



# Polycyclic Aromatic Hydrocarbons in Sediments and Oysters Collected in S.E. North Carolina

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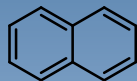
# Background

- \* Polycyclic Aromatic Hydrocarbons (PAH)
- \* Many are toxic and pose human health concerns
- \* Bioaccumulate in aquatic life posing a potential human impact (e.g. NOAA Mussel Watch Program)
- \* The objective of this study was to establish broad baseline concentrations of PAHs in oysters and associated sediments within Southeastern NC

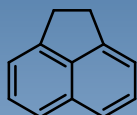
# Some Source of PAHs



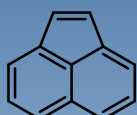
# Structures of EPA Priority Pollutants



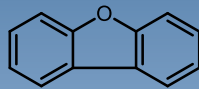
Naphthalene



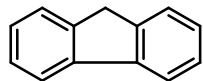
Acenaphene



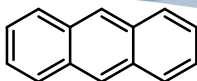
Acenaphthylene



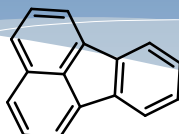
Dibenzofuran



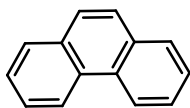
Fluorene



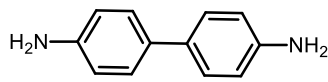
Anthracene



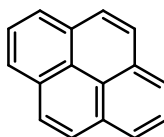
Fluoranthene



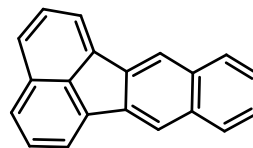
Phenanthrene



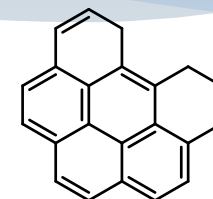
Benzidine



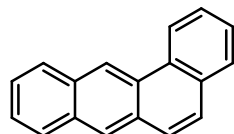
Pyrene



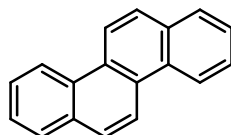
Benzo(k)fluoranthene



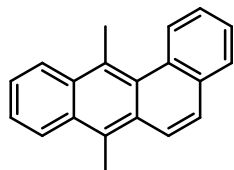
Benzo(g,h,i)perylene



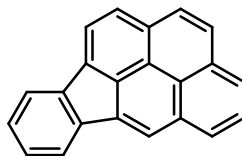
Benzo(a)anthracene



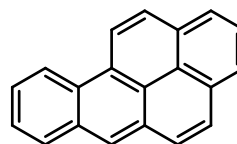
Chrysene



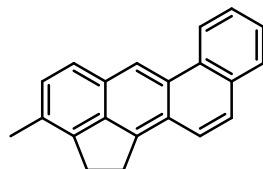
7,12-dimethylbenz(a)anthracene



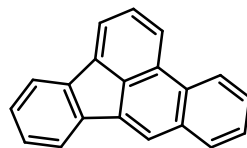
indeno(1,2,3-cd)pyrene



Benzo(a)pyrene



3-methylcholanthrene



Benzo(b)fluoranthene

- The PAHs in this study are a mix of 2-6 member rings

# Sample Processing

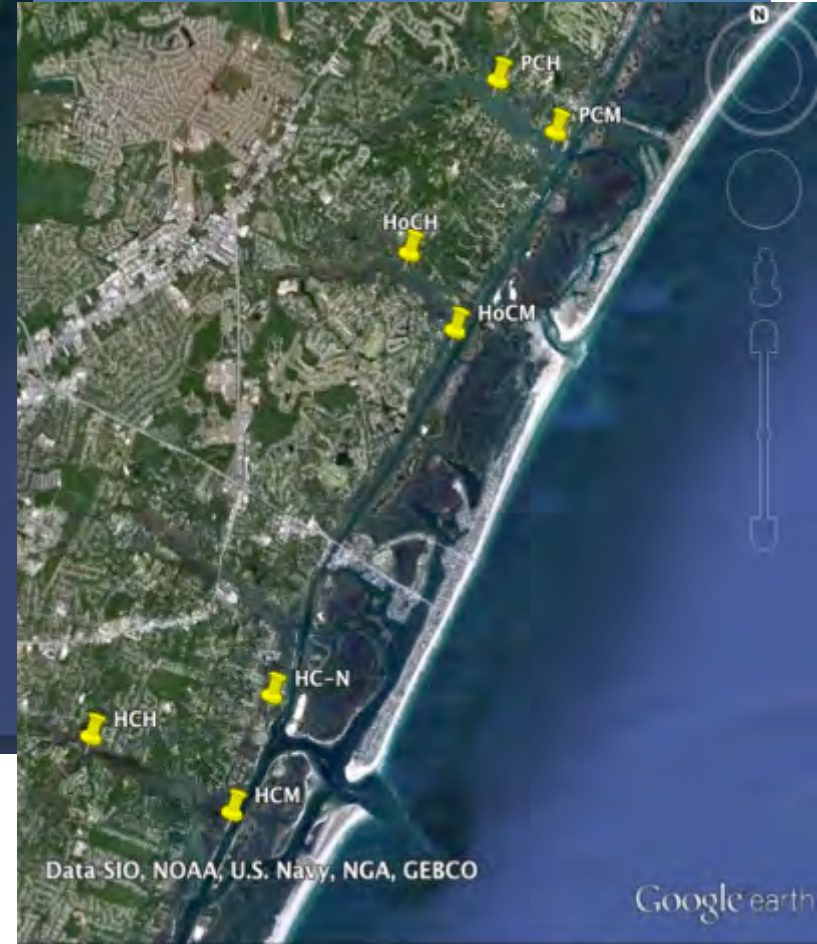
- \* Trace Organics followed EPA method 8270D
- \* 20 Oysters (*Crassostrea virginica*) were collected shucked, dried and ground. Treated as one composite sample.
- \* Sediment was collected (top 2 cm) immediately adjacent to oysters and composited, dried and sieved
- \* Solvent extraction, silica gel column fractionation and finally GC/MS
- \* Recoveries of analytes were between 80-110% for sediments (SRM 1941b) and 70-90% for oysters (SRM 2974)
- \* Detection limits for the 2-3 member rings was 0.5 pg/ $\mu$ L injection and the 4-6 member rings was 1 pg/ $\mu$ L injection





- Page's Creek Mouth
- Page's Creek Head
- Hewlett's Creek Mouth
- Bradley Creek Bridge
- Howe's Creek Mouth
- Center for Marine Science
- Bald Head 1
- Bald Head 3
- Lockwood Foley 1
- Lockwood Foley 2
- Lockwood Foley 3
- Lockwood Foley 4

Sediments  
collected between  
2011-2012



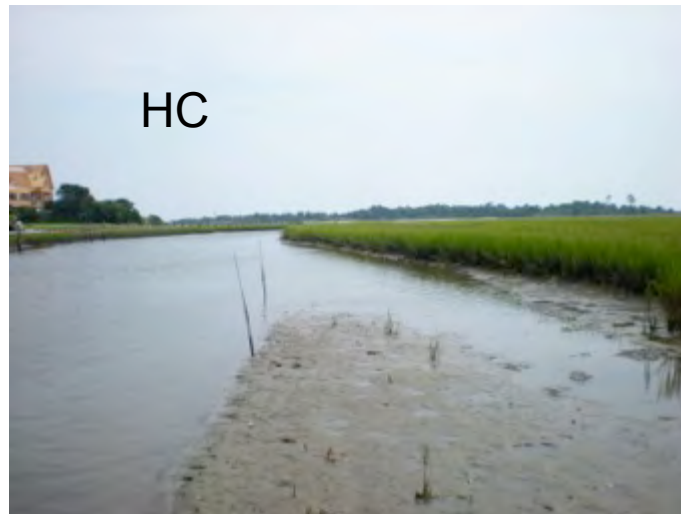
BC



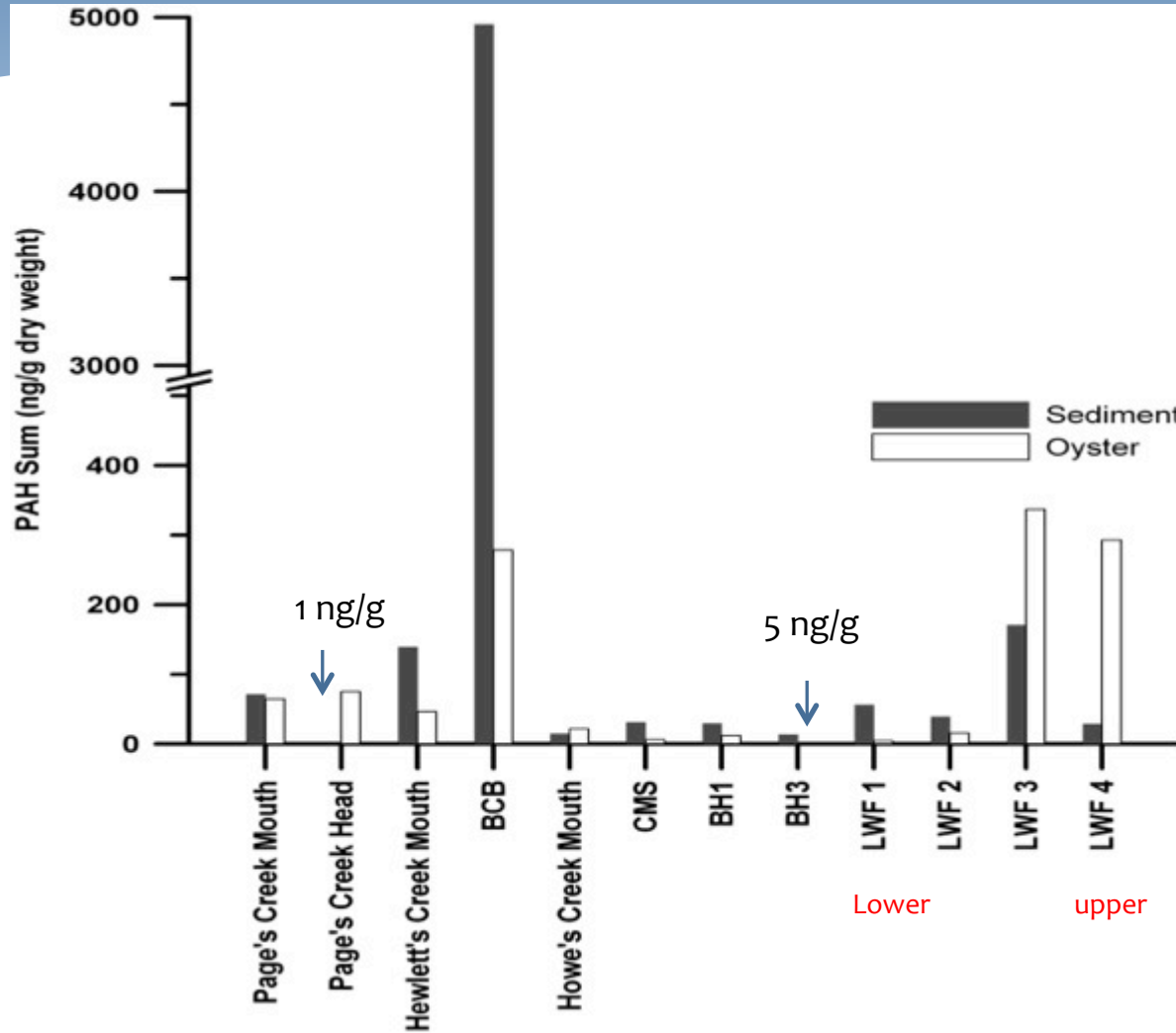
HC



HC



# Distribution of PAH



ence

1995

al. 2012

et al.

ly



# Ring Size Distribution

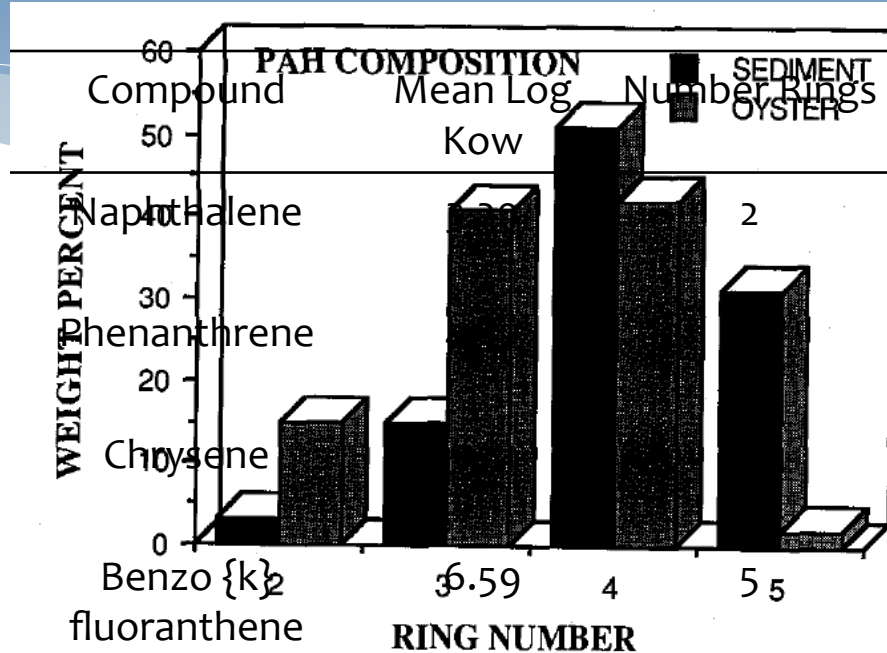
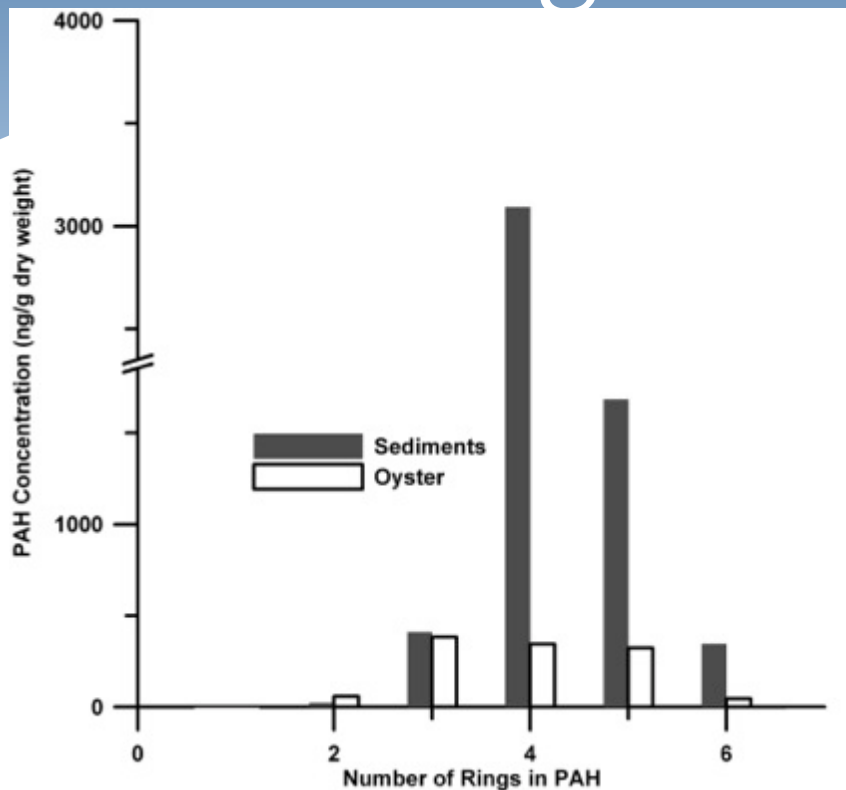
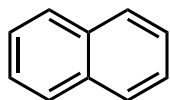


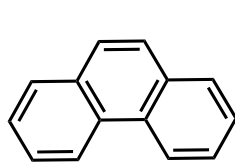
Fig. 2. Average weight percent PAH ring number composition in sediments and oysters.

Wade et al. 1988

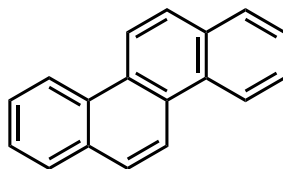
Example PAH:



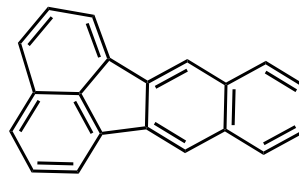
Naphthalene



Phenanthrene



Chrysene

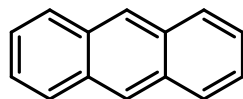


Benzo(k)fluoranthene

Smaller log Kow = more water soluble

# Source of PAHs to Sediments: Isomer Ratios

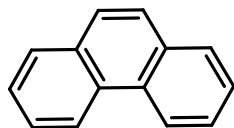
	An/An+Ph		Fl/Fl+Py		Pyrogenic origin	Petrogenic Origin
	Oyster	Sediment	Oyster	Sediment		
Page's Creek Mouth	0.5	0.7	0.3	0.6		
Page's Creek Head	0.3	0.5	0.5	0.5		
Hewlett's Creek Mouth		0.6	0.5	0.6		
Bradley Creek Bridge	0.4	0.3	0.5	0.5		
Howe's Creek Mouth		0.6		0.6		
Center for Marine Science		0.7		0.5	An/An+Ph	>0.1
Bald Head 1		0.6		0.2	Fl/Fl+Py	>0.4
Bald Head 3						<0.4
Lockwood Foley 1		0.4		0.5		
Lockwood Foley 2		0.3		0.5		
Lockwood Foley 3	0.4	0.5		0.6		
Lockwood Foley 4		0.4		0.5		



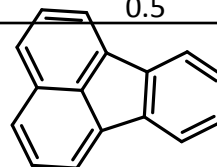
Anthracene



An/An+Ph = anthracene / (anthracene + phenanthrene)



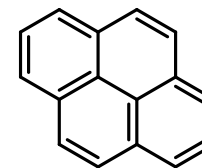
Phenanthrene



Fluoranthene



Fl/Fl+Py = fluoranthene / (fluoranthene + pyrene)



Pyrene

kinetic vs. thermodynamic stability (e.g. Yunker et al 2002)

# Potential Ecological Impacts?

Station (Sediments)	Acenaphthene	anthracene	chrysene	dibenzo(a,h)anthracene
Minimum Effects Value	6.7 ng/g	46.9 ng/g	108 ng/g	6.2 ng/g
BCB	6.8	71.3	527.8	52.9
BH1	11.3	XX	XX	XX
BH3	163.2	81.7	225	XX

XX= Less than value



[www.epa.gov/region4/superfund/programs/riskassess/ecolbul.html](http://www.epa.gov/region4/superfund/programs/riskassess/ecolbul.html) data 2001

# Implications

- \* Overall, appears to be hotspots of PAHs in oyster and sediments throughout tidal creeks. Limited number of stations above minimum effects threshold
- \* Pyrogenic sources of PAH contribute to sediment and oysters with smaller PAH (2-3 ring) preferential accumulation in oysters
- \* Future work entail seasonal and episodic event sampling

# Acknowledgements

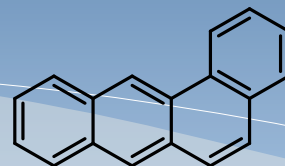
- \* Funding provided through NCDENR- Division of Marine Fisheries Coastal Recreational Fishing License



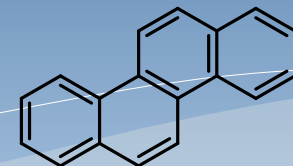
- \* UNCW Department of Chemistry and Biochemistry



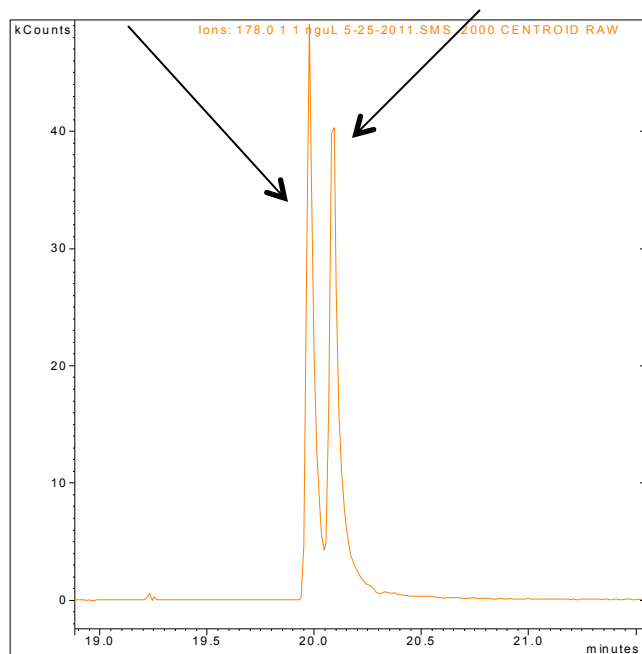
# Resolution of Closely Eluting Analytes (1 ppm)



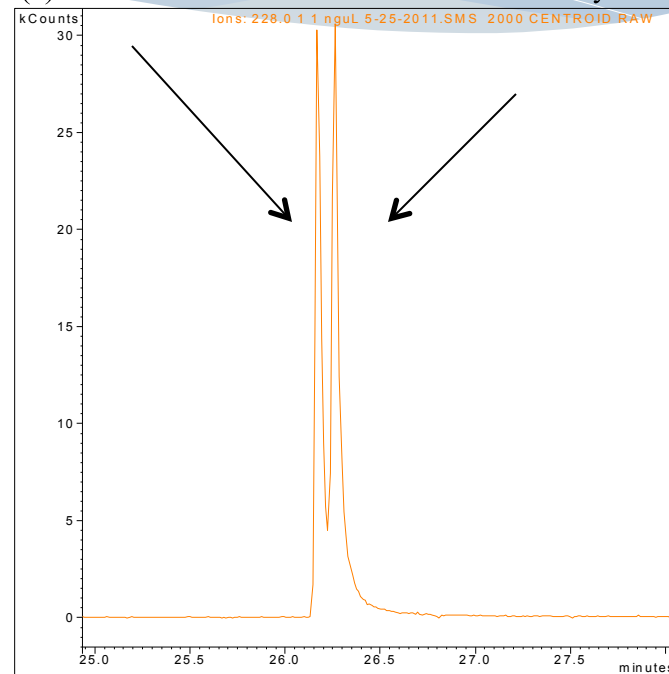
Benzo(a)anthracene



Chrysene



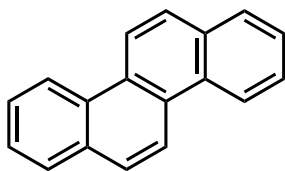
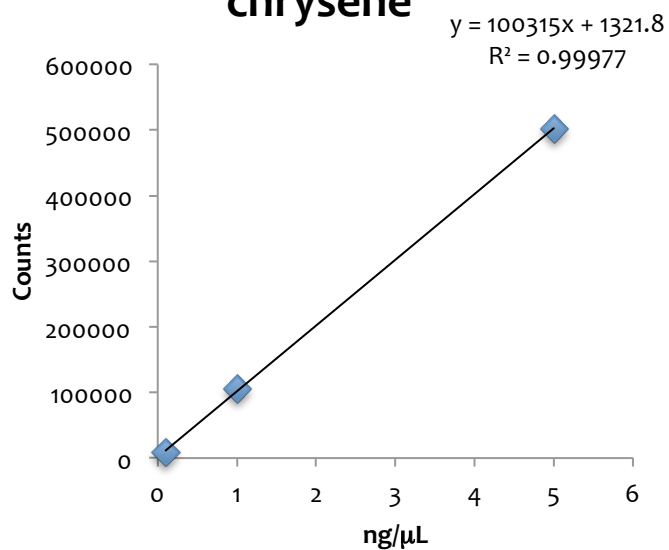
EIC of 178 m/z



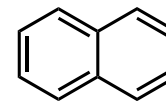
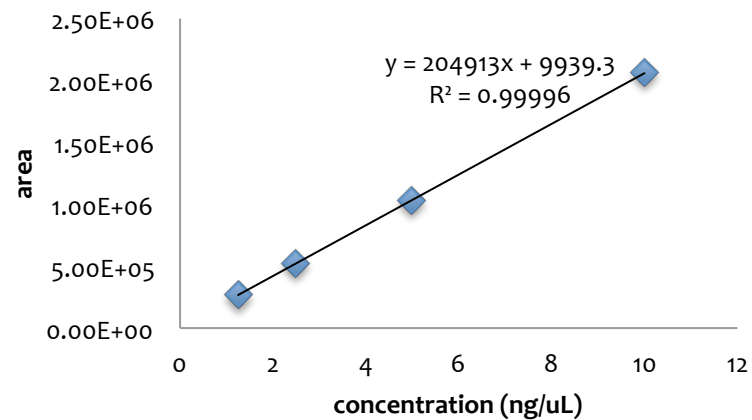
EIC of 228 m/z

# Typical Calibration Curves

**chrysene**



**naphthalene**



# GC/MS trace of Calibration Standard 68 Components

