

Muskoka's Acid Rain Problem:
Is it time to hand out the chocolate to
celebrate recovery?

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One Brick Shy

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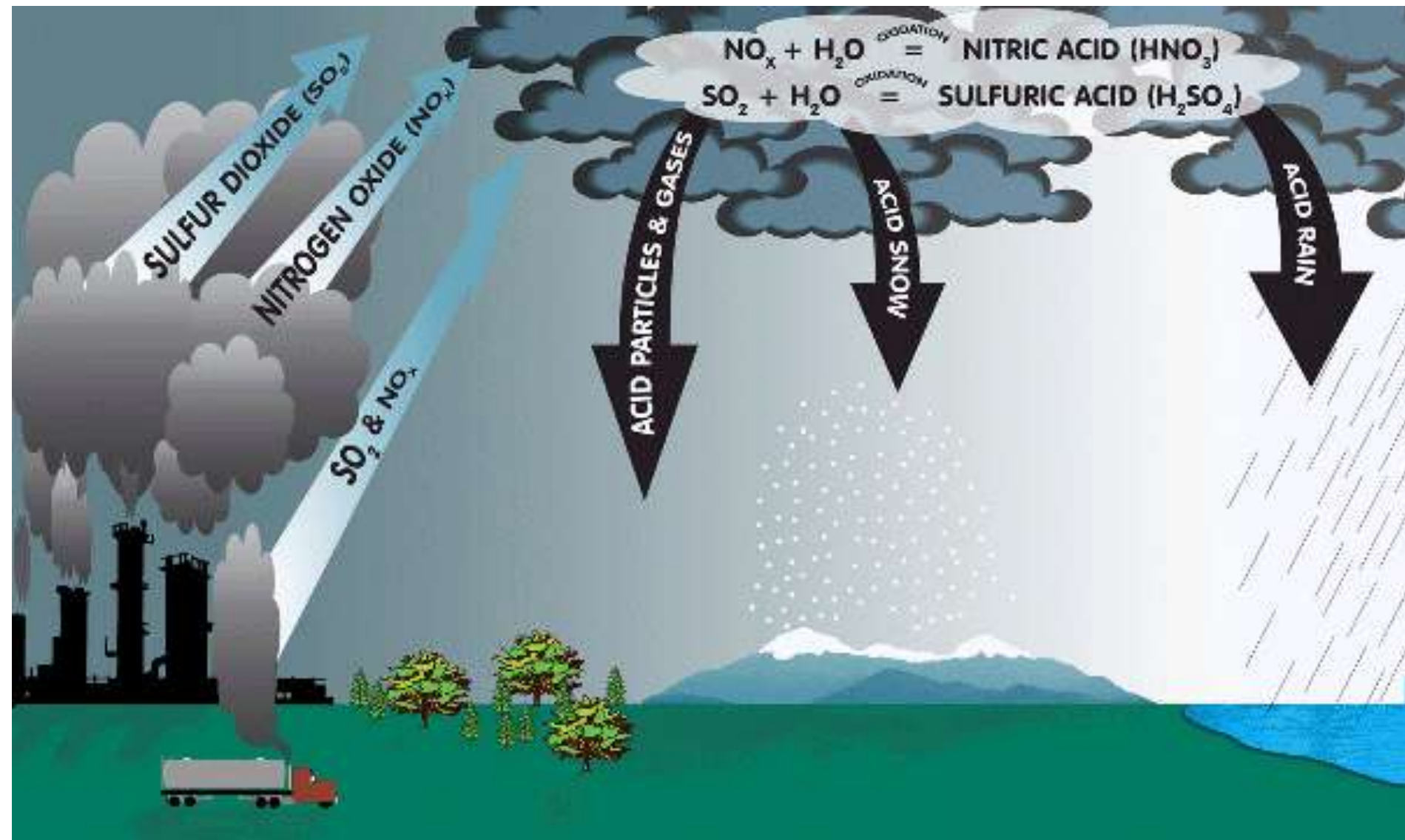
"Dad, what's acid rain?"

What makes our rain acid?

- $\sim 2/3$ sulphuric acid
- $\sim 1/3$ nitric acid
- Trace of hydrochloric acid
- Trace of carbonic and other weak natural acids

Acid Rain: a problem over large regions

Our acid comes from elsewhere



pH Scale

↑
More
alkaline

↑

neutral

↓

More
acid

↓



Household lye

Household bleach

Distilled water

Clean rain

Tea

Orange juice
Tomato juice

White vinegar
Lemonade

Battery Acid

Hard water lake

NW Ont soft-water lake

Local soft-water lake

Our local most acid lake

Ontario's most acid lake

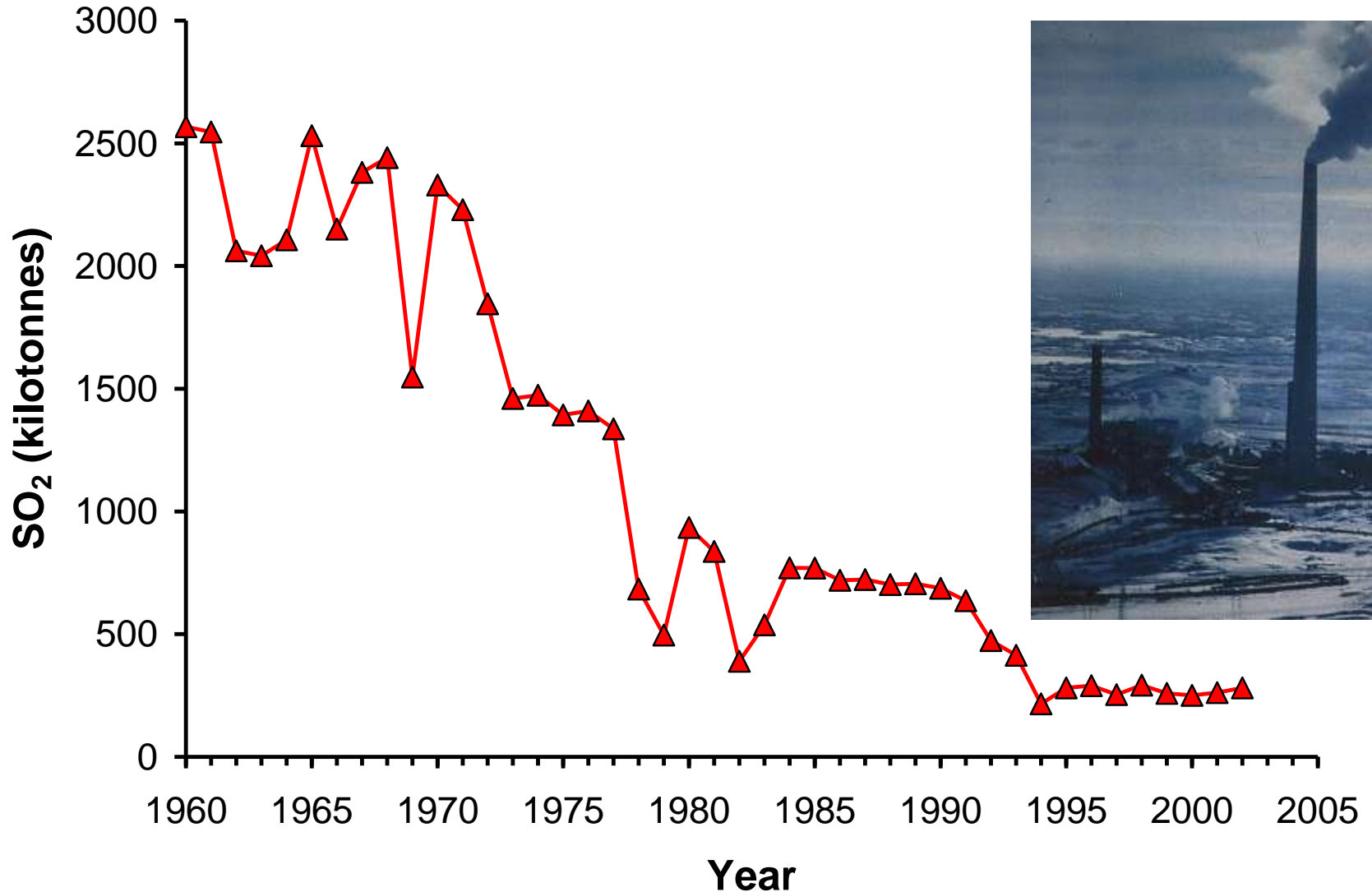
Typical acid mine lake

Most acid volcanic lake

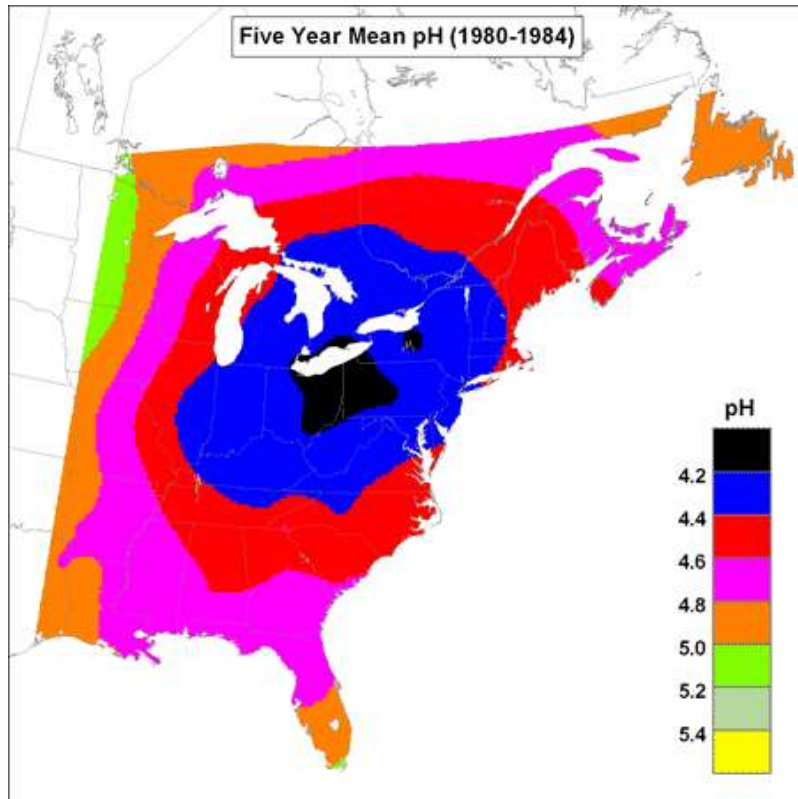
*

SO₂ emissions have been greatly reduced:

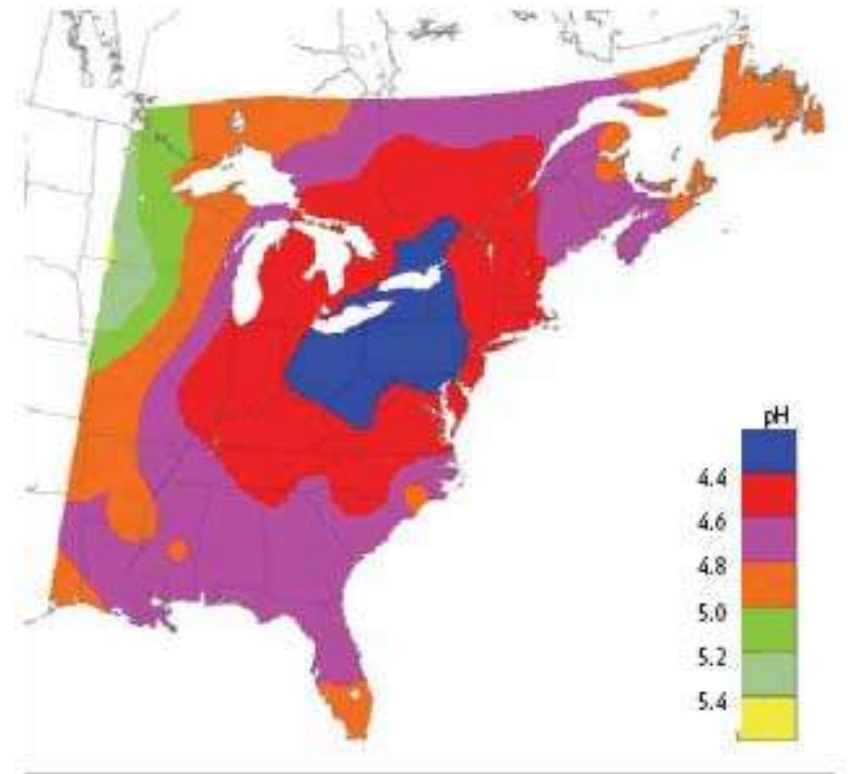
Especially in Sudbury, Ontario



The rain is ~50% less acid now



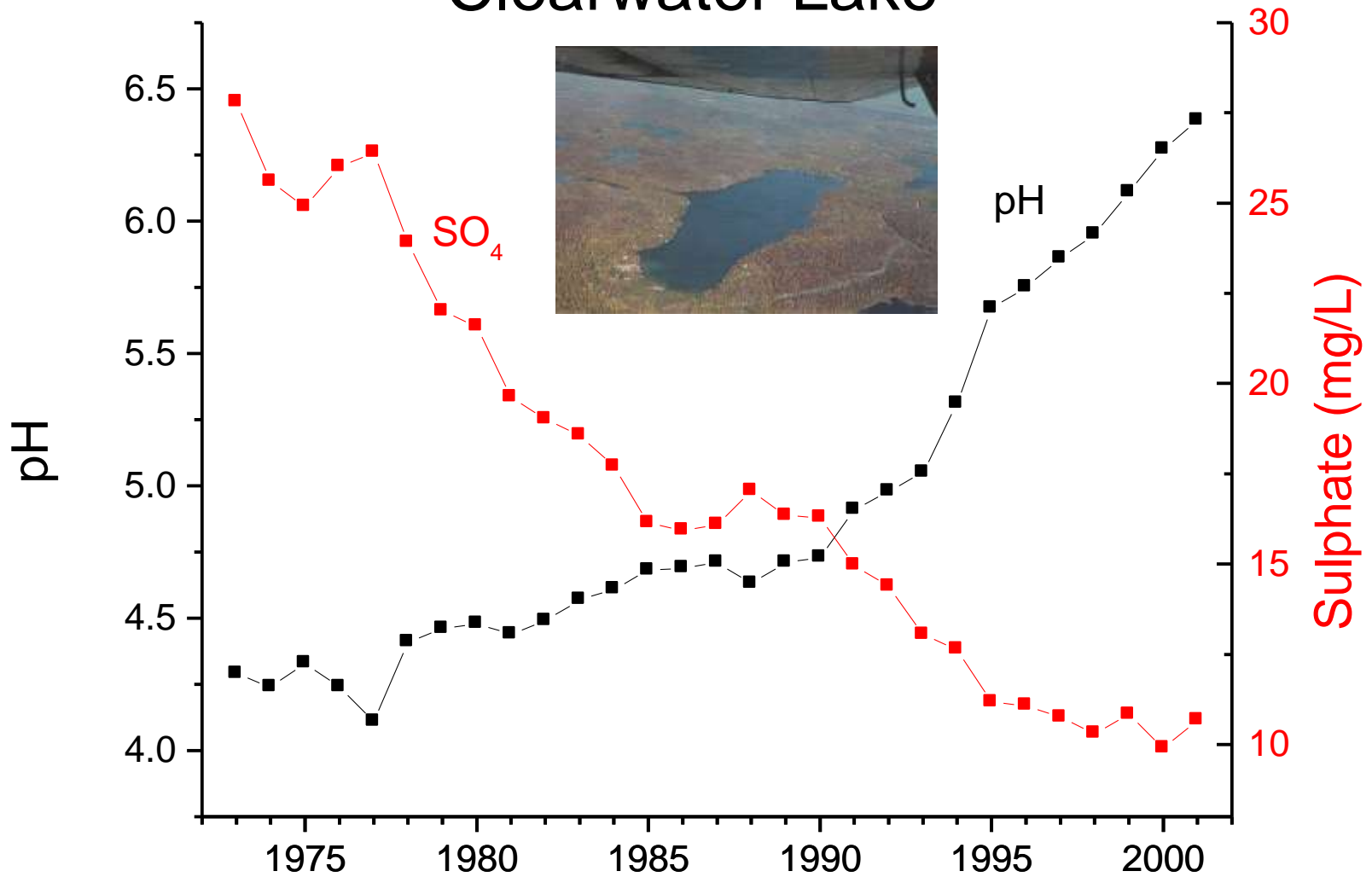
1980-1984



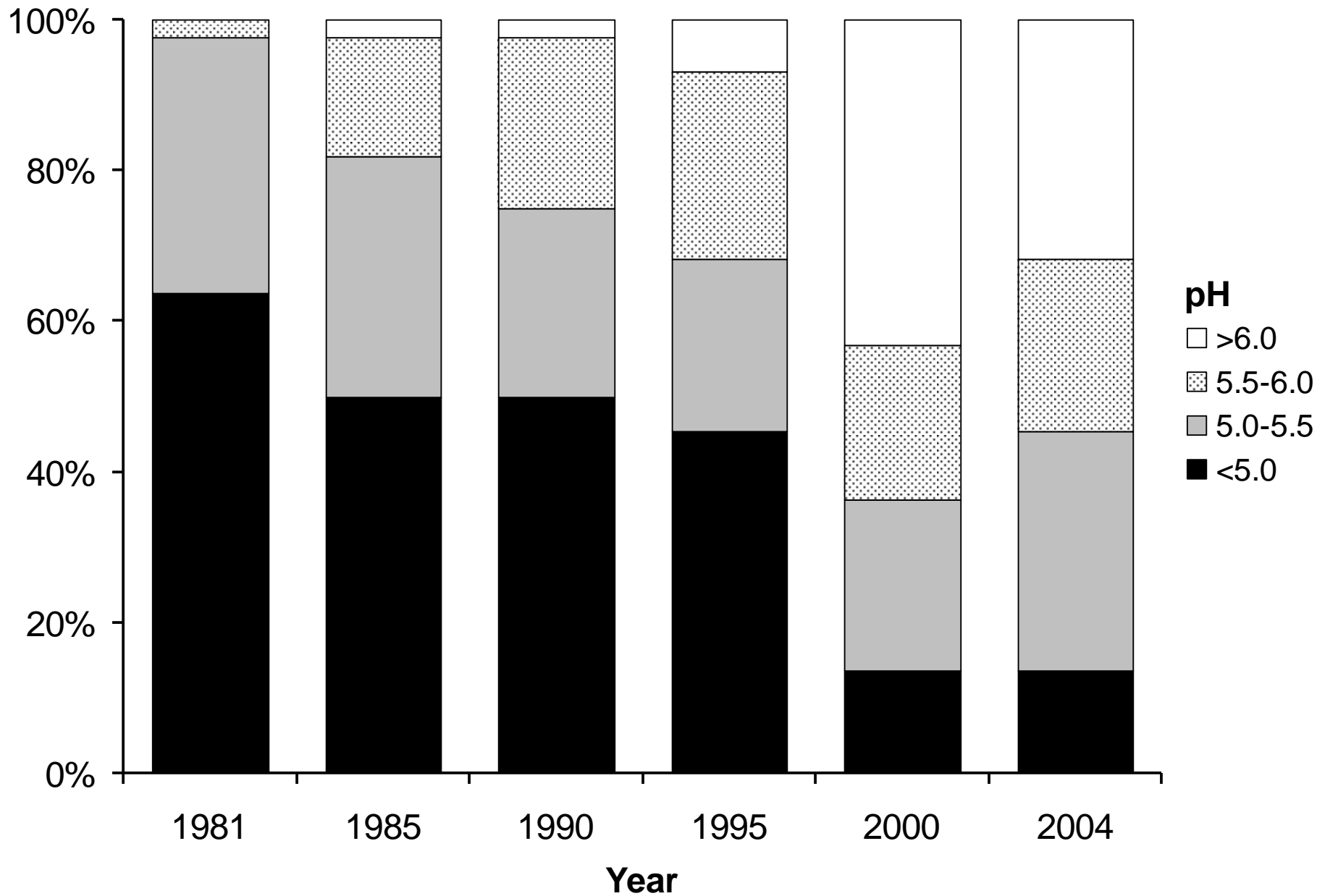
2000-2004

And lake acidity has declined near Sudbury

Clearwater Lake



Recovery of Sudbury lake trout lakes (Keller et al. 2005)

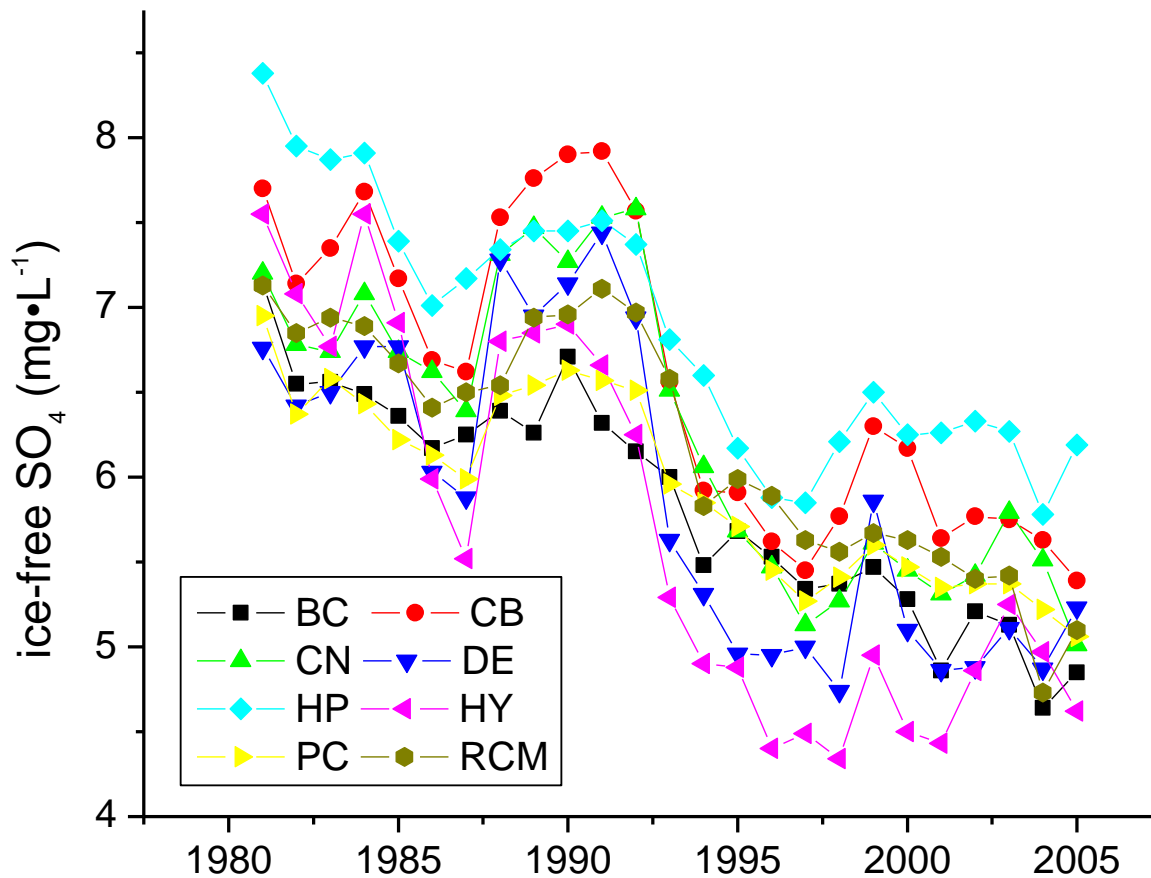


And 4 fish species colonized Clearwater Lake



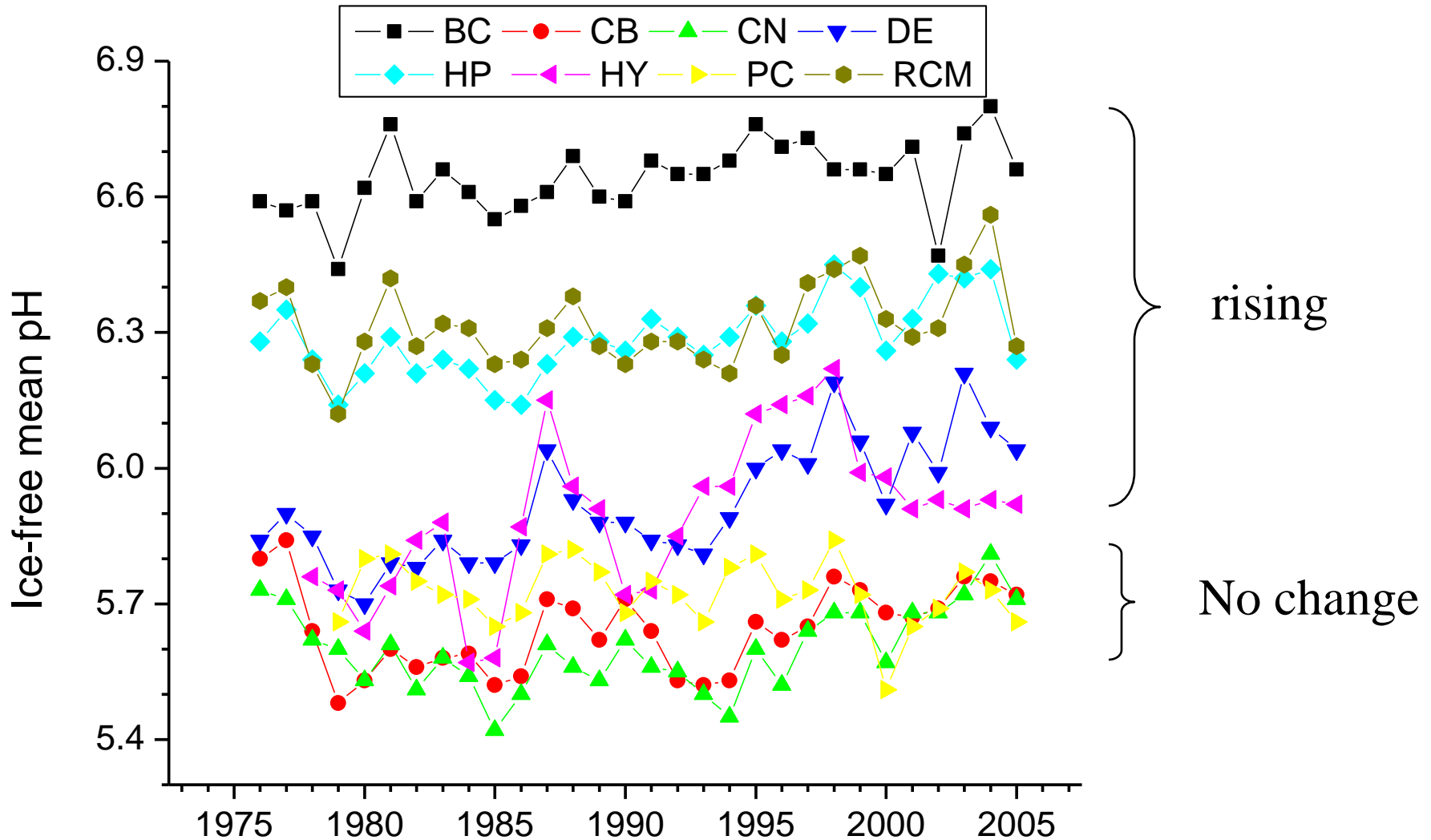
What about Muskoka?

Sulphate trends are similar in all lakes*



- Declining overall
- In synchrony, but
- Not monotonically
- Increasing after droughts, so climate change matters
- Less decline (50%) than in Sudbury (200%) since 1980

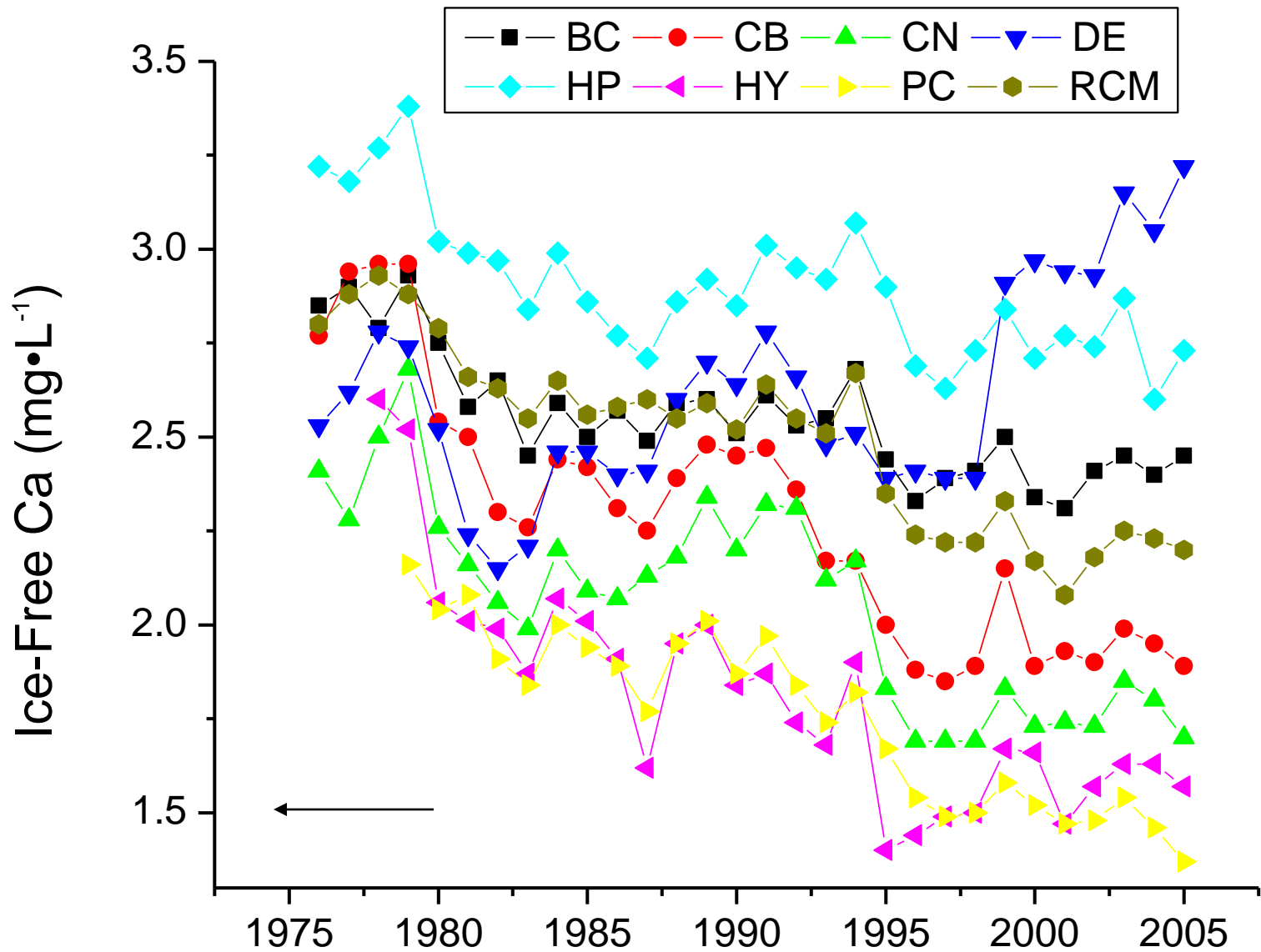
And pH is not yet uniformly rising



So....

- For our moderately acidic lakes, order the chocolates, but don't hand them out yet
- There has been real improvement. The rain is too acid for 20%, no longer 75%, of our lakes
- For our most acidic lakes (~20% of our lakes), don't order them yet. We need more reduction in S emissions and thus in local acid deposition, before they will recover, and some might have been naturally acid
- The Sudbury story proves that more reduction in S deposition will help Muskoka

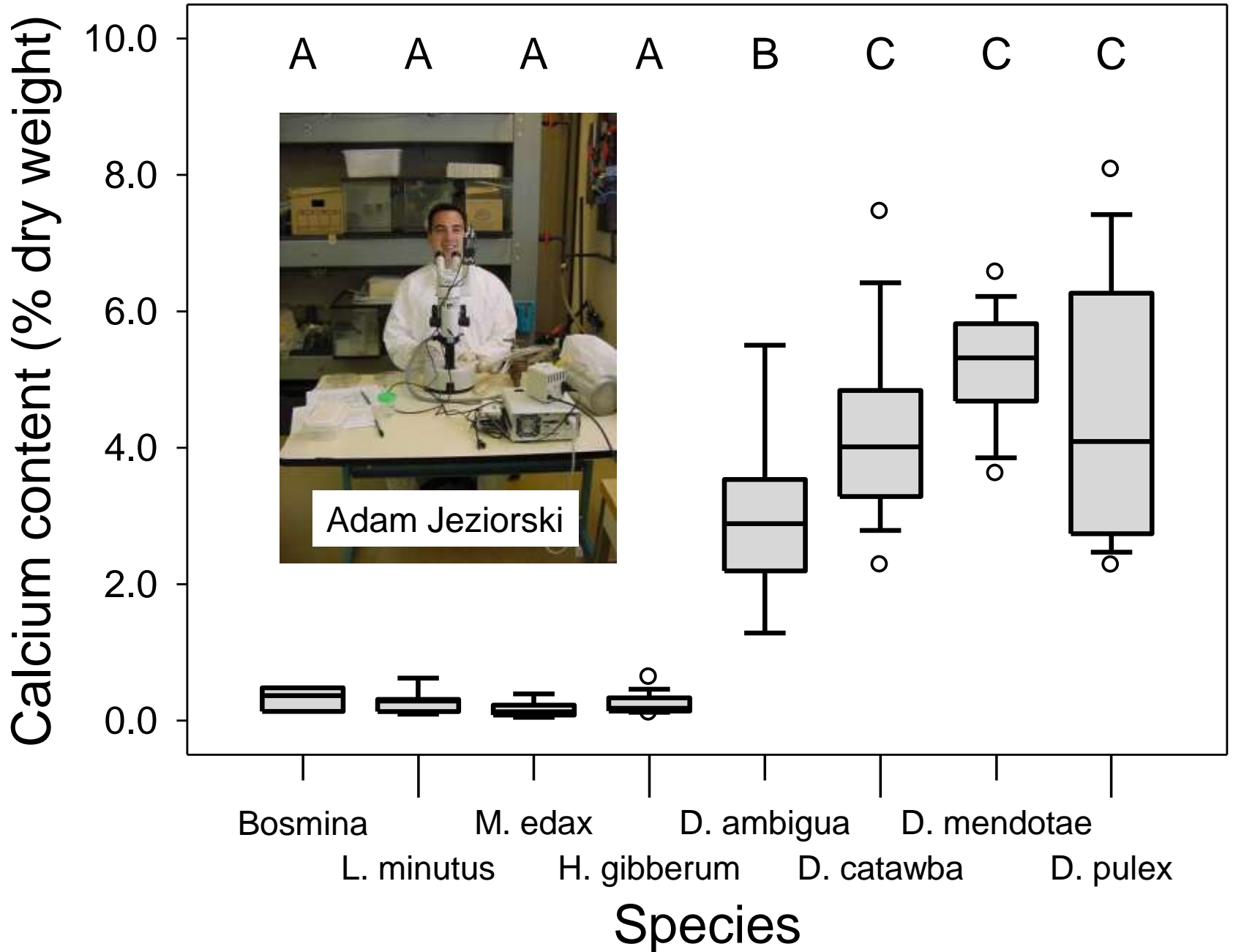
An emerging complication – lake ‘osteoporosis’



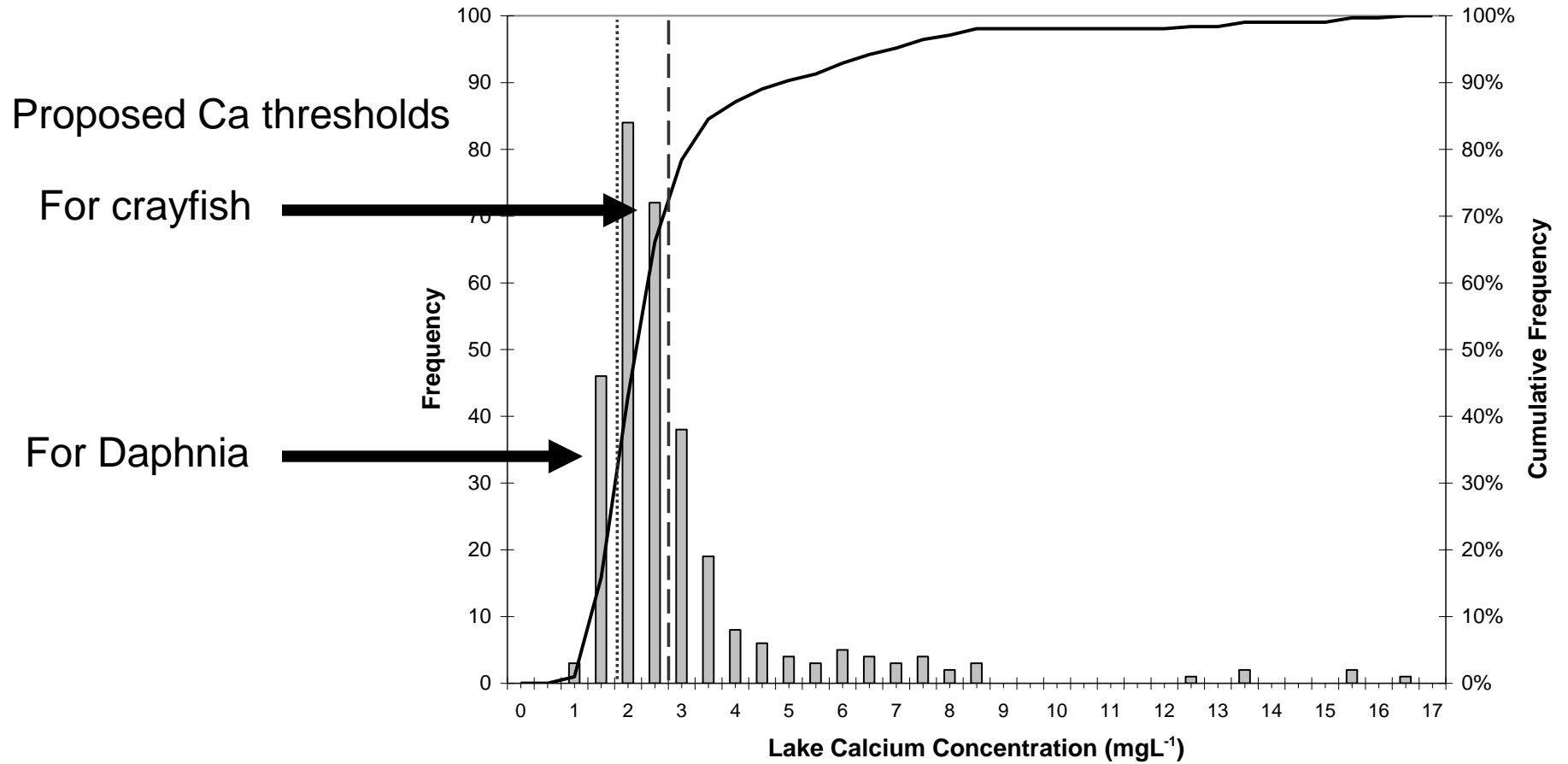
All creatures need Ca



But some need more than others



Might Ca loss already be a problem?



Cairns and Yan (in revision)

So.....

- Both declining Ca levels and climate change are complicating the story of recovery from acid rain.
- We need to further reduce S emissions both to allow recovery of more lakes from acidity, and to prevent the further loss of Ca from our soils and our lakes.
- We have made real progress, but don't hand out the cigars (or the chocolate)

Acknowledgements

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