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

PROTECTING HUMAN HEALTH

- 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 FATE IN THE ENVIRONMENT

- *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

NAVASOTA RIVER CASE STUDY

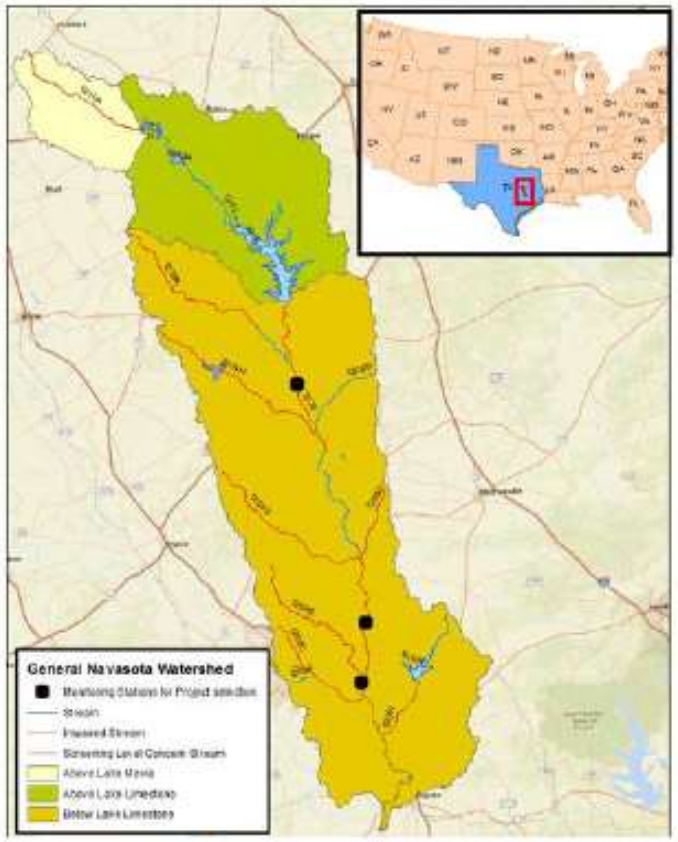

Figure 1. Navasota River watershed in Central Texas, USA

Table 1. *E. coli* concentration descriptive statistics by flow category

E. coli concentrations CFU/100mL	*N*	*Median*	*Standard Deviation*	*Geometric Mean*
Safe flows	32	110	163.1	106.4
Unsafe flows	9	290	1835.7	510.4
All flows	41	124	978.9	150.1

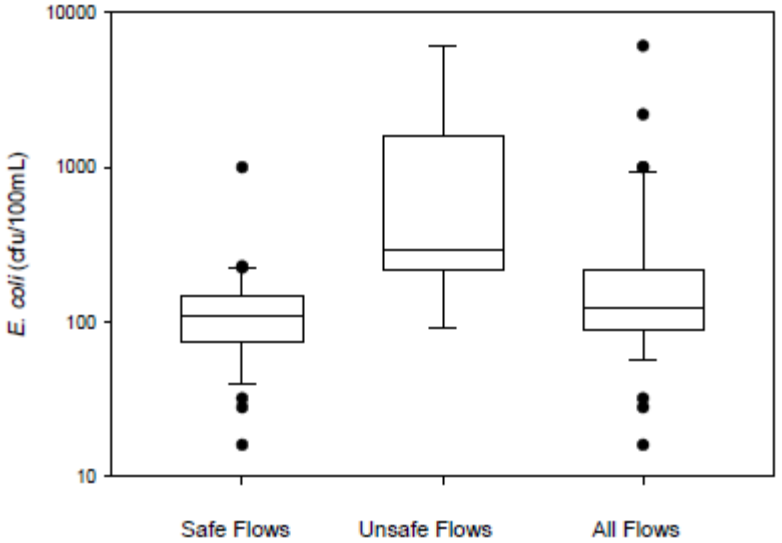

Figure 2. *E. coli* concentrations by flow condition

HYDROLOGIC CONDITIONS CHANGE RECREATION

POLICY RECOMMENDATION

- 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 = [Log(*E.coli* geometric mean)-1.249]/0.1064

At 126 cfu/100 mL *E. 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

TEXAS A&M UNIVERSITY

TEXAS A&M AGRILIFE RESEARCH

Texas Water Resources Institute
make every drop count

QUESTIONS?

Lucas Gregory
LFGregory@ag.tamu.edu