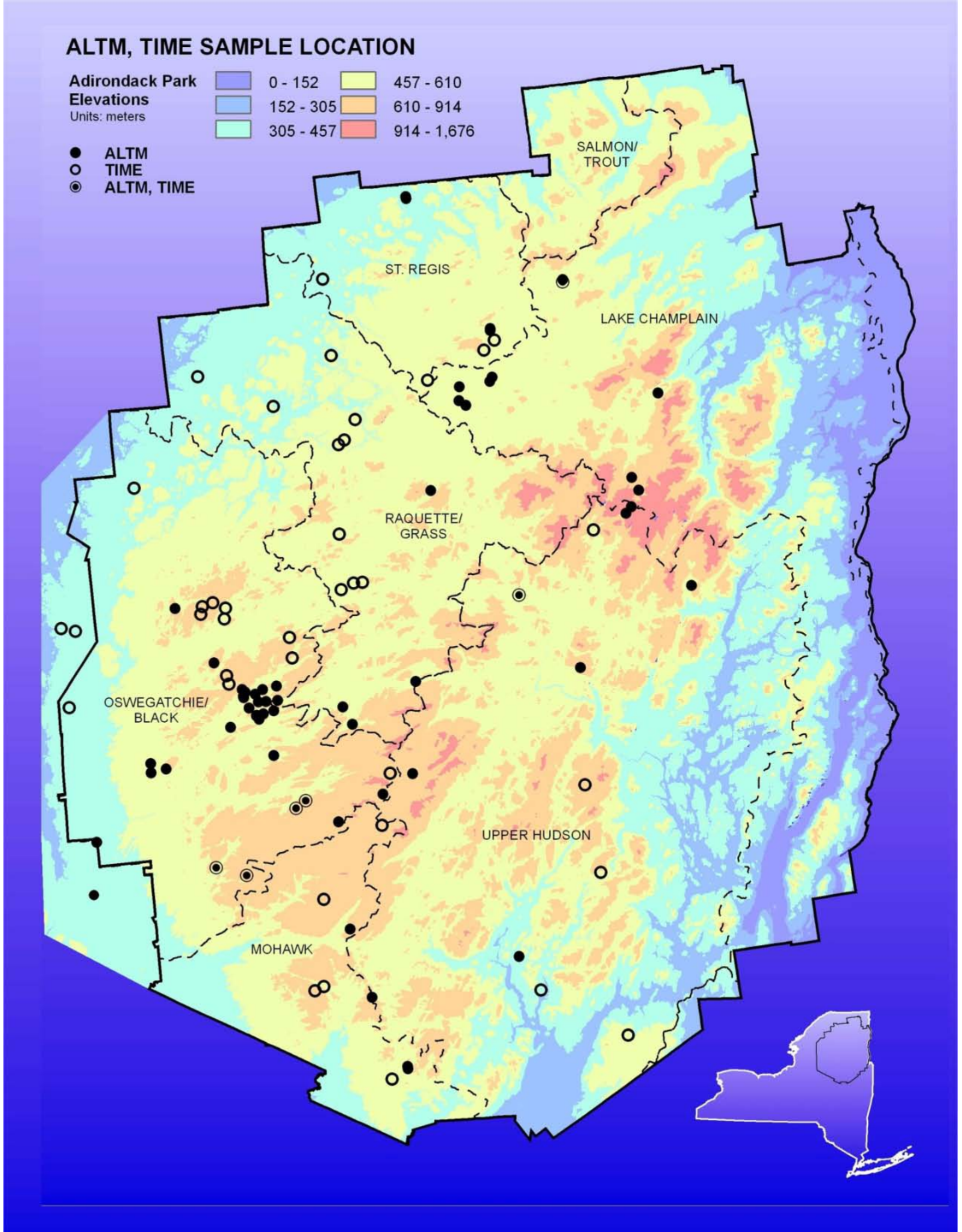
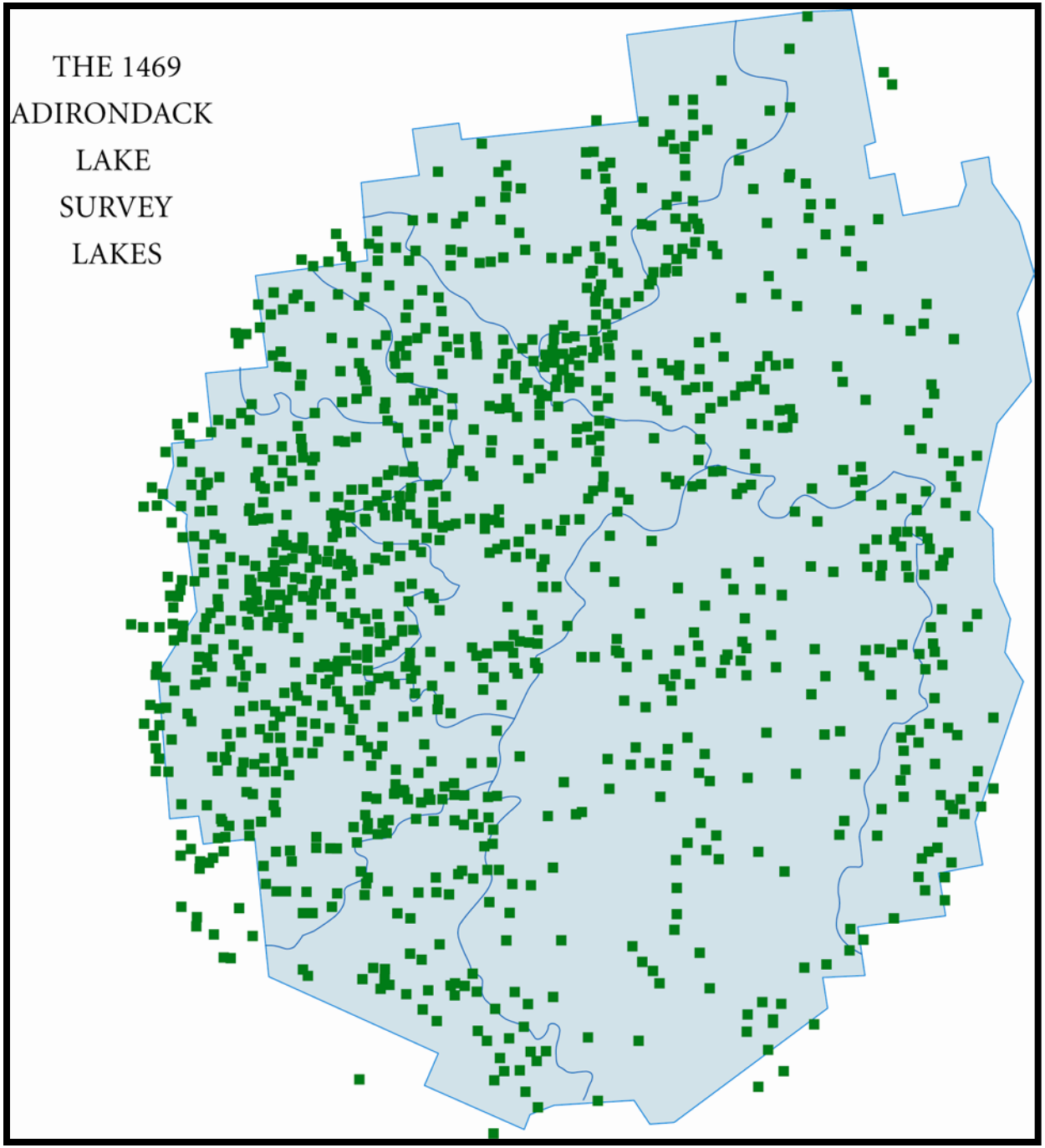
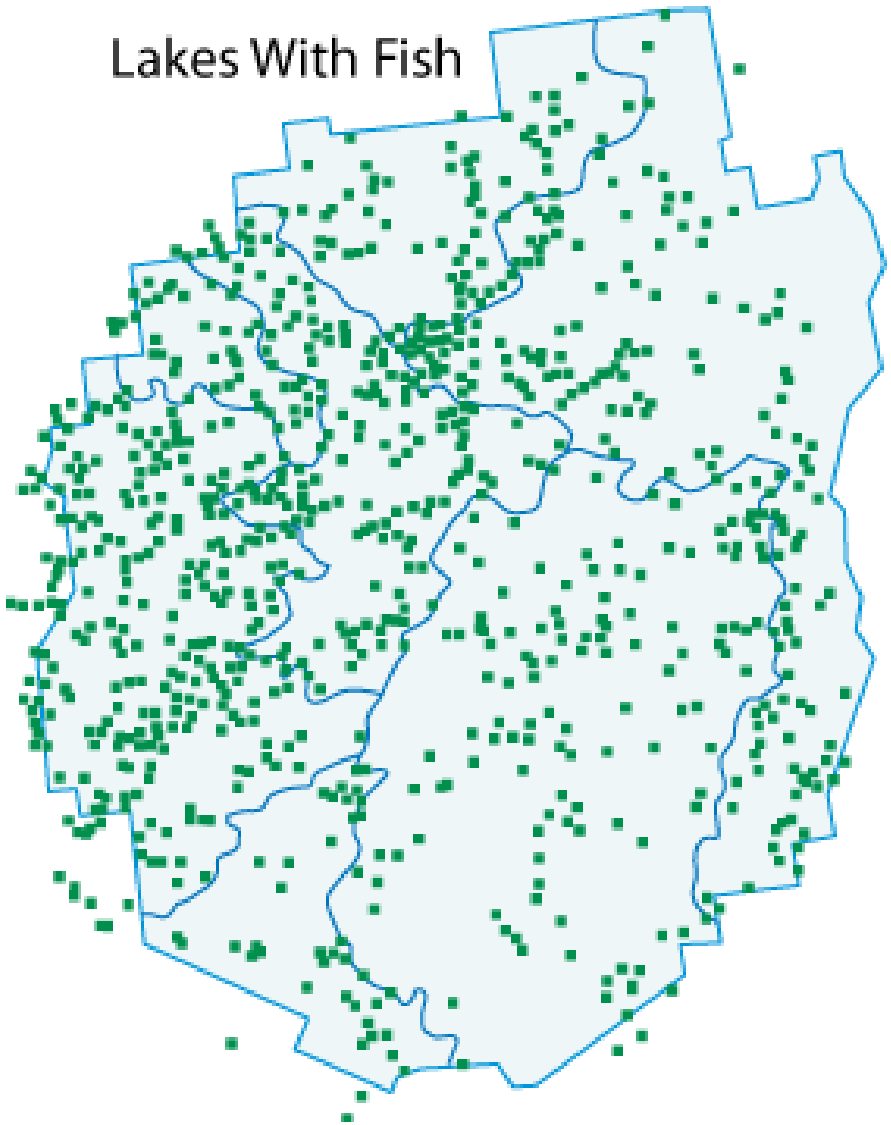
Changes in Fish Communities in Adirondack Lakes

Karen Roy[1], Arthur Bulger[2], and Charles Driscoll[3]

[1]New York State Department of Environmental Conservation
[2]University of Virginia
[3]Syracuse University


ALTM, TIME SAMPLE LOCATION
Adirondack Park Elevations
Units: meters
0 - 152
152 - 305
305 - 457
457 - 610
610 - 914
914 - 1,676
ALTM
TIME
ALTM, TIME
SALMON/ TROUT
ST. REGIS
LAKE CHAMPLAIN
RAQUETTE/ GRASS
OSWEGATCHIE/ BLACK
UPPER HUDSON
MOHAWK


THE 1469
ADIRONDACK
LAKE
SURVEY
LAKES


Lakes With Fish

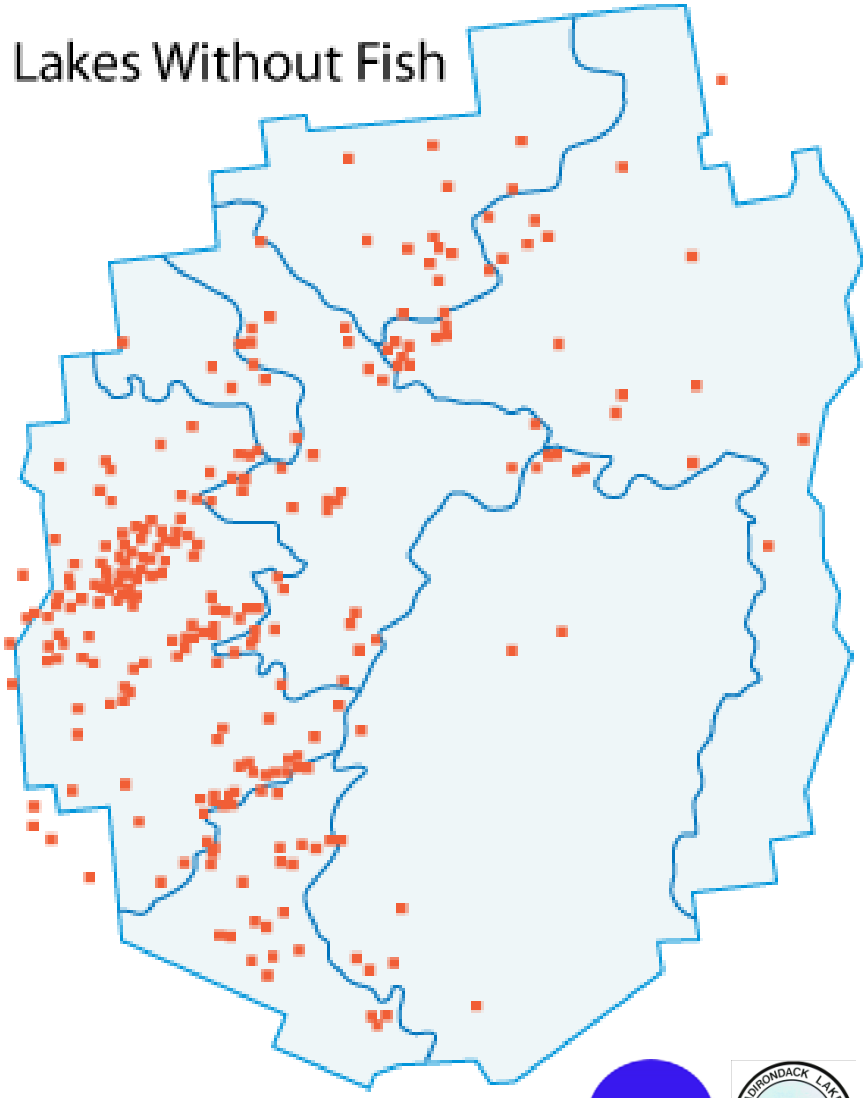
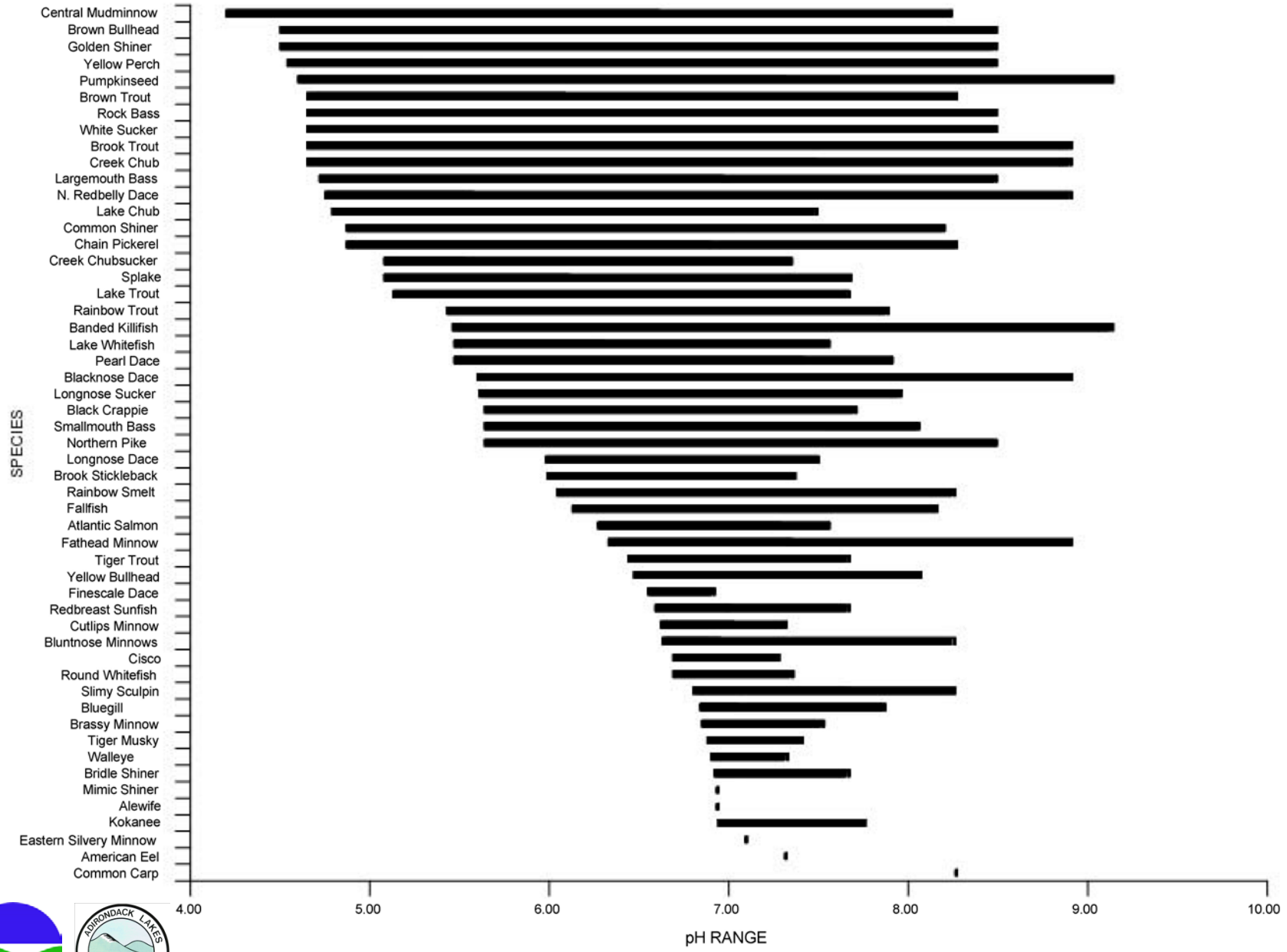

Lakes Without Fish

Figure 1. pH ranges for fish species collected in surveyed waters based on spring and fall chemistry samples Adirondack Lakes Survey (ALS) of 1469 waters (Kretser et al. 1989, table 3-9) from1984-1987



Adirondack fisheries surveys

	Lakes	Fish species	Comments
Broad survey (ALS)			**Broadly tolerant and pH sensitive;**
1984 - 1987	**1469**	**53**	**Sensitive minnows (13);**
			Spring, fall surveys (gill, trap nets).
This study (ALTM)			
1984 - 1987	**42**	**27**	**Broadly tolerant and pH sensitive;**
1995 - 2005	**42**	**29**	**Sensitive minnows (8).**
			Spring, fall surveys (gill,trap nets).
		32	**Of the 53 species found in the region, 32 were found in either survey during the study.**

24 lakes (57%) no stocking ever or since 1975.

18 lakes stocked since 1979. Possible effect in 6 lakes.

Fish population changes (n=42)

Period of Study	All lakes	Median*	Mean*	Maximum*
1984 - 1987	141	3	3.36	10
1995 - 2005	169	4	4.02	12
Change	+28	+1	< 1	+2
*per lake				

Fish species change between surveys by response category.

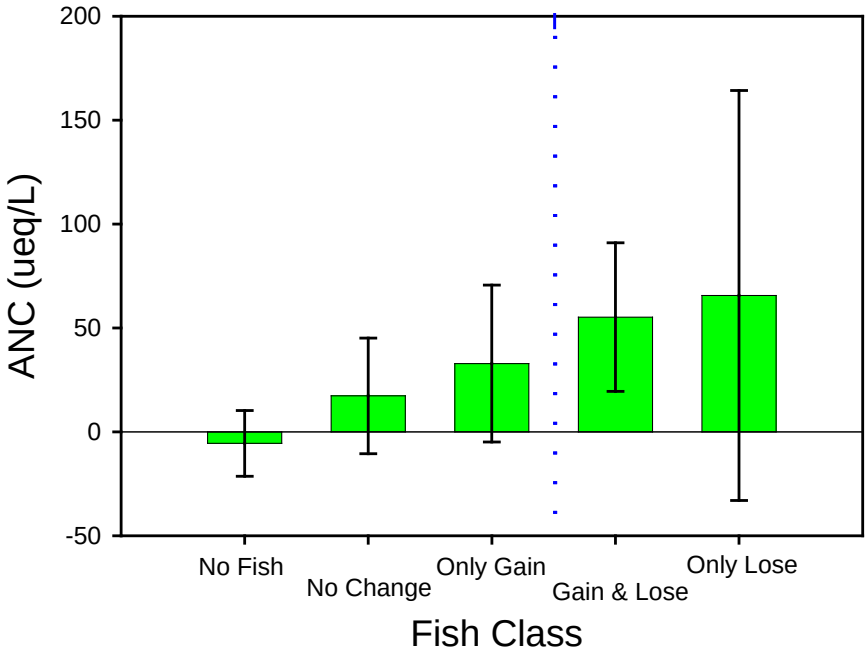
	n	Total species mean	Species change net	Species change ranges	pH median
No fish					
1984-1987	9	0		0	4.71
1994-2005		0	0	0	4.64
No change					
1984-1987	7	1.71		1-4	5.06
1994-2005		1.71	0	1-4	5.29
Gain only					
1984-1987	14	4.3		1-4	5.75
1994-2005		6.2	+1.9	1-4	6.07
Lost only					
1984-1987	4	3.00		1-2	6.34
1994-2005		1.75	-1.25	1-2	6.26
Gain/lost					
1984-1987	8	7.13		(+) 1-4	6.22
1994-2005		7.88	+0.9	(-) 1-4	6.45

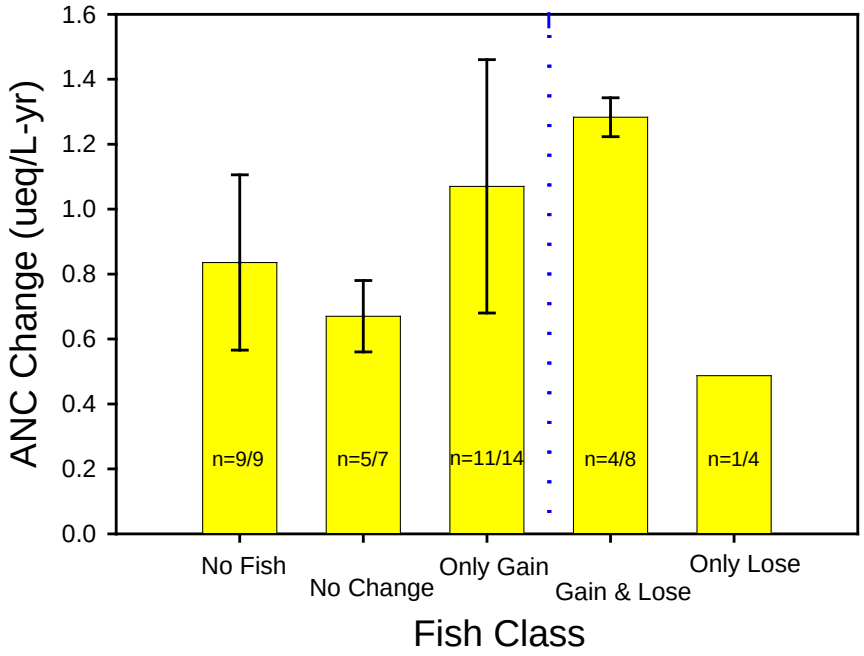
Fish species change between surveys by response category.

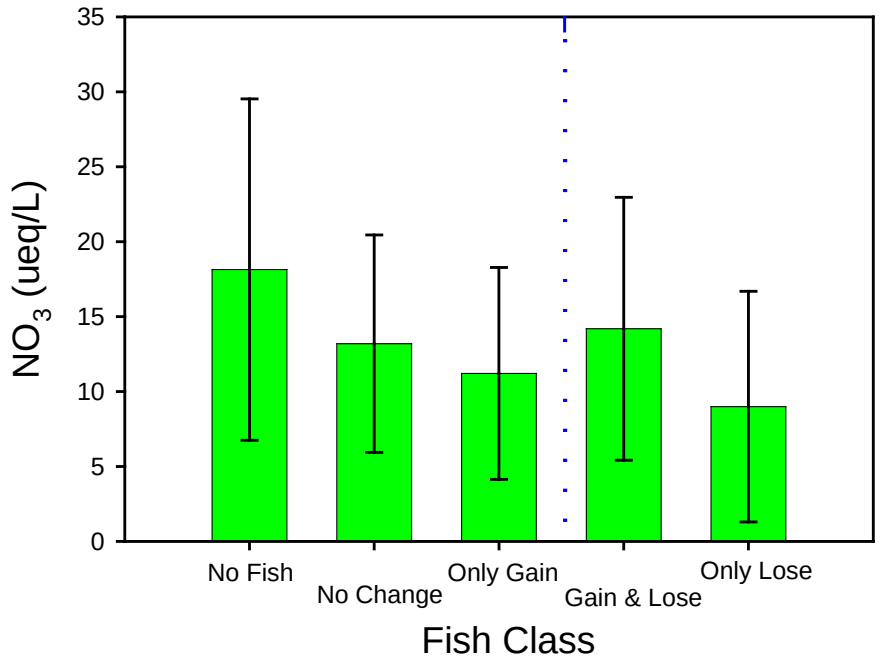
	n	Total species mean	Species change net	Species change ranges	pH median
No fish					
1984-1987	9	0		0	4.71
1994-2005		0	0	0	4.64
No change					
1984-1987	7	1.71		1-4	5.06
1994-2005		1.71	0	1-4	5.29
Gain only					
1984-1987	14	4.3		1-4	5.75
1994-2005		6.2	+1.9	1-4	6.07
Lost only					
1984-1987	4	3.00		1-2	6.34
1994-2005		1.75	-1.25	1-2	6.26
Gain/lost					
1984-1987	8	7.13		(+) 1-4	6.22
1994-2005		7.88	+0.9	(-) 1-4	6.45

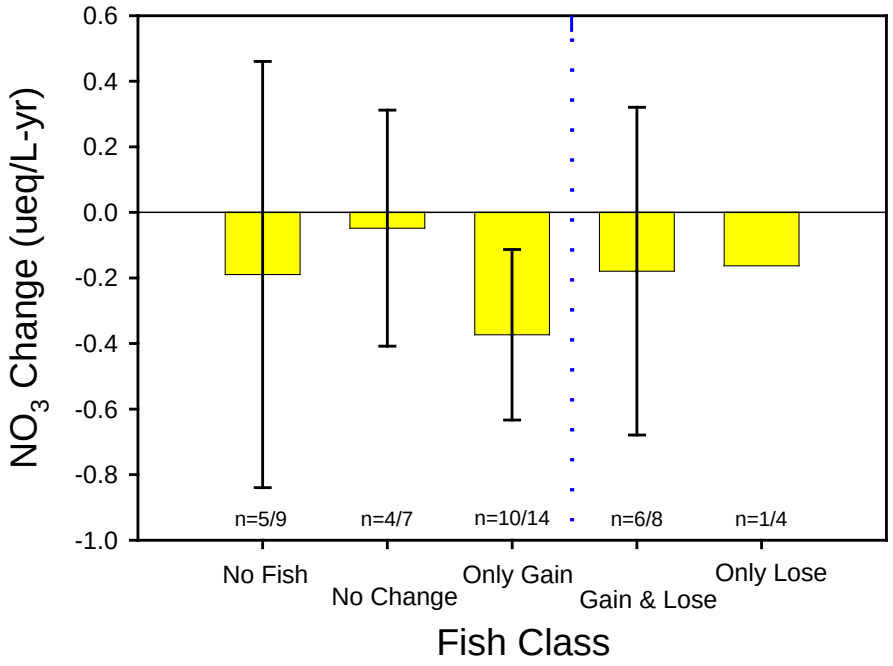
Changes in Fish in Adirondack Lakes (n=42)

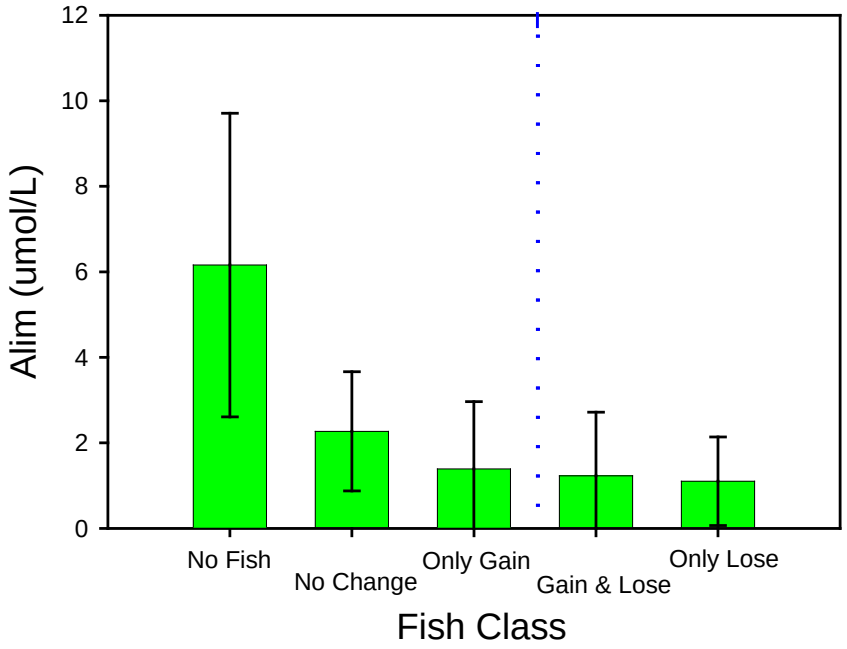
				Species Richness		
Category	**n**	**Median pH**	**Volume (10^4 m^3)**	**1984-87**	**1994-2005**	**Δ**
No fish	9	4.7 – 4.6	46	0	0	0
No change	7	5.1 - 5.3	100	1.7	1.7	0
Only gained	14	5.5 - 5.7	198	4.3	6.2	+1.9
Only lost	4	6.3 - 6.3	56	3.0	1.75	-1.25
Gained and lost	8	6.2 - 6.5	350	7.1	7.9	+0.9

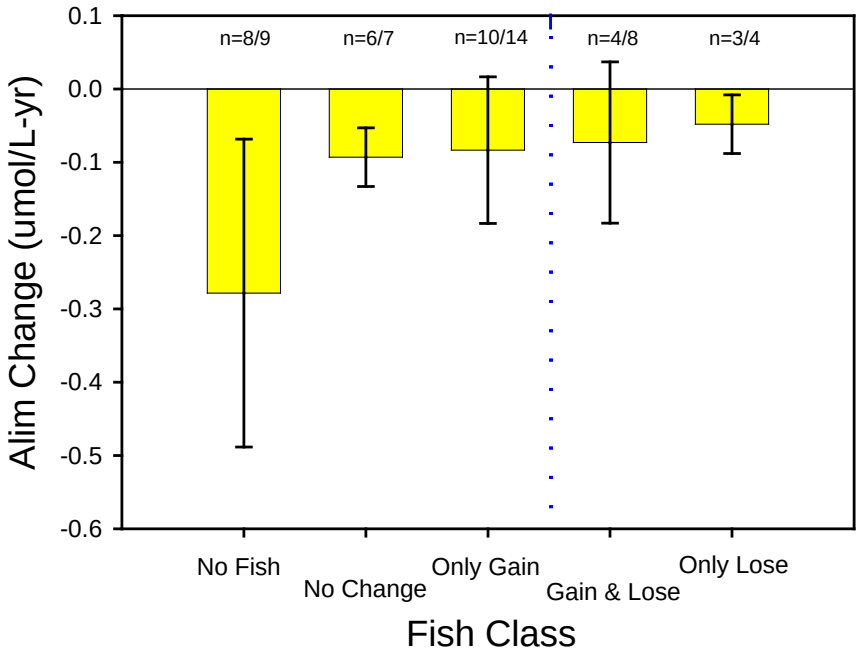

200
150
100
50
0
-50
ANC (ueq/L)
No Fish
No Change
Only Gain
Gain & Lose
Only Lose
Fish Class

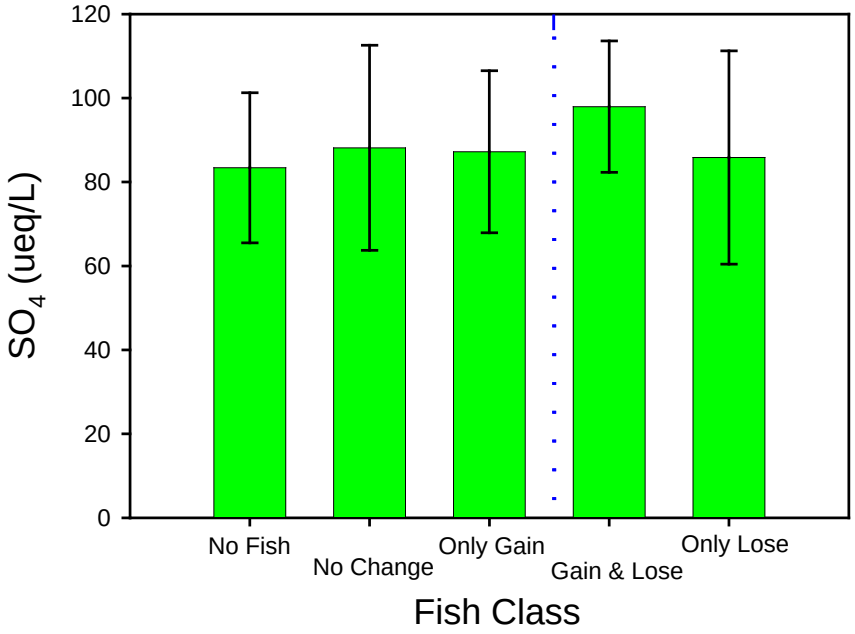

1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
ANC Change (ueq/L-yr)
n=9/9
n=5/7
n=11/14
n=4/8
n=1/4
No Fish
No Change
Only Gain
Gain & Lose
Only Lose
Fish Class

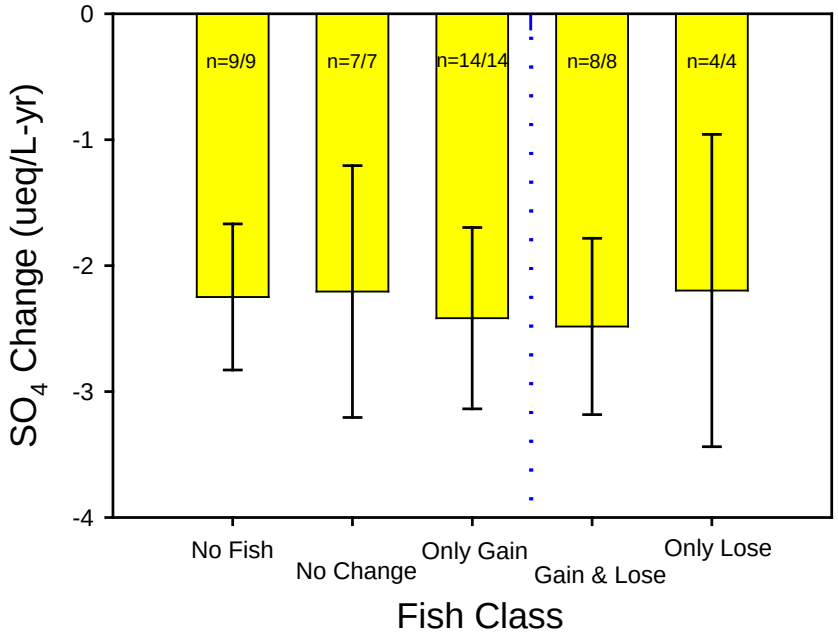

35
30
25
20
15
10
5
0
NO_3 (ueq/L)
No Fish
No Change
Only Gain
Gain & Lose
Only Lose
Fish Class


0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
NO_3 Change (ueq/L-yr)
n=5/9
n=4/7
n=10/14
n=6/8
n=1/4
No Fish
No Change
Only Gain
Gain & Lose
Only Lose
Fish Class


Alim (umol/L)
12
10
8
6
4
2
0
No Fish
No Change
Only Gain
Gain & Lose
Only Lose
Fish Class


Alim Change (umol/L-yr)
0.1
0.0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
n=8/9
n=6/7
n=10/14
n=4/8
n=3/4
No Fish
No Change
Only Gain
Gain & Lose
Only Lose
Fish Class


120
100
80
60
40
20
0
SO_4 (ueq/L)
No Fish
No Change
Only Gain
Gain & Lose
Only Lose
Fish Class

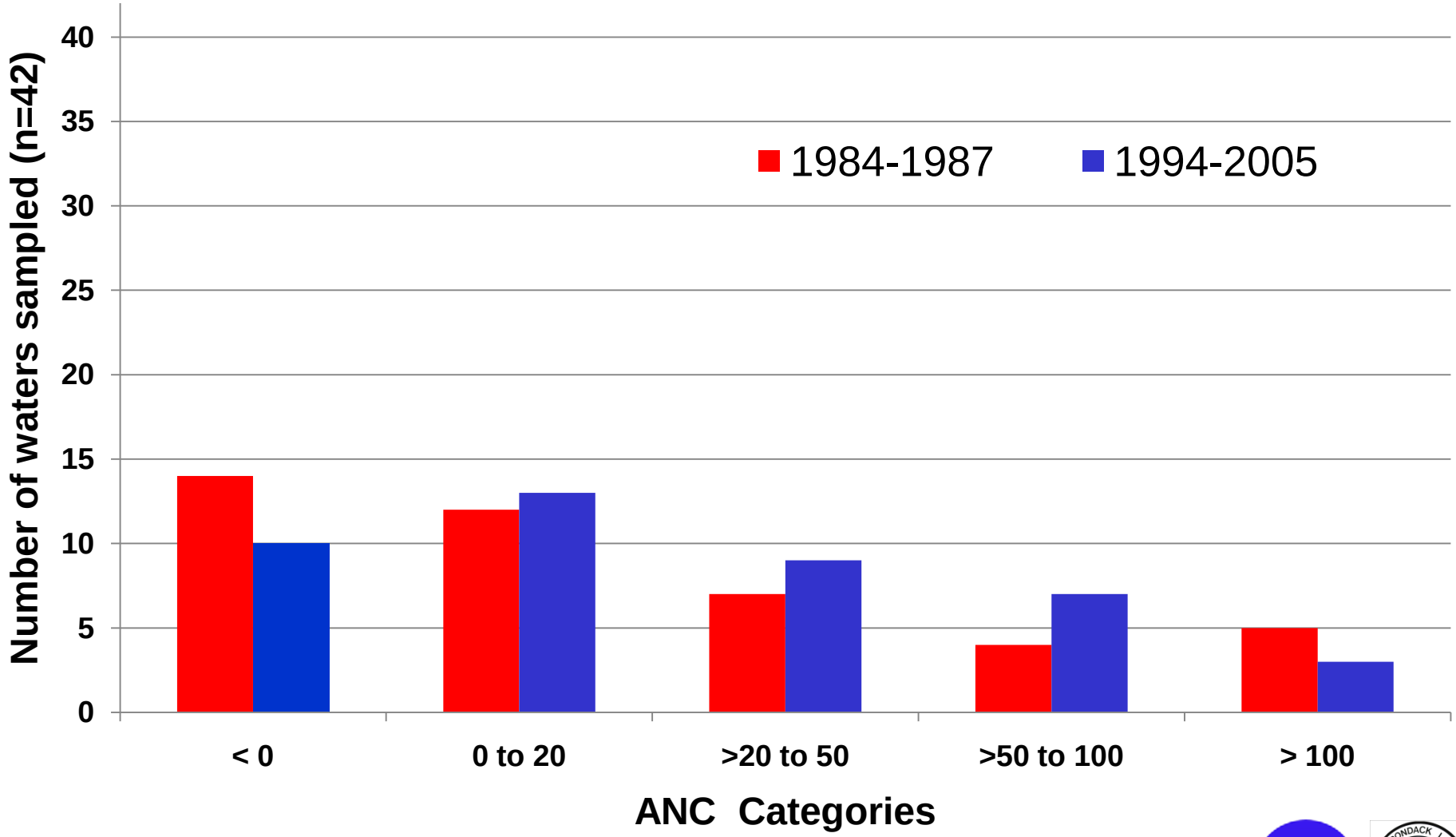

0
-1
-2
-3
-4
SO_4 Change (ueq/L-yr)
n=9/9
n=7/7
n=14/14
n=8/8
n=4/4
No Fish
No Change
Only Gain
Gain & Lose
Only Lose
Fish Class

Populations of potential indicator minnows found in both surveys.

Species	ALS Sensitive Minnows	ALS Minimum pH	ALS Total lakes (%) of all 1469 lakes	This study	1984 - 1987	1995 -2005
Common Shiner	x	4.86	156	x	6	9
Pearl Dace	x	5.46	58	x	1	0
Blacknose Dace	x	5.59	47	x	1	4
Longnose Sucker	x	5.60	9	x	1	1
Fallfish	**x**	**6.12**	**29 (2%)**	**x**	**0**	**1**
Finescale Dace	x	6.54	2 (<1%)			
Fathead Minnow	**x**	**6.32**	**40 (3%)**	**x**	**0**	**2**
Cutlips Minnow	x	6.61	11 (<1%)	x	1	1
Bluntnose Minnow	**x**	**6.62**	**46 (3%)**	**x**	**1**	**1**
Brassy Minnow	x	6.84	3 (<1%)			
Bridle Shiner	x	6.91	3 (<1%)			
Mimic Shiner	x	6.92	1 (<1%)			
Eastern Silvery Minnow	x	7.08	1 (<1%)			

Note: Highlighted species are more pH sensitive; **bold** are more commonly occurring and are potential indicator species.

ANC changes over study period



Conclusions

- There are signs of response/recovery in fish species number in some ALTM lakes over the 14 year interval (1984-87 and 1994-2005);
- The response is modest and mixed, and generally consistent with chemistry trends (ANC, NO_3 and Al_{im});
- The greatest species gains occurred in moderately sized lakes with pH 5.5 – 6.0;
- Fish community sensitivity indices were created along with possible sensitive minnow indicators (fallfish, fathead minnow and bluntnose minnow);
- The majority of lakes are still below critical chemistry indicators (e.g. ANC less than 50 µeq/L);
- Resurveys continuing with a 3rd round 2008-2012.

Acknowledgements

Adirondack Lakes Survey Corporation (ALSC) staff

New York State Department of Environmental Conservation

New York State Energy Research and Development Authority (NYSERDA) Environmental Monitoring, Evaluation and Protection program

USEPA Temporally Integrated Monitoring of Ecosystems and Long Term Monitoring (TIME/LTM) program

C. Driscoll and K. Driscoll, Syracuse University, NY

G. Lawrence, US Geological Survey, Troy, NY

Special thanks to

A. Bulger, University of Virginia

H. Simonin, NYSDEC Fisheries

B. Baldigo, USGS, Troy, NY

C. Kraft, Cornell University


www.adirondacklakessurvey.org