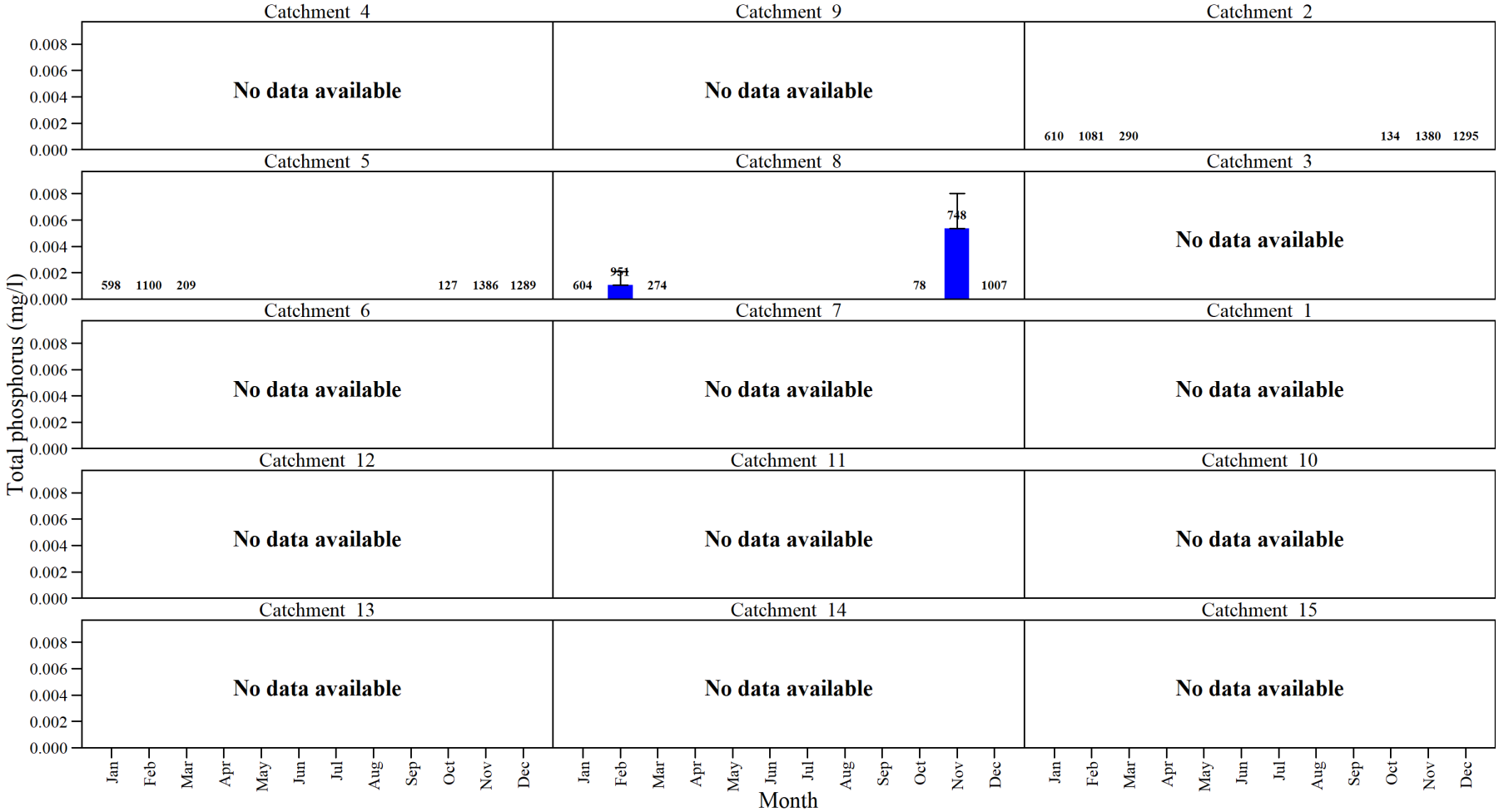


Figure 57: Monthly means for total phosphorus

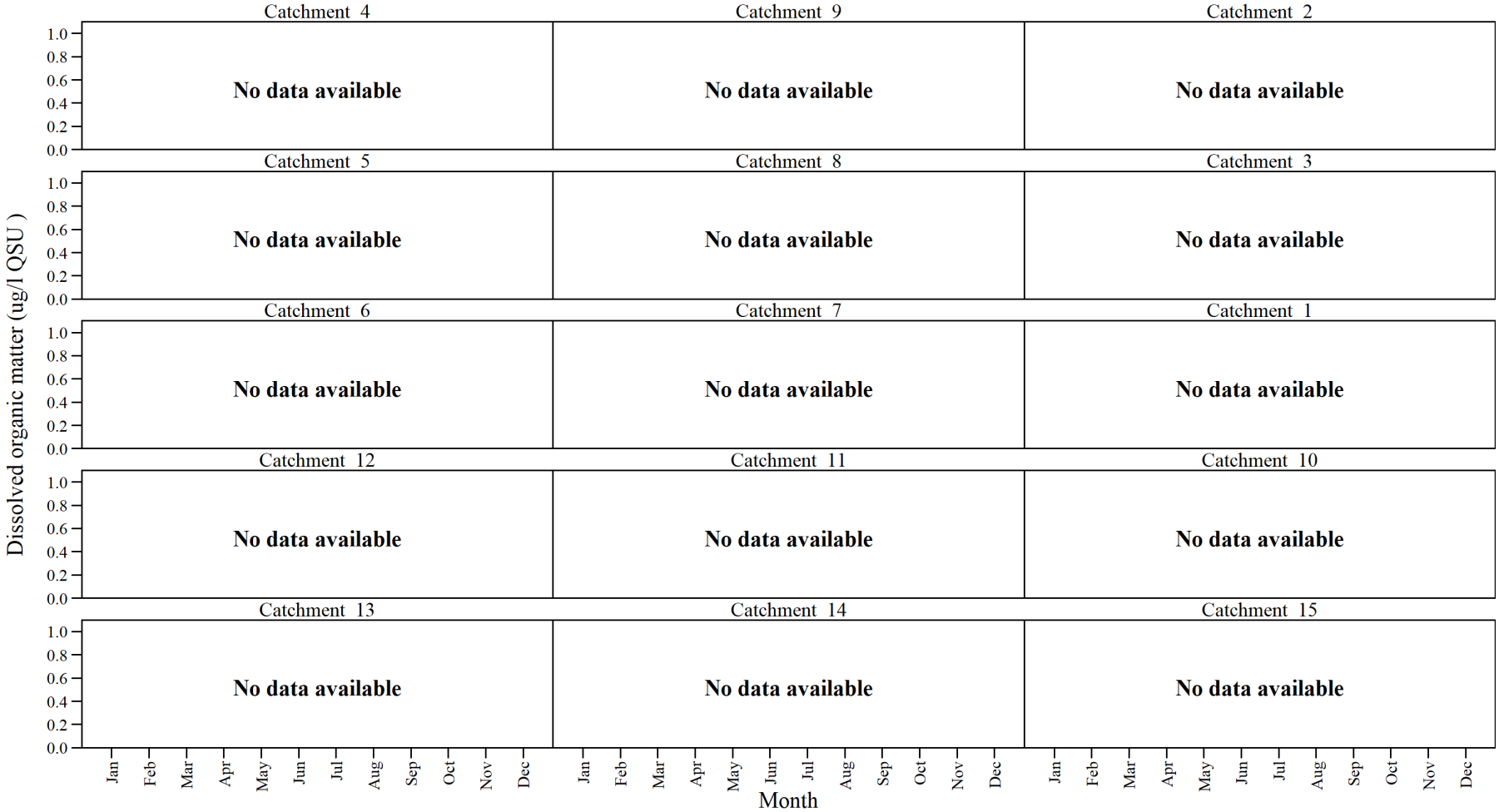


Figure 58: Monthly means for dissolved organic matter

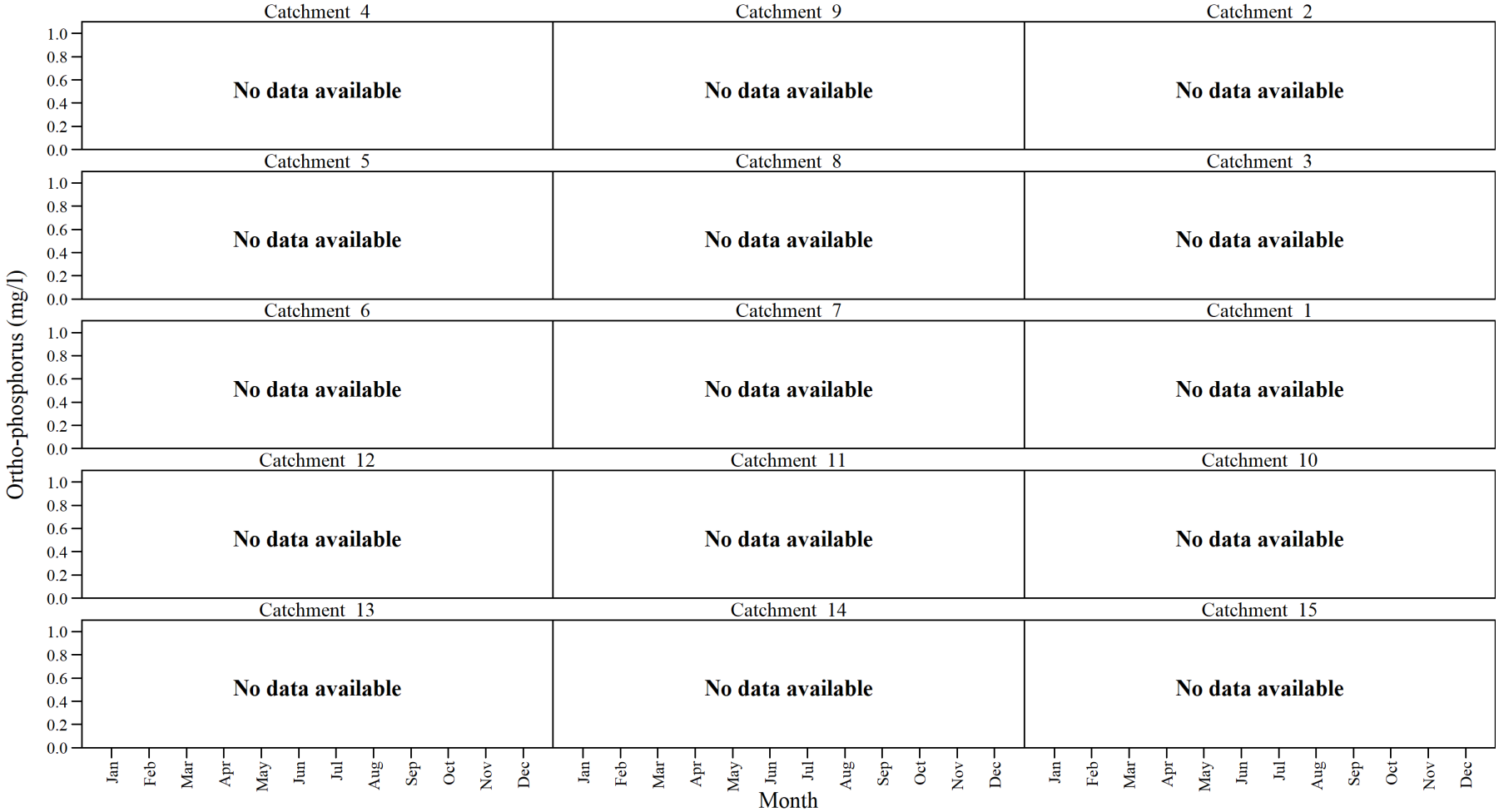


Figure 59: Monthly means for ortho-phosphorus

2.3 Chloropleth maps of means

Grey areas represent missing data

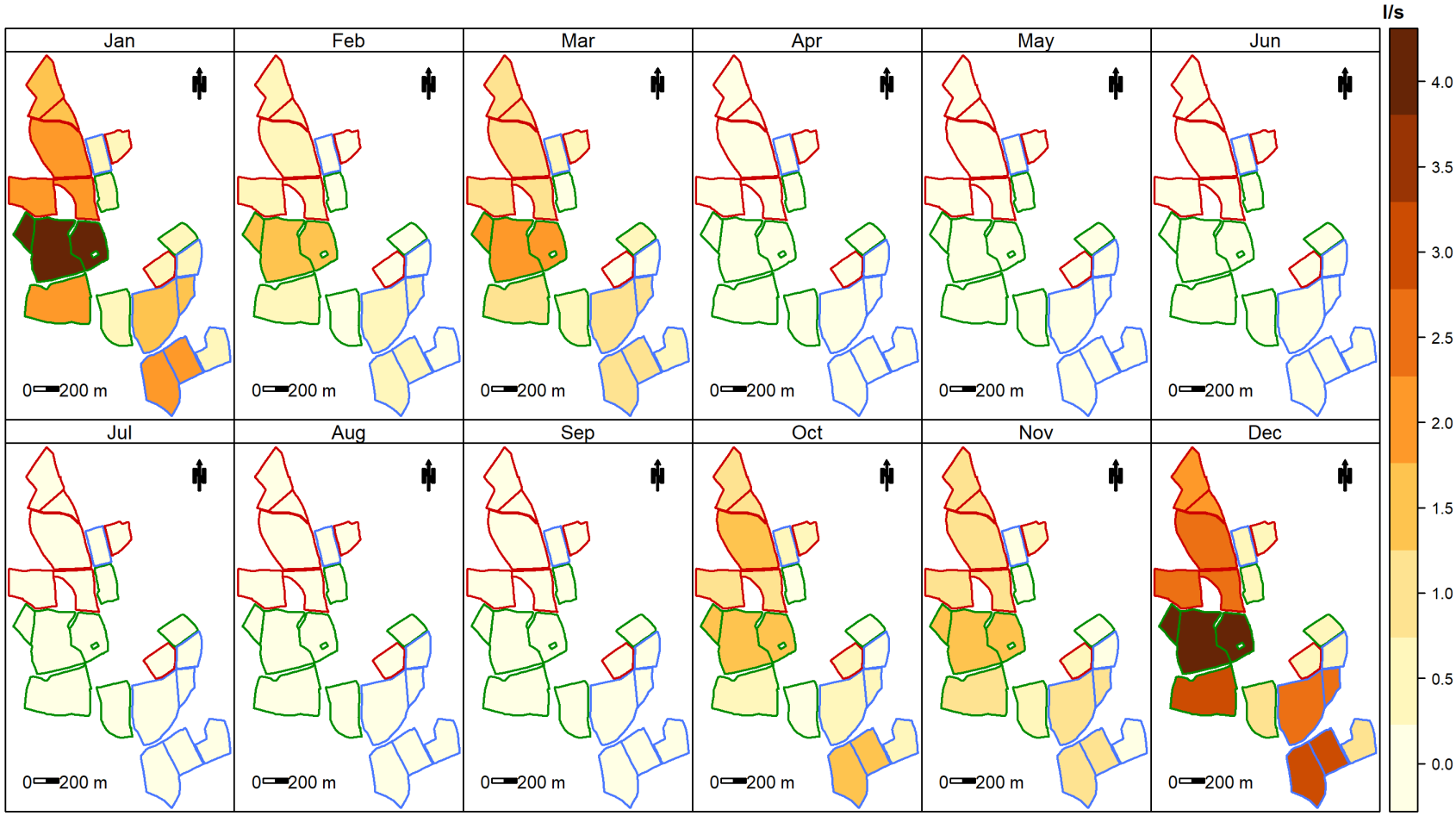


Figure 60: Mapped means for flow

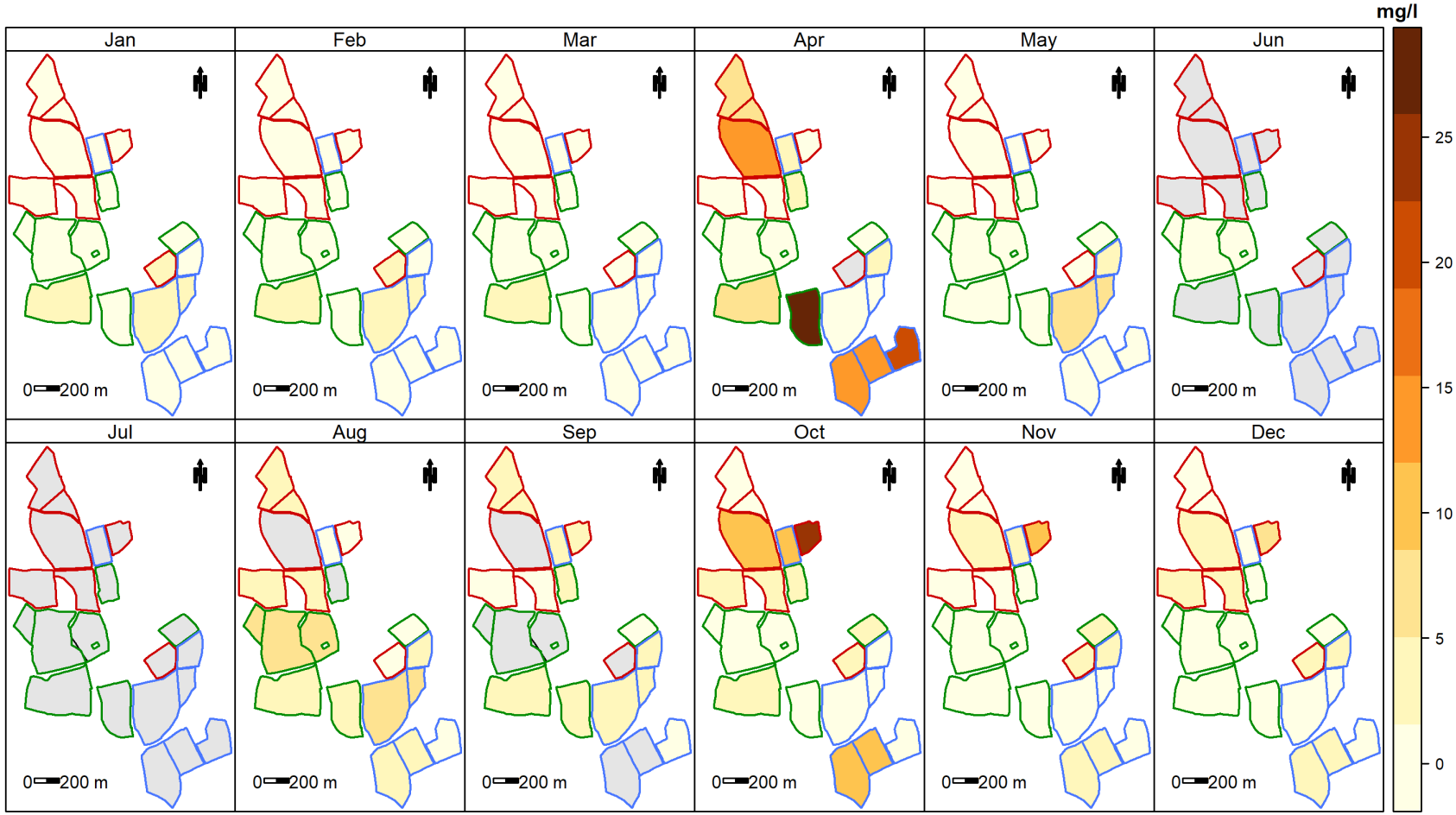


Figure 61: Mapped means for nitrate+nitrite

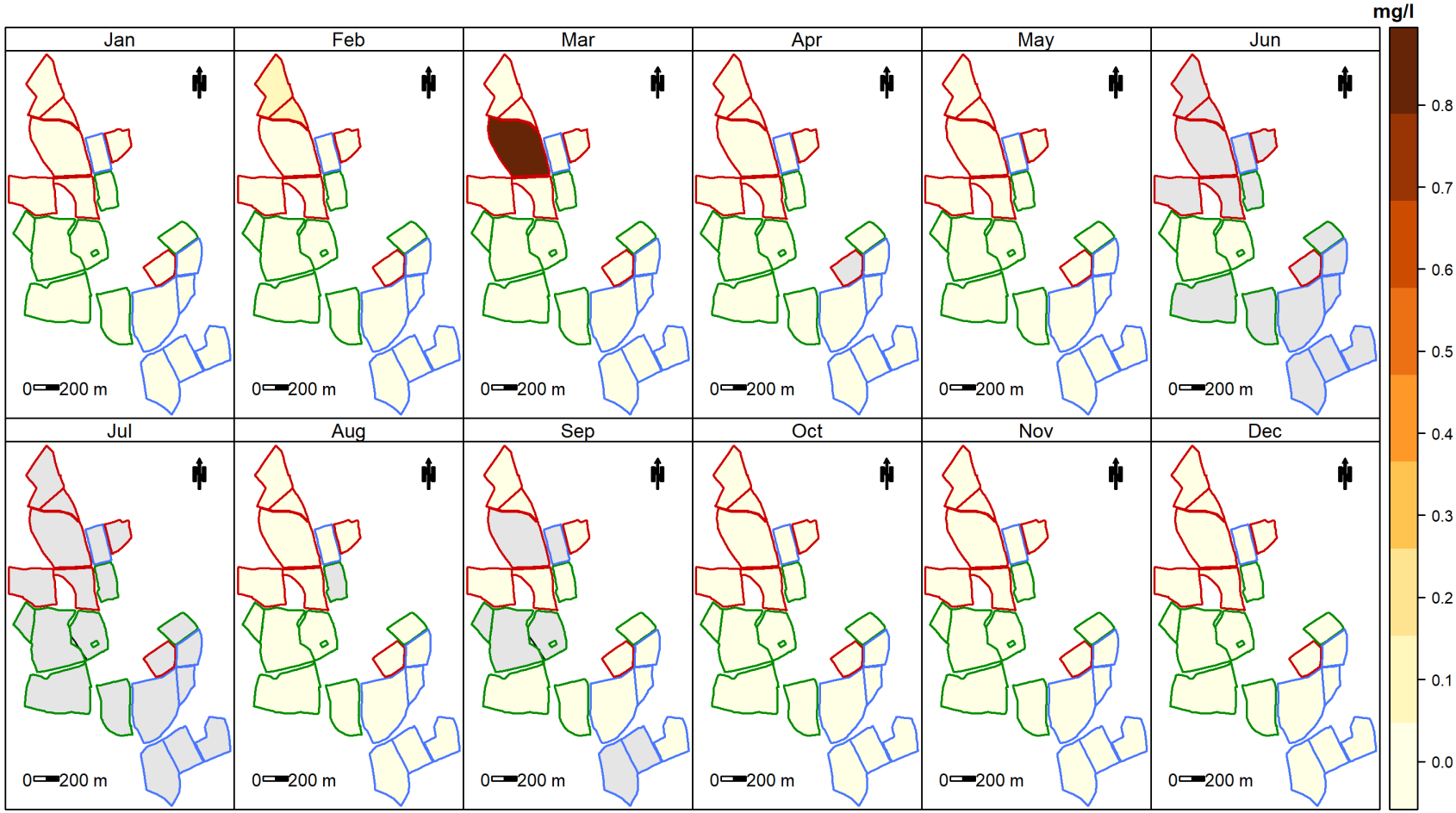


Figure 62: Mapped means for ammonia

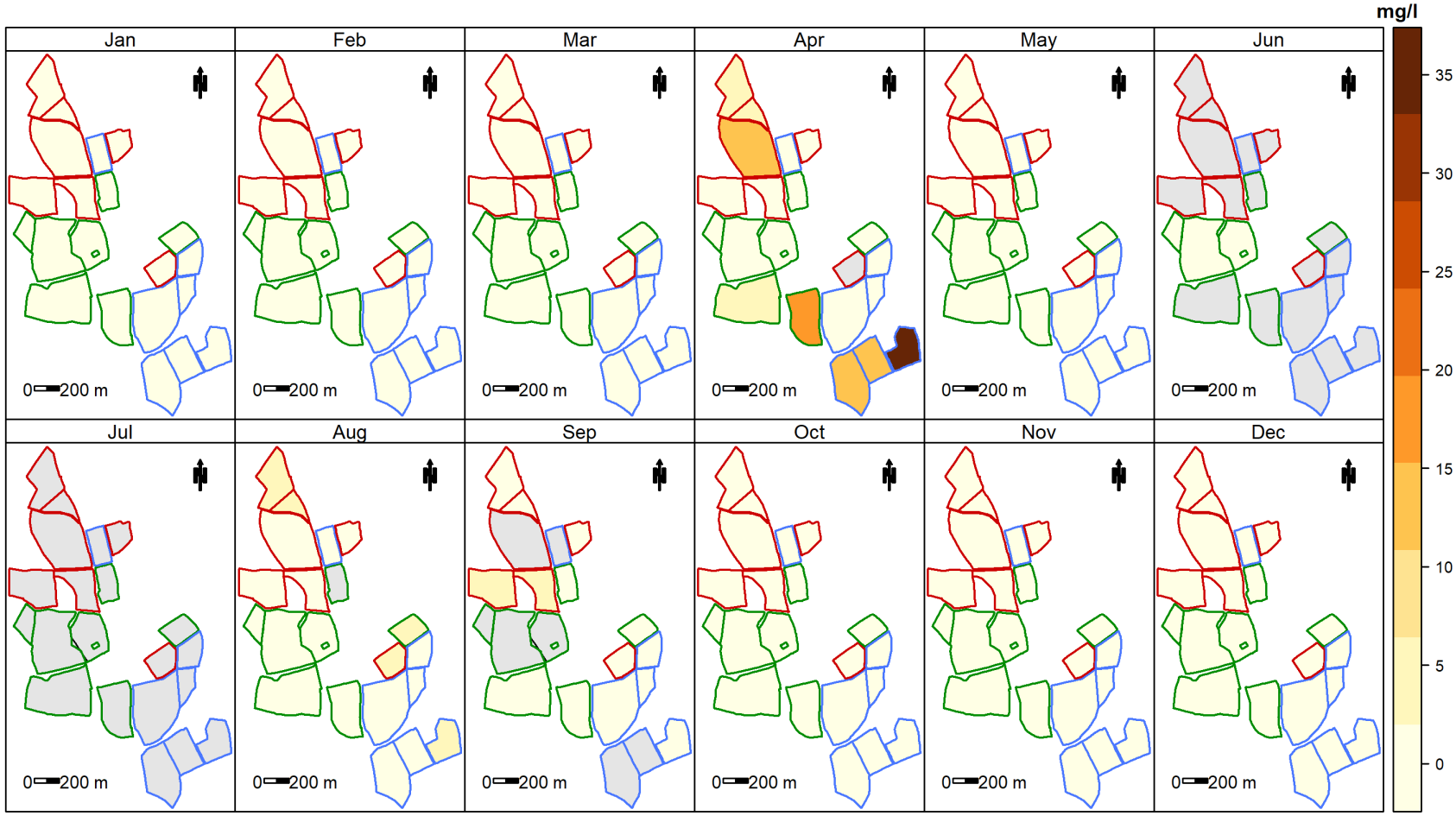


Figure 63: Mapped means for ammonium

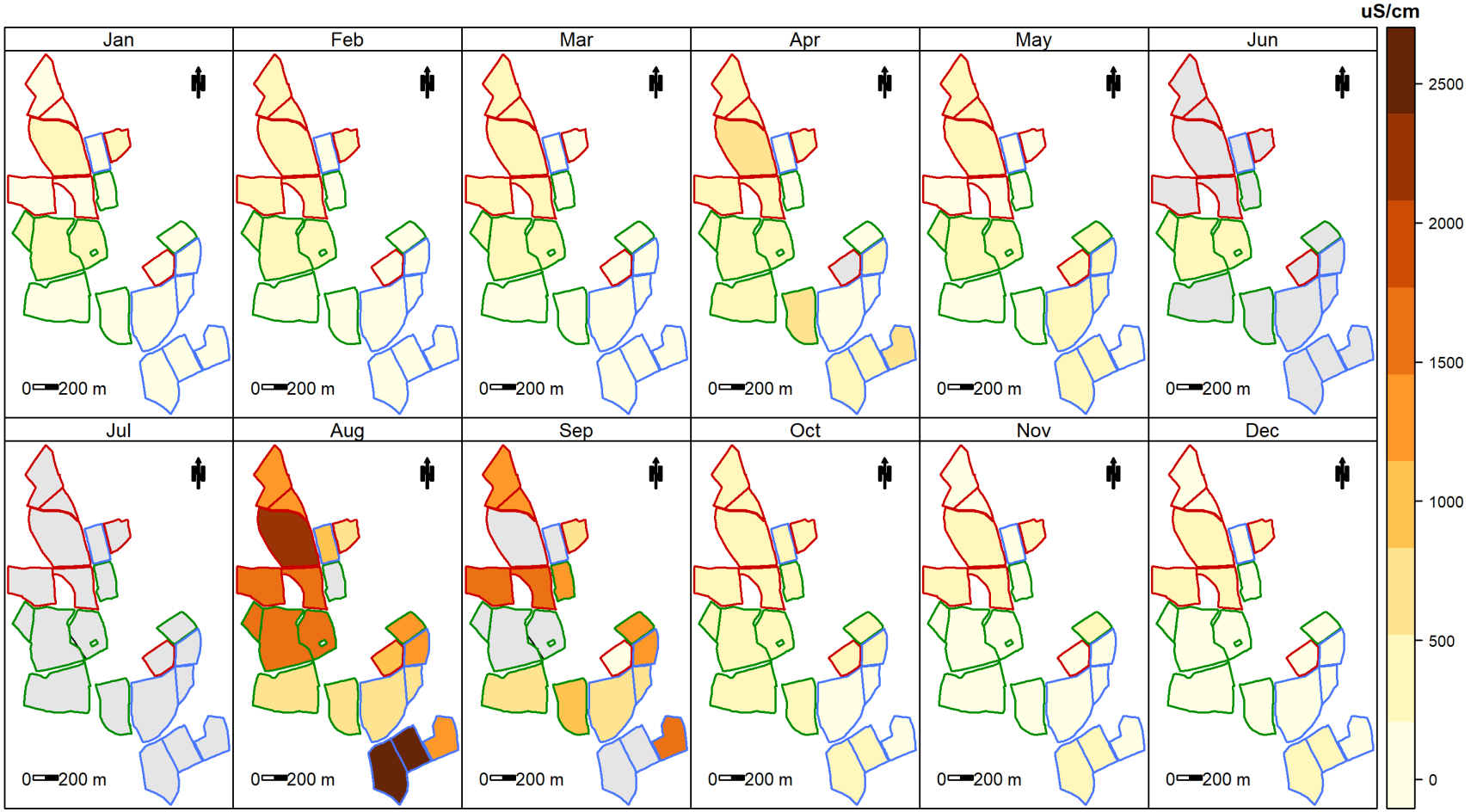


Figure 64: Mapped means for conductivity

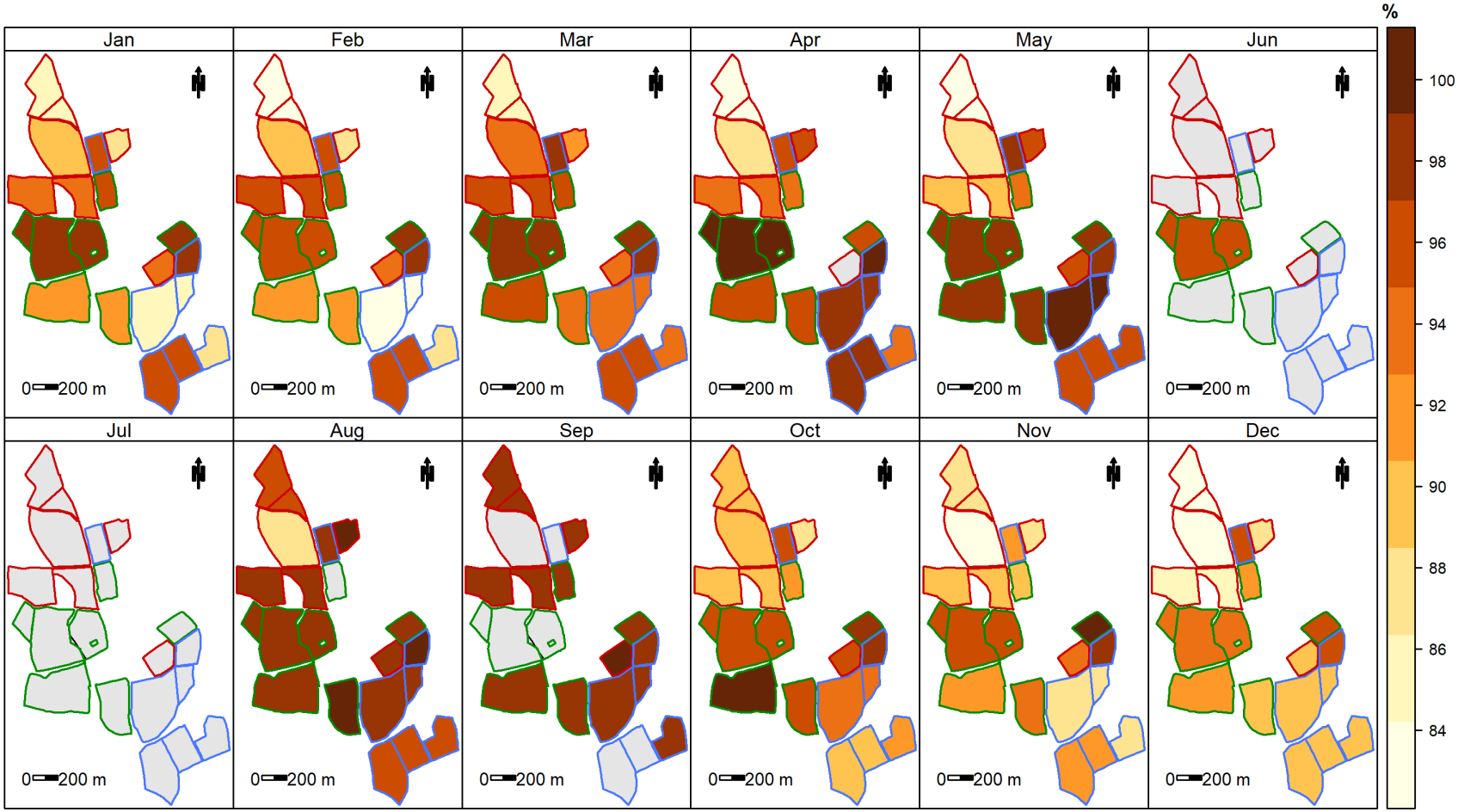


Figure 65: Mapped means for dissolved oxygen

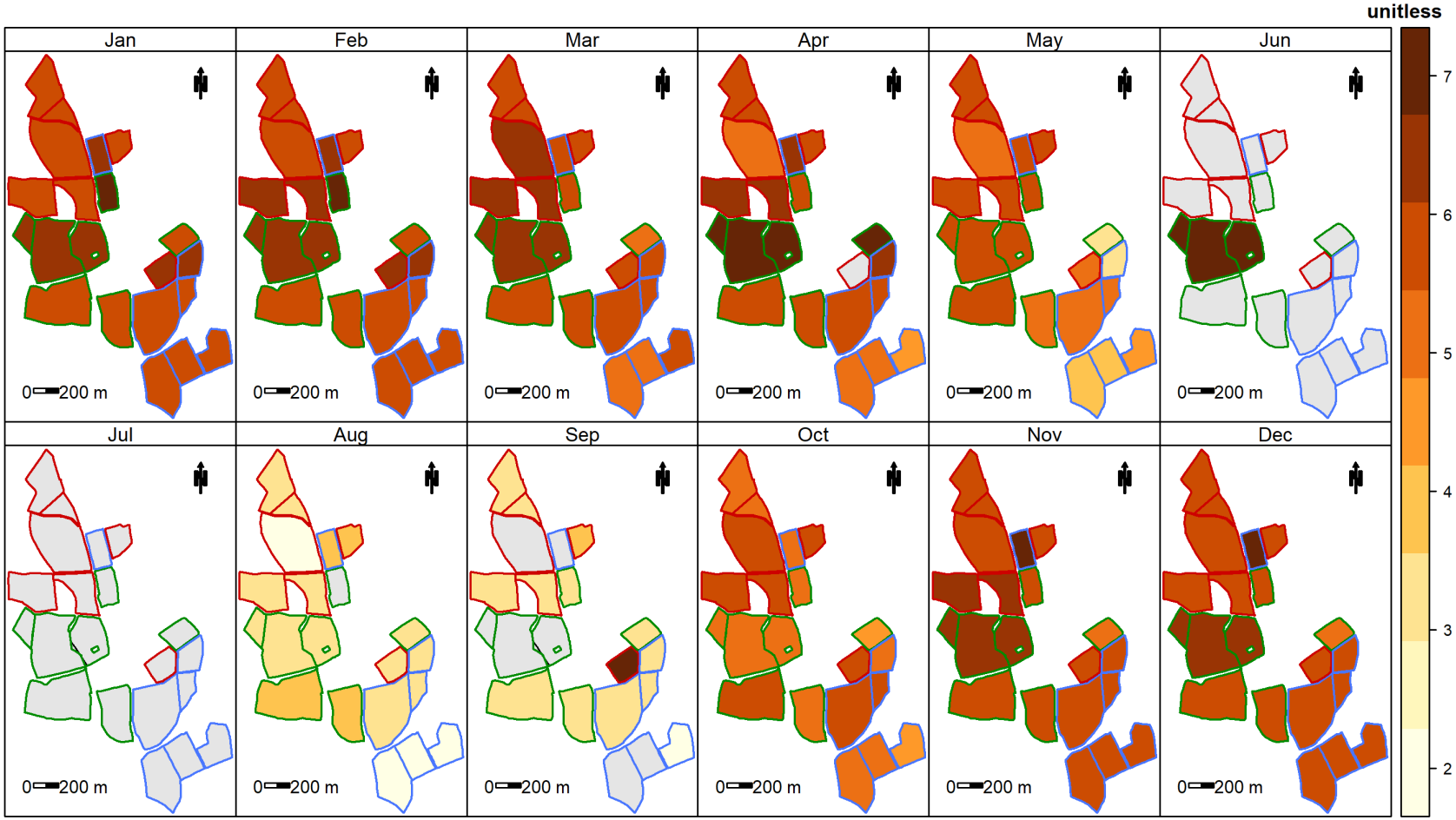


Figure 66: Mapped means for pH

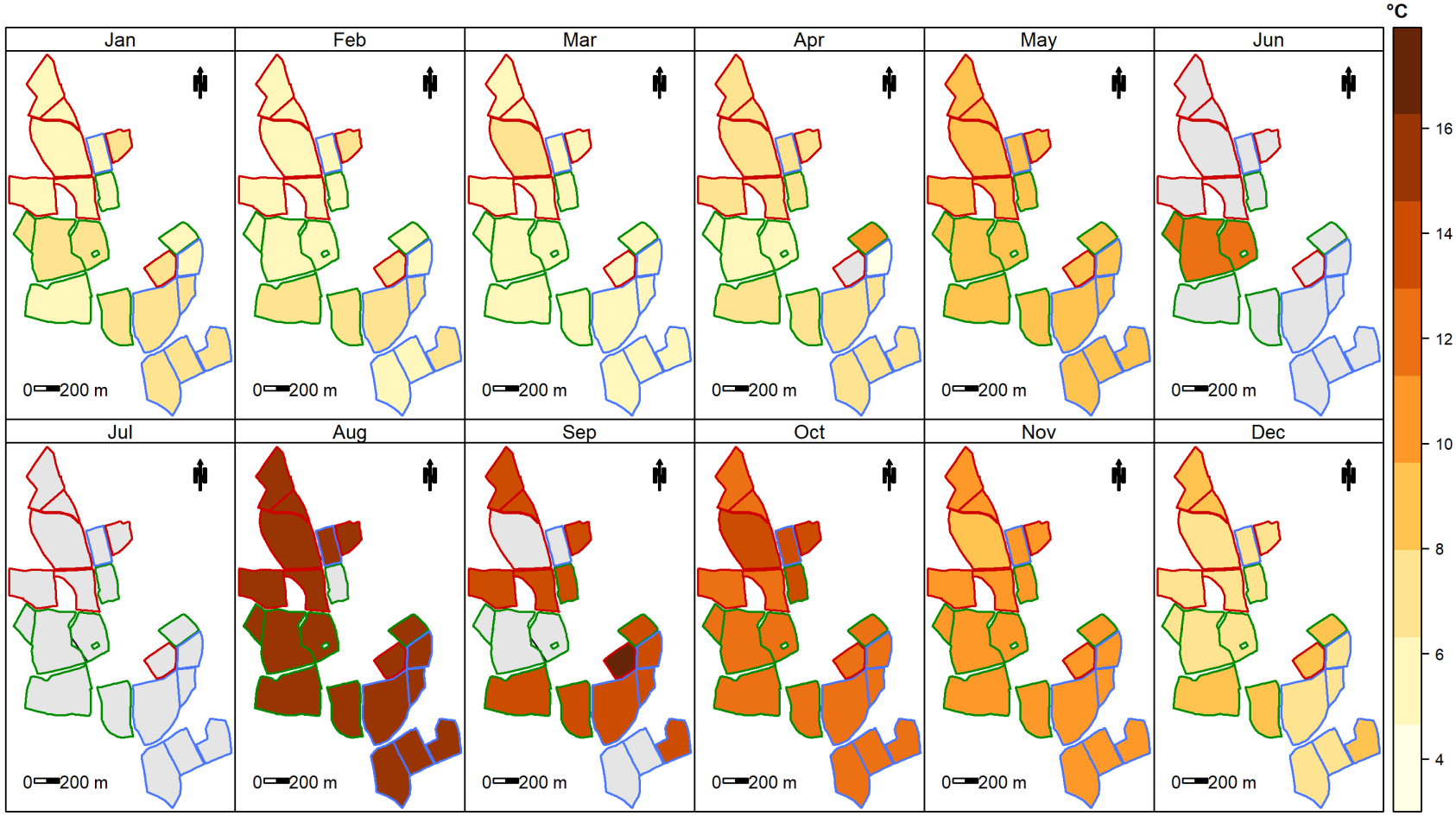


Figure 67: Mapped means for flow cell water temperature

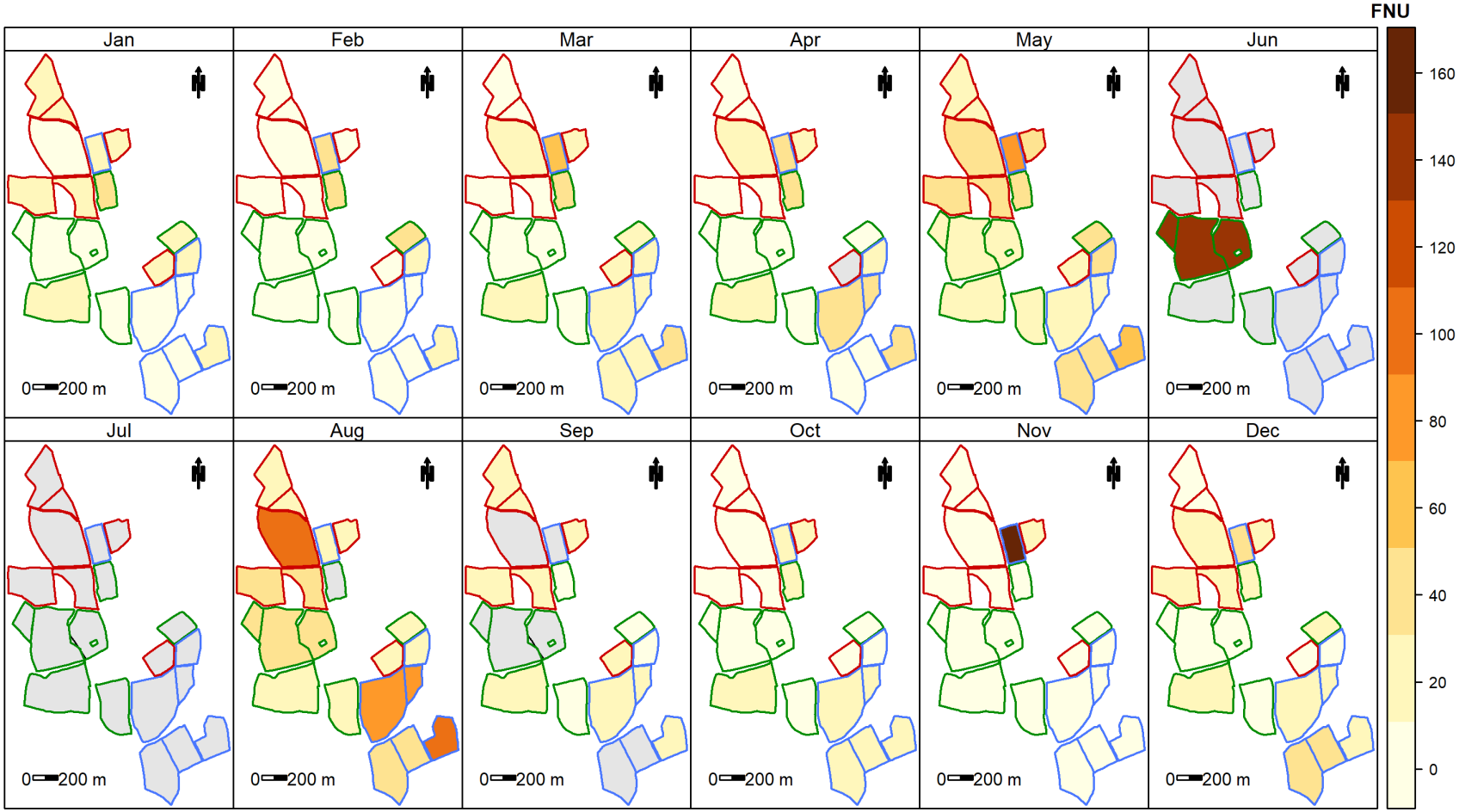


Figure 68: Mapped means for turbidity

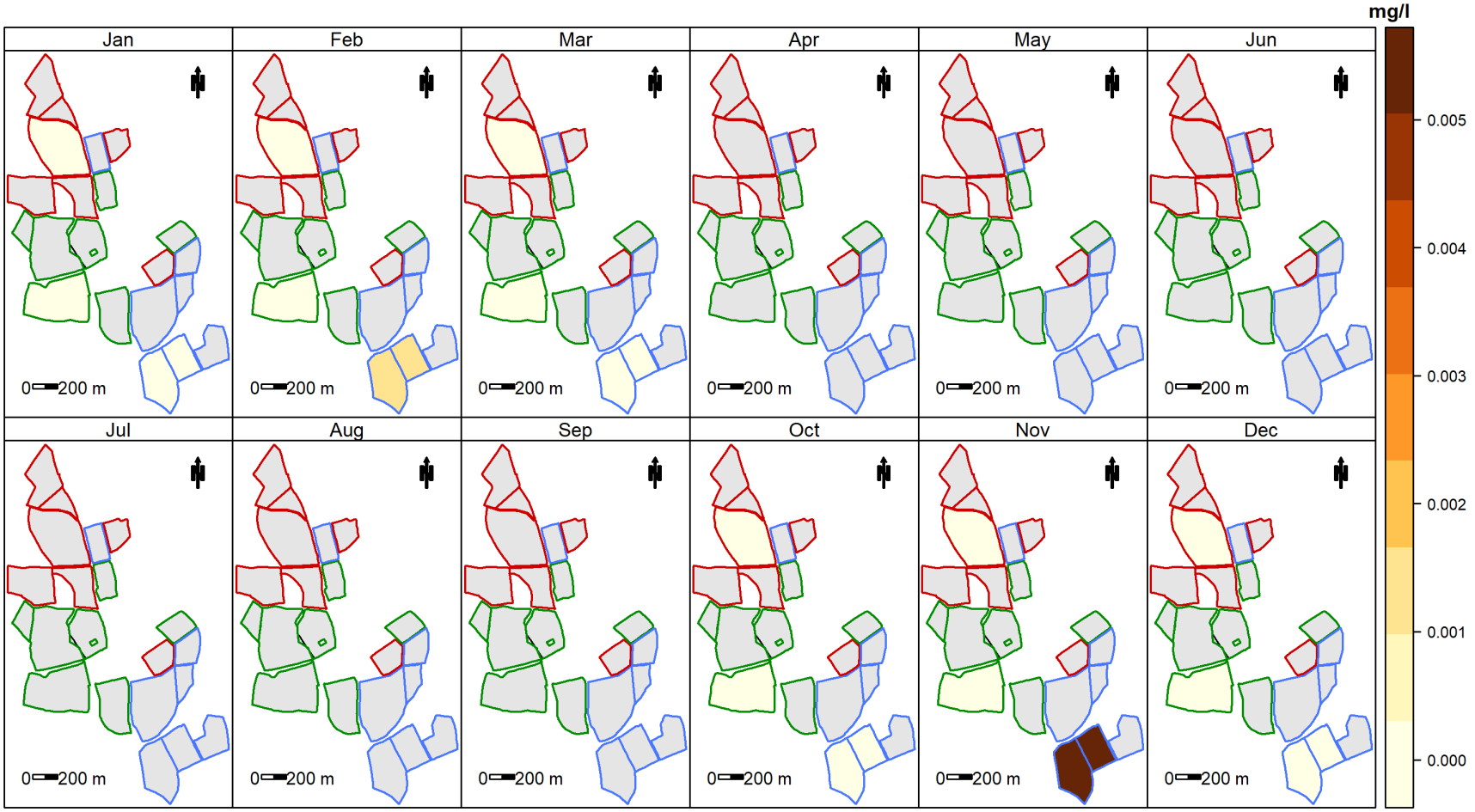


Figure 69: Mapped means for total phosphorus

No dissolved organic matter mean data available

Figure 70: Mapped means for dissolved organic matter

No ortho-phosphorus mean data available

Figure 71: Mapped means for ortho-phosphorus

2.4 Chloropleth maps of standard deviations

Grey areas represent missing data

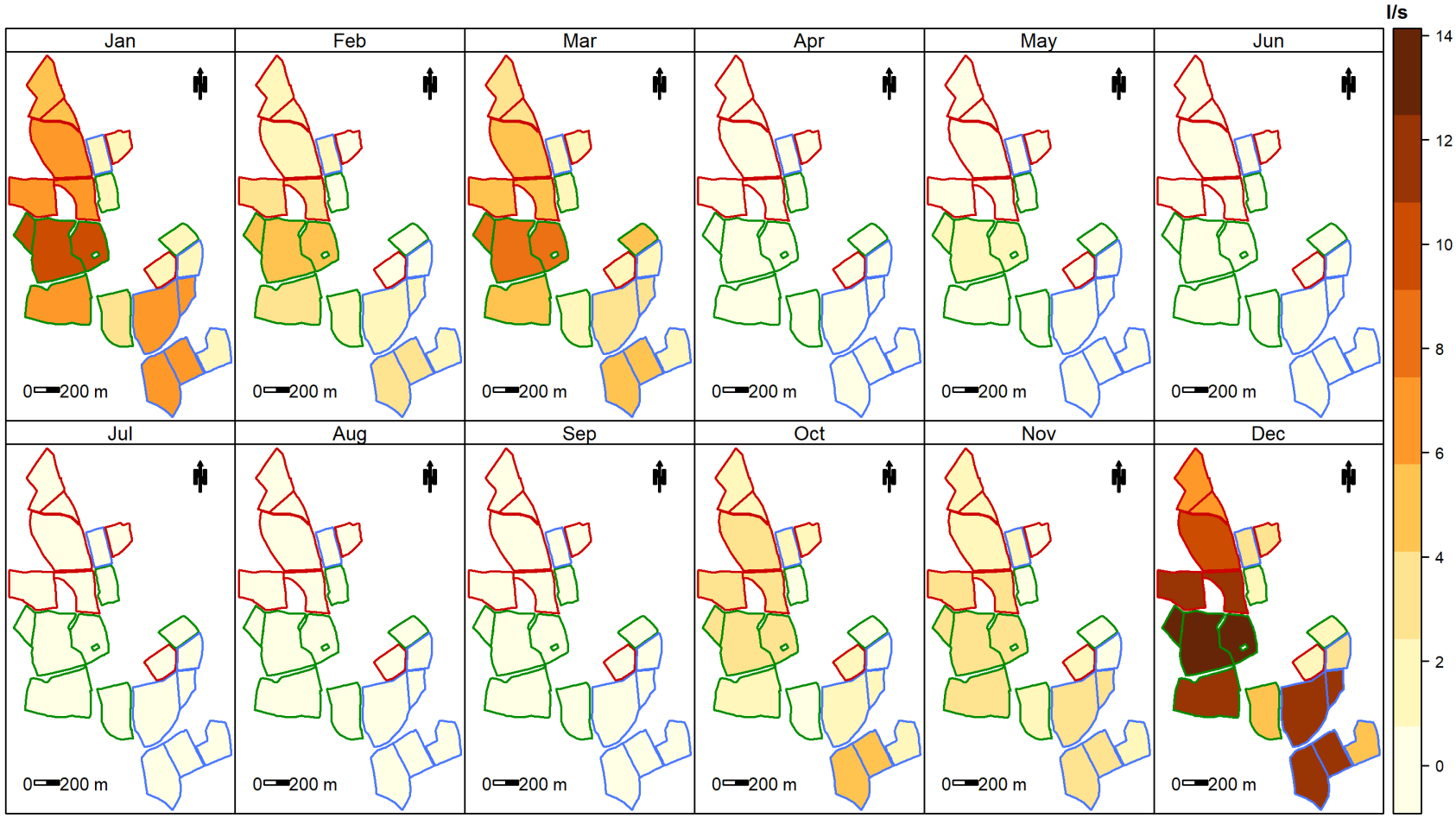


Figure 72: Mapped standard deviations for flow

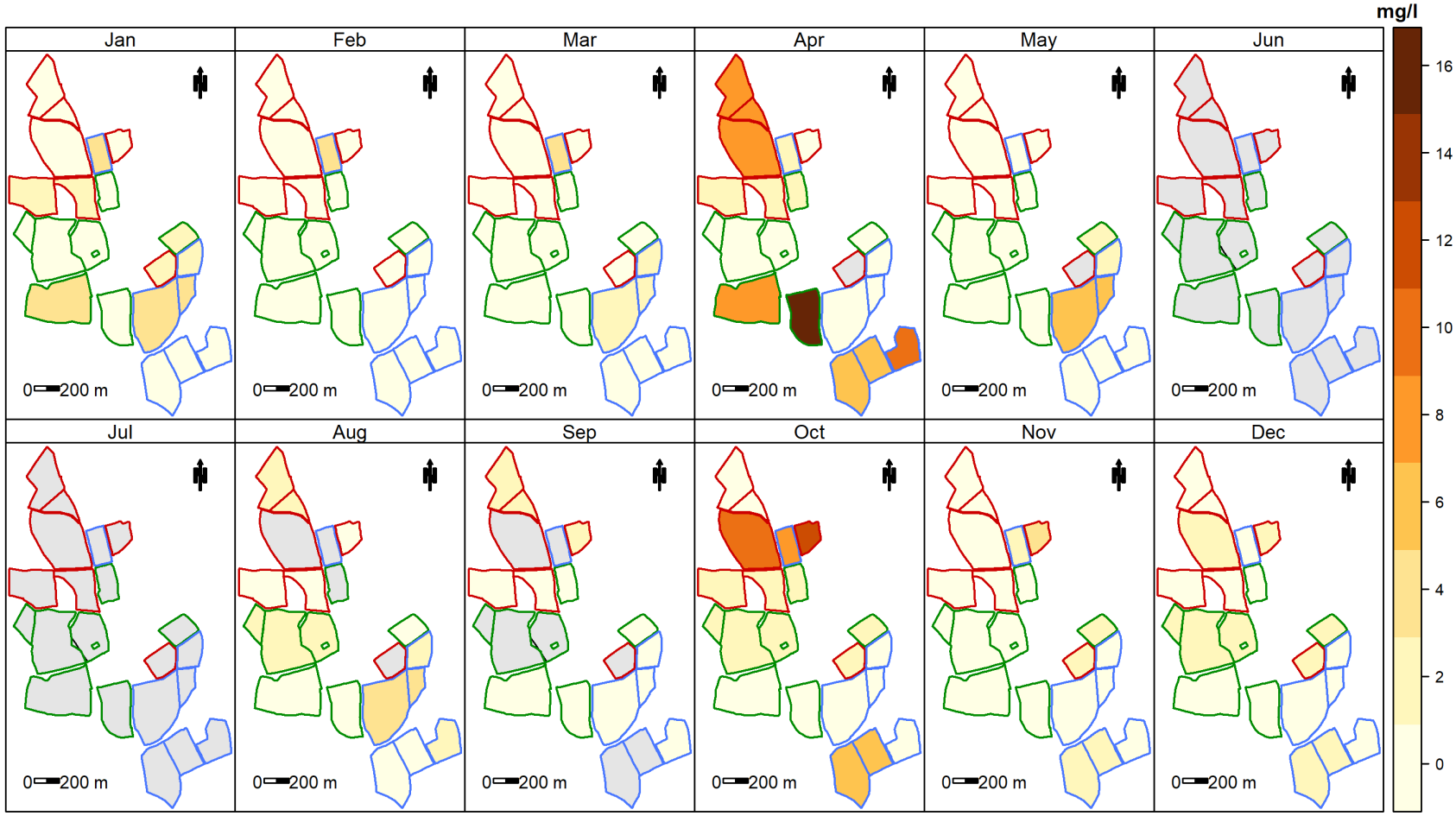


Figure 73: Mapped standard deviations for nitrate+nitrite

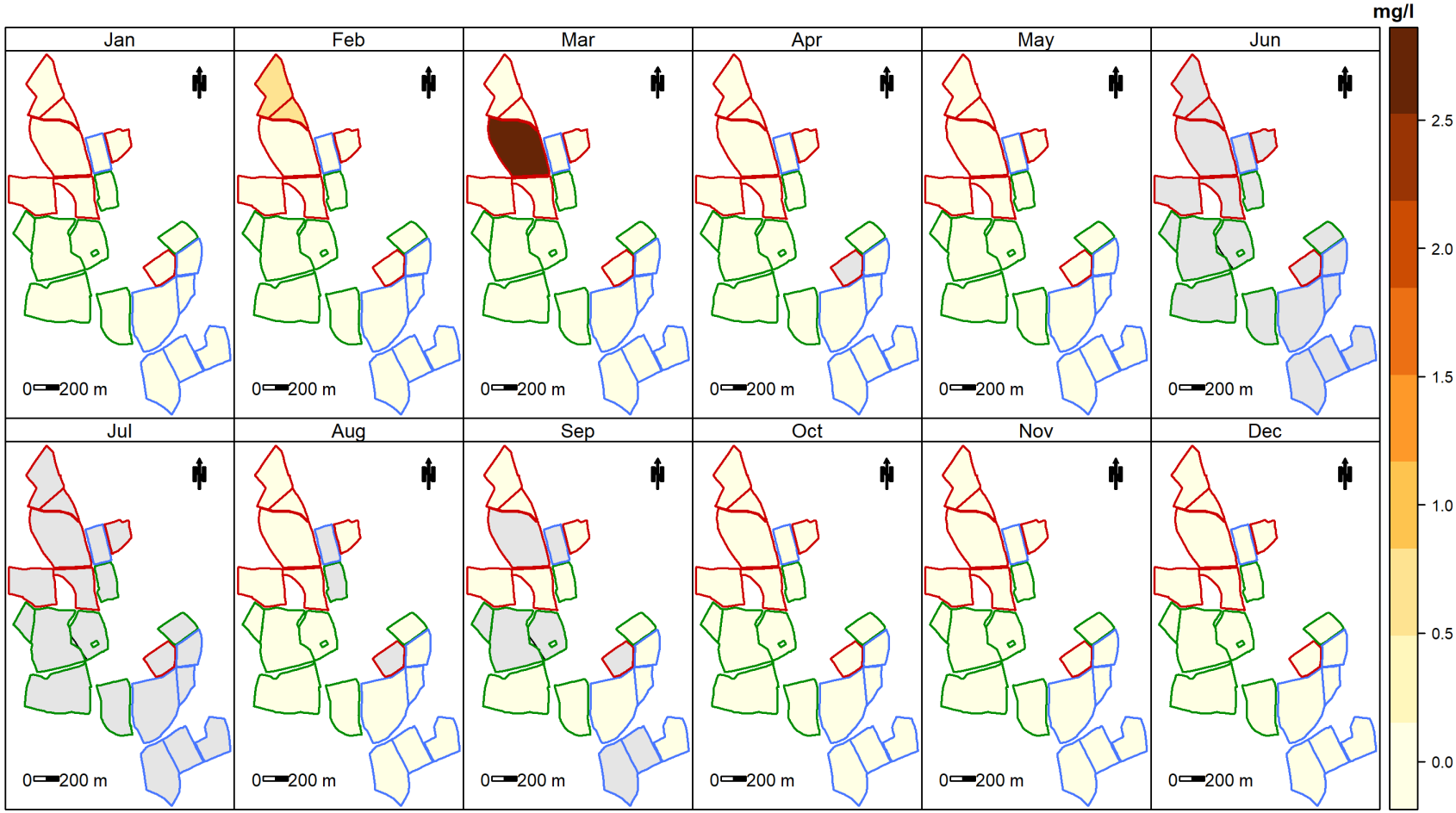


Figure 74: Mapped standard deviations for ammonia

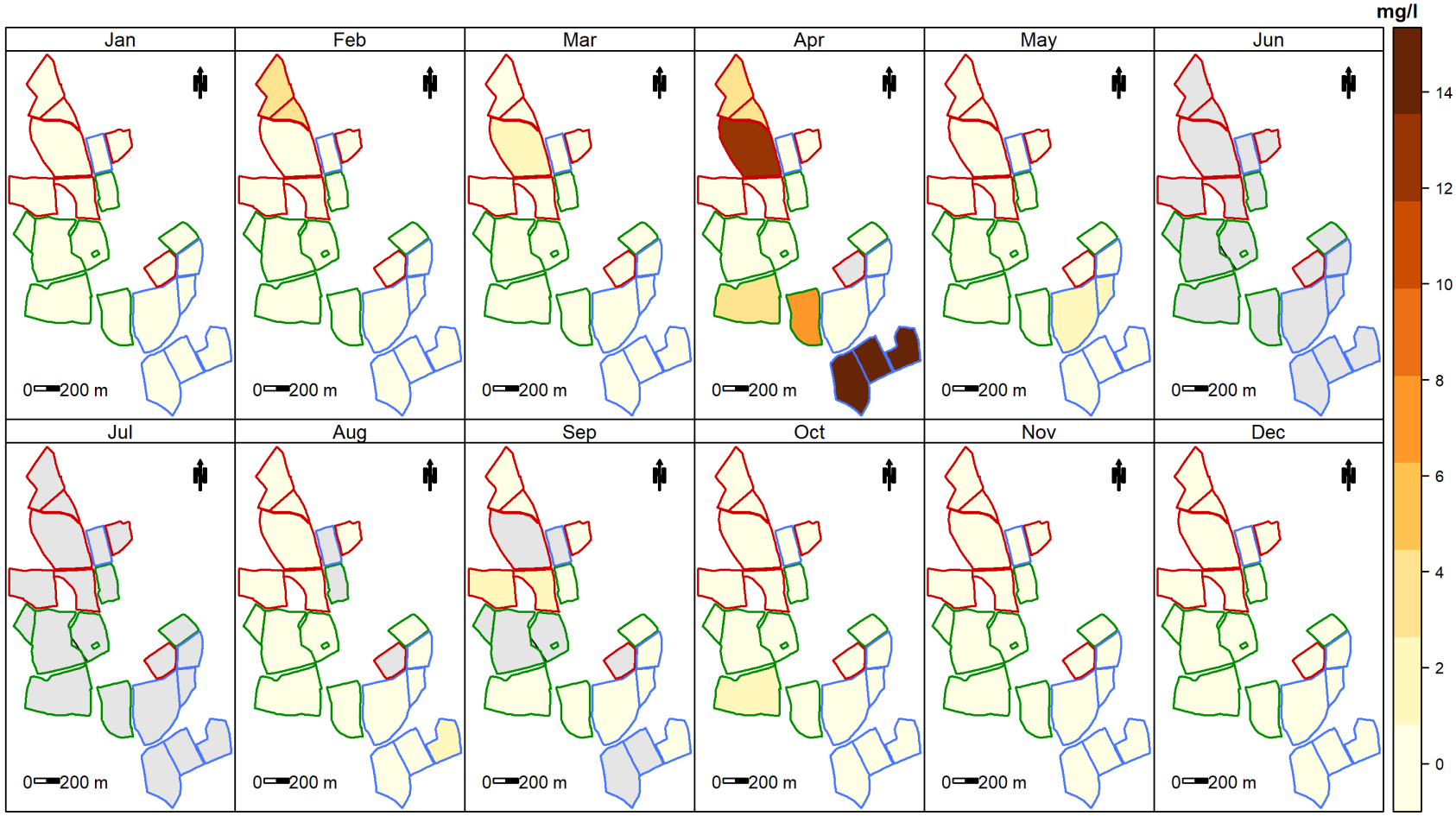


Figure 75: Mapped standard deviations for ammonium

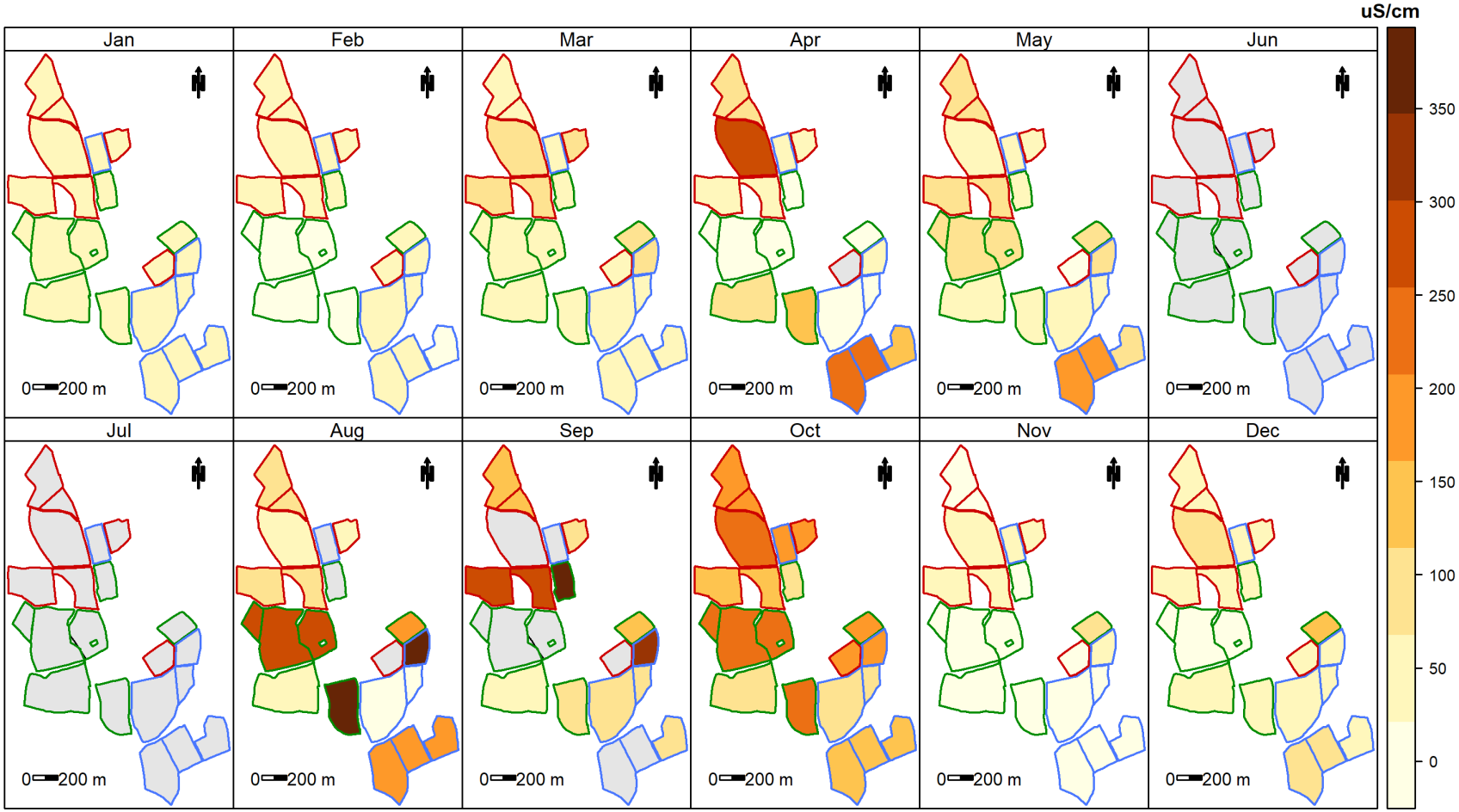


Figure 76: Mapped standard deviations for conductivity

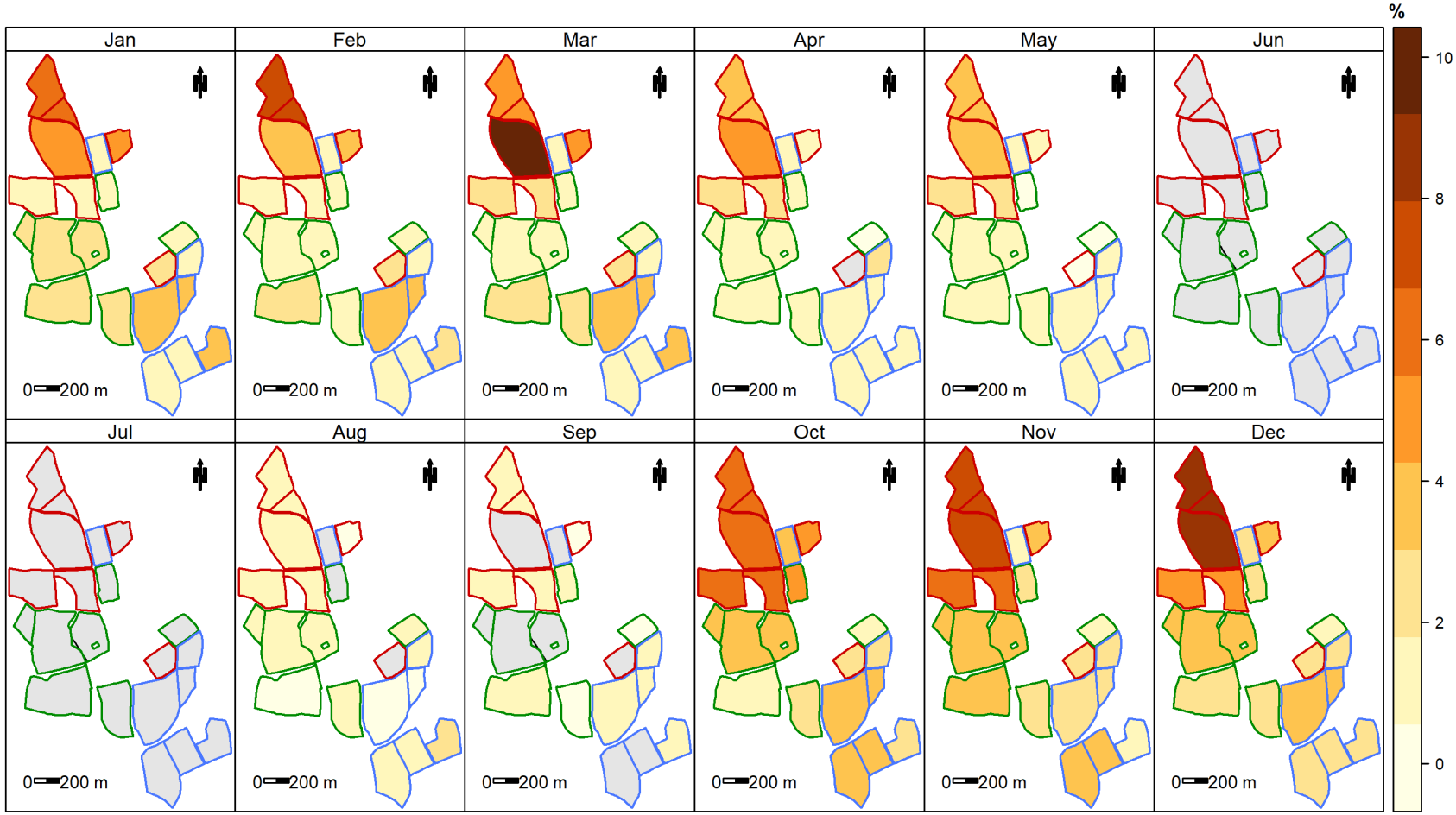


Figure 77: Mapped standard deviations for dissolved oxygen

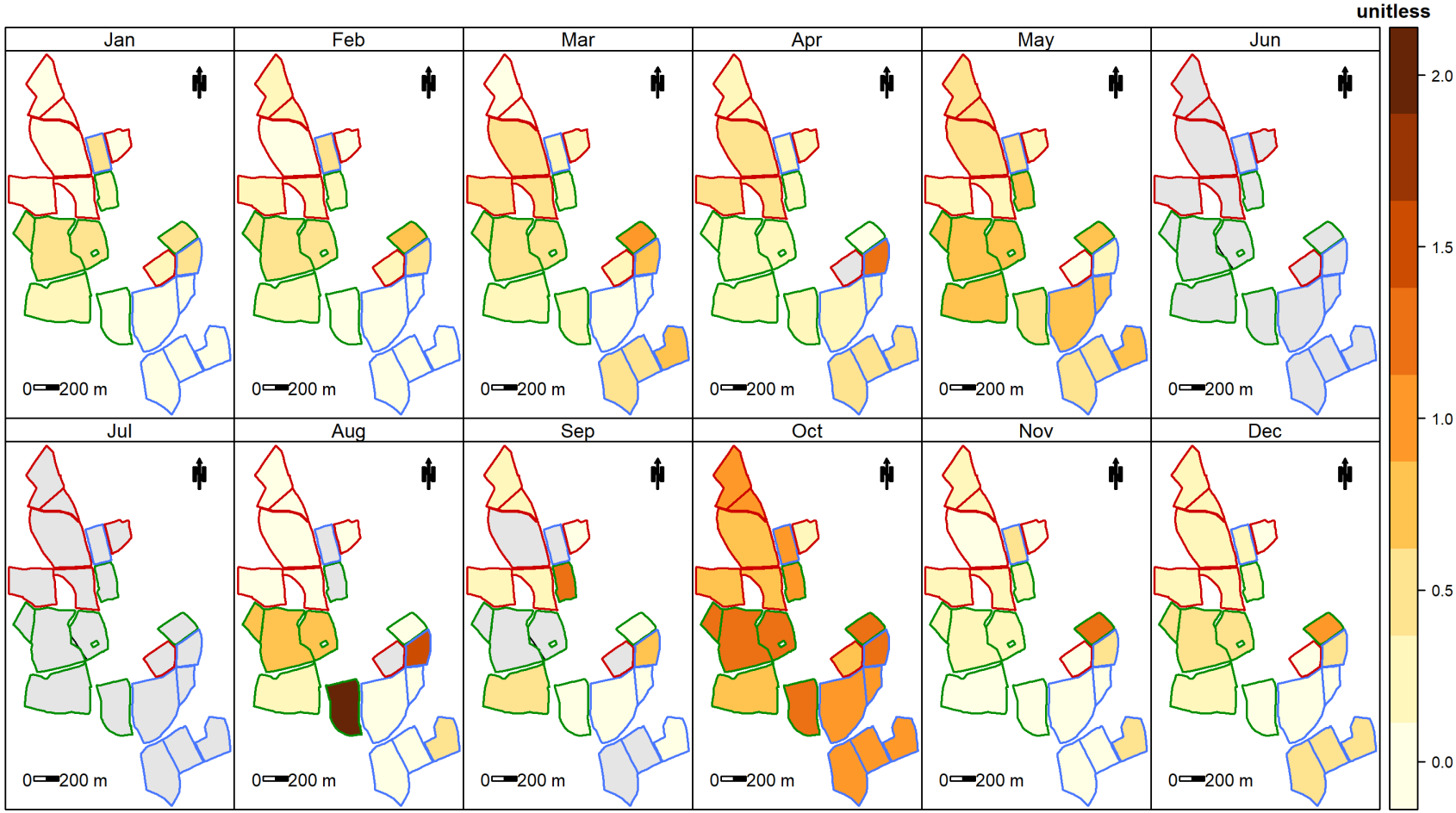


Figure 78: Mapped standard deviations for pH

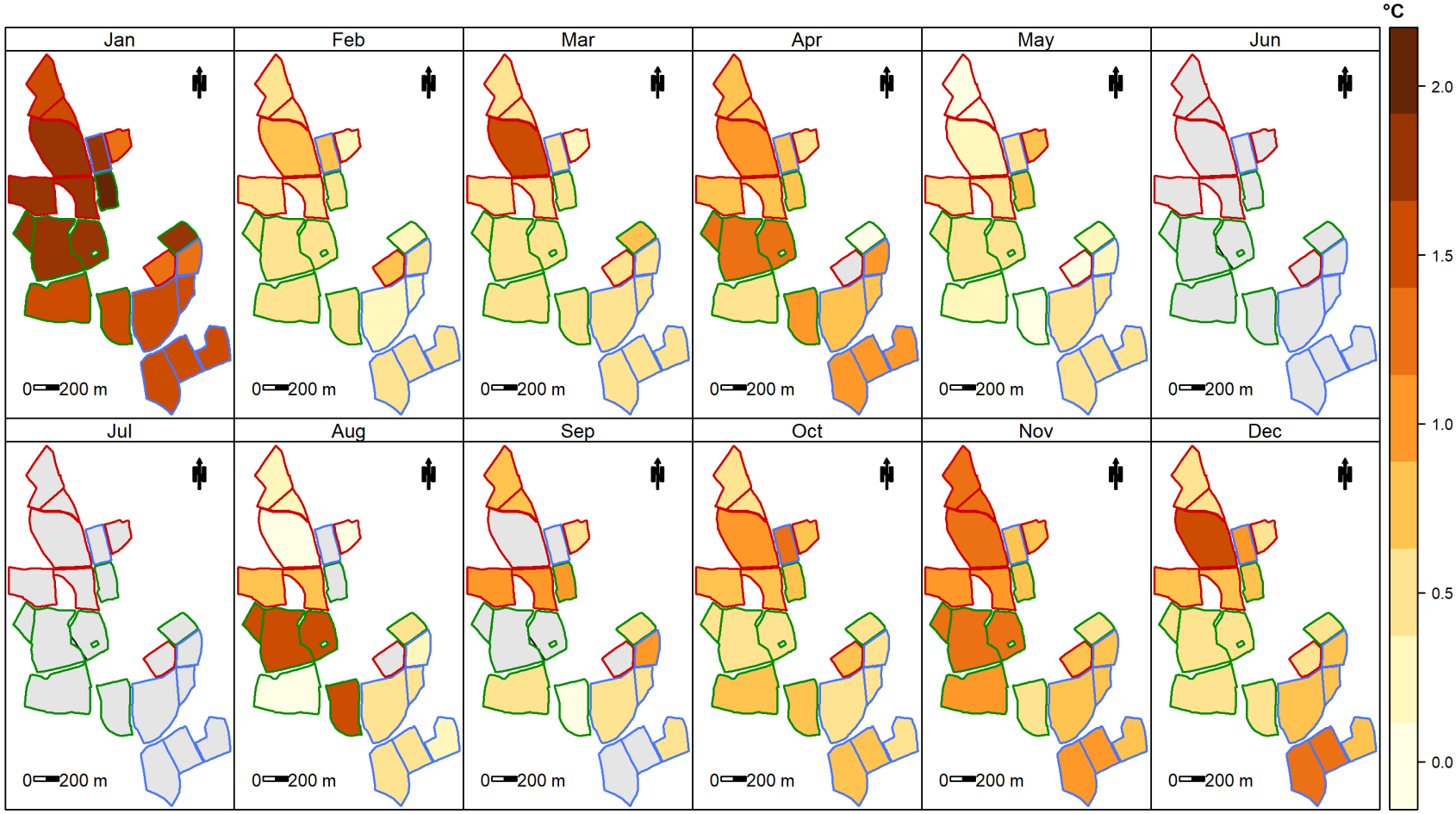


Figure 79: Mapped standard deviations for flow cell water temperature

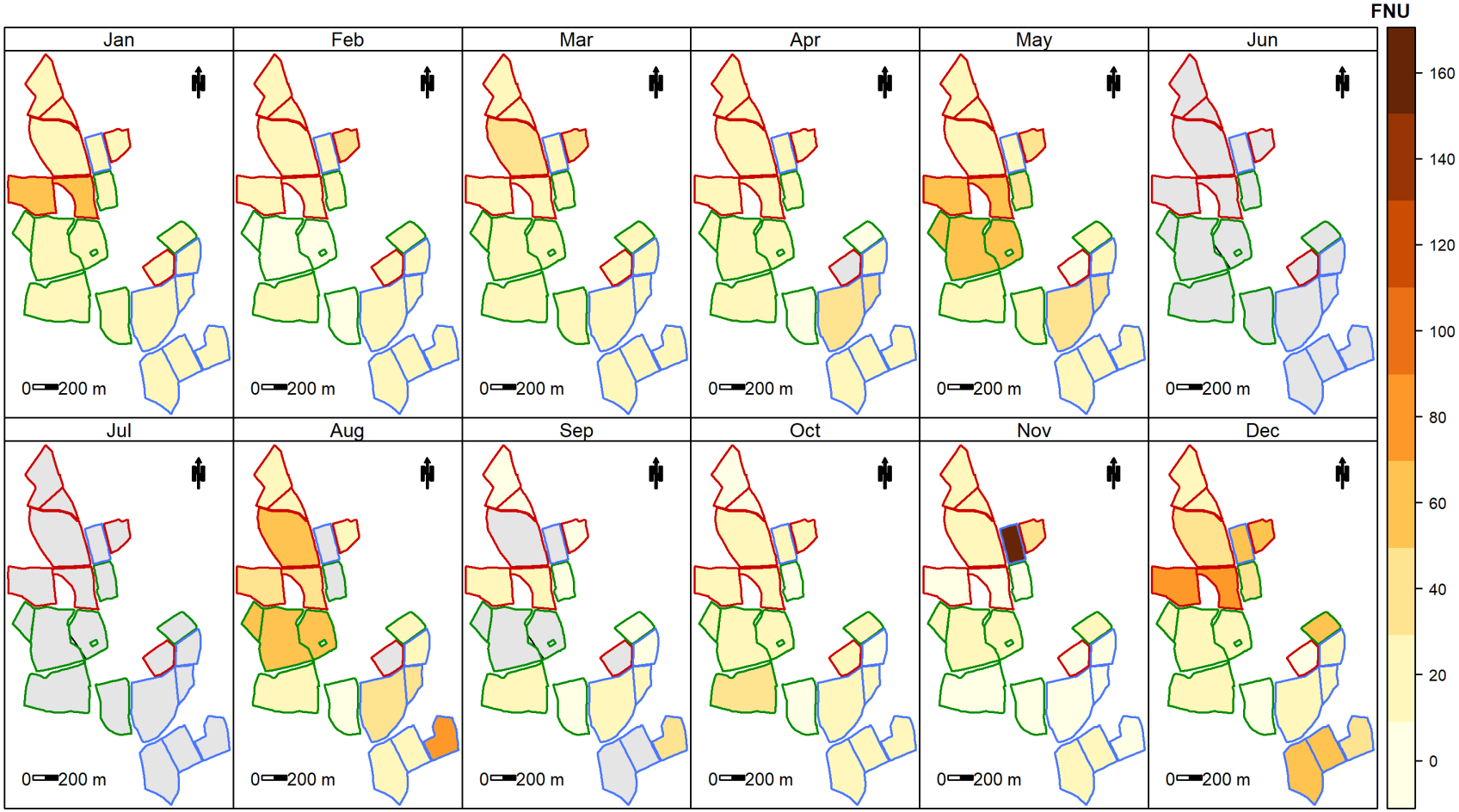


Figure 80: Mapped standard deviations for turbidity

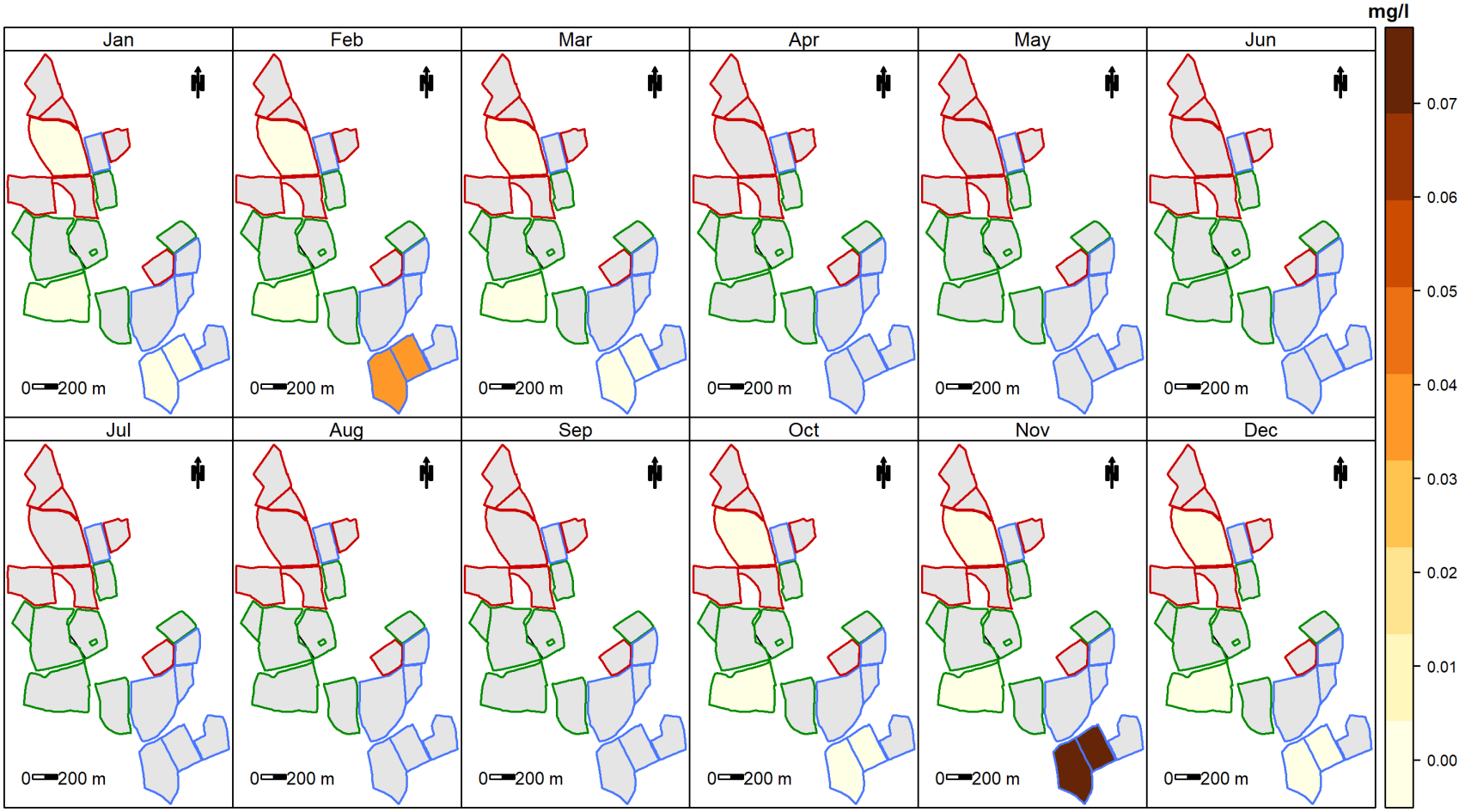


Figure 81: Mapped standard deviations for total phosphorus

No dissolved organic matter standard deviation data available

Figure 82: Mapped standard deviations for dissolved organic matter

No ortho-phosphorus standard deviation data available

Figure 83: 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	0.7	0.2	0.1	0.1	0.5	0.8	0.2	0.1	0.2	0.7	0.7	0.6	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	6.0	4.4	1.9	1.5	0.8	4.1	4.6	1.6	1.0	1.2	3.8	4.3	2.9	0.9	1.0
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	4.9	6.7	7.9	14.5	9.5	7.7	5.8	8.2	9.9	7.6	5.4	6.2	4.8	8.1	6.6
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	183.0	156.0	76.0	67.0	33.0	153.0	147.0	58.0	39.0	46.0	140.0	148.0	70.0	38.0	41.0
Missing values	count	624	313	0	593	0	0	0	0	0	0	36	0	0	0	0
Missing values as a %	%	2	1	0	2	0	0	0	0	0	0	0	0	0	0	0

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	0.8	1.8	1.3	1.7	1.2	1.7	2.9	1.1	1.5	3.9	3.3	1.2	0.6	3.2	7.9
Median	mg/l	1.0	2.0	1.0	1.0	1.0	2.0	1.0	1.0	2.0	2.0	1.0	1.0	0.0	3.0	4.0
Standard deviation	mg/l	0.7	1.9	1.5	2.0	1.2	2.0	4.4	2.4	1.0	6.1	6.2	1.0	2.2	1.8	10.1
Inter-quartile range	mg/l	1.0	1.0	1.0	3.0	2.0	1.0	4.0	0.0	1.0	2.0	2.0	1.0	1.0	2.0	10.0
Coefficient of variation	mg/l	0.9	1.1	1.2	1.2	1.0	1.2	1.5	2.1	0.6	1.6	1.9	0.8	3.5	0.6	1.3
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	8.0	33.0	48.0	33.0	6.0	34.0	25.0	30.0	8.0	33.0	45.0	12.0	36.0	8.0	45.0
Missing values	count	16402	23430	25218	32627	31276	24586	25112	27756	30332	30221	24446	22935	21895	29056	25394
Missing values as a %	%	47	67	72	93	89	70	72	79	87	86	70	65	62	83	72

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	0.1	0.1	0.1	0.0	0.0	0.4	0.3	0.0	0.0	0.7	0.0	0.2	0.0	0.1
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	0.2	0.7	1.4	0.3	0.1	0.2	2.9	3.3	0.2	0.1	2.4	0.2	1.6	0.2	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	1.0	0.0	0.0	0.0	0.0
Coefficient of variation	mg/l	14.0	5.8	14.1	4.3	7.9	12.8	7.0	12.0	7.4	7.8	3.5	5.5	9.5	5.4	3.9
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	19.0	12.0	27.0	3.0	2.0	5.0	49.0	49.0	2.0	1.0	48.0	3.0	47.0	2.0	1.0
Missing values	count	18114	24641	25234	32577	31323	24246	25457	26131	30315	29719	25054	23925	23272	28888	25176
Missing values as a %	%	52	70	72	93	89	69	73	75	87	85	72	68	66	82	72

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	225.4	185.5	187.4	212.9	162.0	186.2	211.4	157.5	198.8	248.2	319.2	232.8	222.8	195.7	300.0
Median	uS/cm	221.0	186.0	178.0	191.0	156.0	189.0	189.0	140.0	183.0	197.0	276.0	232.0	209.0	196.0	268.0
Standard deviation	uS/cm	107.4	56.1	101.3	179.6	89.6	58.7	129.2	109.7	129.5	178.2	163.6	95.2	117.1	78.3	129.0
Inter-quartile range	uS/cm	36.0	21.0	21.0	129.0	41.0	49.0	77.0	33.0	45.0	101.0	82.0	69.0	53.0	34.0	85.0
Coefficient of variation	uS/cm	0.5	0.3	0.5	0.8	0.6	0.3	0.6	0.7	0.7	0.7	0.5	0.4	0.5	0.4	0.4
Minimum	uS/cm	66.0	57.0	56.0	31.0	41.0	40.0	39.0	52.0	42.0	31.0	20.0	35.0	16.0	44.0	50.0
Maximum	uS/cm	1974.0	940.0	1656.0	1592.0	1519.0	1001.0	2823.0	1742.0	1608.0	953.0	2394.0	1806.0	1668.0	1028.0	1033.0
Missing values	count	16830	24643	25234	32577	31323	24246	24348	26128	30316	29719	24035	23930	22068	28888	25177
Missing values as a %	%	48	70	72	93	89	69	69	75	87	85	69	68	63	82	72

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	%	96.6	92.5	92.5	99.0	92.3	87.5	93.4	89.0	97.2	95.6	87.5	91.8	85.4	93.3	87.7
Median	%	97.0	92.0	92.0	99.0	92.0	86.0	95.0	88.0	97.0	95.0	88.0	93.0	85.0	93.0	87.0
Standard deviation	%	3.0	3.6	2.8	1.6	3.9	5.5	3.8	3.2	2.1	3.0	7.1	5.3	7.1	2.9	4.5
Inter-quartile range	%	4.0	6.0	3.0	2.0	7.0	8.0	6.0	4.0	3.0	5.0	10.0	7.0	12.0	4.0	7.0
Coefficient of variation	%	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.1
Minimum	%	87.0	83.0	86.0	94.0	86.0	77.0	84.0	83.0	90.0	88.0	70.0	74.0	65.0	87.0	75.0
Maximum	%	103.0	102.0	101.0	103.0	102.0	103.0	103.0	101.0	103.0	102.0	113.0	102.0	113.0	101.0	103.0
Missing values	count	16827	25828	25234	32577	31324	24246	24344	26127	30315	29719	23480	23925	21892	28888	25176
Missing values as a %	%	48	74	72	93	89	69	69	75	87	85	67	68	62	82	72

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	6.3	6.0	5.9	5.2	6.0	5.9	5.8	5.6	5.8	6.1	5.9	6.0	5.9	6.0	6.0
Median	unitless	6.0	6.0	6.0	5.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Standard deviation	unitless	0.8	0.3	0.5	1.2	0.8	0.4	0.6	0.7	0.8	0.9	0.4	0.5	0.5	0.4	0.1
Inter-quartile range	unitless	1.0	0.0	0.0	2.0	0.0	0.0	0.0	1.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
Coefficient of variation	unitless	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.0
Minimum	unitless	2.0	3.0	3.0	3.0	3.0	3.0	2.0	2.0	3.0	4.0	2.0	3.0	3.0	3.0	4.0
Maximum	unitless	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	8.0	8.0	7.0	8.0
Missing values	count	16827	24641	25234	32577	31323	24246	24344	26127	30315	29719	23480	23925	21892	28888	25176
Missing values as a %	%	48	70	72	93	89	69	69	75	87	85	67	68	62	82	72

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	8.2	8.7	9.2	8.9	8.5	8.1	8.8	8.6	9.1	8.5	8.1	8.1	9.2	8.8
Median	°C	8.0	8.0	8.0	10.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	9.0	8.0
Standard deviation	°C	2.5	2.3	2.4	2.9	3.0	2.3	2.5	2.4	2.8	3.5	2.8	2.7	2.6	2.5	2.5
Inter-quartile range	°C	3.0	4.0	4.0	5.0	4.0	3.0	4.0	4.0	5.0	7.0	4.0	4.0	4.0	4.0	4.0
Coefficient of variation	°C	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.3	0.3	0.3	0.3	0.3
Minimum	°C	3.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	2.0	1.0
Maximum	°C	23.0	17.0	18.0	17.0	17.0	16.0	16.0	17.0	17.0	16.0	17.0	17.0	18.0	17.0	16.0
Missing values	count	16827	24641	25234	32577	31323	24246	24344	26127	30315	29719	23480	23925	21892	28888	25176
Missing values as a %	%	48	70	72	93	89	69	69	75	87	85	67	68	62	82	72

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	5.2	11.3	4.4	19.5	22.8	9.3	13.8	16.2	11.5	39.0	11.0	11.4	7.3	7.9	16.5
Median	FNU	1.0	4.0	1.0	15.0	15.0	3.0	7.0	8.0	7.0	24.0	5.0	3.0	3.0	3.0	3.0
Standard deviation	FNU	18.0	25.3	10.6	27.5	27.2	17.1	26.0	27.2	13.5	59.3	23.3	39.9	18.9	13.1	39.3
Inter-quartile range	FNU	4.0	8.0	4.0	23.0	23.0	8.0	11.0	15.0	11.0	28.0	10.0	8.0	5.0	6.0	14.0
Coefficient of variation	FNU	3.5	2.2	2.4	1.4	1.2	1.8	1.9	1.7	1.2	1.5	2.1	3.5	2.6	1.7	2.4
Minimum	FNU	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	FNU	547.0	582.0	243.0	895.0	512.0	362.0	485.0	606.0	247.0	963.0	708.0	965.0	661.0	347.0	813.0
Missing values	count	19149	24900	26052	33258	31325	25766	24356	26346	30315	29843	25558	23928	23249	29138	26618
Missing values as a %	%	55	71	74	95	89	74	70	75	87	85	73	68	66	83	76

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	NA	NA	NA	NA
Median	mg/l	NA	0.0	NA	NA	NA	NA	0.0	NA	NA	NA	0.0	NA	NA	NA	NA
Standard deviation	mg/l	NA	0.0	NA	NA	NA	NA	0.0	NA	NA	NA	0.0	NA	NA	NA	NA
Inter-quartile range	mg/l	NA	0.0	NA	NA	NA	NA	0.0	NA	NA	NA	0.0	NA	NA	NA	NA
Coefficient of variation	mg/l	NA	NA	NA	NA	NA	NA	27.0	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	NA	NA	NA	NA
Maximum	mg/l	NA	0.0	NA	NA	NA	NA	1.0	NA	NA	NA	0.0	NA	NA	NA	NA
Missing values	count	35039	30331	35039	35039	35039	35039	31378	35039	35039	35039	30250	35039	35039	35039	35039
Missing values as a %	%	100	87	100	100	100	100	90	100	100	100	86	100	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	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Median	ug/l QSU	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Standard deviation	ug/l QSU	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Inter-quartile range	ug/l QSU	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Coefficient of variation	ug/l QSU	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Minimum	ug/l QSU	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Maximum	ug/l QSU	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Missing values	count	35039	35039	35039	35039	35039	35039	35039	35039	35039	35039	35039	35039	35039	35039	35039
Missing values as a %	%	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

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	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Median	mg/l	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Standard deviation	mg/l	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Inter-quartile range	mg/l	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	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	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Maximum	mg/l	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Missing values	count	35039	35039	35039	35039	35039	35039	35039	35039	35039	35039	35039	35039	35039	35039	35039
Missing values as a %	%	100	100	100	100	100	100	100	100	100	100	100	100	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