

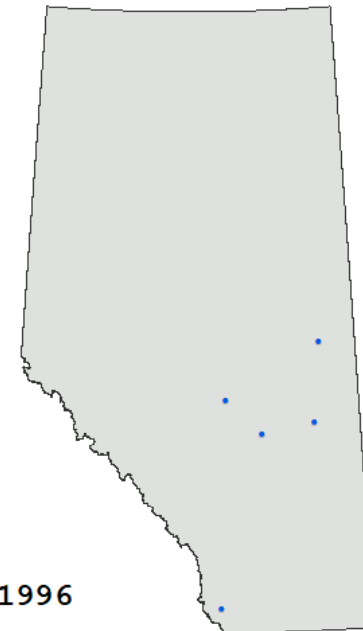
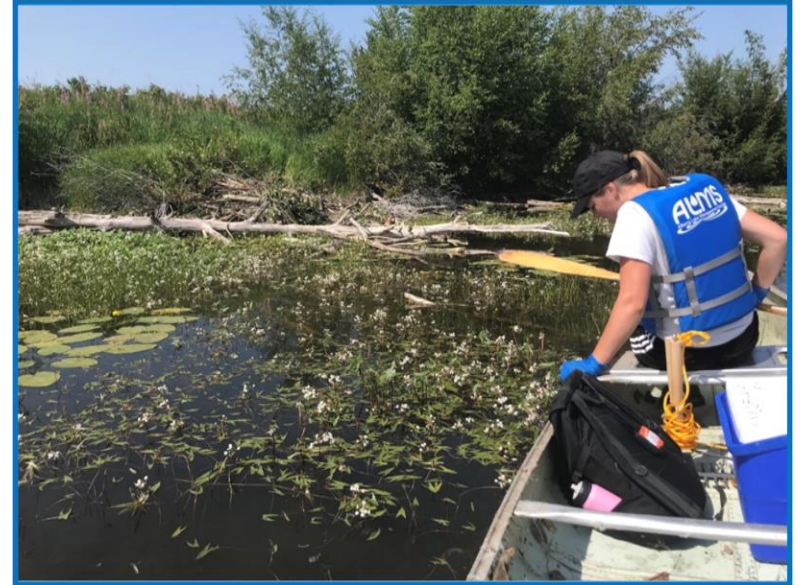


NSWA SALT MANAGEMENT
WORKSHOP
JANUARY 18, 2023





- Began in 1991 as a non-profit organization
- Objective: improve understanding and awareness of lakes, reservoirs, and their watersheds
- LakeWatch: Participatory lake monitoring program, monitoring lakes in Alberta since 1996
- Other programming includes: LakeKeepers, scholarships, beach monitoring, invasive plant monitoring, research, education & outreach



1996

“Monitoring Salt in Alberta’s Lakes through Citizen and Community Science”

How are ALMS’ programs building knowledge about salt levels in lakes?





- Both programs are designed to track baseline water quality conditions over time
- Parameters & samples collected consist of a wide variety of major physical, chemical, and biological characteristics
- Programs can identify impacts, but not designed to isolate sources of pollution from watershed

Lakewatch

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JACKFISH LAKE
AUGUST 12TH, 2021

Nutrients

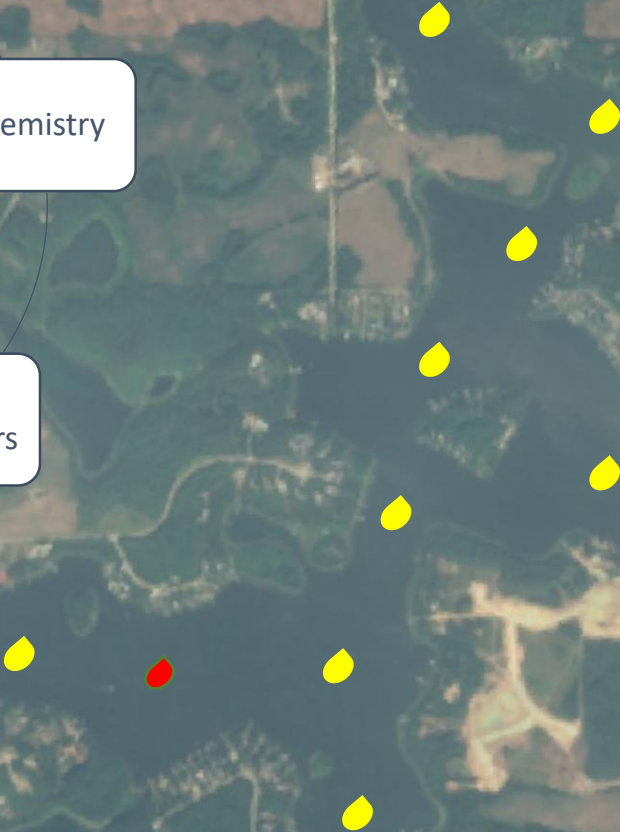
Invasive
Species

Chemistry



Biological
Parameters

Physical
Parameters



Lakewatch

26 LAKEWATCH LAKE BASINS IN 2022

OVER 100 SAMPLING TRIPS

WITH SUPPORT FROM:



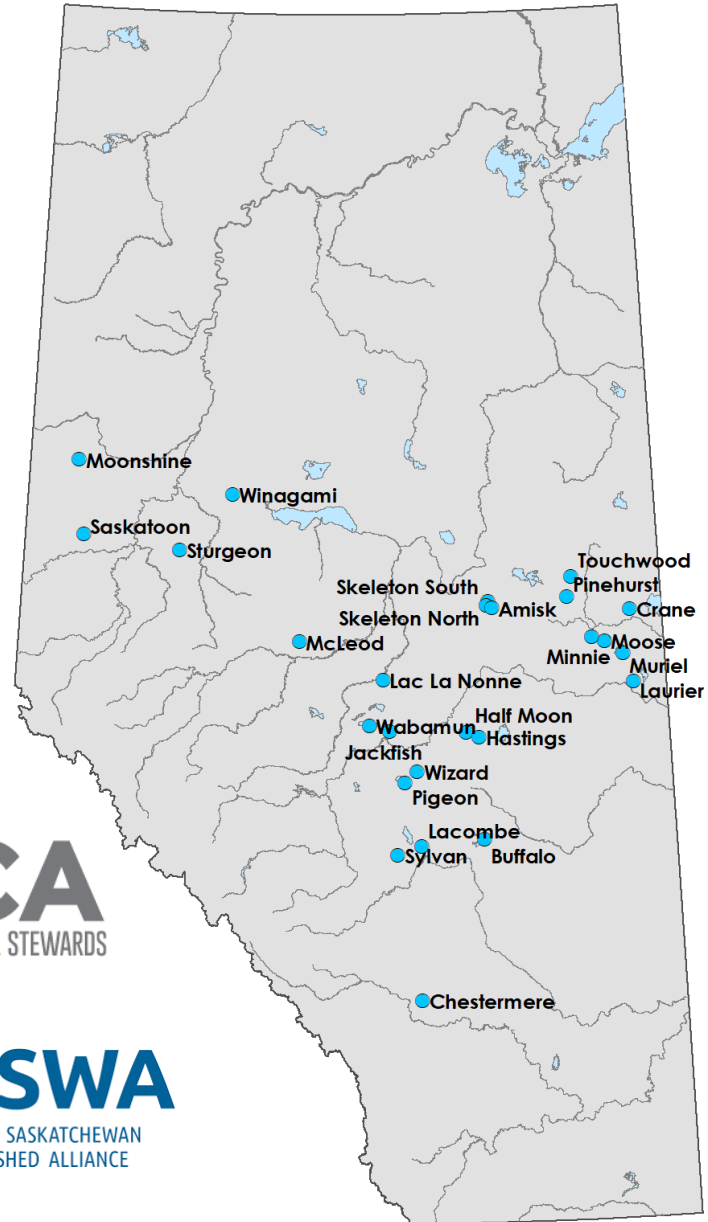
Environment and Parks



LICA
ENVIRONMENTAL STEWARDS



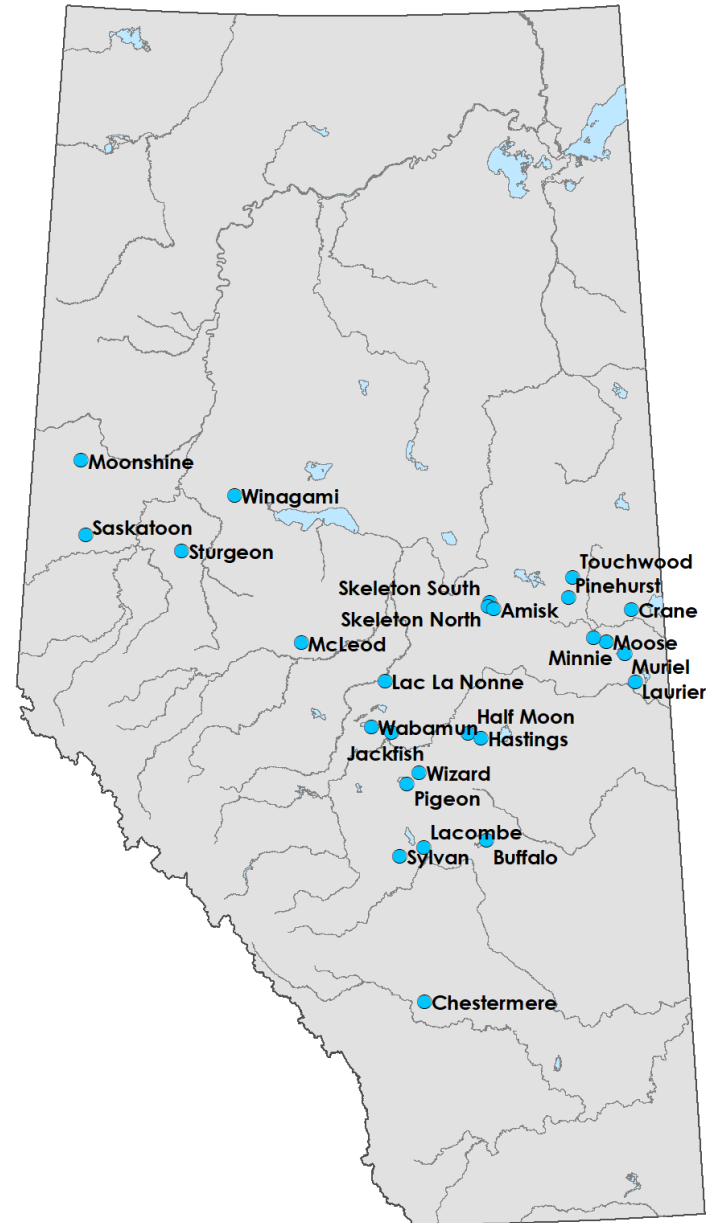
NSWA
NORTH SASKATCHEWAN
WATERSHED ALLIANCE



Lakewatch

WATER QUALITY PARAMETERS COLLECTED RELEVANT TO SALT LEVELS:

- MAJOR ION CHEMISTRY
- TOTAL DISSOLVED SOLIDS (TDS) –
INDICATOR OF TOTAL SALINITY
- CONDUCTIVITY (PROFILE, COMPOSITE) –
INDICATOR OF TOTAL SALINITY
- BIOLOGICAL SAMPLES (ALGAE,
CYANOBACTERIA, AQUATIC INVERTEBRATES)
- PROFILE MEASUREMENTS (TEMP, DO, PH)





LakeKeepers

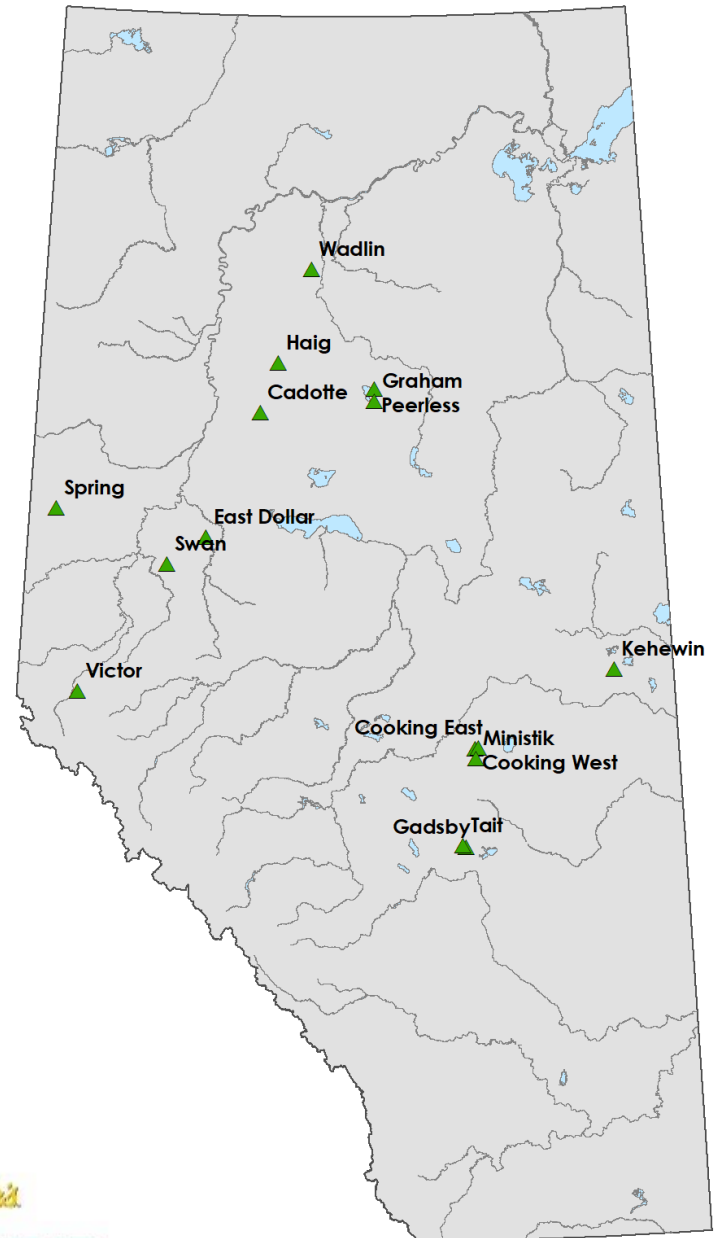




LakeKeepers

SUMMER LAKEKEEPERS:

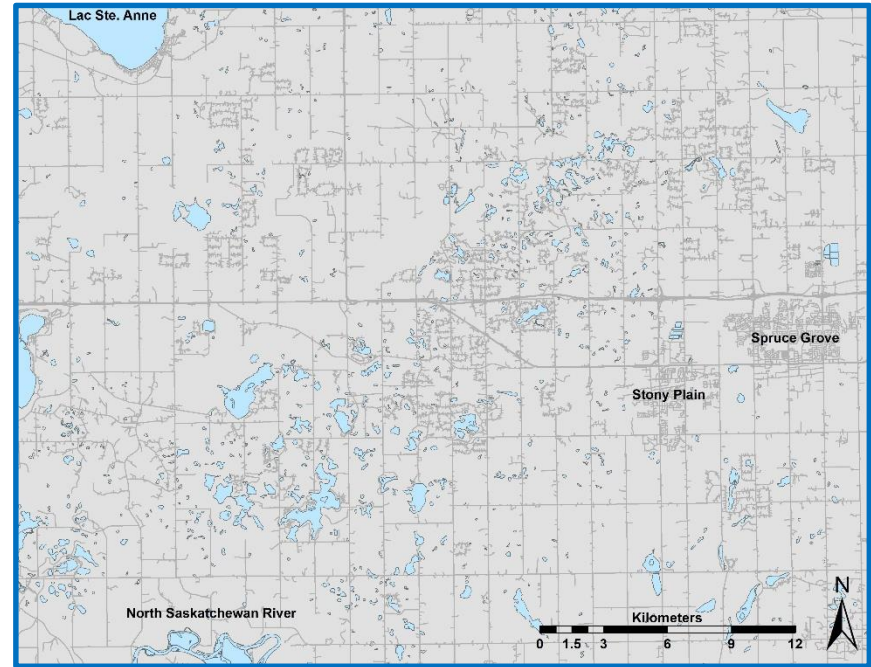
- **DEFAULT PROGRAM DOES NOT FACILITATE THE COLLECTION OF MAJOR ION CHEMISTRY OR INDICATORS (SAMPLE HOLD TIME)**
- **PARAMETERS FOCUS ON TEMPERATURE / OXYGEN MEASUREMENTS, NUTRIENT CHEMISTRY, CHLOROPHYLL (ALGAE)**
- **SOME LAKES SAMPLED ONCE FOR ADDITIONAL WATER CHEMISTRY (COOKING, MINISTIK)**



OUTDOOR FUND

LAKES OF THE CARVEL PITTED DELTA

- MAINLY UNNAMED LAKES (FOSTERS “PRIVATE” LAKE STEWARDSHIP)
- CONDUCTIVITY, TDS & MAJOR ION CHEMISTRY, BIOLOGICAL SAMPLES
- 44 LAKES IN 2021, 50 LAKES IN 2022

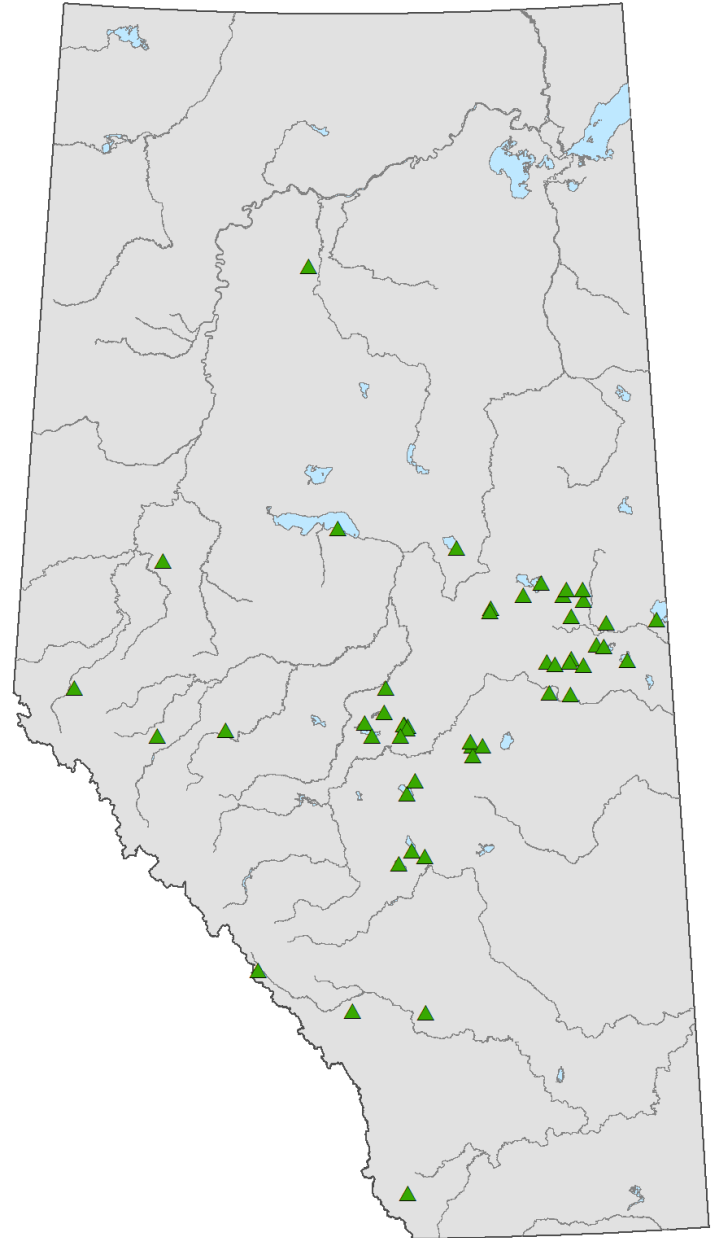




LakeKeepers

WINTER LAKEKEEPERS:

- **MULTI-PROTOCOL PROGRAM TO ENABLE SAMPLING THROUGHOUT ALBERTA, AND FACILITATES ADDITIONAL SAMPLE COLLECTION**
- **ENHANCED PROTOCOL ENABLES CONDUCTIVITY, CHLORIDE, BIOLOGICAL SAMPLE COLLECTION**
- **50 LAKES IN 2021-2022, 30 SAMPLED FOLLOWING ENHANCED PROTOCOL**




OUTDOOR FUND




Alberta Conservation
Association

Where is all of this data available?


Lakewatch
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- Water chemistry data: GoA Water Quality Data Portal 
- Biological samples: not routinely analyzed, no public database
- Reporting: ALMS LakeWatch reports (<https://alms.ca/reports/>)

 **LakeKeepers**

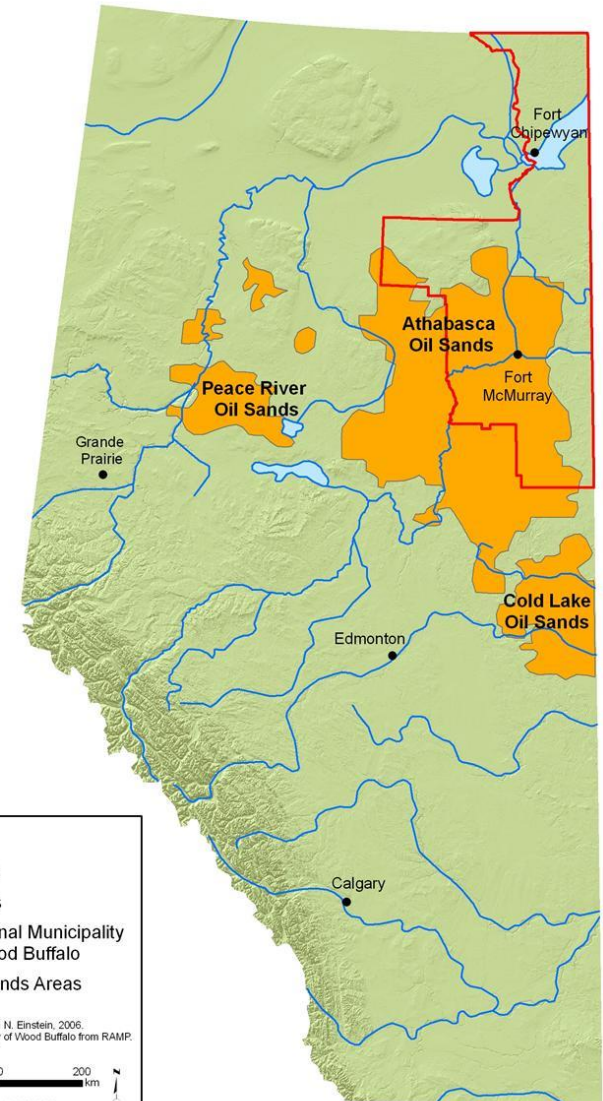
- Water chemistry data: DataStream (<https://mackenziedatastream.ca>) 
- Biological samples: not routinely analyzed, no public database
- Reporting: ALMS LakeKeepers reports (<https://alms.ca/summer-lakekeepers/>) (<https://alms.ca/winter-lakekeepers/>)

**LAKES OF THE CARVEL
PITTED DELTA**

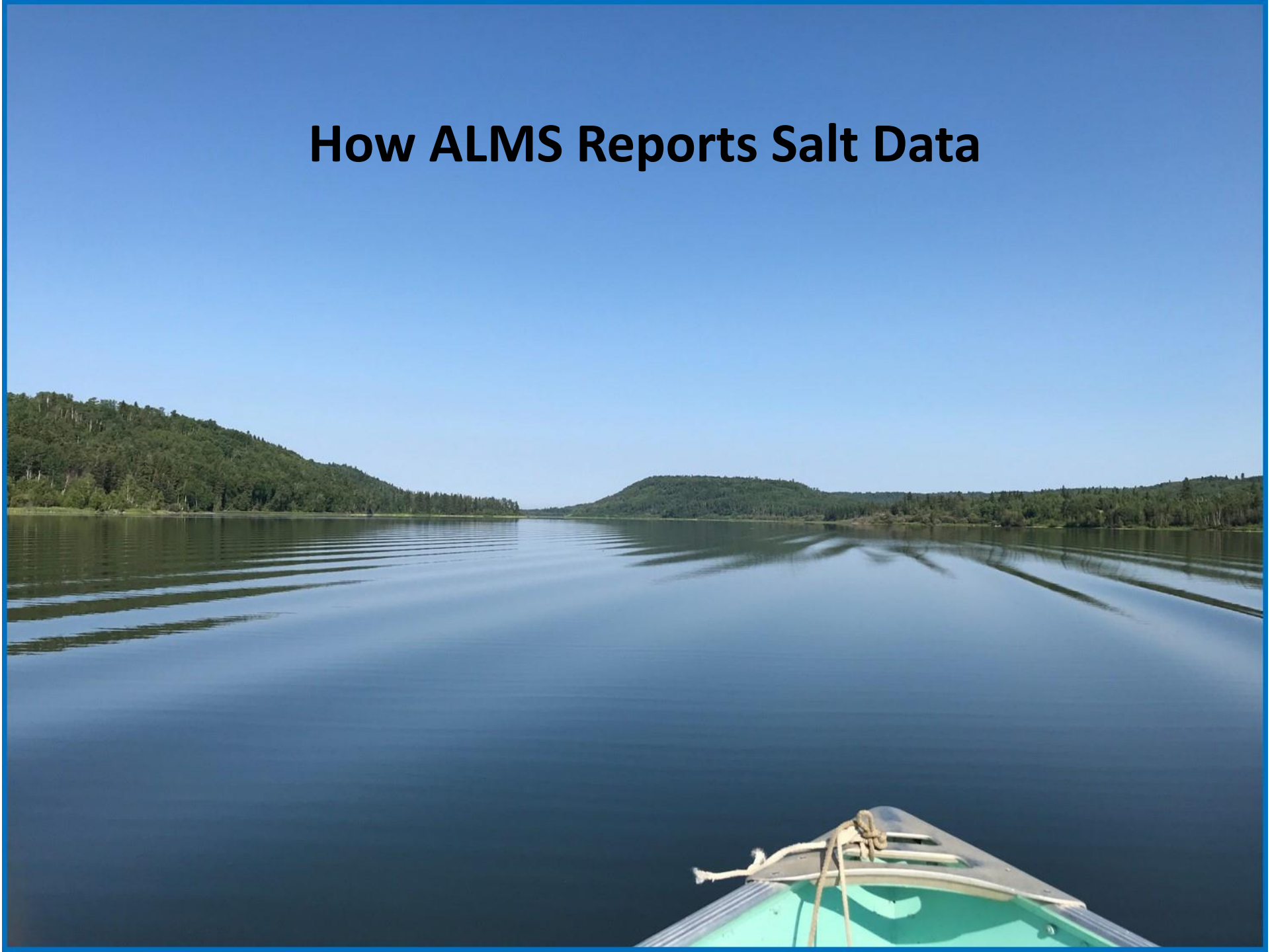
- Water chemistry data: DataStream 
- Biological samples: not routinely analyzed, no public database
- Reporting: ALMS Annual Summary reports (<https://alms.ca/carvel-pitted-delta/>)

ICBM IN OIL SANDS REGION

- WORKING WITH FIRST NATIONS AND METIS IN ALBERTA'S OIL SANDS REGION TO COLLECT WATER QUALITY DATA AT PRIORITY LAKES
- SAMPLING YEAR-ROUND, BEGINNING IN WINTER 2022-2023
- FUNDED THROUGH OIL SANDS MONITORING PROGRAM, AND IS A COLLABORATIVE EFFORT BETWEEN AEPA, AU, ECCC, AND PARTNER NATIONS
- CONDUCTIVITY, TDS, MAJOR IONS, NO BIOLOGY (YET)

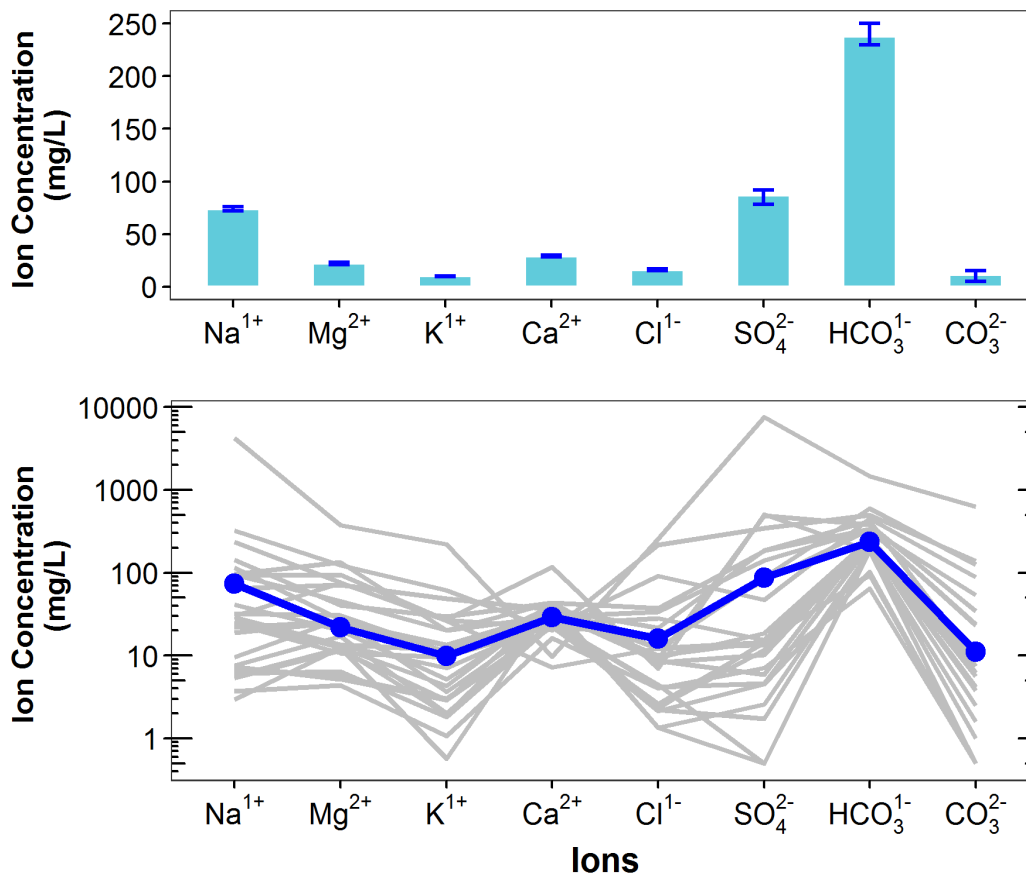


How ALMS Reports Salt Data





Individual LakeWatch Reports – Long Term Trend Analysis



WABAMUN LAKE: 2021 REPORT

- LAKE BICARBONATE DOMINATE, FOLLOW BY SULPHATE AND SODIUM. LEVELS MODERATE COMPARED TO OTHER LAKES SAMPLED THROUGH LAKEWATCH PROGRAM IN 2021

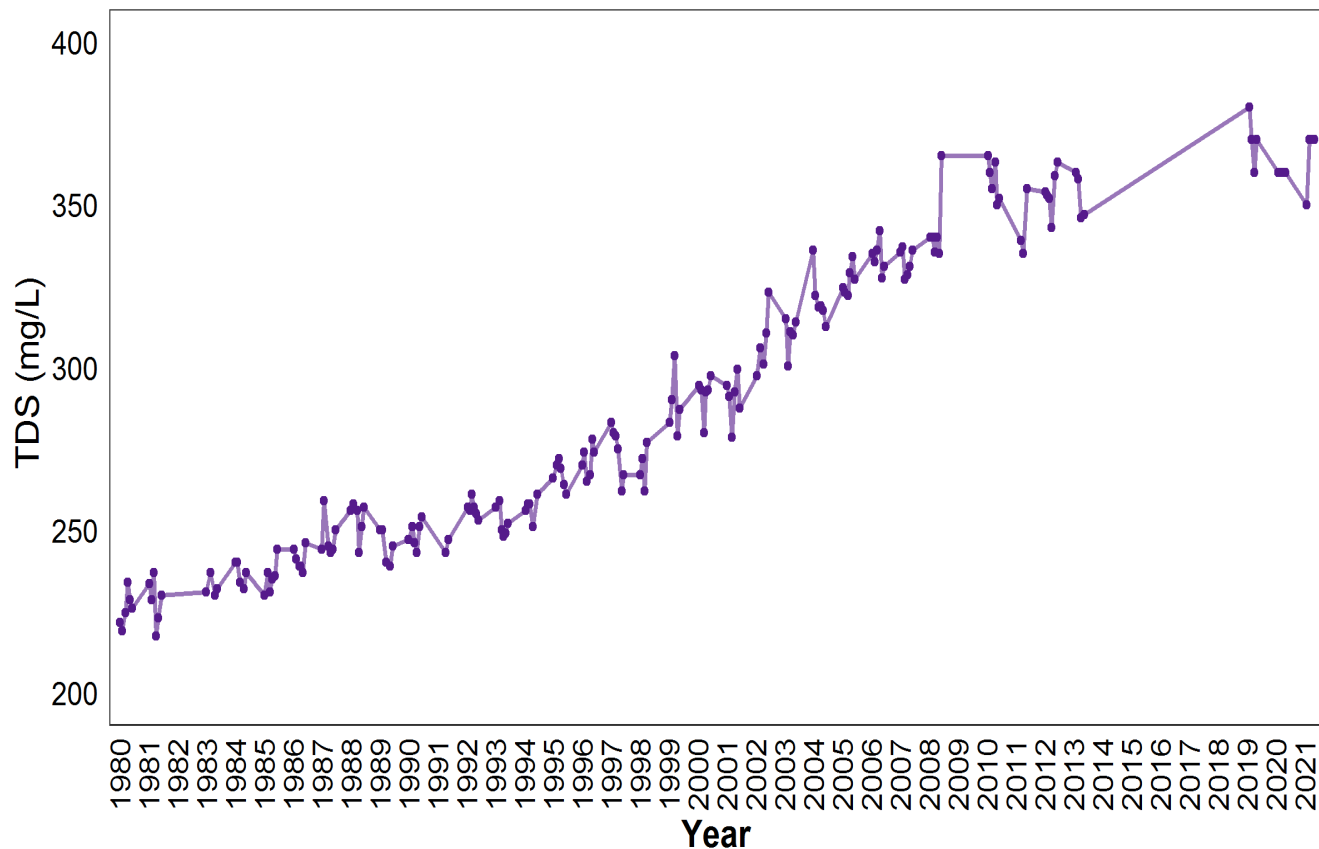
Individual LakeWatch Reports – Long Term Trend Analysis

Table 2c. Average Secchi depth and water chemistry values for Wabamun Lake. Historical values are given for reference. Number of sample trips are inconsistent between years.

Parameter	2006	2007	2008	2010	2011	2012	2013	2014	2016	2019	2020	2021
TP ($\mu\text{g/L}$)	21	28	22	34	40	33	36	416	26	27	44	26
TDP ($\mu\text{g/L}$)	5	8	7	13	9	14	14	22	6	7	6	7
Chlorophyll- <i>a</i> ($\mu\text{g/L}$)	10.8	13.9	10.3	7.9	11.5	11	8.8	9.1	9.2	11.1	11.7	12
Secchi depth (m)	2.70	2.41	2.27	1.93	1.47	2.00	1.80	2.39	2.82	2.70	2.42	2.70
TKN (mg/L)	1	0.9	0.9	1.1	1.1	1	1	0.8	0.9	0.9	1	1
NO ₂ -N and NO ₃ -N ($\mu\text{g/L}$)	4	4	3	7	2	3	2	26	4	2	2	3
NH ₃ -N ($\mu\text{g/L}$)	48	41	57	12	12	17	11	26	25	15	24	15
DOC (mg/L)	12	11	10	12	/	11	/	10	11	10	10	10
Ca (mg/L)	25	26	26	/	/	/	/	/	26	28	29	29
Mg (mg/L)	19	19	20	/	/	/	/	/	22	22	22	22
Na (mg/L)	69	67	70	77	73	72	73	79	76	75	74	74
K (mg/L)	10	9	9	10	10	10	9	10	10	10	10	10
SO ₄ ²⁻ (mg/L)	74	75	76	86	80	85	83	84	90	88	87	86
Cl ⁻ (mg/L)	10	10	12	13	13	13	12	14	15	16	16	16
CO ₃ (mg/L)	9	6	10	8	9	7	10	8	7	7	7	11
HCO ₃ (mg/L)	240	241	238	243	233	245	239	242	252	255	230	238
pH	8.59	8.50	8.57	8.62	8.65	8.50	8.36	8.43	8.54	8.59	8.54	8.62
Conductivity ($\mu\text{S/cm}$)	562	561	577	592	583	602	608	610	623	612	598	630
Hardness (mg/L)	140	142	144	141	140	146	153	149	157	158	162	162
TDS (mg/L)	334	332	343	356	343	353	353	370	372	370	360	365
Microcystin ($\mu\text{g/L}$)	/	/	/	0.10	0.17	0.20	0.10	0.13	0.19	0.12	0.24	0.08
Total Alkalinity (mg/L CaCO ₃)	212	208	211	213	207	212	213	212	217	220	198	212
Basin Sampled	E, W	E, W	E, W	M	M	M	M	E	E	M	M	M



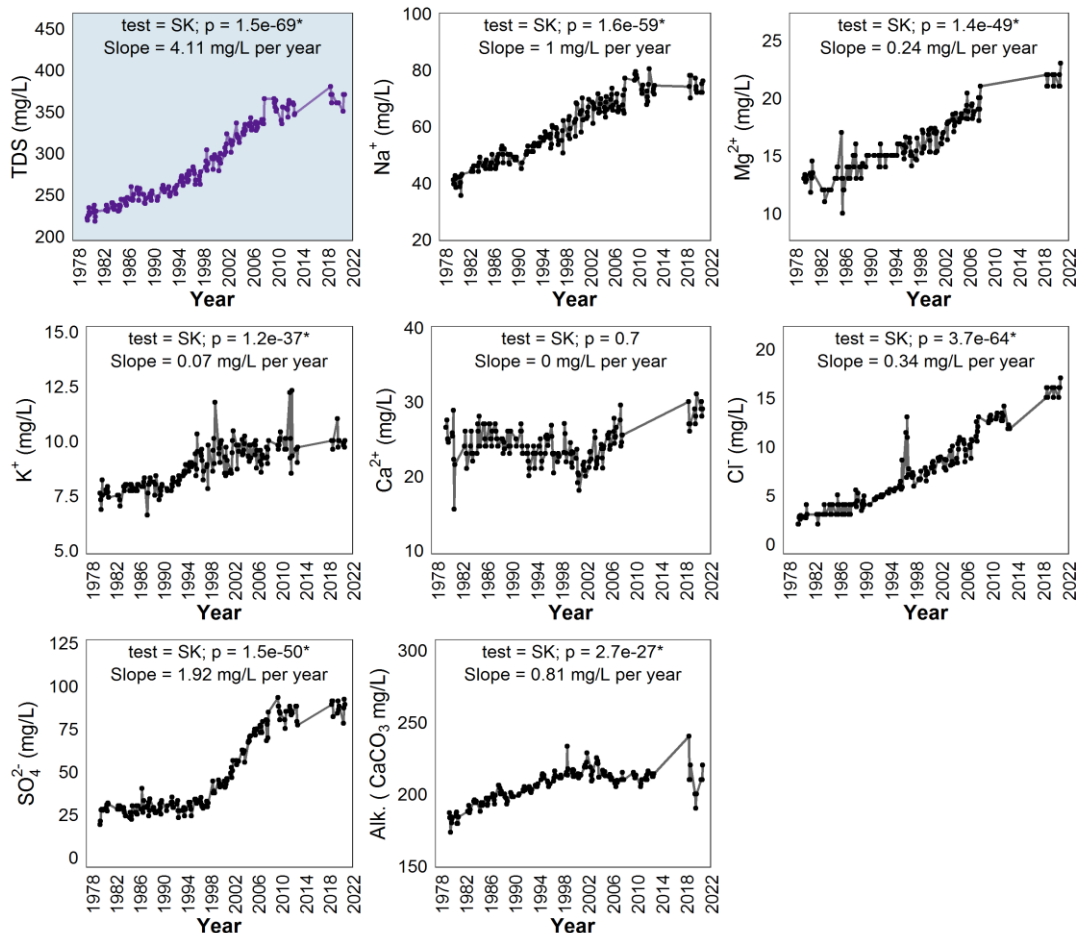
Individual LakeWatch Reports – Long Term Trend Analysis



WABAMUN LAKE: 2021 REPORT

- **TDS SEASONAL KENDALL TREND TEST: SIGNIFICANTLY INCREASING SINCE 1980, BY 4.11 MG/L PER YEAR, 150 MG/L TOTAL INCREASE.**

Individual LakeWatch Reports – Long Term Trend Analysis



WABAMUN LAKE: 2021 REPORT

- MAJOR ION SEASONAL KENDALL TREND TESTS: SULPHATE, CARBONATES, SODIUM MAIN DRIVERS
- CHLORIDE, MAGNESIUM, POTASSIUM ALSO INCREASING

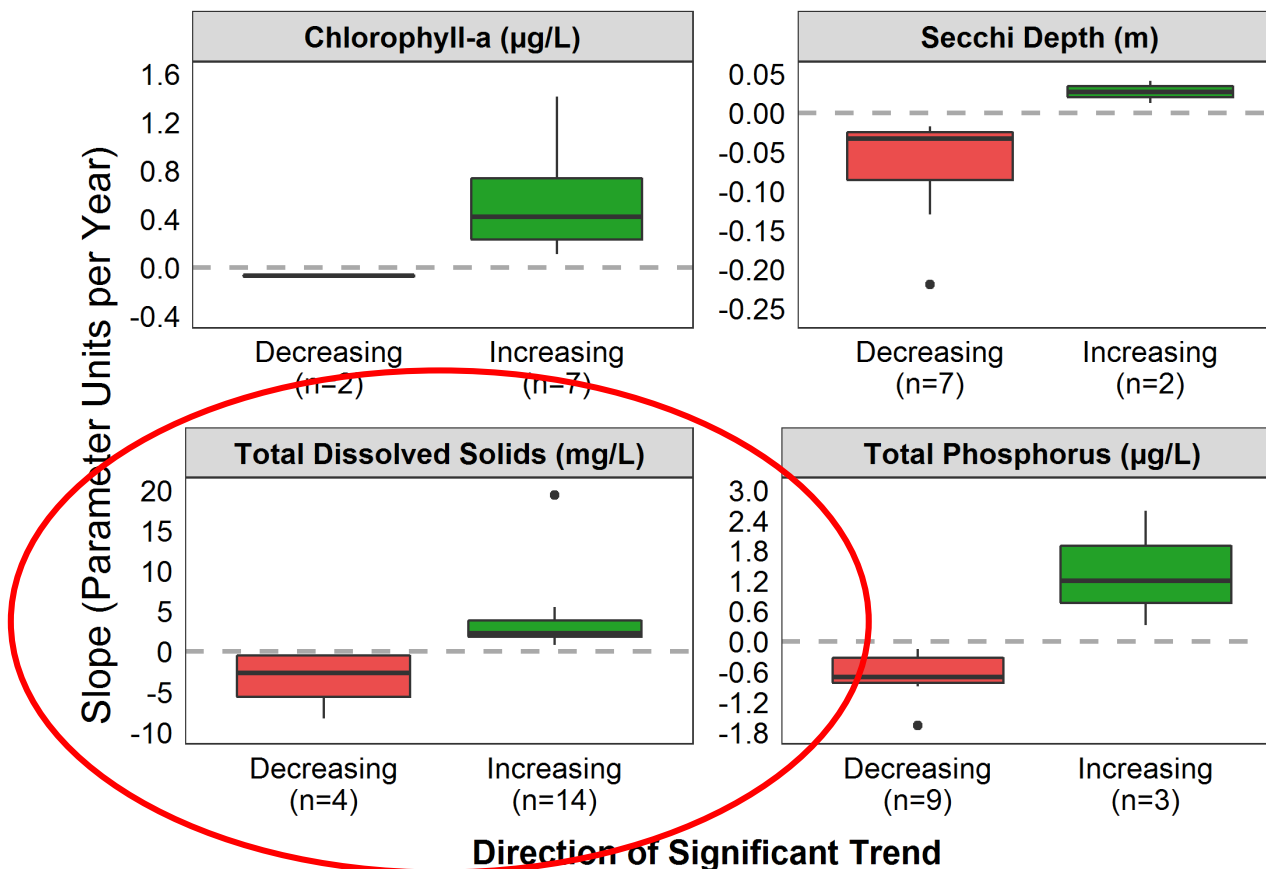


LakeWatch Trend Summary Report

Table 3. Summary of trend analysis for total dissolved solids (TDS) at lakes sampled through the LakeWatch program. Tau = strength and direction of trend, Slope = rate of change of trend (mg/L per year), p = significance of trend (bolded indicates significance at $p < 0.05$), n = number of sampling events, Trend Test = either Seasonal Kendall (SK) or Mann Kendall (MK), Trend Range = range of years included in trend analysis. Table ordered by Slope magnitude.

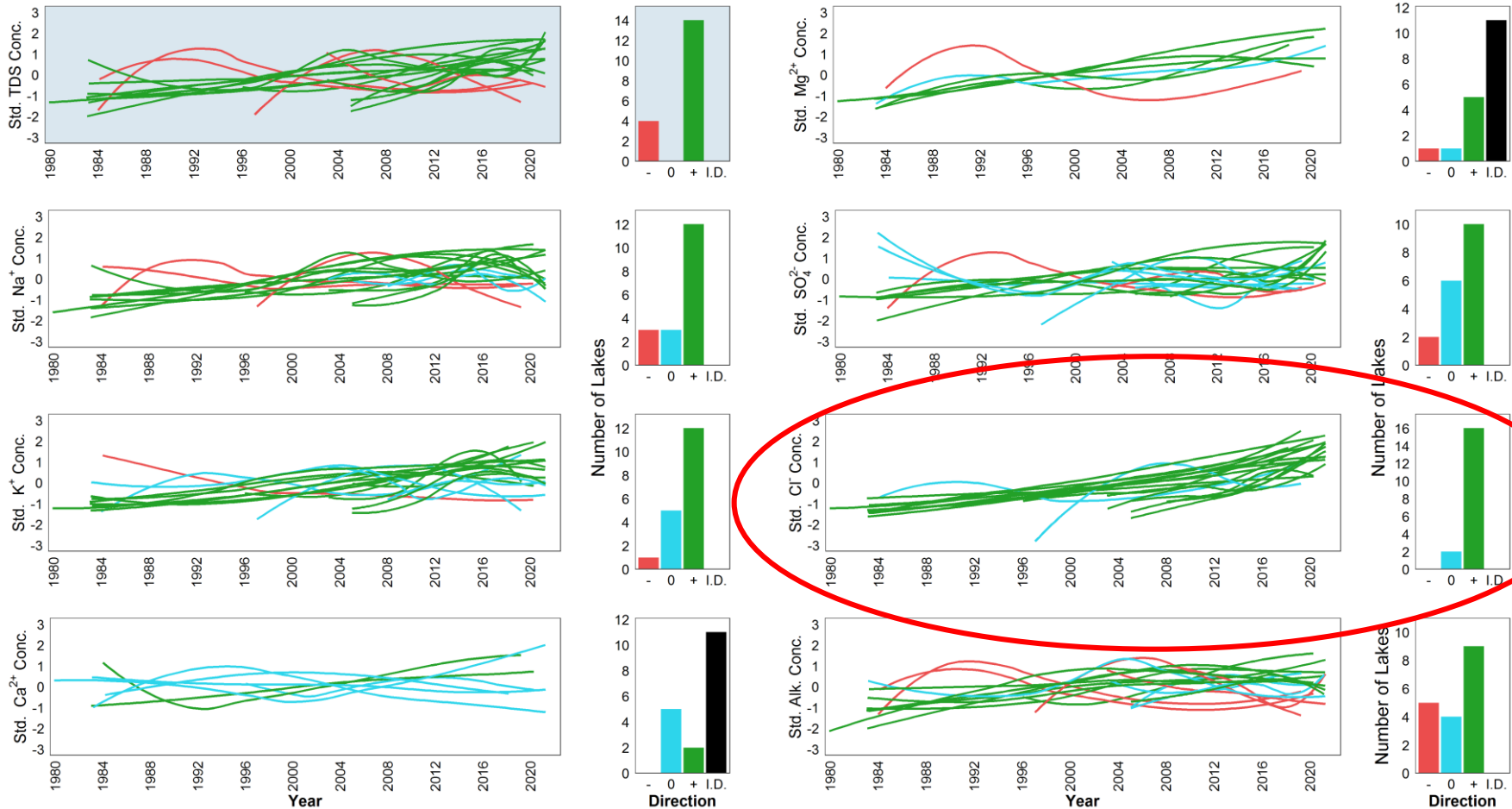
Lake	Tau	Slope (mg/L per year)	p	n	Trend Test	Trend Range
Alix	0.52	19.35	1.11E-05	43	SK	1996-2020
Minnie	0.33	5.52	4.80E-03	43	SK	2008-2021
Moose	0.48	5.15	2.52E-09	81	SK	1983-2021
<u>Wabamun</u>	0.92	4.11	1.47E-69	185	SK	1980-2021
Skeleton North	0.57	2.83	4.04E-07	45	SK	2005-2021
Gull	0.48	2.36	3.76E-06	57	SK	1983-2021
Skeleton South	0.67	2.24	6.97E-09	46	SK	2005-2021
Chestermere	0.58	2.21	1.15E-07	48	SK	1983-2020
Crane	0.35	2.00	1.41E-03	48	SK	2005-2020
Isle	0.74	1.94	7.79E-10	42	SK	1983-2021
<u>Kehewin</u>	0.46	1.80	0.01	23	SK	2003-2019
Pigeon	0.58	0.96	1.75E-12	81	SK	1983-2021
Pine	0.20	0.95	0.01	81	SK	1983-2021
Sylvan	0.44	0.79	4.34E-05	54	SK	1983-2018
Marie	-0.26	-0.33	0.03	32	MK	2003-2021
Beauvais	-0.33	-0.57	6.70E-03	42	SK	1984-2020
Buffalo	-0.24	-4.76	0.01	59	SK	1984-2019
Laurier	-0.36	-8.33	2.79E-03	52	SK	1997-2019

LakeWatch Trend Summary Report



- COMPARED TO OTHER PARAMETER ANALYZED, TDS INCREASING TREND MOST COMMON ACROSS LAKES, VARYING BETWEEN 1 – 5 MG/L INCREASE PER YEAR**

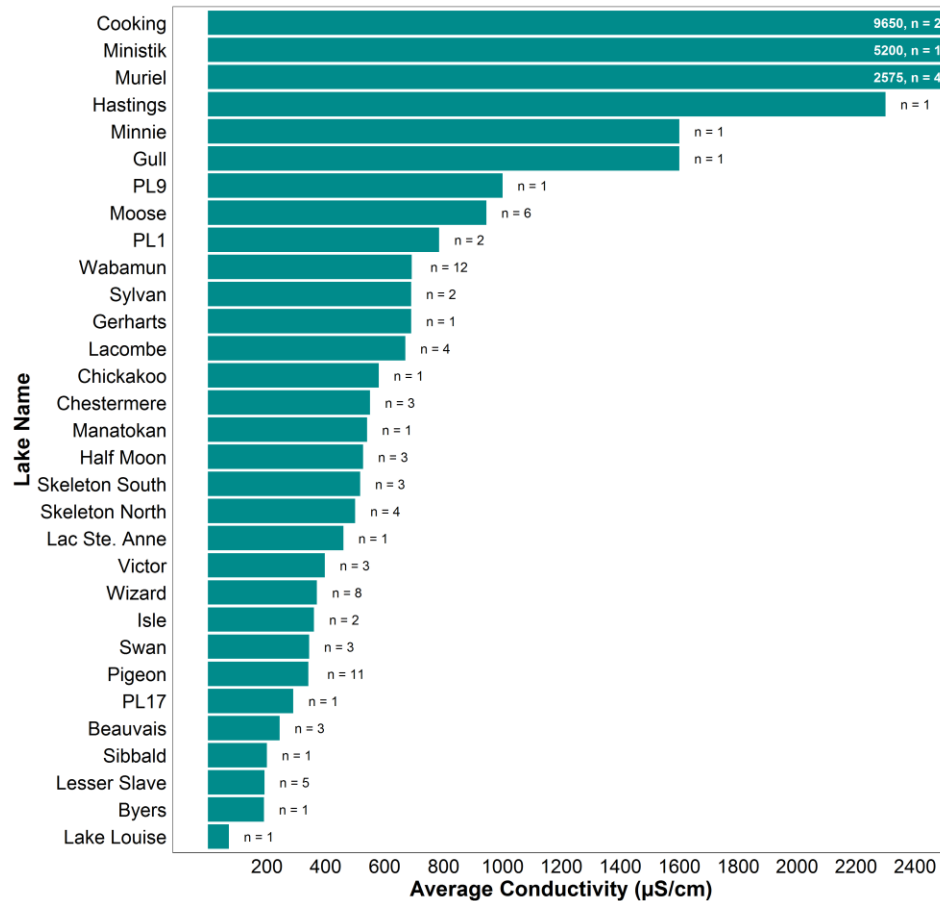
LakeWatch Trend Summary Report



- **CONCENTRATIONS STANDARDIZED IN ORDER TO ENABLE CLEARER COMPARISON**
- **SIGNIFICANT INCREASING CHLORIDE TRENDS IDENTIFIED AT 16 OF 18 LAKES ACROSS ALBERTA – MOST OF ANY MAJOR ION**



Winter LakeKeepers Summary Reports



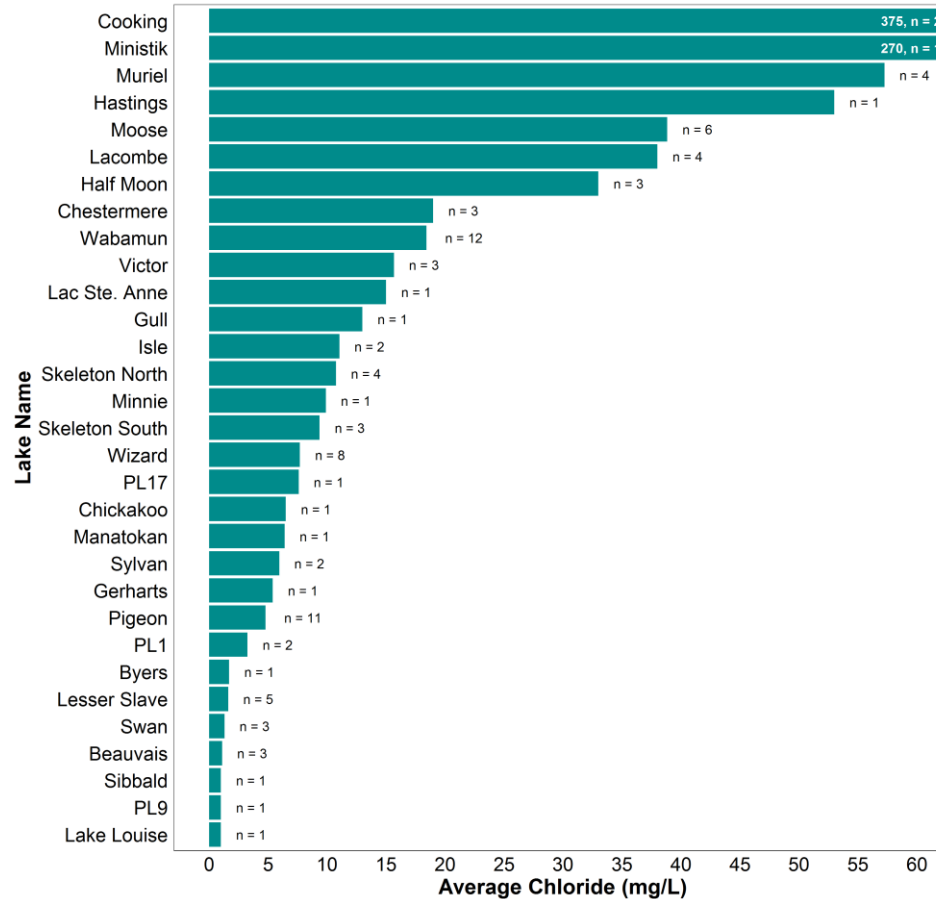
WINTER LAKEKEEPERS 2021 – 2022 REPORT

- DISPLAYS RANGE OF AVERAGE CONDUCTIVITY AT EACH LAKE FROM WINTER SAMPLES



LakeKeepers

Winter LakeKeepers Summary Reports



WINTER LAKEKEEPERS 2021 – 2022 REPORT

- DISPLAYS RANGE OF AVERAGE CHLORIDE AT EACH LAKE FROM WINTER SAMPLES



LakeKeepers

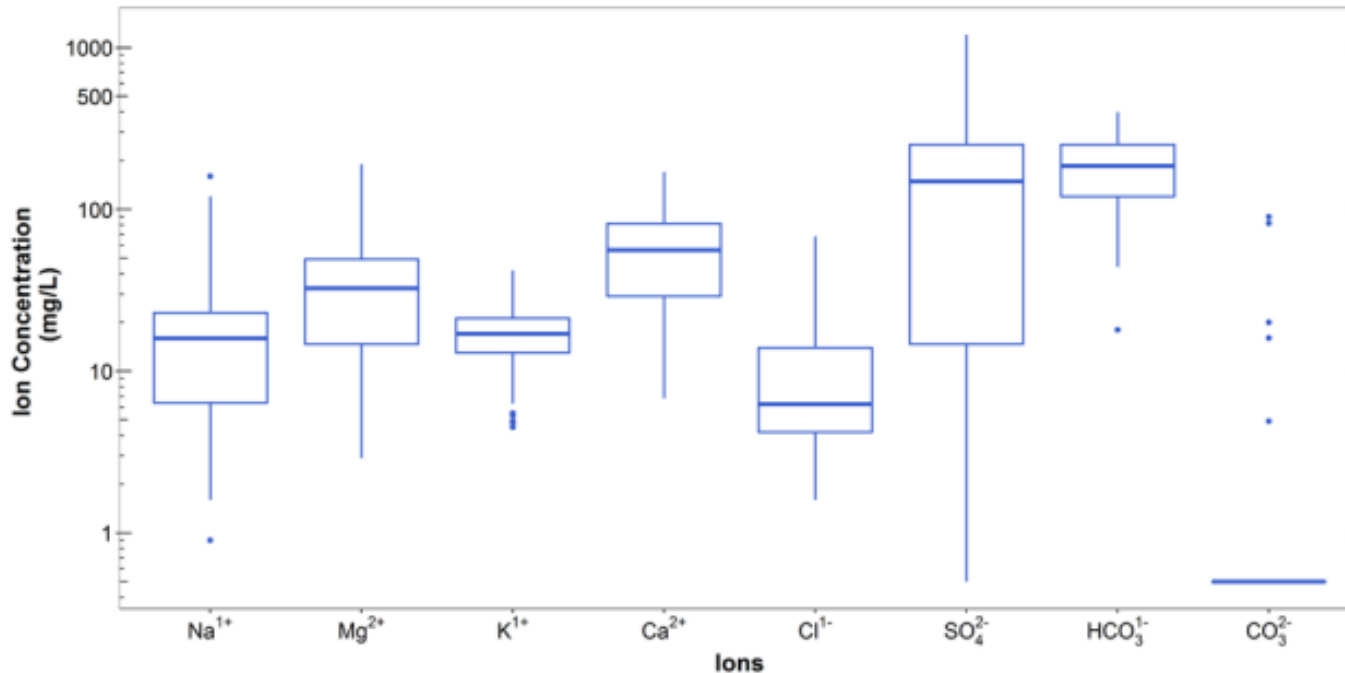
Winter LakeKeepers Summary Reports

Site	Date	TKN	ChIA	TP	TDP	NO3+NO2	NH3	DOC	Cl-	Cond.	pH
Wizard Lake, Jubilee	2022-01-11	1.2	4.1	10.0	9.3	150.0	160.0	20.0	7.7	410	7.88
Wizard Lake, Jubilee	2022-02-06	1.2	2.7	20.0	13.0	260.0	30.0	14.0	8.7	410	7.97
Wizard Lake, Jubilee	2022-02-27	1.5	16.4	110.0	60.0	230.0	7.5	14.0	8.7	370	8.03
Wizard Lake, Jubilee	2022-03-22	1.8	52.7	280.0	200.0	88.0	23.0	15.0	4.9	210	7.68
Wizard Lake, West Basin	2022-01-11	1.2	3.2	23.0	12.0	51.0	170.0	18.0	7.9	410	8.19
Wizard Lake, West Basin	2022-02-06	1.3	1.7	26.0	20.0	190.0	86.0	15.0	8.7	420	8.07
Wizard Lake, West Basin	2022-02-27	1.3	9.2	27.0	13.0	230.0	18.0	13.0	8.4	390	8.06
Wizard Lake, West Basin	2022-03-22	1.0	15.0	20.0	10.0	180.0	35.0	11.0	6.6	340	8.17

WINTER LAKEKEEPERS 2021 – 2022 REPORT

- **DISPLAYS RAW DATA TO COMPARE CHANGE THROUGH THE SEASON**

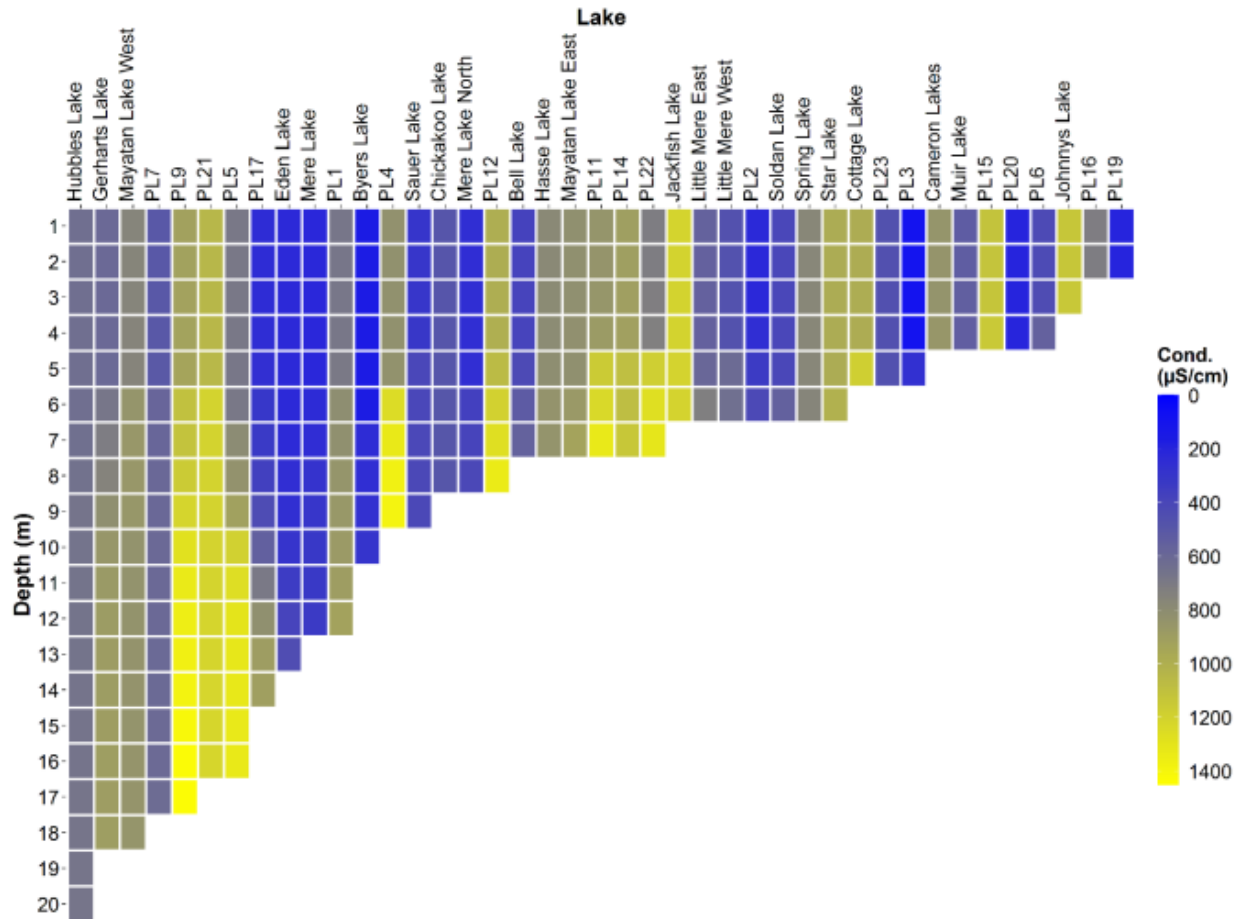
LAKES OF THE CARVEL PITTED DELTA



2021 SUMMARY REPORT

- LAKES HAVE BROAD DISTRIBUTION OF ION LEVELS, EVEN WITHIN CONFINED GEOGRAPHICAL REGION
- DOMINATED BY BICARBONATE, SULPHATE, CALCIUM

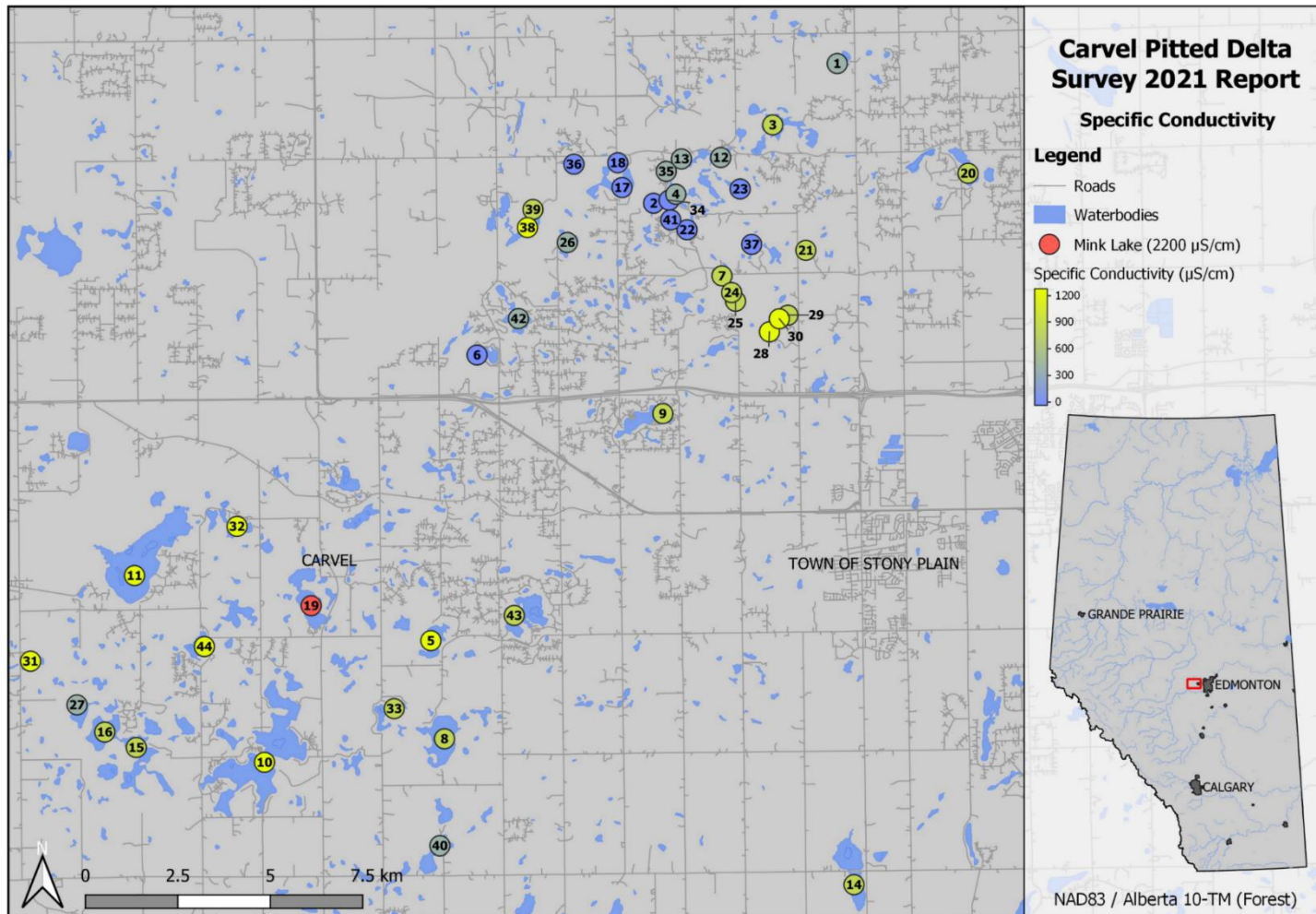
LAKES OF THE CARVEL PITTED DELTA



2021 SUMMARY REPORT

- LAKES VARY IN CONDUCTIVITY LEVELS THROUGH WATER COLUMN – CONDUCTIVITY INCREASES APPRECIABLY AT DEPTH WITHIN SOME LAKES

LAKES OF THE CARVEL PITTED DELTA



2021 SUMMARY REPORT

- **GEOGRAPHIC DISTRIBUTION OF LAKE AND ASSOCIATED CONDUCTIVITY**

CONCLUDING REMARKS

- **LAKEWATCH, LAKEKEEPERS, LAKES OF THE CARVEL PITTED DELTA ARE PROGRAMS COMPILING BASELINE LAKE WATER QUALITY INFORMATION**
- **THE PROGRAMS DIFFER IN THEIR DESIGN IN TERMS OF CAPTURING SALT ABUNDANCE AND ION DISTRIBUTION, AS WELL AS WHAT OTHER LAKE FACTORS MIGHT BE IMPACTED (BIOLOGY, LAKE LAYERS IN EXTREME CASES)**
- **THE DATA IS ACCESSIBLE THROUGH EITHER THE GOA WQ DATA PORTAL, OR DATASTREAM**
- **ALMS SYNTHESIZES DATA INTO REPORTS, WHICH WILL DESCRIBE SALT ABUNDANCE AND CHARACTER DEPENDING ON THE PROGRAM'S DESIGN AND LAKE'S HISTORICAL DATASET**
- **INTERESTED IN LEARNING MORE ABOUT SALT IN YOUR LAKE? VOLUNTEER WITH US!**

QUESTIONS?

THANK YOU:

STAFF!

VOLUNTEERS!

BOARD!

SUPPORTERS!

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