An Analysis of Rainwater from Rural Alaska Catchments: Findings and Recommendations for Healthy Utilization

Masters of Public Health Project Practicum

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Background and Significance

• World Health Organization (WHO)
  – Household water security defined as access to 13.2 gp⁻¹d⁻¹

• Water Security in Alaska
  – Highest in U.S. for proportion of homes without in-home piped water
    • Increased risk of diseases
      – Pneumonia, MRSA, Respiratory-tract Infections, Skin Infections, and RSV

(ADEC, 2009; Brubaker, 2011; Hennessy et al., 2008; Thomas et al., 2013; Eichelberger, 2010).
Research Question & Objectives

• **Research Question**
  – What is the quality of water in rainwater catchments in rural Alaska?

• **Objectives:**
  – Sample & analyze rainwater from across the state
  – Document methods and materials employed to collect rainwater
  – Provide homeowners with the results of the testing on their water
  – Discuss possibilities for healthy utilization of rainwater based on findings
  – Discuss utilization and development of community sourced volunteer sampling
Research Methods

• Sampling Protocol Development
• Volunteer Recruitment
• Sample Collection
• Processing Rainwater samples
  – UAA Lab
    • E. coli
  – Professional Lab (SGS)
    • Conductivity
    • Metals Scan
    • pH
    • TOC
Method - Volunteers

• Volunteer recruitment method based on Adventurers & Scientists for Conservation

  – Develop cadre of professionals traveling to difficult to reach places interested in health and science
Methodology

- Pilot study, convenience sample
  - Volunteers were asked to approach homes with catchments
- Sample processing Considerations
  - What was needed to ensure quality?
    - Timeline – within 3 days of Collection
    - Maintain sample temperature (1°C - 10°C)
## Sample Locations, Samples (N), and Volunteer Group

<table>
<thead>
<tr>
<th>Sample Location</th>
<th>Samples (N)</th>
<th>Volunteer /Group</th>
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<tr>
<td>Alakanuk</td>
<td>2</td>
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<tr>
<td>Brevig Mission</td>
<td>3</td>
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<td>Tununak</td>
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Size of the Catchment Vessel (N=21)

- >1000 Gallons: 15, 71.4%
- <100 Gallons: 2, 9.5%
- 100-1000 Gallons: 2, 9.5%
- 5 Gallons: 2, 9.5%
Rainwater Catchment Pictures
Rainwater Catchment Pictures
Was the Catchment Vessel Open or Covered? (N=21)

- Open: 8, 38.1%
- Covered: 13, 61.9%

How Full was the Catchment Vessel? (N=21)

- Full: 1, 4.8%
- More than 1/2 full: 9, 42.9%
- About 1/2 full: 4, 19.0%
- Less than 1/2 full: 7, 33.3%
Rainwater Catchment Pictures
How Clean Did the Rainwater Look? (N=21)

- **No debris**: 13 observations
- **Visible leaves, insects, feathers, etc.**: 3 observations
- **Clear on top, sediment on the bottom**: 1 observation
- **Cloudy or turbid water**: 1 observation
- **Metal, bone**: 1 observation
- **Paint chips, aluminum, wood**: 1 observation
- **Slight sheen or fine particles**: 1 observation
Samples were tested for:

- Total Organic Carbon
- pH
- Conductivity
- Aluminum
- Antimony
- Arsenic
- Barium
- Beryllium
- Boron
- Cadmium
- Calcium
- Chromium
- Cobalt
- Copper
- Iron
- Lead
- Magnesium
- Manganese
- Mercury
- Molybdenum
- Nickel
- Potassium
- Selenium
- Silver
- Sodium
- Thallium
- Vanadium
- Zinc
- E-Coli
E-coli

• All of the 21 samples collected indicated the most probable number (MPN) for E-coli was 0. (6 of the 21 samples were within the time and temperature windows)

• Testing was conducted to ensure the result was accurate.
# Metal Results $\mu g\ L^{-1}$

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Limitations

• Small sample size (N=21)
• One point in time sampling
• Potential seasonal variation
• Utilization patterns of collected rainwater
Recommendations

• Additional biological testing of rainwater catchments
• Develop a set of quality standards & recommended uses for non-potable water
• How does rainwater quality compare with other non-treated sources?
• Provide health-related education for rainwater utilization
• Proper storage and containment are key to maintaining high quality water
Thank you to all the volunteers!

• Ted Jacobson
• Anna Boyko
• Amy Modig
• Katy Krings
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• Joe Fitzgerald

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• Paul Schuster
• Robert Taylor
• Paul Cascio
• Rachel Lord
• Korie Hickel
• Lance Whitwell
Questions?
References


http://www.who.int/water_sanitation_health/diseases/WSH03.02.pdf
