

RECOVERY PLAN FOR THE MT LOFTY RANGES SOUTHERN EMU-WREN *STIPITURUS MALACHURUS INTERMEDIUS* 1999–2003

**by the
Mt Lofty Ranges Southern Emu-wren Recovery Team**



Mt Lofty Ranges
Southern Emu-wren
Recovery Program

A report on Project No. 319 submitted to the
Regional Wildlife Programs Section,
Wildlife Australia

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1.0 Summary

Current Subspecies Status: The Mt Lofty Ranges (MLR) Southern Emu-wren *Stipiturus malachurus intermedius* is Critically Endangered in terms of the *IUCN Red List Categories* (1994). It is nationally Endangered under the *Environment Protection and Biodiversity Conservation Act 1999*, *The Action Plan for Australian Birds*, and *The ANZECC List of Threatened Australian Vertebrate Fauna* (1995). The Southern Emu-wren *S. malachurus*, as a species, is Rare in South Australia under the *National Parks and Wildlife Act 1972*.

Habitat Requirements and Limiting Factors: The MLR Southern Emu-wren occurs in two broad habitat types: swamp and dry-heath. Most sub-populations occur in dense swamp (which includes wet-heath, sedgeland, reedland, and occasionally lignum), although one of the two largest sub-populations inhabits dry-heath. These habitats are dense at the 0–1m level. Swamp habitat occurs almost entirely on private property, is fragmented, rare and subject to incremental alteration or clearance. Sub-populations are apparently isolated due to the bird's poor ability to fly across open spaces, and thus may suffer local extinction due to habitat degradation, fire, flooding, predation, inbreeding depression and other factors.

Recovery Objectives:

1. *Long-term:* Establish long-term community support structures for the ongoing recovery and management of the MLR Southern Emu-wren in the Fleurieu Peninsula as a Conservation Dependent (IUCN) taxon.
2. *For the life of the plan:* Improve the status of the MLR Southern Emu-wren from Critically Endangered to Endangered (IUCN criteria) within five years (i.e. by 2004) by increasing the number of adult MLR Southern Emu-wrens, increasing the area, quality and extent of the habitats they use, and decreasing the fragmentation of MLR Southern Emu-wren sub-populations.

Recovery Criterion:

1. *For the life of the plan:* A measured increase of 30% in the number of adult MLR Southern Emu-wrens and an increase of 30% in the area that they occupy due to implementation of the actions in this Recovery Plan.

Specific Objectives:

1. Increase the area and quality, and decrease the fragmentation, of habitats used by MLR Southern Emu-wrens.
2. Increase regional planning recognition, protection, awareness and involvement of the community, and establish long-term support structures for the MLR Southern Emu-wren and its habitats.
3. Increase the numbers of adult MLR Southern Emu-wrens by at least 30%.
4. Operate the Recovery Plan through a Recovery Team.

Specific Criteria:

1. Demonstrated rehabilitation of 25 ha of MLR Southern Emu-wren habitat per year for five years.
2. Measured re-establishment of 10 ha of habitat links per year for five years at selected sites.
3. Successful application of the Swamp Management Strategy, swamp management guidelines and vegetation monitoring check sheet that have been completed, adopted, endorsed, distributed and revised within five years.
4. A measured increase in the level of protection of MLR Southern Emu-wrens and their habitats through the use of conservation covenants, letters of agreement and/or recognition in Property Management Plans within five years.
5. Recognition of the significance of the species and its habitats by the major regional planning boards and within relevant forestry and reserve management plans, particularly fire management, within two years.
6. Measured increased awareness and involvement of land owners and other members of the community in the recovery of the MLR Southern Emu-wren; and identified structures in place to ensure the ongoing support of these activities in the region beyond the life of the Recovery Plan.
7. Demonstrated confirmation within five years of a 30% sustained increase in the number of adult MLR Southern Emu-wrens.
8. Demonstrated successful procedures for the active management of MLR Southern Emu-wrens within five years.
9. Completed nomination of Fleurieu Peninsula swamps as threatened ecological communities under the *Environment Protection and Biodiversity Conservation Act 1999* within one year.
10. Demonstrated successful operation of the Recovery Team over five years.

Actions Needed (Note that Actions 1a and 1b represent two actions under the heading of Action 1, and so on. Actions 6 and 7 are complete actions.):

ACTION 1: Instigate on-ground vegetation works to increase the quality and area and decrease the fragmentation of MLR Southern Emu-wren habitats

ACTION 1a: Map priority sites for rehabilitation, habitat enhancement and the re-establishment of habitat connections in consultation with landholders and other stakeholders

ACTION 1b: Rehabilitate and enhance 125 ha of swamp habitat and re-establish 50 ha of habitat connections at selected sites to favour MLR Southern Emu-wrens

ACTION 2: Analyse vegetation and apply the results to MLR Southern Emu-wren habitat management

ACTION 2a: Define the key structural and floristic features of swamp and dry-heath habitats at points flagged in Action 4a to refine habitat restoration and monitoring methods

ACTION 2b: Determine the response of swamp vegetation to grazing and burning trials, and measure opportunistically the effects of chemical spraying, draining, slashing, wildfire and destocking on swamp vegetation

ACTION 2c: Develop and implement a Fleurieu Peninsula Swamp Management Strategy and guidelines to facilitate best management practices for MLR Southern Emu-wrens and other biodiversity values

ACTION 3: Implement Community Extension and Public Relations Programs

ACTION 3a: Facilitate consideration and management of MLR Southern Emu-wrens and their habitats in relevant planning processes at all levels within the region

ACTION 3b: Establish the long-term commitment and infrastructure necessary for the Fleurieu Peninsula community to manage swamps and MLR Southern Emu-wrens beyond 2003

ACTION 3c: Increase the awareness and involvement of the regional and broader community in relation to MLR Southern Emu-wrens and their habitats

ACTION 4: Monitor the key indicators of MLR Southern Emu-wren performance

ACTION 4a: Flag points in selected swamps and dry-heaths which MLR Southern Emu-wrens use and occupy for the definition of key vegetation features in Action 2a

ACTION 4b: Monitor and assess the performance (home range, breeding success, dispersal and recruitment) of MLR Southern Emu-wren sub-populations at selected management sites in relation to environment (type, shape, size and fragmentation of habitat)

ACTION 4c: Conduct a biennial census of adult MLR Southern Emu-wrens to indicate the effectiveness of on-ground recovery actions and the status of MLR Southern Emu-wrens

ACTION 5: Actively Manage MLR Southern Emu-wrens

ACTION 5a: Prepare a translocation strategy for MLR Southern Emu-wrens and, if necessary, undertake and monitor best-practice translocation of emu-wrens

ACTION 5b: Develop microsatellite DNA markers for the Southern Emu-wren and determine the variation and dispersal within and between MLR Southern Emu-wren sub-populations and identify sources for MLR Southern Emu-wren translocations

ACTION 5c: Update the Population Viability Analysis and apply the results to the translocation strategy in Action 5a

ACTION 6: Nominate Fleurieu Peninsula swamps as Threatened Ecological Communities under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

ACTION 7: Assemble a Recovery Team twice yearly to review progress of the Recovery Plan

Biodiversity Benefits: Fleurieu Peninsula swamp habitats critically need further conservation. MLR Southern Emu-wren Recovery Actions will enhance biodiversity in swamp habitats, particularly where habitat is enhanced by on-ground revegetation work. Species which may benefit include threatened birds (e.g. the South Australian listed Lewin's Rail *Rallus pectoralis*, Spotless Crane *Porzana tabuensis*, and Latham's Snipe *Gallinago hardwickii*), native fish, and other species of conservation significance including additional birds (e.g. Golden-headed Cisticola *Cisticola exilis*), as well as reptiles (e.g. Yellow-bellied Water Skink *Eulamprus heatwolei*), frogs (e.g. Bibron's Toadlet *Pseudophryne bibronii*), invertebrates, and numerous plants. Findings regarding MLR Southern Emu-wren behaviour and management may benefit other threatened species/subspecies of emu-wren, such as the Mallee Emu-wren *Stipiturus mallee* and the Eyre Peninsula Southern Emu-wren *S. malachurus parimeda*, both of which are Vulnerable (under *The ANZECC List of Threatened Australian Vertebrate Fauna (1995)*, and *The Action Plan for Australian Birds*).

Table 1. Estimated cost of recovery of the MLR Southern Emu-wren (in \$'000s)

Action		Year:			1999			2000			2001			2002			2003			TOTALS		
		TC*	INK	OT	TC	INK	OT	TC	INK	OT	TC	INK	OT	TC	INK	OT	TC	INK	OT	TC	INK	OT**
1. Onground vegetation	1a. ID priority sites	29.9	12.5	17.4	0	0	0	0	0	0	0	0	0	0	0	0	29.9	12.5	17.4			
	1b. Revegetation	34.1	9.7	24.4	37.1	9.7	27.4	27.4	9.7	17.7	58.4	19.4	39.0	77.4	20.0	57.4	234.4	68.5	165.9			
2. Vegetation analysis	2a. Key veg. features	0	0	0	28.2	10.3	17.9	32.9	11.9	21.0	0	0	0	0	0	0	61.1	22.2	38.9			
	2b. Swamp trials	32.0	12.3	19.7	30.1	11.2	18.9	23.3	11.5	11.8	31.9	11.9	20.0	27.4	12.2	15.2	144.7	59.1	85.6			
	2c. Swamp mgt strat.	7.5	2.5	5.0	0	0	0	10.1	2.5	7.6	30.3	10.4	19.9	8.9	2.4	6.5	56.8	17.8	39.0			
3. Community extension	3a. Planners	14.9	7.7	7.2	15.4	7.9	7.5	15.9	8.2	7.7	13.9	8.4	5.5	14.3	8.7	5.6	74.4	40.9	33.5			
	3b. Community	15.6	7.2	8.4	16.1	7.5	8.6	16.5	7.6	8.9	15.4	7.9	7.5	15.8	8.1	7.7	79.4	38.3	41.1			
	3c. PR, Volunteers	49.9	22.9	27.0	51.3	22.3	29.0	56.4	24.6	31.8	46.5	22.6	23.9	47.5	23.2	24.3	251.6	115.6	136.0			
4. Bird performance	4a. Vegetation use	51.5	21.0	30.5	55.5	21.6	33.9	0	0	0	0	0	0	0	0	0	107.0	42.6	64.4			
	4b. Performance	47.0	27.2	19.8	50.8	28.0	22.8	78.4	28.9	49.5	80.5	29.7	50.8	77.6	30.6	47.0	334.3	144.4	189.9			
	4c. Census	21.3	15.5	5.8	0	0	0	22.5	16.4	6.1	0	0	0	23.9	17.4	6.5	67.7	49.3	18.4			
5. Bird management	5a. Transloc. strategy.	0	0	0	0	0	0	5.8	1.3	4.5	0	0	0	0	0	0	5.8	1.3	4.5			
	5b. Genetics	0	0	0	0	0	0	47.4	12.2	35.2	0	0	0	0	0	0	47.4	12.2	35.2			
	5c. Pop. viab. analysis	0	0	0	0	0	0	2.6	0	2.6	0	0	0	0	0	0	2.6	0	2.6			
6. Thr. ecol. communities	6. Nomination	4.6	2.7	1.9	0	0	0	0	0	0	0	0	0	0	0	0	4.6	2.7	1.9			
7. Recovery team	7. Recovery team	8.8	7.0	1.8	9.1	7.2	1.9	9.5	7.5	2.0	9.8	7.7	2.1	10.1	7.9	2.2	47.3	37.3	10.0			
Subtotals:		317.1	148.2	168.9	293.6	125.7	167.9	348.7	142.3	206.4	286.7	118.0	168.7	302.9	130.5	172.4	1549.0	669.7	879.3			

*TC = Total Cost; INK = Inkind funding support; OT = Funding sources external to the Conservation Council of South Australia

2.0 Introduction

2.1 General Description

The Mt Lofty Ranges (MLR) Southern Emu-wren *Stipiturus malachurus intermedius* (Ashby 1920), is a subspecies of the Southern Emu-wren *S. malachurus*. The emu-wren genus *Stipiturus* (Aves: Maluridae) describes a unique group of small (approximately 5–8 g body mass), insectivorous passerines having characteristic tails comprising six long, emu-like feathers with a reduced, skeletonised structure. Emu-wrens have short, rounded wings and are relatively poor fliers. They tend to hop, flutter, and scramble through their habitat which is characterised by dense, low vegetation. Their calls consist of very high-pitched trills, similar to but much higher pitched and softer than those of fairy-wrens *Malurus* spp. Louder and harsher buzzing calls are issued in alarm. Emu-wrens are secretive and cryptic in habit, and can be difficult to observe in the field. Detection of emu-wrens usually requires an observer to have both good vision and acute hearing.

The genus *Stipiturus* comprises three species (Schodde 1982; Christidis and Schodde 1997): Rufous-crowned Emu-wren *S. ruficeps*, Mallee Emu-wren *S. mallee*, and Southern Emu-wren *S. malachurus*. *S. ruficeps* has a wide distribution across arid spinifex-clad (*Triodia* spp., and *Plectrachne* spp.) regions of central and central-western Australia, whilst *S. mallee* has a local distribution in mallee-heath areas of south-eastern South Australia (SA) and north-western Victoria (Schodde 1982; Rowley and Russell 1997). *S. malachurus* occurs across coastal regions of southern Australia in a range of vegetation types, e.g. wet- and dry-heath, swamp, sedgeland, tussock grassland, and shrubland (Schodde 1982; Rowley and Russell 1997).

Seven subspecies of Southern Emu-wren may be recognised (Rowley and Russell 1997): *S. malachurus intermedius* in the South Mt Lofty Ranges; *S. m. parimeda* on southern Eyre Peninsula; *S. m. malachurus* along the south-eastern coast of mainland Australia from the Coorong in SA to south-east Queensland; *S. m. halmaturinus* on Kangaroo Island; *S. m. littleri* in Tasmania; *S. m. westernensis* in south-western Western Australia; and *S. m. hartogi* on Dirk Hartog Island.



Figure 1. Adult male MLR Southern Emu-wren (photo. David Edey).

The MLR Southern Emu-wren has an overall length of approximately 16–18 cm, including the exceptionally long tail of almost twice body length at about 10–11 cm (see Figure 1). Body mass is generally 7–8 g. MLR Southern Emu-wrens are sexually dimorphic (as are the other two species of emu-wrens). The male has upper parts brownish with a greyish cast about the neck, thick black striations from crown to rump, and forehead more rufous. Underparts are tawny-brown except for the whitish belly, and pale blue upper breast, throat and eye-brow. The female is similarly coloured to the male but with no blue colouration, and more prominent striations on the upper parts, especially the crown and forehead. Sexual differences in plumage colouration are apparent when juvenile emu-wrens leave the nest, males being distinguished by their pale grey-blue upper-breast, throat and eye-brows. At about two months of age young males (as observed in the field) are essentially indistinguishable from their fathers, the blue having

attained the intensity of adulthood (Pickett, in prep.). Males maintain the blue plumage throughout the year, and do not moult into an eclipse plumage during the non-breeding season, as do some other Australian wrens with sexual dimorphism in plumage (e.g. Superb Fairy-wren *Malurus cyaneus*).

2.2 Status

Research associated with the existing Recovery Program indicates that the MLR Southern Emu-wren is Critically Endangered in terms of the *IUCN* (International Union for the Conservation of Nature) *Red List Categories* (IUCN SSC 1994). It is classified as Endangered nationally under the *Environment Protection and Biodiversity Conservation Act 1999*, *The Action Plan for Australian Birds* (Garnett 1992b), and *The ANZECC* (Australian and New Zealand Environment and Conservation Council) *List of Threatened Australian Vertebrate Fauna* (1995). As a species, the Southern Emu-wren is listed as Rare in SA under Schedule 9 of the *National Parks and Wildlife Act 1972*.

The insecure conservation status of the MLR Southern Emu-wren has been recognised by ornithologists for some time (e.g. South Australian Ornithological Association 1977; Reid and Vincent 1979; Ford and Howe 1980). In an inventory of threatened avian taxa, Garnett (1992a) categorised the MLR Southern Emu-wren as Endangered (*sensu* IUCN SSC 1994), and furthermore, identified threats to, and suggested conservation measures for, the subspecies. Prior to the first year of funding of recovery related activities in 1993, Garnett (1992b) stated that, '...the small remnant population is fragmented and at least one instance of local extinction has been recorded in the last decade. Population estimates vary from <100 to a few thousand individuals.' A recovery plan for the MLR Southern Emu-wren was outlined in *The Action Plan for Australian Birds* (Garnett 1992b). In 1993, a survey was conducted to determine the numbers and distribution of remaining MLR Southern Emu-wrens on the Fleurieu Peninsula in SA, and was accompanied by an assessment of their habitat (Littlely and Cutten 1994). The survey of 86 sites (84 swamps and two dry-heath sites) resulted in an estimated total number of MLR Southern Emu-wrens of 480 individuals (including juveniles), occurring in 18 isolated sub-populations. Only two sub-populations contained more than 100 individuals, whilst the remaining 16 each contained less than 30 individuals. Littlely and Cutten (*ibid.*) found that MLR Southern Emu-wrens occupied an estimated 2.9 sq. km of swamp habitat and a maximum of 3 sq. km of coastal dry-heath.

A census conducted in September 1998 recorded 98 adult MLR Southern Emu-wrens (plus 15 birds from two banding sites). Difficulties with the weather prevented accurate counts of some sites and two private properties were not searched as permission for access was not obtained at the time of census. The census served as a successful trial and will be modified and repeated in 1999, 2001 and 2003.

The MLR Southern Emu-wren is thus considered Critically Endangered according to *IUCN Red List Categories* (IUCN SSC 1994). It satisfies Critically Endangered criterion B, since the area of occupancy is <10 sq. km; and:

1. the population and habitats are severely fragmented; and
2. there has been continuing decline of:
 - extent of occurrence;
 - area of occupancy;
 - area and extent of habitat;
 - quality of habitat; and
 - number of locations and sub-populations;

A downlisting to Endangered is achievable by halting the declines in 2. above (see Endangered criterion C.2.(a), IUCN SSC 1994). Further downlisting to Vulnerable or Conservation Dependent can be achieved by halting any projected decline in the numbers of mature individuals or population structure due to fragmentation, and increasing the number of mature individuals, e.g. through revegetation and improvements in vegetation management.

2.3 Distribution

2.3.1 Former distribution

Prior to funding, the distribution of the MLR Southern Emu-wren was largely unknown due to the cryptic nature of the bird and the fact that most swamps on the Fleurieu Peninsula (South Mt Lofty Ranges) had not been searched, particularly in the Deep Creek/Parawa/Second Valley region (Figure 2). Little published information was available regarding MLR Southern Emu-wren distribution on the Fleurieu Peninsula, although local amateur ornithologists recognised some past and current sites. The MLR Southern Emu-wren's former range was understood to extend from Kuitpo in the north to the Deep Creek region in the south, and east to the Finnis River (Littlely and Cutten 1994). Most records were from wet-heath, and some dry-heath, in the Mt Compass district.

Although there are old records from Hindmarsh Valley and Back Valley, the MLR Southern Emu-wren now appears to be absent from the Inman Valley/Back Valley/Hindmarsh Valley area (Littlely and Cutten 1994) (Figure 2). There are also at least five other sites which emu-wrens had disappeared from prior to the survey in 1993; Yundi, Mt Compass, Cox Scrub Conservation Park, Ashbourne, and (probably) Kuitpo. Many past records, however, only gave vague locations (such as 'the Mt Compass region'), making it difficult to assess any specific distribution changes or loss of sub-populations.

2.3.2 Current distribution

The 1993 MLR Southern Emu-wren survey found 18 sub-populations (26 sites), 17 in swamps and one in dry-heath (Littlely and Cutten 1994). MLR Southern Emu-wrens occurring along the same swamp or separated by less than 100 m of cleared land were grouped as one 'sub-population'¹ and considered to be geographically isolated from other sub-populations. Sub-populations were found in the Deep Creek, Parawa, Myponga, Mt Compass, Nangkita and Finnis regions (Figure 2). Since 1993, 3–5 sub-populations are suspected to have been lost due to loss of habitat (unconfirmed due to limited access to these private properties), and a further sub-population may have disappeared following illegal spraying of a swamp with herbicide (unconfirmed report). Additional searches since the 1993 survey have, however, resulted in the discovery of four additional sub-populations (M. Pickett, pers. comm. November 1998).

One sub-population occurs in a conservation park (Deep Creek Conservation Park), and three in state forestry reserves (Figure 2).

¹ Although important for the purposes of the survey, the definition of 'sub-population' used in Littlely and Cutten (1994) was somewhat arbitrary. At the time areas of contiguous habitat which supported breeding pairs and young birds that had apparently dispersed were defined as 'sub-populations', as were very localised occurrences of one to several apparently non-breeding birds (that may have been in transit). In 1999 the project will attempt to better define MLR Southern Emu-wren sub-populations according to IUCN criteria.

2.4 Habitat

In general, the MLR Southern Emu-wren occurs in two habitat types; swamp and dry-heath (Littlely and Cutten 1994). Swamp habitat for the MLR Southern Emu-wren comprises peat-bog vegetation or 'open forest-wet-heath' (*sensu* Williams and Goodwins 1987) dominated by prickly tea-tree *Leptospermum continentale*, silky tea-tree *L. lanigerum*, *Empodisma minus*, red-fruit cutting-grass *Gahnia sieberiana*, sedges (e.g. *Baumea* spp., *Lepidosperma* spp.) and ferns (e.g. *Blechnum minus*, *Gleichenia microphylla*). Littlely and Cutten (1994) found that a common structural characteristic of swamps in which MLR Southern Emu-wrens occurred was that they were dense from 0–1 m above ground level (Figure 3). MLR Southern Emu-wrens occur in dry-heath in Deep Creek Conservation Park. This may be shrubland with frequent species including common oak-bush *Allocasuarina muelleriana*, tall oak-bush *A. striata*, beaked hakea *Hakea rostrata*, Mount Lofty bush-pea *Pultenea involucrata*, thyme-leaf spyradium *Spyridium thymifolium*, and yacca *Xanthorrhoea semiplana*, or sometimes low open forest with a heath understorey and open canopy of messmate stringybark *Eucalyptus obliqua* or brown stringybark *E. baxteri*. MLR Southern Emu-wrens were also found in dry-heath at Cox Scrub Conservation Park prior to an extensive fire in February 1983. They occasionally occur in open samphire/lignum *Muehlenbeckia florulenta* floodplains with cutting grass *Gahnia trifida* (e.g. Finniss), and reedland (primarily common reed *Phragmites australis*, with scattered *Leptospermum lanigerum*, e.g. Black Swamp).



Figure 3. Wet-heath on private property near Nangkita on the Fleurieu Peninsula (photo. David Edey).

Most (80%) existing sub-populations of MLR Southern Emu-wrens are confined to swamp habitat on private property on the Fleurieu Peninsula. Once covering extensive areas of the peninsula, this habitat now exists mostly as small patches of less than 5 ha (Littlely and Cutten 1994), often isolated and degraded through grazing and draining (Figure 2). It is unclear whether the MLR Southern Emu-wren has any preference for wet habitats or is simply utilising the only vegetation remaining in the region that has a dense understorey at the 0–1m level.

Estimates from the 1993 survey (Littlely and Cutten 1994) showed that approximately 2094 ha of swamp previously existed on the Fleurieu Peninsula, but this has been reduced to 1567 ha (75%). Of this only 545 ha (26% of the original total area) are still in relatively good condition and the remaining 1022 ha (49% of the original total area) exist as severely degraded swampland. Swamps were considered to be in relatively good condition if they contained a structure and species component resembling their natural

state, although many were lightly to moderately grazed. Swamps were considered to be severely degraded if they retained some native vegetation but were affected by a higher level of grazing. The size of these swamps varies, but 75% are less than 5 ha.

2.5 Breeding

Little published information on the breeding biology of the Southern Emu-wren was available prior to the commencement of the Recovery Program in 1995. Most information was from Fletcher (1913, 1915), who observed the Tasmanian subspecies, and a variety of sources cited in Schodde (1982). More recent information regarding Southern Emu-wrens in captivity is provided in Hutton (1991). However, banding and monitoring activities of the Recovery Program to date represent the first comprehensive study of colour-banded emu-wrens ever undertaken, and a great deal of useful data has been collected. A summary of results of this research is currently in preparation (Pickett, in prep.).

The MLR Southern Emu-wren breeds in the spring–summer months. Territories are set up during the breeding period by individual pairs alone (unlike the co-operative breeding behaviour in fairy-wrens *Malurus* spp.), and vary in size from less than half a hectare to up to several hectares (G. Ragless, D. Smith, and D. Murfet, pers. comm. 1994; Pickett, in prep.). These territories may be abandoned outside the breeding period, when emu-wrens seem to move more widely about their habitat. In general, two broods are raised during the spring–summer breeding season; the first during September–November, and a second during December–February (Pickett, in prep.).

The female Southern Emu-wren apparently builds her nest unaided, although accompanied by the male, within a week (Fletcher 1913) to about 10 days (Hutton 1991). The nest is made from interwoven thin, soft dry stems and leaves of grass and sedge, and sometimes strips of bark and rootlets, bound on the outside with sparse spiders' web and egg cases, and scantily lined inside with feathers, finer grass, fur and plant down (Schodde 1982). The nest is globose, but more rounded, rougher and looser than a fairy-wren's. The side entrance is wide, possibly to make way for the long tail (Schodde 1982), and is probably enlarged somewhat by the adults when feeding the young (McGilp 1921). Nests are usually situated 0–1 m from the ground in dense vegetation, e.g. rush *Juncus* spp., *Leptospermum* spp. and *Empodisma minus* in Fleurieu Peninsula swamps (see Figure 4). Most Southern Emu-wren clutches comprise three eggs similar in size and colour to those of the Superb Fairy-wren; i.e. 16–17 mm x 12–13 mm, creamy white with sparse to moderate speckling and fine blotching of reddish-brown concentrated mostly at the larger end (Schodde 1982). The female lays one egg per day in the morning on consecutive days and incubates unaided by the male for 10–12 days. The first few days of brooding are by the female, with the male in attendance, apparently keeping watch (Fletcher 1915). No trapped male MLR Southern Emu-wrens have been found with a brood (incubation) patch during the breeding season (Pickett, in prep.), suggesting that male emu-wrens participate little in incubation and brooding. Hutton (1991) found that the male of a captive pair of the south-western WA subspecies occasionally relieved the female, but only for very short periods.

When first hatched the young Southern Emu-wrens are naked, but quickly develop tufts of blackish down on the head, shoulders and tail. The chicks' eyes are open by day four or five and they beg for food. The blue feathers of the males appear on the fifth day, making the sexes identifiable in the nest. By day eight, well-grown wings and body plumage have developed, and the chicks leave the nest at about 10 days. Both parents then feed the young, which, after fledging, remain highly cryptic in dense vegetation for up to a week, before they are strong enough to follow their parents (Fletcher 1913, 1915).

Juvenile Southern Emu-wrens may become independent at about two months of age, and those from the first brood usually disperse at this age, and the female nests again (Fletcher 1915; Pickett, in prep.), although exceptions have been recorded (Fletcher 1915). This precocial pattern may be viewed as a symptom of early maturity, and seems to fit the habit that emu-wrens have of breeding in dispersed pairs (Schodde 1982). This is in contrast to the social organisation of fairy-wrens in which young 'helper' males often remain with their parents and 'co-operate' in the rearing of successive broods (Rowley and Russell 1997). Young emu-wrens from the second brood, however, generally remain with their parents into the autumn–winter non-breeding period until dispersing some time prior to the next breeding season (Fletcher 1915; Pickett, in prep.), although their dispersal prior to a third (consecutive) nesting and successful fledging of young may also occur (one record; Pickett, in prep.).

Recently, good observational evidence of inbreeding amongst closely related (mother–son, brother–sister) MLR Southern Emu-wrens has been acquired (Pickett, in prep.). The likelihood of extra-pair copulations (involving more distantly related emu-wrens) effectively nullifying an inbreeding interpretation is small, since the sub-population concerned has been monitored regularly and apparently comprised only closely related individuals during the breeding activities considered. It is important though, to recognise that the evidence is not conclusive, and that further support of the observed inbreeding from genetic analysis of tissues collected is desirable (M. Pickett, pers. comm. November 1998). The effects of inbreeding upon small sub-populations of emu-wrens are unknown, and knowledge of such would be useful in the ongoing development and implementation of appropriate conservation options for the MLR Southern Emu-wren.



Figure 4. MLR Southern Emu-wren nest, post-breeding, located in swamp near Nangkita on the Fleurieu Peninsula (photo. David Edey).

2.6 Diet

Published information on the diet of Southern Emu-wrens is limited. Barker and Vestjens (1984) list a large variety of arthropods, chiefly insects. Common food items, recorded from stomach contents and observations of feeding, are spiders, moths, butterflies, caterpillars, leaf-eating beetles, weevils, wasps, ants, bees, and water-beetles. Insect and spider eggs, seeds and pieces of vegetable matter have also been mentioned as food items (Fletcher 1915; Morgan 1919; Schodde 1982). Banding and monitoring activities under the Recovery Program to date have facilitated the opportunistic collection of a large number of emu-wren droppings (from bird holding-bags), and analysis of the remains of arthropods in these should provide useful (albeit biased) information regarding MLR Southern Emu-wren diet.

Emu-wrens use their curved beak, flanked with stout rictal bristles to protect the eyes, to glean along the shrubbery, and occasionally hawk for prey. Fletcher (1915) reported the stems of pale rush *Juncus pallidus* as an important food supply, the emu-wrens splitting open stems of reeds and rushes to obtain insects. In a common feeding method in shrubby habitat, emu-wrens work around and up through a shrub and then flit from there down to the base of the next shrub to start again.

2.7 Existing Conservation Measures and Community Awareness

The MLR Southern Emu-wren is severely under-represented in the parks system, being found in only one SA conservation reserve; Deep Creek Conservation Park. Emu-wrens were recorded in Cox Scrub

Conservation Park prior to a bushfire in 1983 which burnt almost the entire park. Maps showing known emu-wren sites in Deep Creek Conservation Park and Second Valley Forest (includes several areas of state forestry reserves in the Deep Creek/Parawa region of the Fleurieu Peninsula) have been distributed to rangers and forestry officers for consideration in future reserve management. Support for the MLR Southern Emu-wren Recovery Program has been included among principal management strategies in the *Deep Creek and Talisker Conservation Parks Management Plan* (Fleurieu District, Natural Resources Group 1997). Forestry and conservation park officers engage in frequent communication with Recovery Program personnel with regards to MLR Southern Emu-wren recovery activities in their areas.

Six of the 11 Fleurieu Peninsula swamps listed on the National Estate Register contain MLR Southern Emu-wrens. Most of these were nominated following a survey carried out almost 20 years ago (Lamprey and Mitchell 1979), and the presence of emu-wrens was not a reason for nomination.

The majority of MLR Southern Emu-wren sites (an estimated 80%) are on privately owned land involving approximately 40 properties. Prior to 1993, landholders in the district were generally unaware of the high conservation value of their swamps. Many did not realise that swamps contained native vegetation protected from clearance under the South Australian *Native Vegetation Act 1991*. Traditionally, swamp-owners on the Fleurieu Peninsula had regularly burnt, grazed, slashed and/or drained parts of their swamps, either through ignorance or through exemptions under the Act. In many cases these activities still continue.

Most swamp owners on the peninsula have been visited and supplied with a plant species list for their swamp, a colour photograph of the MLR Southern Emu-wren and general information about the emu-wren and its swamp habitat. Many landholders have sought further information and some have expressed interest in fencing and/or rehabilitating swamps. This interest should continue to be encouraged, but must be guided in the long-term by the results of emu-wren and habitat monitoring and research into the effects of activities such as grazing, burning and slashing. The local community, particularly landholders, is developing a sense of ownership of MLR Southern Emu-wrens and their habitats, and this sense of ownership must continue to be fostered.

Recent conservation actions, including Actions from the previous Recovery Plan (Littlely and Cutten 1994), include the following:

- documentation of the numbers and locations of emu-wrens and the size and condition of their habitats;
- liaison with landholders and other decision-makers about actions in the Recovery Plan;
- gathering information from landholders about the management histories of their swamps;
- preparation of a draft revegetation strategy for the Fleurieu Peninsula swamps (final draft to be subject to landholder and community consultation);
- fencing, rehabilitation and/or re-establishment of four privately owned swamps, with two further landholders expressing the desire to rehabilitate a degraded swamp over time (this Action is being assisted by the Compass Creek Care Landcare Group and Willunga Trees for Life);
- postponement of burning by three landholders, in one case until emu-wrens had fledged, and in the other two cases indefinitely until the potential effects of burning on swamp ecology are better understood;
- establishment and training of a network of volunteers to assist with field and office activities; and preparation of occupational health and safety guidelines for volunteers;
- a biological survey of the Fleurieu Peninsula Swamps (Littlely 1998) for the Nature Conservation Society of SA, funded by the Australian Heritage Commission's National Estate Grants Program; a report on the survey has been widely circulated to landholders, regional planning bodies, community groups and schools;
- execution of manipulative experiments in swamps on six private properties to develop swamp management guidelines, particularly for burning, grazing and slashing regimes (the local Country Fire Service provided voluntary assistance with controlled burns);
- establishment of photopoints and monitoring plots in two swamps affected by wildfire in 1997;
- monitoring of population dynamics such as breeding success, recruitment, dispersal, mortality, habitat preference and territory/home range sizes;
- requests from landholders at the study sites for copies of capture data and reports;
- initiation of a literature review on translocation;
- initiation of the annual MLR Southern Emu-wren population census;

- production and distribution of fact sheets, a colour brochure featuring the MLR Southern Emu-wren and the Fleurieu Peninsula swamps with assistance from the Threatened Species Network (TSN) and Mt Lofty Ranges Catchment Program, colouring-in sheets for children;
- creation of an emu-wren display for show at regional banks, libraries, shopping centres and festivals;
- collaboration with the TSN(SA) to promote the MLR Southern Emu-wren and Fleurieu Peninsula swamps as the feature threatened species and habitat, respectively, for Threatened Species Month in SA in September 1997; media coverage for this event included articles in six newspapers and seven newsletters, segments on four television and three radio programs, and displays at the SA Museum and Mt Lofty Summit Information Centre; this extensive coverage resulted in a large number of enquiries from the local community about the project and endangered species protection, and led to an increase in voluntary support for the project;
- ongoing collaboration with the TSN resulting in referral of volunteers to the Recovery Program, the publication of a colour poster in the *Advertiser* and widespread media coverage;
- ongoing collaboration with the Threatened Bird Network resulting in MLR Southern Emu-wrens being featured in a poster and the referral of volunteers from interstate and overseas;
- talks to schools, conservation groups, landholder groups, the public and at conferences;
- organisation of a colouring-in competition for children offering over \$2000 in donated prizes;
- Leona Woolcock donating 25 copies of her book *Eden in a Bog: A Mt Lofty Ranges Swamp* (Woolcock, 1993) to be sold through the Conservation Council of SA bookshop and other locations to raise funds for on-ground works;
- continuing use of the Population Viability Analysis (Littlely and Cutten 1996) as a study guide for students at the University of Adelaide;
- collaboration with the Mt Compass Primary school which manages a swamp containing MLR Southern Emu-wrens, boardwalk and information centre;
- completion of a trial census in 1998 which tested and established methods for future census; and
- collaboration with the Mt Lofty Ranges Catchment Program in whole of landscape catchment management programs in the Tookayerta catchment; and collaboration with the Local Action Planning groups and local governments.

2.8 Reasons For Listing

2.8.1 Degree of decline

It is generally accepted that there has been a severe decline in the total number of MLR Southern Emu-wrens due to the large reduction in available habitat over the last century (Garnett 1992a; Littlely and Cutten 1994). Since the earliest dated museum records MLR Southern Emu-wren populations are known to have disappeared from six specific sites (i.e. at Toadspring Swamp and the five sites listed in 2.3.1). The disappearance at the Toadspring Swamp site has occurred within the last five years. MLR Southern Emu-wrens have not been seen in Cox Scrub Conservation Park since fires in 1983, nor have they been observed recently in some areas where previously recorded (e.g. Hindmarsh Tiers, and Willow Creek).

2.8.2 Causes of past decline

The population of MLR Southern Emu-wrens has been greatly reduced by clearance, degradation and fragmentation of both swamp and dry-heath habitat. Land clearance for primary production activities has been extensive on the Fleurieu Peninsula. Large areas have been developed for sheep and cattle grazing, dairying, forestry, and horticulture. Water resource management has seen many natural drainage systems modified through construction of dams for water storage, and drains to divert water from potentially productive sites. Fragmentation of habitat has exacerbated problems since isolated local populations of emu-wrens are now highly vulnerable to catastrophic events such as fire, with local extinctions known to have occurred as a consequence of such events (e.g. Cox Scrub Conservation Park and Toadspring Swamp sub-populations, lost as a result of bushfires in February 1983 and January 1997 respectively). In addition to outright clearance of previously available emu-wren habitat, degradation of remaining habitat by slashing, burning, draining, and heavy grazing has further contributed to the reduction in MLR Southern Emu-wren habitat on the Fleurieu Peninsula.

Introduced predators such as the Fox *Vulpes vulpes*, Cat *Felis catus*, and Black Rat *Rattus rattus* may prey upon the MLR Southern Emu-wren, however very little information is available on predation of emu-wren eggs, nestlings, juveniles or adults by introduced or other predators.

2.8.3 Continuing threats

2.8.3 a) Fragmentation of habitat

MLR Southern Emu-wren swamp habitat remains only as small, isolated patches on the Fleurieu Peninsula. Individual MLR Southern Emu-wren sub-populations appear to be confined to these areas due to an apparent inability or reluctance to fly long distances across the open spaces separating the swamps. The average distance between adjacent swamps on the peninsula is 1.7 km and the average distance between existing MLR Southern Emu-wren sub-populations is 3.4 km, ranging from 850 m to 8350 m (Littlely and Cutten 1994). At some times of the year (e.g. spring/summer when grazing pressure is low) swamps along the same drainage line are connected by high pasture growth and/or scattered sedges, twig-rushes or reeds. Emu-wren movements that have been recorded between swamps of this nature within and near to the Recovery Program study site population at Nangkita probably occurred through this type of connective vegetation (Pickett, in prep.). MLR Southern Emu-wrens have been observed utilising blackberry *Rubus* sp. amongst rough pasture for short-distance movement (<280 m) between habitat patches at the study site. No inter-swamp movement of MLR Southern Emu-wrens has been observed through scrub or woodland (*ibid.*).

Juvenile emu-wrens leave their parents at a relatively early age, perhaps to ensure their dispersal to new areas (Schodde, 1982). Where populations are isolated, however, successful dispersal may not be occurring. Very few banded MLR Southern Emu-wren juveniles from the Recovery Program study site have been recruited to the breeding population at the site (Pickett, in prep.). The fate of MLR Southern Emu-wrens no longer observed at the study site is unknown.

Banding and monitoring has revealed only three relatively long-distance movements by individual emu-wrens. A male and female (apparently together) moved approximately 2.5 km and were observed at the new location on three consecutive visits over three months, but have not been recorded there since, despite searches of the site. A female moved an estimated 3 km but was not seen at the site after the first observation. These movements were to sites in which emu-wrens had not previously been recorded, despite periodic searches, but which appeared to be suitable as emu-wren habitat. Importantly, the sites from and to which the emu-wrens moved are connected by essentially contiguous swamp, thus suggesting the importance of suitable connective vegetation between habitat patches in order to facilitate dispersal (Pickett, in prep.).

The isolation of MLR Southern Emu-wren sub-populations in many swamps may place them at risk of inbreeding depression. As previously mentioned, there is some evidence that inbreeding amongst closely related individuals may have occurred at the Nangkita study site (see 2.5).

Actions 1, 2, 3, 4 & 7

2.8.3 b) Small population size

The small population, estimated to be less than 500 individuals, combined with a suite of threatening processes places the MLR Southern Emu-wren at serious risk of extinction.

Actions 1, 2, 3, 4 & 7

2.8.3 c) Fire and flood

The two largest sub-populations at Deep Creek Conservation Park and Finniss together comprise most of the entire population of MLR Southern Emu-wrens. A wildfire at either of these locations would severely reduce the total population of emu-wrens. Wildfire has caused local extinctions of smaller MLR Southern Emu-wren sub-populations (e.g. Cox Scrub Conservation Park in 1983, and Toadspring Swamp in 1997), and there is a risk of incremental loss of sub-populations if isolated habitats that experience fire are not recolonised.

A great deal of MLR Southern Emu-wren habitat along the outer edges of river systems, such as the Tookayerta Creek and Finniss River systems, has been cleared or grazed and emu-wrens may be forced to nest closer to the main channels. This may be placing them at greater risk from flood (J. Eckert, R. Taplin, pers. comm. 1994).

Actions 1, 2, 3, & 4

2.8.3 d) Alteration of habitat

Private properties which contain MLR Southern Emu-wren habitat range from 10 ha to several hundred hectares in size and owners include subsistence farmers, hobby farmers and large commercial enterprises with employed managers. These factors contribute to a suite of management practices. On some properties 'maintenance' of swamp areas by grazing, slashing and burning is rather severe and poses a continuing threat to MLR Southern Emu-wren populations. These practices are performed by some landholders to ensure that swamps do not expand into surrounding pasture and do not become 'overgrown' and/or pose a fire hazard. Less severe practices such as light grazing appear to be tolerated by MLR Southern Emu-wrens, at least in the short-term, as the vegetation remains sufficiently dense and the size of the swamp remains constant.

The total clearance of swamps by spraying, slashing, draining, burning, and severe grazing is generally not permitted under the South Australian *Native Vegetation Act 1991*. Clearance still does occur, however, either through ignorance or through exemptions under the Act, and is having a significant impact on the small area of remaining MLR Southern Emu-wren habitat.

Exemption 1(1)(q) of the *Native Vegetation Act 1991*, states that native vegetation may be cleared where '(i) the land on which the vegetation is situated was used for cultivation, pasture or forestry within five years immediately before the proposed clearance occurs; (ii) the clearance is necessary to maintain the land so that it can continue to be used for cultivation, pasture or forestry to the extent to which it had been used for that purpose within the immediately preceding five years; and (iii) (A) the vegetation has a stem diameter at the lowest point on the stem above ground level of 150 millimetres or less; or (B) the vegetation is of the genus *Xanthorrhoea*'. Thus, in swamps that fall into this category, regrowth of up to five years in age (which may include edges and/or interior) may be cleared. Similarly, landholders are able to graze their swamps provided the land is grazed by the same species and at the same grazing pressure at which it has been carried out over the last 10 years. Grazing requirements will often vary from year to year, depending on the season and amount of available pasture, so monitoring of this practice is difficult, and many swamps slowly deteriorate over time as a result.

Burning is defined as a form of clearance and is therefore included under exemption 1(1)(q) above. However, many landholders will leave their burning swamps to extinguish naturally, so the area burnt may be larger than the area that is actually exempt. In some cases 1(1)(q)(iii)(A) is misinterpreted by landholders as an exemption which allows swamp vegetation with narrow stems to be cleared, regardless of the applicability of (i) and (ii) above (M. Crawford, pers. comm. October 1998).

In parts of the Fleurieu Peninsula property changes ownership every five years on average (M. Crawford pers. comm.). New owners (or managers) are not always aware of the conservation significance of their swamps and some may alter existing management practices to the detriment of swamp habitat. Properties closer to Adelaide (i.e. in the Mt Compass–Nangkita area) may be subject to pasture improvement and intensification of land use as a flow-on effect of urban sprawl.

Actions 1, 2, 3, 4 & 7

2.8.3 e) Water quantity and quality

Reductions in water quantity and quality, especially those in the Mt Compass–Nangkita area, may affect MLR Southern Emu-wren swamp ecology. Factors relating to water quantity include sand mining at the source of springs near Mt Compass (because the sand collects and stores water in winter, releasing it to the spring system throughout the year), the level of water allocation for agricultural use, dams, drains, and groundwater extraction associated with horticulture and intensification of land use. Factors affecting water quality include herbicides, pesticides, and increased nutrient loads from fertilisers and effluent from stock. Poor catchment management would adversely impact on many business ventures in the region, including a trout farm and 'natural spring water' suppliers.

Actions 2, 3, 4 & 7

2.8.3 f) Lack of scientific knowledge of the effects of current management practices on swamp habitat

The effects of current management practices on MLR Southern Emu-wren habitats are largely unknown. Initial observations from swamp management experiments have indicated that light grazing or patch burning could help maintain plant diversity and general biodiversity in swamps over time, although not

when performed simultaneously. Whether it is desirable in the long-term to maintain biodiversity at a certain level by using practices such as these is also unknown. Many species of marsupials that used to fulfil the grazing role have disappeared from the Fleurieu Peninsula, and the remaining Western Grey Kangaroos *Macropus fuliginosus* seem to spend more time grazing pasture than swamp.

Actions 2, 4 & 7

2.8.3 g) Predators

The MLR Southern Emu-wren's natural predators may include the Red-bellied Black Snake *Pseudechis porphyriacus*, Tiger Snake *Notechis scutatus*, Water Rat *Hydromys chrysogaster* and birds of prey. Due to the MLR Southern Emu-wren's secretive nature few observations have been made relating to predation, however many landholders have reported an apparent increase in Fox and Cat numbers in and around swamps. As previously mentioned, introduced predators such as the Fox, Cat, and Black Rat may prey upon the MLR Southern Emu-wren, however very little information is available. Prior documentation of predation on the MLR Southern Emu-wren is limited to one record of predation by a domestic Cat (D. Paton, pers. comm.) and one observation of a dead nestling being consumed by a spider (taxon unknown) (G. Ragless, pers. comm. 1998).

Actions 2, 3 & 4, 7

2.8.3 h) Lack of allocation of swamp habitat to reserves

The Fleurieu Peninsula swamps are severely under-represented in the parks system with only 4% conserved (Williams and Goodwins 1987). These swamps are considered a threatened habitat type (Davies 1982; Lang and Kraehenbuehl 1987; Williams and Goodwins 1987) containing many threatened plant species of which many are endemic to the Mt Lofty Ranges (Littlely 1998).

Action 6

2.9 Biodiversity Benefits of Conserving the MLR Southern Emu-wren

In 1999 some of the Fleurieu Peninsula swamps will be nominated through the Recovery Team as Threatened Ecological Communities under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

Protection and appropriate management of MLR Southern Emu-wren habitat will conserve a wide variety of taxa, many of which are presently recognised as being of high conservation significance on a regional basis. Biodiversity benefits to swamp ecological communities are viewed as being closely associated with the implementation of MLR Southern Emu-wren conservation objectives.

As previously mentioned, Fleurieu Peninsula swamps are essentially unrepresented in the SA reserve system. Both Davies (1982) and Williams and Goodwins (1987) described these swamps as being in critical need of further conservation. Appropriate conservation efforts directed at the MLR Southern Emu-wren can be expected to enhance and encourage conservation of these particularly important ecological communities.

Lang and Kraehenbuehl (1987) calculated that 42% of the plants of conservation significance on the Fleurieu Peninsula are confined to upland freshwater swamps. The 1993 survey (Littlely and Cutten 1994) and subsequent vegetation survey (Littlely 1998) have confirmed this very high incidence of plants of conservation significance within the swamps. Littlely and Cutten (1994) and Littlely (1998) provide lists of plant species recorded from 41 and 12 swamp sites on the Fleurieu Peninsula respectively. The survey of 41 sites recorded 66 plants of conservation significance, and the survey of 12 swamp sites recorded 54 plants of conservation significance, although many species were common to the resulting two species lists (Littlely 1998).

Findings regarding MLR Southern Emu-wren behaviour and management may be of invaluable assistance in the conservation of other species/subspecies of emu-wren. The Mallee Emu-wren *S. mallee* and the Eyre Peninsula Southern Emu-wren *S. malachurus parimeda* are both listed as Vulnerable in *The ANZECC List of Threatened Australian Vertebrate Fauna (1995)*, and *The Action Plan for Australian Birds* (Garnett 1992b).

Other threatened birds which would benefit from efforts to conserve the MLR Southern Emu-wren include the Lewin's Rail *Rallus pectoralis* (Vulnerable), Spotless Crake *Porzana tabuensis* (Rare), Latham's Snipe *Gallinago hardwickii* (Vulnerable), and Golden-headed Cisticola *Cisticola exilis* (Rare), (Schedule 1, *National Parks and Wildlife Act 1972*). Each of these species has been recorded in swamps utilised by MLR Southern Emu-wrens and also in other swamps which comprise apparently suitable emu-wren habitat (M. Pickett, pers. comm. November 1998).

Other vertebrate fauna which would benefit include a range of species of conservation significance that have been recorded in Fleurieu Peninsula swamps. Included are several threatened native fish (threatened in SA; Lamprey and Mitchell, 1979), the Yellow-bellied Water Skink *Eulamprus heatwolei* (considered vulnerable in SA; preliminary classification, M. Hutchinson in Littlely 1988), and Bibron's Toadlet *Pseudophryne bibronii* (considered rare in SA; preliminary classification, M. Hutchinson in Littlely 1988).

Fleurieu Peninsula swamps are also regionally important in terms of invertebrate conservation. Numerous important swamps occur along the Tookayerta Creek. A study of the aquatic macroinvertebrate fauna of this creek system (Suter 1987) found the most diverse mayfly (Ephemeroptera) and stonefly (Plecoptera) faunas in SA, and identified two species unique to the catchment; *Nousia fuscata* (Ephemeroptera), and *Leptoperla tasmanica* (Plecoptera). Furthermore, of the 143 taxa recorded, 24 had not previously been recorded from any other stream in the Mt Lofty Ranges or the River Murray in SA. More recent sampling efforts in Fleurieu Peninsula swamps (Littlely 1998) found several beetles of significance: *Acanthoferonia ferox* (Carabidae), previously thought to be extinct; *Platynectes bakewelli* (Dytiscidae), first record for SA; *Parosten gibbir* (Dytiscidae), a rare species; and a new species of *Cyphon* (Scritidae).

2.10 Recovery Strategy

Note: The terms 'Research Action' and 'Management Action' in parentheses refer to the 1994 Recovery Plan (Littlely and Cutten, 1994), while all other actions in parentheses refer to this Recovery Plan (see section 4.0).

2.10.1 Recovery strategy pre-October 1998

In 1993 a survey of MLR Southern Emu-wren habitats and numbers confirmed the endangered status of the MLR Southern Emu-wren (Littlely and Cutten 1994). Analysis of the threats and subsequent searches of potential habitat have indicated that the MLR Southern Emu-wren is Critically Endangered in terms of the IUCN Red List Categories (IUCN SSC 1994).

A banding and monitoring site was established within a swamp system near Nangkita in November 1994 (Research Action 1). This small study site has provided information on MLR Southern Emu-wren breeding success, longevity, home ranges, social organization, movement between patches of habitat within the site and dispersal to adjacent areas. A full report of this research is currently in preparation (Pickett in prep.) although a partial report is included in Littlely, Squire and Pickett (1998).

In 1997 experiments were initiated to investigate the effects of stock grazing and burning on swamp vegetation and opportunistic data has been collected on the response of swamp vegetation to a wild fire at another site. Information on current landholder management practices, attitudes and awareness has been gathered as part of this action (Research Action 2).

Genetic studies based on mitochondrial DNA (mtDNA) have been conducted at the SA Museum. Preliminary results indicate genetic distinction between the northern MLR Southern Emu-wren sub-populations at Nangkita–Mt Compass and the southern sub-populations at Parawa–Deep Creek Conservation Park (Research Action 3). This may have implications for any translocations that are proposed, and would need to be confirmed by analysis of MLR Southern Emu-wren nuclear DNA, i.e. microsatellites, as the results so far from the single genetic marker (mtDNA) can be subject to alternative interpretations that are not compatible with population isolation.

The impact of predators was briefly assessed (Research Action 4) and predators were found to be a lower priority threat to MLR Southern Emu-wrens than other threats. Consequently Cat and Fox control (Management Action 6) was not carried out as part of the Recovery Project, although it remains a recommended management action for properties on the Fleurieu Peninsula.

In 1996 a Population Viability Analysis (Littlely and Cutten 1996) using the Analysis of the Likelihood of Extinction program (Possingham, Lindenmeyer and Norton 1993) identified critical biological parameters and management options for the MLR Southern Emu-wren based on existing data (Research Action 5). The main threats are considered to be habitat fragmentation, low emu-wren numbers, habitat degradation, a suite of incompatible management practices and lack of knowledge or awareness on the part of land managers and the broader community in relation to MLR Southern Emu-wrens and their habitats (Littlely and Cutten 1996).

Liaison by ornithologists and botanists involved in field work has resulted in some improvements in landholder management of swamps and consideration of MLR Southern Emu-wrens in the management of forestry and conservation reserves (Management Action 1).

The swamp management experiments and discussions with landholders about their traditional management practices have contributed to the preparation of a Management Strategy for the Fleurieu Peninsula Swamps (Research Action 2).

On-ground vegetation works have occurred at several properties and include fencing swamps to restrict access by stock, controlled burns, weeding and revegetation (Research Action 3). This action has involved a high degree of landholder and community support. Priority sites for rehabilitation, habitat enhancement and the re-establishment of habitat connections have been identified (Littlely unpubl.), but a consultation process needs to be completed.

Although the re-introduction of MLR Southern Emu-wrens to suitable sites was de-prioritised for this period, a literature search on translocation methods commenced in 1998 (Management Action 4).

Publicity and community activities conducted throughout the program have led to increasing requests for written information, swamp visits, and community involvement. The MLR Southern Emu-wren is now a 'well-known' threatened species and awareness of the conservation value of its habitats has increased significantly, particularly in the local region (Management Action 5).

2.10.2 Recovery strategy post-October 1998

Landholders have demonstrated a willingness to become involved in the recovery of MLR Southern Emu-wrens and their habitats in 1999–2003 and beyond, and an important component of recovery will be on-ground vegetation works (under **Action 1**).

In 1999 a botanist will assess the 18 priority sites which have been identified for revegetation and rehabilitation (Littlely unpubl.) and recommend any additional sites for rehabilitation, habitat enhancement and habitat connection to benefit MLR Southern Emu-wrens, in consultation with the local community (**Action 1a**).

Of the estimated 545 ha of intact and semi-intact swamp on the Fleurieu Peninsula, it is anticipated that 125 ha can be actively rehabilitated over five years. These figures are significant given that the MLR Southern Emu-wren is considered to currently occupy (see 2.2 Status) less than 590 ha of habitat. In addition, 50 ha of moderately degraded swamp have been identified for revegetation as corridor habitats to link fragmented swamps and a target of 10 hectares per year over five years is achievable (**Action 1b**). There is every indication that the high degree of landholder and community involvement and their in-kind contributions, as demonstrated in Research Action 3 above, will continue. These on-ground vegetation works will decrease the fragmentation of MLR Southern Emu-wren sub-populations and increase the amount of available habitat, and should contribute to an increase in MLR Southern Emu-wren numbers.

In addition to on-ground vegetation works it will be important to analyse vegetation with a view to maximising the quality of MLR Southern Emu-wren habitats (under **Action 2**).

It is known the MLR Southern Emu-wrens currently occupy some swamps and dry-heaths and not others, and within occupied swamps and dry-heaths they use parts of these habitats more frequently than other parts. In 2000 and 2001, after one and two years of emu-wren observations in action 5b, a botanist will measure the key structural and floristic features of preferred emu-wren habitat. The results will enable future revegetation programs to focus on high priority areas and provide for best practice management of

emu-wren habitats (**Action 2a**) with a view to maximising MLR Southern Emu-wren numbers per unit area of vegetation managed. In addition, a vegetation check sheet will be prepared to enable landholders and volunteers to monitor and score the quality of vegetation in terms of suitability for MLR Southern Emu-wrens.

Ultimately the success of the recovery program for the MLR involves managing swamp habitats for MLR Southern Emu-wrens while maintaining rare plants and the 'nature' of these threatened communities. Continued measurement of the response of swamp vegetation to grazing and burning trials, and opportunistic measurement of the effects of chemical spraying, draining, slashing, wildfire and destocking on swamp vegetation (**Action 2b**) will determine which of these widely used management actions (or events) produce preferred biodiversity outcomes. Measurements would run from 1999 to 2002 and reporting of results would occur in 1999, 2002 and 2003.

Of the estimated 545 ha of intact and semi-intact swamp on the Fleurieu Peninsula, an estimated 420 ha will not be actively rehabilitated in action 1b. It can, however, be rehabilitated through improvements in management practices and vegetation monitoring. To this end a draft Swamp Management Strategy will be circulated for comment in 1999 and completed in 2001. By 2001, results from the measurement of key habitat features, the vegetation check sheet (both from Action 2a) and interim results from swamp management experiments (from Action 2b) will be added to the Swamp Management Strategy package as habitat management guidelines (**Action 2c**). Under this action landholders, other stakeholders and interest groups would be trained in relation to the habitat management guidelines and monitoring in 2002, and there will be a minor update of the guidelines in 2003 when the final report on the swamp management experiments is available (from action 2b).

The strategy (Action 2c) will pinpoint priority swamps for conservation of biodiversity and threatened species, swamps that could be regenerated and/or replanted, swamps requiring specific management (such as burning or weed control), areas for potential creations of links and areas requiring future research. (Action 1a involves specifically identifying and mapping high priority sites for vegetation work and, in consultation with landholders, site-specific project development.)

The guidelines for land managers on the Fleurieu Peninsula (Action 2c) will include information on legal aspects of swamp management, the effects of burning and grazing on vegetation and wildlife and corresponding recommendations on conditions under which these practices should be carried out. They will also include lists of flora and fauna from several swamps and include recognition of threatened species, primarily the MLR Southern Emu-wren.

Community extension and public relations programs will occur under **Action 3**. This will involve ongoing liaising with natural resource planners and managers at all levels with the Fleurieu Peninsula to facilitate the formal recognition of MLR Southern Emu-wrens and their habitats in planning processes (**Action 3a**). The community extension officer will also endeavour to establish a community group(s) with the skills and commitment to actively monitor MLR Southern Emu-wrens and their habitats beyond the life of this Recovery Plan (**Action 3b**). The actions of the Recovery Plan will be promoted regionally and beyond to increase awareness of MLR Southern Emu-wrens and their habitats and increase volunteer involvement in recovery actions (**Action 3c**).

Another component of the Recovery Program will involve measuring and monitoring the key indicators of emu-wren performance under **Action 4**.

An ornithologist will determine the 'hot' and 'cold' spots in swamps and dry-heath where MLR Southern Emu-wrens are frequently and infrequently recorded during 1999 and 2000 (**Action 4a**). The floristic and structural vegetation features of these spots will be determined under Action 2a.

In conjunction with action 5a, the key performance response (home range, breeding success, dispersal and recruitment) of MLR Southern Emu-wren sub-populations at selected management sites in relation to environment (type, shape, size and fragmentation of habitat) will be monitored (**Action 4b**). Detailed observations in one site suggest that the ability to disperse and/or survival of juveniles during the first year are limiting factors to recovery. However this work is based on a single site and may not reflect demographic patterns for the population as a whole. These patterns need to be confirmed over two years so that on-ground management actions can confidently address these limiting factor(s) to population growth. After two years this action will measure the response of MLR Southern Emu-wrens to on-ground

management such as enhancement and re-establishment of their habitats to ensure improved performance and thus population growth of MLR Southern Emu-wrens.

A census will be conducted in 1999, 2001 and 2003 to indicate if adult MLR Southern Emu-wrens and their sub-populations are changing in number or distribution over time (**Action 4c**). Any increases, decreases or discoveries of new sub-populations may impact on management and awareness-raising actions and indicate the effectiveness of on-ground recovery actions.

Active management of MLR Southern Emu-wrens will occur under **Action 5**. A translocation strategy for emu-wrens would be prepared in 2001, with any best-practice translocation, if recommended, initiated in 2002 (**Action 5a**).

In consideration of translocations, the genetic distinction between the northern MLR Southern Emu-wren sub-populations at Nangkita–Mt Compass and the southern sub-populations at Parawa–Deep Creek Conservation Park will need to be confirmed. This would also occur in 2001 by analysing their nuclear DNA, i.e. microsatellites (**Action 5b**). If the distinction is confirmed this will indicate that the groups were not interbreeding prior to habitat disturbance by Europeans and may influence the MLR Southern emu-wrens chosen in any translocation strategy. In addition, the use of microsatellite markers will complement and efficiently enhance the information obtained from the measurement of emu-wren population performance indicators through banding (Action 5b) in terms of recruitment, dispersal, mate fidelity, and gene flow.

In the same year the Population Viability Analysis will be updated by adding data collected since 1996 (**Action 5c**) and the results applied to the translocation strategy to help determine source populations, the number of emu-wrens to be translocated and the sites which will receive emu-wrens.

In 1999, the recovery team will nominate at least some of the Fleurieu Peninsula swamps as a Threatened Ecological Community under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* in recognition of the conservation significance of the swamps (**Action 6**).

The recovery team, which has appropriate expertise, community standing and concern for conservation of the MLR Southern Emu-wren, will periodically review progress of the Recovery Plan and amend actions as required (**Action 7**).

In summary, the recovery project aims to increase the numbers of MLR Southern Emu-wrens and decrease fragmentation of the population. This is to be achieved through on-ground vegetation works, vegetation analysis, providing habitat management guidelines, abating major threats, facilitating long-term community involvement in and ownership of the recovery process, raising community awareness, monitoring the performance of emu-wrens, and intervening with a translocation program if required.

3.0 Recovery Objectives and Criteria

3.1 Overall Objectives:

Long-term:

Establish long-term community support structures for the ongoing recovery and management of the MLR Southern Emu-wren in the Fleurieu Peninsula as a Conservation Dependent (IUCN) taxon.

For the life of the plan:

Improve the status of the MLR Southern Emu-wren from Critically Endangered to Endangered (IUCN criteria) within five years (i.e. by 2004) by increasing the number of adult MLR Southern Emu-wrens, increasing the area, quality and extent of the habitats they use, and decreasing the fragmentation of MLR Southern Emu-wren sub-populations.

3.2 Recovery Criteria:

For the life of the plan:

A measured increase of 30% in the number of adult MLR Southern Emu-wrens and an increase of 30% in the area that they occupy due to implementation of the actions in this Recovery Plan.

Note: Limiting factors for the MLR Southern Emu-wren, in terms of the IUCN criteria, are the low numbers of mature individuals, small area of occupancy, and the severe fragmentation of habitat. A down-listing to the Endangered category can occur by 2004 by achieving a stable or increased: area of occupancy; area, extent and quality of habitat; and number of individuals (IUCN SSC 1994). Its threat rating could conceivably be down-listed to Endangered under criterion C with: a population much less than 2500 mature individuals; a continuing threat of decline of at least 20% due to the risk of wildfire at Deep Creek Conservation Park; and a continuing threat of decline due to severe fragmentation. With on-ground management and the development of community support structures as detailed in the Recovery Actions, the MLR Southern Emu-wren can be maintained as a Conservation Dependent (IUCN) taxon.

3.3 Specific Objectives:

1. Increase the area and quality, and decrease the fragmentation, of habitats used by MLR Southern Emu-wrens.
2. Increase regional planning recognition, protection, awareness and involvement of the community, and establish long-term support structures for the MLR Southern Emu-wren and its habitats.
3. Increase the numbers of adult MLR Southern Emu-wrens by at least 30%.
4. Operate the Recovery Plan through a Recovery Team.

3.4 Progress Criteria:

1. Demonstrated rehabilitation of 25 ha of MLR Southern Emu-wren habitat per year for five years. This includes:
 - completed mapping of at least 18 priority areas for habitat rehabilitation and re-establishment of habitat connections in full consultation with landholders within one year.
1. Measured re-establishment of 10 ha of habitat links per year for five years at selected sites.
2. Successful application of the Swamp Management Strategy, swamp management guidelines and vegetation monitoring check sheet that have been completed, adopted, endorsed, distributed and revised within five years. This includes:
 - completed reports on the response of swamp vegetation to management actions in the first, fourth and fifth years;
 - completed monitoring of habitat use by MLR Southern Emu-wrens within two years;

- identification of the key features of vegetation used by MLR Southern Emu-wrens and a completed vegetation monitoring check sheet within three years;
 - completed production and revision of the Swamp Management Strategy and swamp management guidelines in the first, third and fifth years;
 - completed skills transfer of swamp management and monitoring techniques to landholders and involved community groups in the fourth year; and
 - measured improvements in the management of swamps for MLR Southern Emu-wrens and their habitats in terms of grazing and burning regimes on private property within five years.
1. A measured increase in the level of protection of MLR Southern Emu-wrens and their habitats through the use of conservation covenants, letters of agreement and/or recognition in Property Management Plans within five years.
 2. Recognition of the significance of the species and its habitats by the major regional planning boards and within relevant forestry and reserve management plans, particularly fire management, within two years.
 3. Measured increased awareness, and involvement of land owners and other members of the community in the recovery of the MLR Southern Emu-wren; and identified structures in place to ensure the ongoing support of these activities in the region beyond the life of the Recovery Plan. This would include:
 - completed development of a communications strategy within six months;
 - demonstrated production of a six-monthly newsletter, information on the Internet within six months, completed revision and circulation of brochures and fact sheets within three years, and demonstrated ongoing media coverage, with demonstrated high profile media coverage at least once per year;
 - demonstrated increase in inquiries about the project over five years; and
 - demonstrated involvement in the project of at least 40 land owners and over 100 days in additional volunteer hours drawn largely from the local community and specialist interest groups which will maintain this support in the long-term within five years.
1. Demonstrated confirmation within five years of a 30% sustained increase in the number of adult MLR Southern Emu-wrens. This would include:
 - demonstrated positive response of selected MLR Southern Emu-wren populations to on-ground vegetation management within five years; and
 - demonstrated completion of census of adult MLR Southern Emu-wrens in the first, third and fifth years.
1. Demonstrated successful procedures for the active management of MLR Southern Emu-wrens within five years. This would include:
 - demonstrated completion of a translocation strategy for MLR Southern Emu-wrens in the third year;
 - demonstrated development of DNA markers for emu-wrens and completed results on dispersal patterns and the genetic relatedness of selected MLR Southern Emu-wren groups in the third year; and
 - completed update of the Population Viability Analysis in the third year.
1. Completed nomination of Fleurieu Peninsula swamps as threatened ecological communities under the *Environment Protection and Biodiversity Conservation Act 1999* within one year.
 2. Demonstrated successful operation of the Recovery Team over five years.

The key links between the specific objectives, progress criteria and actions are shown in Figure 5 overleaf.

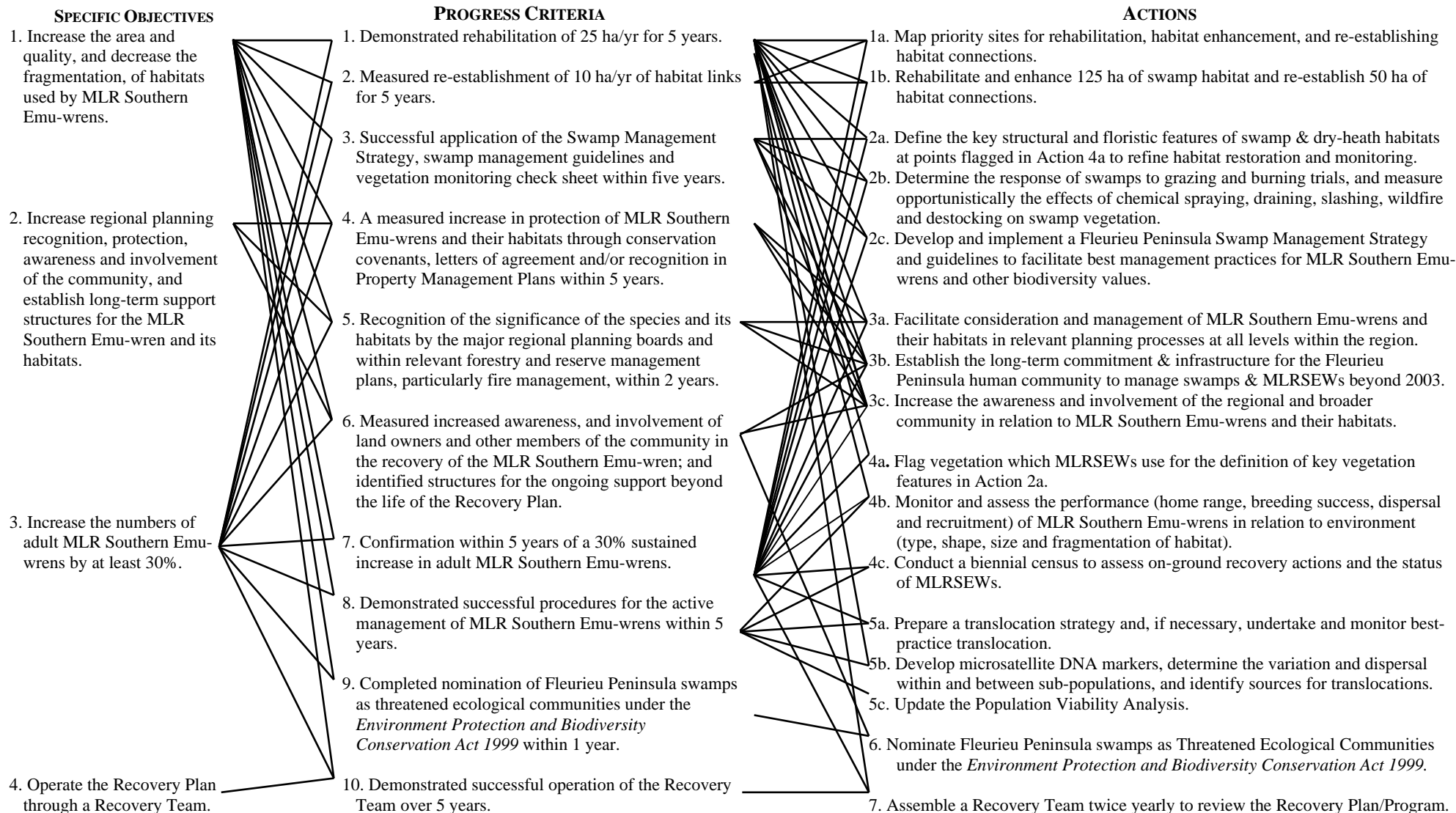


Figure 5. Links between specific objectives, progress criteria and recovery actions.

4.0 Recovery Actions

The Recovery Plan for the MLR Southern Emu-wren (Littlely and Cutten 1994) identified 11 Actions (five Research and six Management) for the six-year period 1995–2000. This Recovery Plan identifies 16 Actions (some modified and others new) for the five-year period 1999–2003, and these are detailed below.

Actions

- 4.1 ACTION 1:** Instigate on-ground vegetation works to increase the quality and area and decrease the fragmentation of MLR Southern Emu-wren habitats
 - 4.1.1 ACTION 1a:** Map priority sites for rehabilitation, habitat enhancement and the re-establishment of habitat connections in consultation with landholders and other stakeholders
 - 4.1.2 ACTION 1b:** Rehabilitate and enhance 125 ha of swamp habitat and re-establish 50 ha of habitat connections at selected sites to favour MLR Southern Emu-wrens
- 4.2 ACTION 2:** Analyse vegetation and apply the results to the management of MLR Southern Emu-wren habitats
 - 4.2.1 ACTION 2a:** Define the key structural and floristic features of swamp and dry-heath habitats at points flagged in Action 4a to refine habitat restoration and monitoring methods
 - 4.2.2 ACTION 2b:** Determine the response of swamp vegetation to grazing and burning trials, and measure opportunistically the effects of chemical spraying, draining, slashing, wildfire and destocking on swamp vegetation
 - 4.2.3 ACTION 2c:** Develop and implement a Fleurieu Peninsula Swamp Management Strategy and guidelines to facilitate best management practices for MLR Southern Emu-wrens and other biodiversity values
- 4.3 ACTION 3:** Implement Community Extension and Public Relations Programs
 - 4.3.1 ACTION 3a:** Facilitate consideration and management of MLR Southern Emu-wrens and their habitats in relevant planning processes at all levels within the region
 - 4.3.2 ACTION 3b:** Establish the long-term commitment and infrastructure necessary for the Fleurieu Peninsula community to manage swamps and MLR Southern Emu-wrens beyond 2003
 - 4.3.3 ACTION 3c:** Increase the awareness and involvement of the regional and broader community in relation to MLR Southern Emu-wrens and their habitats
- 4.4 ACTION 4:** Monitor the key indicators of MLR Southern Emu-wren performance
 - 4.4.1 ACTION 4a:** Flag points in selected swamps and dry-heaths which MLR Southern Emu-wrens use and occupy for the definition of key vegetation features in Action 2a
 - 4.4.2 ACTION 4b:** Monitor and assess the performance (home range, breeding success, dispersal and recruitment) of MLR Southern Emu-wren sub-populations at selected management sites in relation to environment (type, shape, size and fragmentation of habitat)
 - 4.4.3 ACTION 4c:** Conduct a biennial census of adult MLR Southern Emu-wrens to indicate the effectiveness of on-ground recovery actions and the status of MLR Southern Emu-wrens
- 4.5 ACTION 5:** Actively Manage MLR Southern Emu-wrens
 - 4.5.1 ACTION 5a:** Prepare a translocation strategy for the MLR Southern Emu-wrens and, if necessary, undertake and monitor best-practice translocation of emu-wrens
 - 4.5.2 ACTION 5b:** Develop microsatellite DNA markers for the Southern Emu-wren and determine the variation and dispersal within and between MLR Southern Emu-wren sub-populations and identify sources for MLR Southern Emu wren translocations
 - 4.5.3 ACTION 5c:** Update the Population Viability Analysis and input the results to the translocation strategy in Action 5a
- 4.6 ACTION 6:** Nominate Fleurieu Peninsula swamps as Threatened Ecological Communities under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
- 4.7 ACTION 7:** Assemble a Recovery Team twice yearly to review progress of the Recovery Plan

Table 2 provides a schedule of key tasks for each recovery action.

Table 2. Schedule of key tasks for each action in the MLR Southern Emu-wren Recovery Plan

Action		1999	2000	Key Tasks* 2001	2002	2003
1. Onground vegetation	1a. ID Priority Sites 1b. Revegetation	consult, <i>map sites</i> revegetate, rehabilitate	– revegetate, rehabilitate, monitor	– revegetate, rehabilitate, monitor	– <i>enhance</i> , revegetate, rehabilitate, monitor	– <i>enhance</i> , revegetate, rehabilitate, monitor
2. Vegetation analysis	2a. Key veg. features 2b. Swamp trials 2c. Mgt strategy	– quarterly visits, <i>report</i> <i>draft</i> strategy & guidelines, consult	measure, analyse quarterly visits –	measure, analyse, report, <i>check sheet</i> , circulate six-monthly visits <i>rewrite</i> strategy & guidelines, circulate	– six-monthly visits, <i>report</i> <i>training sessions</i> , strategy feedback	– end trials, <i>final</i> report <i>final</i> strategy, check sheet, guidelines
3. Community extension	3a. Planners 3b. Community 3c. PR, volunteers	liaise with planners esp. LAPs, reserves build community support structures <i>communications</i> <i>strategy</i> , web, media, newsletter, train volunteers, feedback	liaise with planners build community support structures <i>reprint brochures</i> website, media, newsletter, train volunteers, feedback	liaise with planners build community support structure website, media, newsletter, train volunteers, <i>distribute</i> <i>swamp strategy</i>	liaise with planners build community support structures website, media, newsletter, train & coordinate volunteers, <i>survey attitudes</i>	liaise with planners build community support structures website, media, newsletter, train & coordinate volunteers
4. Bird performance	4a. Veg use 4b. Performance 4c. Census	<i>flag</i> MRLSEW use of vegetation <i>band</i> in breeding season, monitor coordinate, analyse	<i>flag</i> MLSEW use of vegetation <i>band</i> in breeding season, monitor –	– MLRSEW response to vegetation mgt coordinate, analyse	– MLRSEW response to reveg., translocation –	– MLRSEW response to reveg., translocation coordinate, analyse
5. Manage birds	5a. Transloc. strategy 5b. Genetics 5c. Pop. Viab. Analysis	– – –	– – –	<i>translocation strategy</i> <i>develop markers</i> , <i>genetic variation</i> <i>update PVA</i>	– – –	– – –
6. Thr. ecol. community	6. Nomination	<i>nomination</i>	–	–	–	–
7. Recovery team	7. Recovery team	review/amend actions, report	review/amend actions, report	review progress, amend actions	review/amend actions, report	review/amend actions, report

*Italicised key tasks indicate important deadlines.

NOTE: Key personnel referred to in the 'summary of costs' in the following Actions are a botanist, ornithologist, and community extension officer. The botanist and ornithologist are costed at \$24.05/h (\$20.91/h plus 15% on-costs) and the community extension worker is costed at \$18.76/h (\$16.31/hr plus 15% on-costs) in 1999. Hourly rates are based on a state Social and Community Services Award, Community Services Worker Levels 5 and 3 respectively. Return travel to and between sites from Adelaide is based on 200 km per trip @ 49 c/km. A 3% CPI per annum increase has been applied for each year after 1999.

4.1 ACTION 1: Instigate on-ground vegetation works to increase the quality and area and decrease the fragmentation of MLR Southern Emu-wren habitats

4.1.1 ACTION 1a: Map priority sites for rehabilitation, habitat enhancement and the re-establishment of habitat connections in consultation with landholders and other stakeholders

Justification: Increases in the size and distribution of the MLR Southern Emu-wren population depend on increasing the area of habitat that is maximally suitable for MLR Southern Emu-wrens as quickly as possible. This can be done by selecting swamps that are moderately degraded for habitat rehabilitation and enhancement rather than by repairing badly degraded habitats. Badly degraded areas take many years to achieve sufficient cover to support Emu-wrens and although needing attention will not help meet the objectives set for this 5-year Recovery Plan. In addition to rehabilitation, revegetation programs which develop connections between selected areas of good MLR Southern Emu-wren habitat should aid natural dispersal of MLR Southern Emu-wrens. As a priority, areas of apparently suitable habitat which are not currently occupied by MLR Southern Emu-wrens would be selected for linkage to those which are occupied. These connections may involve establishing or enhancing discontinuous patches of potentially suitable habitat between isolated fragments of existing MLR Southern Emu-wren habitat.

Eighteen priority sites for revegetation and rehabilitation have been identified (Littlely unpubl.), however this report requires refinement through community consultation and further research.

Methods: In 1999 a botanist will assess the 18 priority sites which have been identified for revegetation and rehabilitation (Littlely unpubl.) and recommend any additional sites for rehabilitation, habitat enhancement and habitat connection (Action 1b) to benefit MLR Southern Emu-wrens. Habitat connections may involve swamp along drainage lines or dry-heath across drainage lines. Stakeholders, including landholders, Landcare groups, Catchment groups and the Local Action Planning Committee, will provide input into the assessment of sites and preparation of a draft report. Maps outlining proposed vegetation work will be prepared and forwarded to landholders and other stakeholders.

Responsibilities: administration – Conservation Council of SA; mapping and consultation – contract botanist and volunteer botanists.

Summary of costs: Contract botanist for 600 hours in 1999 (\$14,430) involving 5,000 km of travel (\$2,450) and materials which include aerial photographs (\$520). Volunteer botanist(s) for 250 hours (\$6,250) to assist the identification of sites. The contribution of landholders in consultation regarding priority sites will be 250 hours (\$6,250).

Funding for action 1a (in \$'000s):

Source	1999	2000	2001	2002	2003	Total
Vols	12.5	–	–	–	–	12.5
Other	17.4	–	–	–	–	17.4
Total	29.9		–	–	–	29.9

4.1.2 ACTION 1b: Rehabilitate and enhance 125 ha of swamp habitat and re-establish 50 ha of habitat connections at selected sites to favour MLR Southern Emu-wrens

Justification: Landholders have demonstrated a willingness to become involved in on-ground works for the recovery of MLR Southern Emu-wrens and their habitats. Landholders have altered management practices and, in conjunction with Recovery Program volunteers, have worked on fencing and revegetation projects. To date, three have fenced swamps to control stock access, two have received seed for swamp rehabilitation projects and another landholder has undertaken a revegetation program using seed from the Compass Creek Care Landcare Group and seedlings from Willunga Trees For Life. Several other landholders have expressed an interest in rehabilitation/revegetation projects in 1999–2003 and the consultation process in Action 1a will identify additional landholders with an interest in these projects.

Of the estimated 545 ha of intact and semi-intact swamp on the Fleurieu Peninsula, active rehabilitation of 125 ha over five years is a realistic target. Much of the remaining 420 ha can be rehabilitated through improvements in management practices facilitated by the Swamp Management Strategy and related extension work (see Action 3). In addition, 50 ha of moderately degraded swamp have been identified for revegetation as corridor habitats to link fragmented swamps and a target of 10 hectares per year for five years is achievable. *These actions will decrease the fragmentation of the MLR Southern Emu-wren population, increase the amount of available habitat and thus contribute to an increase in MLR Southern Emu-wren numbers.*

In 2002 and 2003 understanding of MLR Southern Emu-wren habitat needs will be improved to the extent that habitat enhancement can occur with the aim of increasing the density of MLR Southern Emu-wrens in any given area. Enhancement of habitat is cost effective and vital given the limitations on the amount of habitat which can be re-established or revegetated. Observations of MLR Southern Emu-wren habitat use (Action 4a), identification of the key features of their habitats (Action 2a) and the results of the swamp management experiments (Action 2b) will be critical factors in determining procedures for habitat enhancement.

Methods: For each site identified in Action 1a the contract botanist will contact landholders, provide co-ordination and advice on the development of project plans and encourage a high degree of participation from landholders and the broader community. Each plan will identify the expected outcomes, time-frames, monitoring, costs, contributions, responsibilities, terms of agreement with landholders, and potential funding sources (e.g. State Revegetation Programs, NHT).

Based on the outcomes of measuring the response of vegetation to management practices such as burning and grazing (Action 2c), appropriate and best practice methods will be implemented at selected sites. These methods would include fencing to reduce grazing, allowing natural regeneration, using selective plantings and weeding to facilitate production of suitable habitat within and between swamps. Habitat connections may involve re-establishing swamp vegetation along drainage lines or re-establishing heath over hills to link swamps.

By 2002, observations of MLR Southern Emu wrens use of preferred microhabitats (Action 3a) would have led to the identification of key habitat features and production of a check sheet for monitoring vegetation (Action 2c). In that year, results from the swamp burning and grazing experiments (Action 2b) would have contributed to the Swamp Management Strategy and guidelines. These actions would enable land managers to enhance habitats for MLR Southern Emu-wrens.

The performance of the vegetation at the sites will be monitored by landholders and other stakeholders. These people will use vegetation assessment skills developed in Action 2c. Long-term regional planning and community support structures will be developed in Actions 3a and 3c. Initial response of selected MLR Southern Emu-wrens to vegetation works will be monitored by the contract ornithologist in 2001–3 (Action 4b), and any initial effects of revegetation and habitat enhancement on the emu-wren population will be indicated by census (Action 4c). Vegetation works will be adaptively managed according to the response of emu-wrens and vegetation.

Responsibilities: administration – Conservation Council of SA; liaison & co-ordination – contract botanist; revegetation, seed collection, seedling propagation, vegetation monitoring – contract botanist, revegetation groups and landholders; fencing – landholders and volunteers; weed control – landholders with assistance/advice from the Animal & Plant Control Commission/Boards.

Summary of costs: Contract botanist for 520 h in the year 1999; 600 h in 2000; 500 h in 2001; 600 h in 2002; and 1200 h in 2003. Travel is 4,000 km (\$1,960), 5,000 km (\$2,500), 5,000 km (\$2,600), 6,000 km (\$3,240) and 8,000 km (\$4,480) respectively.

The involvement and work load of the contract botanist and volunteers increases in 2002 and 2003 to enable both new vegetation projects and monitoring of previous vegetation projects to occur. Projects would be adaptively managed according to the response of vegetation and emu-wrens. By this time the degree of skills transfer to the community group formed under Action 3b would be high, and the Swamp Management Strategy and guidelines (in 2001, Action 2c), and a vegetation monitoring sheet would have been produced (in 2001, Action 2a).

Rehabilitation and enhancement of 25 ha/yr would require an average of 2.5 km/year of fencing; and the re-establishment of 10 ha/year of links would require an average of 1 km/year of fencing (allowing for some existing fences on properties). Funds required for fencing would be \$1,000 per km. In addition there would be \$750 in-kind support and voluntary labour for project planning, fencing, seed collection, seedling propagation, weed control, planting and monitoring. Of the 25 ha/yr subject to rehabilitation and enhancement, 16 ha would naturally regenerate, while the remaining 9 ha would be seeded/planted. Most of the 10 ha/yr of habitat links would be subject to seeding/planting.

Funding for action 1b (in \$'000s):

Source	1999	2000	2001	2002	2003	Total
Vols	9.7	9.7	9.7	19.4	20.0	68.5
Other	24.4	27.4	27.7	39.0	57.4	165.9
Total	34.1	37.1	27.4	58.4	77.4	234.4

4.2 ACTION 2: Analyse vegetation and apply the results to the management of MLR Southern Emu-wren habitats

4.2.1 ACTION 2a: Define the key floristic and structural features of swamp and dry-heath habitats at points flagged in Action 4a to refine habitat restoration and monitoring methods

Justification: MLR Southern Emu-wrens currently occupy some swamps and dry-heaths and not others. Within occupied swamps and dry-heaths, MLR Southern Emu-wrens use parts of these habitats more frequently than other parts.

This action will measure and compare the habitat features of sections of swamps and dry-heaths that are used frequently or infrequently by MLR Southern Emu-wrens. Any patterns or differences found will then be used to:

- a) identify the swamps and dry-heaths with the *best quality habitats* in terms of the largest amount of favoured microhabitat (for use in Actions 1a, 1b, 3a, 4b);
- b) determine if areas of swamps and dry-heaths currently not supporting MLR Southern Emu-wrens have prime habitat for MLR Southern Emu-wrens; and if so, as a priority, *direct revegetation programs* to link these to other swamps or dry-heaths in which MLR Southern Emu-wrens occur (see Action 1b) and/or to use these as sites for receiving translocated birds (see Actions 5a and 4b);
- c) provide a *focus for vegetation enhancement* (improving poor quality swamps with appropriate planting) and revegetation programs (see Action 1b); and
- d) assess the *effects of the burning and grazing trials for generating suitable (prime) habitat* for MLR Southern Emu-wrens and the time required to do so (see Action 2b).

Importantly, this action will provide for best practice vegetation management, and thus maximise MLR Southern Emu-wren numbers per unit area of vegetation managed.

Methods: Monitoring of individually marked birds (Action 4a) during 1999 and 2000 will be used to identify areas used frequently, infrequently or not at all by MLR Southern Emu-wrens. These locations would be flagged with coloured tape and mapped (see Action 5a). At each of these tagged sites features of the vegetation (floristic and structural) would be measured by a botanist in 2000 and 2001 using similar methods to those developed for the swamp management trials (see Action 2b). Data would be stored and analysed electronically to identify microhabitat differences between areas used and not used by MLR Southern Emu-wrens.

In 2001 the botanist would report on findings of the analysis and develop a user-friendly check sheet for use by landholders and community to score the quality of vegetation in relation to suitability for MLR Southern Emu-wrens. On-ground training in vegetation management, monitoring and use of this sheet would occur under Action 2c in 2002.

Responsibilities: administration – Conservation Council of SA; field work, data entry and analysis, reporting, and development of check sheet – contract botanist.

Summary of costs: Five swamps and two dry-heaths each with 10 frequently used and 10 infrequently used areas would require 140 botanical assessments per year. Contract botanist for 600 h in the year 2000 for measuring and analysis (\$14,880), and 700 h in 2001 for measuring, analysis, reporting and preparation of check sheet (\$17,878). Travel is 5,000 km each year (\$2,500 and \$2,600, respectively). Materials include film, development, and flagging tape (\$500/yr). A volunteer botanist would contribute 400 hours per year in field work and data entry (\$10,300 in the year 2000, indexed for 2001). Landholders and other members of the regional community would contribute 50 h in development and testing of the check sheet in the year 2001 (\$1,326).

(Note: The Table showing the funding for action 2a is overleaf.)

Funding for action 2a (in \$'000s):

Source	1999	2000	2001	2002	2003	Total
Vols	–	10.3	11.9	–	–	22.2
Other	–	17.9	21.0	–	–	38.9
Total	–	28.2	32.9	–	–	61.1

4.2.2 ACTION 2b: Determine the response of swamp vegetation to grazing and burning trials, and measure opportunistically the effects of chemical spraying, draining, slashing, wildfire and destocking on swamp vegetation

Justification: *Ultimately the success of the recovery program for the Mt Lofty Ranges involves managing swamp habitats for MLR Southern Emu-wrens while maintaining rare plants and the 'nature' of these threatened communities.* Current and historical methods of managing swamps all need to be assessed to develop a suitable management program. Initial trials commenced in 1997 and these involve assessing single fire and single stock grazing treatments, since fire and grazing have been used widely by landowners to manage their swamps. Other widely used forms of management (e.g. slashing, spraying with chemicals, and drainage) and the effects of events such as wildfire and destocking will need to be measured opportunistically in view of the prohibitive costs of establishing additional trials. This information is needed *to develop appropriate swamp management guidelines* for property owners to protect the habitat features needed by emu-wrens and thus *maximise the numbers of MLR Southern Emu-wrens per unit area of swamp.*

This action has been under way for 12 months, with four of the proposed five sites established. The cost of continued monitoring of the sites is now small relative to the past expenses of designing the methods and establishing plots at the sites. The work needs to continue for at least three years to maximise the value of the investment. The trials were established using funding provided through the Native Vegetation Conservation Section of the Department for Environment, Heritage and Aboriginal Affairs from the National Estate Grants Program.

Methods: The experiment comprises 25 plots at four sites, with 4–8 plots to be added at a fifth site in 1999. Control and treatment plots have been established by means of controlled burning of swamp vegetation and/or constructing exclusion fences around the plots within different types/qualities of swamp vegetation. At 3-monthly intervals a contract botanist collects data on the number of individuals of each plant species and their structure (size) at 48 points within each plot.

In addition, an accidental fire occurred at Tooperang in January 1997, and it was considered important to collect opportunistic post-fire data despite the lack of pre-fire information. At Tooperang four repeatable photopoints have been set up in two swamps. Data on diversity and abundance counts is collected from ten 1 m x 1 m plots at 6-monthly intervals.

The trials will determine the effects and recovery time of various burning and grazing regimes on the abundance and diversity of plant species and vegetation structure with time since disturbance until plots reach pre-fire conditions and/or the habitats are once again suitable for MLR Southern Emu-wrens. Opportunistic data on plant responses to wild fire (instead of control burns), chemical spraying, draining, slashing and destocking programmes will provide information of a similar nature. Results from the experimental and opportunistic sites will be passed on to landholders, relevant government agencies and other land managers through the Swamp Management Strategy and guidelines and associated skills transferred to landholders and community (Action 2c).

Each plot will be visited four times per year in 1999 and 2000, and two times per year in 2001–3. A report on findings is due in June 1999 for inclusion in the draft Swamp Management Strategy and guidelines which are to undergo a consultation process (Action 2c). A second report will be due in 2001 for inclusion in the Swamp Management Strategy, guidelines and vegetation check sheet (the latter developed in Action 2a). A final report will occur in 2003 when the Swamp Management Strategy, guidelines and check sheet will be amended (Action 2c).

Responsibilities: administration – Conservation Council of SA; establish & monitor experiments – contract botanist and volunteer botanists; controlled burning – landholders & CFS; controlled stock grazing – landholders; data analysis – contract botanist and volunteer botanists.

Summary of costs: Contract botanist for 600 h in 1999 (\$14,430) & 2000 (\$14,863) to establish an extra site and monitor the established sites; 300 h in 2001 (\$7,654), 600 h in 2002 (\$15,768) includes reporting on findings; 400 h in 2003 (\$10,827) includes update of report. Travel is 7,000 km each year (\$3,430 indexed from 1999). Materials include film and development (\$500/yr). Fencing is for wire and droppers for the experimental plots (\$1,300) in 1999. Fencing labour is

voluntary (\$500 per year including travel to sites, and establishment and maintenance of fences). Other volunteer hours are 70 h in 1999 to help set up the remaining plots, plus 220 h monitoring each year, plus 100 h data entry each year (\$20/h in 1999). Landholders contribute by monitoring the fences around the plots and controlling stock in the vicinity of the plots (\$4,000/yr)

Funding for action 2b (in \$'000s):

<u>Source</u>	<u>1999</u>	<u>2000</u>	<u>2001</u>	<u>2002</u>	<u>2003</u>	<u>Total</u>
Vols	12.3	11.2	11.5	11.9	12.2	59.1
<u>Other</u>	<u>19.7</u>	<u>18.9</u>	<u>11.8</u>	<u>20.0</u>	<u>15.2</u>	<u>85.6</u>
Total	32.0	30.1	23.3	31.9	27.4	144.7

4.2.3 ACTION 2c: Develop and implement a Fleurieu Peninsula Swamp Management Strategy and guidelines to facilitate best management practices for MLR Southern Emu-wrens and other biodiversity values

Justification: The development and implementation of a management strategy and guidelines will benefit MLR Southern Emu-wrens principally through the reduction of threats relating to current swamp management practices. Many landholders do not understand how the South Australian *Native Vegetation Act 1991* relates to swamps, and few understand how to sustainably manage swamps for biodiversity benefits. Some landholders have already requested swamp management advice and interest from the community is promising. *A proactive approach* to the implementation of the strategy through skills transfer to landholders and other stakeholders will *encourage appropriate management practices and reduce the need for expensive and time consuming remedial action*. Procedures for regular review of the management strategy and guideline will allow new information on success and efficacy of new management actions to be incorporated as best practice adaptive management.

Methods: A botanist has been contracted to complete in June 1999 a draft Swamp Management Strategy and a draft document containing guidelines for swamp management.

The strategy will pinpoint priority swamps for conservation of biodiversity and threatened species, swamps that could be regenerated and/or replanted, swamps requiring specific management (such as burning or weed control), areas for potential creations of links and areas requiring future research. (Action 1a involves specifically identifying and mapping high priority sites for vegetation work and, in consultation with landholders, site-specific project development.)

The guidelines for land managers on the Fleurieu Peninsula will include information on legal aspects of swamp management, the effects of burning and grazing on vegetation and wildlife and corresponding recommendations on conditions under which these practices should be carried out. They will also include lists of flora and fauna from several swamps and include recognition of threatened species, primarily the MLR Southern Emu-wren.

In 1999 the strategy and guidelines will be widely circulated and feedback will be actively sought.

In 2001 the draft documents will be reviewed based on feedback from landholders and other stakeholders and new information on swamp management. By this time the key features of vegetation will be identified and a vegetation check sheet prepared (Action 2a). This information, along with the results of a report on the swamp experiments (Action 2b), will be included in the strategy and guidelines to be released in 2001.

The botanist will ensure the documents have a high degree of regional relevance, accuracy, acceptance, understanding and 'ownership' by actively pursuing issues and feedback and arranging meetings and forums. Skills will be transferred to landholders and the community support group (established in Action 3b) in on-ground training sessions in 2002. Participants will be encouraged to improve management of swamps, and to link any swamp management programs to other management plans for wider biodiversity outcomes. The documents will be promoted by the community extension officer (Action 3).

In 2003 the documents will be amended based on information gained from the on-ground landholders, vegetation works (Action 1a), swamp experiments (Action 2b), community (Action 3), and response of MLR Southern Emu-wrens to management actions (Actions 4b and 4c).

Throughout the process links will be developed with landholders, state and local government agencies, catchment and other management boards, the Country Fire Service, Local Action Planning groups and other community groups (see also Action 3).

Responsibilities: administration – Conservation Council of SA; incorporation of information, consultation, writing and printing of strategy – contract botanist; training – contract botanist

Summary of costs: Contract botanist for 160 h in 1999 (plus travel = \$5,000); 300 h in 2001 (\$7,622); 600 h in 2002 (\$15,786); 200 h in 2003 (\$5,480). Travel is 2,000 km in year 2002 (\$1080) when there will be forums and training sessions (\$3,000). Printing of the final strategy

and guidelines will be \$1,000 for 100 copies in 2003. Volunteer input is for office and field support of botanist, with high volunteer input for the training sessions in 2002.

Funding for action 2c (in \$'000s):

Source	1999	2000	2001	2002	2003	Total
Vols	2.5	–	2.5	10.4	2.4	19.8
Other	5.0	–	7.6	19.9	6.5	39.0
Total	7.5	–	10.1	30.3	8.9	56.8

4.3 ACTION 3: Implement Community Extension and Public Relations Programs

4.3.1 ACTION 3a: Facilitate consideration and management of MLR Southern Emu-wrens and their habitats in relevant planning processes at all levels within the region

Justification: The Fleurieu Peninsula, part of the Mt Lofty Ranges Region, is currently undergoing a series of complementary planning processes, partly stimulated by the onset of the federal Natural Heritage Trust program. *It is imperative that each regional plan duly consider the requirements and appropriate management of the MLR Southern Emu-wrens and their habitats.*

It is crucial that the *Mt Lofty Ranges Regional Organisation* be fully briefed as to the objectives and activities of the MLR Southern Emu-wren Recovery Plan, the local threats to and values of the MLR Southern Emu-wren and its habitats, and appropriate management practices which will complement the bird's recovery. Consideration must be given to these factors in the region's *Local Action Plan, its Regional Biodiversity Plan and any associated Catchment Plans.*

Wildfire is considered to be another significant threat to MLR Southern Emu-wrens in heath habitats. Extension work which provides input into the fire management of heath in Deep Creek and Cox Scrub Conservation Parks will help to reduce this threat.

Many land owners on the Fleurieu Peninsula are running small or hobby farms and urban development is approaching the region quickly from the southern reaches of the City of Adelaide. Local Government must be provided with information about the MLR Southern Emu-wren and its habitats which can assist them prepare sound planning decisions in the future, for issues such as land use and sub-division. Further sub-divisions within the emu-wren's habitat are likely to have a significant impact on the bird and extension work is needed to work alongside Local Government to minimise its potential impact. Local Government could provide other forms of significant assistance to the project through its information and advisory services, particularly in a region where land owner turn-over is so high. It is important that the Recovery Program work closely with them and utilise this support.

Property Management Planning Project Officers work in the region to assist land owners to prepare plans which maximise both the productivity and biodiversity outcomes for their property. Sites of conservation significance for the MLR Southern Emu-wren should be recognised in these plans and consideration given to appropriate management. This will become particularly pertinent with the completion of the swamp experiments (Action 2b) and the release of the swamp management strategy and guidelines (Action 2c) and user-friendly vegetation check sheet (Action 2a). Extension work is needed to ensure that PMP Project Officers, their support agencies and individual land owners be provided with the information, training and support (Action 2c) necessary.

Methods: The community extension officer will develop links with landholders, community groups, state and local government agencies, catchment and other management boards, the Country Fire Service, the Mt Lofty Ranges Regional Organisation and Local Action Planning groups. Extension work is needed to provide opportunities for these key groups to receive advice, presentations and training where appropriate. The officer will develop information material and distribute the swamp management strategy and guidelines which will assist these groups in the long-term.

In relation to reserve management, the officer will continue to work with the National Parks and Wildlife Service and Forestry SA to refine the management of MLR Southern Emu-wrens, especially in relation to the threat of wildfire in heath. The community extension officer will dedicate time consistently to this action over the life of the program, reducing the hours in year 2002 when many of the large-scale regional plans will have been completed.

The extension officer will also develop social structures and materials which will facilitate the long-term adoption of the strategy and account for the lack of awareness often associated with changes of land ownership.

Responsibilities: administration – Conservation Council of SA; community extension – extension officer.

Summary of costs: Extension Officer for 360 h in 1999 (\$6,753), 2000 (\$6,956), and 2001 (\$7,165); 240 h in 2002 (\$4,920) and 2003 (\$5,067). Travel is 1,000 km per year (\$490 in 1999, indexed each year). Volunteer input will be maintained at 385 h/y (\$7,700 in 1999, indexed each year).

Funding for action 3a (in \$'000s):

Source	1999	2000	2001	2002	2003	Total
Vols	7.7	7.9	8.2	8.4	8.7	40.9
Other	7.2	7.5	7.7	5.5	5.6	33.5
Total	14.9	15.4	15.9	13.9	14.3	74.4

4.3.2 ACTION 3b: Establish the long-term commitment and infrastructure necessary for the Fleurieu Peninsula community to manage swamps and MLR Southern Emu-wrens beyond 2003

Justification: The success of any regional project depends entirely on the level of support it receives from the local community. *The on-ground actions and management changes needed on the Fleurieu Peninsula to ensure the survival of the Emu-wren and its habitats need to be understood and supported by the community and the skills and infrastructure established.*

In the long-term the Fleurieu Peninsula community will be encouraged to take *full responsibility for ongoing work beyond the life of the Recovery Program, as ultimately communities must become custodians of their local biodiversity.* Integration of the project and the MLR Southern Emu-wren into regional tourist plans, community group work plans and the curriculum of local schools will support this process. Already over 30 local land owners and many community groups have shown their interest and support for this project but much more extension work needs to be done, such as skills transfer, to enable further improvements in future management.

Targeted contacts will need to be developed if the MLR Southern Emu-wren is to be maintained as a conservation dependent taxon beyond the life of the current Recovery Plan and long-term monitoring and management actions are to be undertaken. The extension officer will need to provide training opportunities for local community members and land owners (see also Action 2c) to support this work. Through consultation with the local community *a Friends Group or a coalition of existing groups may form to provide the structure for long-term action.*

Methods: The community extension officer will identify those recovery actions which require the support of the community and other volunteers for the benefit of the short- and long-term recovery of the MLR Southern Emu-wren and its habitats. The officer will also identify the key stakeholders whose co-operation and involvement is crucial to these actions, such as local land owners, local community groups and state-wide community groups which are able to provide outside expertise and support.

The community extension officer will develop and maintain strong links with these groups by providing advice, training (Action 2c), skills transfer, feedback and opportunities to participate in activities and events throughout the life of the project. In the long-term the Fleurieu Peninsula community will be encouraged to take full responsibility for ongoing work beyond the life of the Recovery Program. Infrastructure, to establish ongoing support networks and facilitate activities, will be developed by the extension officer in close consultation with the local community. Through consultation with the local community a Friends Group or a coalition of existing groups may form to provide the structure for long-term action. Wherever possible this infrastructure will be provided by and complement existing local programs.

Responsibilities: administration – Conservation Council of SA; community extension – extension officer; volunteer training and supervision – extension officer.

Summary of costs: Extension Officer for 360 h in years 1999 (\$6,754), 2000 (\$6,956), and 2001 (\$7,165); reducing to 280 h in 2002 (\$5,740) and 2003 (\$5,912). Travel is 2,800 km per year (\$1,372 in 1999, indexed each year). Materials are \$250/yr. State-wide community groups would contribute 100 h/yr of inkind support (\$2,200 in 1999, indexed each year) and the regional community would provide 250 h/yr of voluntary support towards the development of long-term commitment and infrastructure (\$5,000 in 1999, indexed).

Funding for action 3b (in \$'000s):

Source	1999	2000	2001	2002	2003	Total
Vols	5.0	5.2	5.3	5.5	5.6	26.6
Community Groups	2.2	2.3	2.3	2.4	2.5	11.7
Other	8.4	8.6	8.9	7.5	7.7	41.1
Total	15.6	16.1	16.5	15.4	15.8	79.4

4.3.3 ACTION 3c: Increase the awareness and involvement of the regional and broader community in relation to MLR Southern Emu-wrens and their habitats

Justification: Through the actions of the Recovery Team to date many people on the Fleurieu Peninsula have become aware of the plight of the MLR Southern Emu-wren and its habitats and *there is growing appreciation of the conservation value of swamps. A continued proactive approach is crucial if the actions of the plan are to be implemented successfully.*

Local land owner support is necessary, including access to land, at every stage of the project. The MLR Southern Emu-wren and its management must be considered at every level of decision making in the region and the Recovery Plan must facilitate the development of a community ethic which values the Emu-wren and its habitats as a valued asset to the region and to the local community. Integration of the project and the Emu-wren in to regional tourist plans, community group work plans and the curriculum of local schools will support this process.

Thousands of hours of volunteer time are needed to assist the actions of the Recovery Plan, contributing much in-kind resourcing. Volunteers are crucial for the success of the following: swamp revegetation and rehabilitation efforts (Action 1b); swamp experiments (Action 2b) and identifying key features of Emu-wren habitat (Action 2a); monitoring MLR Southern Emu-wren dispersal (Action 4b) and participating in the biennial census (Action 4c); ongoing monitoring of Emu-wrens (Action 4b and beyond life of project) and the condition of swamp vegetation (Action 2a and beyond life of project). Extension work within the local community and Adelaide region will be crucial to recruit, train and facilitate volunteer participation. Occupational Health and Safety issues are also of paramount importance. In the long-term, volunteer management, will also enable skills transfer and develop a greater sense of local ownership for the bird and its habitats.

The Emu-wren is not only *a flagship species for the Fleurieu Peninsula swamps* but also for other threatened species in the region and the valuable work of the Endangered Species Program which is attempting to engage widespread *community involvement in the recovery of threatened species* across Australia. Extension work is needed to reinforce the value of this flagship species and threatened species and ecological communities within the region. This work will ultimately lead to *better regional management for all species.*

Methods: The extension officer will become conversant with all other recovery actions and support and promote all recovery actions through community awareness, education and promotional activities. The officer will respond to enquiries about the project and feed relevant information into the other actions.

The officer will identify and prioritise the current and potential human threats to the MLR Southern Emu-wren and its habitats which can be addressed by liaison, awareness raising and management advice. Advice will be prioritised according to the urgency, complexity, degree of knowledge of solutions, time frame, chances of success and cost.

In conjunction with other key members of the Recovery Team the extension officer will develop a Communications Strategy which will provide strategic direction for all facets of extension work across the project and outline clear and measurable outcomes. This Strategy will be completed within six months of the Recovery Plan. The strategy would address the specific extension requirements for each of the recovery actions and develop means by which to foster a long-term commitment and ethic in the region.

The strategy would be implemented through community extension work and might address some of the following activities:

- attracting, training and supervising volunteers;
- working with land holder and community groups and establishing long-term structures to support their involvement;
- increasing public exposure by showing the MLR Southern Emu-wren display at rural events, field days and other public places;
- distributing the MLR Southern Emu-wren brochure and fact sheet and updating these when necessary;

- developing a Website or page on the Website of a complementary project/organisation,
- producing a six-monthly newsletter, and distributing it within the region and to others on the mailing list to provide participants with feedback;
- promoting the MLR Southern Emu-wren as a local icon to local business and regional tourism organisations; and
- talking to students and local community groups, particularly Landcare and catchment groups.

This action links strongly with all other actions including the distribution and implementation of the Fleurieu Peninsula Swamp Management Strategy (Action 2c).

Wherever possible volunteers will be recruited from the local community. Additional volunteers will be recruited through a range of networks including universities, schools, interested community groups and individuals. Volunteers will be encouraged to make a regular contribution to the project over the life of the Recovery Program to ensure consistency, develop skills and a sense of ownership. This will encourage participants to make a long-term commitment to the program.

An important component of this action is the establishment of an office through which enquires can be addressed, volunteers can be managed and recruited, the distribution of the Fleurieu Peninsula Swamp Management Strategy (Action 2c), information sheets and check sheets can be facilitated.

Responsibilities: administration – Conservation Council of SA; community extension including communications strategy, publicity and publications – extension officer; volunteer training and supervision – extension officer.

Summary of costs: The extension officer will work 360 h in 1999 (\$6,754), 2000 (\$6,956), and 2001 (\$7,165) and 200 h in 2002 (\$4,100) and 2003 (\$4,223). Travel is 800 km per year (\$392 in 1999, indexed each year). Printing is for biannual newsletter (\$500/yr) and brochures in the year 2000 (\$1,500). Materials are for volunteer training (\$250/yr). Volunteers (other than CCSA volunteers) will contribute 175 h/y to office related duties including the newsletter. A committee of five people will volunteer a total of 50 h in 1999 (\$1,250) to produce a communications strategy.

Costed here is the Conservation Council of South Australia's (CCSA) rate of 10% (of external funding) for operation of the recovery project, plus \$3,600 office rent and \$2,000 consumables per year. This equates to \$19,086 in 1999; \$19,444 in 2000; \$23,409 in 2001; \$18,609 in 2002; and \$18,944 in 2003. CCSA's inkind contribution is 5% p.a. (of external funding) less \$5,600 p.a. (i.e. \$1,143 in 1999; \$1,362 in 2000; \$3,305 in 2001; \$905 in 2002; and \$1,072 in 2003). CCSA will also provide \$2,000 p.a. publicity through *Environment South Australia* and displays and 500 h of volunteers p.a. to assist in regard to office duties (\$10,000 in 1999, indexed).

The South Australian print and television media is anticipated to contribute \$5,000 p.a. through stories and other promotions about the MLR Southern Emu-wren and swamp habitats. This is based on the extensive media coverage the project has secured over the past five years (some in conjunction with the Threatened Species Network, SA).

(Note: The Table showing the funding for action 3c is overleaf.)

Funding for action 3c (in \$'000s):

Source	1999	2000	2001	2002	2003	Total
Vols	4.8	3.6	3.7	3.8	3.9	19.8
CCSA	13.1	13.7	15.9	13.8	14.3	70.8
SA Media	5.0	5.0	5.0	5.0	5.0	25.0
Other	27.0	29.0	31.8	23.9	24.3	136.0
Total	49.9	51.3	56.4	46.5	47.5	251.6

4.4 ACTION 4: Key indicators of MLR Southern Emu-wren performance

4.4.1 ACTION 4a: Flag points within selected swamps and dry-heaths which MLR Southern Emu-wrens use and occupy for the definition of key vegetation features in Action 2a

Justification: At all sites (swamp and dry-heath) where MLR Southern Emu-wrens are extant, patterns of habitat use are not known, other than that certain parts of these swamps and heaths appear to be used and other parts not. This suggests that certain habitat features may be preferred. Given this simply rehabilitating swamps (see Action 1b) may not be adequate to allow population expansion unless the specific (preferred) habitat features are also increased. *Identifying patterns of use of swamps by MLR Southern Emu-wrens is critical to developing and monitoring effective habitat restoration.*

Methods: This will involve selecting at least seven sites (five swamps and two dry-heaths) for adequate replication of data. Within each site, the positions where MLR Southern Emu-wrens are frequently and infrequently observed (or heard) in four seasons will be recorded on scaled maps to an accuracy of 10 m². The contract ornithologist will determine 'hot' and 'cold' spots for each season and mark them with flagging tape. A contract botanist would then assess the floristic and structural vegetation features of these spots under Action 2a and establish if there are consistent patterns in the vegetation being used frequently and infrequently by MLR Southern Emu-wrens.

Responsibilities: administration – Conservation Council of SA; field work and mapping – contract ornithologist and volunteer ornithologists.

Summary of costs: Contract ornithologist for 800 h in 1999 (\$19,264) increasing to 900 h in 2000 (\$22,320). Travel for the contract ornithologist is 23,000 km per year in 1999 (\$11,270) and 2000 (\$11,608). Based on using five swamp sites and two heath sites and spending 2 days per month at each site (including mapping etc.) during the each year would need (14 days x 12 months x 8 h/day) 1344 hours of work in the field. The hours are completed with the assistance of volunteer ornithologists (600 h each year is \$15,000 and \$15,450 respectively). The contract and volunteer ornithologists contribute a total of \$1,000 in equipment each year, while volunteers contribute \$5,000 in travel each year. Note: The four sites in Acton 4b coincide with four of the seven sites in this action, and travel for 1999 and 2000 is costed here and not in Action 4b.

Funding for action 4a (in \$'000s):

Source	1999	2000	2001	2002	2003	Total
Vols	21.0	21.6	–	–	–	42.6
Other	30.5	33.9	–	–	–	64.4
Total	51.5	55.5	–	–	–	107.0

4.4.2 ACTION 4b: Monitor and assess the performance (home range, breeding success, dispersal and recruitment) of MLR Southern Emu-wren sub-populations at selected management sites in relation to environment (type, shape, size and fragmentation of habitat)

Justification: Detailed observations in one site have revealed that MLR Southern Emu-wrens are successful in fledging young and have high nest success. This suggests that an inability to breed successfully is not limiting the ability of MLR Southern Emu-wrens to increase in abundance. However, very few of the offspring produced at this site during the study period are known to have been recruited into the breeding population there, and only one juvenile subsequently dispersed to an adjacent area of swamp habitat (c.2.5 km distant). Furthermore, only two other adult emu-wrens are known to have dispersed to adjacent swamp habitat (c. 2.5–3 km distant), although none of these three emu-wrens is known to have reproduced, all three having ‘disappeared’. This suggests that apparently poor ability to disperse, low recruitment of juveniles, and/or limited availability of mates/optimal breeding habitat are limiting factors to recovery, particularly in small, localised populations (such as at the Nangkita Study Site). However this work is based on a single site and may not reflect demographic patterns for the population as a whole. These patterns need to be confirmed over two years so that on-ground management actions can confidently address these limiting factor(s) to population growth.

After two years this action will focus on monitoring and assessing the performance of MLR Southern Emu-wrens following on-ground management such as enhancement and re-establishment of their habitats (see Action 1b) to ensure improved performance and thus population growth of MLR Southern Emu-wrens. *This action is considered to be a key indicator of MLR Southern Emu-wren response to on-ground management projects relating to vegetation/revegetation, particularly habitat enhancement (Action 1b); and translocations, if any occur (Action 5a).*

Methods: Of the seven sites in Action 6a above, four (three swamps and one dry-heath) will be selected for additional monitoring relating to this action. A contract ornithologist and volunteer ornithologist will colour-band MLR Southern Emu-wrens during the breeding season when adults and juveniles can be trapped and identified easily. They will follow the fate of these birds through time by visiting each site for at least two days per month for at least two years and locating all birds that still remain. This will provide monthly records of survival and identify the periods of the year when MLR Southern Emu-wrens either die or disperse. When tagged birds cannot be located then intensive searches of adjacent areas will be conducted to determine if the apparent loss of a bird is due to dispersal. On each visit to a site the positions of tagged birds would be plotted on scaled maps to the nearest 10 m². These positions would then be assigned co-ordinates (eastings and northings) and used to determine areas of intensive use in swamps and home range sizes using computer packages like ‘Ranges V’. The home range data can be used to help assess the quality and carrying capacities of swamps, where small home ranges should indicate better quality of habitat and be linked to Action 2a. In addition, during the first two years MLR Southern Emu-wren flight feathers will be collected and sent to the SA Museum for genetic analysis and reporting by a contract geneticist (see Action 5b).

After two years the contract ornithologist will measure the response of MLR Southern Emu-wrens to management actions which include enhancement and re-establishment of vegetation (Action 1b), improved swamp management (see Actions 3 and 4) and any translocations (Action 5a).

Responsibilities: administration – Conservation Council of SA; field work, mapping and data analysis – contract ornithologist and volunteer ornithologist.

Summary of costs: Contract ornithologist for 800 h in 1999 (\$19,264); 900 h in 2000 (\$22,320); 1450 h in 2001 (\$37,033); 1440 h in 2002 (\$37,886); and 1240 h in 2003 (\$33,604). Travel for 1999 and 2000 is covered by Action 4a above. Travel is 23,000 km per year in 2001–2003 (\$11,961 in 2001, indexed each year). Equipment includes nets, bands, film and development (\$500/yr). The contract ornithologist and a volunteer ornithologist (with banding qualifications) will intensively band for three months each year *beginning* anytime between early-October and early-December depending on the timing and quality of the breeding season; plus 10 days of observations and tracking per month. The volunteer ornithologist(s) will contribute 450 h banding each year (\$11,200 in 1999, indexed). In addition, volunteer ornithologists will contribute 400 h to the tracking each year (\$10,000 in 1999, indexed). The contract and volunteer ornithologists will

contribute a total of \$1,000 in equipment each year, while volunteers contribute \$5,000 in travel each year.

Funding for action 4b (in \$'000s):

<u>Source</u>	<u>1999</u>	<u>2000</u>	<u>2001</u>	<u>2002</u>	<u>2003</u>	<u>Total</u>
Vols	27.2	28.0	28.9	29.7	30.6	144.4
Other	19.8	22.8	49.5	50.8	47.0	189.9
Total	47.0	50.8	78.4	80.5	77.6	334.3

4.4.3 ACTION 4c: Conduct a biennial census of adult MLR Southern Emu-wrens to indicate the effectiveness of on-ground recovery actions and the status of MLR Southern Emu-wrens

Justification: *A biennial census will indicate if adult MLR Southern Emu-wrens and their sub-populations are changing in number or distribution over time.* Any increases, decreases or discoveries of new sub-populations may impact on management and awareness-raising actions and indicate the effectiveness of on-ground recovery actions. Census will help to determine the conservation status of the MLR Southern Emu-wren.

Methods: A trial census conducted in September 1998 has been assessed and modified. In 1999, 2001, 2003 there will be a census of all known, and some potential, MLR Southern Emu-wren sites, subject to landholder permission at each site. The extension officer will co-ordinate survey pairs comprising ornithologists, landholders or other volunteers, of which at least one person per pair must be experienced in MLR Southern Emu-wren detection. Sites are searched on calm days during a week in August/September prior to breeding when juvenile MLR Southern Emu-wrens are not expected to be present. Taped calls are used in moderation to elicit responses from otherwise cryptic MLR Southern Emu-wrens. Observers record the weather, times, numbers of birds seen or heard, sex, colours of bands, degree of certainty of record, habitat, and size of area searched. Data will be electronically stored and analysed to produce estimates of sub-population sizes and overall population size. Results will be forwarded to participants and other relevant parties and used to modify management actions, guidelines and recommendations (Actions 1b, 2c, 3a, b and c, and 5a).

Responsibilities: administration – Conservation Council of SA; co-ordination – contract ornithologist; field work – contract ornithologist, volunteer ornithologists, landholders and other volunteers; database – contract ornithologist and volunteers.

Summary of costs: Contract ornithologist for 200 h in 1999 (\$4,816), 2001 (\$5,108), and 2003 (\$5,420) to co-ordinate the census and analyse results. Travel for the contract ornithologist is 1,000 km per census year (\$490 in 1999, indexed each year). Equipment includes tape-recorders and tapes, protective goggles, gloves and sun-screen (\$500 per census year). There is approximately 500 ha of emu-wren habitat to undergo census (in addition to the habitat covered by the contract ornithologist), and each hectare takes approximately 30 minutes for two people to census. Voluntary fieldwork consists of 20 people @ 25 hours each @ \$25/h (indexed from 1999). Voluntary travel and equipment is approximately \$3,000 per census.

Funding for action 4c (in \$'000s):

Source	1999	2000	2001	2002	2003	Total
Vols	15.5	–	16.4	–	17.4	49.3
Other	5.8	–	6.1	–	6.5	18.4
Total	21.3	–	22.5	–	23.9	67.7

4.5 ACTION 5: Actively Manage MLR Southern Emu-wrens

4.5.1 ACTION 5a: Prepare a translocation strategy for the MLR Southern Emu-wrens and, if necessary, undertake and monitor best-practice translocation of emu-wrens

Justification: In view of the Critically Endangered status of the MLR Southern Emu-wren, the preparation of a translocation strategy which identifies source populations, suitable habitats and the timing of translocation is recommended.

Actions 1a, 4a, 4b, and 5b, in particular, are/will provide valuable data on Emu-wren habitat requirements, dispersal, group dynamics, population dynamics and behaviour which would contribute to effective feasibility studies.

Of the 18 known sub-populations of MLR Southern Emu-wrens, most contain less than 20 individuals and may be threatened by inbreeding depression, represented by a single-sex, or non-breeding. Many of these sub-populations are very isolated and linking them with other sub-populations through revegetation may not be practicable. Therefore determining the feasibility of restocking is recommended.

In addition an estimated 124 ha of apparently suitable MLR Southern Emu-wren habitat is currently vacant. Determining the feasibility of re-introducing MLR Southern Emu-wrens to those vacant sites is recommended. Observations from the Nangkita banding and monitoring site indicate that although juveniles are produced, very few appear to have been recruited to the breeding population at the site and they are 'disappearing'. Monitoring of sub-populations will examine if these juveniles are being lost from the population due to a lack of nearby habitat to colonise. If they are, then support for translocation is increased.

Methods: An independent ornithologist will prepare a translocation strategy using established protocols.

A literature review is under way with the assistance of a volunteer. A strategy for restocking would consider the overall chance of success, site priority, landholder consent, condition of habitat, reasons for decline of the sub-population, degree of isolation, security of the site, cost-benefit analysis. A genetically suitable source population would need to be located. Other considerations are the likely impact on the source populations, method of transport, timing, age, sex and number of birds.

The feasibility of re-introducing MLR Southern Emu-wrens to vacant habitat would have similar considerations, although the condition of habitat at selected sites would need to be rigorously tested and both male and female birds would be required.

Any translocation of emu-wrens would need to be monitored for at least three years. Results of translocation would be assessed in relation to the objectives of the Recovery Program.

Responsibilities: administration – Conservation Council of SA; translocation strategy – independent ornithologist; translocation and monitoring – contract ornithologist

Summary of costs: Independent ornithologist to prepare translocation strategy based on 150 h @ \$30/h in 2001 (\$4,500). The costs of trapping, transporting and monitoring emu-wrens in 2002 and 2003 would come out of the emu-wren monitoring budget in Action 4b for those years, and are therefore not costed here.

(Note: The Table showing the funding for action 5a is overleaf.)

Funding for action 5a (in \$'000s):

Source	1999	2000	2001	2002	2003	Total
Vols	—	—	1.3	—	—	1.3
Other	—	—	4.5	—	—	4.5
Total	—	—	5.8	—	—	5.8

4.5.2 ACTION 5b: Develop microsatellite DNA markers for the Southern Emu-wren and determine the variation and dispersal within and between MLR Southern Emu-wren sub-populations and identify sources for MLR Southern Emu-wren translocations

Justification: Microsatellite markers will need to be developed directly from the Southern Emu-wren as microsatellites available to the SA Museum that had been developed from the closely related fairy-wrens have failed to adequately work on Southern Emu-wren DNA samples. Development of these markers requires an intensive period of research by a person with a high skills level and experience in molecular biology.

Analysis at the SA Museum to date based on mitochondrial DNA (mtDNA) indicates genetic distinction between the northern MLR Southern Emu-wren sub-populations at Nangkita–Mt Compass and the southern sub-populations at Parawa–Deep Creek Conservation Park. This needs to be confirmed by analysis of their nuclear DNA, i.e. microsatellites, as the results so far from the single genetic marker (mtDNA) can be subject to alternative interpretations that are not compatible with population isolation. If the microsatellite analysis confirms the mtDNA result, this will indicate that the groups were not interbreeding prior to habitat disturbance by Europeans. Moreover, should the need arise for translocation of emu-wrens (see Action 5d), this analysis may influence the choice of birds for restocking or the re-establishment of sub-populations.

While the degree of genetic difference between the northern and the southern sub-populations is now known from the mtDNA analysis (to be confirmed), the variation within each of these sub-populations is not known because each had a single type of mitochondrial DNA. *Determining the variation within each sub-population, in particular the highly fragmented northern sub-population, will indicate whether there is sufficient gene flow among fragments to reduce the risk of inbreeding depression and the risk of extinction from random events. The use of microsatellite markers will greatly and efficiently enhance the information obtained from conventional banding studies of recruitment, dispersal, mate fidelity, and gene flow because each approach has different but complementary resolving power for demographic parameters that occur over different time-scales or frequencies.* For example, the DNA approach can detect rare but highly significant dispersal events that conventional banding studies are likely to miss. This has application for the measurement of MLR Southern Emu-wren performance in Action 5b, particularly since banding and monitoring may underestimate dispersal.

Methods: Flight feathers collected during banding (in Actions 4b) are sent to the SA Museum for genetic analysis and reporting. Methods for the isolation of microsatellites and typing of feather samples and markers follow published protocols.

Responsibilities: administration – Conservation Council of SA/ SA Museum; feather collection – contract ornithologist; analysis and reporting – contract geneticist/ SA Museum.

Summary of costs: Feathers may be collected by the contract ornithologist at no extra cost as part of banding. The geneticist will require nine months full time to develop the microsatellite markers and type the samples. Materials include consumable chemical reagents for DNA isolation and characterisation and the fees for the use of automated genotyping facilities (\$7,000). An administrative component covers delivery of feathers and preparation of ethics approvals. Salary & associated costs are \$28,188 and in-kind support is \$12,200.

Funding for action 5b (in \$'000s):

Source	1999	2000	2001	2002	2003	Total
Vols	–	–	–	–	–	–
SA Museum	–	–	12.2	–	–	12.2
Other	–	–	35.2	–	–	35.2
Total	–	–	47.4	–	–	47.4

4.5.3 ACTION 5c: Update the Population Viability Analysis and input the results to the translocation strategy in action 5a

Aim: Revise the Analysis of Likelihood of Extinction of the MLR Southern Emu-wren and apply the result to management guidelines and actions.

Justification: In 1996 data resulting from the Recovery Program to the end of 1995 was used in the preparation of a Population Viability Analysis (PVA) using the program ALEX (Analysis of Likelihood of Extinction, Possingham, Lindenmeyer and Norton 1993). The South Australian Wildlife Conservation Fund provided funding for the PVA which assessed probabilities of extinction under different scenarios to help formulate and prioritise management decisions regarding MLR Southern Emu-wrens and their habitats. *The addition of data collected since the PVA was conducted will increase the value of the model's application to MLR Southern Emu-wren management. The PVA would be a valuable tool in the preparation of the translocation strategy (Action 5a).*

Methods: The model will be refined and will incorporate all available demographic and other relevant data on MLR Southern Emu-wrens and their habitats. Results will be fed into management actions, guidelines and recommendations.

Responsibilities: administration – Conservation Council of SA; update model – contract ornithologist.

Summary of costs: Contract ornithologist 100 h to run PVA in year 2001 (\$2,554).

Funding for action 5c (in \$'000s):

Source	1999	2000	2001	2002	2003	Total
Vols	–	–	–	–	–	–
Other	–	–	2.6	–	–	2.6
Total	–	–	2.6	–	–	2.6

*Funded by South Australian Wildlife Conservation Fund

4.6 ACTION 6: Nominate Fleurieu Peninsula Swamps as Threatened Ecological Communities under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

Justification: There is evidence to suggest that Fleurieu Peninsula Swamps are subject to current and continuing threats that are likely to lead to extinctions as demonstrated by a:

- a) marked alteration of community structure; and
- b) restricted geographic distribution such that the community could be lost within ten years by the action of a threatening process.

Methods: Methods would follow the established protocol for nomination.

Responsibilities: administration – Department for Environment and Heritage (DEH), TSN; nomination – DEH, TSN, contract botanist.

Summary of costs: Contract botanist for 80 hours to assess ecological community in year 1999 (\$1,926). In-kind support is provided by the Ecologist, Threatened Species and Communities, DEH for 40 h and Coordinator, Threatened Species Network (SA) for 20 h to prepare the nomination. Voluntary input is 50 h to assist the botanist and the Threatened Species Network (\$1,000).

Funding for action 6 (in \$'000s):

Source	1999	2000	2001	2002	2003	Total
Vols	1.0	–	–	–	–	1.0
DEH/TSN*	1.7	–	–	–	–	1.7
Other	1.9	–	–	–	–	1.9
Total	4.6	–	–	–	–	4.6

*Funded by Dept for Environment and Heritage; Threatened Species Network

4.7 ACTION 7: Assemble a Recovery Team twice yearly to review progress of the Recovery Plan

Justification: The appropriate body to undertake reviews of the Recovery Plan is a Recovery Team drawn from representatives of funding bodies, land management agencies, landholders, the community and other people with relevant expertise.

Methods: A Recovery Team with appropriate expertise, community standing and concern for conservation of the MLR Southern Emu-wren will meet at least twice a year. The team will consist of one representative (except where indicated) from each of the following:

- Conservation Council of South Australia
- Department for Environment and Heritage
 - Senior Ecologist, Species Conservation
 - Ecologist, Threatened Species and Communities
 - Senior Ranger, Deep Creek Conservation Park
- Ornithologist, University of Adelaide
- Local Landholder
- Threatened Species Network SA
- Local Government
- Regional Catchment Program
- Others, including contract employees, will attend as expert participants

Members of the recovery team will encourage ongoing monitoring and evaluation of the recovery process by administrators and contract employees, and provide advice on changes to actions which result from this process.

Responsibilities: team administration – Conservation Council of SA and DEH

Summary of costs: Team member for 75 h to prepare minutes and report on meetings to funding bodies (\$1,800 in 1999, indexed).

The in-kind contribution from DEH includes the time of three staff (includes preparation, attendance, and tasks arising from the meetings) and travel for a ranger from Deep Creek Conservation Park (two trips/yr at 200 km each). The TSN component is for time relating to the meetings.

The volunteer component is for time and travel associated with meetings for landholder and other voluntary participants. Travel for the landholder is two trips/yr at 200 km each. There is also a voluntary component for tasks arising from the meetings. The involvement of the Conservation Council of SA is covered in action 3c. The CCSA also outsources the advisory position of the ornithologist from the University of Adelaide.

Funding for action 7 (in \$'000s):

Source	1999	2000	2001	2002	2003	Total
Vols	3.0	3.1	3.2	3.3	3.4	16.0
DEH*	3.0	3.1	3.2	3.3	3.4	16.0
TSN**	1.0	1.0	1.1	1.1	1.1	5.3
Other	1.8	1.9	2.0	2.1	2.2	10.0
Total	8.8	9.1	9.5	9.8	10.1	47.3

*Funded by Department for Environment and Heritage & Aboriginal Affairs; and Threatened Species Network

5.0 Implementation Schedule

Action	Description of Action	Priority	Feasibility	Responsible Party*	Estimated Costs (in \$'000s)					Total Costs
					1999	2000	2001	2002	2003	
1a	Identify revegetation sites	1	100%	Bot./CCSA	29.9	0	0	0	0	29.9
1b	Revegetate, rehabilitate and enhance	1	90%	Bot./CCSA	34.1	37.1	27.4	58.4	77.4	234.4
2a	I.D. key vegetation features	1	90%	Bot./CCSA	0	28.2	32.9	0	0	61.1
2b	Swamp experiments	1	90%	Bot./CCSA	32.0	30.1	23.3	31.9	27.4	144.7
2c	Swamp management strategy	1	100%	Bot./CCSA	7.5	0	10.1	30.3	8.9	56.8
3a	Liaise with planners	1	100%	EO/CCSA	14.9	15.4	15.9	13.9	14.3	74.4
3b	Community support structures	1	85%	EO/CCSA	15.6	16.1	16.5	15.4	15.8	79.4
3c	Public relations and volunteers	2	95%	EO/CCSA	49.9	51.3	56.4	46.5	47.5	251.6
4a	Emu-wren use of vegetation	1	95%	Orn./CCSA	51.5	55.5	0	0	0	107.0
4b	Emu-wren performance	1	95%	Orn./CCSA	47.0	50.8	78.4	80.5	77.6	334.3
4c	Census	2	95%	Orn./EO/CCSA	21.3	0	22.5	0	23.9	67.7
5a	Translocation strategy	2	100%	Consultant	0	0	5.8	0	0	5.8
5b	Genetics	2	90%	SAM/Orn.	0	0	47.4	0	0	47.4
5c	Population viability analysis	3	100%	Orn./CCSA	0	0	2.6	0	0	2.6
6	Nominate thr. ecol. Community	3	100%	DEH/TSN/Bot.	4.6	0	0	0	0	4.6
7	Operate recovery team	1	100%	Team	8.8	9.1	9.5	9.8	10.1	47.3
Totals:					317.1	293.6	348.7	286.7	302.9	1549.0

*Bot. = Contract Botanist; CCSA = Conservation Council of South Australia; EO = Extension Officer; Orn. = Contract Ornithologist; SAM = South Australian Museum; DEH = Department for Environment and Heritage; TSN = Threatened Species Network (SA); Team = MLR Southern Emu-wren Recovery Team.

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