APPLICATION OF CONSISTENT CONTACT RECREATION WATER QUALITY STANDARDS ACROSS HYDROLOGICAL EXTREMES: REASONABLE OR RIDICULOUS?

DR. LUCAS GREGORY
Research Scientist
Texas Water Resources Institute

Co-authors:
Stephen Muela & Dr. Kevin Wagner

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WATER QUALITY STANDARDS

- Describe desired condition of waterbody
- Form legal basis for controlling pollution
- Advise user of potential health risks
- Consist of:
  - Designated Uses
  - Numeric Criteria
  - Antidegradation Requirements
  - General Policies
CONTACT RECREATION

- **Primary contact** – activities with presumed significant risk of water ingestion
  - Swimming, children wading, water skiing, surfing, diving, tubing, whitewater sports (kayaking, rafting)

- **Secondary contact 1** – commonly occurring activities with limited body contact; less ingestion risk than primary contact
  - Adults wading, fishing, canoeing, kayaking, boating

- **Secondary contact 2** – limited body contact activities with less ingestion risk due to physical waterbody characteristics and limited access
  - Fishing, canoeing, kayaking, boating

- **Noncontact** – activities with no significant risk of ingestion; where activities should not occur due to unsafe conditions
  - Birding, hiking, biking; contact prohibited by law
RECREATION TYPES
Contact recreation standards provide reasonable assurance that human health risk from fecal pollution is acceptable.

Feces contains:
- Pathogens including *cryptosporidium*, pathogenic *E. coli*, and *giardia*.
- Non-pathogenic organisms: many strains of *E. coli* and fecal coliform.
  - *E. coli* commonly used as Fecal Indicator Bacteria.

Presence of Fecal Indicator Bacteria in water considered indicative of recent fecal contamination.

Concentrations correlate to human health risk.
**E. coli** can survive for a period of time outside of the host organism in soil, water, sediment

Survival influenced by temperature, moisture level, available nutrition, salinity, solar radiation, and predation levels

- Levels of each vary in soil, water, and sediment

Long-term survival has been documented in all environments

- *E. coli* may not be associated with recent contamination events

- Surviving *E. coli* can contribute to measured quantity in water samples
  - Baseflow contributions ~90%
  - Stormflow increases of ~ 2 orders of magnitude
(CONTACT RECREATION STANDARDS
APPLICATION IN TEXAS)

- **E. coli**
  - Public Lakes
  - Rivers
  - Creeks

- **Enterococcus**
  - Bays
  - Estuaries

- No considerations for flow condition
- No risk conferred to the person recreating due to type of activity
- No consideration of use type relative to flow conditions
TABLE 1. E. coli concentration descriptive statistics by flow category

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Median</th>
<th>Standard Deviation</th>
<th>Geometric Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safe flows</td>
<td>32</td>
<td>110</td>
<td>163.1</td>
<td>106.4</td>
</tr>
<tr>
<td>Unsafe flows</td>
<td>9</td>
<td>290</td>
<td>1835.7</td>
<td>510.4</td>
</tr>
<tr>
<td>All flows</td>
<td>41</td>
<td>124</td>
<td>978.9</td>
<td>150.1</td>
</tr>
</tbody>
</table>

Figure 1. Navasota River watershed in Central Texas, USA

Figure 2. E. coli concentrations by flow condition
HYDROLOGIC CONDITIONS CHANGE
RECREATION
Risk based water quality standard

Consider the number of people engaged in recreation, appropriate type of recreation, and flow condition

Example considering 5,000 swimmers and only 50 whitewater rafters per year

Illness rate/1000 people = $\frac{\log(E.\text{coli geometric mean}) - 1.249}{0.1064}$

At 126 cfu/100 mL $E.\text{coli}$ concentration: 40 swimmers get sick; only 0.4 whitewater rafters get sick

Applying less restrictive standard to rafting conditions only still yields adequate human health protection
  
  At 630 cfu/100 mL: only 0.72 whitewater rafters get sick
IMPLICATIONS

- Requires more data: water quality and recreation use
- Must consider type and levels of waterbody use
- People will assume increased level of risk when recreating
- Can reduce the number of waterbodies considered impaired
- Can reduce costs for restoring impaired waterbodies
QUESTIONS?

Lucas Gregory
LFGregory@ag.tamu.edu