What is Representativeness, and why are we confused?

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State Water Resources Control Board

Today's objectives:

- Make some distinctions
- Suggest words to communicate
- Try to do some confusion abatement

Googled it 4/20/06 **Found 2,410,000 hits**

The hypothesis that people evaluate **probabilities** by **representativeness** … by **intuitive statistical heuristic..**

similar effect of the **gambler's fallacy…**

The question of the **representativeness** of the **organizations** is fundamental

…to hold a **Representative town meeting**

Representativeness refers to **judgments based on stereotypes**

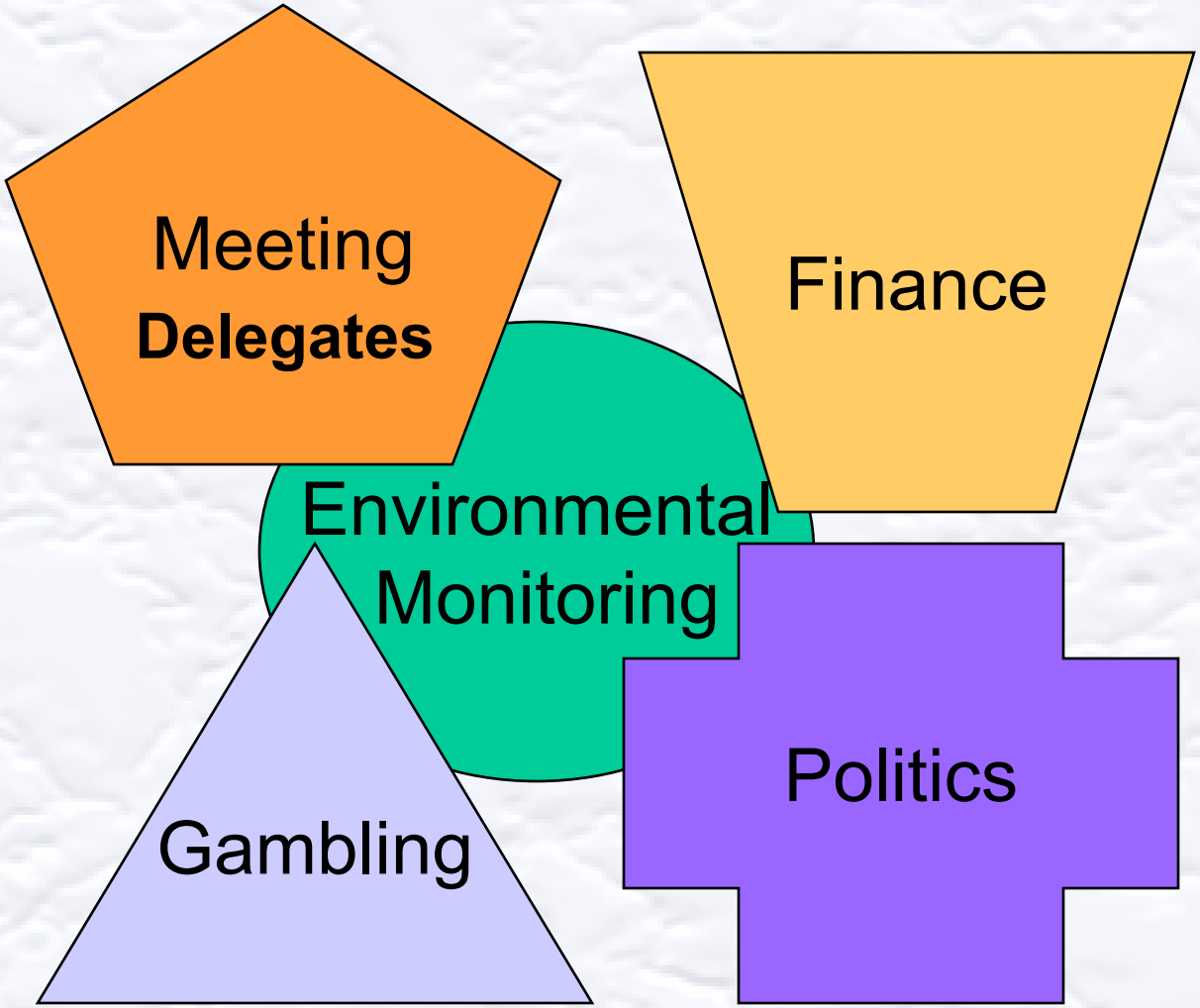
The legal concept of union **representativeness** implies a **process of selection…**

Behavioral **finance, representativeness bias**, overreaction, earnings announcements

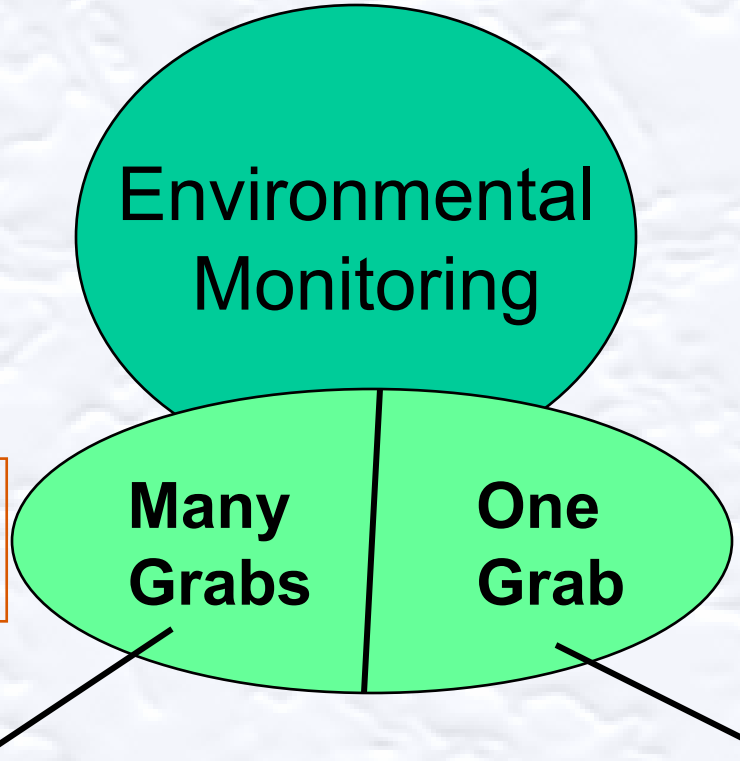
And finally…

..sites that have a 'typical' species composition for the considered ecosystem

Different meanings



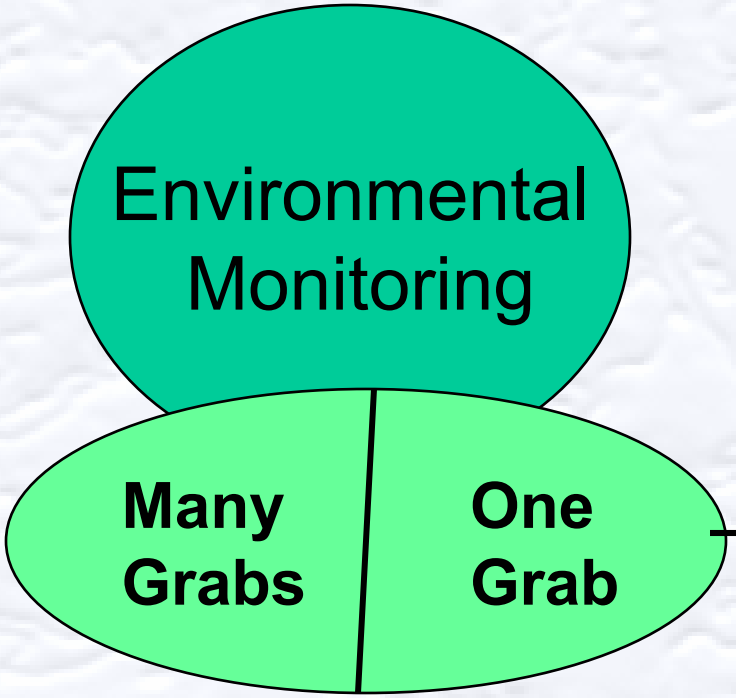
Focus: Environmental



Confusion Item # 1:
One sample or many?

Statistical meaning
non-representative ‘sample’
= statistically biased

Sample properties
Different meanings for
‘Representative sample’



Confusion Item # 2:
How the sample represents **itself**, versus the environment

'Analytical Quality':
Sample integrity
- Lack of contamination
- Lack of deterioration

Sample homogeneity
Uniformity of aliquots

The Environment
Representative sample and what it represents in the environment
[next 7 slides]

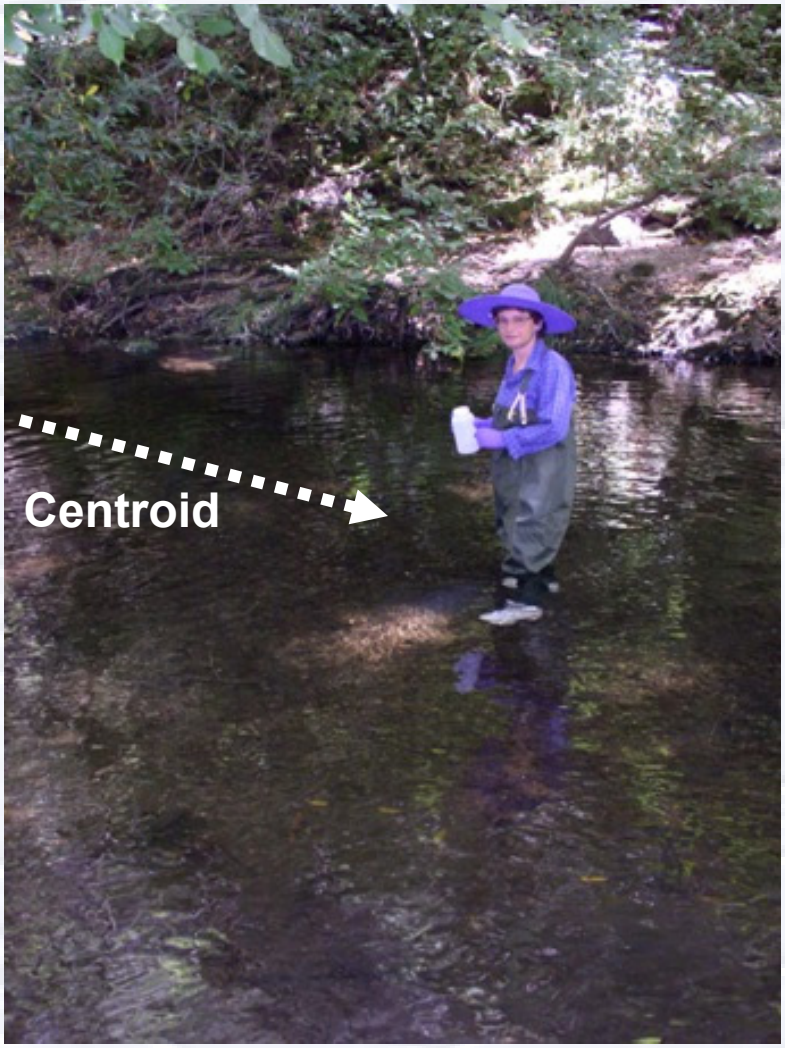
‘The Environment’: an example

Alameda Creek, April 2006

The Environment

Representative sample and what it represents in the environment

Confusion Item # 3:
A representative sample versus what it represents

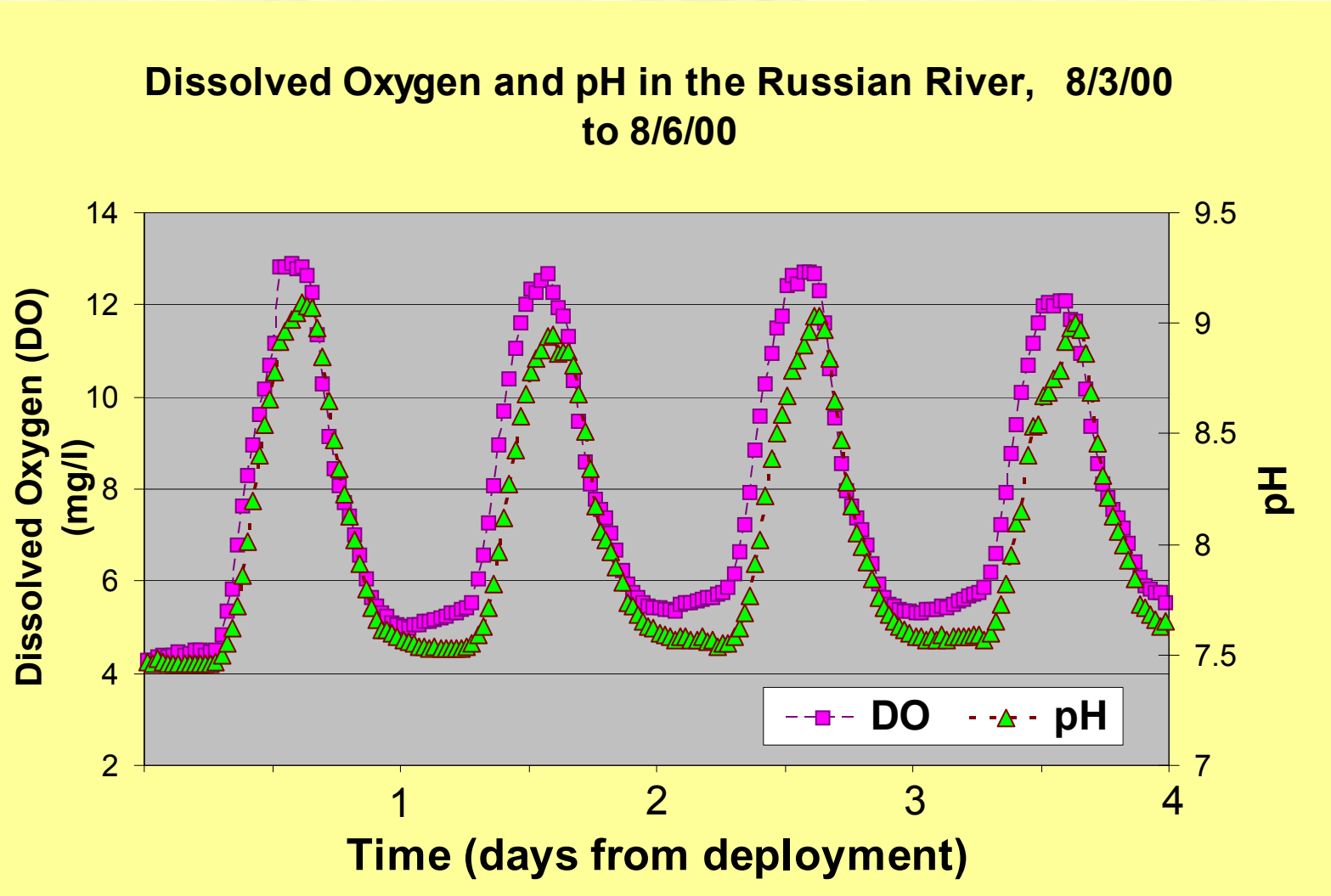


How the sample is collected – e.g., bottle dipped in the **centroid** of the flow rather than at the edge, so it is representative of the bulk of the flow

What the sample represents in the environment in the context of inherent environmental variability **[next slide and later]**

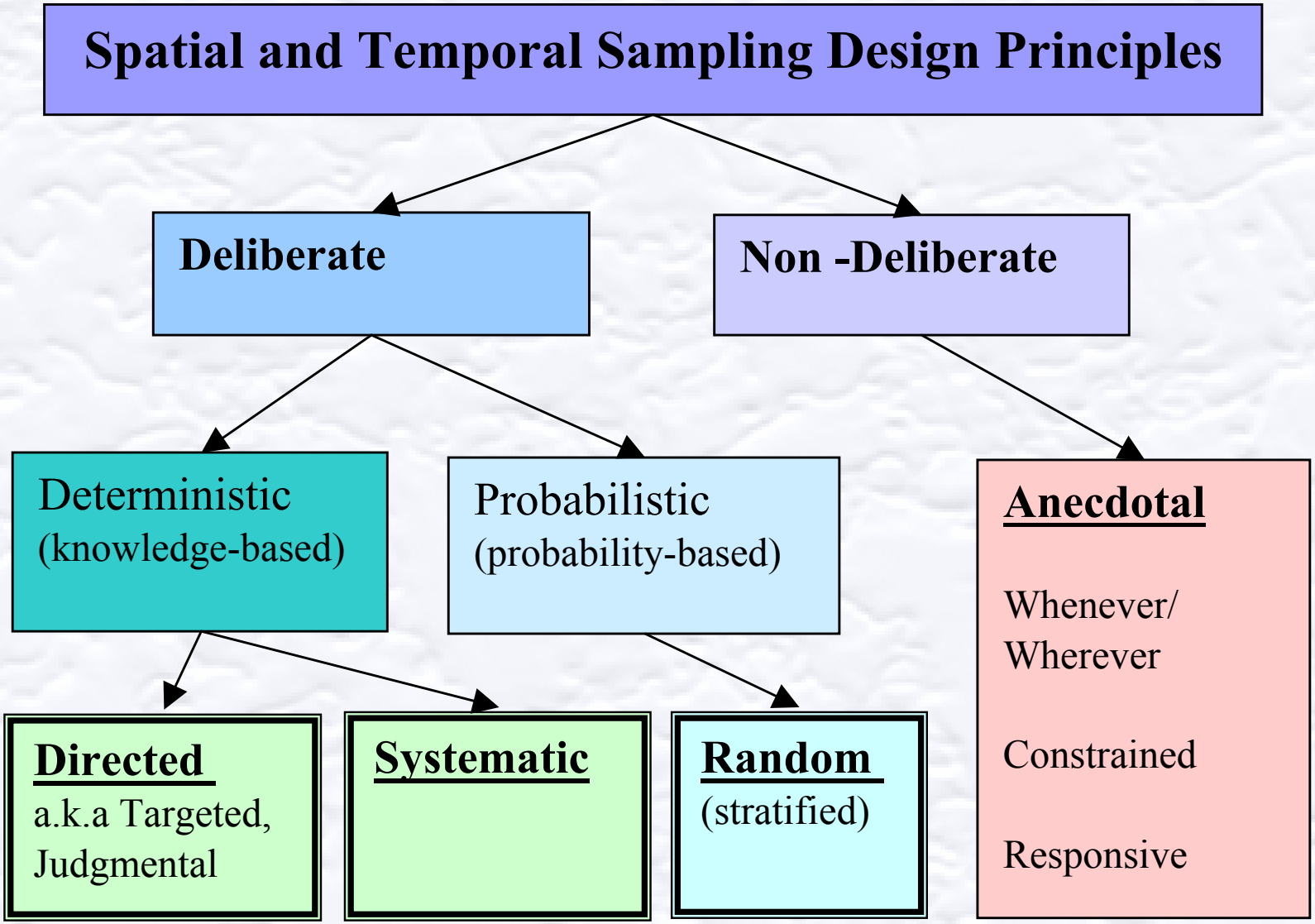
What the sample represents in the environment in the context of inherent environmental variability

Temporal Variability



What time of day is more representative?
Or - does each time represent something else? What is YOUR intent?

How will you select monitoring location and timing?
In other words, which sampling design principle will you apply?



Useful Words

Spatial descriptors

Station Type : Creek, Outfall, Ditch

Station Selection Intent: Impact assessment, Source ID

Reach Selection Design: Systematic, Directed, Random, or Non-Deliberate (Anecdotal)

Station Selection Design: (same options)

Temporal descriptors

Flow Conditions: Storm runoff flows (wet) or base flow (dry) weather

Sample Timing Intent: Worst case, Snapshot, Routine Monitoring

Seasonal Sampling Design: Systematic, Directed, Random, etc.

Diurnal Sampling Design: **(same options)**

Season of interest: Summer, Fall

Applications of these words

- Training tool to teach the basic concepts of variability;

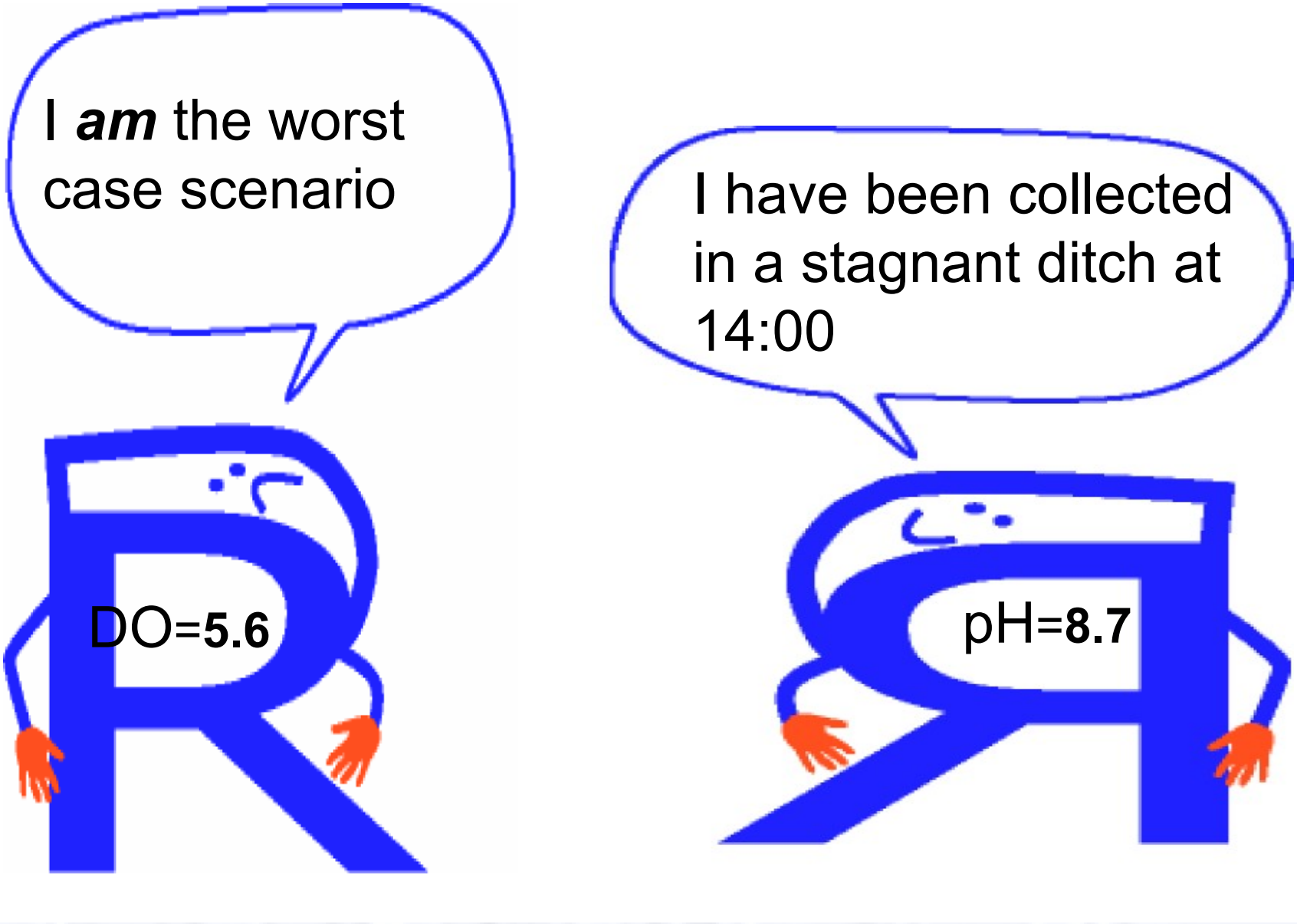
- Planning tool to hone in on the intent and the design of the study;

- Dialogue tool to solicit feedback from experts;

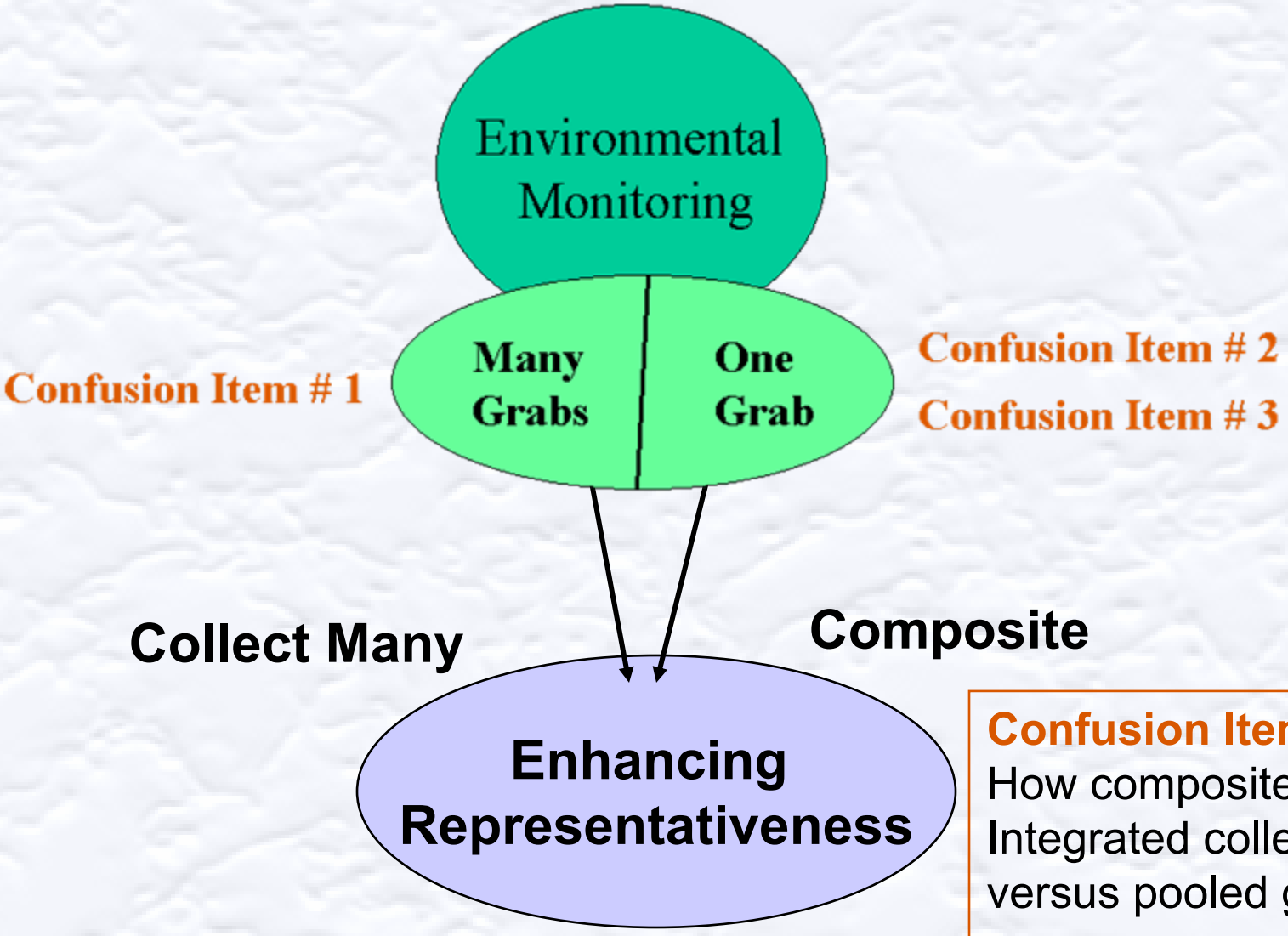
- Instruction tool to guide Project operators; and

- Communication tool to inform data users what each result represents in the environment.

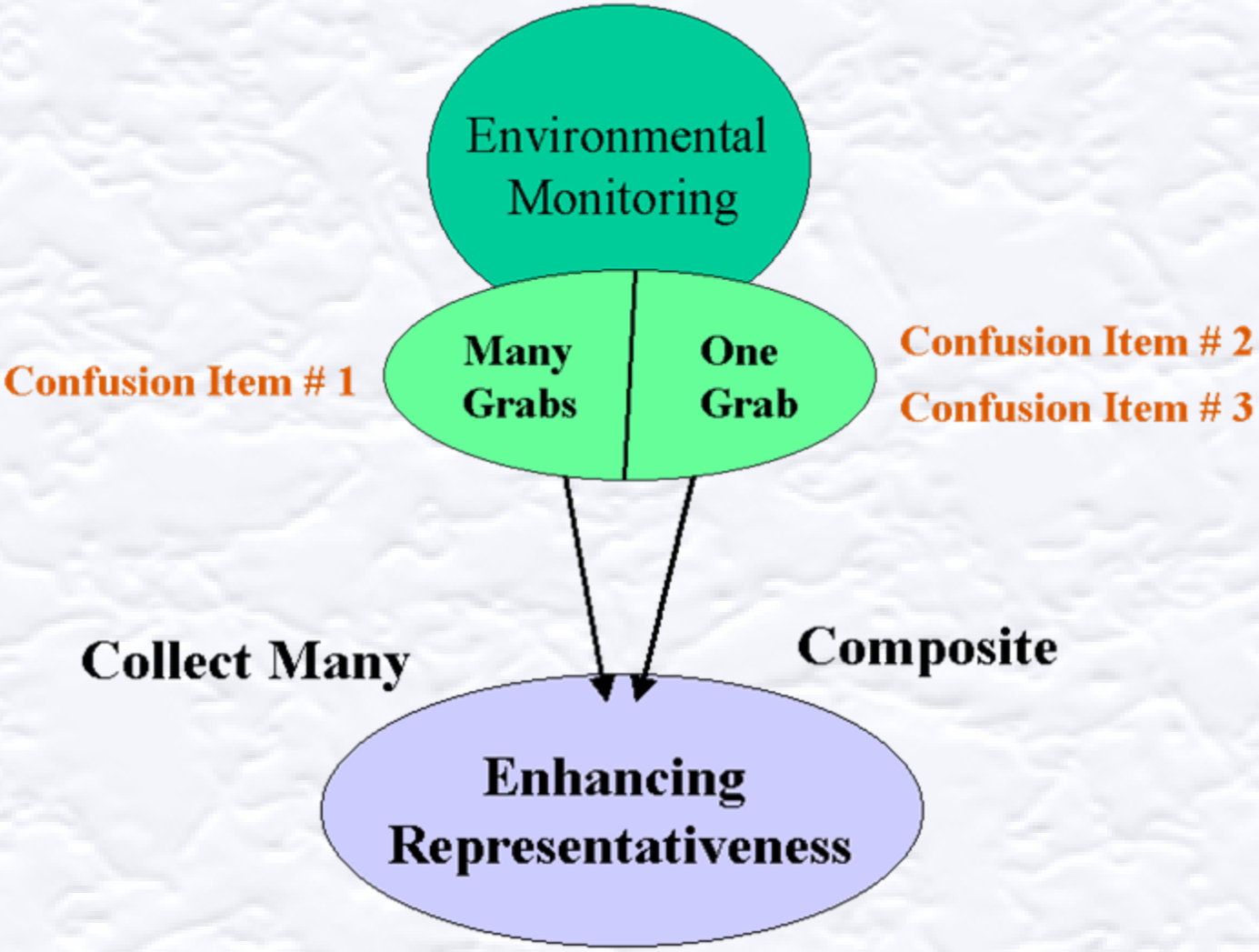
Let Monitoring Results Speak for Themselves!



Back to Representativeness…



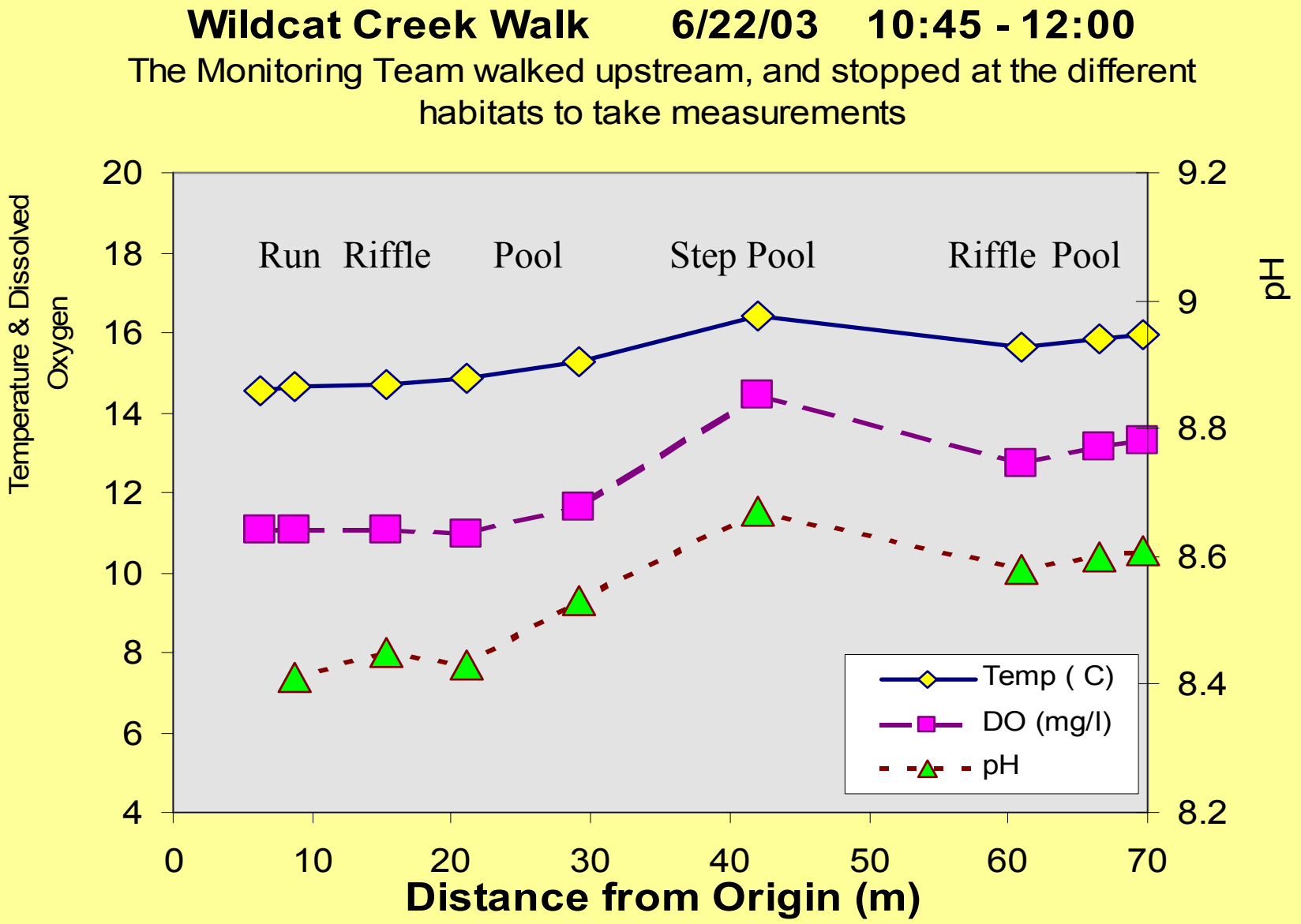
Confusion Item # 4:
How composited?
Integrated collection versus pooled grabs



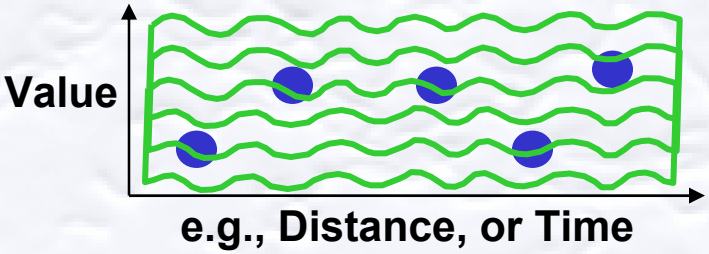
Bonus Confusion Item!

What the sample represents in the environment in the context of inherent environmental variability

Spatial Variability



Inherent Variability (Field Variability)



Measurement Precision Error (Lab Variability)

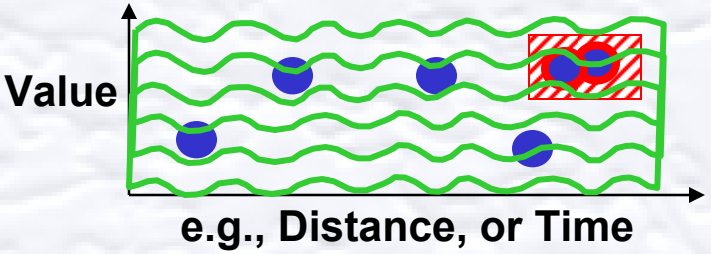
= One Grab Sample

= Environment

= Repeated Measurement (Rep, Dup)

= Error Range,
e.g., Lab Control Chart

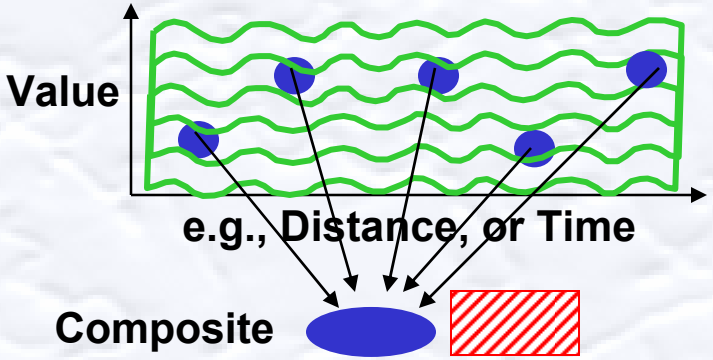
Do…(w field measurement or Sample)



Do…. Collect as many individual samples as you can, and analyze separately!
Collect paired samples often (at the same time and place), and calculate measurement precision.
You will know both:

+ the measurement error
+ and the inherent variability

Or…(w Sample only, if less $$)



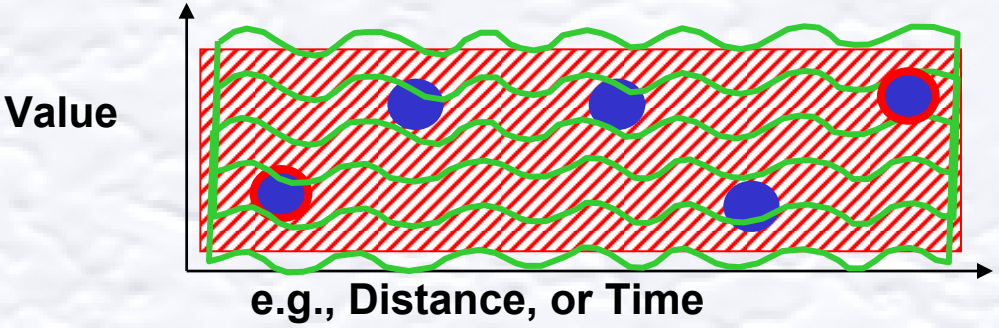
Or…. Create a composite sample and analyze it (preferably in two lab reps).
Calculate or apply lab measurement precision.
You will know:

+ the measurement error
-- But not the inherent variability

But Please Don't Lump Inherent Variability with Measurement Error

If your individual samples are used as repeated measurements to calculate measurement precision, you will **NOT** know either:

-- the measurement error
-- Or the inherent variability

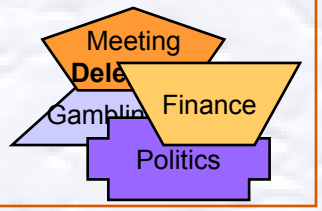


Summary

‘Analytical’:
Sample Integrity,
Homogeneity,
Uniform aliquots

‘Environmental’:
What a Sample or a Measurement Represents (Intent, Design, Conditions, Station type)

‘Non-Env.:



(Not about this)

Environmental Monitoring

Statistical:
How multiple Samples represent average conditions

Collection Protocol:
How a Sample represents
The bulk of flow

Measurement Error:
Accuracy&Precision of the Measurement System

Inherent Variability:
How values change over space and time