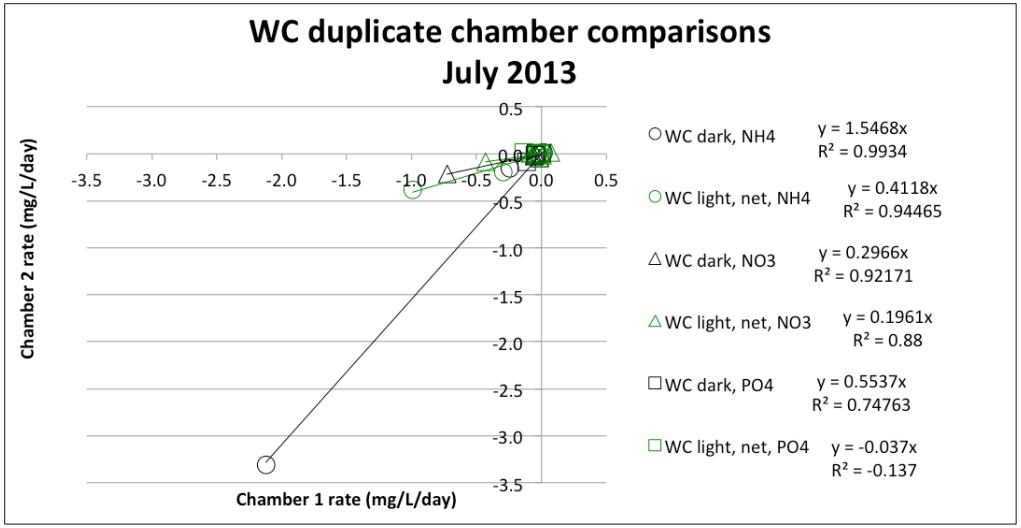
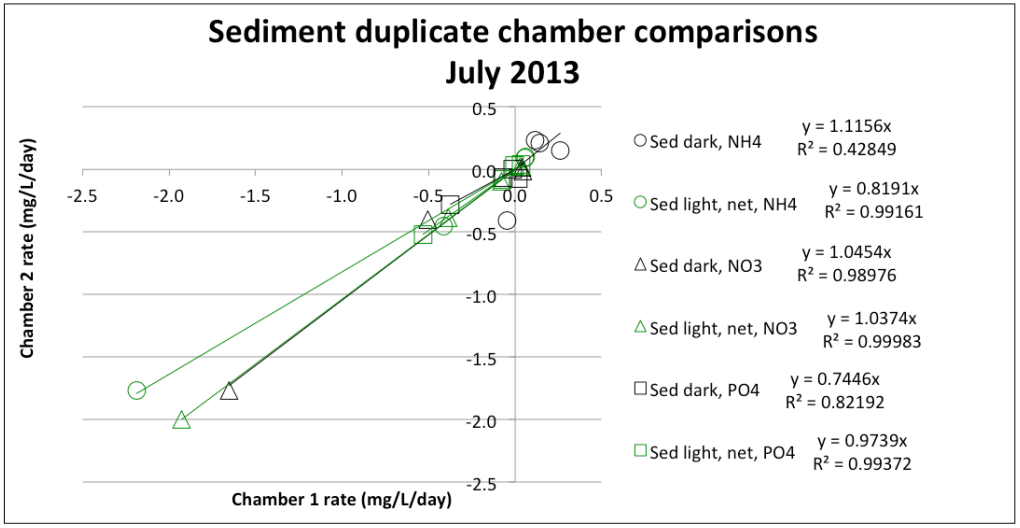
2013 Chamber Study

Chamber Duplicates



WC chambers did not have great reproducibility

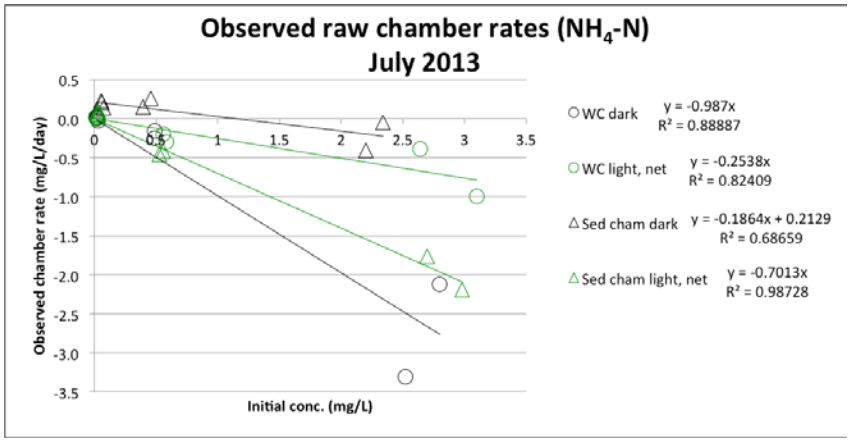
- note poor 1:1 ratio
- low ambient nutrient conc. coupled with small changes

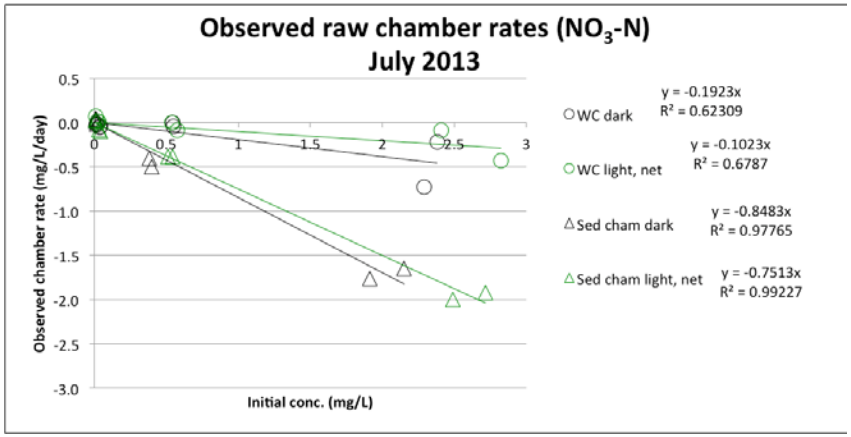


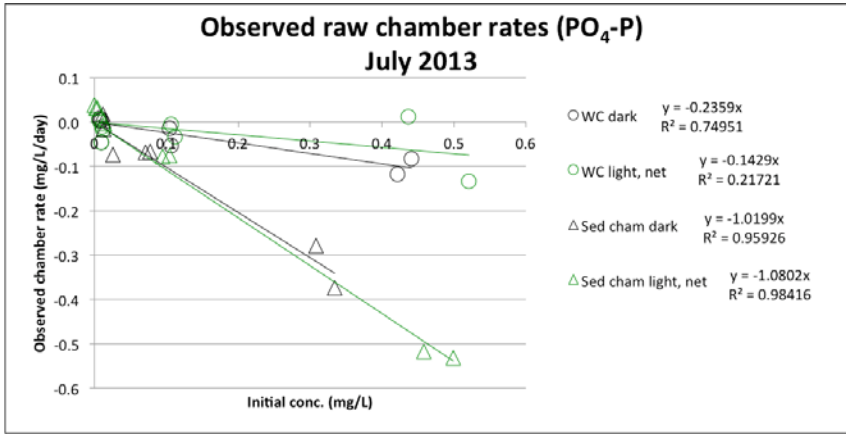
Sediment chambers had great reproducibility

- note consistent 1:1 ratio
- positive ‘control’ nighttime ammonia fluxes (+:+) imply that sediments are a source of ammonia

Observed rate vs. Concentration







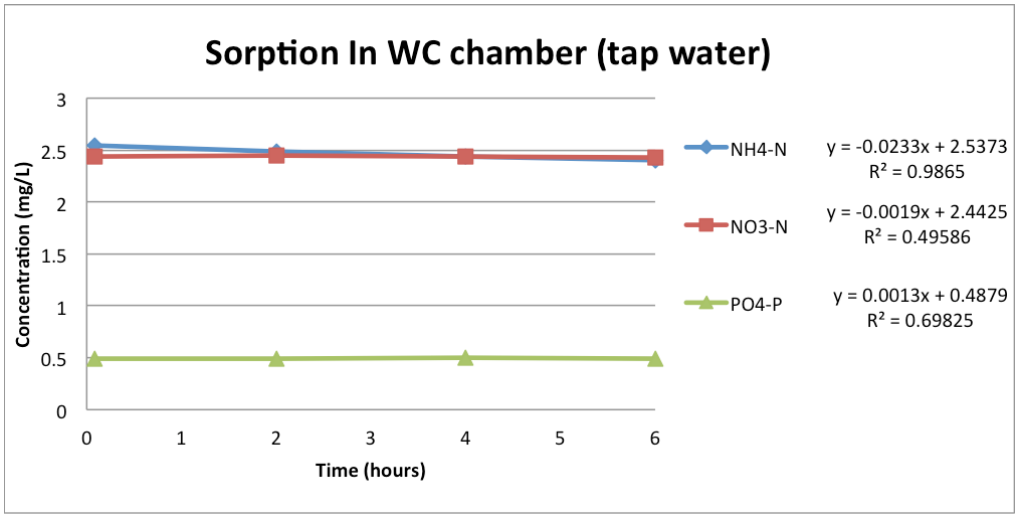
Note that the sediment chamber nighttime ammonia rates do not pass through zero

- Sediments are a source of ammonia
- All other rates pass through zero

Note 1:1 relationship for sediment P removal (day and night)

Compare rates with Jeff and Toby's k coefficients

Chamber sorption test with tap water



Ammonium is sticky (NH_4^+)

- Need to reflect this sampling artifact in final 'spiking' results

'Ambient' or 'control' experiments do not have an sorption artifact

chamber sorption rates (mg/L/day)		
NH_4-N	NO_3-N	PO_4-P
-0.558	-0.045	0.030

Roughly 80% of the daytime ammonia removal in the WC could be a result of chamber sorption

Net or 'observed' day and night dynamics

NET rates and fluxes ($g/m^3/d$) ($g/m^2/d$)			
Chamber	**NO_3-N**	**PO_4-P**	**NH_4-N**
WC_{dark} Control	-0.035	-0.007	0.000
$WC_{light, net}$ Control	0.019	-0.017	0.011
Sed_{dark} Control	0.024	-0.004	0.074
$Sed_{light, net}$ Control	-0.021	0.018	0.028
WC_{dark} (low spike)	-0.024	-0.034	-0.201
$WC_{light, net}$ (low spike)	-0.021	-0.010	-0.123
Sed_{dark} (low spike)	-0.180	-0.014	0.170
$Sed_{light, net}$ (low spike)	-0.072	-0.012	-0.040
WC_{dark} (high spike)	-0.472	-0.100	-2.716
$WC_{light, net}$ (high spike)	-0.129	-0.030	-0.344
Sed_{dark} (high spike)	-0.520	-0.095	1.044
$Sed_{light, net}$ (high spike)	-0.358	-0.097	-0.271

NOTE: used average depth of 0.42 m for all calculations

WC=dC/dt

Sed=(dC/dt - WC)*depth

Note:
WC = volumetric rate
Sediments = aerial flux

Ammonia was always released from the sediments during nighttime

- Sediment OM decay

Gross day and night dynamics

GROSS rates and fluxes ($g/m^3/d$) ($g/m^2/d$)			
Chamber	**NO_3-N**	**PO_4-P**	**NH_4-N**
WC_{dark} Control	-0.035	-0.007	0.000
$WC_{light,\ gross}$ Control	0.055	-0.010	0.011
Sed_{dark} Control	0.024	-0.004	0.074
$Sed_{light,\ gross}$ Control	-0.045	0.022	-0.047
WC_{dark} (low spike)	-0.024	-0.034	-0.201
$WC_{light,\ gross}$ (low spike)	0.003	0.024	0.078
Sed_{dark} (low spike)	-0.180	-0.014	0.170
$Sed_{light,\ gross}$ (low spike)	0.108	0.002	-0.210
WC_{dark} (high spike)	-0.472	-0.100	-2.716
$WC_{light,\ gross}$ (high spike)	0.343	0.069	2.372
Sed_{dark} (high spike)	-0.520	-0.095	1.044
$Sed_{light,\ gross}$ (high spike)	0.162	-0.002	-1.315

NOTE: used average depth of 0.42 m for all calculations

WC_{dark} = as measured

$WC_{light,\ gross} = WC_{light,\ net} - WC_{dark}$

Sed_{dark} = as net flux

$Sed_{light,\ gross} = Sed_{light,\ net} - Sed_{dark}$

Note:
WC = volumetric rate
Sediments = aerial flux

Assumes night, or decay, is constant and this dark metabolism is also occurring during the day

Ammonia was always released from the sediments during nighttime

Ammonia is consumed in the benthos during daytime

- Periphyton photosynthesis

Trace amounts of ammonia was generated in the WC during daytime

- Cyanobacteria?

Diurnal nutrient mass balance

diurnal mass balance (mg/L/d)			
Chamber	**NO_3-N**	**PO_4-P**	**NH_4-N**
nighttime Control	0.008	-0.007	0.066
daytime Control	-0.019	0.015	0.048
24-hour Control	-0.011	0.009	0.114
nighttime (low spike)	-0.170	-0.026	0.077
daytime (low spike)	-0.121	-0.024	-0.136
24-hour (low spike)	-0.290	-0.049	-0.059
nighttime (high spike)	-0.641	-0.123	-0.086
daytime (high spike)	-0.613	-0.164	-0.618
24-hour (high spike)	-1.255	-0.286	-0.704

NOTE: used average depth of 0.42 m for all calculations

NOTE: used photoperiod of 15 hours (0.625 days)

nighttime = $(WC_{dark} + (Sed_{dark}/depth))*(1-photo)$

daytime = $(WC_{light,\ net} + (Sed_{light,\ net}/depth))*photo$

Note: do not use gross, use net

24-hour = nighttime + daytime

Note:
(mg/L/day)*1 day = expected ambient conc.

Assumes night, or decay, is constant and this metabolism is also occurring during the day

The sediments are a source of ammonia to the ambient water

- +0.114 mg/L/d
- Ambient ammonia was 0.3 mg NH_4-N/L
- SAV and epiphytes may utilize excess ammonia (not measured)

Nutrient spikes appear to be dominated by an ‘equilibrium’, not ‘biological’ process