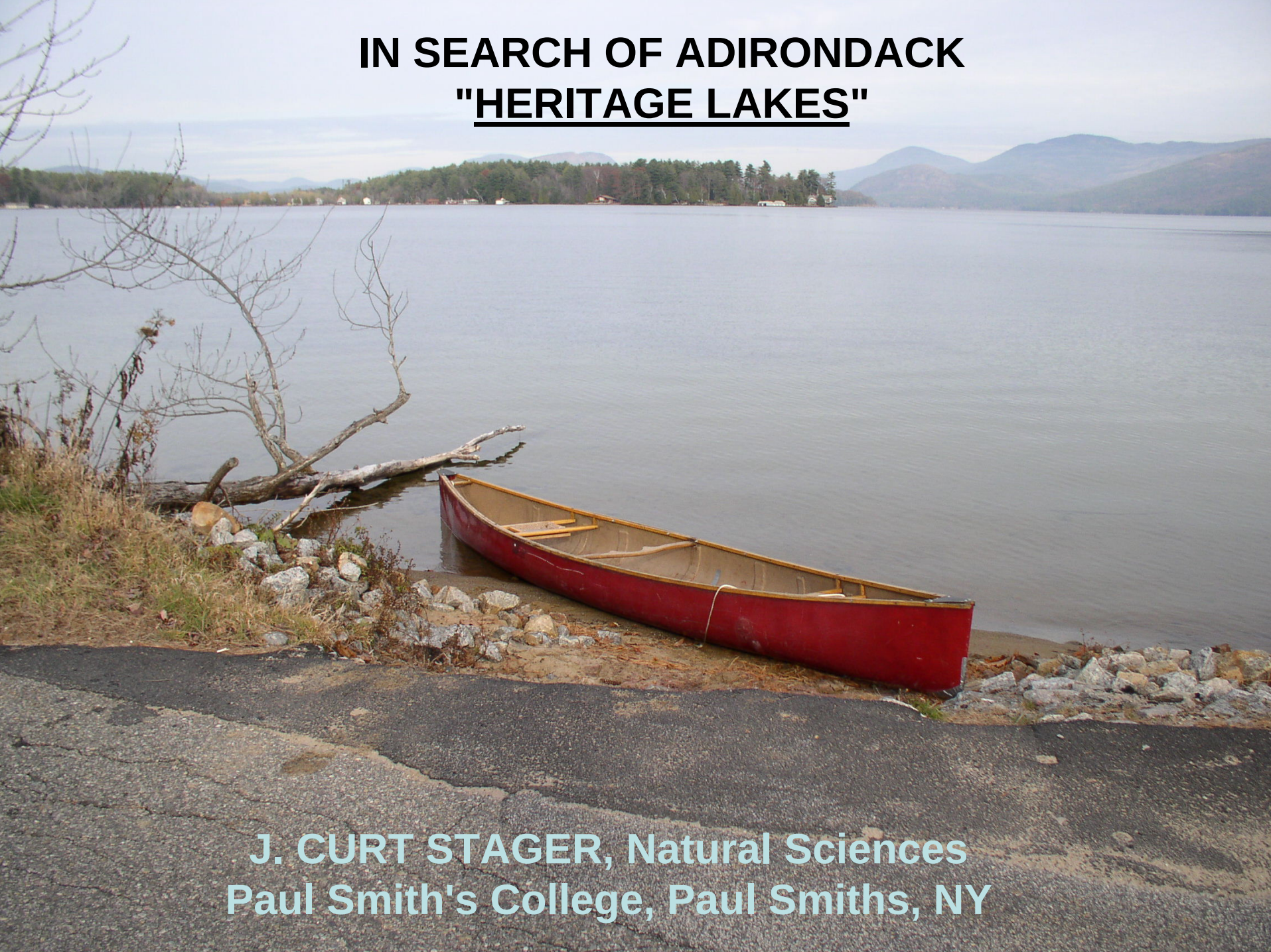
IN SEARCH OF ADIRONDACK "HERITAGE LAKES"

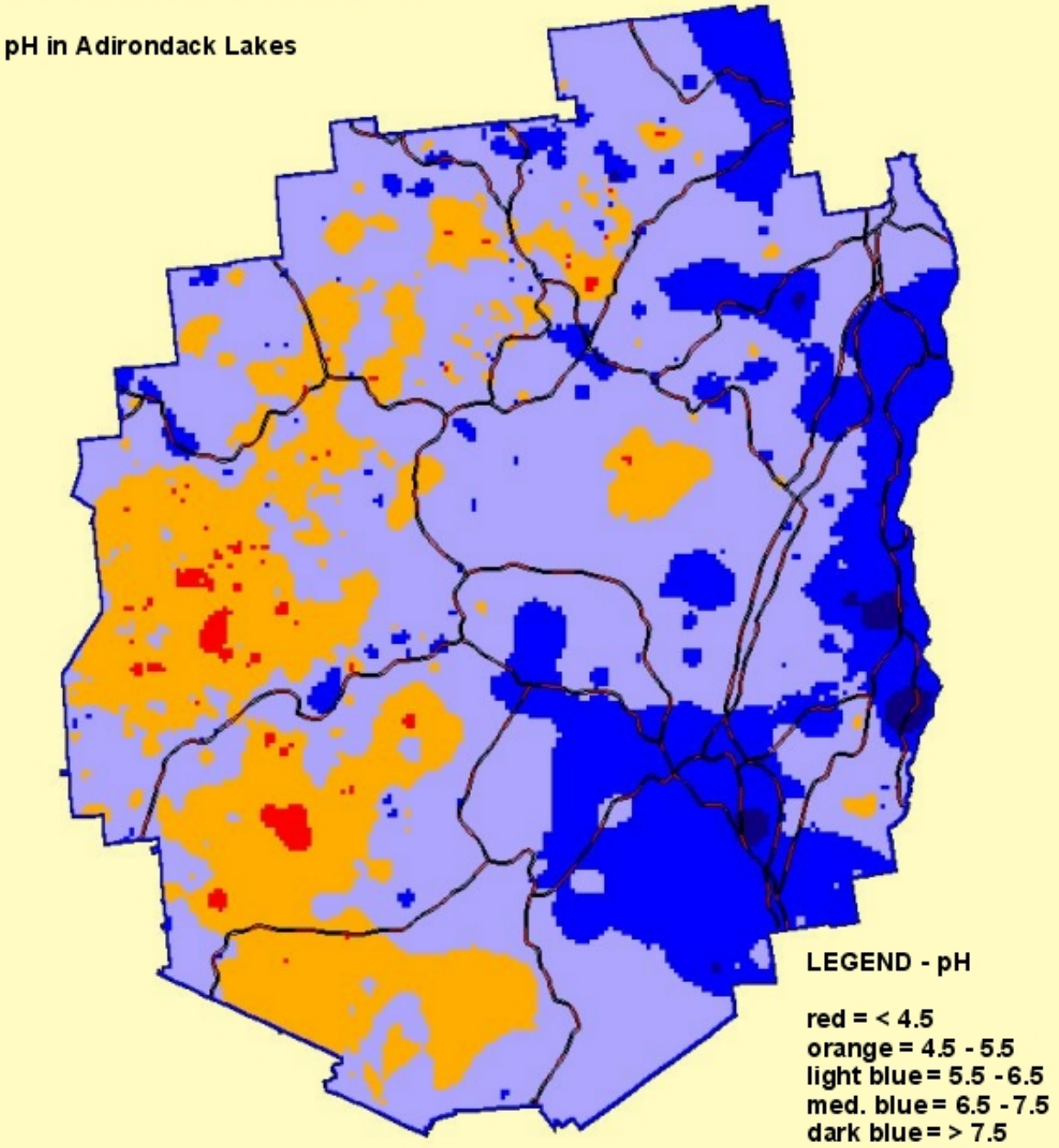


J. CURT STAGER, Natural Sciences
Paul Smith's College, Paul Smiths, NY

INTRODUCTION

Many people come to the Adirondacks each year to enjoy the beautiful lakes. A key component of their experience is the sense of ***wilderness***.

However, although Adirondack lakes may appear to be "pristine," this is largely an ***illusion***.



Acidification

is still affecting ADK lakes, especially at high elevations...

... but it's not the only issue to consider.

NUMEROUS OTHER HUMAN IMPACTS AFFECT ADIRONDACK LAKES, INCLUDING:

Mercury contamination

Eutrophication

Invasive species

Reclamation

Road Salt

Liming

and more

OTHER ISSUES:

Long-term studies of these lakes are rare, so we often don't know what they were like *before* the impacts occurred.

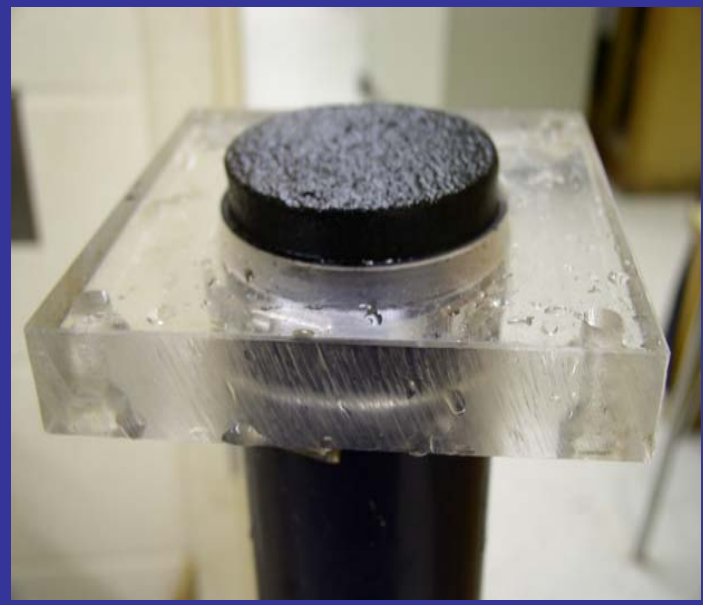
Without a solid idea of what an "*original state*" is, how can we identify *changes?*

How do we know if we've *really* "*restored*" them?

Paleolimnology

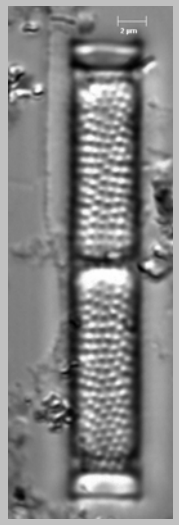
can provide some of this background information through the study of lake sediments.

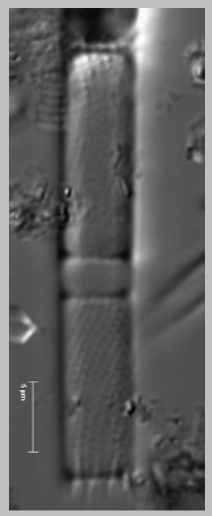
Sediment cores can be collected with simple equipment, extruded vertically to minimize sediment disturbance, and dated with radio-isotopic methods.

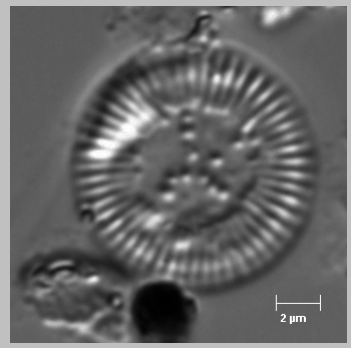


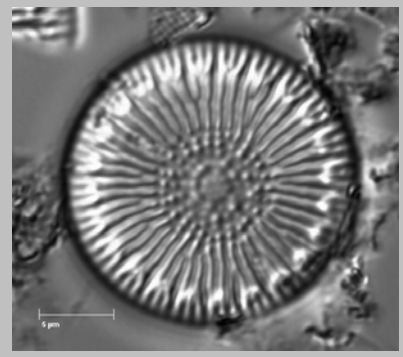
A 30 cm core typically yields ca. 100-200 years of record in ADK lakes.

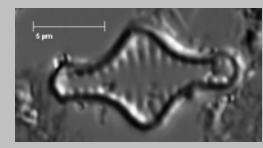
DIATOMS

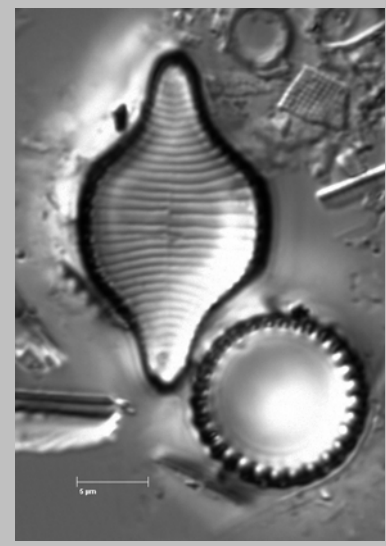


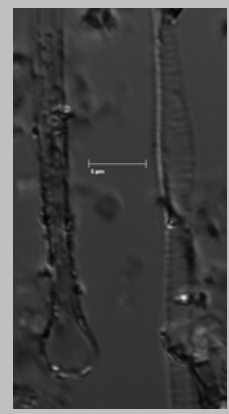


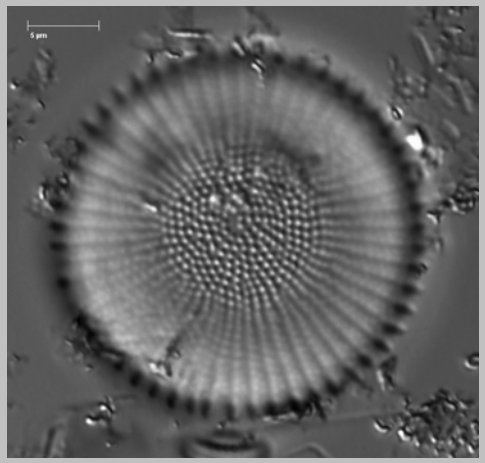


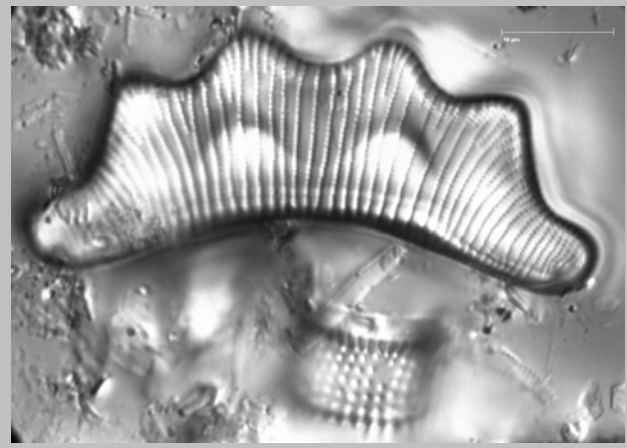


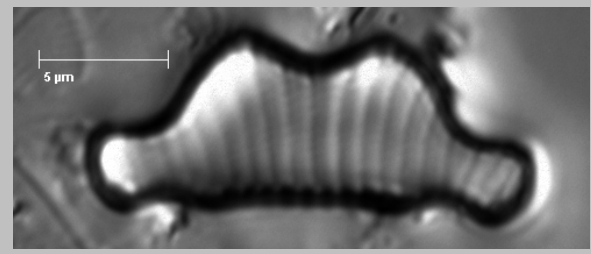


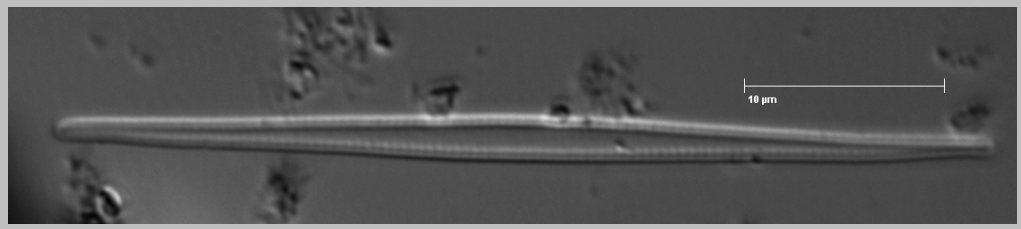


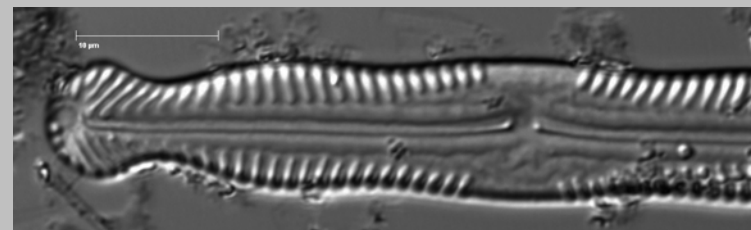












Long-term perspectives on ecological processes.

… Most ecological field studies last only 1-5 years.

… Most lakes lack detailed historical information on past conditions.

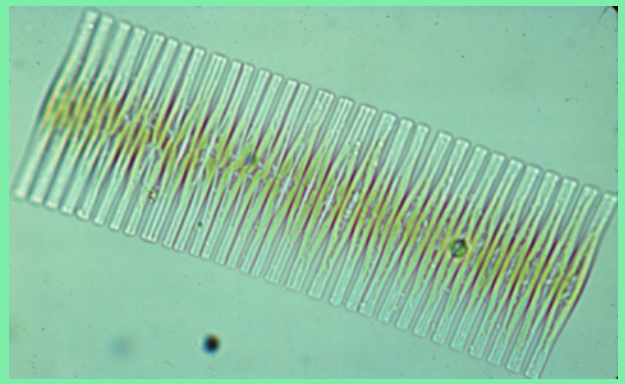
PALEOLIMNOLOGY can provide detailed, long-term ecological datasets of great value in determining:

… Whether or not present conditions are “normal.”

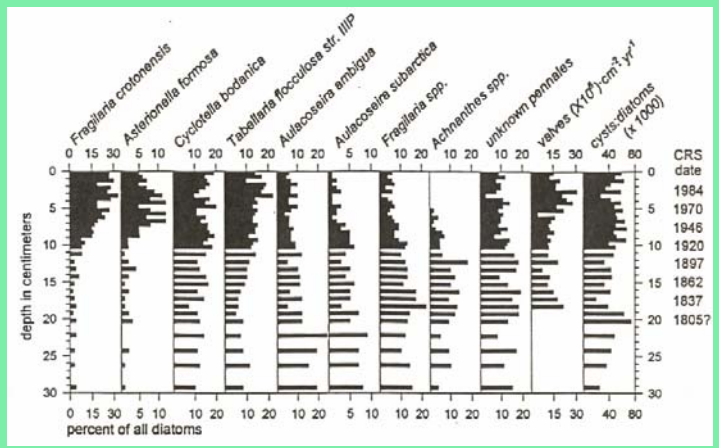
… What a lake was like prior to human impact.

… What trends exist, and *how fast* they are changing.

… What effects environmental disturbances, such as pollution and fisheries manipulations, have had on lakes *in the past*.



Fossil diatom assemblage data can be converted to water quality parameters through the use of transfer functions, as was done for Upper Saranac Lake.



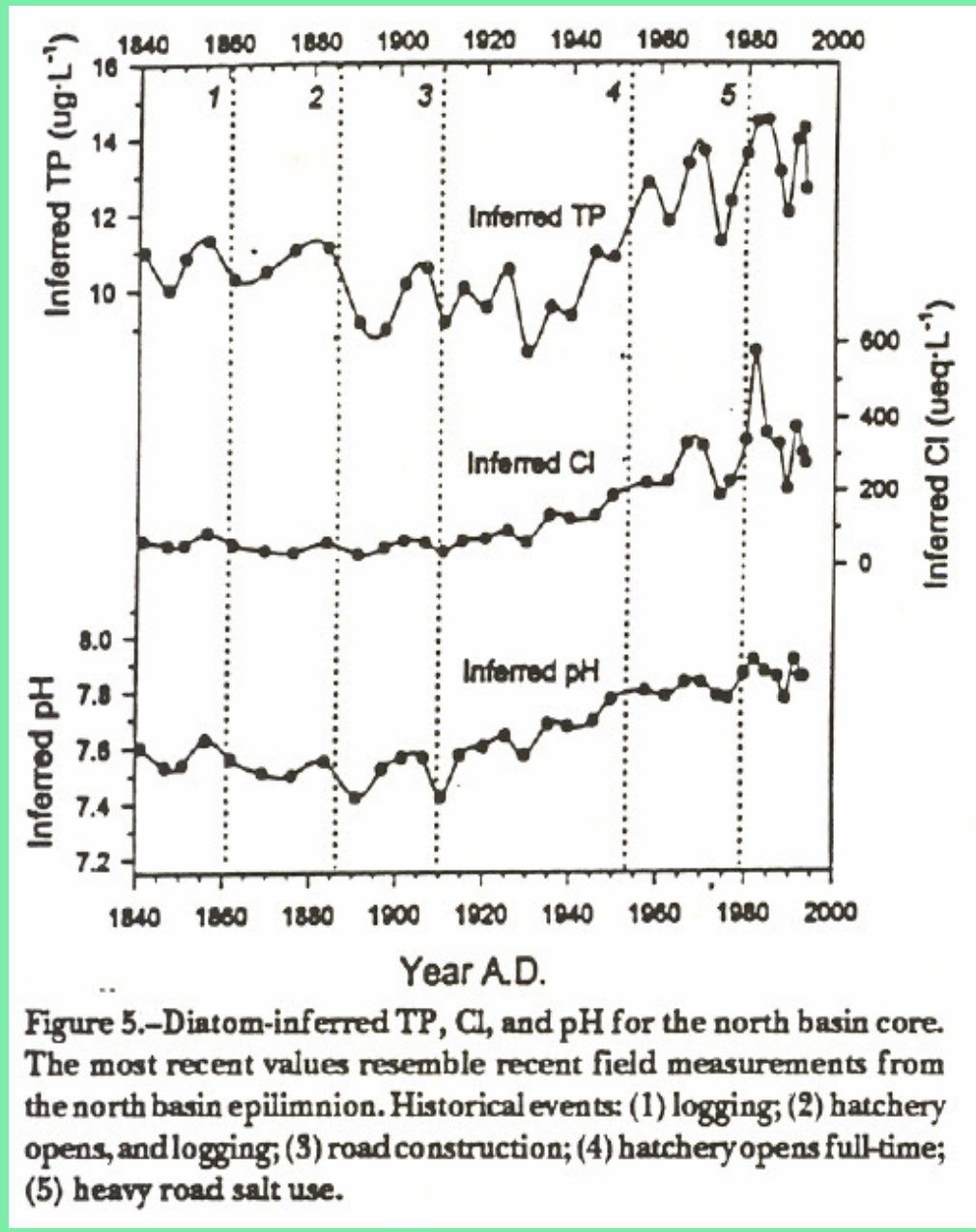
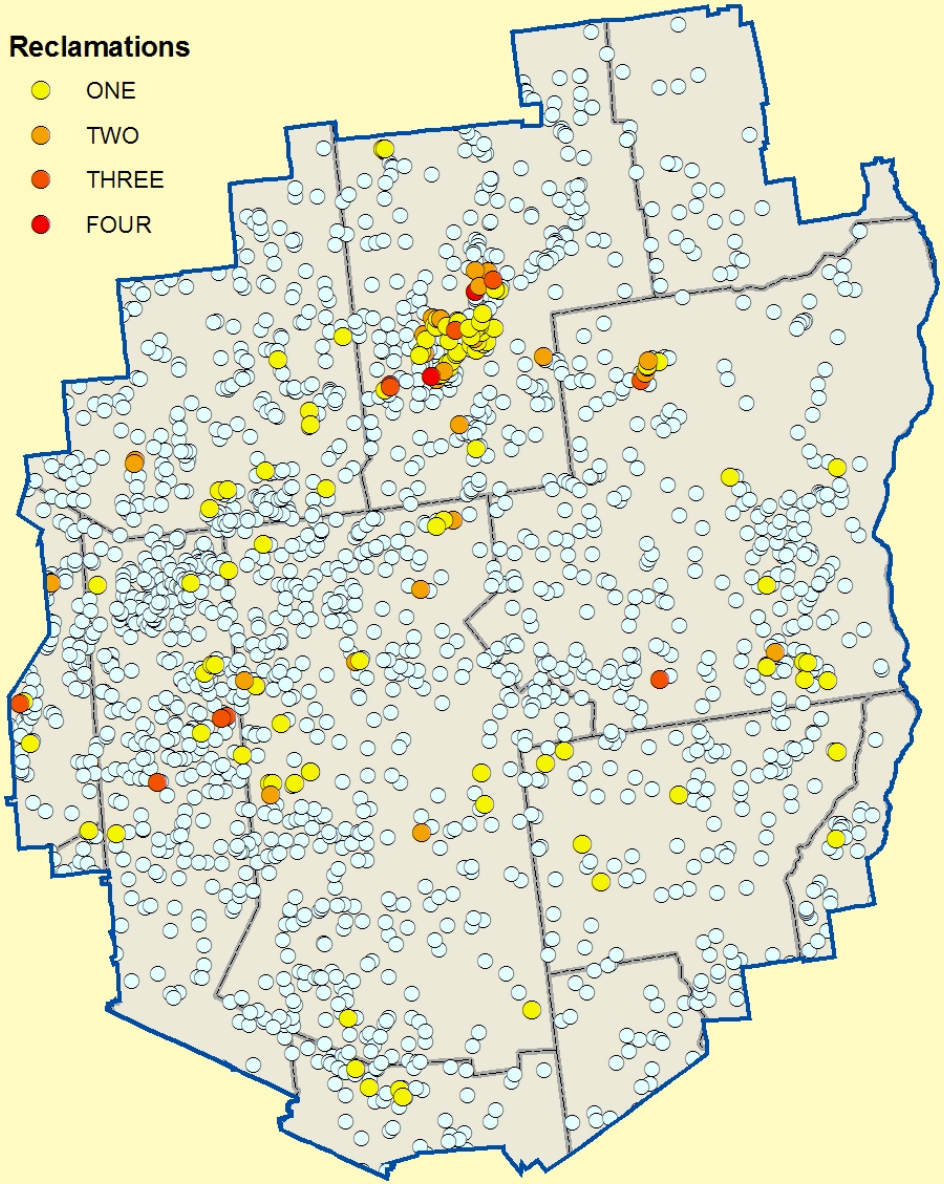


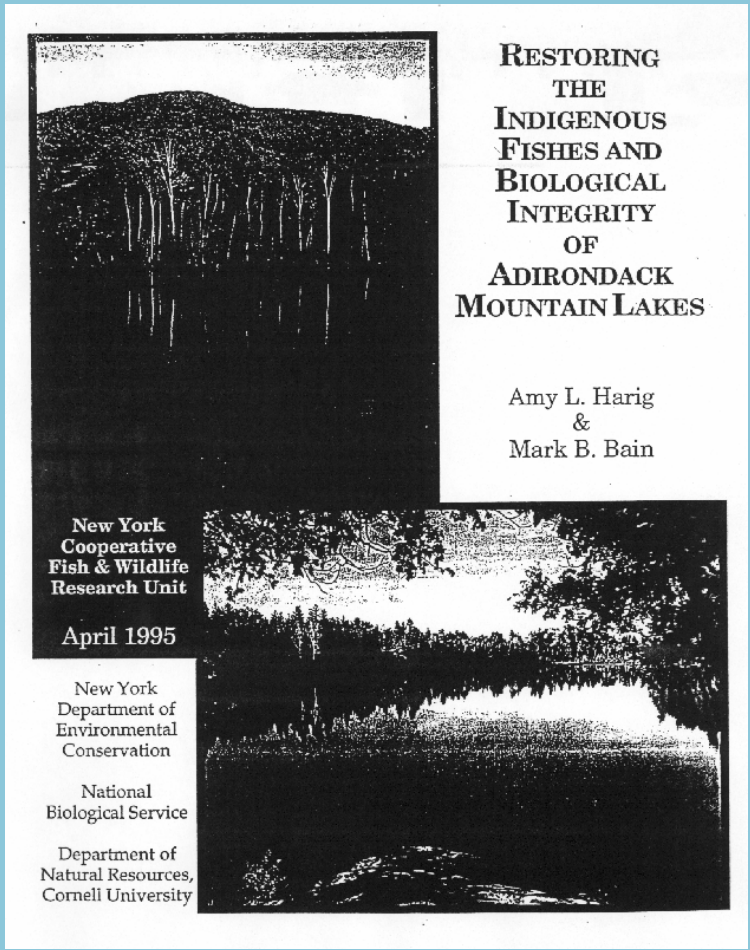
Figure 5.–Diatom-inferred TP, Cl, and pH for the north basin core. The most recent values resemble recent field measurements from the north basin epilimnion. Historical events: (1) logging; (2) hatchery opens, and logging; (3) road construction; (4) hatchery opens full-time; (5) heavy road salt use.



Michael Martin, Cedar Eden LLC

More than 130 Adirondack lakes have been reclaimed since the mid-1950's.

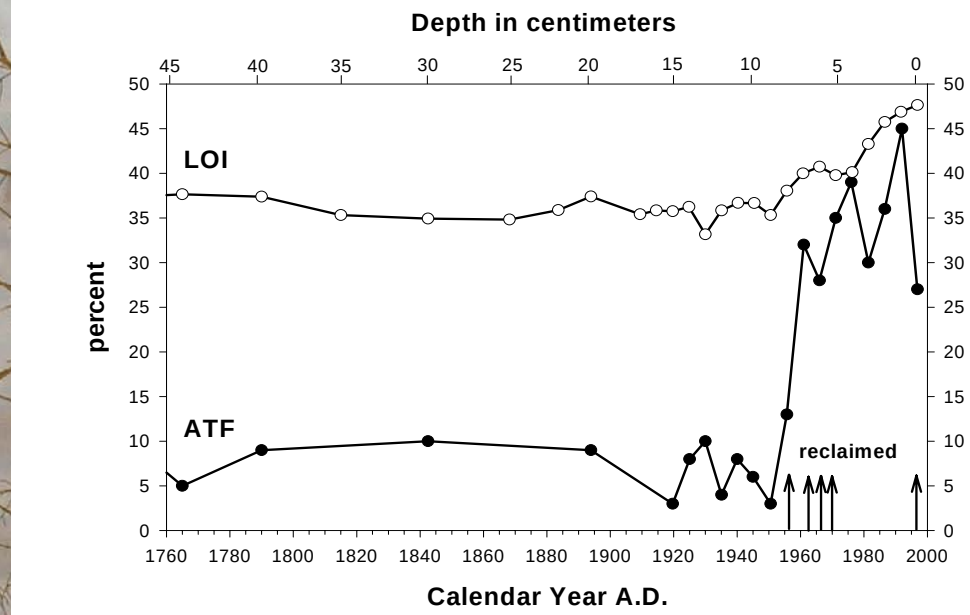
Harig & Bain field study, 1995

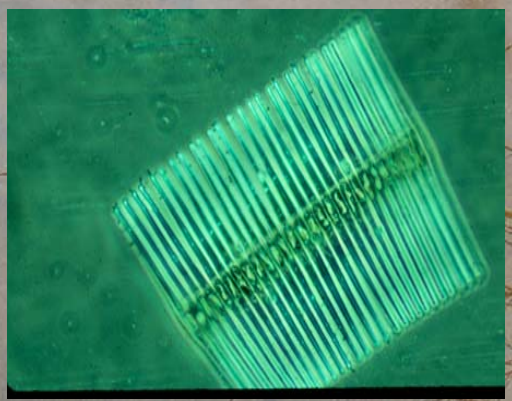


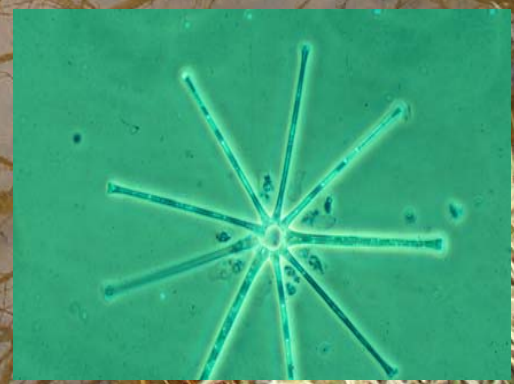
- Reclaimed 3 lakes in 1992
- Studied these and 12 controls for 2 years
- Large cladocera lost
- Slightly less algal biomass
- Few other changes noted

- **Only 1 pre-treatment test**
- **Used Green Pond as a "control" despite past reclamations and non-native fish species.**

BLACK & LONG PONDS: Reclamation & Invasives


Depth in centimeters
45 40 35 30 25 20 15 10 5 0
50 45 40 35 30 25 20 15 10 5 0
percent
LOI
ATF
reclaimed
1760 1780 1800 1820 1840 1860 1880 1900 1920 1940 1960 1980 2000
Calendar Year A.D.





Black Pond was later restocked with Windfall strain brook trout,

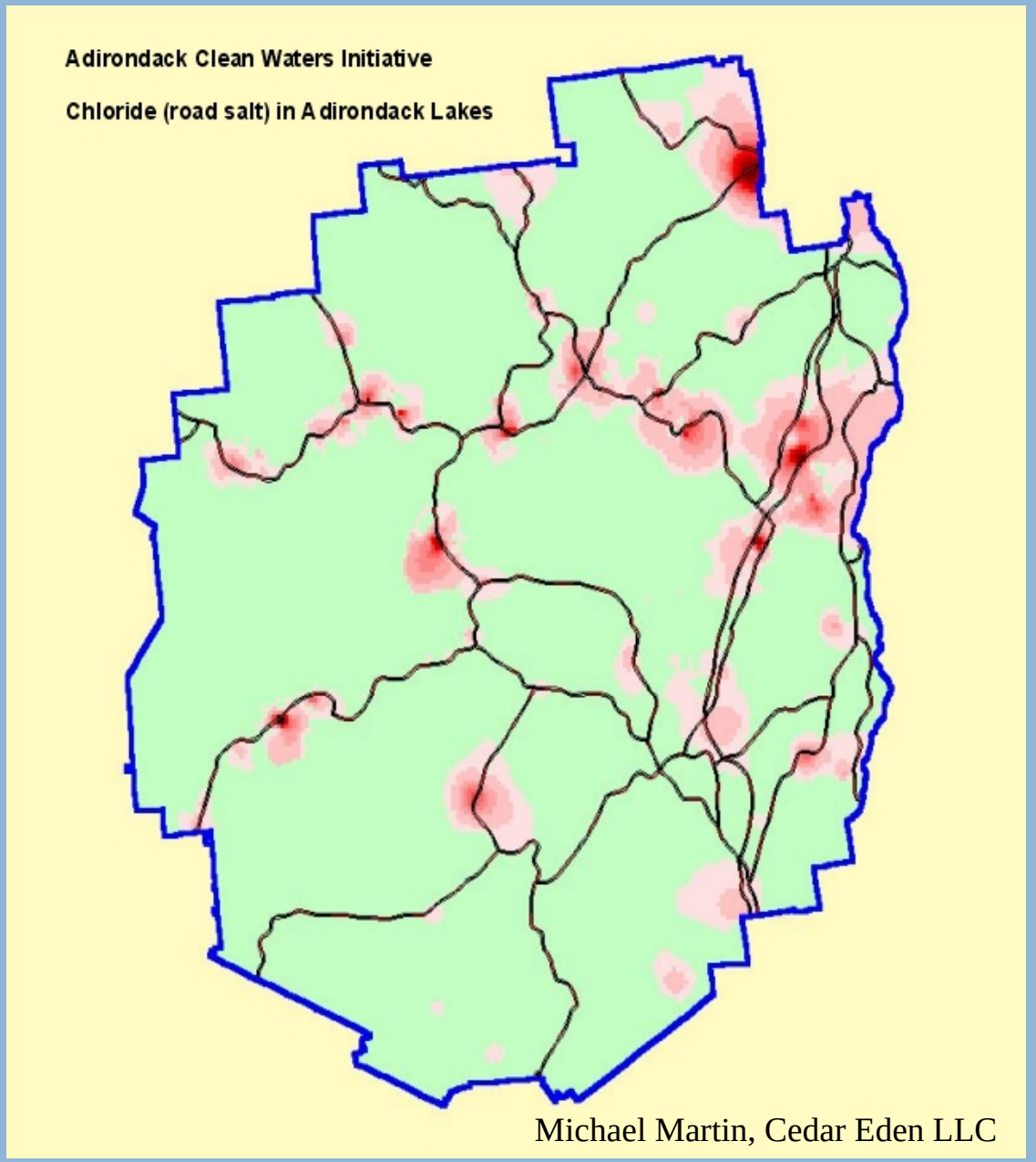
and

***no major algae blooms developed since then*.**

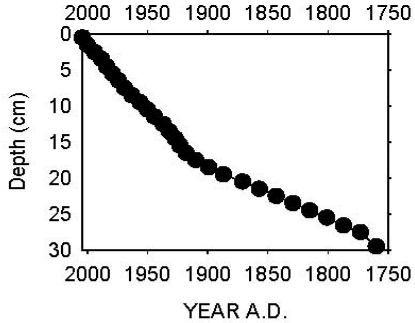
Until...

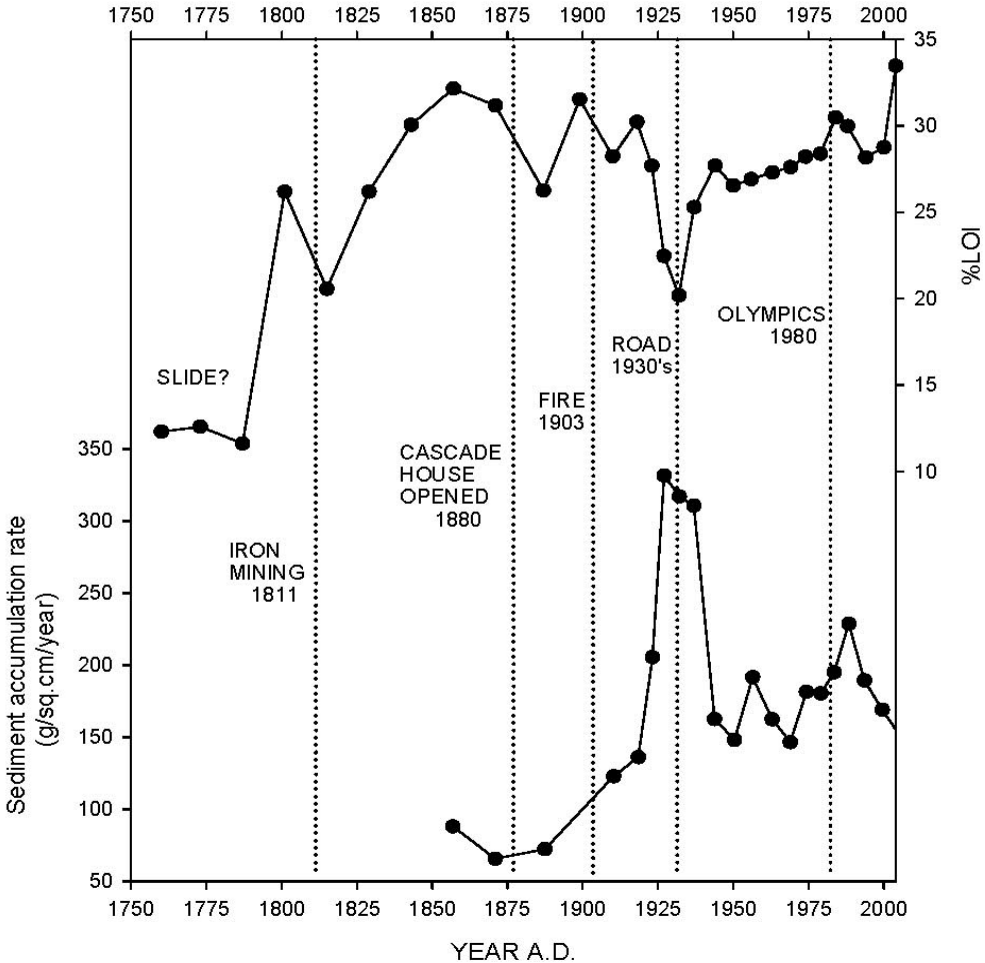

BLACK POND, Sept. 16, 2007

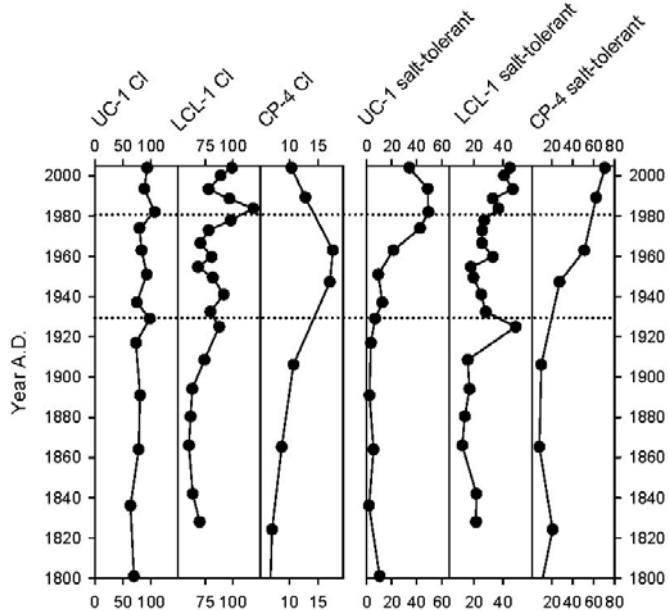
Cascade Lakes (*pre/post 1980*)



Michael Martin, Cedar Eden LLC







UPPER CASCADE LAKE

ARE *ANY* ADIRONDACK LAKES TRULY *PRISTINE*?

In the strictest sense: *NO*.

***ALL* lakes are more or less contaminated with atmospheric pollutants like acids, mercury, PCB's, and such.**

***And most also contain non-native fishes*.**

Golden shiner
Notemigonus crysoleucas

Yellow perch
Perca flavescens

At least 2/3 of all ADK lakes now have at least one of these “alien” species in them.

What is a “native?"

- “*Lake Sandford…abounds in white and yellow perch*…” (John Burroughs, on a trip to the central Adirondacks in summer, 1863)

- “*The state used to pay us young guys to backpack hatchery trout fingerlings into the remotest lakes*.” (Long Lake elderly resident, 1995)

Brown bullhead
Ameiurus nebulosus

Brook Trout
Salvenlinus fontinalis

"HERITAGE STRAINS" OF BROOK TROUT
(*Windfall Pond*)

IS THIS *GENETIC* OR *ECOTPHENOTYPIC* VARIATION?

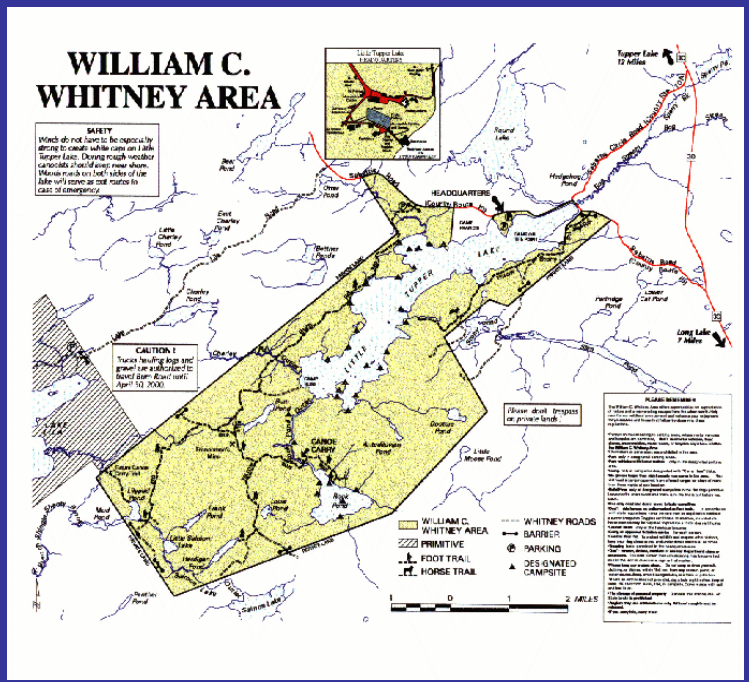
ROUND WHITEFISH:
Lower Cascade Lake

Deer Pond

Little Moose Lake

LITTLE TUPPER LAKE: *HERITAGE LOST*?

Formerly private-access only, owned by the Whitney family. Recently acquired by NYS. Home to "Little Tupper" Heritage strain.



FROM NYSDEC WEBSITE

"*Special fishing regulations will be enforced to help protect the genetically unique heritage strain.... Artificial lures only will be allowed...**This will protect the heritage strain from accidental introduction of non-native fish species**...*"

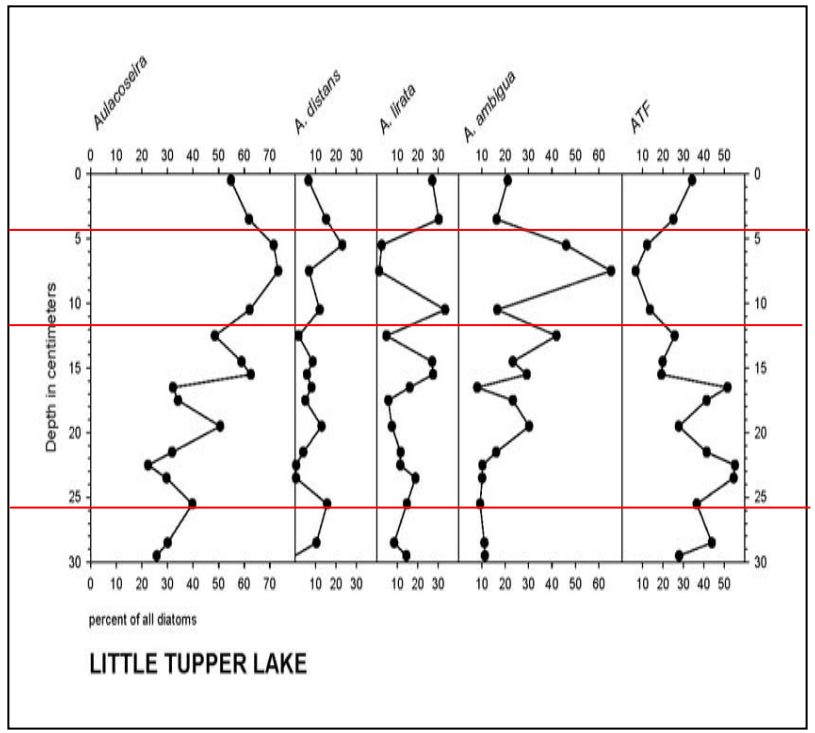
SADLY: a disgruntled local resident released bass into Little Tupper Lake, apparently in retribution for the new fishing restrictions.

http://tupperlake.net/whitfish.htm

AND ANYWAY...

Rainbow smelt and hatchery trout were previously stocked in LTL by the owners; so the fish community was *already* no longer "Heritage."

Sediment core analysis by PSC students shows significant fluctuations in past diatom communities, probably reflecting a range of human impacts.



BUT…

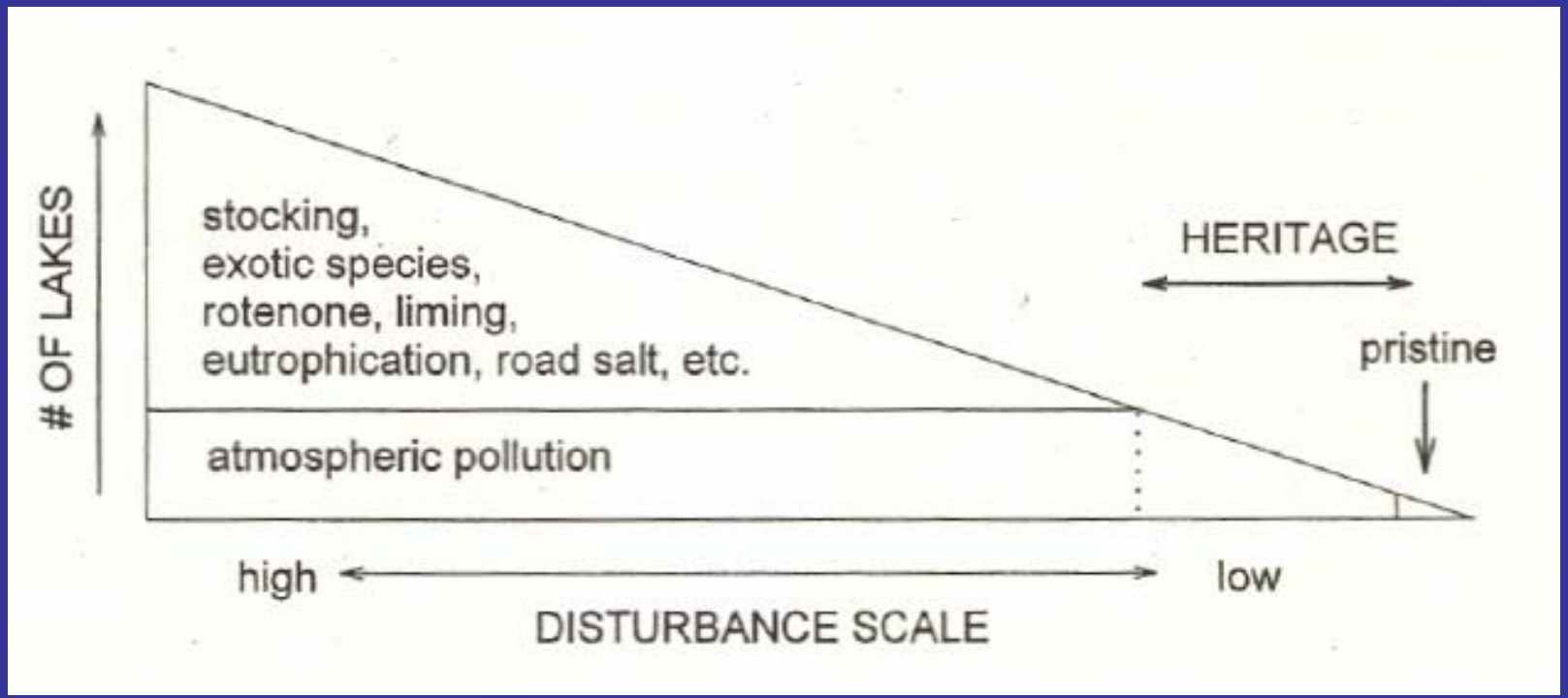
***Some* lakes may still be *pretty close* to the condition they were in before human impacts altered them.**

We propose giving them a name:

"HERITAGE LAKES"

A "HERITAGE LAKE" CONCEPT:

A conceptual framework for identifying, studying, and protecting lakes that lie nearest the extreme end of the "pristine" scale.



WHICH **"*original state*" should we focus on in evaluating Heritage status?**

CURRENT CHOICE: ca. 1800 AD

"Heritage Lake" screening:

...Is the pH > 6?

...Are invasives absent?

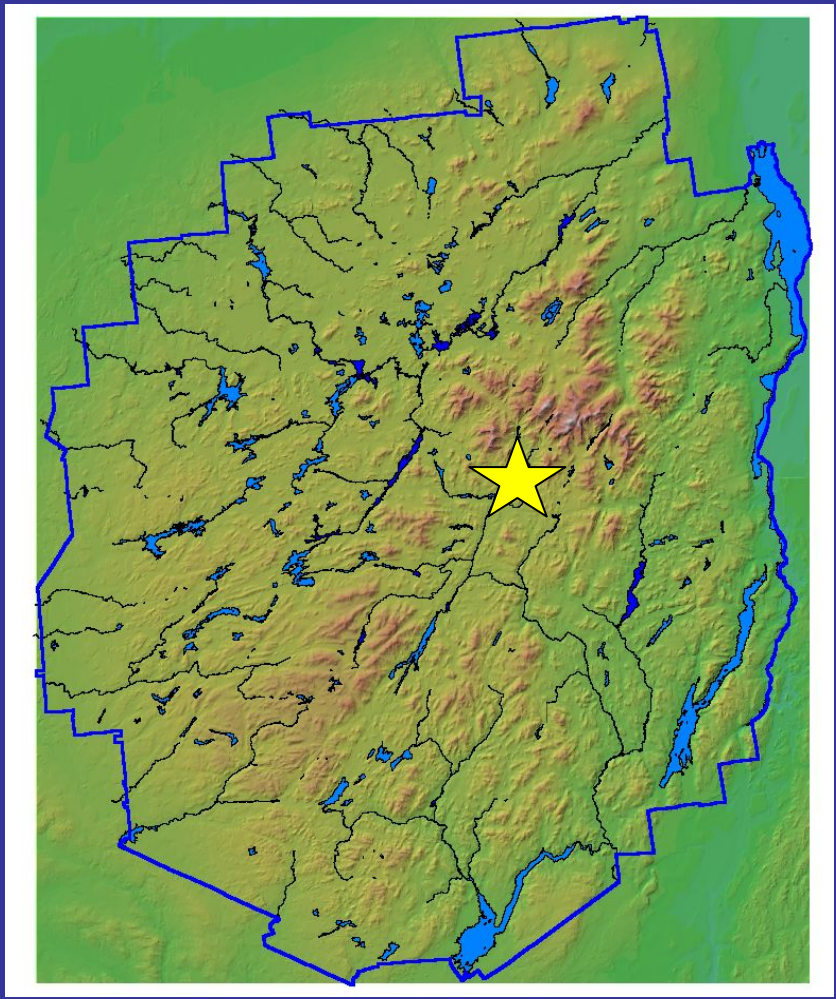
...Do the sediment diatom assemblages resemble those of the early 1800's?

(*pre-impact, post- Little ice Age*)

CASE STUDY:

PSC students investigated a lake suggested by Ray Masters, Huntington Wildlife Forest, to see if it qualifies for "Heritage" status.

WOLF LAKE



Historical records

Huntington Wildlife Forest records show that Wolf Lake has had a **pH close to neutral** throughout the last 70 years.

No invasive fish species have ever been found in net studies on this lake.

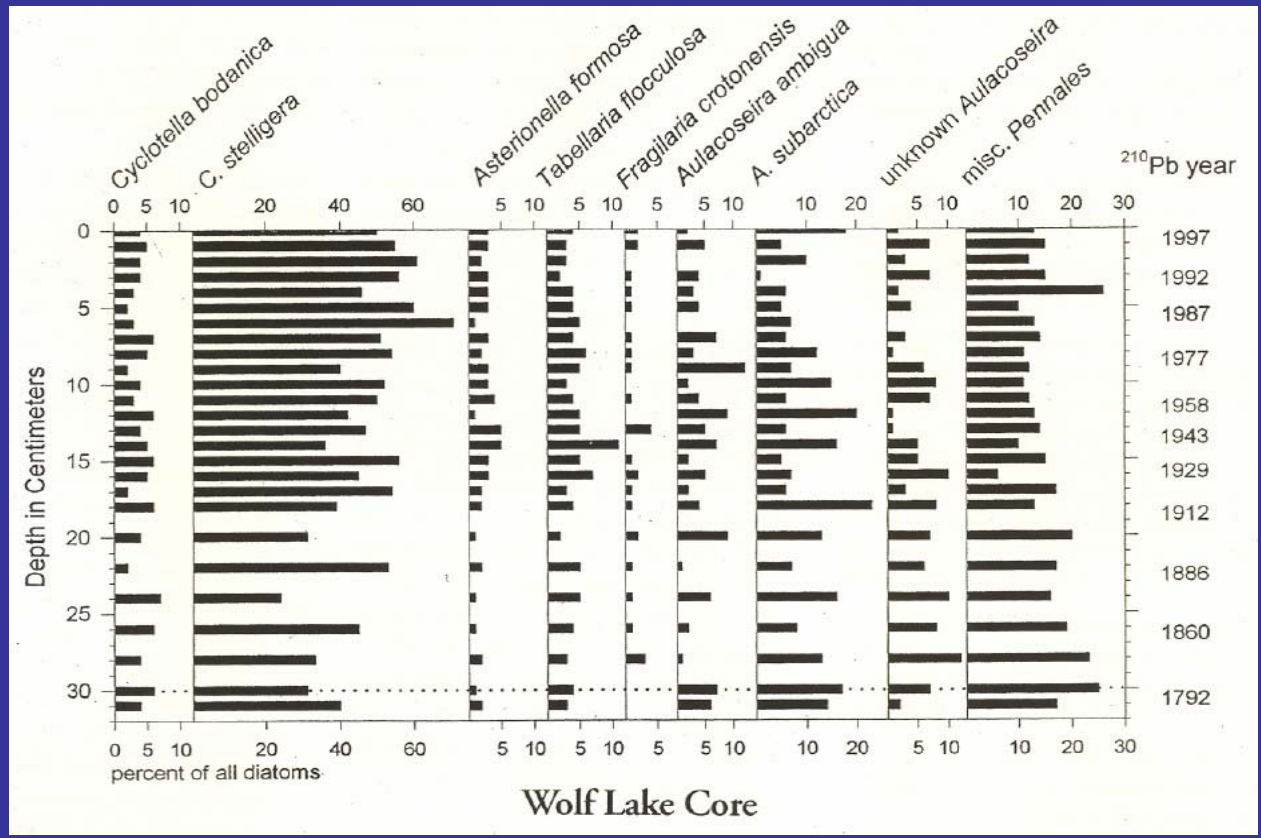
Wolf Lake has **never** been stocked, dammed, road-salted, reclaimed, or limed.

(It has always been **off-limits to the public**).

There was no significant change in sediment color throughout the core.

This suggests that no major changes in sediment type or redox conditions occurred in the main basin of Wolf Lake during recent centuries.

OUR FIRST HERITAGE LAKE



FOLLOW-UP SCREENING

(*Dan DeSorcy: senior capstone project, 2006*)

Circumneutral: not acidified recently

(in future: seek naturally acidic lakes, etc.?)

No evidence of road salt

No invasive fish

No reclamation

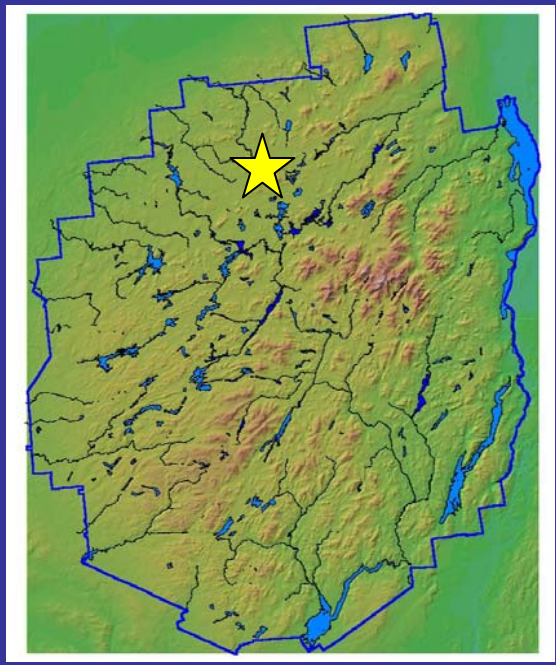
No stocking

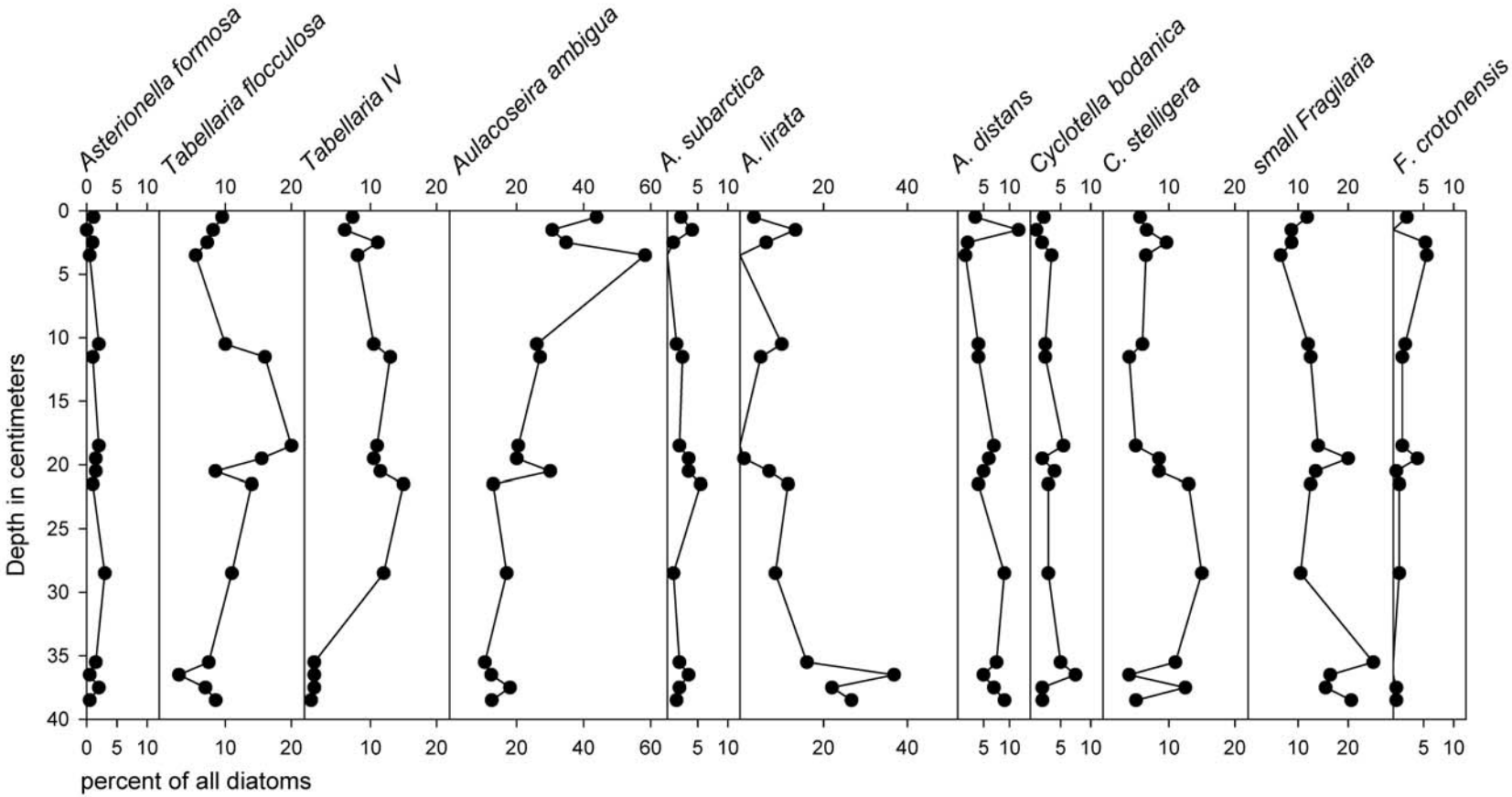
No liming

No dam

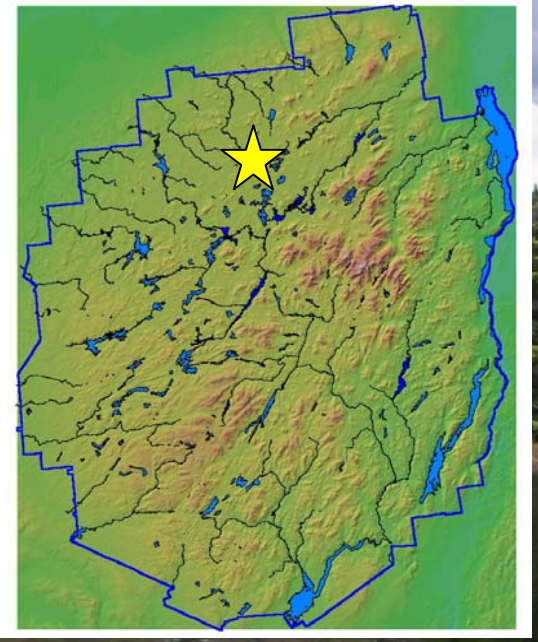
WINDFALL POND

("Windfall strain")





WINDFALL POND (analyses by Dan DeSorcy)



LEDGE POND

max. depth 14.9 m
pH ca. 6.1-6.2

whitefish
white sucker
brook & lake trout...

LEDGE POND

CORING RESULTS:

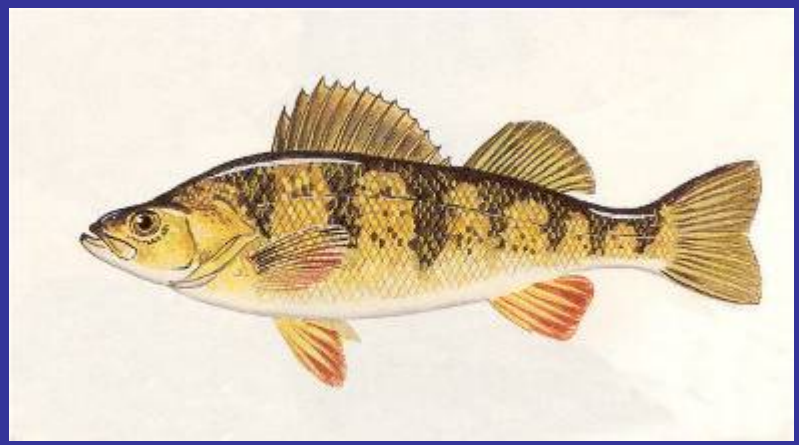
Significant changes in diatom assemblages

NYSDEC Region 5 Fisheries Bureau:

Fish survey in 1989

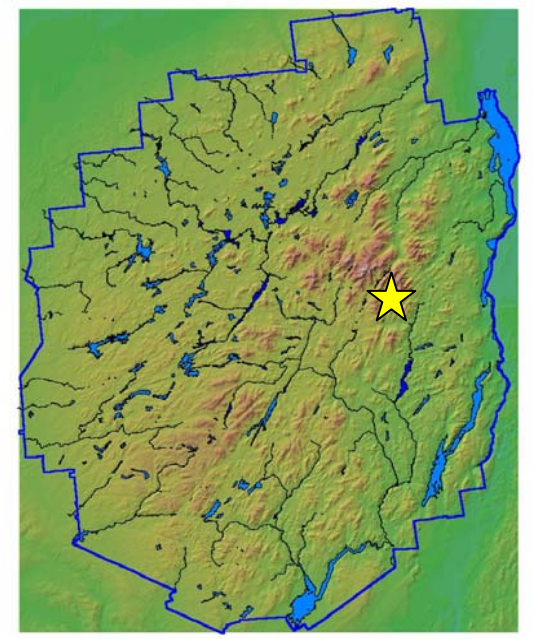
reported yellow perch and cisco

Yellow Perch



Cisco

DIX POND



Max depth 1 m

Lab pH 6.6

Air eq. pH 7.1

Brook Trout

Creek Chub

White Sucker

DIX POND

Chemistry

pH: 7.28

ANC: 138 ueq/l

conductivity: 27 umhos.

(NYSDEC Region 5 Fisheries Bureau, 2000)

Heritage strain of brook trout

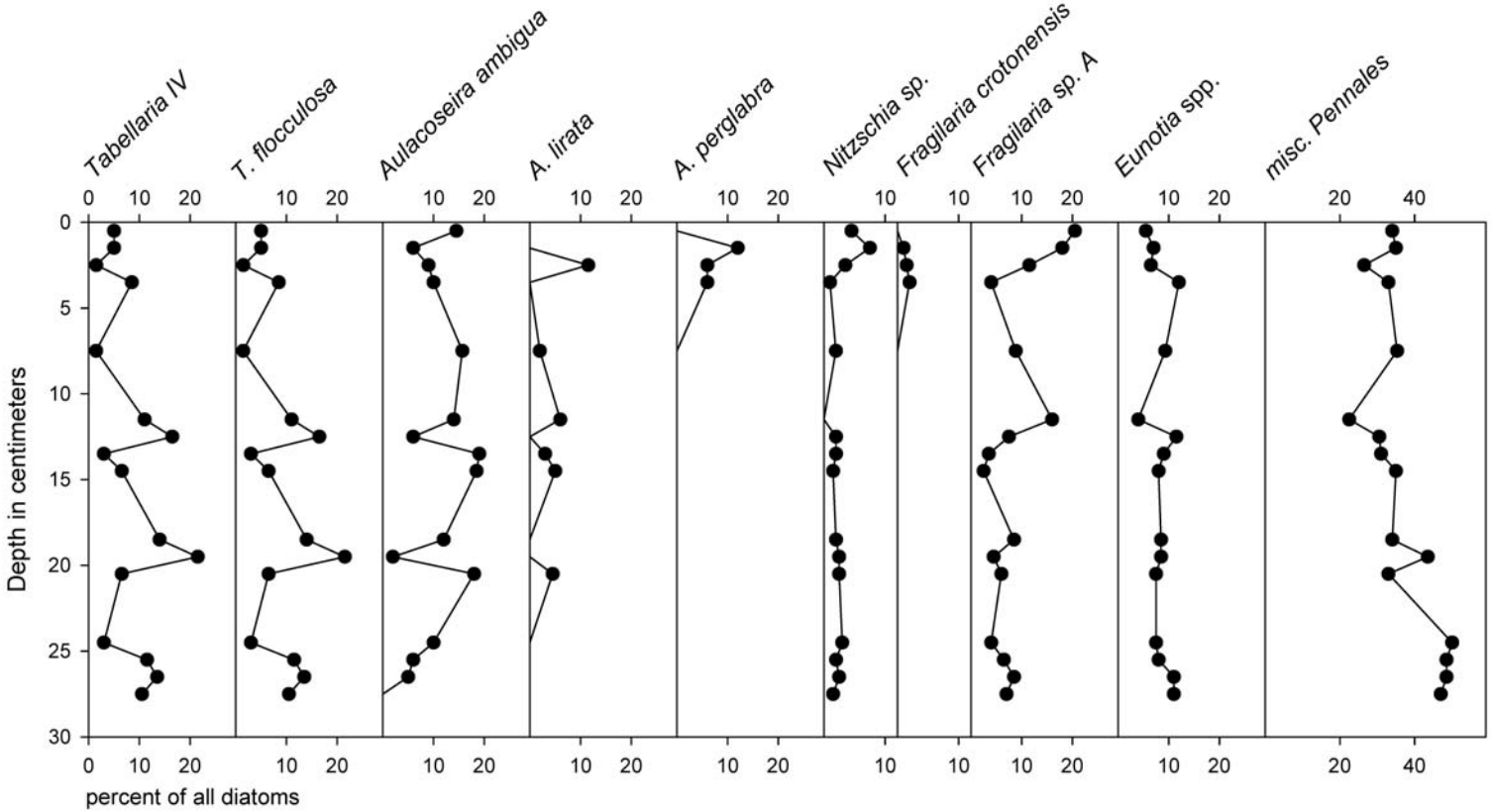
(NYSDEC Region 5 Fisheries Bureau, 2000)

Native taxa also caught included:

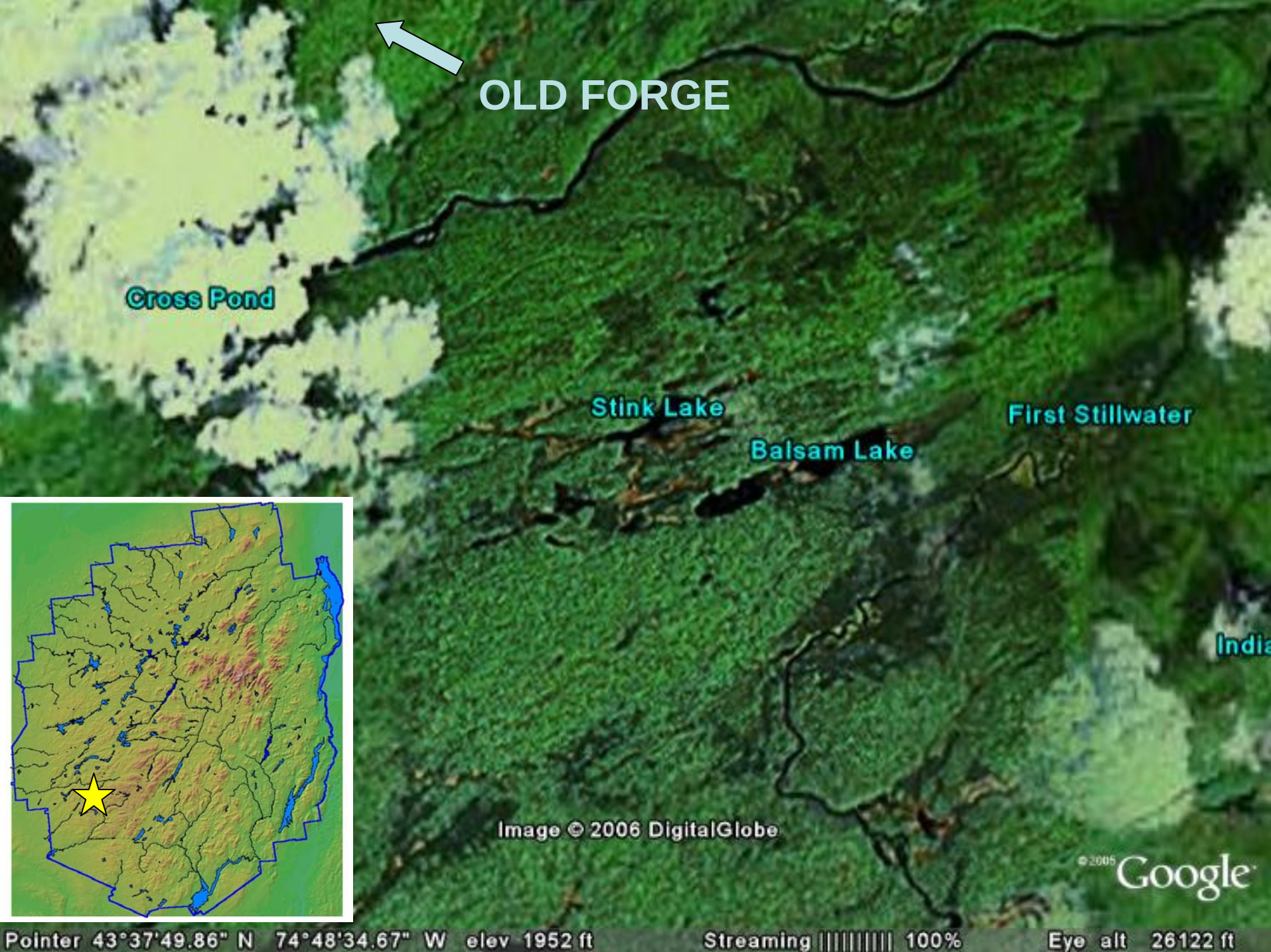
Creek chub

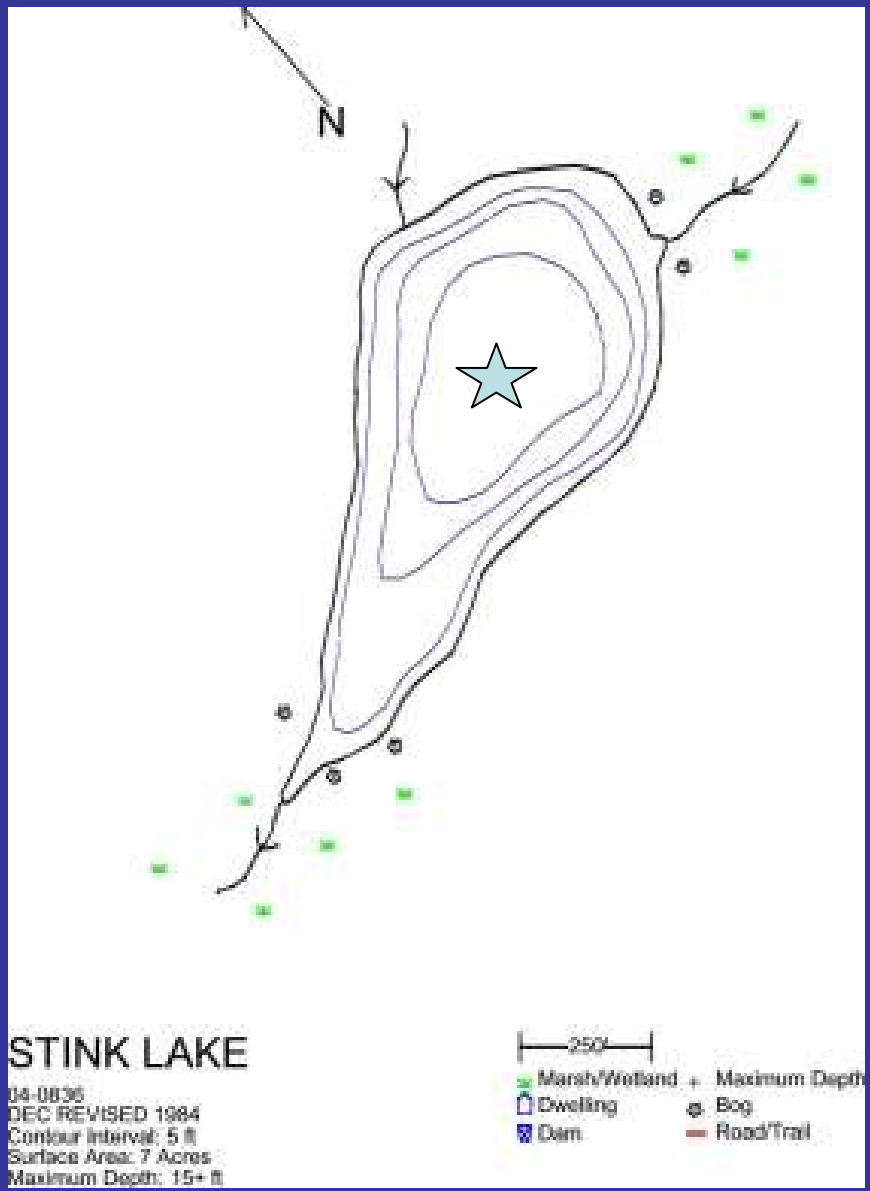
White sucker

Can a NATURALLY altered lake be a "HERITAGE" lake?



DIX POND (analyses by Dan DeSorcy)


OLD FORGE
Cross Pond
Stink Lake
Balsam Lake
First Stillwater
Image © 2006 DigitalGlobe
© 2005 Google
Pointer 43°37'49.86" N 74°48'34.67" W elev 1952 ft
Streaming 100%
Eye alt 26122 ft



STINK LAKE

(*Herkimer County*)

W. Canada Lake Wilderness

Lat. 433751, Long. 744837

Elevation 582 m
Watershed 114 ha

Mean depth 2.9 m
Max. depth 4.6 m

STINK LAKE (ALSC #040836)

8/7/84 Chemistry:

Lab pH = 5.95

Air eq. pH = 6.62

ANC = 79 ueq/L

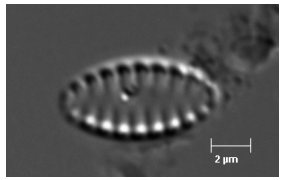
conductivity = 23.2 uhmos/cm

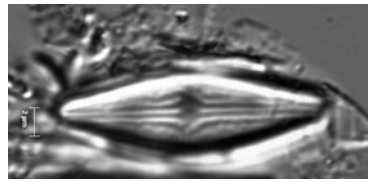
8/7/84 Fish:

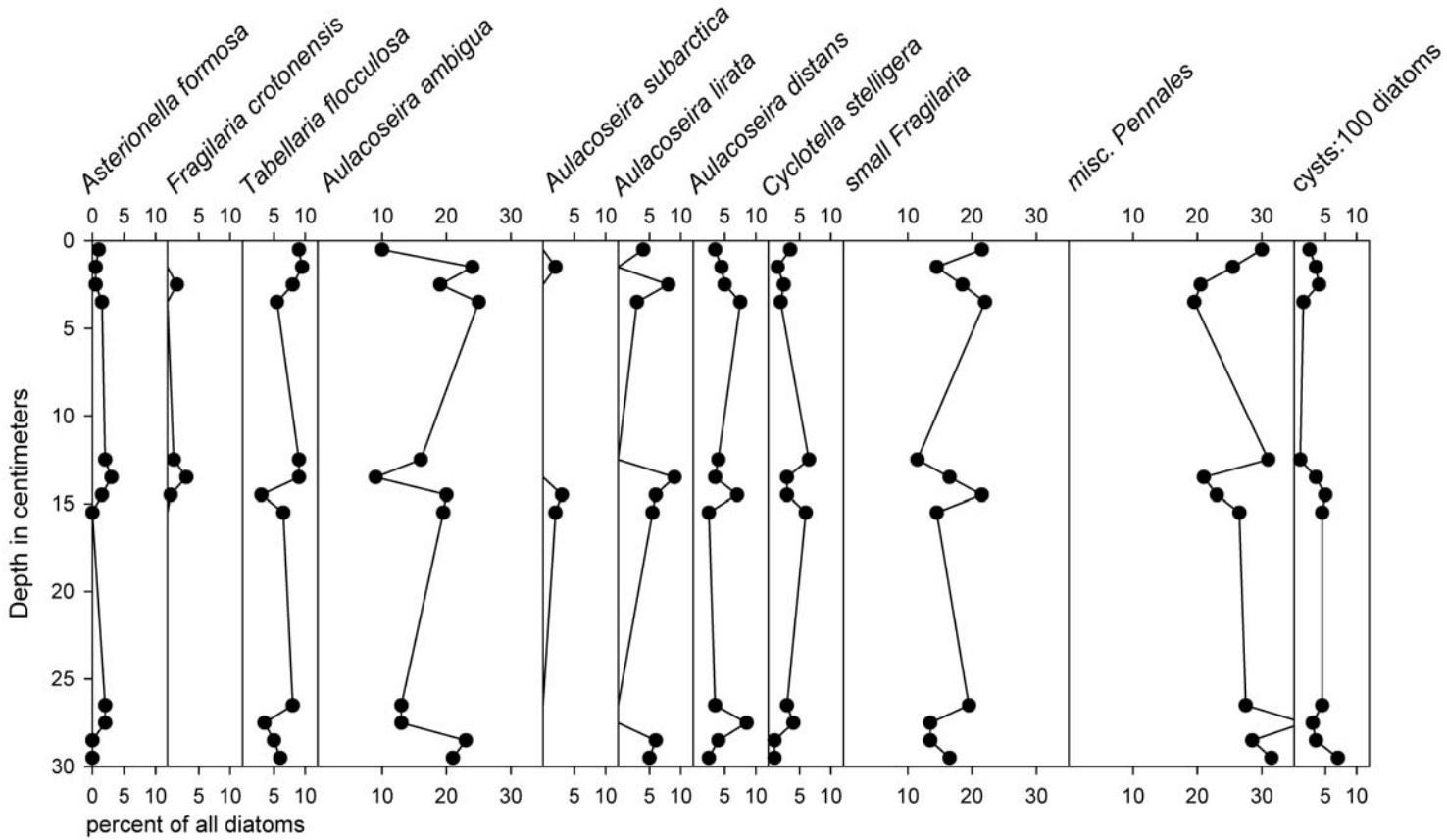
Brook trout, common shiner

creek chub, white sucker


N129SP







STINK LAKE, NY (analyses by Dan DeSorcy)

RECOMMENDATION:

Keep calling it *STINK* lake....

(or rename it “ANTHRAX LAKE?”)

WHY IDENTIFY HERITAGE LAKES?

They can serve as true scientific "control" systems and as models for lake restoration/preservation efforts.

They are inherently attractive and relatively easy and inexpensive to manage (*hands off*).

And they are rare, perhaps becoming rarer; *we don't even know yet!*

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CAN A RECLAIMED LAKE BE "HERITAGE?"

IT DEPENDS:

If Toxaphene was used: probably *NO.*

If *all* of the *original* species and genetic strains are present, in proportions close to the 1800 AD pre-disturbance state, then …*YES (?)*

(Long adaptation of native strains to particular lakes may have led to significant genetic divergence…hard to regain if lost)

Toxaphene can linger for years

- Carcinogenic, nerve and organ damage.
  - Stable, bioaccumulates.
  - Present in Canadian lake sediments after 30+ years.
- Fish in treated Canadian lakes are still inedible after 30 years.
- At least 15 Adirondack lakes were treated with Toxaphene between 1951 and 1966. Only **Wolf Lake** and **Black Pond** have been tested for it so far (negative test on trout).

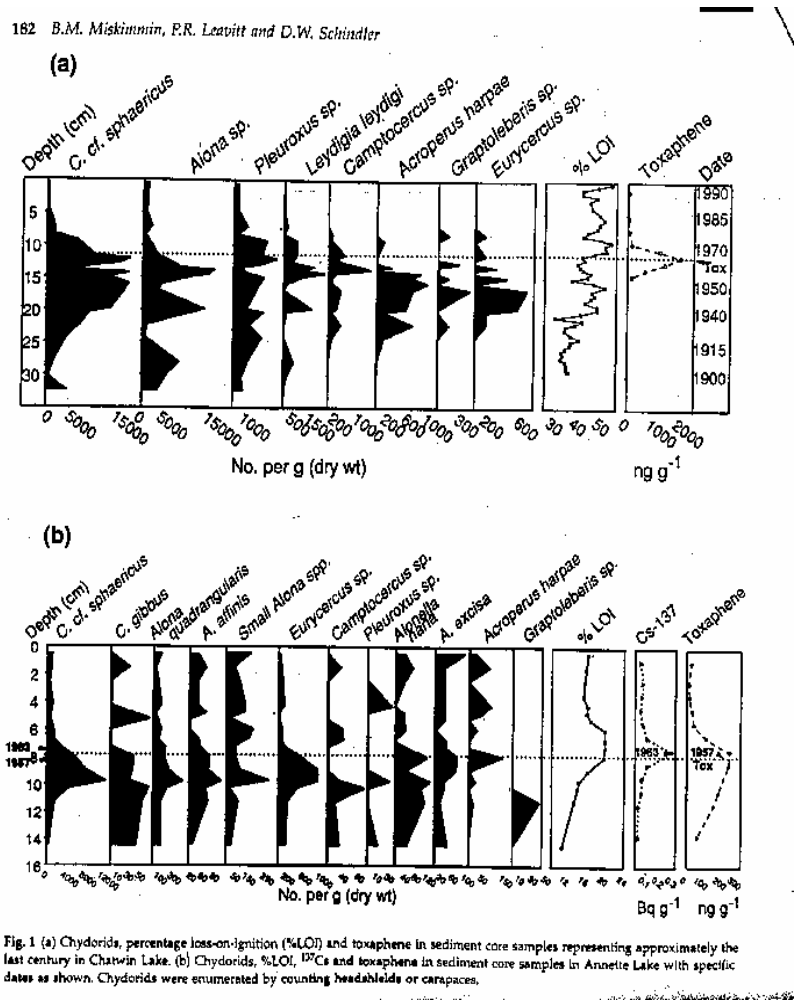

Fig. 1 (a) Chydorids, percentage loss-on-ignition (%LOI) and toxaphene in sediment core samples representing approximately the last century in Chatwin Lake. (b) Chydorids, %LOI, ^{137}Cs and toxaphene in sediment core samples in Annette Lake with specific dates as shown. Chydorids were enumerated by counting headshields or carapaces.