

Commonwealth Environmental Water Office Long Term Intervention Monitoring Basin Matter - Aggregation of Selected Area biodiversity outcomes (generic diversity) foundation report

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#### Long Term Intervention Monitoring

## **Basin Matter - Aggregation of Selected Area biodiversity outcomes (generic diversity) foundation report**

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## **Basin Matter - Aggregation of Selected Area biodiversity outcomes** (generic diversity) foundation report

## 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?
- What did Commonwealth environmental water contribute to ecosystem diversity?

Monitoring at Selected Areas will include measures of:

- Vegetation (Goulburn, Edward-Wakool, Gwydir, Warrego-Darling)
- Fish (All Selected Areas)
- Frogs (Murrumbidgee, Lachlan, Warrego-Darling)
- Turtles (Murrumbidgee, Lachlan)
- Waterbirds (Murrumbidgee, Lachlan, Gwydir, Warrego-Darling)

Data collected varies across groups and Selected Areas, but includes a list of species with some associated records of abundance (e.g. cover, catch per unit effort, calls per unit time), and in some instances breeding (e.g. nests, eggs, larvae) and recruitment (e.g. young of year fish). It is possible that observations of non-target species will also be made and could include bats (southern myotis; *Myotis macropus) or aquatic mammals (e.g. platypus - Ornithorhynchus anatinus; rakali - Hydromys chrysogaster) and floodplain dependent mammals (e.g.*brush-tailed phascogale - *Phascogale tapoatafa*) and yellow-footed antechinus- *Antechinus flavipes*).

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 key steps in the evaluation of generic diversity are illustrated in Figure 1 and involve consolidation of data from two primary sources:

- Aggregation of monitored data from Selected Areas, for groups of species that do not form part of a Basin matter (waterbirds, turtles, frogs, mammals); and
- Synthesis of Basin scale evaluations from other Basin Matters (vegetation, fish, ecosystem diversity).

## 3.1 Evaluation approach for waterbirds, frogs, turtles and mammals

There are five steps involved in the evaluation of generic diversity for groups of species NOT covered by other Basin Matter Evaluations (waterbirds, frogs, turtles, mammals):

- 1. Identification of key species (with a focus on threatened species) that benefited from Commonwealth environmental water for sites that were monitored;
- 2. Develop a conceptual model for key species (or groups of species) that have been observed to benefit from Commonwealth environmental water:
  - a. Life history strategies
  - b. Flow-ecology relationships
  - c. Habitat requirements (e.g. ecosystem types known to support key species)
  - d. Likely distribution across the Basin
- 3. Collating the outputs of the Ecosystem Diversity Basin Matter to identify:
  - a. Ecosystem types that Commonwealth environmental water at which key species were observed to have benefited;

- b. Ecosystems types that were watered but not monitored
- 4. Collating the outputs of the Hydrology Basin Matter to identify likely water regimes at ecosystems that benefited from Commonwealth environmental water.
- 5. Predicting the likely responses for key and threatened species at sites that were watered but not monitored based on conceptual understanding and spatial distributions.



**Figure 1.** Key elements of the Basin scale evaluation of generic diversity. The two data sources are from Selected Area monitoring (highlighted in blue) and outputs of Basin matter evaluations (clear).

The final step (step 5) is based on combining the conceptual life history model with hydrological information and ecosystems types watered to infer potential basin scale outcomes. Hydrological information will be used to identify wetlands at each of the selected areas which have been inundated with similar length and frequency as sites within the Selected Areas that have recorded positive ecological responses for waterbirds, frogs, turtles and mammals. These wetlands will be cross referenced with species distribution lists and used to approximate locations where key species responses could have occurred.

### 3.2 Conceptual model development

Conceptual models will be developed using existing information on species;

- life cycles,
- habitat requirements, including ecosystem types and vegetation, and
- water requirements including key events and long-term regime requirements

The information will be sourced from key references including Roberts and Marston (2011), Rogers and Ralph (2011) and available habitat preference curves. Once the conceptual models have been developed they will be refined based on the information generated by monitoring at the selected areas. Other sources of information may also become available (MDB EWKR, Basin Plan Monitoring and Evaluation, Published Papers) and this information will be incorporated into the models as it becomes available.

## 3.3 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.

#### 3.4 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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