Assessing the Reliability of a Community-Based Approach to qPCR Water Monitoring

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Environmental Health
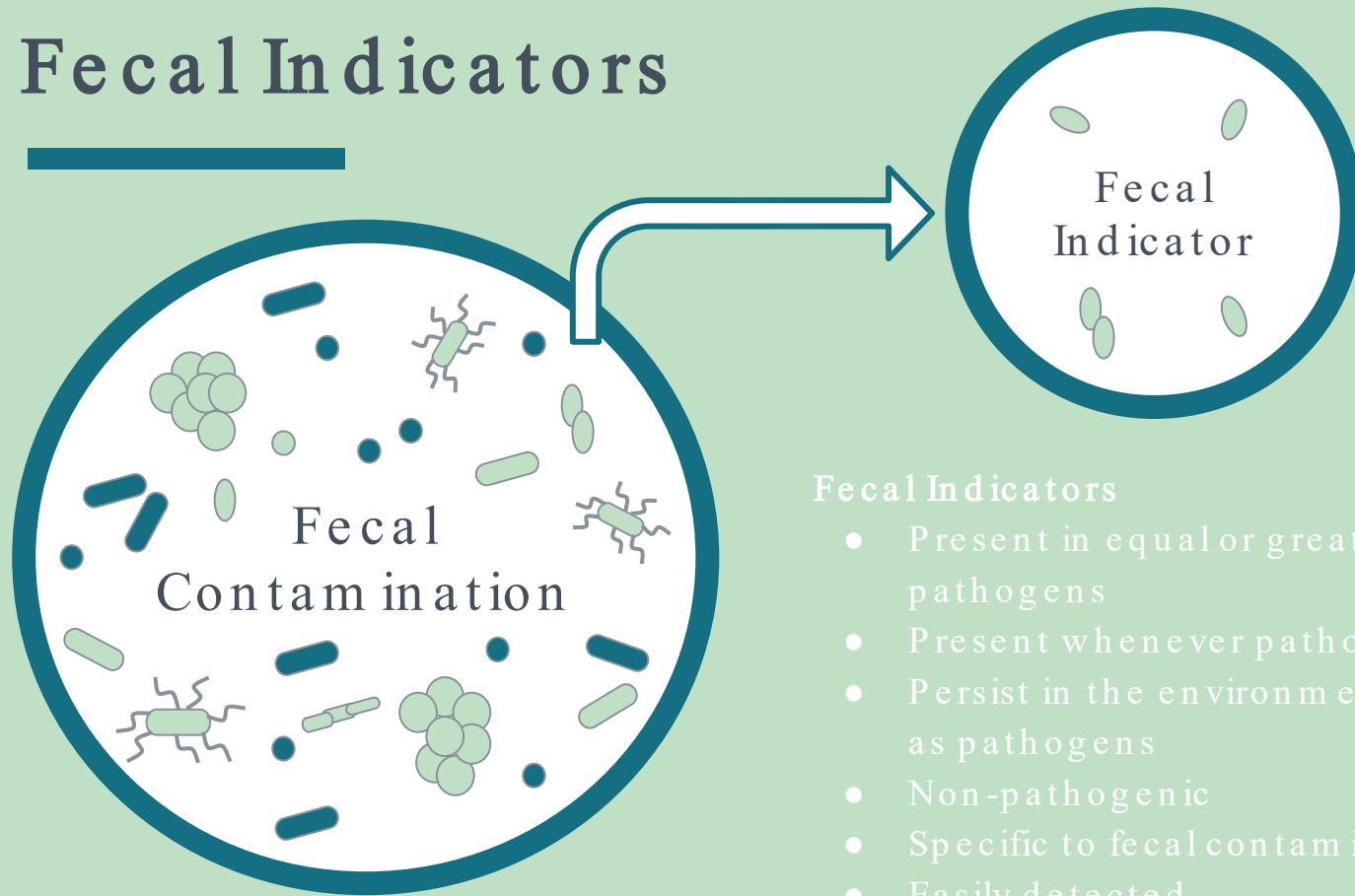School of Public Health, University of Alberta

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1.

Background

Water Monitoring

Microbial profile

Chemical & physical parameters

Aquatic invasive species

Fecal Indicators

Fecal Indicator

Fecal Contamination

Fecal Indicators
- Present in equal or greater quantity as pathogens
- Present whenever pathogens are present
- Persist in the environment at least as long as pathogens
- Non-pathogenic
- Specific to fecal contamination
- Easily detected

(Grabow, 1996)

qPCR

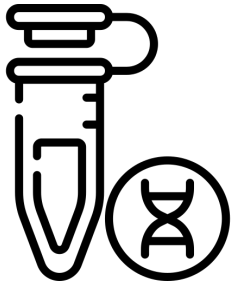Sensitive

Specific

Flexible
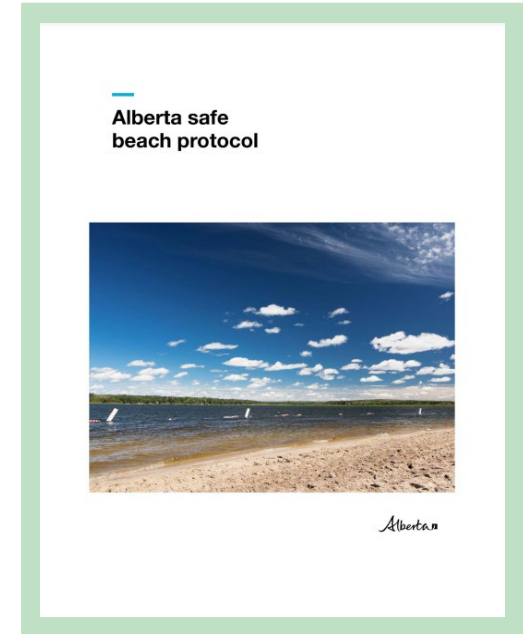
Efficient

Recreational Water Monitoring in Alberta

- Fecal indicator monitoring target: enterococcus
  - Samples exceeding guideline → microbial source tracking
- Cyanobacteria monitoring

Alberta safe beach protocol

Alberta Safe Beach Protocol cover. Alberta Health, 2021. Retrieved from: https://open.alberta.ca/publications/9781460145395

Room for Improvement

- Numerous sampling locations
- Numerous monitoring targets
- Limited resources
- Time-to-results

Community-Based Monitoring

- ▣ Valuable approach in environmental studies
- ▣ Potential to improve monitoring programs
    - □ Increase sampling
    - □ Increase testing
    - □ Increase geographic range
    - □ Empower communities
    - □ Improve science literacy
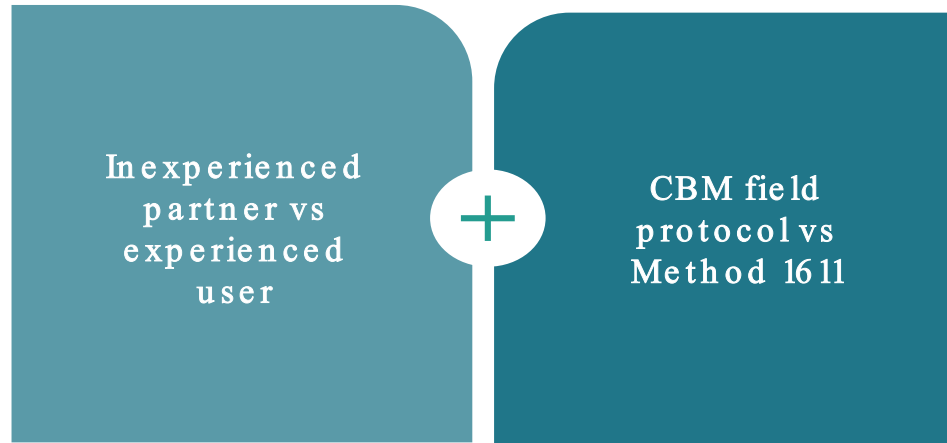

Quantabio Q qPCR Instrument. Retrieved from:
https://www.quantabio.com/product/products-pcr-instrumentation-q/

2.

Research Question

Objective:

Assess the quality of community partner-generated data

Inexperienced partner vs experienced user

+

CBM field protocol vs Method 1611

Research Protocol

Sample Collection & Filtration → **DNA Extraction by Partner** → **qPCR Run by Partner** → **qPCR Run by Expert**

Water samples collected from beach monitoring sites and kept on ice until filtration

Sample is divided equally between two 0.4µm polycarbonate filter

Filters stored frozen. One filter is set aside for expert analysis with Method 1611, one is analyzed by community partner

DNA extraction conducted using Qiagen DNEasy Kit

Extracted DNA samples kept frozen until qPCR analysis

qPCR performed by community partner following field protocol

Assay reagents prepared by expert
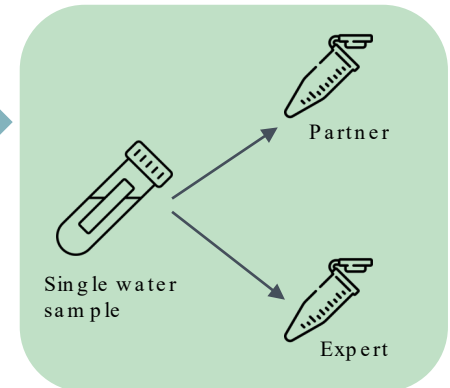
qPCR performed on community partner-extracted sample by expert user following field protocol

DNA Extraction by Expert → **qPCR Run by Expert**

DNA extraction conducted by expert user following Method 1611

qPCR performed by expert user following Method 1611

Single water sample

Partner

Expert

Inexperienced Partner vs Experienced User

How is this be assessed?

Single water sample

Analyzed by community partner via CBM protocol

Analyzed by experienced user via CBM protocol

Analyzed by expert via Method 1611
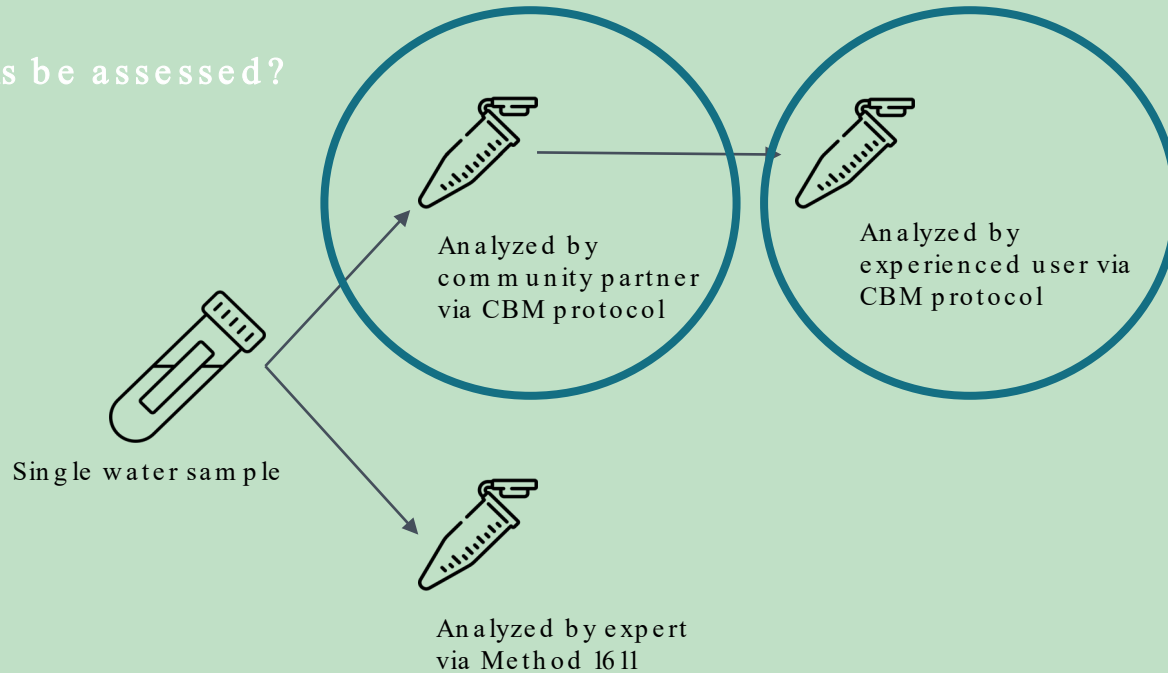
CBM Protocol vs Method 1611

How is this be assessed?

Single water sample

Analyzed by community partner via CBM protocol

Analyzed by experienced user via CBM protocol
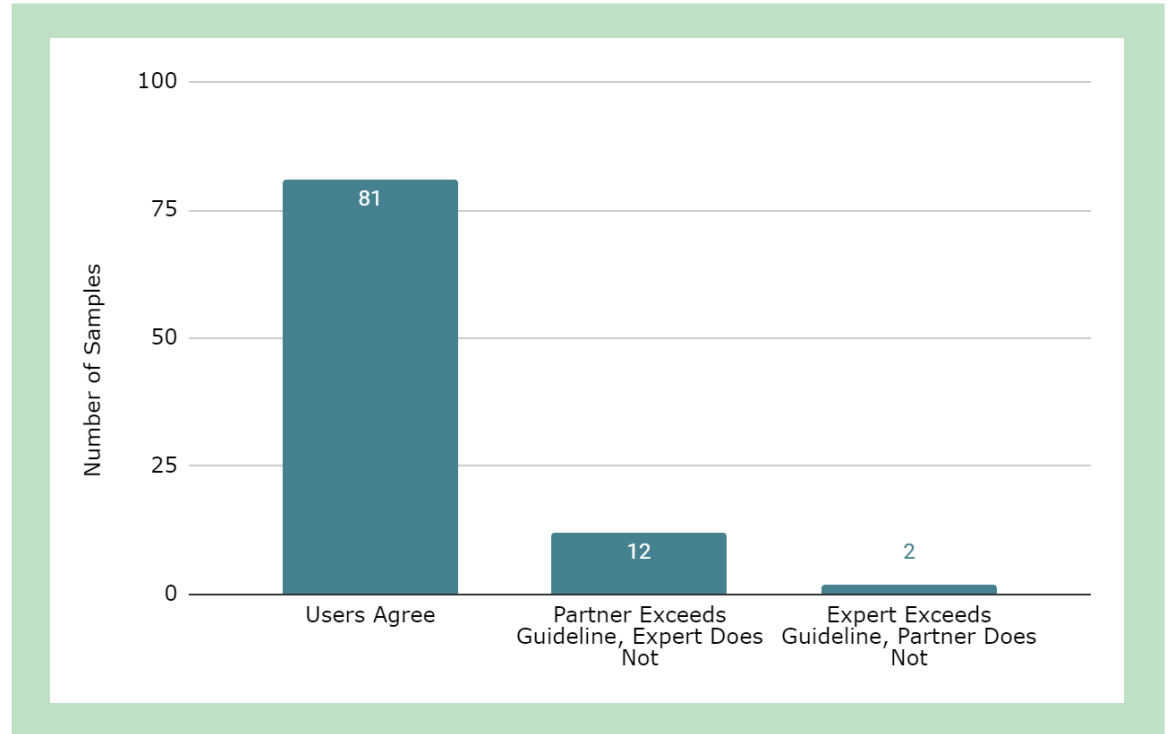
Analyzed by expert via Method 1611
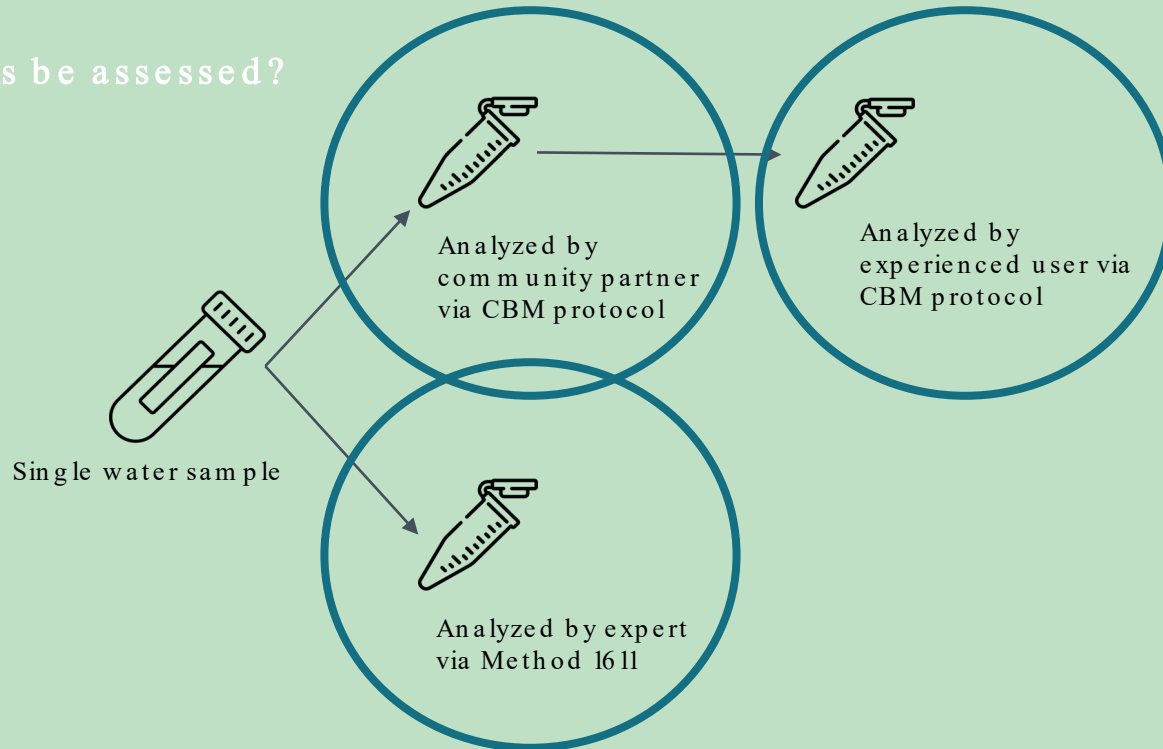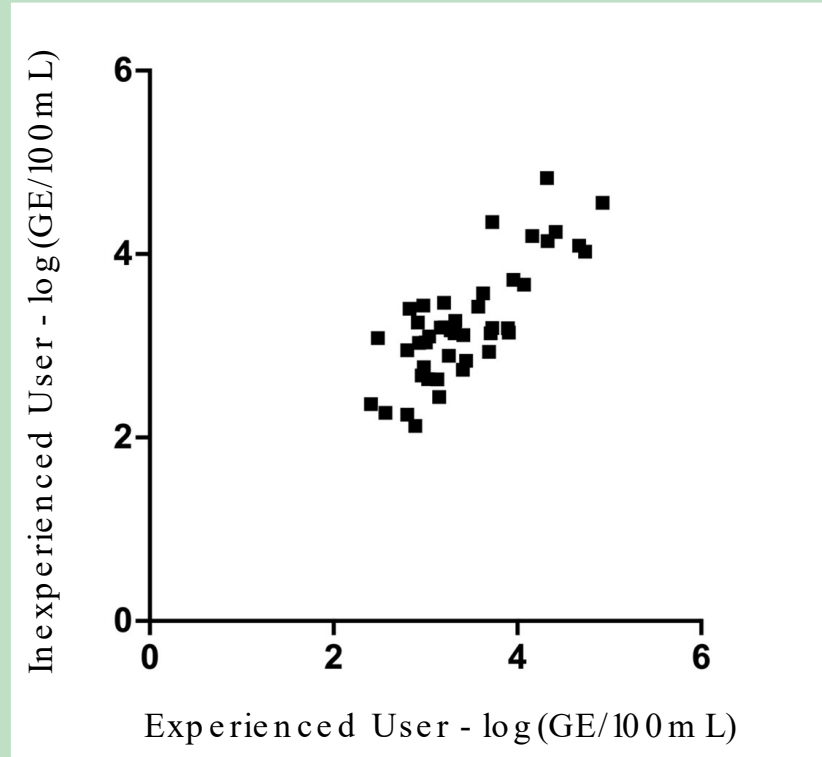
3.
Results to Date

CBM vs Method 1611

- 2020 field season

- Comparison of CBM protocol performed by inexperienced partner against Method 1611 performed by an expert user
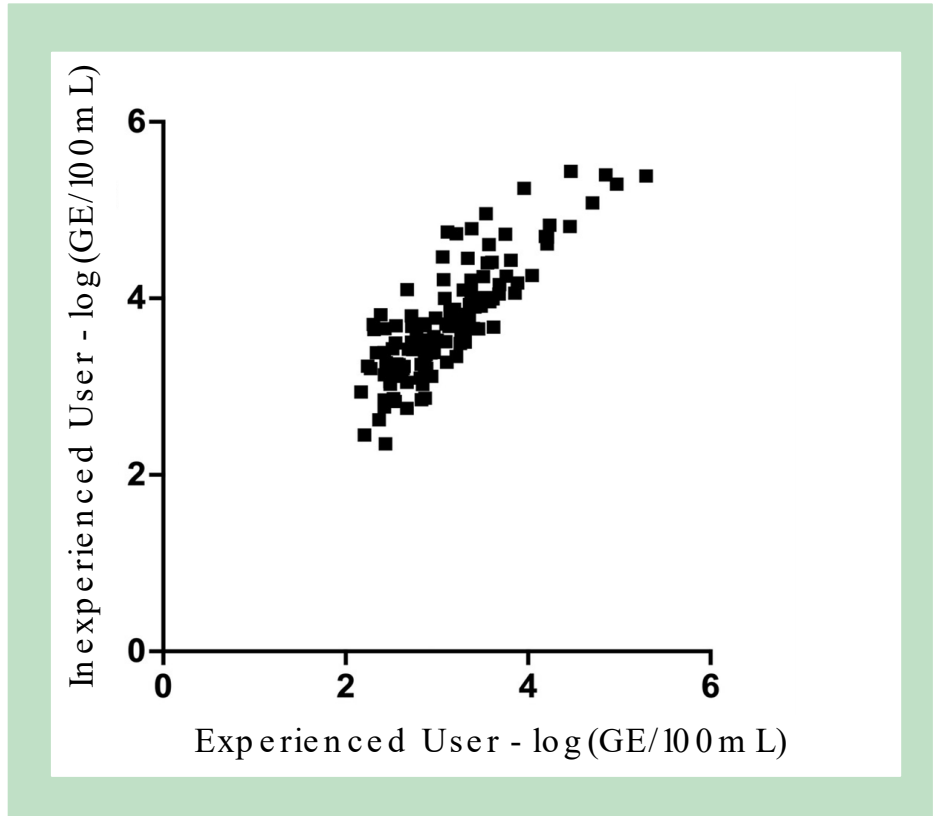
Partner vs Experienced User - 2020

- 2020 field season

- Comparison of CBM protocol performed by inexperienced partner against CBM protocol performed by an experienced user

- Spearman ρ = 0.714, p<0.0001
- ICC = 0.765

Partner vs Experienced User - 2021

- 2021 field season

- Comparison of CBM protocol performed by inexperienced partner against CBM protocol performed by an experienced user

- Spearman $\rho = 0.804$, $p < 0.0001$
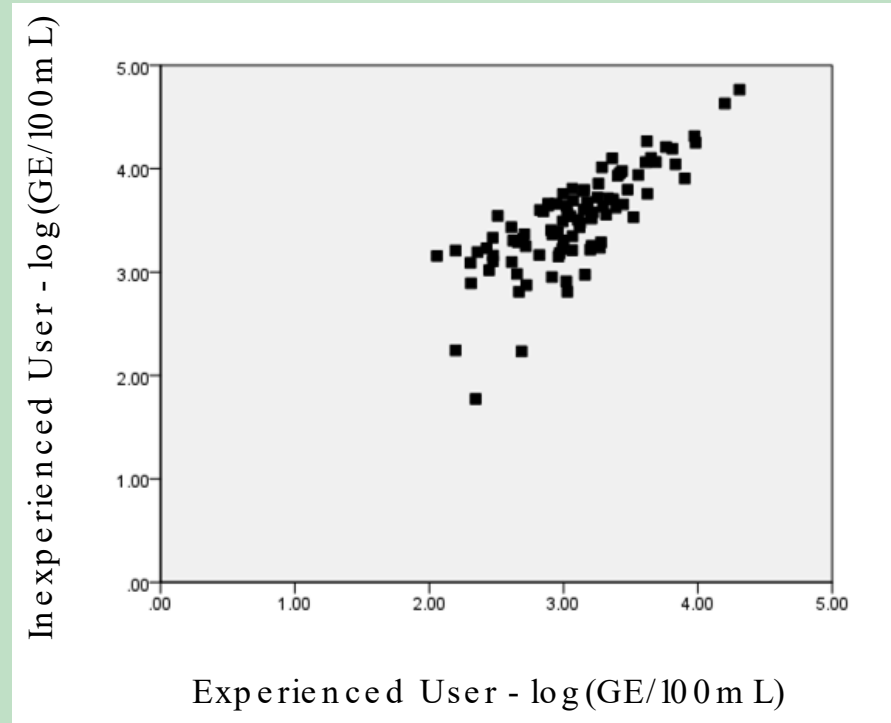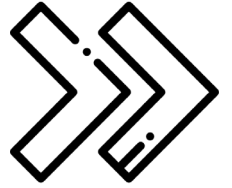- ICC $= 0.911$

Partner vs Experienced User - 2022

- 2022 field season

- Comparison of CBM protocol performed by inexperienced partner against CBM protocol performed by an experienced user

- Spearman ρ = 0.765, p<0.0001
- ICC = 0.882

Value & Future Applications

- Display legitimacy of community-based methods

- Complement existing monitoring programs

- Provide valuable research and monitoring data

- Empower community monitoring programs

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Thank you!

Questions?

References

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