Seasonal impact of a mega-drought (2010-2015) on the water quality of Biobío river, Central Chile

Mariela Yevenes[1,2], Ricardo Figueroa[3], Oscar Parra[3], Laura Farías[1,2]

[1]Departamento de Oceanografía, Universidad de Concepción

[2]Centro del Clima y la Resiliencia CR2

[3]Facultad de Ciencias Ambientales, Universidad de Concepción

(CR)² Center for Climate and Resilience Research

CONICYT/FONDAP/15110009

@CR2_uchile

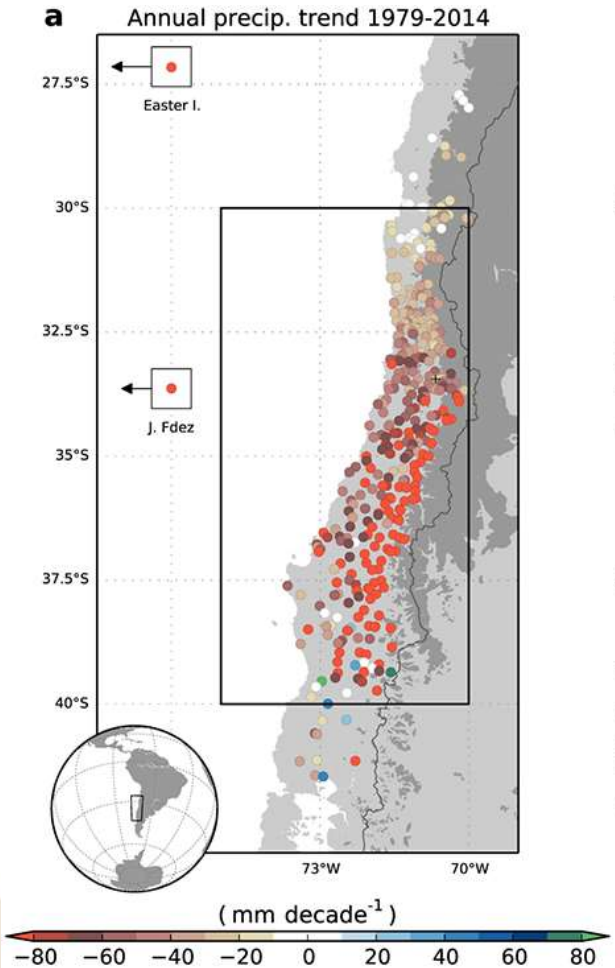
Center for Climate and Resilience Research - CR2

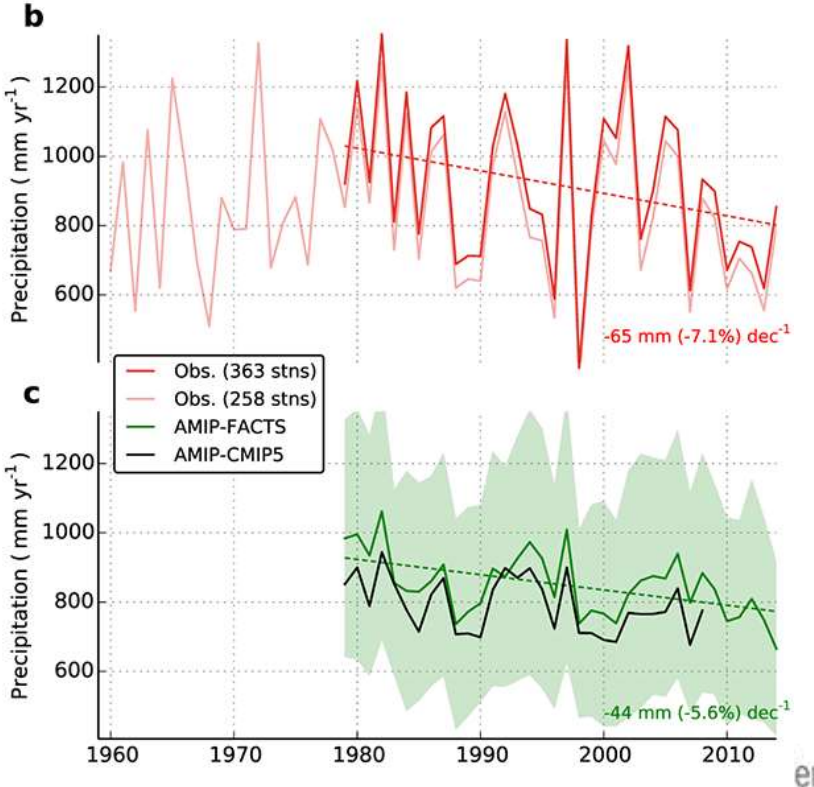
http://www.cr2.cl/

Sponsoring Institution | Associated Institutions | Funding Agency

Introducción

- Water resources are under pressure from multiple stresors such as climate change (droughts), agriculture and water abstraction.
- Prolongated drought from 2010 to date in Central Chile: Megadrought (Garreaud et al. 2017)

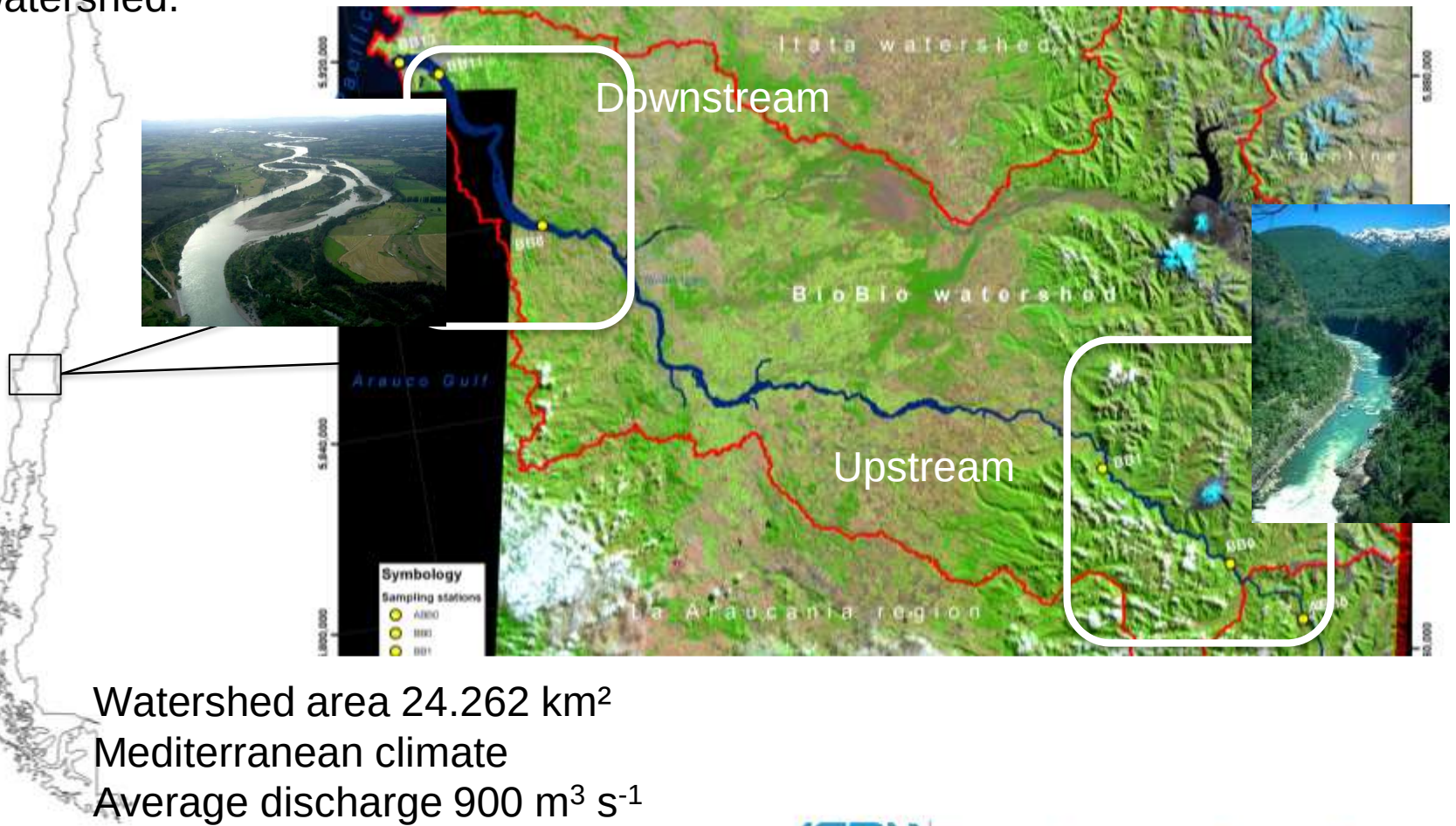




ence Research
silience in a changing climate

Megadrought effects (2010-2015) that affect on different resources water quality

Objetive: We perform a Trend analysis of recent trends in hidroclimatic parameters and water quality in a Central Chile watershed, Biobio river watershed.



Watershed area 24.262 km²
Mediterranean climate
Average discharge 900 $m^3 s^{-1}$
Snow melt-precipitation

(CR)² Center for Climate and Resilience Research
Earth system science for Chile: a sound basis for building resilience in a changing climate

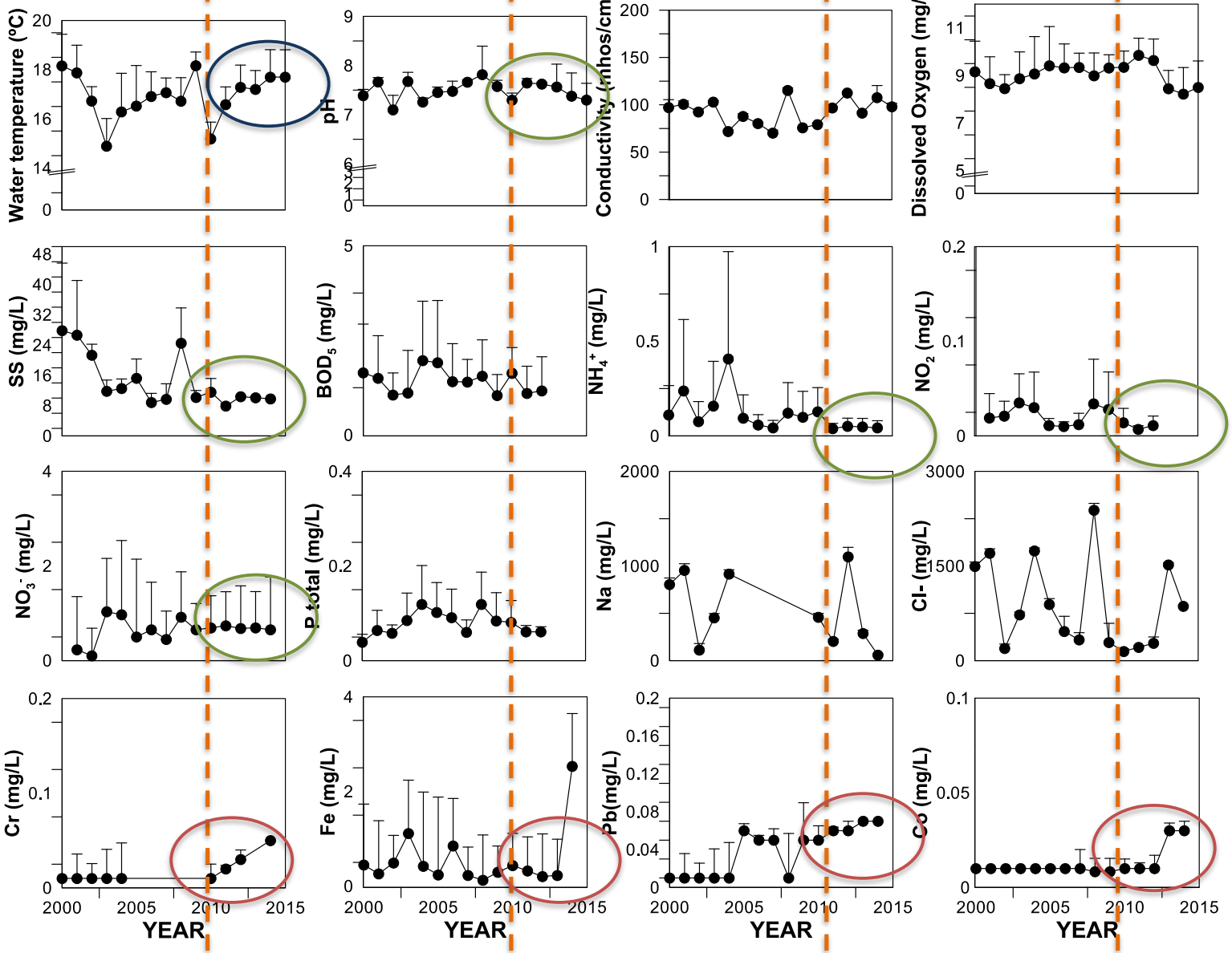
Metodology

- Baseline (2000-2014of six locations for 17 parameters.

Centro EULA-Universidad de Concepción and Dirección General de Aguas (DGA)

Variable	Abreviación	Units
Water flow	C	m2 d-1
Water Temperature	Tº	ºC
Electrical Conductivity	EC	µScm-1
Total Suspended solids	SS	mg L-1
Nitrate	NO3	mg L-1
Ammonium	NH4	mg L-1
Nitrite	NO2	mg L-1
pH	pH	
Dissolved oxygen	DO	mg L-1
Phosphorus	P	mg L-1
Sodium	Na	mg L-1
Biological oxygen demand	BOD	mg L-1
Cloride	Cl	mg L-1
Crome	Cr	mg L-1
Cobalt	Co	mg L-1
Iron	Fe	mg L-1
Lead	Pb	mg L-1

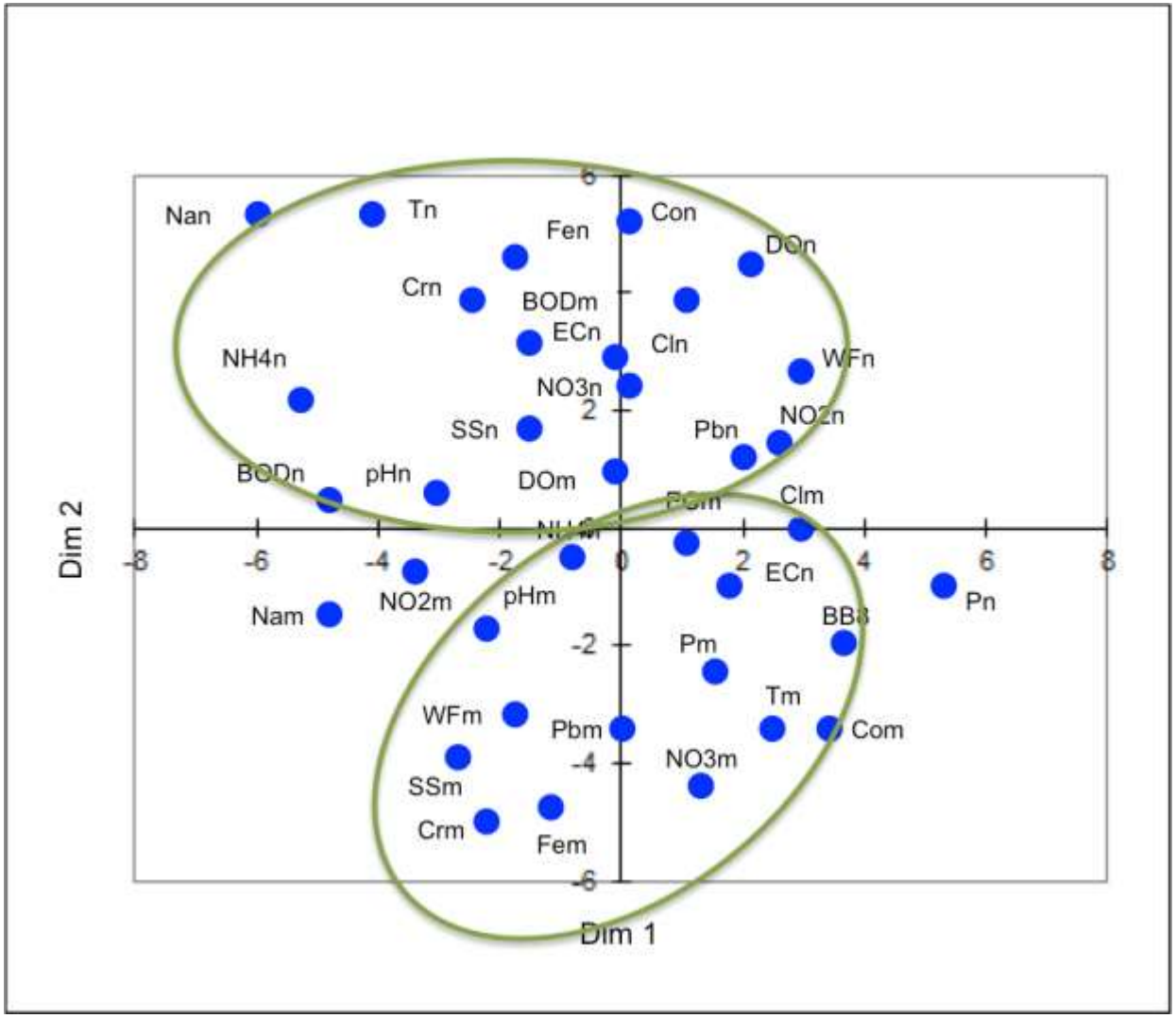
Results: Mann Kendall, seasonal Mann Kendall, Biobio upstream



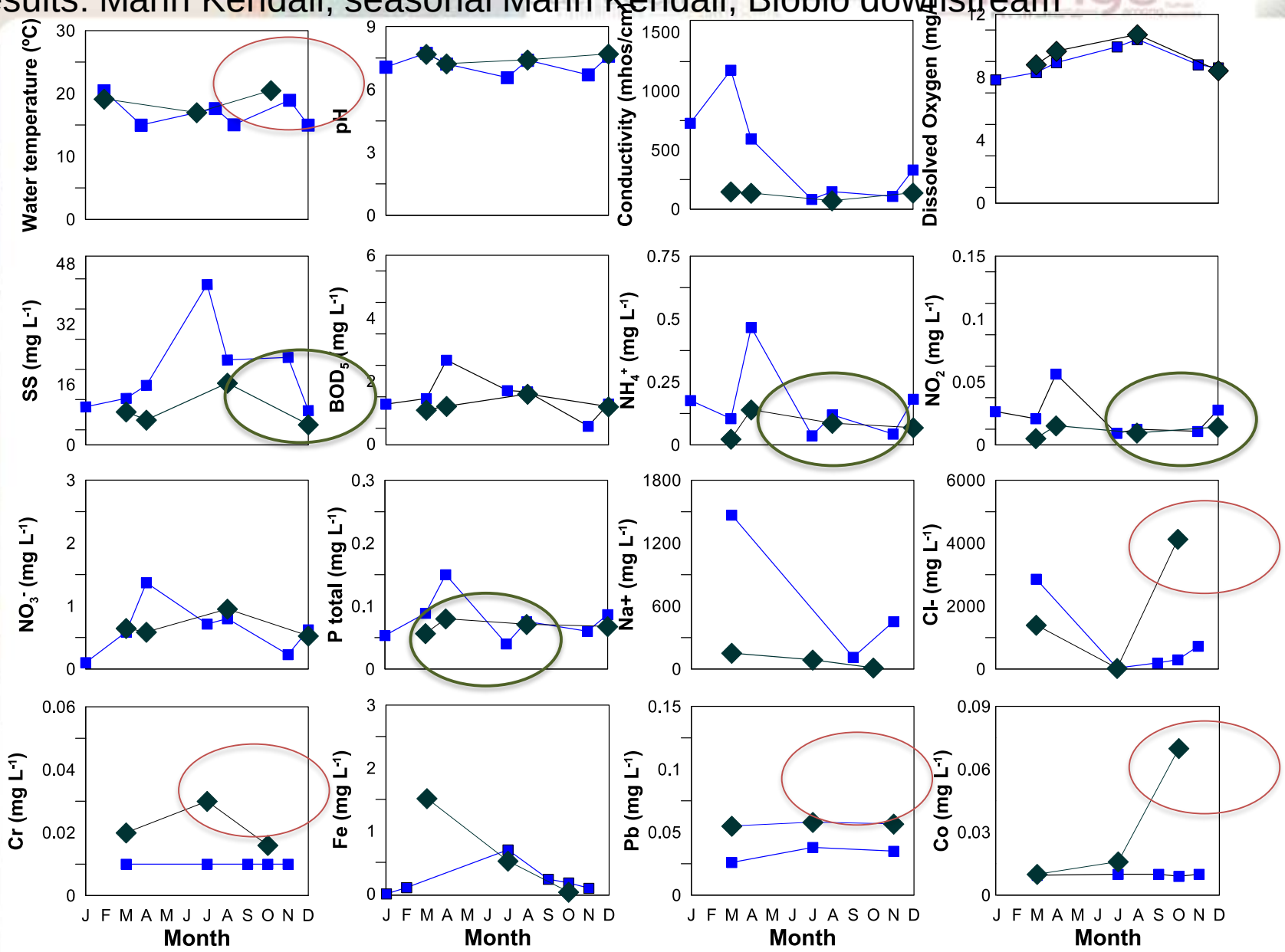
Center for Climate and Resilience Research

Earth system science for Chile: a sound basis for building resilience in a changing climate

Results: scaling (MDS)



Results: Mann Kendall, seasonal Mann Kendall, Biobio downstream



Mann Kendall Trends

Location	Test	T	pH	EC	SS	NH_4^+	NO_3^-	Co	Cr	Fe	Pb
Upstream	MK	0.6	-0.4	0	-0.4	0.4	0.1	0.5	0.9	0.01	0.5
	MKS	**0.8**	**-0.5**	0.2	-0.5	0.4	0.3	0.55	0.98	0.23	0.6
Downstream	MK	0.8	0.04	0.3	-0.3	-0.1	0.2	**0.5**	**0.9**	0.01	0.5
	MKS	**0.9**	0.1		-0.4	-0.4	-0.4	**0.5**	**1.0**	0.28	0.6

- Differences between TºC, nutrients and trave metals upstream.
- Downstream, Nutrients and pH decrased considerably with negative trends.
- Positive trends were recorded for Temperature and trace metals like Pb, Fe, Cr y Co.

Sen slope (trend analysis)

St.	Test	T	pH	EC	SS	NH_4^+	NO_3^-	Co	Cr	Fe	Pb
ABB0	S	**0.88**	0.11	**0.9**	**-1.8**	**-0.9**	**-1.7**	-	-	-	-
BB0	S	**0.95**	-0.2	**1.8**	**-1.3**	**0.8**	0.4	**5.4**	**16**	**12**	**4.5**
BB1	S	**0.75**	0.01	**0.8**	0.3	0.1	0.2	**5.4**	**16**	**12**	**4.5**
BB8	S	**0.96**	**-0.5**		**-5.0**	**-3.7**	**-1.7**	**5.4**	**16**	**12**	**4.5**
BB11	S	**0.71**	**-0.5**	**0.5**	**-2.9**	**-2.1**	**-0.6**	-	-	-	-
BB13	S	**0.77**	**-1.2**	**0.3**	**-2.2**	**-1.6**	**-0.5**	**4.6**	**14**	**11**	**3.8**

Positive trend in **blue**
Negative trend in **green**

Quantification of Sen slope showed suspended solid and trace metals.

Discussion and Conclusion

- Water quality generate multidimensional data that needs to be studied statistically to analyze and interpret the underlying information.

- Trend analysis with the Mann-Kendall test and Sen slope showed a greater reduction in nutrient concentrations, mainly associated with decreased flow mainly in autumns and summers.

- The low flow rates associated with drought affect water quality decreasing pH and suspended solids, nutrients, and increasing trace metals, since the metal dilution capacity is reduced.

- The decrease in water quality during summer drought period is related to the high temperatures both the water and the lower discharge (lower dilution of the chemical load of the point sources).

¡Gracias!