

Atlas

Calidad del Agua

Chile 2020



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CARTA DEL DIRECTOR

El cambio climático ha afectado a Chile, que recibido el impacto de los efectos de una de las mayores sequías de nuestra historia al reducir la disponibilidad hídrica que afecta directamente a las personas, a nuestro medio ambiente y a las actividades productivas que usan el agua.

Este contexto impulsó al Presidente de la República, Sebastián Piñera, a convocar en octubre del 2019 a 26 representantes de la sociedad civil, del Gobierno y del Congreso Nacional a integrar la Mesa Nacional del Agua con la misión de encontrar soluciones de mediano y largo plazo para enfrentar la crisis hídrica.

En el Primer Informe de la Mesa Nacional del Agua se plantearon los tres desafíos en materia hídrica para nuestro país: Seguridad hídrica, Calidad de las aguas y ecosistemas y Marco legal e institucional.

En sintonía con la Mesa Nacional del Agua, la Dirección General de Aguas (DGA) del Ministerio de Obras Públicas (MOP) asumió el desafío de contribuir a dar “Seguridad hídrica a Chile”, entendida como el acceso a este recurso, tanto en cantidad como en calidad, especialmente para el consumo humano, pero que también permita la preservación medioambiental y el desarrollo económico.

El segundo desafío “Calidad de las aguas y ecosistemas” relacionados parte de la base de reconocer los altos estándares chilenos en calidad de las aguas para la salud humana, pero advirtiendo un lento avance en materia de normas secundarias de calidad ambiental, lo que impide una adecuada gestión de la calidad de los cuerpos de aguas.

El documento señala que parte de este retraso se atribuye a que la problemática de la calidad del agua suele quedar invisibilizada por el desbalance hídrico o las situaciones de sequía e inundaciones y se destaca que debe ser un tema relevante en la toma de decisiones.

La “Protección de los ecosistemas” es uno de los ejes temáticos de este segundo desafío. La conservación medio ambiental requiere de una política hídrica que incluya sistemas de monitoreo y de alerta de riegos y lineamientos de preservación y reestablecimiento de los ecosistemas.

La Misión Institucional de la DGA es “Gestionar, verificar y difundir la información hídrica del país, en especial respecto su cantidad y calidad, las personas naturales y jurídicas que están autorizadas a utilizarlas, las obras hidráulicas existentes y la seguridad de las mismas; con el objetivo de contribuir a una mayor competitividad del mercado y el resguardo de la certeza jurídica e hídrica para el desarrollo sustentable del país” y uno de sus objetivos estratégicos es “Promover el aprovechamiento sustentable y proteger los servicios ambientales del recurso hídrico, a través de los pronunciamientos ambientales del Servicio y el mejoramiento de la normativa”, para lo cual se cuenta con el trabajo de todo el equipo nuestro Departamento de Conservación y Protección de Recursos Hídricos (DCPRH).



Oscar Cristi Marfil
Director General de Aguas
Ministerio de Obras Públicas

La labor valiosa labor del DCPRH permite generar información relativa a la calidad de las aguas, que no solo ha permitido promover y proteger nuestros recursos hídricos, sino que también contribuir a la investigación científica y al avance de los Objetivos de Desarrollo Sostenible (ODS) acordados el año 2015 por los estados miembros de la Organización de Naciones Unidas .

En este marco, el desarrollo y la publicación del Atlas de la Calidad del Agua 2020 por parte de nuestro Departamento de Conservación y Protección de Recursos Hídricos (DCPRH) constituye un gran hito tanto para la Dirección General de Aguas (DGA) como para el Ministerio de Obras Públicas (MOP), pero también para todos aquellos actores involucrados en esta temática entre los cuales se incluye la Mesa Nacional del Agua.

Este trabajo, que refleja en parte el trabajo y la dedicación del DCPRH, tenemos la convicción que será un referente bibliográfico y una fuente importante para la investigación en torno a los recursos hídricos en Chile.

INTRODUCCIÓN

La protección de la calidad del agua es clave en la gestión de esta, puesto que una degradación de la calidad del agua puede limitar los usos humanos (p. ej. consumo humano, agricultura, industria) y el ecosistema (United Nations Environment Programme, 2008). En este sentido, la generación de información de calidad del agua, tanto de aguas superficiales como subterráneas, junto al desarrollo de modelos conceptuales y modelos cuantitativos, son herramientas imprescindibles para la toma de decisiones y el desarrollo de políticas públicas en torno al agua.

Diversas instituciones a nivel internacional llevan a cabo programas de monitoreo de calidad del agua. Por ejemplo, el Servicio Geológico de los Estados Unidos (USGS, por sus siglas en inglés) implementó el proyecto NAWQA (National Water-Quality Assessment) en el año 1991, para evaluar “dónde, cuándo, por qué y cómo ha cambiado la calidad del agua de ese país, o puede cambiar en el futuro, en respuesta a actividades humanas y factores naturales” (U.S. Geological Survey, n.d.-a). En aguas superficiales, el USGS genera mapas regionales de la calidad del agua (U.S. Geological Survey, n.d.-b), mapas de tendencias de calidad del agua a nivel nacional (U.S. Geological Survey, n.d.-c) y mapas que identifican las principales fuentes de contaminantes (U.S. Geological Survey, n.d.-d).

En Europa, la Directiva Marco del Agua establece que los Estados deberán implementar programas de monitoreo de la calidad del agua, incluyendo el estado químico y ecológico, así como los lineamientos para tales planes (Publication Office of the European Union, 2000). La consolidación de los datos está a cargo de la Agencia Europea de Medio Ambiente (EEA, por sus siglas en inglés), que estableció una red de monitoreo llamada Eionet-Water (European Environment Agency, n.d.-a). La

información generada por esta red está disponible en una base de datos llamada Waterbase, en la cual también se puede acceder a gráficos (de barras y tendencias) con información de calidad del agua (European Environment Agency, n.d.-b).

En el caso de Chile, la Dirección General de Aguas (DGA), a través del Departamento de Conservación y Protección de los Recursos Hídricos (DCPRH), genera y publica la información de calidad de aguas superficiales y subterráneas de todo el país¹. Esta información ha sido utilizada con diversos fines: publicación de artículos científicos, reporte de datos de acuerdo a Norma Secundaria de Calidad Ambiental, información de líneas de base, etc. Otro uso relevante de la información de la DGA, es la evaluación del avance en los Objetivos de Desarrollo Sostenible (ODS). En particular, la información de la DGA ha sido usada para calcular el indicador ODS 6.3.2 “Porcentaje de cuerpos de agua de buena calidad” en 6 cuerpos de agua².

Por este motivo, la información de la DGA que se había utilizado previamente para diversos fines estaba disponible en formato tabular, dificultando su visualización. Por ejemplo, para identificar las variaciones espaciales y temporales en mediciones de calidad de agua. Por esto, la DGA encargó el año 2019 al DICTUC S.A la consultoría para la realización del Mapa Hidroquímico Nacional sistematizando los datos de calidad de agua generados en una base de datos, realizando el análisis estadístico y el cálculo de indicadores, y generando mapas que presenten los resultados de este análisis, toda esta información puede ser descargada desde la página web de la DGA presentándose a continuación un resumen de dicho análisis.

¹ Artículos 299 y 129 bis 3 del Código de Aguas

² Gobierno de Chile, 2017, <https://www.un.org/sustainabledevelopment/es/water-and-sanitation/>



Parque Nacional Conguillío - Laguna Arcoiris

PROCESO DE GENERACIÓN DE DATOS DE LAS REDES DE CALIDAD DE AGUAS DE LA DGA



Objetivo Redes de Calidad

Generar información pública y sistemática que caracterice la calidad de los Recursos Hídricos para su Conservación y Protección

Capítulo 1

MAPAS DE PROMEDIOS

A continuación, se presentarán mapas de promedio de diversos parámetros los cuales fueron confeccionados con los datos de calidad agua que dispone la DGA desde la década de los cincuenta.

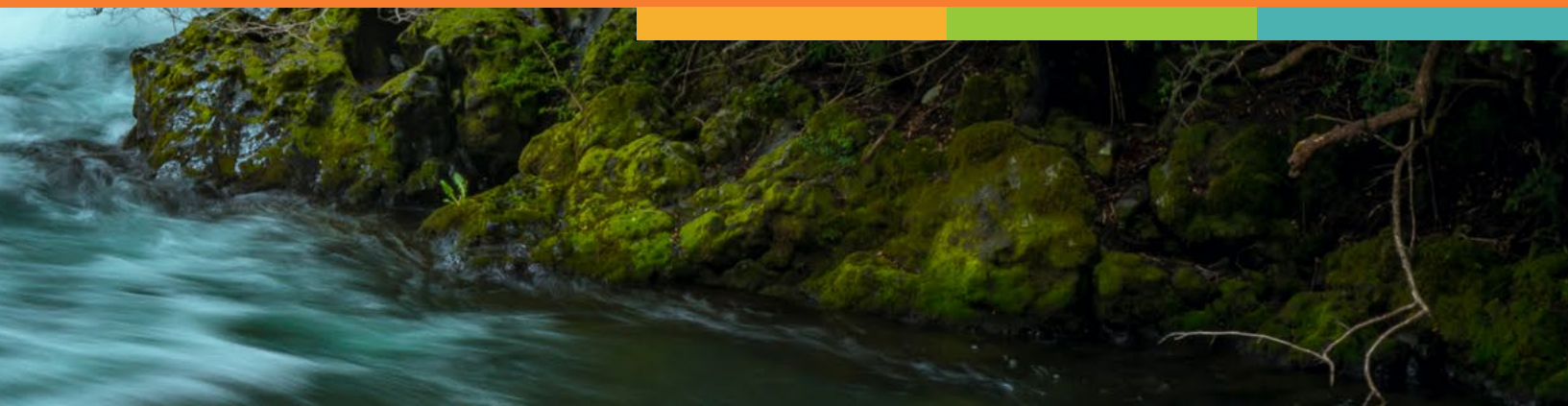
La información en detalle se encuentra disponible en la página web de la DGA en el estudio SIT N°448 Mapa Hidroquímico de Chile DGA/DICTUC S.A 202019.

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MAPAS PROMEDIOS

1. Promedio - Estaciones DGA	10
2. Promedios - Temperatura	11
3. Promedios - Conductividad	12
4. Promedios - pH	13
5. Promedios - Oxígeno Disuelto	14
6. Promedios - Cobre Total	15
7. Promedios - Arsénico Total	16
8. Promedios - Nitrógeno	17
9. Promedios - Hierro Total	18
10. Promedios - Cloruro Total	19
11. Promedios - Sulfato	20
12. Promedios - Relación de Adsorción de Sodio	21
13. Promedios - Manganeseo Total	22
14. Promedios - Bicarbonato	23
15. Promedios - Litio Disuelto	24
16. Promedios - Cianuro Total	25
17. Promedios - Demanda Química de Oxígeno	26
18. Promedios - Boro Total	27
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20. Promedios - Cobalto Total	29
21. Promedios - Cromo Total	30
22. Promedios - Mercurio Total	31
23. Promedios - Molibdeno Total	32
24. Promedios - Níquel Total	33
25. Promedios - Plomo Total	34
26. Promedios - Selenio Total	35
27. Promedios - Zinc Total	36



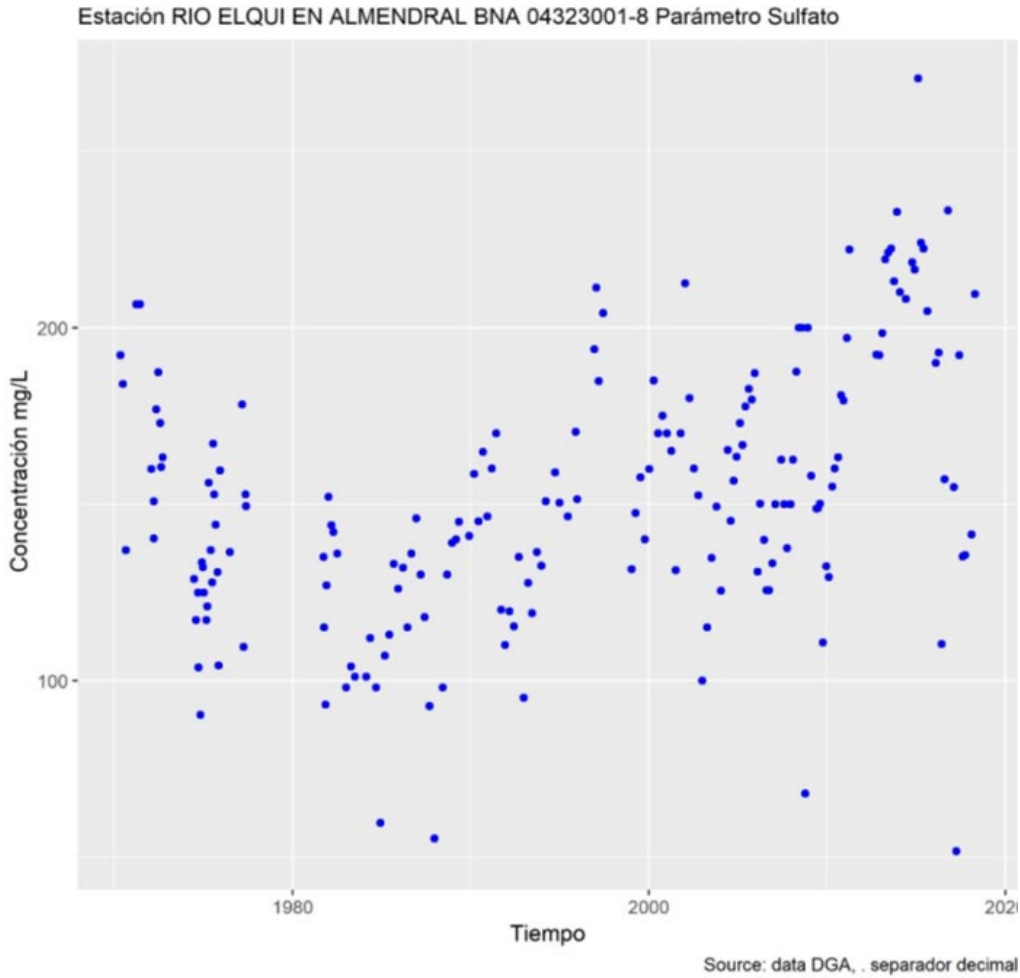
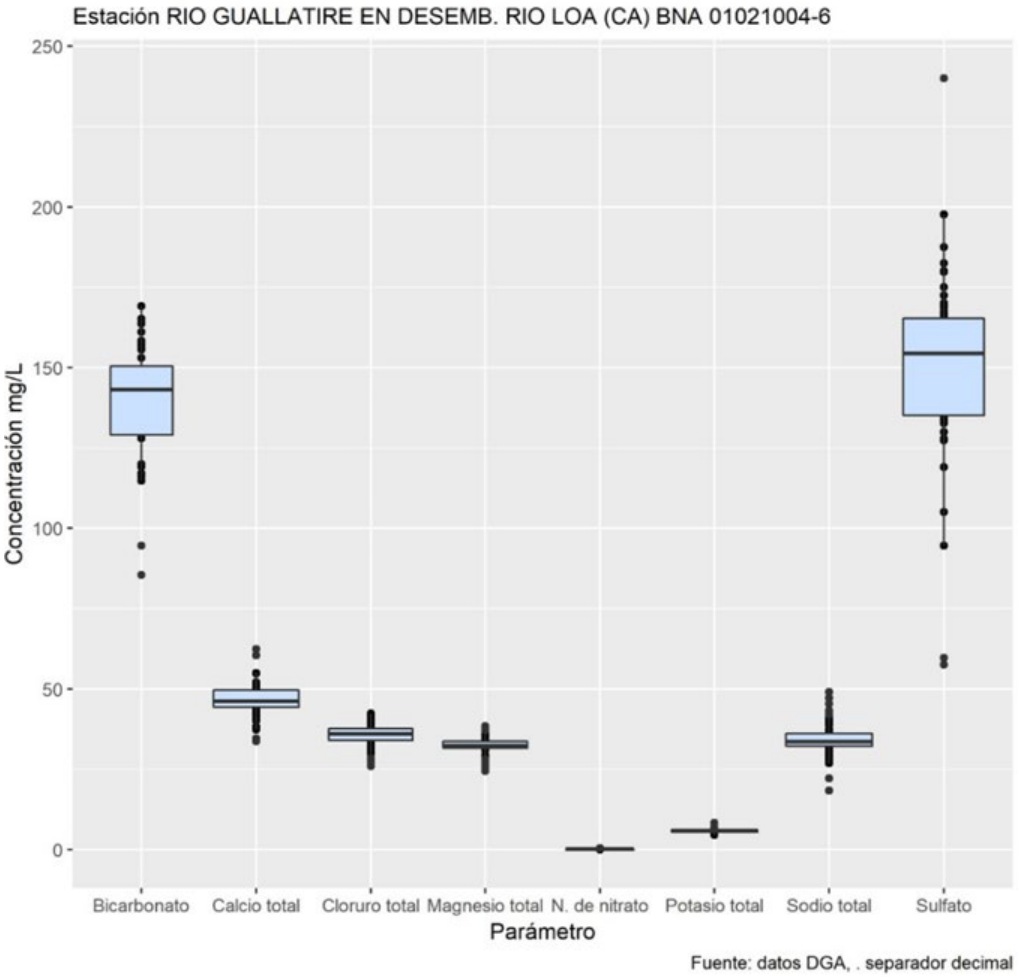
MAPAS DE PROMEDIOS

Para la confección de mapas de promedios se procedió a analizar la Base de datos Histórica de Calidad de Aguas de la DGA que contiene datos desde 1959 y un total de 1.037.234 datos brutos. Esta base de datos presenta las siguientes características: Los valores son todos positivos, no existen valores negativos, contiene presencia de outliers o valores extremos, existe asimetría o sesgo positivo, los datos poseen un distribución no-normal, existe observaciones censuradas (valores bajo el Limite de detección), existen de tendencias estacionales, existe autocorrelación y dependencia con otras variables no medidas. Para la confección de todos los gráficos y mapas se utilizó un Base de datos depurada, para observar la metodología de depuración se puede revisar el Estudio Mapa Hidroquímico Nacional DGA-Dicctuc 2019 publicado en la página web de la DGA.

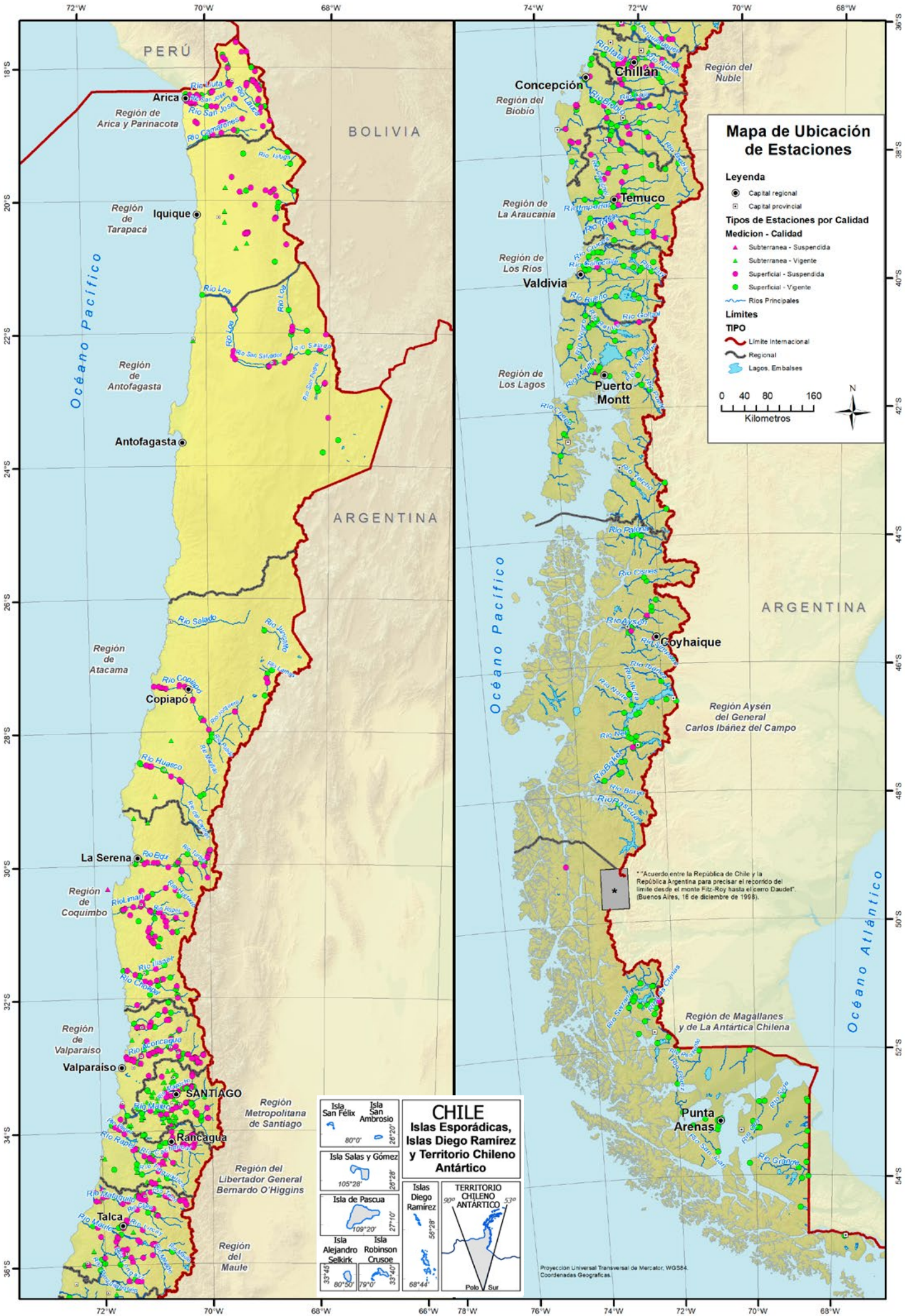
Los mapas de Promedios son una manera rápida de identificar la distribución de concentración de cierta variable en el territorio, a continuación se presenta una serie de mapas promedio de diversas variables presentes en el agua, cabe recordar que los resultados presentados corresponden a muestras de agua cruda es decir previo cualquier sistema de tratamiento y corresponden a un subconjunto de los realizado en el Estudio Mapa Hidroquímico Nacional DGA-Dicctuc S.A 2019 donde se realizó por cada estación de calidad de aguas una análisis descriptivo que incluye fichas de resumen, diagramas de Boxplot, gráficos de evolución en el tiempo, tal como se ejemplifica en las siguientes imágenes.

IDENTIFICACIÓN ESTACIÓN (Cod. BNA)				01010002-K				
Región	ARICA Y PARINACOTA							
Nombre estación	RIO CHUNGARA EN DESEMBOCADURA							
Estado	VIGENTE							
Cuenca	ALTIPLANICAS							
Coordenadas	LATITUD	-18,287		LONGITUD	-69,135			
PARÁMETRO:		ALUMINIO TOTAL				mg/L		
Periodo registro	Inicio 12-12-1997			Fin 12-04-2018				
% Datos censurados	52,9 con outlier			55,1 sin outlier				
Número de datos	51		Número outlier	2				
Promedio	0,2		desv. Estandar	0,2				
Mínimo	percentil 5	0,07	Máximo	percentil 95	0,5			
Percentil 25	0,1		Percentil 50	0,2				
Percentil 75	0,4		Rango intercuartil	0,2				
PROMEDIO ACUMULADO	Promedio sacumulados, x sustitución simple							
	0,1	año	1997					
	0,05	año	1998					
	0,15	año	1999					
	0,23	año	2000					
	0,27	año	2001					
	0,31	año	2002					
	0,3	año	2003					
	0,31	año	2004					
	0,29	año	2005					
	0,28	año	2006					
	0,31	año	2007					
	0,3	año	2008					
	0,28	año	2009					
	0,27	año	2010					
	0,26	año	2011					
	0,26	año	2012					
	0,26	año	2013					
	0,25	año	2014					
	0,25	año	2017					
	0,25	año	2018					

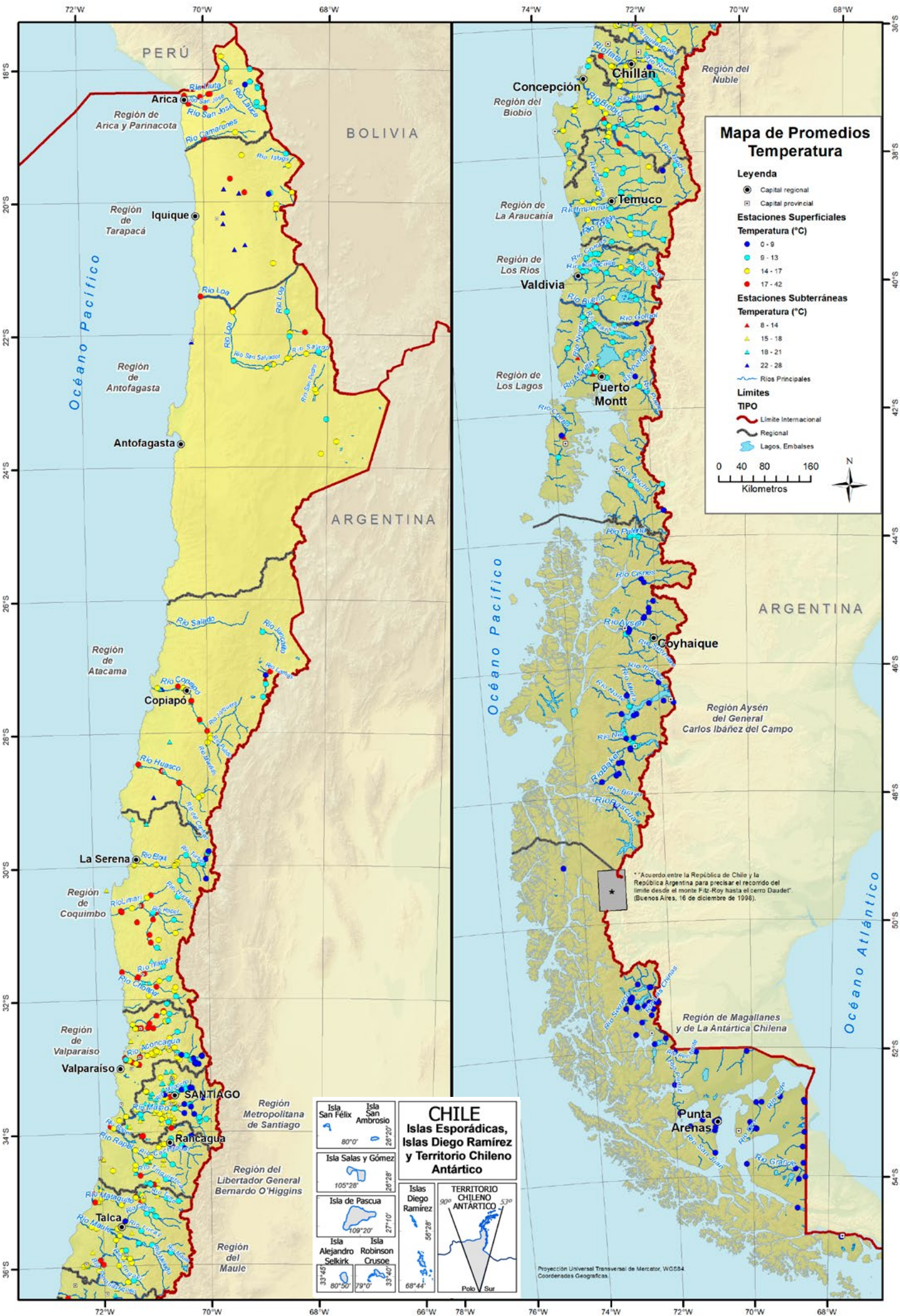
Tabla 1 - Identificación estación



1. PROMEDIO – UBICACIÓN ESTACIONES DGA



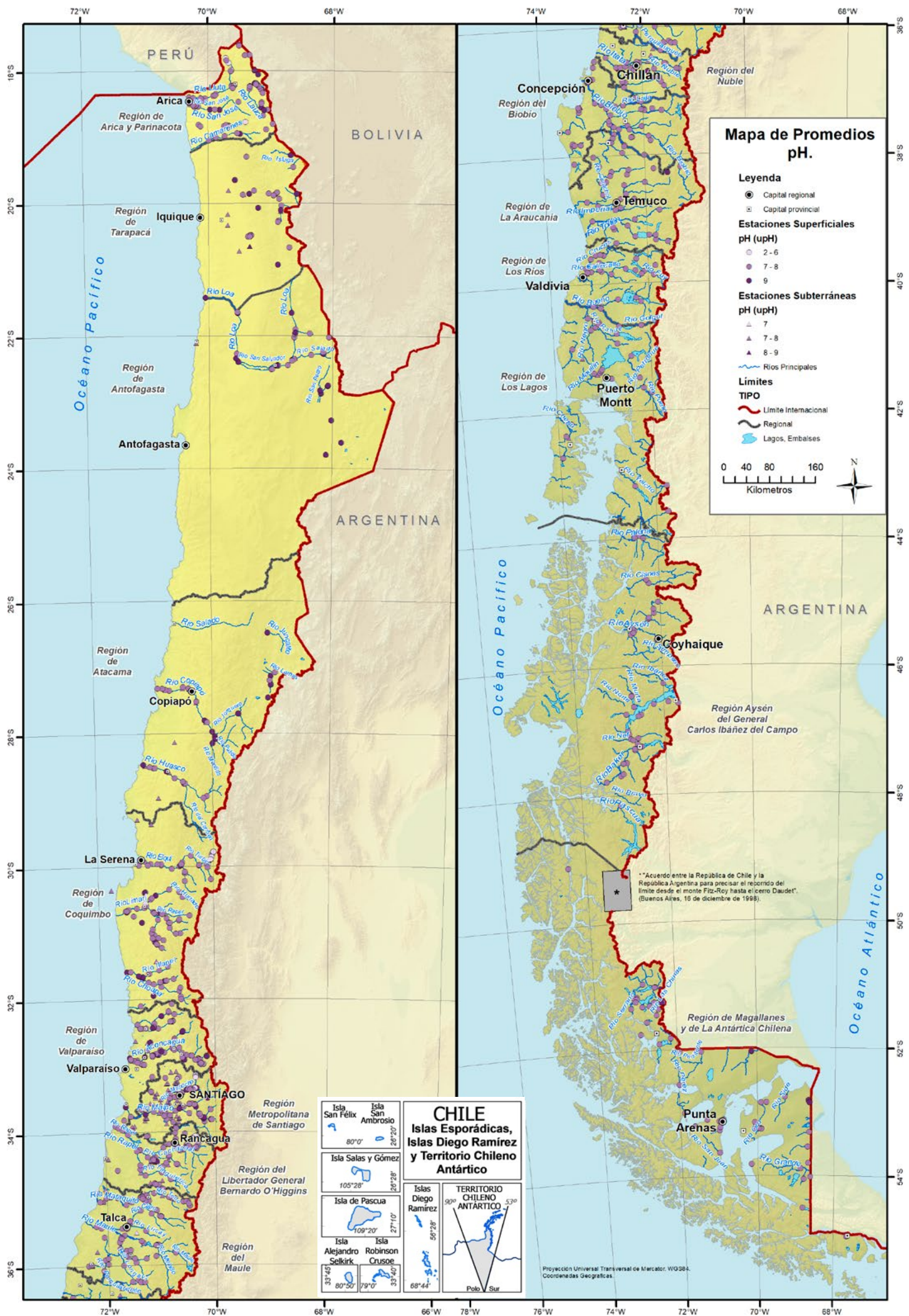
2. PROMEDIOS - TEMPERATURA



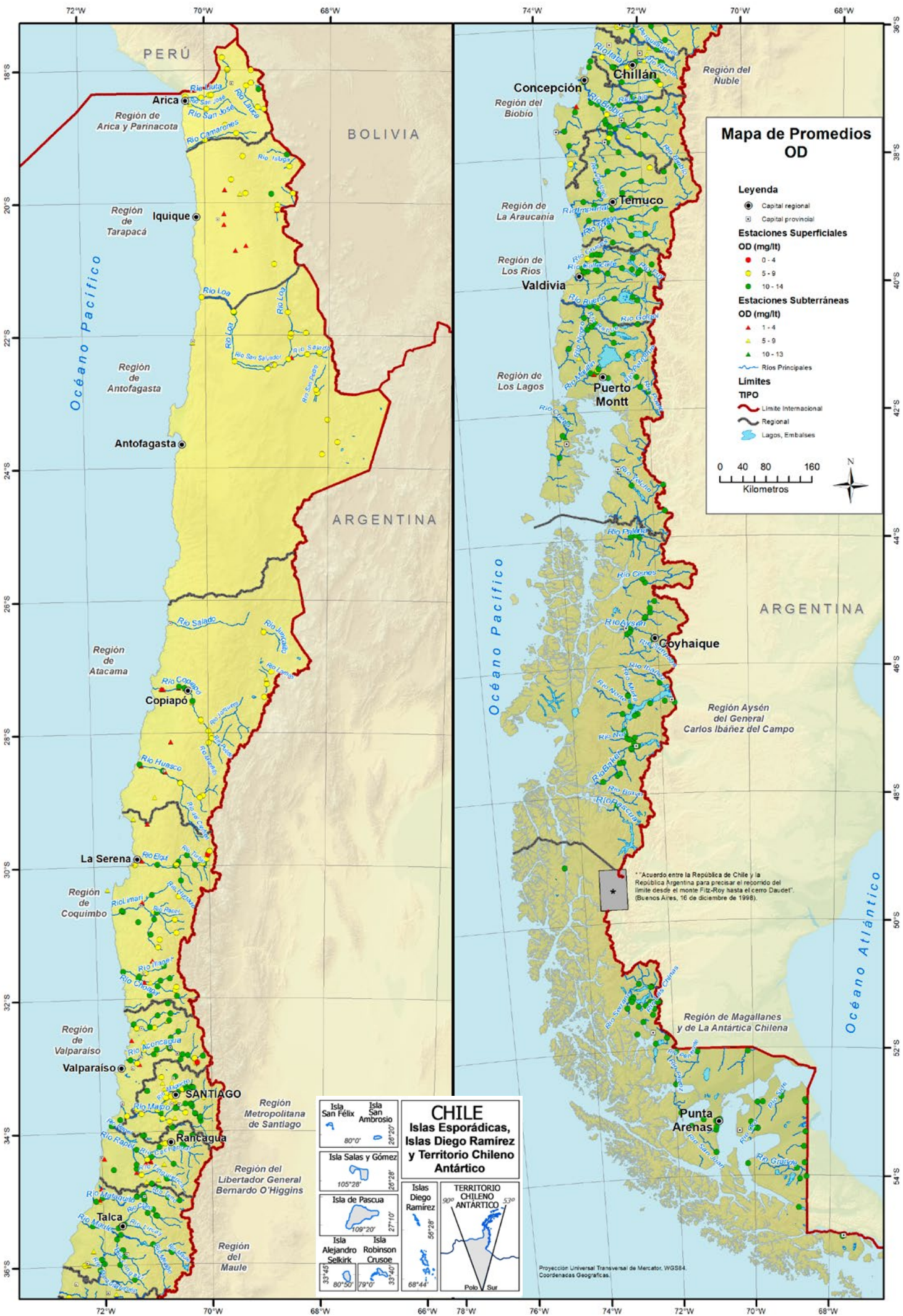
3. PROMEDIOS - CONDUCTIVIDAD



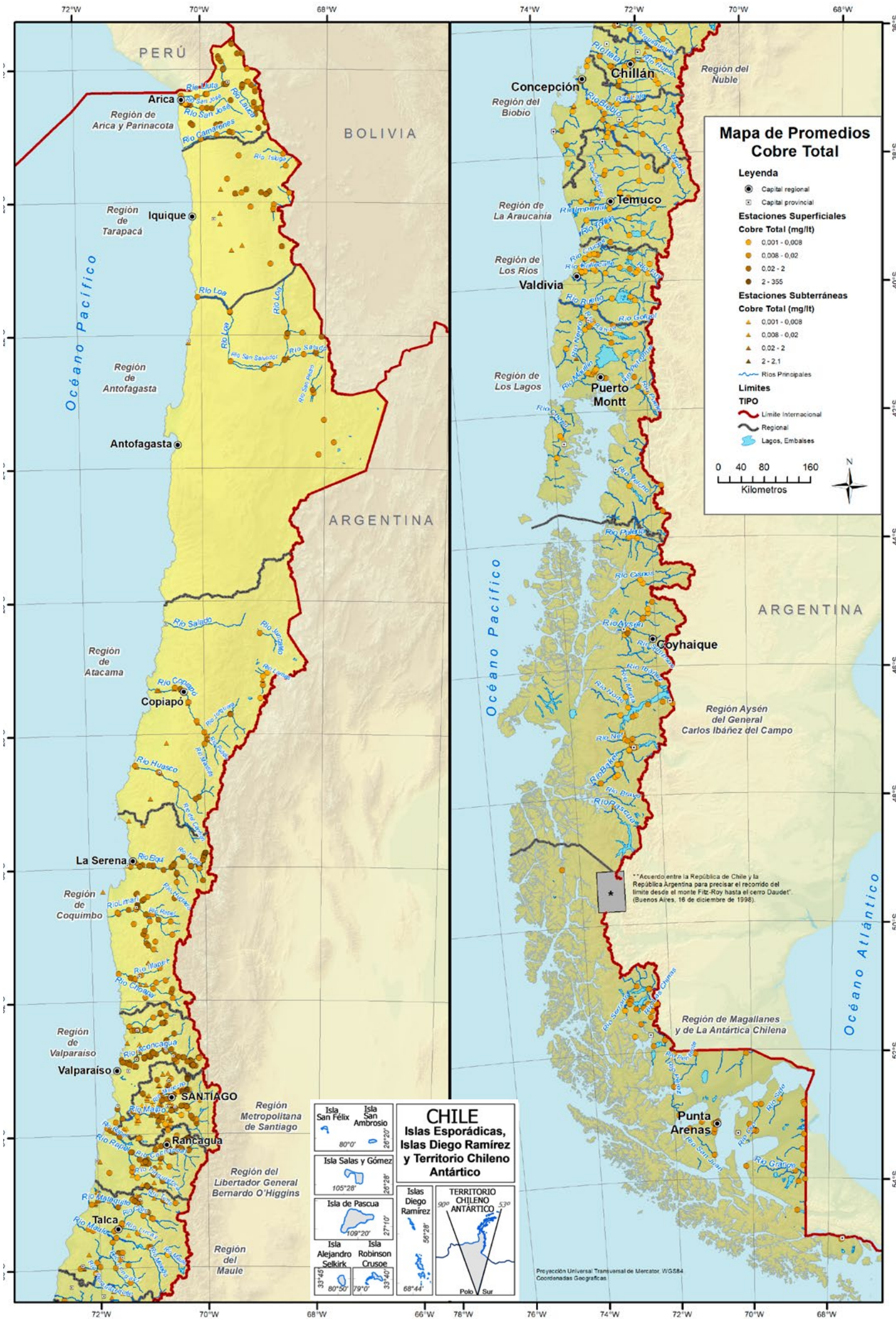
4. PROMEDIOS - PH



5. PROMEDIOS - OXÍGENO DISUELTO



6. PROMEDIOS - COBRE TOTAL



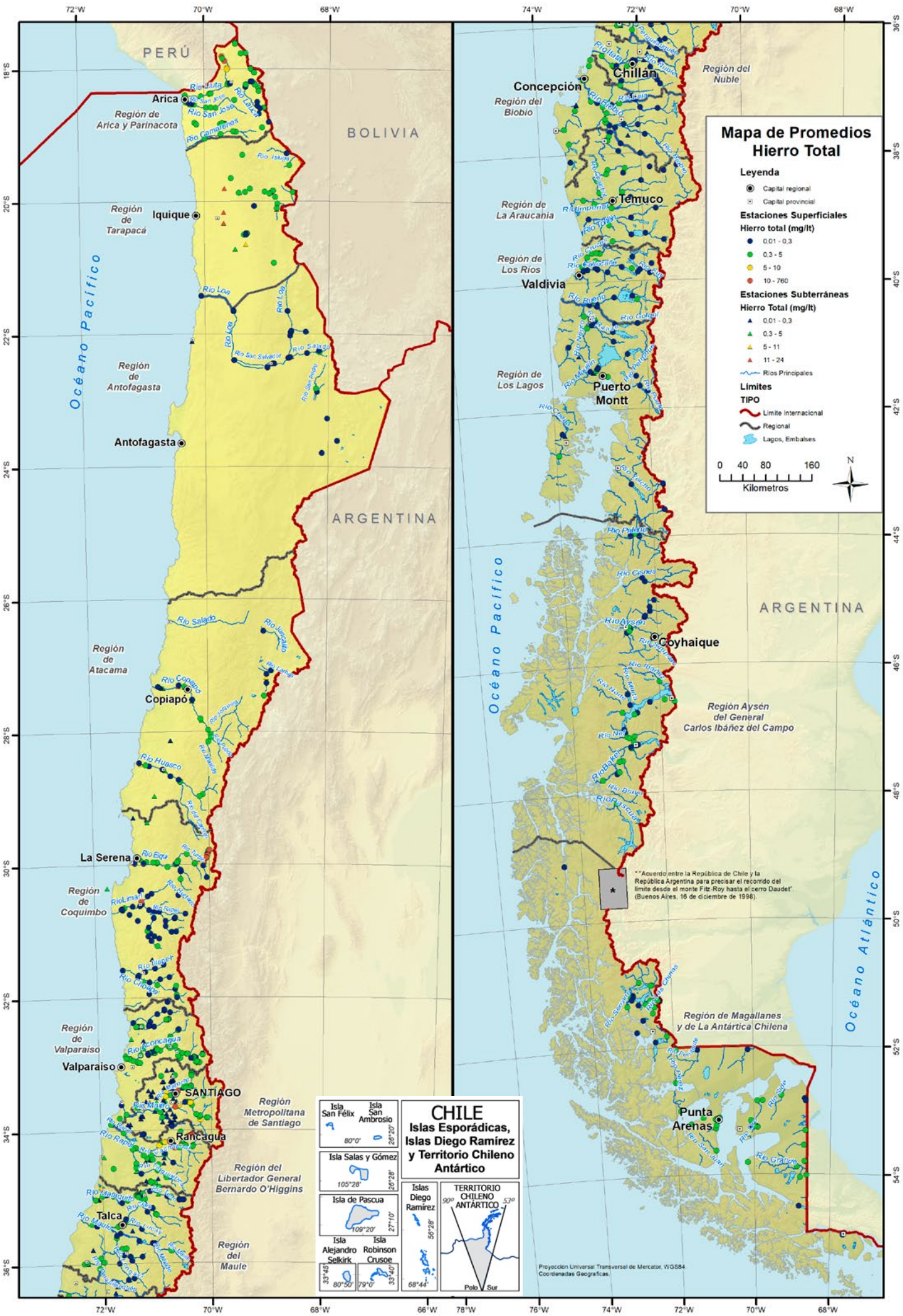
7. PROMEDIOS – ARSÉNICO TOTAL



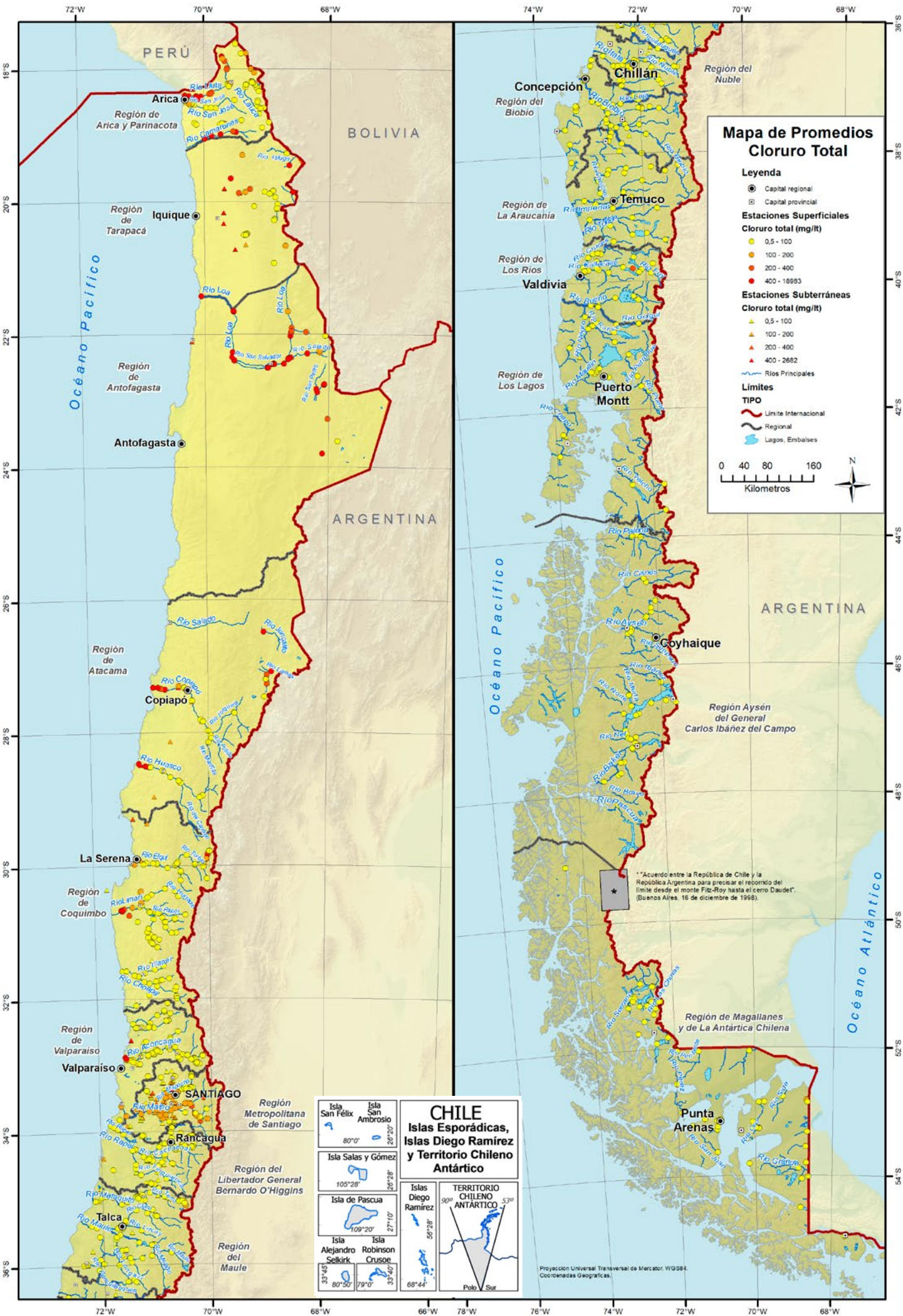
8. PROMEDIOS - NITRÓGENO



9. PROMEDIOS - HIERRO TOTAL



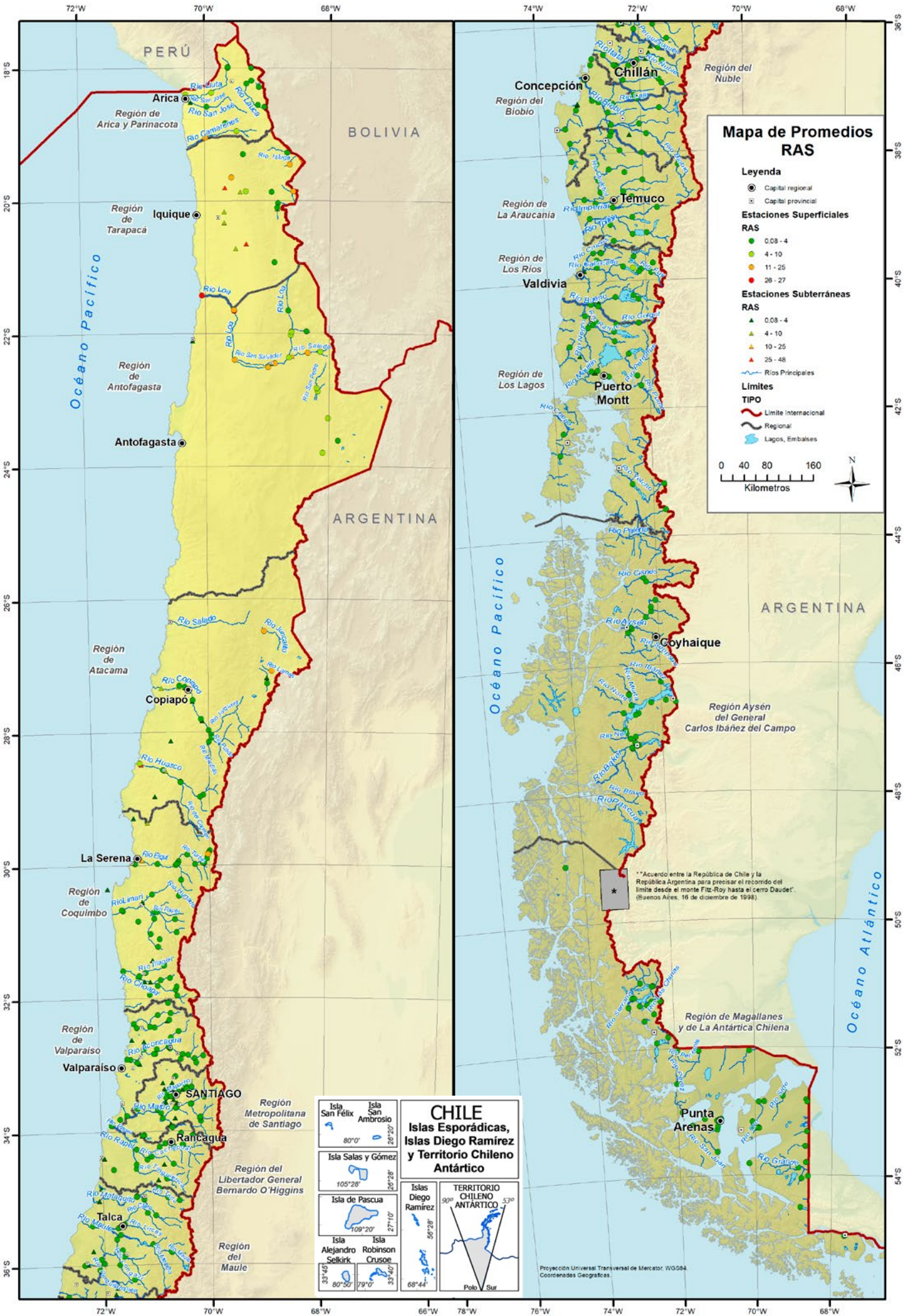
10. PROMEDIOS - CLORURO TOTAL



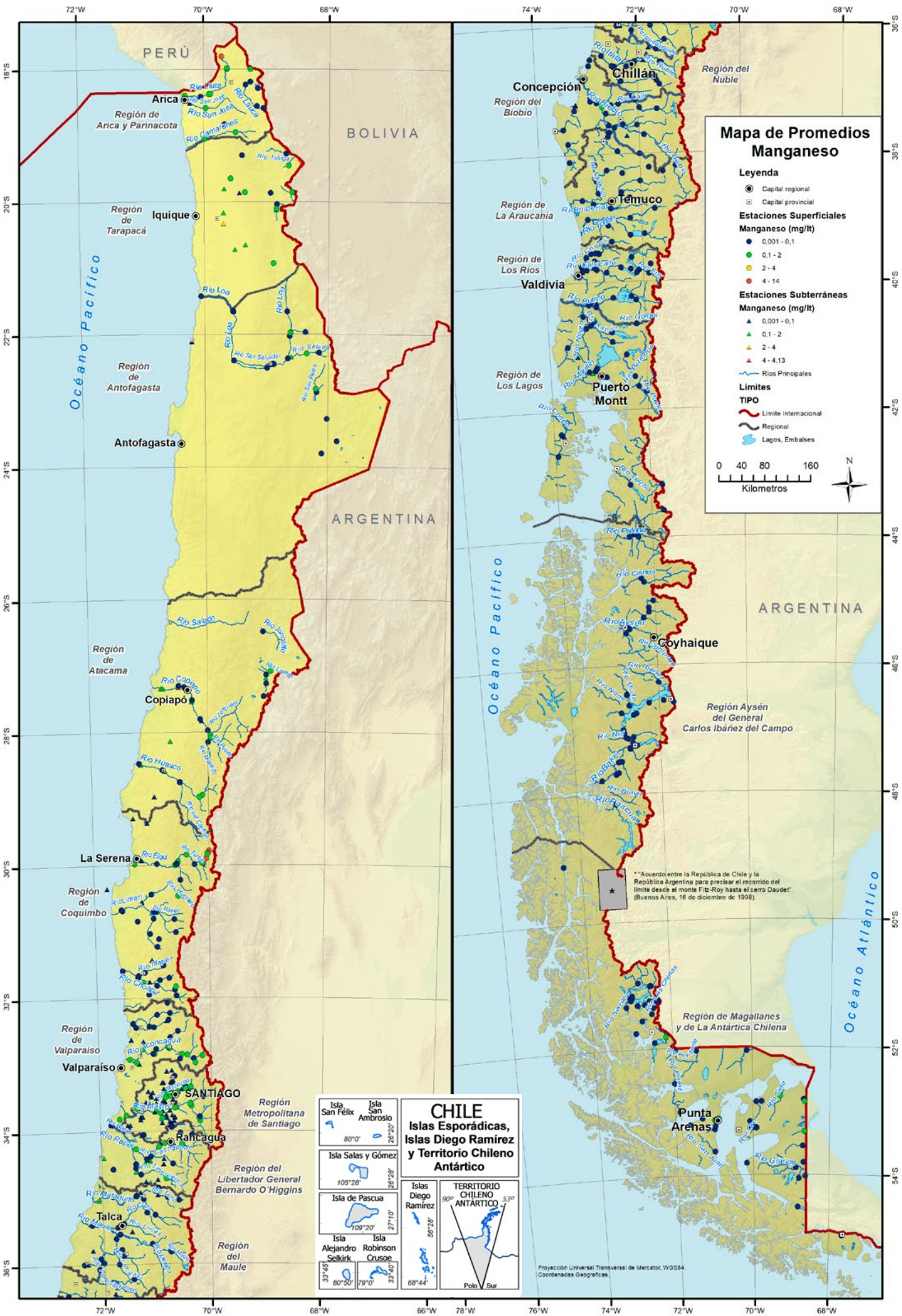
11. PROMEDIOS – SULFATO



12. PROMEDIOS - RELACIÓN DE ADSORCIÓN DE SODIO



13. PROMEDIOS - MANGANESO TOTAL



14. PROMEDIOS – BICARBONATO



15. PROMEDIOS - LITIO DISUELTO



16. PROMEDIOS - CIANURO TOTAL



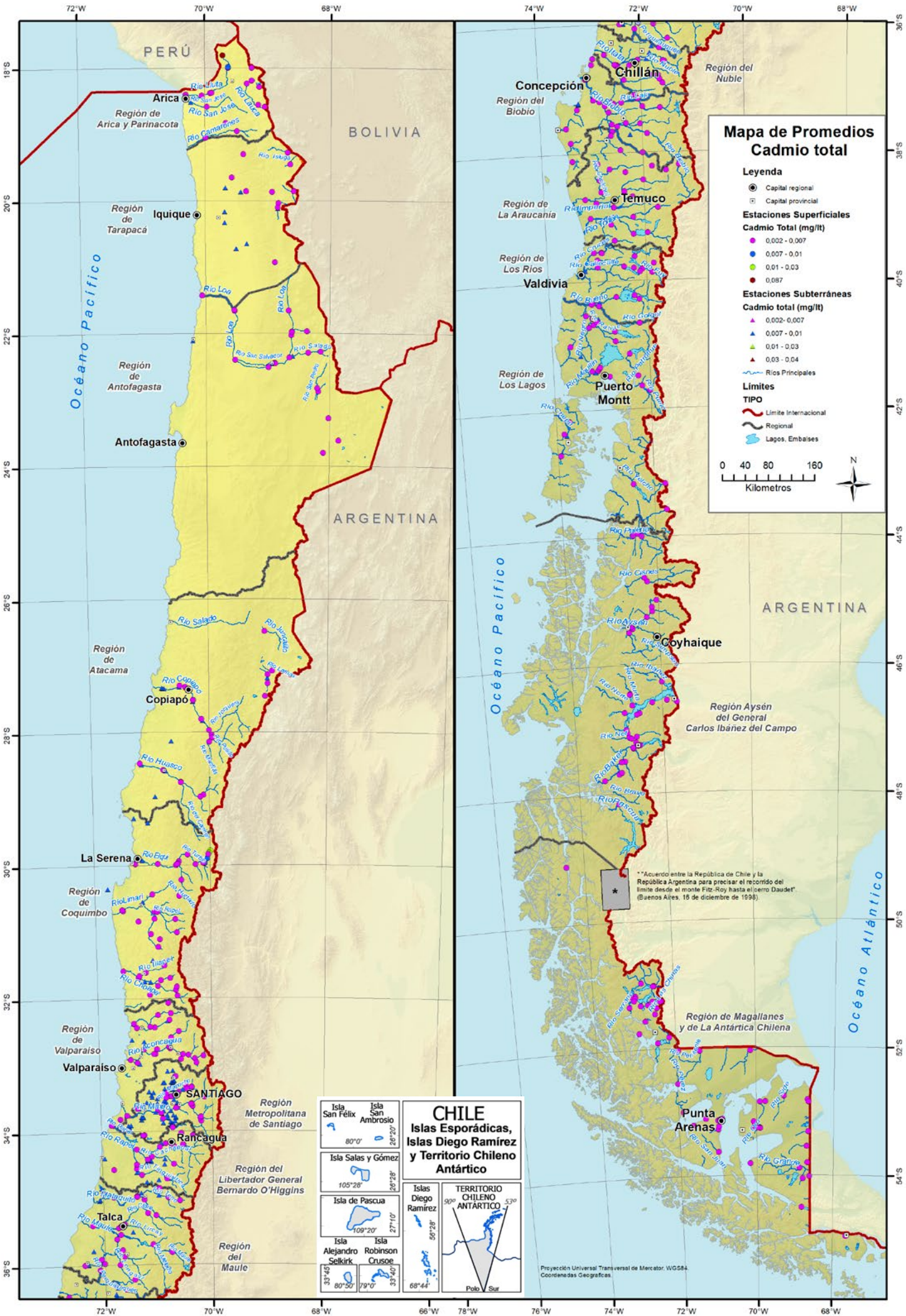
17. PROMEDIOS – DEMANDA QUÍMICA DE OXÍGENO



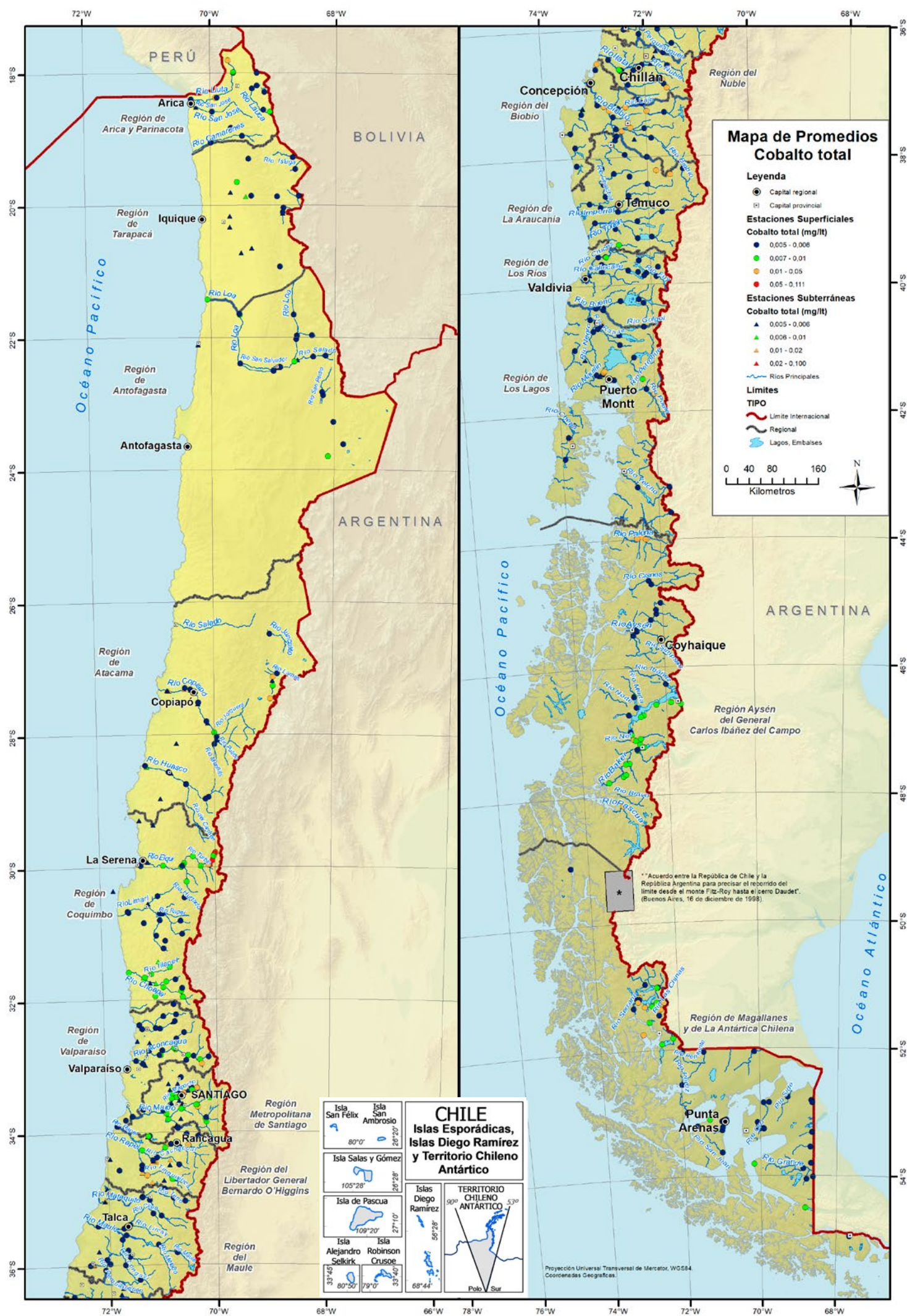
18. PROMEDIOS – BORO TOTAL



19. PROMEDIOS - CADMIO TOTAL



20. PROMEDIOS – COBALTO TOTAL



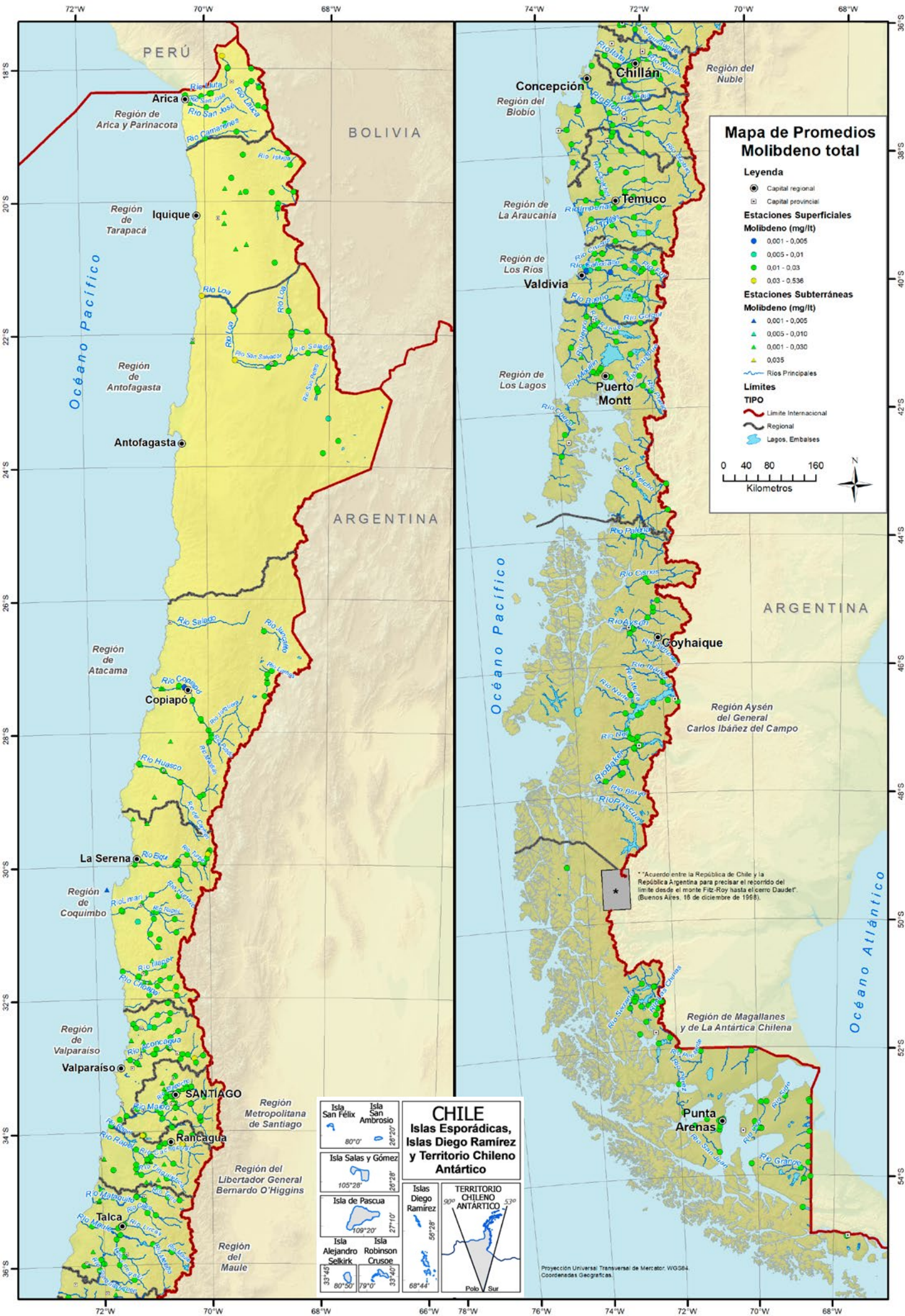
21. PROMEDIOS - CROMO TOTAL



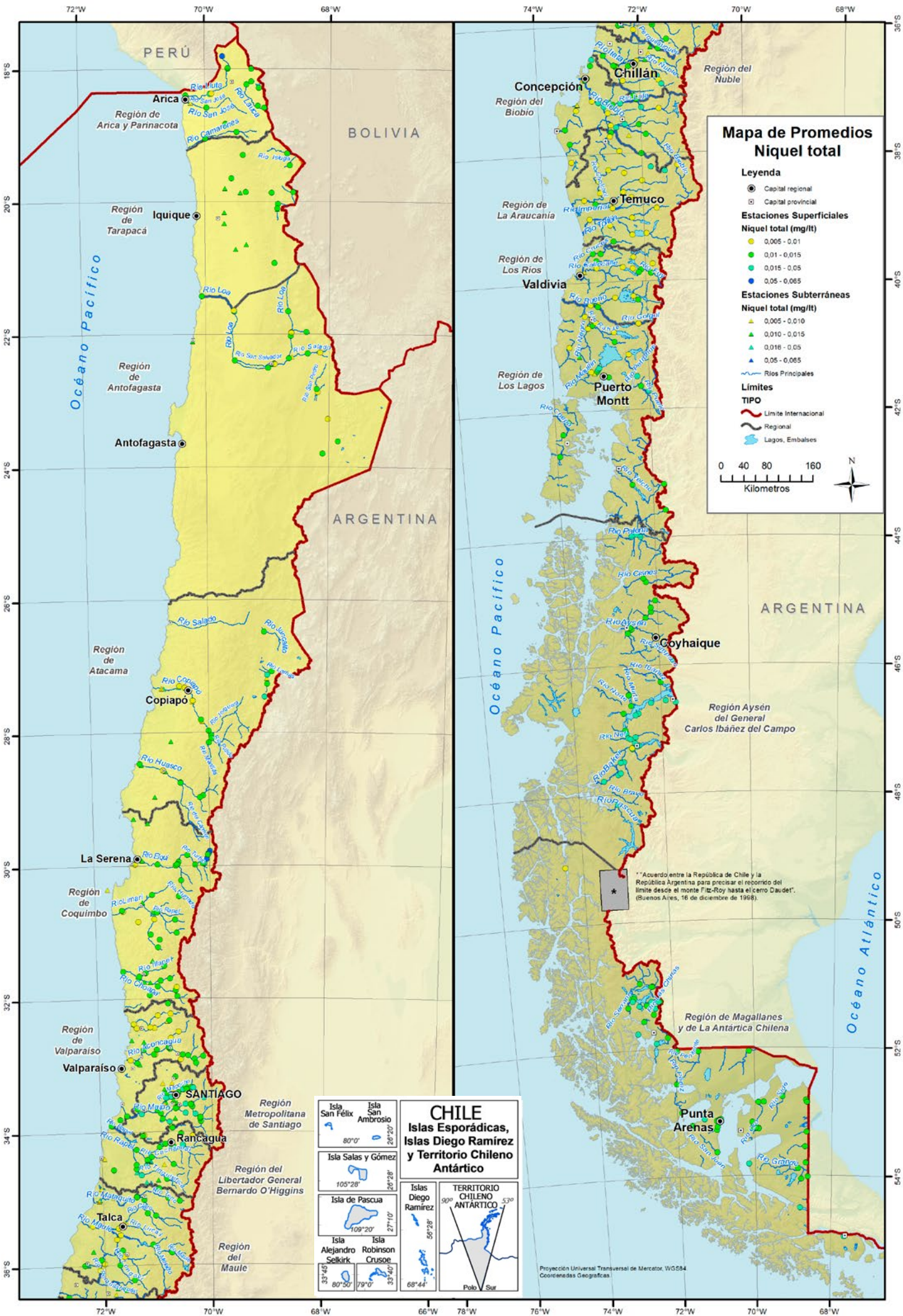
22. PROMEDIOS – MERCURIO TOTAL



23. PROMEDIOS - MOLIBDENO TOTAL



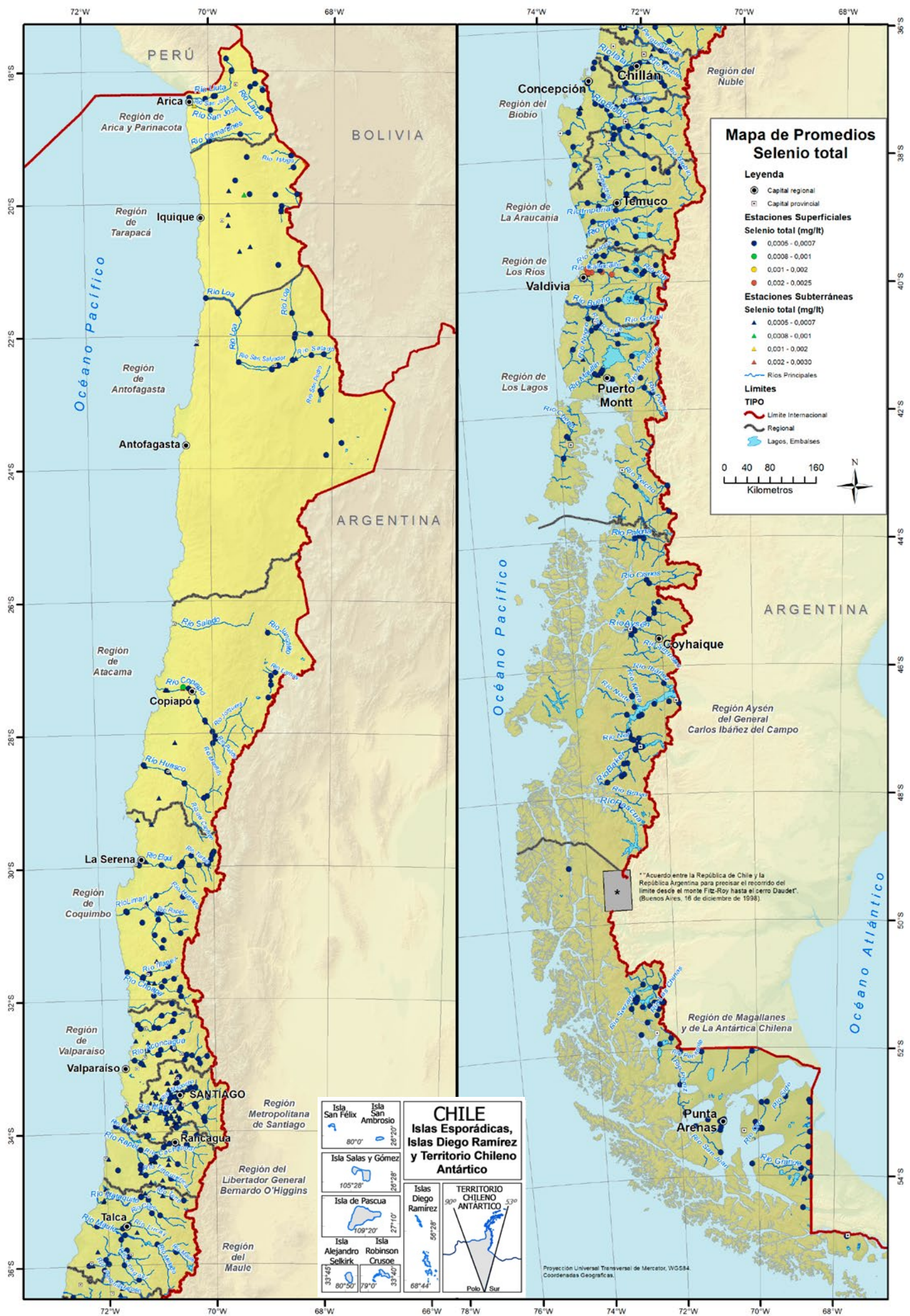
24. PROMEDIOS - NÍQUEL TOTAL



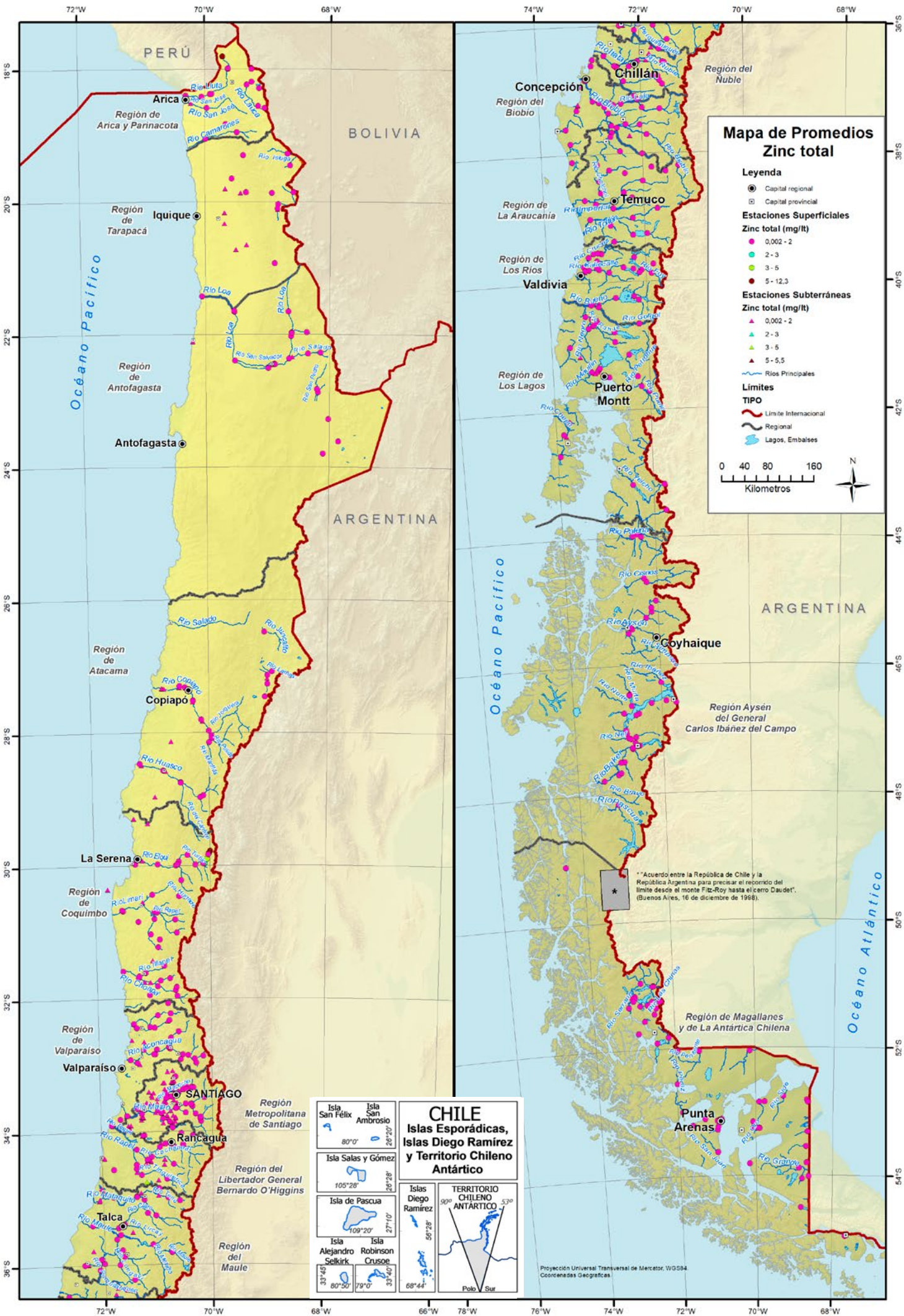
25. PROMEDIOS - PLOMO TOTAL



26. PROMEDIOS - SELENIO TOTAL



27. PROMEDIOS - ZINC TOTAL



PARÁMETROS ANALIZADOS RED CONTROL NORMA SECUNDARIA MAIPO

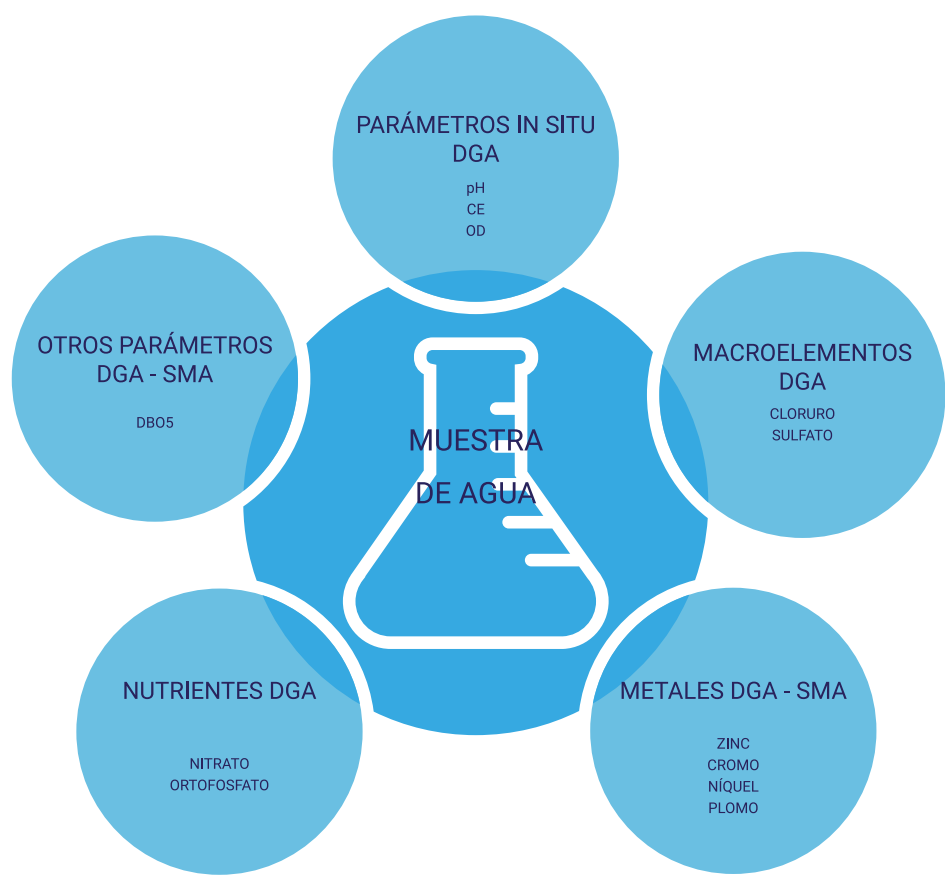


Figura 1. Parámetros Analizados en la red de Control de la Norma Secundaria de la Cuenca del Maipo en coordinación con la Superintendencia del Medio Ambiente SMA

Capítulo 2

MAPAS DE TENDENCIA

A continuación, se presentan una serie de mapas de tendencias de ciertos parámetros, cuya metodología para se explica en el estudio Mapa Hidroquímico de Chile DGA/DICTUC S.A 2020.

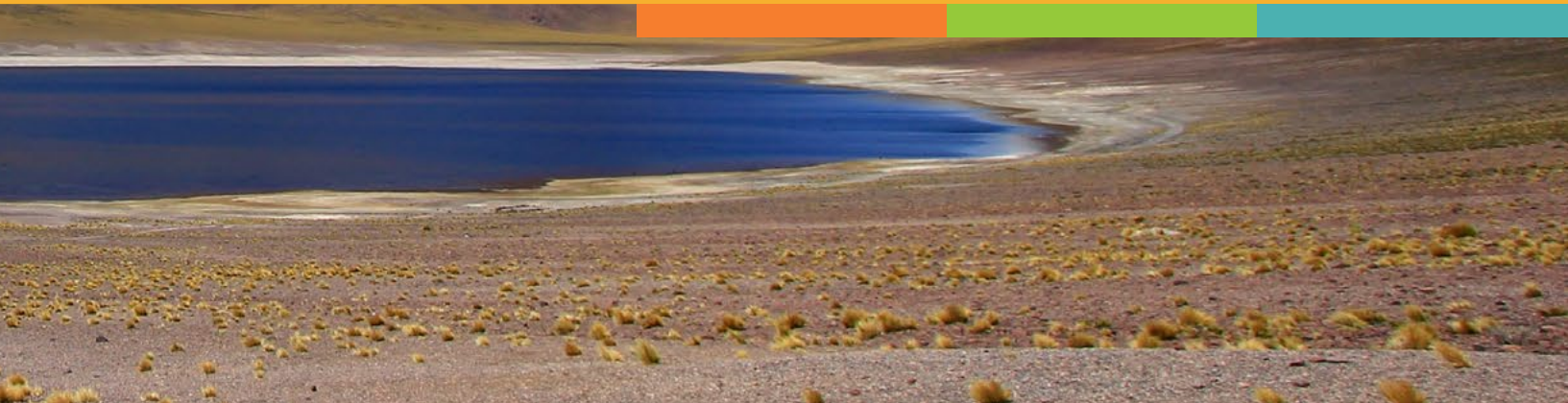
La aplicación de esta metodología se realizó a un subconjunto de estaciones que cumplen con los requisitos definidos, que incluyen entre otros, la cantidad mínima de datos, frecuencia de medición y número de datos sobre el Limite de detección.

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MAPAS TENDENCIA

28. Tendencia - Temperatura	42
29. Tendencia - Sulfato	43
30. Tendencia - Conductividad	44
31. Tendencia - Arsénico	45
32. Tendencia - Hierro	46
33. Tendencia - Oxígeno Disuelto	47
34. Tendencia - Calcio	48
35. Tendencia - Magnesio	49
36. Tendencia - Potasio	50
37. Tendencia - pH	51
38. Tendencia - Sodio	52
39. Tendencia - Cloruro	53



MAPAS DE TENDENCIA

Para el mapa de tendencias se utilizó una aplicación estadística ESTimate TREND (ESTREND) de la USGS (Servicio Geológico de los Estados Unidos) para el análisis de series de tiempo de calidad de agua . Dicha aplicación, realiza las pruebas de Kendall estacional y Tobit para identificar tendencias en los datos. Se consideró como período de análisis desde enero de 1990 a enero de 2018, en base a la disponibilidad de datos y una frecuencia de muestreo que permitiera reflejar la variación estacional, sin considerar datos outliers. Para mayores detalles de la metodología ver el Estudio Mapa Hidroquímico Nacional DGA-Dictuc S.A 2019.

En los mapas se visualizan 3 tipos de descriptores: **UP** que significa que esa variable en una estación determinada tiene una tendencia al alza, **None** que significa que esa variable no hay una tendencia y **DOWN** que significa que esa variable tiene una tendencia a la disminución.

Ejemplo: Extracto de Estudio Mapa Hidroquímico Resultado de análisis de Tendencia

Estación	Parámetro	Prueba	N° años	Temporadas por año	N °obs	Tend	Tend %	P.value	Tend dirección
03404001-K	Arsenico	uncensored seasonal Kendall	28	6	89	0.000	0.391	0.669	none
03404001-K	Calcio	uncensored seasonal Kendall	28	6	87	2.791	1.753	0.000	up
03404001-K	Cloruro	uncensored seasonal Kendall	28	6	85	1.005	1.287	0.000	up
03404001-K	Hierro	uncensored seasonal Kendall	28	6	87	-0.004	-0.239	0.949	none
03404001-K	CE	uncensored seasonal Kendall	28	6	89	13.253	0.919	0.001	up
03404001-K	Mg	uncensored seasonal Kendall	28	6	88	0.499	1.465	0.000	up
03404001-K	pH	uncensored seasonal Kendall	28	6	95	0.013	0.165	0.114	none
03404001-K	Potasio	uncensored seasonal Kendall	28	6	85	0.051	0.963	0.055	none
03404001-K	Sodio	uncensored seasonal Kendall	28	6	82	1.654	1.406	0.000	up
03404001-K	Sulfato	uncensored seasonal Kendall	28	6	82	6.166	1.191	0.003	up
03404001-K	Temp	uncensored seasonal Kendall	28	6	95	-0.043	-0.266	0.234	none
03414001-4	Arsenico	censored seasonal Kendall	28	6	91	0.000	2.381	0.021	up
03414001-4	Calcio	uncensored seasonal Kendall	28	6	86	1.391	1.705	0.000	up
03414001-4	Cloruro	uncensored seasonal Kendall	28	6	85	0.227	1.388	0.011	up
03414001-4	Hierro	uncensored seasonal Kendall	28	6	85	0.047	5.177	0.007	up
03414001-4	CE	uncensored seasonal Kendall	28	6	87	5.183	0.843	0.000	up
03414001-4	Mg	uncensored seasonal Kendall	28	6	88	0.314	1.916	0.000	up
03414001-4	Potasio	uncensored seasonal Kendall	28	6	84	0.044	1.896	0.003	up
03414001-4	Sodio	uncensored seasonal Kendall	28	6	86	0.087	0.395	0.115	none
03414001-4	Sulfato	uncensored seasonal Kendall	28	6	82	3.267	1.778	0.000	up
03414001-4	Temp	uncensored seasonal Kendall	28	6	97	-0.142	-0.922	0.003	down
03421001-2	Arsenico	censored seasonal Kendall	28	6	89	0.000	3.704	0.004	up

Tabla 2 - Ejemplo cálculo de tendencias

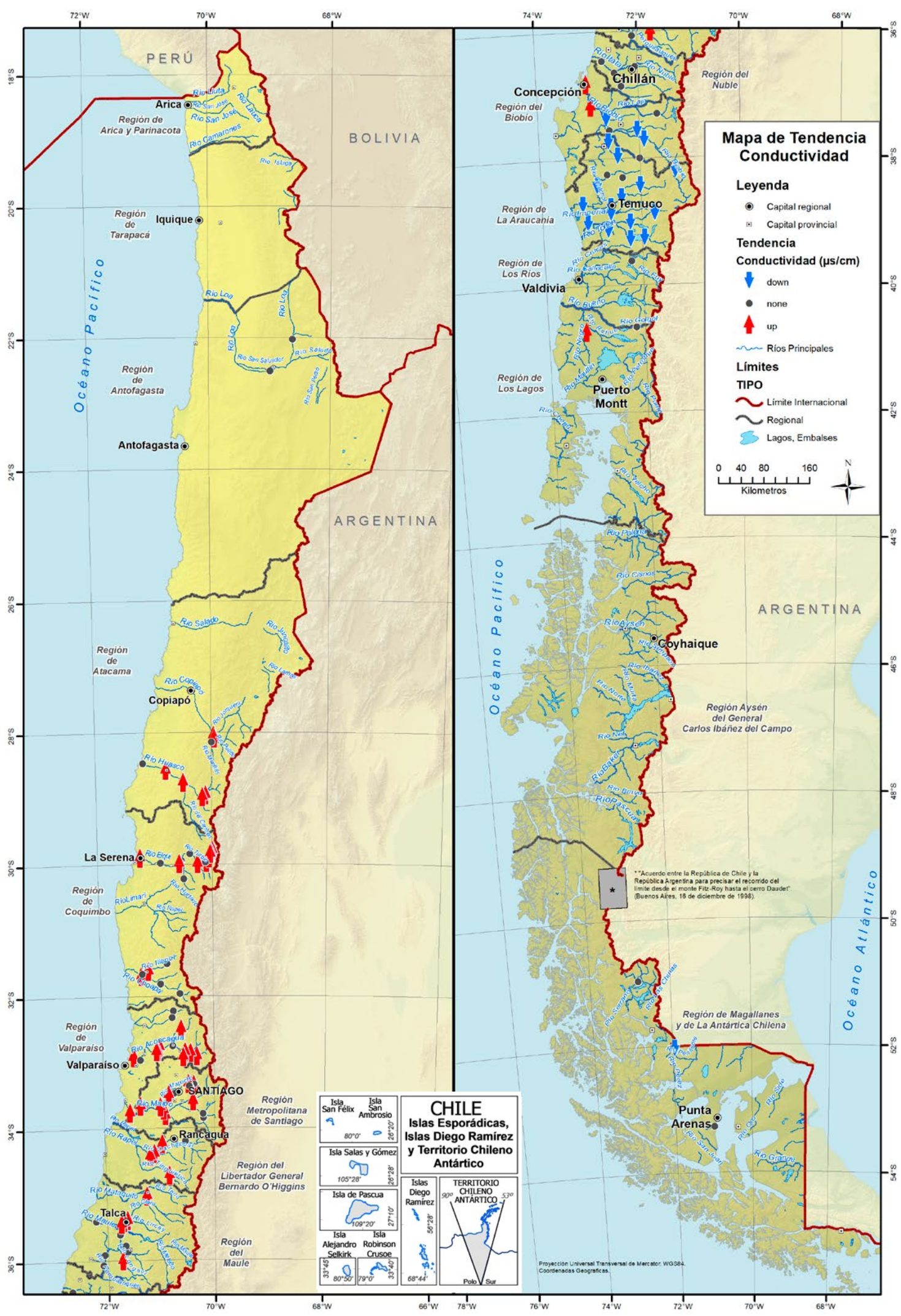
28. TENDENCIA - TEMPERATURA



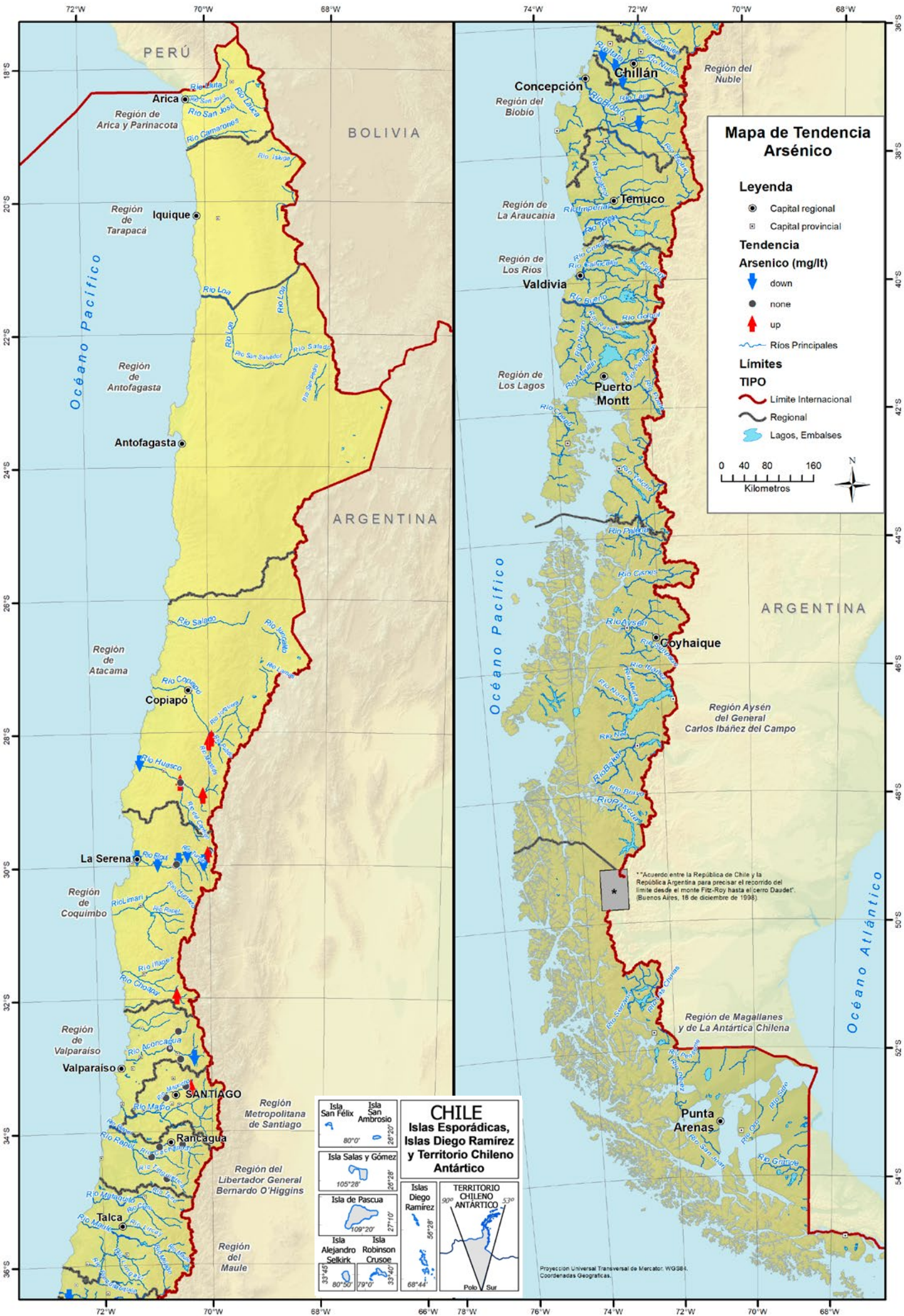
29. TENDENCIA - SULFATO



30. TENDENCIA - CONDUCTIVIDAD



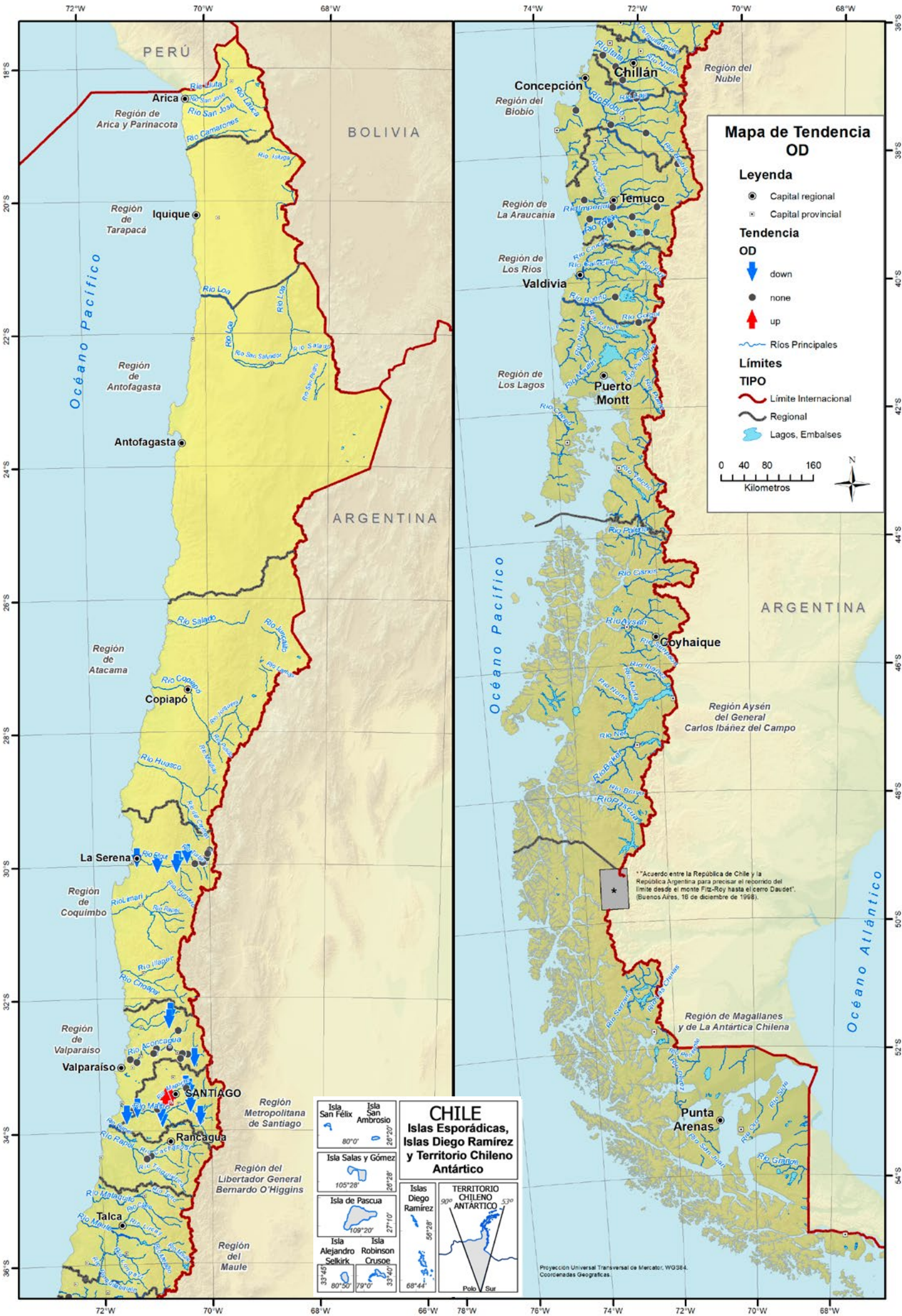
31. TENDENCIA - ARSÉNICO



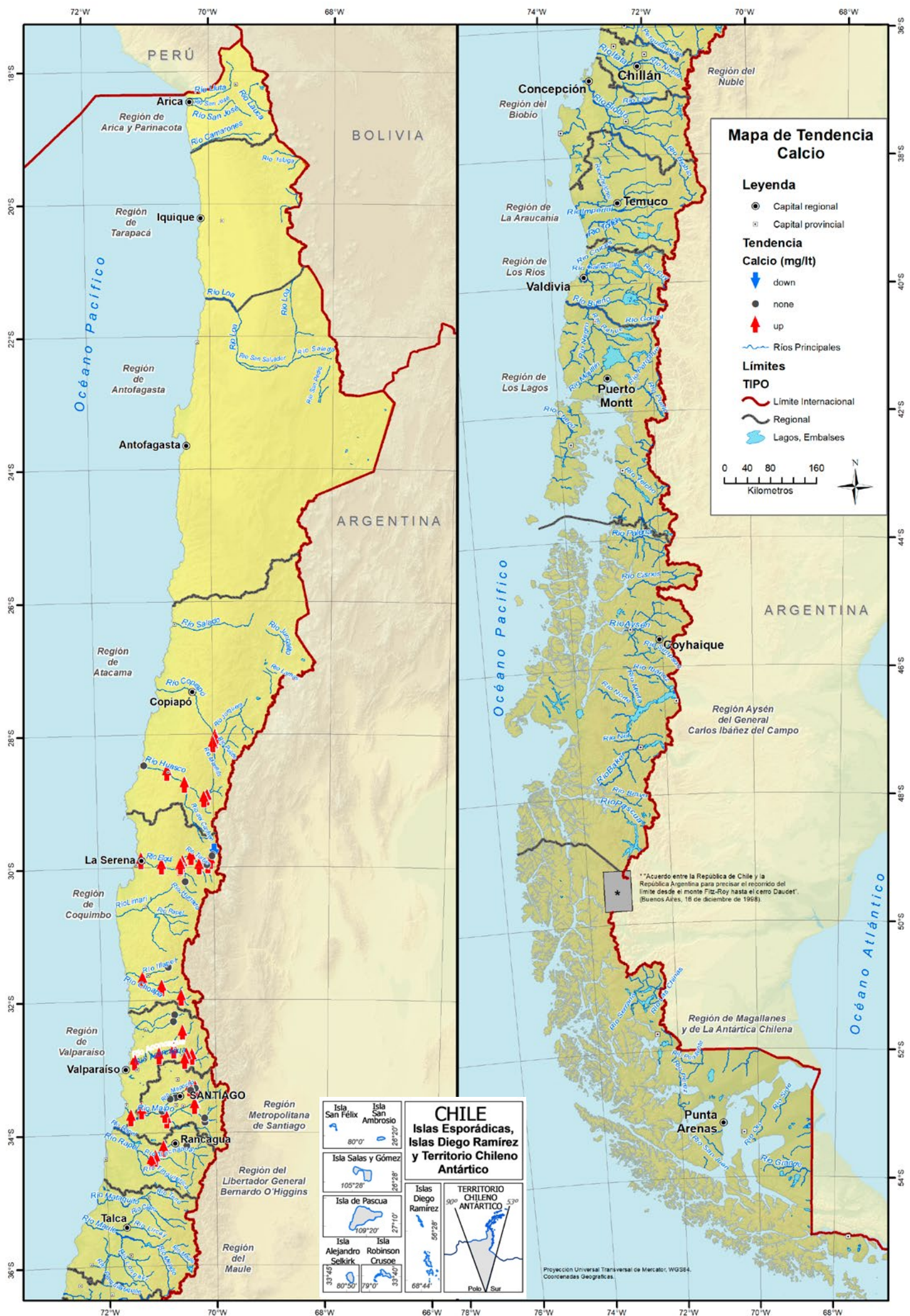
32. TENDENCIA - HIERRO



33. TENDENCIA - OXÍGENO DISUELTO



34. TENDENCIA - CALCIO



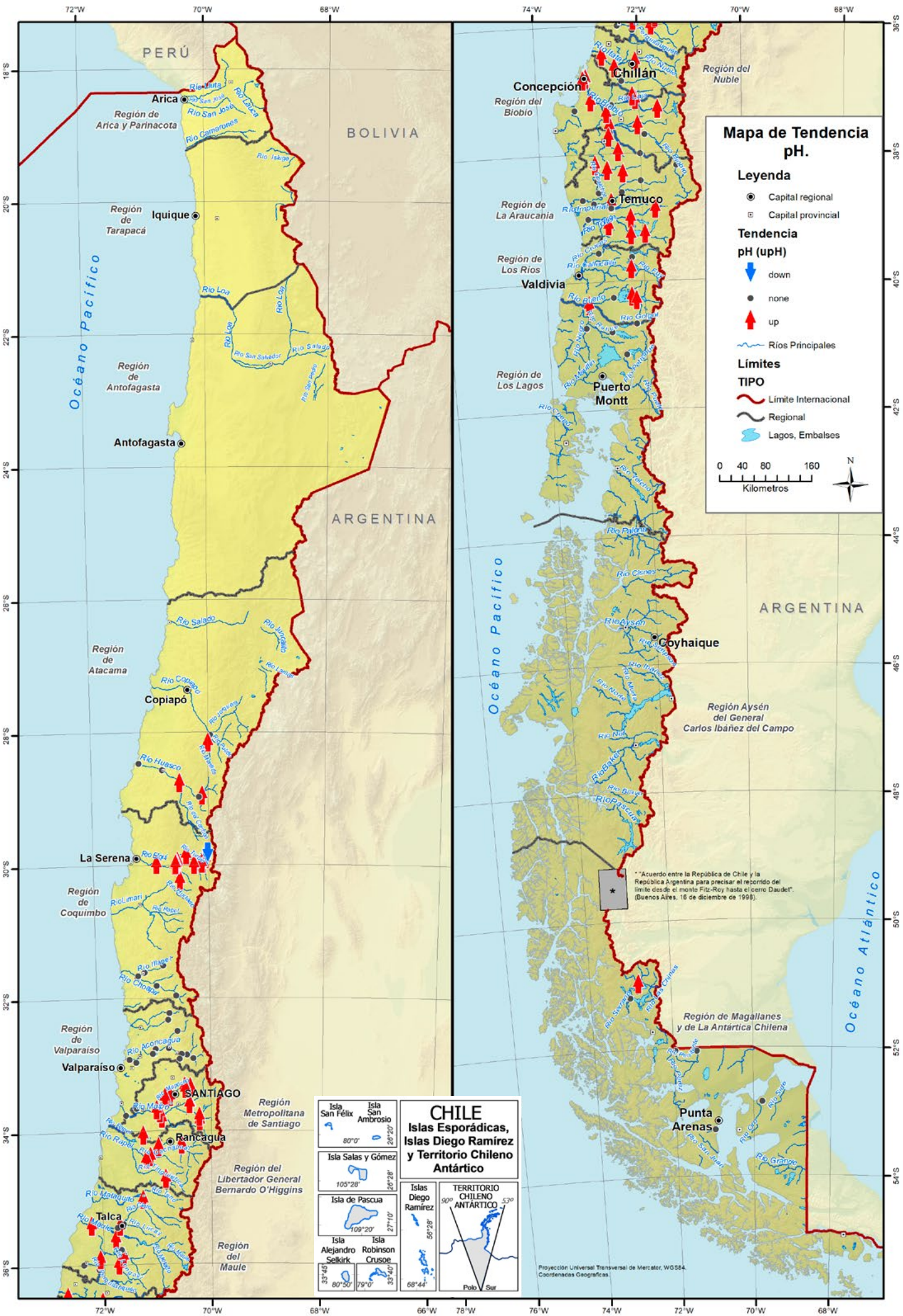
35. TENDENCIA – MAGNESIO



36. TENDENCIA – POTASIO



37. TENDENCIA - PH



38. TENDENCIA - SODIO



39. TENDENCIA - CLORURO



MOTIVACIÓN

RED DE CALIDAD DE AGUAS SUBTERRÁNEAS

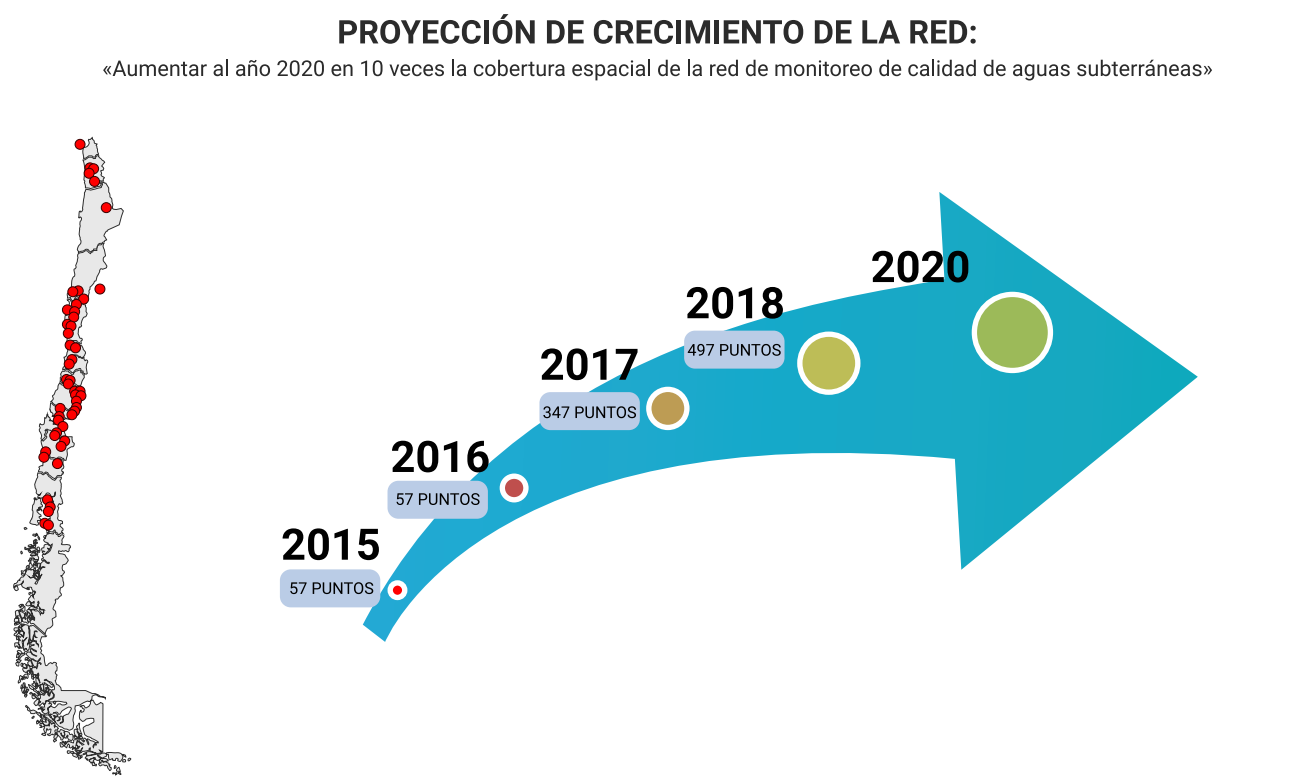


Figura 2. Motivación - Red de calidad de aguas subterráneas

Capítulo 3

MAPAS ODS

Los objetivos en la Agenda 2030 sobre el Desarrollo Sostenible aprobada por Naciones Unidas el año 2015, se definieron una serie de objetivos enfocados en el bienestar de las personas, la transformación hacia un mundo sustentable y resiliente.

En específico a continuación se muestra el resultado del indicador 6.3.2 perteneciente al ODS 6. Se aplicó la metodología propuesta por ONU en las estaciones de monitoreo de la DGA para el período 2015-2018.

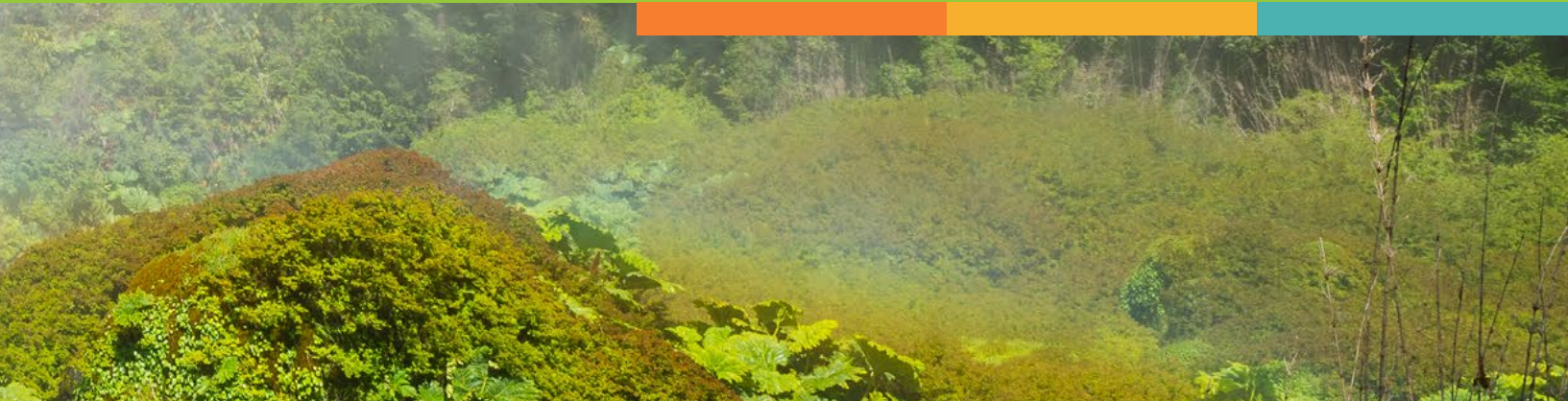
Atlas del Agua – Chile 2020



Puñón - Cascada de Salto El León

MAPAS ODS

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41.- ODS - 2016	59
42.- ODS - 2017	60
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ODS (OBJETIVO DE DESARROLLO SOSTENIBLE)

En septiembre de 2015, los Estados Miembros de las Naciones Unidas aprobaron la Agenda 2030 para el Desarrollo Sostenible. Esta agenda pretende cambiar el rumbo del mundo mediante un plan de acción enfocado en el bienestar de las personas y la transformación hacia un mundo sustentable y resiliente. Esta agenda consiste en 17 Objetivos (ODS) (Figura 1), 169 metas, y 230 indicadores para poder medir el avance.



Figura 3. Logos representativos de cada uno de los 17Objetivos para el Desarrollo Sostenible (Fuente: <https://sdgs.un.org/goals>).

El Objetivo 6 de Desarrollo Sostenible pretende “Asegurar la disponibilidad, el manejo sustentable del agua y su saneamiento para todos”. De este ODS se desprenden 8 metas (Figura 2):

- **6.1.** Lograr el acceso al agua potable en condiciones de seguridad y a un precio asequible.
- **6.2.** Lograr el acceso a servicios de saneamiento e higiene y poner fin a la defecación al aire libre.
- **6.3.** Mejorar la calidad del agua, el tratamiento de las aguas residuales y su reutilización sin riesgos.
- **6.4.** Aumentar el uso eficiente de los recursos hídricos y asegurar el abastecimiento de agua dulce.
- **6.5.** Implementar la gestión integrada de los recursos hídricos.
- **6.6.** Proteger y restablecer los ecosistemas relacionados con el agua.
- **6.a.** Ampliar la cooperación internacional y la creación de capacidad.
- **6.b** Apoyar la participación de los interesados. El total de indicadores diseñados para monitorear el ODS 6 son 11.

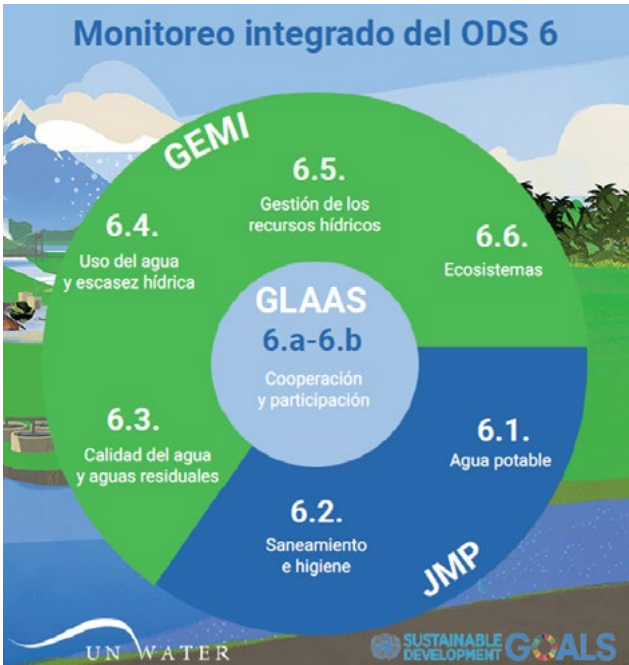


Figura 4. Metas contenidas en el ODS 6: Agua y Saneamiento para todos.

Para monitorear la **meta 6.3** se cuenta con 2 indicadores:

6.3.1 - Proporción de aguas residuales tratadas en forma segura.

6.3.2 – Porcentaje de cuerpos de agua con buena calidad de agua ambiental.

La Dirección General de Aguas (DGA) tiene como una de sus funciones principales el investigar y medir la cantidad y calidad del agua del país (Código de Aguas, 2005), y para eso cuenta con una red hidrométrica implementada desde la década de 1950, la cual incluye una red de calidad de agua.. El monitoreo de calidad de agua sigue un programa estricto que hasta el año 2018 permitió levantar más de un millón de datos, esta cantidad de información y la necesidad de comunicarla al público ha llevado a la DGA a calcular el indicador 6.3.2.

Este indicador cuenta con una metodología oficial elaborada por UN-Water (UN-Water 2018) la cual ha sido seguida casi íntegramente por la DGA salvo ciertas modificaciones que permiten reflejar de mejor forma la realidad hidrográfica del país. Estas modificaciones son capturadas por las Minutas del Departamento de Conservación y Protección de Recursos Hídricos DCPRH

N°32/2017 (DGA 2017) y N°11/2019 (DG A 2019a). De forma preliminar se calculó este indicador para el primer reporte de los ODS el año 2017 utilizando 6 cuerpos de agua (DGA 2017), y este año 2020 para el segundo reporte utilizando todos los datos de la red superficial de ríos (DGA 2019b).

El cálculo requiere de un grupo de parámetros base para ríos, lagos y acuíferos, siendo la mayoría de estos transversales entre los diferentes cuerpos de agua. Se requiere además de la adopción o definición de umbrales de calidad para cada parámetro, los cuales deberán idealmente reflejar las condiciones de un agua de buena calidad ambiental .

Estos valores umbrales son contrastados con el dato monitoreado para verificar si este último cumple o no, y una vez determinado el cumplimiento por parámetro durante un periodo determinado se debe calcular el porcentaje de cumplimiento de un cuerpo de agua y su posterior clasificación como un cuerpo con calidad de agua “Buena” o “No Buena”. Un cuerpo de agua con calidad “Buena” es aquel que tiene un porcentaje mayor o igual al 80% de mediciones respetando los umbrales de calidad, mientras que aquellos cuerpos de agua que no cumplen esta condición son considerados con una calidad “No Buena”.

$$WBGQ = \frac{n_g}{n_t} \times 100$$

WBGQ es el porcentaje de cuerpos de agua del país clasificados con una Buena calidad

n_g es el número de cuerpos de agua con una Buena calidad.

n_t es el número total de cuerpos de agua monitoreados y clasificados.

REFERENCIAS

A continuación se indica cómo se calcula el indicador 6.3.2 a nivel país.

DGA 2019a, Minuta DCPRH N°11: Metodología de cálculo indicador 6.3.2 y consideraciones nacionales– Objetivo ODS 6.

DGA 2019b, Mapa Hidroquímico de Chile , informe elaborado por DICTUC para DGA.

DGA 2017, Minuta DCPRH N°32. Se corrige Minuta

N°29/2017: Indicador 6.3.2: Porcentaje de cuerpos de agua con buena calidad de agua ambiental.

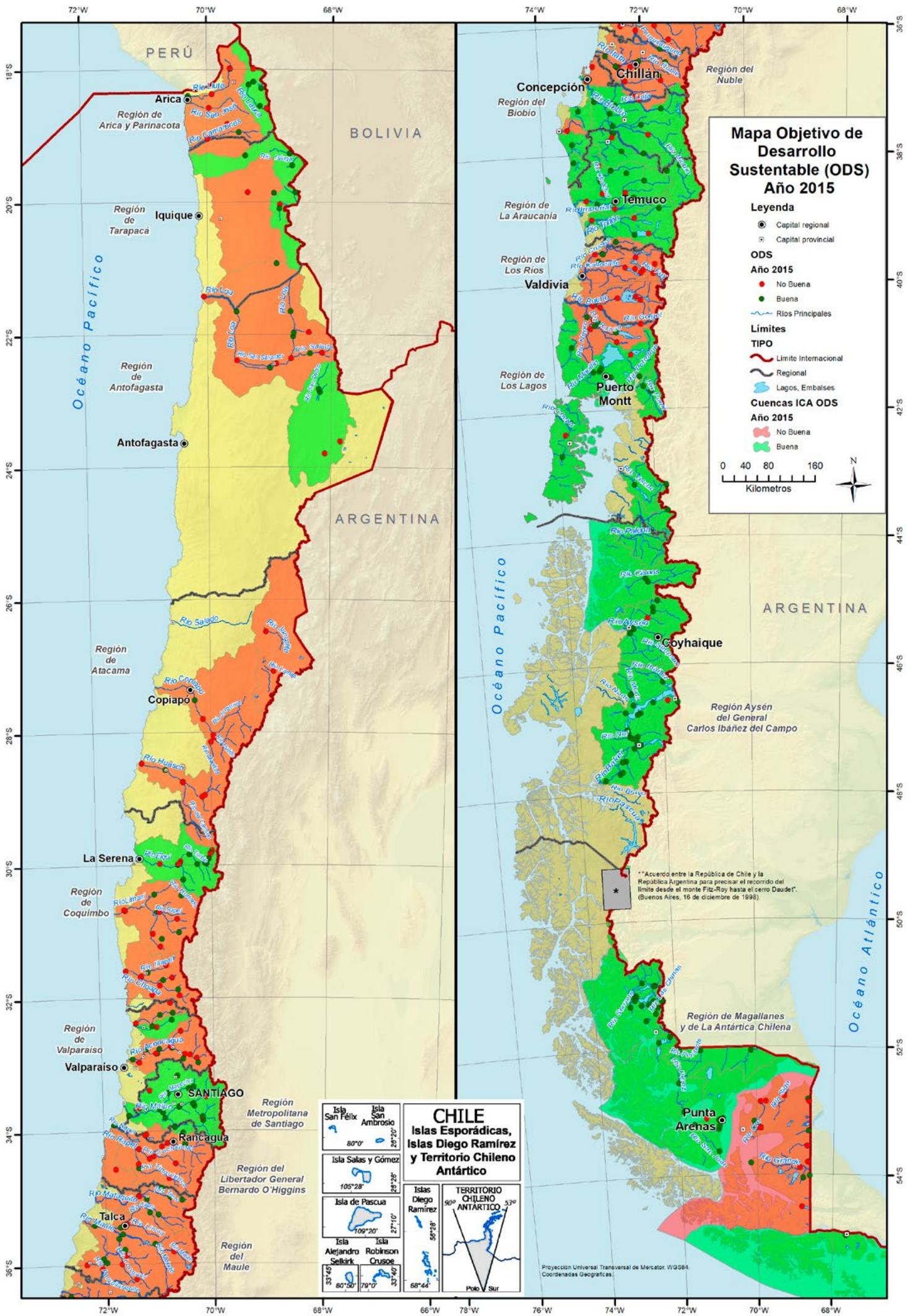
«UN-WATER.» Step by Step methodology for monitorin water quality (6.3.2).10 de Marzo de 2018. <http://www.unwater.org/publications/step-step-methodology-monitoring-water-quality-6-3-2/> (último acceso: 14 de Enero de 2019).

¹ Conductividad eléctrica, pH, nitrógeno, fósforo y oxígeno disuelto. Oxígeno disuelto no se mide en acuíferos.

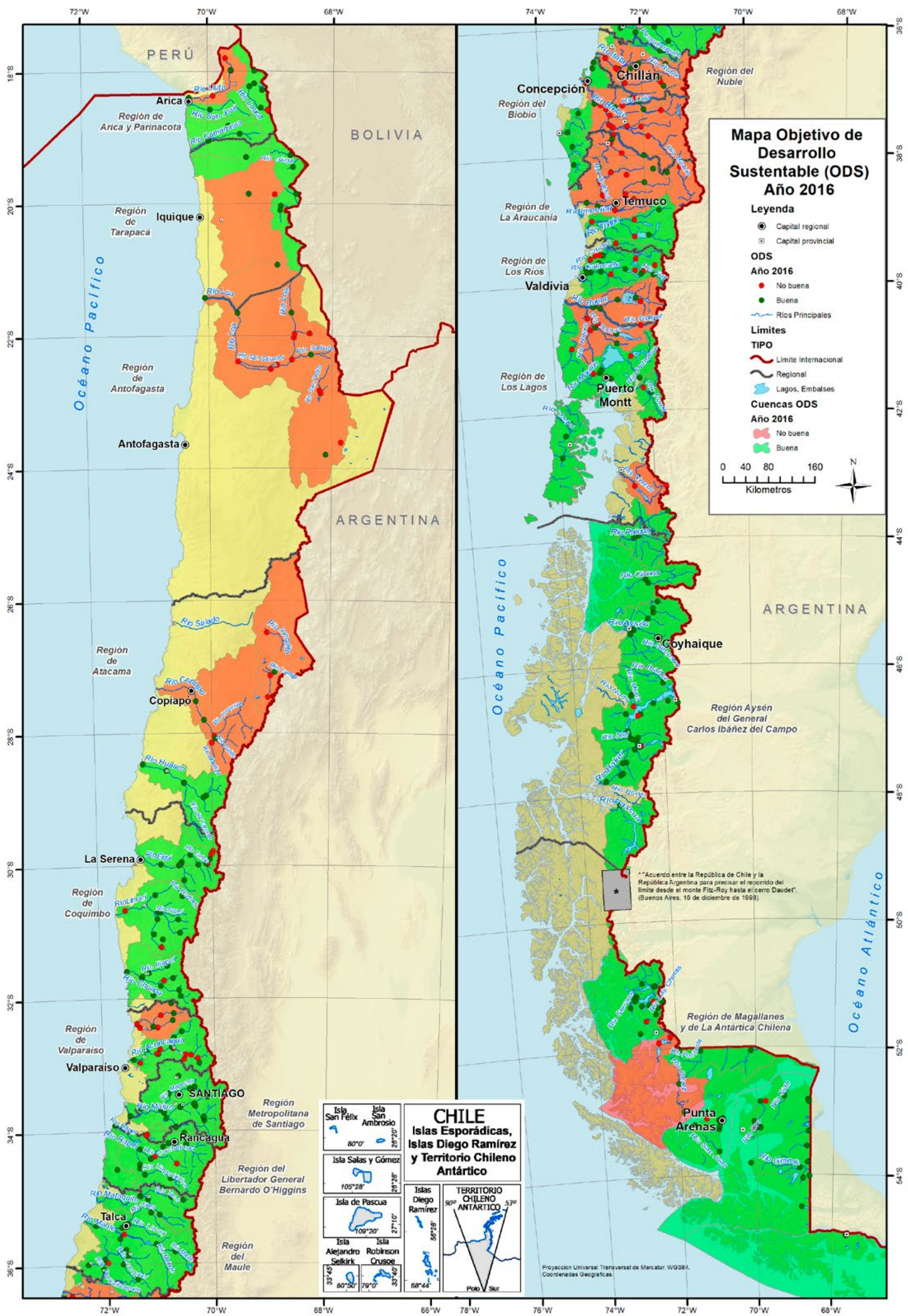
² Los umbrales pueden ser de corte superior y/o inferior. Como en el caso del oxígeno disuelto donde se contrasta con un valor mínimo, y el pH donde se contrasta con un rango.

³ Una buena calidad ambiental está definida como aquella que permite usos antrópicos (riego, bebida) como también ambientales. En el caso de Chile las zonas extremas presentan un desafío al determinar umbrales para este tipo de calidad pues si bien la calidad ambiental puede ser un reflejo fiel de una zona sin o con poca intervención, puede ser que esta no permita usos antrópicos por su alta concentración de metales u otros elementos naturales.

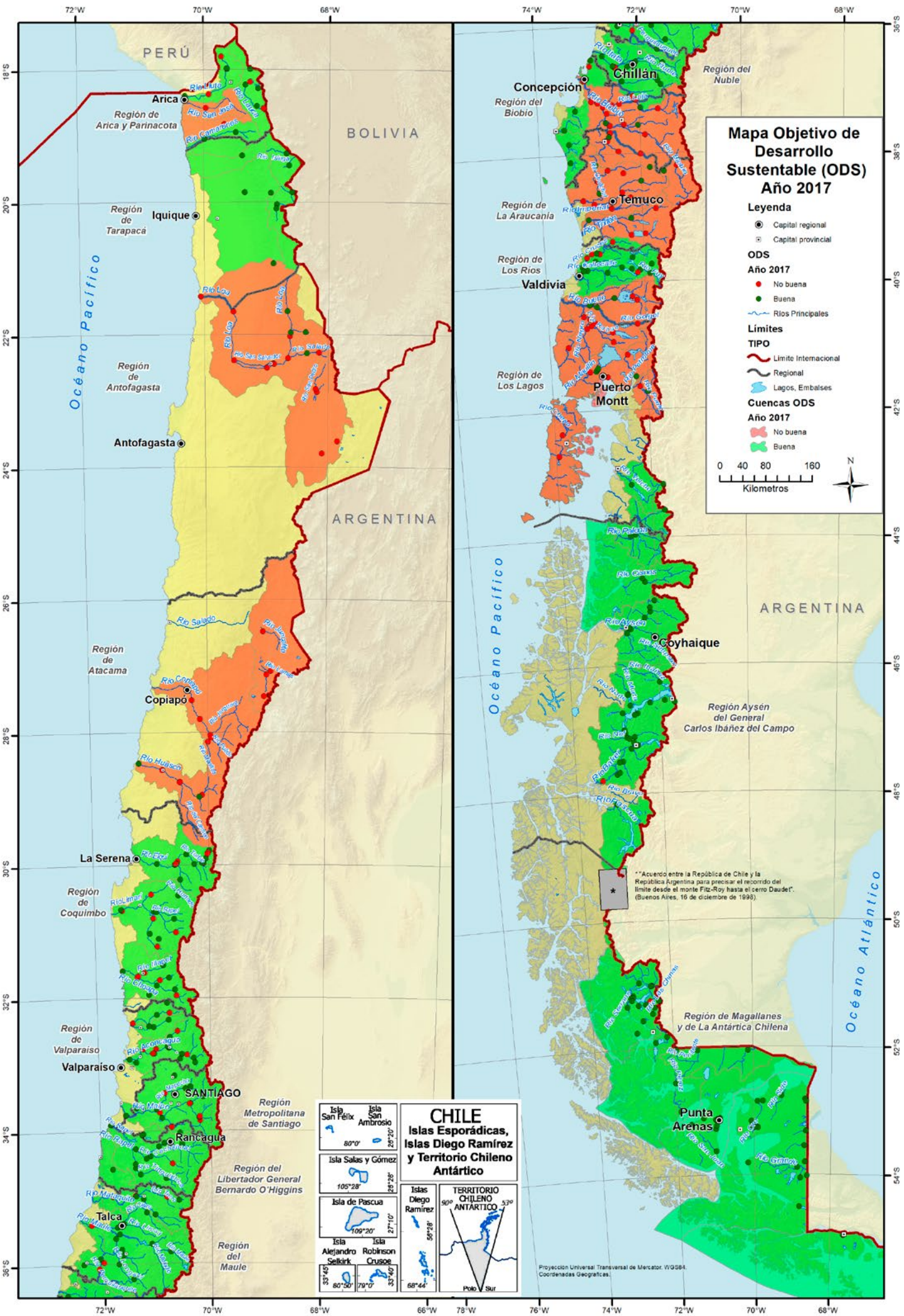
40.- ODS - 2015



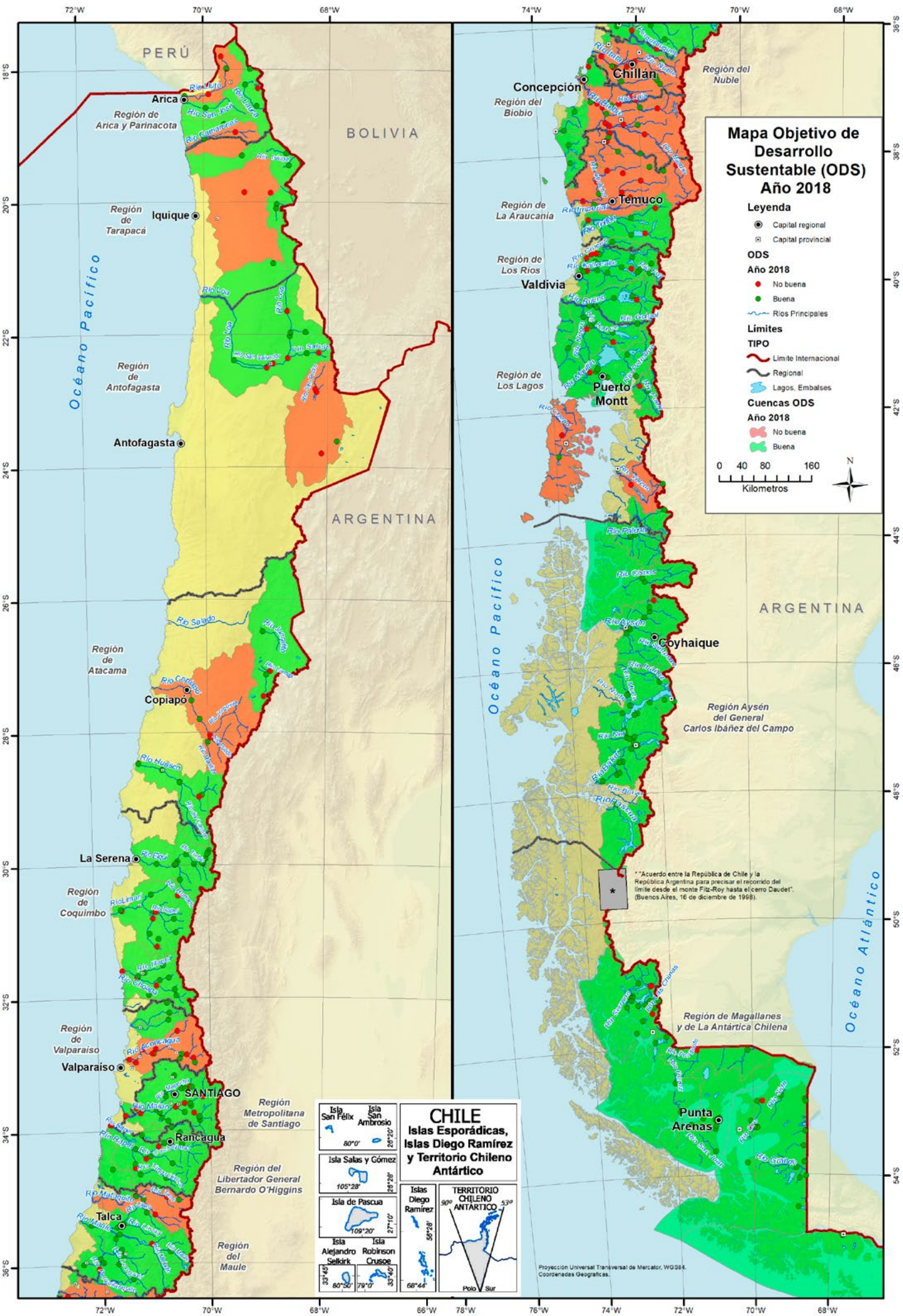
41.- ODS - 2016



42.- ODS - 2017



43.- ODS - 2018



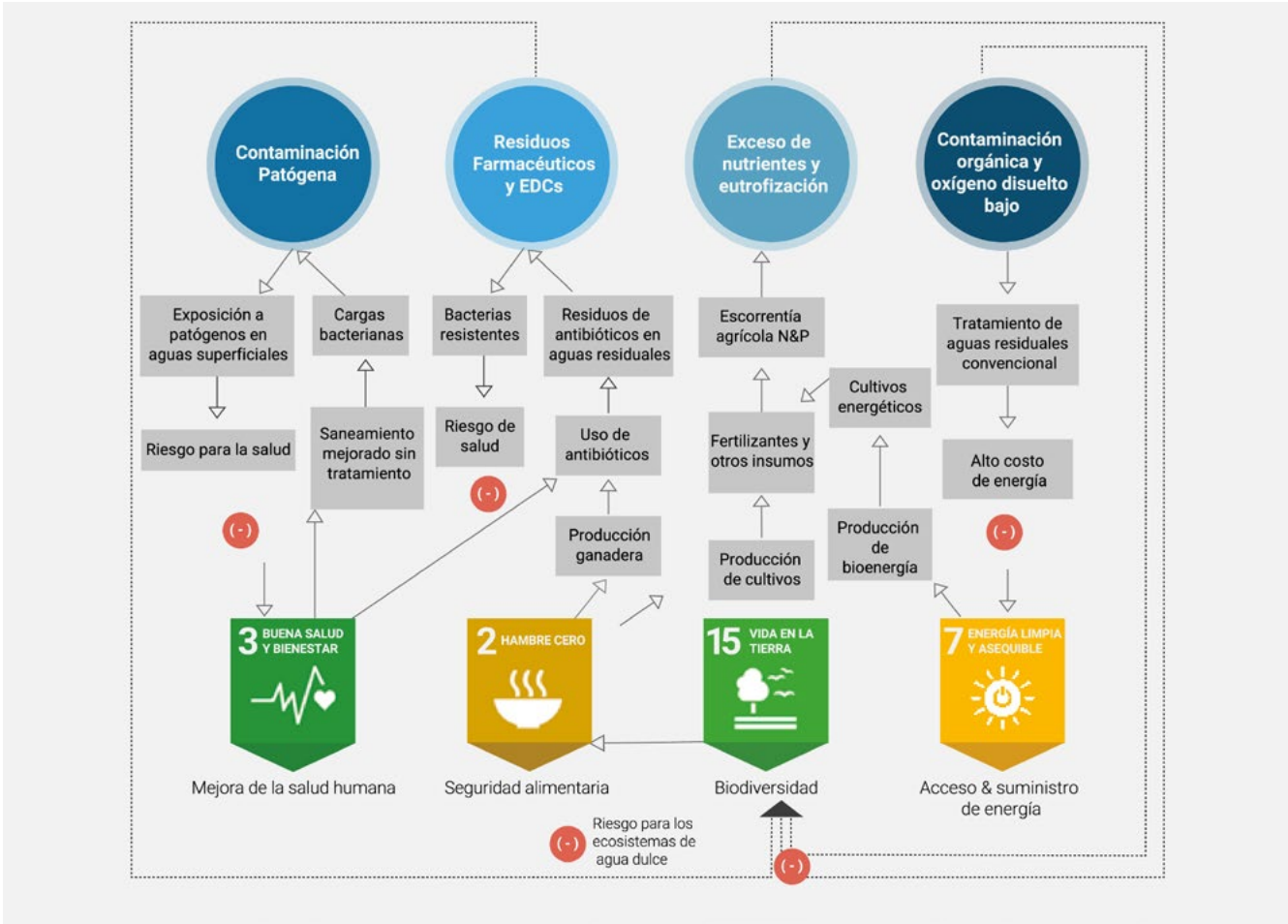


Figura 5. SDG6



Figura 6 . Los 17 Objetivos de Desarrollo Sostenible centrados en el agua para cada sector



Capítulo 4

MAPAS DE EVOLUCIÓN

La red de calidad de aguas cuenta con datos desde la década de los cincuenta, que ha permitido contar con una línea base de calidad de agua y observar la evolución de estos datos en el tiempo.

Esta evolución resulta relevante para determinar variaciones de la calidad de agua, debido a cambios climáticos, y/o efectos antrópicos.

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MAPAS DE EVOLUCIÓN

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65. Evolución Macrozona Sur - Hierro	136
66. Evolución Macrozona Sur - Nitrato	140
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82. Evolución Macrozona Austral - Macro Elementos	191
83. Evolución Macrozona Austral - Micro Elementos	194



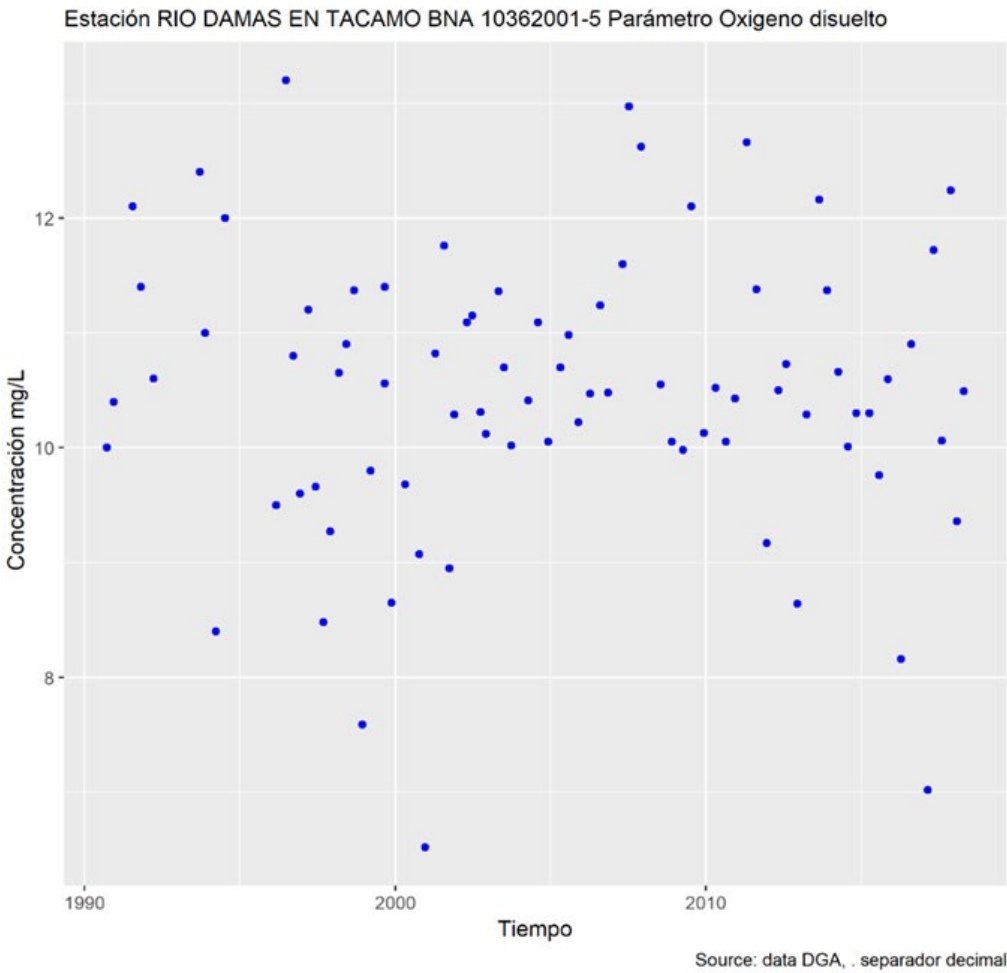
Lago Calafquen y Volcán Lanín

MAPAS DE EVOLUCIÓN TEMPORAL

A partir de la Base de datos depurada, excluyendo *outliers*, se generaron gráficos de concentración vs tiempo para todas las estaciones vigentes y suspendidas, de acuerdo al siguiente ejemplo. Dichos gráficos se generaron para los siguientes parámetros: conductividad eléctrica, temperatura, pH, oxígeno disuelto, fósforo total, fósforo de ortofosfato, nitrógeno de nitrato, arsénico total, hierro

total, aluminio total, calcio total, magnesio total, sodio total, potasio total, sulfato, cloruro total y bicarbonato.

En los siguientes mapas se presentan como resumen 93 estaciones. Sin embargo, en el Estudio Mapa Hidroquímico Nacional DGA-Dictuc 2019 se puede descargar el total de gráficos de Evolución temporal para el total de estaciones.



44. EVOLUCIÓN MACROZONA NORTE - ARSÉNICO



44 – 1.1 Gráficos – Evolución Macrozona Norte – Arsénico

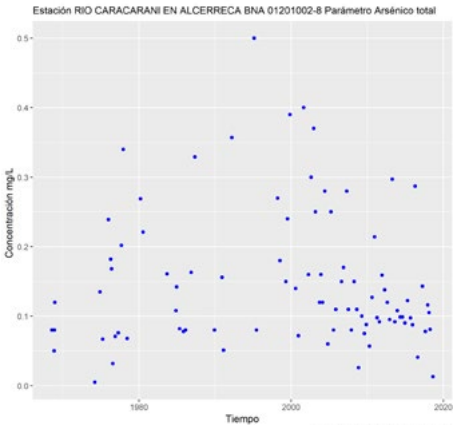


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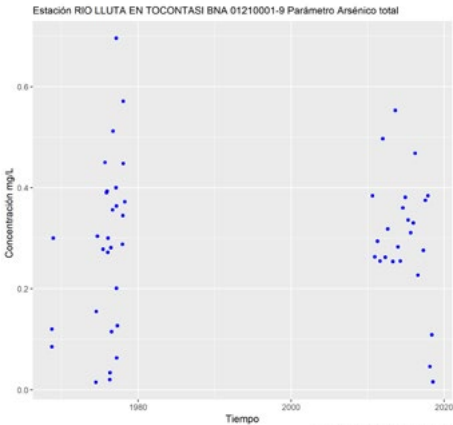


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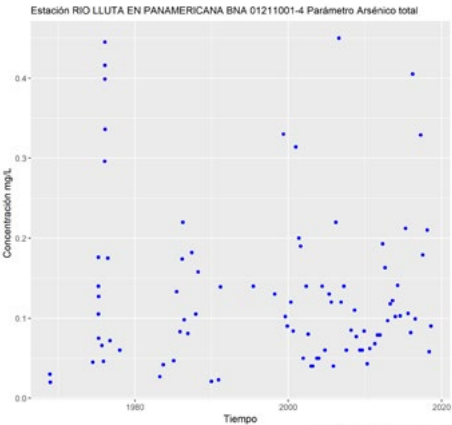


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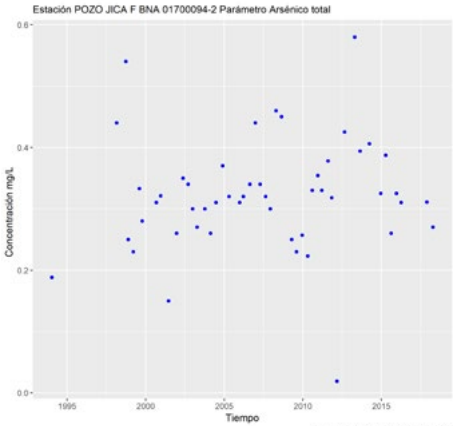


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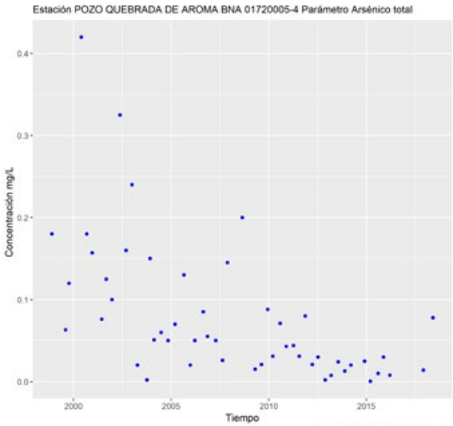


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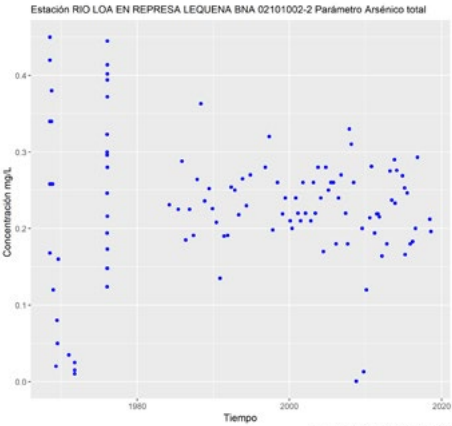


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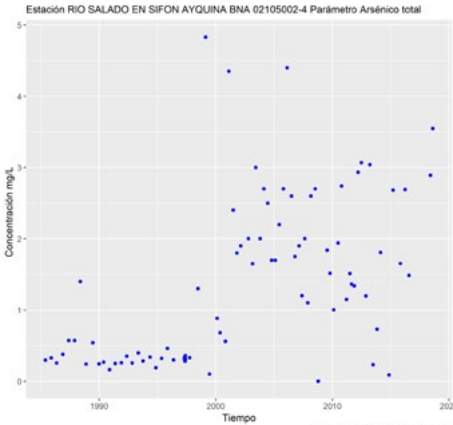


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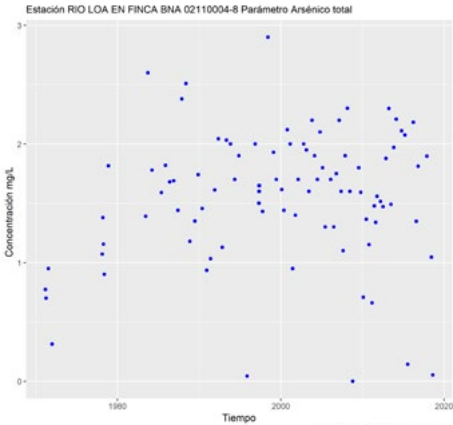


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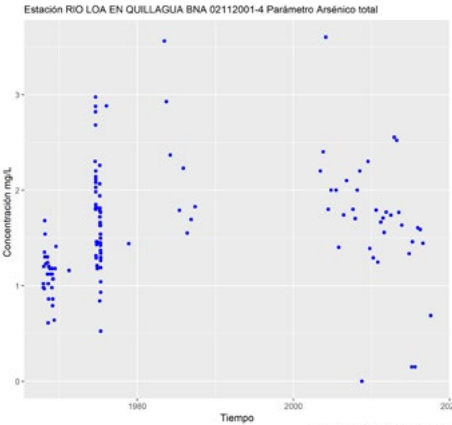


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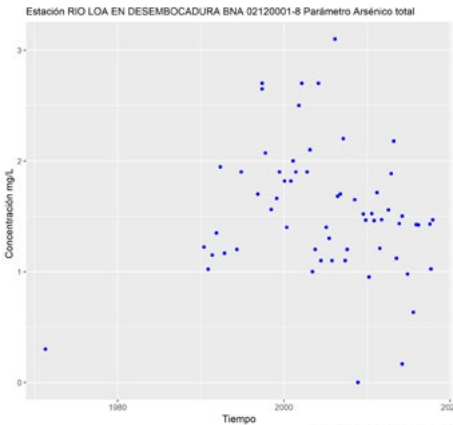


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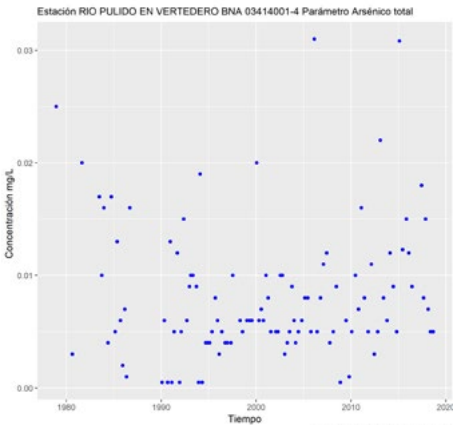


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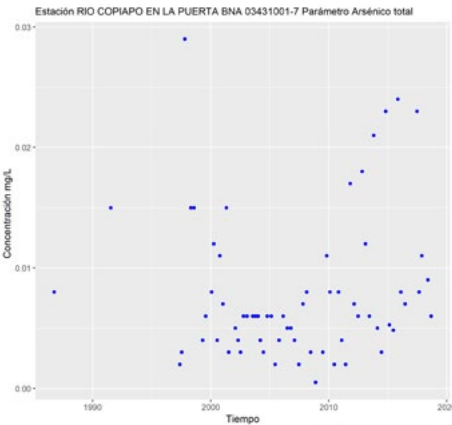


fig03431001-7Arsenico_total.png

44 - 1.2 Gráficos - Evolución Macrozona Norte - Arsénico

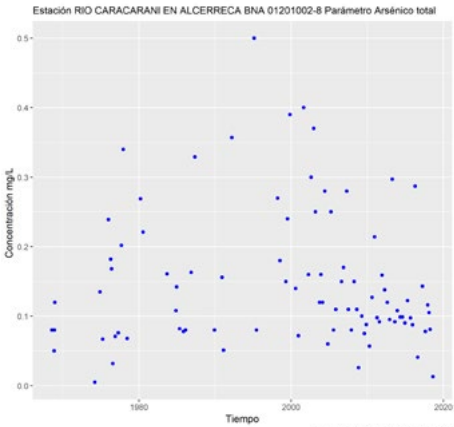


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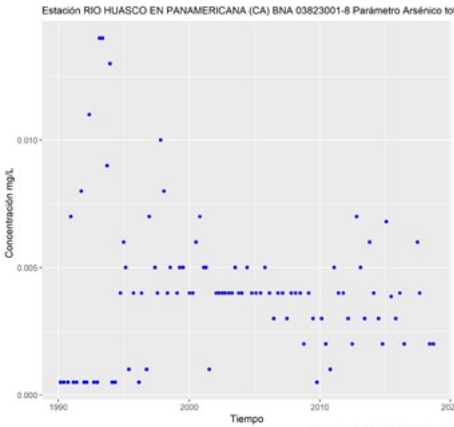


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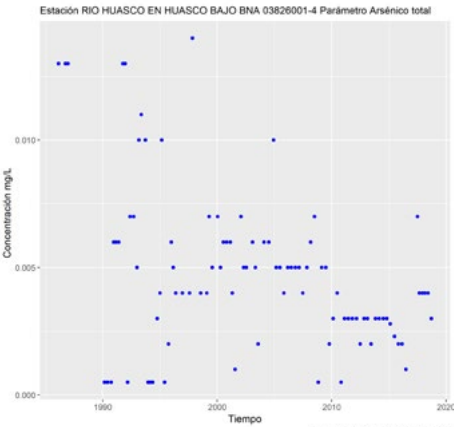


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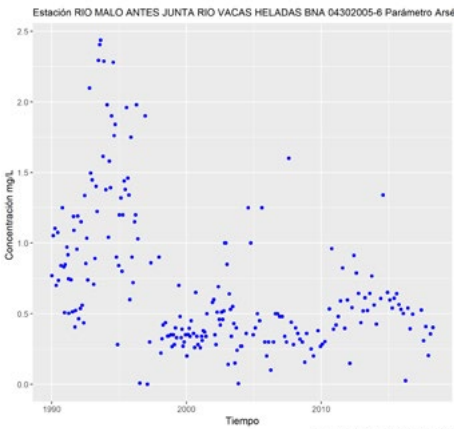


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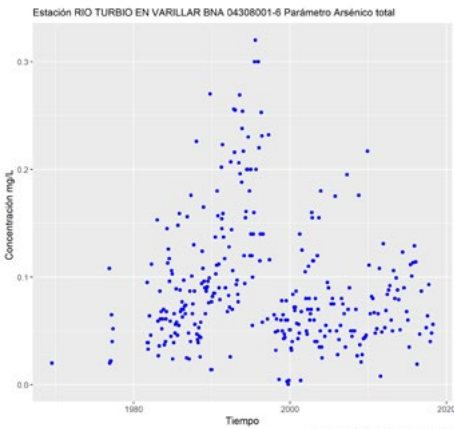


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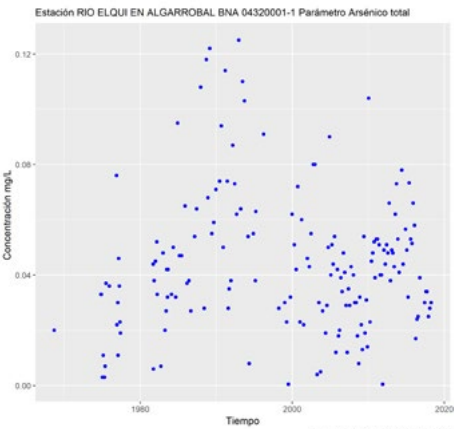


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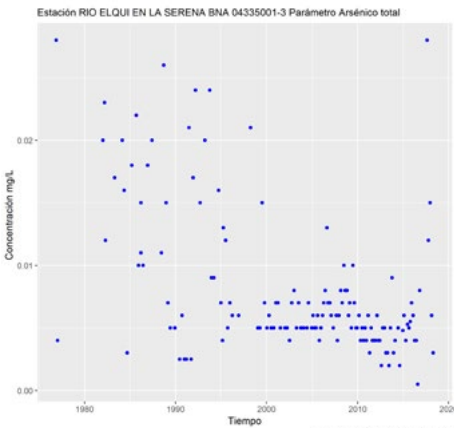


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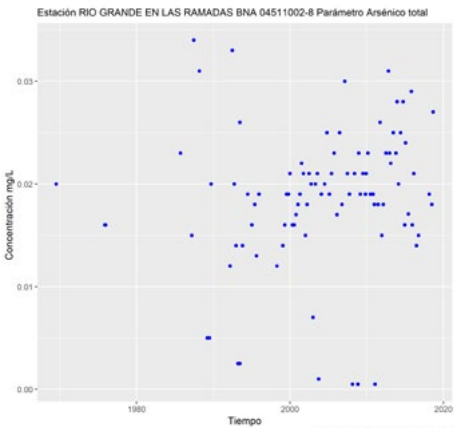


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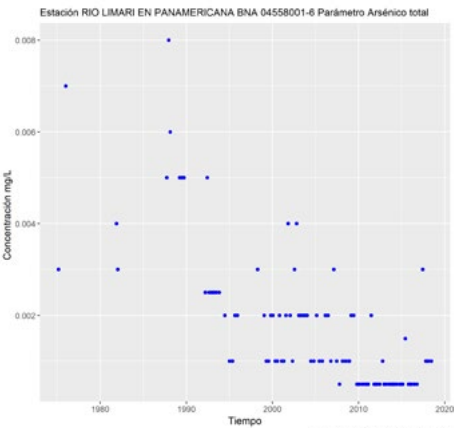


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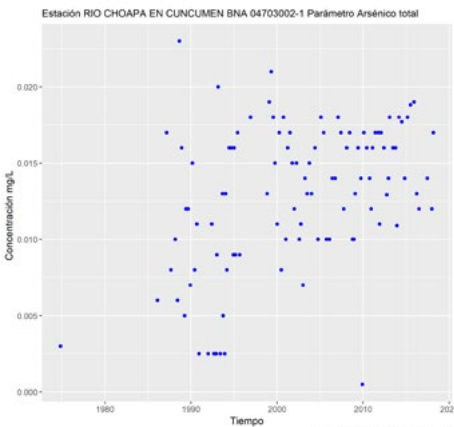


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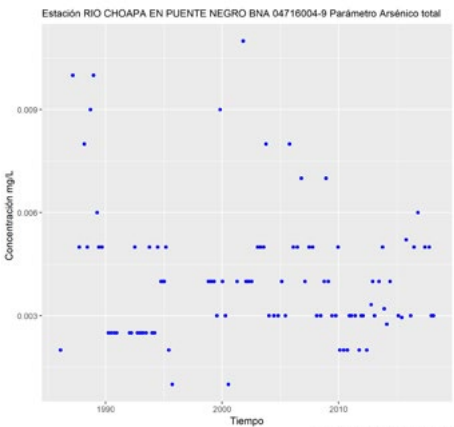


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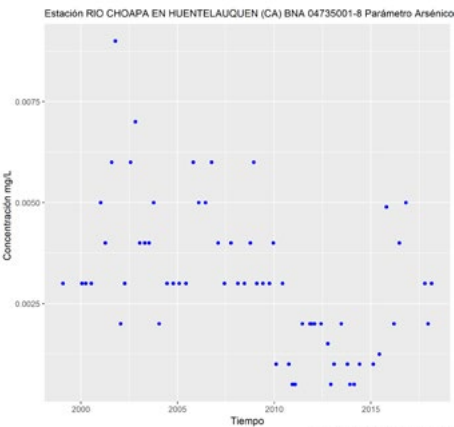


fig04735001-8Arsenico_total.png

45. EVOLUCIÓN MACROZONA NORTE - CONDUCTIVIDAD



45 - 1.1 Gráficos - Evolución Macrozona Norte - Conductividad

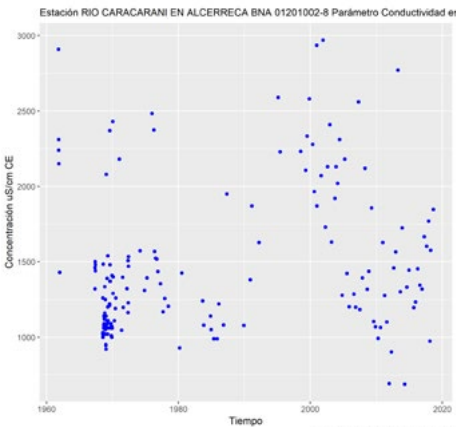


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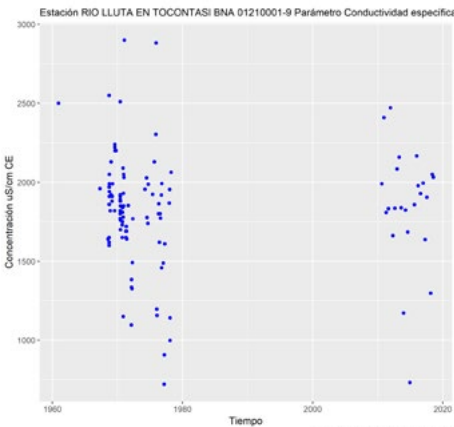


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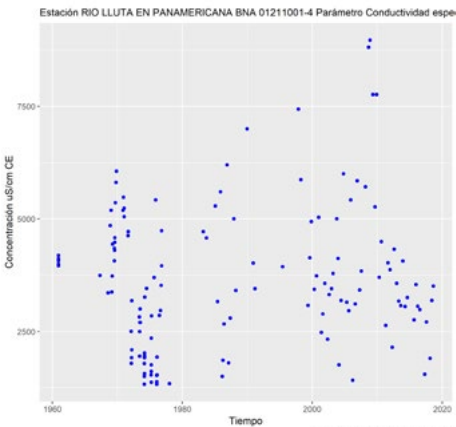


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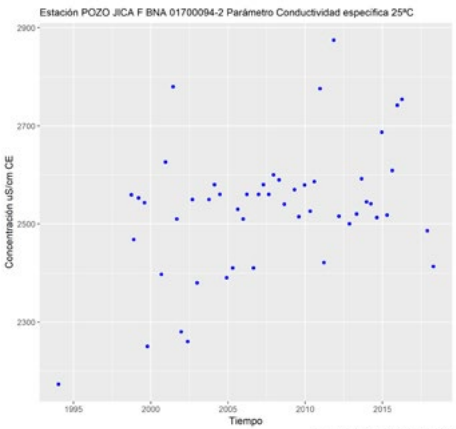


fig01700094-2Conductividad_especifica_.png

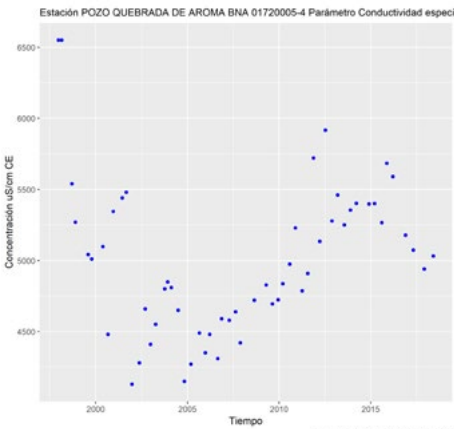


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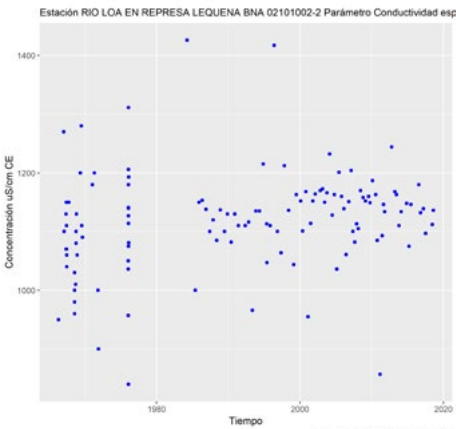


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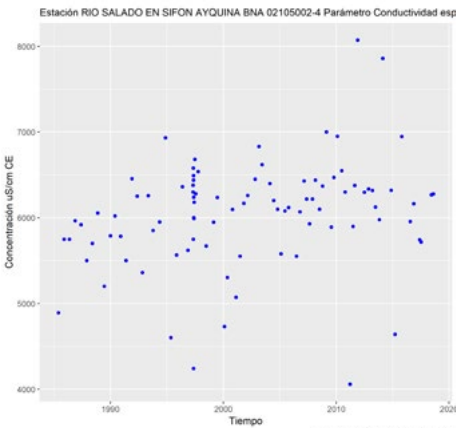


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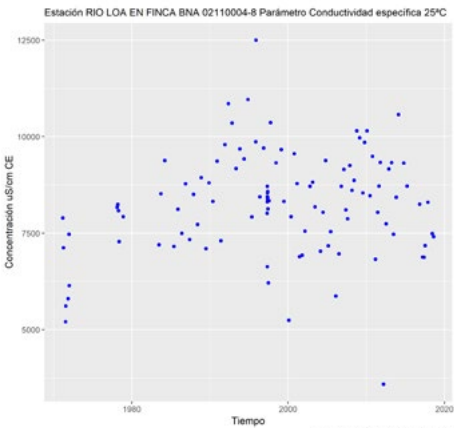


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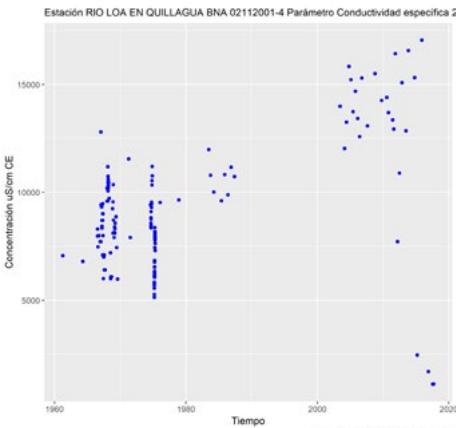


fig02112001-4Conductividad_especifica_.png

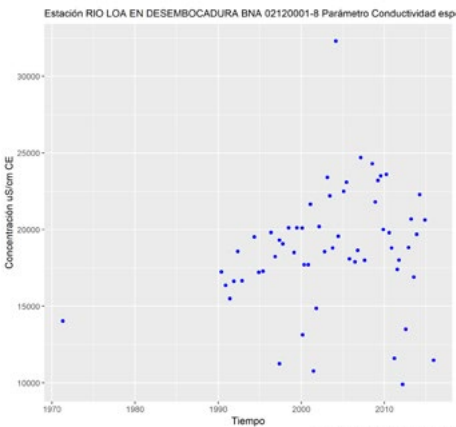


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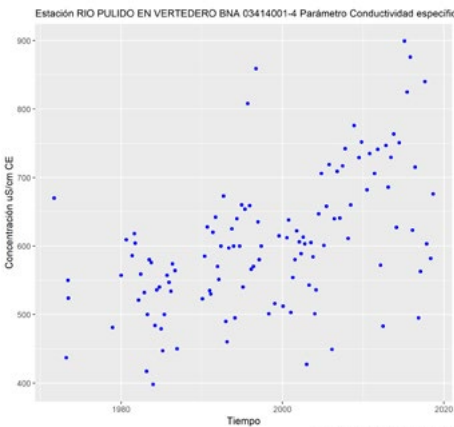


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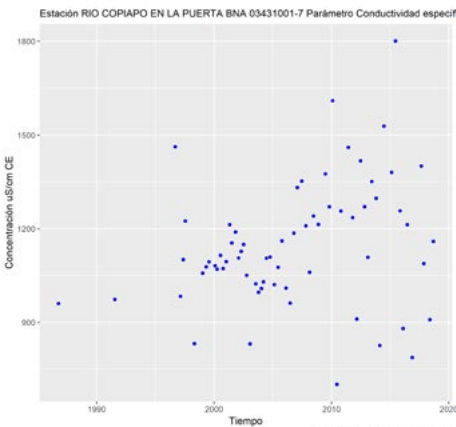


fig03431001-7Conductividad_especifica_.png

45 – 1.2 Gráficos – Evolución Macrozona Norte – Conductividad

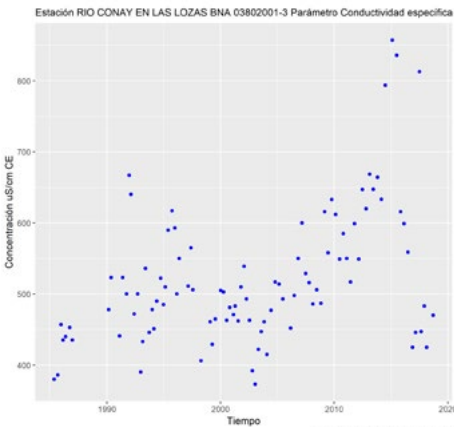


fig03802001-3Conductividad_especifica_.png

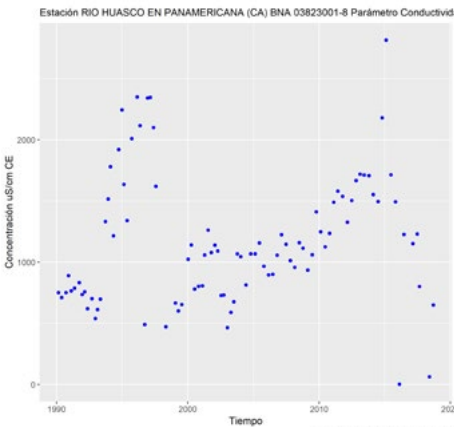


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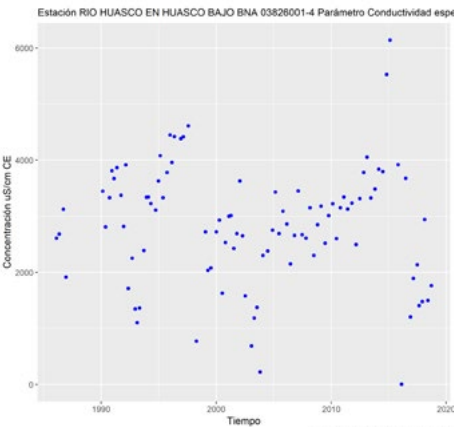


fig03826001-4Conductividad_especifica_.png

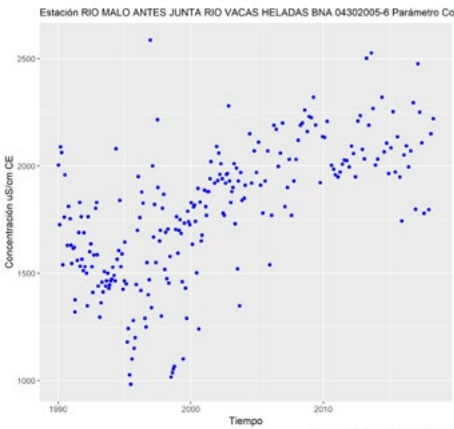


fig04302005-6Conductividad_especifica_.png

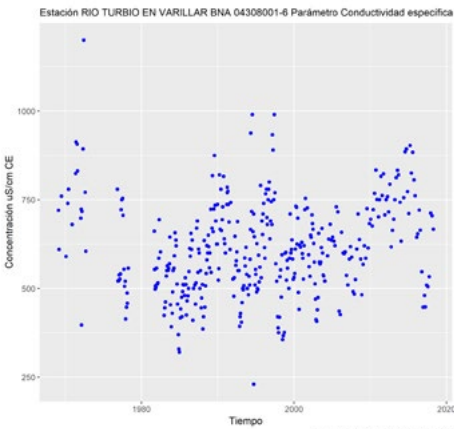


fig04308001-6Conductividad_especifica_.png

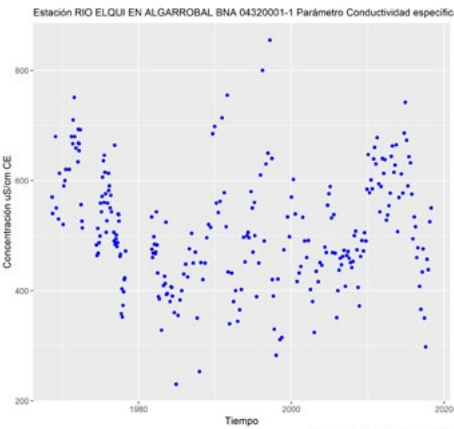


fig04320001-1Conductividad_especifica_.png

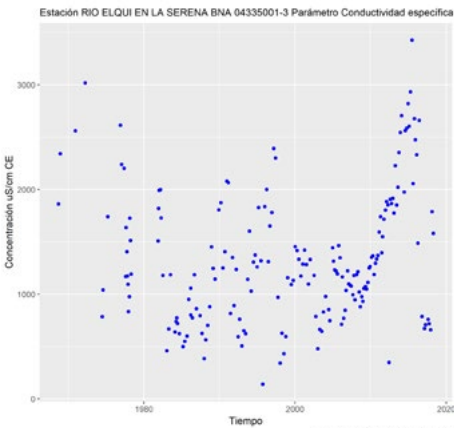


fig04335001-3Conductividad_especifica_.png

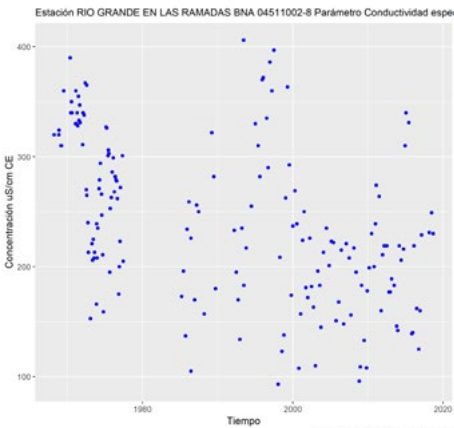


fig04511002-8Conductividad_especifica_.png

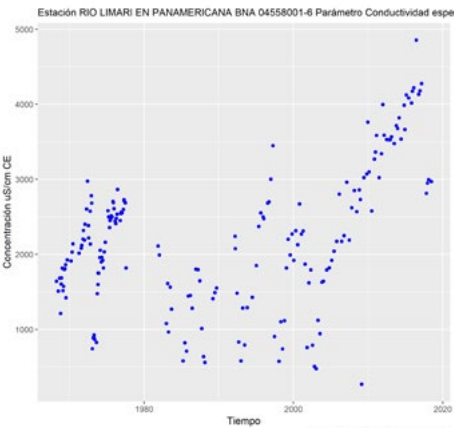


fig04558001-6Conductividad_especifica_.png

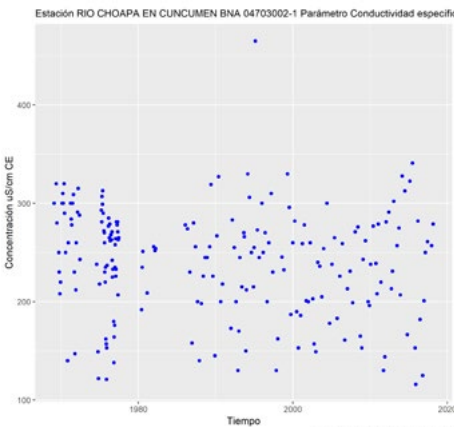


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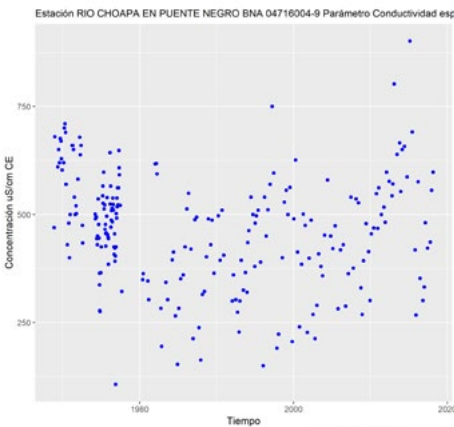


fig04716004-9Conductividad_especifica_.png

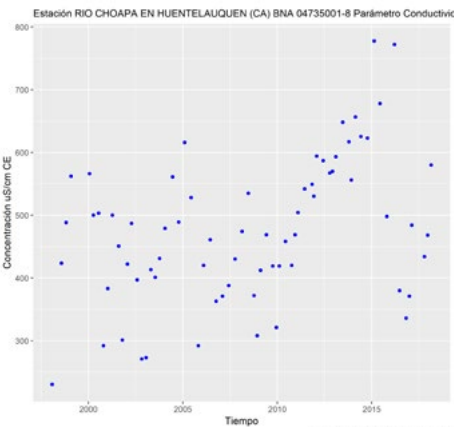
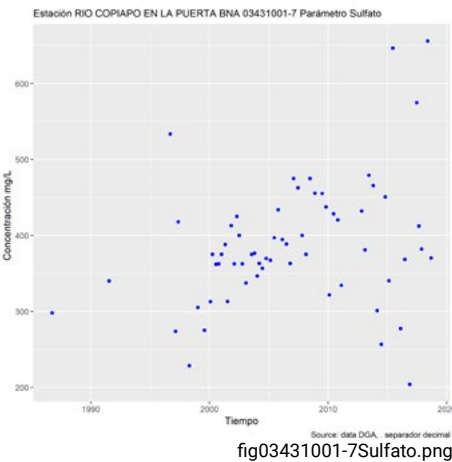
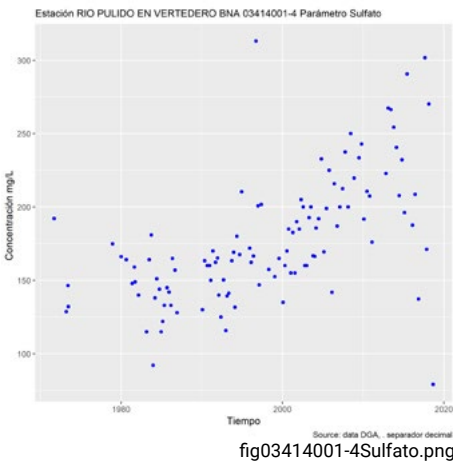
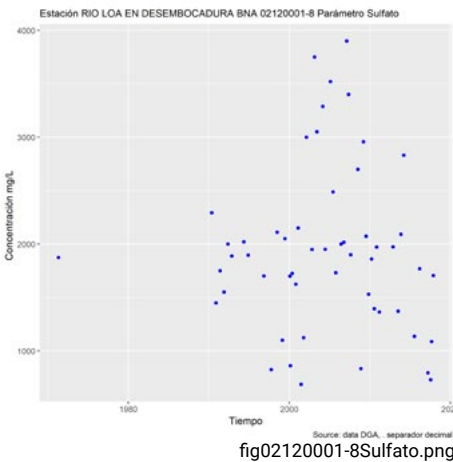
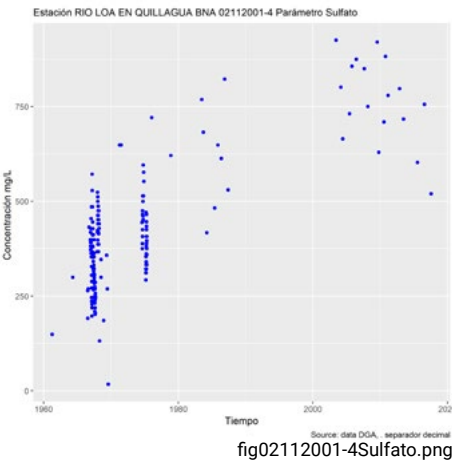
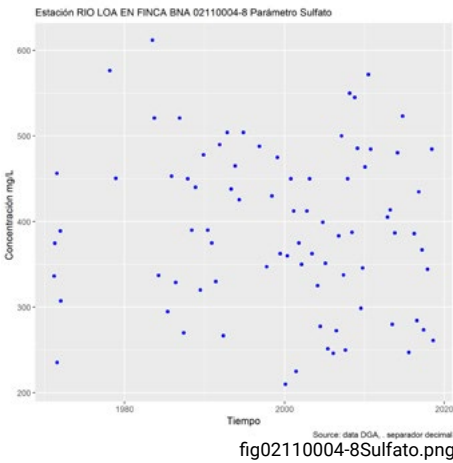
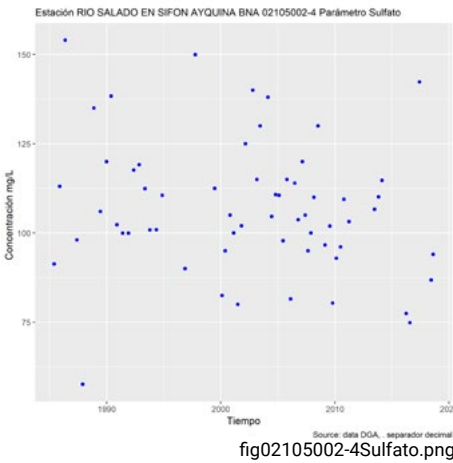
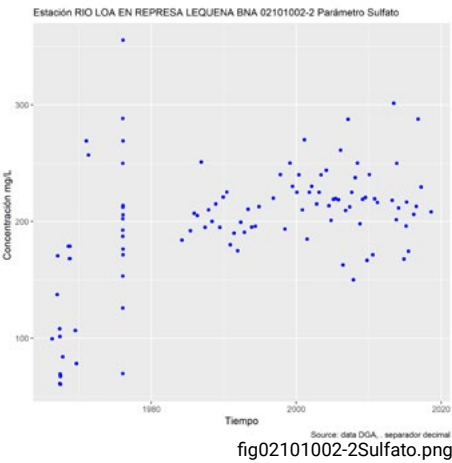
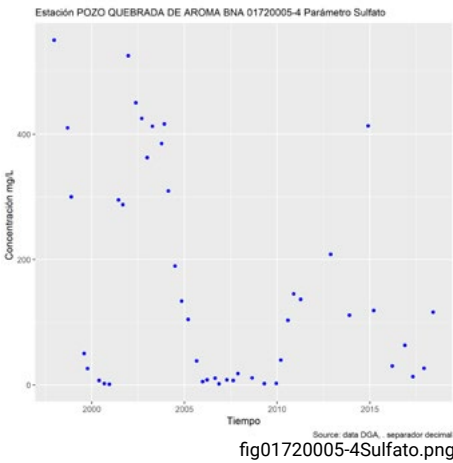
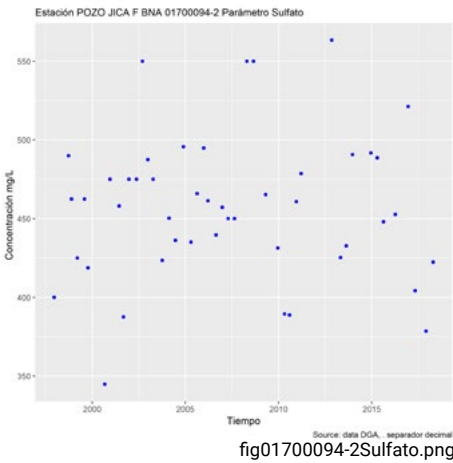
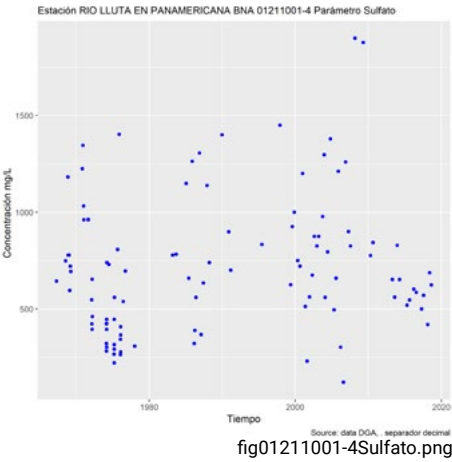
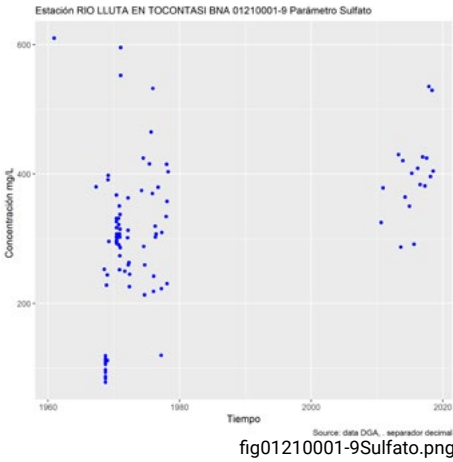
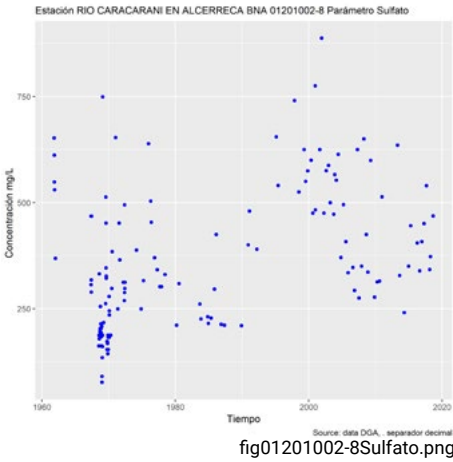


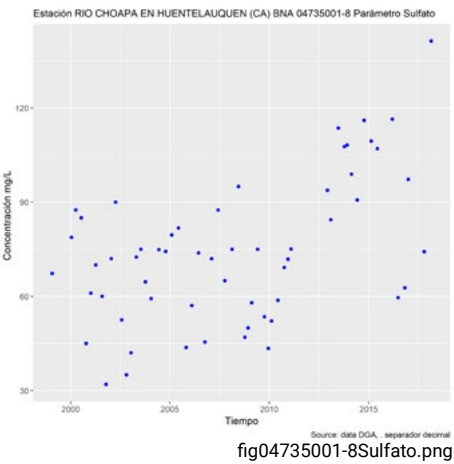
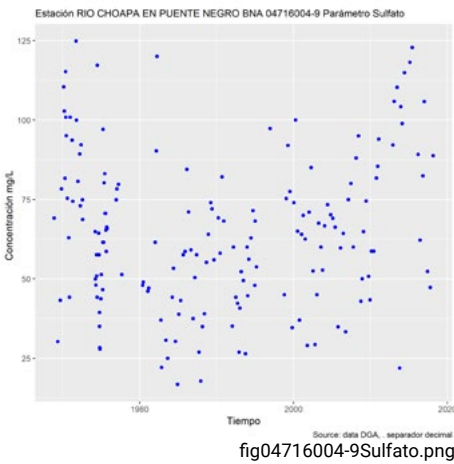
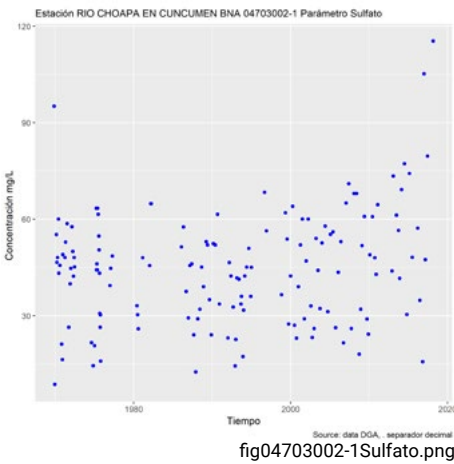
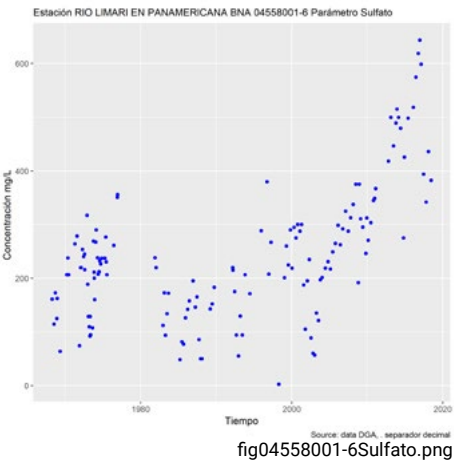
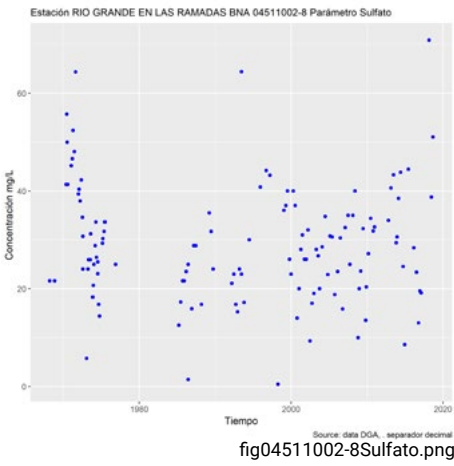
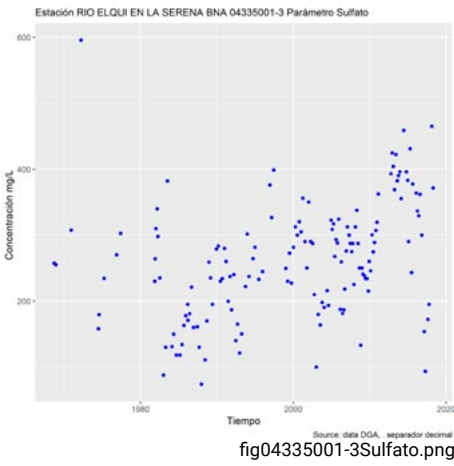
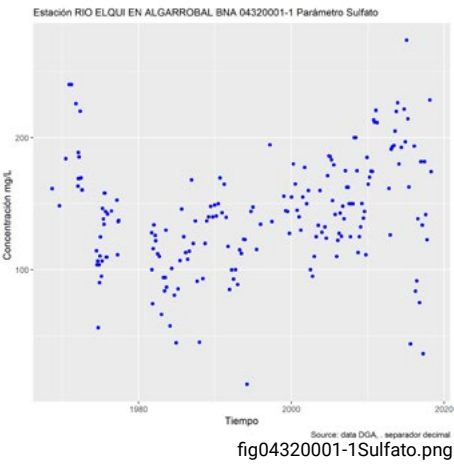
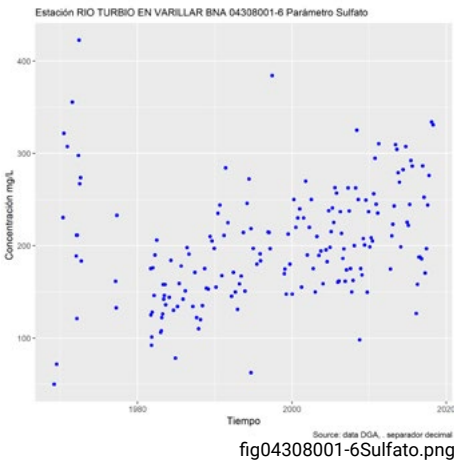
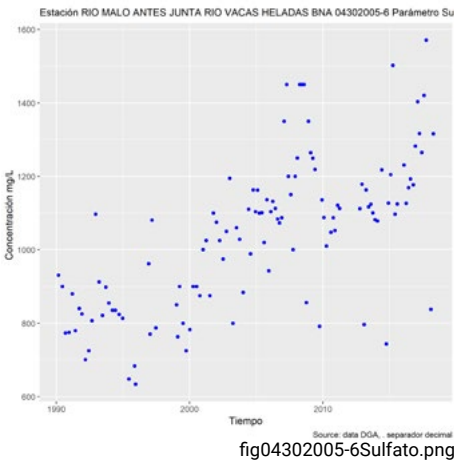
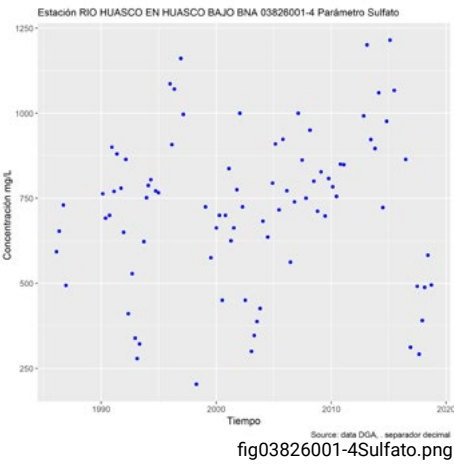
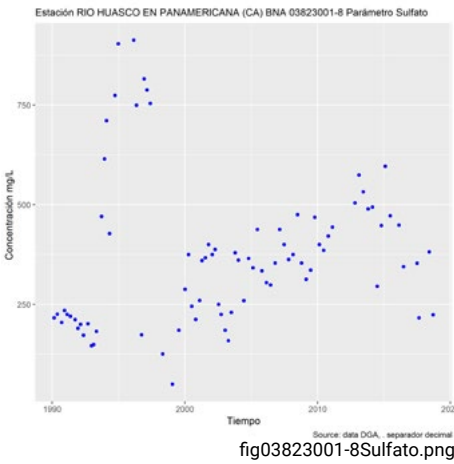
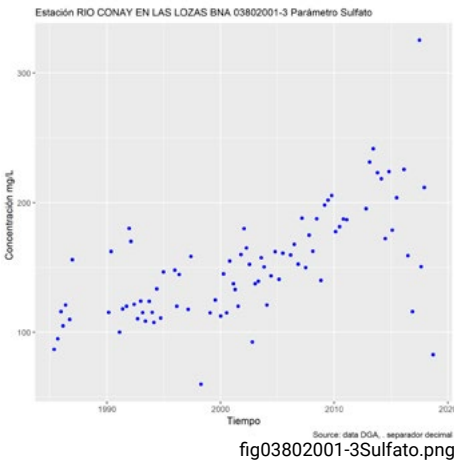
fig04735001-8Conductividad_especifica_.png



46 – 1.1 Gráficos – Evolución Macrozona Norte – Sulfato



46 -1.2 Gráficos - Evolución Macrozona Norte - Sulfato



47. EVOLUCIÓN MACROZONA NORTE - CLORURO



47 - 1.1 Gráficos - Evolución Macrozona Norte - Cloruro

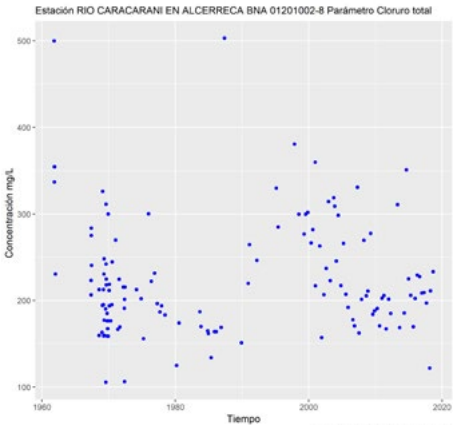


fig01201002-8Cloruro_total.png

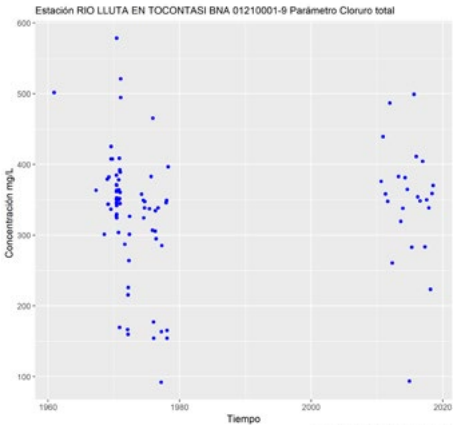


fig01210001-9Cloruro_total.png

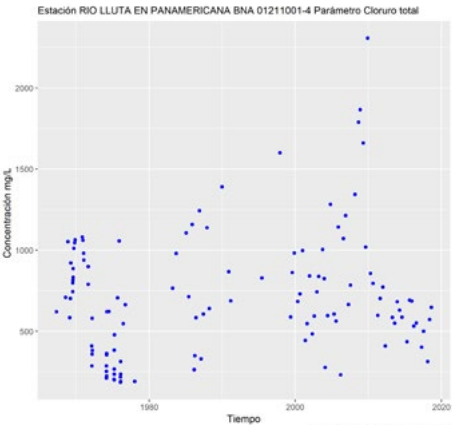


fig01211001-4Cloruro_total.png

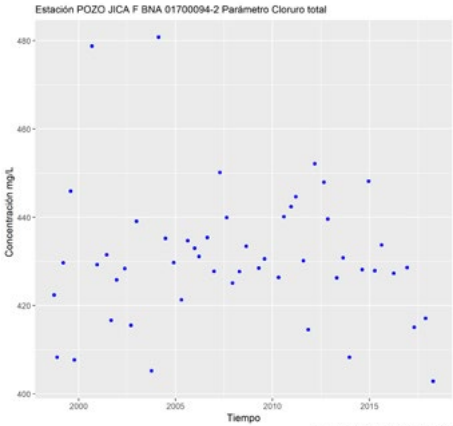


fig01700094-2Cloruro_total.png

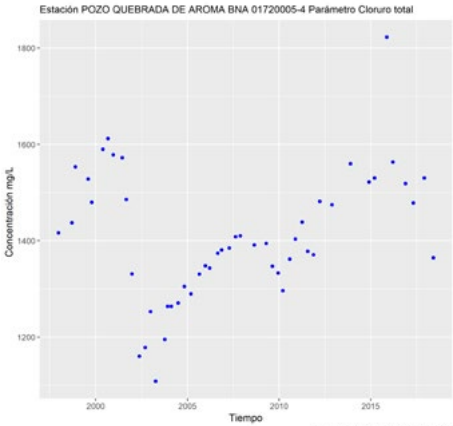


fig01720005-4Cloruro_total.png

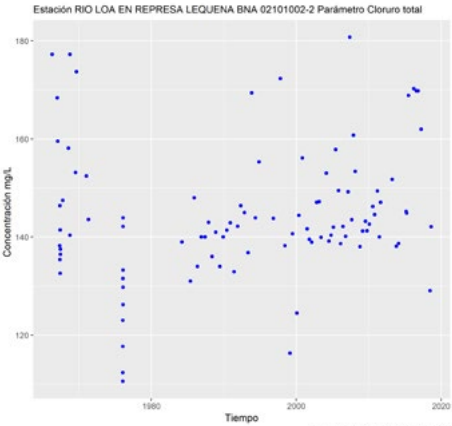


fig02101002-2Cloruro_total.png

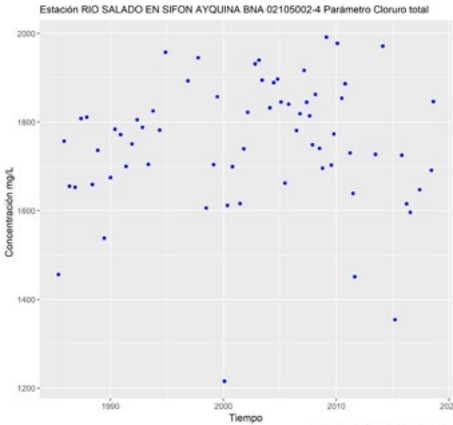


fig02105002-4Cloruro_total.png

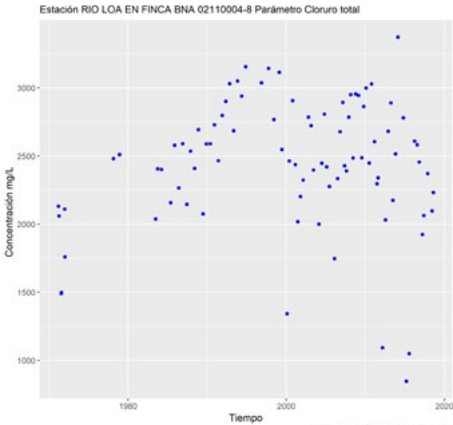


fig02110004-8Cloruro_total.png

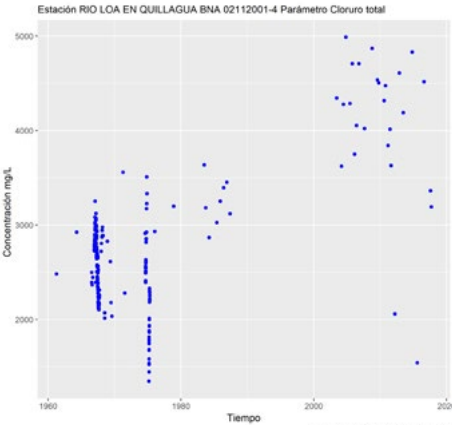


fig02112001-4Cloruro_total.png

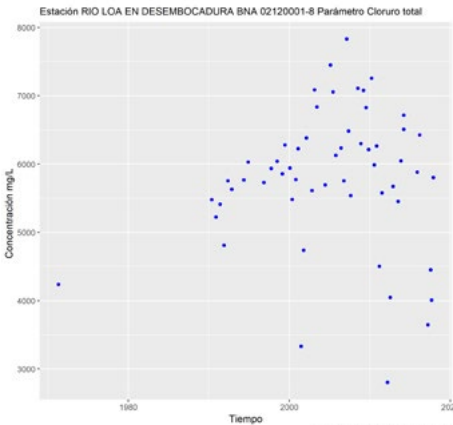


fig02120001-8Cloruro_total.png

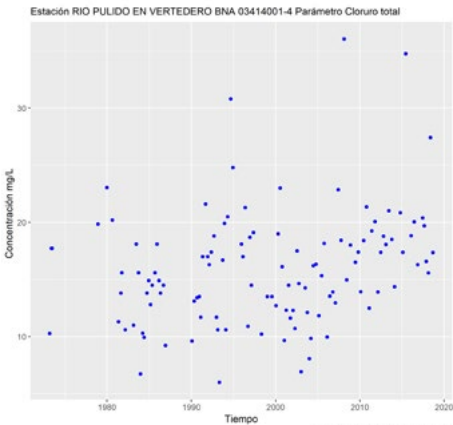


fig03414001-4Cloruro_total.png

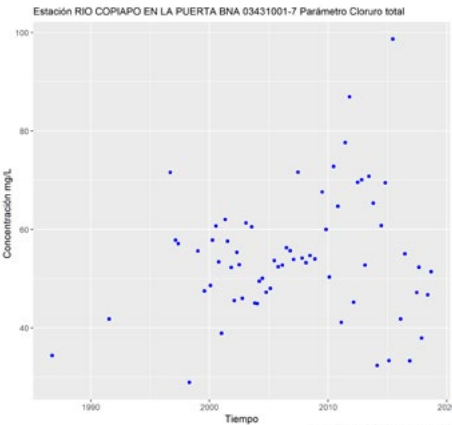


fig03431001-7Cloruro_total.png

47 – 1.2 Gráficos – Evolución Macrozona Norte – Cloruro

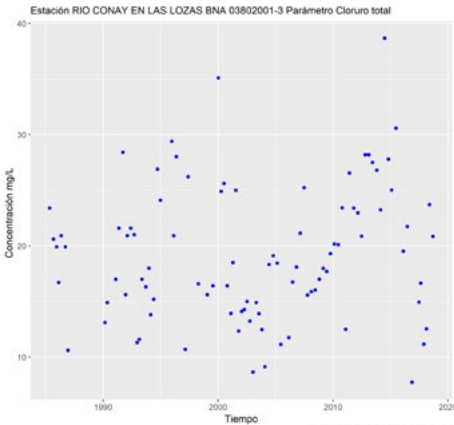


fig03802001-3Cloruro_total.png

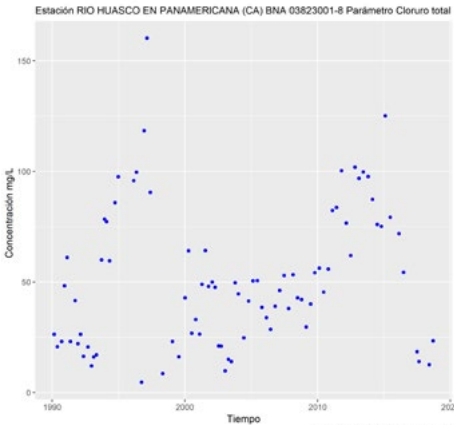


fig03823001-8Cloruro_total.png

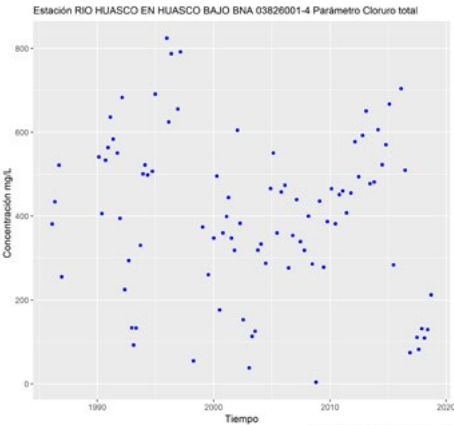


fig03826001-4Cloruro_total.png

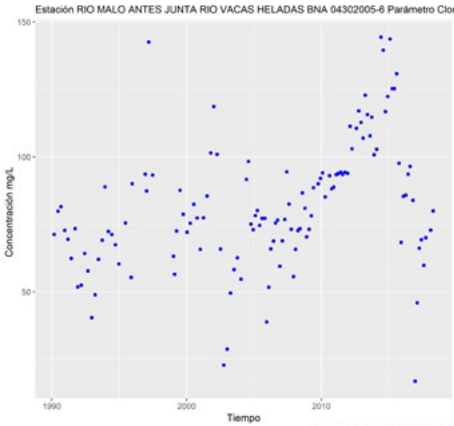


fig04302005-6Cloruro_total.png

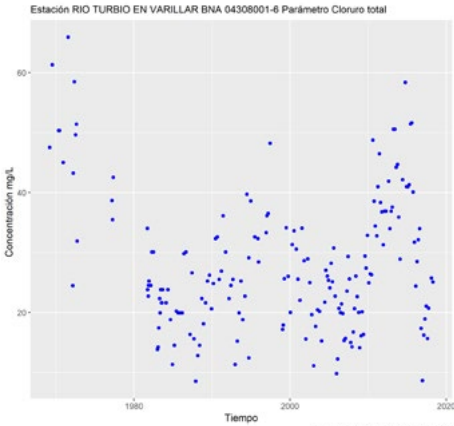


fig04308001-6Cloruro_total.png

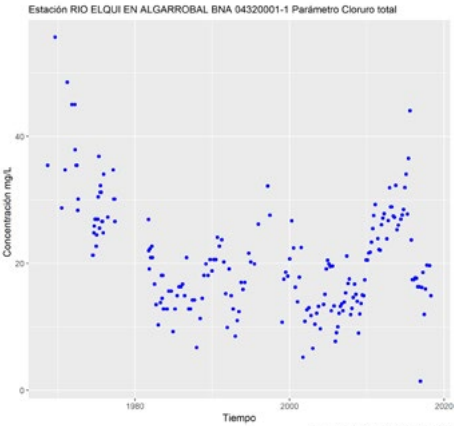


fig04320001-1Cloruro_total.png

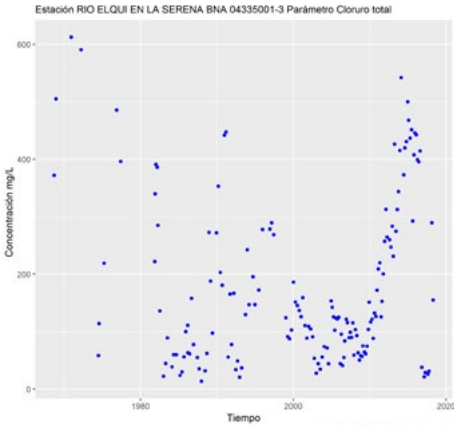


fig04335001-3Cloruro_total.png

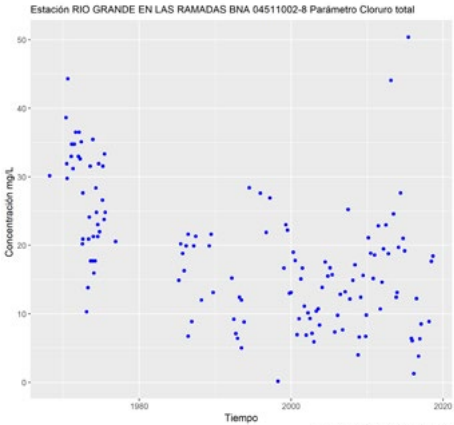


fig04511002-8Cloruro_total.png

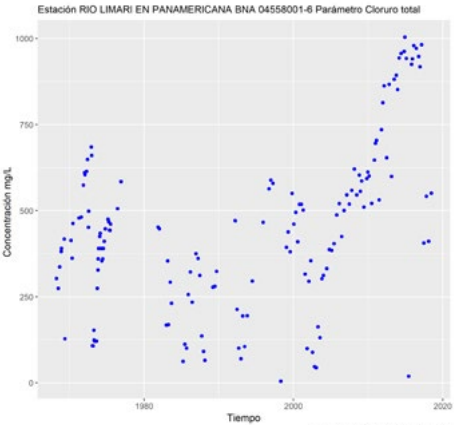


fig04558001-6Cloruro_total.png

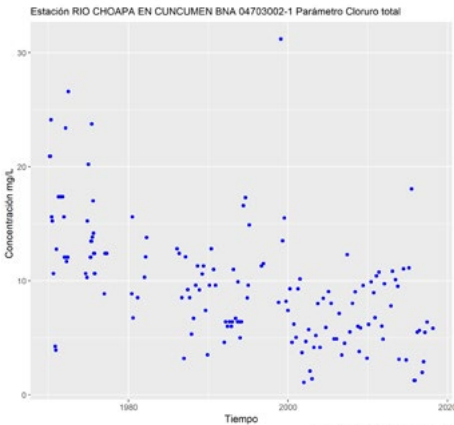


fig04703002-1Cloruro_total.png

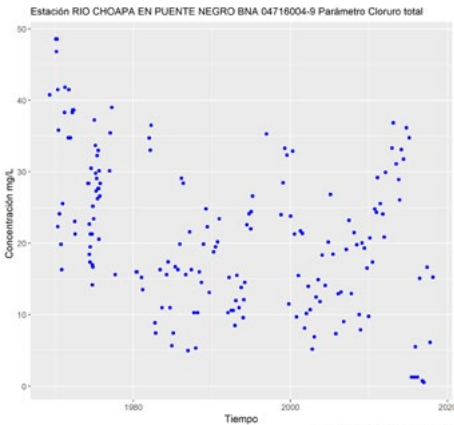


fig04716004-9Cloruro_total.png

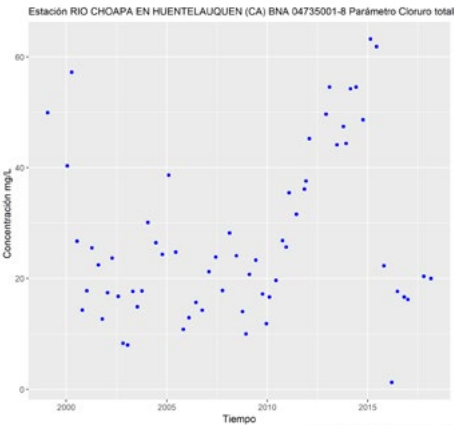


fig04735001-8Cloruro_total.png

48. EVOLUCIÓN MACROZONA NORTE - TEMPERATURA



48 – 1.1 Gráficos – Evolución Macrozona Norte – Temperatura

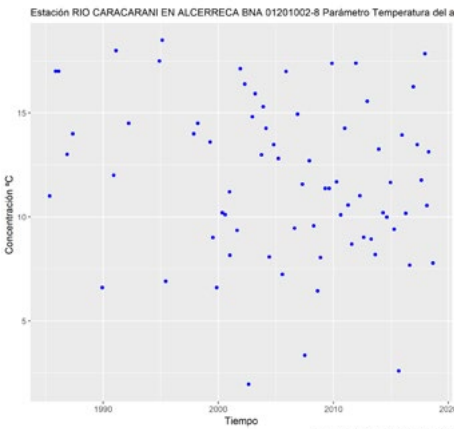


fig01201002-8Temperatura_del_agua.png

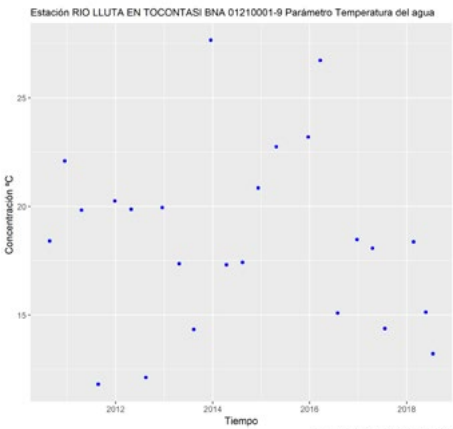


fig01210001-9Temperatura_del_agua.png

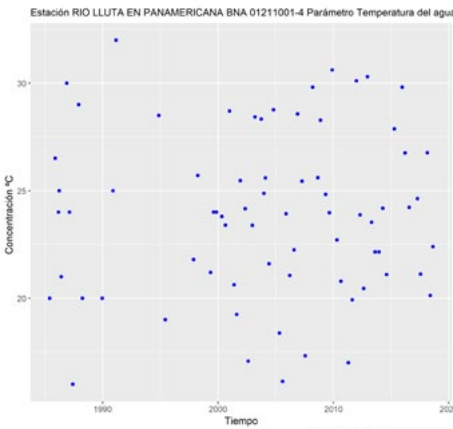


fig01211001-4Temperatura_del_agua.png

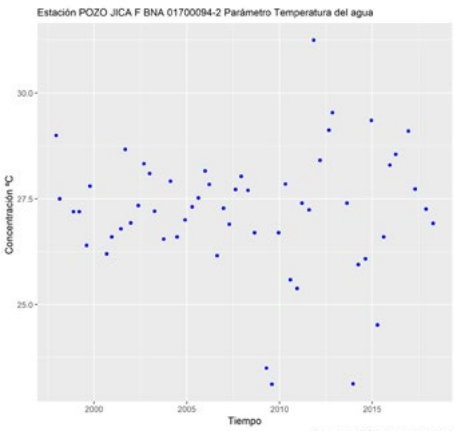


fig01700094-2Temperatura_del_agua.png

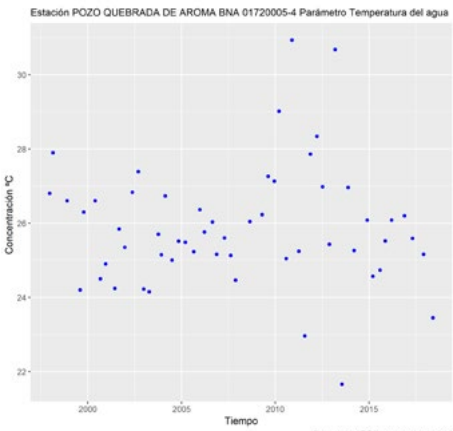


fig01720005-4Temperatura_del_agua.png

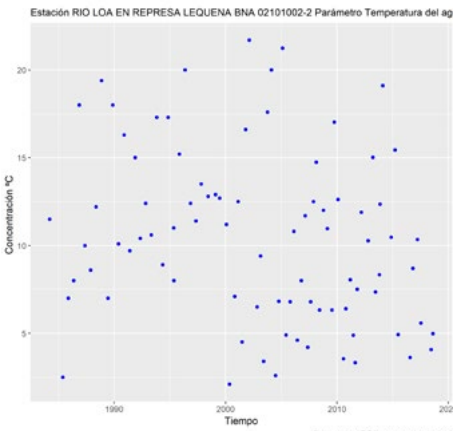


fig02101002-2Temperatura_del_agua.png

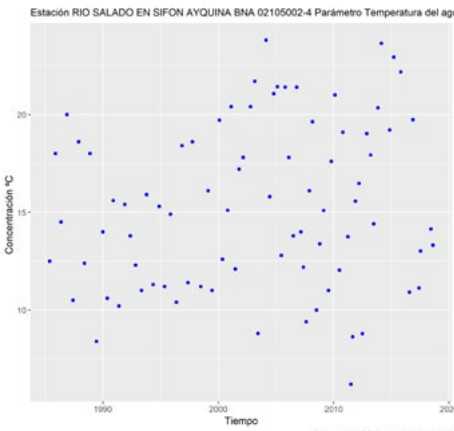


fig02105002-4Temperatura_del_agua.png

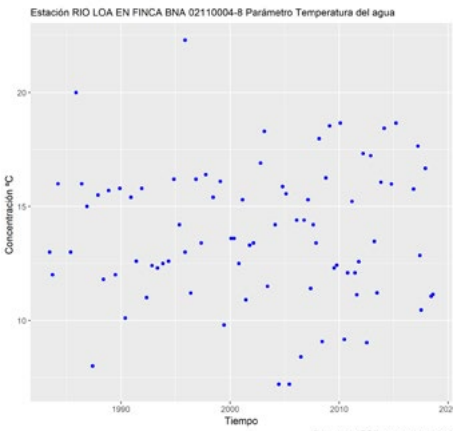


fig02110004-8Temperatura_del_agua.png

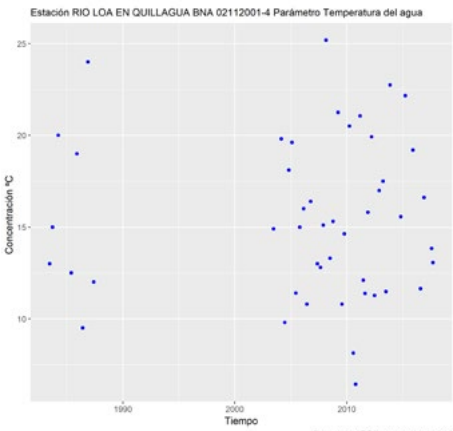


fig02112001-4Temperatura_del_agua.png

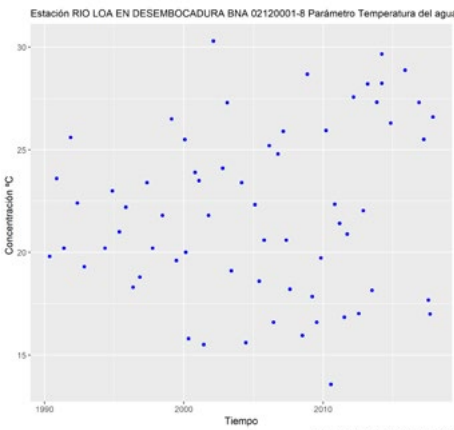


fig02120001-8Temperatura_del_agua.png

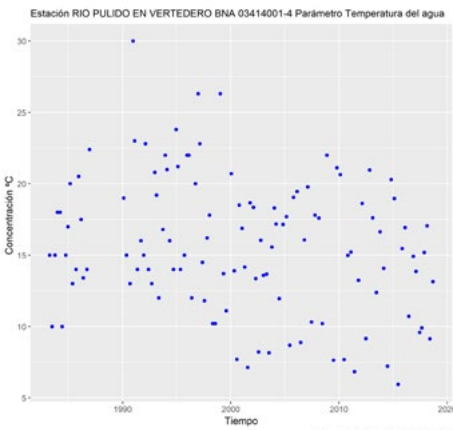


fig03414001-4Temperatura_del_agua.png

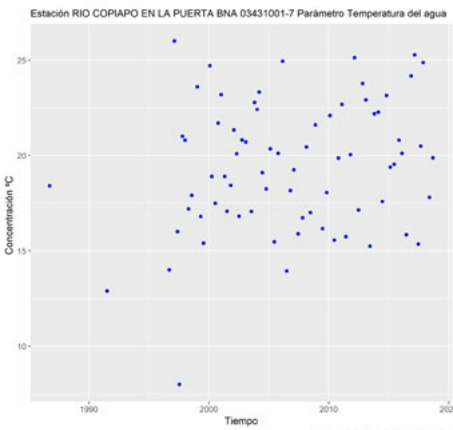


fig03431001-7Temperatura_del_agua.png

48 - 1.2 Gráficos - Evolución Macrozona Norte - Temperatura

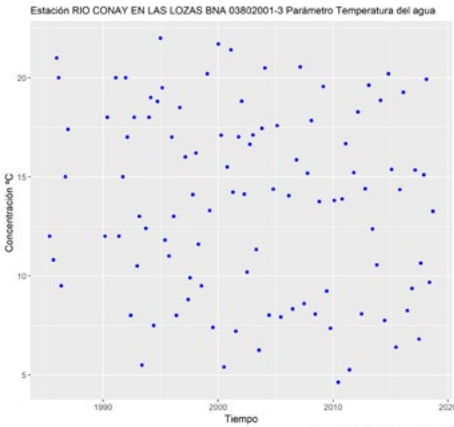


fig03802001-3Temperatura_del_agua.png

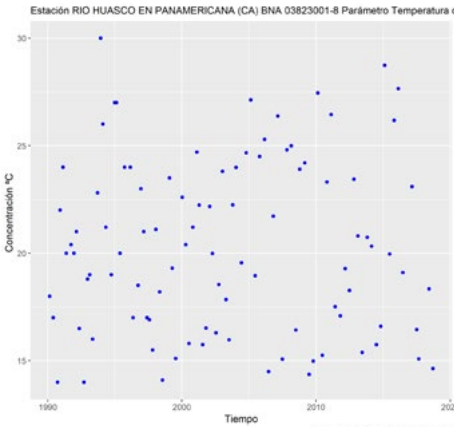


fig03823001-8Temperatura_del_agua.png

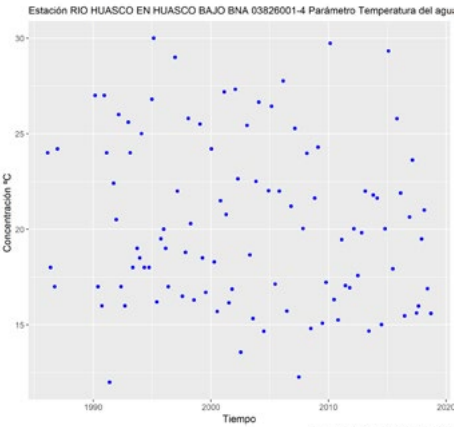


fig03826001-4Temperatura_del_agua.png

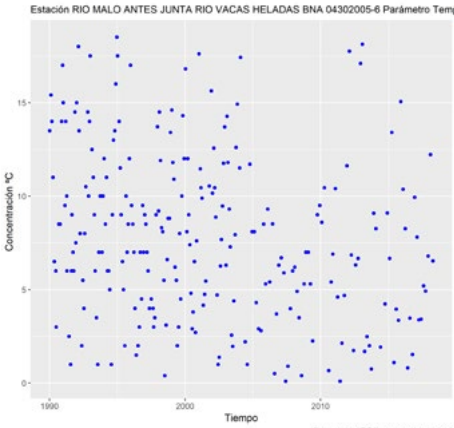


fig04302005-6Temperatura_del_agua.png



fig04308001-6Temperatura_del_agua.png

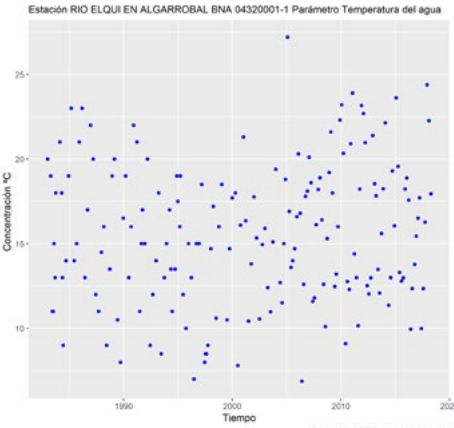


fig04320001-1Temperatura_del_agua.png

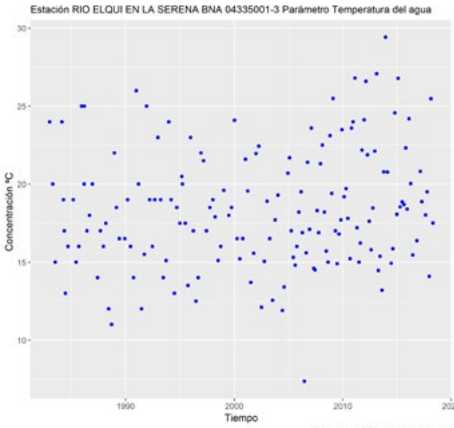


fig04335001-3Temperatura_del_agua.png

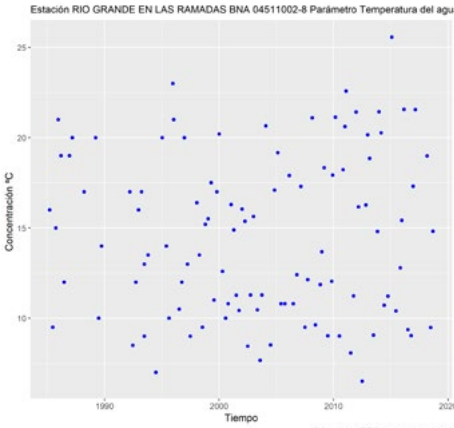


fig04511002-8Temperatura_del_agua.png

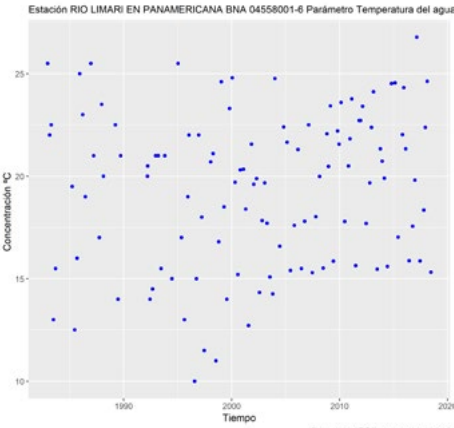


fig04558001-6Temperatura_del_agua.png

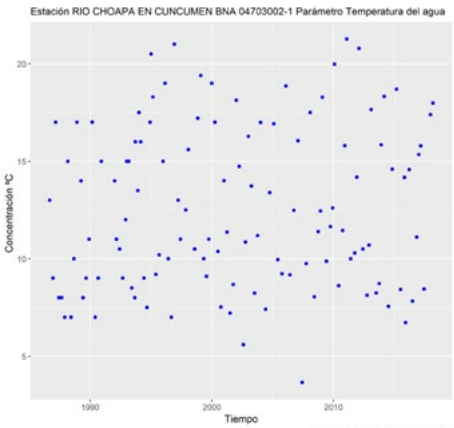


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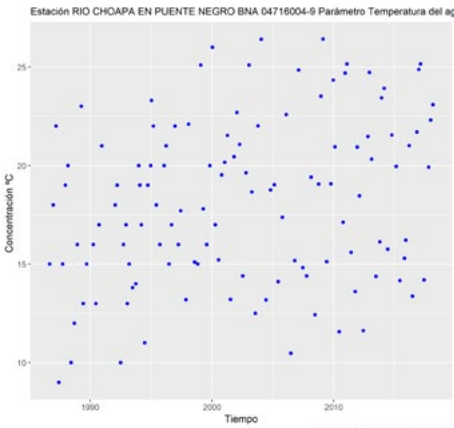


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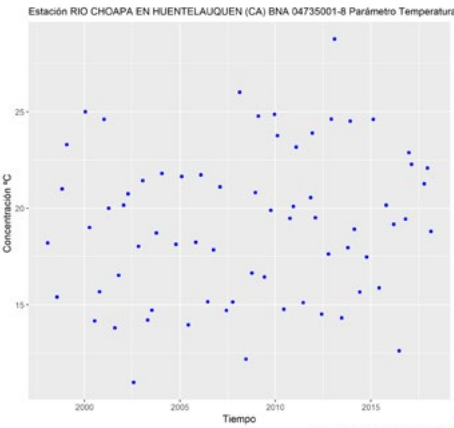
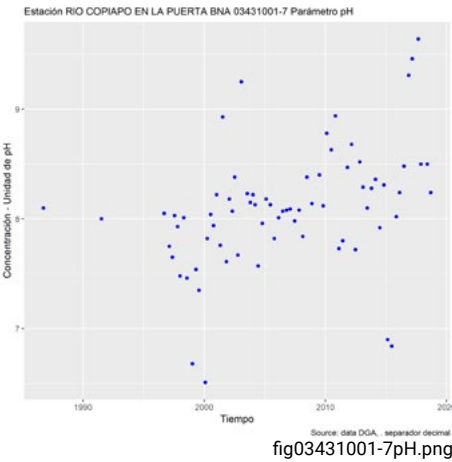
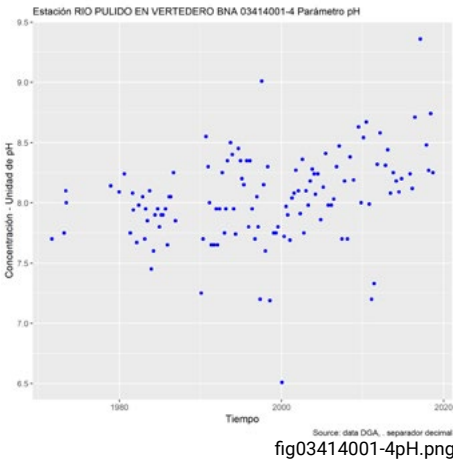
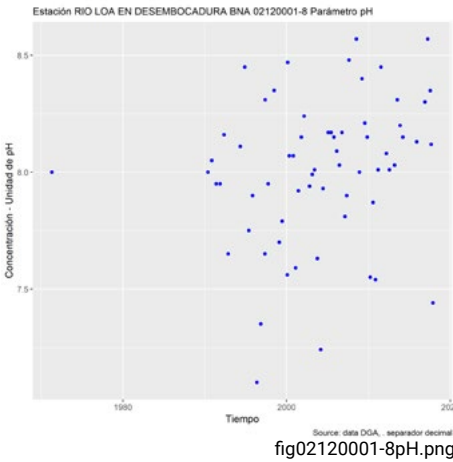
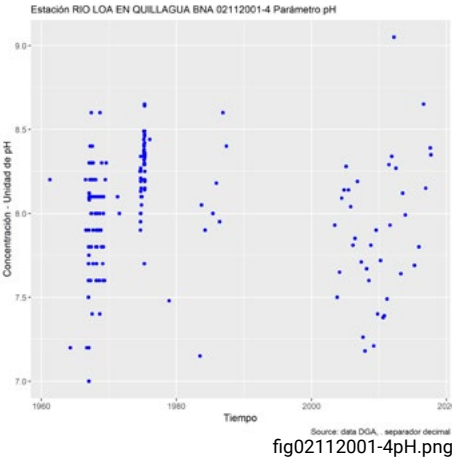
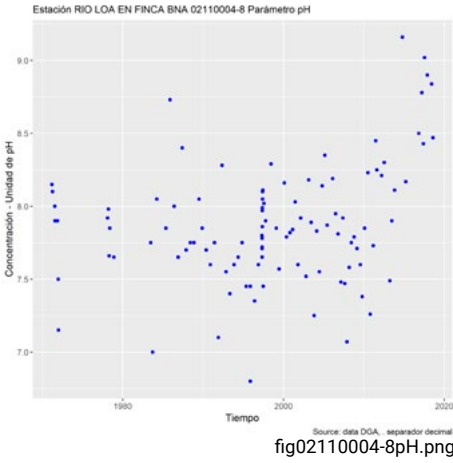
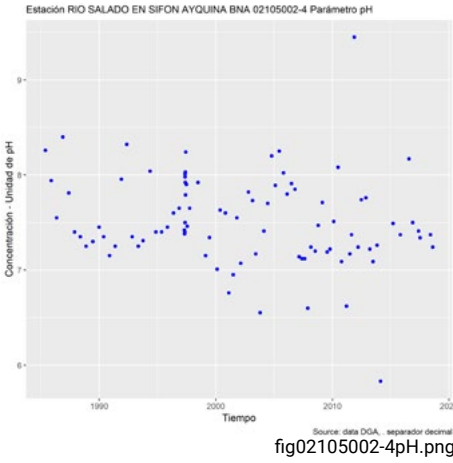
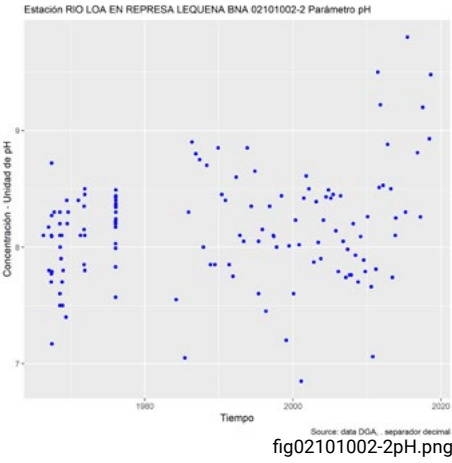
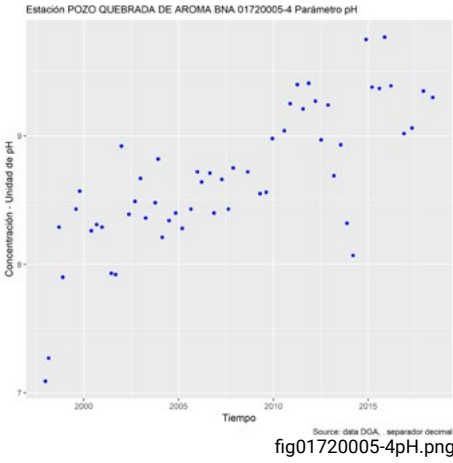
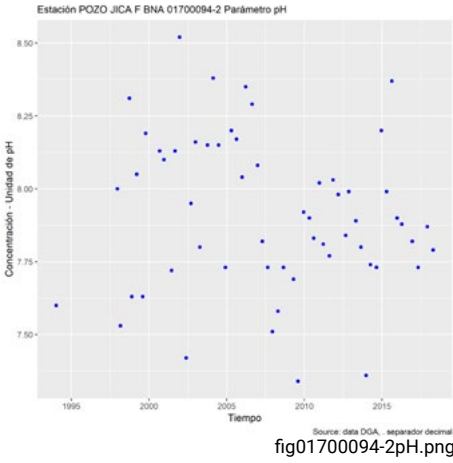
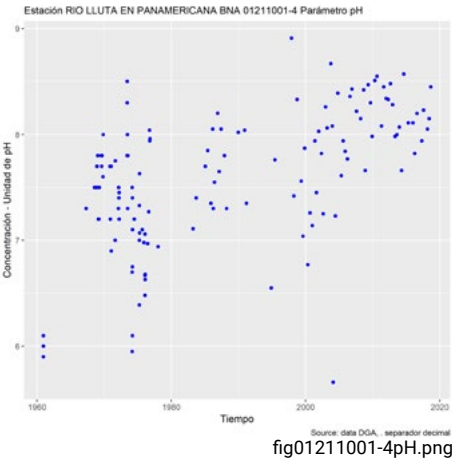
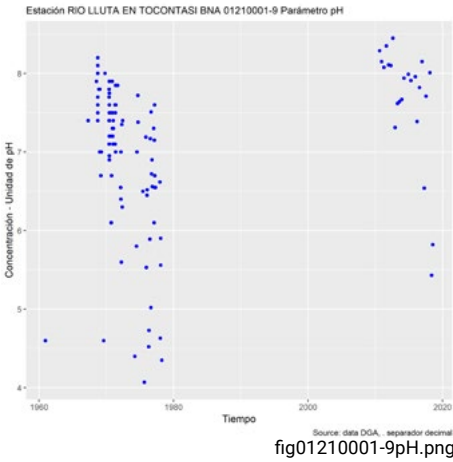
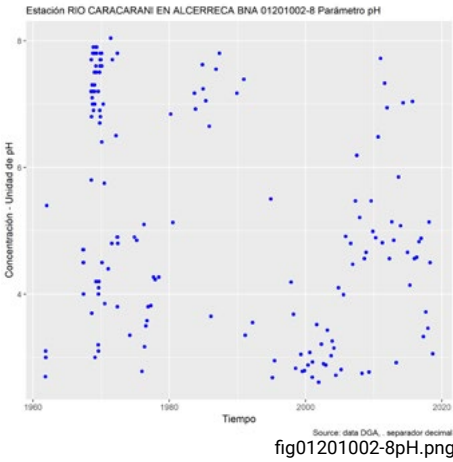


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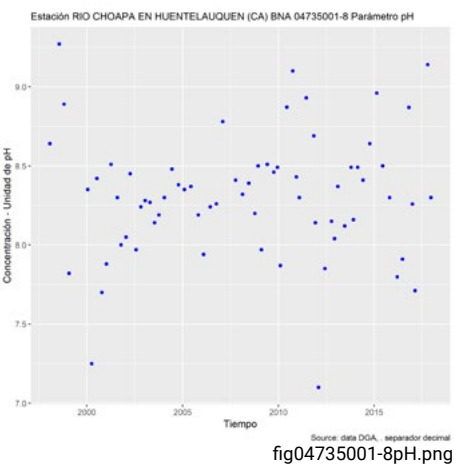
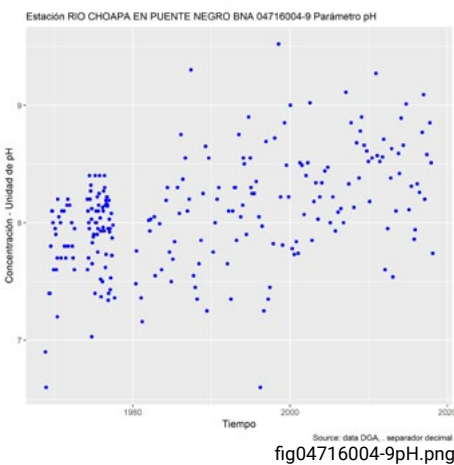
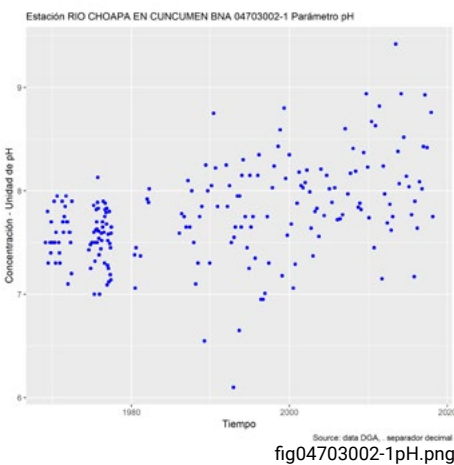
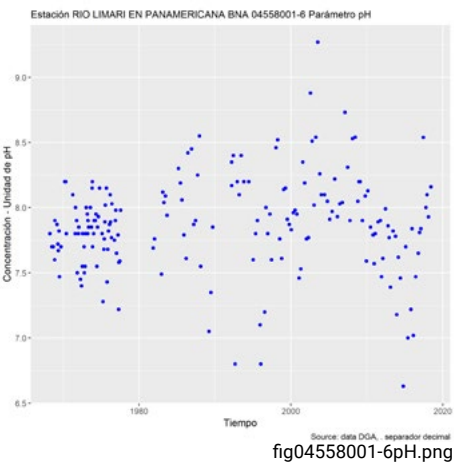
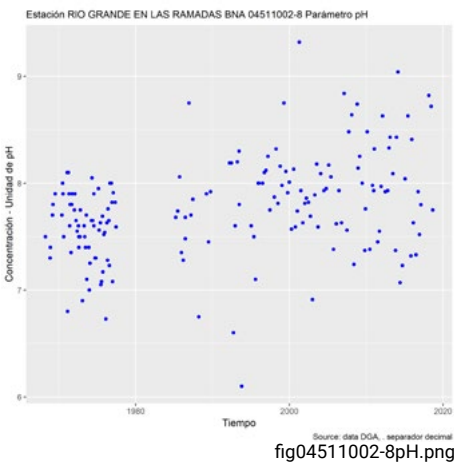
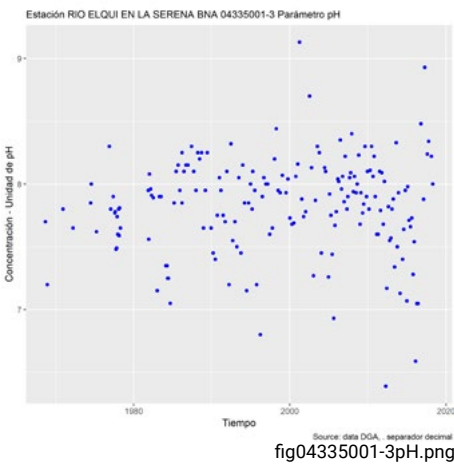
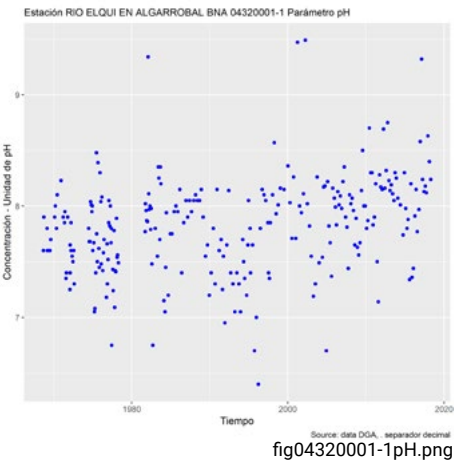
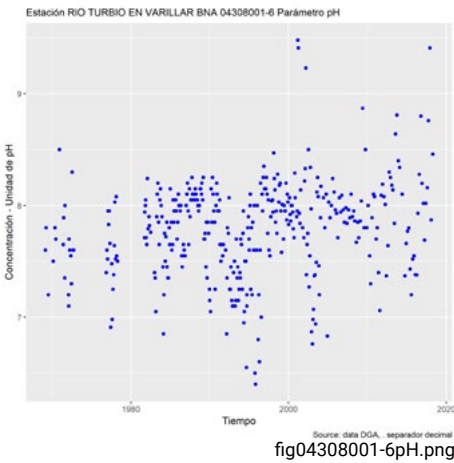
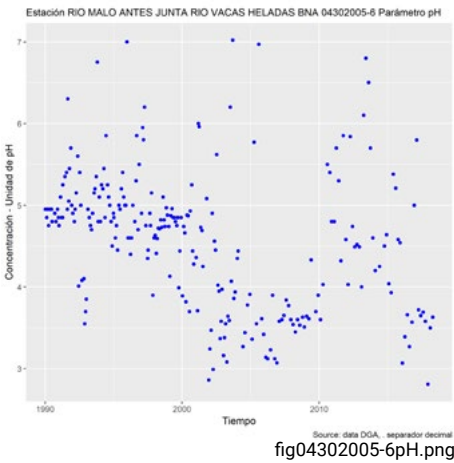
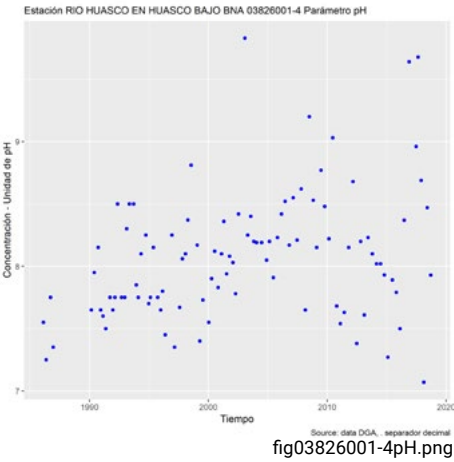
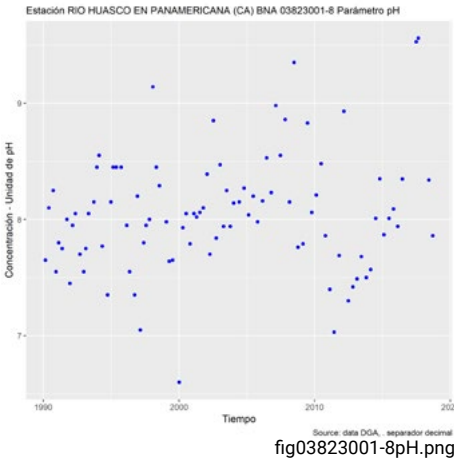
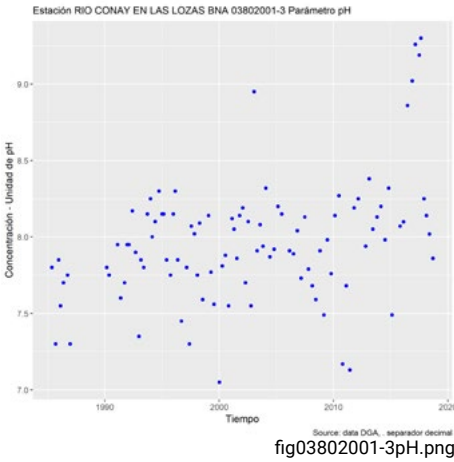
49. EVOLUCIÓN MACROZONA NORTE - PH



49 - 1.1 Gráficos - Evolución Macrozona Norte - PH



49 – 1.2 Gráficos – Evolución Macrozona Norte – PH



50. EVOLUCIÓN MACROZONA NORTE - HIERRO



51. EVOLUCIÓN MACROZONA CENTRO - ARSÉNICO



51 - 1.1 Gráficos - Evolución Macrozona Centro - Arsénico

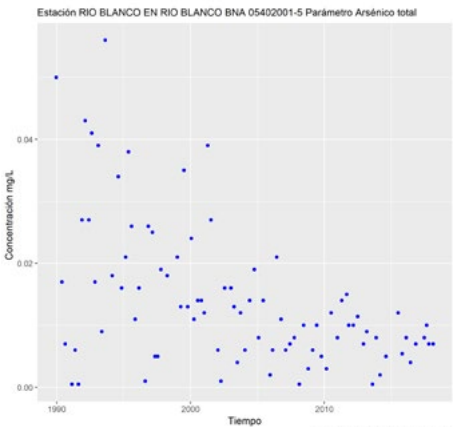


fig05402001-5Arsenico_total.png

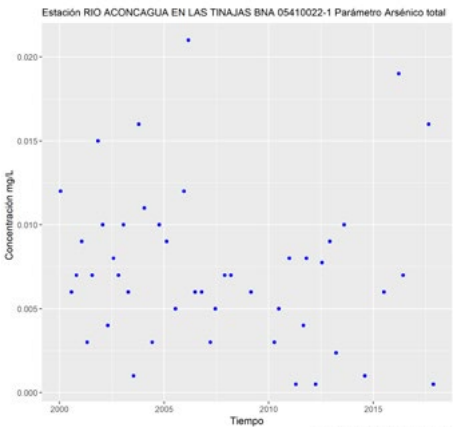


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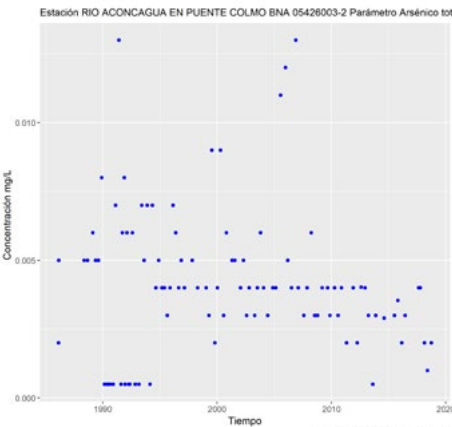


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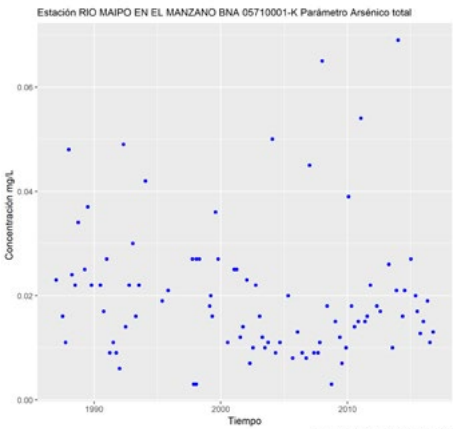


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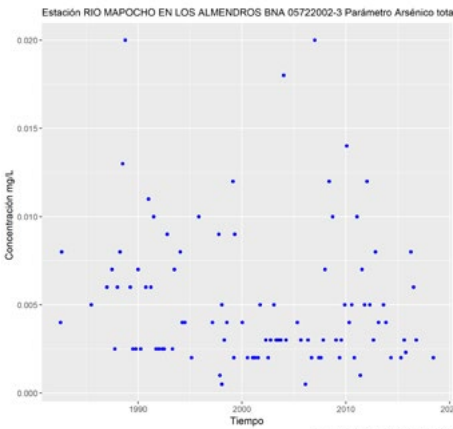


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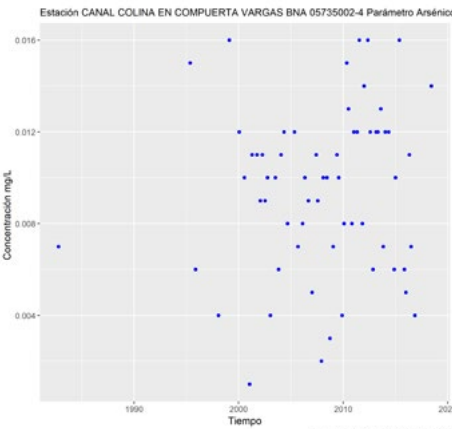


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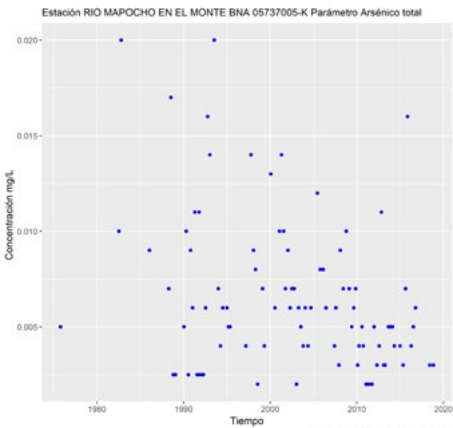


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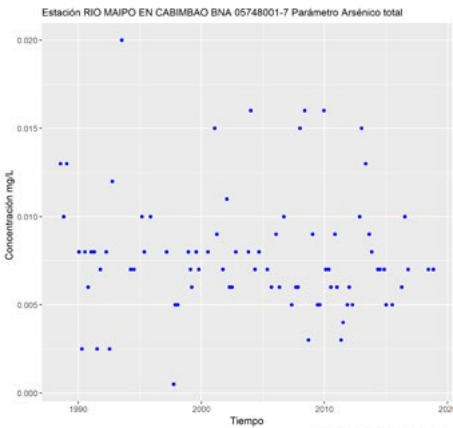


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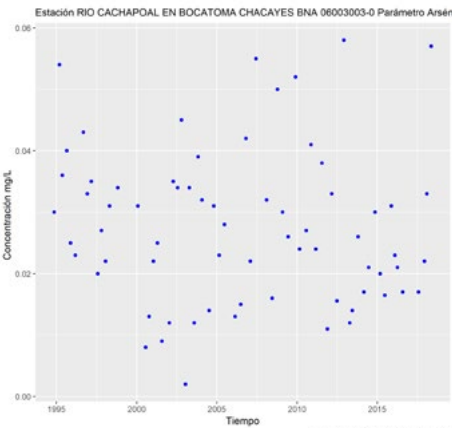


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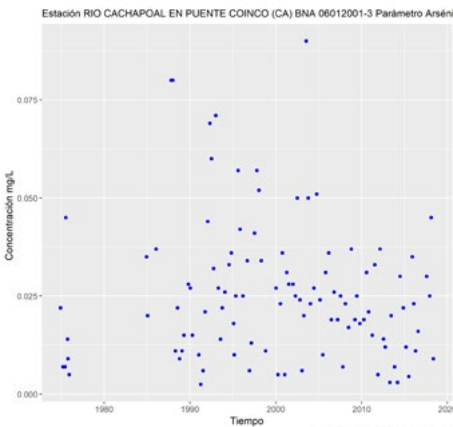


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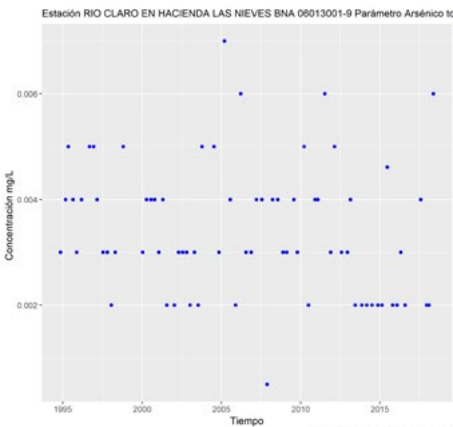


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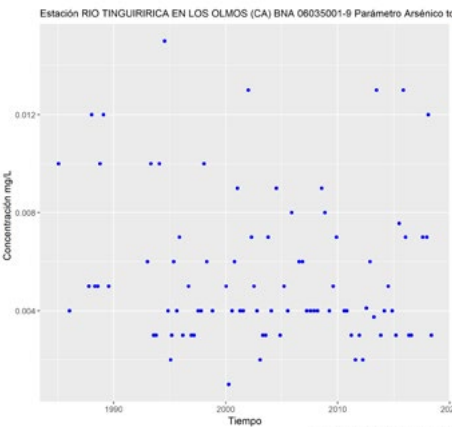


fig06035001-9Arsenico_total.png

51 – 1.2 Gráficos – Evolución Macrozona Centro – Arsénico

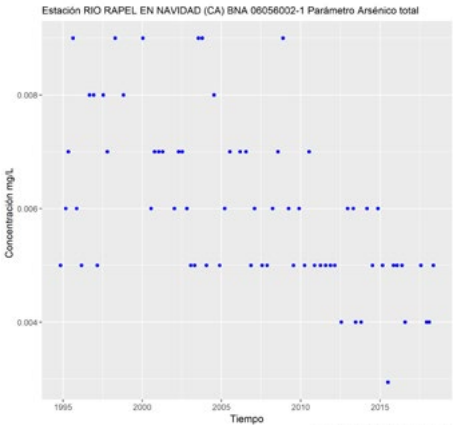


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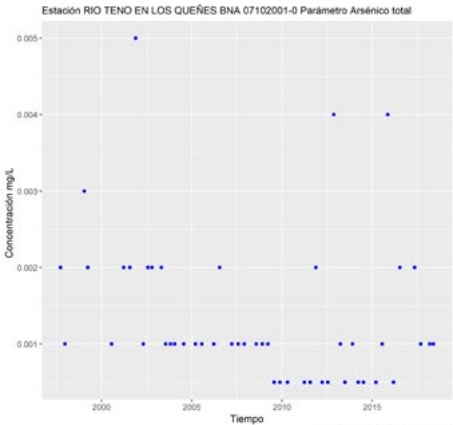


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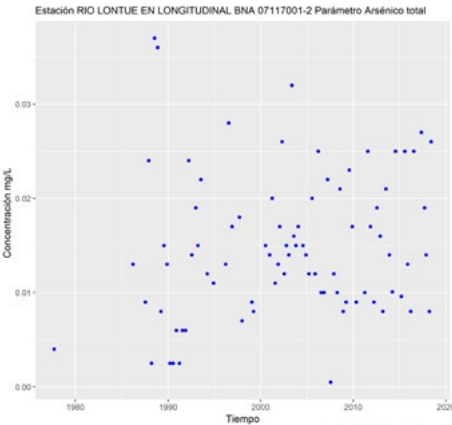


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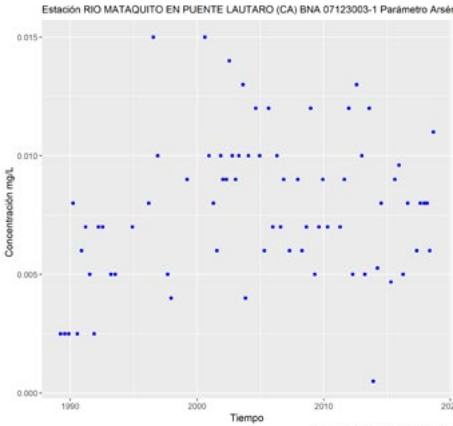


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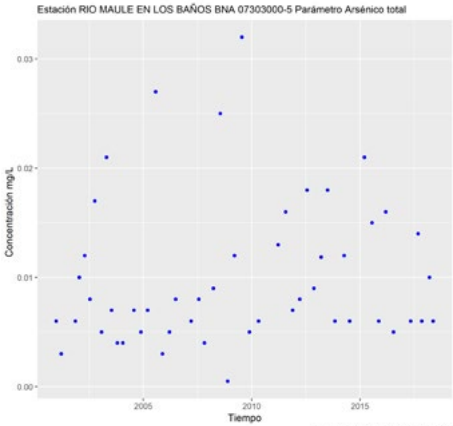


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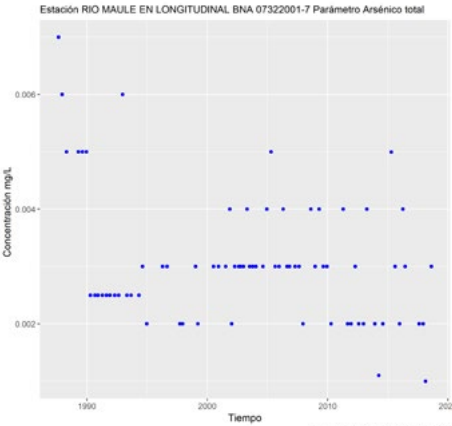


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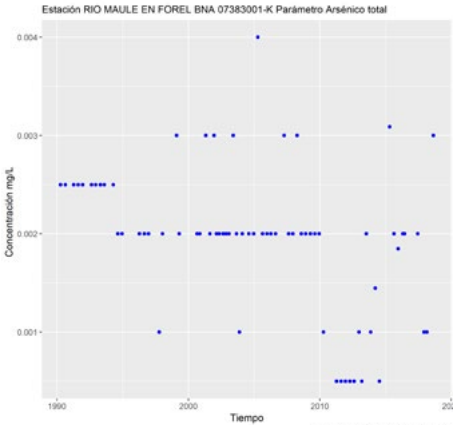


fig07383001-KArsenico_total.png

Mapa de Evolución Conductividad Macrozona Centro

LEYENDA

- ▲ Centros Montañosos
- Capital Regional
- ◻ Capital provincial
- Comunas
- Estaciones Superficiales
- Ríos Principales
- Esteros Principales
- Lagos, Lagunas, Embalses
- Ciudades Principales
- Glaciares

Límites

TIPO

- Límite Internacional
- Límite Regional

0 5 10 20 30 40
Kilómetros

Indice de Gráficos

Identificador de Gráfico

1. fig05402001-5
2. fig05410022-1
3. fig05426003-2
4. fig05735002-4
5. fig05737005-K
6. fig05748001-7
7. fig06003003-0
8. fig06012001-3
9. fig06013001-9
10. fig06035001-9
11. fig06056002-1
12. fig07102001-0
13. fig07117001-2
14. fig07123003-1
15. fig07303000-5
16. fig07322001-7
17. fig07383001-K
18. fig05710001-K
19. fig05722002-3

52 – 1.1 Gráficos – Evolución Macrozona Centro – Conductividad

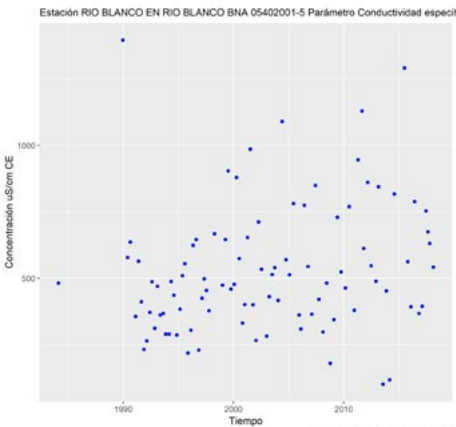


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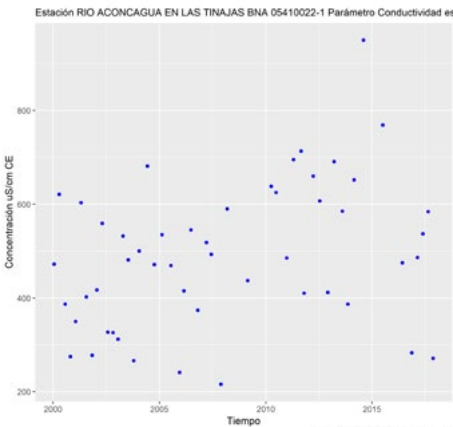


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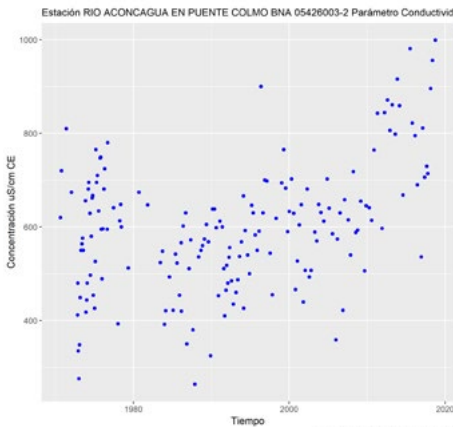


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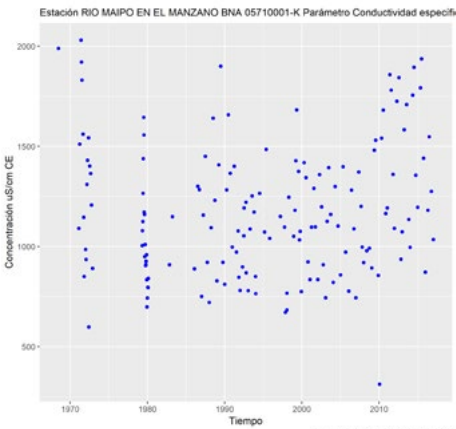


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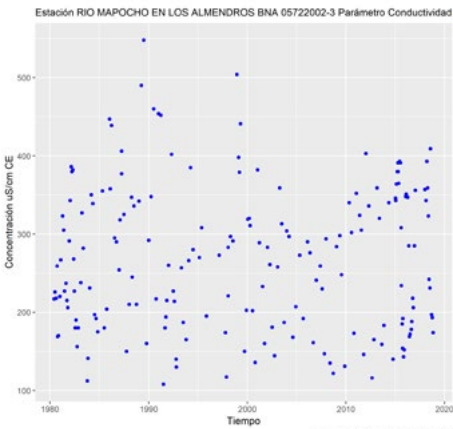


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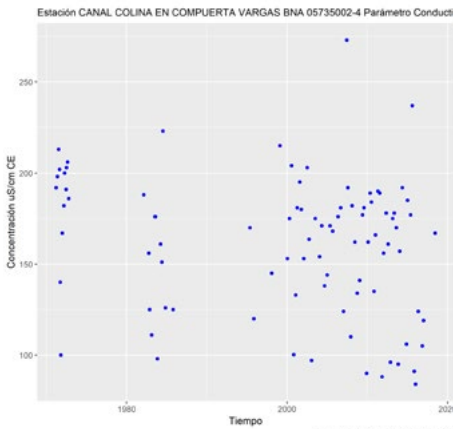


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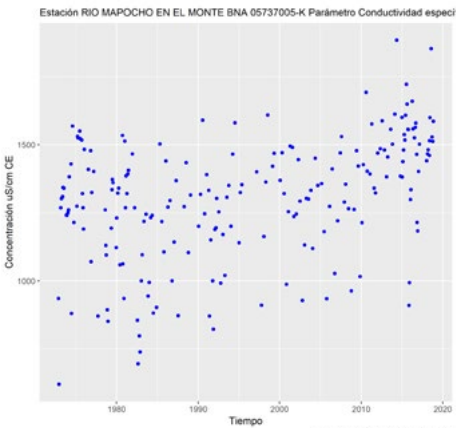


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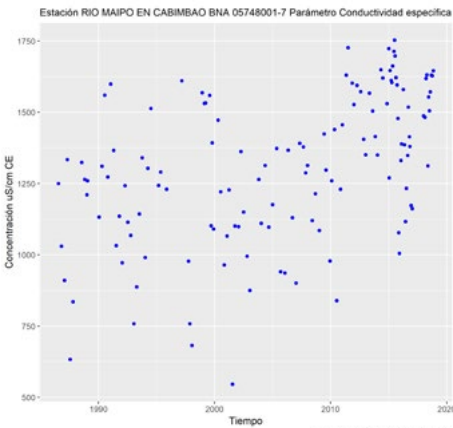


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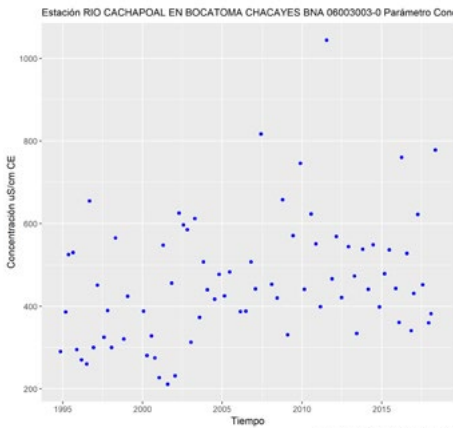


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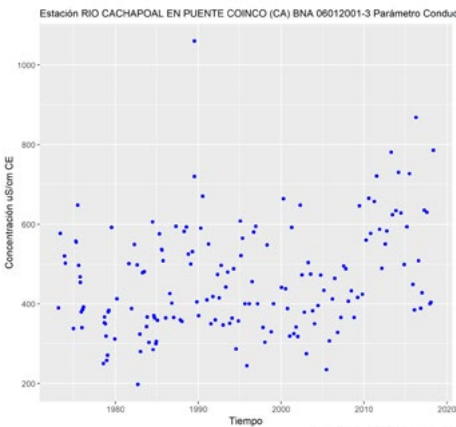


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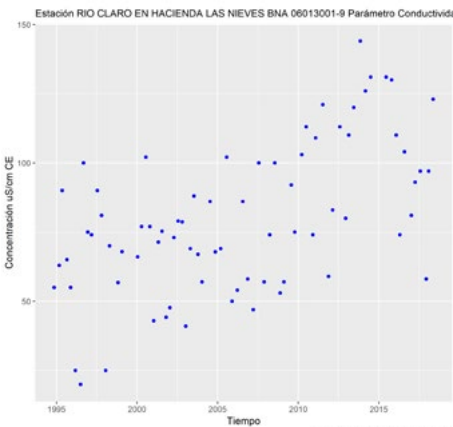


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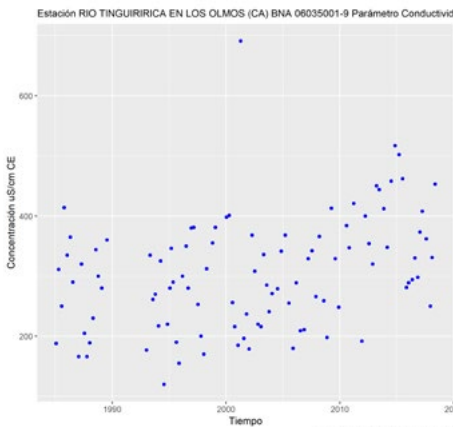


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52 - 1.2 Gráficos - Evolución Macrozona Centro - Conductividad

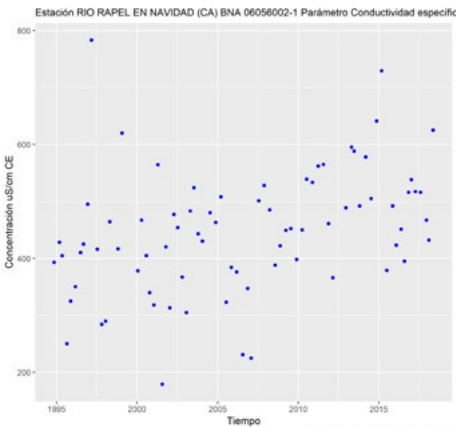


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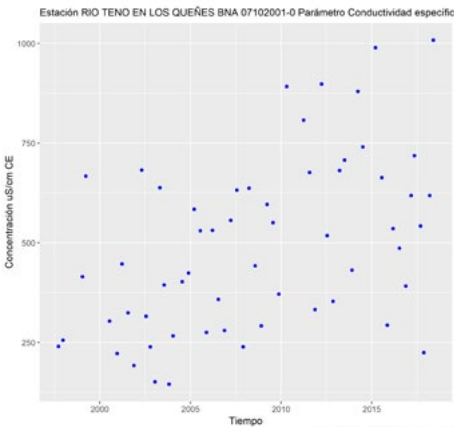


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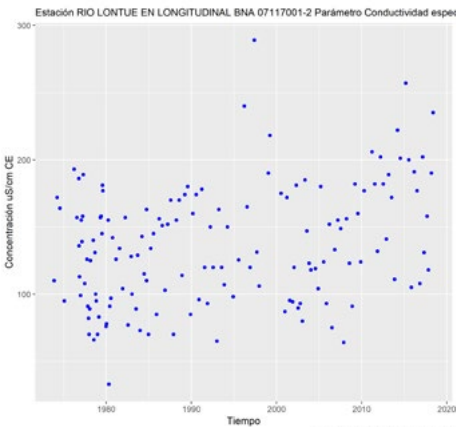


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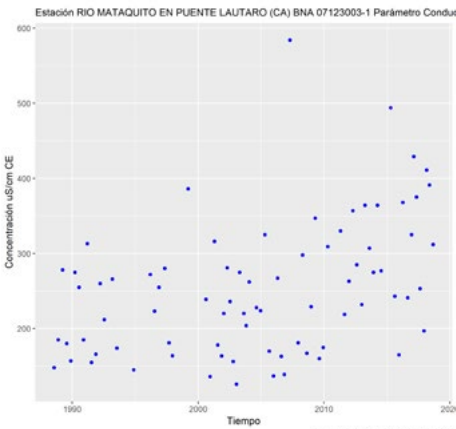


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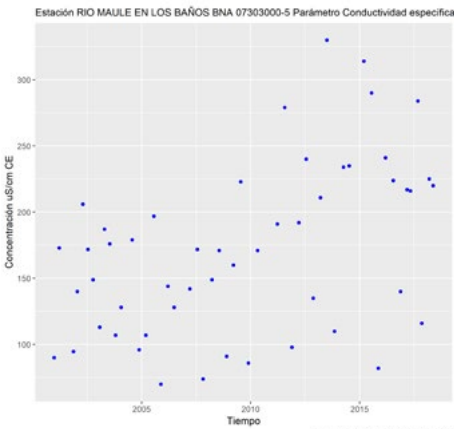


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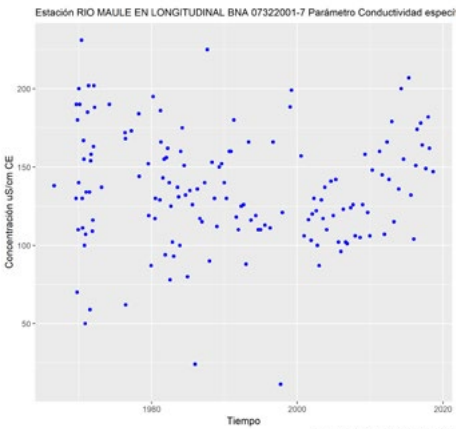


fig07322001-7Conductividad_especifica_.png

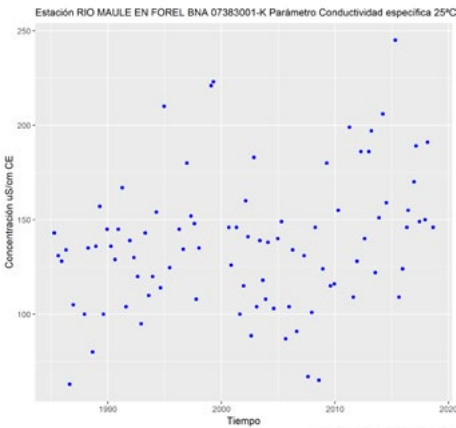
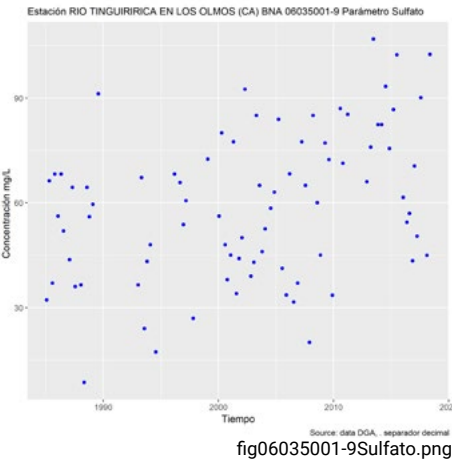
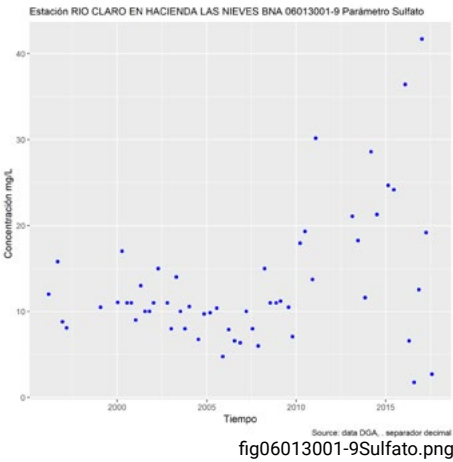
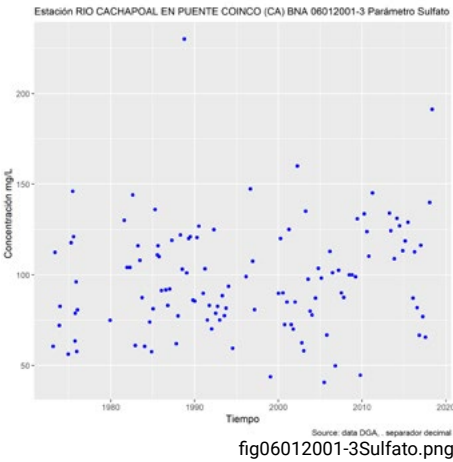
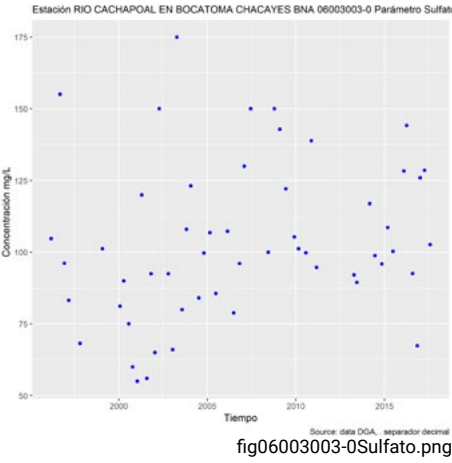
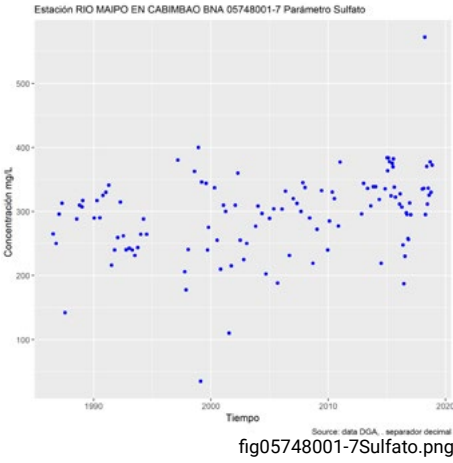
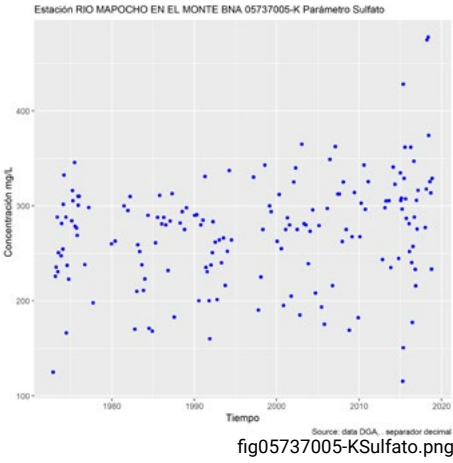
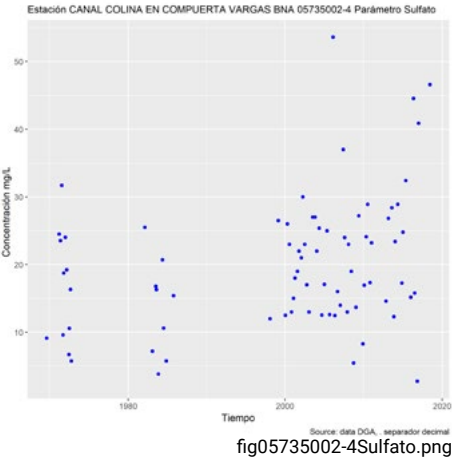
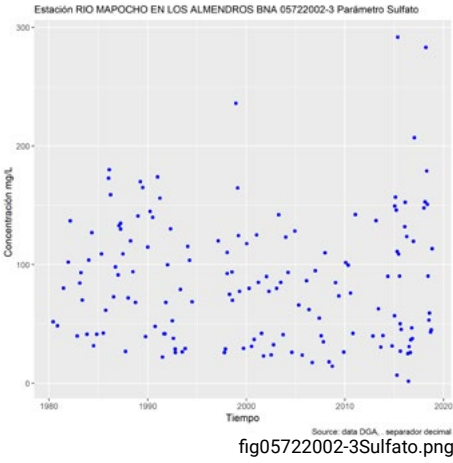
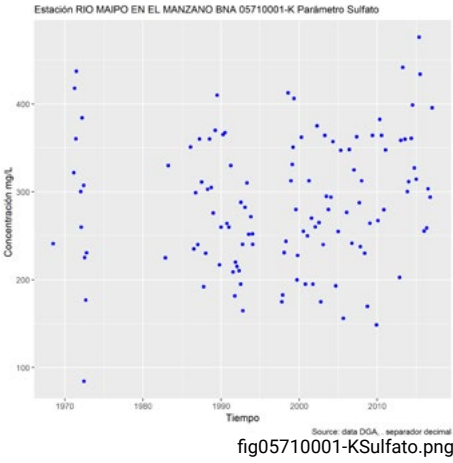
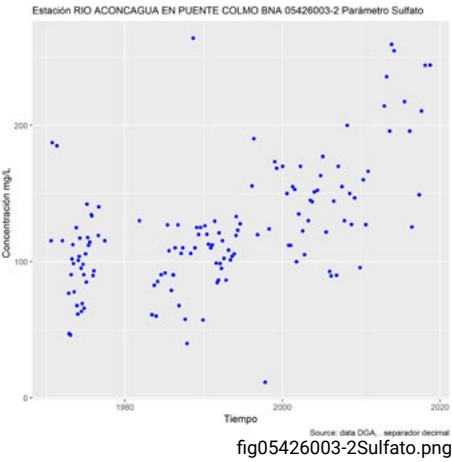
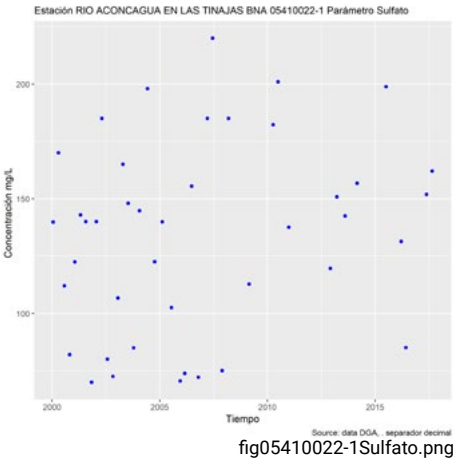
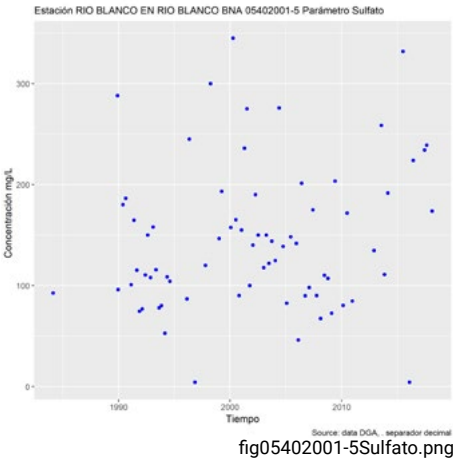


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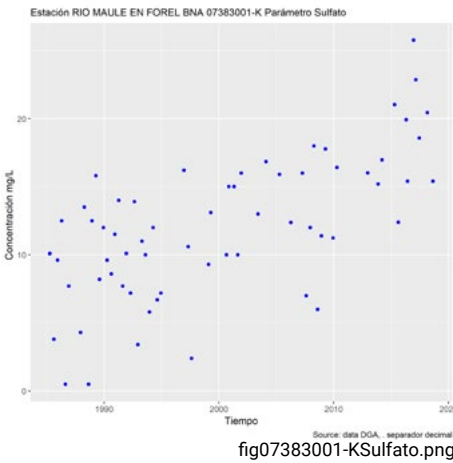
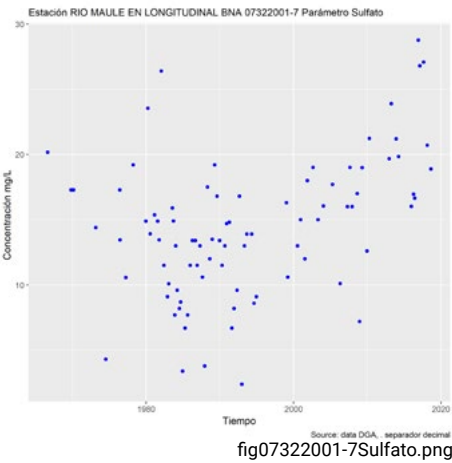
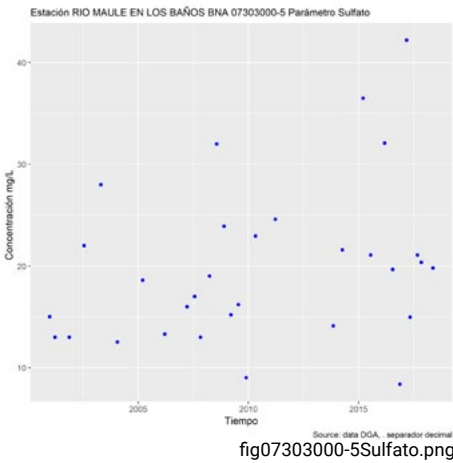
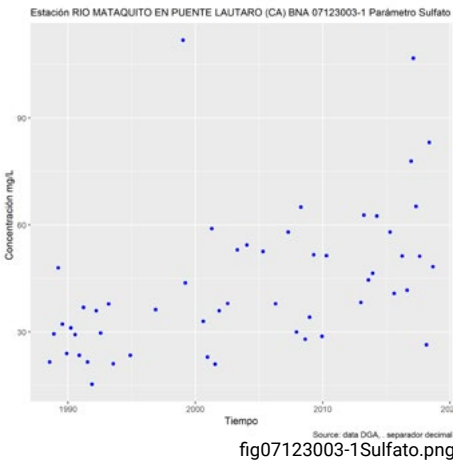
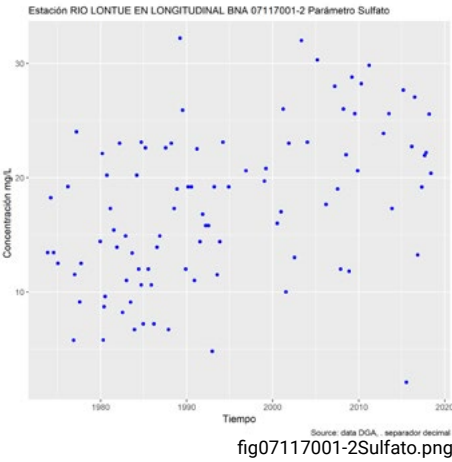
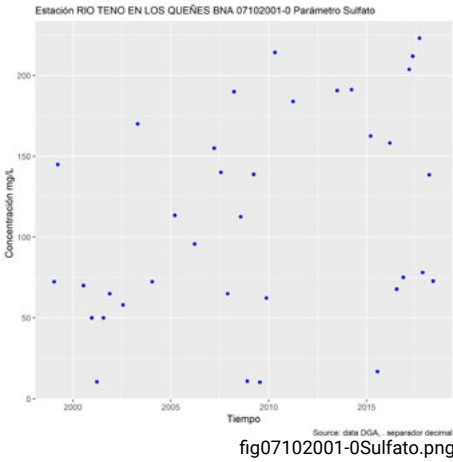
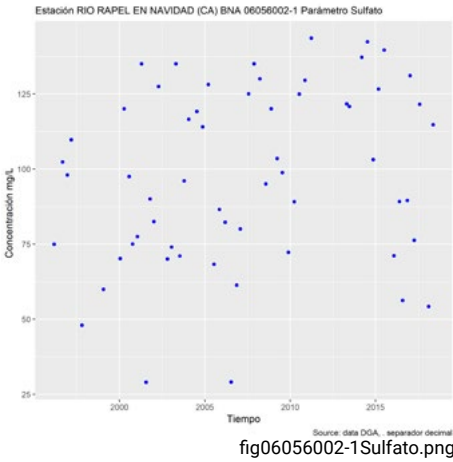
53. EVOLUCIÓN MACROZONA CENTRO - SULFATO



53 – 1.1 Gráficos – Evolución Macrozona Centro – Sulfato



53 – 1.2 Gráficos – Evolución Macrozona Centro – Sulfato



Mapa de Evolución Cloruro
Macrozona Centro

LEYENDA

- Centros Montañosos
- Capital Regional
- Capital provincial
- Comunas
- Estaciones Superficiales
- Ríos Principales
- Esteros Principales
- Lagos, Lagunas, Embalses
- Ciudades Principales
- Glaciares

Límites TIPO

- Límite Internacional
- Límite Regional

0 5 10 20 30 40
Kilómetros

Indice de Gráficos
Identificador de Gráfico

- fig05402001-5
- fig05410022-1
- fig05426003-2
- fig05735002-4
- fig05737005-K
- fig05748001-7
- fig06003003-0
- fig06012001-3
- fig06013001-9
- fig06035001-9
- fig06056002-1
- fig07102001-0
- fig07117001-2
- fig07123003-1
- fig07303000-5
- fig07322001-7
- fig07383001-K
- fig05710001-K
- fig05722002-3

The map displays the central macrozone of Chile, showing the evolution of chloride levels across various regions including Valparaíso, Metropolitana de Santiago, Libertador General Bernardo O'Higgins, and Maule. It features numerous rivers, lakes, and urban centers, with specific sampling points identified by codes like 04703002-1, 05735002-4, and 07102001-0. An inset map shows the location of this zone within the country of Chile.

54 – 1.1 Gráficos – Evolución Macrozona Centro – Cloruro

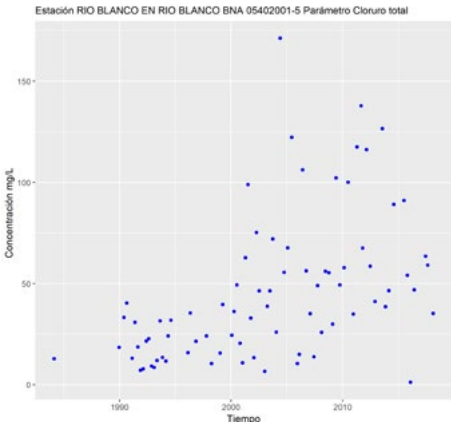


fig05402001-5Cloruro_total.png



fig05410022-1Cloruro_total.png

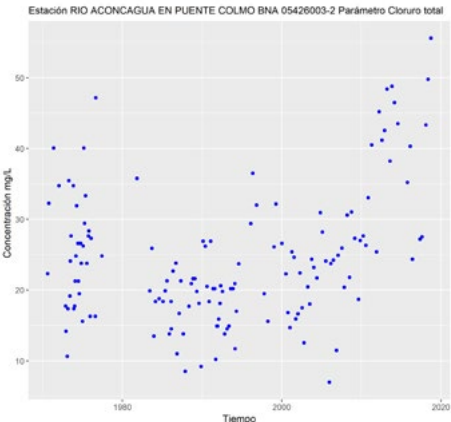


fig05426003-2Cloruro_total.png

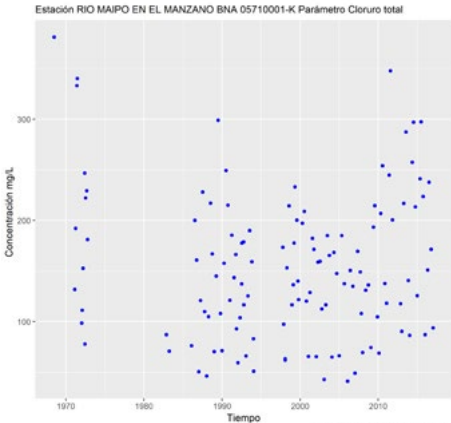


fig05710001-KCloruro_total.png

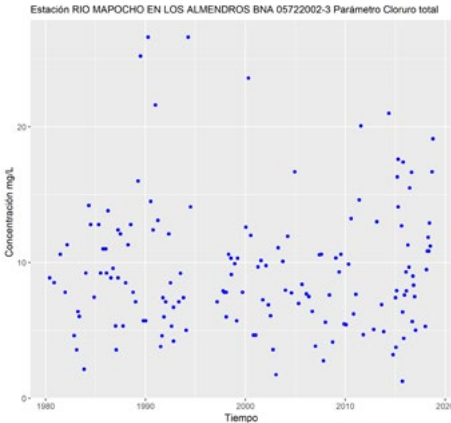


fig05722002-3Cloruro_total.png

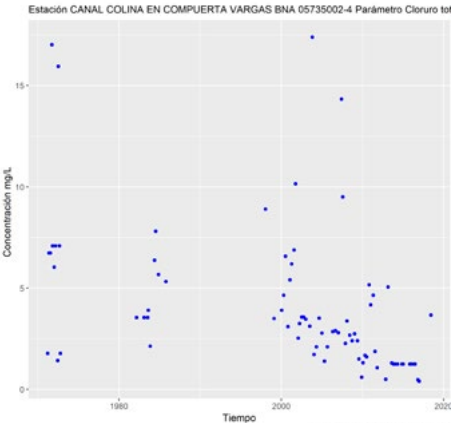


fig05735002-4Cloruro_total.png

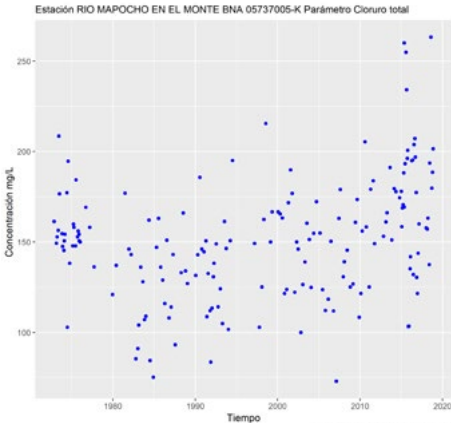


fig05737005-KCloruro_total.png

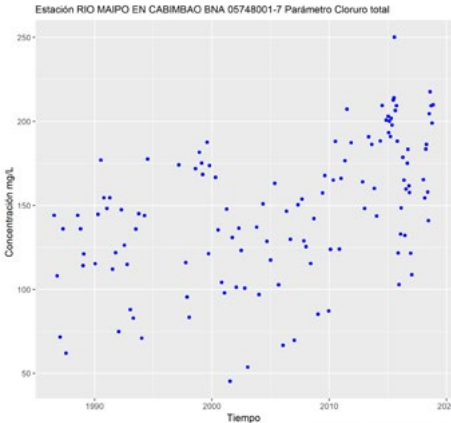


fig05748001-7Cloruro_total.png

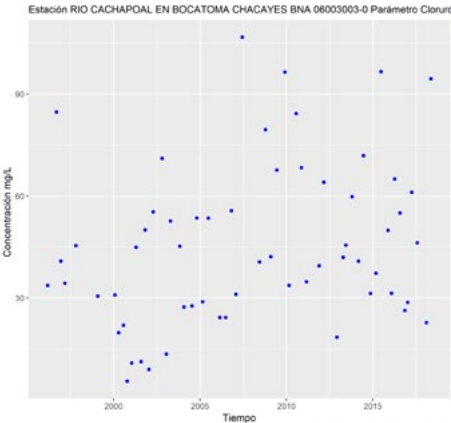


fig06003003-0Cloruro_total.png

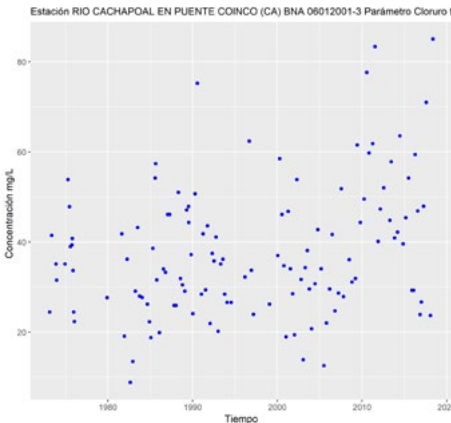


fig06012001-3Cloruro_total.png

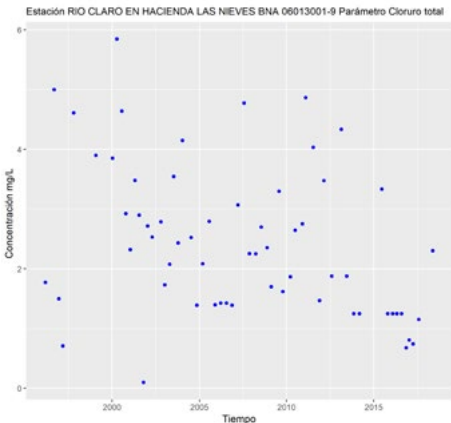


fig06013001-9Cloruro_total.png

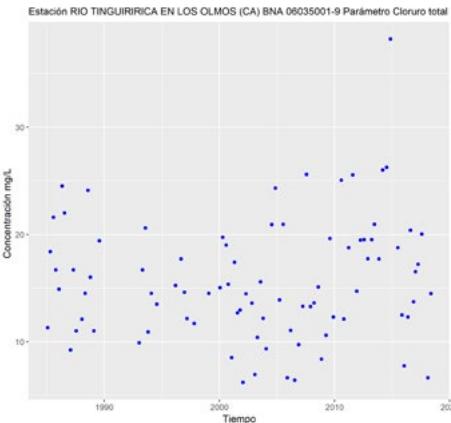
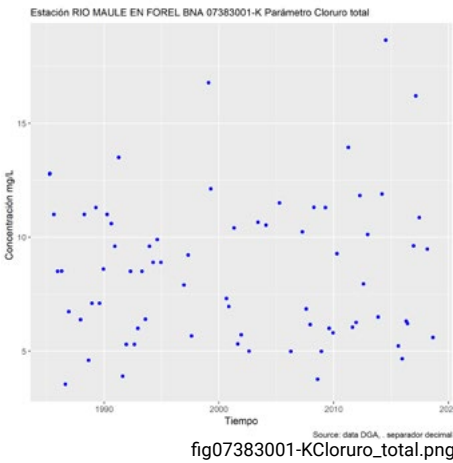
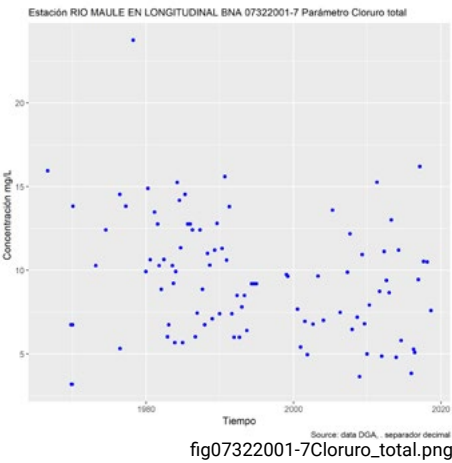
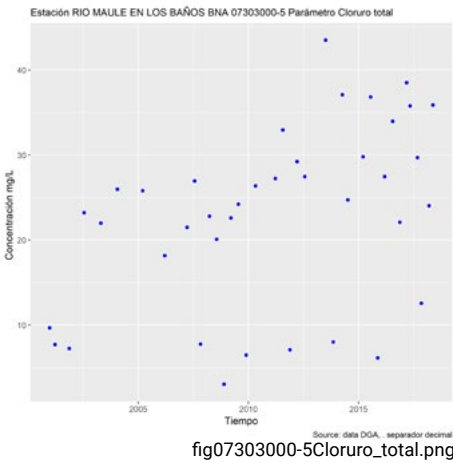
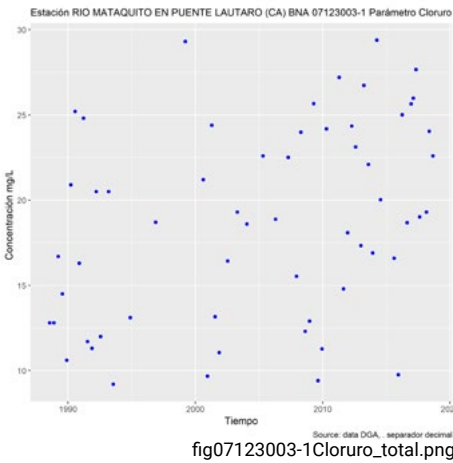
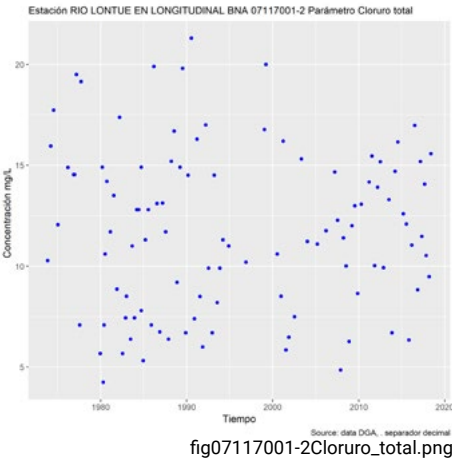
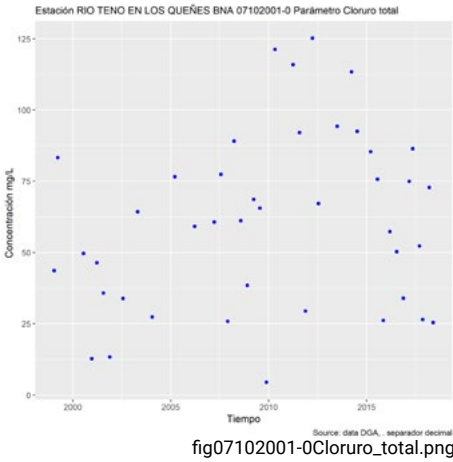
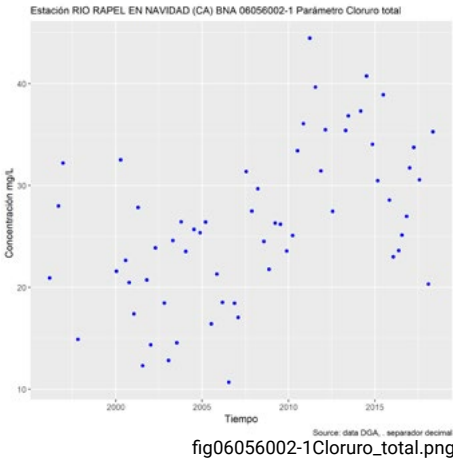


fig06035001-9Cloruro_total.png

54 - 1.2 Gráficos - Evolución Macrozona Centro - Cloruro



55. EVOLUCIÓN MACROZONA CENTRO - TEMPERATURA



55 - 1.1 Gráficos - Evolución Macrozona Centro - Temperatura

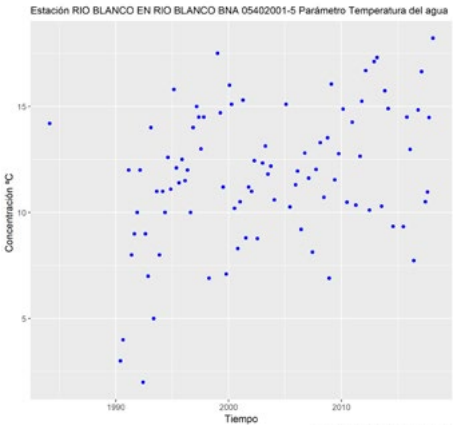


fig05402001-5Temperatura_del_agua.png

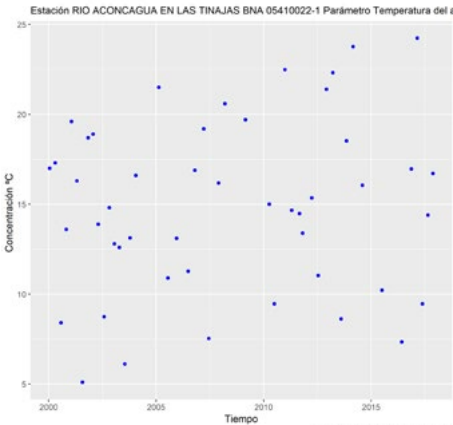


fig05410022-1Temperatura_del_agua.png

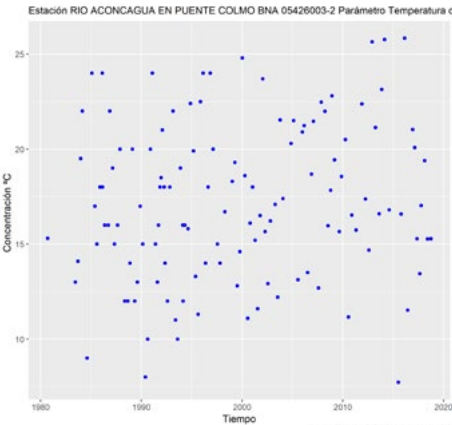


fig05426003-2Temperatura_del_agua.png

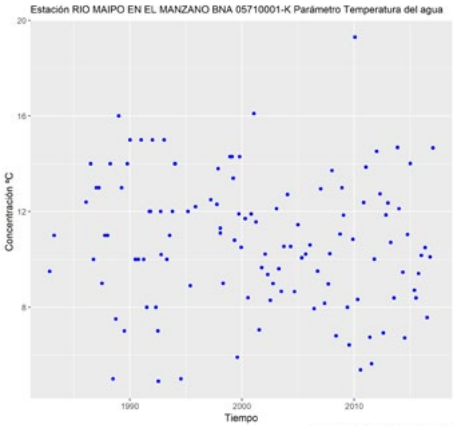


fig05710001-KTemperatura_del_agua.png

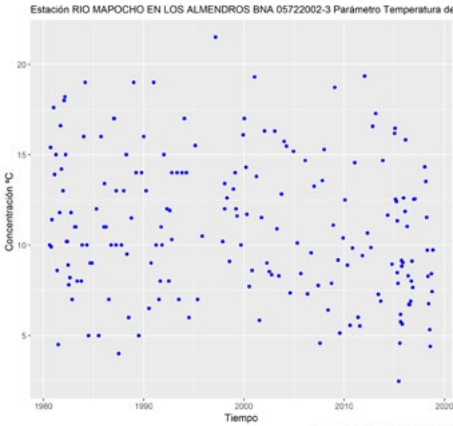


fig05722002-3Temperatura_del_agua.png

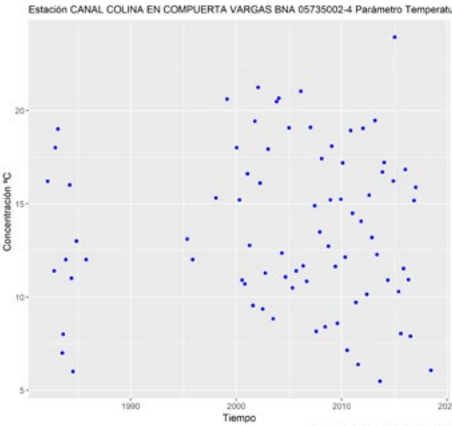


fig05735002-4Temperatura_del_agua.png

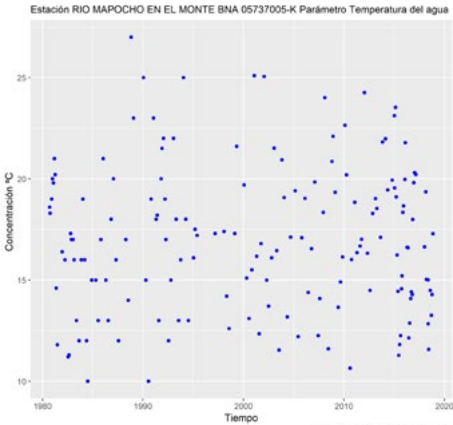


fig05737005-KTemperatura_del_agua.png

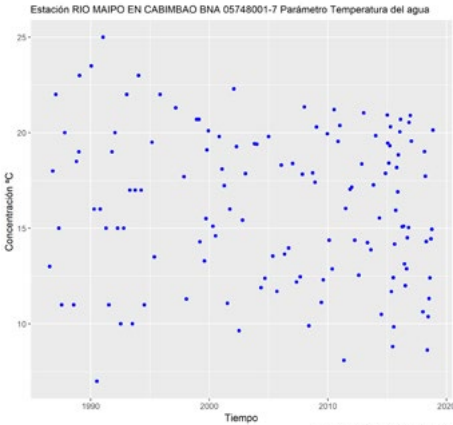


fig05748001-7Temperatura_del_agua.png

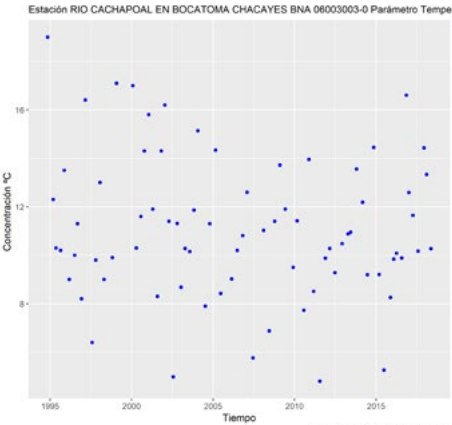


fig06003003-0Temperatura_del_agua.png

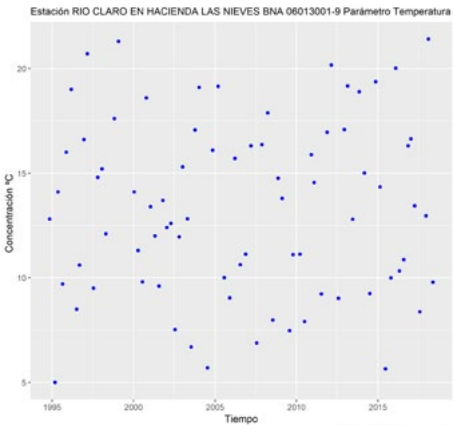


fig06013001-9Temperatura_del_agua.png

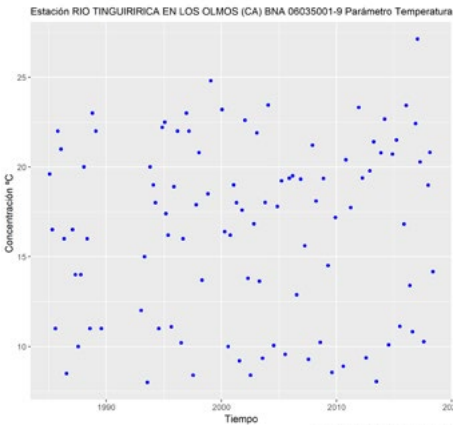


fig06035001-9Temperatura_del_agua.png

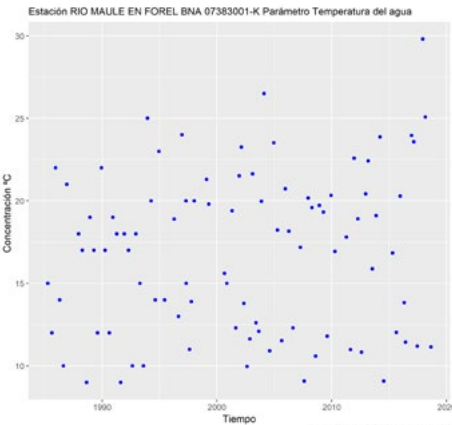


fig07383001-KTemperatura_del_agua.png

55 – 1.2 Gráficos – Evolución Macrozona Centro – Temperatura

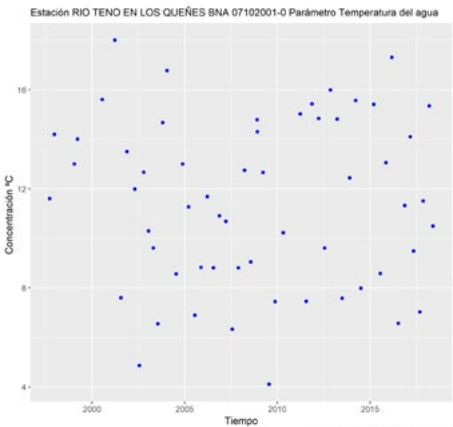


fig07102001-0Temperatura_del_agua.png

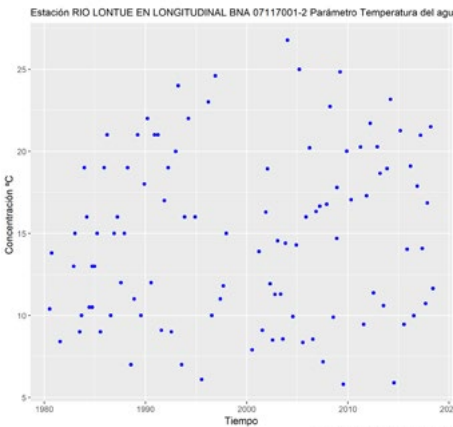


fig07117001-2Temperatura_del_agua.png

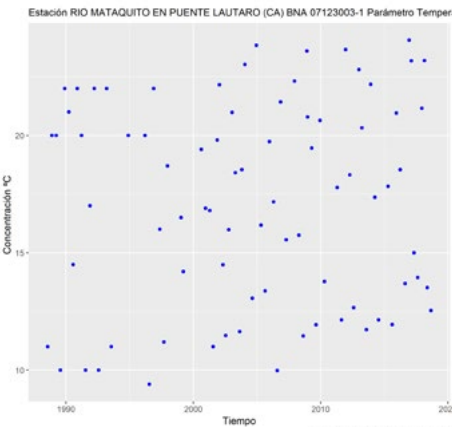


fig07123003-1Temperatura_del_agua.png

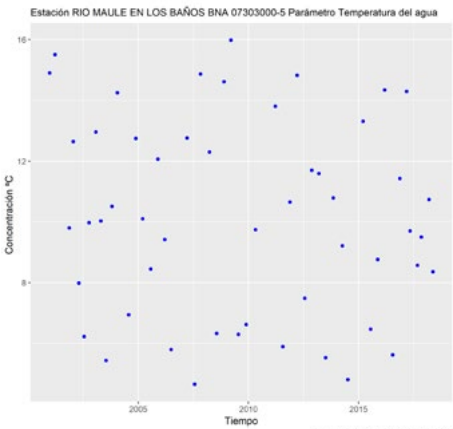


fig07303000-5Temperatura_del_agua.png

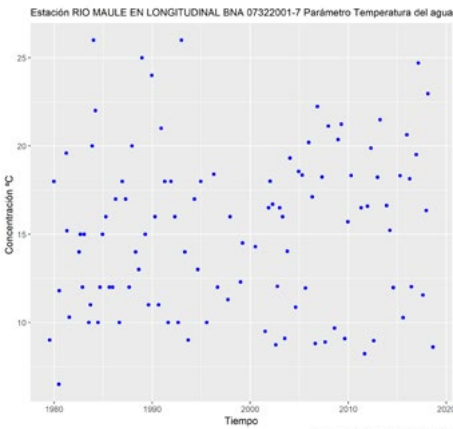


fig07322001-7Temperatura_del_agua.png

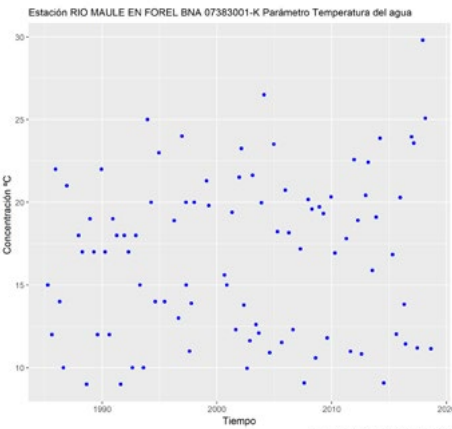
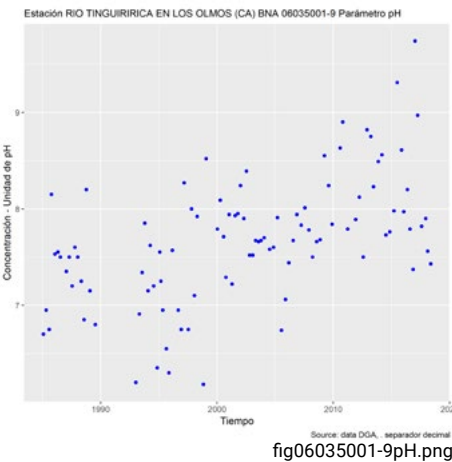
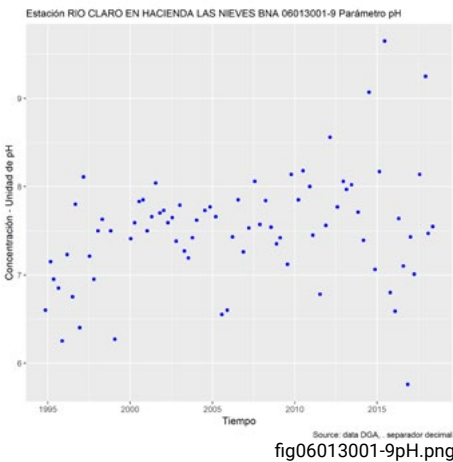
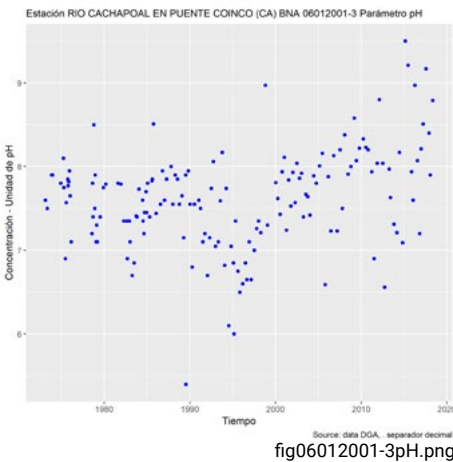
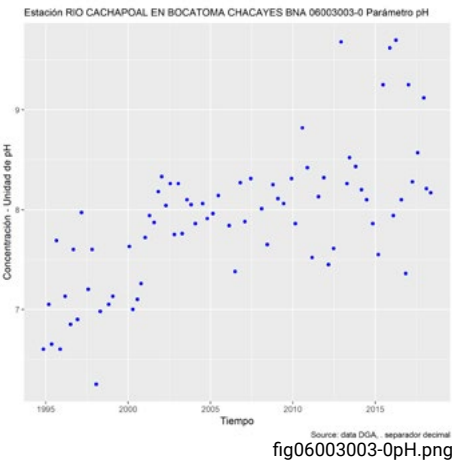
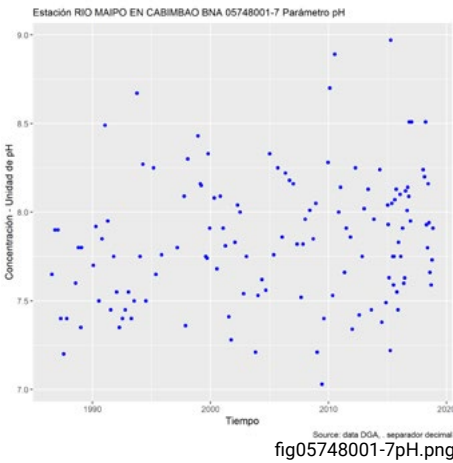
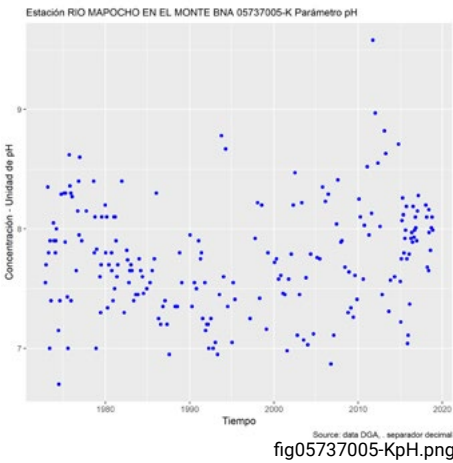
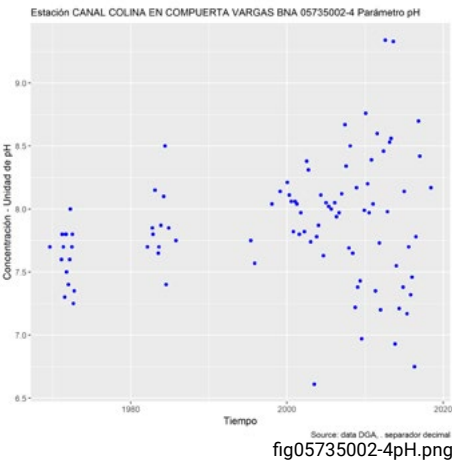
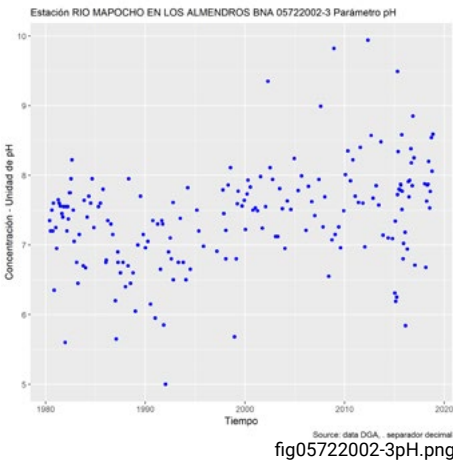
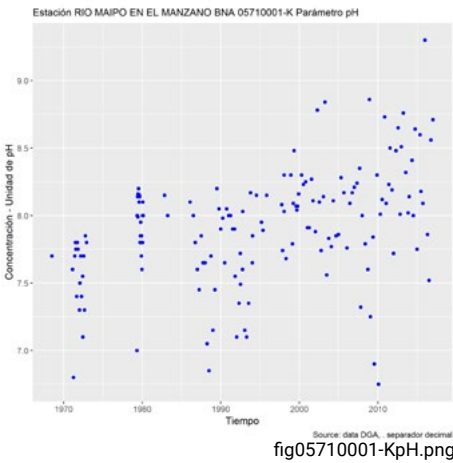
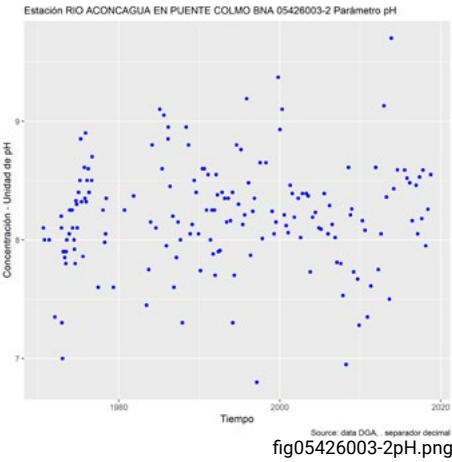
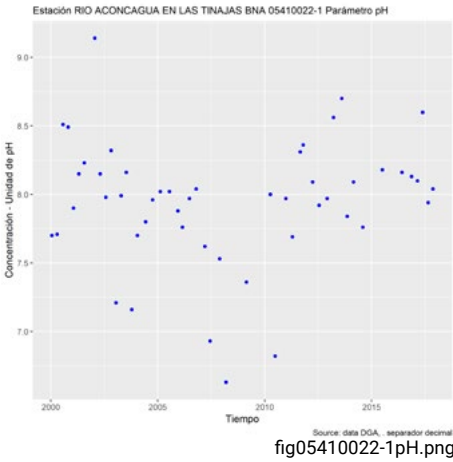
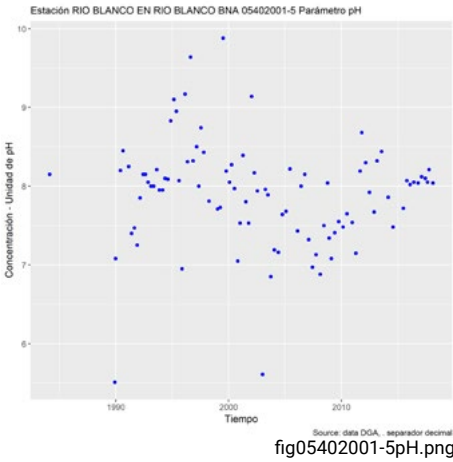


fig07383001-KTemperatura_del_agua.png

56. EVOLUCIÓN MACROZONA CENTRO - PH



56 – 1.1 Gráficos – Evolución Macrozona Centro – PH



56 – 1.2 Gráficos – Evolución Macrozona Centro – PH

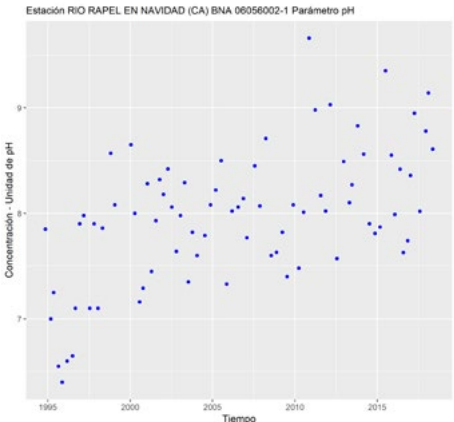


fig06056002-1pH.png

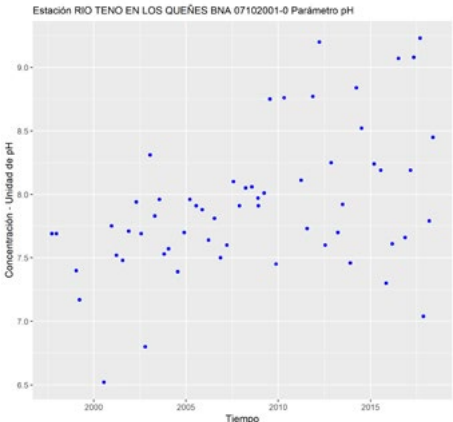


fig07102001-0pH.png

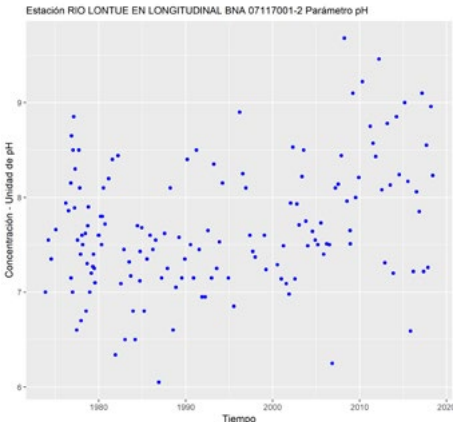


fig07117001-2pH.png

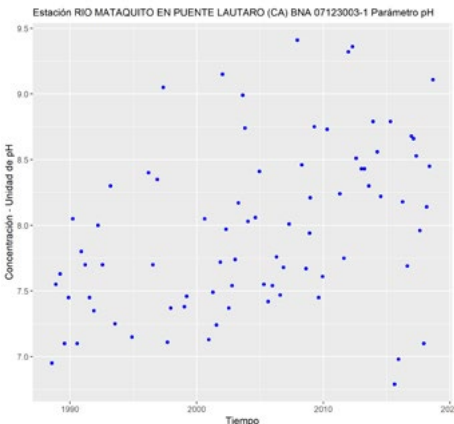


fig07123003-1pH.png

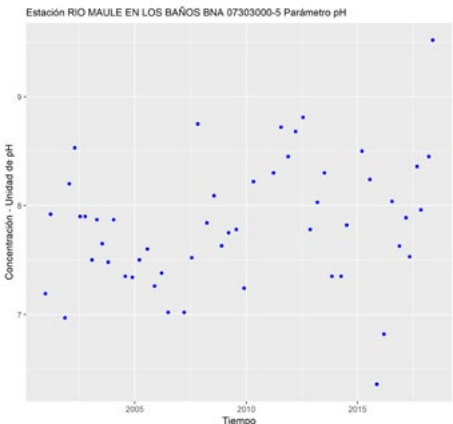


fig07303000-5pH.png

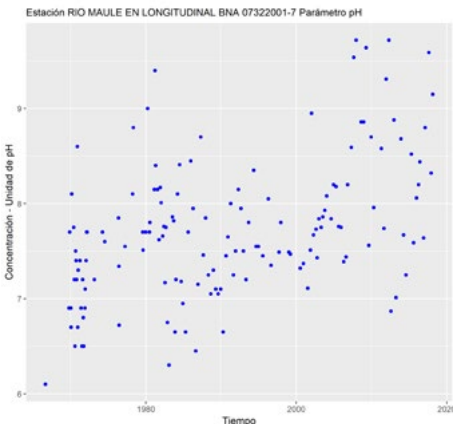


fig07322001-7pH.png

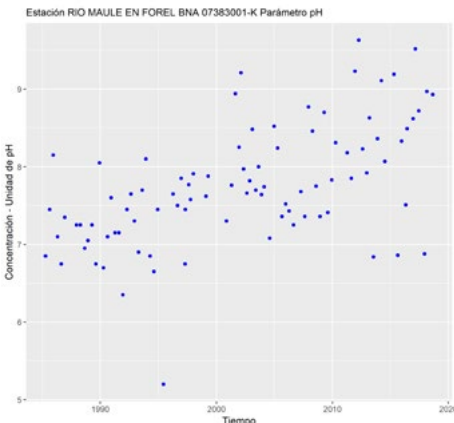
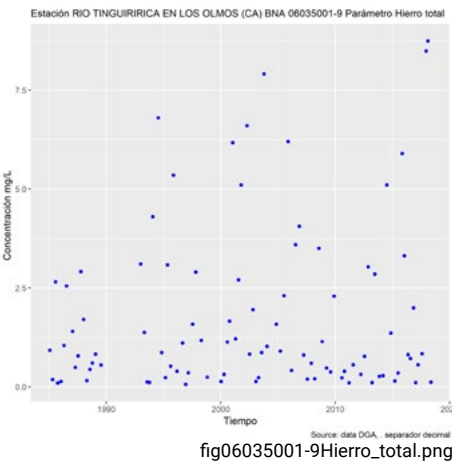
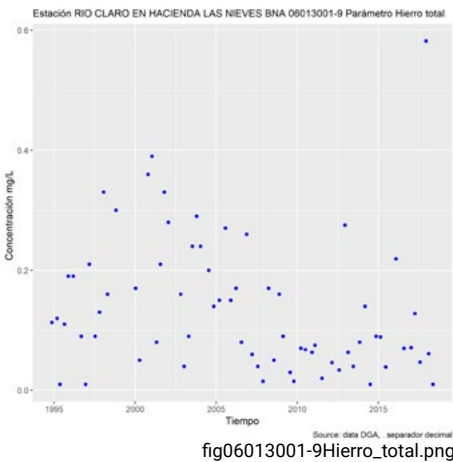
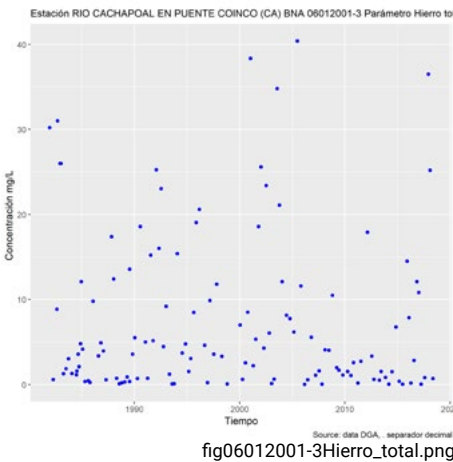
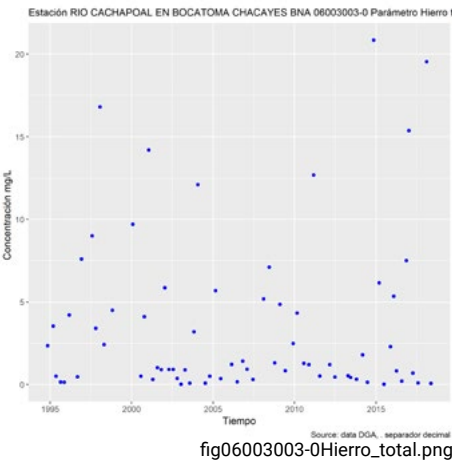
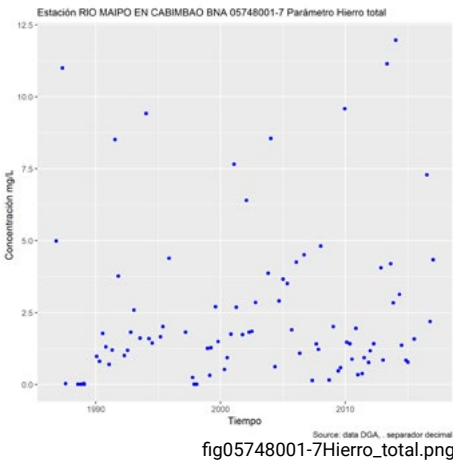
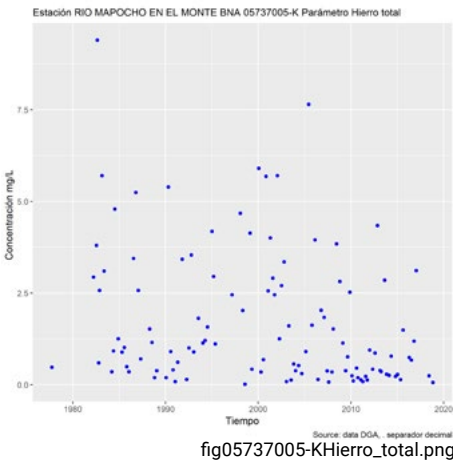
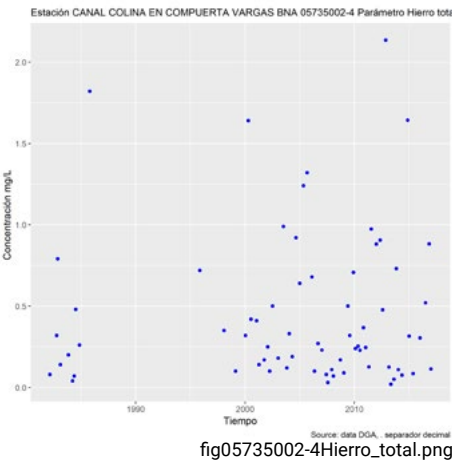
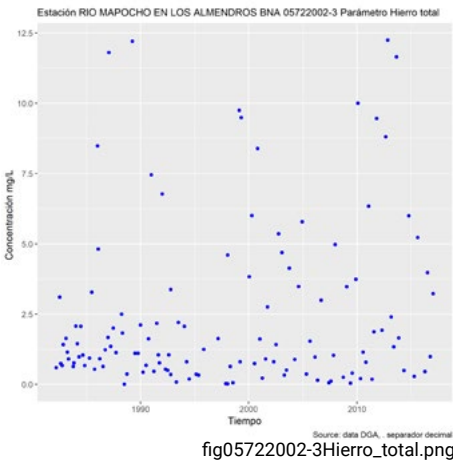
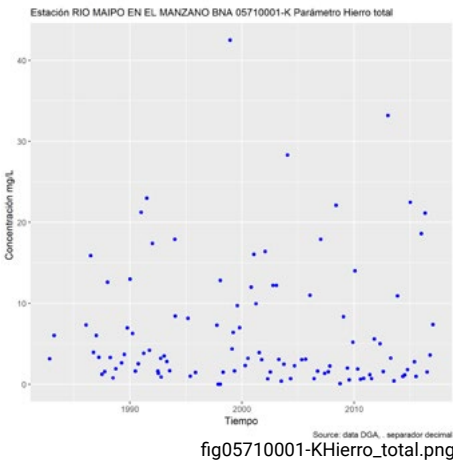
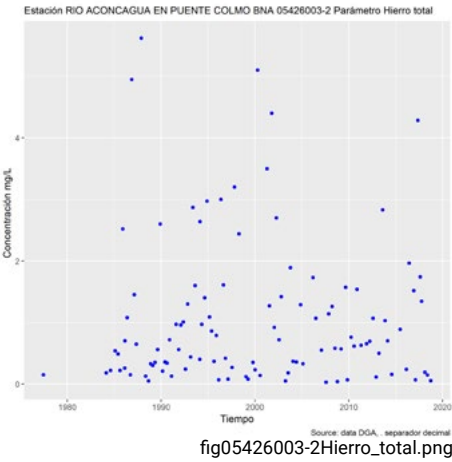
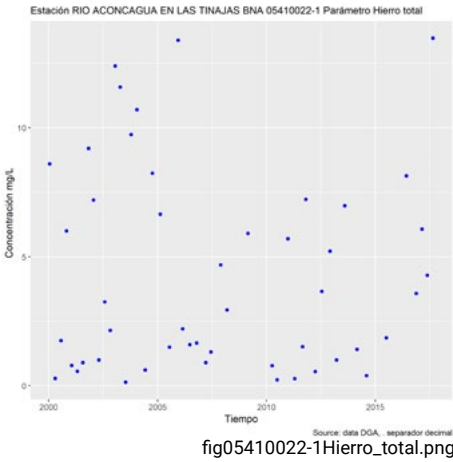
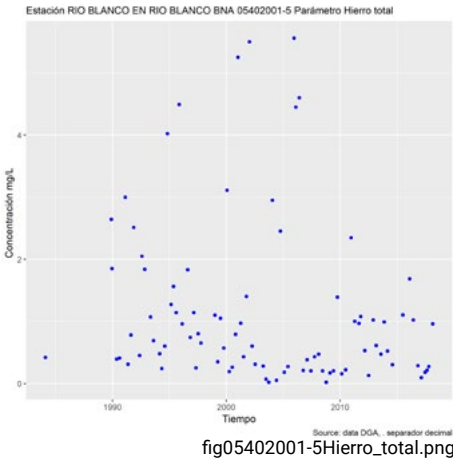


fig07383001-KpH.png

57. EVOLUCIÓN MACROZONA CENTRO - HIERRO



57 - 1.1 Gráficos - Evolución Macrozona Centro - Hierro



57 – 1.1 Gráficos – Evolución Macrozona Centro – Hierro

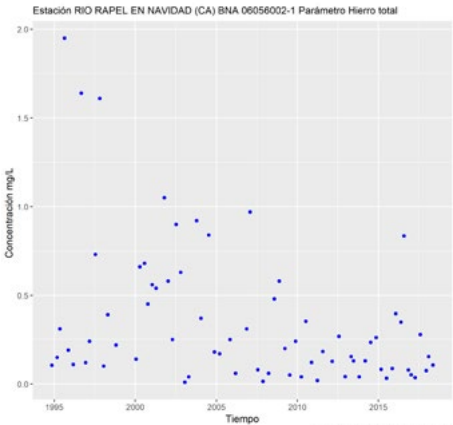


fig06056002-1Hierro_total.png

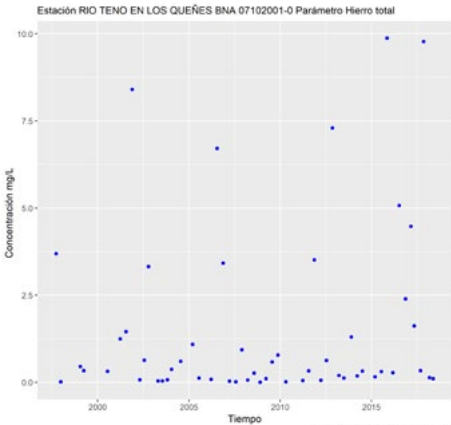


fig07102001-0Hierro_total.png

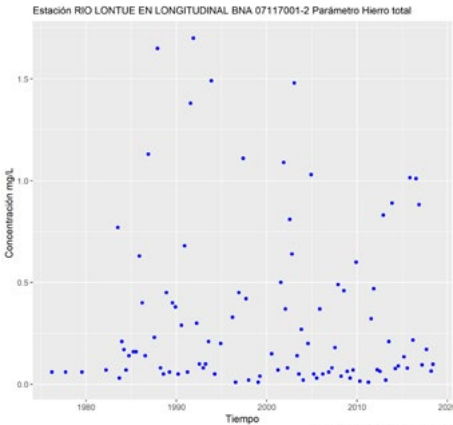


fig07117001-2Hierro_total.png

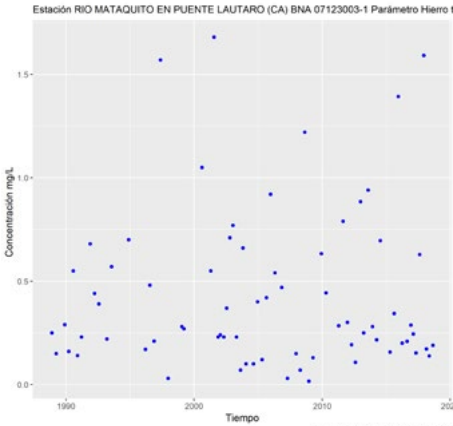


fig07123003-1Hierro_total.png

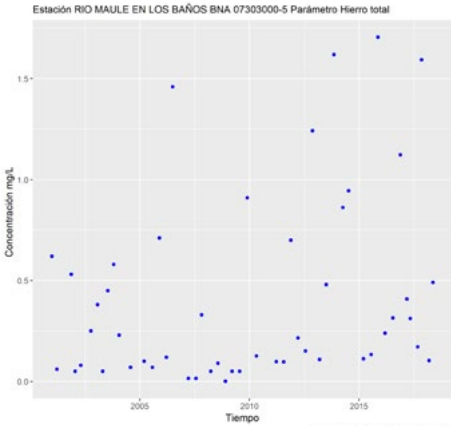


fig07303000-5Hierro_total.png

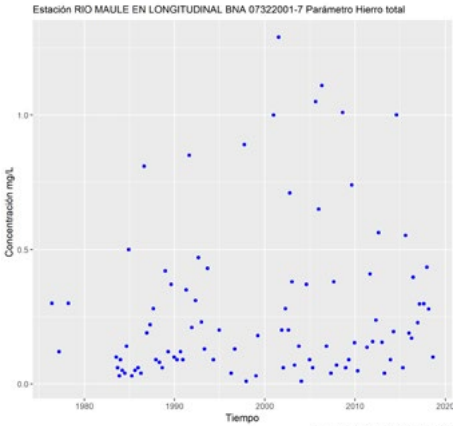


fig07322001-7Hierro_total.png

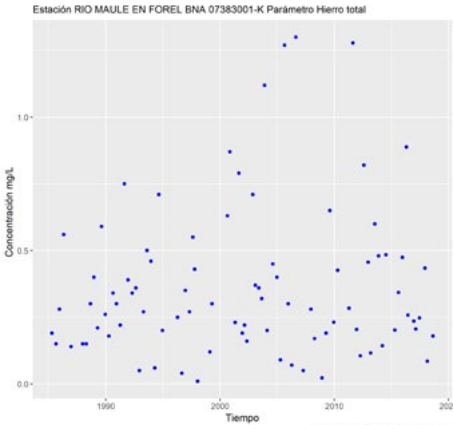


fig07383001-KHierro_total.png

58. EVOLUCIÓN MACROZONA CENTRO - NITRATO



58 – 1.1 Gráficos – Evolución Macrozona Centro – Nitrato

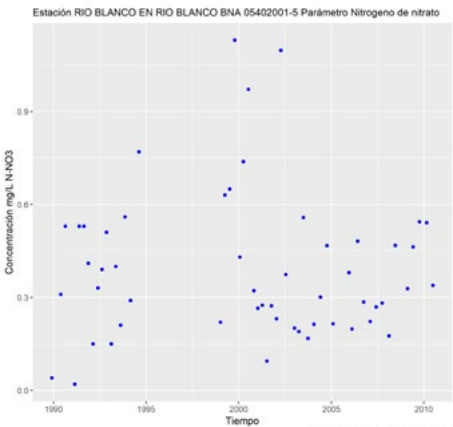


fig05402001-5Nitrogeno_de_nitrato.png

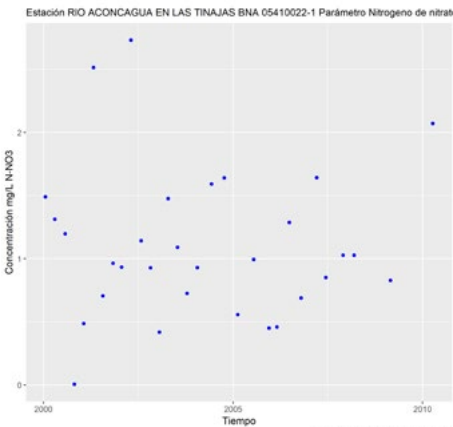


fig05410022-1Nitrogeno_de_nitrato.png

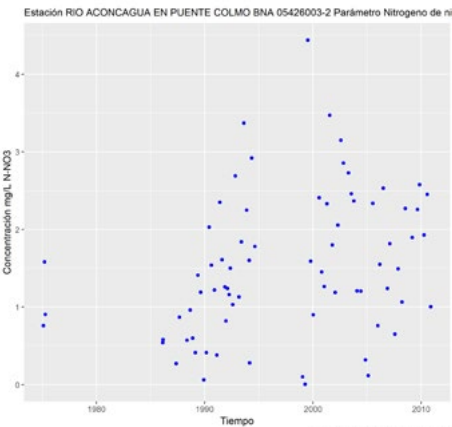


fig05426003-2Nitrogeno_de_nitrato.png

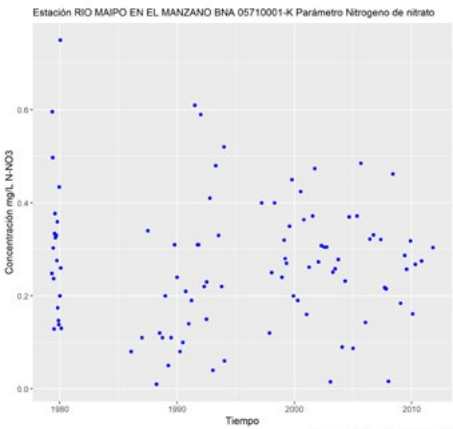


fig05710001-KNitrogeno_de_nitrato.png

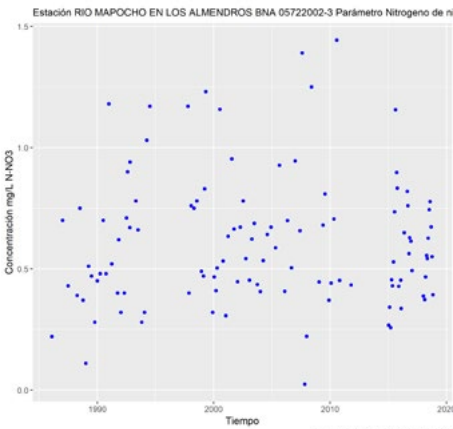


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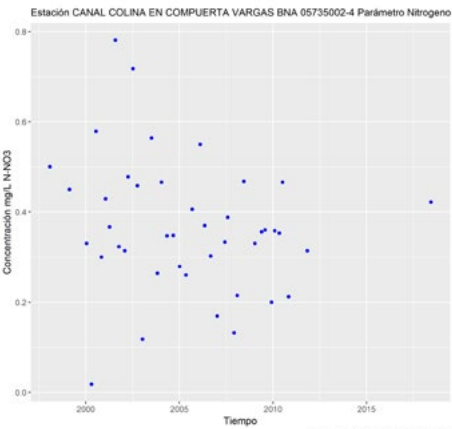


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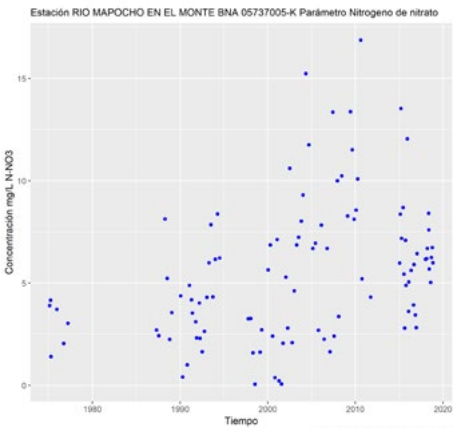


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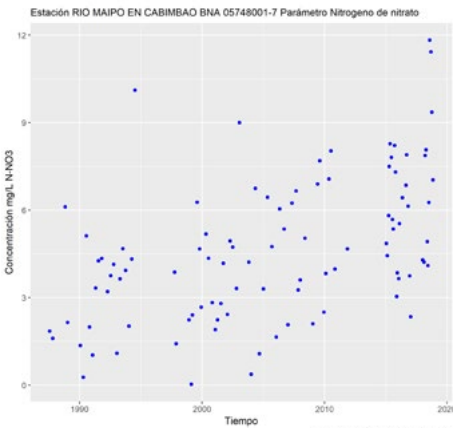


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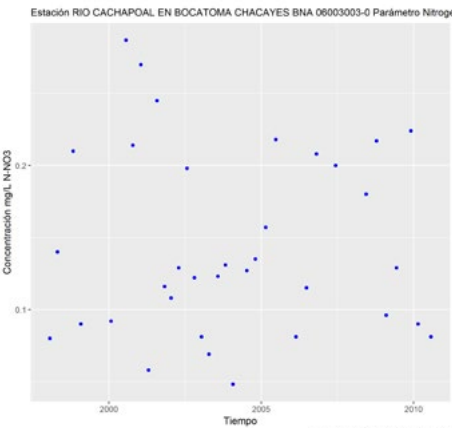


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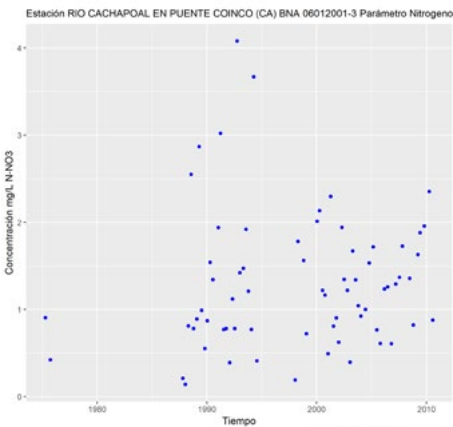


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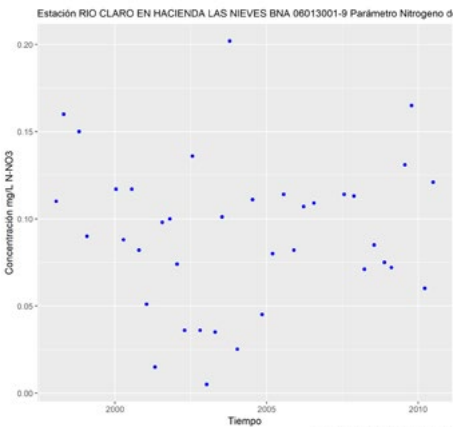


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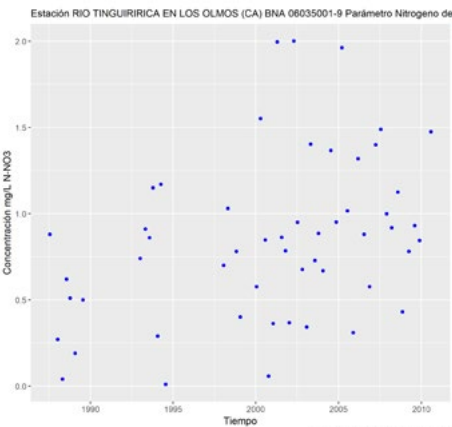


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58 – 1.2 Gráficos – Evolución Macrozona Centro – Nitrato

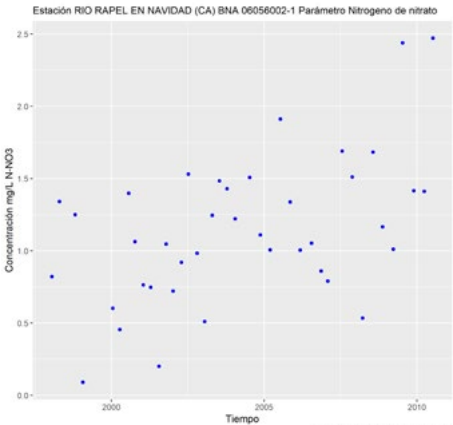


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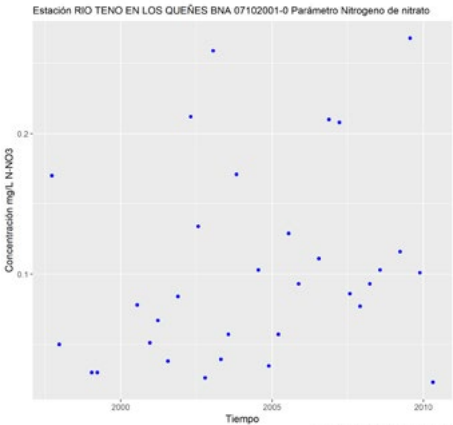


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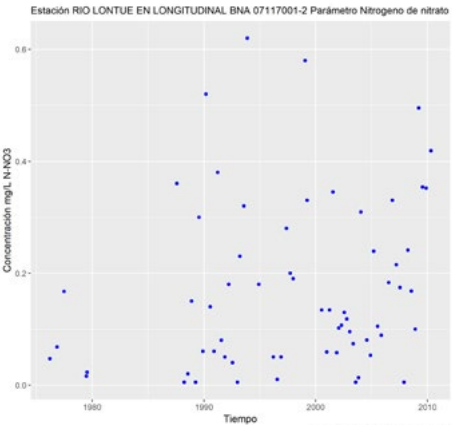


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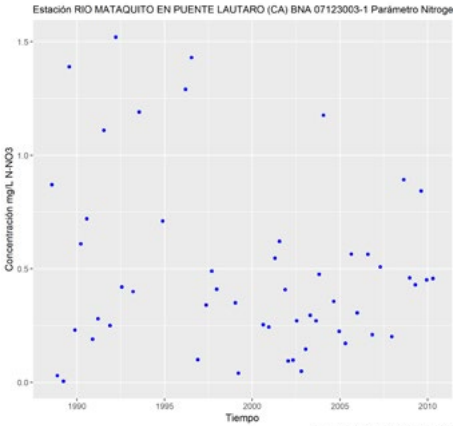


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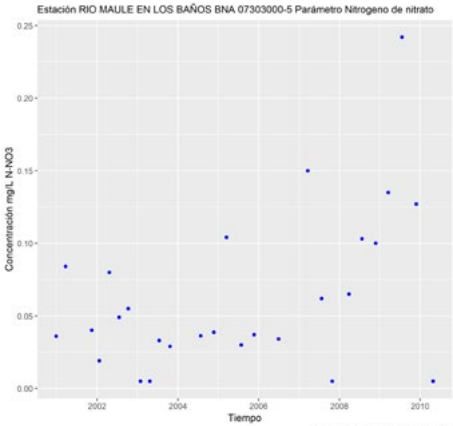


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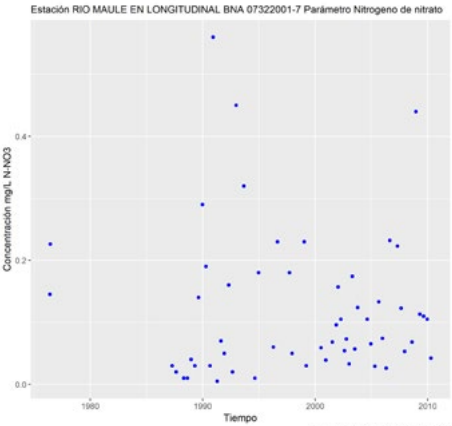


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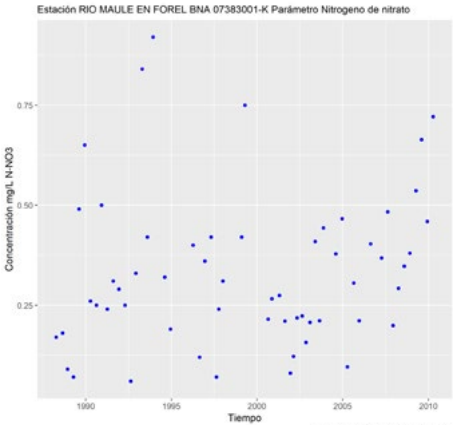


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59. EVOLUCIÓN MACROZONA CENTRO - ORTOFOSFATO



59 – 1.1 Gráficos – Evolución Macrozona Centro – Ortofosfato

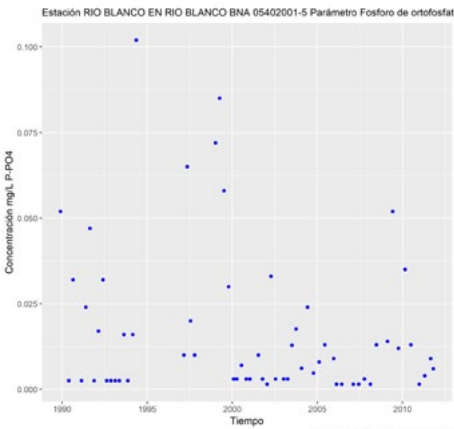


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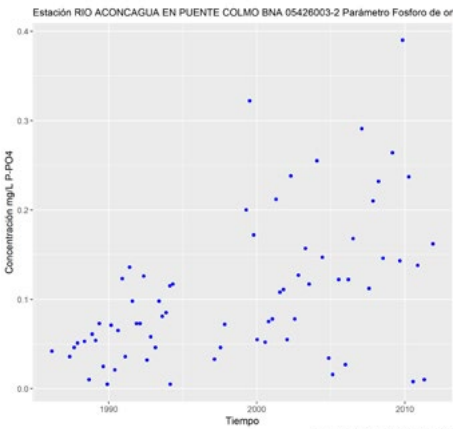


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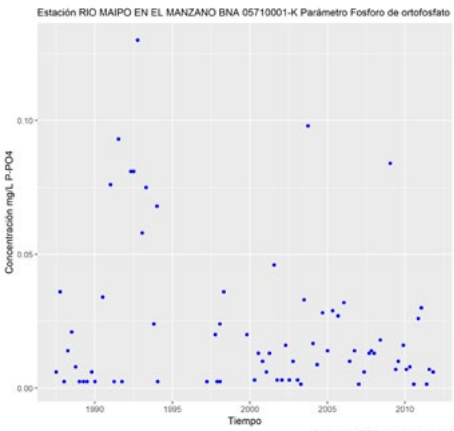


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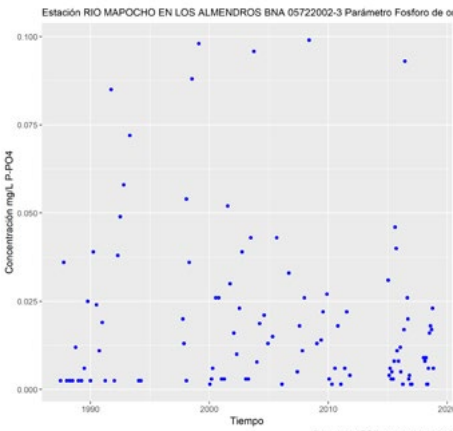


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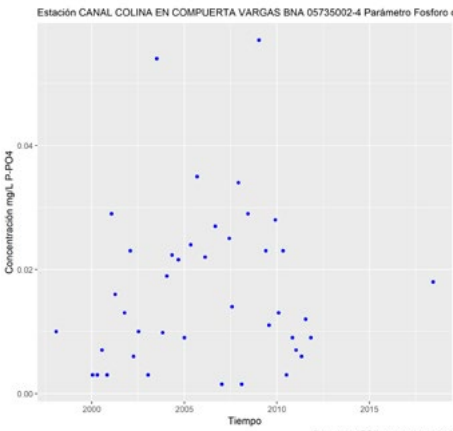


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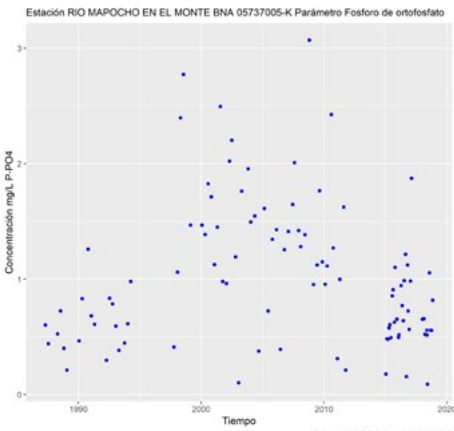


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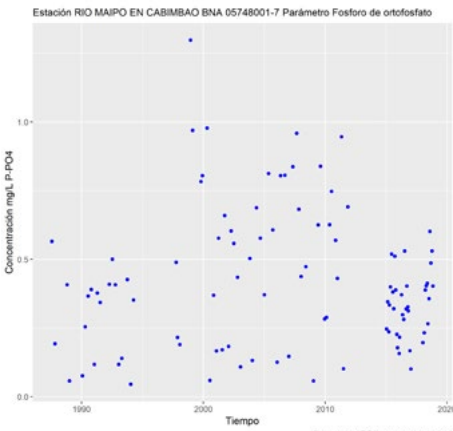


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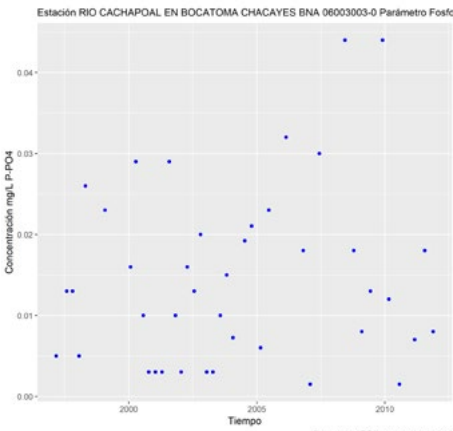


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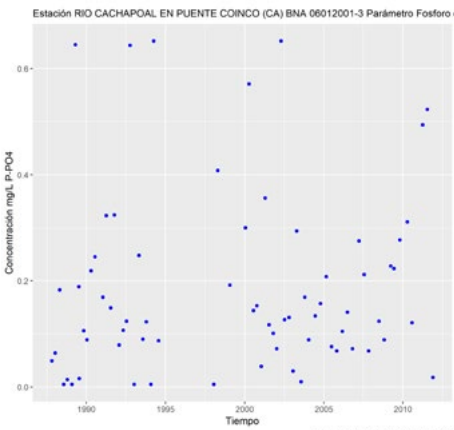


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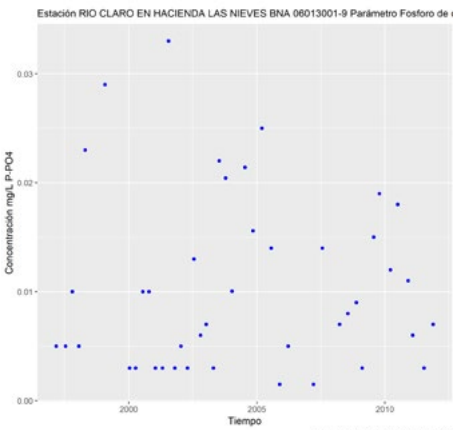


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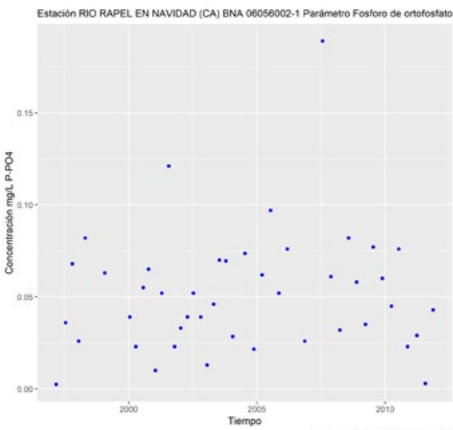


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59 – 1.1 Gráficos – Evolución Macrozona Centro – Ortofosfato

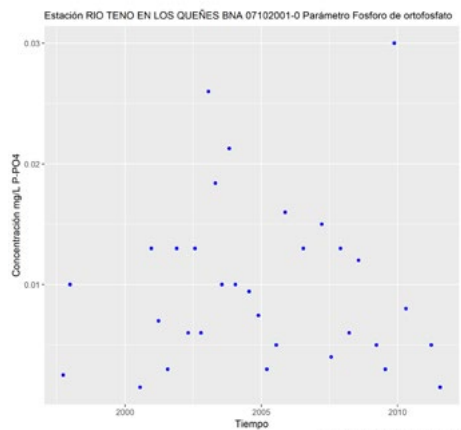


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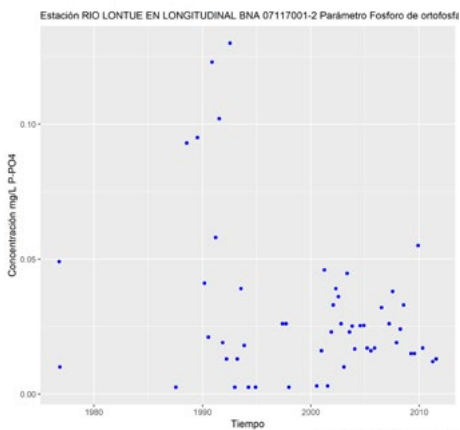


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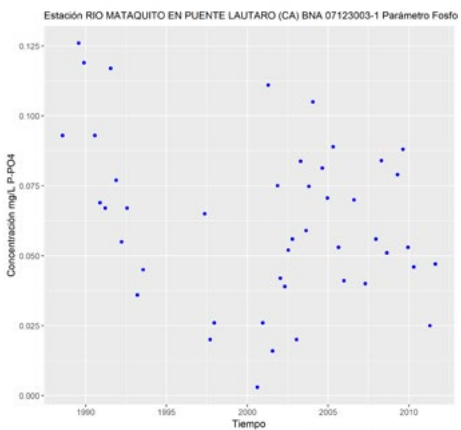


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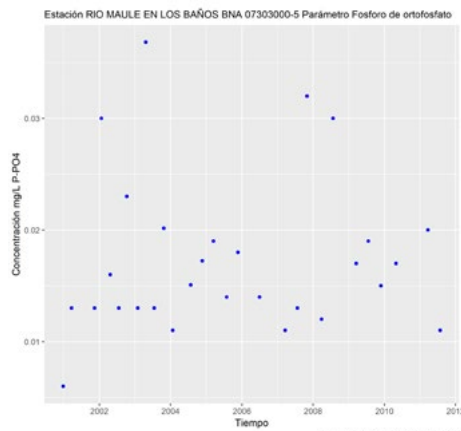


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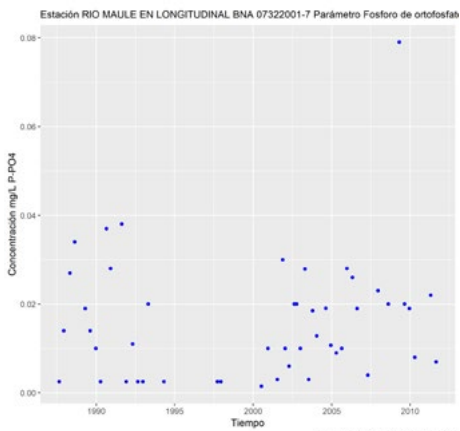


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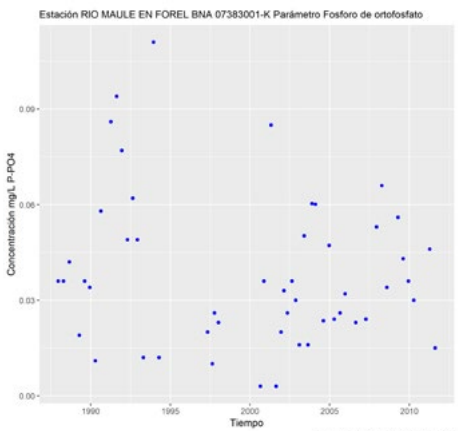


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60 – 1.1 Gráficos – Evolución Macrozona Sur – Conductividad

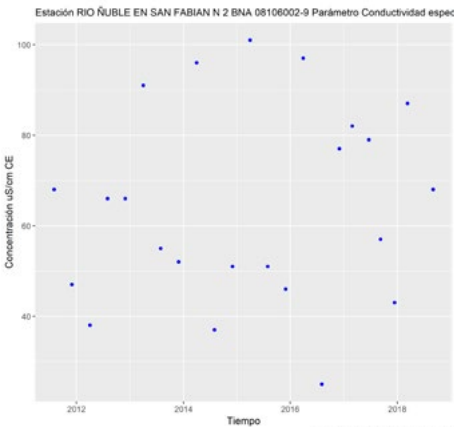


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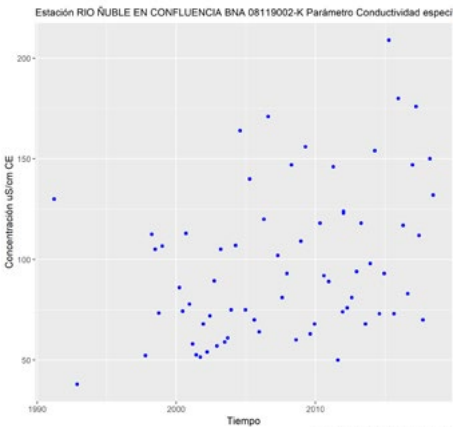


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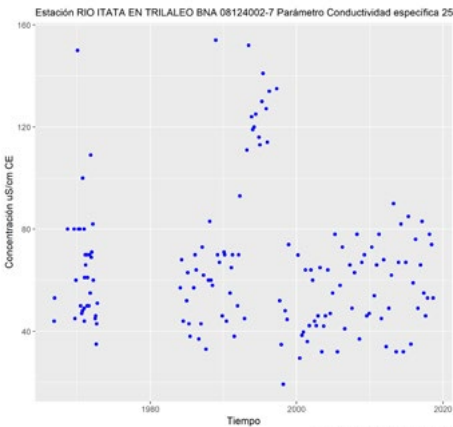


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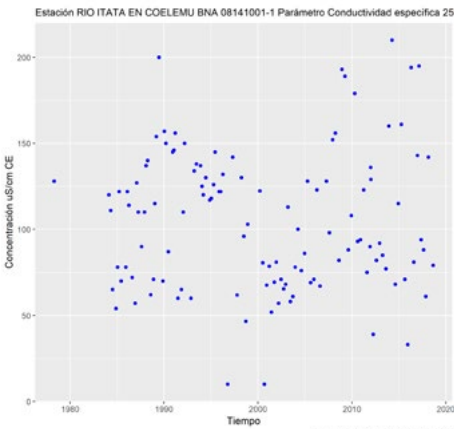


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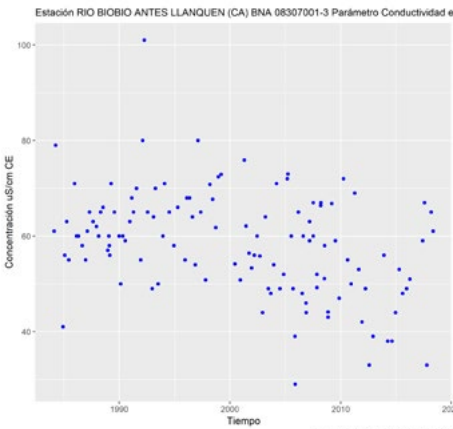


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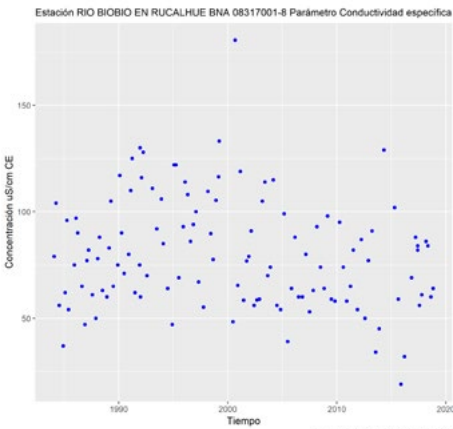


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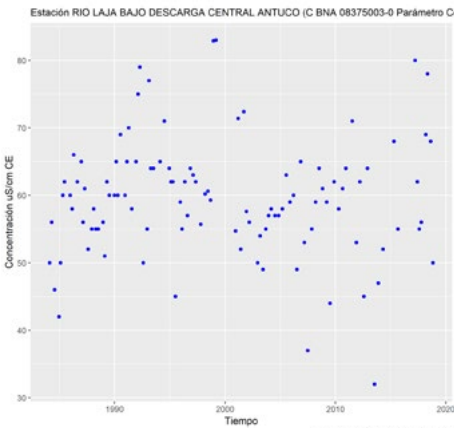


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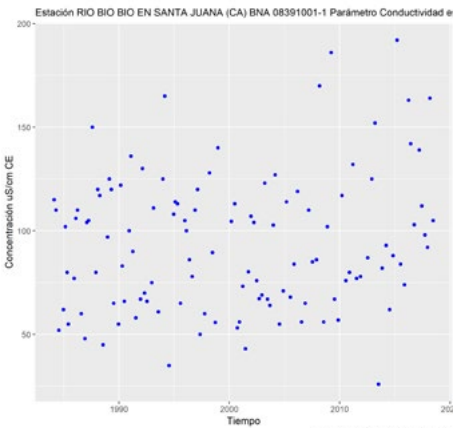


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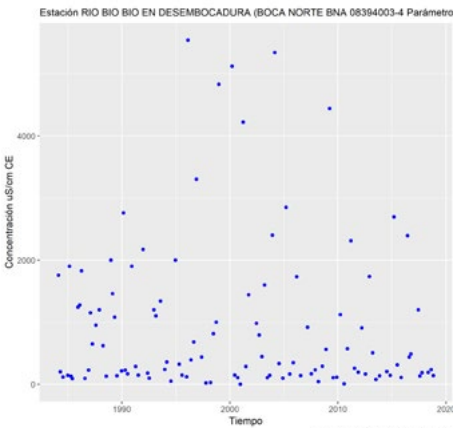


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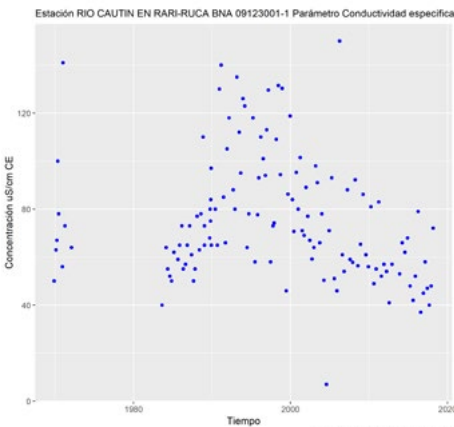


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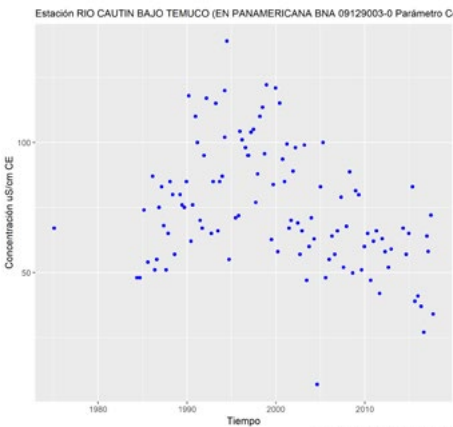


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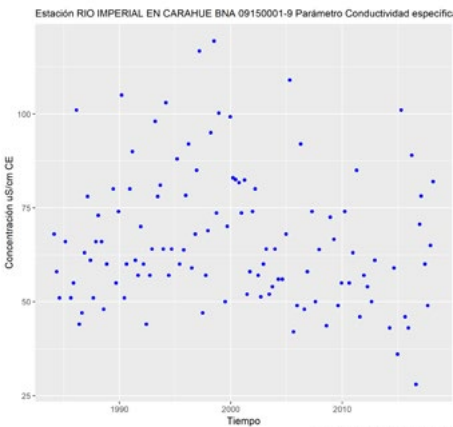


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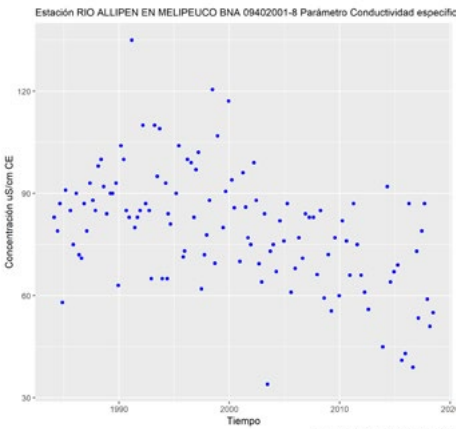


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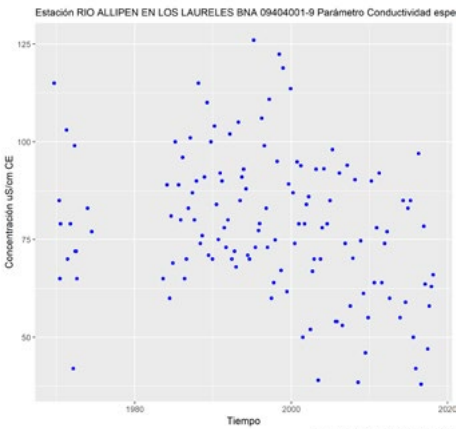


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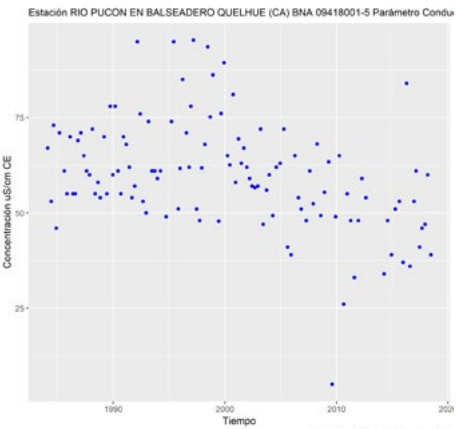


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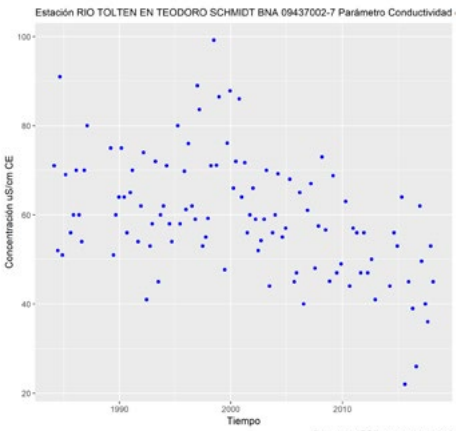


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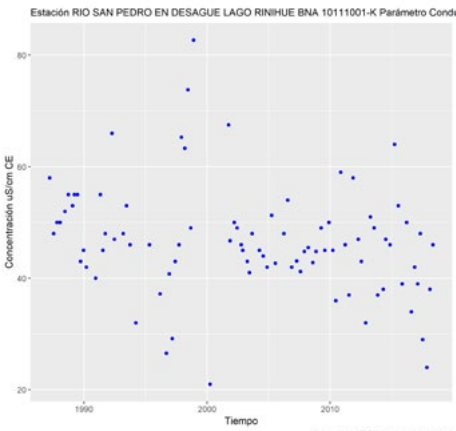


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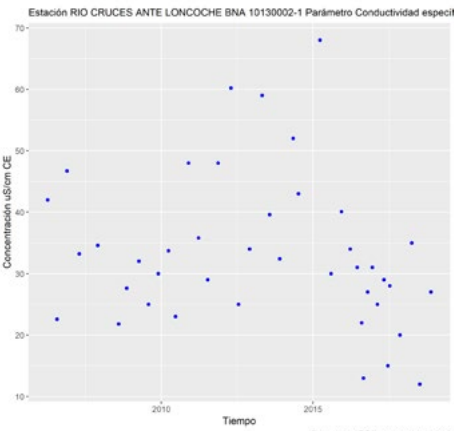


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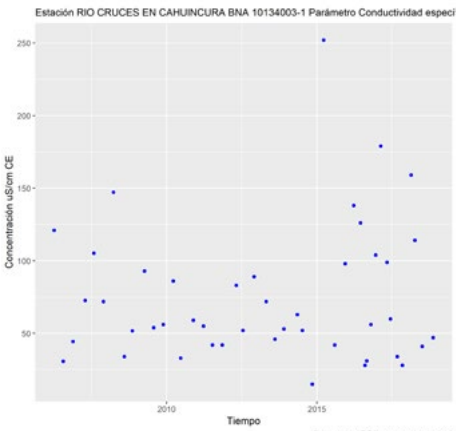


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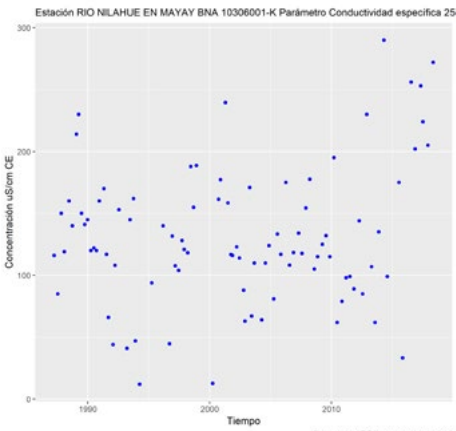


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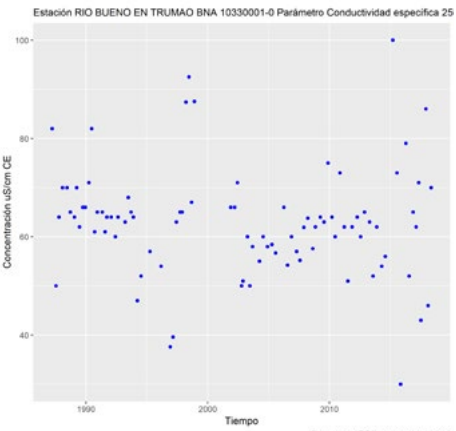


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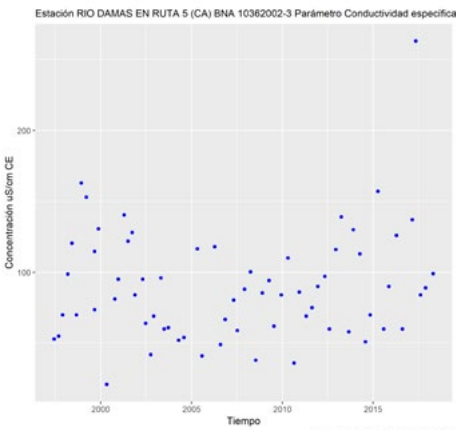


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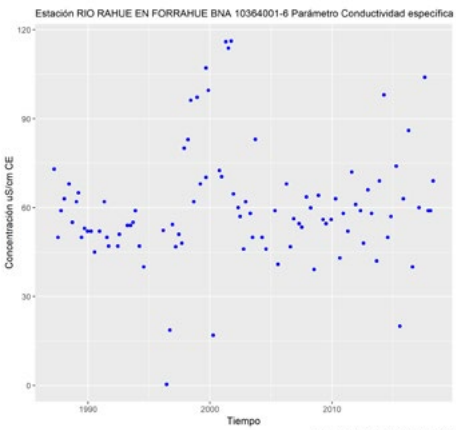


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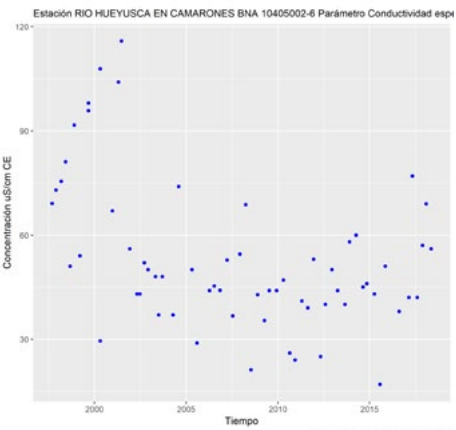


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60 – 1.3 Gráficos – Evolución Macrozona Sur – Conductividad

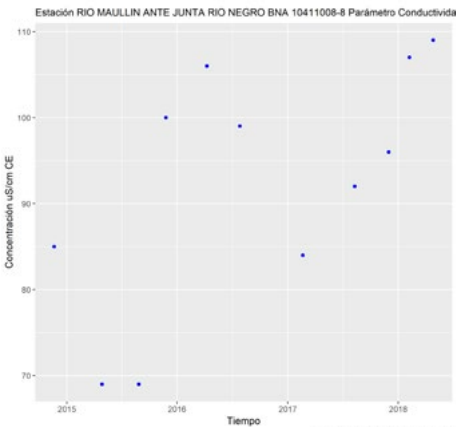


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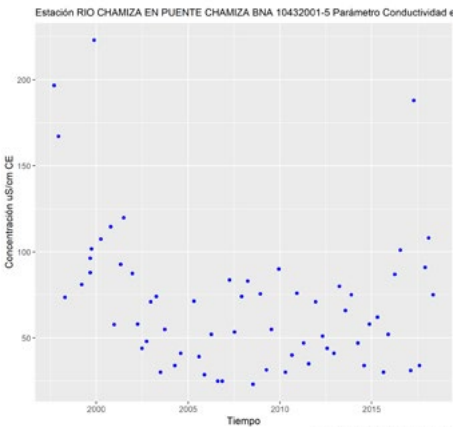


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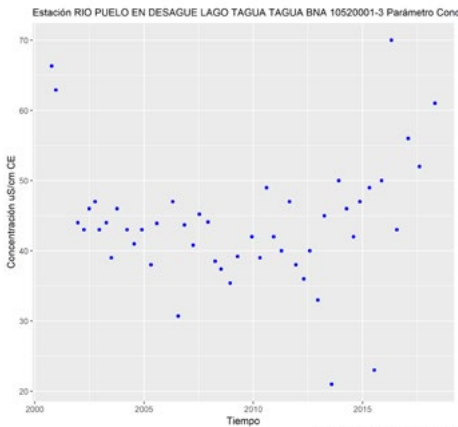


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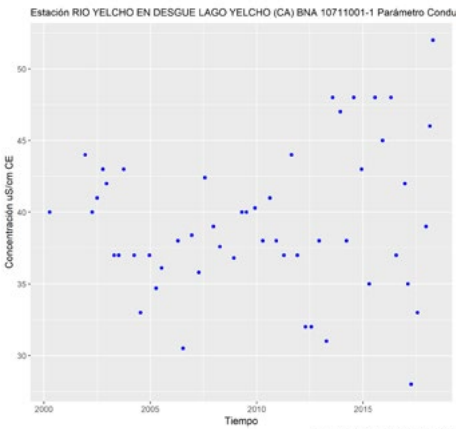


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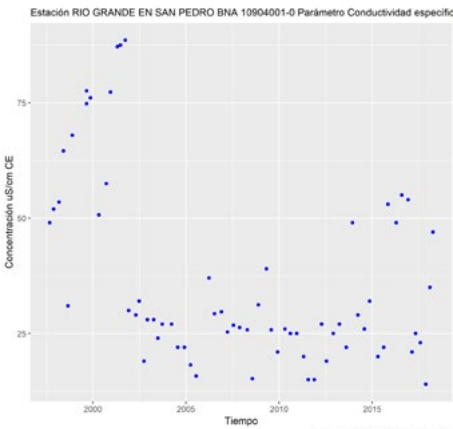


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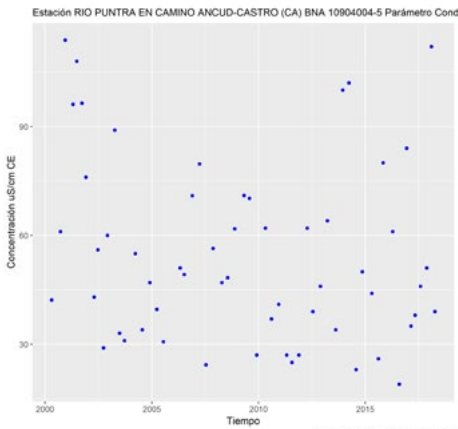


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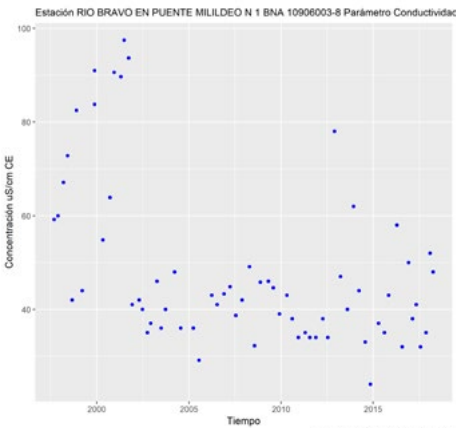
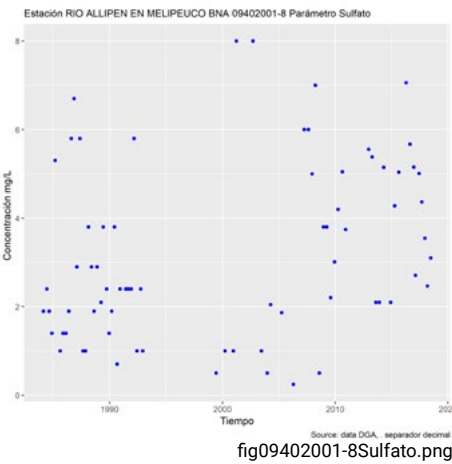
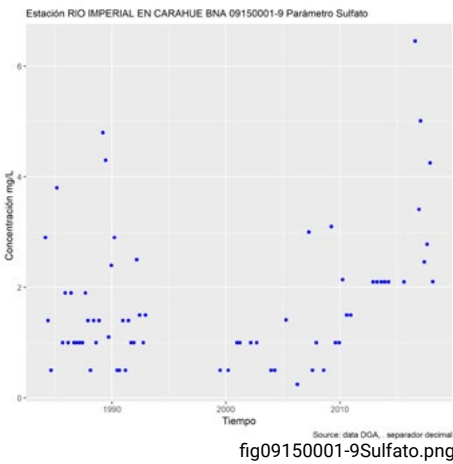
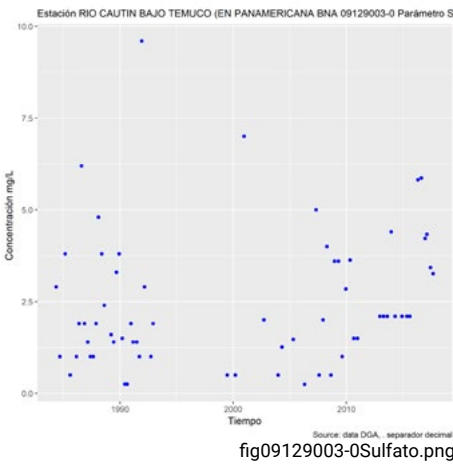
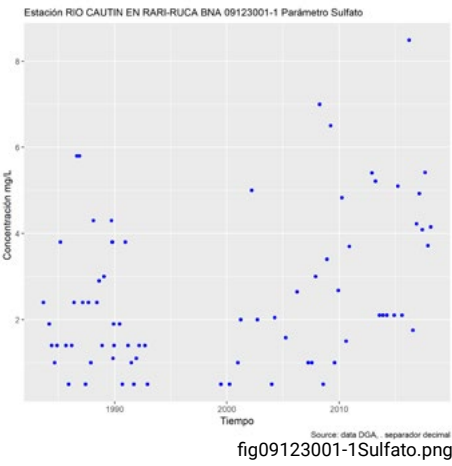
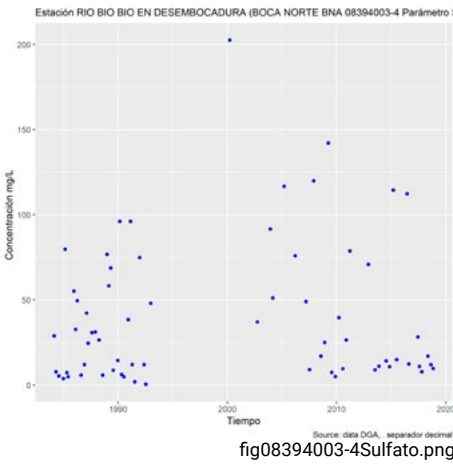
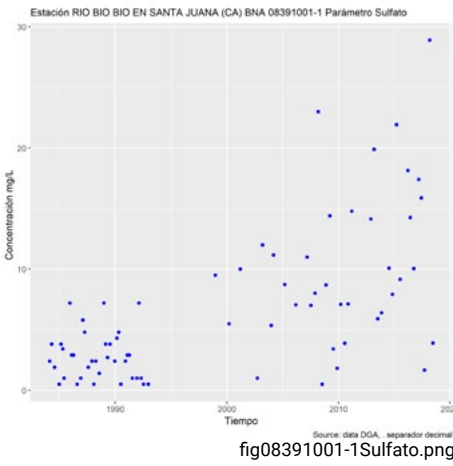
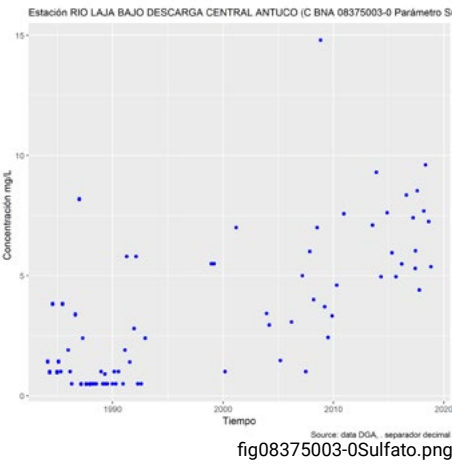
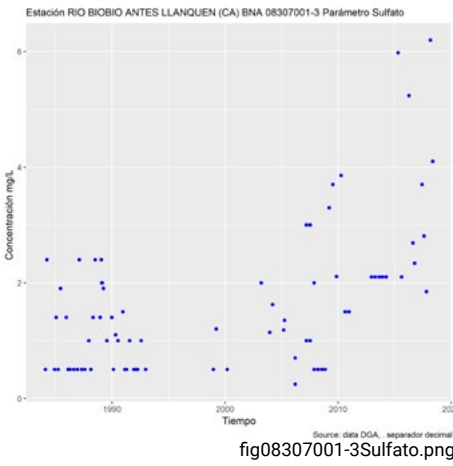
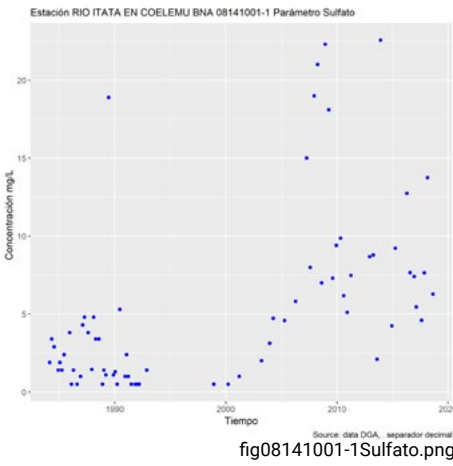
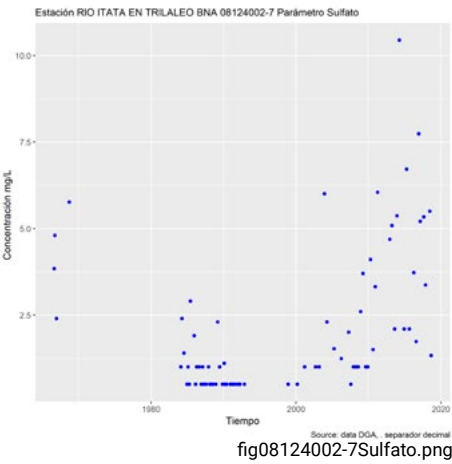
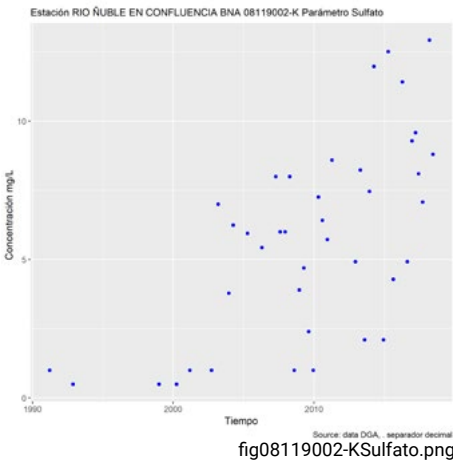
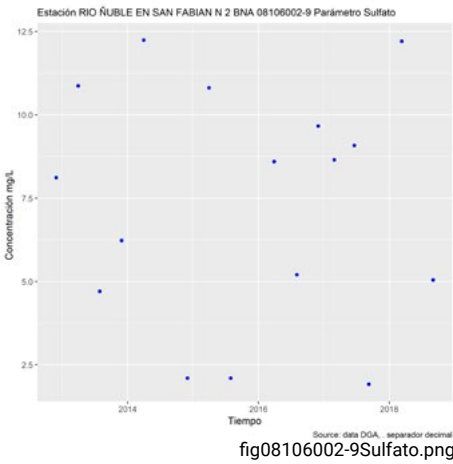


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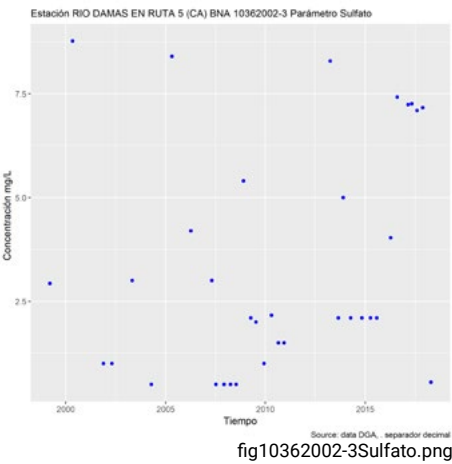
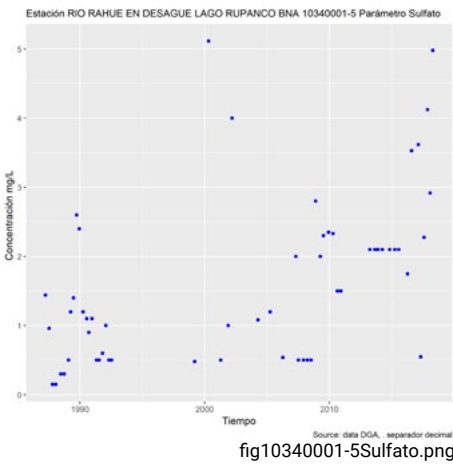
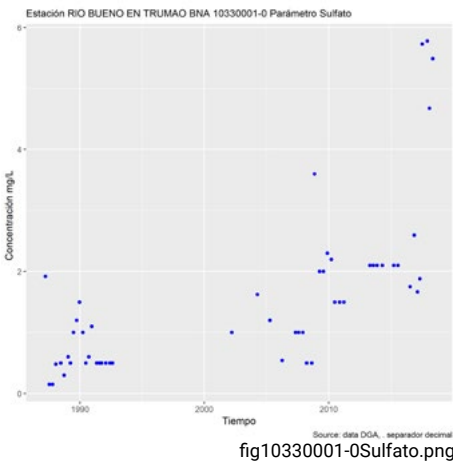
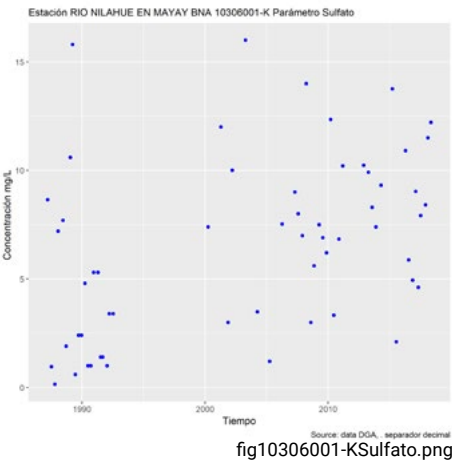
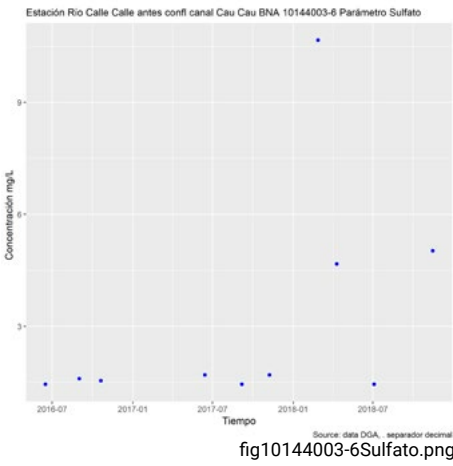
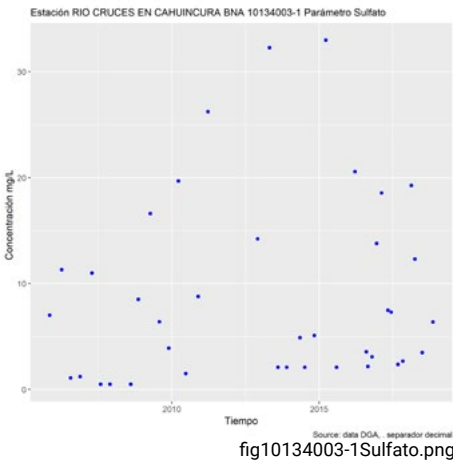
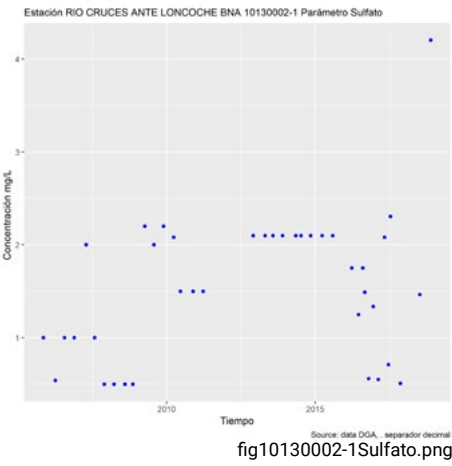
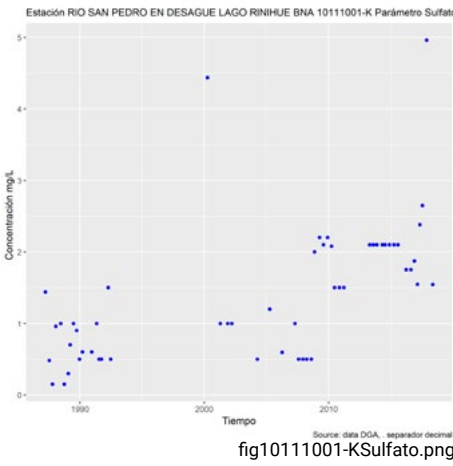
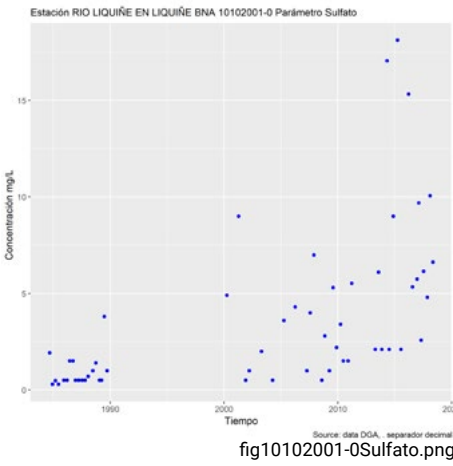
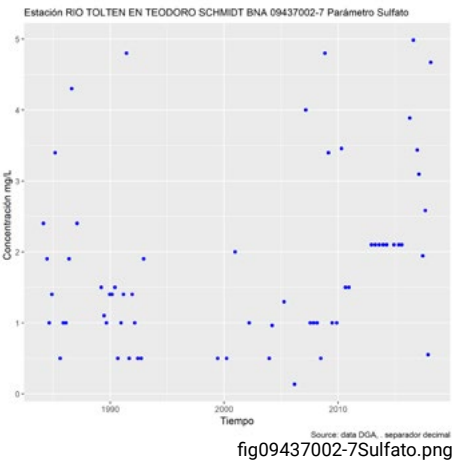
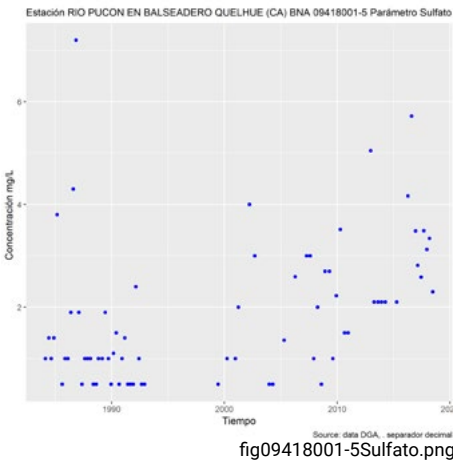
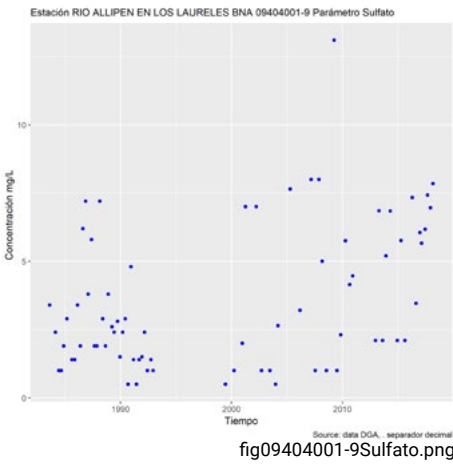
61. EVOLUCIÓN MACROZONA SUR - SULFATO



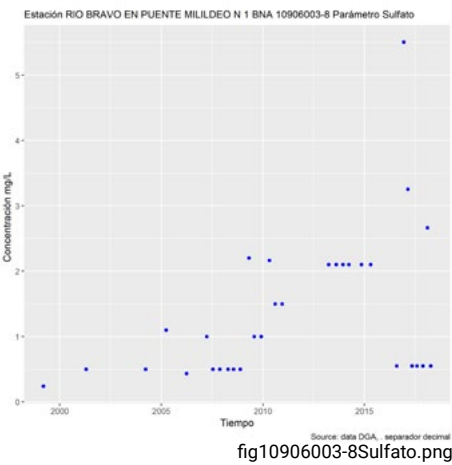
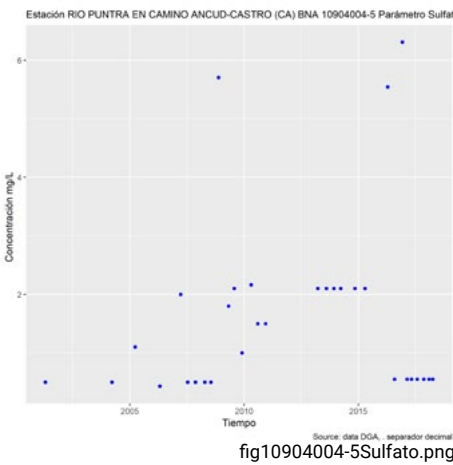
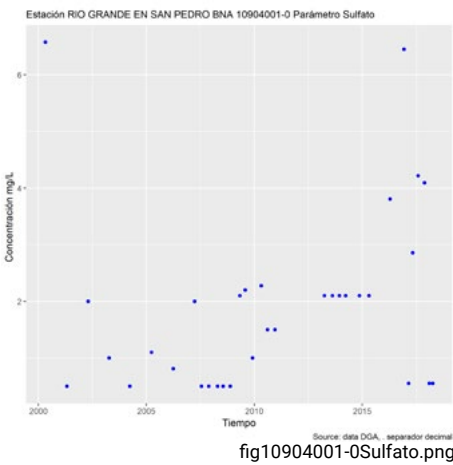
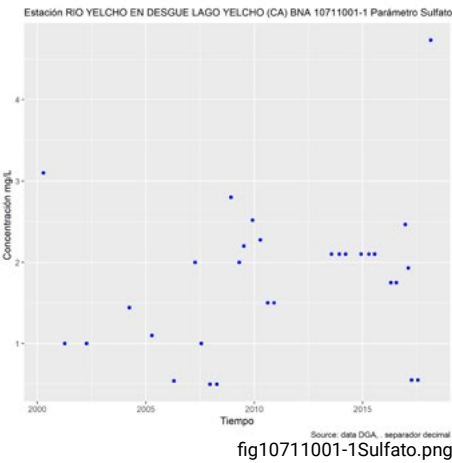
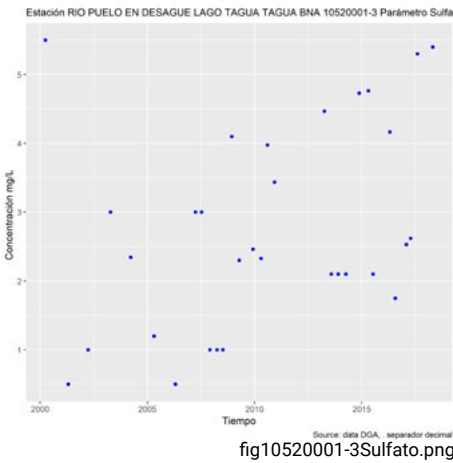
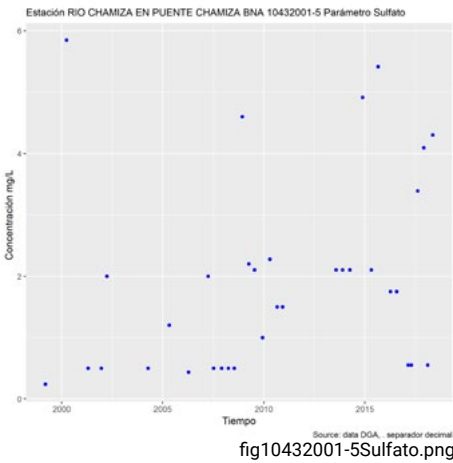
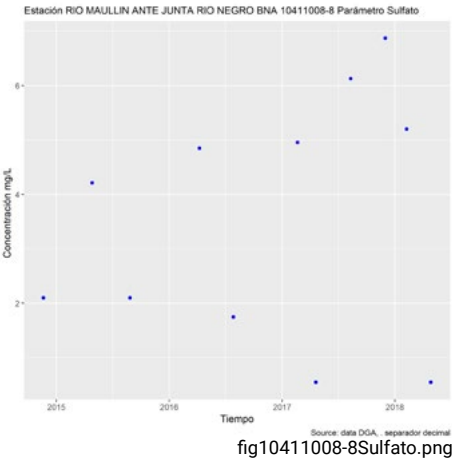
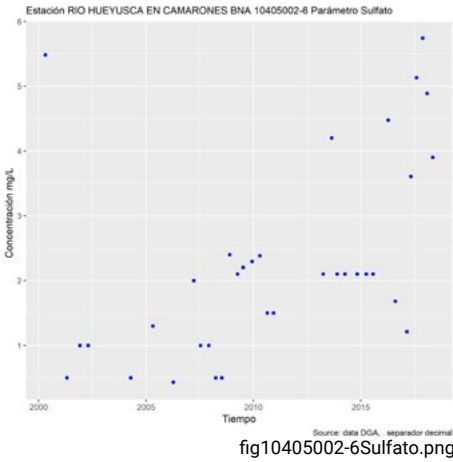
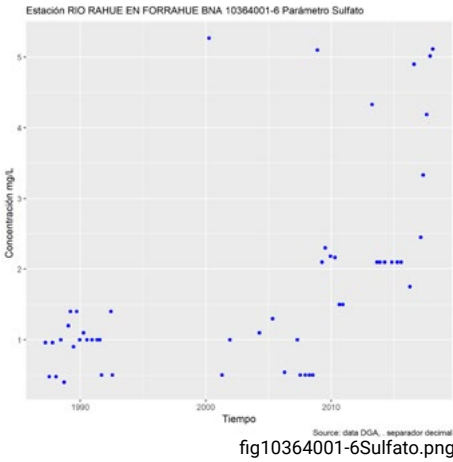
61 – 1.1 Gráficos – Evolución Macrozona Sur – Sulfato



61 - 1.2 Gráficos - Evolución Macrozona Sur - Sulfato



61 – 1.3 Gráficos – Evolución Macrozona Sur – Sulfato



Mapa de Evolución Cloruro Macrozona Sur

LEYENDA

- Capital regional
- Capital provincial
- Estaciones Superficiales
- Ríos Principales
- ▲ Centros Montañosos

Límites

TIPO

- Límite Internacional
- Regional
- Lagos, Lagunas, Embasces
- Ciudades
- Glaciares

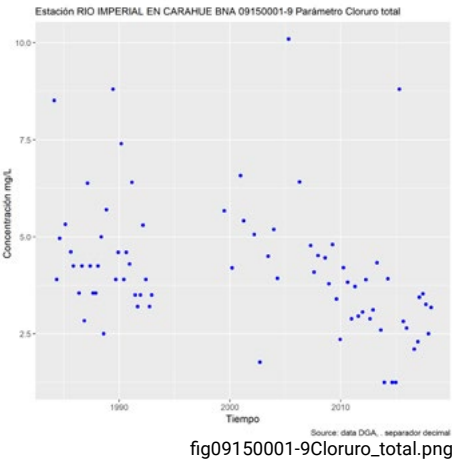
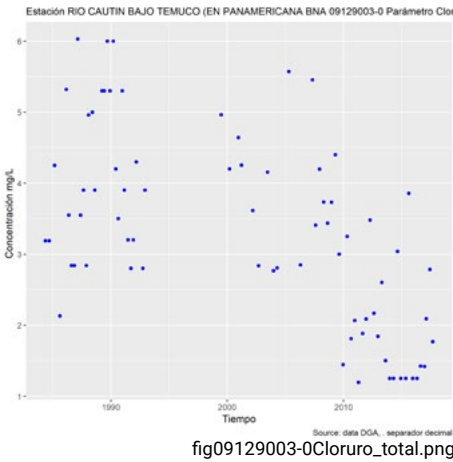
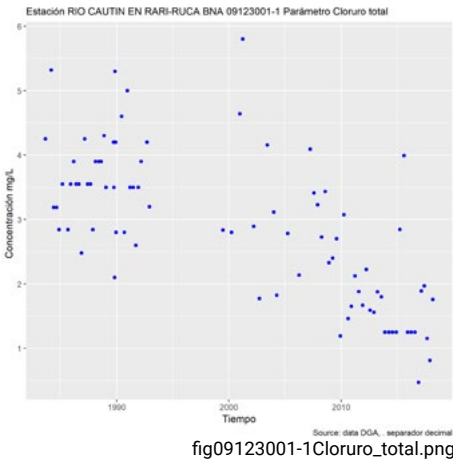
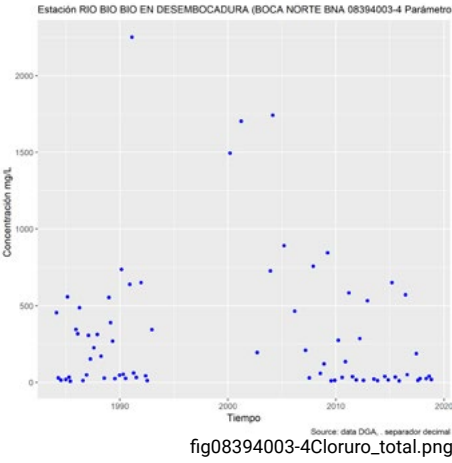
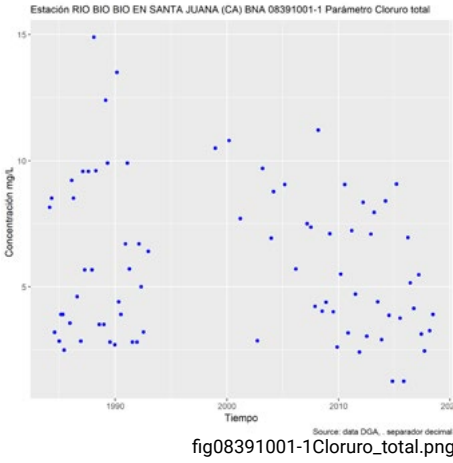
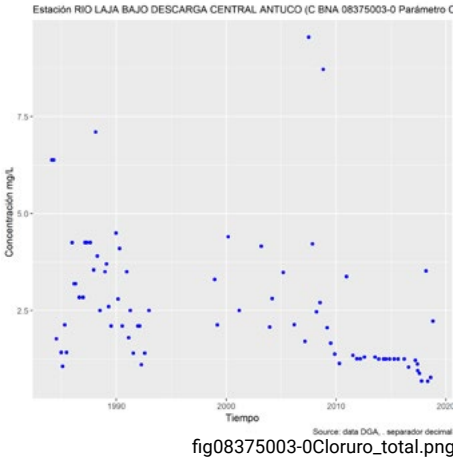
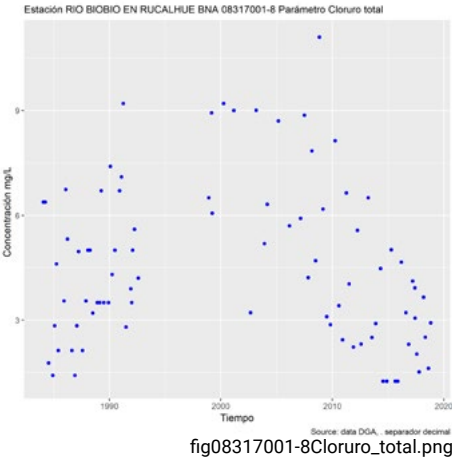
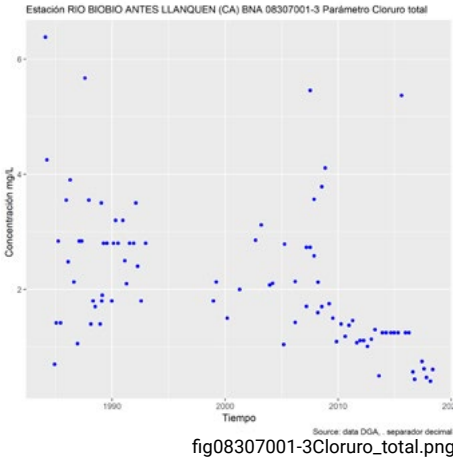
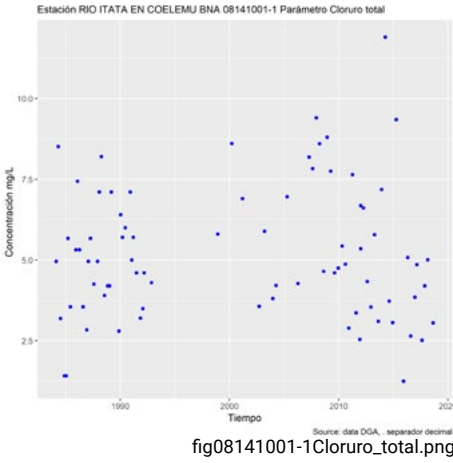
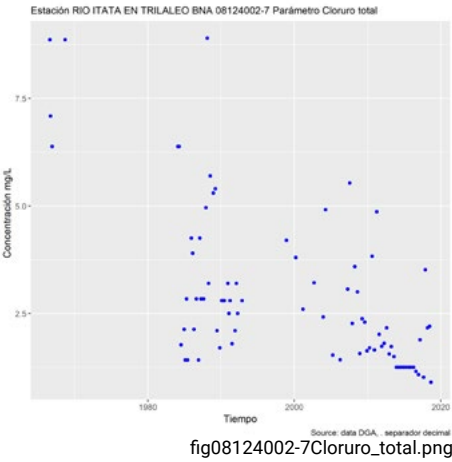
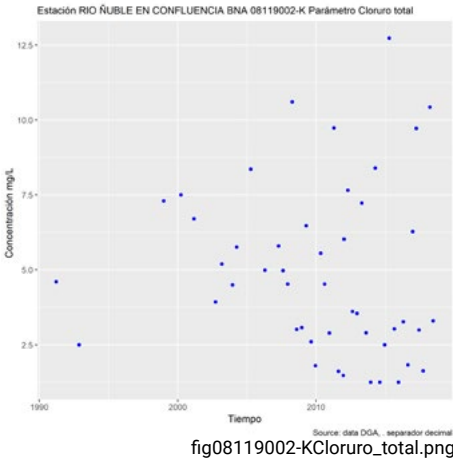
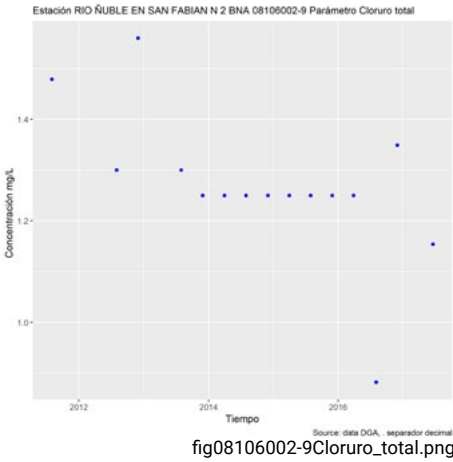
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Indice de Gráficos

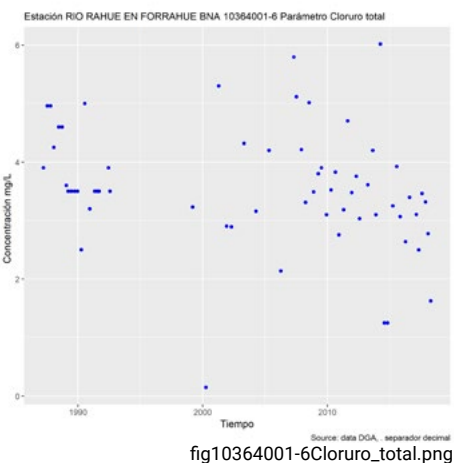
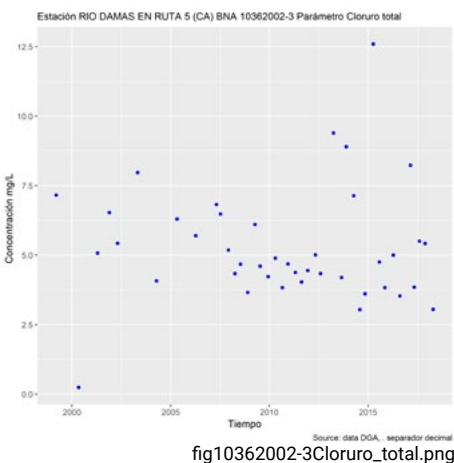
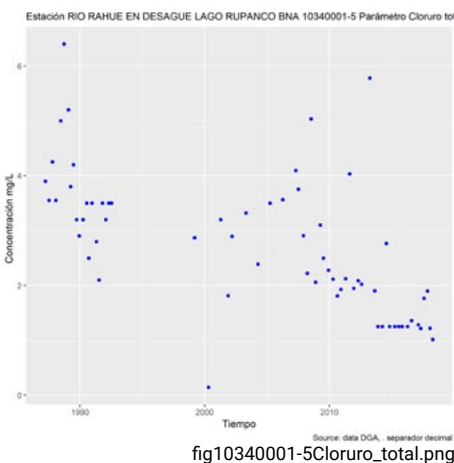
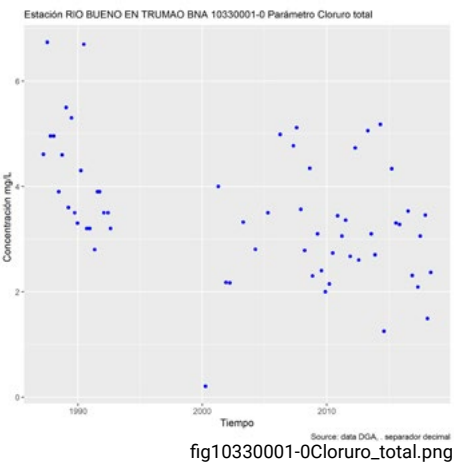
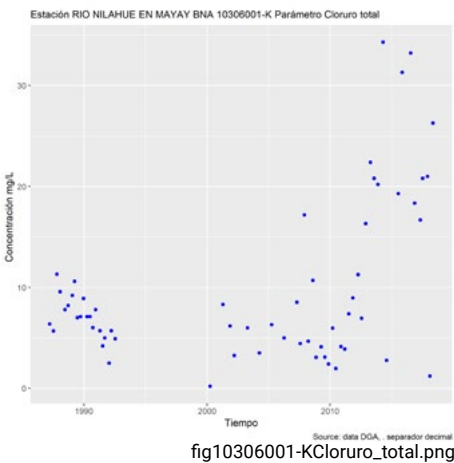
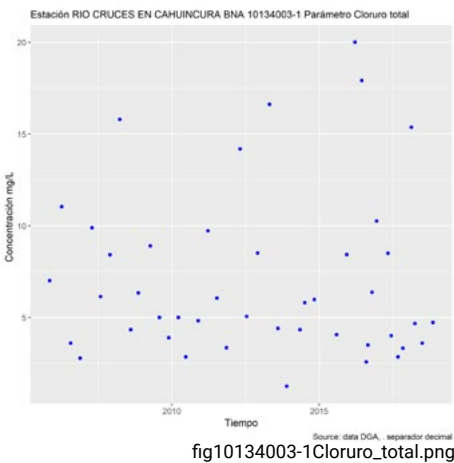
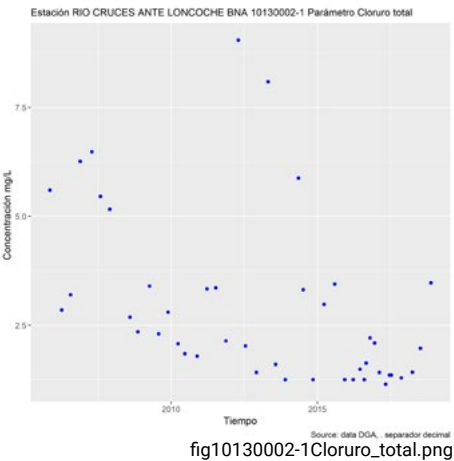
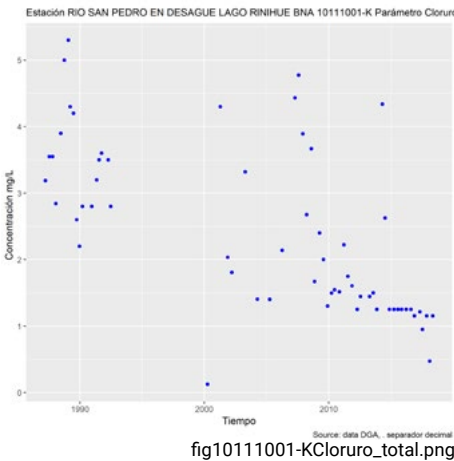
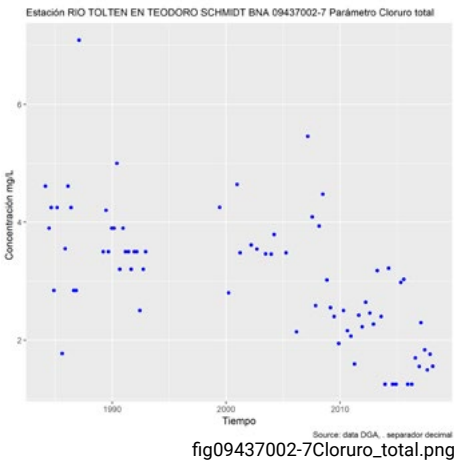
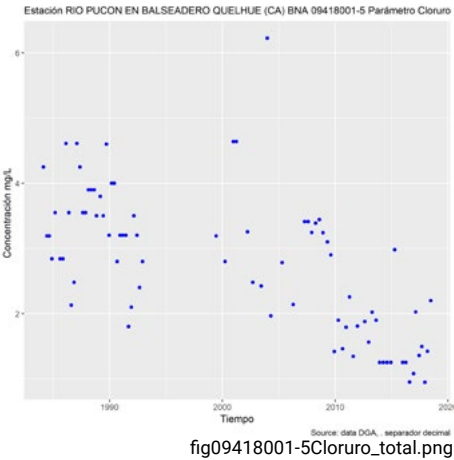
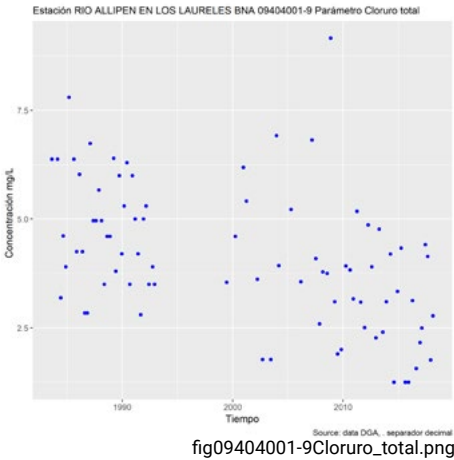
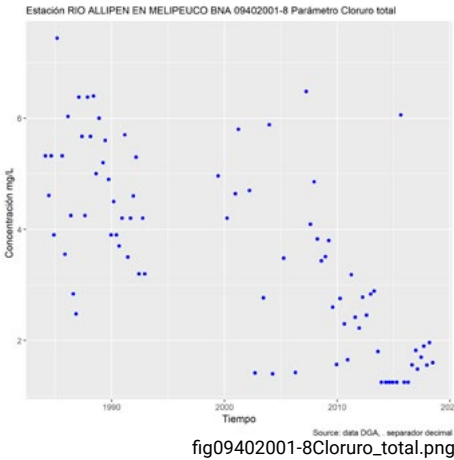
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3. fig08124002-7
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5. fig08307001-3
6. fig08317001-8
7. fig08375003-0
8. fig08391001-1
9. fig08394003-4
10. fig09123001-1
11. fig09129003-0
12. fig09150001-9
13. fig09402001-8
14. fig09404001-9
15. fig09418001-5
16. fig09437002-7
17. fig10102001-0
18. fig10111001-K
19. fig10130002-1
20. fig10134003-1
21. fig10306001-K
22. fig10330001-0
23. fig10340001-5
24. fig10362002-3
25. fig10364001-6
26. fig10405002-6
27. fig10411008-8
28. fig10432001-5
29. fig10520001-3
30. fig10711001-1
31. fig10904001-0
32. fig10904004-5
33. fig10906003-8

62 – 1.1 Gráficos – Evolución Macrozona Sur – Cloruro



62 - 1.2 Gráficos - Evolución Macrozona Sur - Cloruro



62 – 1.3 Gráficos – Evolución Macrozona Sur – Cloruro

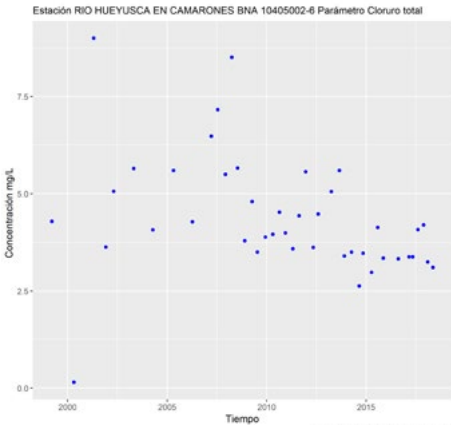


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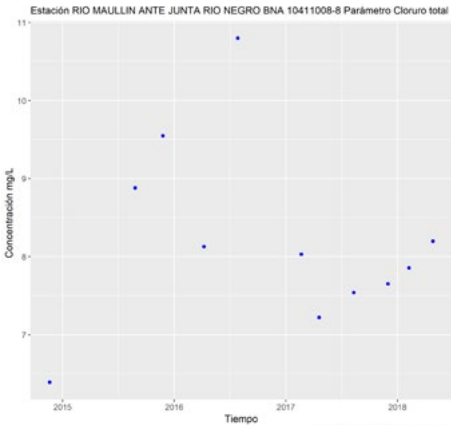


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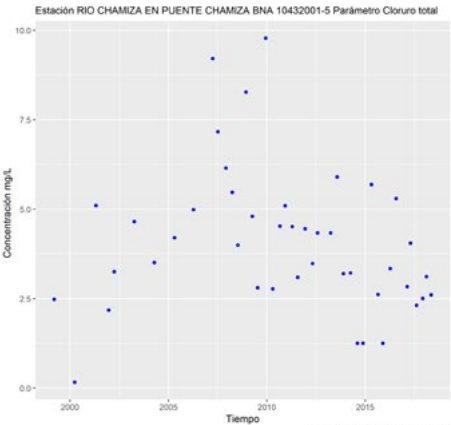


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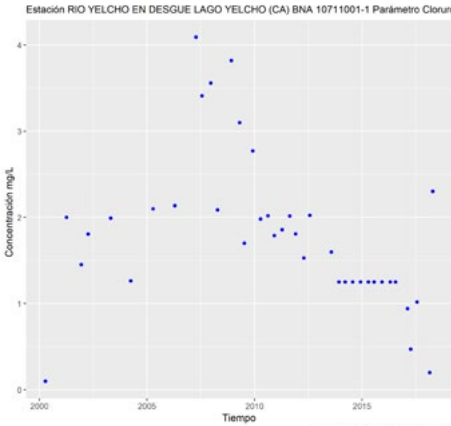


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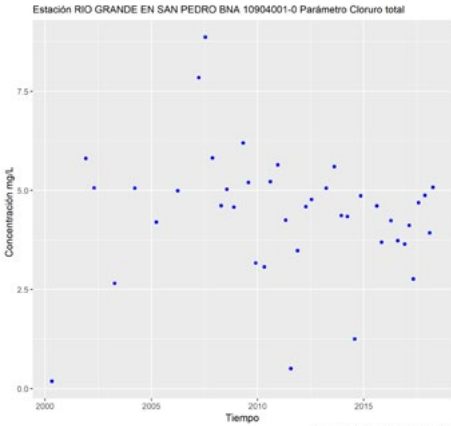


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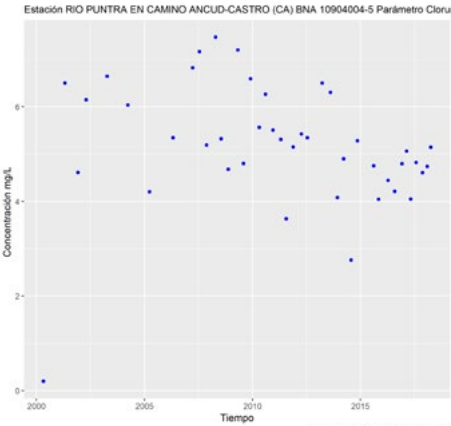


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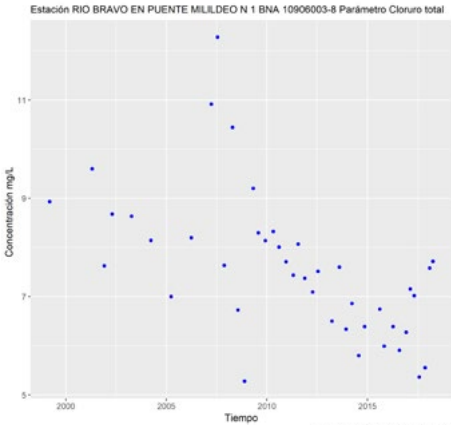


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63. EVOLUCIÓN MACROZONA SUR - TEMPERATURA



63 – 1.1 Gráficos – Evolución Macrozona Sur – Temperatura

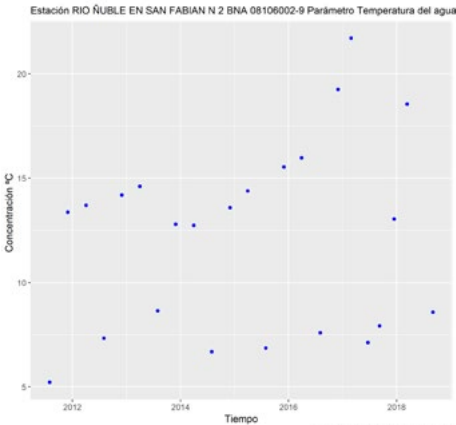


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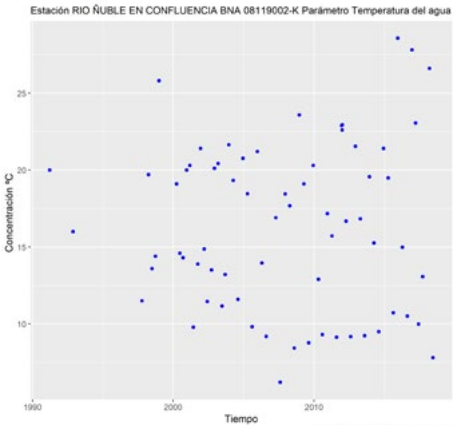


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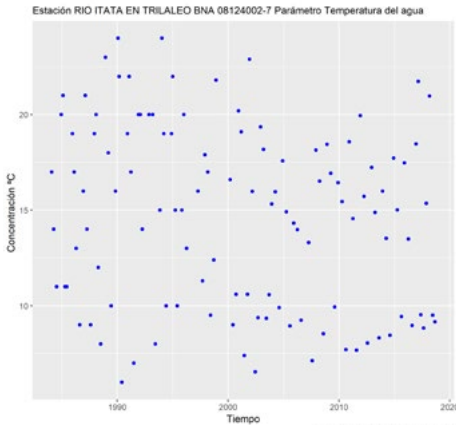


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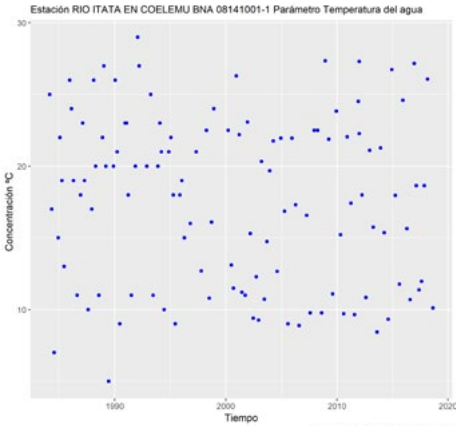


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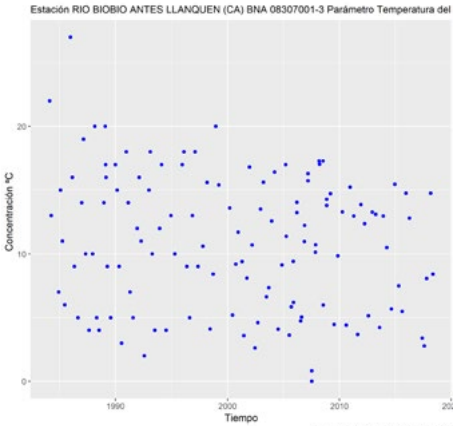


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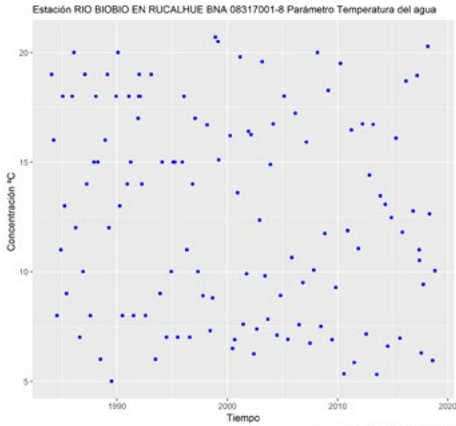


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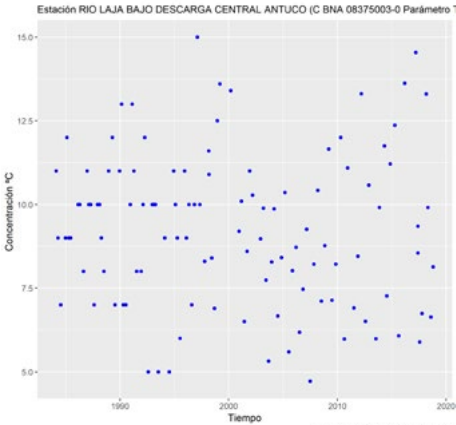


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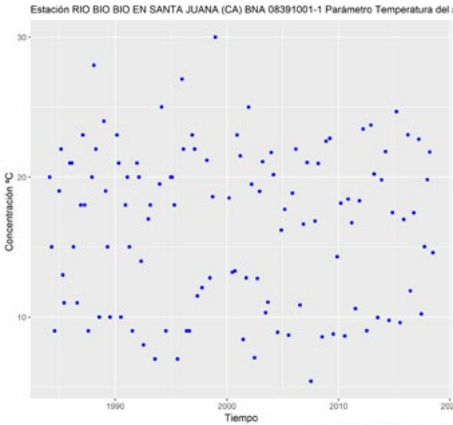


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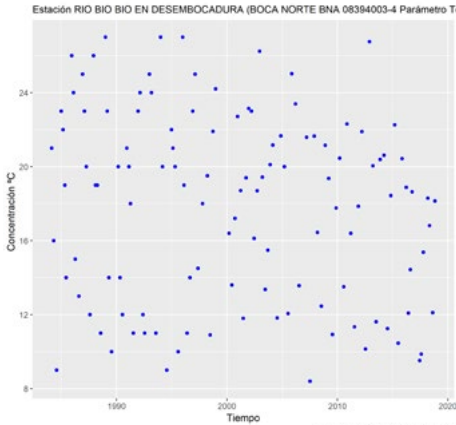


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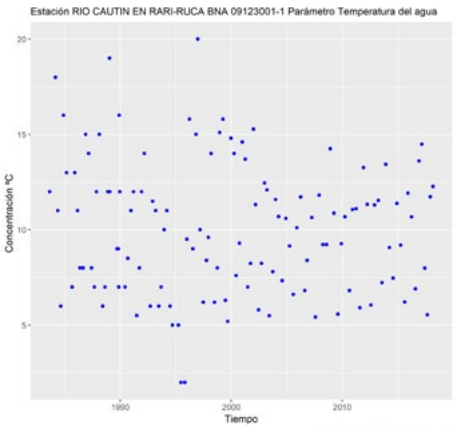


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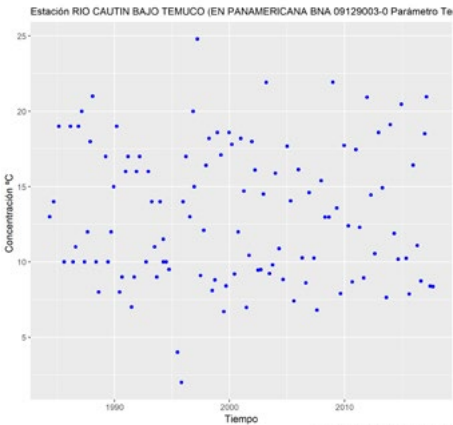


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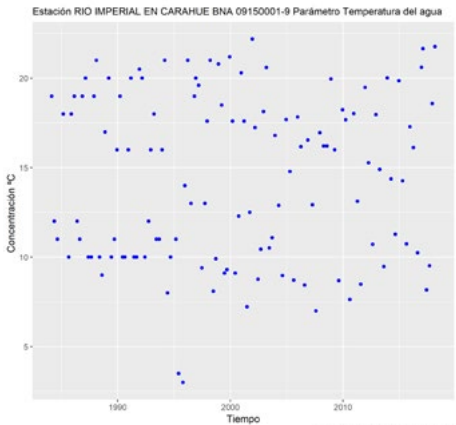


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63 – 1.2 Gráficos – Evolución Macrozona Sur – Temperatura

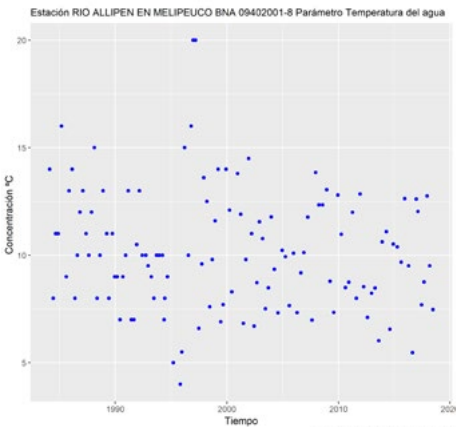


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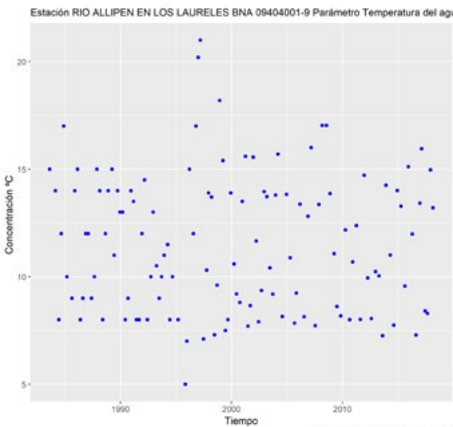


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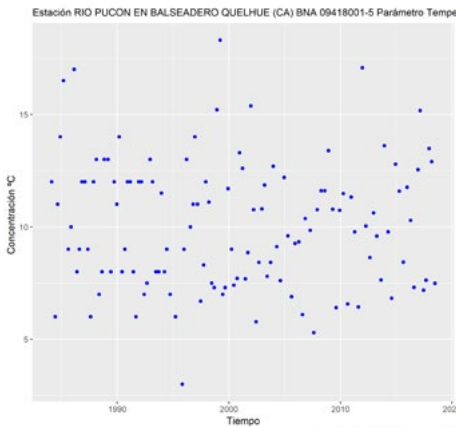


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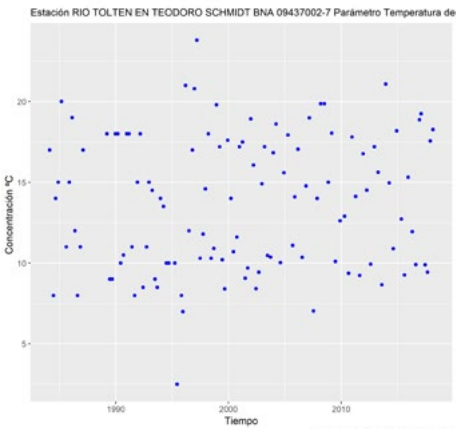


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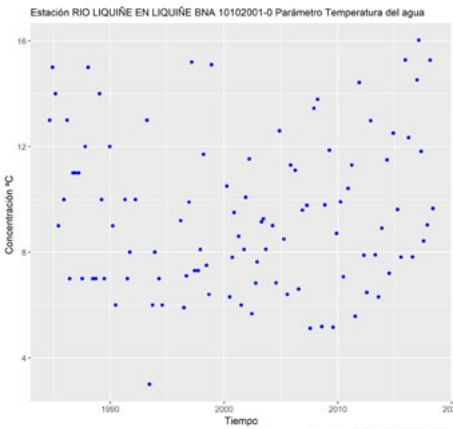


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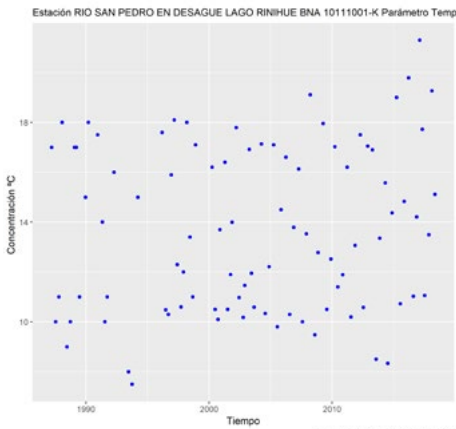


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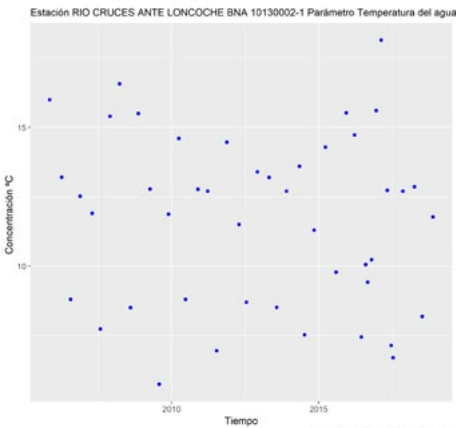


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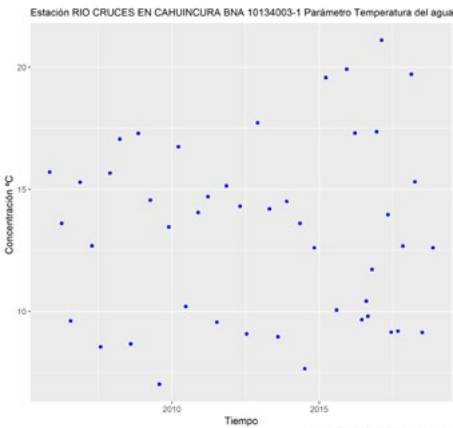


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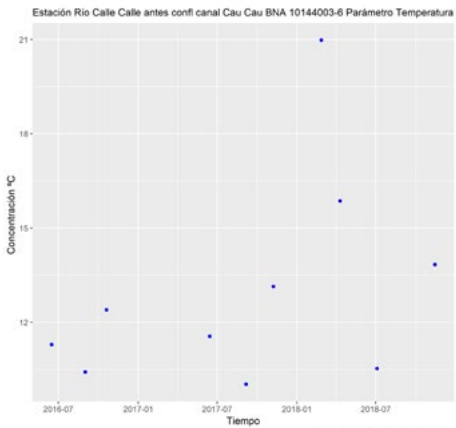


fig10144003-6Temperatura_del_agua.png

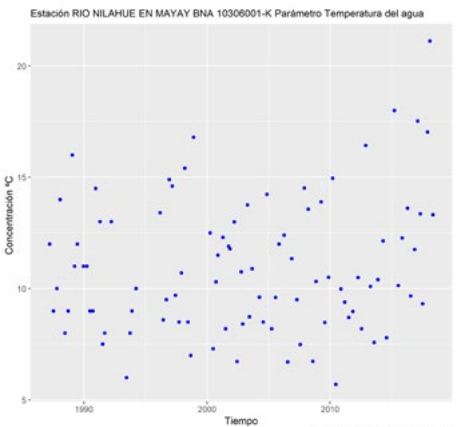


fig10306001-KTemperatura_del_agua.png

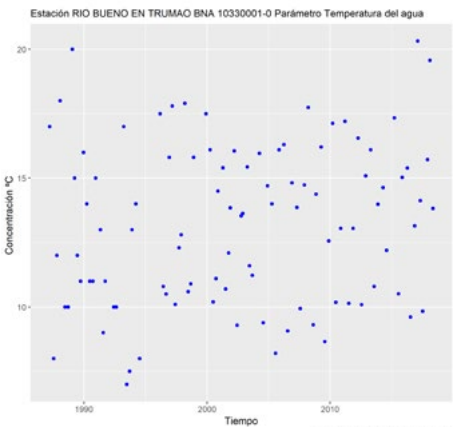


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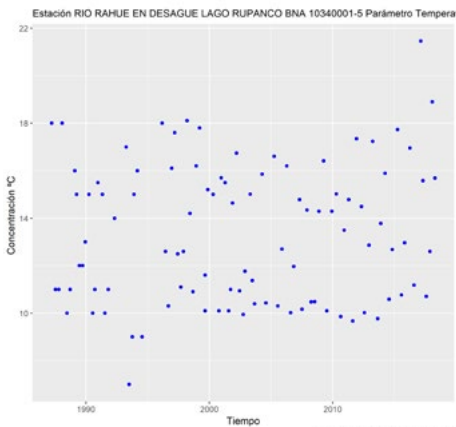


fig10340001-5Temperatura_del_agua.png

63 – 1.3 Gráficos – Evolución Macrozona Sur – Temperatura

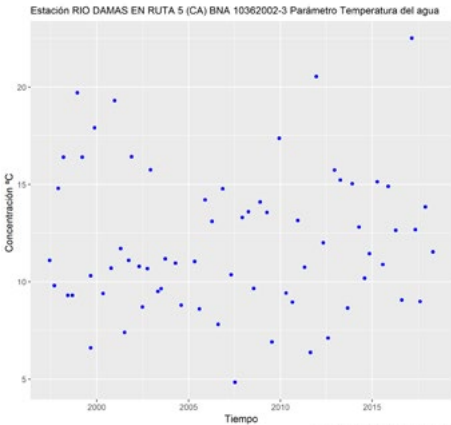


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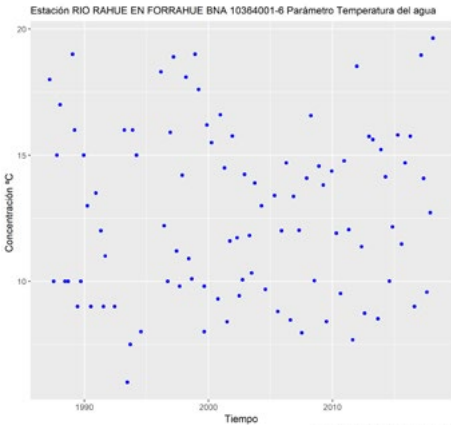


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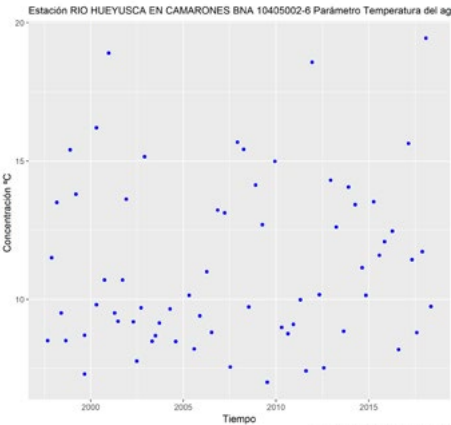


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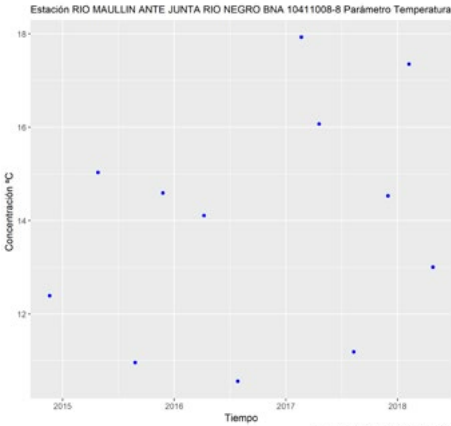


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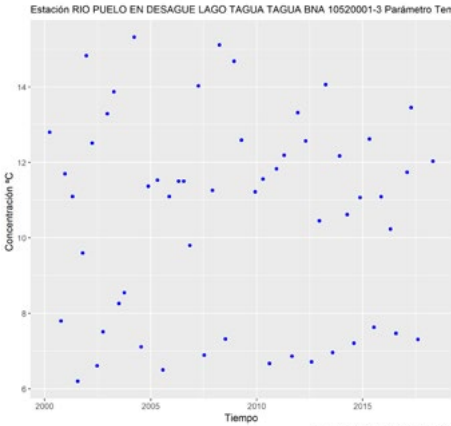


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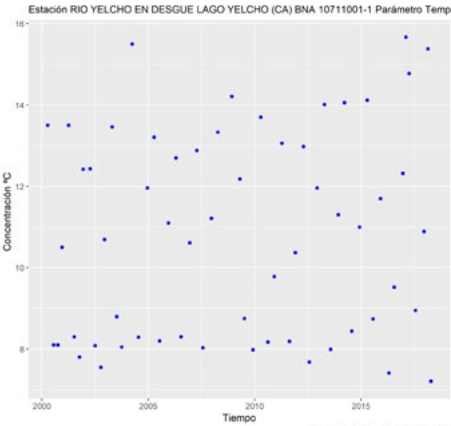


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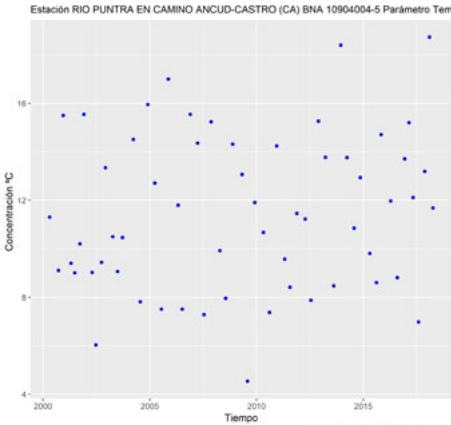


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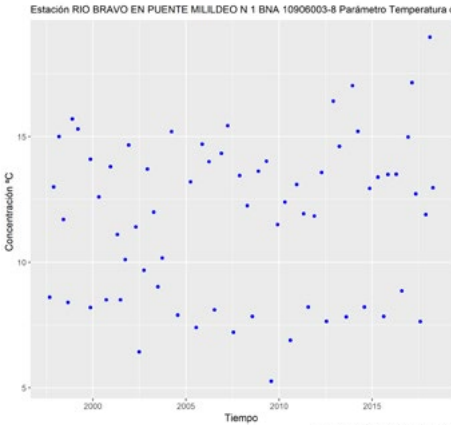
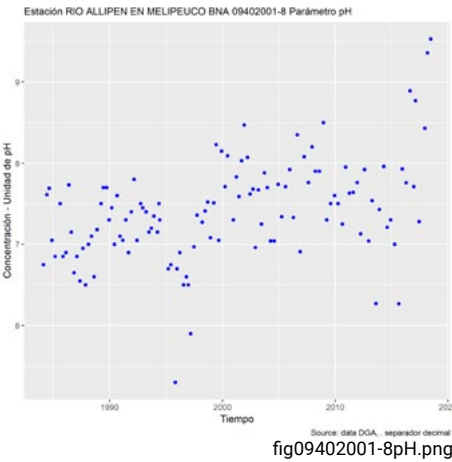
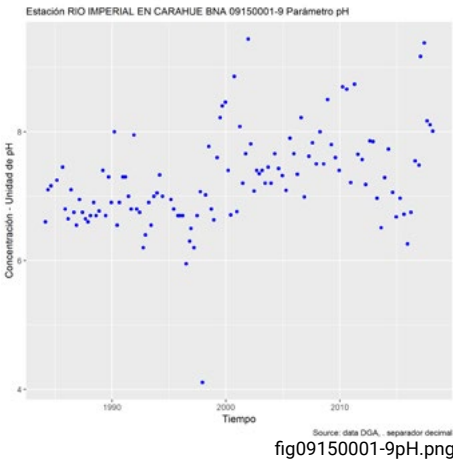
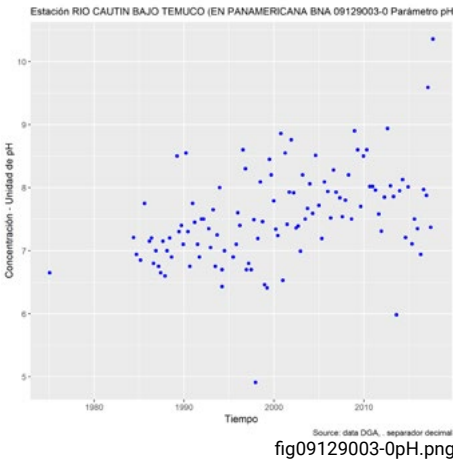
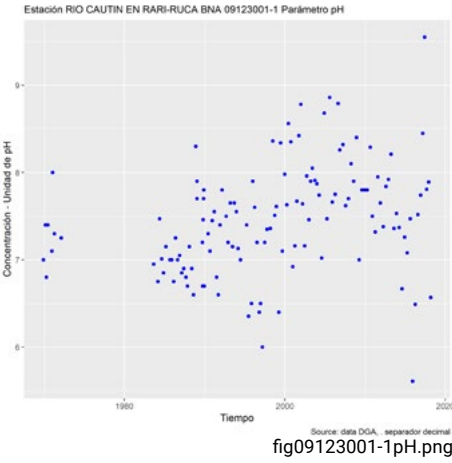
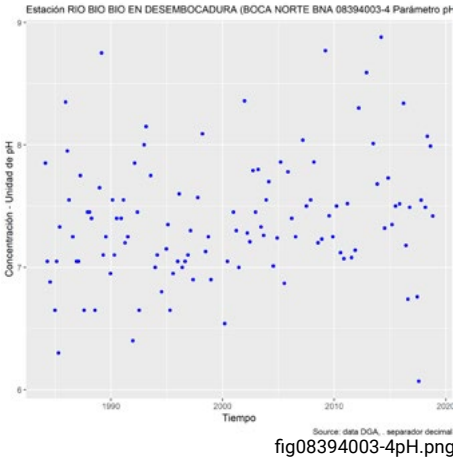
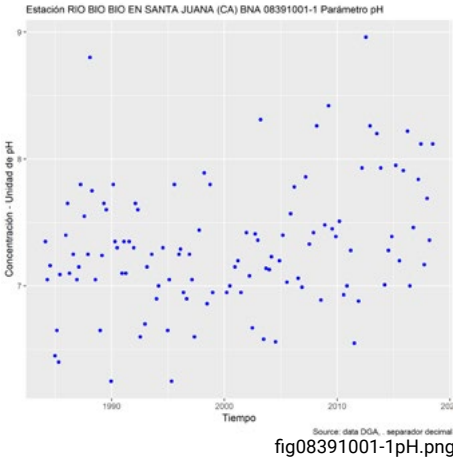
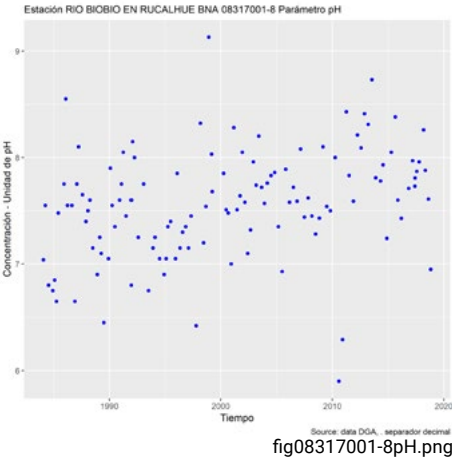
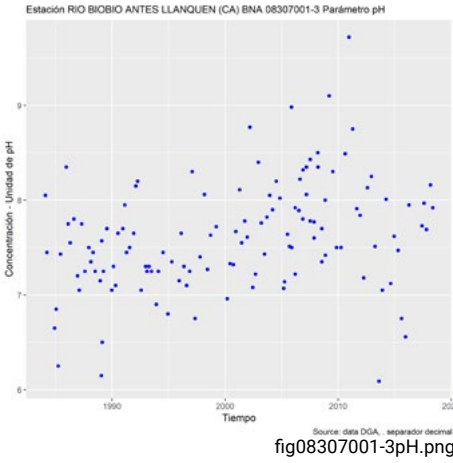
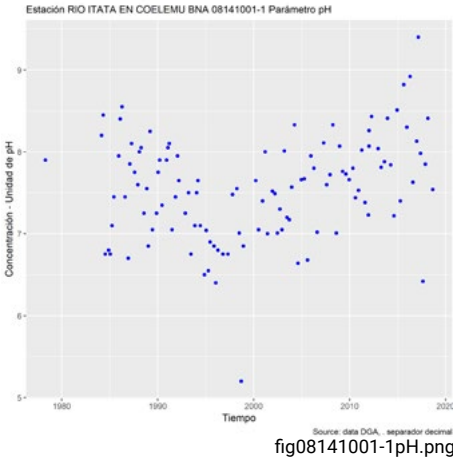
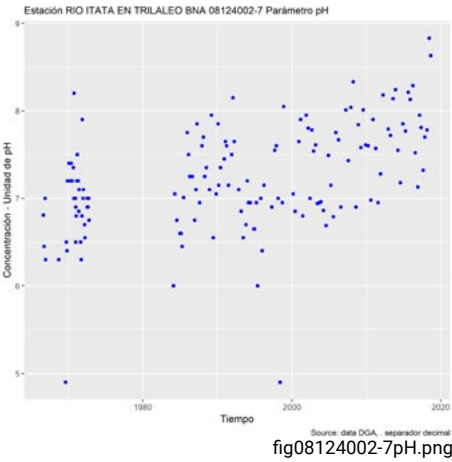
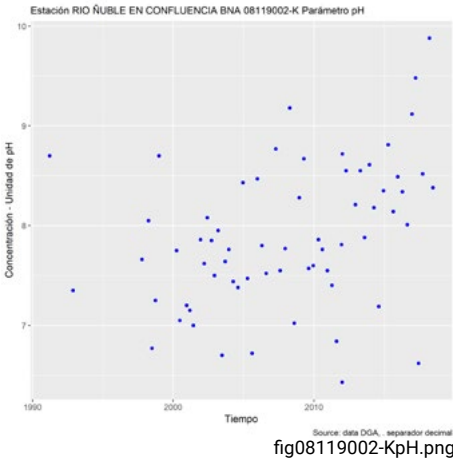
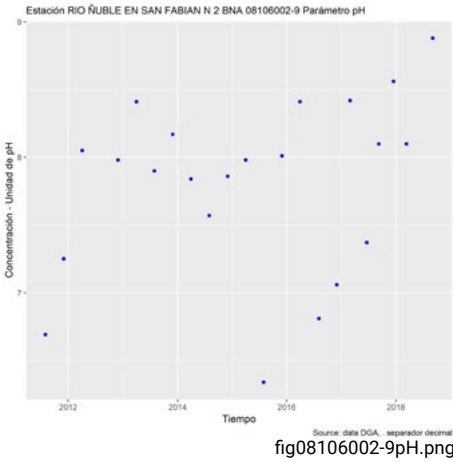


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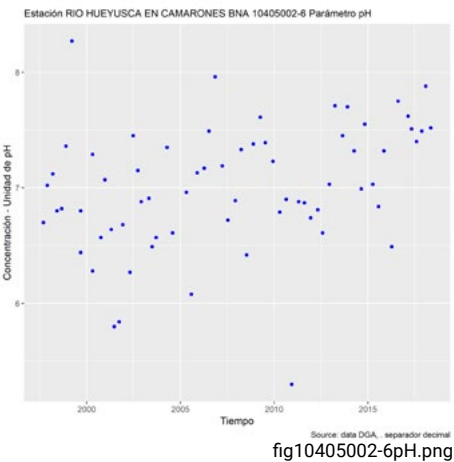
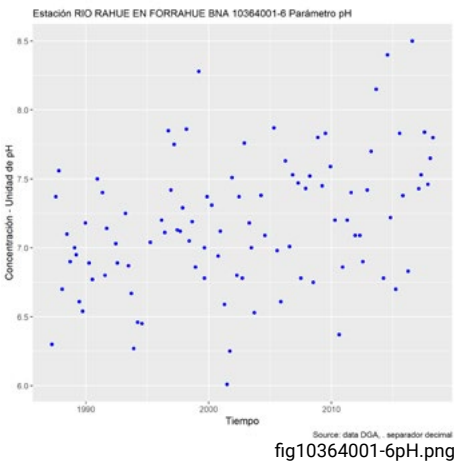
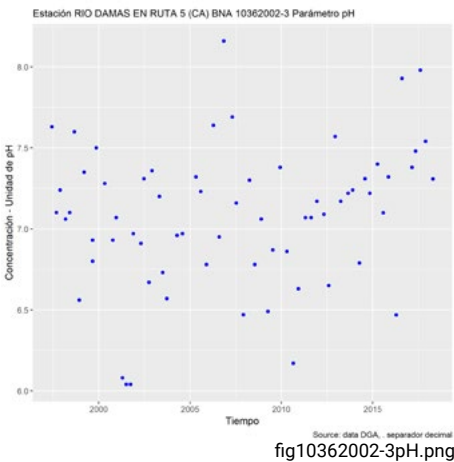
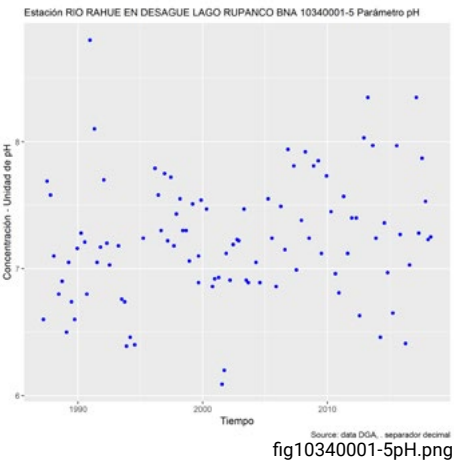
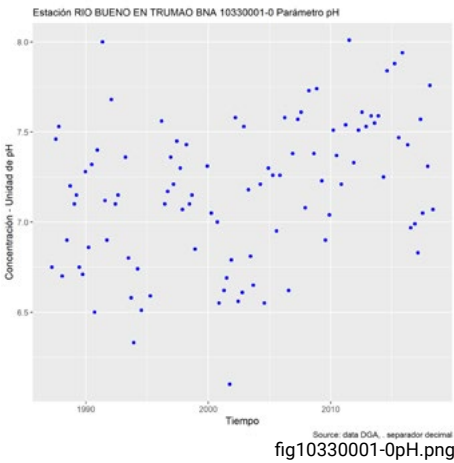
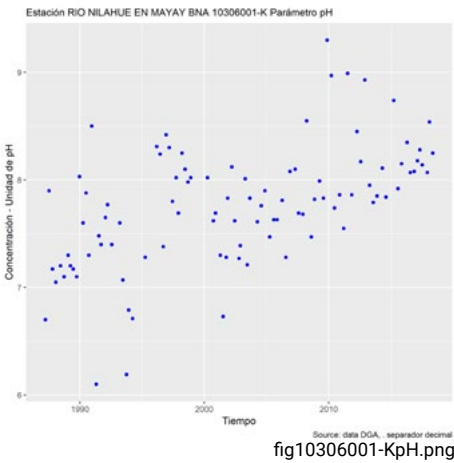
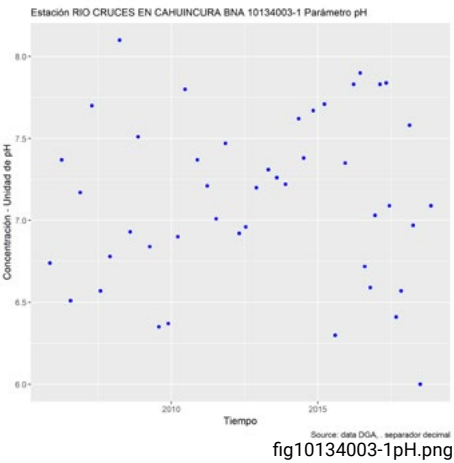
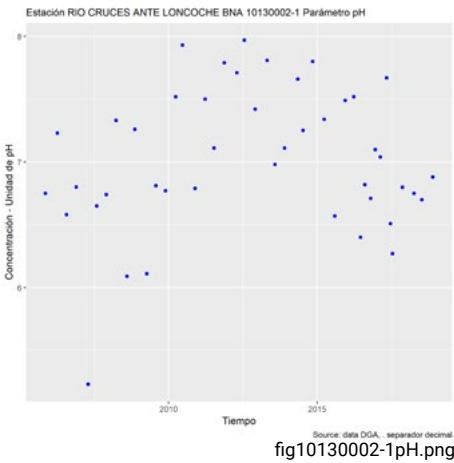
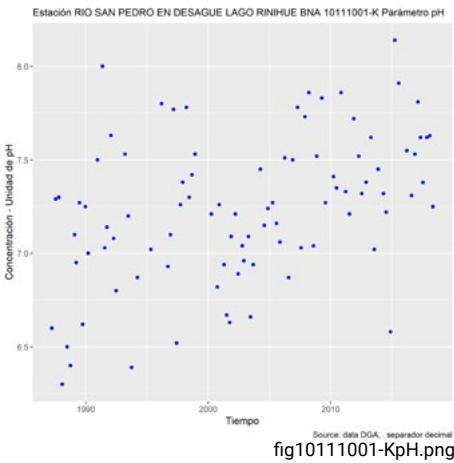
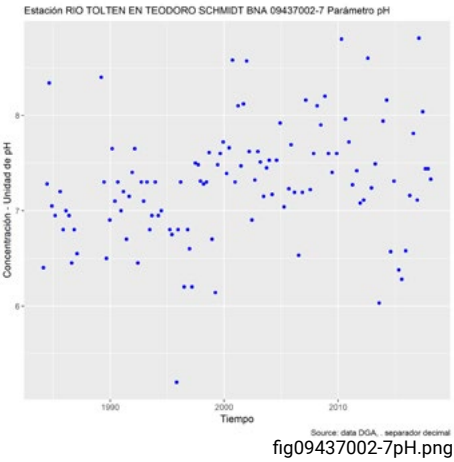
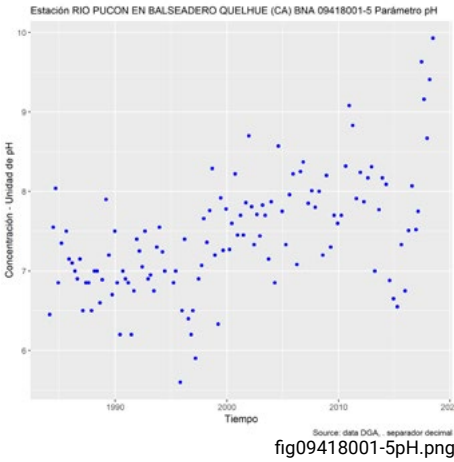
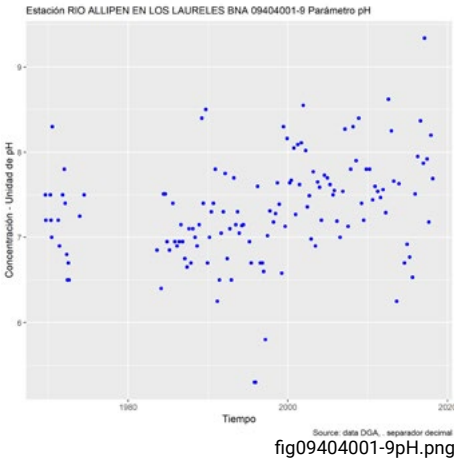
64. EVOLUCIÓN MACROZONA SUR - PH



64 – 1.1 Gráficos – Evolución Macrozona Sur – Ph



64 - 1.2 Gráficos - Evolución Macrozona Sur - Ph



64 – 1.3 Gráficos – Evolución Macrozona Sur – Ph

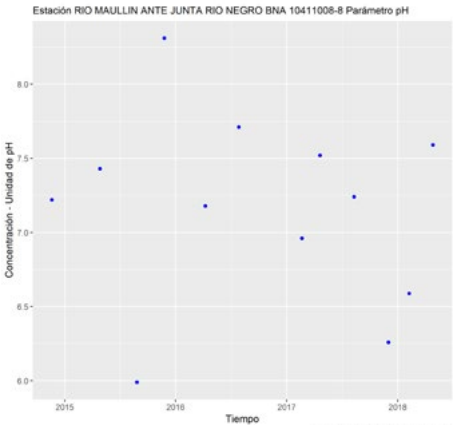


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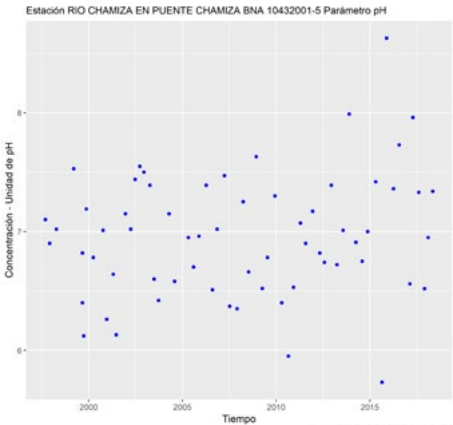


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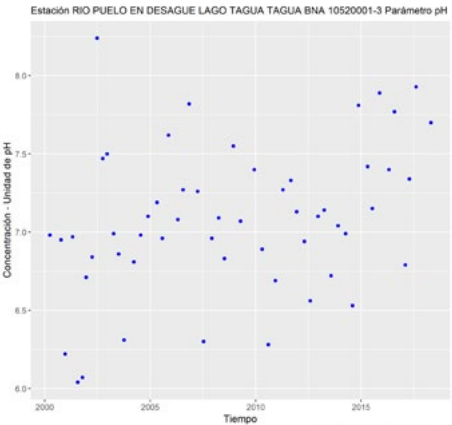


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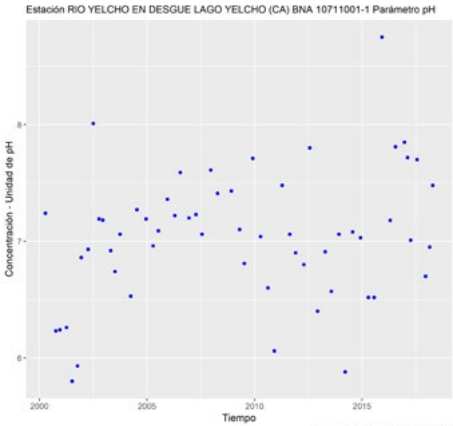


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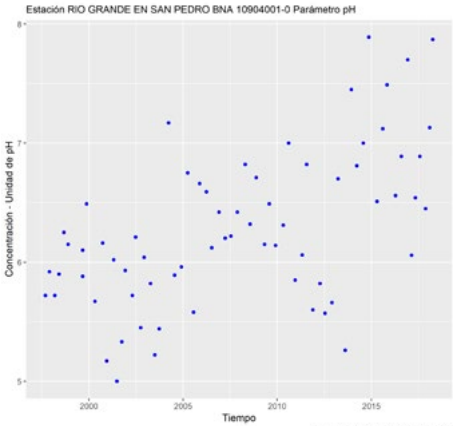


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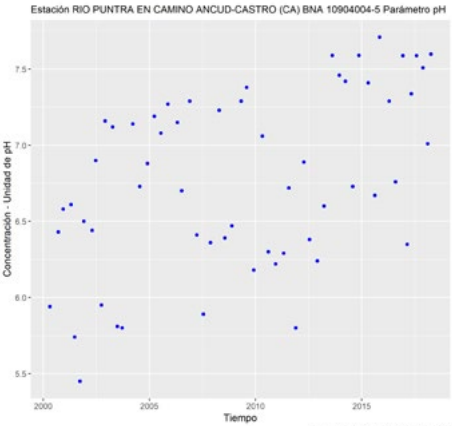


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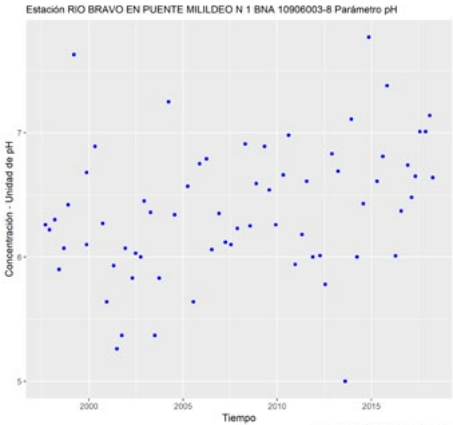


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Mapa de Evolución Hierro Macrozona Sur

LEYENDA

- Capital regional
- Capital provincial
- Estaciones Superficiales
- Ríos Principales
- ▲ Centros Montañosos

Límites

TIPO

- Límite Internacional
- Regional
- Lagos, Lagunas, Embalses
- Ciudades
- Glaciares

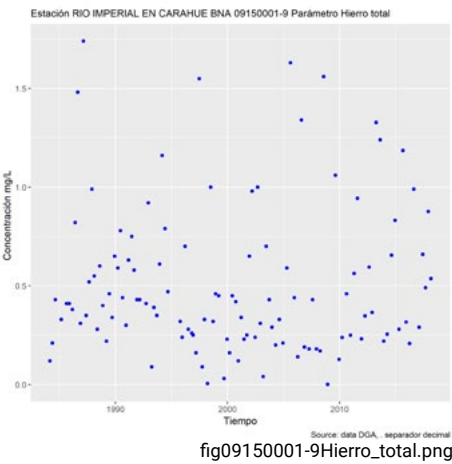
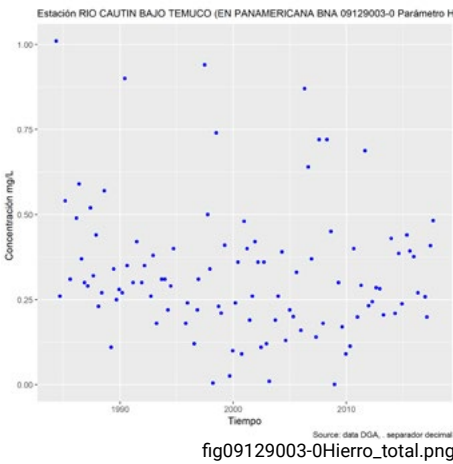
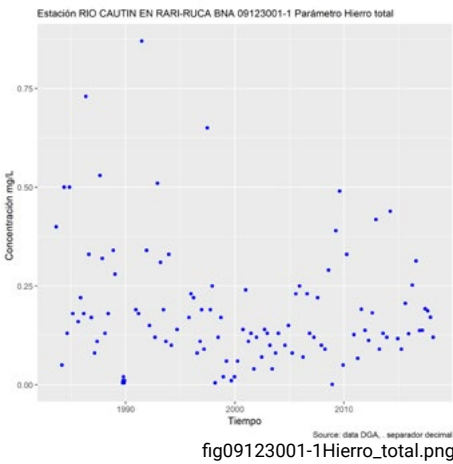
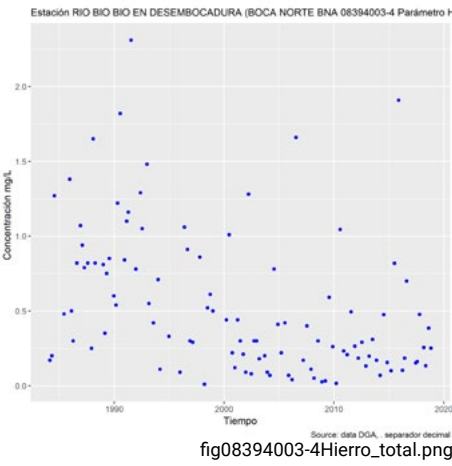
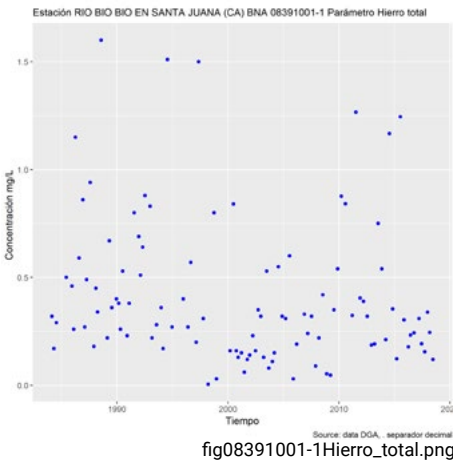
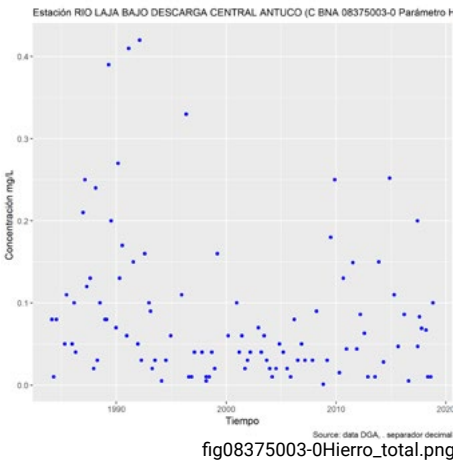
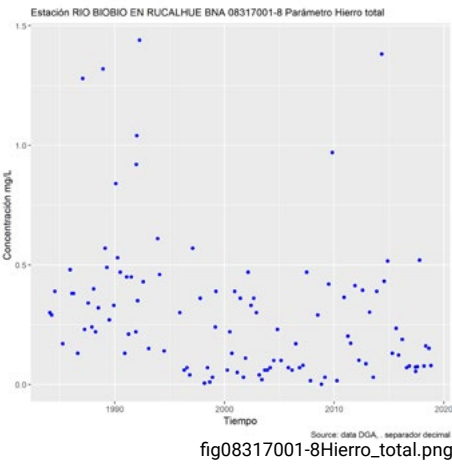
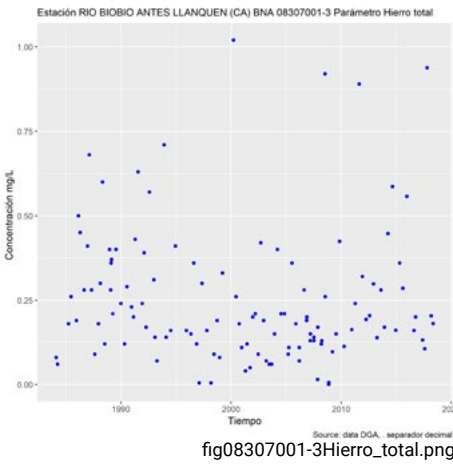
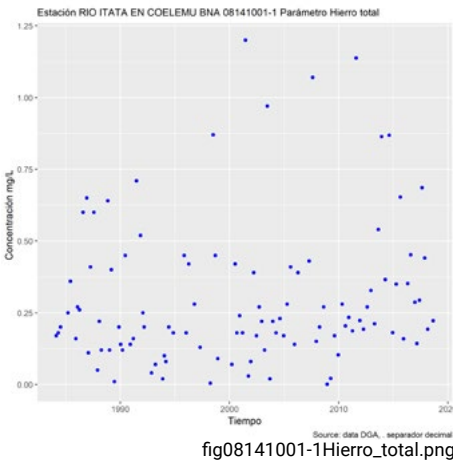
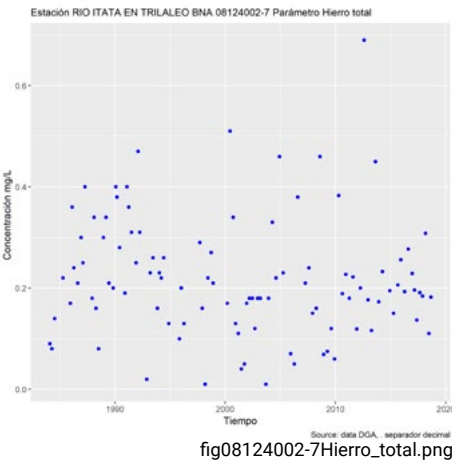
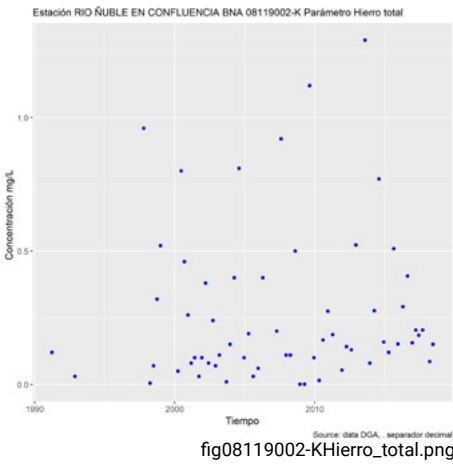
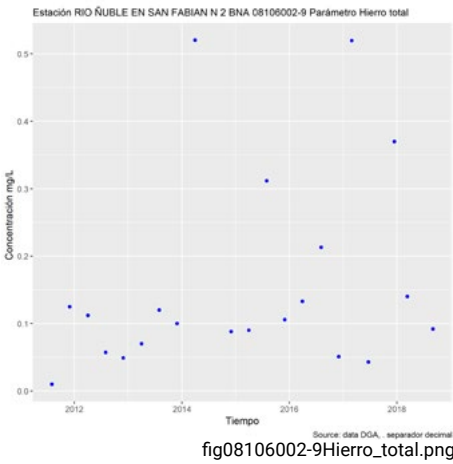
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Indice de Gráficos

Identificador de Gráfico

1. fig08106002-9
2. fig08119002-K
3. fig08124002-7
4. fig08141001-1
5. fig08307001-3
6. fig08317001-8
7. fig08375003-0
8. fig08391001-1
9. fig08394003-4
10. fig09123001-1
11. fig09129003-0
12. fig09150001-9
13. fig09402001-8
14. fig09404001-9
15. fig09418001-5
16. fig09437002-7
17. fig10102001-0
18. fig10111001-K
19. fig10130002-1
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22. fig10306001-K
23. fig10330001-0
24. fig10340001-5
25. fig10362002-3
26. fig10364001-6
27. fig10405002-6
28. fig10411008-8
29. fig10432001-5
30. fig10520001-3
31. fig10711001-1
32. fig10904001-0
33. fig10904004-5
34. fig10906003-8

65 – 1.1 Gráficos – Evolución Macrozona Sur – hierro



65 – 1.2 Gráficos – Evolución Macrozona Sur – hierro

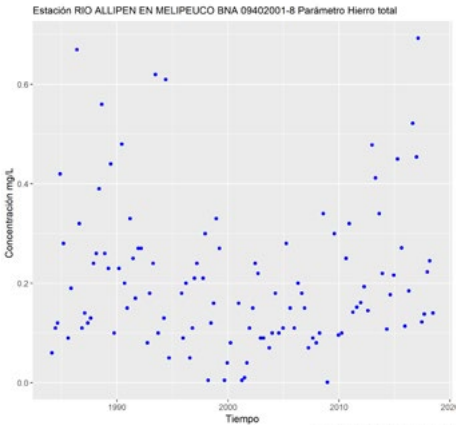


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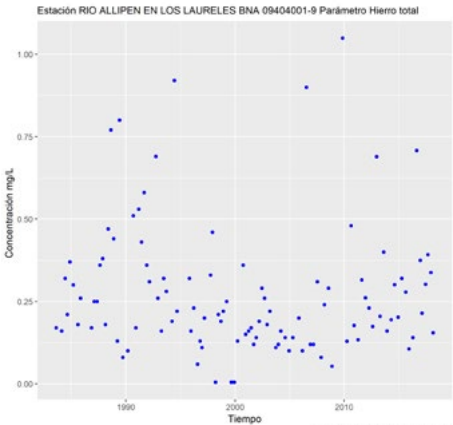


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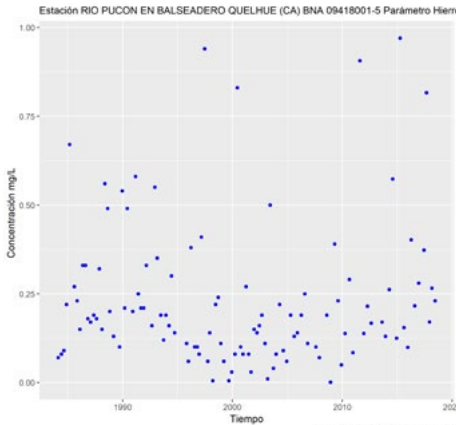


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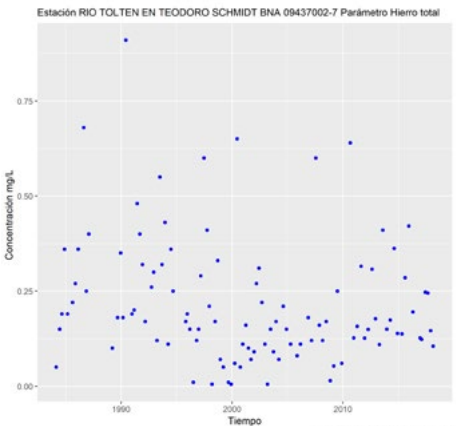


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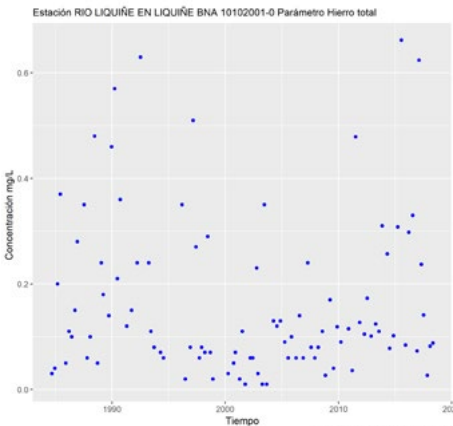


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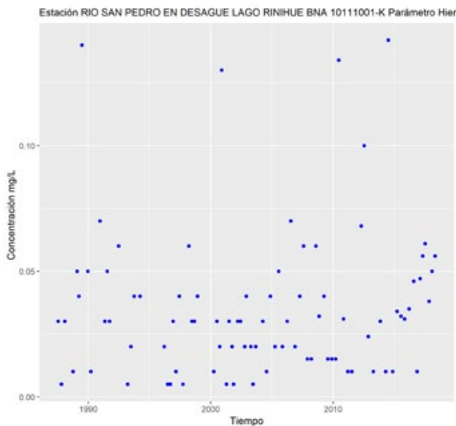


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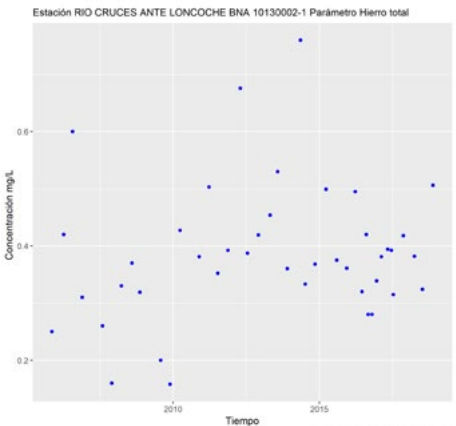


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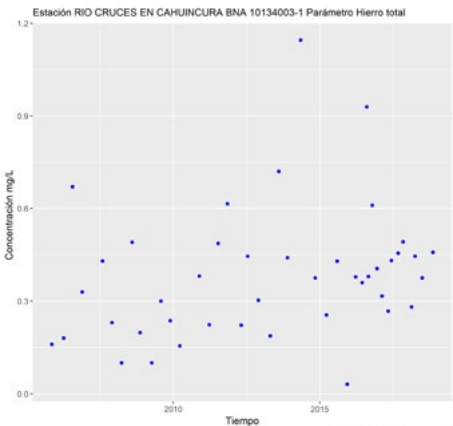


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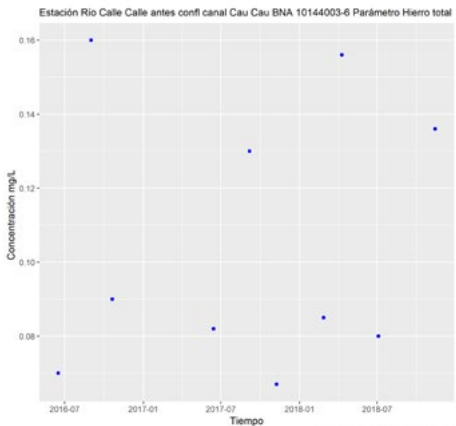


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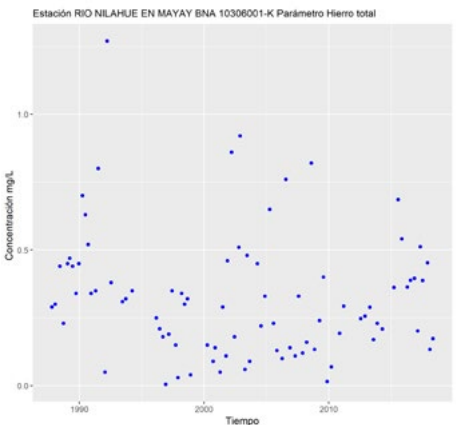


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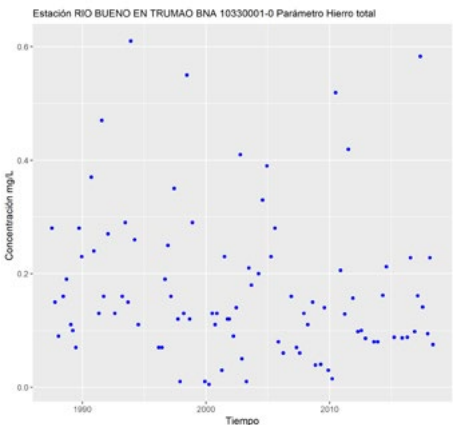


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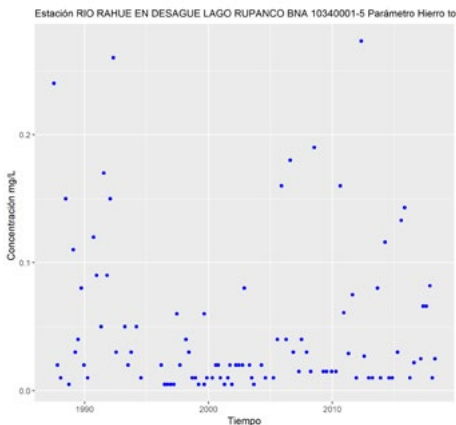


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65 – 1.3 Gráficos – Evolución Macrozona Sur – hierro

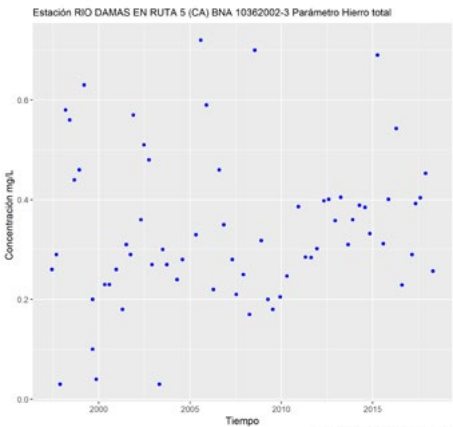


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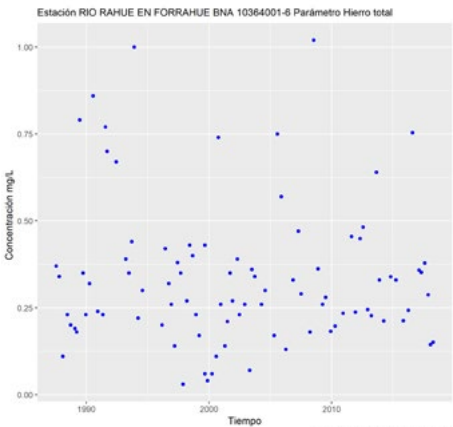


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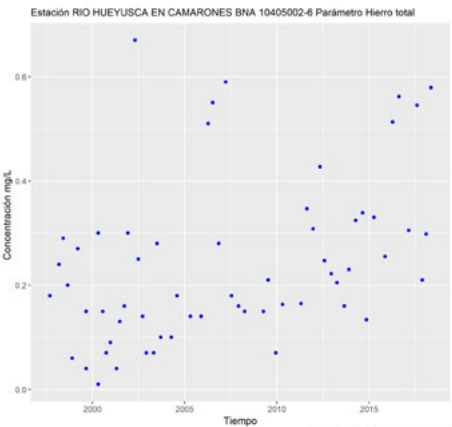


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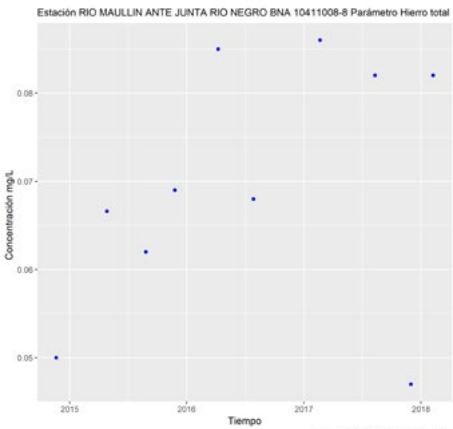


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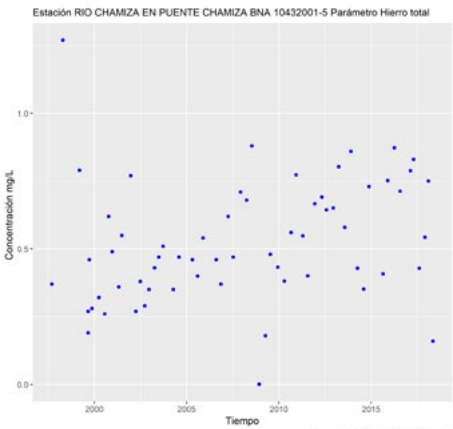


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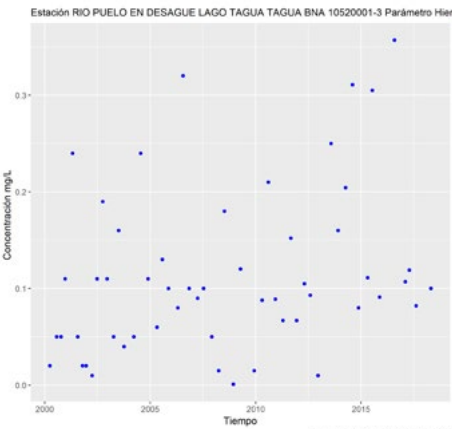


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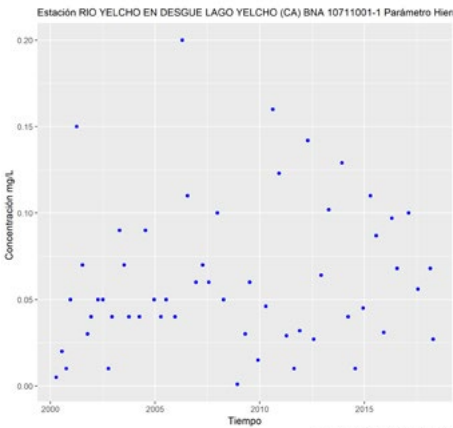


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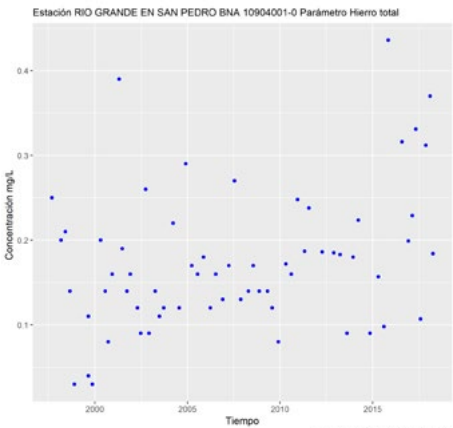


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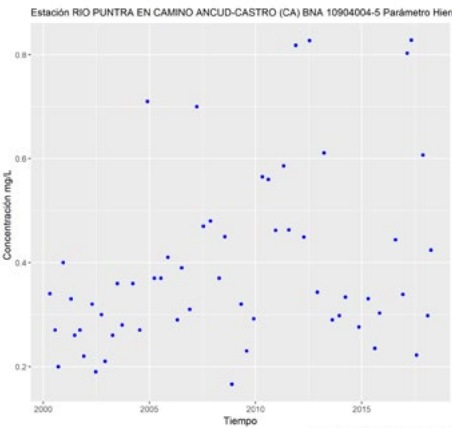


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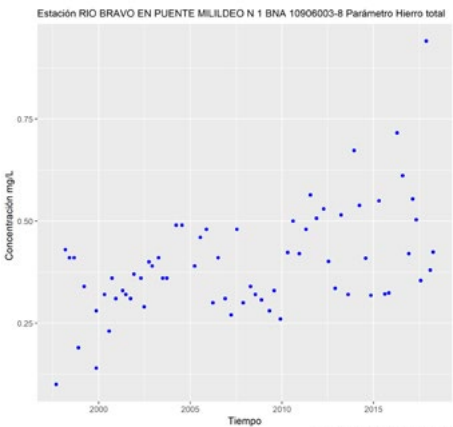


fig10906003-8Hierro_total.png

66. EVOLUCIÓN MACROZONA SUR - NITRATO



66 – 1.1 Gráficos – Evolución Macrozona Sur – Nitrato



fig08119002-KNitrogeno_de_nitrato.png

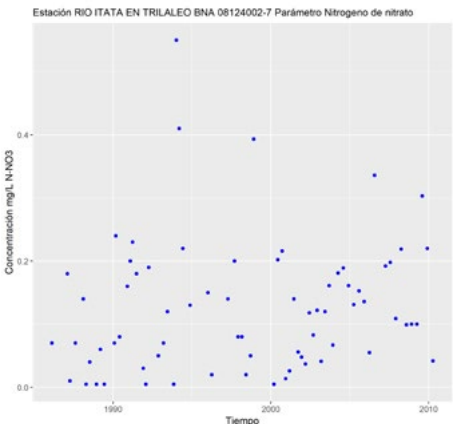


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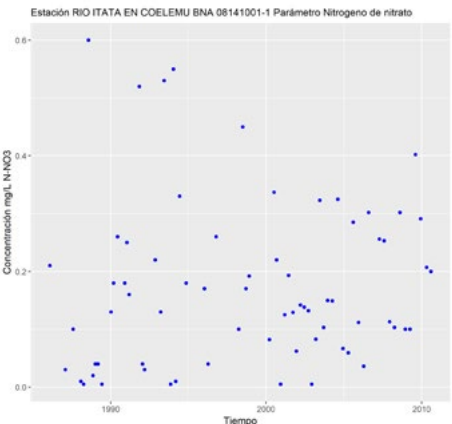


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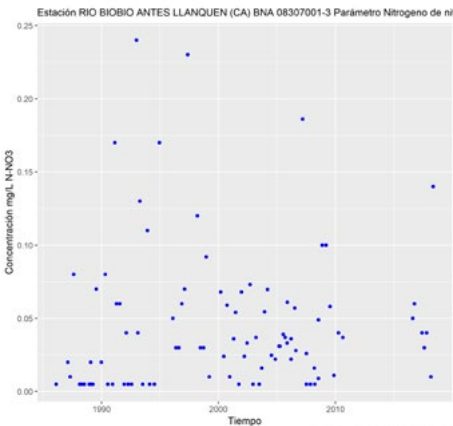


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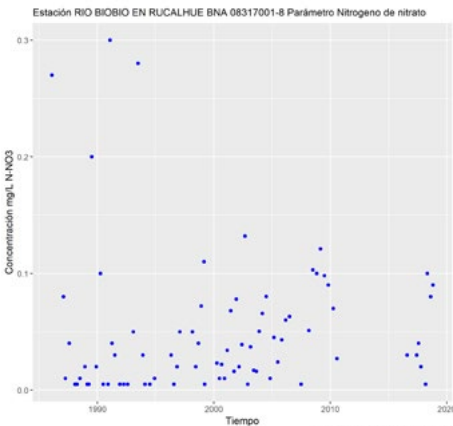


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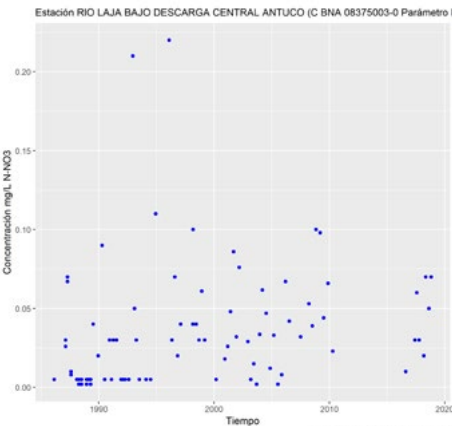


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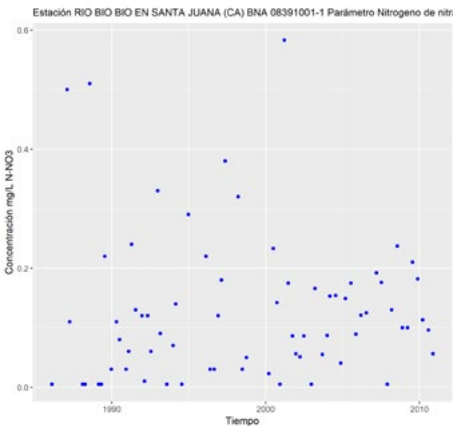


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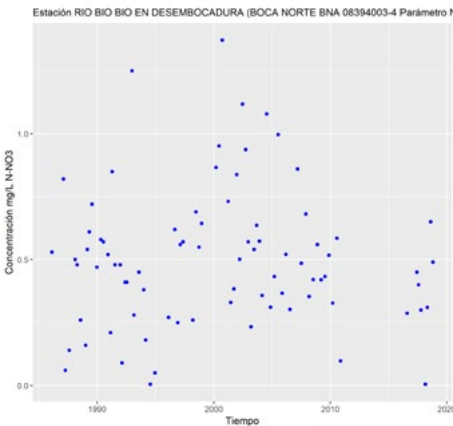


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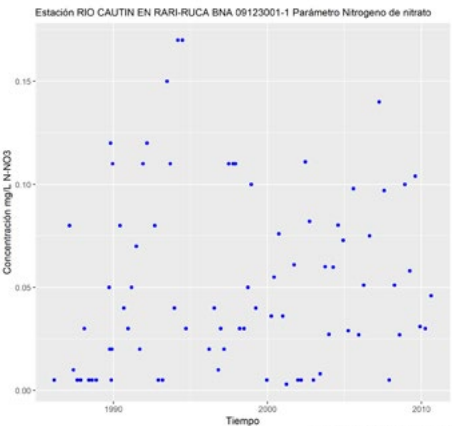


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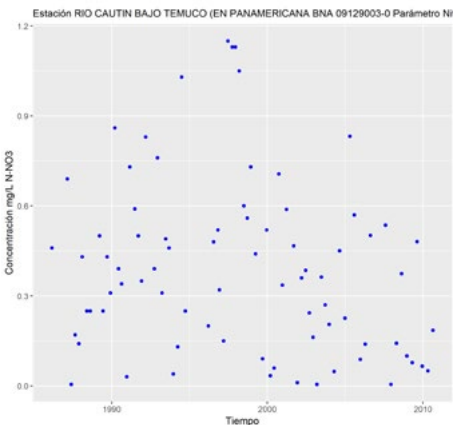


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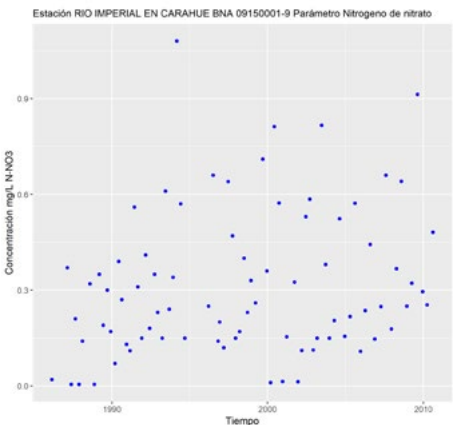


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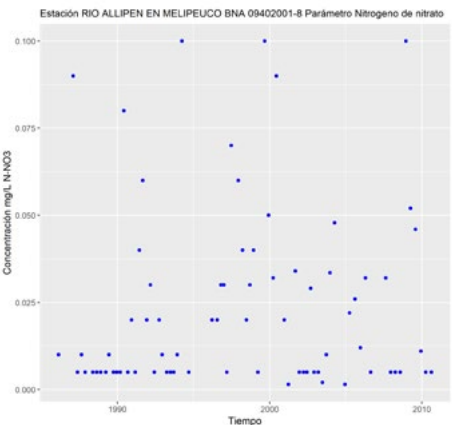


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66 - 1.2 Gráficos - Evolución Macrozona Sur - Nitrato

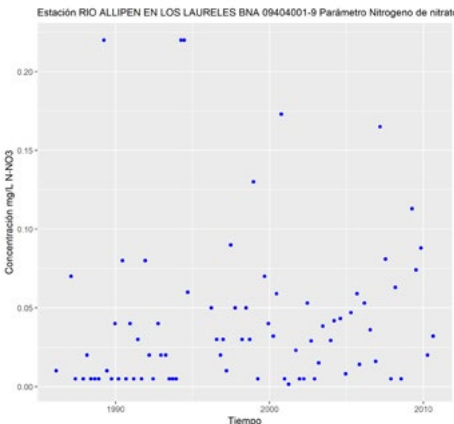


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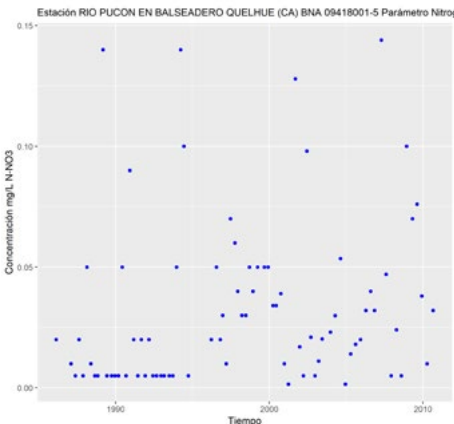


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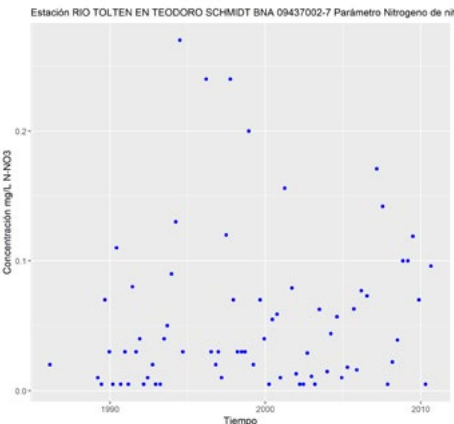


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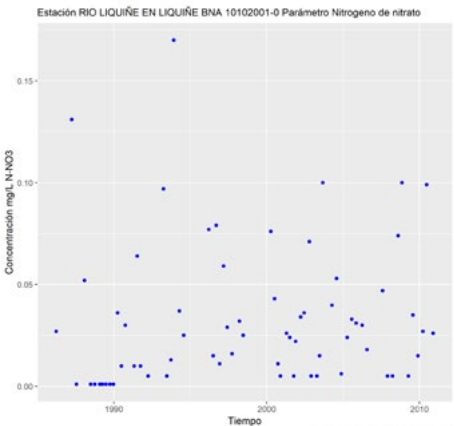


fig10102001-0Nitrogeno_de_nitrato.png

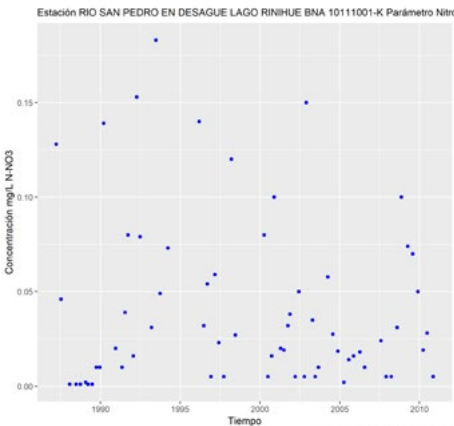


fig10111001-KNitrogeno_de_nitrato.png

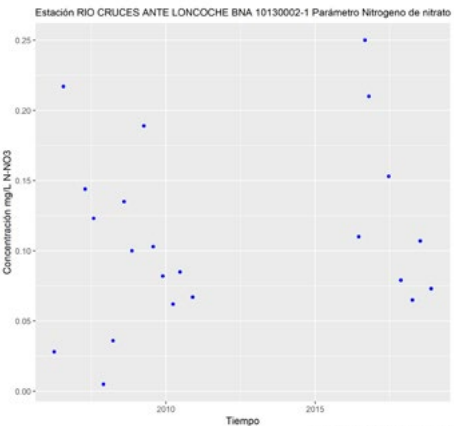


fig10130002-1Nitrogeno_de_nitrato.png

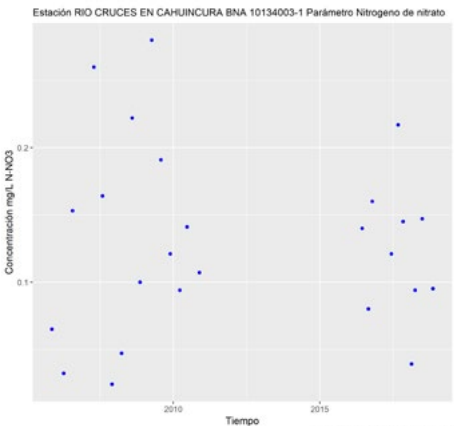


fig10134003-1Nitrogeno_de_nitrato.png

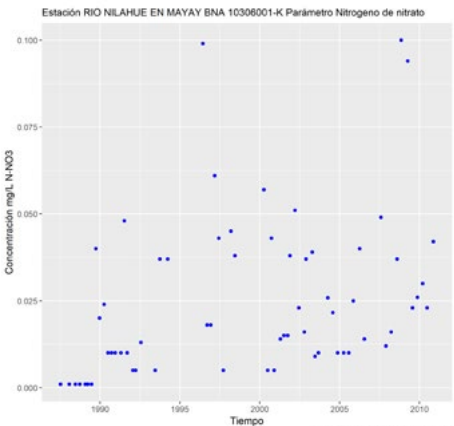


fig10306001-KNitrogeno_de_nitrato.png

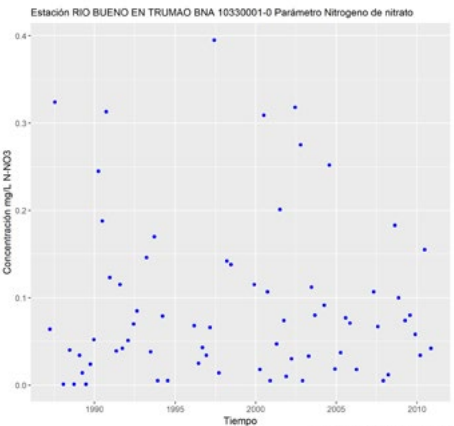


fig10330001-0Nitrogeno_de_nitrato.png

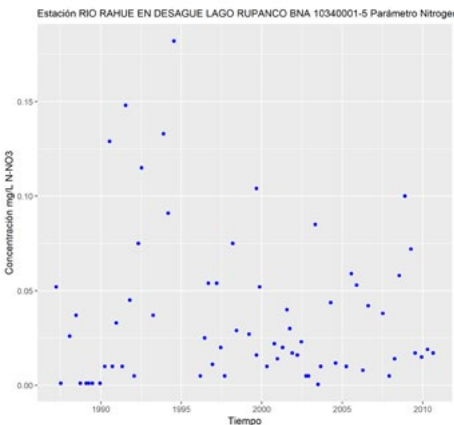


fig10340001-5Nitrogeno_de_nitrato.png

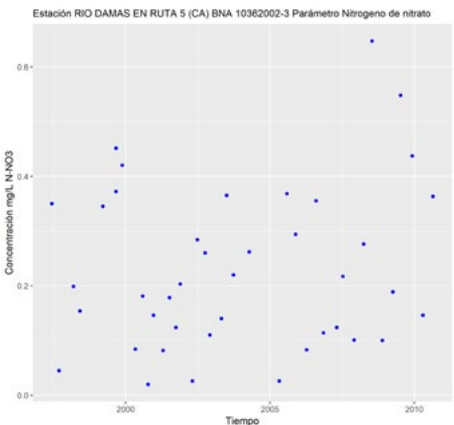


fig10362002-3Nitrogeno_de_nitrato.png

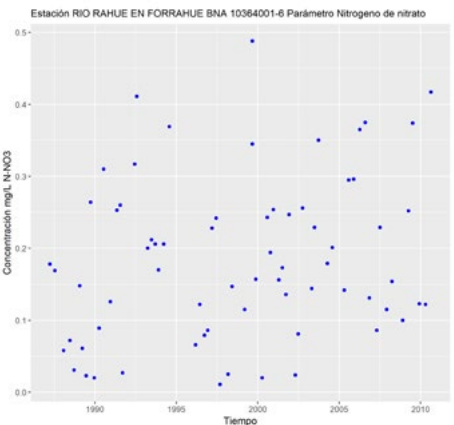


fig10364001-6Nitrogeno_de_nitrato.png

66 – 1.3 Gráficos – Evolución Macrozona Sur – Nitrato

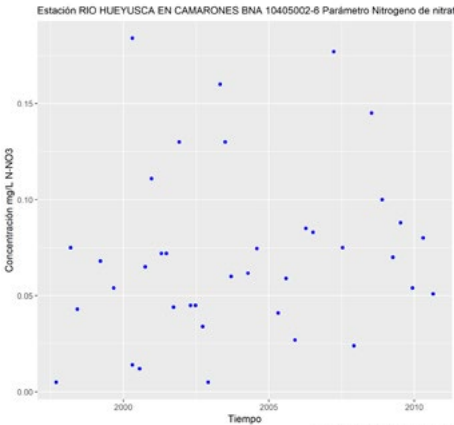


fig10405002-6Nitrogeno_de_nitrato.png

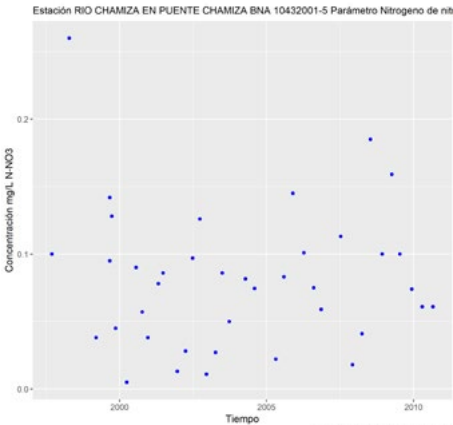


fig10432001-5Nitrogeno_de_nitrato.png

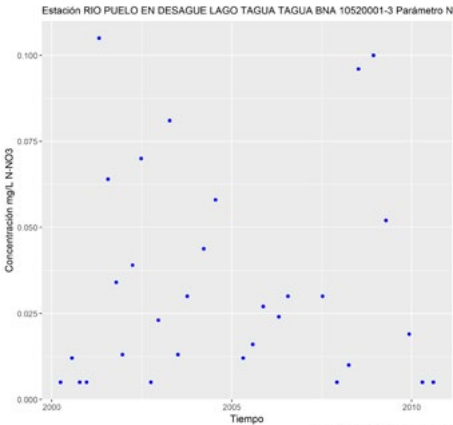


fig10520001-3Nitrogeno_de_nitrato.png

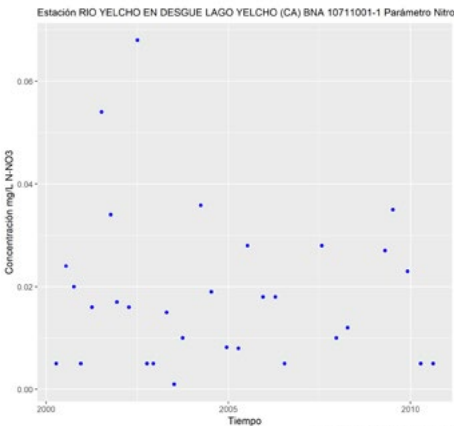


fig10711001-1Nitrogeno_de_nitrato.png

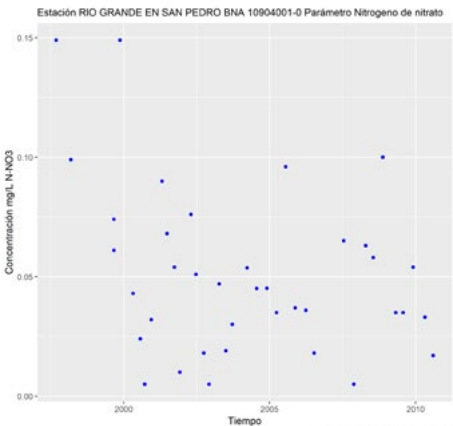


fig10904001-0Nitrogeno_de_nitrato.png

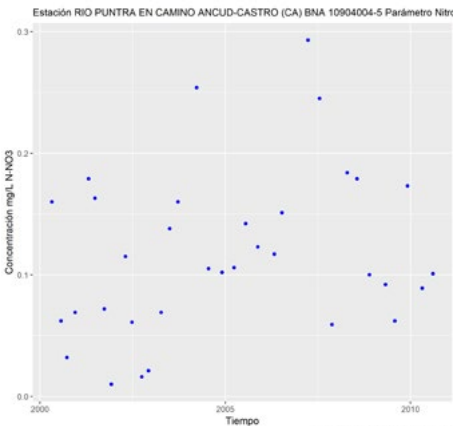


fig10904004-5Nitrogeno_de_nitrato.png

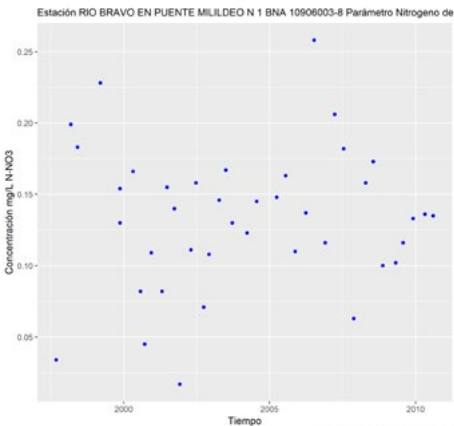


fig10906003-8Nitrogeno_de_nitrato.png

67. EVOLUCIÓN MACROZONA SUR - ORTOFOSFATO



67 – 1.1 Gráficos – Evolución Macrozona Sur – Ortofosfato

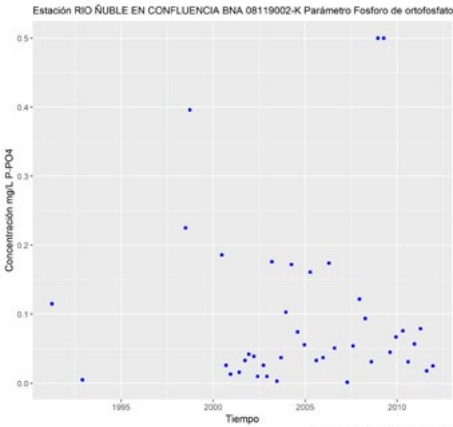


fig08119002-KFosforo_de_ortofosfato.png

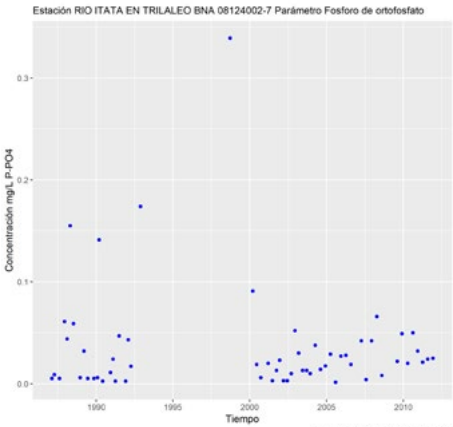


fig08124002-7Fosforo_de_ortofosfato.png

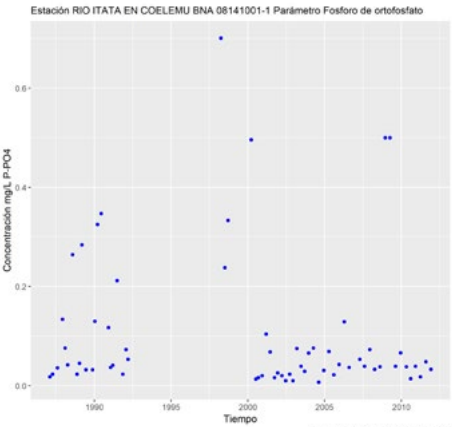


fig08141001-1Fosforo_de_ortofosfato.png

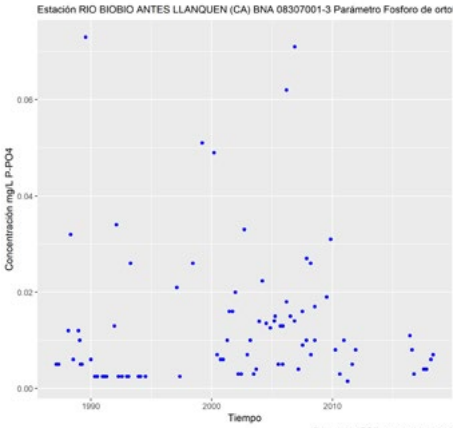


fig08307001-3Fosforo_de_ortofosfato.png

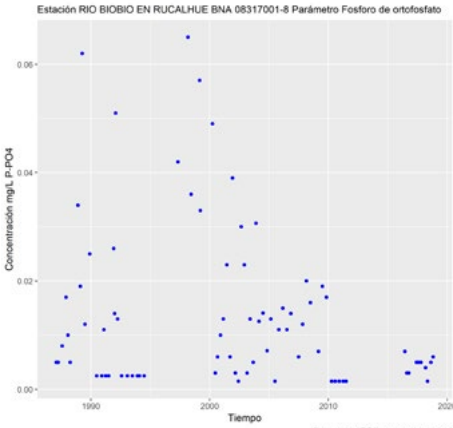


fig08317001-8Fosforo_de_ortofosfato.png

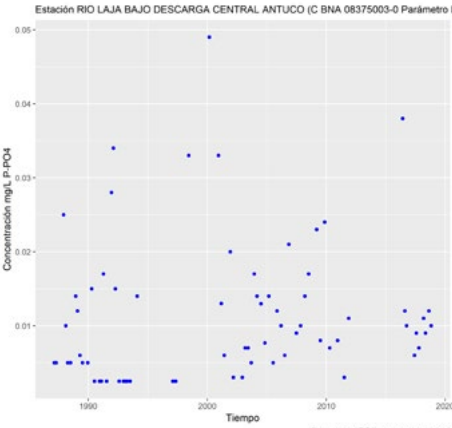


fig08375003-0Fosforo_de_ortofosfato.png

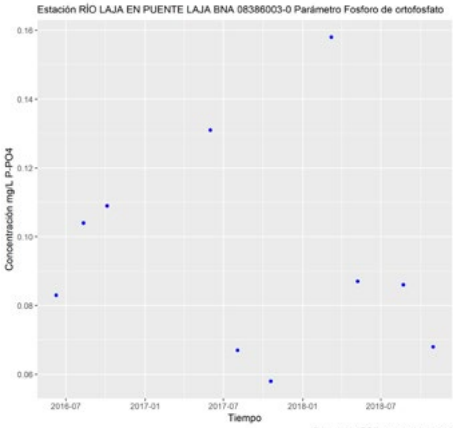


fig08386003-0Fosforo_de_ortofosfato.png

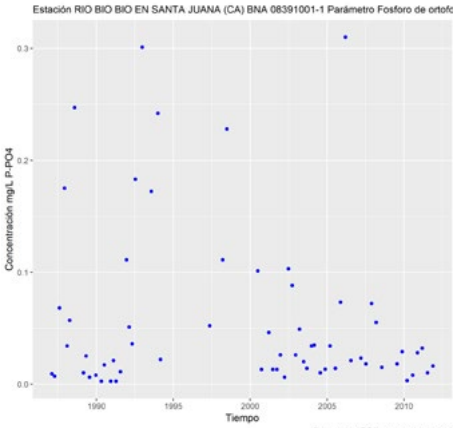


fig08391001-1Fosforo_de_ortofosfato.png

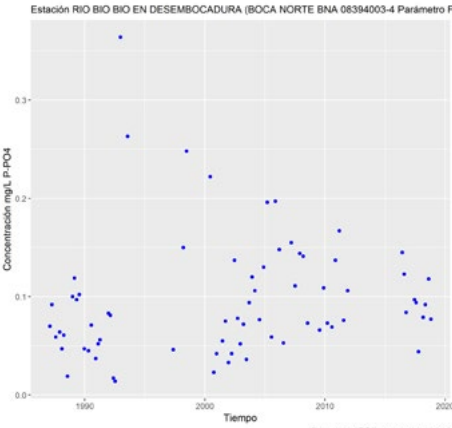


fig08394003-4Fosforo_de_ortofosfato.png

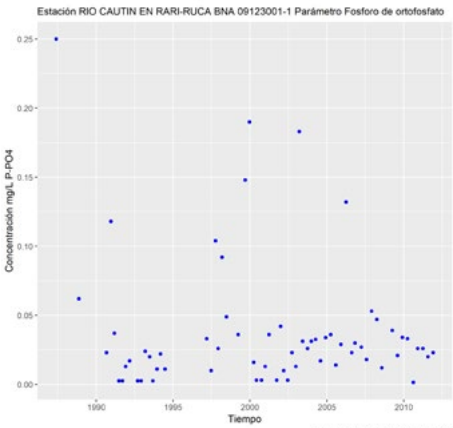


fig09123001-1Fosforo_de_ortofosfato.png

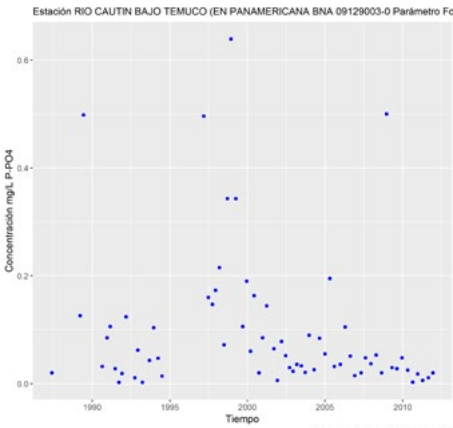


fig09129003-0Fosforo_de_ortofosfato.png

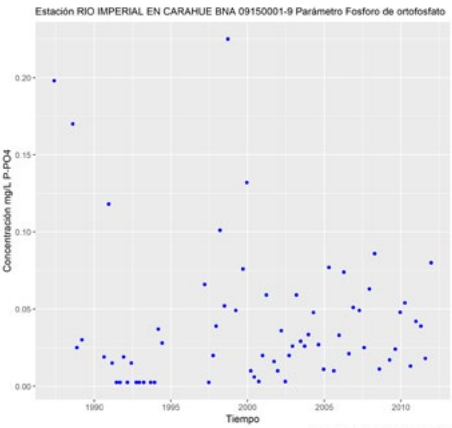


fig09150001-9Fosforo_de_ortofosfato.png

67 - 1.2 Gráficos - Evolución Macrozona Sur - Ortofosfato

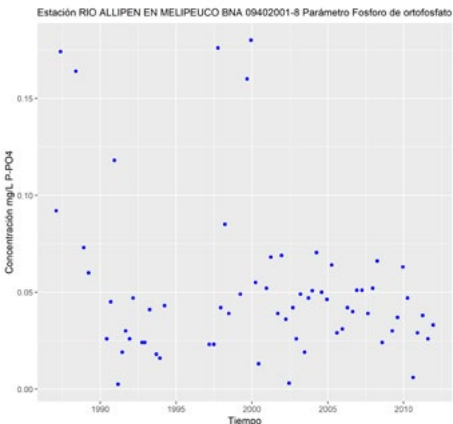


fig09402001-8Fosforo_de_ortofosfato.png

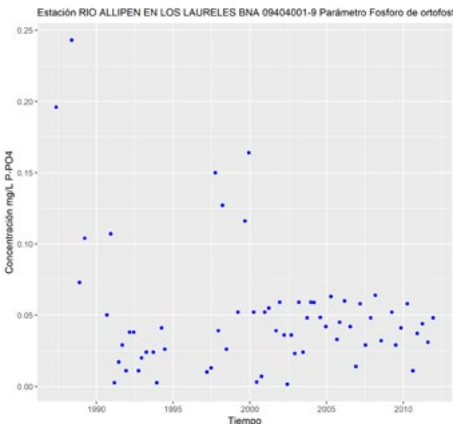


fig09404001-9Fosforo_de_ortofosfato.png

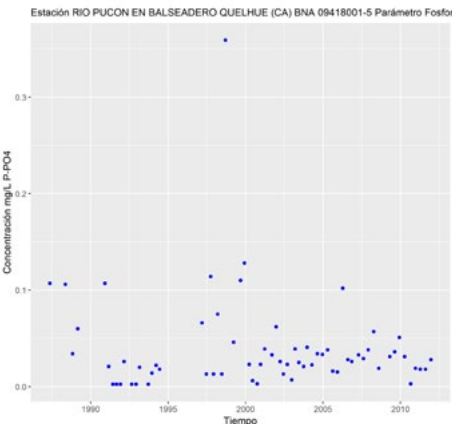


fig09418001-5Fosforo_de_ortofosfato.png

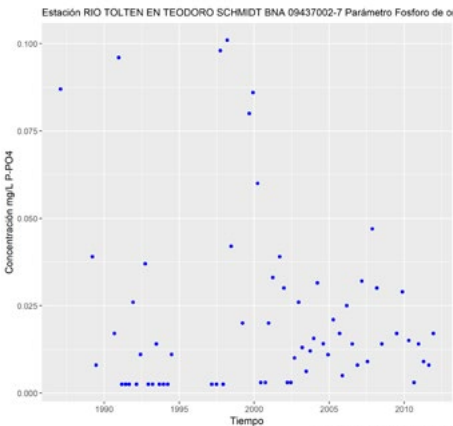


fig09437002-7Fosforo_de_ortofosfato.png

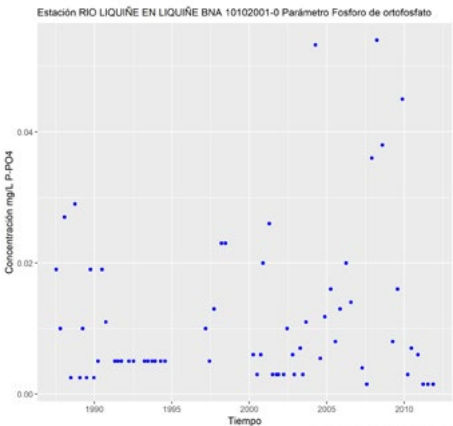


fig10102001-0Fosforo_de_ortofosfato.png

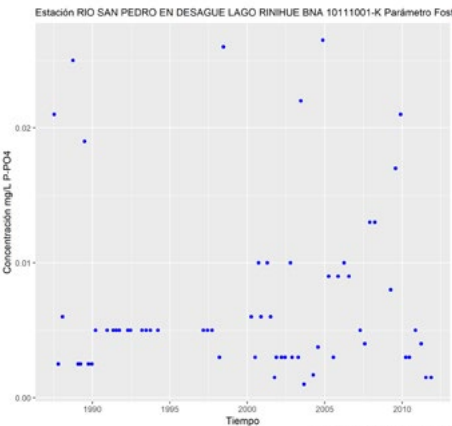


fig10111001-KFosforo_de_ortofosfato.png

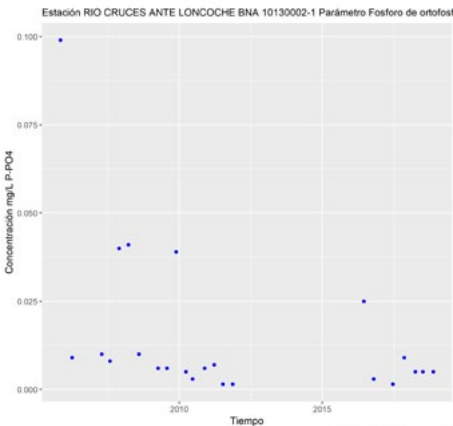


fig10130002-1Fosforo_de_ortofosfato.png

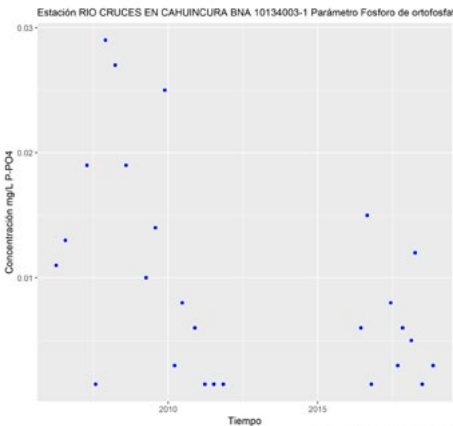


fig10134003-1Fosforo_de_ortofosfato.png

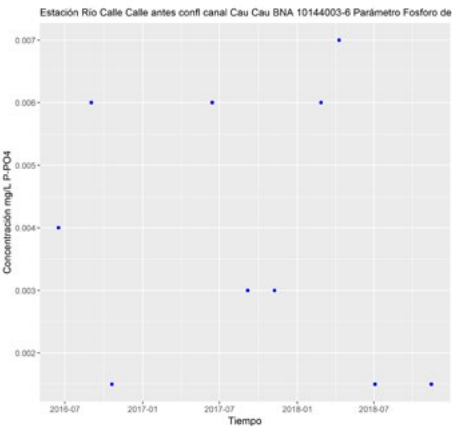


fig10144003-6Fosforo_de_ortofosfato.png

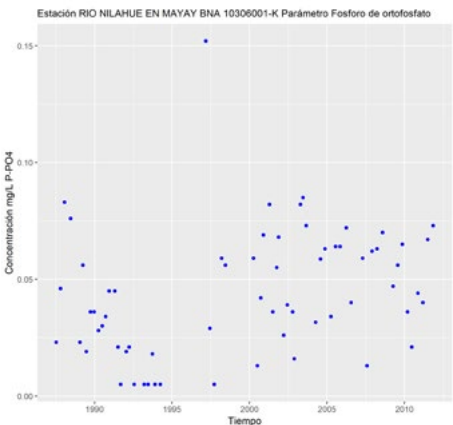


fig10306001-KFosforo_de_ortofosfato.png

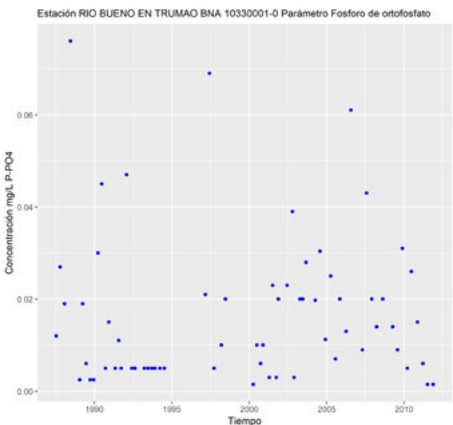


fig10330001-0Fosforo_de_ortofosfato.png

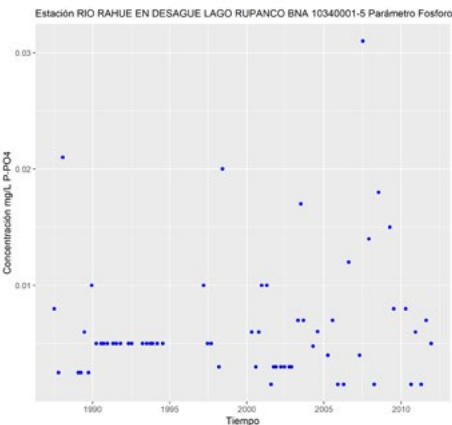


fig10340001-5Fosforo_de_ortofosfato.png

67 – 1.3 Gráficos – Evolución Macrozona Sur – Ortofosfato

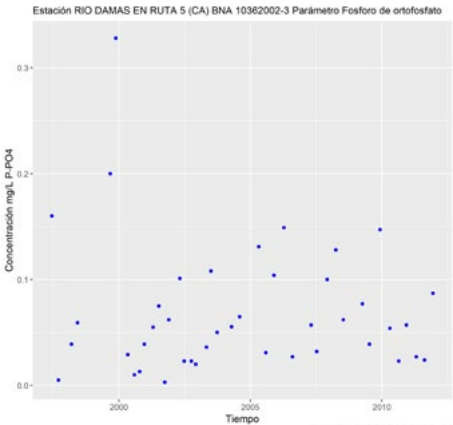


fig10362002-3Fosforo_de_ortofosfato.png

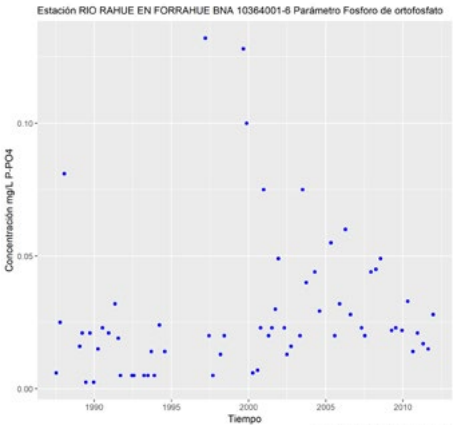


fig10364001-6Fosforo_de_ortofosfato.png

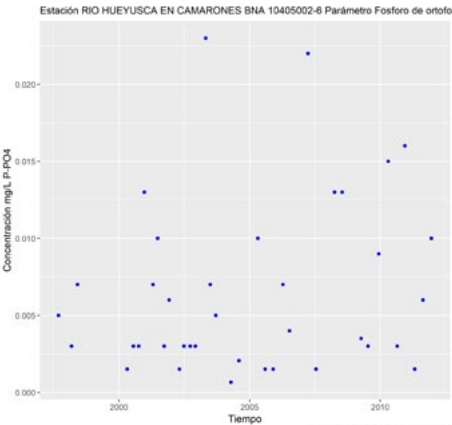


fig10405002-6Fosforo_de_ortofosfato.png

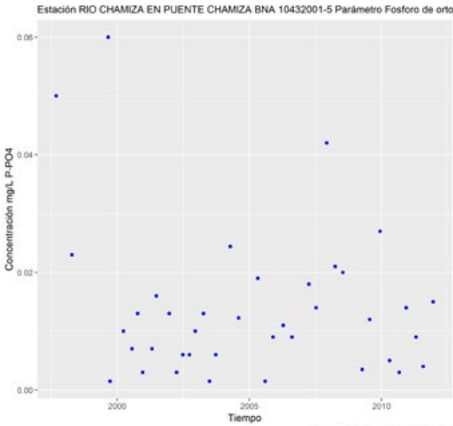


fig10432001-5Fosforo_de_ortofosfato.png

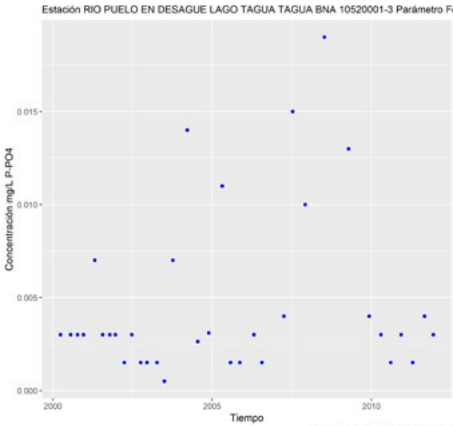


fig10520001-3Fosforo_de_ortofosfato.png

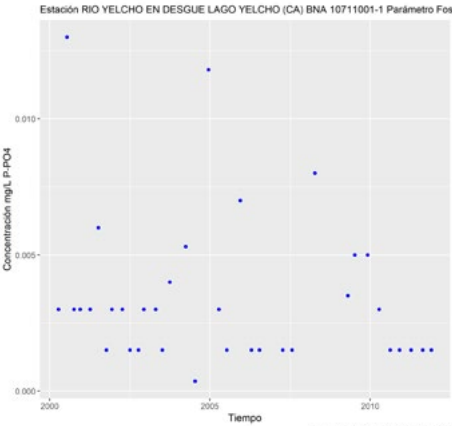


fig10711001-1Fosforo_de_ortofosfato.png

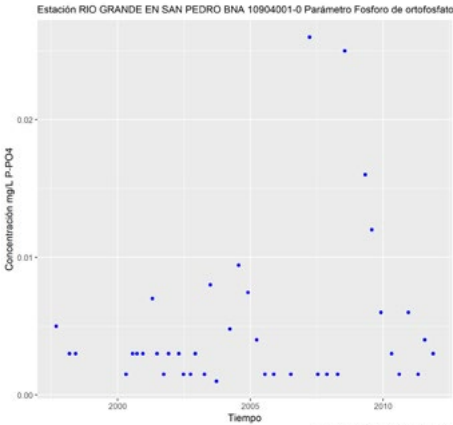


fig10904001-0Fosforo_de_ortofosfato.png

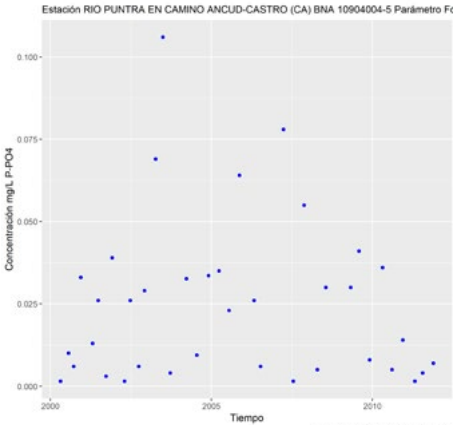


fig10904004-5Fosforo_de_ortofosfato.png

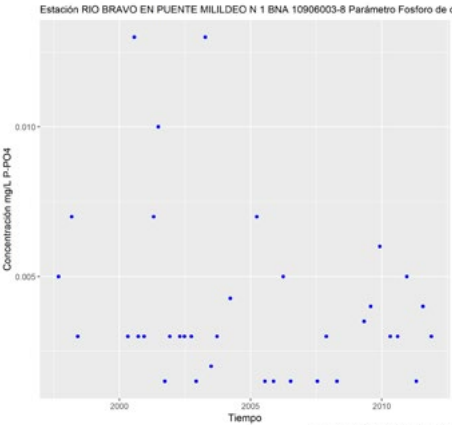
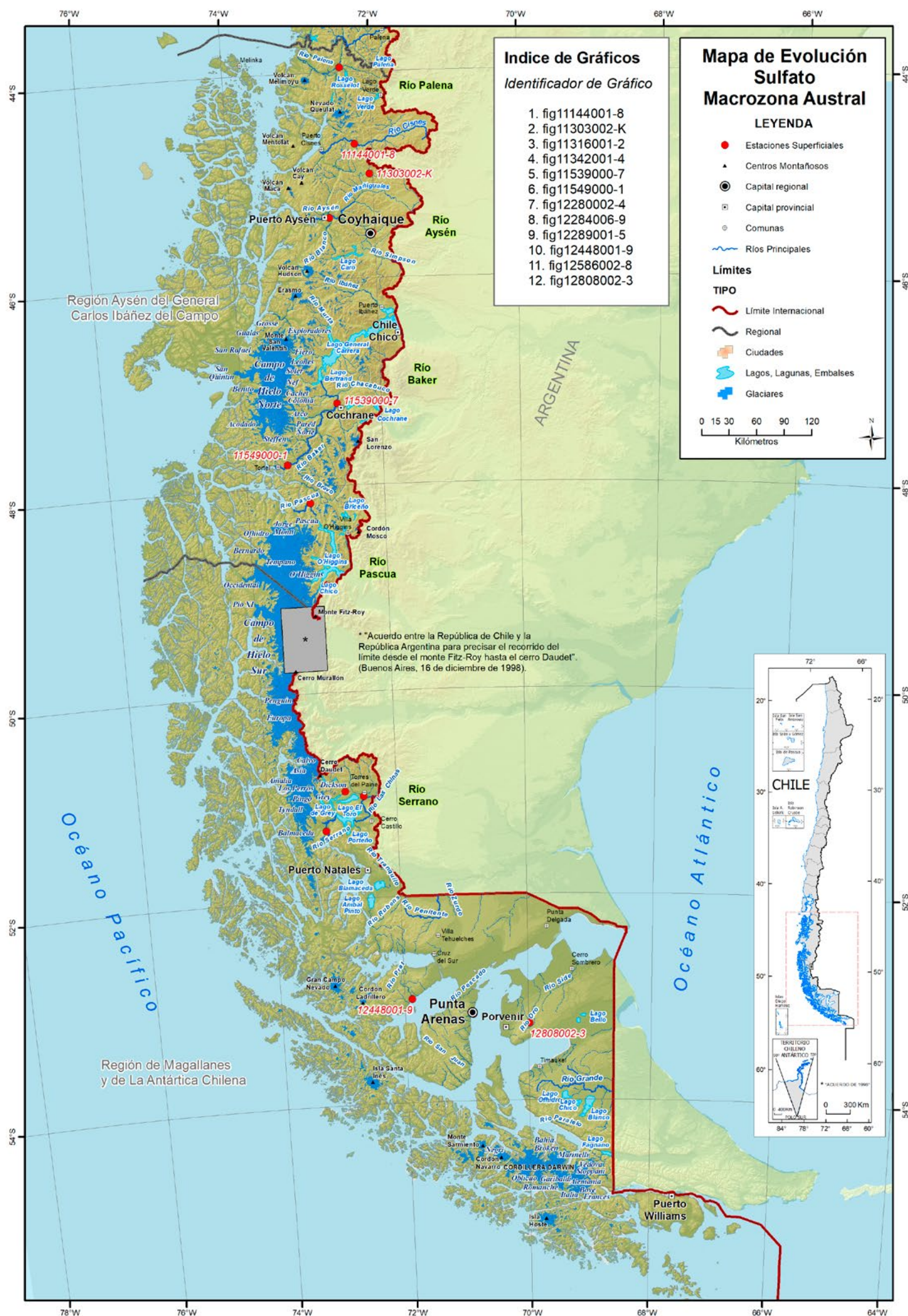


fig10906003-8Fosforo_de_ortofosfato.png

68. EVOLUCIÓN MACROZONA AUSTRAL – SULFATO



68 – 1.1 Gráficos – Evolución Macrozona Austral – Sulfato

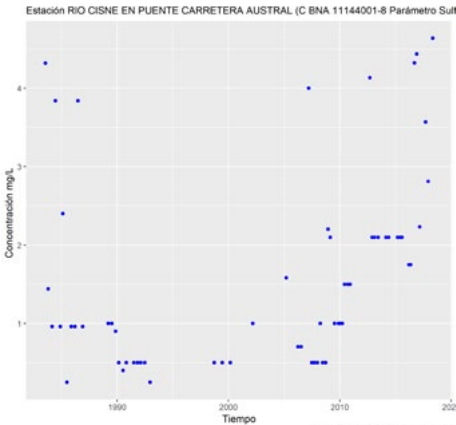


fig11144001-8Sulfato.png

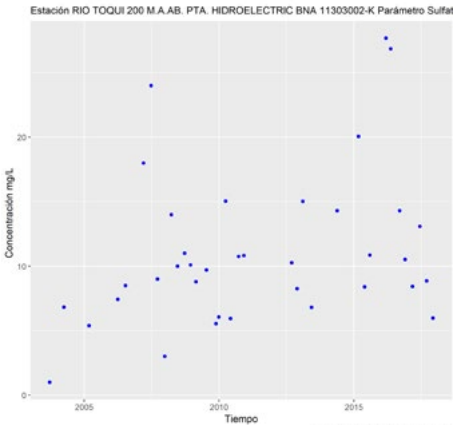


fig11303002-KSulfato.png

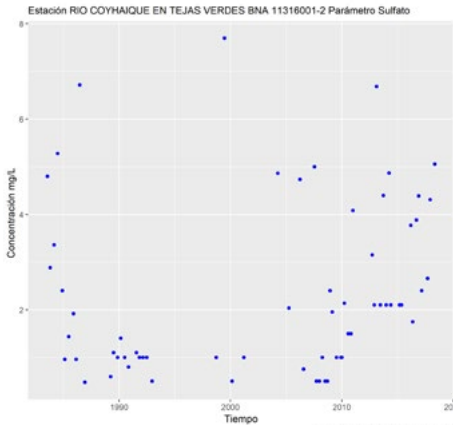


fig11316001-2Sulfato.png

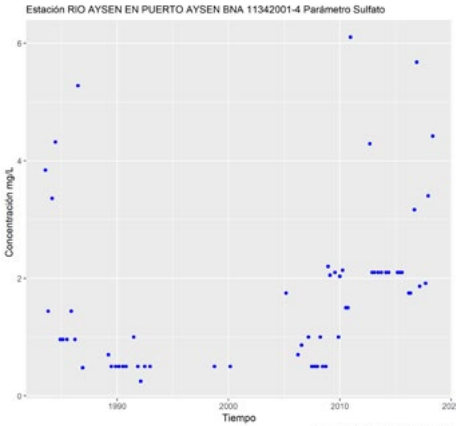


fig11342001-4Sulfato.png

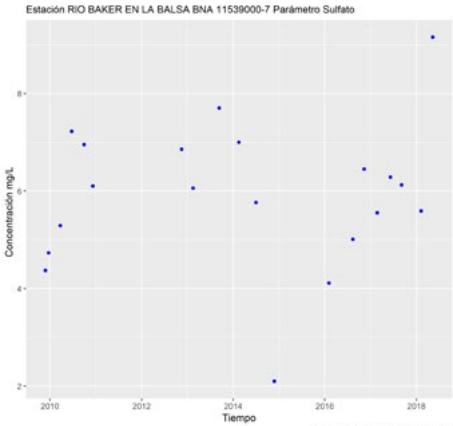


fig11539000-7Sulfato.png

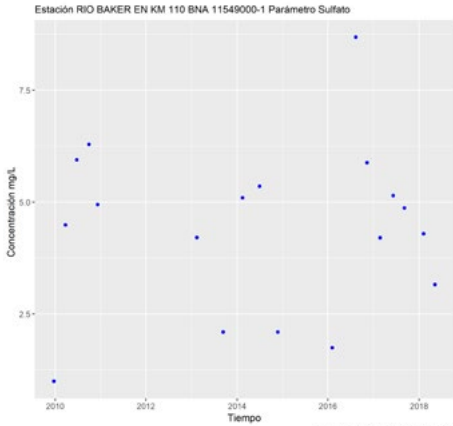


fig11549000-1Sulfato.png

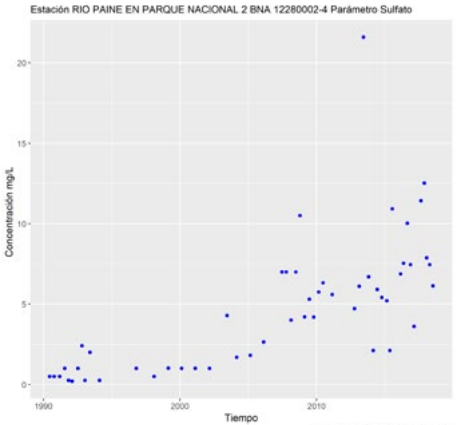


fig12280002-4Sulfato.png

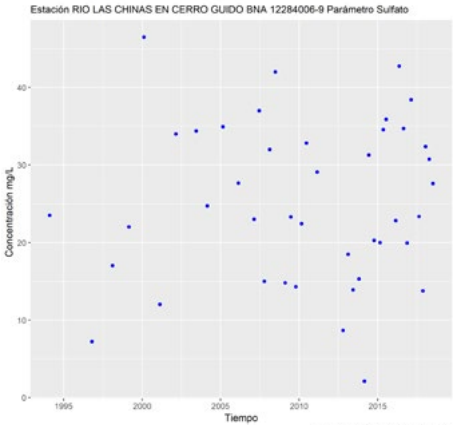


fig12284006-9Sulfato.png

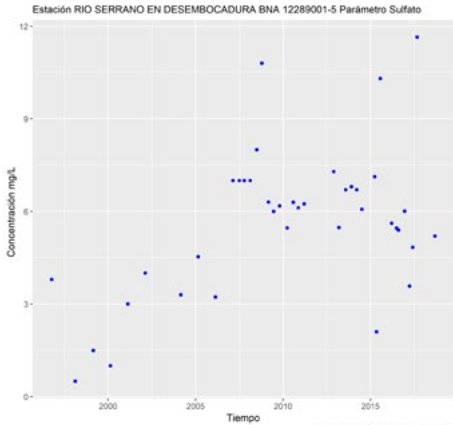


fig12289001-5Sulfato.png

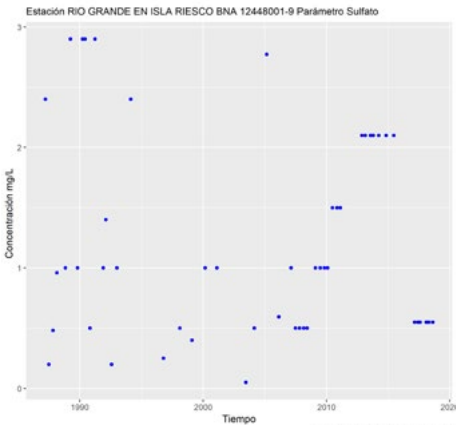


fig12448001-9Sulfato.png

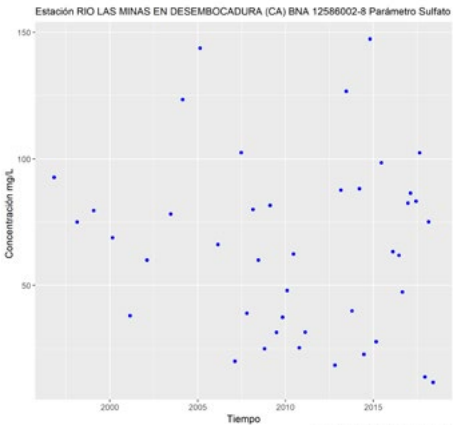


fig12586002-8Sulfato.png

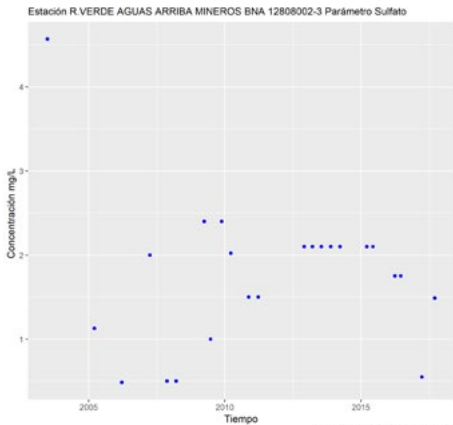
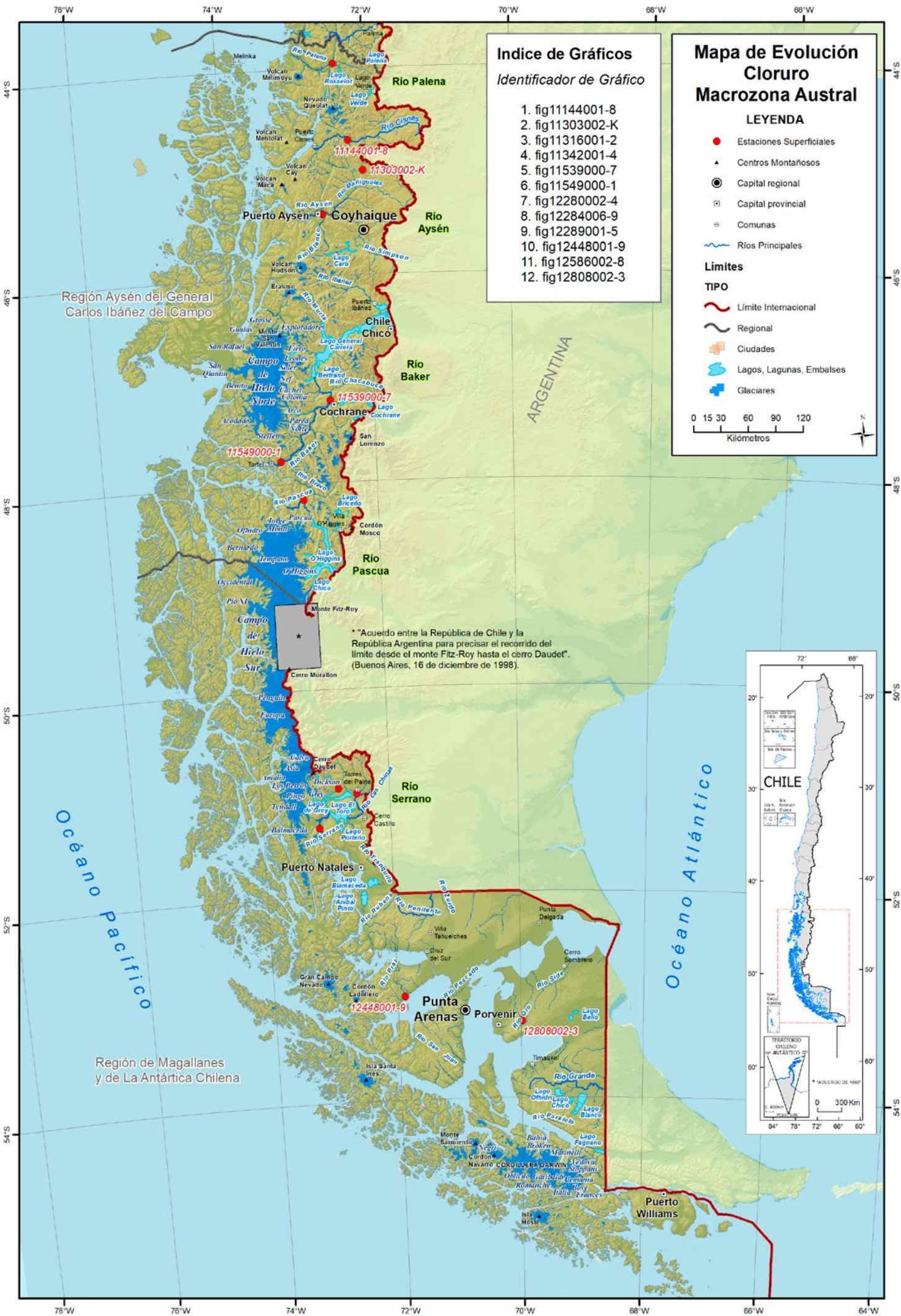


fig12808002-3Sulfato.png

69. EVOLUCIÓN MACROZONA AUSTRAL - CLORURO



69. – 1.1 Gráficos – Evolución Macrozona Austral – Cloruro

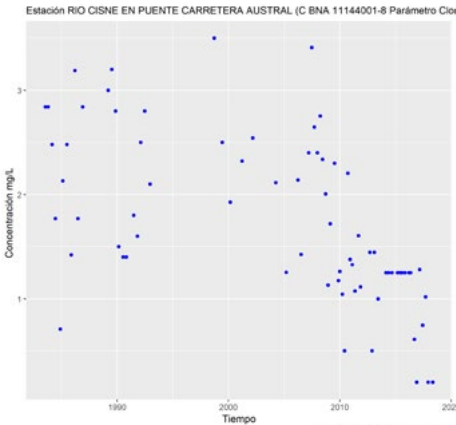


fig11144001-8Cloruro_total.png

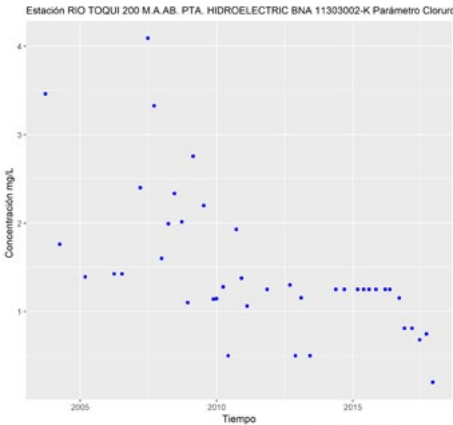


fig11303002-KCloruro_total.png

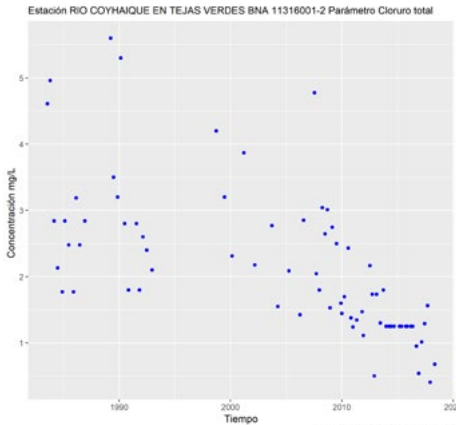


fig11316001-2Cloruro_total.png

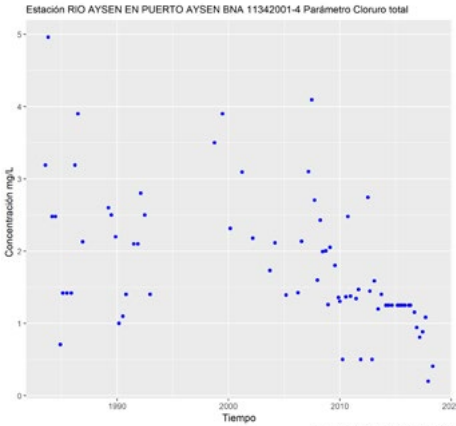


fig11342001-4Cloruro_total.png

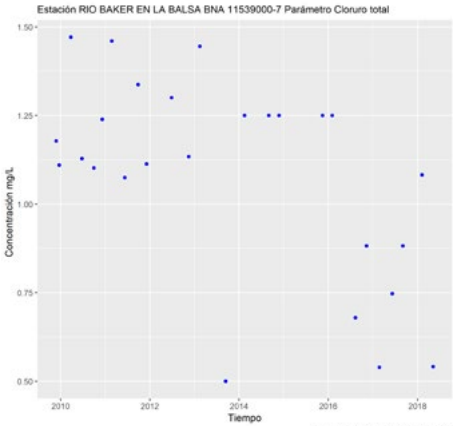


fig11539000-7Cloruro_total.png

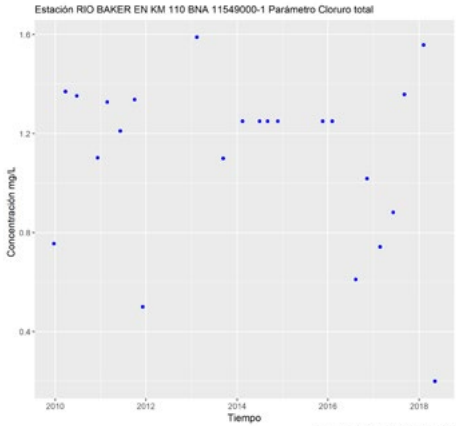


fig11549000-1Cloruro_total.png

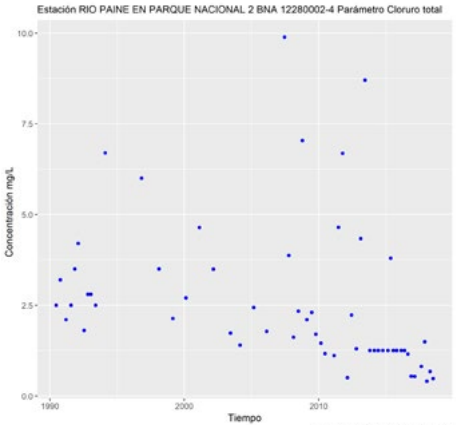


fig12280002-4Cloruro_total.png

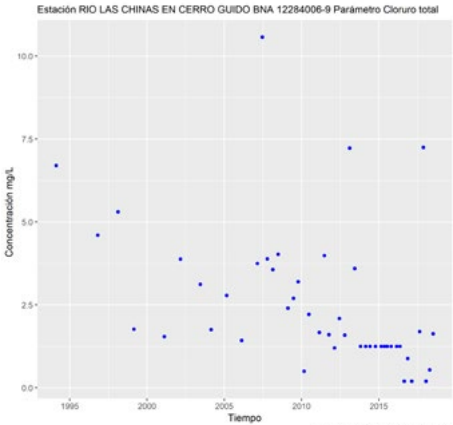


fig12284006-9Cloruro_total.png

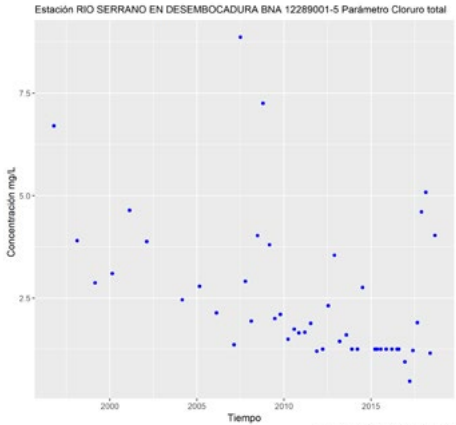


fig12289001-5Cloruro_total.png

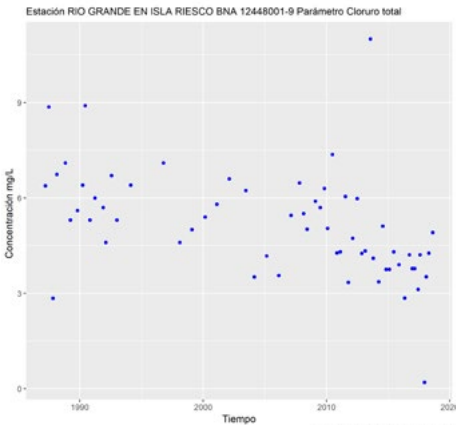


fig12448001-9Cloruro_total.png

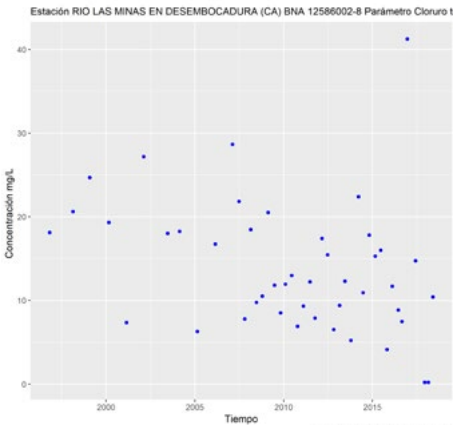


fig12586002-8Cloruro_total.png

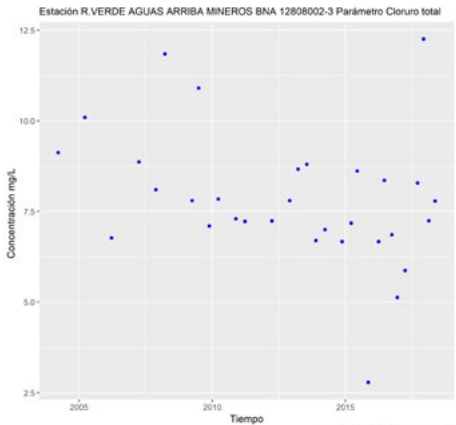
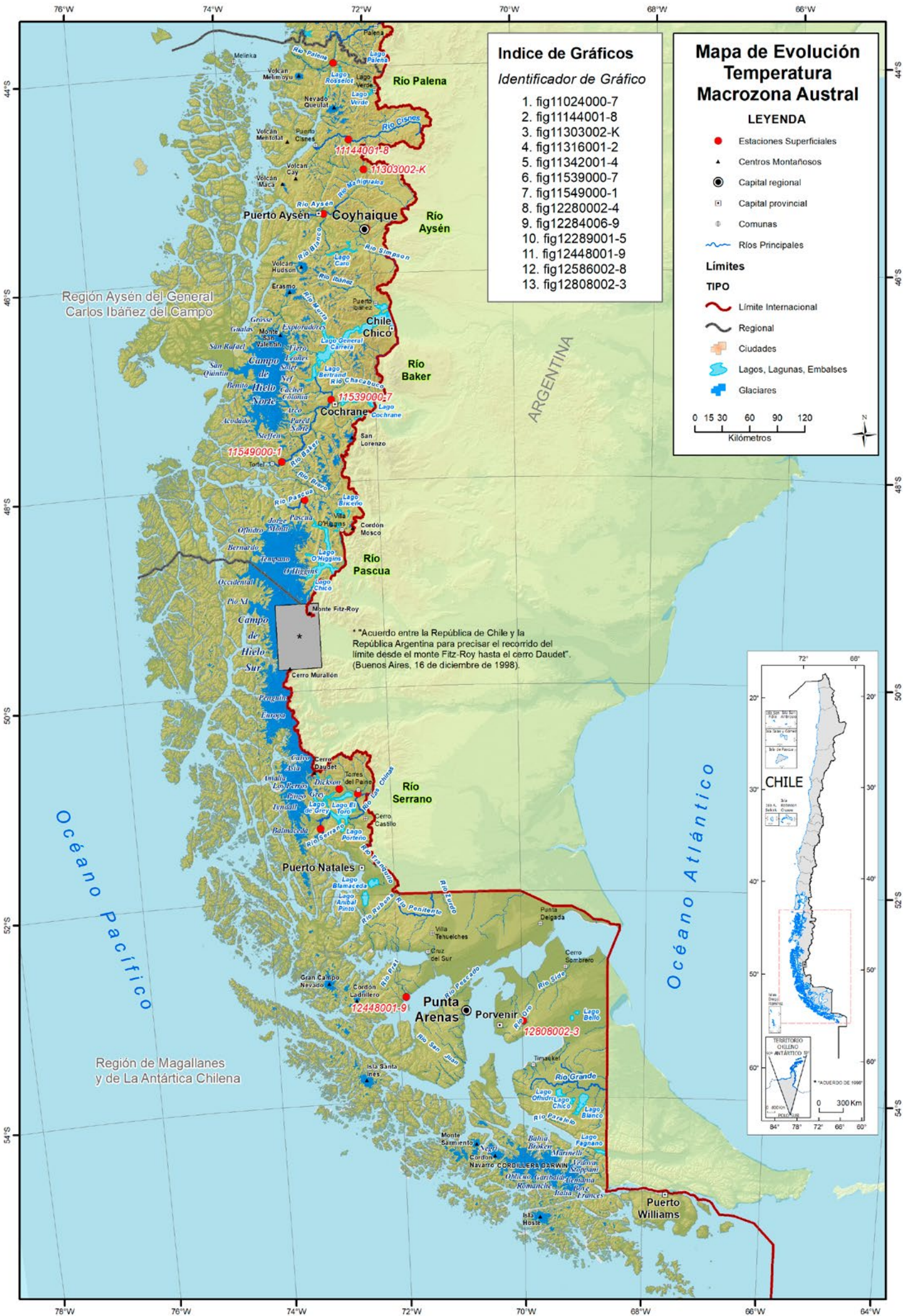


fig12808002-3Cloruro_total.png

70. EVOLUCIÓN MACROZONA AUSTRAL - TEMPERATURA



70. – 1.1 Gráficos – Evolución Macrozona Austral – Temperatura

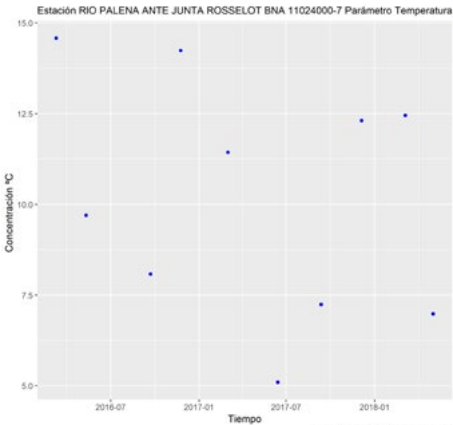


fig11024000-7Temperatura_del_agua.png

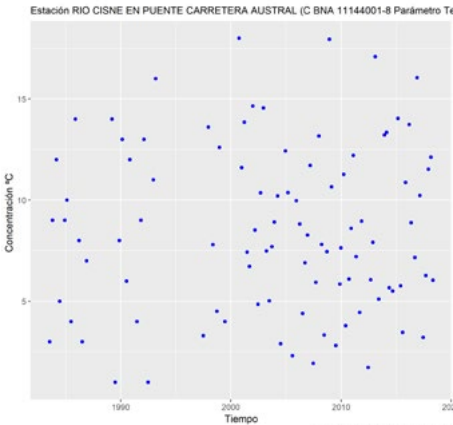


fig11144001-8Temperatura_del_agua.png

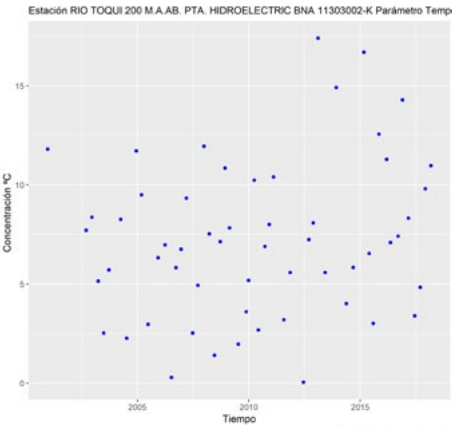


fig11303002-KTemperatura_del_agua.png

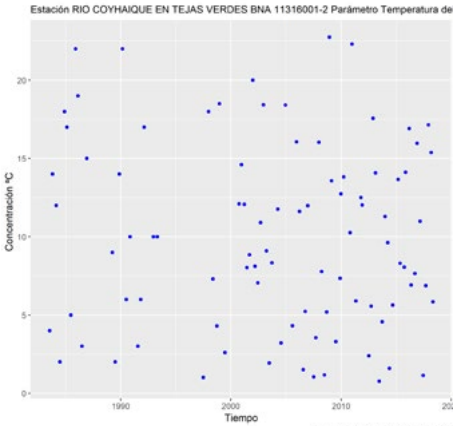


fig11316001-2Temperatura_del_agua.png

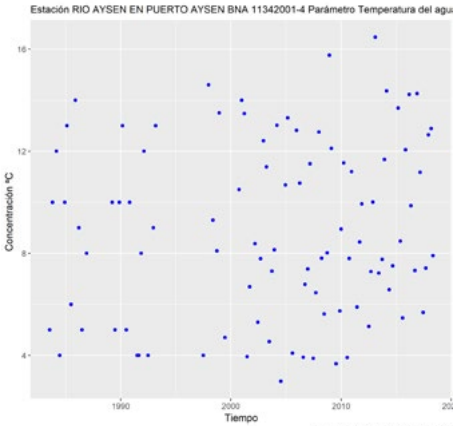


fig11342001-4Temperatura_del_agua.png

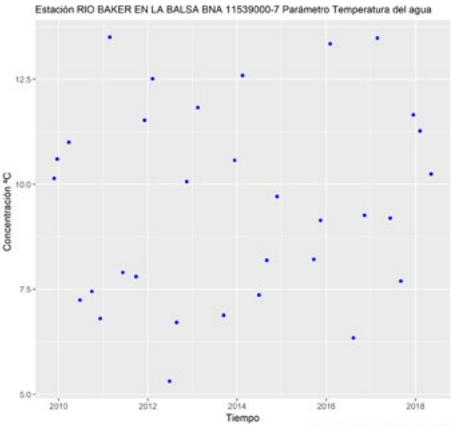


fig11539000-7Temperatura_del_agua.png

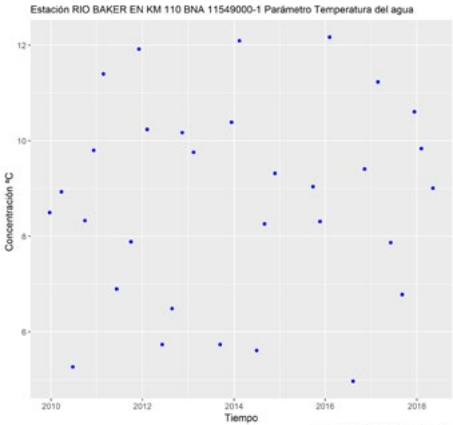


fig11549000-1Temperatura_del_agua.png

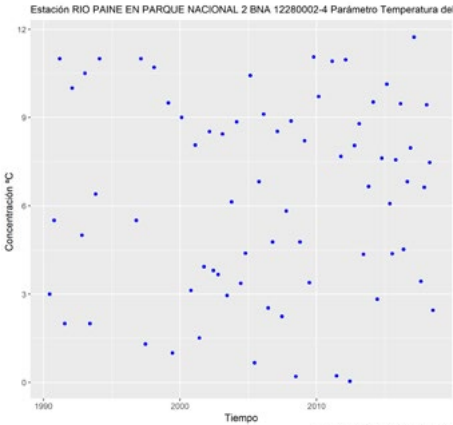


fig12280002-4Temperatura_del_agua.png

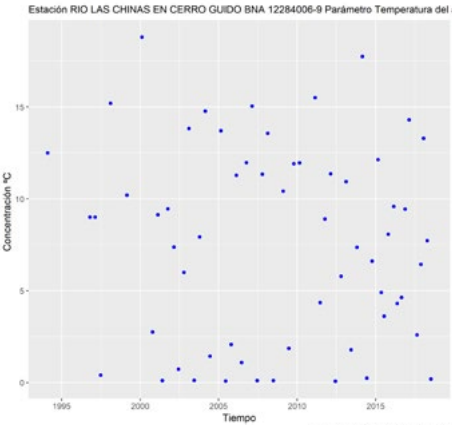


fig12284006-9Temperatura_del_agua.png

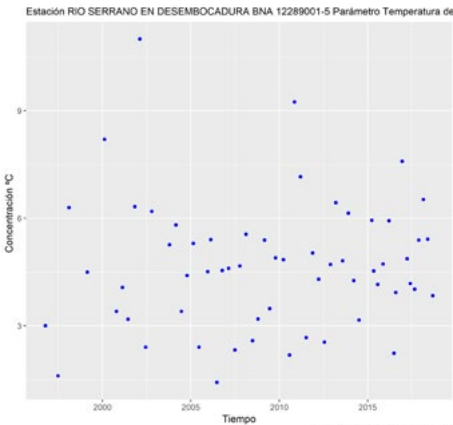


fig12289001-5Temperatura_del_agua.png

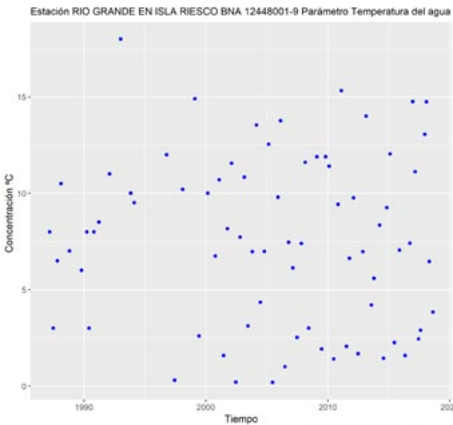


fig12448001-9Temperatura_del_agua.png

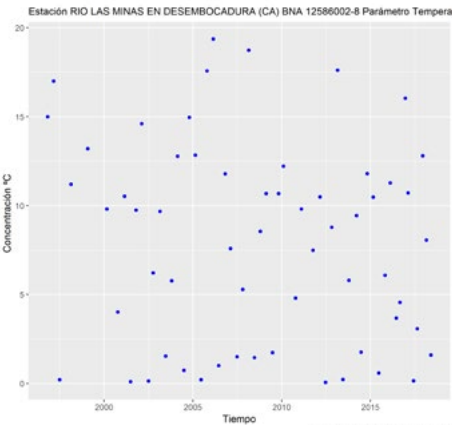
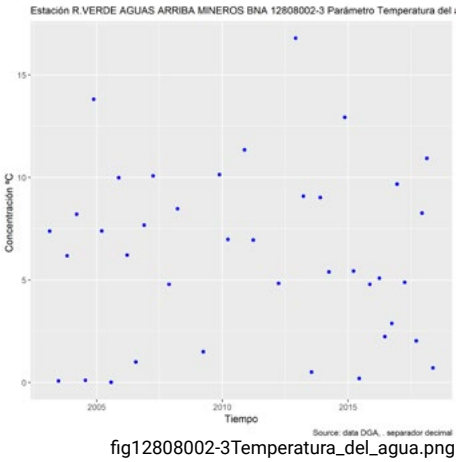
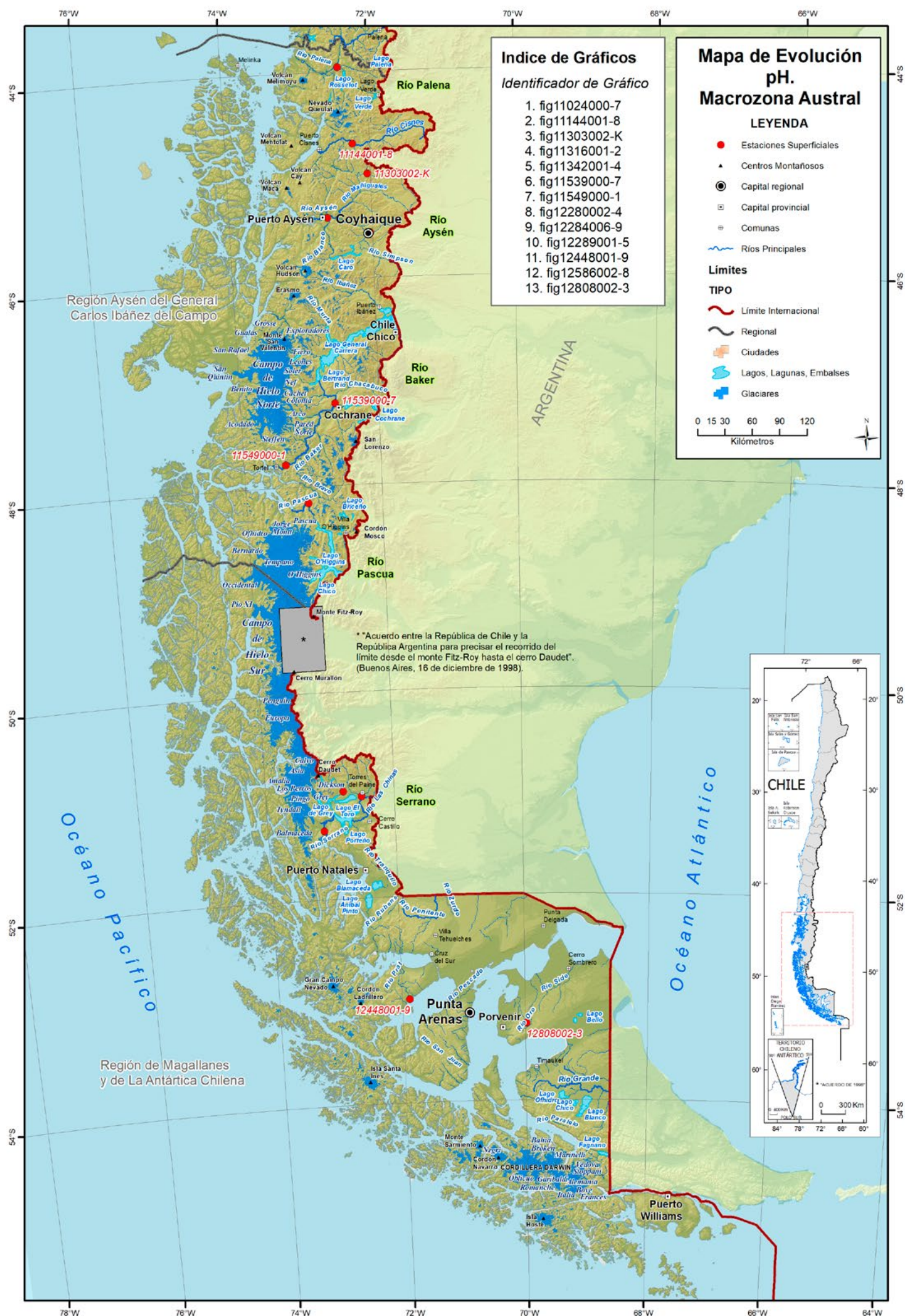


fig12586002-8Temperatura_del_agua.png

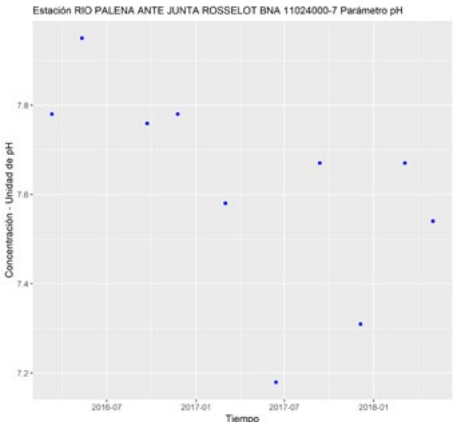
70. - 1.2 Gráficos – Evolución Macrozona Austral – Temperatura



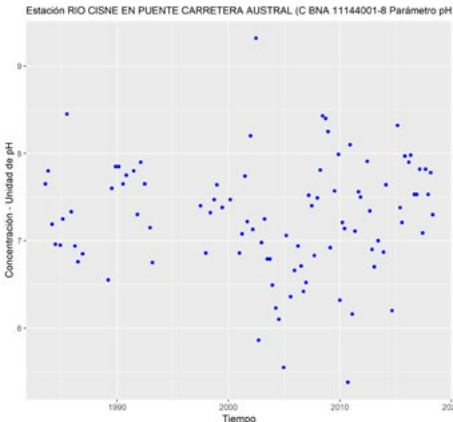
71. EVOLUCIÓN MACROZONA AUSTRAL – PH



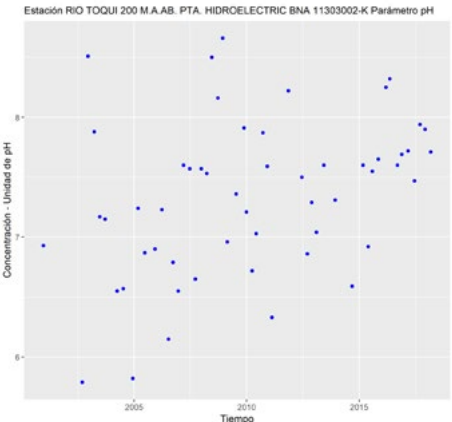
71 - 1.1 Gráficos - Evolución Macrozona Austral- PH



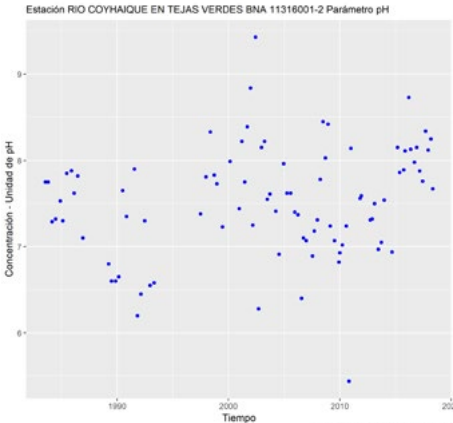
Source: data DGA, separador decimal
fig11024000-7pH.png



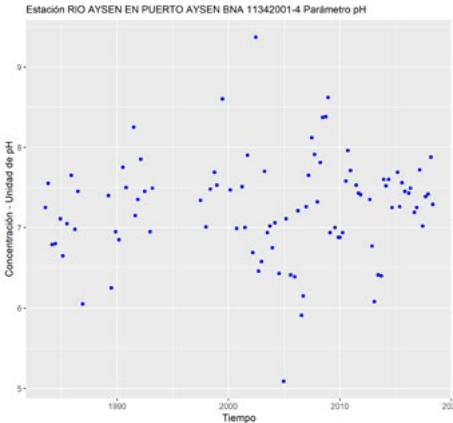
Source: data DGA, separador decimal
fig11144001-8pH.png



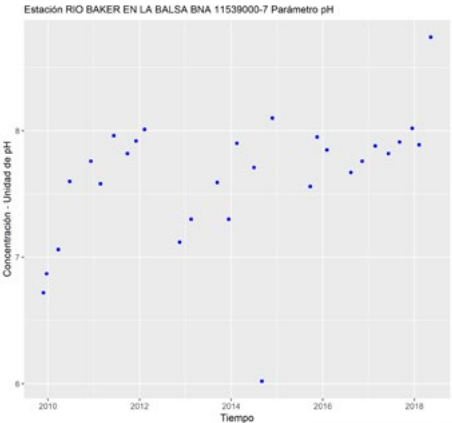
Source: data DGA, separador decimal
fig11303002-KpH.png



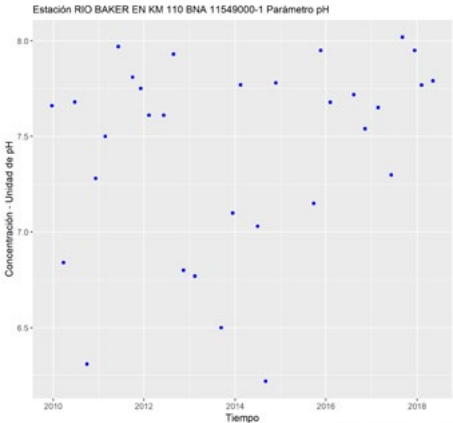
Source: data DGA, separador decimal
fig11316001-2pH.png



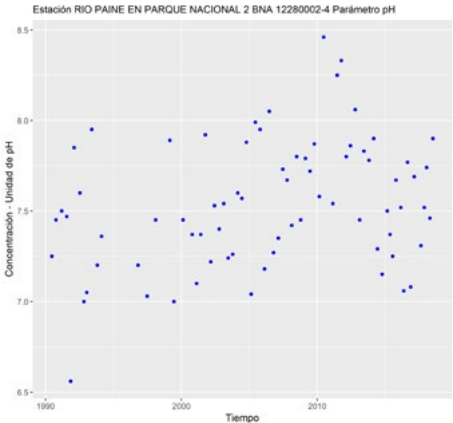
Source: data DGA, separador decimal
fig11342001-4pH.png



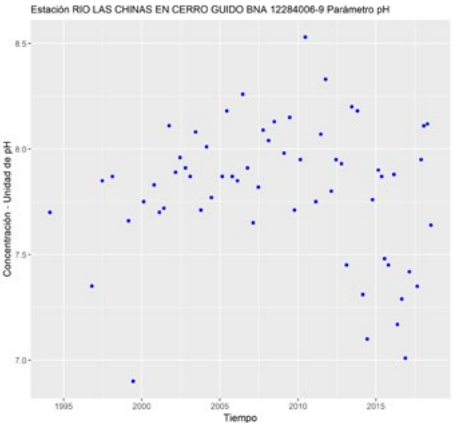
Source: data DGA, separador decimal
fig11539000-7pH.png



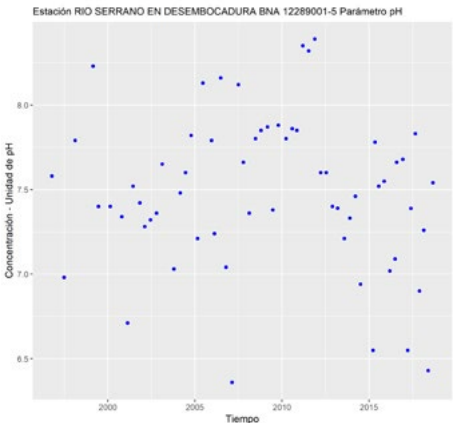
Source: data DGA, separador decimal
fig11549000-1pH.png



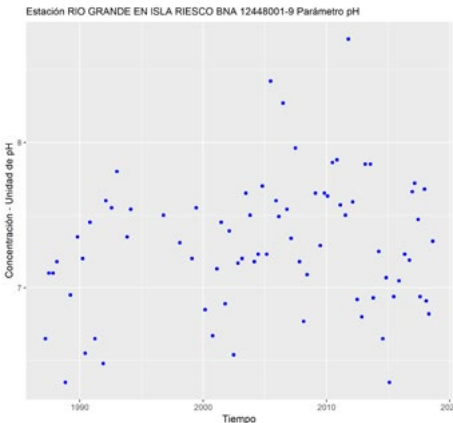
Source: data DGA, separador decimal
fig12280002-4pH.png



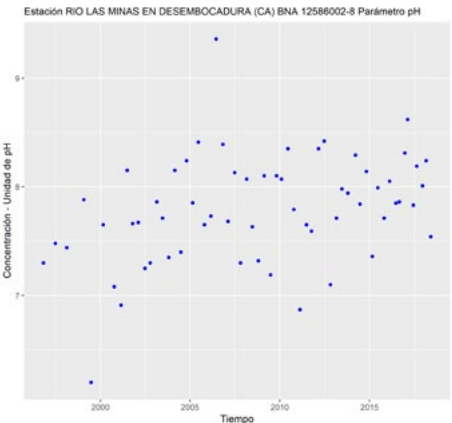
Source: data DGA, separador decimal
fig12284006-9pH.png



Source: data DGA, separador decimal
fig12289001-5pH.png

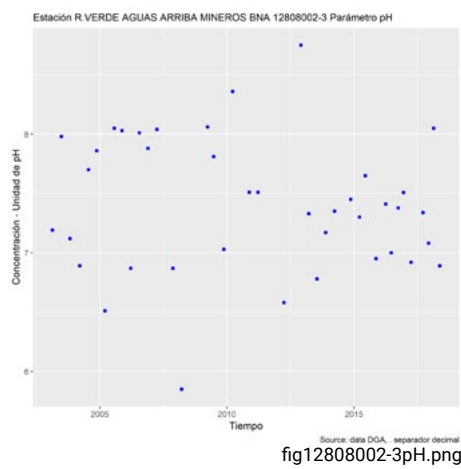


Source: data DGA, separador decimal
fig12448001-9pH.png

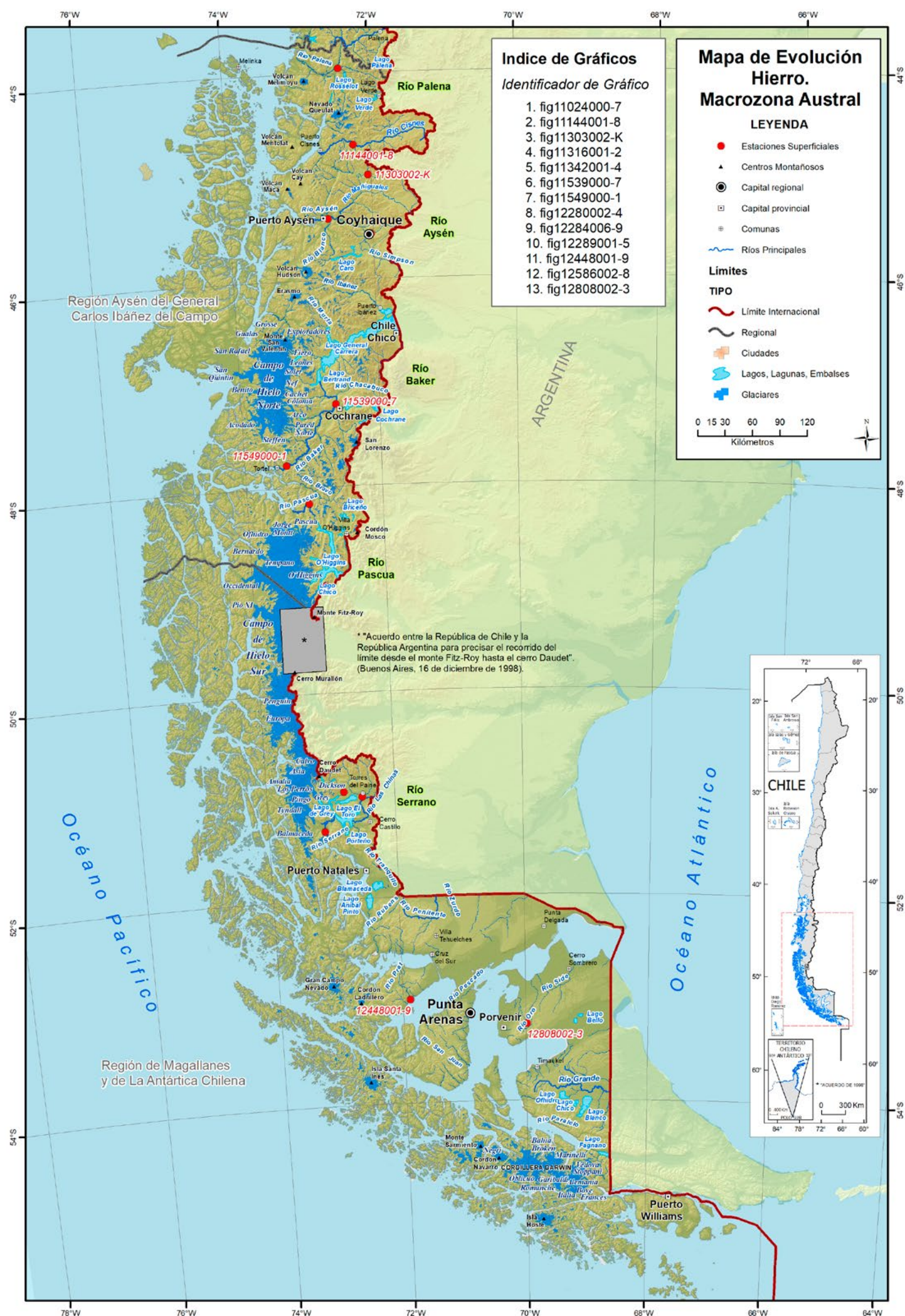


Source: data DGA, separador decimal
fig12586002-8pH.png

71 – 1.2 Gráficos – Evolución Macrozona Austral- PH



72. EVOLUCIÓN MACROZONA AUSTRAL – HIERRO



72. – 1.1 Gráficos – Evolución Macrozona Austral – Hierro

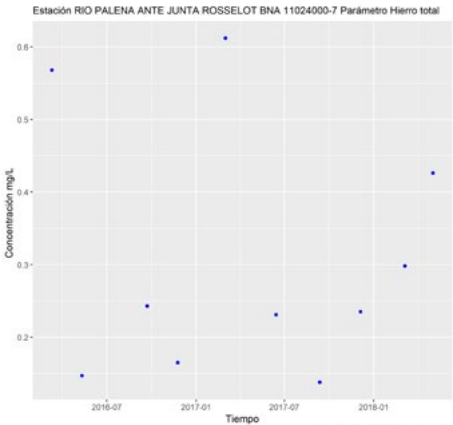


fig11024000-7Hierro_total.png

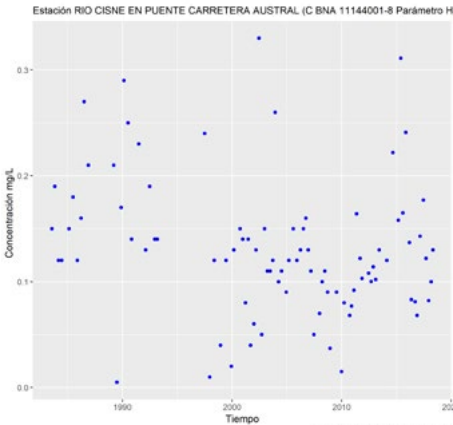


fig11144001-8Hierro_total.png

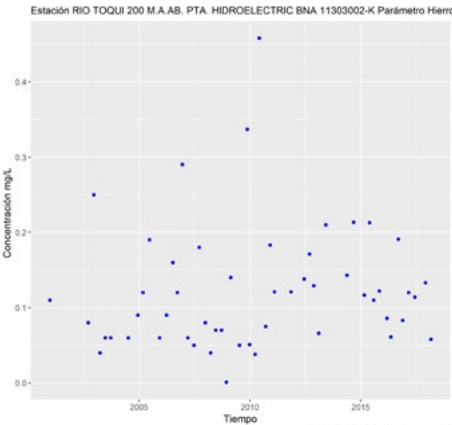


fig11303002-KHierro_total.png

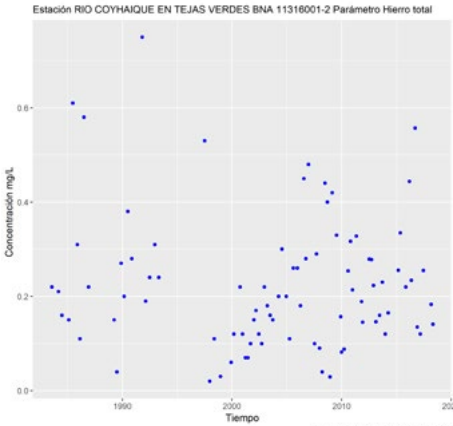


fig11316001-2Hierro_total.png

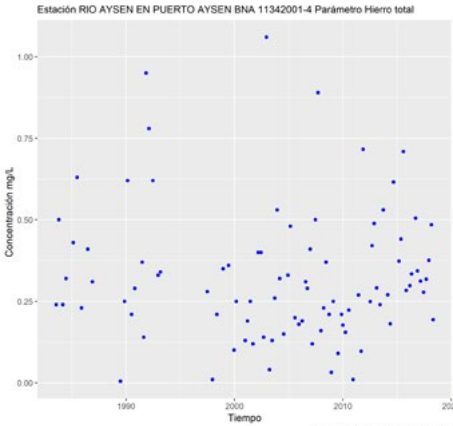


fig11342001-4Hierro_total.png

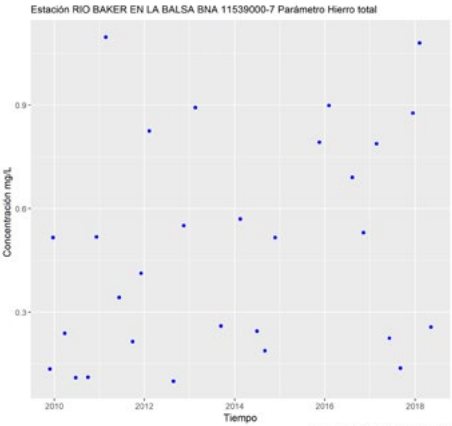


fig11539000-7Hierro_total.png

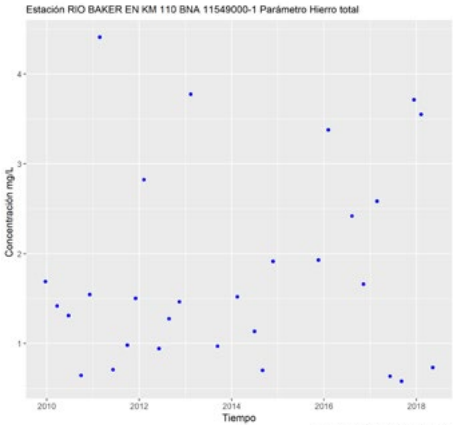


fig11549000-1Hierro_total.png

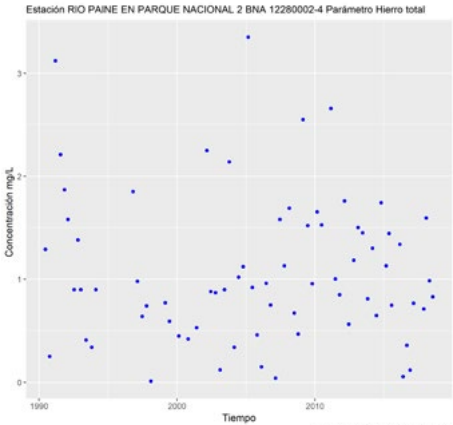


fig12280002-4Hierro_total.png

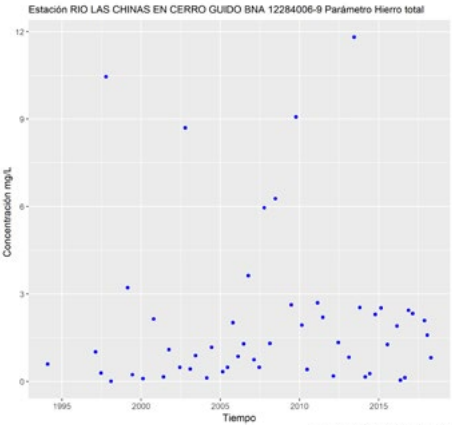


fig12284006-9Hierro_total.png

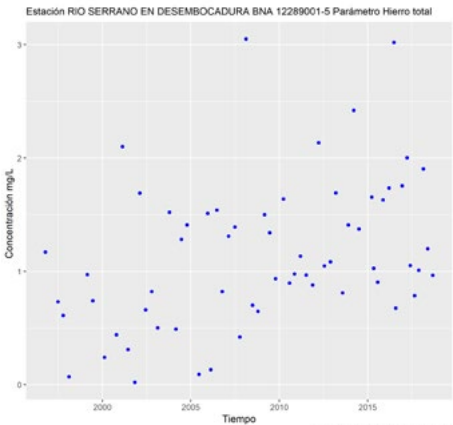


fig12289001-5Hierro_total.png

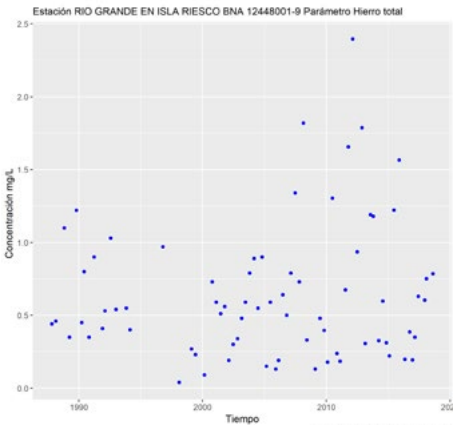


fig12448001-9Hierro_total.png

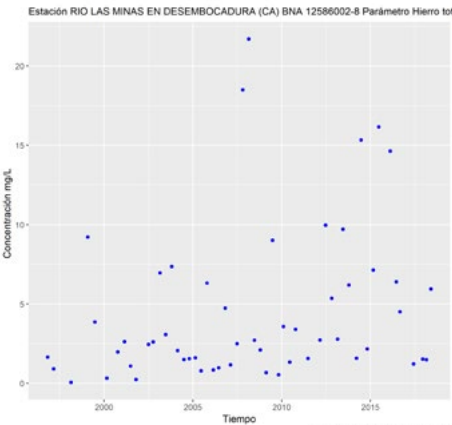
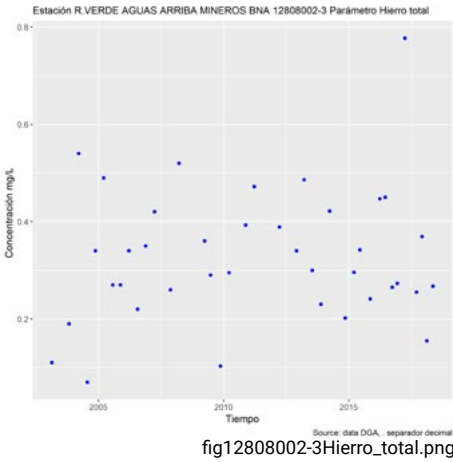
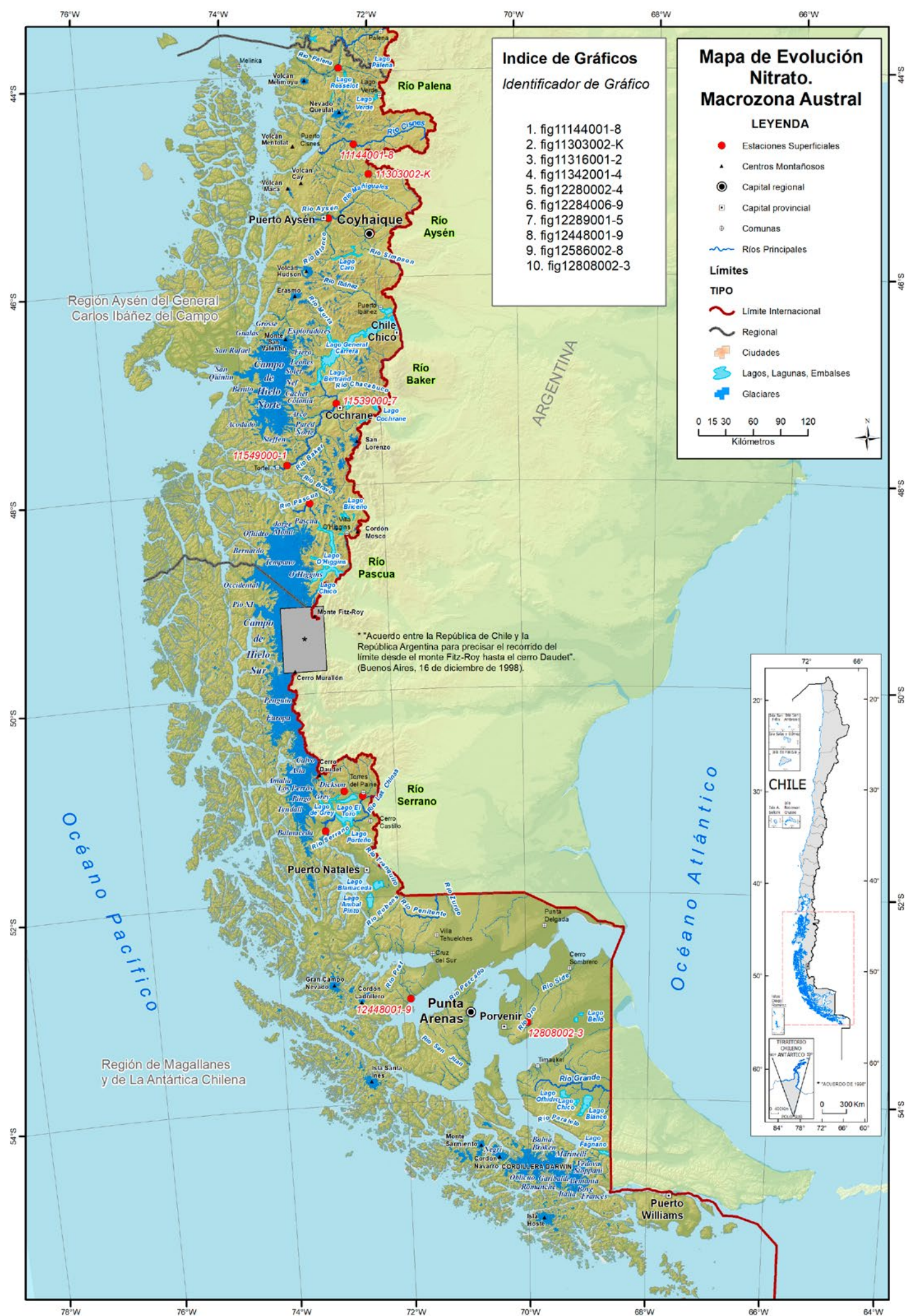


fig12586002-8Hierro_total.png

72. - 1.2 Gráficos – Evolución Macrozona Austral – Hierro



73. EVOLUCIÓN MACROZONA AUSTRAL – NITRATO



73 - 1.1 Gráficos - Evolución Macrozona Austral- Nitrato

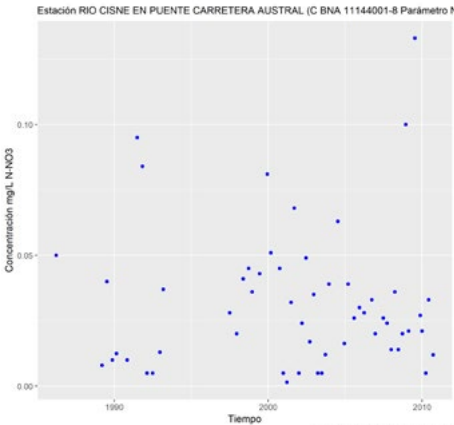


fig11144001-8Nitrogeno_de_nitrato.png

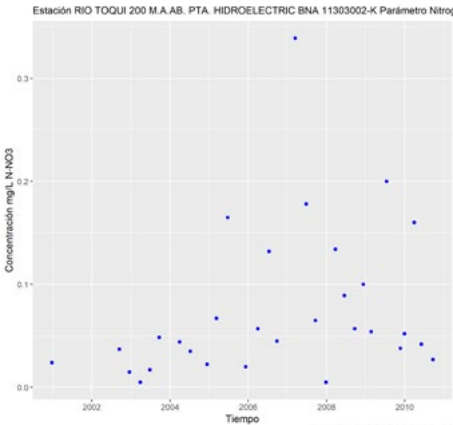


fig11303002-KNitrogeno_de_nitrato.png

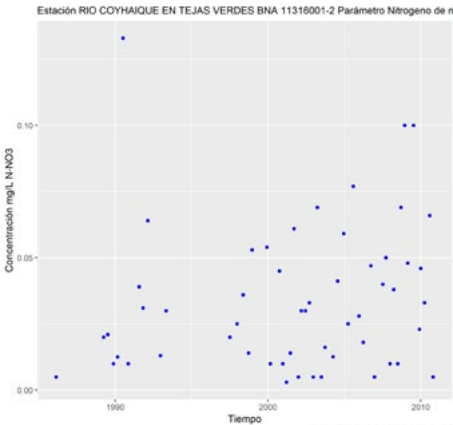


fig11316001-2Nitrogeno_de_nitrato.png

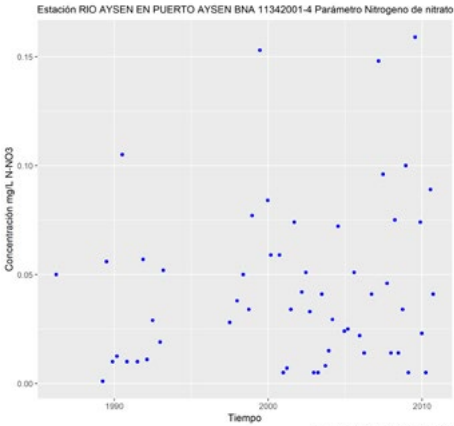


fig11342001-4Nitrogeno_de_nitrato.png

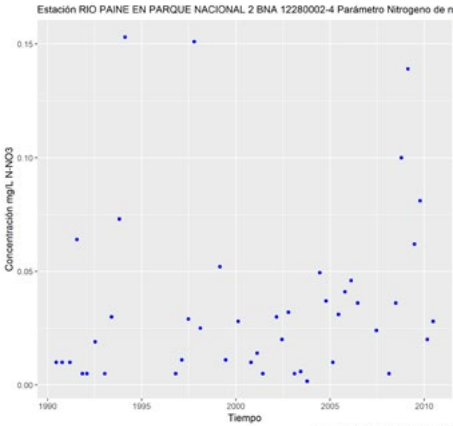


fig12280002-4Nitrogeno_de_nitrato.png

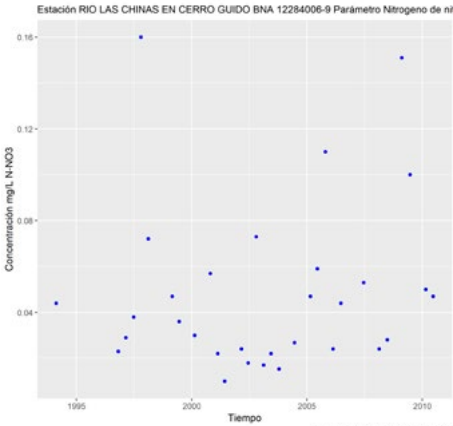


fig12284006-9Nitrogeno_de_nitrato.png

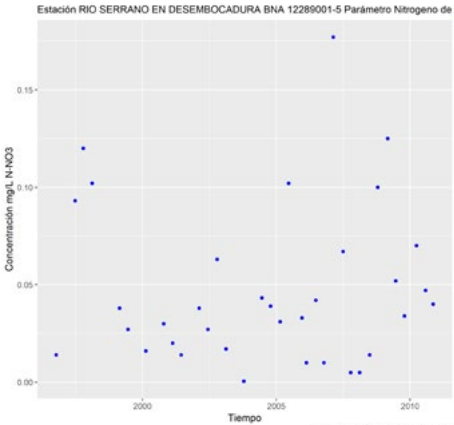


fig12289001-5Nitrogeno_de_nitrato.png

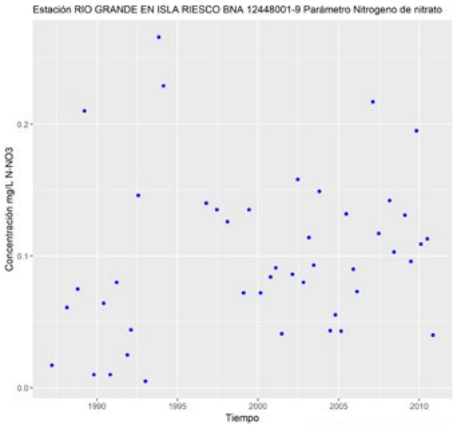


fig12448001-9Nitrogeno_de_nitrato.png

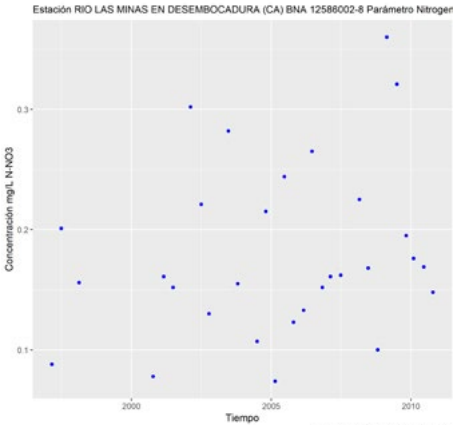


fig12586002-8Nitrogeno_de_nitrato.png

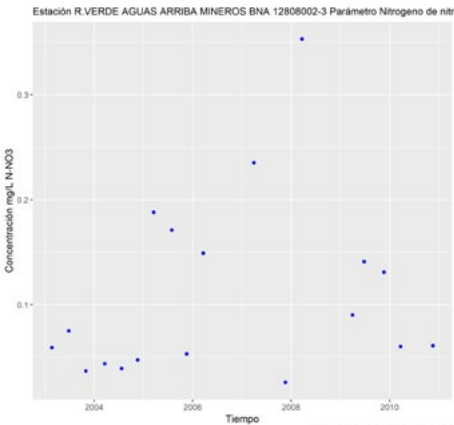
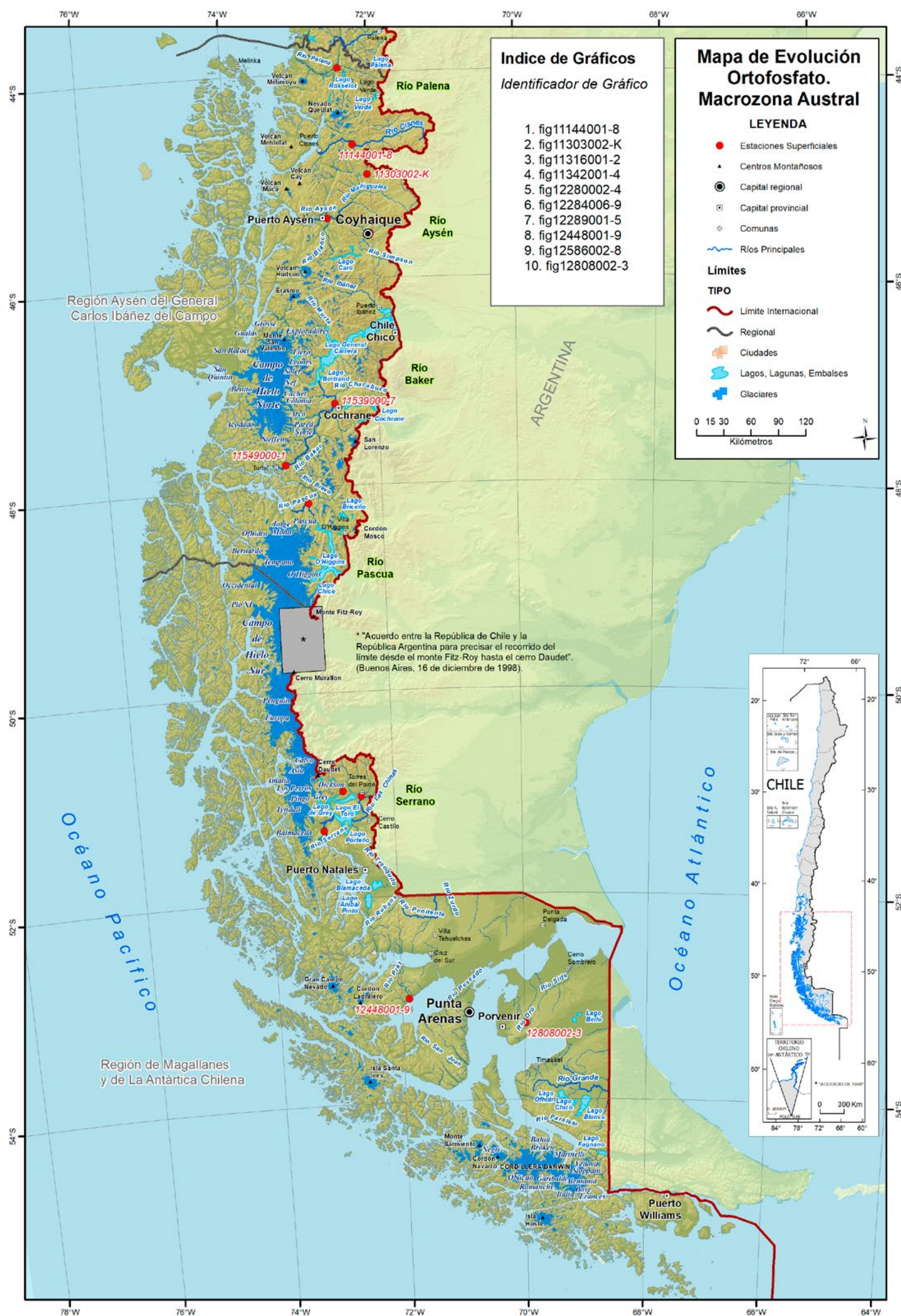


fig12808002-3Nitrogeno_de_nitrato.png

74. EVOLUCIÓN MACROZONA AUSTRAL - ORTOFOSFATO



74 - 1.1 Gráficos - Evolución Macrozona Austral- Ortofosfato

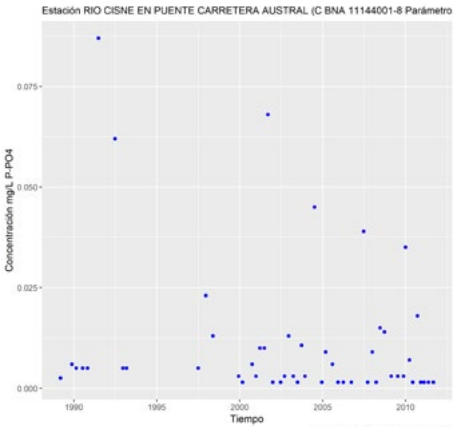


fig11144001-8Fosforo_de_ortofosfato.png

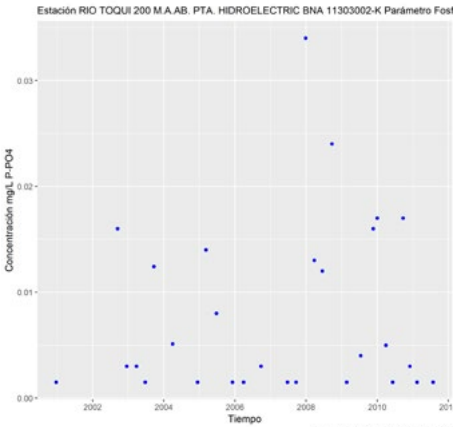


fig11303002-KFosforo_de_ortofosfato.png

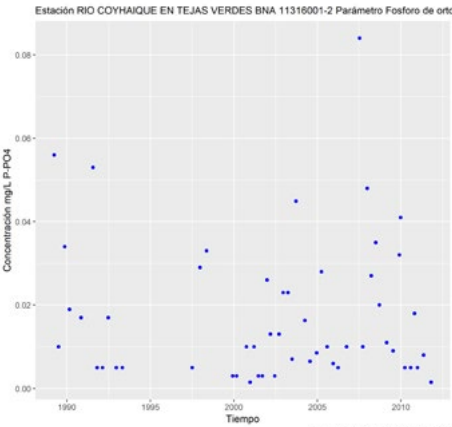


fig11316001-2Fosforo_de_ortofosfato.png

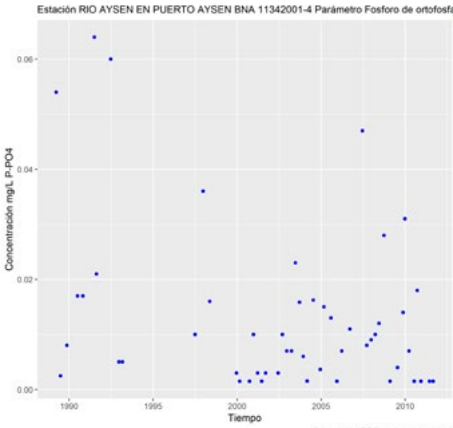


fig11342001-4Fosforo_de_ortofosfato.png

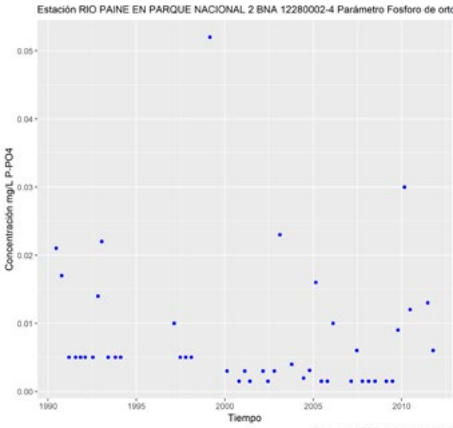


fig12280002-4Fosforo_de_ortofosfato.png

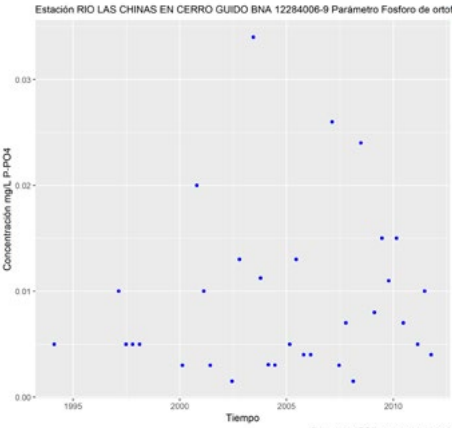


fig12284006-9Fosforo_de_ortofosfato.png

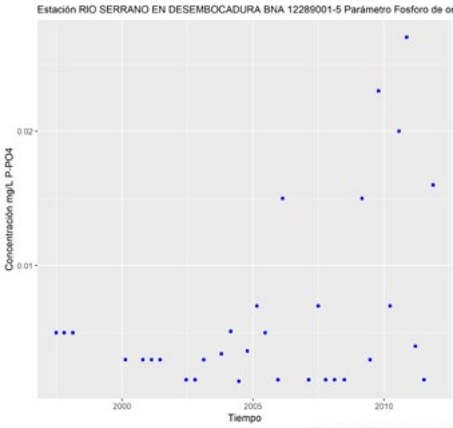


fig12289001-5Fosforo_de_ortofosfato.png

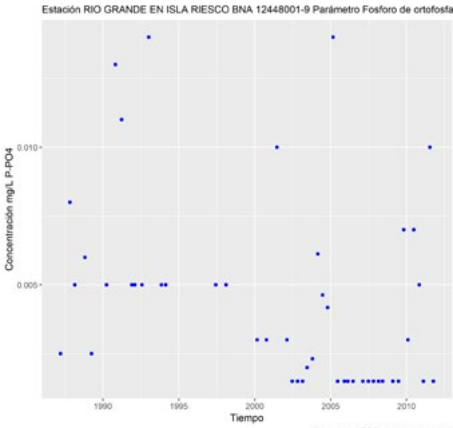


fig12448001-9Fosforo_de_ortofosfato.png

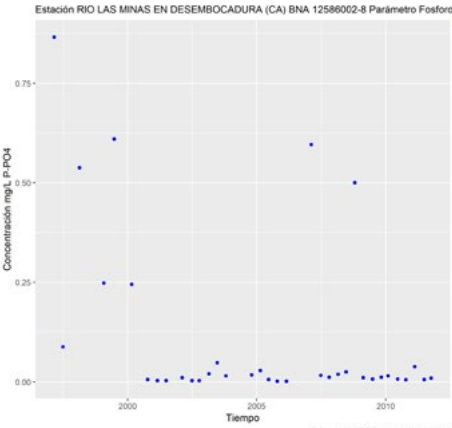


fig12586002-8Fosforo_de_ortofosfato.png

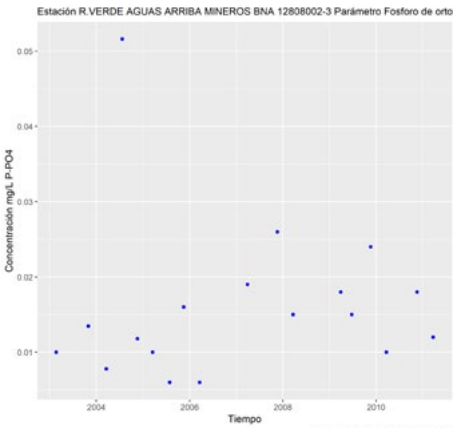
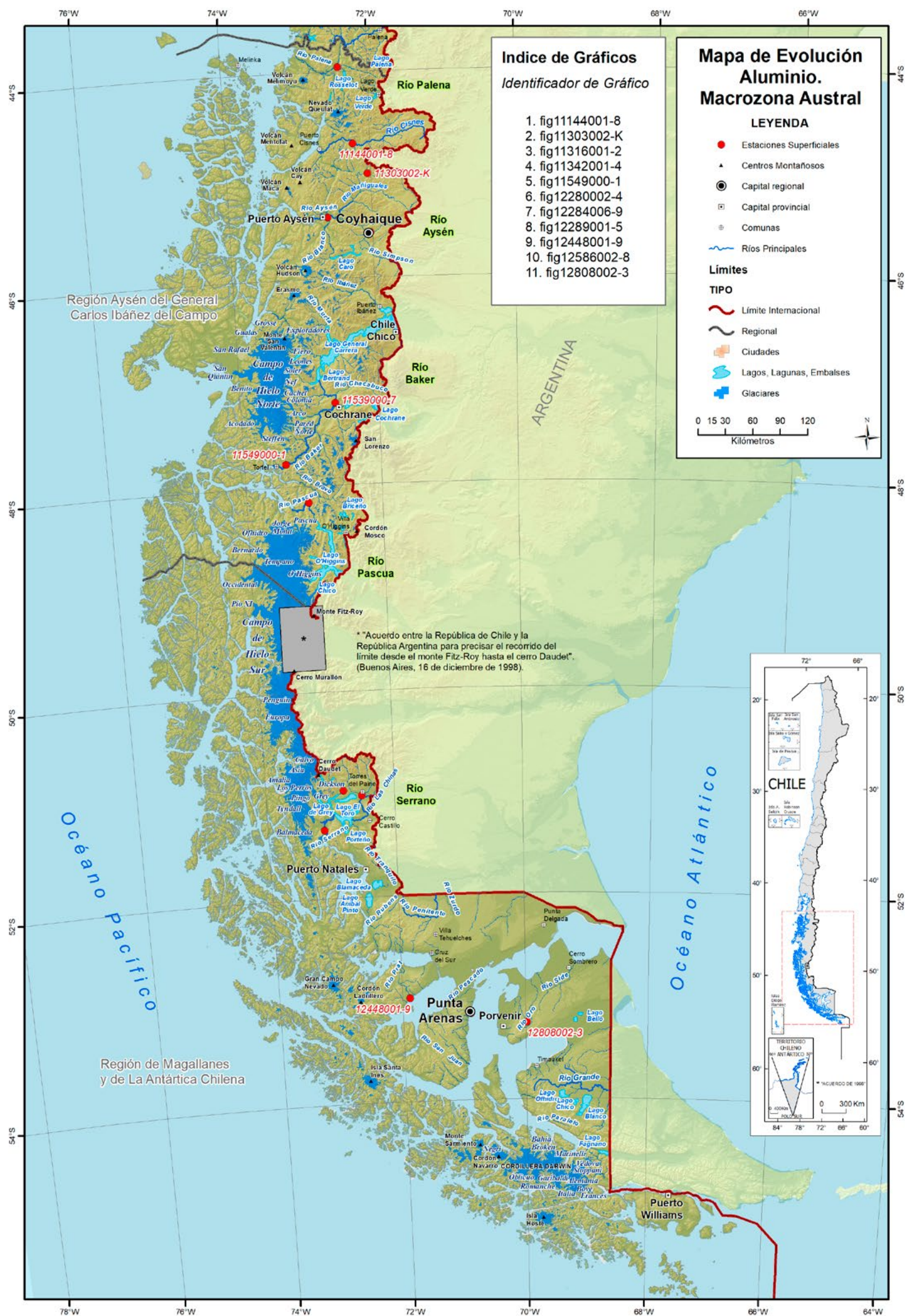


fig12808002-3Fosforo_de_ortofosfato.png

75. EVOLUCIÓN MACROZONA AUSTRAL – ALUMINIO



75 - 1.1 Gráficos - Evolución Macrozona Austral- Aluminio

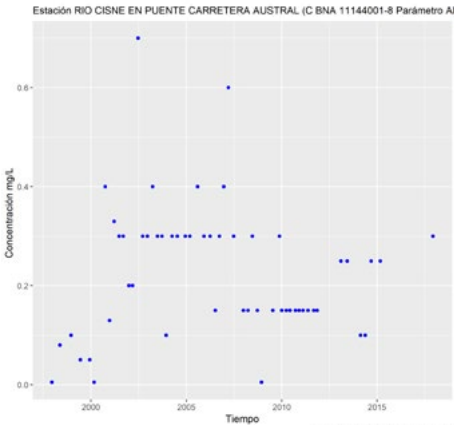


fig11144001-8Aluminio_total.png

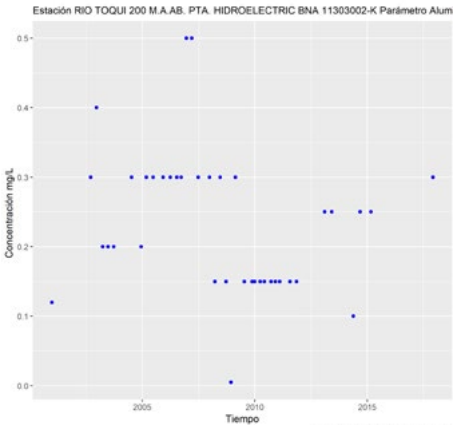


fig11303002-KAluminio_total.png

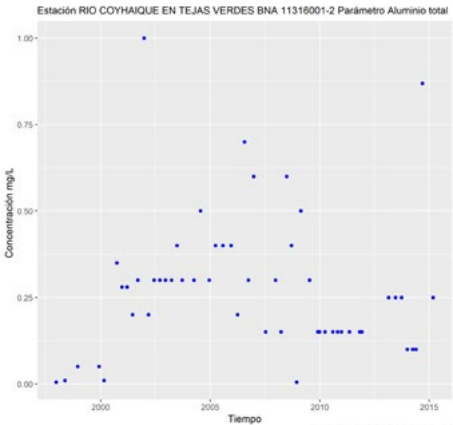


fig11316001-2Aluminio_total.png

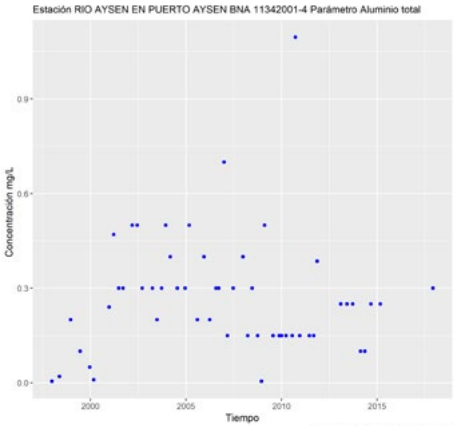


fig11342001-4Aluminio_total.png

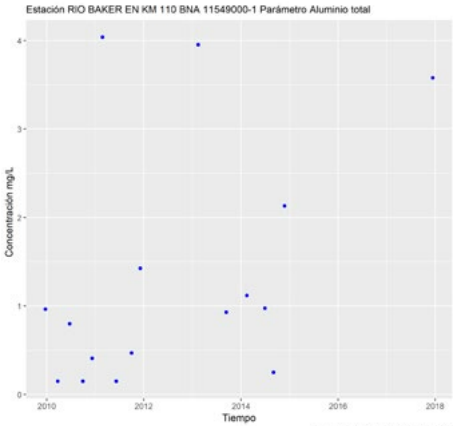


fig11549000-1Aluminio_total.png

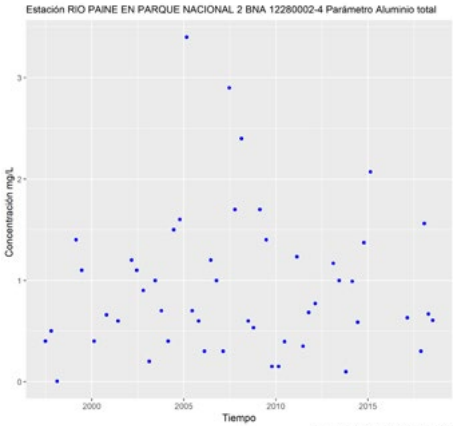


fig12280002-4Aluminio_total.png

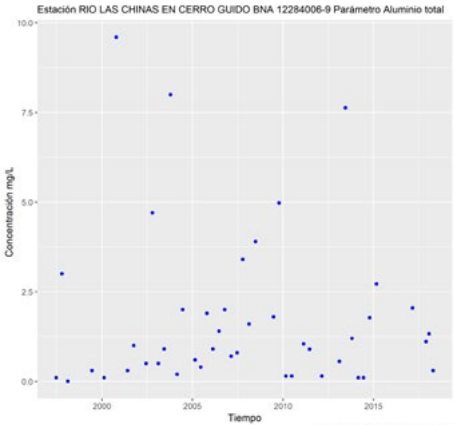


fig12284006-9Aluminio_total.png

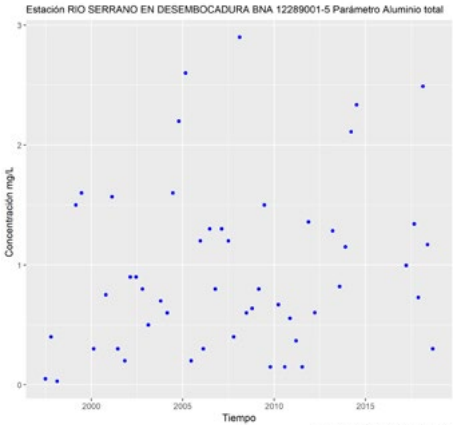


fig12289001-5Aluminio_total.png

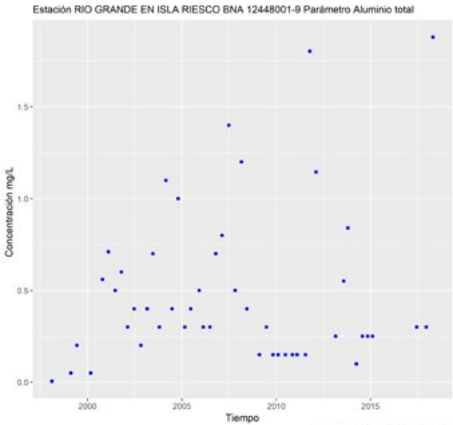


fig12448001-9Aluminio_total.png

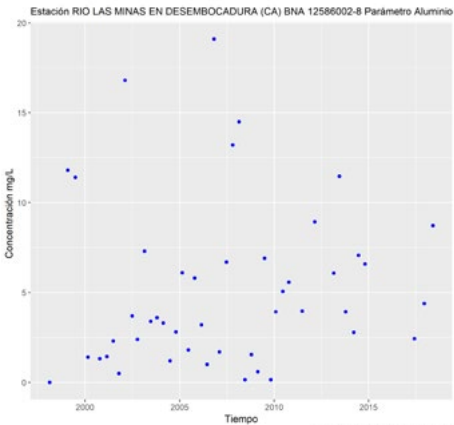


fig12586002-8Aluminio_total.png

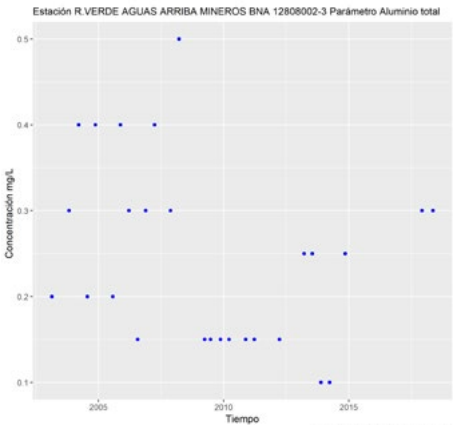
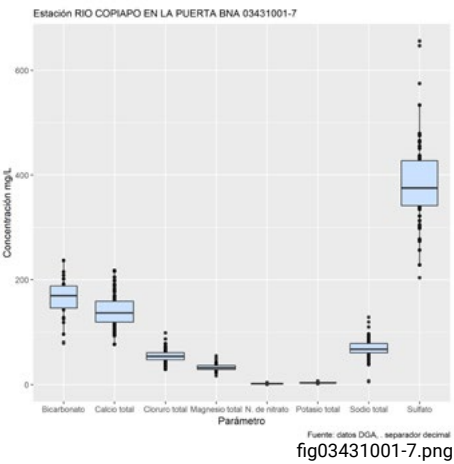
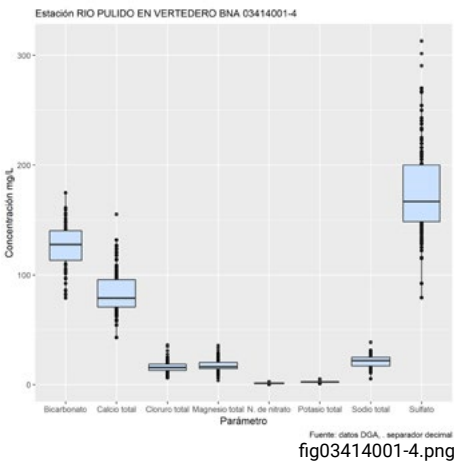
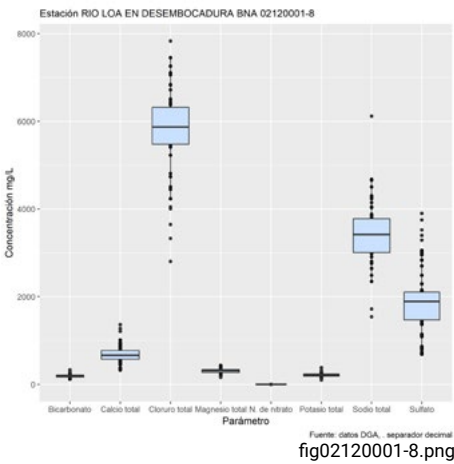
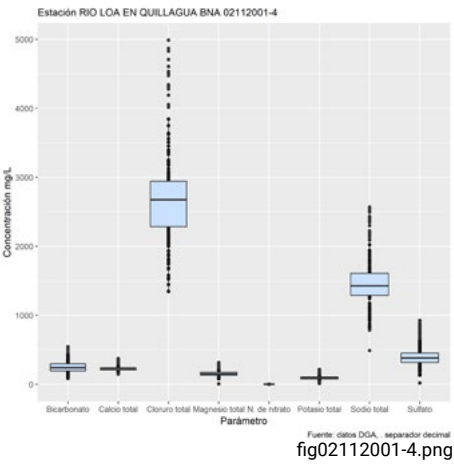
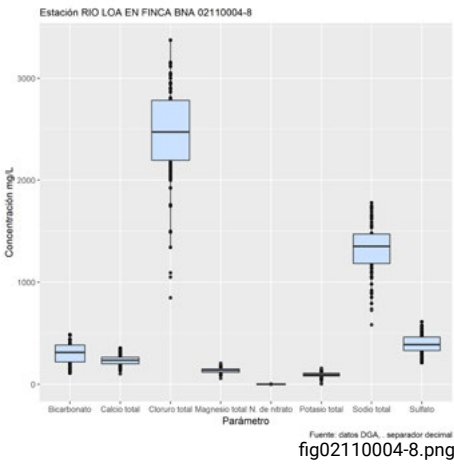
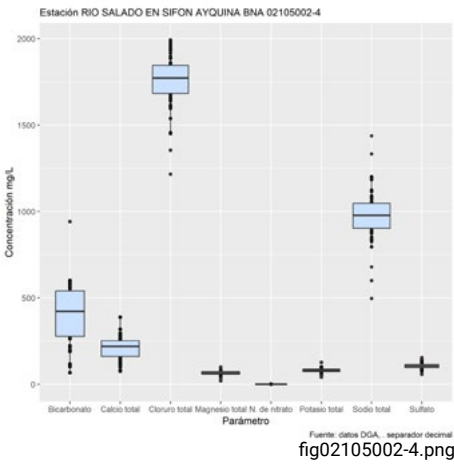
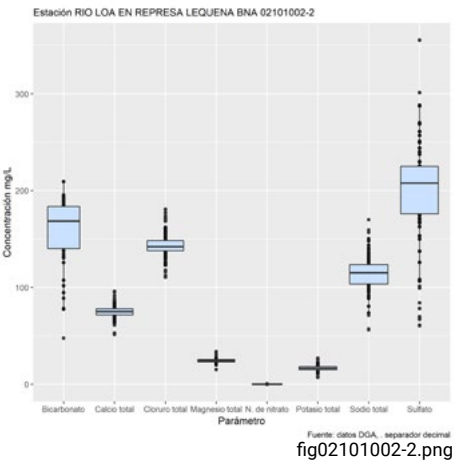
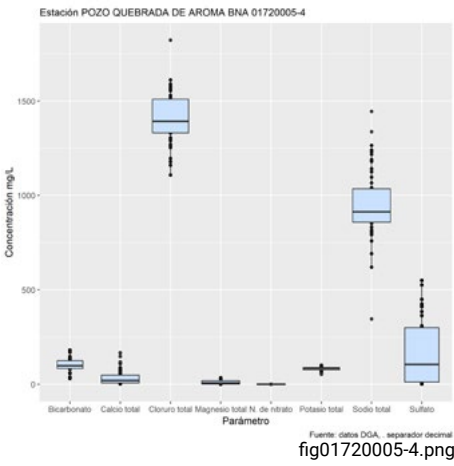
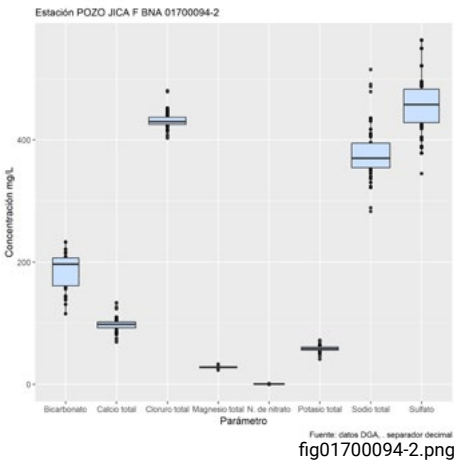
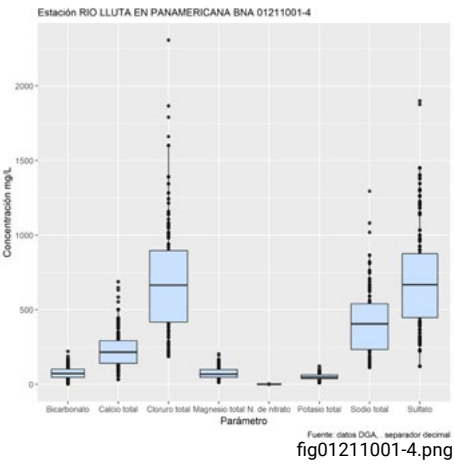
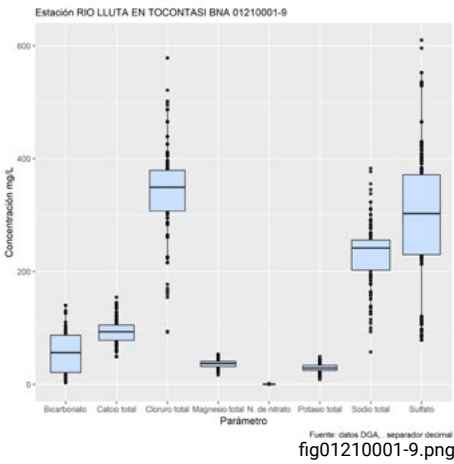
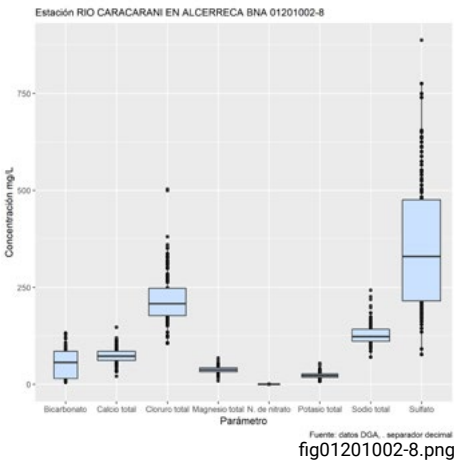


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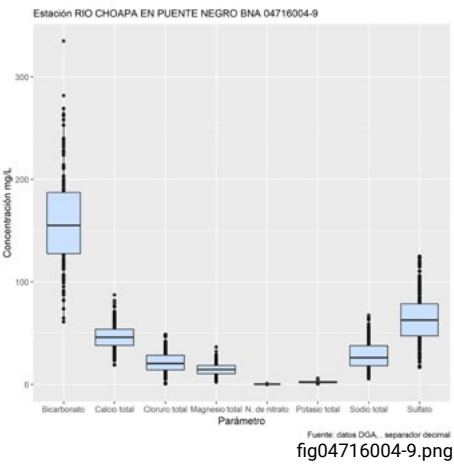
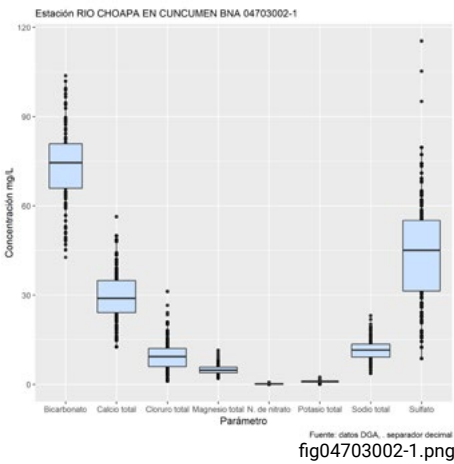
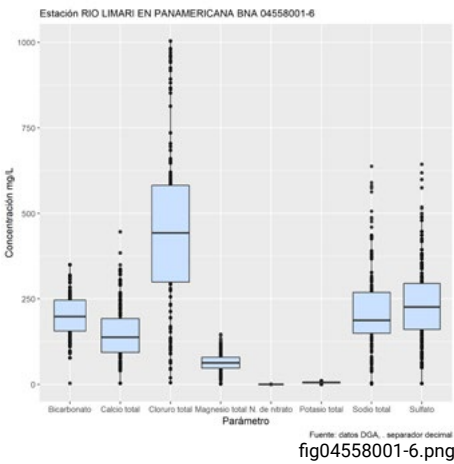
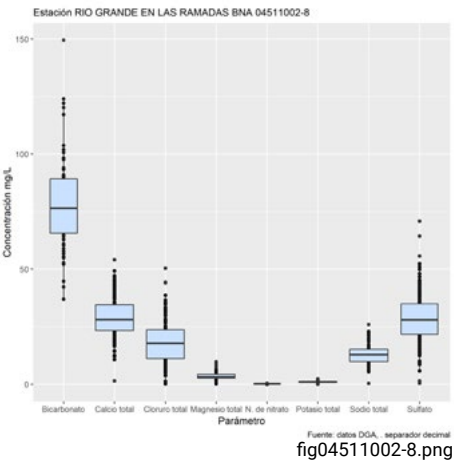
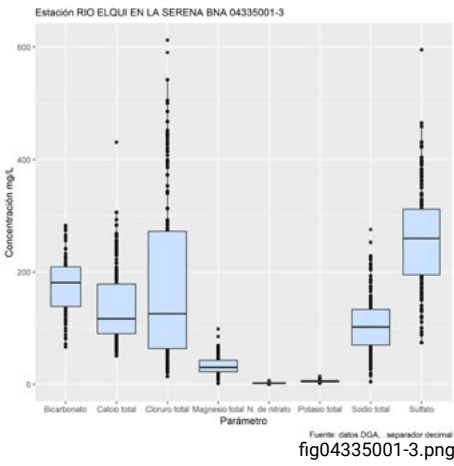
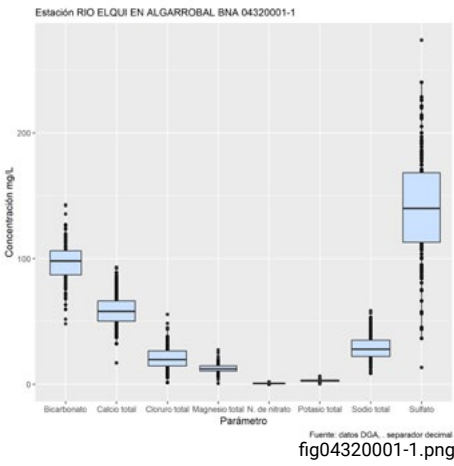
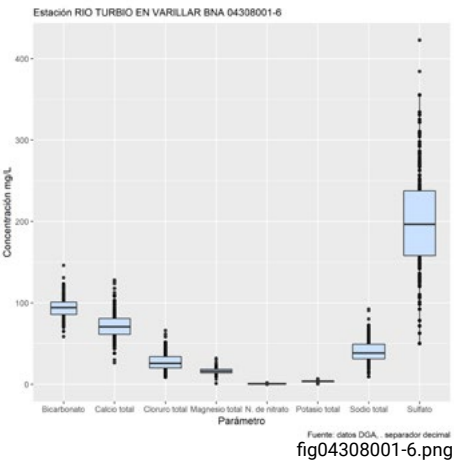
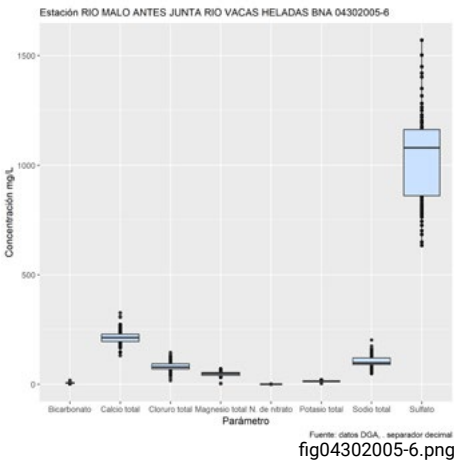
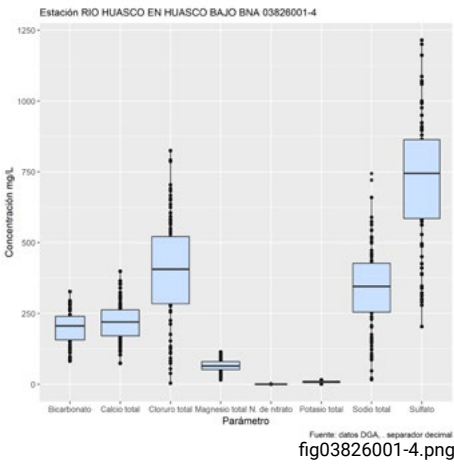
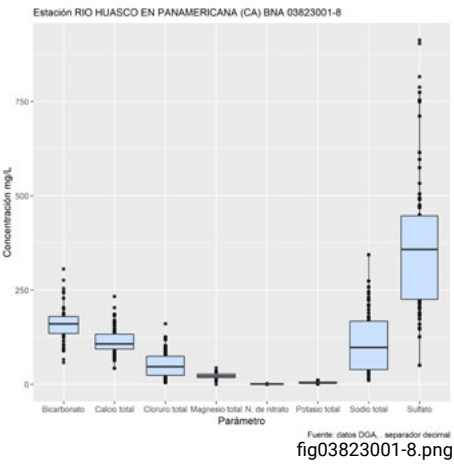
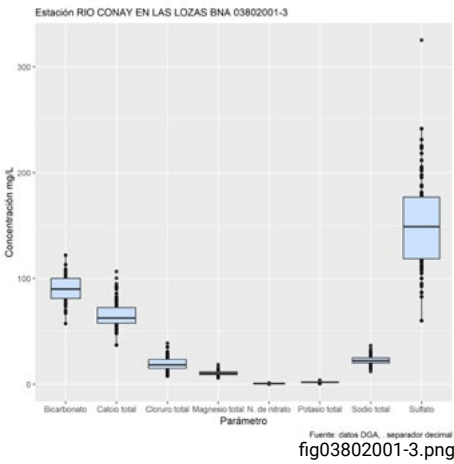
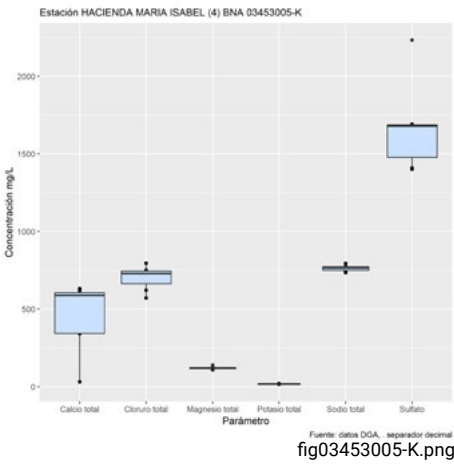
76. EVOLUCIÓN MACROZONA NORTE - MACRO ELEMENTOS



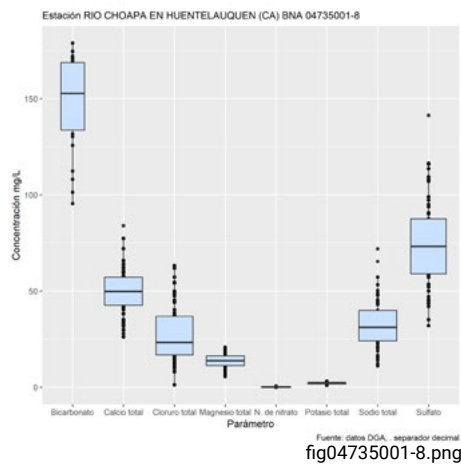
76. - 1.1 Gráficos - Evolución Macrozona Norte - Macro Elementos



76. – 1.2 Gráficos – Evolución Macrozona Norte – Macro Elementos



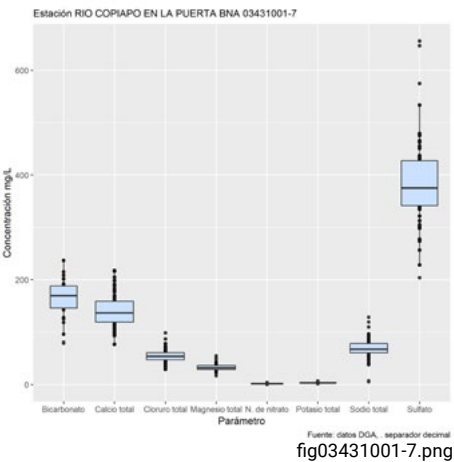
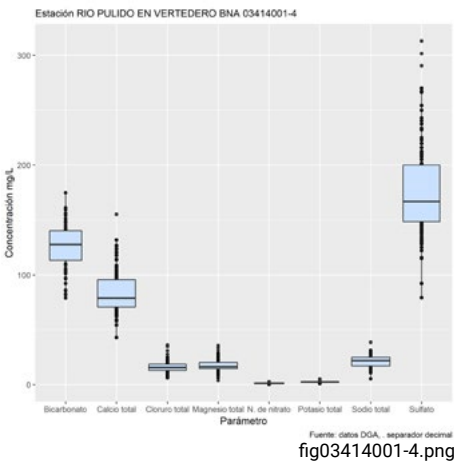
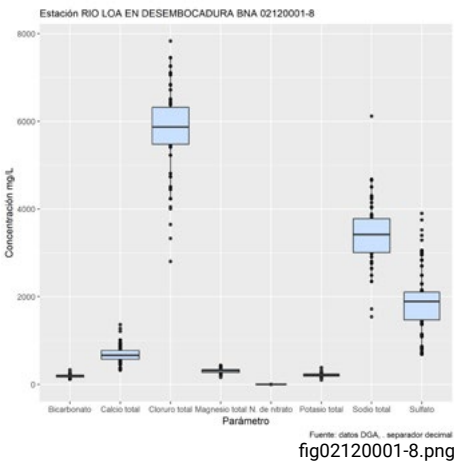
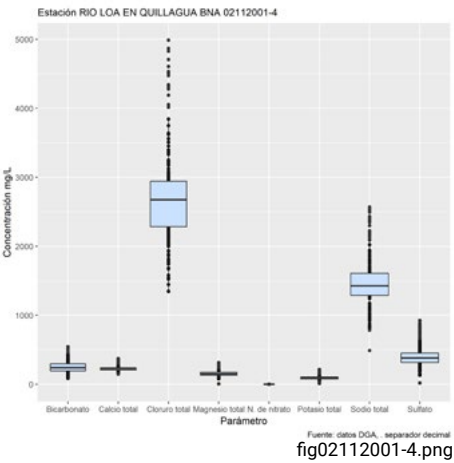
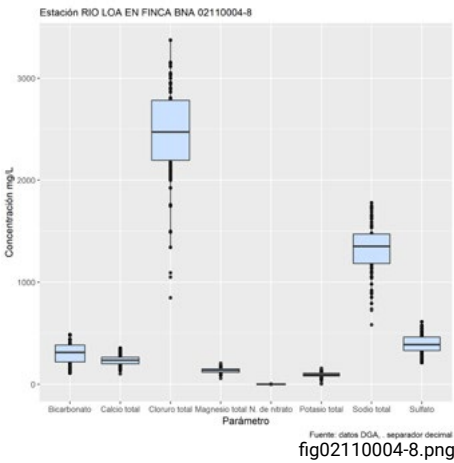
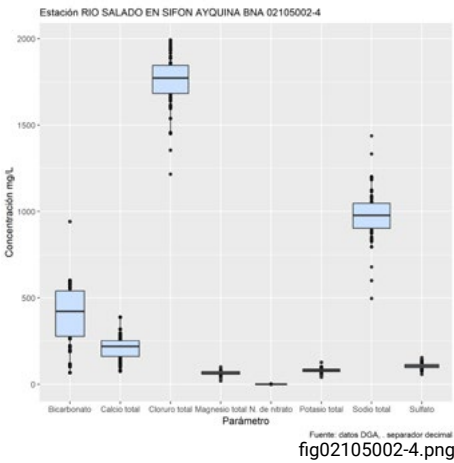
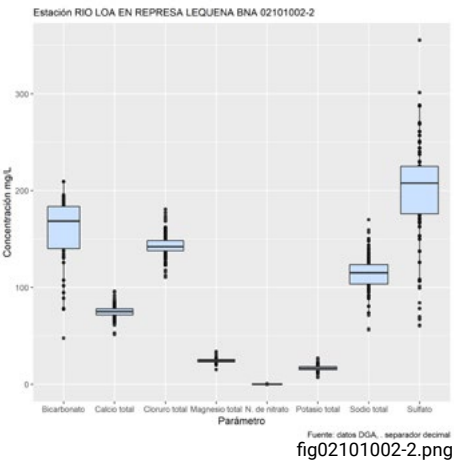
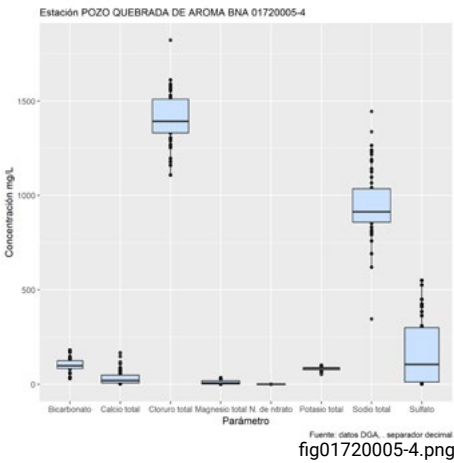
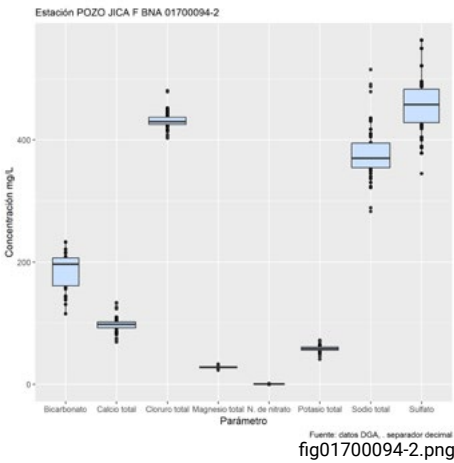
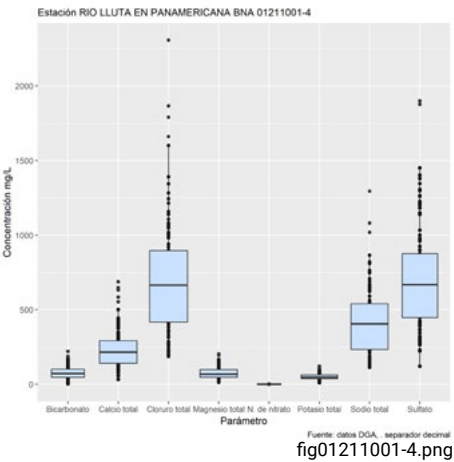
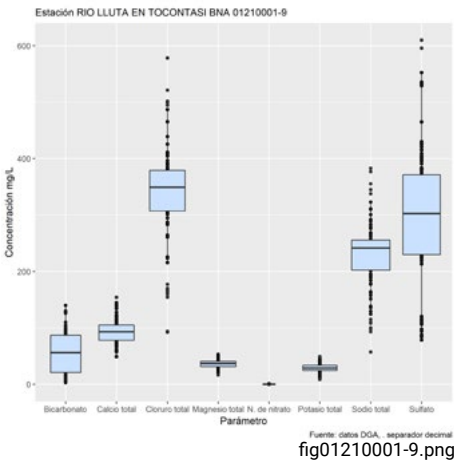
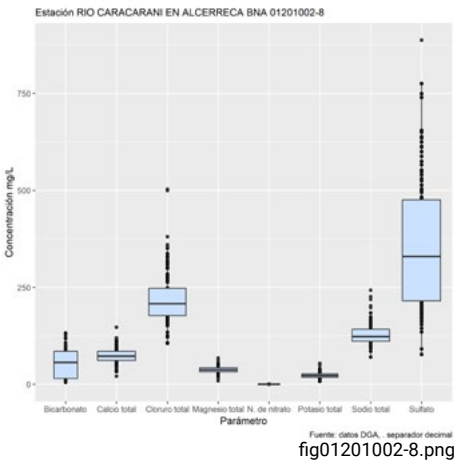
76. - 1.3 Gráficos – Evolución Macrozona Norte – Macro Elementos



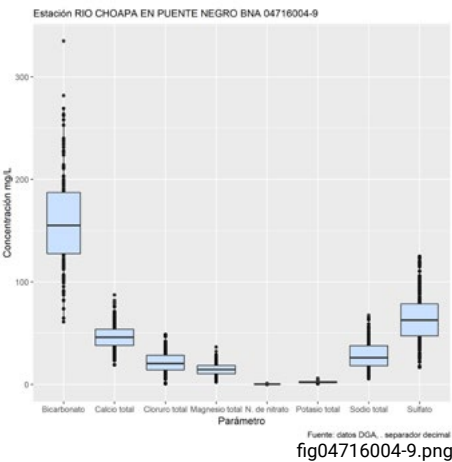
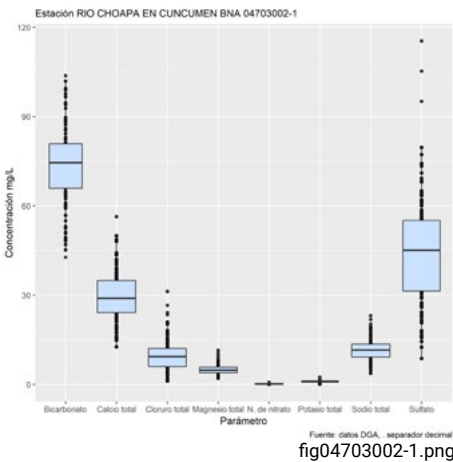
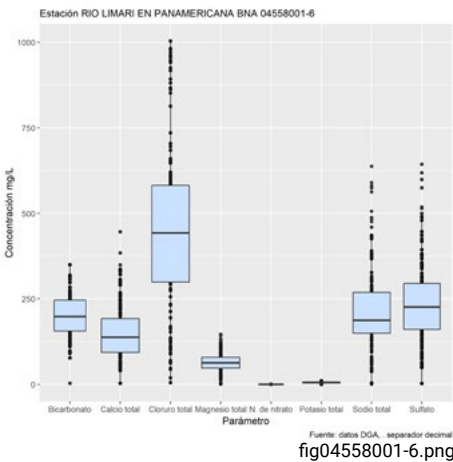
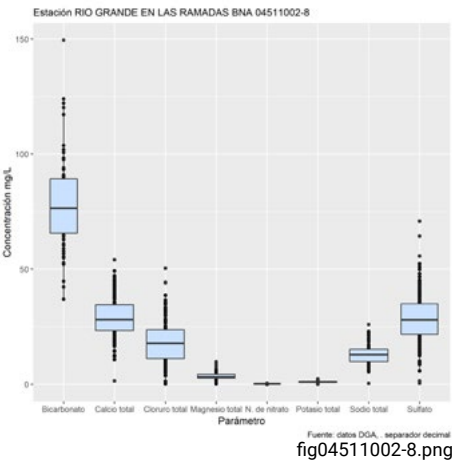
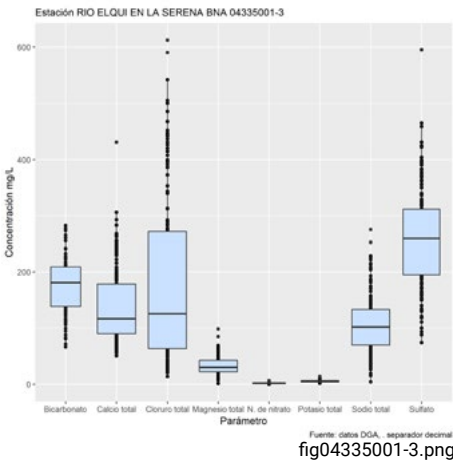
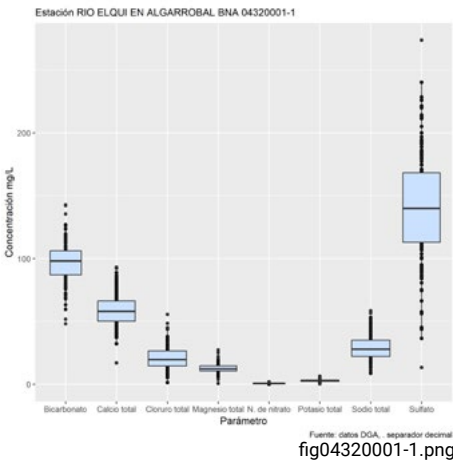
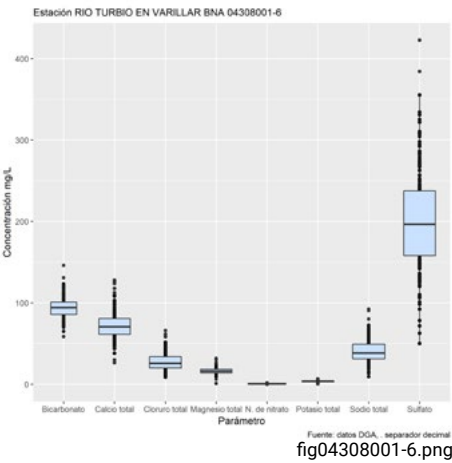
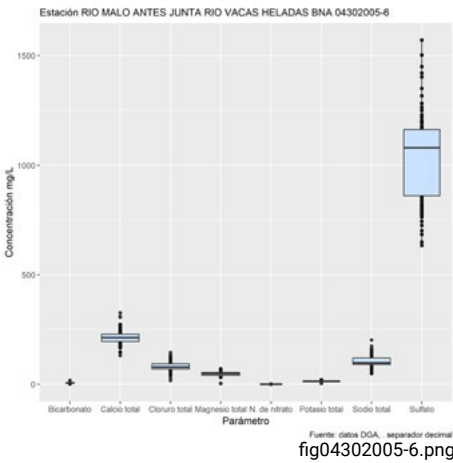
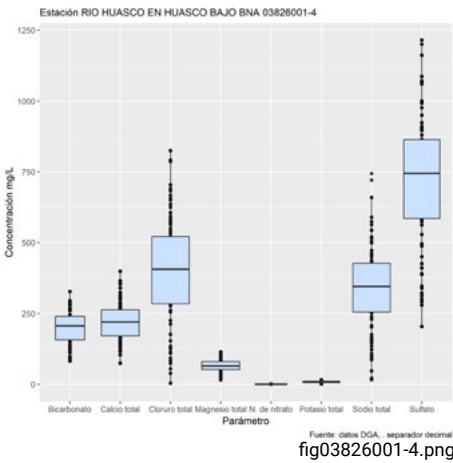
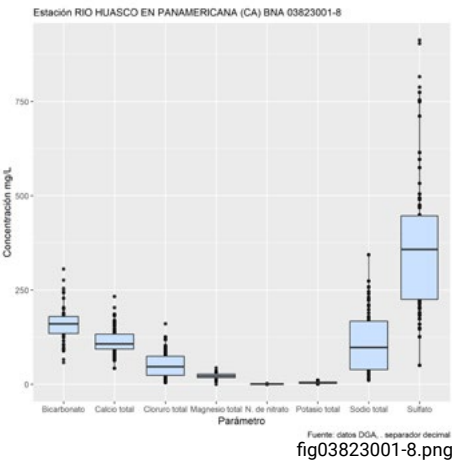
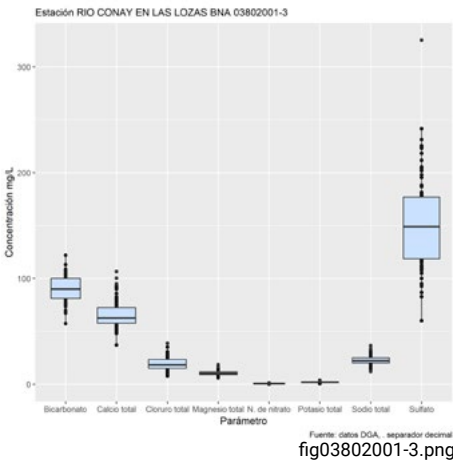
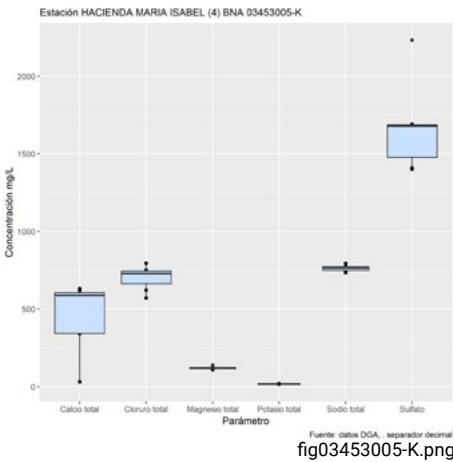
77. EVOLUCIÓN MACROZONA NORTE - MICRO ELEMENTOS



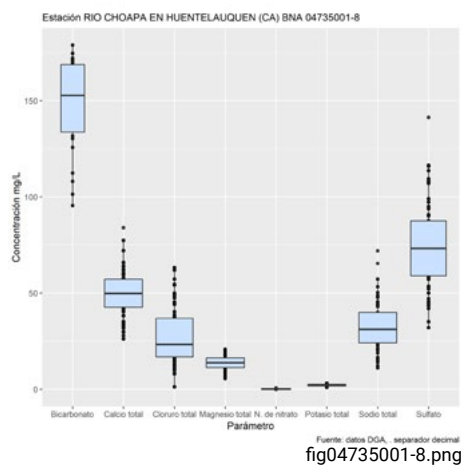
77. - 1.1 Gráficos - Evolución Macrozona Norte - Micro Elementos



77. – 1.2 Gráficos – Evolución Macrozona Norte – Micro Elementos



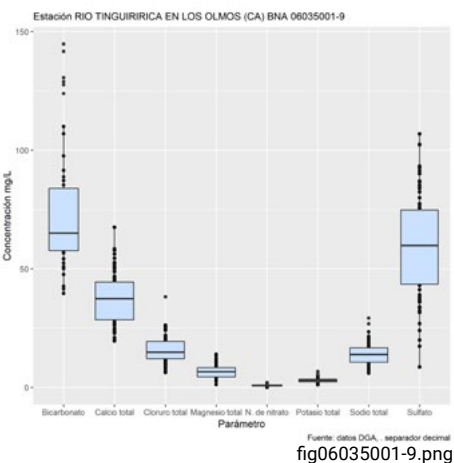
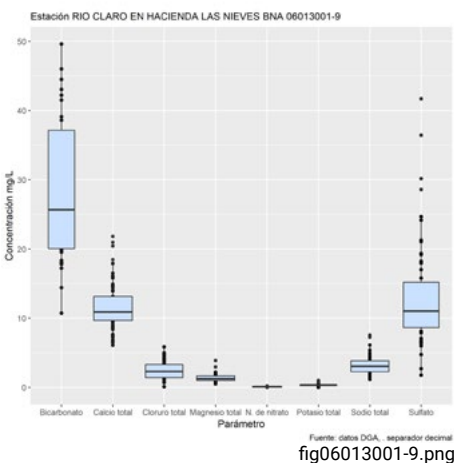
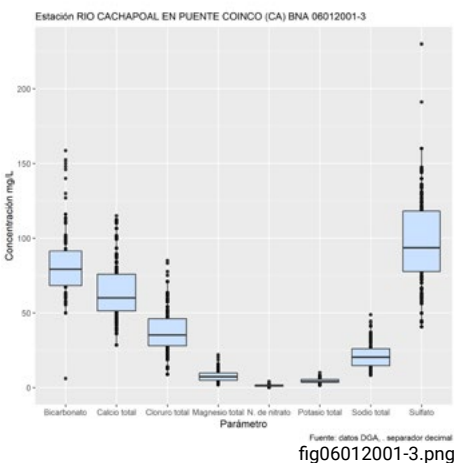
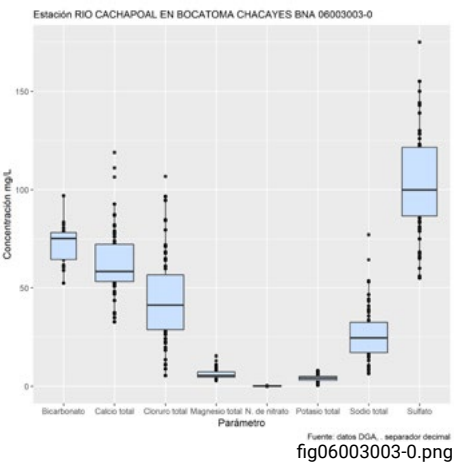
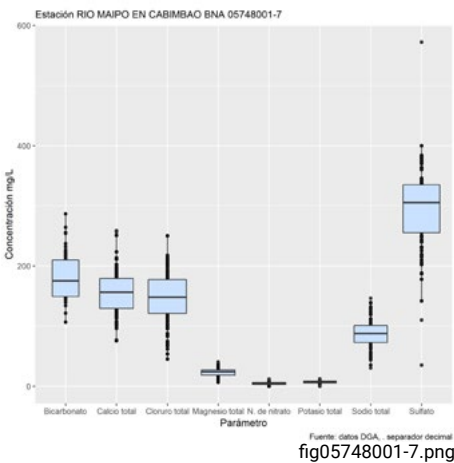
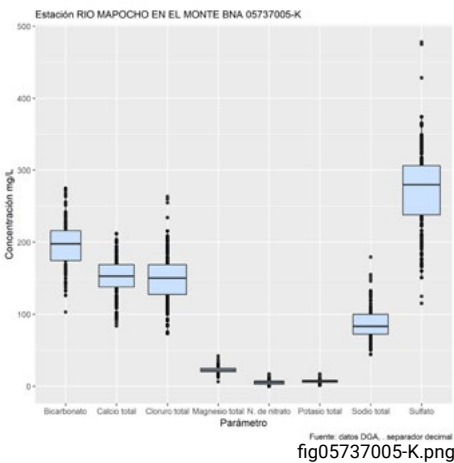
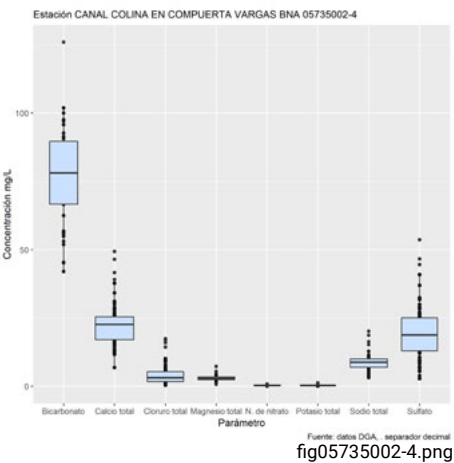
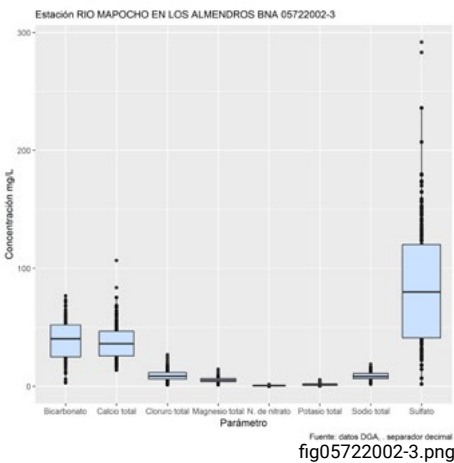
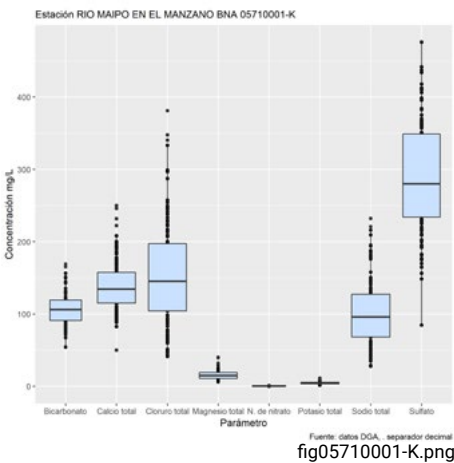
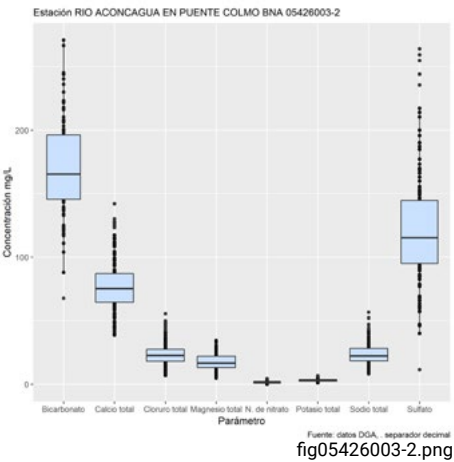
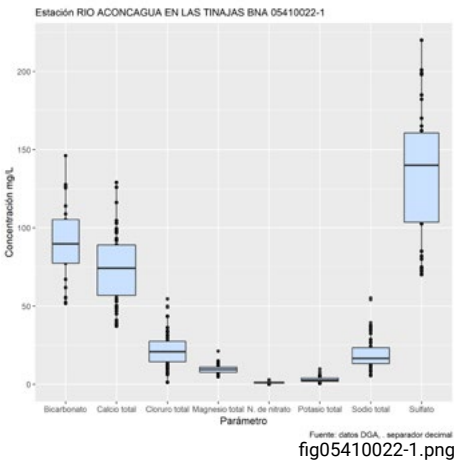
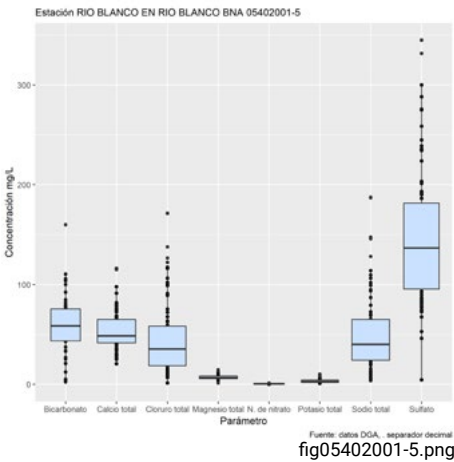
77. - 1.3 Gráficos - Evolución Macrozona Norte - Micro Elementos



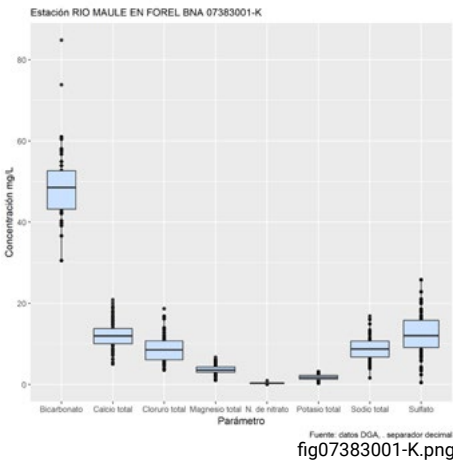
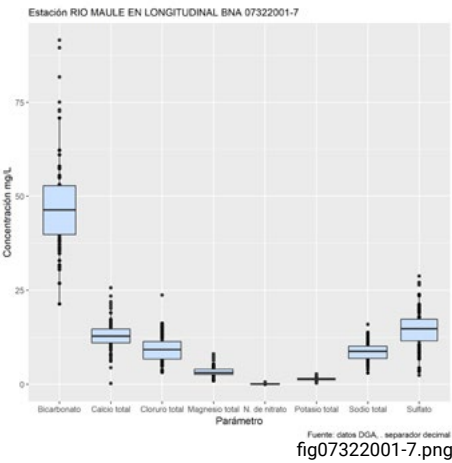
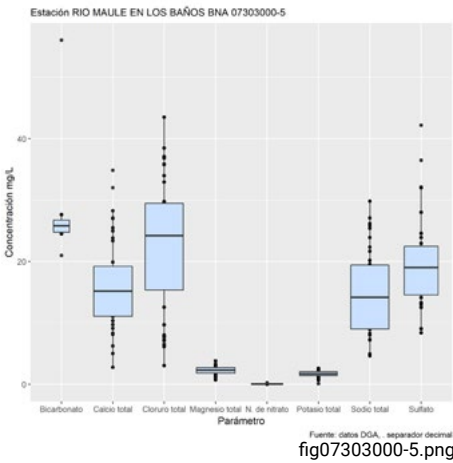
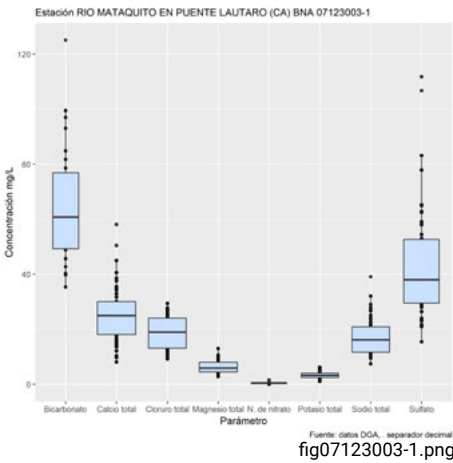
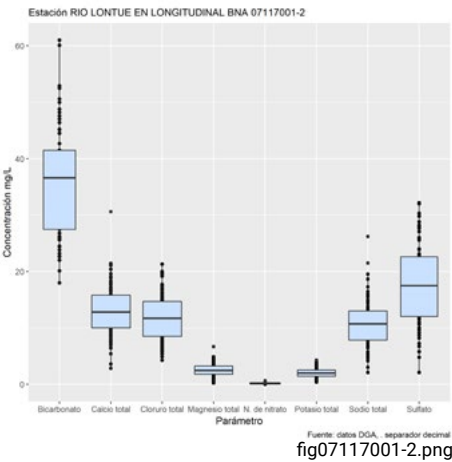
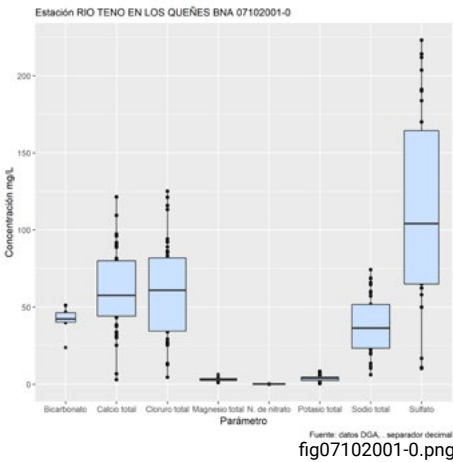
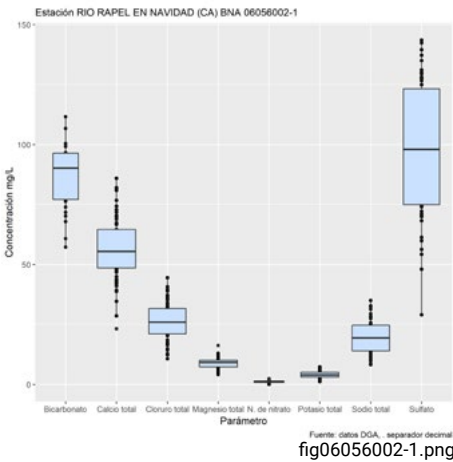
78. EVOLUCIÓN MACROZONA CENTRO - MACRO ELEMENTOS



78. - 1.1 Gráficos - Evolución Macrozona Centro - Macro Elementos



78. – 1.2 Gráficos – Evolución Macrozona Centro – Macro Elementos



Mapa de Evolución Micro Elementos Macrozona Centro

LEYENDA

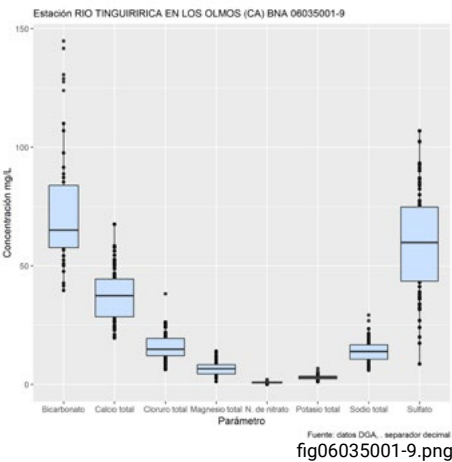
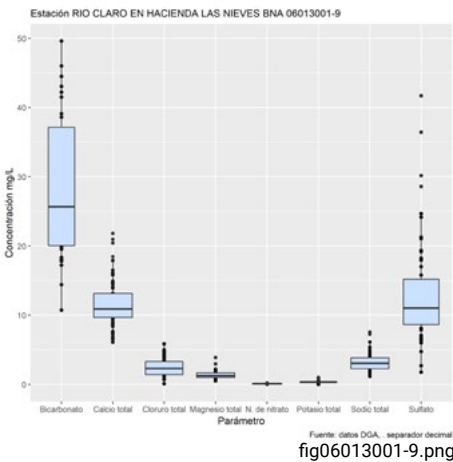
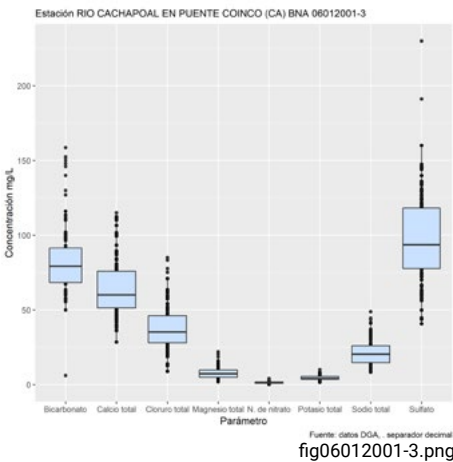
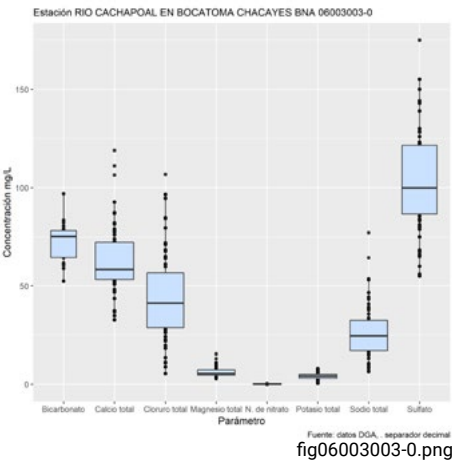
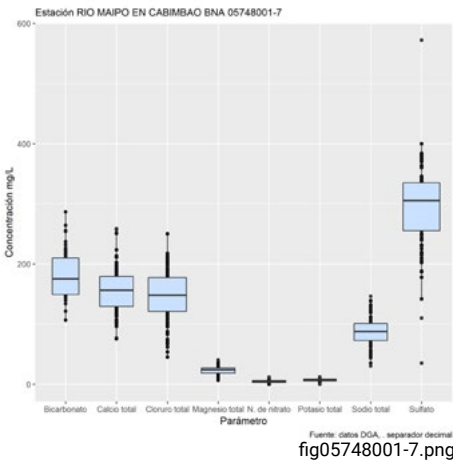
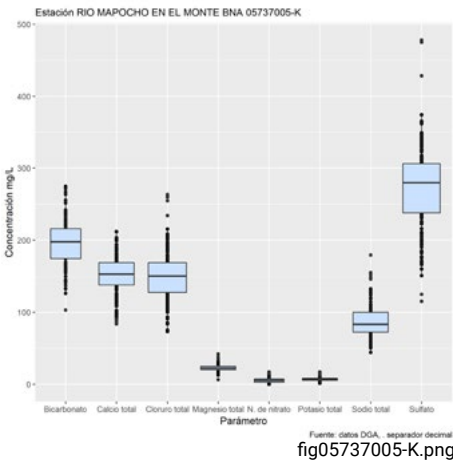
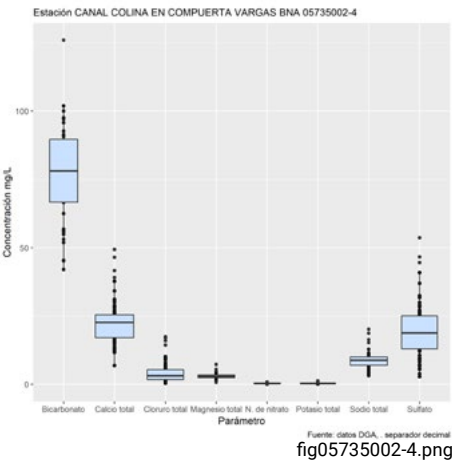
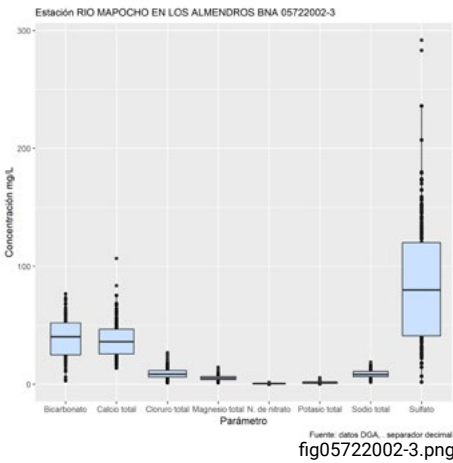
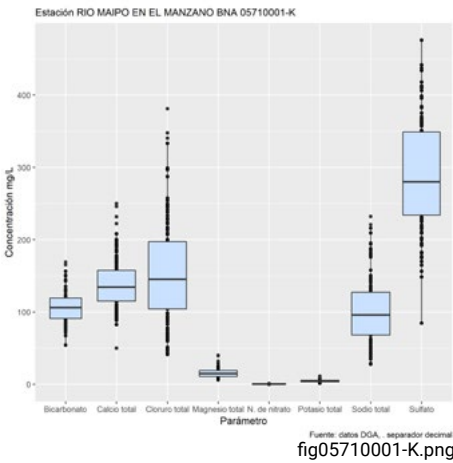
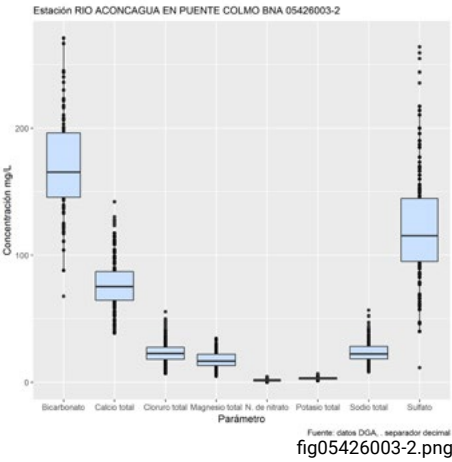
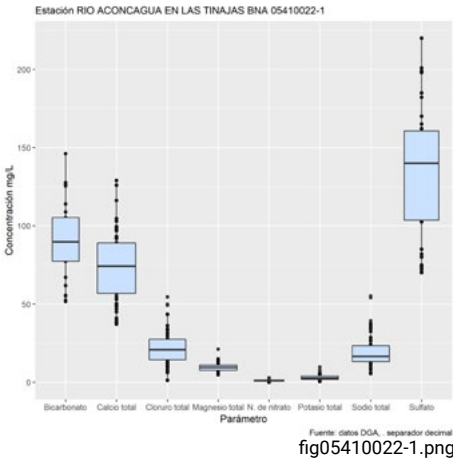
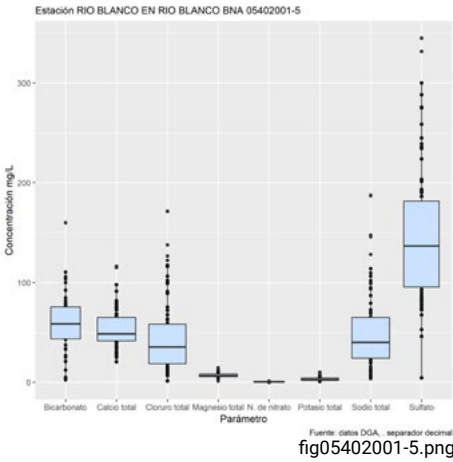
- ▲ Centros Montañosos
- Capital Regional
- () Capital provincial
- Comunas
- Estaciones Superficiales
- Ríos Principales
- Esteros Principales
- Lagos, Lagunas, Embalses
- Ciudades Principales
- Glaciares
- Límites
- TIPO
- Límite Internacional
- Límite Regional

Indice de Gráficos

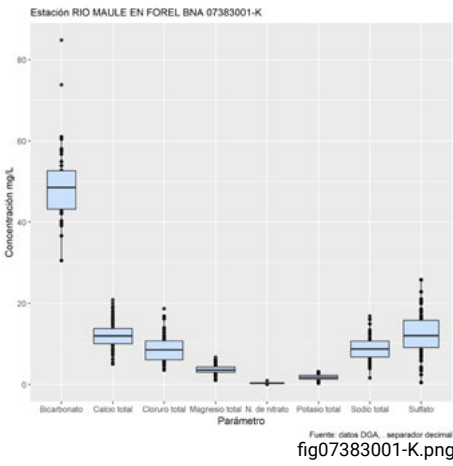
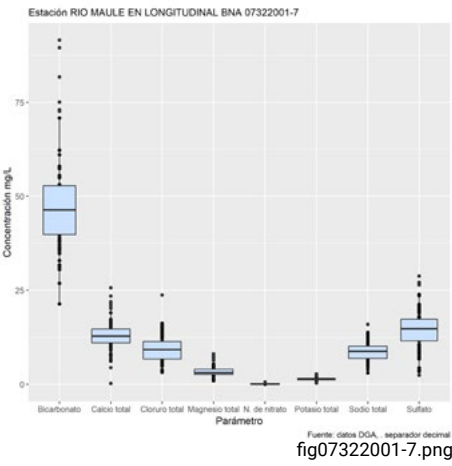
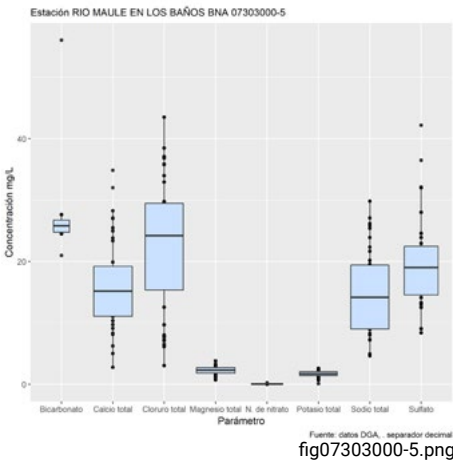
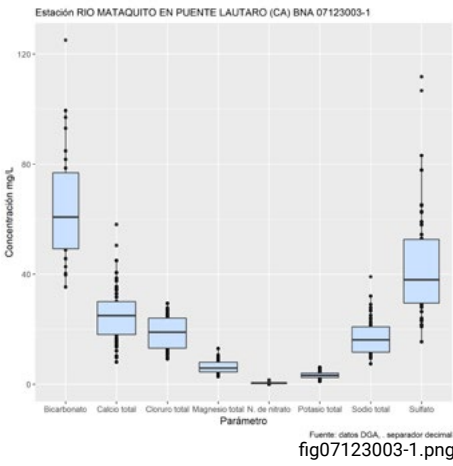
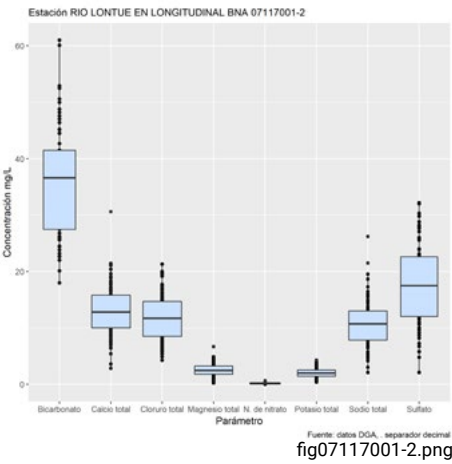
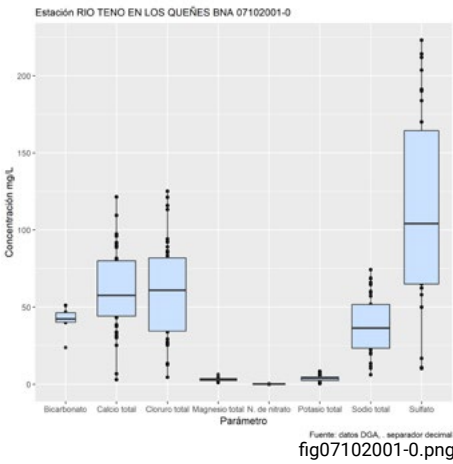
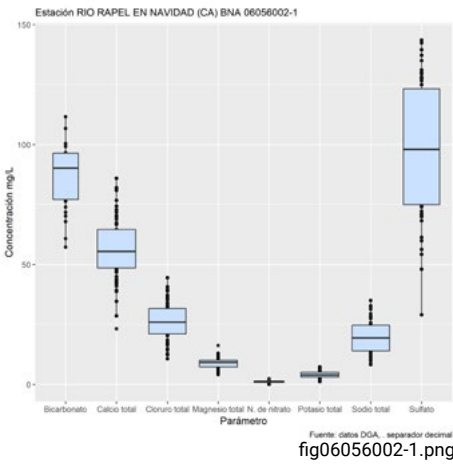
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79. – 1.1 Gráficos – Evolución Macrozona Centro – Micro Elementos



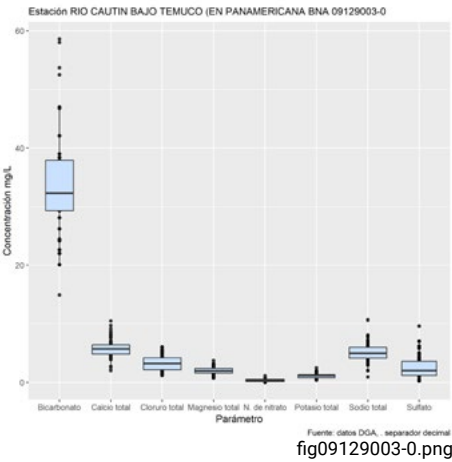
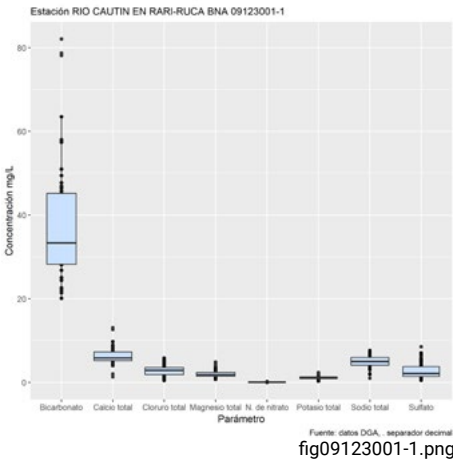
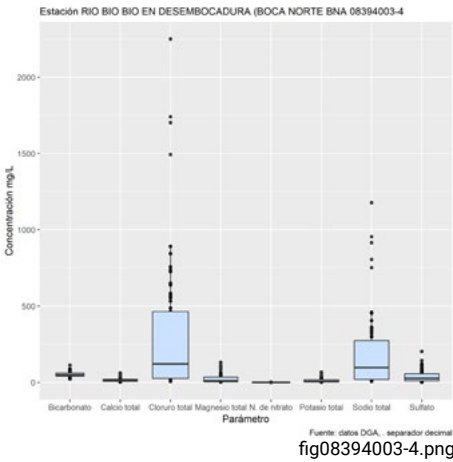
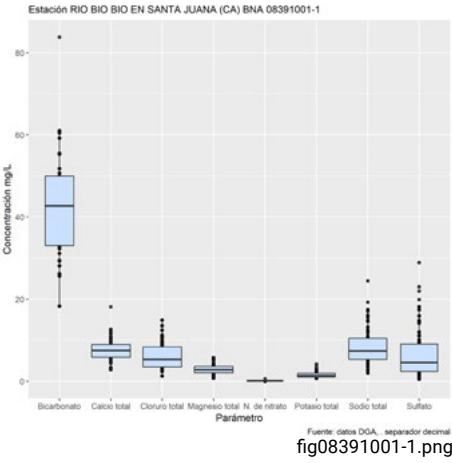
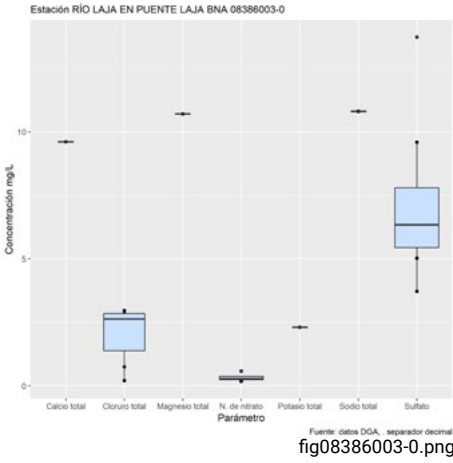
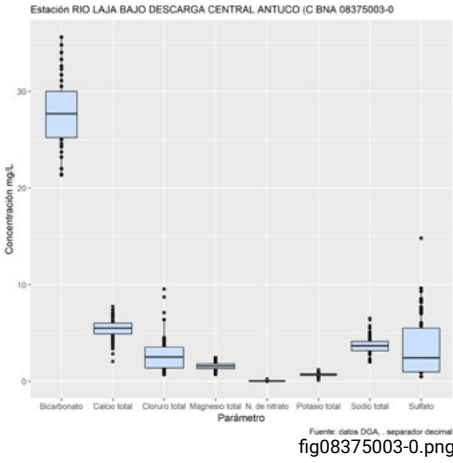
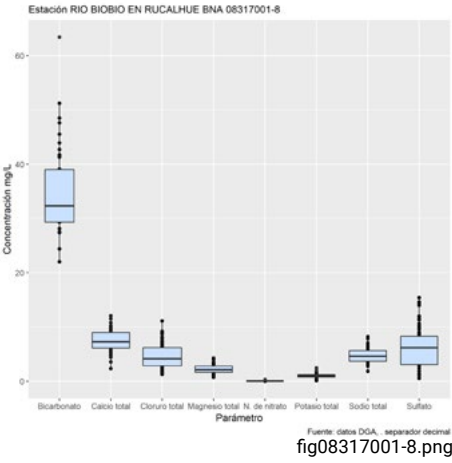
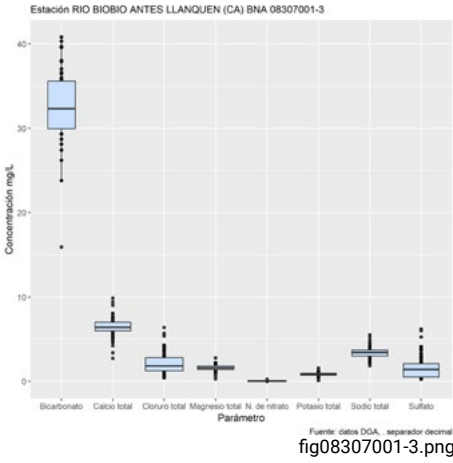
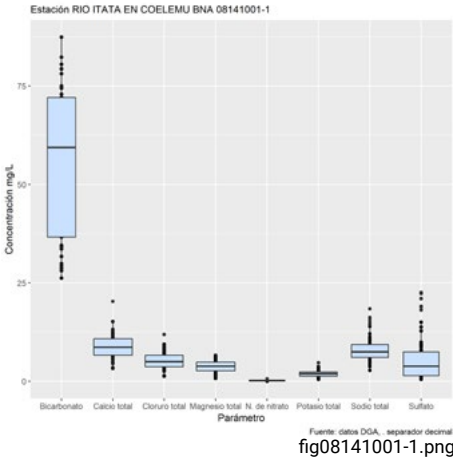
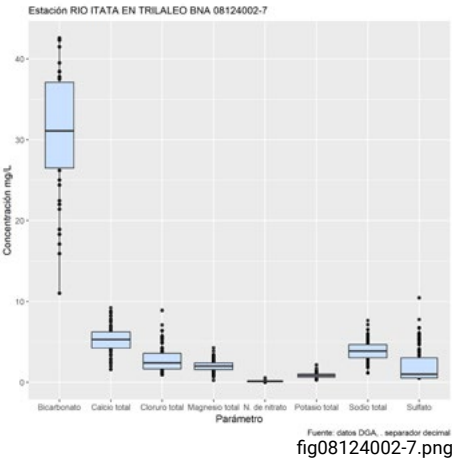
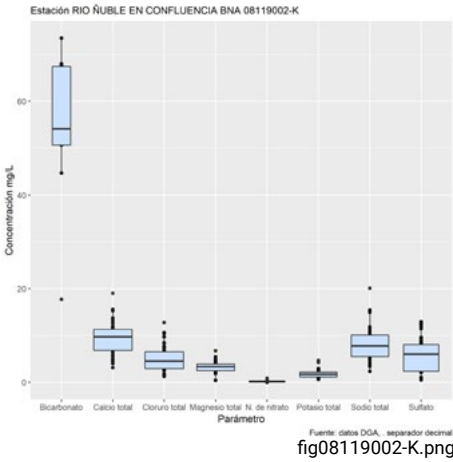
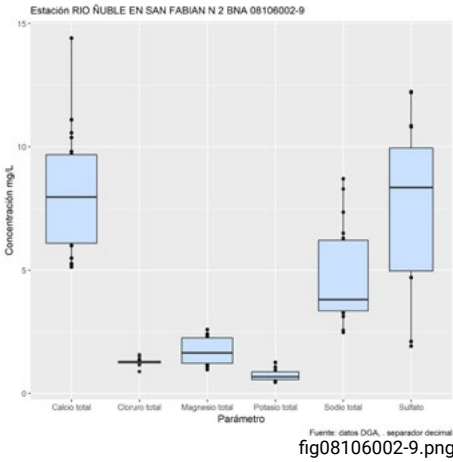
79. - 1.2 Gráficos - Evolución Macrozona Centro - Micro Elementos



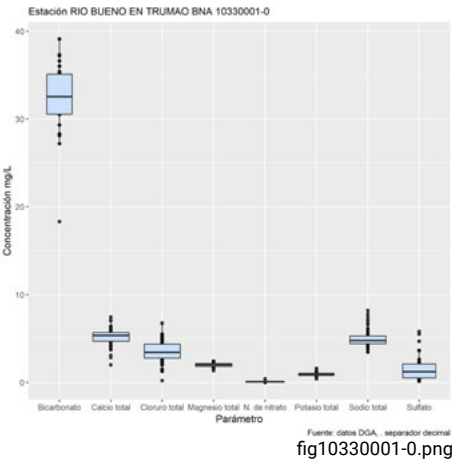
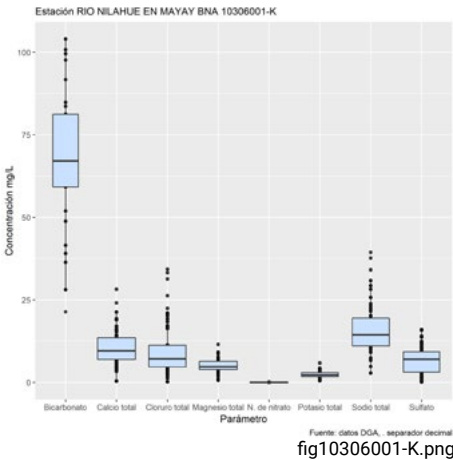
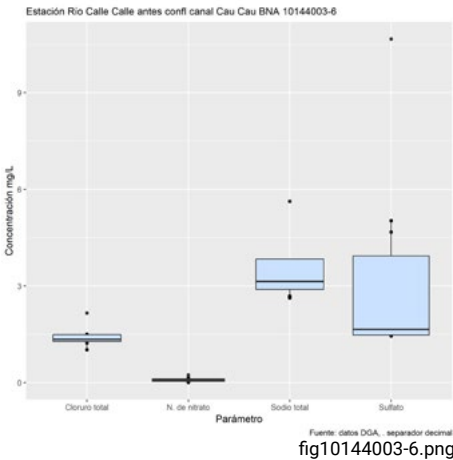
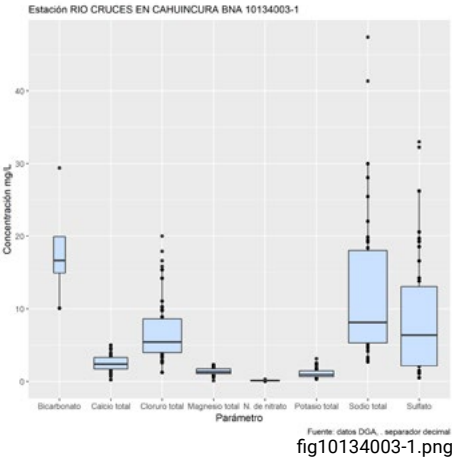
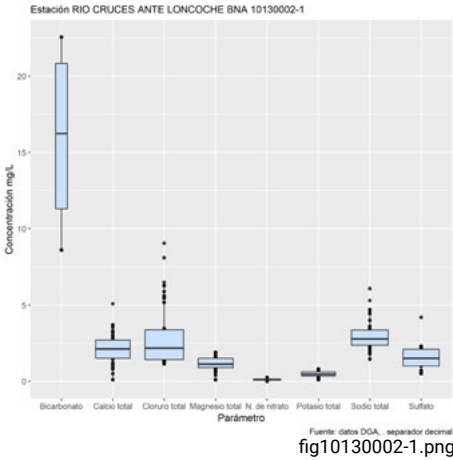
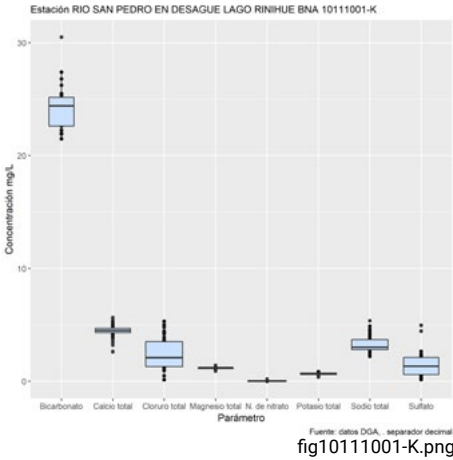
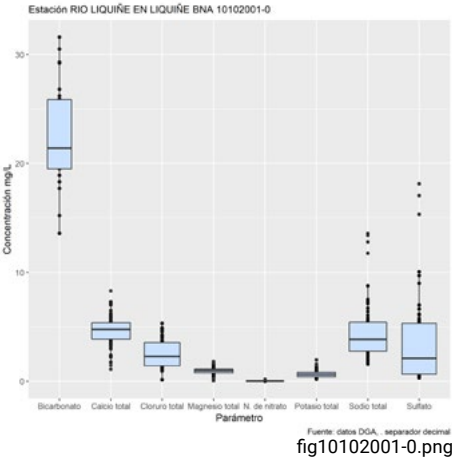
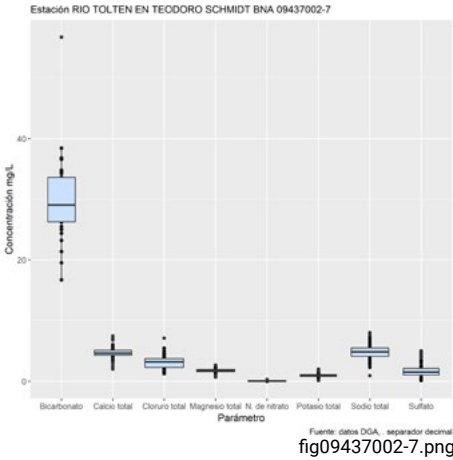
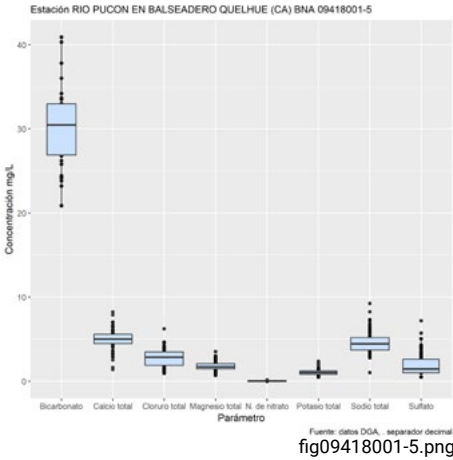
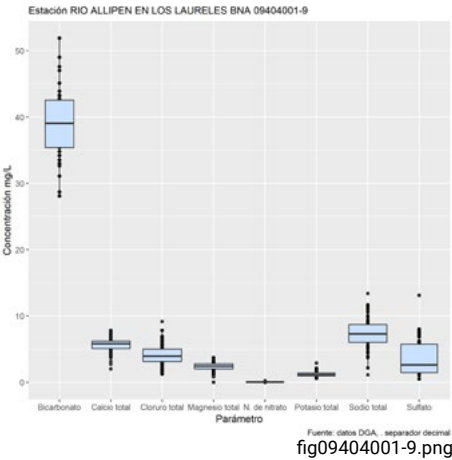
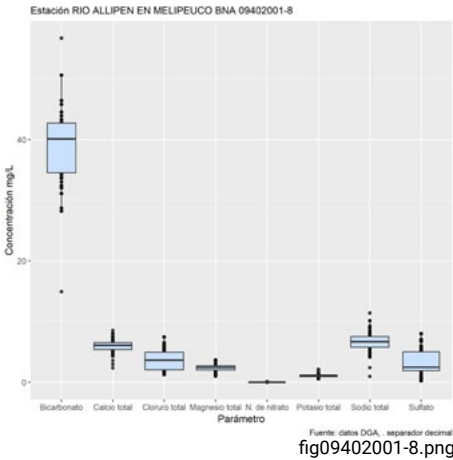
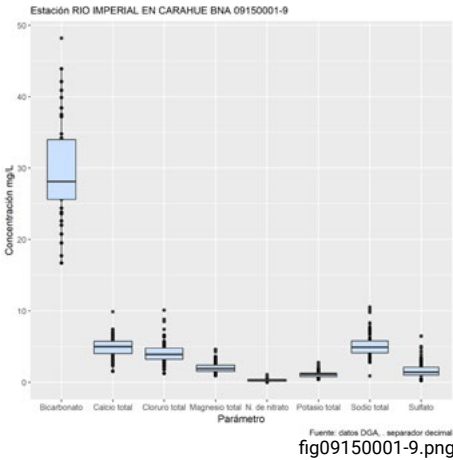
80. EVOLUCIÓN MACROZONA SUR - MACRO ELEMENTOS



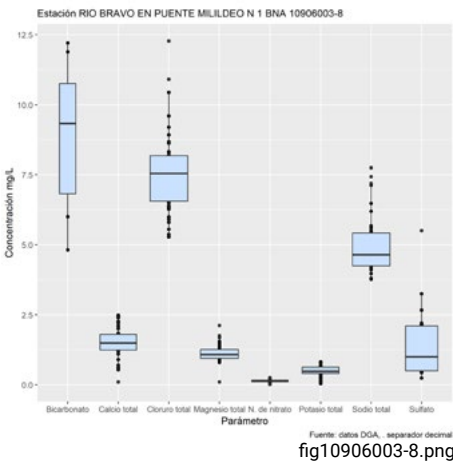
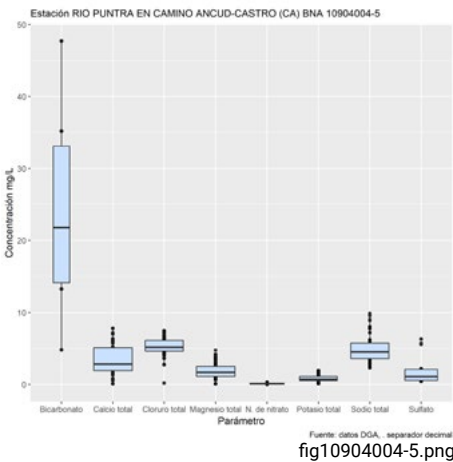
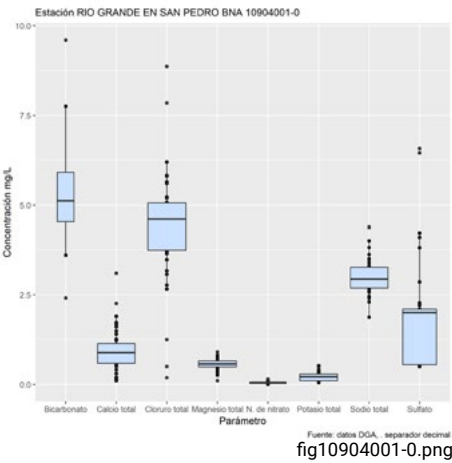
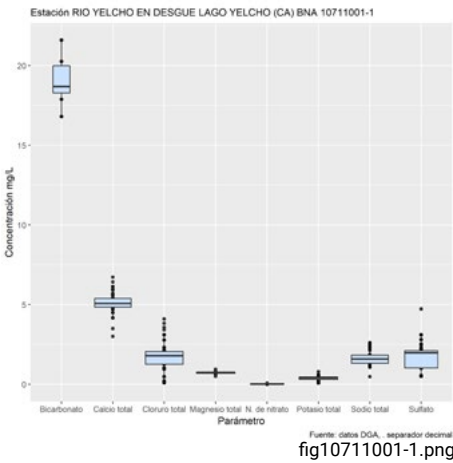
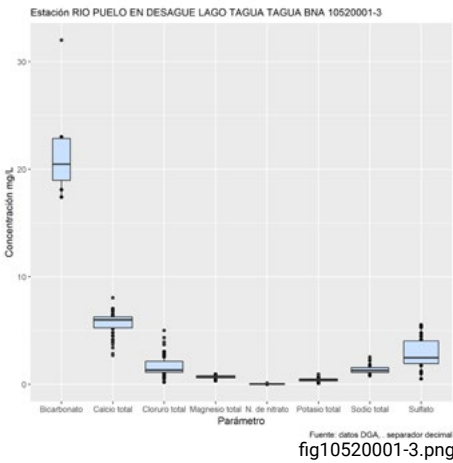
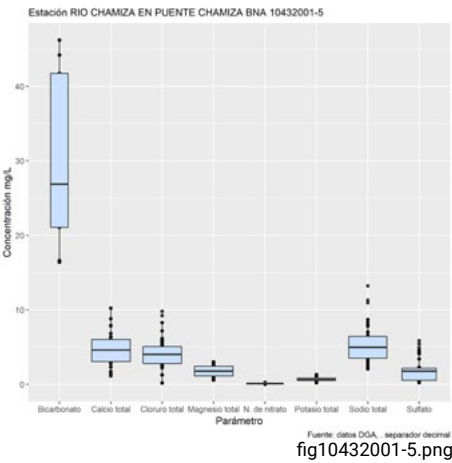
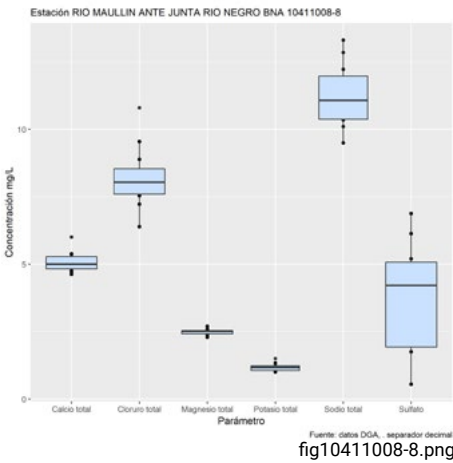
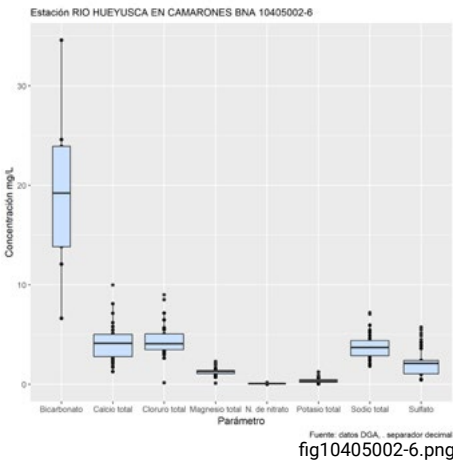
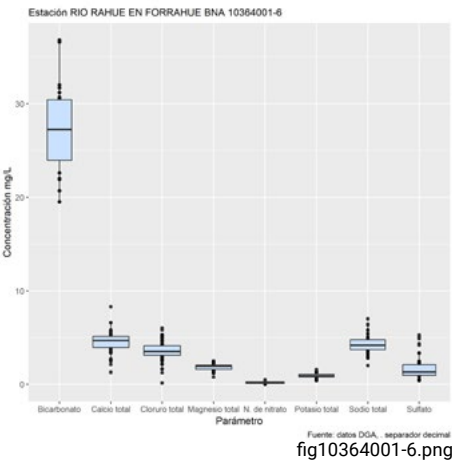
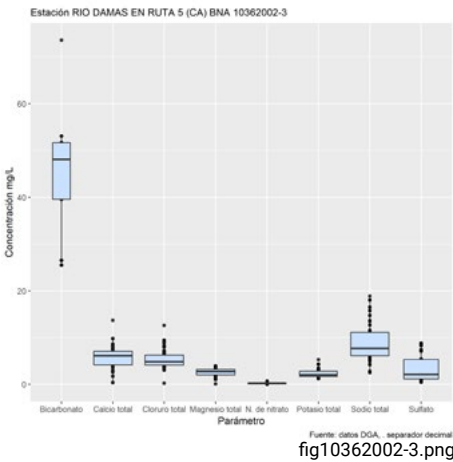
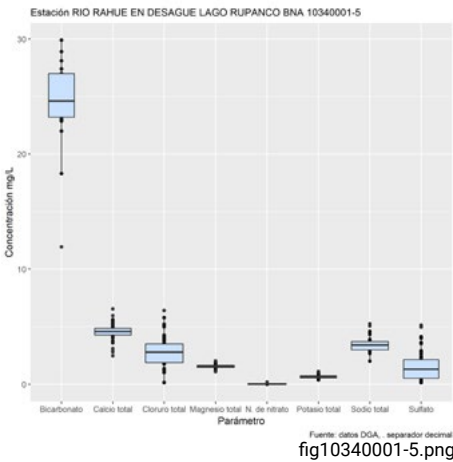
80. - 1.1 Gráficos - Evolución Macrozona Sur - Macro Elementos



80. – 1.2 Gráficos – Evolución Macrozona Sur – Macro Elementos



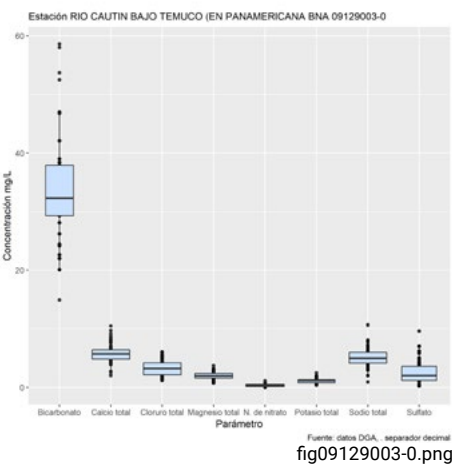
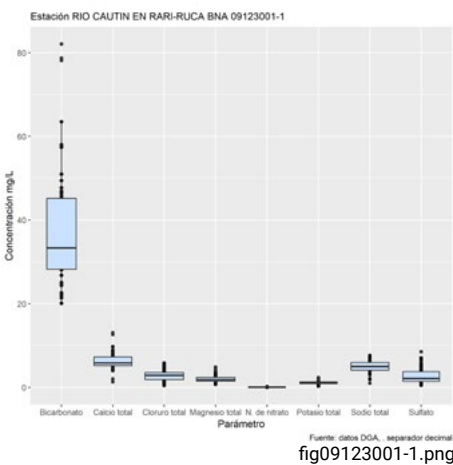
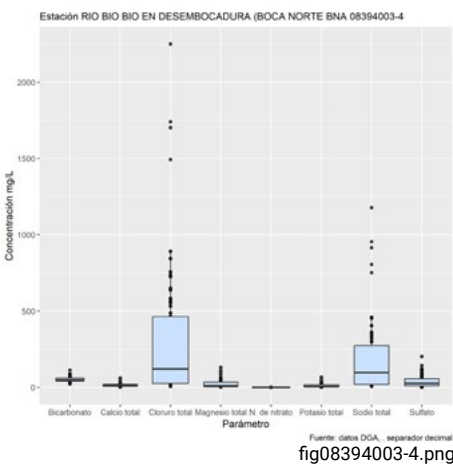
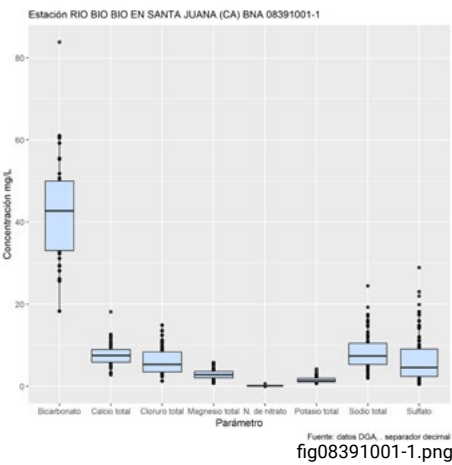
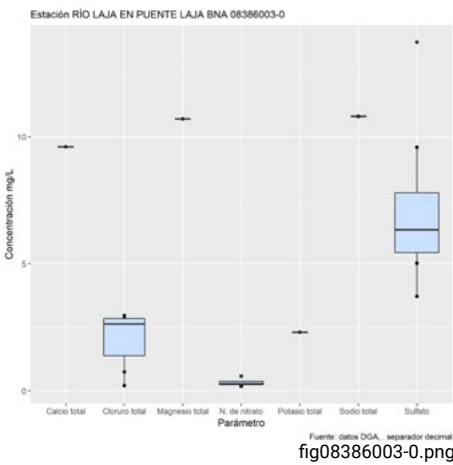
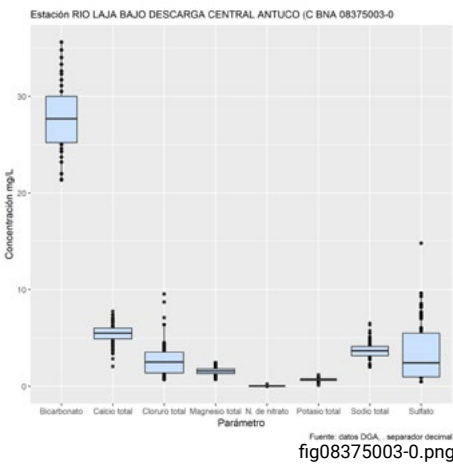
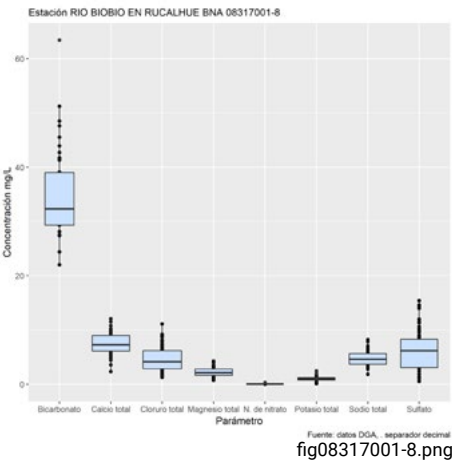
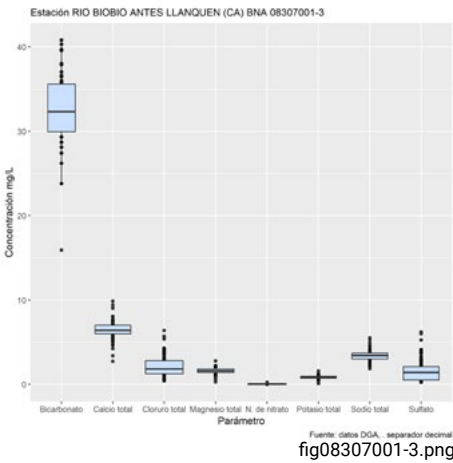
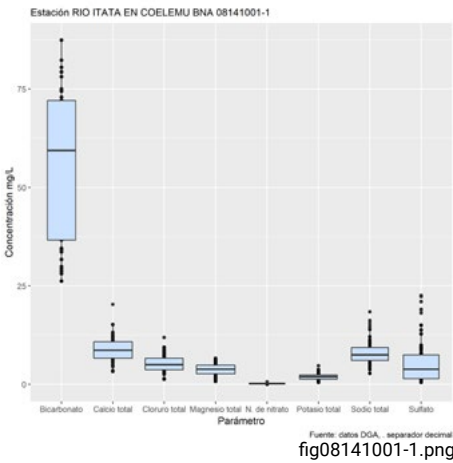
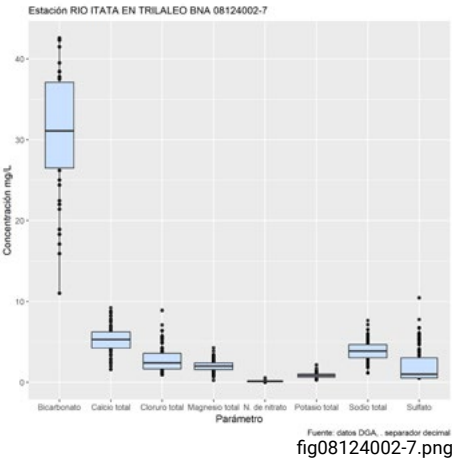
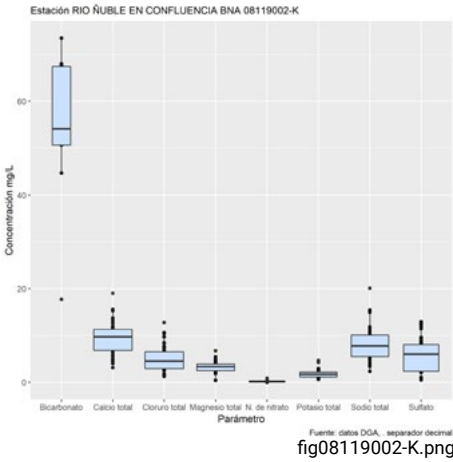
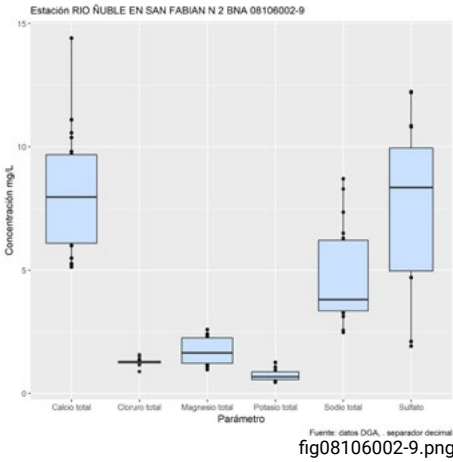
80. - 1.3 Gráficos - Evolución Macrozona Sur - Macro Elementos



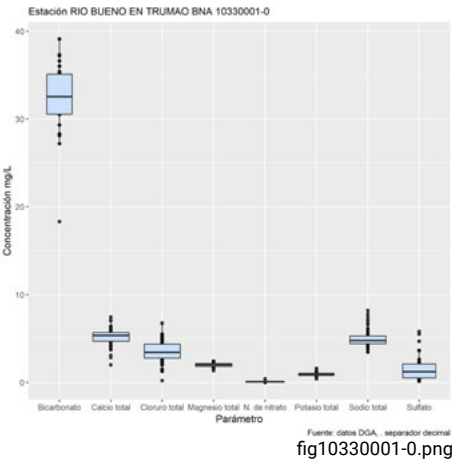
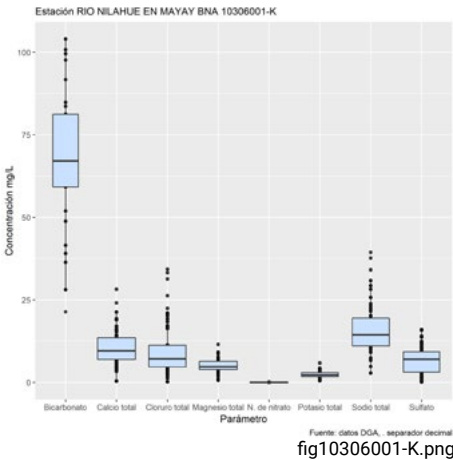
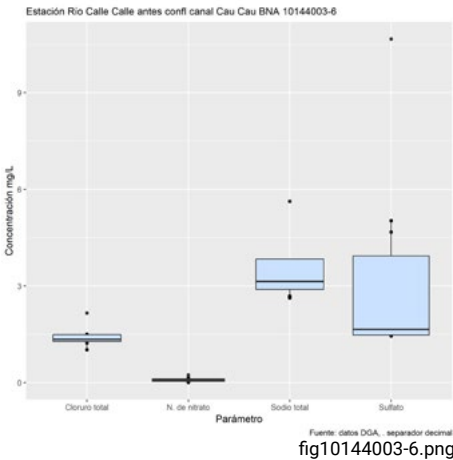
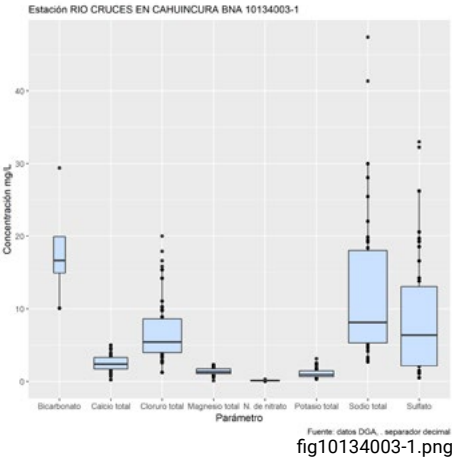
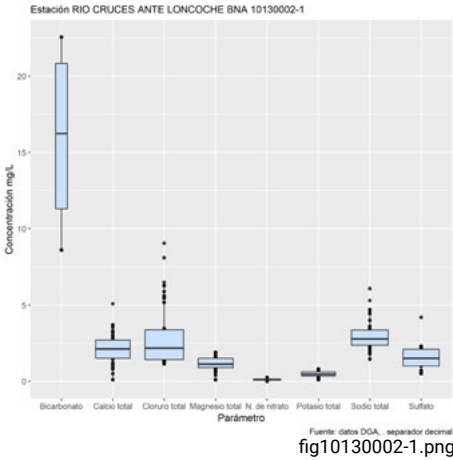
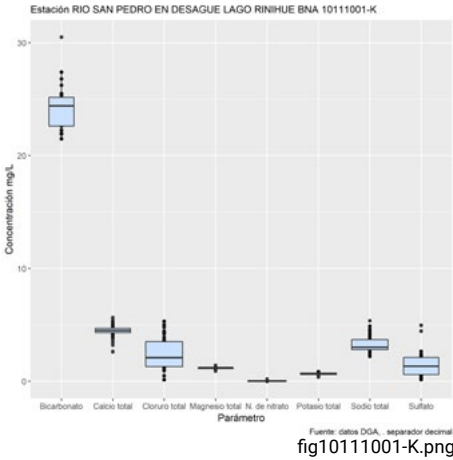
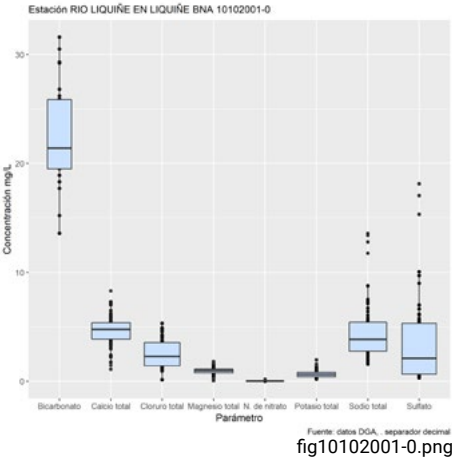
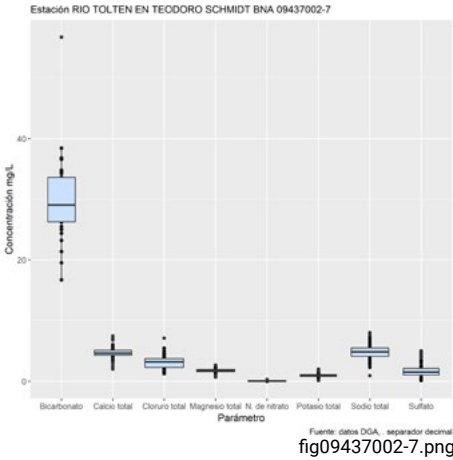
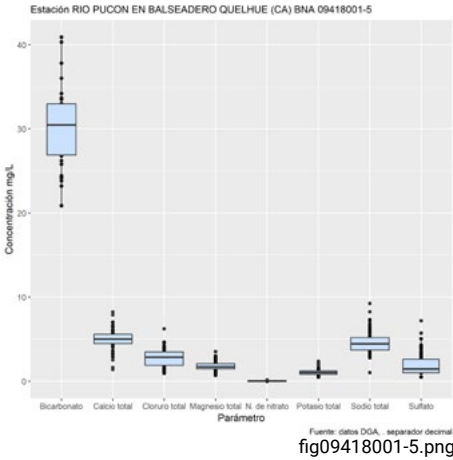
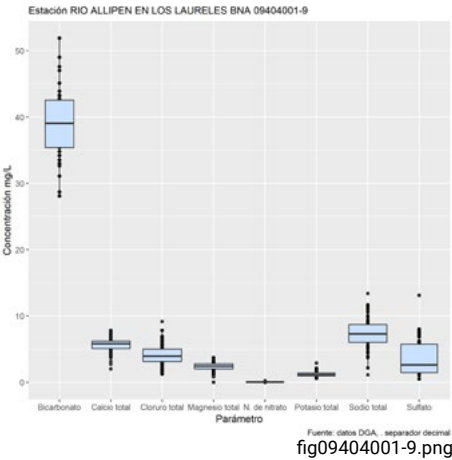
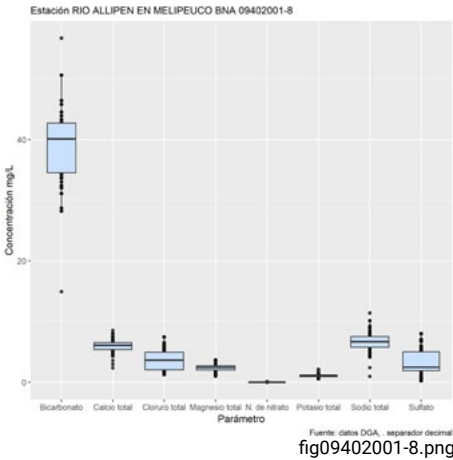
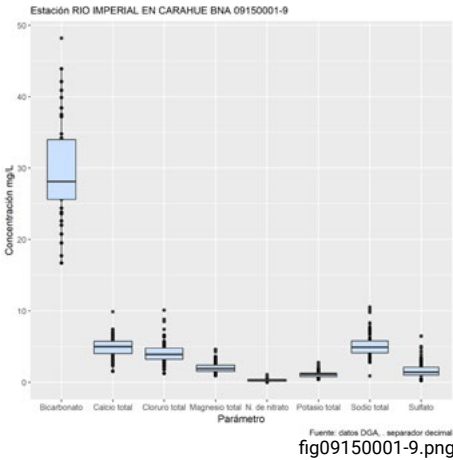
81. EVOLUCIÓN MACROZONA SUR - MICRO ELEMENTOS



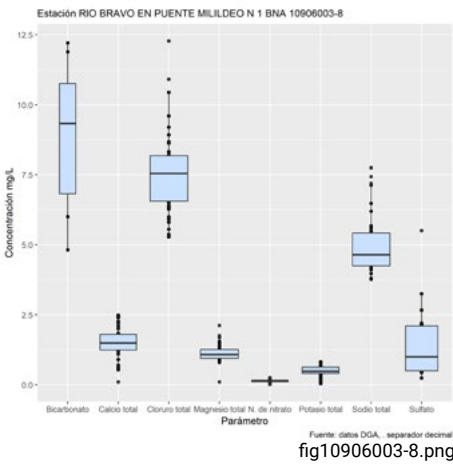
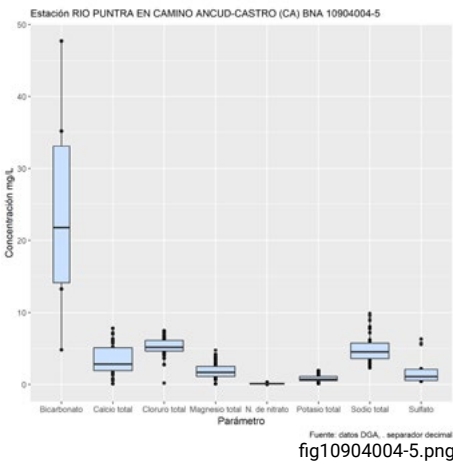
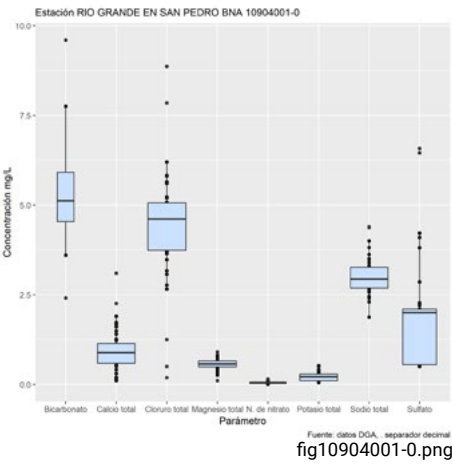
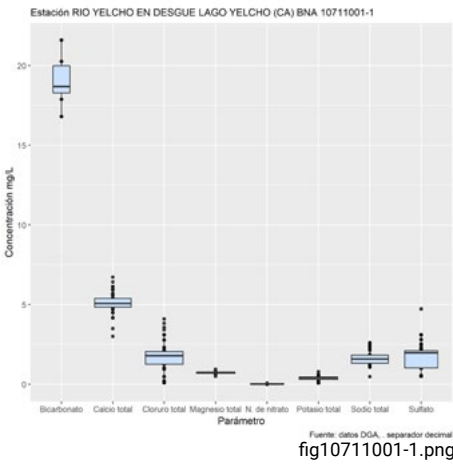
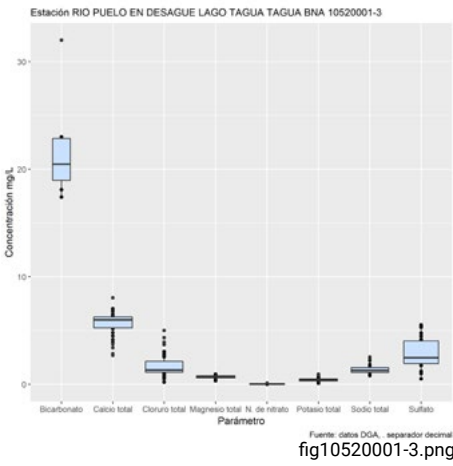
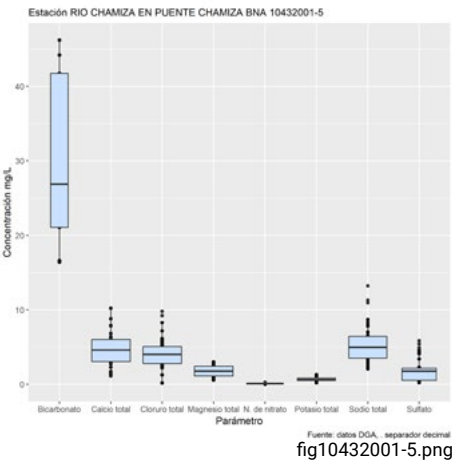
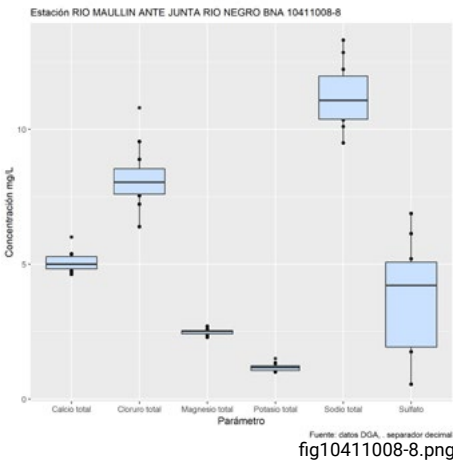
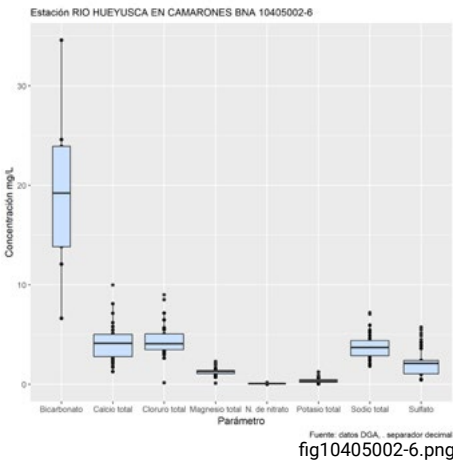
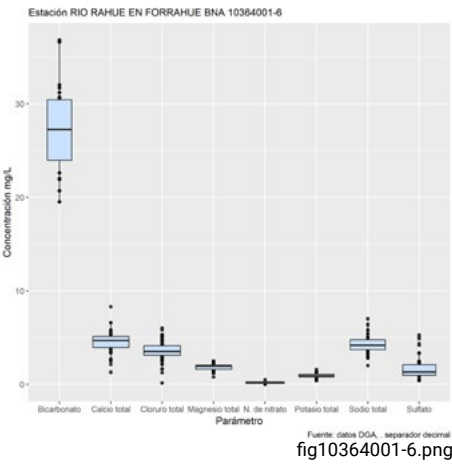
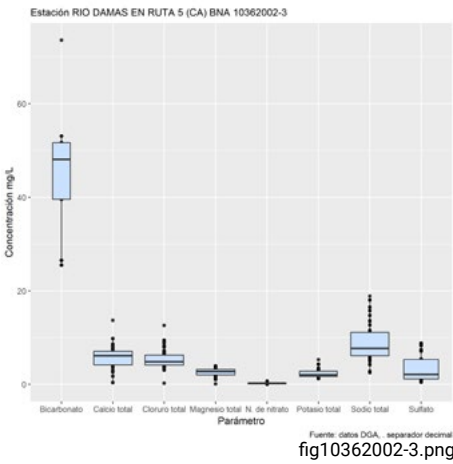
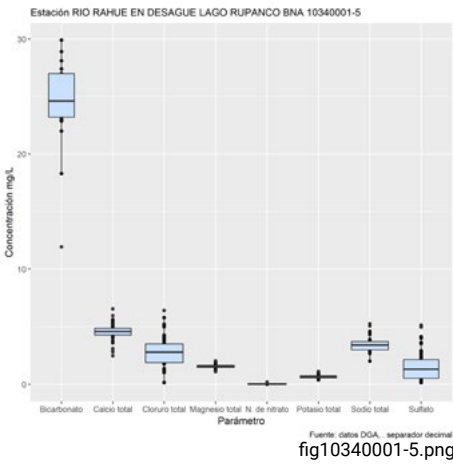
81. - 1.1 Gráficos - Evolución Macrozona Sur - Micro Elementos



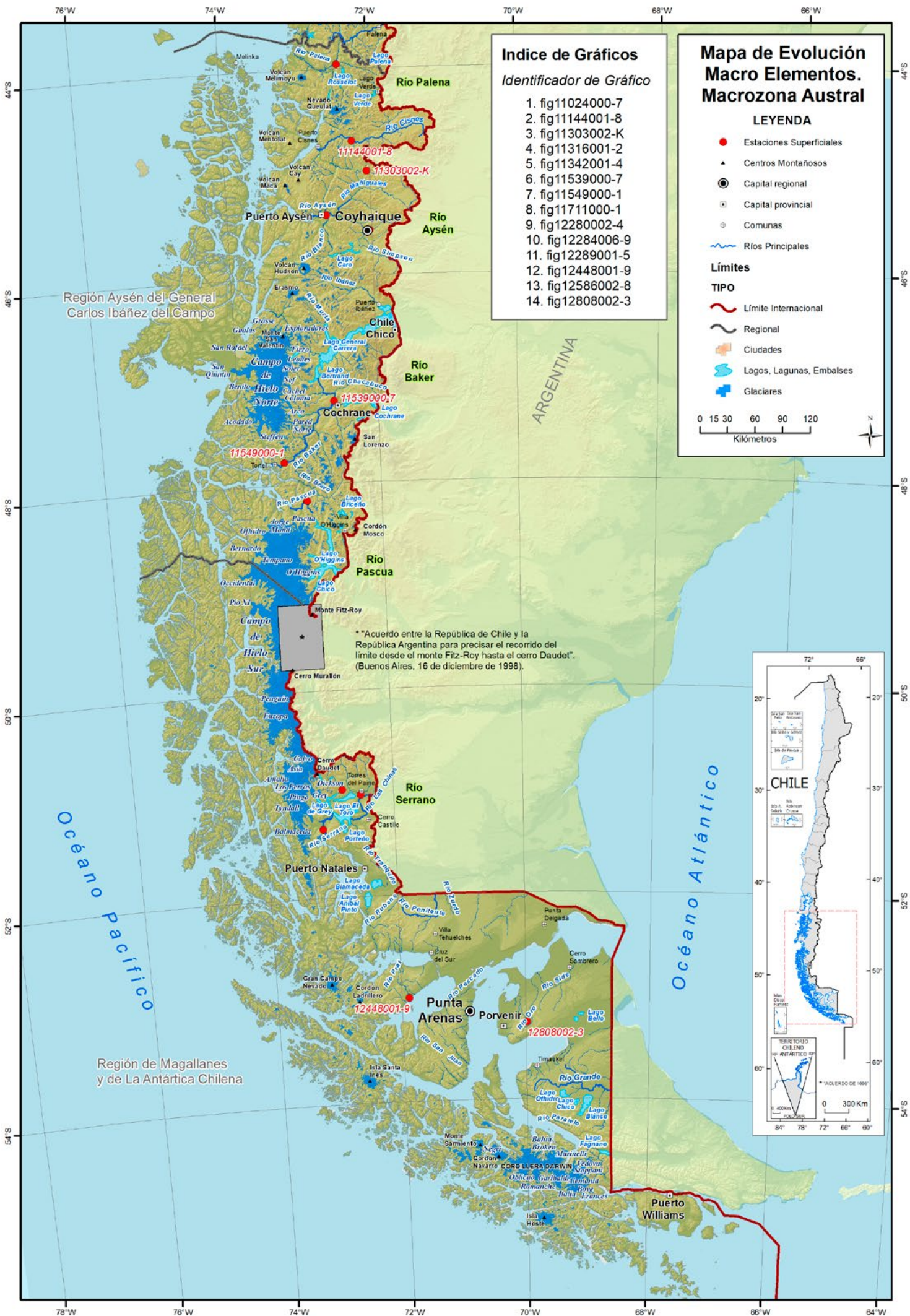
81. – 1.2 Gráficos – Evolución Macrozona Sur – Micro Elementos



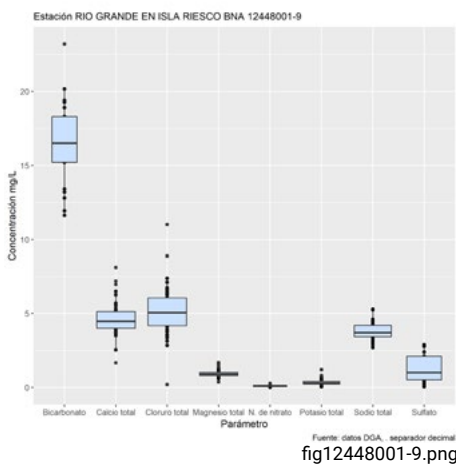
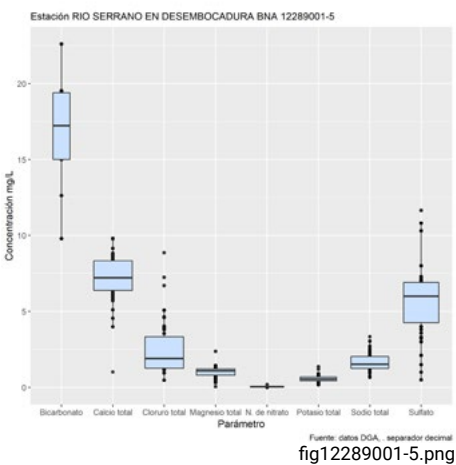
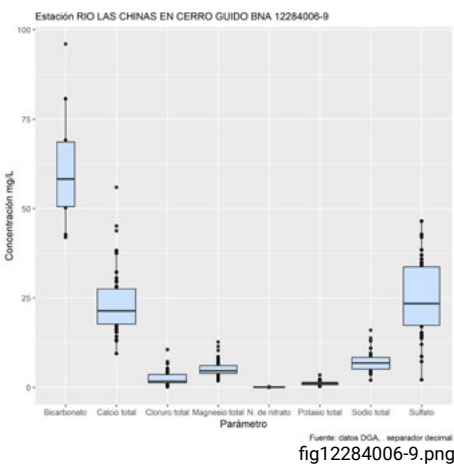
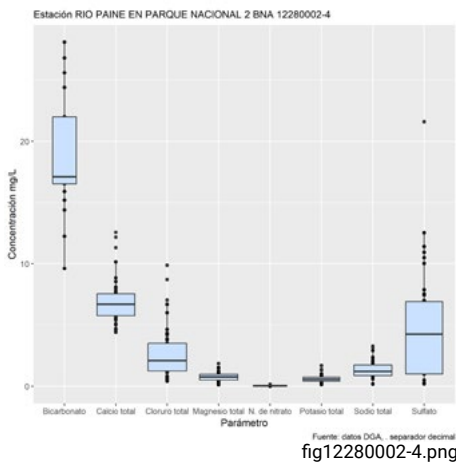
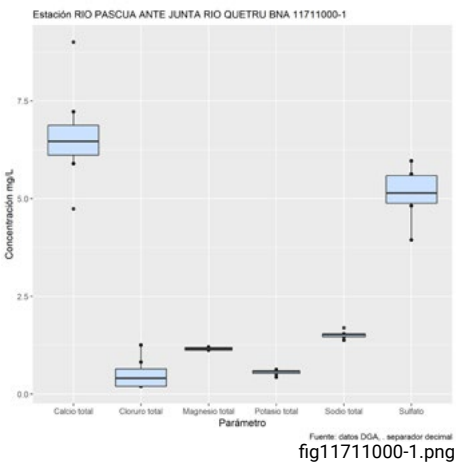
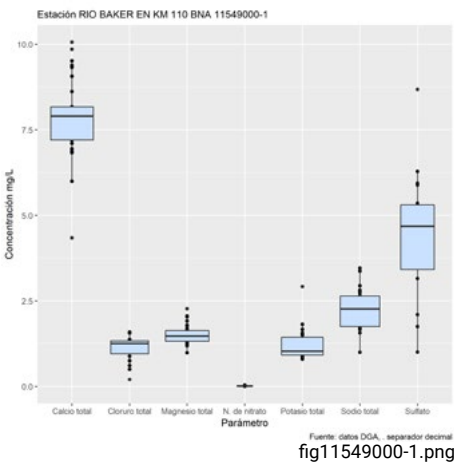
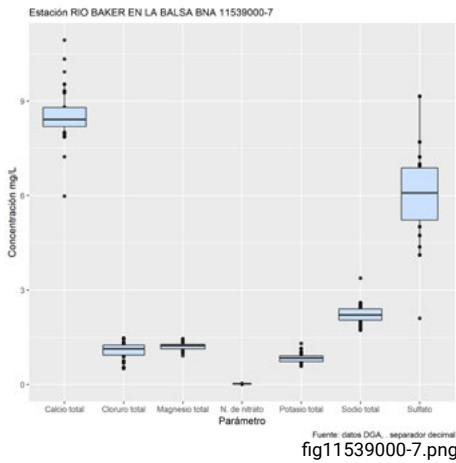
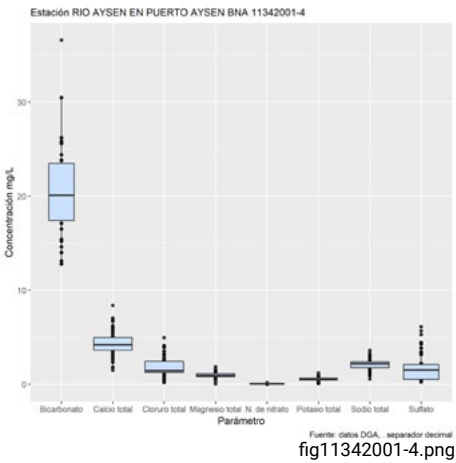
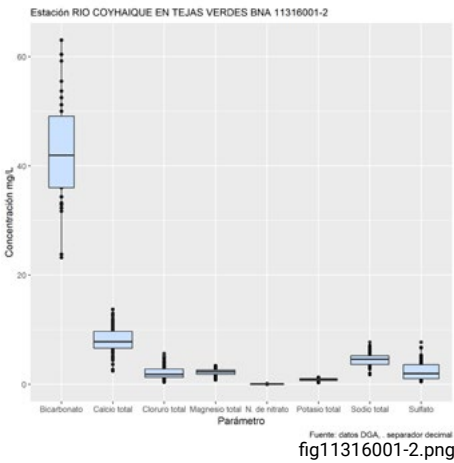
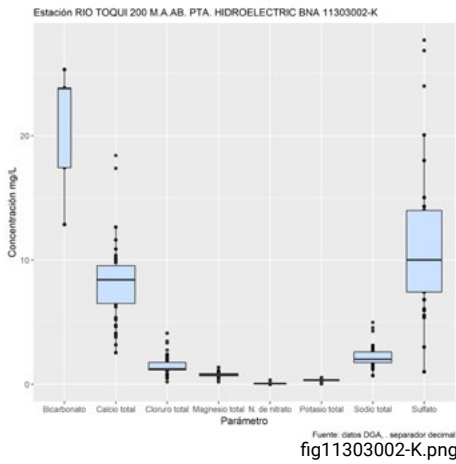
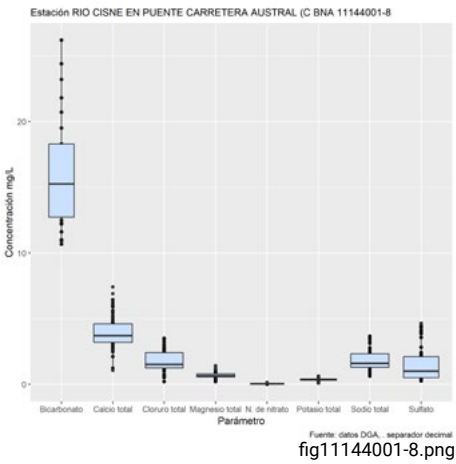
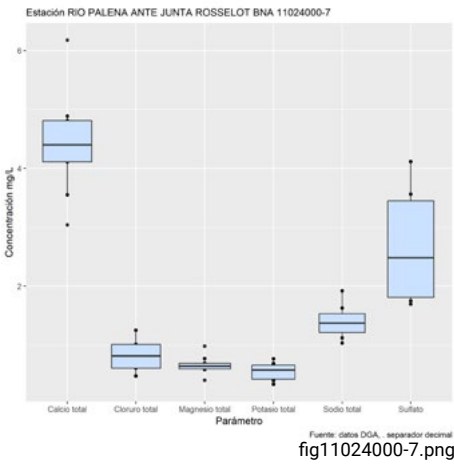
81. - 1.3 Gráficos - Evolución Macrozona Sur - Micro Elementos



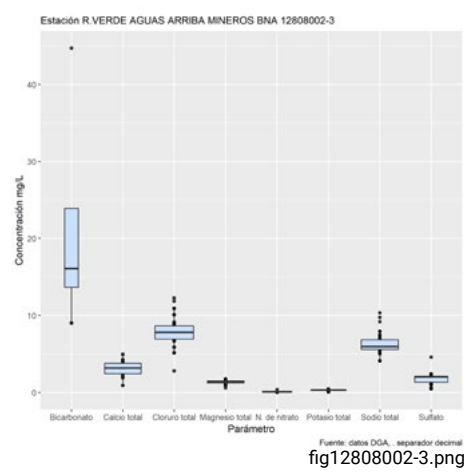
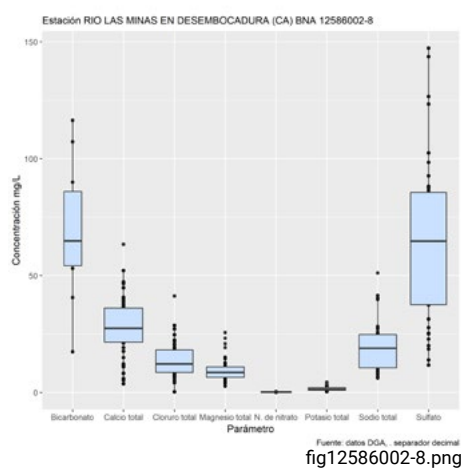
82. EVOLUCIÓN MACROZONA AUSTRAL – MACRO ELEMENTOS



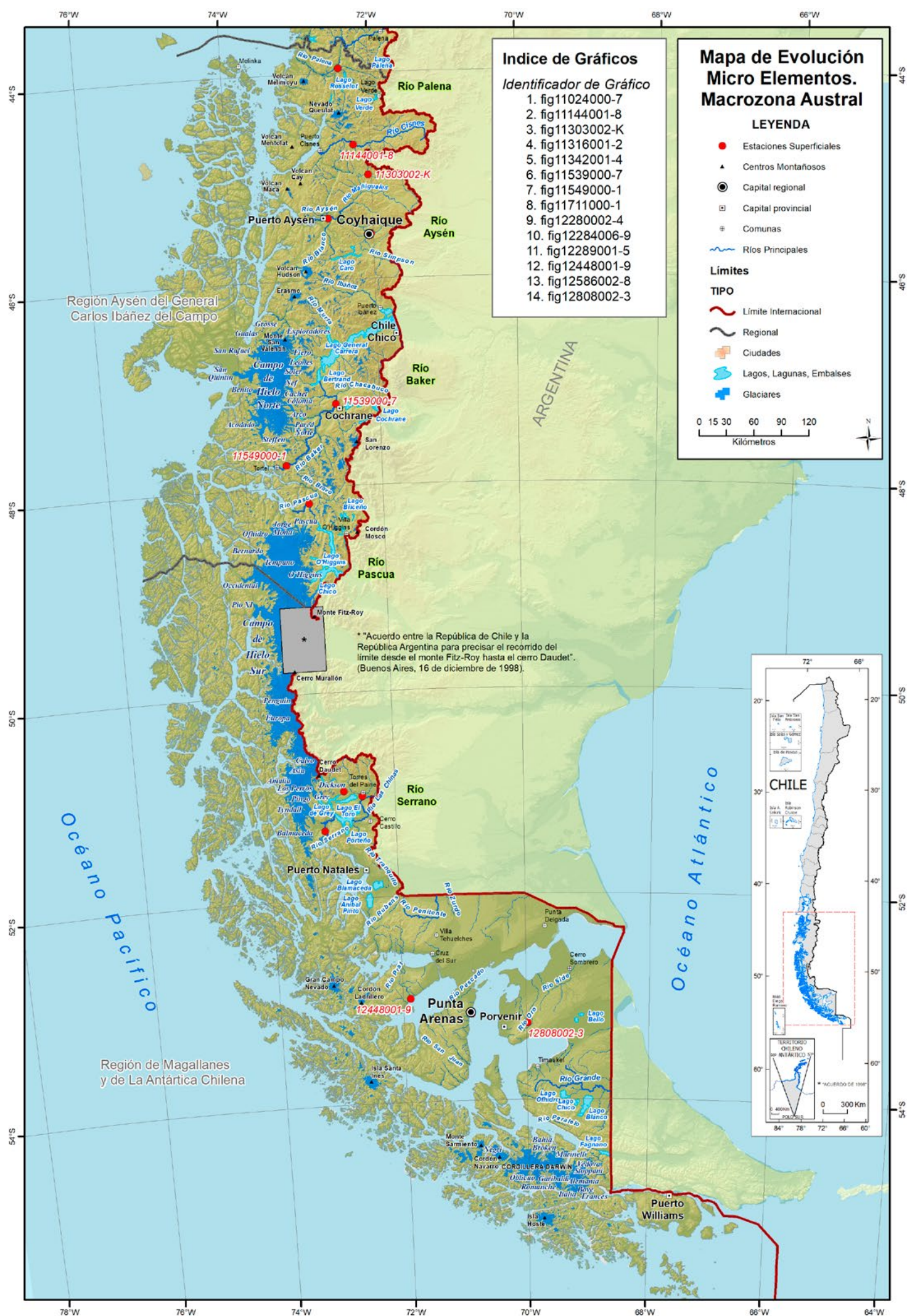
82. - 1.1 Gráficos - Evolución Macrozona Austral - Macro Elementos



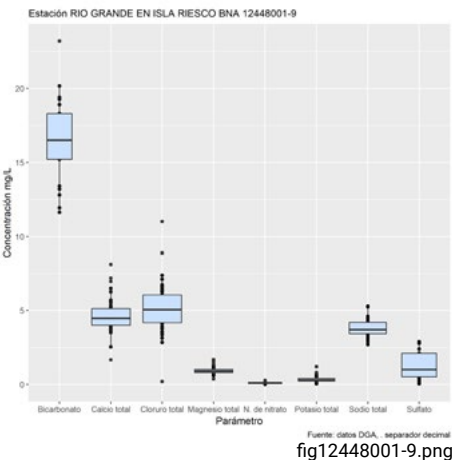
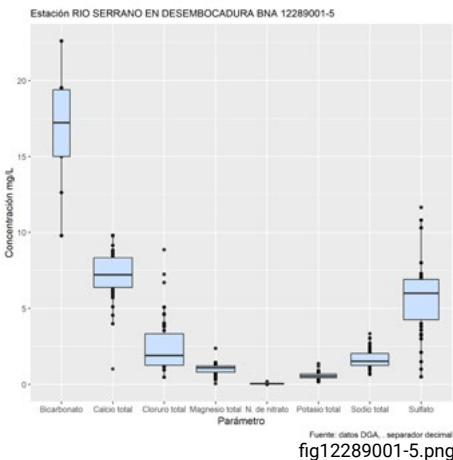
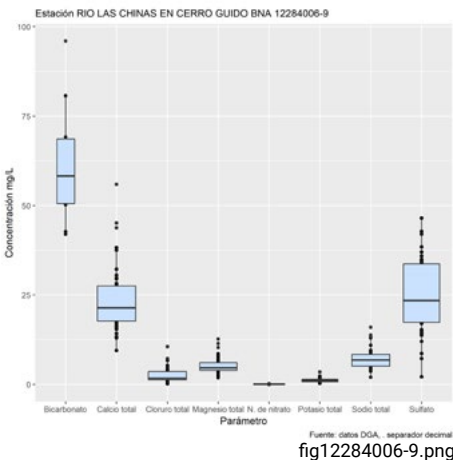
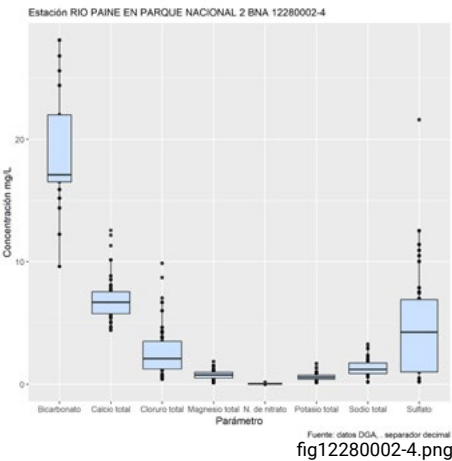
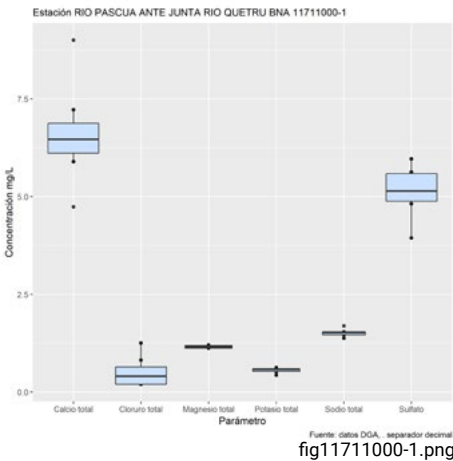
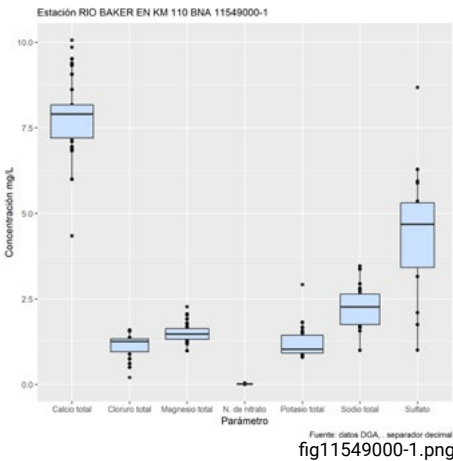
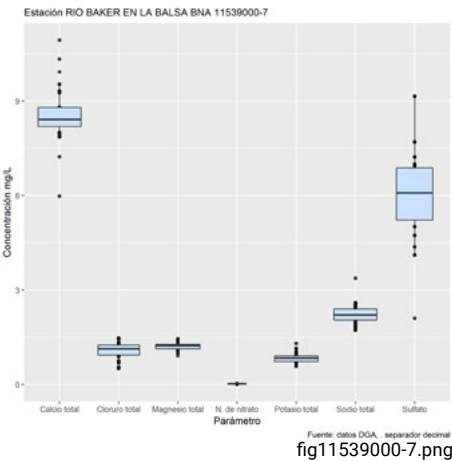
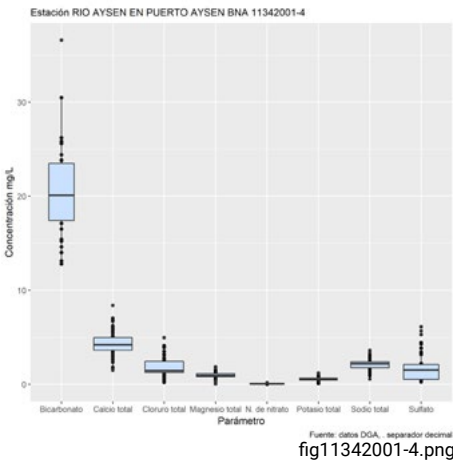
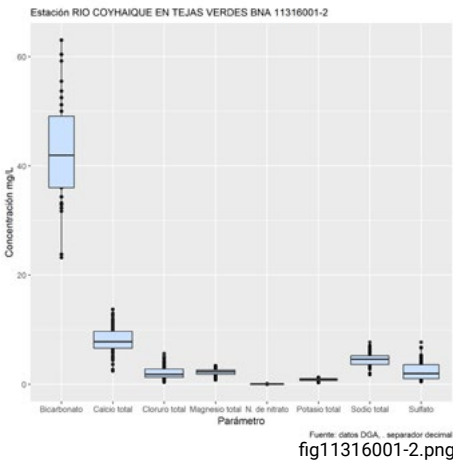
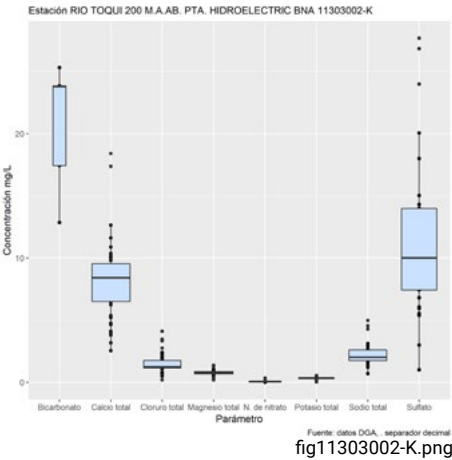
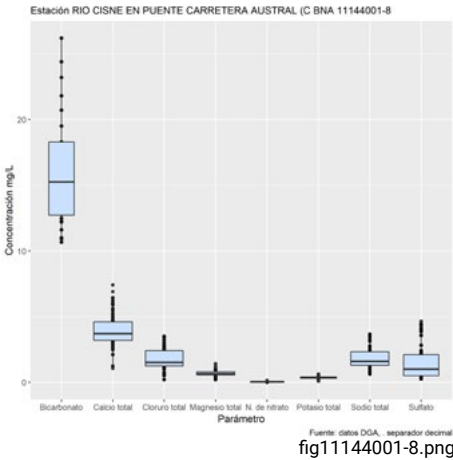
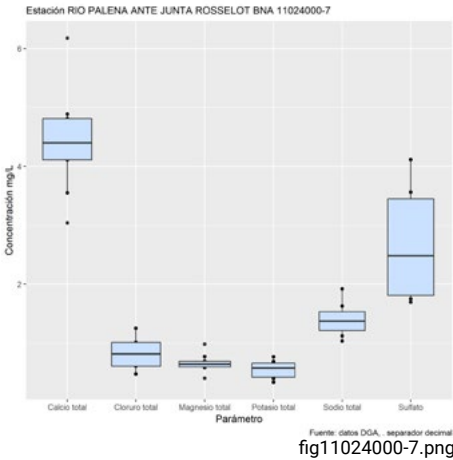
82. – 1.2 Gráficos – Evolución Macrozona Austral – Macro Elementos



83. EVOLUCIÓN MACROZONA AUSTRAL – MICRO ELEMENTOS



83. – 1.1 Gráficos – Evolución Macrozona Austral – Micro Elementos



83. - 1.1 Gráficos - Evolución Macrozona Austral - Micro Elementos

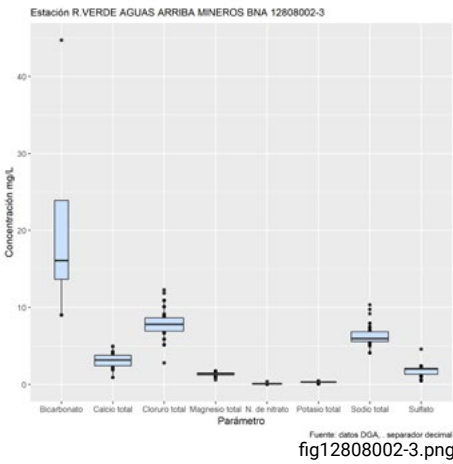
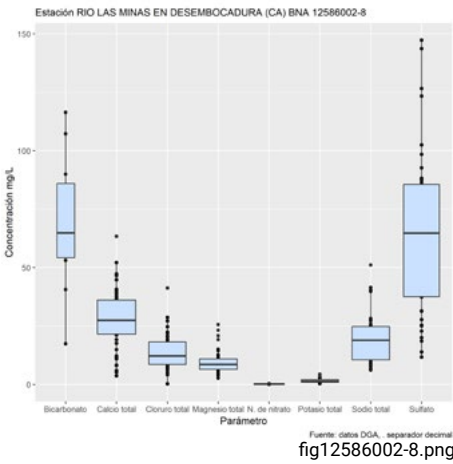




Figura 8 - Etapas y plazos de la elaboración de NSCA (según D.S. N° 38/2012, MMA).

NORMAS SECUNDARIAS VIGENTES



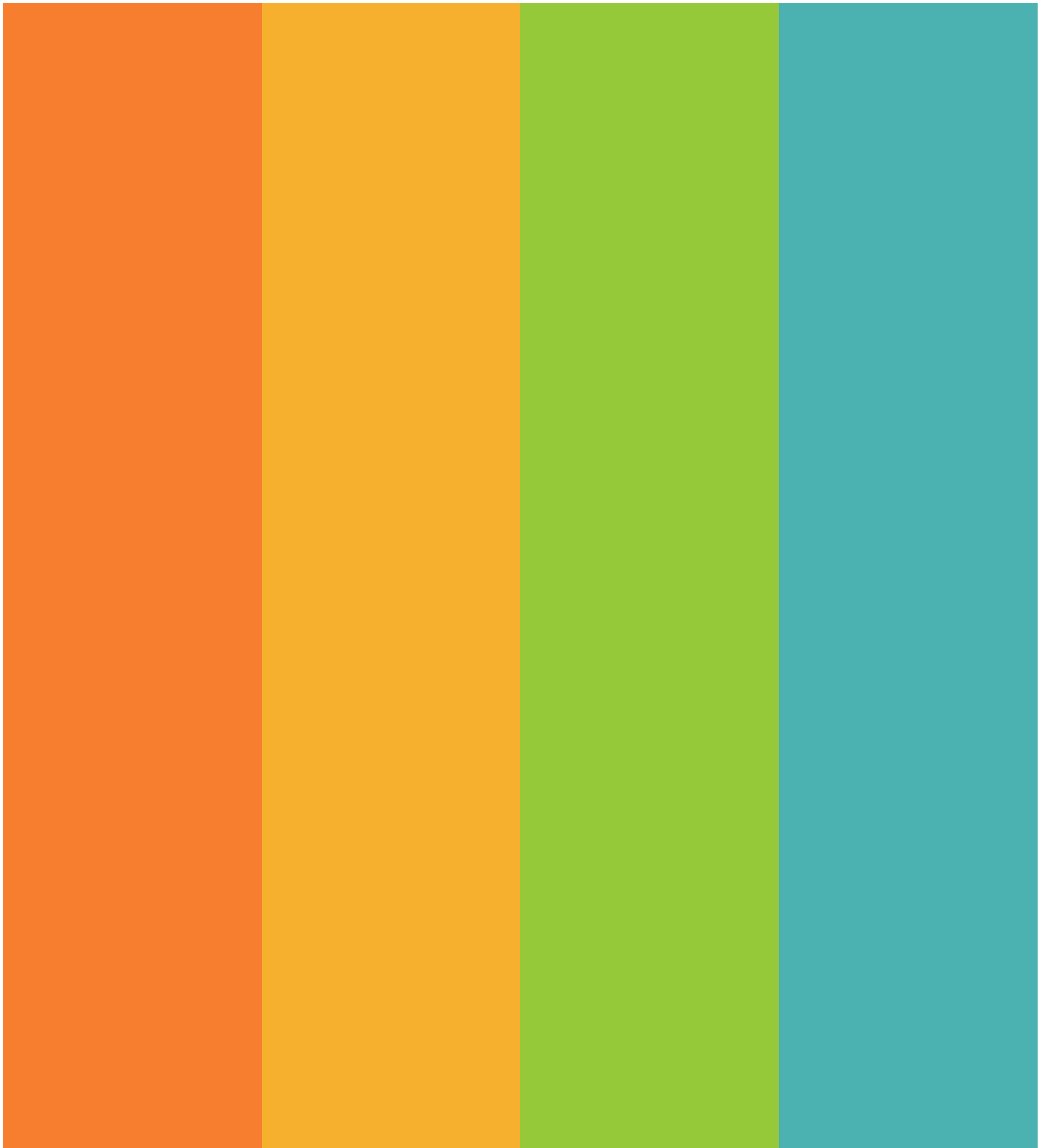
Figura 9 - Normas Secundarias de calidad ambiental vigentes a octubre de 2020



ANEXOS

Se presenta a continuación los estudios generados por la DGA relativos a la caracterización de calidad de aguas que están públicos en el centro documental.

Atlas del Agua - Chile 2020





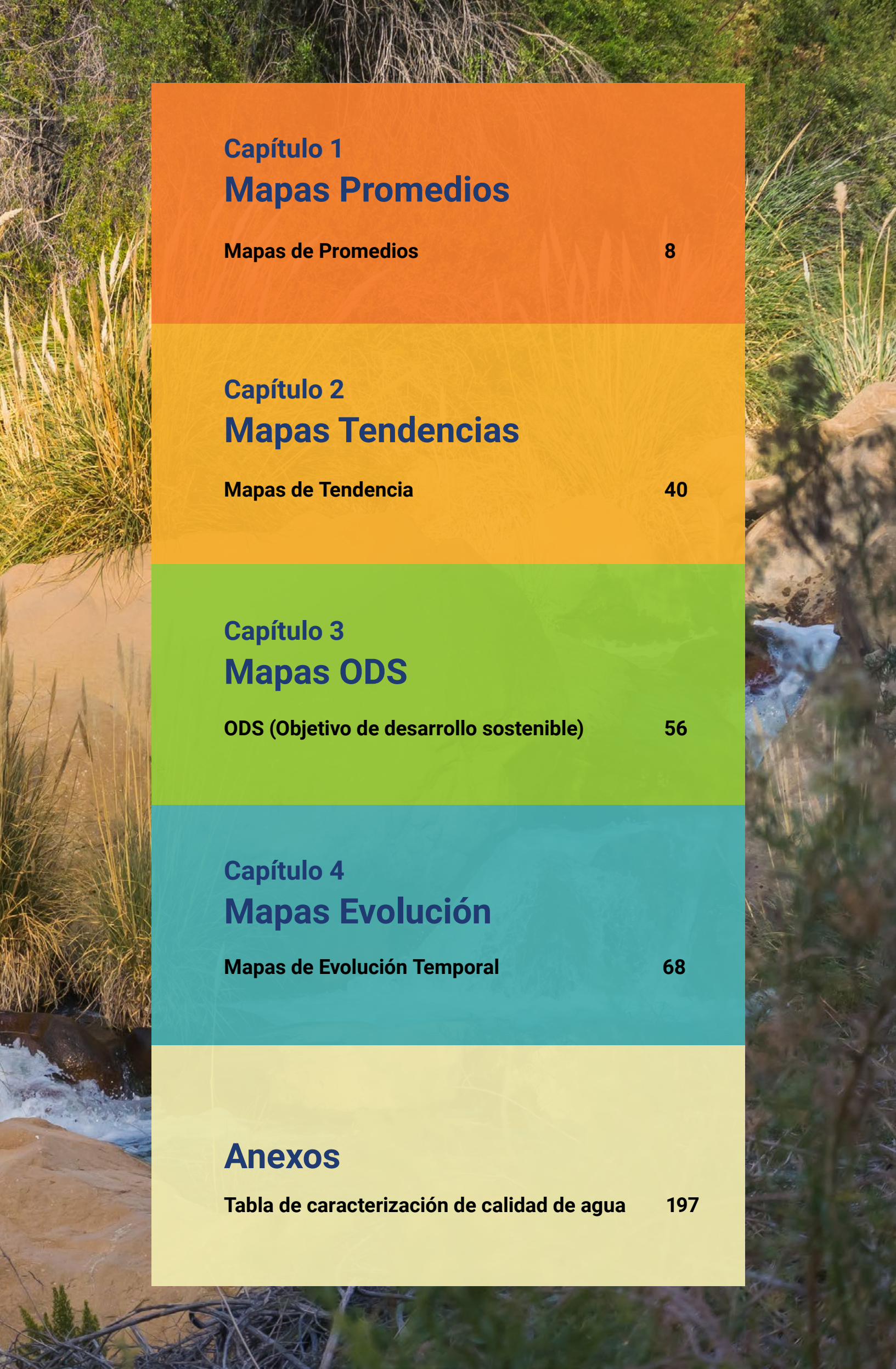
Volcán Osorno y cataratas de Petrohue desde Puerto Varas

ESTUDIOS DE CARACTERIZACIÓN DE CALIDAD DE AGUA

Título	Link
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