2. Overview of Inventory & Survey Methods

Scope

This section describes the methods used to conduct the inventory, including an overview of the survey techniques. Techniques used to survey birds, plants and fishes are discussed further in chapters on each group. The mapping methodology is presented in chapter 13 together with a review of pre-existing mapping and results of new mapping.

2.1 Background: Required Elements of a Wetlands Inventory

There is a growing body of literature on techniques and requirements for regional wetlands inventory, in an Australian context. Reviews of the Australian situation, including past inventories in each state and territory, were written by: Barson and Williams (1991); Pressey and Adam (1995); and Spiers and Finlayson (1999).

Techniques for enhanced wetland inventory and monitoring (Finlayson and Spiers 1999) is a report which focused on Australian issues, and was funded under the National Wetlands Program by the Environment Australia Biodiversity Group. In particular, the report includes proposed protocols for an Australian national wetland inventory (Finlayson 1999). The report also includes a section assessing the extent of wetland inventory data in Australia at that time (Spiers & Finlayson 1999). In that section the authors join others in advocating a national approach to wetland inventory. Whilst there is still no nationally endorsed approach, this inventory of the arid NT has taken account of the recommended protocols of Finlayson (1999) as advised by Roger Jaensch (Jaensch 2000).

Finlayson and Spiers (1999) present the following internationally agreed definition of wetland inventory:

> 'Inventory is the collection and/or collation of core information for wetland management, including the provision of an information base for specific assessment and monitoring activities' (Finlayson & Spiers 1999, p.141).

Two fundamental aspects of wetland inventory are:

- mapping, which Finlayson (1999, p.120) calls 'delineating wetland habitats'; and
- describing ecological character.

Both of these generally involve creating or applying a classification of wetland types, for use in summarising ecological character and as a basis for presenting the area and distribution of types in mapped and tabular form. The classification derived for the arid NT and the wetland attributes incorporated into it are reported in a separate chapter of this report.

Key aspects of wetland character are size, the pattern of inundation through space and time, the salinity and the vegetation structure, the presence of characteristic and rare or threatened species and general use by wetland animals.

Several authors stress the importance of recording 'primary data' (direct observations and measurements) as opposed to derived, interpreted or classified data (Barson & Williams 1991; Blackman *et al*. 1992). In our experience, it is also important to provide room on survey forms for free format descriptions of wetland features to incorporate unanticipated types of observation and local testimony.

Biodiversity assessment is not an essential part of all wetland inventory (Jaensch 2000) and may be better described as wetland assessment (Finlayson 1999). However, some biodiversity survey was essential in this inventory of the arid NT, given the general lack of knowledge of the biota of arid NT wetlands, the requirement to assess their conservation significance and the expense of reaching sites for ground survey.

In the original funding proposal for this wetlands inventory, it was indicated that the survey methodology used to inventory the semi-humid tropics of the NT (Jaensch 1994; Jaensch & Bellchambers 1997) would be adopted for the inventory of the arid NT. However, this was not possible due to the lesser importance of waterbirds in the arid as opposed to semi-humid portions of the NT and the importance of incorporating other aspects of wetland inventory.

2.2 Consultations with Experts and Community

Consultations were important in the following areas of the project: refining methods; creating a preliminary list of wetland types; identifying pre-existing information on important wetlands and survey priorities; arranging access to field sites; and obtaining information about individual wetlands from local knowledge. A list of people consulted is included in appendix 4.

Early in the project, two workshops were held in 1999 to obtain input from local scientists and others with field experience of arid NT wetlands. The first workshop was with Parks and Wildlife staff (8 Nov 1999) and the second was with the broader scientific and land management community of Alice Springs (Rangelands Society Seminar Series, 15 Dec 1999).

Roger Jaensch of Wetlands International assisted the project team in developing the methodology. An initial consultancy of one week (May 2000) involved intensive office based discussions of the issues and options and brief field excursions with other members of the project team. A comprehensive report was prepared by the consultant based on these activities (Jaensch 2000). A second one week consultancy (July 2000) consisted of an aerial reconnaissance flight and a four day field trip to a diverse array of wetland types, to further develop both the working classification and the ground survey methods.

General discussions of the aims and methods of the project were held with the Central Land Council and the Centralian Land Management Association (CLMA - a Landcare group comprised of pastoralists). These two organisations represent the majority of landholders. Consultations were held with owners and or managers of individual properties prior to and during survey work. A project information sheet was distributed during consultations with landholders and others. It is appended to this report as appendix 3.

A summary report was prepared of wetlands surveyed on each pastoral property visited, and was sent to the station managers. Pictorial reports were prepared and sent to traditional owners of areas surveyed on Aboriginal Land Trusts.

2.3 Field Survey Methods

The broad aims of the ground survey component of the inventory were:

- collect sufficient information (and photographs) to define and describe wetland types;
- allocate individual wetlands to preliminary (apriori) wetland types;
- record data relevant to assessing conservation significance including the presence of rare or threatened species, hydrological regime, and waterbird abundance and breeding;
- identify threats to wetland conservation;
- test the accuracy of water body mapping on the 1:250,000 topographic map series, including floodouts and land subject to inundation;
- identify indicator plants of use for identifying wetlands and the nature of their inundation history;
- collect frozen specimens of fishes for genetic research by the South Australian Museum and Deakin University; and
- add to knowledge of the distribution and habitat preferences of plants, fishes and wetland birds.

Field testing the mapping of wetlands on the 1:250,000 topographic maps involved recording erroneous mapping of an area as a wetland, recording an area as a wetland which was not mapped and recording broad wetland type.

The survey methodology adopted for the arid NT inventory was flexible in terms of the size of a site and the detail in which various wetland attributes were recorded. This was necessary in order to meet the broad objectives of a reconnaissance scale inventory, combined with some detailed biological survey necessary to describe the range of wetland types.

The detail with which a site was surveyed was influenced by: the state of inundation and vegetation response; a preliminary assessment of conservation importance; and available time. Where time permitted, primary information was recorded about the wetland, rather than allocation of wetland features to categories. Even where attributes were estimated and not measured, such as maximum depth observed and potential maximum water depth, the estimated values were recorded, often as a range, rather than categories. In order to cover sufficient area during the ground survey, some sites were very rapidly assessed; sometimes without getting out of the vehicle. Such sites were called 'ultra-rapid' and served the purpose of documenting the abundance and distribution of wetland types and attributing and testing the mapping of waterbodies on 1:250,000 topographic maps.

Aerial photography was used in the field for navigation and site selection in a small proportion of areas visited. The large areas covered in each field trip and limited resources did not permit consistent use of existing aerial photography for either survey or mapping. Any more detailed survey work subsequent to this inventory would benefit greatly from the use of aerial photographs. A scale of 1:50,000 or more detailed is recommended. Plots of recent satellite imagery (ETM+) were used as a navigation aid where available (roughly half the survey area).

The survey of plants and animals was less systematic than in studies focused primarily on ecology or vegetation mapping. A compromise was necessary between detailed biological survey and broader wetland inventory. The emphasis was on recording the presence of species at wetlands and in distinctive sub-habitats (zones) within wetlands (plants only). Quantitative sampling and abundance estimates were of secondary importance. Estimates of abundance were made for birds (numbers) and plants (modified Braun-Blanquette cover-abundance classes) at a sub-set of sites, and only opportunistic sampling of fish and aquatic invertebrates was undertaken. The size of sampling areas was not standardised. This allowed maximum flexibility in obtaining comprehensive species lists in the least amount of time. There is a large variation in spatial arrangement and patch size of sub-habitats (zones) within wetlands and systematic but representative sampling would require multiple small fixed area plots in each zone and/or a gradient-transect method. The use of such methods would have conflicted with the need to inspect a large number of sites. For the same reason, plot locations were not randomised within wetlands and neither was the selection of wetlands to be surveyed.

Survey Site Selection

The aim was to survey a representative sample of wetlands across the range of wetland types as well as across the geographic range of the study area. A formal stratification was not undertaken. Survey trips were planned according to particular geographic areas on the basis of existing knowledge about wetland values and accessibility. Land tenure was a defacto stratification layer, in that wetlands on pastoral leases, national parks and Crown Land could generally be more easily visited than those on Aboriginal controlled land. Gaining permission to visit Aboriginal Land Trusts is often time consuming due to cultural and language differences and the fact that often many different people must be consulted. Both the IBRA bioregions (Thackway & Cresswell 1995) and national drainage basins were considered in trying to make the sampling representative.

Information about potential survey sites and areas was obtained from existing mapping of wetlands, various general biological survey reports, satellite imagery, some limited aerial survey and advice from local scientists, particularly Peter Latz. Also, existing data about the distribution and wetland affinities of plants and animals were collated and records of vascular plants, birds and fish were inspected with a geographic information system. Based on the collated information survey trip itineraries were developed.

Survey routes were chosen so that a large number of wetlands could be briefly inspected and assessed against a preliminary classification of wetland types, in addition to more thoroughly surveyed sites.

Landholders were a valuable source of extra information about the occurrence and nature of wetlands and access routes. Additional sites were often selected during the field trips based on discussions with landholders.

Survey Sites and Individual Wetlands

The term 'site' is not necessarily equivalent to a wetland. In our survey, a site was the part of the wetland observed and for which information was recorded on a site sheet. The size of the site was variable and only sometimes did it incorporate an entire 'wetland'. Where possible, sites were located so as to be representative of the wetland being surveyed and information was recorded regarding the entire wetland as well as for sub-habitats within it. Some large and complex wetlands were surveyed with more than one site. Similarly, at large complex wetlands some parts were often surveyed more thoroughly than others.

Site location was not necessarily equivalent to the centre of the wetland (centroid). The coordinates of a point within or adjacent to the survey area were recorded using a global positioning system device (GPS). Where possible the GPS fix was taken in the centre of the area surveyed. The relative position of the coordinates with respect to the surveyed area and the whole wetland were described. The general location of the site was described with respect to features mapped on the 1:250,000 scale topographic map and included the property name.

Attributes Surveyed

The following core data was collected at all ground survey sites:

- date;
- observer(s);
- site code (combination of letters indicating the property name or survey area and the sequential site number for that property or area);
- sample type (rapid/standard);
- map sheet name (1:250k);
- wetland name(s) and origins of name (m=map, s=name created during survey, l =local);
- position coordinates, datum, method, accuracy and relative position with respect to the wetland (GPS/Map, +/- x metres; for some rapid sites the site number was marked on a topographic map, with coordinates determined later);
- location description (property name, distance and direction from a named feature on 1:250,000 topographic map);
- whether or not mapped on 1:250,000 topo map (Y / N);
- adequacy of mapping (comment);
- general description (uniformity, patterning, vegetation structure and key plants if not recorded elsewhere, and information from local or other knowledge of the wetland);
- wetland type(s) from working (apriori) classification (proportion of dominant and other types);

The following attributes were described at most ground survey sites:

- comments on access;
- wetland size (estimated dimensions);
- observation method (one or more of ground, boat, hill, aircraft, drive by);
- proportion of wetland inundated;
- current depth (estimated or measured);
- maximum depth (estimated or measured);
- water colour (e.g. clear / yellow brown / milky brown / other);
- water turbidity (estimated not measured: clear / low / medium / high turbidity);
- flow speed (still / slow / fast);
- water conductivity and pH (where a sample was taken for laboratory testing this was noted);
- algal growths in water (comment);
- water regime (permanent / long-term / temporary ; other information on inundation events/frequency and information sources);

- catchment / hydrology comments;
- earthworks or other mechanical modifications (description);
- presence of fish (seen / not seen / listed);
- presence of aquatic invertebrates (seen / not seen / listed; no. of samples);
- presence of waterbirds (seen / not seen / listed);
- detail of plant list (whether or not comprehensive: full / partial);
- adjacent and nearby landforms and vegetation types (general description);
- photographs (photo number/description);
- time spent (estimated person hours);
- presence and extent of visible salting on surface;
- thickness of salt crust if extensive;
- ground surface cover types (% bare ground, % loose rock, % bare rock);
- surface soil description (colour, estimated texture, cracking, thickness of inorganic crust); or
- rapid assessment of disturbance factors (weeds, rabbits, horses/donkey, camels, cattle; impact scored as 1 – 5);
- vegetation condition (shrubs & trees stressed, forbs stressed, fresh growth, no stress, seedlings present, drowned dead shrubs);
- dominant and key plants (e.g. Redgum, Coolabah, Lignum, Nardoo, Couch; even if not dominant)
- vegetation structure (brief description);
- lists/comments regarding species seen: plants, fish, waterbirds, other birds, invertebrates, frogs;
- sketch map (shape of wetland, arrangement of sub-habitats, dimensions, and position of adjacent landforms).

At some sites, more detailed floristic survey was conducted of the vegetation in one or more zones of the wetland. At these sites soils were also surveyed in more detail. Soil and vegetation sampling are described in more detail in the chapter on plants, but included:

- compiling a plant species list for the wetland as a whole or for particular zones (sub-habitats);
- where time permitted, cover and abundance were estimated for each species in one or more zones (sub-habitats);
- soils were described in moderate detail from a soil pit in at least one zone where full plant cover and abundance were recorded (soil texture, pH, stoniness, mottling, and horizon depths);
- soil salinity was determined in the laboratory (as conductivity) for all horizons sampled from pits.

At some sites birds were systematically observed and counted. Details of methods are described in the chapter on wetland birds.

At some sites fish and aquatic invertebrates were sampled. This was done with a variety of methods as described in the chapter on fishes. The sampling was opportunistic and did not involve systematic sampling of different aquatic environments within the wetland.

The field survey data proformas are presented as Appendix 2.

Aerial survey

Aerial survey was used for general reconnaissance, for rapid site assessment, to conduct bird counts of selected wetlands and to obtain photographs to assist with interpreting and promoting wetlands. Counting numbers of waterbirds was not a core activity of the inventory and was restricted by time and budget constraints. There was only two days of aerial survey for bird counting and one wetland reconnaissance flight over parts of the Finke and MacDonnell Ranges bioregions. However, wetland occurrence and broad wetland type data were collected during an extensive aerial camel survey that was conducted in 2001, concurrent with the wetland inventory.