

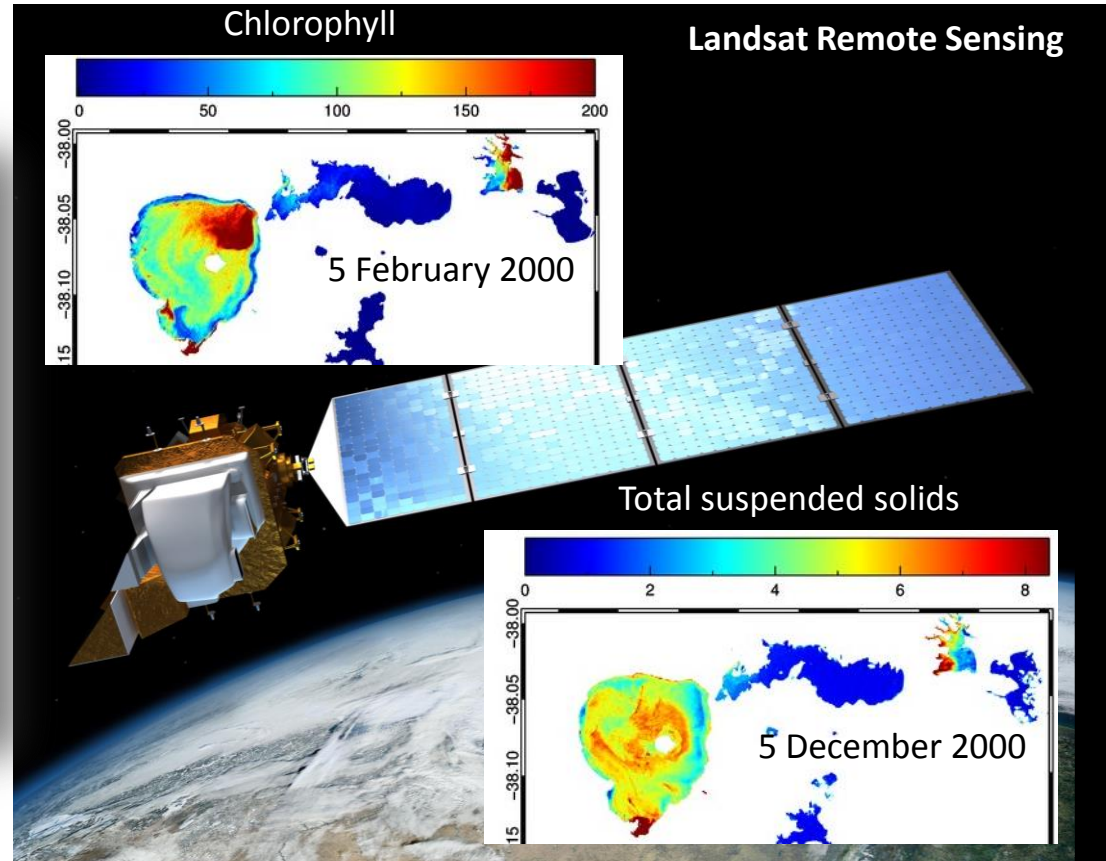
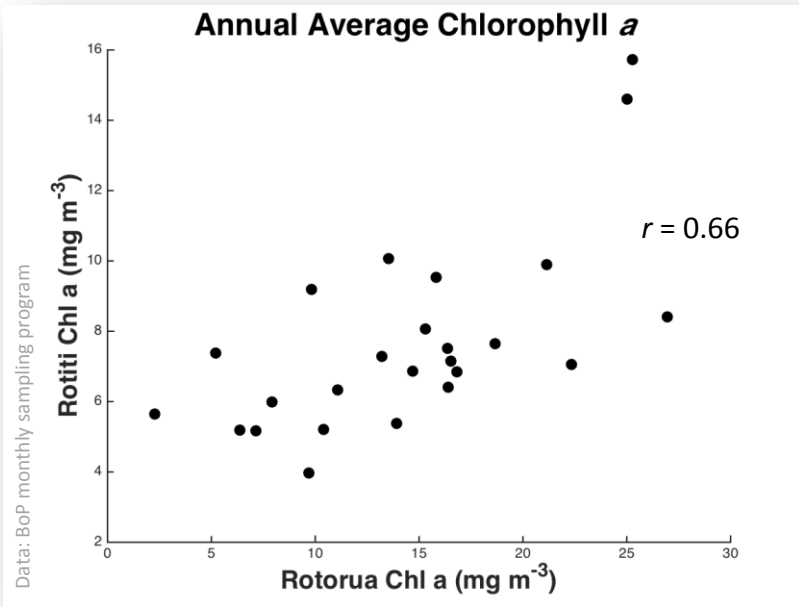
Ohau channel diversion wall: detecting biological effects

Moritz Lehmann

Rotorua water flows into Rotoiti via Ohau Channel



Water quality between Rotorua and Rotoiti is linked



Simulating the mixing of Rotorua water in Rotoiti

- 3-D hydrodynamic model (Delft3d),
- 37,830 grid cells, met and run-off forcing
- Passive tracer in Ohau channel inflow
- Mixing strongly dependent on wind
- Mixing throughout lake



- Steel pile wall built in 2008
- Diverts water from Rotorua towards Rotoiti's outflow (Kaituna River)

$5 \text{ m}^3 \text{ s}^{-1}$

$15 \text{ m}^3 \text{ s}^{-1}$

$20 \text{ m}^3 \text{ s}^{-1}$

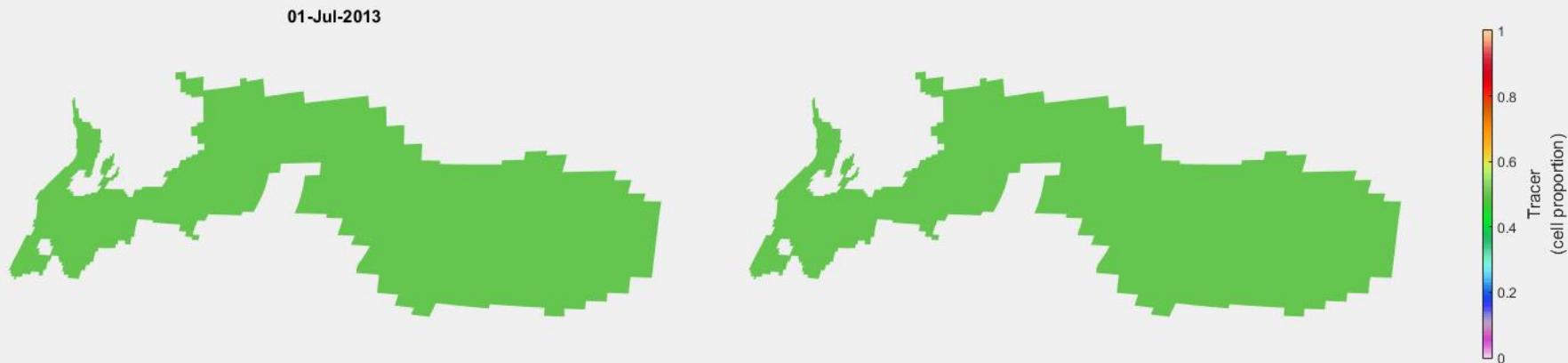


Simulating the mixing of Rotorua water in Rotoiti

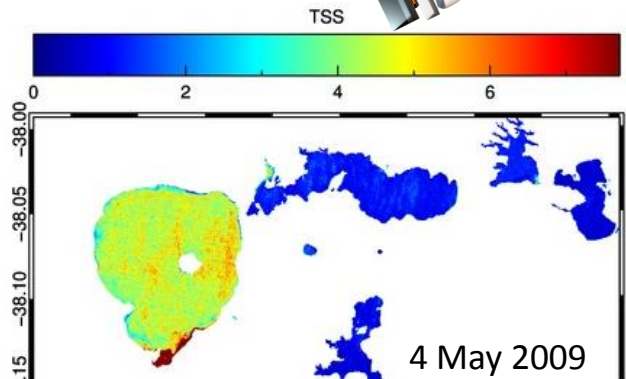
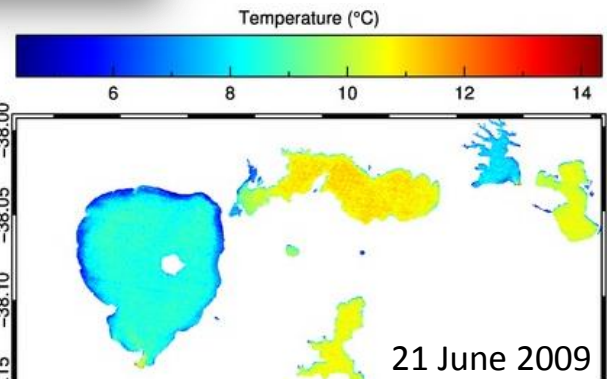
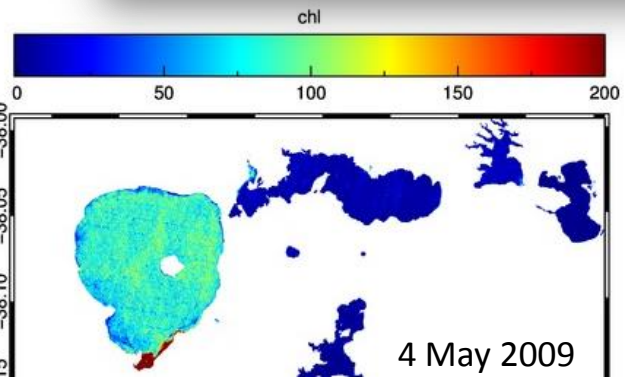
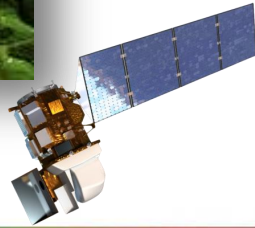
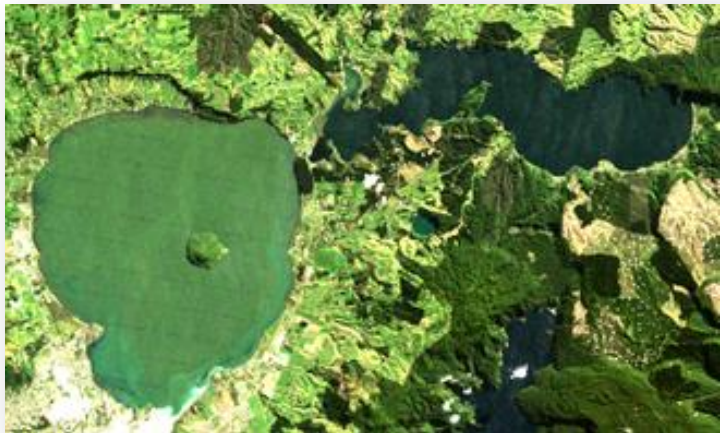
- Wall reduces mixing greatly
- Under certain conditions, Rotorua water still mixes with Rotoiti western basin

Pre-wall scenario

Wall scenario



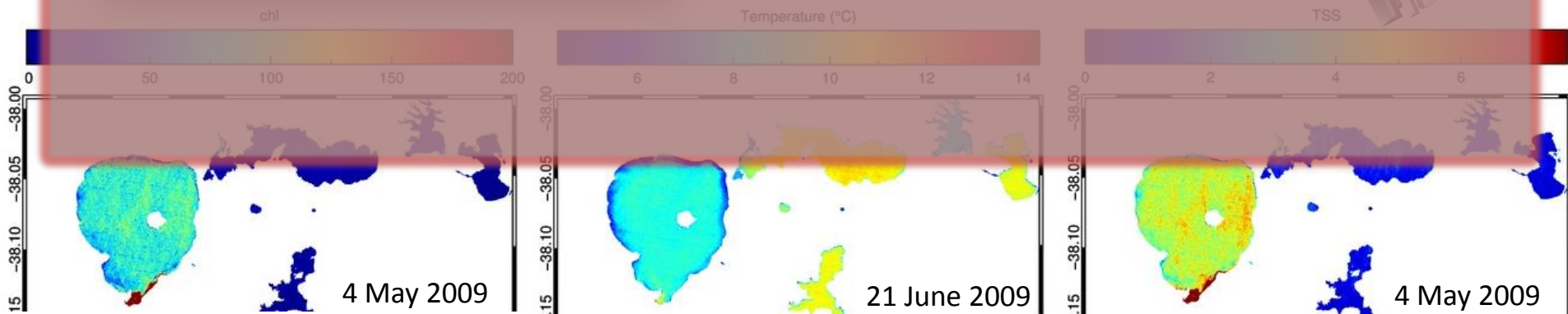
Anecdotal evidence suggests water-quality improvements in Rotoiti since 2008



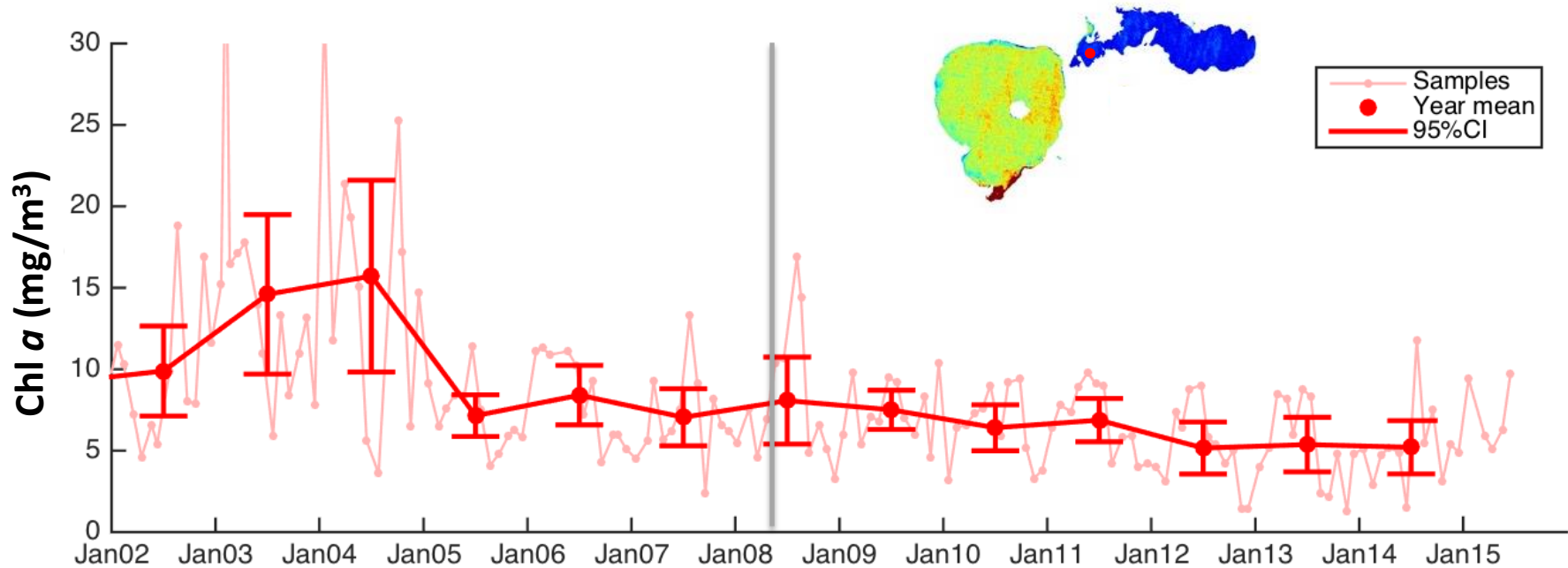
Anecdotal evidence suggests water-quality improvements in Rotoiti since 2008



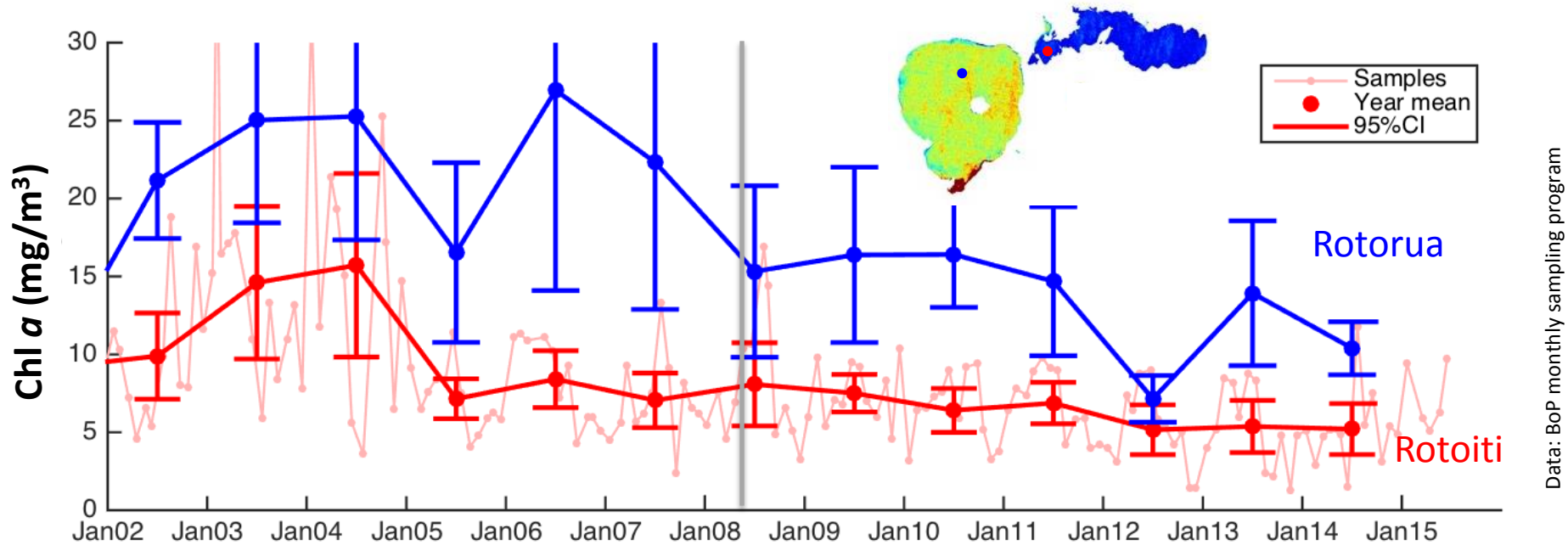
Do we have solid scientific evidence for the wall effect on water quality in Lake Rotoiti?



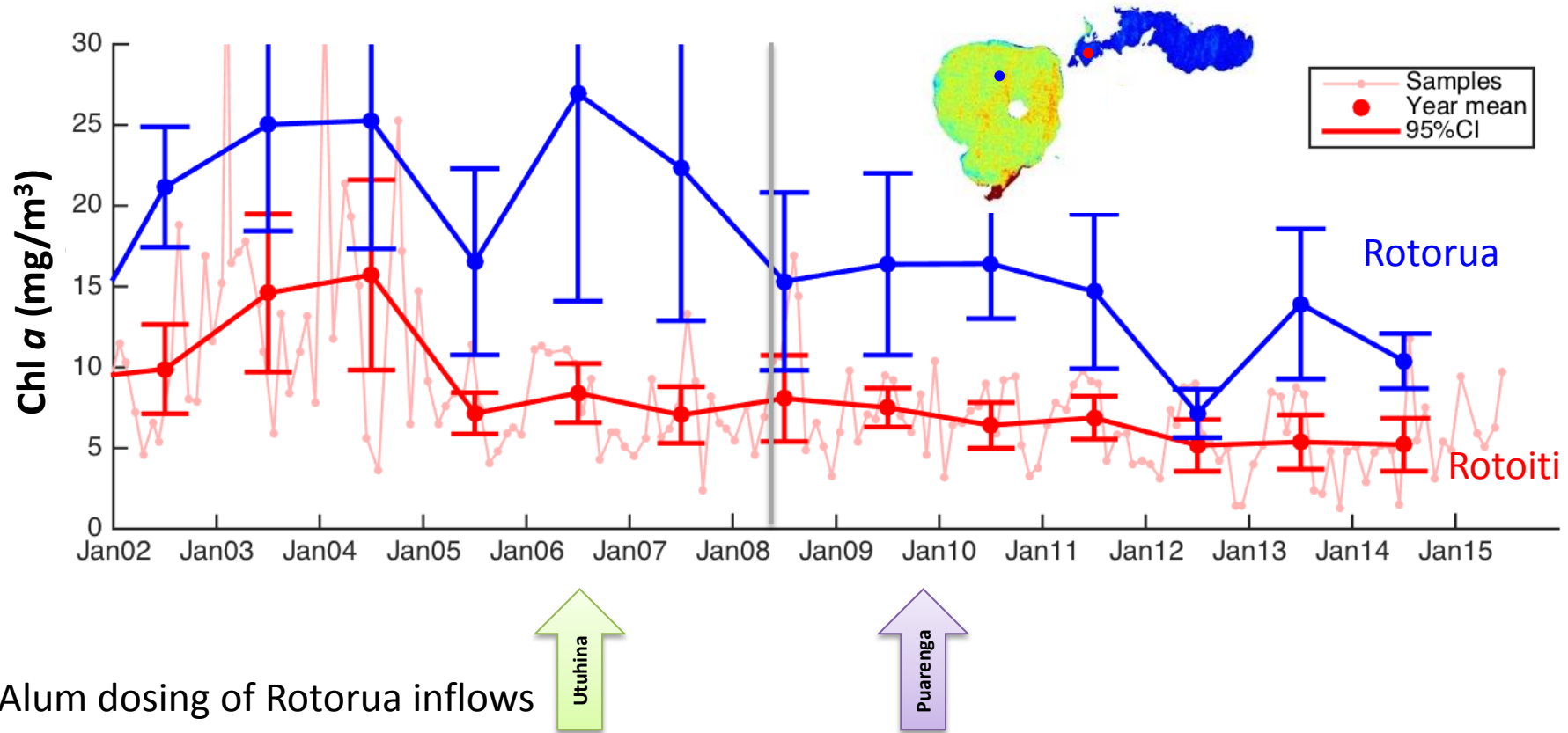
Algae concentration in Rotoiti declined but also in Rotorua



Algae concentration in Rotoiti declined But also in Rotorua



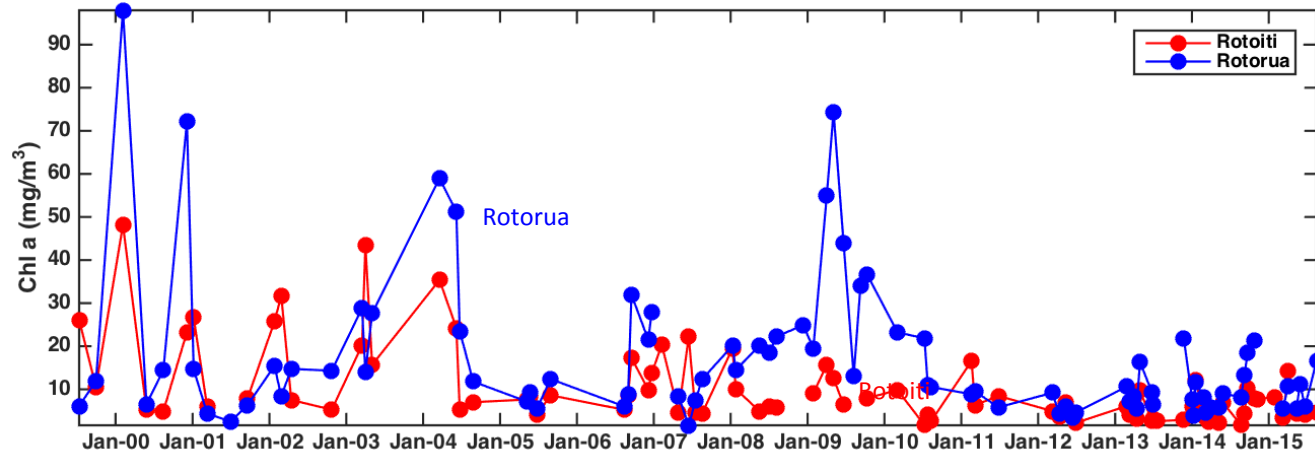
No straightforward cause-and-effect



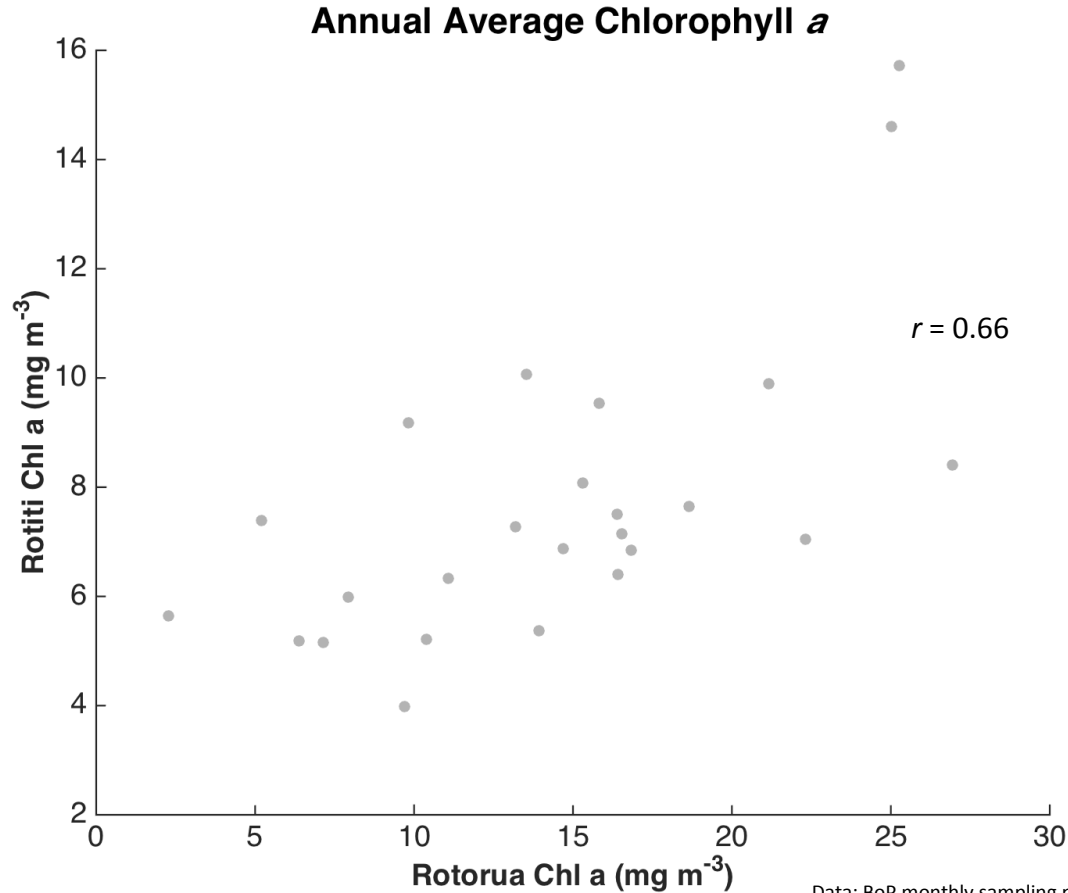


Remote Sensing

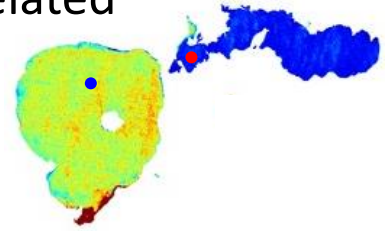
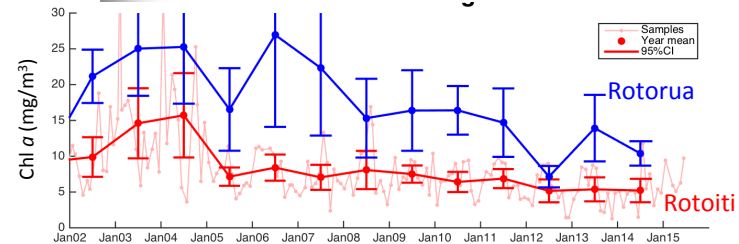
- 98 clear images since 1999 (51 post-wall)
- Definite reduction in chl since 2008 in both lakes
- No clear wall effect



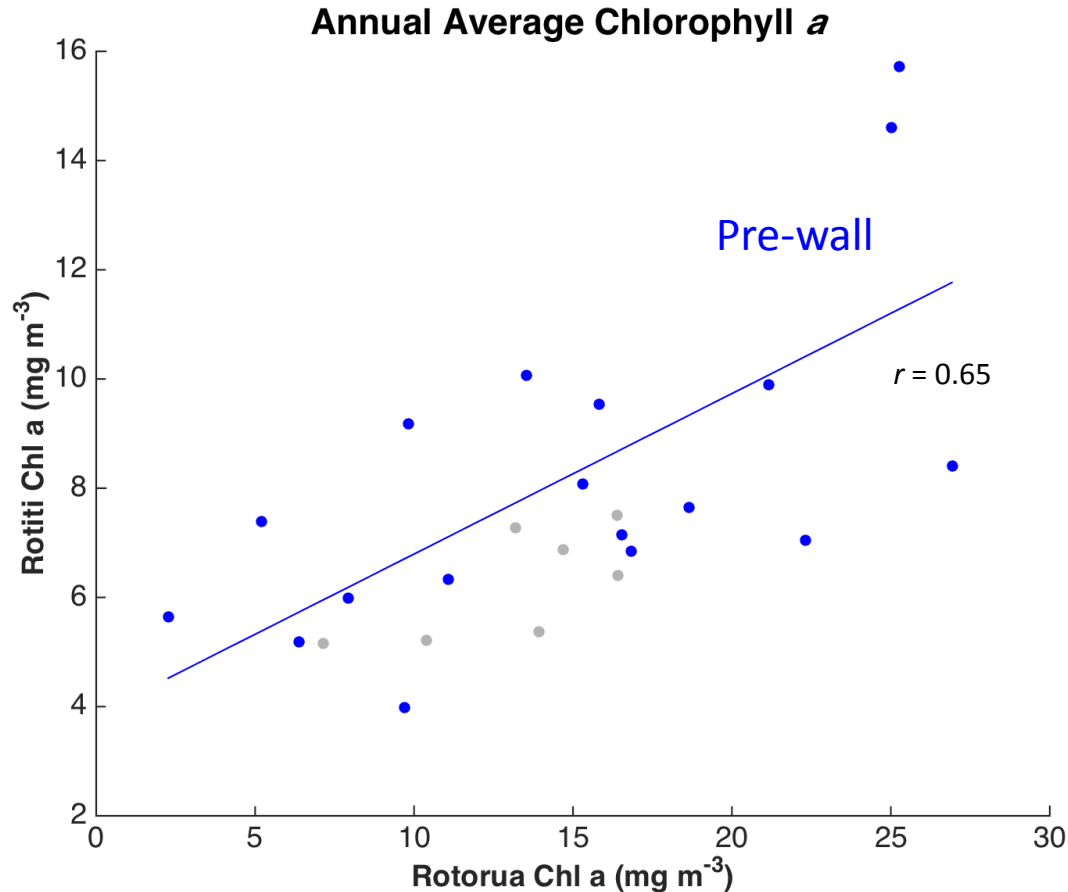
Water quality between Rotorua and Rotoiti is correlated



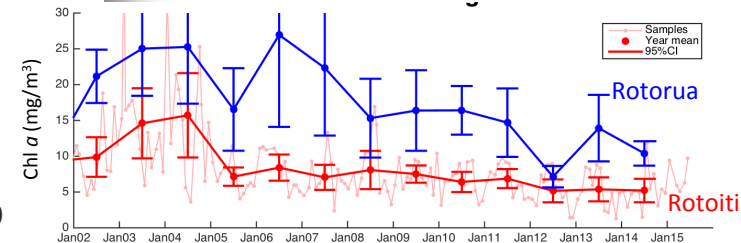
Data: BoP monthly sampling program



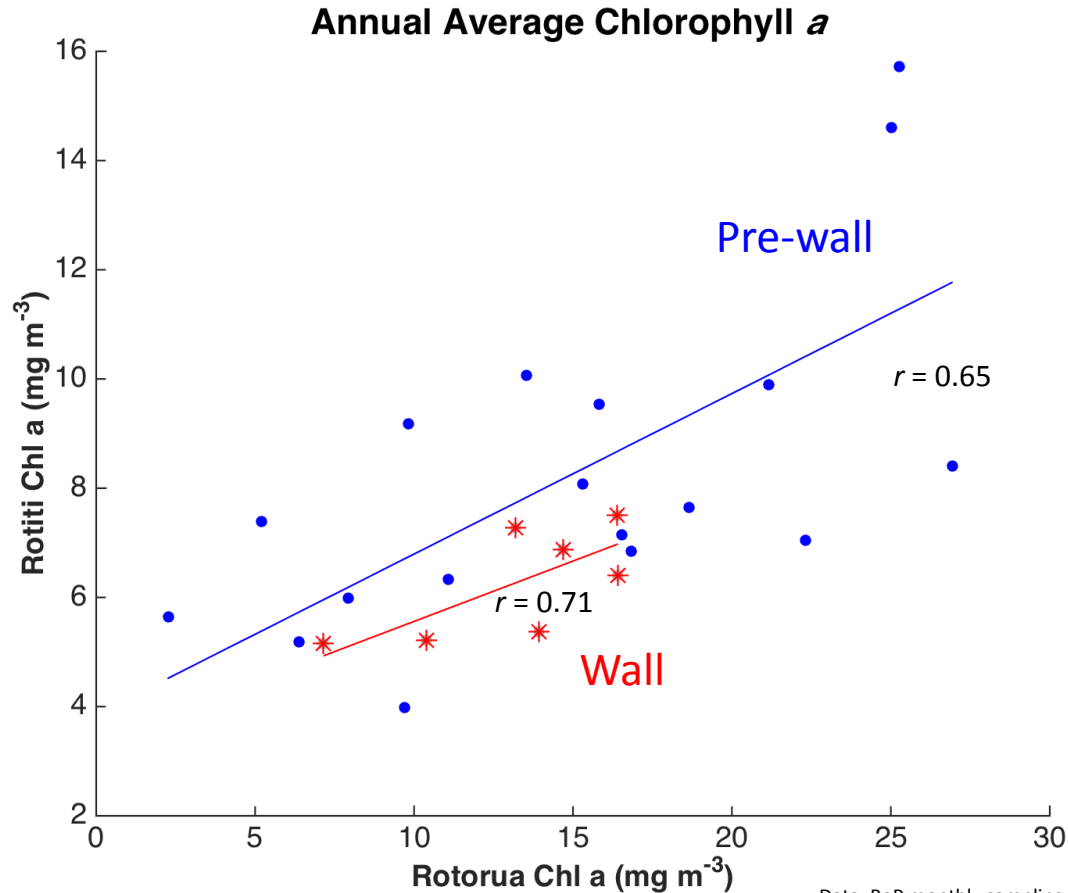
Water quality between Rotorua and Rotoiti is correlated



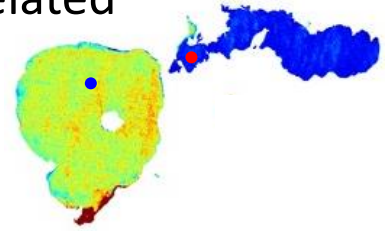
A significant change in the relationship between Rotorua-Rotoiti chl would suggest inherent modification of wq forcing of Rotoiti



Water quality between Rotorua and Rotoiti is correlated

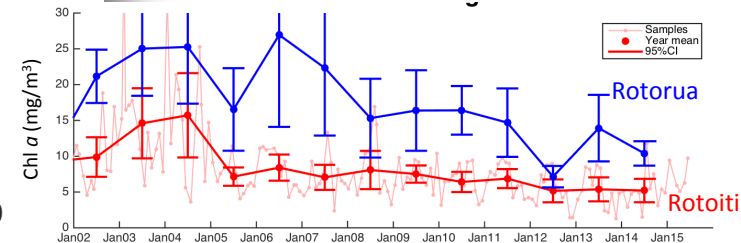


Data: BoP monthly sampling program



The change in this relationship may be attributed to the effect of the diversion wall.

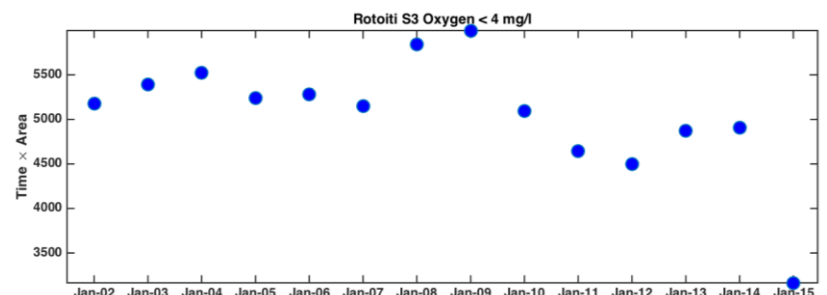
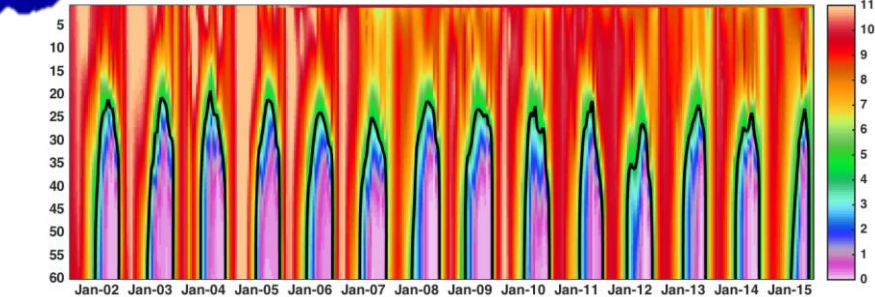
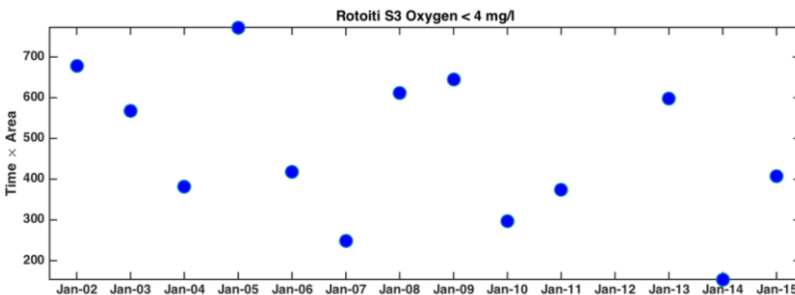
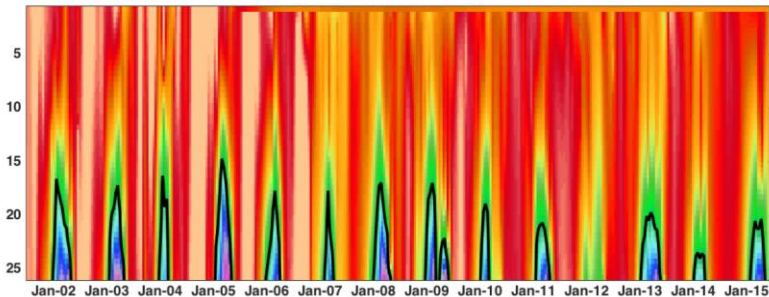
Change in intercept suggests reduction in chl by at least 0.5 mg m^{-3}



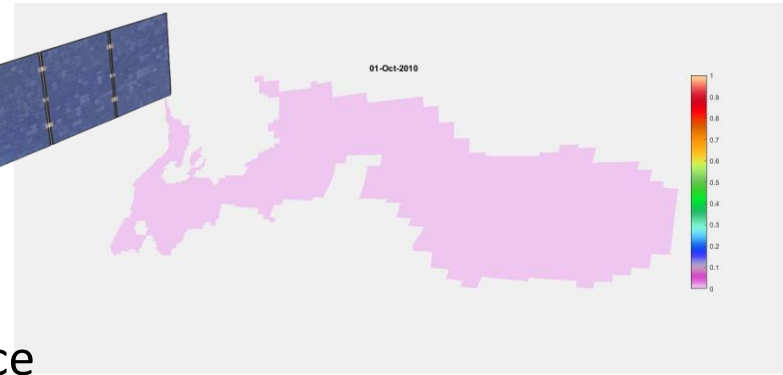
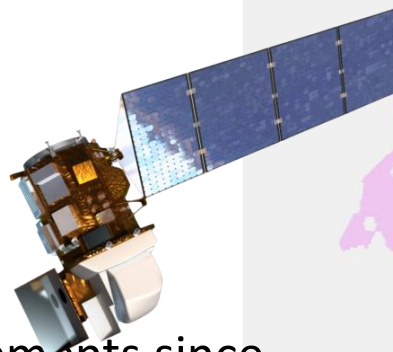
Hypolimnion oxygen depletion

- Oxygen consumption under stratified conditions causes anoxia of deep water
- Extent of anoxia is an integrated measure of community metabolism
- There is no clear trend towards reduction of anoxia over the years

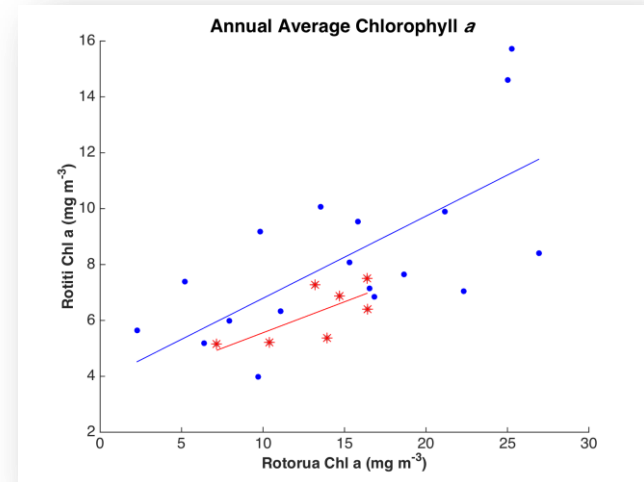
Western Basin ←  Crater



Conclusions



- There is evidence for wq improvements since 2008; but
- There is as yet not proof for wall effect; and
- Multiple lines of evidence are needed to tell the story (water samples, buoy monitoring, remote sensing, casual observations, models).





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Thank you!

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