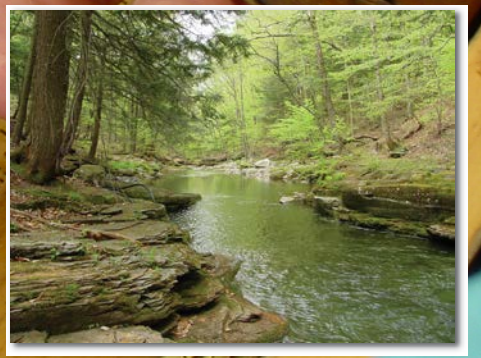
A Clean Air Act Success: Indicators of Recovery in Fish Assemblages and Water Quality from Acidified Streams of the Catskill and Adirondack Mountains, New York



B.P. Baldigo, S.D. George, M.R. McHale, and G.B. Lawrence
U.S. Geological Survey, NY Water Science Center, Troy, NY

RONDOUT NEVERSINK STREAM PROGRAM
SULLIVAN COUNTY SOIL & WATER CONSERVATION DISTRICT

NYC Environmental Protection

NEW YORK STATE OF OPPORTUNITY. NYSERDA

USGS science for a changing world

A Clean Air Act success story: Signs of recovering

Environmental Pollution 229 (2017) 607–620

Contents lists available at ScienceDirect

Environmental Pollution

journal homepage: www.elsevier.com/locate/envpol

The response of soil and stream chemistry to decreases in acid deposition in the Catskill Mountains, New York, USA☆

Michael R. McHale*, Douglas A. Burns, Jason Siemion, Michael R. Antidormi

U.S. Geological Survey, New York Water Science Center, 425 Jordan Rd., Troy, NY 12180, United States

ARTICLE INFO

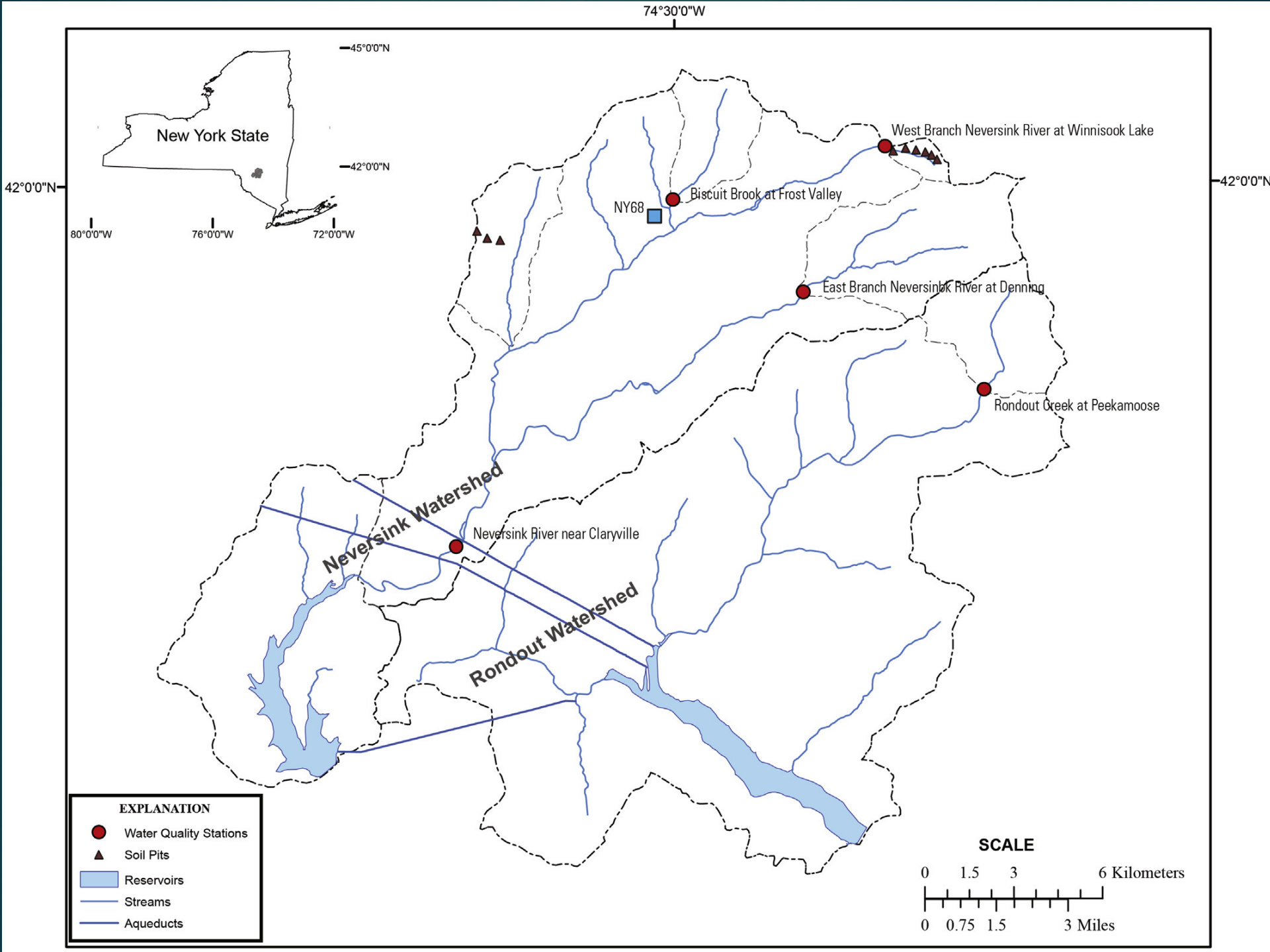
Article history:
Received 12 January 2017
Received in revised form

ABSTRACT

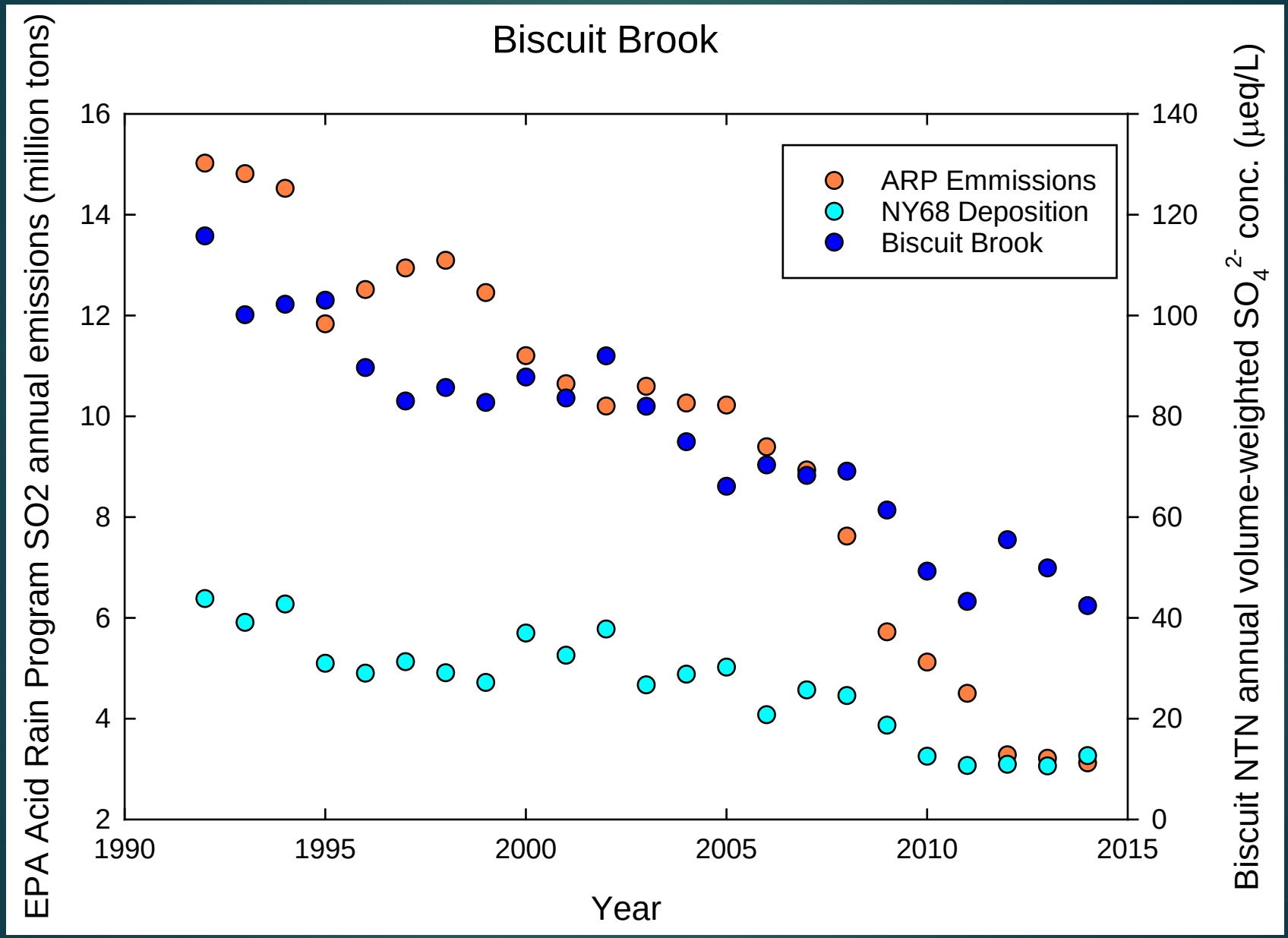
The Catskill Mountains have been adversely impacted by decades of acid deposition, however, since the early 1990s, levels have decreased sharply as a result of decreases in emissions of sulfur dioxide and nitrogen oxides. This study examines trends in acid deposition, stream-water chemistry, and soil

B.P. Baldigo, S.D. George, M.R. McHale, and G.B. Lawrence
U.S. Geological Survey, New York Water Science Center, Troy, NY

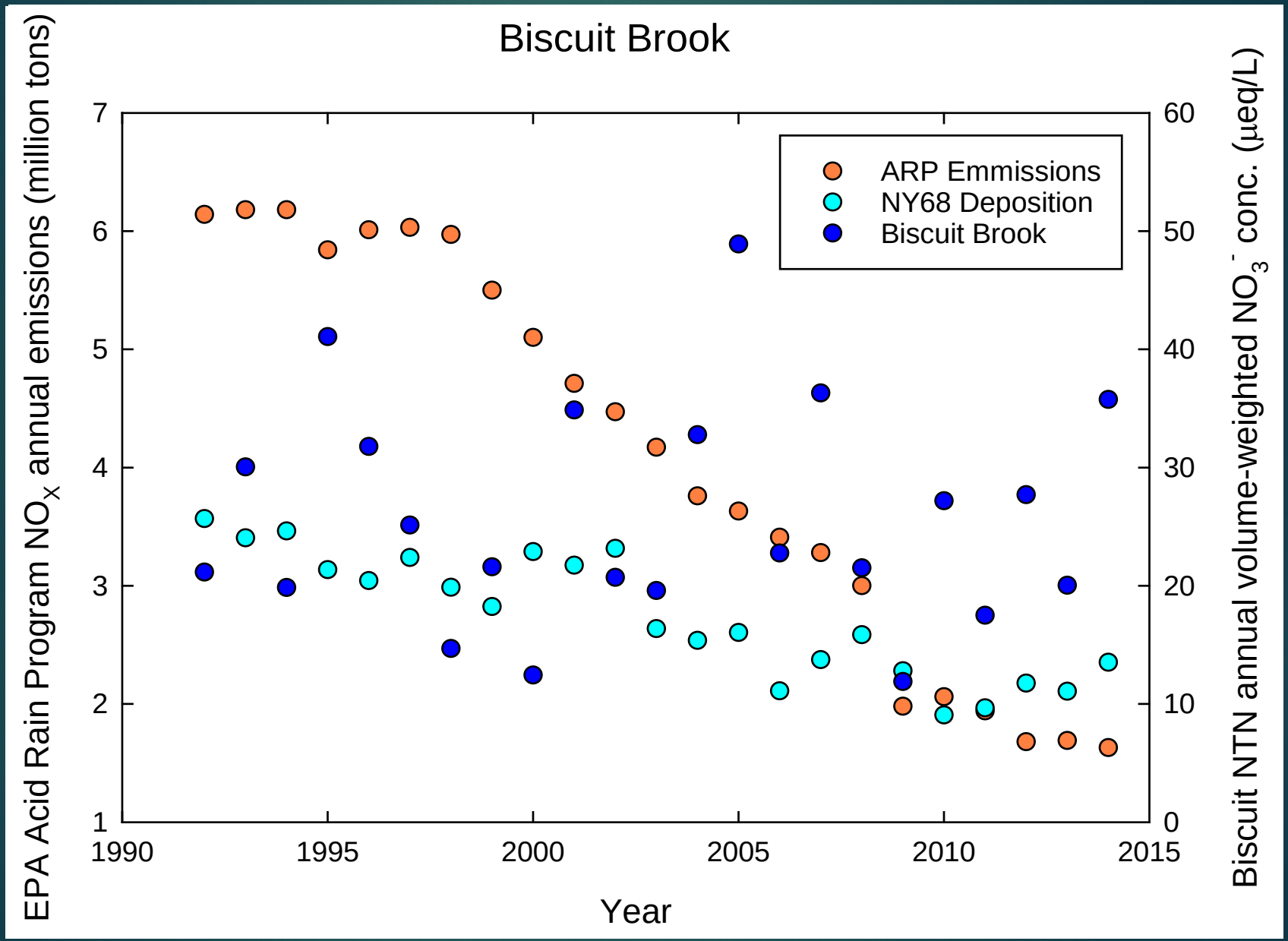
science for a changing world


74°30'0"W
42°0'0"N
45°0'0"N
42°0'0"N
New York State
80°0'0"W
76°0'0"W
72°0'0"W
West Branch Neversink River at Winnisook Lake
Biscuit Brook at Frost Valley
NY68
East Branch Neversink River at Denning
Rondout Creek at Peekamoose
Neversink Watershed
Neversink River near Claryville
Rondout Watershed
EXPLANATION
Water Quality Stations
Soil Pits
Reservoirs
Streams
Aqueducts
SCALE
0 1.5 3 6 Kilometers
0 0.75 1.5 3 Miles

Sulfur trends



Nitrogen trends



74°30'0"W

74°30'0"W

74°20'0"W

42°

42°0'0"N

.ake

loose

ometers

EAGLE MOUNTAIN

BIG INDIAN MOUNTAIN

PANTHER MOUNTAIN

GIANT LEDGE

FORK RIDGE

Oliverea-Slide Mountain Rd

1178 m

WOODPECKER RIDGE

BEAVER SLIDE RANGE

KILLEVENGER RANGE

Frost Valley Rd

1277 m

WILDCAT MOUNTAIN

West Branch Neversink River

East Branch Neversink River

BLACKMOOSE MOUNTAIN

Catskill Forest Preserve

Pole Rd

Blackmoose Rd

Watson Hollow Rd

839 m

HILL

DENMAN MOUNTAIN

BANGLE HILL

SPENCERS

POPLE HILL

FLAT HILL

STEINY HILL

Creek

Rondout

Greenville Rd

Sundown

EAST MOUNTAIN

Grahamsville

Main St

B W S Rd

Yagerville Rd

Neversink

Neversink Reservoir

Neversink Rd

SOUTH HILL

Rondout Reservoir

Ulster Heights

wb04

wb05

bs01

wb03

ds01

oc02

eb06

eb03

ebevr

wbcb

wb02

eb02

ebbhl

eb01

wb01

rc05

rc04

rc03

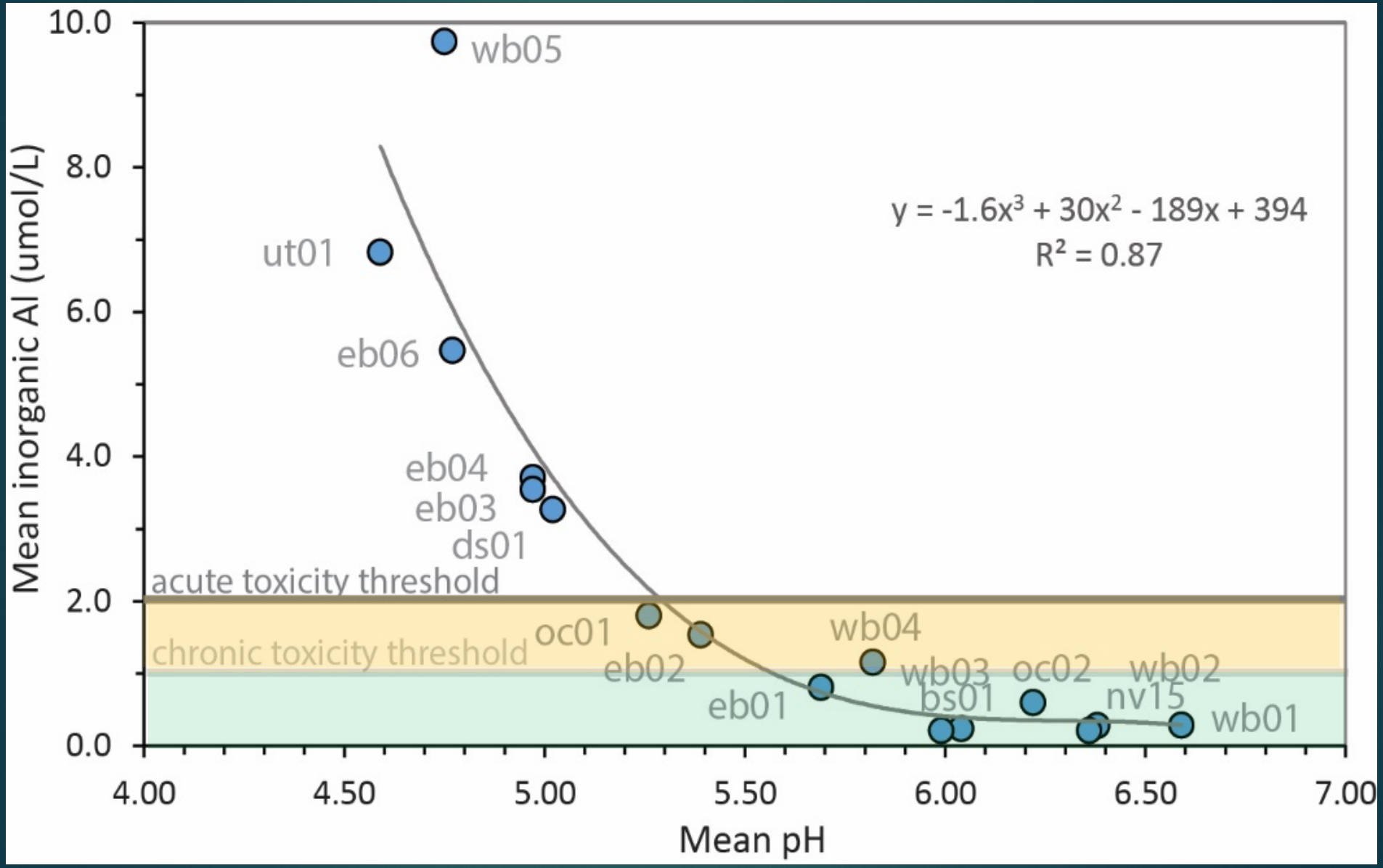
nv15

rcsrr

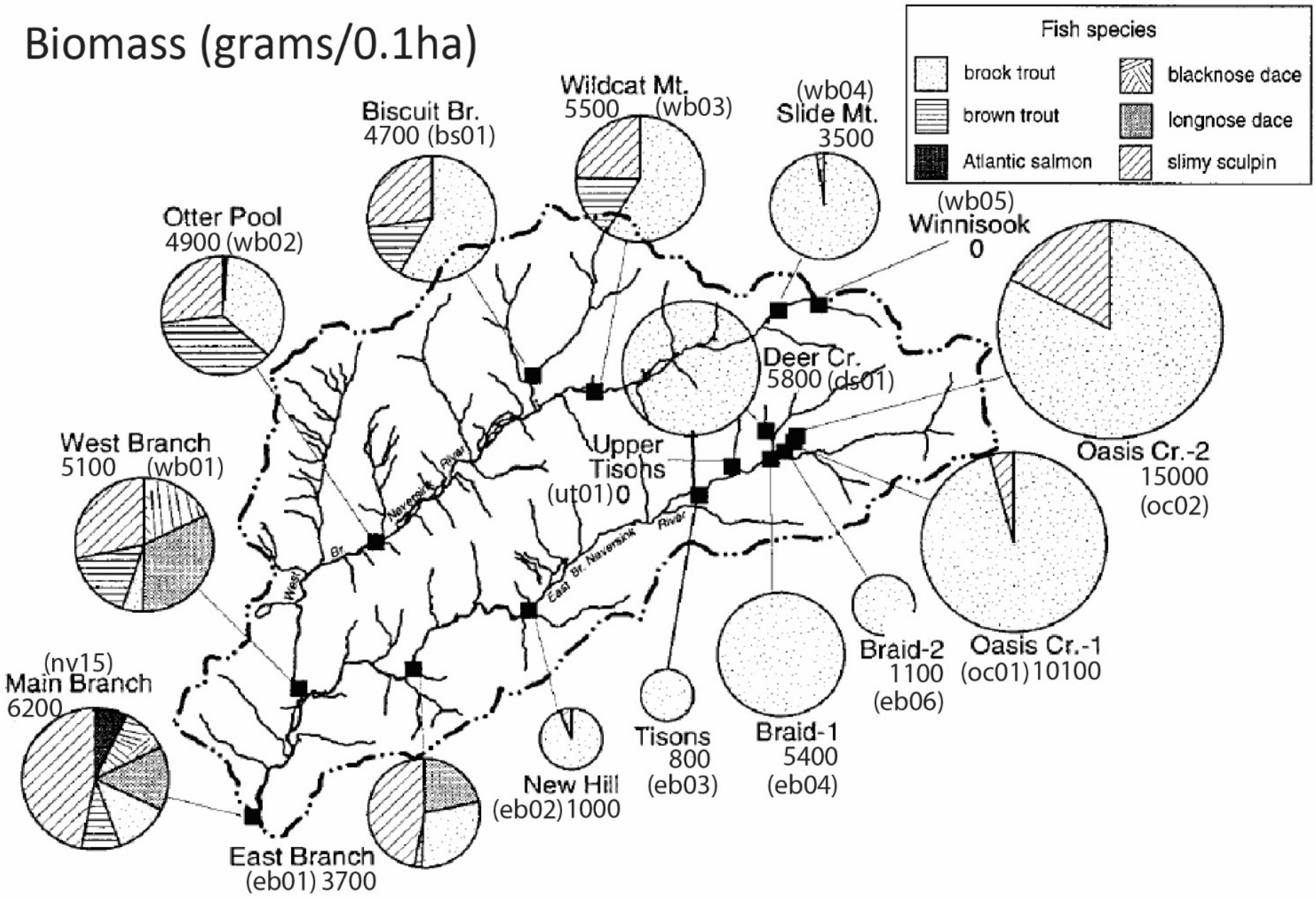
rc02

rc01

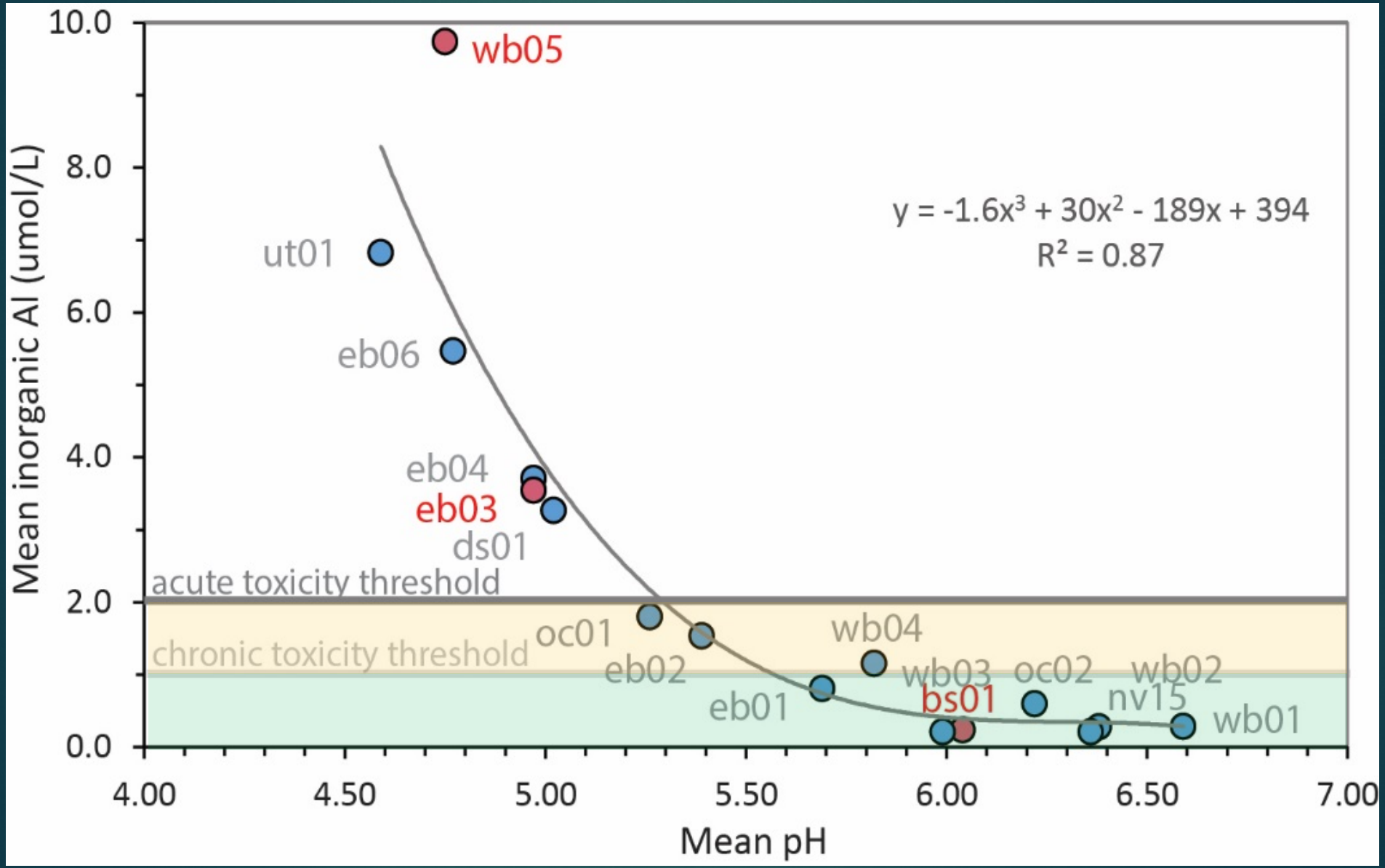
Relationship between pH and inorganic aluminum at Neversink River sites, 1991-93



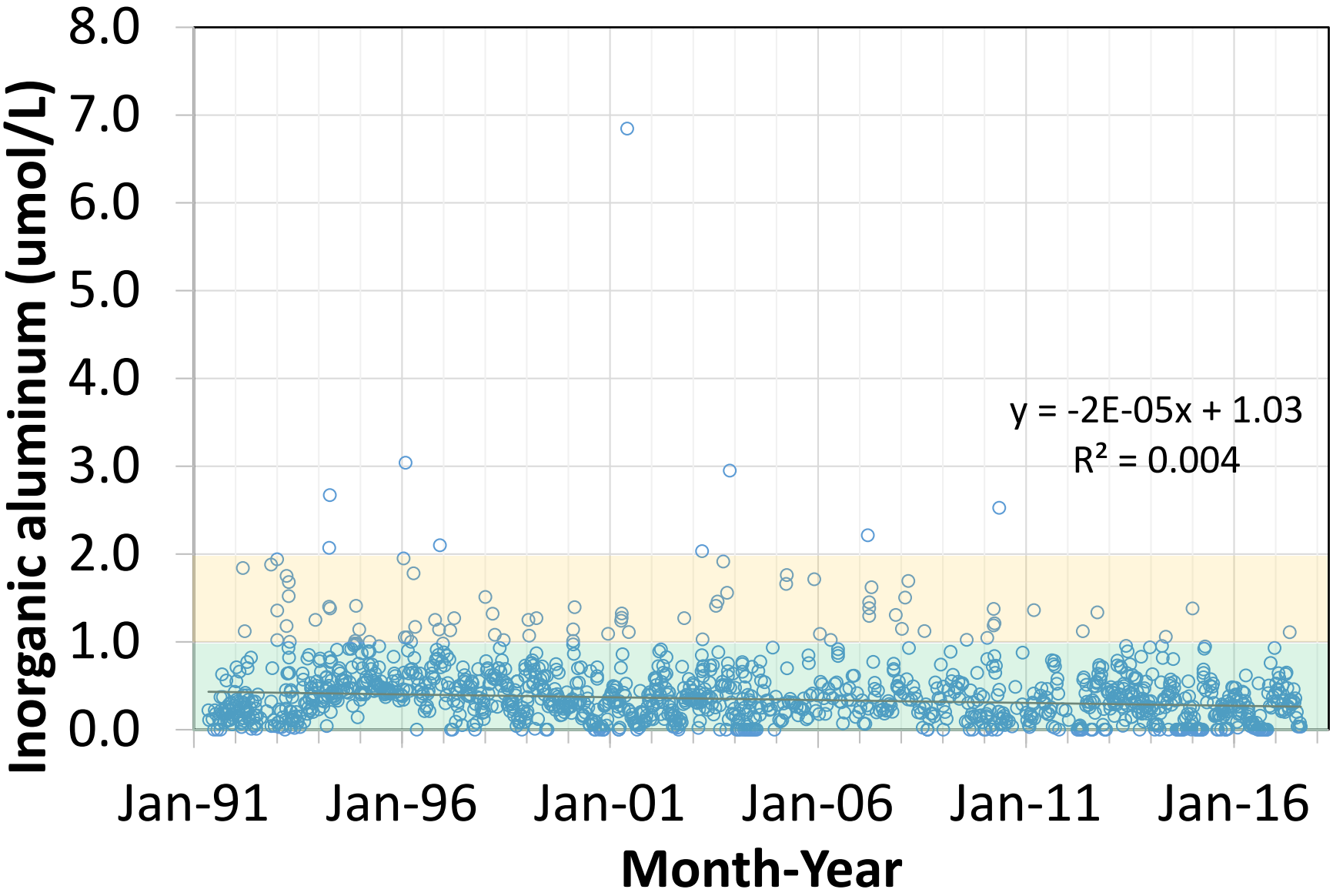
Community Biomass in Neversink 1991-93



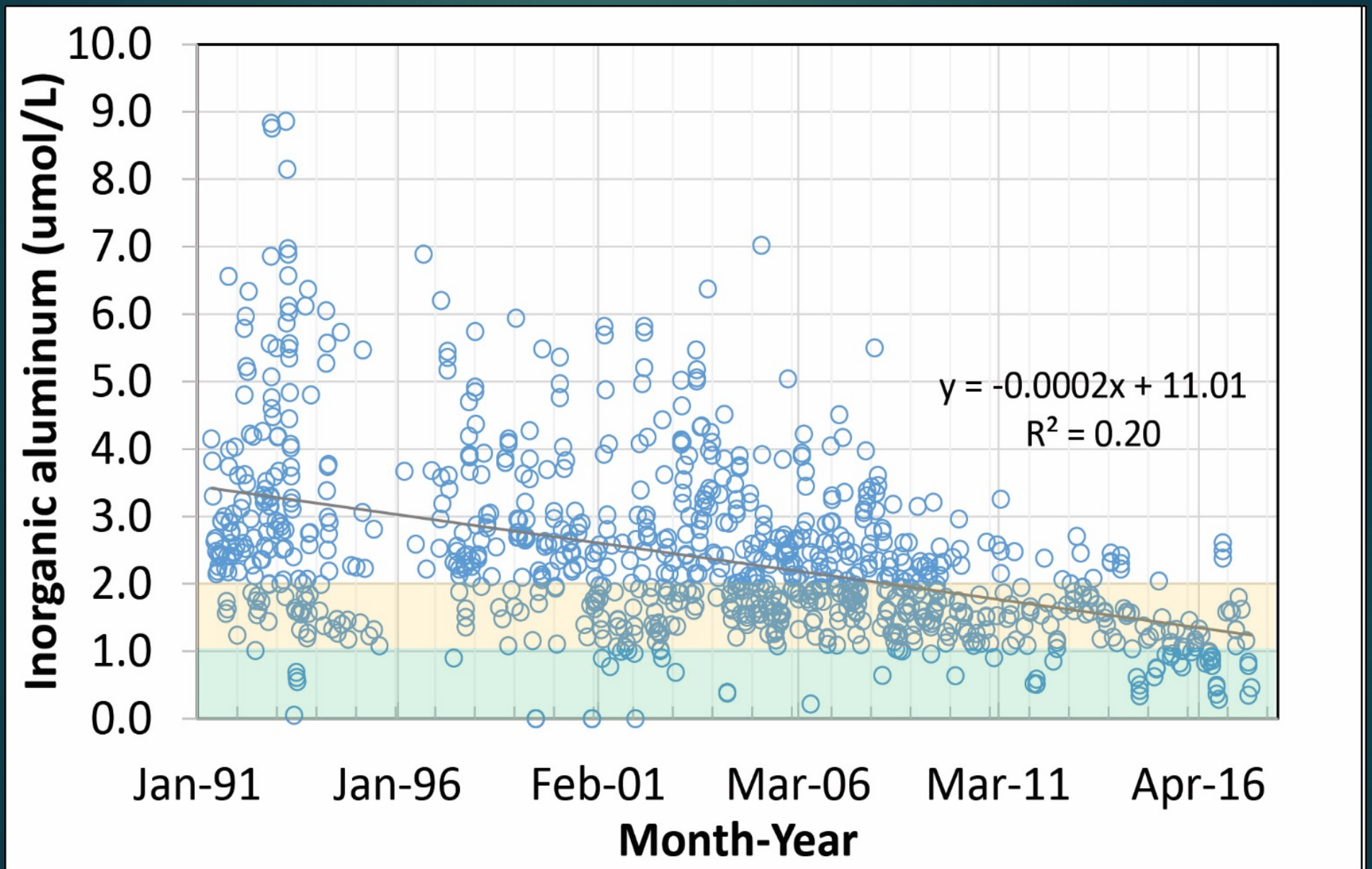
Relationship between pH and inorganic aluminum at Neversink River sites, 1991-93



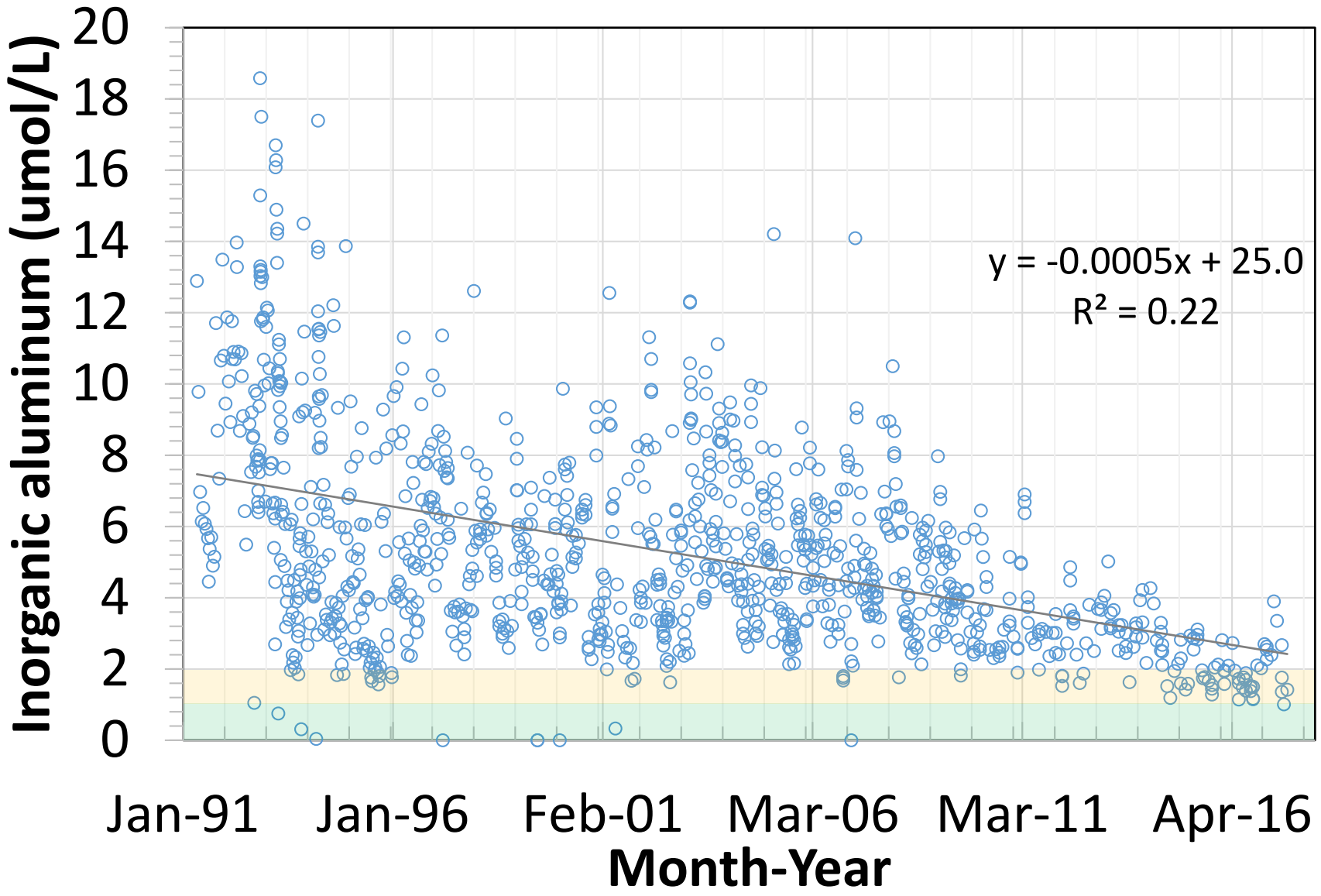
pH and inorganic Al trends at Biscuit Brook from 1991 to 2017



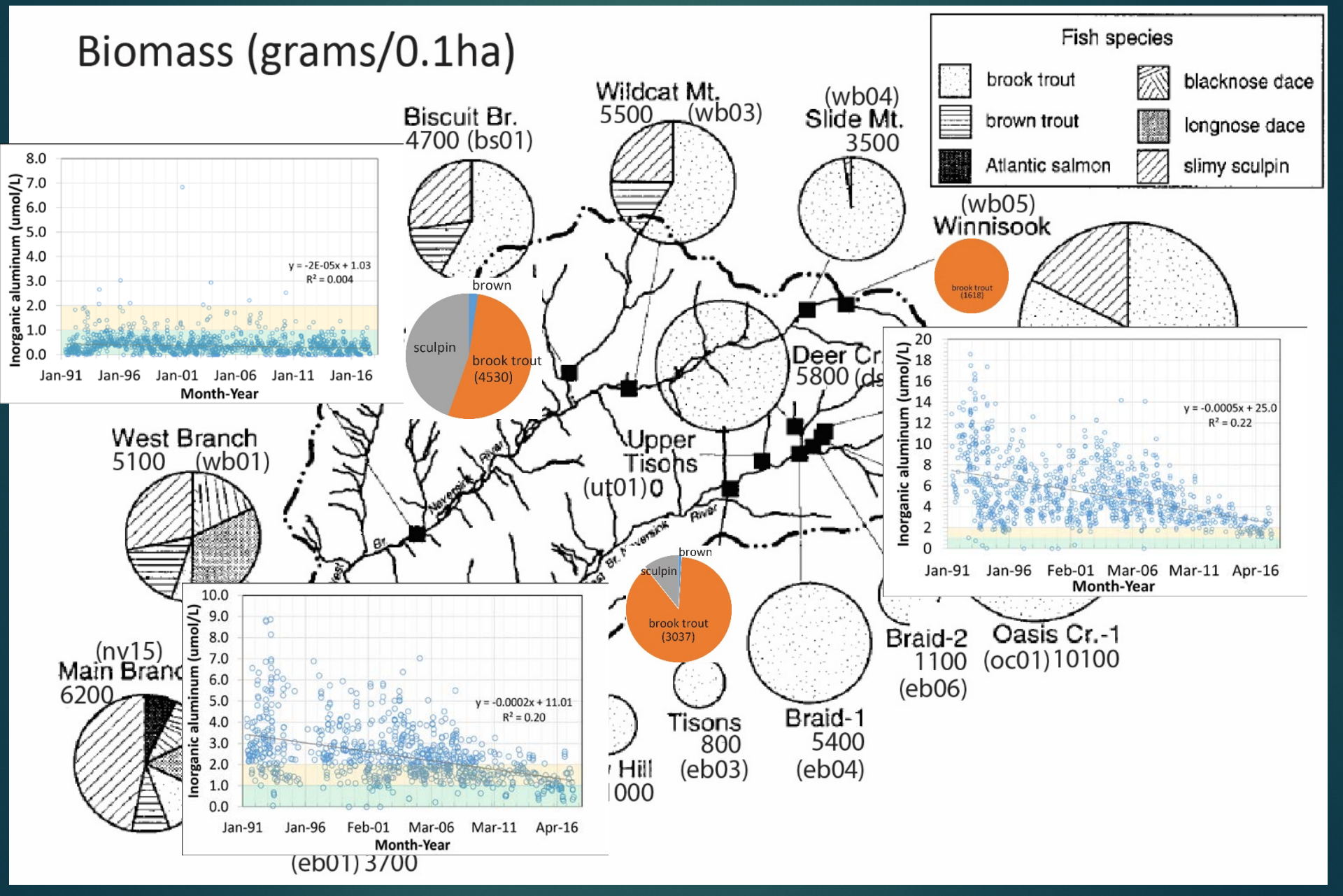
pH and inorganic Al trends at Tisons (eb03) from 1991 to 2017



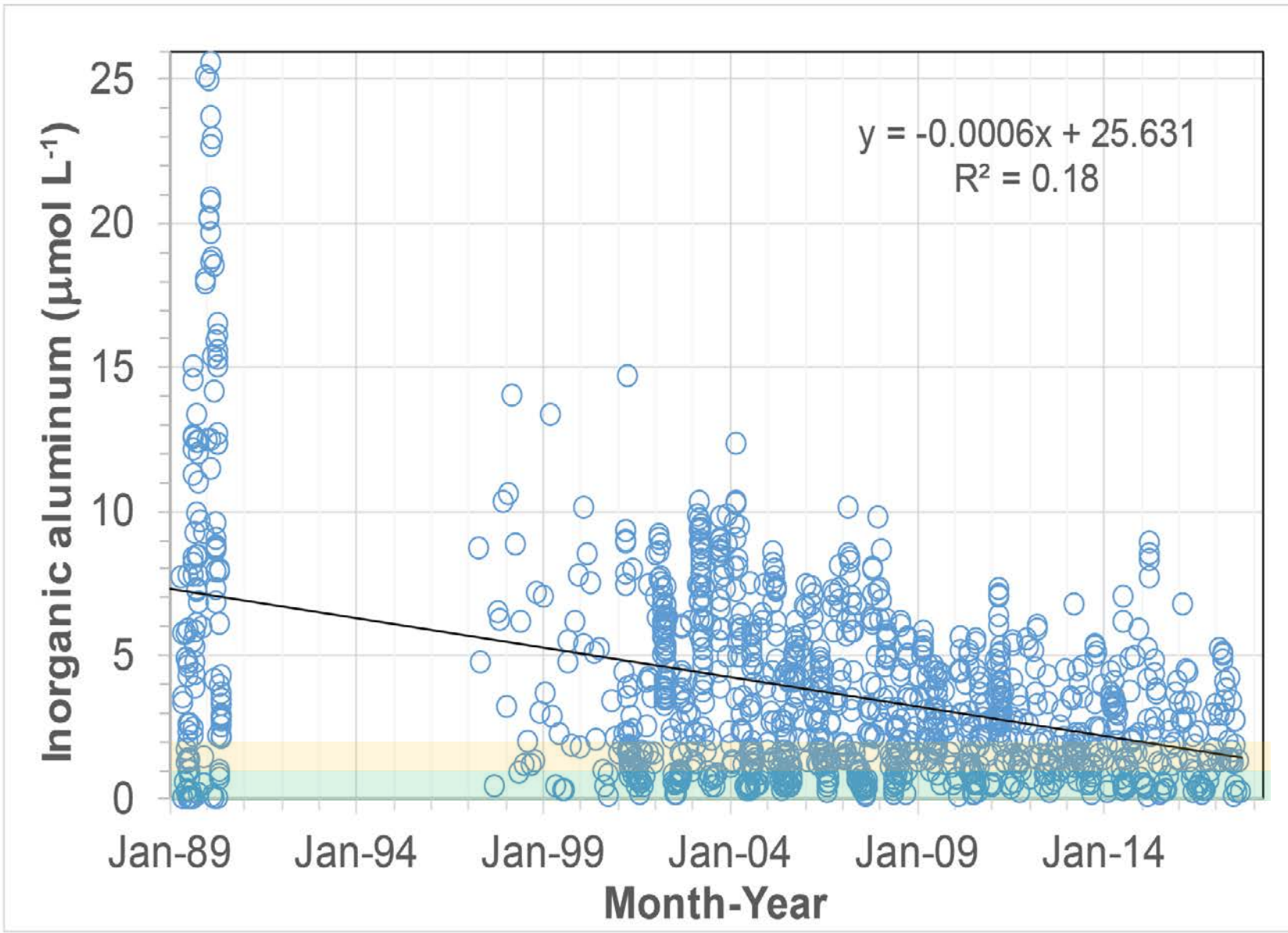
pH and inorganic Al trends at Winnisook (wb05) from 1991 to 2017



Fish Biomass in Neversink-2017 update



pH and inorganic Al trends at Buck Creek from 1989 to 2017



Stream	Air-equilibrated pH		Fish/100 m^2		Calcium (mg/L)	Sulfate (mg/L)	Nitrate (mg/L)	ANC (μeq/L)
	Fall 1999	Spring 2000	Brook trout	Other				
Nick's Lake Inlet	7.43	4.38	0	0	1.78	4.15	5.63	−33.5
Cellar Brook	5.95	4.56	3	0	0.99	5.41	0.43	−25.4
Bradley Brook	5.57	4.57	0	0	1.22	5.87	0.33	−21.1
Constable Creek	6.45	4.63	0	9	1.65	5.31	2.92	−12.7
Beaver Brook	4.52	4.70	0	0	1.54	4.44	4.17	−5.2
Fourmile Brook (upstream)	7.01	4.98	7	5	1.65	4.78	3.02	4.0
Cold Stream	6.76	5.06	9	25	1.78	4.35	3.40	6.5
Moss Lake Inlet	7.20	5.07	21	36	1.74	4.44	3.06	4.7
Windfall Pond Outlet	6.94	5.25	20	69	2.26	4.74	3.36	14.6
Black Bear Mountain Brook	7.22	5.35	19	0	2.38	5.01	3.27	25.9
Birch Creek	6.68	5.36	17	0	1.88	4.64	2.01	21.5
Mill Stream	6.98	5.42	11	147	1.83	4.50	3.28	13.0
Silver Run	7.25	5.62	15	0	1.42	4.96	0.68	15.7
Lawrence Brook	5.71	5.70	3	6	1.67	5.18	0.98	17.6
T4 Tupper Lake	6.12	5.76	0	28	2.38	5.34	3.28	27.3
Mill Creek	7.20	5.79	24	17	1.89	4.60	2.62	27.7
Rondaxe Creek	7.41	5.90	56	3	2.24	5.16	2.75	24.6
Cascade Brook	7.17	5.91	3	41	2.26	5.10	2.29	26.5
Payne Brook	6.00	6.03	4	0	1.51	4.46	0.42	26.5
Minnow Brook	6.79	6.10	6	5	4.43	5.68	3.00	34.7
T17 West Branch Sacandaga	6.93	6.21	0	50	2.77	5.67	0.71	66.7
Kibby Brook	6.98	6.23	12	66	2.68	5.15	3.14	39.1
T14 West Branch Sacandaga	6.56	6.28	11	15	2.16	5.84	0.97	26.5
Fourmile Brook (downstream)	7.42	6.32	5	72	2.22	4.96	2.24	52.4
Sheriff Lake Outlet	7.52	6.35	0	39	2.32	4.17	2.55	56.6
Griffin Brook	6.80	6.42	5	44	3.70	6.91	2.80	49.4
Fly Creek	6.79	6.48	0	30	3.10	4.68	4.25	54.6
Robb's Creek	6.96	6.61	0	42	3.21	4.87	5.15	61.8
Mountain Pond Outlet	7.54	6.67	43	0	3.22	4.83	3.53	76.4
Jubin Vly	7.24	6.73	33	130	4.17	5.42	1.14	98.6
Platt Brook	6.99	6.91	2	10	3.67	5.58	1.58	137.6
Rogers Brook	7.21	6.98	3	20	4.56	5.64	1.87	151.0
Bottle Brook	7.25	7.03	24	21	3.78	4.67	2.05	152.3
Hatchery Brook	7.42	7.04	2	130	5.13	5.56	3.35	158.2
Horseshoe Pond Brook	7.40	7.19	65	0	5.25	6.62	0.37	252.3
Gray Lake Outlet	7.14	7.41	0	165	5.19	4.77	1.93	174.6

Site ID	All species (% change)	Brook trout (% change)
nicks	0	0
bradley	100+	100+
beaver	0	0
fourmile	166	-10
moss	18	43
windfall	-60	-42
black	27	27
birch	-9	-9
silver	-22	-22
minnow	241	252
fly	na	20
sli	na	72
bald	na	-67
buck	na	91
Mean change (%)	51	35

Summary/Conclusions

- The CAAA reduced S & N emissions & acid deposition, and improved water quality in headwater streams of NY
- Decreases in acidity and aluminum reduced toxicity in many acidified streams
- Fish communities in acid-sensitive Catskill streams are beginning to recover from acidification
- Recovery of fish communities in acid-sensitive Adirondack streams may be delayed or just beginning
- More quantitative fish (and chemistry) data, and more thorough analyses, are needed to document and interpret biological recovery in streams across New York, especially in the Adirondacks


Questions?
bbaldigo@usgs.gov