What Is Evidence-Based Practice for Environmental Flow Programs?

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Acknowledgements

eWater CRC - EcoEvidence Tools
•Partnership with Richard Norris and Sue Nicholls (Uni of Canberra)
•Ralph Ogden (eWater CRC)

MDBA – Scoping Study for Evidence Based Practice in Env Water Planning
- Jason Alexander and Richard Moxham (MDBA)

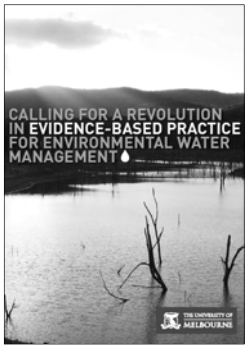
Vic Env Flow Mon & Asses Prog (VEFMAP)
•DSE and the Vic CMA's
•Mike Jensz & Sabine Schreiber (DSE)

ARC Linkage Project – Novel Approaches to Env Flow M&E
- DSE, MDBA, Melb Water, Vic CMA's, SKM, Env Evidence Aust, Colorado State Uni

Key Messages

- We can learn from evidence-based practice in the medical sciences
- There is a big opportunity to improve evidence-based practice for environmental water programs
- To progress this we need…
  - Standards,
  - Tools, and
  - Case studies.

We need You!



The Need

Billions of dollars is being spent on environmental water in the MDB

Changes to the Water Act


//soundwaves.usgs.gov/2009/05/awards3.html

Total – Human – Environmental

- BUT…
  - Ability to challenge allocations
  - Onus on researchers to determine defensible environmental allocations

Evidence-Based Practice

Resources are limited so they should be invested in actions previously shown to be effective

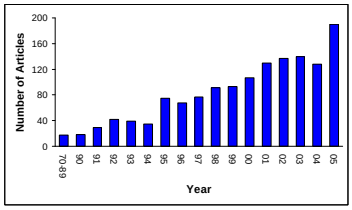
Systematic reviews are a key tool for EBP

- Problem formulation
- Design and document the review procedure
- Conduct review
- Structured synthesis of knowledge
- Reporting

Arguments for shifting to evidence-based practice

- Improve effectiveness
  - through better use of research
- Provide an updateable knowledge base
  - for future decision support
- Underpin accountability and auditability
- Demonstrate compliance
  - with regulatory obligations to gather relevant information, canvass and manage risks and in doing so, avoid liability

How much evidence is there?



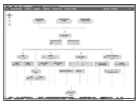
- Lack of knowledge no longer a viable excuse
- But we still lack well-established techniques for synthesizing this knowledge

International Evidence Exchange

- 'merge' databases
  - Devise standards
  - Develop exchange architecture
  - Business models for sustainability
- Reduce burden of evidence extraction
  - Instant tripling of size
  - Natural Language Processing (NLP)
  - Peer Production
    - Public resource

Tools for Evidence-Based Practice

- Problem Formulation
  - Set question
  - Develop conceptual model
- Gather Evidence
  - Systematic literature search
  - Extract evidence
    - Nature of response
    - Study quality (Design & Replication)
- Synthesize Evidence
  - Collate evidence for individual hypotheses
  - Weight by study quality
  - Combine evidence
  - Reach a conclusion
- Reporting and Dissemination



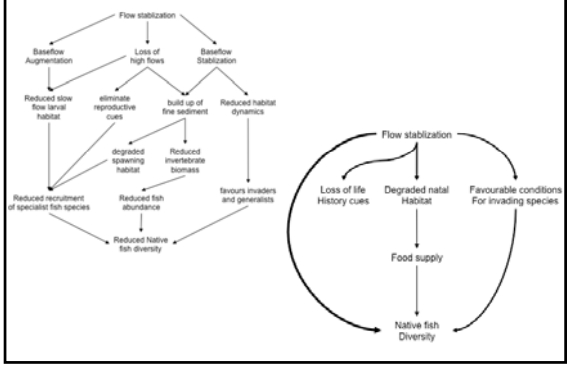
How does it work

- Evidence Synthesis based on Poff and Zimmerman (2010) review
- What is the effect of flow alteration on rivers?

Evidence Synthesis

Response to change in flow magnitude	Causal Analysis evidence weight			
	Supporting	Dose-Response	Not supporting	Conclusion
Fish Assemblage	40	34	6	Support for Effect
Fish Abundance	75	70	14	Support for Effect
Fish Reproduction	12	6	6	Insufficient Evidence
Fish Diversity	49	33	9	Support for Effect
Fish Behavior	0	0	6	Insufficient Evidence
Fish Competition	6	6	0	Insufficient Evidence

Evidence-based conceptual model



Evidence-Based Modelling

KNOWLEDGE

Evidence-based conceptual model

Process-based numerical model

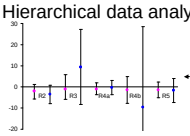
$$Abund = Adj + \delta Tu + \gamma dQ$$

$$Adj \sim N(Ravg, Rsd)$$

$$Ravg = \alpha + \beta \frac{\overline{Q}}{Q_a}$$

DATA

Hierarchical data analysis



Stewardson M and Webb A (2010) Modelling Ecological Responses to Flow Alteration: Making the Most of Existing Data and Knowledge. Chapter 3 of Ecosystem Response Modelling in the Murray-Darling Basin (eds. Overton I and Saintilan N), CSIRO Publishing, Canberra, Australia, pp 37-49.

The Way Forward

- Standards
  - What is and what is not evidence-based practice
  - Who should set these
- Tools
  - eWater CRC
  - International evidence exchange
- Case Studies
  - Cooperative effort
  - Adapt methods to specific cases
  - Demonstrate value

Contact us if you want to discuss this further!