



# Alternative Crop Protection Approaches to Chemicals and Pesticides

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# Why ponds crash?

				Crash. Following the 6th harvest, the OD continued to decline (0.5 to 0.3). Invaders count inc. from 50 to 300. Dusty rainy conditions may have played a role. VV data unknown.		
ARID	CS	4/18/17 9:00	5/17/17 10:00	Crash. OD drop 1.1 to 0.9. Ciliate count 12 to 50 followed by gradual increase. Unintended snd/chl polyculture. Pale bubble like cells. On 5/4, Chl cell count 1 log reduction, 6 log drop to n.d. in one day. By termination on 5/5/2017, OD = 0.7. Ciliate # = 7000/slide.	Post-harvest (1.3 ppm). Initial (0.5 ppm). Additional dose during crash. 7 total	30
PW1	SO	4/20/17 14:00	5/3/17 10:30		N/A	13

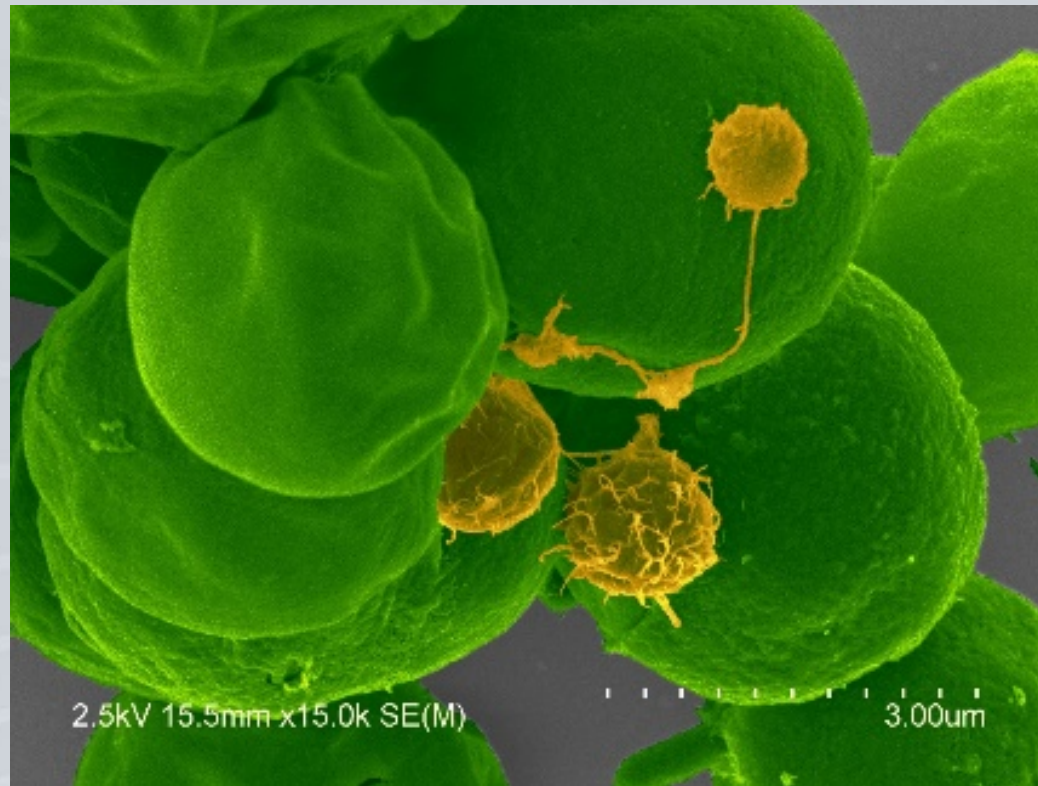


# Why ponds crash?

PW1	CS	11/9/16 15:00	11/30/16 9:30	Early termination. Healthy. OD750 = 0.898. Clean.	Every 4 d (2 ppm)	
PW2	CS	11/9/16 15:00	11/19/16 9:00	Crashed. OD dropped from 0.7 to 0.6. VV biomass fraction increased steadily and then spiked between 11/18 and 11/20. Invader count was 20/slide at crash and increased to 2000/slide by termination (opportunists). Observation of vacuuous cells.	No BZK control	10
ARID	MM	11/29/16 12:00	12/27/16 14:00	Crash. Very rainy season. 1670 L of rain prior to start of crash on 12/27. Additional 700 L of rain by 1/1. Overfilled reactor. Sump pump malfunction due to precipitation and settling algae combined with overcast days meant limited agitation. Replacement sump pump also failed. Invaders.	N/A	28



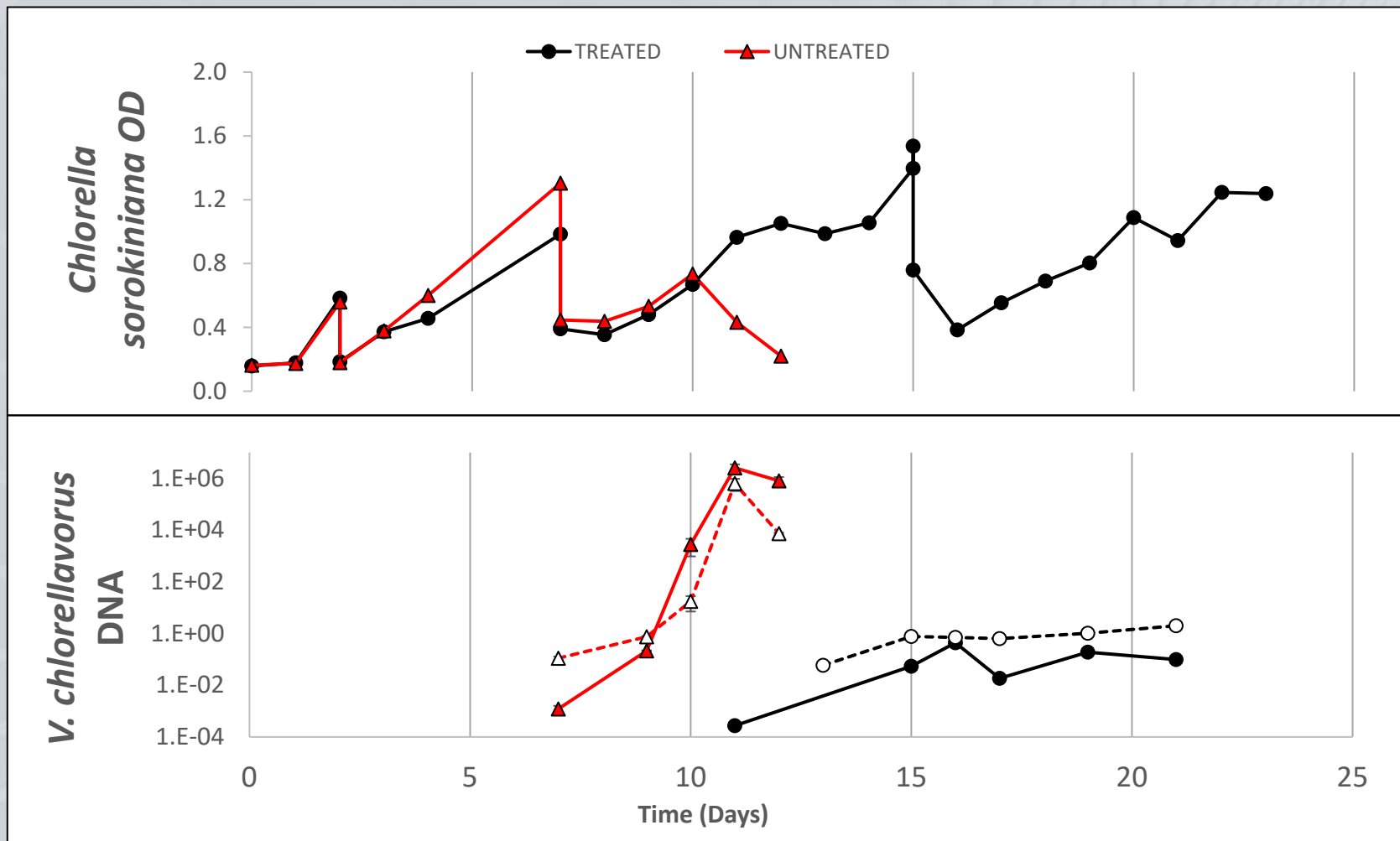
# My biggest pest - *Vampirovibrio chlorellavorus*





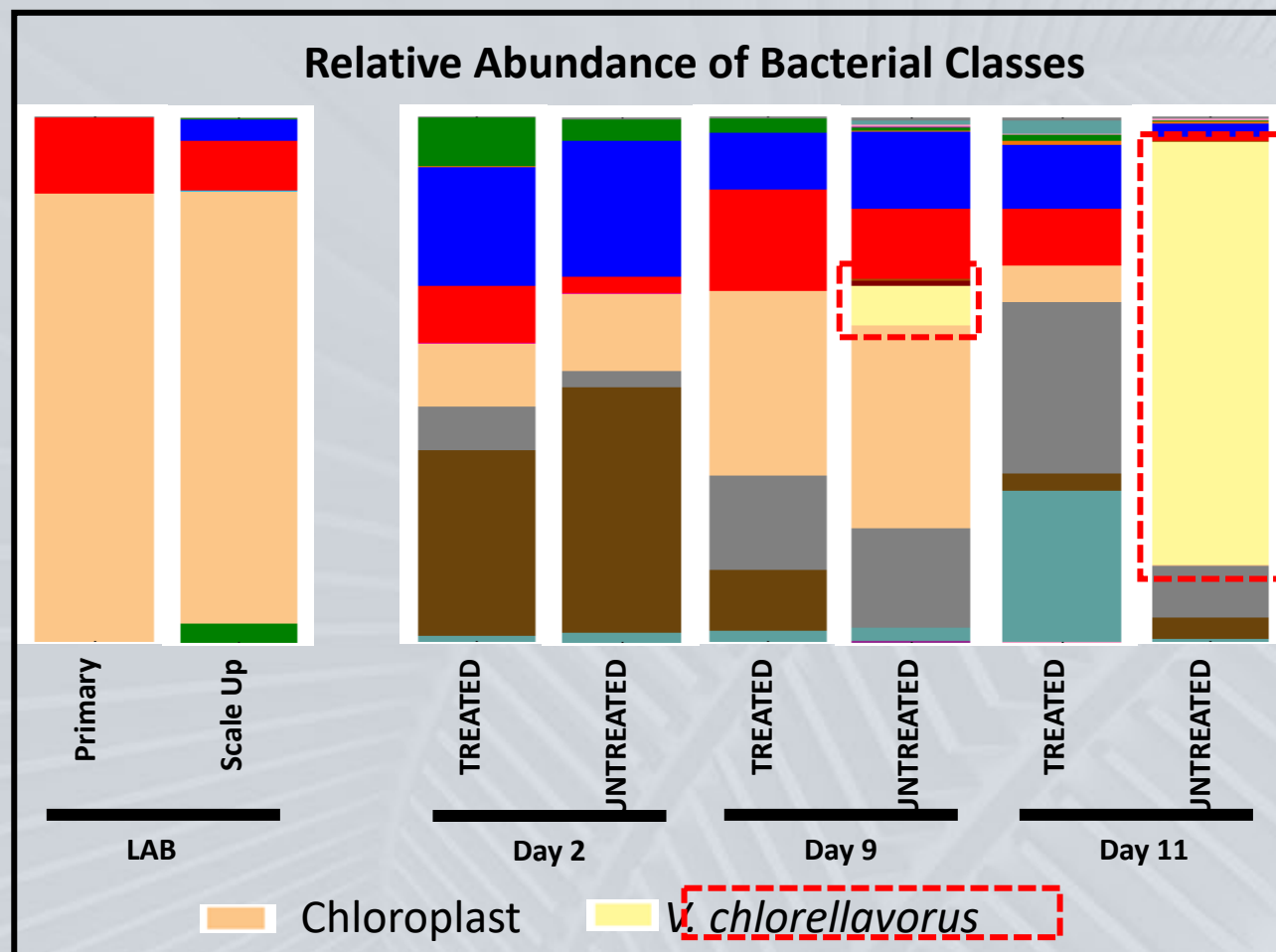
# Biocide Treatment Experiment

- Outdoor cultures treated with benzalkonium chloride (2 ppm doses)
- Pathogen detection by quantitative PCR
  - Limit of detection ~ 19 *V. chlorellavorus* DNA copies
- Untreated culture crashed early and accumulated a high concentration of pathogen
- **Treated culture sustained**



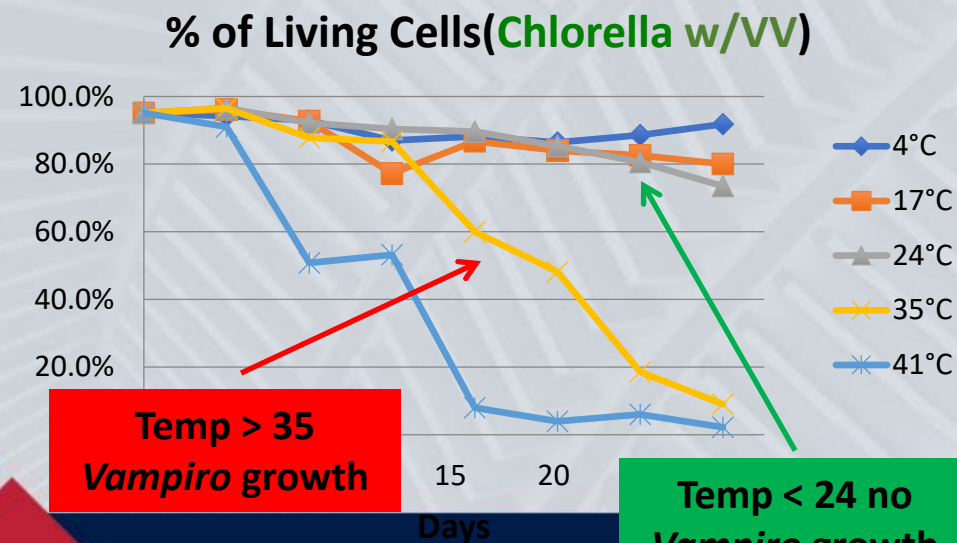
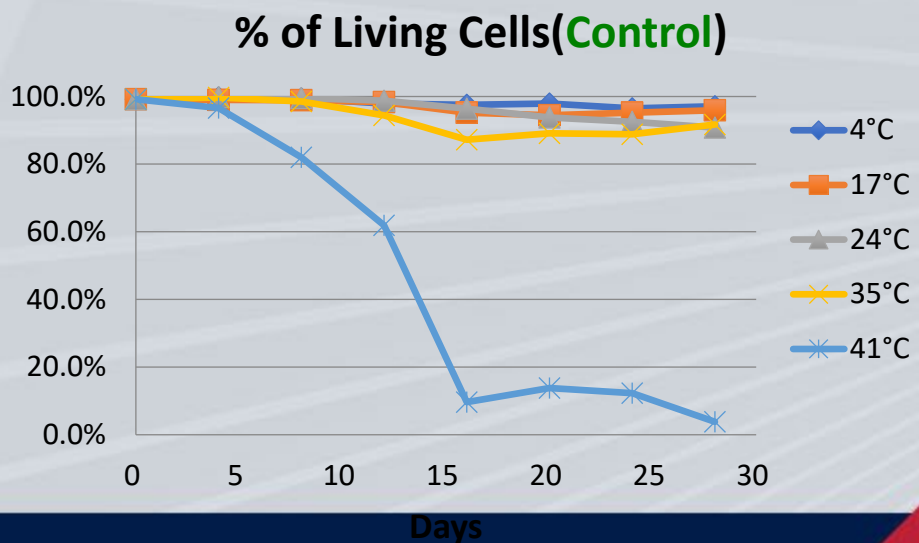
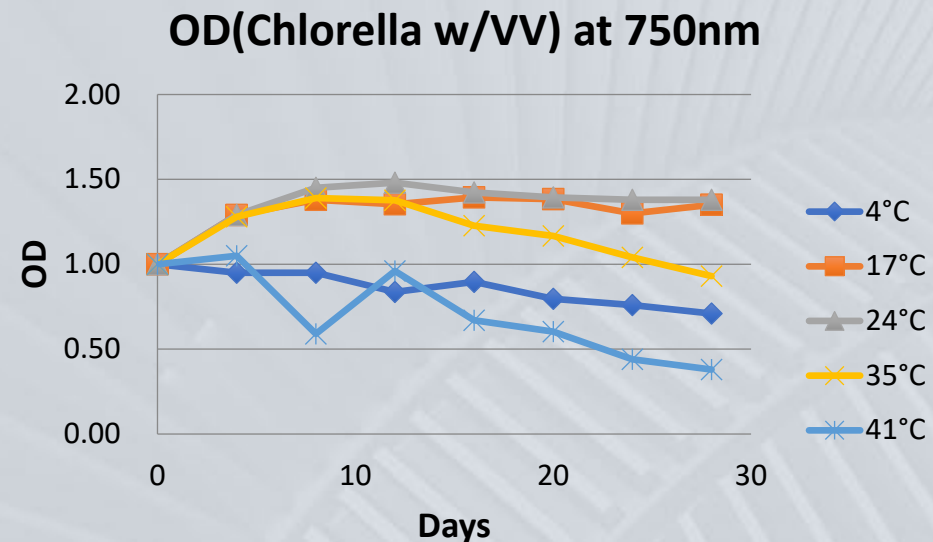
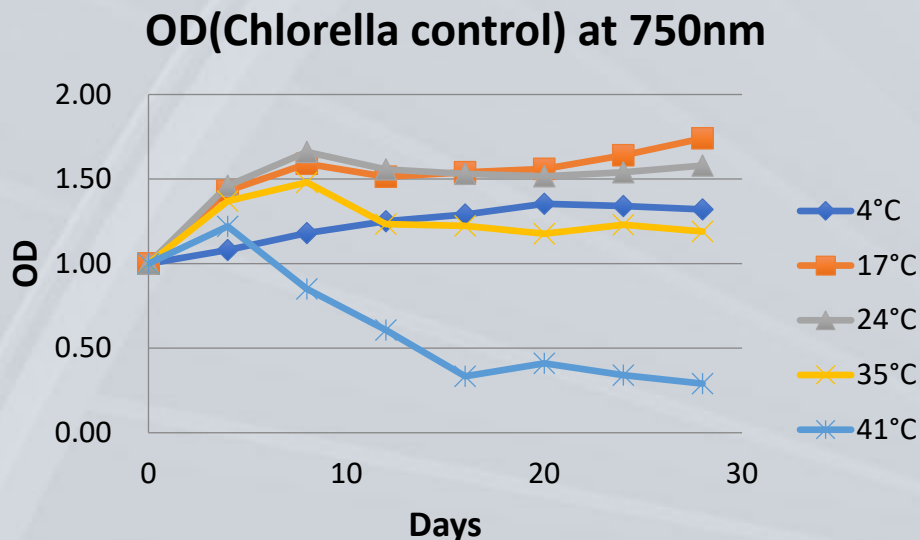
# Bacterial Community DNA Analysis after treatment

- Deep sequencing of total bacterial communities
- Outdoor culture community rapidly became complex
- *V. chlorellavorus* displaces variety of beneficial bacteria
  - TREATED D11 = 615 bacteria types
  - UNTREATED D11 = 191 bacteria types
- Treatment induced recovery of bacterial community





# Relationship between Temp and *Vampirovibrio*

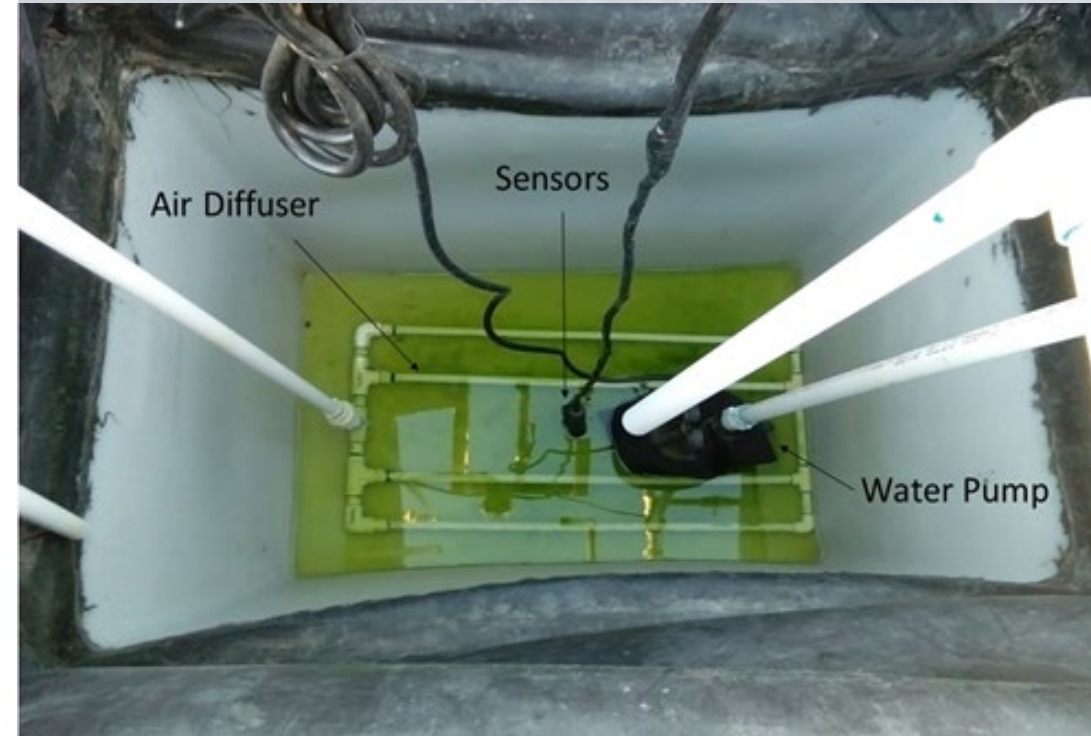
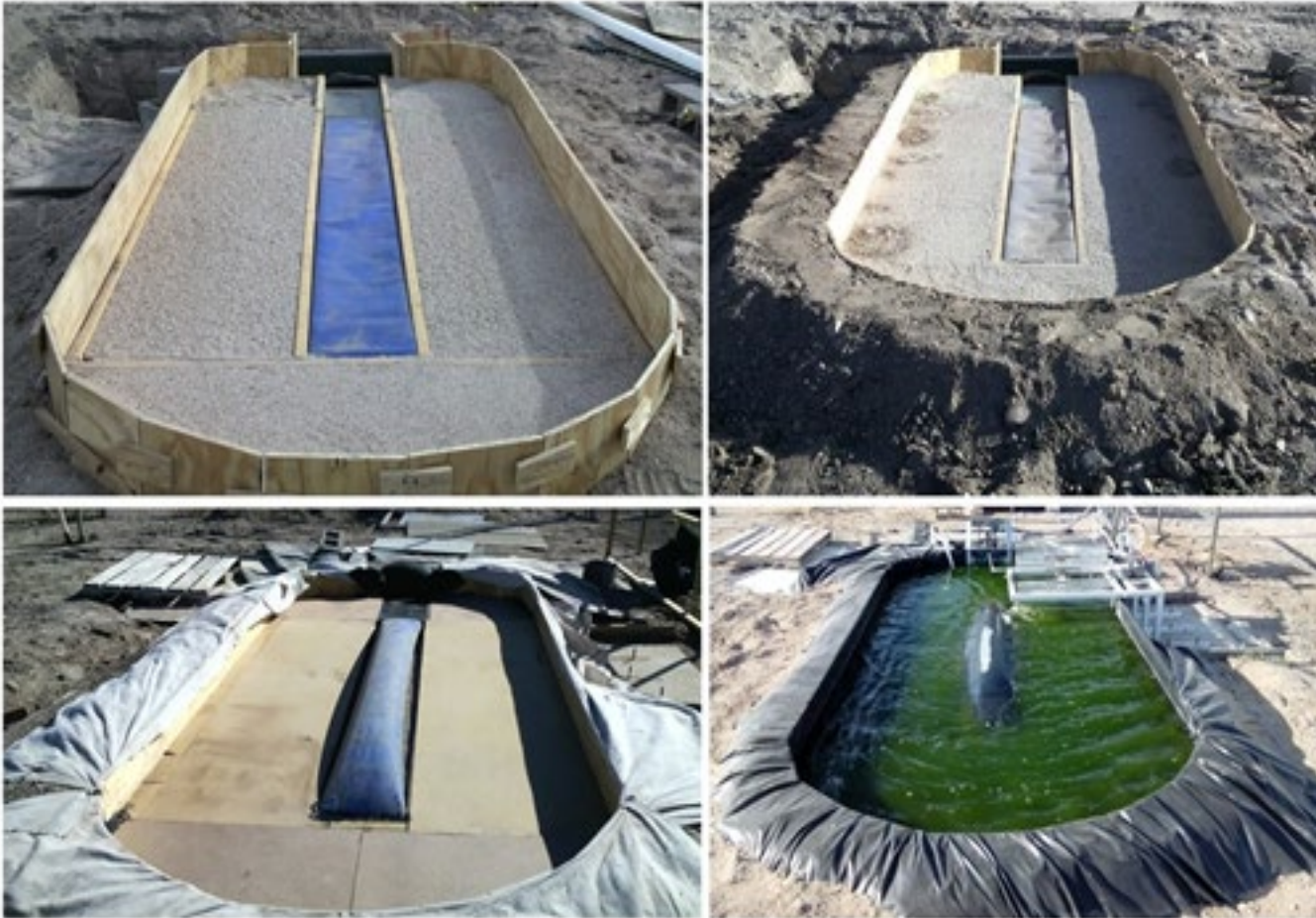


Temp > 35  
Vampiro growth

Temp < 24 no  
Vampiro growth



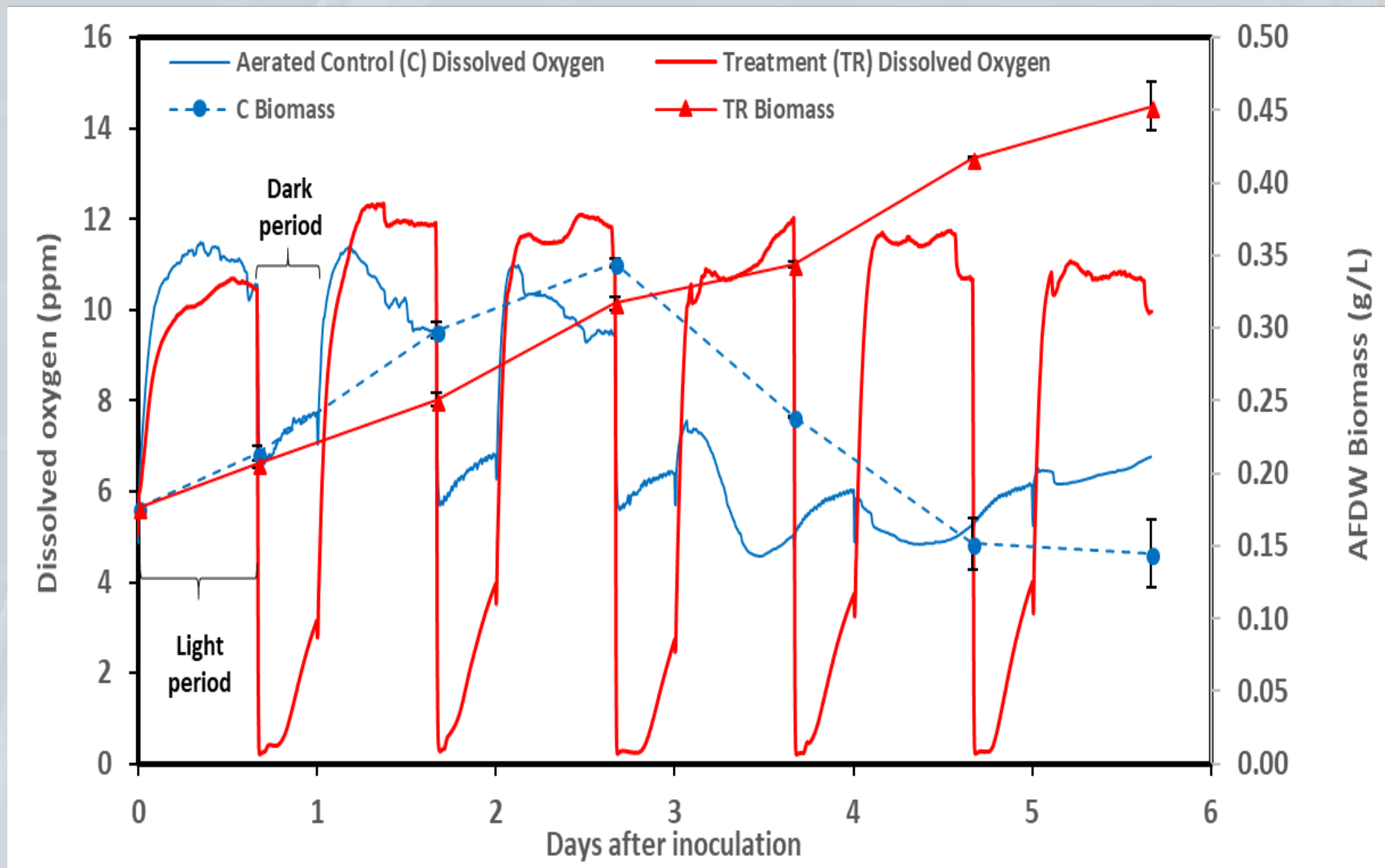
# Can we use reactor design to manage???







# Temperature maybe, but Dissolved Oxygen – YES!!



Treatment – 1 hr of Nitrogen purge in canal at start of dark phase

Control – Aeration in canal

# Acknowledgements

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