# Effects of backwash frequency on water quality using nitrate as the indicator



April, 2009

## background info on exhibit

 Animal Planet Australia; Wild Extremes:
 Baramundi, catfish, archerfish, saratoga, snakeneck turtles, freshwater stingray, rainbowfish.

- ~115,833 liter freshwater exhibit
- ► Water and air temperature ~28°C
- Open exhibit- birds, free roaming animals.
- Company standard parameters-
  - Exhibit must be ready for guests to view by 9:00 am.
  - Bioload:

~314 kg fish + 90 kg turtles= ~404 kg total animal



- observational study done on a LSS; not a controlled study
- not advocating as regular LS operations
- Despite all attempts to avoid outliers, some outliers occurred throughout the study that have been accounted for.





## Purpose and Goals

- to characterize the role of mechanical filtration... how does a backwash effect the rate of accumulation with respect to NO3- ?
- can different backwash procedures change the net gain of NO3- over a period of time?



- 4 Neptune Benson sand filters
- backwashing schedule for the 8 week study period:
  - One backwash per day, timed for 15 days- 2 samples/ day (before backwashing and ~90 min after backwash is completed)
  - Two backwashes per day, timed for 15 days- 3 samples/ day (before backwashing, ~90 min after backwashing and ~90 min after the 2<sup>nd</sup> backwash)



### mechanical waste removal

water

solid waste
sand
gravel

~ 757 liters of water inside the filter



### Three rates of accumulation to assess

I) theoretical NO3- value based on food inputII) change in slope doing one backwash/ dayIII) change in slope doing two backwashes/ day



# Info for slope I. (predicted)

Daily food weights taken by Australia husbandry staff

•Superworms •Mysis shrimp •Fish •Krill •Crickets •Fruits/greens •Mazuri gel •flakes N03 time



# How much food is getting metabolized and how much food is going to waste?

 daily food log with metabolic efficiencies of animals to know how much food is being used by the animals and what percentage of the food is going to waste.

	DATE	food type	food weight (g)	%protein/g	%N/g	metabollic efficiency	N/g/day	total g N/day
B 1 7	2/15/2009	flakes	2	0.48	0.16	0.5	0.0768	0.08
	2/16/2009	flakes	2	0.47	0.16	0.5	0.0752	
		krill	1072.6	0.58	0.16	0.5	49.76864	
		fruits	1074.6	0.01	0.16	0.50	0.42984	
		greens	145.3	0.01	0.16	0.50	0.05812	
		crickets	101.2	0.21	0.16	0.5	1.70016	
time		fish	1045	0.58	0.16	0.5	48.488	101.01

**N**0

Formula: (food weight)(% protein)(%N/g)(1-m.eff.)= N/g/day

Average daily food or ammonia input is ~100 g/N/day

## Data analysis

#### Water samples analyzed by Ion Chromatography

•<u>Sample methods</u>- 15 mL sample from the filter (same filter per sample), before backwashing and ~90 min after completed backwash.



### Results







• High frequency daily backwashing does slow the rate of nitrate accumulation over time, preventing solids from breaking down and mineralizing into the water column.

• In an effort to conserve water resources, timing system water changes based upon feeding schedule can prove to be useful for this high temperature, heavy bio-load freshwater exhibit.



# Thank you!...

•<u>NAIB Life Support</u>- for completing requested backwash procedures during length of the study and for acquiring samples during nights and weekends.

•<u>NAIB Water Quality Lab</u>- sample preparation, data analysis and project review.

•<u>Australia Husbandry staff</u>- diligent daily food weights and feeding.



### http://www.corinnepastore.com/pump/pump.html

