Preliminary report on the impacts of restricted passage for Australian lungfish (*Neoceratodus forsteri*) at Paradise Dam on the Burnett River, Queensland.

Professor Jean Joss

Australian Lungfish
Neoceratodus forsteri

Report prepared for proceedings in the Federal Court of Australia at Brisbane, *Wide Bay Burnett Conservation Council v Burnett Water Pty Ltd* (No. QUD 319/08)

2 December 2008

Introduction

I have been asked by the solicitor for the Wide Bay Burnett Conservation Council Inc ("WBBCC") to write a short, preliminary report on the impacts of restricted passage for Australian lungfish (*Neoceratodus forsteri*) at Paradise Dam on the Burnett River. The purpose of the report is to assist the Federal Court to understand the nature of the issues at the preliminary stage of making directions in proceedings brought by WBBCC against Burnett Water Pty Ltd alleging that the construction and operation of the fish transfer device on the Paradise Dam contravenes a condition of its approval under the *Environment Protection and Biodiversity Conservation Act* 1999 (Cth). In particular, I am asked to comment on whether a statement made in an affidavit sworn by Philip Leigh Murray on 6 November 2008 for Burnett Water Pty Ltd provides evidence of no adverse consequences for lungfish from the construction of the Paradise Dam or any restricted passage over it. At paragraph [8] of that affidavit Mr Murray stated:

> "On 22 October 2008 I was informed by Mr Peter Kind, Principal Scientist, Freshwater at the Queensland Department of Primary Industries and Fisheries and the project leader for the Lungfish monitoring carried out pursuant to the Approval [for the Paradise Dam], and believe that based on the monitoring that he has carried out to date there is no evidence of a change in the size or structure of the population of Lungfish in the Burnett River which he is monitoring and that his monitoring reveals that the size and structure of the population of Lungfish is consistent with earlier baseline assessment of that Lungfish population."

Due to time constraints I am asked to respond to the statement attributed to Mr Kind in a short, preliminary report to assist the Court at a directions hearing on 5 December 2008 in the proceedings brought by WBBCC. I have been instructed to prepare a full report on the biology, ecology and conservation status of the lungfish for the trial. The opinions expressed here are, therefore, of a preliminary nature only and may change in my final report.

Expertise

I am a Professor and the Director of the Australian Lungfish Research Facility at Macquarie University in Sydney. My research interests lie broadly in the area of vertebrate evolution. I have studied to a greater or less extent, almost all the living key species. However, currently I am almost completely preoccupied with lungfish - a key species in the greatest transition of all, from water to land. I have established the only lungfish breeding facility in the world associated with a research program, here on campus at Macquarie University. The breeding facility consists of two large lungfish breeding ponds constructed in 1992. The research program is primarily directed at endrocrine and developmental questions but many other aspects of research are also being addressed by visiting researchers that come to use the lungfish breeding facility, or to whom lungfish material is being sent. Current and recently ARC-funded projects include the patterning of paired fin development, neural crest and thyroid axis. A proposed future direction is to characterise the very large lungfish genome.

I was consulted to a limited extent during the design of the fishways for Paradise Dam due to criticisms I had made publicly about the dam. I therefore have background knowledge of the dam and fishway design but I have not at this stage carried out a site inspection for the purposes of preparing my report in this court case.

Duty to the Court

I have been provided with a copy of the Guidelines for Expert Witnesses in Proceedings in the Federal Court of Australia (Version 6, 5 May 2008) and I understand that my paramount duty is to assist the Court.

Lungfish

Australian lungfish, *Neoceratodus forsteri* (originally described as *Ceratodus forsteri* by Krefft in 1870), was once abundant across most of the Australian mainland and also parts of South America. Fossils that appear to be those of essentially the same species as today have been found from as long ago as 150 million years. Thus it can lay fame to being the longest surviving vertebrate species – a true "living fossil". Lungfish are a group of fishes, which were abundant during the Devonian, The "Great Age of Fishes". Today they are represented by only three genera, *Protopterus* in Africa, *Lepidosiren* in South America and *Neoceratodus* in Australia. Of these three living lungfish, *Neoceratodus* is the most primitive and its habitat is the most restricted. A picture of an adult *Neoceratodus* is shown on the cover of this report.

Australian lungfish occur naturally in only a few coastal river systems in south-east Queensland, where it is usually referred to as the Queensland lungfish. The only two endemic (i.e. native) populations occur in the Mary River and the Burnett River systems in south-eastern Queensland. It has been introduced into other rivers including the Brisbane, Fitzroy, Albert, Stanley, and Coomera Rivers, and the Enoggera Reservoir in the past century but its presence is only recorded recently in the Brisbane River.

Listing under the EPBC Act

The Australian or Queensland lungfish has been totally protected in Queensland for almost 100 years and is also protected by the *Convention for International Trade in Endangered Species* (CITES).

The species was listed as vulnerable to extinction under the *Environment Protection and Biodiversity Conservation Act 1999* on 6 August 2003. **Appendix 1** to this affidavit is the species profile and threats database for the lungfish obtained from the Department of the Environment, Water, Heritage and the Arts' website at http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=67620. It describes the species distribution, life cycle and threats.

Possible impacts of restricted passage on Paradise Dam

My principal concern in relation to the possible impacts of restricted passage for lungfish over the Paradise Dam is that lungfish are faithful to their spawning sites and need to be able to return to their spawning sites following movement away from these sites, primarily for feeding, following each spawning season. Moreover, due to habitat loss associated with the construction of the Paradise Dam and upstream and downstream water infrastructure, there is a potential for over-crowding at the remaining spawning sites.

I have been asked to comment particularly on the following statement attributed to Peter Kind by Philip Leigh Murray:

> "On 22 October 2008 I was informed by Mr Peter Kind, Principal Scientist, Freshwater at the Queensland Department of Primary Industries and Fisheries and the project leader for the Lungfish monitoring carried out pursuant to the Approval [for the Paradise Dam], and believe that based on the monitoring that he has carried out to date there is no evidence of a change in the size or structure of the population of Lungfish in the Burnett River which he is monitoring and that his monitoring reveals that the size and structure of the population of Lungfish is consistent with earlier baseline assessment of that Lungfish population."

I also have spoken in some detail with Peter Kind concerning the monitoring of lungfish in the Burnett River. My understanding is that the definition of "earlier baseline assessment" requires more explanation. If the earlier assessment, to which Mr Kind referred was post construction of Walla Weir, then it is very likely that the adult population of lungfish now trapped between Paradise Dam and Ned Churchwood (Walla weir) has not changed. There was no recruitment then and there is still no recruitment, despite active spawning each year at the few remaining sites left between these two impoundments. Moreover, it is very hard to monitor lungfish under 300mm. Even if Mr Kind's study shows the adult population was unchanged, then that is no reason for complacency because the monitoring process is not taking recruitment into account.

I also draw attention to two reports on the EIS for the proposed Traveston Crossing dam on the Mary River, relevant extracts of which are included as **Appendices 2 and 3**. These are relevant to the present enquiry because they make some very pertinent comments, which apply to both the Burnett and the Mary Rivers. In particular the comments listed below refer to problems about which I fully concur on the usefulness or otherwise of the fish transporters incorporated into construction of the Paradise Dam and subsequently proposed for the Mary River dam:

- Prof Stuart Bunn, Director, Australian Rivers Institute, Griffith University, Brisbane. "Review of EIS and supplementary materials on proposed Traveston Crossing Dam, Mary River,SE Qld: II Final Report." Report to the Department of Environment, Water, Heritage and the Arts, Canberra. The full report is available at: http://www.environment.gov.au/epbc/notices/assessments/2006/3150/pubs/independent-expert-report-on-matters-of-nes-bunn.pdf.

- Assoc Prof Keith Walker, Consultant in River and Floodplain Ecology, School of Earth and Environmental Sciences, The University of Adelaide. "Environmental Impact Statement for Traveston Crossing Dam (Mary River, Queensland): A Review with regard for Species of Concern under the EPBC Act 1999". Report to the Department of Environment, Water, Heritage and the Arts, Canberra. The full report is available at http://www.environment.gov.au/epbc/notices/assessments/2006/3150/pubs/independent-expert-report-on-matters-of-nes-walker.pdf

The following quotes from Professor Bunn's report address the problem of lungfish spawning in impoundments, the fragmentation of lungfish populations if they cannot pass up or down the river past the dam wall and the problems associated with the use of fishway devices. Prof Bunn notes at page 15:

> "… no documented evidence has been provided of successful spawning in the Paradise Dam. impoundment. Without such evidence, it can be assumed that impoundments provide suitable conditions only for growth and survival of adult lungfish. They do not provide the requisite conditions for spawning and recruitment. …
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> The degree to which the proposed dam will fragment the Mary River lungfish population into two populations will ultimately depend on whether fish are able to successfully move through the prposed fish lock … the risks of local extinctions (e.g. from poor water quality events) are likely to be very high."

Prof Bunn also notes at page 17:

> "Evidence is needed to provide confidence that lungfish can safely move through the proposed fishway, including data on the effectiveness of the downstream fishway on Paradise Dam, which was completed in 2005."

Assoc Prof Walker also addressed the effectiveness of the fishway on the Paradise Dam, and the problems of lungfish recruitment raised by placing barriers (dam walls) across rivers. He noted at pages vii-viii:

> "The EIS recognizes the need for a fishway. It is an integral part of the design for the dam, and will be modelled on one installed at Paradise Dam, although this has yet to perform effectively. … Critical questions remain unanswered over the ability of lungfish and Mary River cod to use fishways. …
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> The EIS does not distinguish between *reproduction* and *recruitment*, but the difference is critical for maintenance of plant and animal populations. 'Recruitment' here refers to the accession to populations of mature, potentially reproductive individuals, in numbers sufficient to maintain the existing population over the course of time. If recruitment were to fail repeatedly, the population age profile would become progressively skewed toward older individuals and the population would decline and eventually disappear. …
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> Connectivity is a vital issue for aquatic and terrestrial flora and fauna. River communities are inherently patchy, and the flowing water in the channel maintains connections between patches. Without connections, the population is fragmented and the isolates, and ultimately the entire population, become vulnerable."

The above two reports, prepared by experts in River Systems, rather than just lungfish *per se* add considerable weight to concerns over the operation of the fishway on the Paradise Dam and just what the eventual consequences for the Australian lungfish may be if their warnings are not heeded.

Declaration

All the facts affirmed to in this report are true and correct to my knowledge and belief except as stated otherwise. I have made all the enquiries I consider desirable and appropriate and no matters of significance I regard as relevant have, to my knowledge, been withheld from the Court. I understand my paramount duty is to assist the Court and believe I have complied with this duty to the best of my ability.

Professor Jean Joss
2 December 2008