

*Evaluation of Count Variability
Among Commercial Laboratories
for Co-located, Concurrently-
collected Total Airborne Mold
Samples*

**Thad Godish, Diana Godish
Ball State University**

Objectives

- Determine variability of analytical results among commercial laboratories using co-located, concurrently conducted total mold spore sampling
- Compare commercial results to reference laboratory and author's analyses of samples
- Determine how commercial laboratories results for total mold spore sampling compare to Andersen culturable /viable test results

Study Design

- Choose laboratories for conduct of analyses
- Select primary sampling methodologies
- Construct sufficient samplers for concurrent sampling

Study Design

- Identify sampling environments
- All instruments calibrated before (and after) each sampling series
- Conduct sampling

Laboratory Selection

- **Criteria**
 - EMLAP certification
 - Prominence
 - Regional Location
- **Number selected**
 - 10
- **Reference laboratory**
 - Counts conducted at 1000X

Sampling Methodology

- Air-O-Cell sampling cassettes
 - Most widely used total mold sampling device
 - Labs have a lot of experience with these devices
- Andersen culturable /viable samplers
 - Still widely used
 - Allows for culturable/viable comparisons to total mold spore/particle analyses

Sampler Setup

- Seven AOCs for 5 minutes (~15 L/min) followed by another round 20 minutes later
- Andersen sampler
 - Two media
 - MEA
 - DG-18
 - Two minute sampling duration (~30L/min)
 - Run during the same period as AOCs
 - Repeat sampling 20 minutes later

Sampling Instruments/Sampling Environments



Sampling Instruments/Sampling Environments



Sampling Instruments/Sampling Environments



Sampling Considerations

- Samplers in the same position during each sampling series
- Commercial laboratories would not get a sample from the same sampler

Analyses Considerations

- Samples were sent to laboratories through private consulting practice to maintain anonymity
- Samples were sent in lots of two (two sampling series)

Analyses Considerations-BSU

- All samples counted at 1000X
- Samples counted taking particle bounce into account(not limited to obvious deposition strip)
- Counts conducted on 5% of the deposition trace repeated twice (total 10%)
- Counts conducted by light microscopy
- Counts conducted over multiple focal planes

Analyses Considerations-BSU

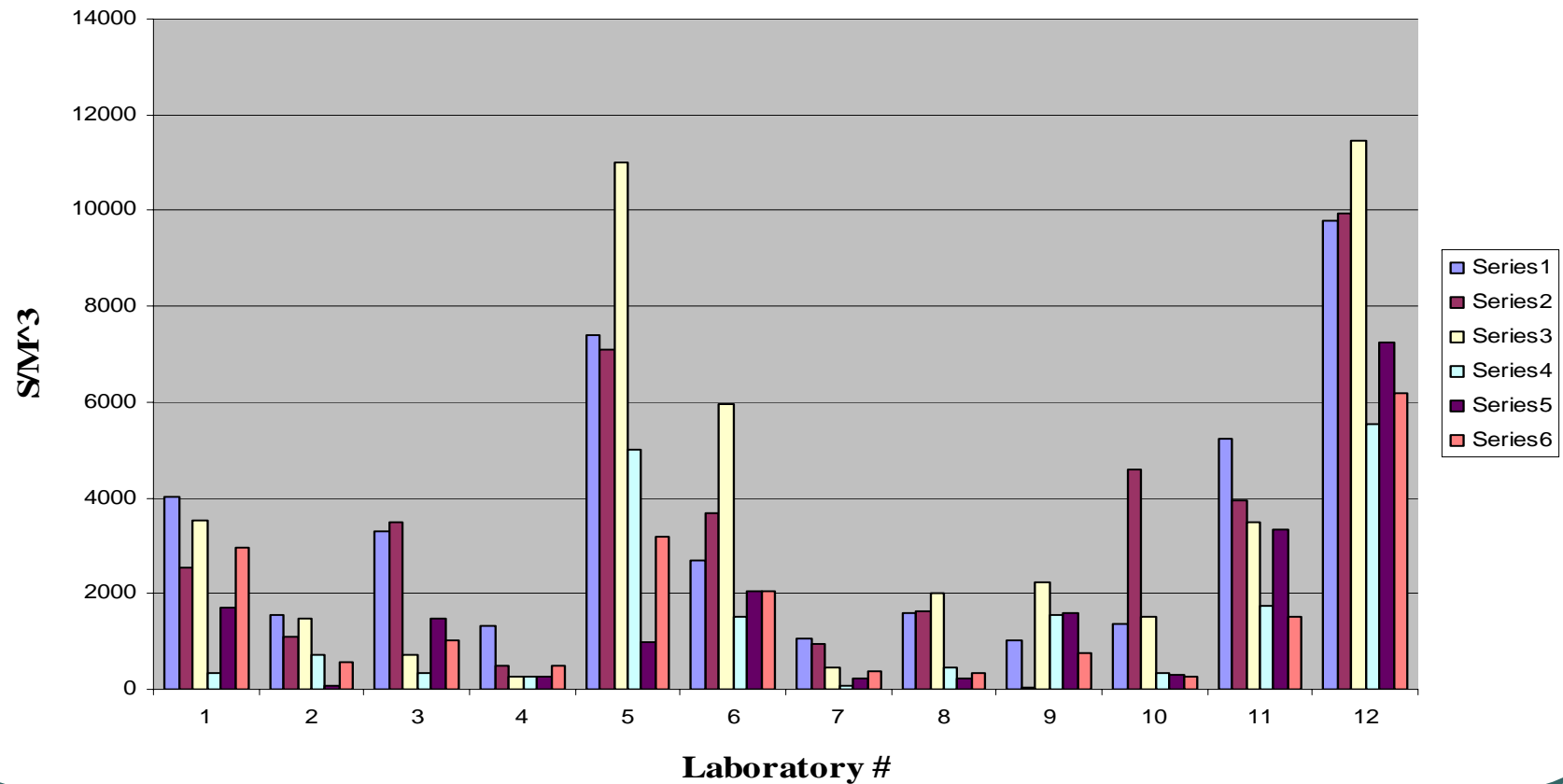
- Counts conducted on two samples for each sampling series (these were taken 20 minutes apart)
 - These counts were averaged
 - When averaged across 6 sampling series were not significantly different from each other

Study Results

- **Significant variability**
 - Within each sampling series
 - Among commercial laboratories

Count Variability Among Laboratories for 6 Sampling Series

Interlaboratory comparison study

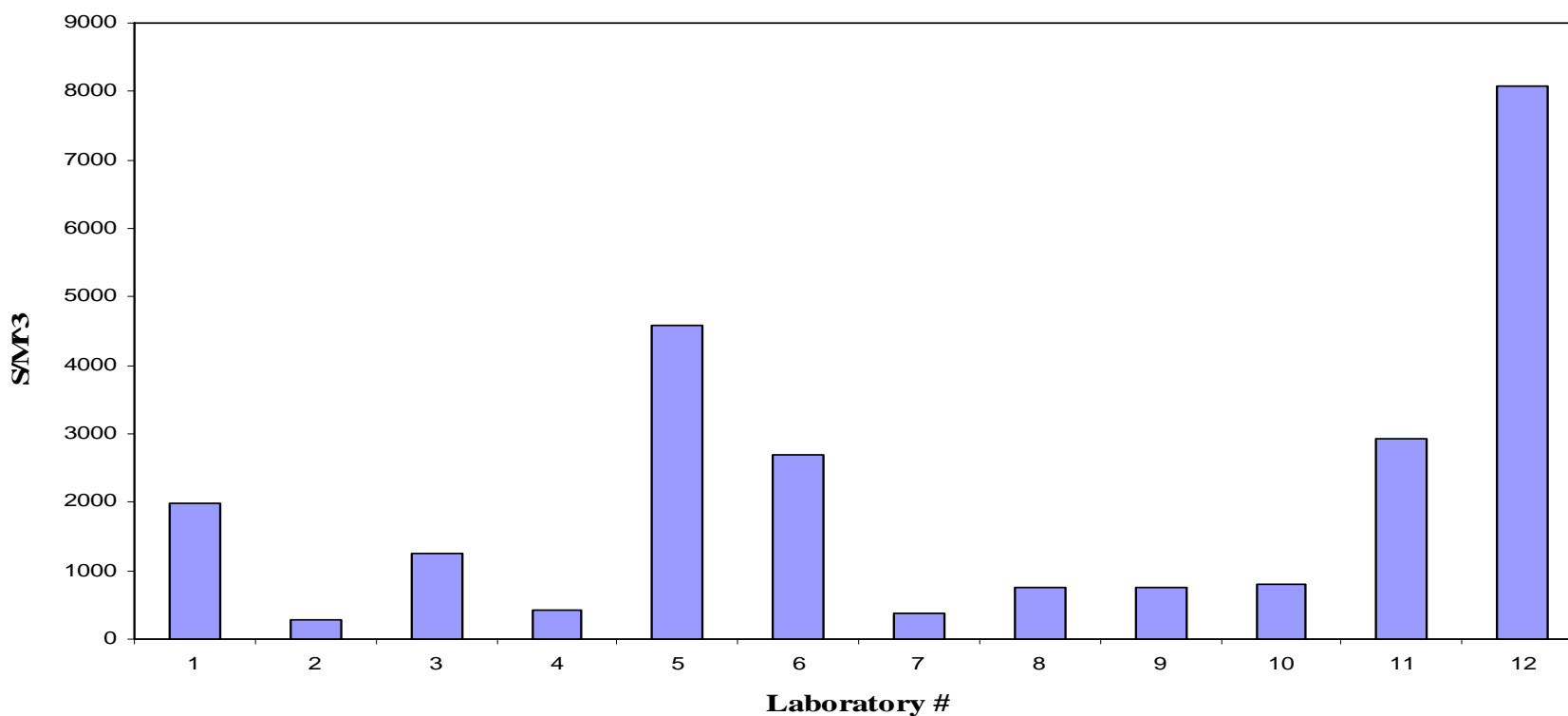


Study Results

- Significant variability in geometric mean values from one laboratory to another

Geometric Mean Values of Count Concentrations from 12 Laboratories

Interlaboratory comparison study-Geomeans

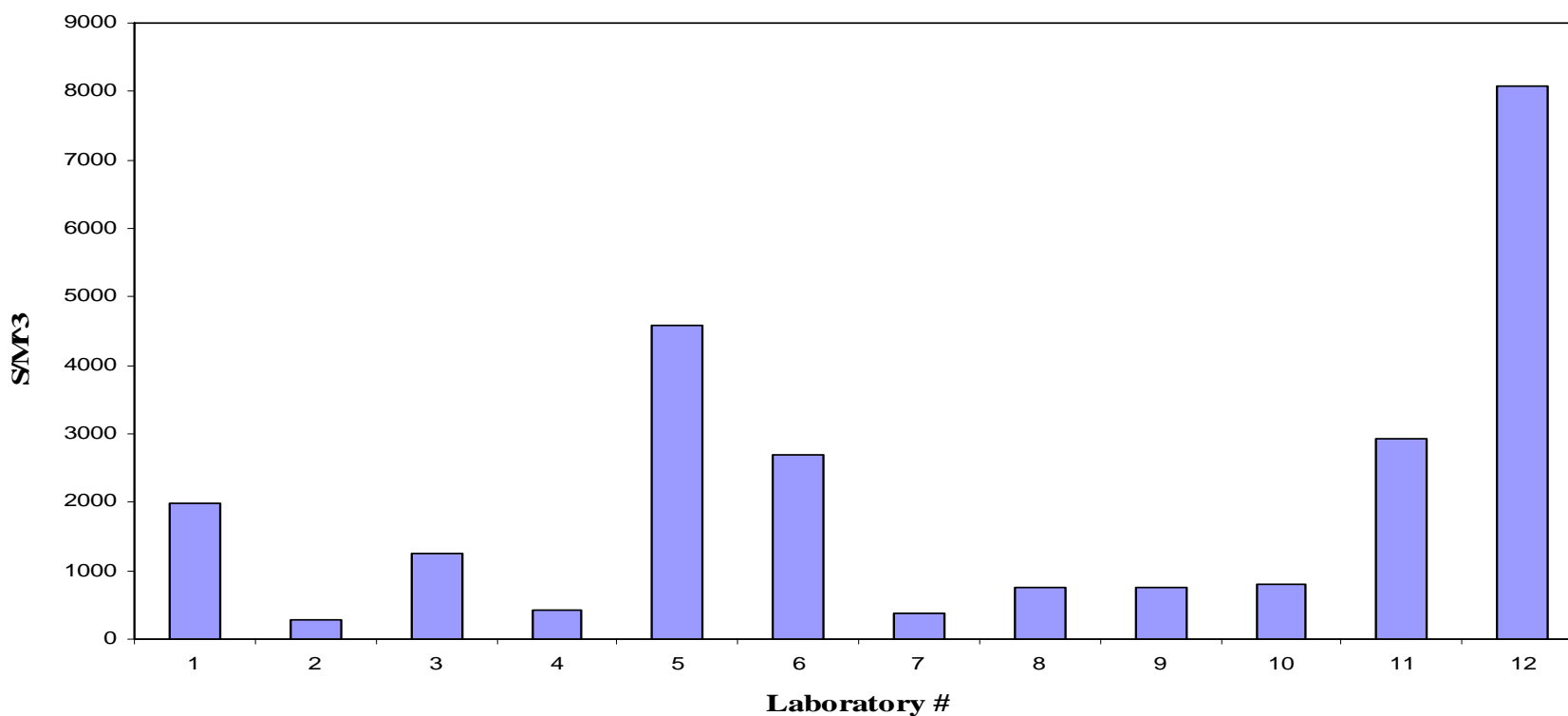


Study Results

- Friedman's nonparametric analyses revealed three count populations
 - Seven laboratories reporting relatively low values which were not significantly different from each other
 - Three commercial laboratories and reference laboratory with count values that were not significantly different from each other but significantly higher than the count population above
 - The authors' laboratory with count values that were significantly higher than all other laboratories

Geometric Mean Values of Count Concentrations from 12 Laboratories

Interlaboratory comparison study-Geomeans

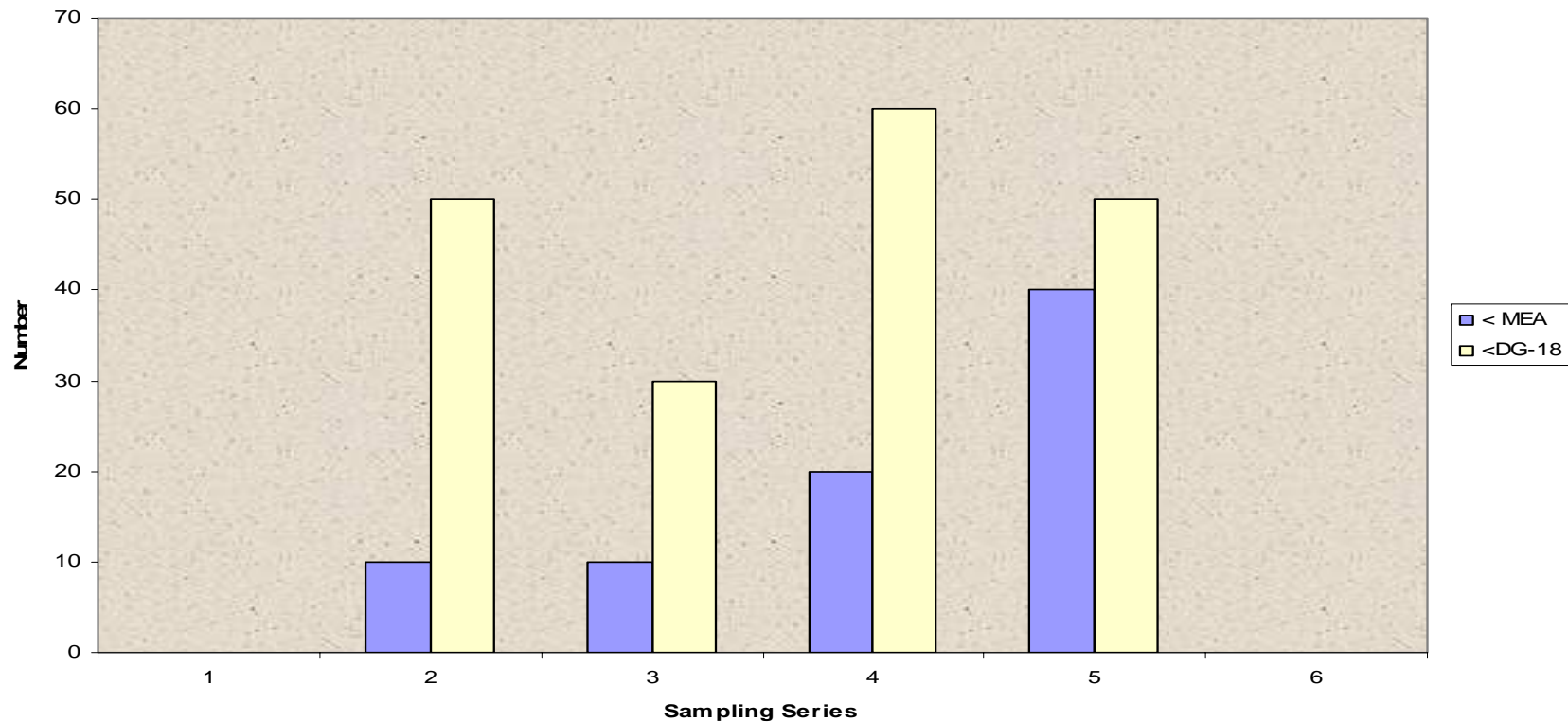


Study Results

- In many cases commercial laboratory count values were less (absolute values) than those obtained by Anderson culturable/viable sampling using MEA and DG-18 media
 - This is notable since culturable/viable values should not (in theory) be higher than total mold spore values (includes both viable and non viable)

% MEA and DG-18 Values > than Commercial Laboratory Total Mold Spore Values

MEA and DG-18 Values > Total Mold Spore Values

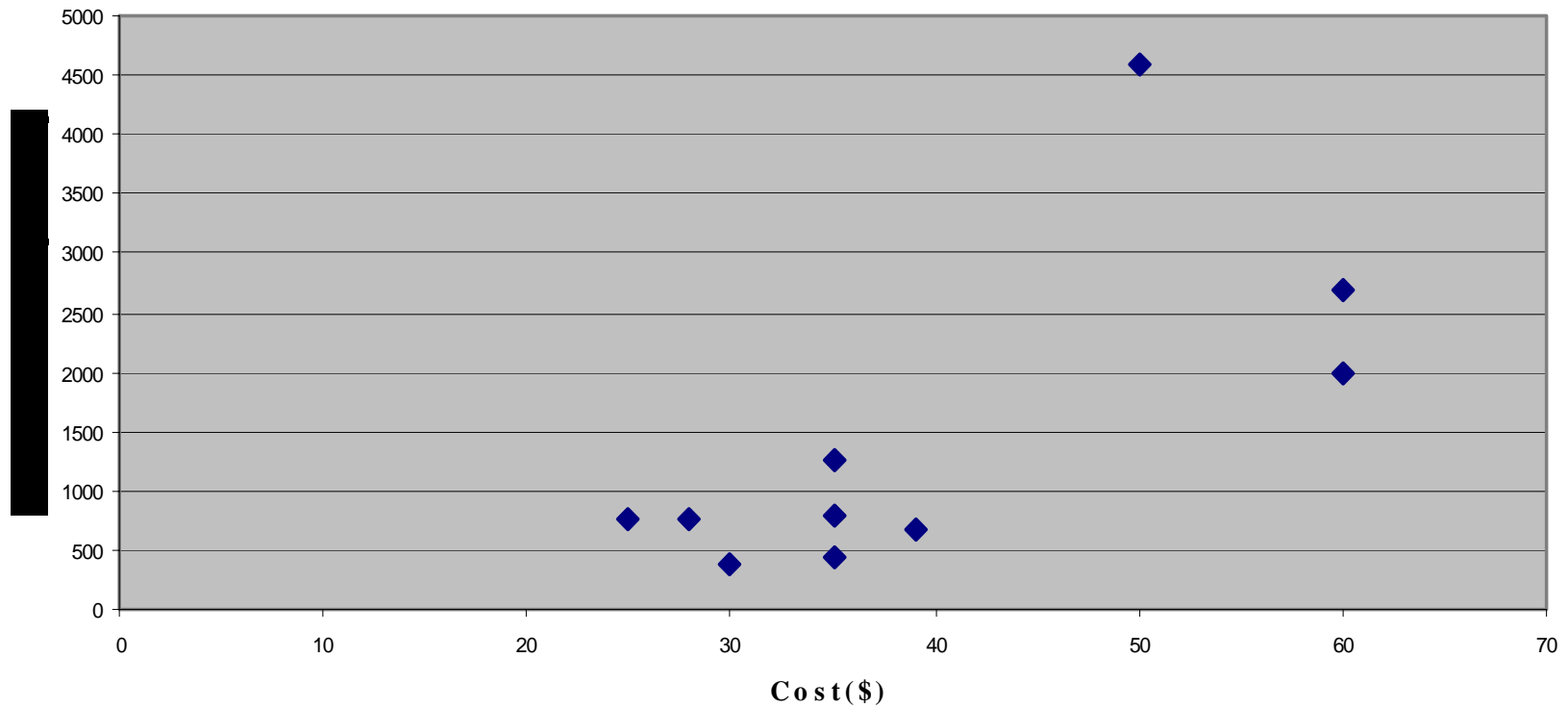


Study Results

- A significant correlation($r=0.73$) was observed between count concentration and laboratory charges for analyses

Analyses Cost vs Reported Concentration

Analysis Cost vs Concentration



Study Results

- BSU counts significant higher than counts reported by commercial laboratories
 - These were two to three times higher than the highest counts of commercial laboratories including the reference laboratory
 - Reasons are likely to include:
 - Use of 1000x magnification
 - Particle bounce considerations
 - Analysis time, focal plane considerations

Conclusions

- Total airborne mold test results reported by commercial laboratories as a general rule may not be reliable as a measure of total airborne mold levels and potential exposures based on:

Conclusions

- Significant variability among laboratories in reported concentrations of samples collected concurrently in the same location
- Significant differences observed among three count populations
- Significant relationship between analyses cost and count values
- Observed apparent relationship between culturable/viable and reported total mold sampling results

Acknowledgements

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