

Table of Contents

LIST OF TABLES	IV
LIST OF FIGURES	V
LIST OF APPENDICES	V
SUMMARY	VII
ACKNOWLEDGMENTS	X
ROLES OF THE AUTHORS	XI
1. INTRODUCTION.....	1
1.1 PURPOSE, SCOPE AND OBJECTIVES	1
1.2 OVERVIEW OF CONTENT AND STRUCTURE	2
1.3 CONTRACTUAL ARRANGEMENT	3
1.4 STUDY AREA DEFINITION AND OVERVIEW	4
1.5 TERRAIN AND BIOREGIONALISATION.....	5
1.6 CLIMATE.....	7
1.7 THE POLICY CONTEXT FOR WETLAND CONSERVATION IN THE ARID NT	14
1.8 OVERVIEW OF PRE-EXISTING KNOWLEDGE AND THE NEED FOR AN INVENTORY	16
2. OVERVIEW OF INVENTORY & SURVEY METHODS	19
2.1 BACKGROUND: REQUIRED ELEMENTS OF A WETLANDS INVENTORY.....	19
2.2 CONSULTATIONS WITH EXPERTS AND COMMUNITY	20
2.3 FIELD SURVEY METHODS	20
3. ORIGINS OF CENTRAL AUSTRALIAN WETLANDS: HYDROLOGY, GEOLOGY, GEOMORPHOLOGY AND PAST CLIMATES.....	25
3.1 HYDROLOGICAL PROCESSES IN ARID NT WETLANDS	25
3.2 GEOLOGY AND PALEOCLIMATE	28
3.3 GEOMORPHOLOGY	31
4. OVERVIEW OF MAJOR DRAINAGE SYSTEMS.....	33
4.1 OVERVIEW OF DRAINAGE FEATURES	33
4.2 DRAINAGE DIVISIONS AND BASINS.....	35
4.3 SUMMARY DESCRIPTIONS OF EACH DRAINAGE DIVISION	39
5. CLASSIFICATION OF ARID NT WETLANDS	45
5.1 OVERVIEW OF WETLAND CLASSIFICATION ISSUES	45
5.2 DEFINITION OF WETLANDS	48
5.3 LANDFORM AND WATER SOURCE AS ATTRIBUTES OF WETLAND TYPE	52
5.4 WETLAND SIZE AS AN ATTRIBUTE OF WETLAND TYPE	55
5.5 WATER REGIME AS AN ATTRIBUTE OF WETLAND TYPE	56
5.6 WETLAND SALINITY AND WATER CHEMISTRY AS ATTRIBUTES OF WETLAND TYPE	61
5.7 VEGETATION AS AN ATTRIBUTE OF WETLAND TYPE	63
5.8 SPATIAL ARRANGEMENT AND WETLAND TYPE	65
5.9 THE WETLAND CLASSIFICATION FOR THE ARID NT	67
6. DESCRIPTIONS OF THE WETLAND TYPES	81
6.1 SALINE WETLANDS: SALT LAKES AND SWAMPS	81
6.2 FRESHWATER BASINS: CLAYPANS AND LAKES	83
6.3 ISOLATED ROCK HOLES	85
6.4 WOODED SWAMPS (FRESHWATER)	85
6.5 BLUEBUSH SWAMPS	86
6.6 LIGNUM SWAMPS	87
6.7 OTHER FRESHWATER SHRUBBY SWAMPS	87
6.8 GRASSY AND OTHER HERBACEOUS FRESHWATER SWAMPS	88
6.9 FLOOD PRONE FLATS.....	89

6.10	WATERCOURSES.....	89
6.11	SPRINGS	94
6.12	SUBTERRANEAN WETLANDS	98
6.13	ARTIFICIAL WETLANDS.....	99
7.	SUMMARY OF FIELD SURVEY.....	101
7.1	GROUND SURVEY	101
7.2	AERIAL SURVEY.....	103
8.	WETLAND BIRDS IN THE ARID NT	105
8.1	DEFINITIONS.....	105
8.2	METHODS.....	106
8.3	SPECIES RICHNESS	107
8.4	ABUNDANCE AND BREEDING ACTIVITY	113
8.5	CONSERVATION STATUS	114
8.6	BIRD DISTRIBUTION ACROSS WETLAND TYPES	115
8.7	SIGNIFICANT WETLANDS FOR BIRDS	116
8.8	ARID NT WETLANDS BIRDS: NATIONAL PERSPECTIVE	116
9.	WETLAND PLANTS IN THE ARID NT	119
9.1	METHODS.....	120
9.2	PRELIMINARY RESULTS.....	121
9.3	ECOLOGICAL ATTRIBUTES OF ARID NT PLANTS	123
9.4	DOMINANT AND CHARACTERISTIC PLANTS OF ARID NT WETLANDS.....	131
9.5	VEGETATION ASSEMBLAGES.....	140
9.6	CONSERVATION SIGNIFICANCE OF ARID NT PLANTS	140
10.	FISHES IN THE ARID NT.....	143
10.1	METHODS.....	143
10.2	FISH SPECIES OF THE ARID NT	146
10.3	TEMPORAL TERMINOLOGY.....	147
10.4	HISTORICAL PERSPECTIVE.....	148
10.5	REVIEW OF NAMING AND DISTRIBUTION OF EACH SPECIES	148
10.6	ANCESTRY OF ARID NT FISHES AND ENDEMISM.....	158
10.7	SUMMARY OF SPECIES DIVERSITY BY DRAINAGE DIVISIONS, BASINS AND RIVER SYSTEMS.....	158
10.8	FISH SPECIES ASSEMBLAGES OF INDIVIDUAL DRAINAGE SYSTEMS	161
10.9	ENVIRONMENTAL TOLERANCES, BEHAVIOURAL AND DISPERSAL CHARACTERISTICS OF NATIVE ARID NT SPECIES.....	168
10.10	PHYSICAL HABITAT CHARACTERISTICS INFLUENCING THE PERSISTENCE AND DIVERSITY OF FISHES IN ARID NT DRAINAGE SYSTEMS.....	171
10.11	DROUGHT REFUGES AND SURFACE WATER CONNECTIVITY WITHIN AND BETWEEN DRAINAGE SYSTEMS.....	173
10.12	OVERVIEW OF INTRODUCTIONS AND TRANSLOCATIONS (AUSTRALIAN NATIVES AND EXOTICS).....	178
10.13	CONSERVATION STATUS OF NATIVES AND THREATS	180
10.14	APPRAISAL OF SURVEY METHODS	182
10.15	IDENTIFICATION GUIDES AND SOURCES OF OTHER INFORMATION	183
11.	INVERTEBRATES IN ARID NT WETLANDS	185
11.1	SUMMARIES OF PRE-EXISTING SURVEYS AND REVIEWS	185
11.2	INVENTORY SURVEY	187
11.3	AQUATIC INVERTEBRATES AND WATERBODY HEALTH.....	191
12.	AMPHIBIOUS AND TERRESTRIAL VERTEBRATES	193
12.1	FROGS	193
12.2	MAMMALS	193
12.3	REPTILES.....	194
13.	DISTRIBUTION AND MAPPING	197
13.1	PUBLISHED AND OTHER PRE-EXISTING MAPS	198
13.2	NON-MAP SOURCES OF WETLAND LOCATION DATA	204
13.3	INVENTORY SURVEY DATA	206
13.4	REVISION OF WETLAND POLYGON MAPPING WITH REMOTE SENSING	210
13.5	CREATION OF GENERALISED DIGITAL DRAINAGE DATA.....	218
13.6	REMOTELY SENSING OF INUNDATION PATTERNS	222

14. CONSERVATION SIGNIFICANCE OF WETLANDS	227
14.1 FRAMEWORK FOR ASSESSING SIGNIFICANCE AND IMPORTANCE	227
14.2 CRITERIA FOR INCLUDING A WETLAND IN A DIRECTORY OF IMPORTANT WETLANDS IN AUSTRALIA	228
14.3 APPLICATION OF THE RAMSAR CRITERIA IN THE ARID NT	228
14.4 IMPORTANT WETLANDS IN THE ARID NT	232
15. SUMMARY OF WETLANDS BY BIOREGION AND COMPARISON WITH OTHER PARTS OF THE ARID ZONE	237
15.1 BURT PLAIN BIOREGION	238
15.2 CENTRAL RANGES BIOREGION	241
15.3 CHANNEL COUNTRY BIOREGION	242
15.4 DAVENPORT MURCHISON RANGES BIOREGION	244
15.5 FINKE BIOREGION	247
15.6 GREAT SANDY DESERT	249
15.7 MACDONNELL RANGES BIOREGION	252
15.8 MITCHELL GRASS DOWNS BIOREGION	256
15.9 SIMPSON-STRZELECKI DUNEFIELDS BIOREGION	258
15.10 STONY PLAINS BIOREGION	260
15.11 TANAMI BIOREGION	262
15.12 RESERVATION STATUS OF WETLAND TYPES	265
15.13 COMPARISON WITH WETLANDS OF NEIGHBOURING STATES	265
16. THREATS AND MANAGEMENT ISSUES	269
16.1 LEGISLATION	269
16.2 WEEDS	269
16.3 WATER RETENTION EARTHWORKS	275
16.4 WATER EXTRACTION	275
16.5 MINING	276
16.6 INTRODUCED AQUATIC ANIMALS AND TRANSLOCATIONS	276
16.7 EXOTIC TERRESTRIAL ANIMALS	276
16.8 RECREATION	277
16.9 POLLUTION	277
16.10 FIRE	278
16.11 EXPLOSIVES	278
17. CONCLUSIONS AND RECOMMENDATIONS	279
17.1 OVERALL VALUE OF WETLANDS IN ARID NT	279
17.2 CONDITION OF WETLANDS IN ARID NT	279
17.3 LANDHOLDER ATTITUDES AND PERCEPTIONS	279
17.4 DATA LIMITATIONS	280
17.5 RECOMMENDATIONS FOR COMMUNITY EDUCATION	280
17.6 RECOMMENDATIONS FOR MANAGEMENT	280
17.7 RECOMMENDATIONS FOR FURTHER INVENTORY AND RESEARCH	282
17.8 RECOMMENDATIONS FOR LISTING IMPORTANT WETLANDS	286
18. REFERENCES	287
19. FURTHER READING	299

List of Tables

Table 1.	Scope of project, from appendix 3.2 of the funding consultancy agreement.....	3
Table 2.	Size of the study area and comparison with NT and the three smallest States.....	5
Table 3.	Names and areas of bioregions (IBRA version 5) of the study area.....	7
Table 4.	Summary of climatic parameters at three latitudes.....	8
Table 5.	Monthly rainfall data indicating high rainfall events in 2000 and 2001.....	13
Table 6.	Areas of national drainage divisions and DEM derived basins in the arid NT.....	37
Table 7.	Summary statistics of the major rivers and creeks in Lake Eyre Drainage Division.....	41
Table 8.	Summary statistics of the major rivers and creeks in Western Plateau Drainage Division.....	44
Table 9.	Water salinity categories recognised by Blackman et al. (1992).....	62
Table 10.	Useful reference values of salinity.....	63
Table 11.	Summary of Arid NT Wetland Types and Equivalent Ramsar Types.....	78
Table 12.	Number of sites by bioregion.....	101
Table 13.	List of waterbirds recorded from the study area.....	108
Table 14.	Taxonomic groups of wetland bird species, summarised by categories of occurrence in the arid NT.....	111
Table 15.	Major sites for wetland birds in the study area, in the inland sub-humid tropics of the Northern Territory and selected other arid sites.....	112
Table 16.	Wetland birds from the arid NT that are listed under international treaties and/or as threatened species.....	114
Table 17.	Summary table of Aquatic Plants.....	133
Table 18.	Summary table of Semi-aquatic Plants.....	134
Table 19.	Known and possible fish species of the arid NT.....	146
Table 20.	Summary of indigenous species distribution by drainage system.....	160
Table 21.	Native fish of the Georgina River system.....	161
Table 22.	Native fish of the Sandover River system.....	162
Table 23.	Native fish of the Finke River system.....	163
Table 24.	Naturally occurring fish of the Whistleduck Creek system.....	164
Table 25.	Naturally occurring fish of the Frew River system.....	164
Table 26.	Native fish of Kurundi Creek.....	165
Table 27.	Native fish of Gosse River.....	165
Table 28.	Native fish of Bonney Creek.....	165
Table 29.	Drainages with a single indigenous fish: <i>Leiopotherapon unicolor</i> (Spangled Grunter).....	166
Table 30.	Drainages with no fish.....	167
Table 31.	Drainages with an unconfirmed absence of fish.....	168
Table 32.	Frog species known from the arid NT.....	193
Table 33.	Bat species known from the arid NT.....	194
Table 34.	Summary of Polygons by Feature Code (Geodata 1:250,000).....	199
Table 35.	Summary of Drainage Lines by Feature Code (Geodata 1:250,000).....	200
Table 36.	Numbers of wetland observations during camel survey, by category.....	208
Table 37.	Numbers of mapped wetland polygons by bioregion and wetland type.....	215
Table 38.	Satellite images used to map drainage connectivity and extension.....	220
Table 39.	Potential wetlands for inclusion in the Directory and their significance rating.....	233
Table 40.	Preliminary table of wetland types in the Burt Bioregion.....	239
Table 41.	Preliminary table of wetland types in the Central Ranges Bioregion.....	241
Table 42.	Preliminary table of wetland types in the Channel Country Bioregion.....	242
Table 43.	Preliminary table of wetland types in the Davenport Murchison Ranges Bioregion.....	245
Table 44.	Preliminary table of wetland types in the Finke Bioregion.....	247
Table 45.	Preliminary table of wetland types in the Great Sandy Desert Bioregion.....	249
Table 46.	Preliminary table of wetland types in the MacDonnell Ranges Bioregion.....	252
Table 47.	Preliminary table of wetland types in the Mitchell Grass Downs Bioregion.....	256
Table 48.	Preliminary table of wetland types in the Simpson-Strzelecki Dunefields Bioregion.....	258
Table 49.	Preliminary table of wetland types in the Stony Plains Bioregion.....	260
Table 50.	Preliminary table of wetland types in the Tanami Bioregion.....	262
Table 51.	Weed species of arid NT wetlands.....	270

List of figures

Figure 1.	Map of the study area.....	4
Figure 2.	Continental extent of bioregions of the study area.....	6
Figure 3.	Northern territory with extent of the arid NT and bioregion boundaries.....	6
Figure 4.	Rainfall isohyet map of the study area.....	9
Figure 5.	Rainfall seasonality (Jan – Dec) histograms for key localities.....	10
Figure 6.	Locations of weather stations referred to in climate tables.....	11
Figure 7.	Rainfall variability index map of the study area.....	12
Figure 8.	Major drainage lines and connections and extensions mapped from satellite imagery.....	35
Figure 9.	Map of nationally defined drainage divisions and basins, with major rivers.....	36
Figure 10.	Difference between DEM derived basin boundaries and those of the Australian Water Resources Commission (AWRC).....	37
Figure 11.	Ground survey site locations.....	102
Figure 12.	Aerial survey flight paths: wetlands specific and camel survey.....	103
Figure 13.	Survey records of inland crabs.....	190
Figure 14.	Extent of 1:50,000 Orthophotomaps.....	201
Figure 15.	Extent of land system and land unit mapping in 2002.....	203
Figure 16.	Wetland locations identified during the 2001 feral camel aerial survey.....	209
Figure 17.	Satellite image type and date for automated wetland mapping.....	210
Figure 18.	Comparison of water detection algorithms as applied to the Snake Creek floodout.....	212
Figure 19.	Spectral contrast across the Snake Creek floodout landscape.....	213
Figure 20.	Map showing centre points of new waterbody polygons.....	216
Figure 21.	Lake Bennett rainfall and inundation diagram.....	225
Figure 22.	Map of identified ‘important’ wetlands.....	235

List of Appendices

APPENDIX 1.	PHOTOGRAPHIC SUMMARY OF WETLAND TYPES AND FEATURES
APPENDIX 2.	SELECTED WETLAND MAPS AND SATELLITE IMAGERY
APPENDIX 5.	PROJECT INFORMATION SHEET
APPENDIX 6.	LIST OF PEOPLE CONSULTED
APPENDIX 7.	SUMMARY OF SURVEY TRIPS
APPENDIX 8.	PRELIMINARY CLASSIFICATION OF ARID NT WETLANDS (SUPERCEDED)
APPENDIX 9.	RAMSAR WETLAND DEFINITION, CLASSIFICATION AND CRITERIA FOR INTERNATIONALLY IMPORTANT WETLANDS
APPENDIX 10.	CRITERIA FOR INCLUDING A WETLAND IN A DIRECTORY OF IMPORTANT WETLANDS IN AUSTRALIA
APPENDIX 11.	GUIDE TO WETLAND ORIENTED ORGANISATIONS
APPENDIX 12.	SURVEY DATA PROFORMAS

There is a second volume of this report, to which access is restricted.

Volume 2: Information Collated for Individual Wetlands