Research consultancies

This section contains a summary of non-uranium mining related research consultancies carried out by ***eriss*** during 2007–2008. Most of these reports are commercial-in-confidence and are not available for public release.

List of non-uranium mining related research consultancies

Environmental Research Institute of the Supervising Scientist 2008. Understanding resources and risks in northern Australia: Establishment of a GIS and online mapping tool. Unpublished report to the Northern Australia Land and Water Taskforce by the Environmental Research Institute of the Supervising Scientist, January 2008.

Harford A & van Dam R 2007. Modification of toxicity testing protocols using a coral larva and the diatom *Nitzschia closterium* to assess marine contaminant issues from Alcan Gove operations – Interim Report, December 2007. Commercial-in-confidence report to to Alcan Gove Pty Ltd.

Harford A, Hogan A & van Dam R 2008. Ecotoxicological testing of receiving waters downstream from Newmont Woodcutter's mine site. Final Report, June 2008. Commercial-in-confidence report to Earth Water Life Sciences Pty Ltd.

Harford A, van Dam R, Hogan A, Tsang J, Parry D, Adams M, Stauber J & Negri A 2008. Modification of toxicity testing protocols using the diatom *Nitzschia closterium* and coral *Acropora tenuis* to assess the effects of waste water discharges from Rio Tinto Gove operations – Final Report, April 2008. Commercial-in-confidence report to Rio Tinto Alcan Gove Pty Ltd.

Humphrey C, Buckle D & Camilleri C 2009. A macroinvertebrate survey of stream sites associated with Territory Resources Frances Creek iron ore project, April 2008. Commercial-in-confidence report to Earth Water Life Sciences.

Humphrey C & van Dam R 2007. Environmental effects of magnesium sulfate-rich seepage waters from Argyle Diamond Mine, Report No. 6, Synthesis and Recommendations. Commercial-in-confidence report to Argyle Diamonds Pty Ltd.

Humphrey C, Fox G, Chandler L, Brazier J, Cammilleri C & Hanley J 2008. An assessment of the effects of mine waste waters arising from the Redbank copper mine on downstream macroinvertebrate community March 2008. Commercial-in-confidence report to Redbank Mines Ltd.

Humphrey C, Storey A, Buckle D, Chandler L, Hanley J, Creagh S & Camilleri C 2007. An assessment of the effects of seepage arising from the Argyle Diamond Mine upon stream biota sampled in 2006 and 2007: Summary results. Commercial-in-confidence report to Argyle Diamonds Pty Ltd.

Humphrey C, van Dam R, Storey A, Chandler L, Hogan A & Buckle D 2008. Assessment of the effects of $MgSO_4$-rich wastewater discharges from Argyle Diamond Mine on downstream aquatic ecosystems: Synthesis of a three-year (2006–08) study. Commercial-in-confidence report to Argyle Diamonds Pty Ltd.

van Dam R, Hogan A & Houston M 2007. Environmental effects of magnesium sulfate-rich seepage waters from Argyle Diamond Mine, Report No. 3: Stage 2 laboratory-based ecotoxicological assessment (full dilution series, risk-based testing). Commercial-in-confidence report to Argyle Diamonds Pty Ltd.

Tropical marine toxicity testing in Australia: a review and recommendations

RA van Dam, AJ Harford, MA Houston, AC Hogan & AP Negri[1]

Background

Developmental pressure across Australia's northern coastal catchments will increase rapidly in the near future. These areas are important strongholds for marine biodiversity and contain some of the least impacted marine habitats in the world. Consequently, such development must take place in an environmentally sustainable manner and needs to be underpinned by sound scientific knowledge. A study was undertaken in 2006 to 1) review the current state of the science for toxicity testing methods that have been developed for, or could be adapted to, Australian tropical marine species and environments and 2) use the information to identify the research and development needs to develop an appropriate suite of Australian tropical marine toxicity test methods. The component of the review focusing on water colum toxicity testing was accepted in 2008 for publication in a Special Issue of the *Australasian Journal of Ecotoxicology*, titled, *Tropical Ecotoxicology in Australasia*. A summary of the outcomes of this component of the review is provided below.

Outcomes

Sixteen taxonomic groupings (from 11 broad taxa groups) were reviewed and their suitability in routine toxicity testing protocols was assessed. The review revealed that there is a paucity of fully developed, regionally-relevant marine toxicity testing methods for Australian tropical marine species. Currently, just two fully developed routine sub-lethal/chronic test protocols exist, both of which are for tropical marine microalgae (*Nitzschia closterium* and *Isochrysis* aff. *galbana*), while sub-lethal tests using various tropical coral species have also been applied regularly. Numerous other Australian tropical marine species have been used for acute toxicity testing. In order to meet minimum requirements recommended by ANZECC/ARMCANZ (2000) for site-specific assessments, additional sub-lethal/chronic toxicity tests need to be developed. This review identified a number of different tropical marine species that may be suitable candidates in a suite of toxicity test protocols. The development of such methods will require a large R&D effort, and regulators, industries and community stakeholders should all have an interest in ensuring that these important knowledge gaps are addressed.

Acknowledgment

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[1] Australian Institute of Marine Science, PMB 3, Townsville, Queensland, 4810

Tropical rivers inventory and assessment project

R van Dam, R Bartolo & P Bayliss[1]

'Australia's tropical rivers – an integrated data assessment and analysis', more commonly known as the 'Tropical Rivers Inventory and Assessment Project' (TRIAP), was completed during 2008. Funded by Land & Water Australia and the Natural Heritage Trust 2, TRIAP was a collaborative effort between ***eriss***, James Cook University and the University of Western Australia, with additional involvement of Charles Darwin University and the University of Wageningen (The Netherlands). The project commenced in late 2004 and aimed to provide an information base to support the management of Australia's tropical rivers. It consisted of three sub-projects: (i) mapping and inventory, (ii) risk assessment of key threats, and (iii) development of a framework for evaluating ecosystem services.

The project examined 51 catchments across northern Australia (from Broome in the west to the western tip of Cape York), covering some 1 192 000 km^2. Three focus catchments, the Fitzroy River (Western Australia), Daly River (Northern Territory) and Flinders River (Queensland), were assessed in more detail.

Inventory and mapping of aquatic ecosystems

The key aim of sub-project 1 was to collate and analyse the existing spatial data for key biophysical attributes of the northern tropical rivers, namely, water quality, hydrology, geomorphology, estuaries, riparian vegetation, macroinvertebrates, fish, aquatic reptiles and waterbirds. A key conclusion following consolidation of the data was that there are substantial information/data gaps across the region.

A number of useful products have arisen from this sub-project, despite the limitations imposed by the lack of data. These included: a hydrologic classification based on streamflow and catchment characteristics; geomorphic classifications at two scales (whole of study area and catchment) based on landform and soil characteristics; a preliminary model for prediction of the distribution of riparian vegetation; and an in-depth discussion of the key water quality variables driving ecological function in tropical rivers and how they could be used as the basis for future classification schemes.

This study has provided the most comprehensive descriptions yet of a number of the key biophysical attributes of the northern tropical rivers, and also served to highlight where further research effort is required.

Major risks to aquatic ecosystems

Sub-project 2 demonstrated the utility of applying a tiered assessment approach for ecological risk assessment for tropical rivers. This involved gaining an initial broad understanding of the extent and status of the ecological assets and the threats they face, followed by formal semi-quantitative methods to assess and compare the significance of the threats, followed by detailed quantitative risk analyses of high priority threats to specific ecological assets. These assessments utilised and also built upon the information base compiled during sub-project 1,

[1] Dr Peter Bayliss, CSIRO Marine & Atmospheric Research, PO Box 120, Cleveland Qld 4163

and were guided by information obtained from workshops and discussions with stakeholders. Various sensitivity and uncertainty analyses were also undertaken to test the rigour and robustness of the modelling approach, and identify areas for model improvement.

Highlights of this study included: the first comprehensive description of the key ecological assets of, and threats to, the northern tropical rivers; the advantages of adopting spatially explicit risk modelling to prioritise catchments in terms of their relative risk of multiple threats or pressures to multiple ecological assets; and the utility of Bayesian approaches (ie. a type of quantitative risk modelling that can integrate quantitative information with qualitative expert knowledge) in quantitative risk assessments.

Focusing in on one aspect of the study, the spatially explicit relative risk modelling across the whole study area identified eight catchments as being of higher relative risk of impacts from multiple threats/pressures. These were the Adelaide, Finniss/Darwin, Daly and Mary Rivers in the NT, and the Mitchell, Gilbert and Leichhardt Rivers in Qld. No catchments in WA were identified as being at higher relative risk. However, this result may have been due to issues associated with spatial data resolution and quality for this region.

The five most significant current threats to the ecological assets of the region's aquatic ecosystems were found to be (from a total of 19 included in the model): cattle grazing (on natural vegetation); feral pigs; poorly managed fire; aquatic weeds; and mining. Climate change and sea level rise are emerging problems for the region's aquatic ecosystems that threaten to cause much greater impacts than currently exist.

Trialling an ecosystem services framework

Sub-project 3 was undertaken by six Masters students from the University of Wageningen in the Netherlands. It was a small project that focused on two regions within the study area – the lower Mary River (NT) and the Daly River (NT). Through stakeholder interviews and the use of existing information, a framework for analysing the value of ecosystem services provided by the wetland and riverine ecosystems was populated and trialled. The analyses drew heavily on the conceptual framework developed for the Millennium Ecosystem Assessment (MA; www.millenniumassessment.org) where ecosystem services are defined as 'the benefits people obtain from ecosystems'.

It was established that local communities and other stakeholders are highly dependent on the wetlands in many ways, including ecological (eg wetlands of national importance, rare and endemic species), socio-cultural (eg cultural heritage, spiritual and existence values, sense of place, recreation) and economic reasons (eg water use, agriculture, carbon sequestration, tourism). The ecosystem services framework also considered the trade-offs and competing interests between these values in the context of the current policy setting, and evaluated the associated management implications.

Reports and information

TRIAP's comprehensive final reports can be accessed via the TRIAP page on the web site of the Supervising Scientist Division (www.environment.gov.au/ssd/tropical-rivers). In addition, a DVD package of the project's GIS coverages has been produced for use for future projects on northern tropical rivers.