Utah Lake Water Quality Study
Science Panel Meeting
February 8, 2019
Salt Lake City, UT
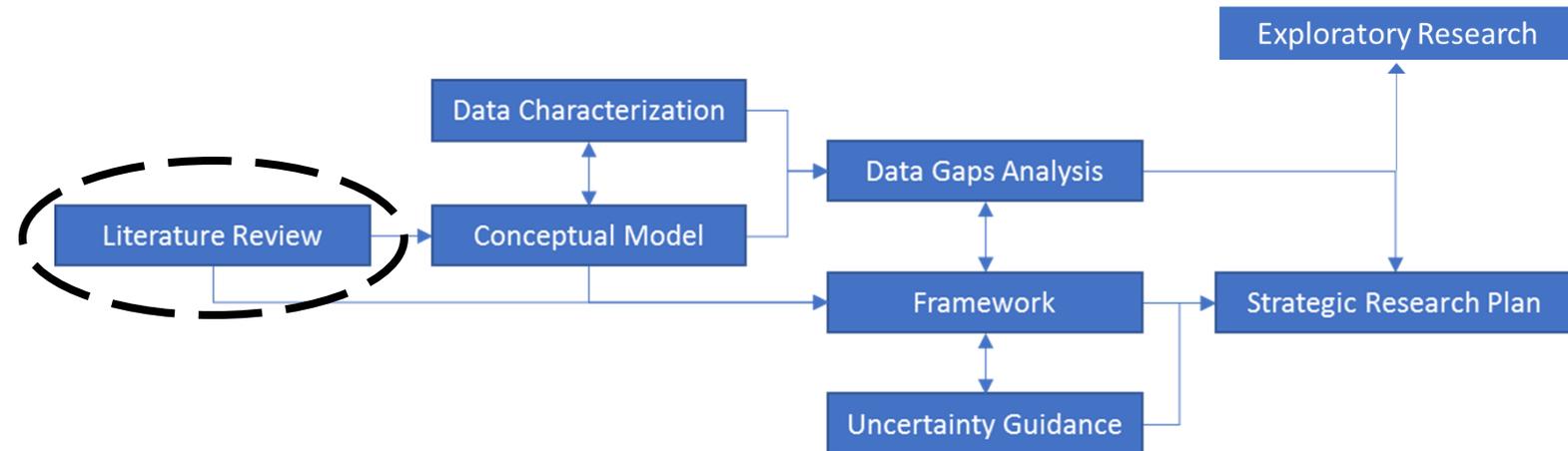
Lines of Evidence/ Literature Review

Utah Lake Nutrient Criteria Development Technical Support

UTAH DEPARTMENT of **ENVIRONMENTAL QUALITY**

Objective

- Review lines of evidence used in criteria setting

- Discuss focus of the literature review

4 Major Approaches

- Reference
- Stressor-Response Models
- Mechanistic Models
- Scientific Literature

Reference

- Original Guidance
- Distribution of nutrient concentrations in "reference populations"
- Population examples:
  - Least disturbed
  - Biologically Attaining
  - Temporal reference*
- Modeled reference
- Historical condition*
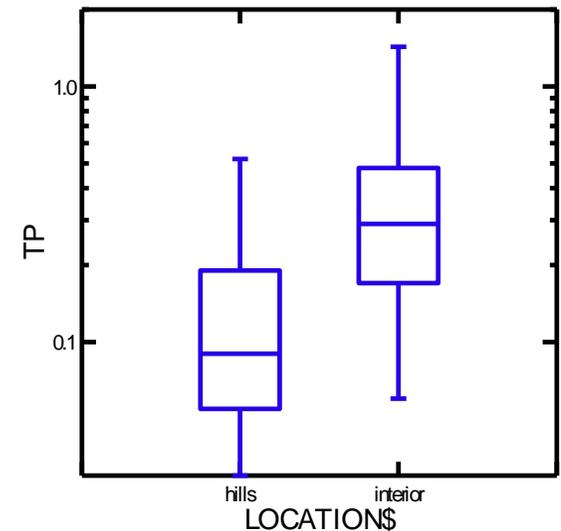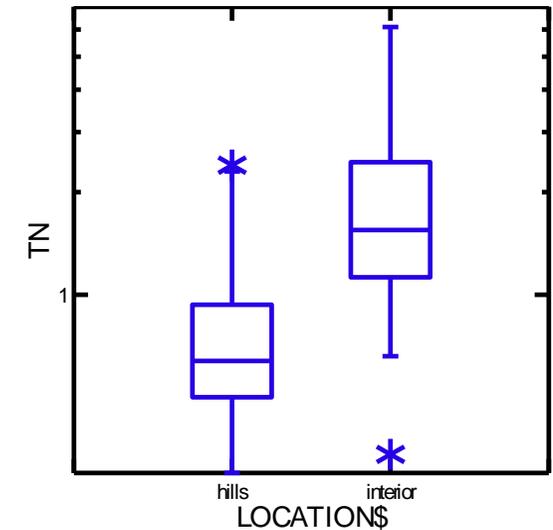
Reference

- Pros
  - Inherently protective, typically
  - Data driven
  - Quantifiable uncertainty

- Cons
  - Not necessarily linked to harm
  - Can be harder for site specific application – what is a reference for Utah Lake?
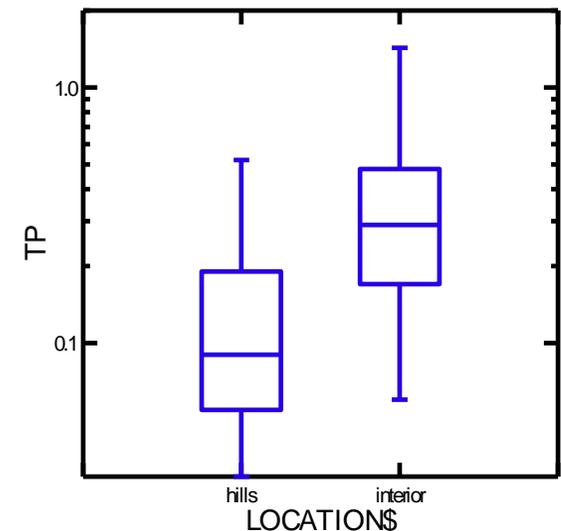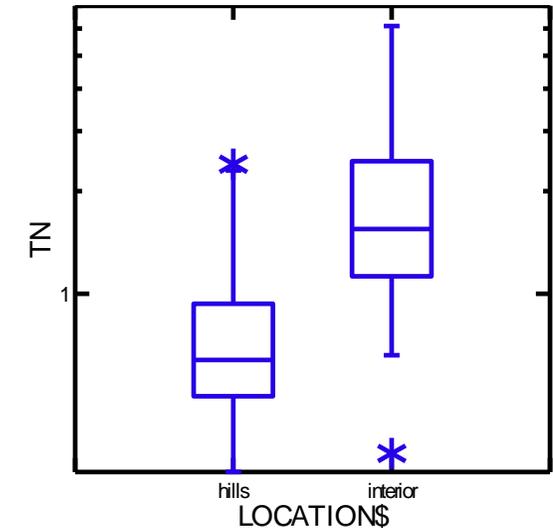
Stressor-Response

- 2010 USEPA Guidance
- Based on conceptual models
- Paired data on nutrients and responses
- Ideally looking along causal paths
- Control for confounding variables/co-stressors
- Example approaches
  - Simple regression - interpolation
  - Hierarchical models
  - Change point models
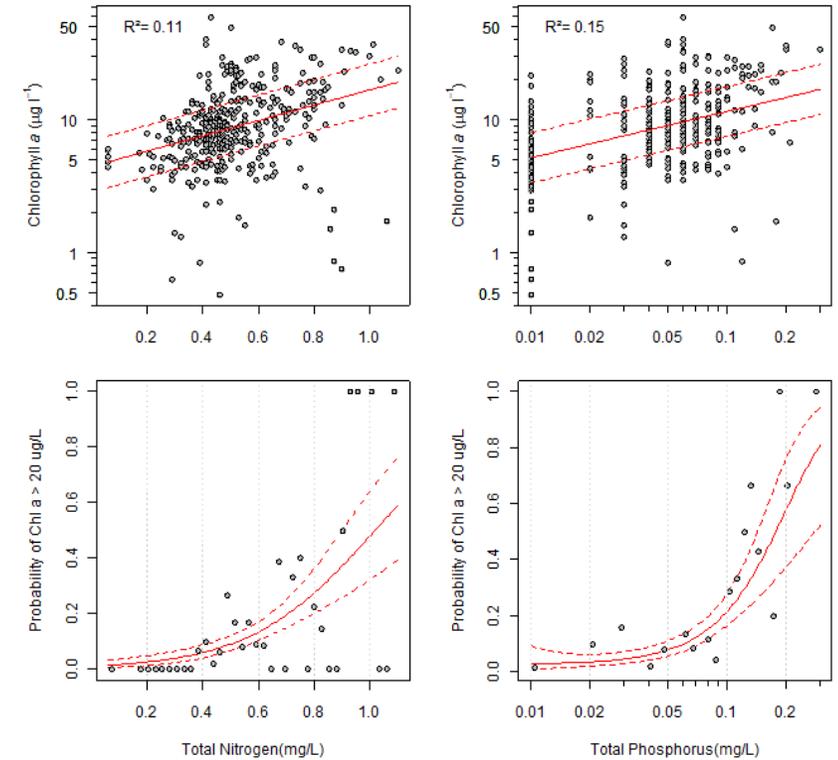
Stressor-Response

- Pros
  - Can tie to protection goals, link to harm
  - Data driven
  - Quantifiable uncertainty

- Cons
  - Noise/confounding effects
  - Communicating models
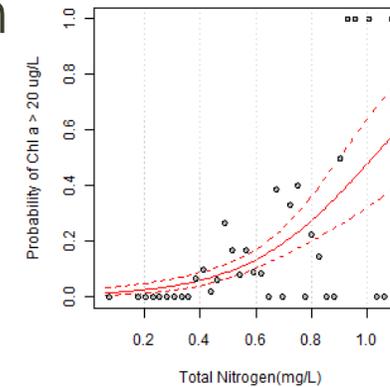 - Can be harder for site specific application – is there an applicable gradient to use in Utah Lake?
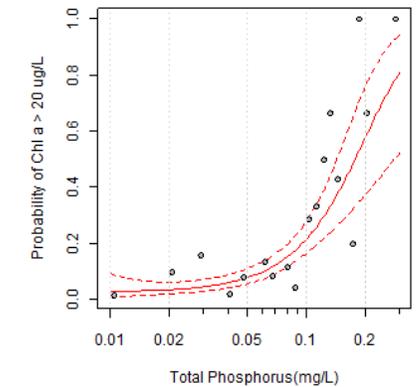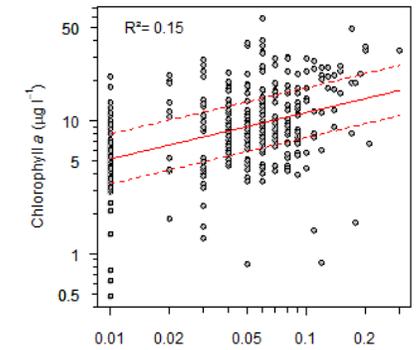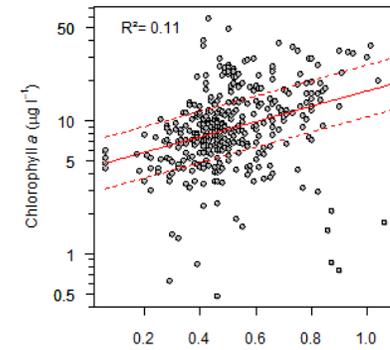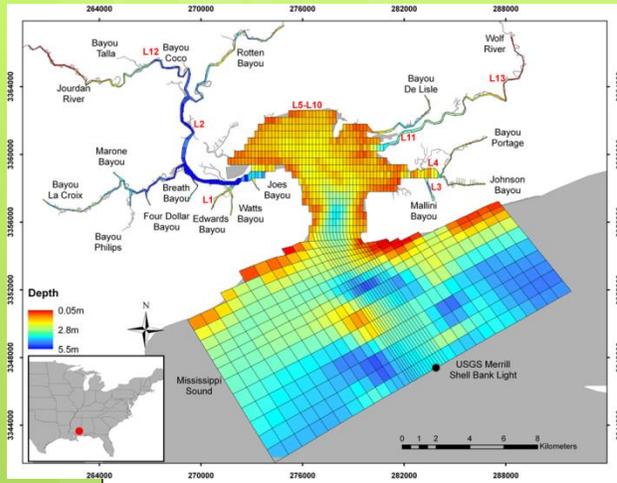
Mechanistic Models

- Water quality models (WASP, QUAL2)
- May be linked to watershed loading and/or hydrodynamic models
- Site specific application, may be extendable
- Widely applied in TMDLs, but also in criteria development (e.g., Florida estuaries, AL and GA lakes, MS and AL estuaries)
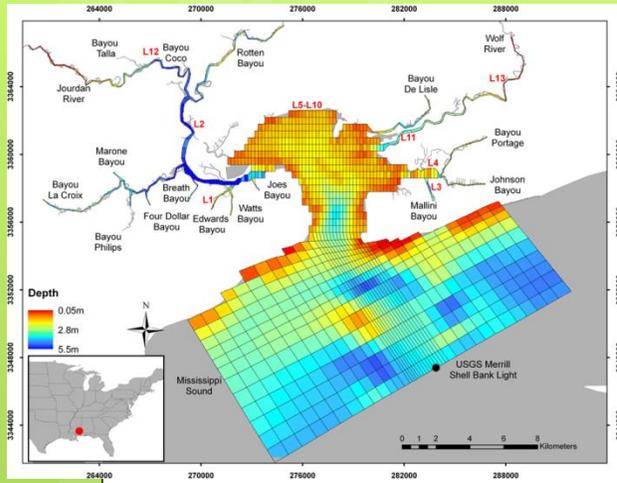
Mechanistic Models

- Pros
  - Can tie to protection goals, link to harm
  - Data driven

- Cons
  - Uncertainty hard to quantify
  - Communicating models
  - Data hungry

Scientific Literature

- Usually a "context" line of evidence
- Lots of relevant publications exist

Comparing effects of nutrients on algal biomass in streams in two regions with different disturbance regimes and with applications for developing nutrient criteria

R. Jan Stevenson[1,*], Steven T. Rier[2], Catherine M. Riseng[3], Richard E. Schultz[4] & Michael J. Wiley[3]

[1]Department of Zoology, Michigan State University, East Lansing, MI, 48824, USA
[2]Department of Biological & Allied Health Sciences, Bloomsburg University, Bloomsburg, PA, 17815, USA
[3]School of Natural Resources and the Environment, The University of Michigan, Ann Arbor, MI, 48109, U

SUGGESTED CLASSIFICATION OF STREAM TROPHIC
STATE: DISTRIBUTIONS OF TEMPERATE STREAM TYPES
BY CHLOROPHYLL, TOTAL NITROGEN,
AND PHOSPHORUS

[*], JOHN R. JONES[2] and EUGENE B. WELCH[1]

te University, Manhattan, KS 66506, U.S.A., [3]School of Natural
all, University of Missouri, Columbia, MO 65211, U.S.A.
of Civil Engineering, P.O. Box 352700, University
shington, Seattle, WA 98195, U.S.A.

DEVELOPING NUTRIENT TARGETS TO CONTROL BENTHIC
CHLOROPHYLL LEVELS IN STREAMS:
A CASE STUDY OF THE CLARK FORK RIVER

W. K. DODDS[1,*], V. H. SMITH[2] and B. ZANDER[3]

[1]Division of Biology, Kansas State University, Manhattan, KS 66506, U.S.A., [2]Environmental Studies Program and Department of Systematics and Ecology, University of Kansas, Lawrence, KS 66045, U.S.A., [3]United States Environmental Protection Agency Region 8, Suite 500, 999 18th St. Denver, CO 80202, U.S.A.

Scientific Literature

SUGGESTED CLASSIFICATION OF STREAM TROPHIC STATE: DISTRIBUTIONS OF TEMPERATE STREAM TYPES BY CHLOROPHYLL, TOTAL NITROGEN, AND PHOSPHORUS

WALTER K. DODDS[1]*, JOHN R. JONES[2] and EUGENE B. WELCH[3]

[1]Division of Biology, Kansas State University, Manhattan, KS 66506, U.S.A., [2]School of Natural Resources, 112 Stephens Hall, University of Missouri, Columbia, MO 65211, U.S.A. and [3]Department of Civil Engineering, P.O. Box 352700, University of Washington, Seattle, WA 98195, U.S.A.

- Pros
  - Can tie to protection goals
  - Quantifiable uncertainty

- Cons
  - Applicability/Extrapolation
  - Communicating models
  - Variable quality, sometimes unknown

What about TMDL targets?

- TMDLs require a target
- Often it is an existing criterion – but if not, have to develop

- USEPA TMDL nutrient protocol: target setting

- Very similar to criteria guidance
  - Reference (single site or population based)
  - Trophic classification
  - Literature
  - User surveys

Literature Review

- Goal: "Summary technical memo of applicable approaches for developing nutrient criteria for shallow lake ecosystems like Utah Lake"

- Sources: Existing reviews, SNAPIT, online review

- Search and screening strategy: what we'll follow

Literature Review

Stressor-Response

- Poikane et al. 2019. Deriving nutrient criteria to support 'good' ecological status in European lakes: An empirically based approach to linking ecology and management.

Mechanistic Modeling of Reference

- Zhang et al. 2018. Construction of lake reference conditions for nutrient criteria based on system dynamics modelling

Reference and Stressor-Response

- Sun, W. C. et al. 2017. Estimating nutrient criteria of the lakes and reservoirs by reference condition approach and stressor-response models.

Next Steps

- Continue Review on Lines of Evidence literature

- Summarize in draft memo – ideally by next meeting

- Science Panel and DWQ review

- Finalize