Basin Matter – Aggregation of Selected Area biodiversity outcomes (biodiversity) foundation report – 2019 revision

Prepared by: Jennifer Hale

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Report prepared for the Commonwealth Environmental Water Office by La Trobe University

For further information contact:

Nick Bond

La Trobe University
PO Box 991
Wodonga VIC 3689

Ph: (02) 6024 9650

Email: N.Bond@latrobe.edu.au
Web: www.latrobe.edu.au
Enquiries: cfe@latrobe.edu.au

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1. Why?

The Basin Plan seeks to protect or restore biodiversity that is dependent on Basin water resources. Biodiversity is defined as (*Water Act 2007*, section 4):

"*..the variability among living organisms from all sources (including terrestrial, marine and aquatic ecosystems and the ecological complexes of which they are a part) and includes:*

(a) diversity within species and between species; and

(b) diversity of ecosystems.

The protection of biodiversity is through two instruments: supporting listed threatened species or listed threatened ecological communities and ensuring that representative populations and communities of native biota are protected and, if necessary, restored (Basin Plan, section 8.05 (3)).

According the Australian National Aquatic Ecosystem (ANAE) mapping project, the Basin contains over 200,000 aquatic ecosystems, including approximately 8000 lakes and 34,000 floodplain wetlands (Brooks *et al.* 2013). Sixteen wetlands of international importance, listed under the Ramsar Convention are within the Basin, as are over 200 nationally important wetlands (Leblanc *et al.* 2012). These ecosystems support a broad range of species and ecological communities that are inundation dependent, or dependent on vegetation communities that are classified as wetland or floodplain systems. The Basin's aquatic ecosystems also support a large number of nationally and internationally significant plant and animal species, including 95 species listed as threatened under national or State legislation (Leblanc *et al.* 2012).

Species and communities can be dependent on flow and water regimes for all or parts of their lifecycles. Most of the biota within the Murray Darling Basin are adapted to cycles of wetting and drying, with many important breeding, migration or germination cues linked to water regime (Brock and Casanova 1997, Young *et al.* 2001, Roberts and Marston 2011). In a climate of increasing pressures on water resources, environmental watering actions can play a crucial role in maintaining species and ecosystem diversity (Beesley *et al.* 2009, Brandis 2010).

2. What?

This component of the Basin Evaluation will address the following short-term (one-year) and long-term (five-year) Basin-scale evaluation questions:

- What did Commonwealth environmental water contribute to species diversity?
  - How did Commonwealth environmental water affect the presence, distribution and abundance of plant, fish, bird, frog, turtle and aquatic ecosystem dependent mammal species?
  - What listed threatened species and ecological communities benefited from Commonwealth environmental water?
  - What migratory species listed under international agreements (Bonn Convention, CAMBA, JAMBA or ROKAMBA) benefited from Commonwealth environmental water?

The analysis will examine changes in species metrics and community composition in response to watering actions to develop lists of species having benefited from Commonwealth environmental water. The species lists for individual Selected Areas and years will be aggregated to provide a list of the species that were protected or restored by Commonwealth environmental water across the Basin.

3. How?

The main output of the Biodiversity evaluation is an aggregated list of species and communities that potentially benefited from Commonwealth environmental water each year. This list has been derived from a number of sources, including: other Basin Matter reports, Selected Area reports, and other monitoring programs (external to LTIM).

Determining if a species or community benefited from Commonwealth environmental water is not straightforward. The presence of a species at a site that received Commonwealth environmental water does not necessarily indicate that the species benefited, nor does it provide any indication of the temporal or spatial scale over which that species may have benefited. The Biodiversity Basin Matter (formerly termed "generic diversity") undertakes a qualitative evaluation of expected outcomes of watering actions undertaken by CEWO. The approach uses information from different sources to identify species that potentially benefited from Commonwealth environmental water. The sources of information include (**Figure 1**):

- evaluations from other Basin Matters (Vegetation, Fish, Ecosystem Diversity)
- monitoring at Selected Areas
- monitoring/observations at sites watered but not monitored as part of LTIM
- a case study approach for wetlands that are nationally or internationally recognised as important (i.e. listed on the Directory of Important Wetlands in Australia (DIWA) or under the Ramsar Convention).

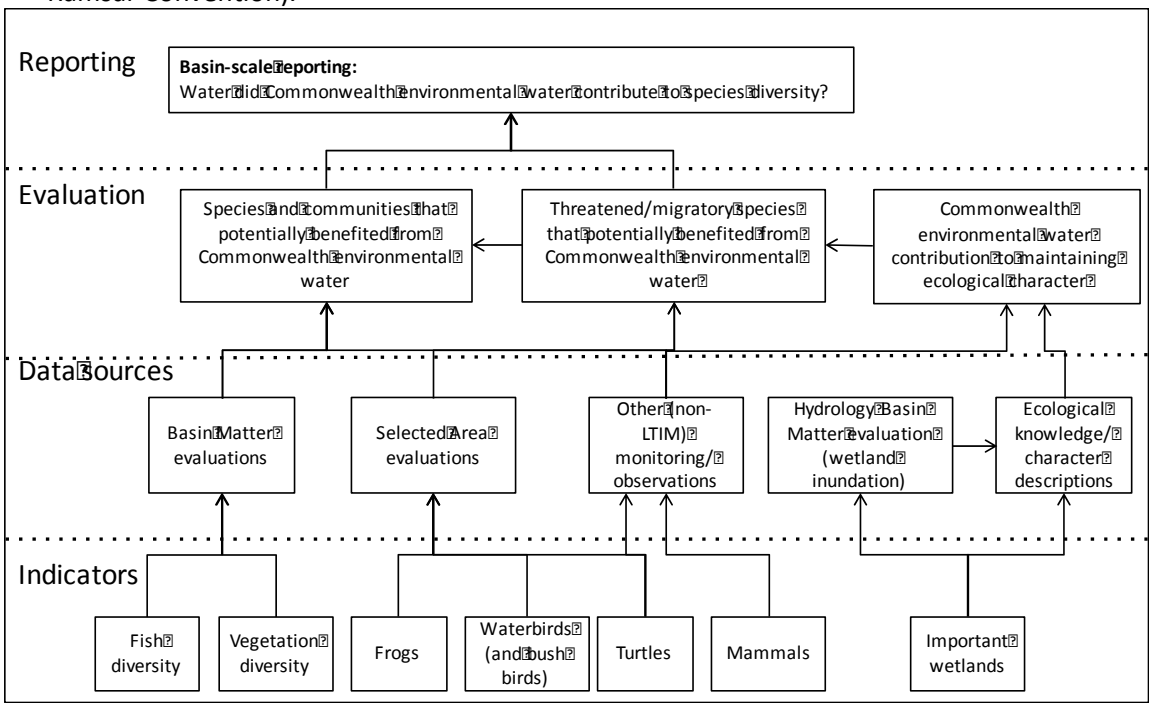

Figure 1. Basin evaluation of Biodiversity.

General information about a species life-history or habitat requirements and broad assumptions about the hydraulic outcomes are used to infer benefit. Increased confidence in the assessment that a species or community benefited from environmental water is assigned as a result of repeated

observations over space and time. That is, as a species or community is observed at sites that receive Commonwealth environmental water at different locations in the Basin and in multiple years, confidence that the species benefited from environmental water is increased.

It was initially envisioned that we would be able to take information from the Ecosystem Diversity Basin Matter about the types and extent of wetlands that received environmental water together with hydrological outputs about timing, extent and duration of inundation to predict outcomes at a variety of aquatic ecosystems that received Commonwealth environmental water but were not monitored. This has proven to be difficult due to very little available information about the hydrological regimes and ecology at unmonitored sites. Therefore, this analysis, and associated conceptual models is replaced with information limited to a smaller number of locations, where we have better information about the number of plants and animal species that are likely to occur and therefore potential benefit arising from Commonwealth environmental water. These important wetland sites (DIWA and Ramsar Sites) were listed for their high biodiversity values and the effects of Commonwealth environmental water on diversity at these locations provides a good representation of the effects Basin wide.

Evaluation approach for vegetation, fish and ecosystem diversity

Vegetation, fish and ecosystem diversity are covered by other Basin matter evaluations. To avoid duplication of effort, the outputs of the evaluation of these matters will be synthesised with respect to Commonwealth environmental water effects on diversity, threatened species and nationally and internationally important wetlands.

Outputs

The outputs of the two approaches described above will be combined to develop an annotated list of species that benefited from Commonwealth environmental water, both in terms of diversity of all species, and in terms of threatened species and communities.

4. Risks

There is a risk that significant outcomes may not be recorded due to:

- monitoring being focussed on other faunal groups
- the species being rare and/or cryptic
- the specific outcome (e.g. change in individual condition or distribution) not being included in the monitoring.

This is an inevitable risk in the design of any monitoring program and the evaluation will seek to reduce this risk through utilising multiple lines of evidence and conceptual models to support evaluation in the absence of dedicated monitoring information.

There will be a higher level of uncertainty around defining the outcomes for watering actions due to the lack of predictive capacity that would support development of expected and without environmental water outcomes. This will affect the levels of confidence in reporting outcomes and will limit the opportunities for adaptive management, particularly in situations where water actions lead to relatively small changes in biodiversity.

Given the diversity of species that may be included in this section, it is not anticipated that predictions of without environmental water outcomes will be based on quantitative models, rather they will rely on a combination of information from conceptual models or control situations (such as sites that did not receive environmental water). Over time, the information generated by the LTIM Project will be used to refine conceptual models and thereby improve their predictions.

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