Two Long-Term Monitoring Studies: Citizen Scientists Track Lake Ice and the Long Term Study of Four of the Western Finger Lakes

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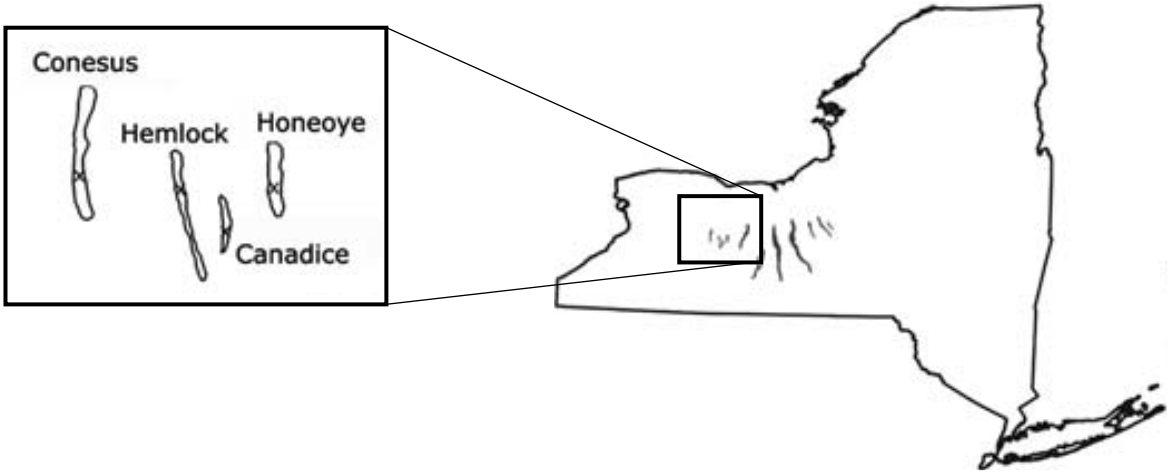
NYSFOLA

19-20 April 2022

Agenda

1. The temporal: 50 + years of work on the Western Finger Lakes
2. The spatial/temporal: 30 + years of lake ice monitoring of lakes in New York and 4 other states
3. Some findings Global, Regional, Local forces
4. Challenges
5. What shows up in our lakes from global, regional and local? Deicing salt we used? What about emissions? What shows up in our lakes? What's changed in the past 50 years?

The Western Fingers



Lake	Depth (m) (mean/max)	Surface Area (km^2)	Volume (10^6 m^3)	Watershed (km^2)	WRT (years)*
Honeoye	4.9/9.2	7.1	34.8	95	1
Canadice	16.4/25.4	2.6	42.6	31.8	4
Hemlock	13.6/27.5	7.2	105.9	96.2	2.5
Conesus	11.5/18	13.7	156.8	180.5	2

Modified from Peng, F and Steven W Effler 2005. Inorganic tripton in the Finger Lakes of New York: Importance to optical characteristics Hyrdobiologia 543(1):259-77.

*From Michel & Krammer (1995) Use of isotope data to estimate water residence times of the Finger Lakes, New York. Journal of Hydrology 164: 1–18.

The Western Fingers

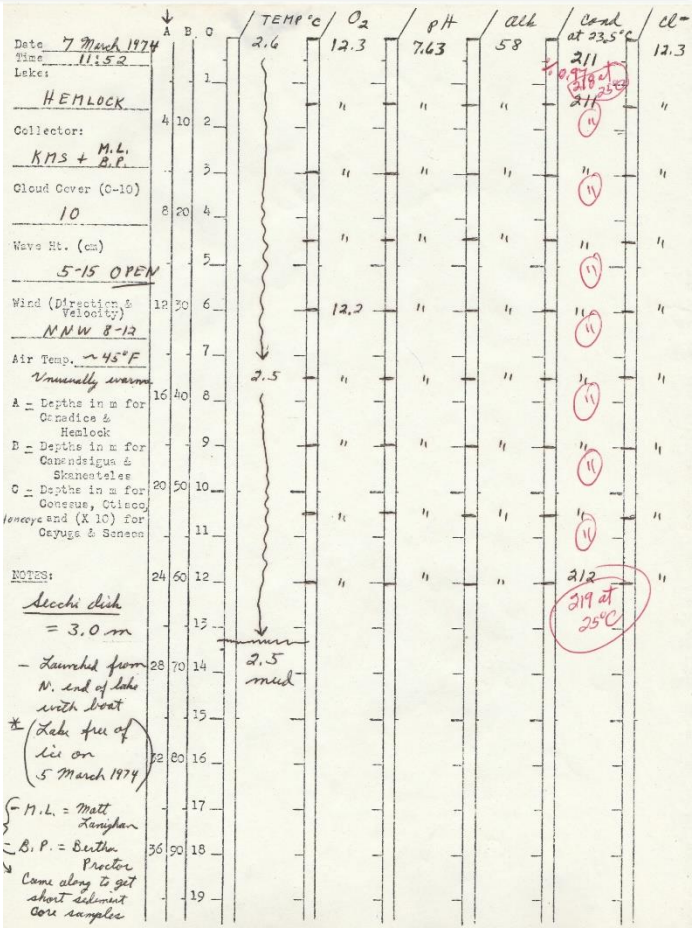
1. Data collection history

2. What was collected

3. How many samples

The Western Fingers Data

- **1500+ water samples ~350/lake**
- **400+ data sheets/lake**
- **Winter sampling**
- **Historic baselines – data sheets from dozens of lakes across NYS**



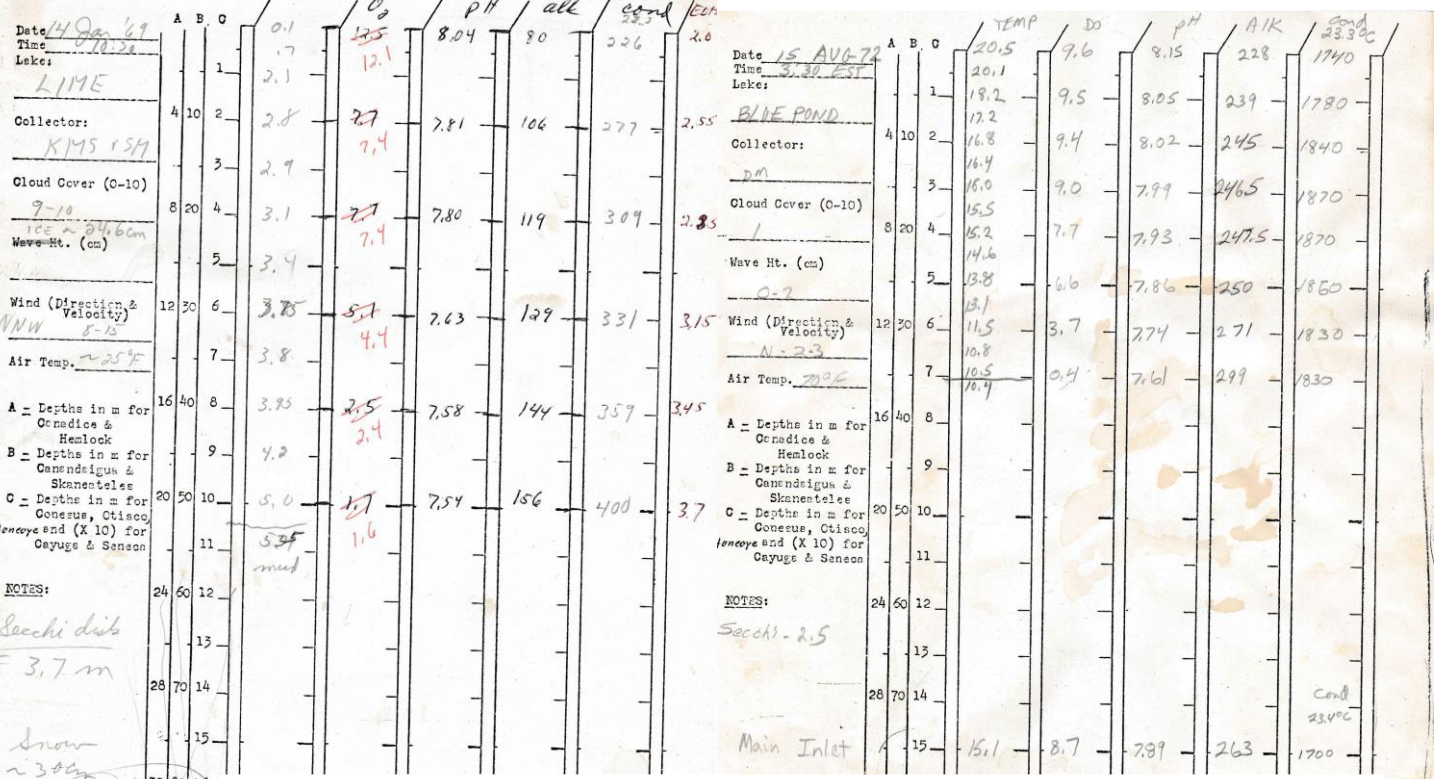


Table 1. Mean and standard deviations of conductivity (µ/s/cm at 25 °C), pH, and concentrations (mg/L) of anions, and cations in Blue Pond.

Cond	pH	Ca	Cl	F	K	Mg	Na	NO_3	SO_4
2323 ±135	8.00 ±.09	317.31 ±20.77	162.03 ±16.61	2.11 ±1.29	2.82 ±0.82	38.30 ±2.24	60.37 ±2.31	4.82 ±1.03	982.24 ±137.92

Bove, G.E., and K.M. Stewart. 2005. 'Spatial variations in cation and anion concentrations in Blue Pond, N.Y., and their relationship to the macrophyte *Chara*', *The International Journal of Theoretical and Applied Limnology*. 29:1341-1347.

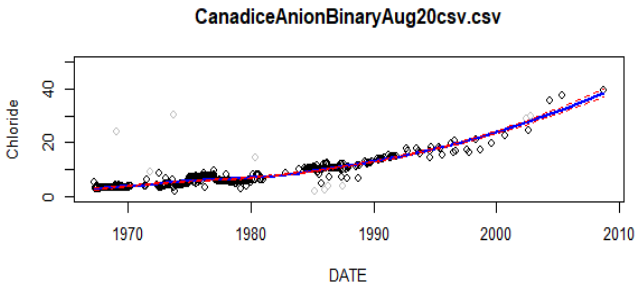
The Western Fingers: Some preliminary findings

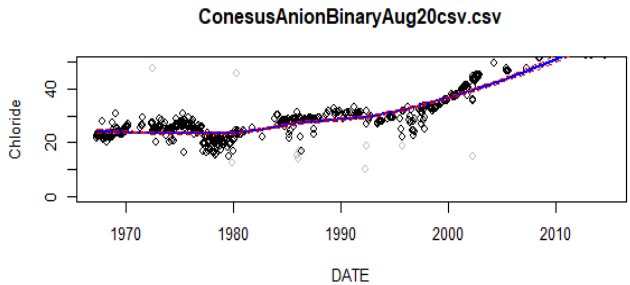
ion Concentrations								
	Ammonium		Calcium		Chloride		Sodium	
	Estimate	P-value	Estimate	P-value	Estimate	P-value	Estimate	P-value
Canadice (Δ1976-2002)	0.0238	0.0002	0.056	<0.001	0.467	<.0001	0.3656	<0.0001
Spring	-0.024	0.892	-0.158	0.615	-0.0364	0.8929	0.8468	0.0068
Summer	0.062	0.64	-0.676	0.012	0.1861	0.416	0.0267	0.92
Fall	0.072	0.69	-0.696	0.038	0.1357	0.574	-0.118	0.7186
Conesus (Δ1967-2002)	0.010	0.064	0.0204	0.1786	0.4255	<0.001	0.277	<0.0001
Spring	0.044	0.843	-0.182	0.755	0.1632	0.7882	0.0944	0.774
Summer	0.359	0.048	-1.688	0.001	-0.1842	0.7283	0.3320	0.237
Fall	0.176	0.355	-0.909	0.0812	0.0515	0.9261	0.506	0.088
Hemlock (Δ1974-2002)	0.00644	0.7929	0.0236	0.125	0.3753	<0.001	0.266587	<.0001
Spring	0.185	0.639	-0.1984	0.639	0.0068	0.1933	0.2184	0.256
Summer	0.227	0.397	-0.288	0.4332	-0.1618	0.63	0.1722	0.305
Fall	0.2546	0.389	0.252	0.543	-0.4666	0.1933	0.0722	0.6993
Honeoye (Δ1967-2004)	0.0158	-0.0618	0.458	0.0032	0.458	<0.0001	0.18322	<0.0001
Spring	-0.498	-1.225	-0.636	0.129	-0.636	0.3328	0.0378	0.8335
Summer	-0.4799	-0.222	-0.994	0.7487	-0.994	0.0989	-0.139	0.3711
Fall	-0.241	0.1002	-1.137	0.8905	-1.137	0.0904	-0.0589	0.7179

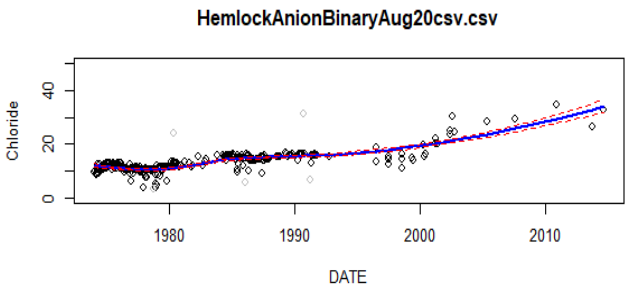
The Western Fingers: Some preliminary findings

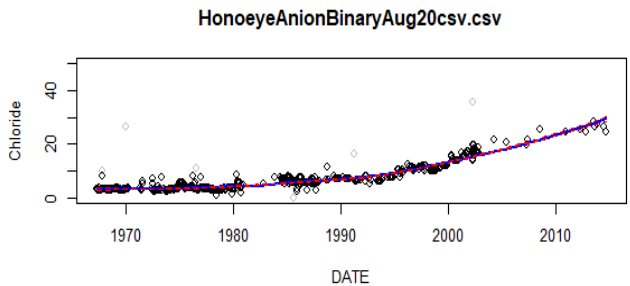
	Magnesium		Potassium		Sulfate	
	Estimate	P-value	Estimate	P-value	Estimate	P-value
Canadice (Δ1976-2002)	0.0132	<0.001	-0.0066	0.0004	-0.1869	<.001
Spring	0.1219	0.1966	-0.150	0.0036	-0.4875	0.0613
Summer	0.00609	0.939	-0.086	0.049	-0.9372	<.001
Fall	-0.007	0.9386	0.103	0.067	-0.6894	0.003
Conesus (Δ1967-2002)	-0.009332	0.1355	-00195	0.1961	-0.487	<0.001
Spring	0.3686	0.1199	-0.0789	0.1701	-0.178	0.744
Summer	0.5050	0.012	-0.0676	0.1685	-0.799	0.098
Fall	0.5177	0.015	-0.0044	0.9311	-1.207	0.017
Hemlock (Δ1974-2002)	0.000744	0.8907	-0.001665	0.557	-0.195	<0.0001
Spring	0.401366	0.0075	-0.20213	0.0091	-0.376	0.416
Summer	0.1682	0.1972	-0.158	0.0196	-0.565	0.153
Fall	0.0057	0.6948	-0.1233	0.1052	-0.283	0.561
Honeoye (Δ1967-2004)	-0.0008	0.816	-0.000964	0.4731	-0.2613	<0.001
Spring	-0.1092	0.431	-0.06247	0.227	0.7579	0.315
Summer	0.0710	0.553	-0.02845	0.5245	-0.613	0.376
Fall	0.1710	0.1746	0.0188	0.69	-2.02	0.009

Cl- global? regional? local?

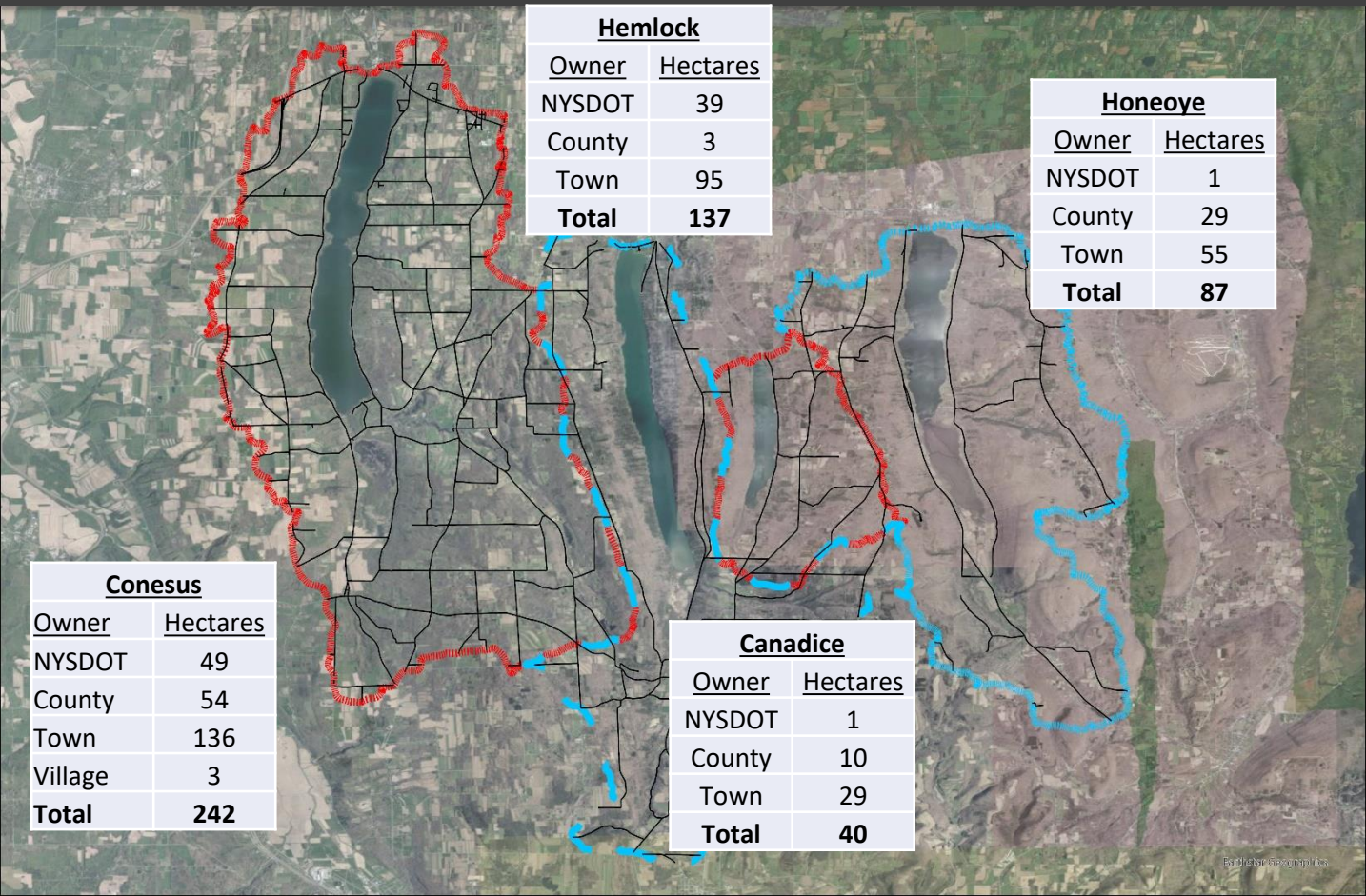








The Western Fingers: Some findings (Cl)



Hemlock	
Owner	Hectares
NYSDOT	39
County	3
Town	95
Total	**137**

Honeoye	
Owner	Hectares
NYSDOT	1
County	29
Town	55
Total	**87**

Conesus	
Owner	Hectares
NYSDOT	49
County	54
Town	136
Village	3
Total	**242**

Canadice	
Owner	Hectares
NYSDOT	1
County	10
Town	29
Total	**40**

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Owner	Hectares
NYSDOT	1
County	10
Town	29
Total	**40**

Conesus	
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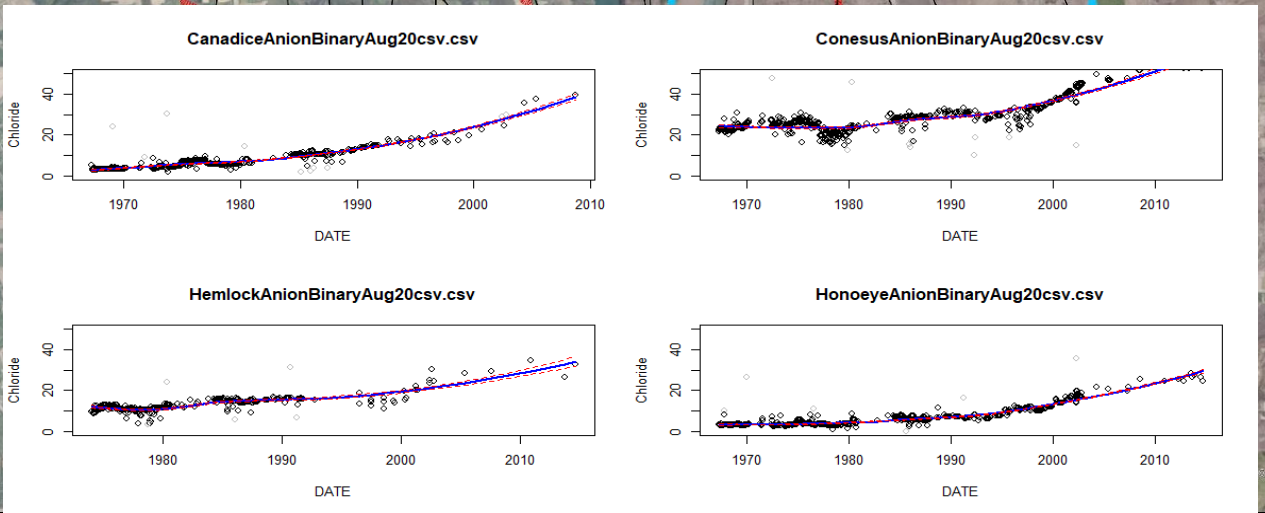

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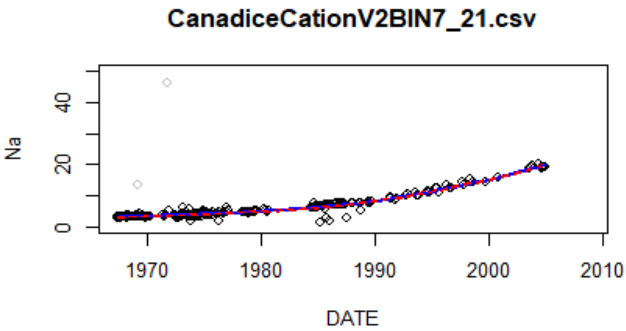
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Na
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1970
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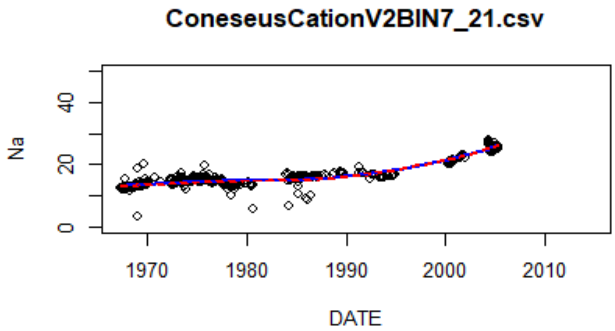
ConeseusCationV2BIN7_21.csv
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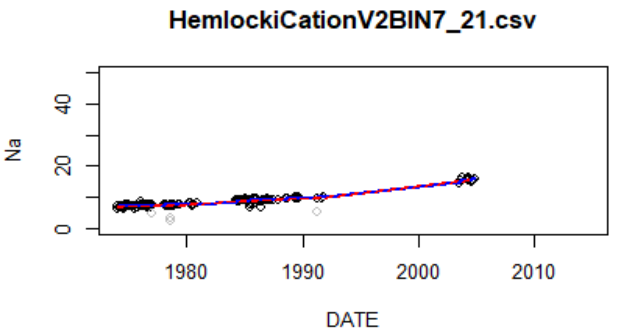
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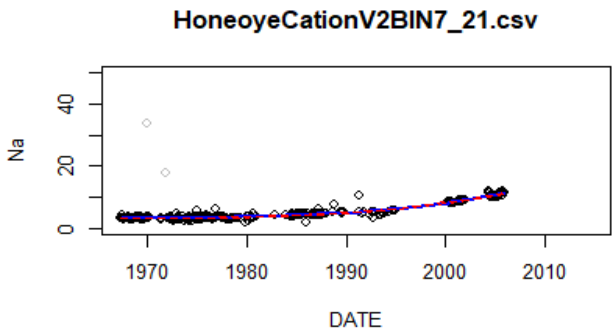
HoneoyeCationV2BIN7_21.csv
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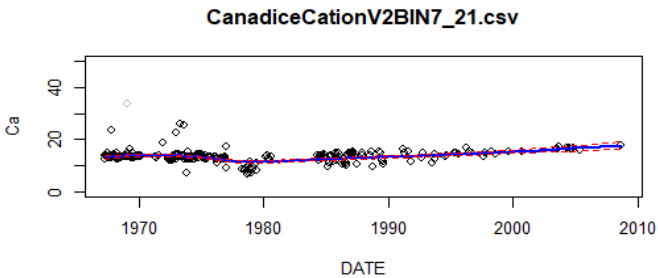
Ca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Ca
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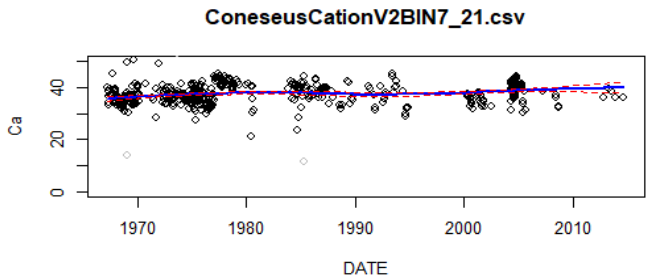
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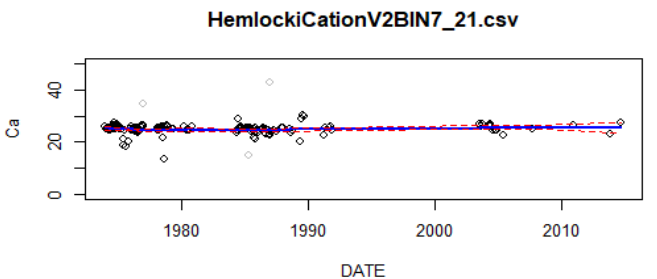
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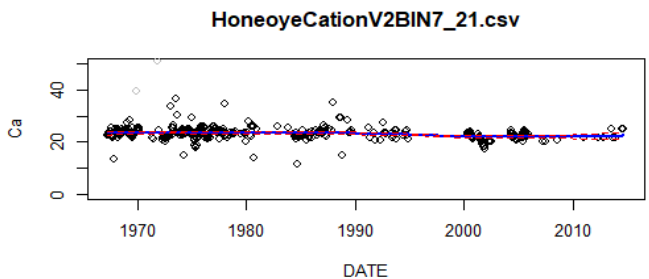
HoneoyeCationV2BIN7_21.csv
Ca
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1970
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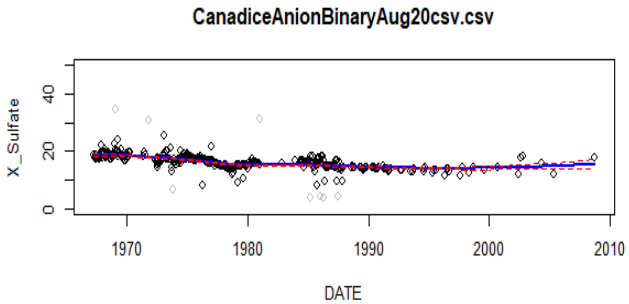
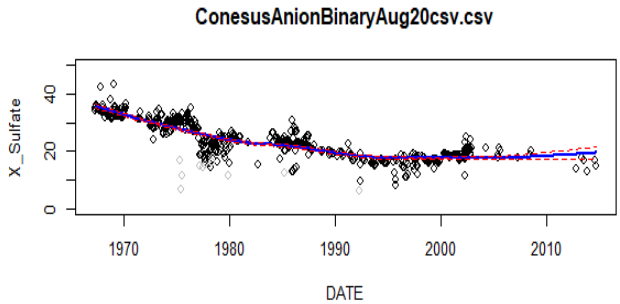
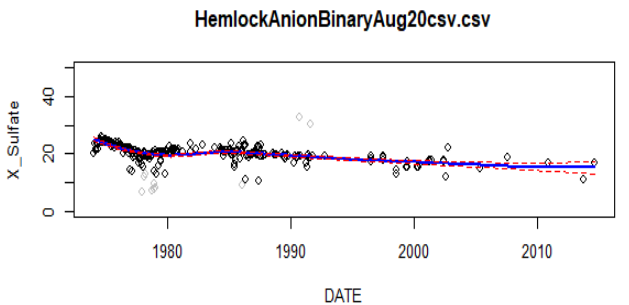
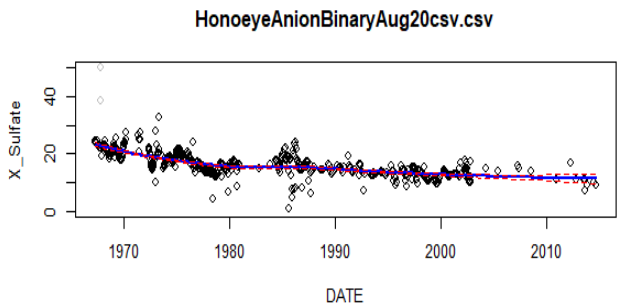
DATE

SO4 – global?regional? local?

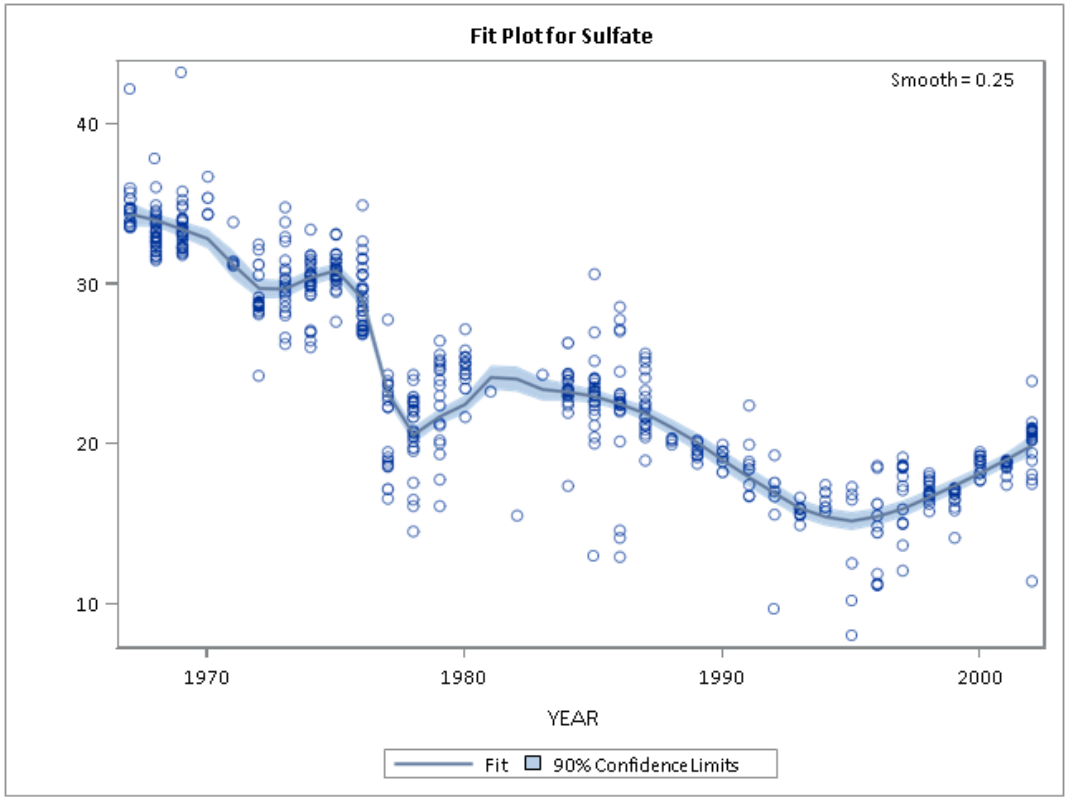








SO4 – Conesus


Fit Plot for Sulfate
Smooth = 0.25
40
30
20
10
1970
1980
1990
2000
YEAR
Fit
90% Confidence Limits

Global, Regional, Local

1959

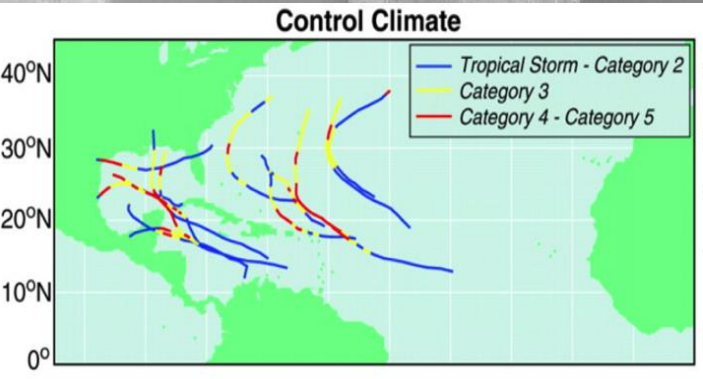
1971

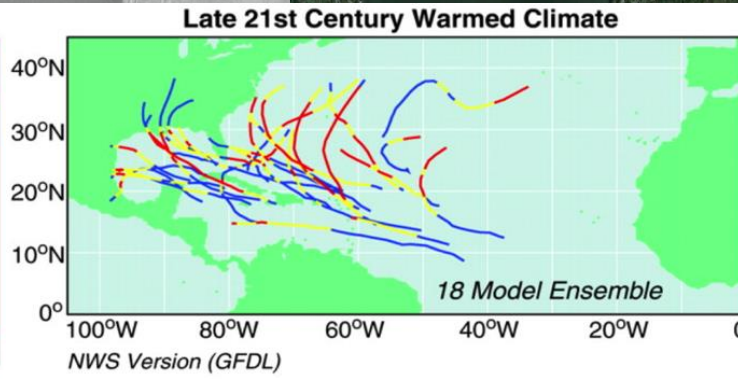
2021

Global forces – temperature (ice cover), winds, rain, upland

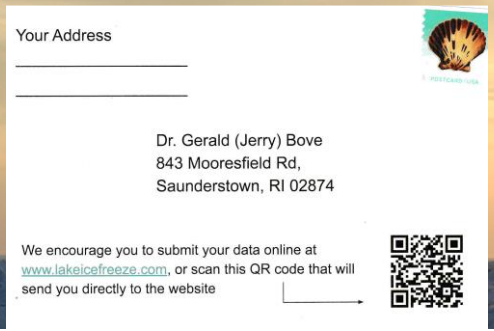
Regional and global forces – SO4

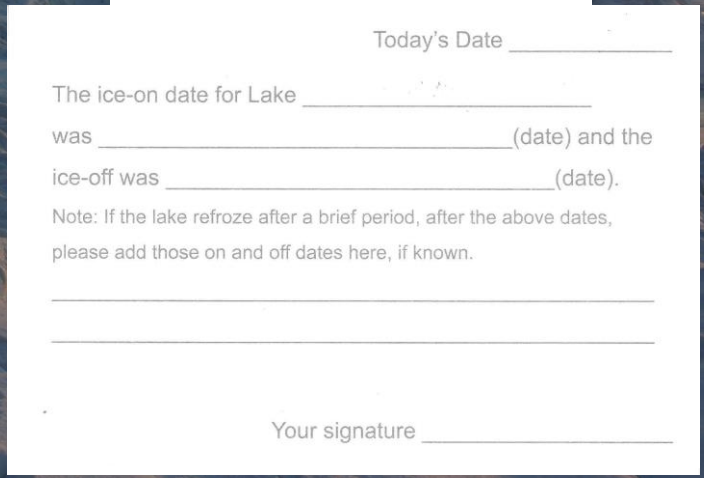
Local – Cl and other



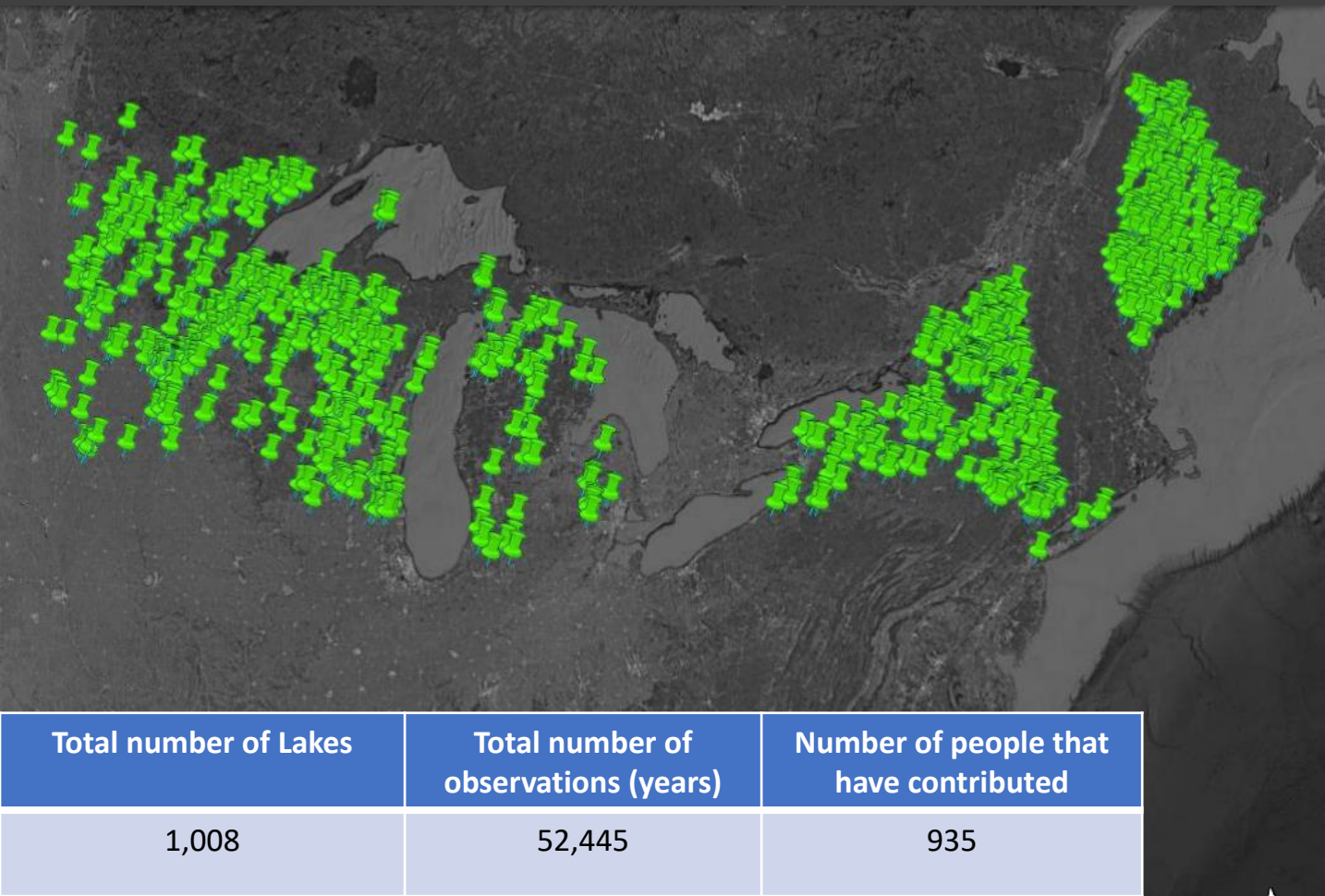


Community Lake Ice Collaboration (CLIC)





CLIC



Total number of Lakes	Total number of observations (years)	Number of people that have contributed
1,008	52,445	935

CLIC

Total number of Lakes	Total number of observations (years)	Number of people that have contributed
295	6,400+	213

CLIC in the Western Finger Lakes

	Average Freeze Dates (Standard Dev.)	
Lake	1989-2000	2001-2018
Canadice	1/8 (18)	1/13 (13)
Conesus	1/10 (18)	1/14 (14)
Hemlock	1/12 (16)	1/16 (14)
Honoeye	12/17 (13)	12/27 (17)
Blue Pond	12/23 (16)	1/2 (24)
	Average Thaw Dates (Standard Dev.)	
	1989-2000	2001-2018
Canadice	3/20 (17)	3/16 (34)
Conesus	3/19 (15)	3/17 (27)
Hemlock	3/20 (15)	3/14 (33)
Honoeye	3/17 (14)	3/15 (26)
Blue Pond	3/12 (15)	3/14 (22)
	Average Number of Days Frozen (Standard Dev.)	
	1989-2000	2002-2018
Canadice	73(27)	62(32)
Conesus	70(28)	64(31)
Hemlock	68(22)	57(30)
Honoeye	90(24)	79(33)
Blue Pond	80(28)	73(38)

Thoughts on impacts

- Changes in ion concentrations are occurring with other rapid changes
- Synergistic effects?
- Other populations (ex. bees?)

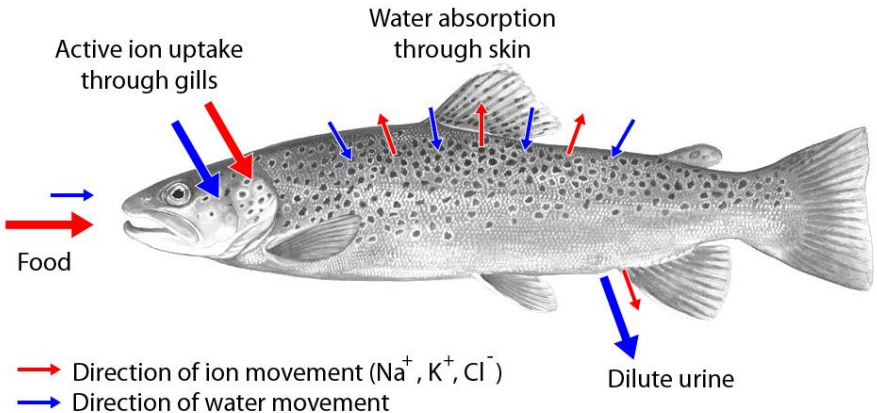


Image: Raver, Duane; modified by Biezl translation improved by User:smartse - NOAA. Transferred from en.wikipedia to Commons by User:Quadell using CommonsHelper., Public Domain, https://commons.wikimedia.org/w/index.php?curid=16466092

Global, Regional, Local

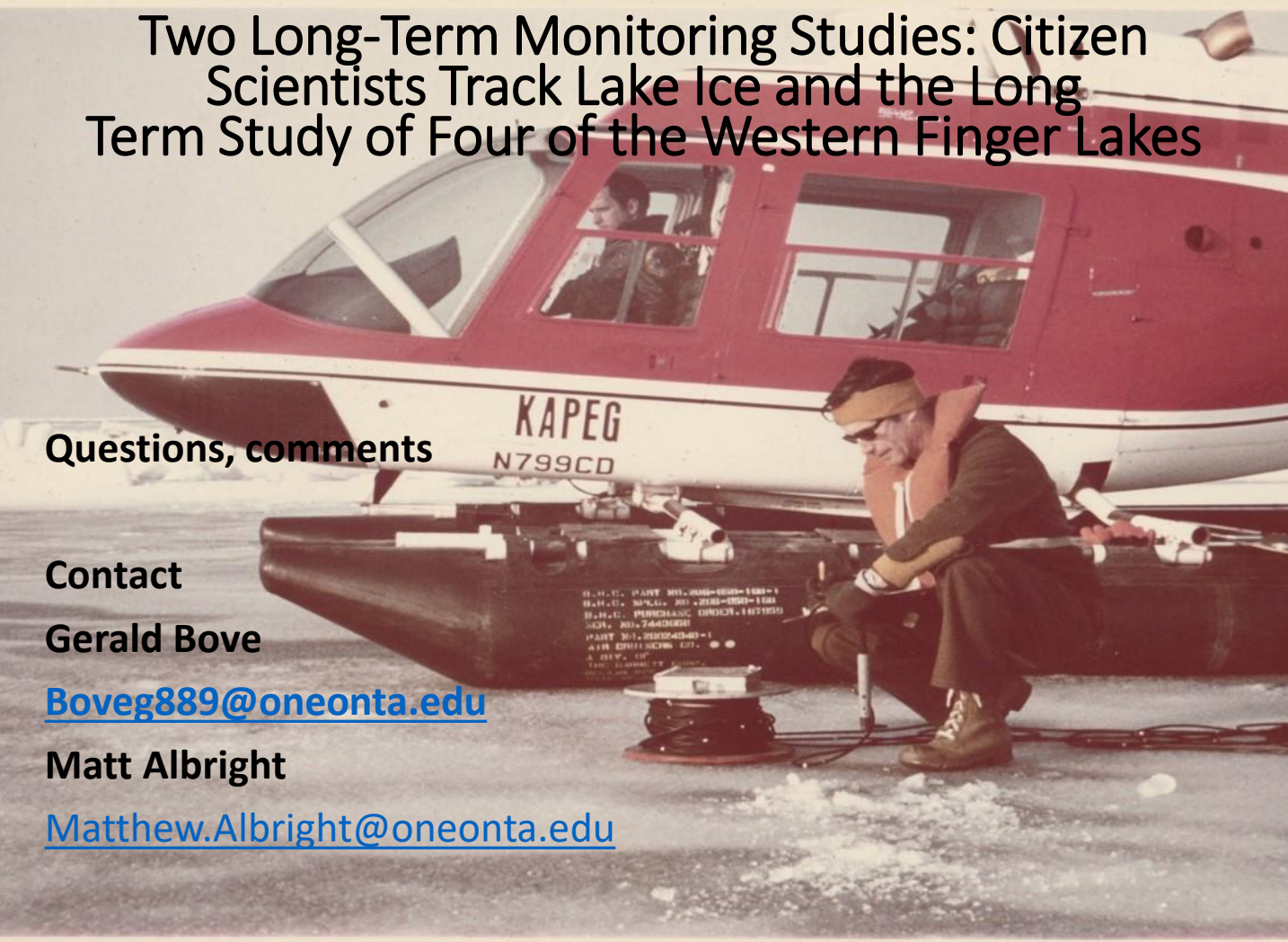
Not all changes have negative impacts

Thoughts from experience of LTER

Current state of projects – ongoing but in need of support –

1. **Several hundred samples left to analyze**
2. **Recruitment needed (“loss to follow-up”)**
3. **Equipment and supplies**
4. **CLIC - What are we really doing ?**
5. **What questions can we ask of these data?**

Two Long-Term Monitoring Studies: Citizen Scientists Track Lake Ice and the Long Term Study of Four of the Western Finger Lakes



Questions, comments

Contact

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Matt Albright

Matthew.Albright@oneonta.edu