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Presentation

Application of aquatic ecology in EIA, past, present and future: predicting, assessing and managing ecological impacts in aquatic environments on the east coast of Australia

Biography

Dr Marcus Lincoln Smith (Co-author and Presenter): Marcus has been consulting aquatic ecologist since 1985 when he founded The Ecology Lab Pty Ltd, which later merged with Cardno Limited in 2008. He completed his PhD in 1998 and his topic examined the application of aquatic ecology in EIA, an outcome of which was the development of practice guidelines for aquatic ecology on behalf of the NSW Planning Department (posted on the web in 2003).   Marcus became a Certified Environmental Practitioner (Ecology Specialist) through the EIANZ in 2016 and he continues to be active in EIA, mentoring upcoming practitioners and a range of research projects.

Dr Adam Smith (Co-author): Adam has worked in multiple roles in research, consulting, management, not-for-profit and Boards including the Great Barrier Reef Marine Park Authority. His is a Director of Reef Ecologic Pty Ltd which provides trusted expert advice and training on reef management. He is a Director of EIANZ and winner of several awards. Adam has a BSc (Hons), PhD and MBA and is a Fellow of the AICD, ARLF, CSL and EIANZ and a CENvP. He has authored 45 scientific papers and books.

Abstract

Aquatic ecology has been formally assessed as part of EIA since the early 1970s. Processes have become more rigorous and complicated including legislative requirements (e.g. EPBC Act, threatened species legislation); publication of water quality guidelines; tools for measuring changes in aquatic ecosystems, risk assessments, offsets and reporting. Current trends indicate that advances in statistical design and analysis, development of rapid assessment methods (RAM), and development of remote sensing, data logging, and underwater photographic techniques will continue as technology and instrumentation improve and become more compact and robust. A key issue emerging is that best practices in aquatic ecology are often not applied in EIA, nor is there clear acceptance of what "best practice" means for EIA. Managers and regulators are often unaware of what constitutes best practice for a specific development, and pressures of timing and cost can take precedent over best practice. Thus, there is often insufficient time allocated to establish ecological and social baselines for EIA. Proposals for small

projects, however, may not warrant large ecological studies but it can be difficult to determine what may be a small, medium or large project. RAM may be suitable for small projects but often does not provide appropriate quantitative data, either for EIA or acquisition of a baseline for monitoring, and may have limited use in terms of analysis using future statistical tools. Looking back, tools have been developed to enable potential impacts to be measured, often these are not applied to EIA. Looking forward, developers, scientists, managers and regulators must ensure that best practice is identified, understood and applied for large projects, with collection of appropriate baseline data; and that the data collected for large projects are viewed as potential case studies to further our understanding of impacts to aquatic ecosystems.

I. What is EIA and how has it been applied?

Canter (1996): *Systematic identification and evaluation of the potential impacts (effects) of proposed projects, plans, programs or legislative actions relative to the physical-chemical, biological, cultural and socioeconomic components of the total environment.*

1. Description of the aquatic environment
2. Description of the Proposed Development
3. Prediction of Ecological and Social Impacts
4. Management during and after establishment

EIA = a construct of legislative process
Ecology = a branch of science

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II. Tools currently used for aquatic ecology in EIA?

1. <u>Description</u> of the Aquatic Environment
    a. Existing information
        ➢ Threatened Species Searches (State-wide; Commonwealth)
        ➢ Previous Investigations (same location; similar or analogous locations)
    b. Habitat Mapping & Descriptions
        ➢ Position Fixing (GPS & DGPS)
        ➢ Photographic Methods (e.g. digital imagery)
    c. Ecological sampling
        ➢ Rapid Assessments (RAM), e.g. Ausrivas, seagrass, coral
        ➢ Quantitative replicated, randomised sampling
        ➢ Spatial and Temporal Baselines

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Continued...

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Available Tools, continued

2. <u>Prediction</u> of Impacts to Aquatic Ecosystems

    a. Project description; other disciplines

    b. Scientific Literature; EIA Policy and Guidelines

        ➢ Habitats and Biota

        ➢ Water and Sediment Guidelines

        ➢ Ground water protection

    c. Case Studies (how much?)

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Available Tools, continued

3. <u>Monitoring</u> Predicted Impacts to Aquatic Ecosystems

   a. Mapping

   b. Rapid Assessment Methods

   c. Surveillance/Compliance against specified standards

   d. Quantitative randomised sampling (e.g. Beyond-BACI, spatial gradients)

What is "Best Practice"?   Whatever is required to objectively answer the key questions!

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III. Emerging Issues for Aquatic Ecology

1. "New" types of development requiring EIA (cf. Fisheries, Artificial Reefs)

2. Threatened species/threatening processes (new listings/delisting)

3. "New" aquatic habitats requiring EIA

   a. Aquifers and associated stygofauna

   b. Deep ocean habitats

4. Contamination of the aquatic environment

   a. Nanoparticles

   b. Perflourinated Compounds (PFCs)

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Emerging Issues, *continued*

5. Climate Change & population growth
   a. new challenges as impacts begin to occur

6. Better ways of valuing aquatic ecosystems
   a. Need to compete with traditional socioeconomic imperatives
   b. It's not just about $

7. Environmental preservation compared with human population increase
   a. Habitat loss & modification
   b. Exploitable biota (fisheries)
   c. Water management and environmental flows
   d. Shifting baselines

IV. Emerging or Potential Tools & Approaches

1. **Sampling Tools**
   a. Automation, including continuous data collection
   b. Remote sensing
   c. Photography/videography
   d. Chemical analyses

2. **Case studies (e.g. other, similar EISs)**

3. **Data analyses and hypothesis testing**
   a. Sampling designs
      ➢ Ecology : EIA (Underwood, 1991, 1997)
      ➢ EIA : Ecology (Lincoln Smith et al. 2006)
   b. Permutational analyses
   c. Freeware (e.g. "R")

4. **Modeling and Ecological Risk Assessments (ERA)**

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V. How does EIA currently perform?

Smith 2008:

Reviews/audits:
- Buckley 1989a, b
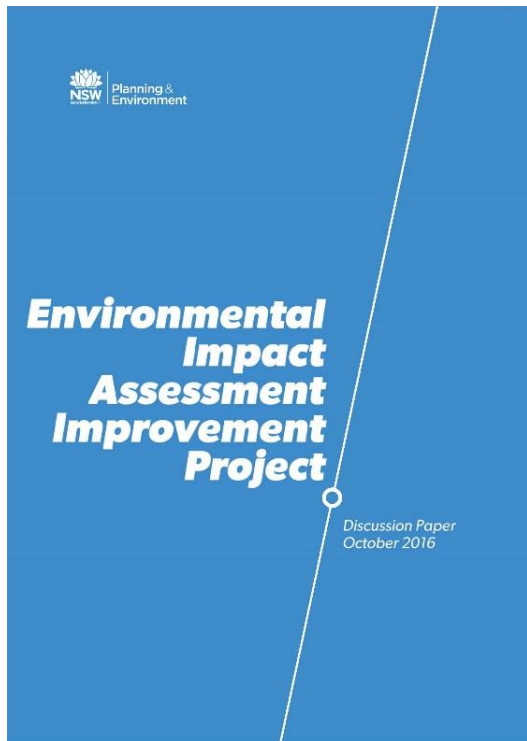- Lincoln Smith 1991, 1998
- Smith 2008

Table 2. Matrix of processes and roles in EIA (with a traffic light scoring system of Red ■ problem, Orange ■ warning, Green ■ good) and overall summary

Process\roles	PLANNING	PREDICTION	MONITORING	MANAGEMENT	Summary
SCOPING	Proposal Legislation Plan Policy\Guideline Options Consultation	Hypothesis	Desktop Baseline Pre-monitoring	Meeting Issues	Inadequate
ASSESSMENT	Preferred Option EIS risk		Monitoring	Consultation (public) Decision Legal	Good
IMPLEMENTATION	Project management Communication		Monitoring	Supervision Adaptive management	Adequate
AUDIT		Accuracy of hypothesis?	Post-monitoring	Audit Workshop Communication Recommendations	Bad
Summary	Adequate	Bad	Adequate	Inadequate	

VI. EIA Improvement Initiative NSW DP&E (October 2016)

NSW | Planning & Environment

Environmental Impact Assessment Improvement Project

Discussion Paper
October 2016

Eight initiatives identified by the Project:

1. Improved scoping
2. Better engagement
3. Quality of EIA documents
4. Approval Conditions
5. Accountability of EIA professionals
6. Greater certainty on EIA timeframes
7. Monitoring, auditing and reporting of compliance
8. Project change following approval

General agreement on what's needed, but how do we get there?

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VII. The Future: Opportunities

1. Revised and New Legislation *(improve scoping)*
   a. NSW EIA Improvement Project
   b. Legislative amendments
   c. Policy and Guidance

2. Technological Advances *(improve descriptions of aquatic environment)*
   a. Remote Sensing
   b. Photography and Videography (underwater; drones)
   c. Tagging/Sonar/Listening Stations (e.g. shark movements)
   d. Laboratory techniques (water, sediment and biota)

Continued…

The Future: Opportunities, continued…

3. Biology, natural history & ecological processes *(improve prediction)*
    - Species' biology
    - Aquatic connectivity
    - Microhabitats

4. Data management and analysis *(improve monitoring & reporting)*
    - Coping with very large data sets (desktop & field)
    - Ability to match monitoring, triggers and response in real time
        - e.g. Ichthys Darwin Coral Monitoring Project (Cardno)

Quantitative coral monitoring – dredging in Darwin Harbour (source: Cardno)

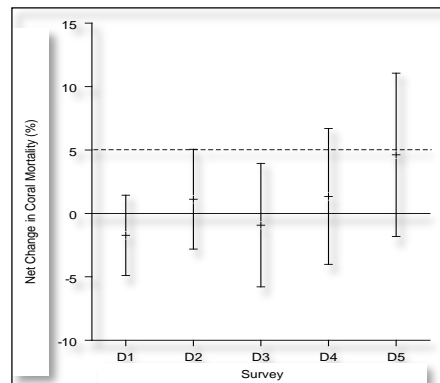Data extraction (Coral Point Count); min. 210 photoquadrats/ survey
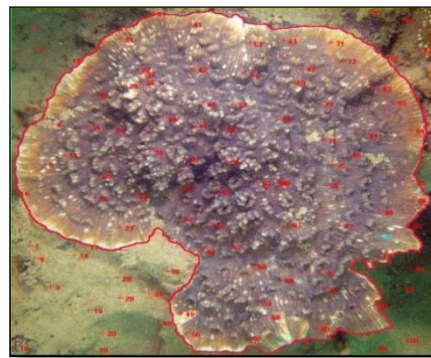
Data analysis (PERMANOVA+)

Assess results against management triggers

Consequence: triggers linked to dredging program

Timeframe: 10 days from survey

VIII. The Future: Risks

1. EIA as a box-ticking exercise (Process vs Outcome driven?)
2. Failure to learn from previous developments (case studies)
3. Lack of standardised methods where appropriate
4. Inadequate scoping
5. Inadequate time for review of EIS
6. Lack of appropriate expertise for EIS review

IX. What is the Future for EIA and Practitioners specialising in Aquatic Ecology?

1. Drivers of change for EIA

   ➢ Population pressures

   ➢ Climate Change

   ➢ Over-exploitation of resources

2. Leads to…

   ➢ Increasing political and community pressure

   ➢ Increasing urgency for timely advice

X. What Role for EIANZ?

1. Accreditation Program ✓

   ➤ Stronger lobbying for national (and international) acceptance

2. Input into government initiatives ✓

   ➤ Practice guidelines

3. Strengthen links with teaching institutions

4. Review Government Legislation & Policy?

5. Review selected/contentious development proposals?

   ➤ Standard indicators of adequacy

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