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Review of Landscape, Multi- and Single Species Recovery Planning for Threatened Species

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Contents

Executive Summary

This project identifies the benefits and shortcomings of three types of recovery plans for threatened species – landscape (ecosystem), multi-species and single species plans – and makes preliminary recommendations regarding the types of plan most suited for delivering specific conservation outcomes. This information was obtained from reviewing 12 Australian recovery plans, interviews with 24 stakeholders associated with writing and implementing these plans and previous evaluation studies of recovery planning, in particular the recently completed study by the US National Center for Ecological Analysis and Synthesis (referred to through out this report as the *SCB Project*). For each plan, the stakeholders were selected so that one worked for a government agency and the other was a community member, with each having involvement in writing and/or implementing the plan.

This review focused on a number of features of recovery plans. Central features were: the extent to which biological information on and threats faced by the focal species were included in the plan; the inclusion and extent of implementation of biologically- and threat-related recovery actions, and research, monitoring and community involvement recovery actions; and the inclusion of costing and mechanisms for accountability and performance reporting. Information on the status and status trend of focal species was sought from the plans and interviews. The interviews were also used to collect information on stakeholders' definitions of recovery 'success', and their views regarding the benefits and shortcomings of the different plan types.

The initial intention in designing this project was to replicate the US study, although with a much smaller sample size, and examine the relative success or otherwise of a recovery plan based on whether it was associated with an improving or at the very least a stable population of the focal species of interest. The US study used population status and the extent of implementation of recovery actions as its dependent variables for determining recovery success. Reliable data were not available on population size for the species covered by the recovery plans we reviewed. The two respondents associated with each plan often provided different advice on the status of the species of interest. As such, we sought other measures of success, predominantly from the interviews, labeled them second order outcomes, and then explored the possible attribution of the features of the different types of recovery plans to these outcomes.

Comparison of Single, Multi- and Landscape Plans

Biological Information and Recovery Actions

Plans were reviewed to determine the extent to which information was provided on the biology of the focal species and the extent of biologically-related recovery actions. More ecological and biological information was included in single species plans than in multi-species plans and more in multi-species than in landscape plans. Life history, genetics, behaviour and general ecology were addressed in a greater percentage of single species plans than in the other two types. The same trend was apparent in the recovery actions with more attention to biological recovery and research actions in single and multi-species plans than in landscape ones. For example, none of the landscape plans had recovery or research actions addressing genetic management, life history or behaviour, all of which appeared in at least one of the single species plans. Research into recovery methods was not part of landscape plans in contrast to its inclusion in several of the multi- and single species plans.

Clark and Harvey (2002), as part of the *SCB Project*, found that multi-species plans (including ecosystem and multi-species plans) reflected a poorer understanding of species-

specific biology, a finding complimenting the results reported here. Gerber and Hatch (2002) concluded from the same study that multi-species plans seemed to have fewer recovery criteria whose selection was very clearly related to biological information. They also noted that only if biological information is known and included in recovery plans (or associated databases), and can be quantified, is determination of recovery success or otherwise possible.

Recommendation 1. The inclusion of biological information in recovery plans is strongly encouraged as it can improve planning and have immediate benefits. It also enables biologically meaningful recovery criteria to be determined and quantitatively measured (e.g. population size). Single species plans are the best performers to-date in terms of including and using biological information.

Managing Habitat and Recovery Actions

Information on habitat requirements is an essential part of understanding the biology of the focal species. Gerber and Hatch (2002) identified habitat quality and quantity as one of five categories of metrics for measuring recovery success. In this study, species' habitat requirements were the most comprehensively included of all the biological features assessed in the plans. All single species plans included details on habitat requirements, compared to just over half of the multi-species plans and one of the three landscape plans.

All three plan types included actions for preventing habitat clearing and supporting habitat restoration and research. Habitat loss is such a fundamental concern in Australia that it is bound to be prominent in the minds of those involved in nature conservation activities. In interviews, respondents noted that single species plans in particular had a strong habitat focus, with an emphasis on critical habitat.

Recommendation 2. Recognising that while habitat requirements are generally well addressed in all three plan types, single species plans are better suited for focusing on habitat (especially critical habitat requirements) than multi-species plans which in turn are better than landscape plans.

Managing Threats and Recovery Actions

There was widespread agreement among those involved in recovery planning that addressing threats is essential for recovery success. The landscape plans reviewed included a diverse array of threats. Such a high number of threats is to be expected given the number of species (~54-157) covered in the landscape plans and hence the associated number and diversity of threats. Interestingly, however, not all the threats mentioned in the landscape plans were accompanied by a recovery action. For example, information on dieback as a threat was included in three plans but associated recovery actions were only included in one plan. Parker (1999) identified inconsistencies between plan elements, commenting that less than one third of the plans she audited displayed a clear relationship between actions, goals and objectives.

A lower percentage of multi- and single species plans, relative to the landscape plans, included information on threats. The reason for this is probably the smaller number of species covered in the multi- and single species plans and hence the smaller number of associated threats. In these two types of plans there was more consistency than in the landscape plans about threats and the associated inclusion of recovery actions. For several threats, however, actions were given in a plan with no background information on the threat provided (e.g. for exotic species – competition, managing resource extraction).

Landscape and multi-species plans were identified in interviews as suitable types of plans for addressing threat management – the former for threat abatement across landscapes and the latter for addressing similar (and disparate) threats. Threatening processes were also a focus of research attention in these two plan types. The only apparent difference in suitability of these two plan types for addressing threats was that multi-species plans appeared 'better' at taking information on threats through to recovery actions. One respondent noted that multi-species plan allowed threats and associated actions to be clearly articulated.

Recommendation 3. All plan types clearly consider threats. Multi-species plans seem the optimal plan type for managing threats: they have the background information on threats and associated, related management actions and can potentially address similar or disparate threats.

Recommendation 4. If possible given the breadth and complexity of landscape plans, the information on threats in these plans should be complemented by related recovery actions. This is a shortcoming in current approaches to landscape planning.

Performance Reporting, Monitoring and Information Management

Almost all of the plans included measurable objectives, against which performance was regularly reported. Measures of performance included focal species, threats and habitat. These findings contrast with those of Campbell *et al.* (2002) from the *SCB Project*, where they found monitoring concentrating on the focal species' status while neglecting habitat requirements and threats. Over two-thirds of all plan types included monitoring as a necessary compliment to recovery actions.

The importance of information management was raised by a number of respondents in the interviews. Around half of the plans in each plan type had or intended to develop a recovery database or similar repository of information. Respondents identified landscape and multi-species plans as useful for bringing together such information. Concerns regarding information and its management were associated with all three plan types. The concern was slightly different for each type. For landscape plans it was the lack of availability of detailed information. When such information was available, the lack of skills to deal with the resultant complexity was an issue. For multi-species plans, the concern was the lack of information and, if it was available, not being able to include the desired level of detail. For single species plans, the concern was not having 'good' information about what actions were possible.

Recommendation 5. Every effort should be made, for all plan types, to collate, store and use information at the level of detail and complexity required by the type of plan. A good recovery database can make a significant contribution to implementation.

Community Involvement and Awareness

There was strong community involvement in all three plan types – via plan preparation and administration, team meetings and recovery activities. Implementation of education programs was underway for most plans. This contrasts strongly with the finding by Tear *et al.* (1995) that although public education programs were mentioned in 92% of plans less than 18% were conducted. In Australia, we have a reasonably long history of community involvement in recovery plan development and implementation (Blyth *et al.* 1995), which has probably made a significant contribution to the apparent commitment to implementing education programs.

Community engagement was of great interest to many of those interviewed (including an equal mix of government and community people). It was perceived in slightly different ways in relation to each plan type. The ability of landscape plans to engage farmers and other landholders was highly regarded. Multi-species plans were identified as helping communication between lots of different people while single species plans make it easy for people to focus and act together.

Recommendation 6. Community members should continue to be engaged, in all three recovery plan types, in the writing of recovery plans, plan administration via recovery teams and other means, and community leadership of recovery planning.

Recommendation 7. The expertise, experience and commitment of government agencies should continue to be engaged, in all three recovery plan types, through similar means to these listed above, while recognising that they may often have statutory responsibilities for areas covered by recovery plans and/or associated species.

Budget and Cost-Effectiveness

Initially we intended to collect funding information so we could make some judgment about the cost-effectiveness per species for each type of recovery plan. However, we were strongly influenced by the advice of Hoekstra *et al.* (2002) from the *SCB Project*. They found, in the early stages of their project, that budgets and cost estimates were 'too variable in format and completeness to reliably include them' (p.639). As such, we did not collect any funding details apart from whether costings were included in the plans. Such costings were included in all multi- and single species plans but in only one of the three landscape plans.

Recommendation 8. Continue to include detailed costings in multi- and single-species plans while ensuing that this approach is also strongly encouraged in landscape planning. Where detailed costings are essential, single and multi-species plans are currently more likely to meet this need than landscape plans.

Recommendation 9. If cost minimisation per species is of central importance then landscape plans are the obvious choice.

Adaptive Management and Uncertainty

There have been a number of calls for adaptive management in recovery planning (e.g. Foin *et al.* 1998; Boersma *et al.* 2001). Multi-species plans were identified in this study as being able to address adaptive management, in contrast to landscape and single species plans. A supporting comment from the interviews was that multi-species plans allowed the lessons learned with one species to be transferred to another covered by the same plan.

Recommendation 10. Where adaptive management is regarded as critical (e.g. where there is poor information, threats and their effects are poorly known, the status of the land and management resources are uncertain), multi-species plans are currently the best choice.

Recommendation 11. Adaptive management seems essential given the increasing complexity of, and uncertainties associated with, recovery of threatened species. As such, efforts should be made in all three plan types, to better understand how adaptive management might be used for recovery planning and management and to subsequently integrate such an approach into recovery planning.

General Comparative Comments

Landscape plans were preferred by almost half of our respondents (46%), even though only 15% of them were directly associated with this type of plan. Landscape plans currently have a high profile in Australia, with the associated enthusiasm probably related in large part to the Commonwealth government's current emphasis on regional delivery of natural resource management. The associated reasoning is that landscape plans enable part, or all, of a natural resource management region to be covered by a single recovery plan, with the associated cost and other resource savings. This current view (Moore and Jennings 2000) explains in large part the support for landscape plans.

Evidence from recent evaluations in the United States (e.g. Boersma *et al.* 2001; Hoekstra *et al.* 2002), provides little support for multi-species plans. Associated researchers found that species covered under multi-species plans were almost four times less likely to exhibit improving status trends than were species covered by single species plans. Lundquist *et al.* (2002) noted that multi-species plans have fewer tasks completed, while Clark and Harvey (2002), also drawing on the *SCB Project*, noted that multi-species plans were less likely to include species-specific biological information, adaptive management or to be revised. No clear benefits from multi-species planning were identified from the *SCB Project*.

In addition to the specific comments made in the preceding sections on the benefits and shortcomings of the different types of plans, some more general comparative comments can also be made. All three plan types can contribute to biodiversity outcomes, threat and habitat management, and community engagement, as well as a number of other outcomes. Variations exist, however, between plans for most of these benefits. For example in terms of biodiversity contributions, landscape plans are good at protecting the whole environment, multi-species plans deal well with biological complexity within a defined geographic area, while single species plans are best for focusing attention on a single species close to extinction. Common shortcomings included lack of funding, and of commitment to research and monitoring, among others. Again, there were differences between plan types. For example, commitment to research was poorer in landscape plans than in the other two.

Recommendation 11. Given the results from the *SCB Project* and this study, landscape plans should be adopted with caution. Clark *et al.* (2002, 1516) noted that 'the USFWS needs to carefully re-evaluate its use of multi-species plans to ensure that species recovery is not compromised in the interest of administrative expediency'.

Recommendation 12. To enhance their potential for success, landscape plans for threatened species should include: biological information on focal species, linked to recovery actions; recovery actions for threats identified, performance reporting and regular monitoring against biologically-related outcomes (such as population size); and sufficient funding and personnel resources for each species in the plan.

Measures of Recovery 'Success'

We identified first and second order measures of success. These measures were derived from research and practice elsewhere, particularly in the United States, and by asking respondents how they defined recovery success as well as the additional benefits they perceived accruing from recovery planning.

First order measures of success were whether a threatened species has been de-listed, whether its status has improved, for example the population has increased, and if a high percentage of recovery actions are implemented or underway. None of the species in the

plans reviewed had been de-listed. In terms of changes in status, there was so much variability in the status reported for the focal species within each plan that this measure could not be used. This problem relates to the lack of accurate information on current numbers of individuals and/or populations. The only general trend apparent was that more of the single and multi-species plans included 'increasing' as a status measure than was apparent from the landscape plans. Boersma *et al.* (2001) were able to use status as trend data were available, noted that species covered under multi-species plans were almost four times less likely to exhibit improving status trends than species covered by single species plans. The only general conclusion that can be drawn is that single and multi-species plans may be more likely to contribute to improving rather than static or declining status trends but there is too little conclusive information to make a definitive statement.

Gerber and Hatch (2002) noted five categories of metrics for defining recovery criteria, all of which rely on quantitatively reporting on status changes. These metrics aim to provide a measure of status. The categories were population size, population trend, habitat quantity and quality, demography (e.g. age structure of population) and legal and policy (e.g. existence/significance of threat). Respondents associated with all three plan types identified species' numbers and population size and numbers, habitat quantity and quality, and extent of threats as measures of success.

In terms of the extent to which recovery actions have been implemented, there was little difference between the three types of plans – 94% of the recovery actions in landscape plans were being implemented, 91% of actions in multi-species plans and 89% in single species plans. The lack of variation in the extent of implementation in our project suggests that no one type of plan is better than any other in terms of the extent to which management actions have been implemented.

These findings are different to those of Lundquist *et al.* (2002) reporting on the implementation component of the *SCB Project*. They found that 87% of the recovery actions in ecosystem plans (equivalent to an Australian landscape plan) were being implemented, 48% of actions in multi-species plans and 76% in single species plans. They concluded that the percentage of tasks implemented was significantly higher in single species and ecosystem plans compared to multi-species plans. Our project showed higher implementation rates for both single and multi-species plans compared to those identified by Lundquist *et al.* (2002). The reasons for these differences between the studies are not clear.

In terms of second order measures of success, a number became apparent from interviews including cost-effectiveness; community awareness, engagement and cultural change; integration with other planning; 'modern' plan structure, integrating existing knowledge; embracing adaptive management; commitment to research and monitoring; and benefits to Aboriginal people. As is described in the last part of this *Executive Summary*, each plan type provides a different relative opportunity for achieving success using these measures.

Recommendation 13. As a matter of highest priority and independent of plan type, quantitative information on key measures of success, such as the total population size, quantity of habitat and existence/significance of threats, should be collected and periodically re-collected. Without this information the success or otherwise of recovery planning can not be determined.

Recommendation 14. Recognise that although achievement of first order measures of success is essential for recovery of a species, the achievement of one or more second order measures are also important outcomes of recovery activities.

Selecting a Plan to Achieve the Desired Outcomes

A simple way of organising desired outcomes is to consider them as the first and second order measures of success as described above. As such, first order outcomes are de-listing, improvements in status, and the percentage of actions implemented (the higher the percentage the better and more 'successful' the plan). Second order outcomes focus on engagement with local communities, efficient planning, adaptive management, and research and monitoring. The following table summarises the relative merits of the three plan types using these outcomes. This analysis should be treated with some caution given the small number of plans reviewed.

A few comments on the ideas given in this table follow, mainly to make sure their general intent is clear. Species de-listing, extent of implementation and focal species' numbers provides little guidance for differentiating between the plan types either because there is no difference between plans (i.e. for de-listing, extent of implementation) or there are insufficient data to judge the difference (i.e. for status based on focal species' numbers). The usefulness of the remainder of the outcomes are as predicted by respondents in interviews; they are not based on measures of success.

In the interviews, respondents noted that all plan types could potentially increase species' and population numbers. In terms of habitat outcomes, landscape plans can protect the whole environment, while multi-species plans are best for general habitat outcomes and single species plans for addressing critical habitat. In terms of threats, landscape plans are best for threat abatement activities across a landscape whereas multi-species plans are best when there are similar threats (and/or species in close proximity, of the same taxonomic group, with similar management requirements or that can be managed by the same agency/group). The view was also put forward that it is better to include different threats/conflicting management within a multi-species plan to get the issues resolved. Single species plans are useful when there are numerous, diverse threats to a species and/or the cause of the threat is unknown (e.g. as for rainforest frogs).

If cost minimisation per species is the objective, then landscape plans are the most cost-effective in terms of grouping species, threats and actions. Community cultural change occurs best in landscape plans where those involved in production activities can recognise the benefits of biodiversity conservation. It can also occur through single species plans where a sense of regional local identity may be constructed around a species. For raising awareness of threatened species, both multi- and single species plans work. They are more likely to work for species that people can see (multi-species plans) or are charismatic (single species plans). All three plan types achieve community engagement in plan development and implementation.

In terms of planning and integration with other planning, whether local government planning schemes or multi- or single species plans, landscape plans were identified as the best. In terms of 'modern' plan structures, all three plan types can incorporate (and effectively use) objectives, detailed actions and performance indicators. Landscape and multi-species plans were regarded as better able to integrate information, and in some cases are using GIS to do so, than single species plans. For adaptive management, multi-species plans offer the best opportunities. Commitment to research and monitoring is greater in multi- and single species plans. Last but not least, if benefits to Aboriginal people are a desired outcome and the species has an association or potential association with Aboriginal people, then a single species plan can potentially contribute to that outcome.

Table. Suitability of Plan Type for Achieving Desired Outcomes

Desired Outcome	**Landscape**	**Multi-species**	**Single species**
First Order Outcomes			
SPECIES DE-LISTED*	No	No	No
EXTENT OF IMPLEMENTATION:			
High percentage of actions implemented or underway*	94%	91%	89%
STATUS: Population size:			
Focal species' numbers*	UU	UU	UU
Focal species' numbers/population stabilised	★		★
Focal species' numbers/population increased	★	★	★
STATUS: Habitat quantity and quality:			
Whole environment protected	★		
General habitat protection & restoration		★	
Critical habitat protection & restoration			★
STATUS: Threat management:			
General threat management	★		
Targeted threat management		★	★
Second Order Outcomes			
Cost effectiveness (saves time & money)	★		
Working with communities:			
Community cultural change	★		★
Increasing community awareness		★	★
Community engagement (inc. support & ownership)	★	★	★
Planning efficiencies:			
Integration with other planning	★		
'Modern' plan structure+	★	★	★
Integrating existing knowledge	★	★	
Embracing adaptive management		★	
Commitment to research & monitoring		★	★
Benefits to Aboriginal people			★

* Lack of information and/or lack of differentiation between plan types for these outcomes means they can not contribute to selecting the ideal plan type; UU – unknown/uncertain; ★ Ideal plan type to provide outcome based on respondents' comments, + Can incorporate (and effectively use) objectives, detailed actions and performance indicators.

Finally, more than one plan type may be selected. For example, the Stock Island Tree Snail is addressed in a single species plan, plus it is one of the 68 listed species in the multi-species recovery plan for south Florida (Boyer 2001). Several respondents mentioned the value of having a landscape plan within which are embedded multi- and/or single species plans for high priority species.

Recommendation 15. The above table and associated text should be used to assist in determining the 'best' type of plan for achieving the desired outcomes of recovery planning, where these may be either first order outcomes such as de-listing of a species and/or second order outcomes such as community engagement or adaptive management.

Recommendation 16. The benefit of using more than one plan type should be recognised, especially where there are critically endangered species. This may mean that such species are the focus of a landscape plan and then receive more species-specific attention in a multi- or single species plan.

1. Introduction

1.1 Project Purpose

This project reviewed current recovery plans and drew on the experiences of those involved in recovery planning and research elsewhere to capture some of the lessons learnt in the actioning of recovery plans, particularly when using the newer, multi-species and landscape approaches. This report begins by briefly describing the status of recovery planning in Australia and gives the project some further context by describing previous efforts at evaluating recovery planning and the associated findings. Next the project's methods are detailed. These are followed by a review of the results from reviewing a selected subset of recovery plans and interviews with those involved in recovery planning. These findings are then discussed and positioned relative to findings from previous work. Particular attention is paid to the benefits and shortcomings of different types of recovery plans and the associated contributing factors. Recommendations are embedded within this discussion.

1.2 Biodiversity and Recovery Planning in Australia

Australia is increasingly being recognised internationally for its biodiversity values. Its south-west corner has been recently recognised as one of the top 25 biodiversity 'hotspots' in the world (Myers *et al.* 2000). A significant part of this diversity is attributable to a raft of threatened plant and animal species. Nationally, over 1,400 species are recognised as threatened (EPBC Act 1999 (Cwth)), due in large part to large-scale land clearing, habitat fragmentation, urban expansion and broad-scale agriculture. Other threats include salinity, climate change, predation and competition by feral animals, altered fire regimes, weed invasion and the declining quality and quantity of freshwater resources. Australia has been identified as of the world's regions most likely to undergo large losses of biodiversity in the next few decades (Sala *et al.* 2000).

Conservation efforts to protect these species are becoming increasingly urgent. Recovery planning, directed towards single species and more recently towards groups of species, landscapes and threatened ecological communities, is one such effort. Such planning has, in recent years, moved away from a focus on only one threatened species per plan/program to addressing several related or unrelated species, or to addressing sections of landscapes. In Australia, this shift to 'broader' planning has been a response to the enormity of the task of producing individual plans for all 1,400 species, plus plans for additional species recognised by individual States. It is also an attempt to reduce the costs of recovery planning.

Another factor pushing threatened species management towards larger-scale recovery efforts is the structuring of the Commonwealth Government's Natural Heritage Trust II (NHT II) and the design and delivery of the National Action Plan for Salinity and Water Quality (NAP) to provide conservation funds to 'regions'. To receive funding, each region must develop a regional plan for accreditation. Once accreditation is secured, each region will then receive funding to implement an investment strategy that complements their strategic plan. Stakeholders within each region can then bid for funds to address particular issues such as salinity, soil degradation or species decline. Given the limited funding available, competition for funding is likely to be fierce, while additionally, the recurring tension between agricultural production and nature conservation outcomes is likely to persist. Broader-scale recovery planning is likely to be regarded as more attractive than single species planning given this competition for limited resources and the greater expenses associated with single species planning.

Of fundamental importance in making these decisions about the types and levels of recovery planning is the efficacy and effectiveness of each type of planning in terms of achieving the desired conservation outcomes. There is little point is adopting a landscape approach if recovery of the species of concern is not achieved. On the other hand, if a multiple-species recovery plan achieves the desired conservation outcomes and costs less per species to write and implement than single species plans, then the former is clearly a better approach. Recovery plans are regarded as a crucial part of the 'recovery process' for species recognised as threatened. The most important parts of the plan are the recovery objectives, criteria for success or failure (performance indicators) and recovery actions (WATSCU, 1999). Researchers such as Burbidge (1996) strongly advocate the inclusion of detailed costings in the plan.

1.3 Aims of this Report

Given the above background, the aims of this report are to:

(1) Identify the *benefits and shortcomings* of a range of different types of recovery plans including single species, multi-species, and landscape/threat-based at a range of scales; and

(2) Develop a *set of criteria* that can be used to identify the type of plan most suited to delivering the best conservation outcomes in a given set of circumstances.

In the United States and in particular through the 1988 amendments to the *Endangered Species Act*, recovery plans are required to include 'objective, measurable' delisting criteria (16 U.S.C. section 1533 (f)(1)(b)(ii)) (Schultz and Gerber 2002). In the United States, these criteria refer to targets, for example a 10% increase in a specified population. The intention was to push planners to quantitatively define recovery goals. In this report and the Australian context, criteria have a different definition, as *principles* or *guidelines* to assist in determining the most appropriate type of plan.

Before moving into the heart of this report it is worth digressing briefly to examine what evaluative efforts have been directed towards recovery planning for threatened species.

1.4 Previous Efforts at Evaluating Recovery Planning

Both quantitative, large-scale and smaller-scale efforts, based on anecdotal evidence, have been made to evaluate or comment on the efficacy of different types of plans. Three comprehensive reviews have been conducted in the United States, by Tear *et al.* (1993, 1995), Foin *et al.* (1998) and most recently by Hoekstra *et al.* (2002) through the *Society for Conservation Biology Project* (SCB Project). A number of more anecdotal, but nevertheless useful, reviews have been completed by authors such as Burbidge (1996) and Parker (1999).[1]

Tear *et al.* (1993, 1995) reviewed all 314 available recovery plans approved by the US Fish and Wildlife Service and the National Marine Fisheries Service as of August 1991. In **Tear *et al.* (1993)** recovery goals were evaluated in relation to population size, number of populations and extinction risk. The analysis showed that 28% of plans had recovery goals below the size of existing populations and 37% of plans had recovery goals below the number of existing populations. For vertebrate recovery plans, 60% had goals that still placed the species in peril of extinction. The authors argue for biologically defensible recovery goals for population size and numbers and probabilities of persistence.

[1] It is likely that a number of other in-house reports exist within government and non-government organizations that were not accessible to us through the normal library database and internet sources.

The features of relevance to this report from the 1995 report by **Tear *et al.* (1995**) were the availability of biological information, whether there is taxonomic bias (a question picked up in subsequent studies) in recovery planning and how much public involvement has been planned for in the recovery process. Information on species' distributions was most common, being mentioned in 88% of recovery plans, while information on species' abundance, population demographics and dynamics (in descending order) was much less available. Generally, there was more biological information available in revised than original plans. There was evidence of taxonomic bias with animals favoured for recovery attention over plants, vertebrates over invertebrates and birds and mammals over fish and herpetofauna. Lastly, it was noteworthy that although public education programs were mentioned in 92% of plans, less than 18% were conducted.

Foin *et al.* (1998) reviewed over 300 (311) US recovery plans approved or available in draft through to mid-1994 in an effort to identify patterns across species and environments that could help set priorities for recovery planning and perhaps enable species to be grouped and considered collectively. They identified a principal and contributing causes of endangerment and used these causes to allocate listed species to one of three management categories, from lowest to highest management intensity – habitat preservation, habitat restoration and active management. They found that habitat reduction, habitat modification and exotic species were the three most commonly invoked causes of endangerment in recovery plans. A total of 42% of the species required active management, 21% habitat restoration and 37% habitat preservation.

These authors don't go as far as to suggest that species can then be grouped and collectively managed according to the required management response (e.g. all species requiring habitat restoration of a particular type could be considered within the one plan). They do, however, advocate recovery plans being based on choosing a management strategy with 'the choice defended by comparative analysis of similar species (taxonomically and/or ecologically) as well as by the particulars of the species', plus a consideration of management requirements (Foin *et al.* 1998, 183-4).

Abbitt and Scott (2001) examined the differences between recovered and declining endangered species. They identified 48 recovered or recovering species and 37 declining species. For all species they gathered data on the species' status and biology, threats and recovery management activities. They found that recovering species face threats that are easier to address, they occupy a greater percentage of their historic range and have a greater percentage of their recovery management objectives completed.

Hoekstra *et al.* (2002) gives the overview of the ***SCB Project*** that reviewed 100 single-species, 29 multi-species and 6 ecosystem recovery plans during the first half of 1999. Single species plans address a single species, multi-species plans were regarded as those addressing multiple listed species and ecosystem plans contained proposed and candidate species as well as listed species. Because few ecosystem plans existed, the few that did were included with the multi-species plans for the sake of analysis (Hoekstra *et al.* 2002). Clark *et al.* (2002) provides an accessible and easy-to-read synthesis of this project in the journal *Conservation Biology*. They detail the objectives of the project as: compiling a database on the characteristics and content of a large, representative sample of recovery plans; quantifying important patterns, trends, and differences among plans in the database through statistical analyses; and making recommendations for improving recovery plans.

The work by both Burbidge (1996) and Parker (1999) gives an Australian perspective. **Burbidge (1996)** detailed the essentials of a good recovery plan based on his experience as a scientist and recovery team member and through analysis of four recovery programs with

which he was familiar. These essentials include having a recovery team, clear responsibility for actions, brief background sections, biological problems have been solved, measurable criteria for success, and flexible plans that are regularly reviewed, facilitate public participation and include actions for education. He also noted that a recovery plan should integrate the management goals for the focal species or community into those of the wider human community. This last point has particular relevance for the newer, landscape approaches to recovery planning.

Parker (1999) conducted an audit of recovery planning in Australia, broadly reviewing 27 plans and of these 7 in detail. As part of this audit, she evaluated how well the plans provided goals, objectives and performance criteria and the links between them. Also of relevance to this project was her evaluation of the extent and quality of performance reporting against the objectives and criteria. Less than a third of the plans she audited displayed a clear relationship between actions, goals and objectives. She noted the need to clarify these links.

1.5 Findings from Previous Evaluations

A number of findings from the above evaluations, and others, are relevant to this project. The most relevant compare the efficacy and efficiencies of single versus multi-species plans.[2] Also relevant are those defining recovery success, given it is extremely difficult to impossible to judge the efficacy of a recovery plan without knowing whether it has been 'successful'. This sub-section concludes with a few additional findings from other studies, related to features of recovery planning regarded as crucial to or reflecting success.

Single Vs Multi-Species Plans

Most of the following findings derive from evaluations conducted in the United States. As of 1990, the US Fish and Wildlife Service has directed that multi-species recovery plans be prepared for groups of species sharing the same ecosystem or groups of taxonomically related species facing similar threats (USFWS, 1990, cited in Clark and Harvey, 2002). Table 1.1 summarises 'suitable' applications for multi-species recovery plans.

Table 1.1 Suitable applications for multi-species recovery plans*

Groups of species sharing an ecosystem or groups of taxonomically related species facing similar threats (Clark and Harvey 2002).
Many species subject to similar threats within a specified geographic area (Brown *et al.* 1996; Burbidge 1996).
Species grouped according to their management requirements (Foin *et al.* 1998).
Two or more species of the same genus, geographical area or political area sharing a common threat; use an ecosystem plan* where several listed species within an ecosystem/community rely on protection and/or restoration of the ecosystem to recover (Jewell 2000).

* Clark and Harvey (2002) categorised ecosystem recovery plans as a form of multi-species plan, an approach adopted in the above review table.

Jewell (2000), writing from within the US Fish and Wildlife Service in the *Endangered Species Bulletin*, provided the following guidance re plan choice: (1) select a single species plan when the species is distinct from other species in its habitat requirements and threats and is the only listed species in its general geographic area; (2) select a multi-species plan

[2]In several of the US studies, the term 'multi-species' plan encompasses ecosystem *and* multi-species plans (e.g. Clark and Harvey 2002).

when two or more species of the same genus or in the same geographic area share a common threat; and (3) select an ecosystem-based plan when several listed members of a biotic community rely on protection and/or restoration of their ecosystem to reach recovery.

A number of benefits as well as shortcomings of multi-species plans have been identified. Benefits relate to cost-effectiveness and preventing duplication of management actions, protecting non-focal species and habitats, and better engaging local communities (Table 1.2). Shortcomings included less time and money spent per species, less species-specific biological information, and the added complexity impeding implementation.

Table 1.2 Benefits of multi-species recovery plans*

Cost-effectiveness (Brown *et al.* 1996; Burbidge 1996; Boyer 2001).
Improved cost-effectiveness and greater opportunity for long-term success by operating within the context of surrounding land uses and species and habitat relationships (LaRoe 1993, in Tear *et al.* 1995). Tear *et al.* (1995) suggested developing recovery plans for multiple species from multiple taxonomic groups.
Protection of habitats and ecosystems also protects suites of species within them (Franklin 1993).
Where subspecies and populations could 'swamp' the recovery planning process, multi-species or ecosystem level planning provides the potential means to protect this diversity within ecosystems (Tear *et al.* 1993).
Multi-species plans can: streamline public comment; save time by reducing the need to describe habitats and threats for each species; promote thinking on a broader scale; reduce conflicts between listed species with potentially conflicting management requirements in the same area; and provide a management benefit for non-listed species (Jewell 2000).
Multi-species plans are more recent and hence may deal better with: rebuilding populations within historic ranges (rather than solely focusing on protecting existing populations as was the case with many early single species plans); environmental variability; community involvement; adaptive management; and political and social aspects of recovery (Boyer 2001).
Local, multi-species or regional approach can: develop local community campaigns to implement recovery actions; avoid duplication (provide a focused plan); be more efficient and cost-effective; and bring together a broader range of interested groups and individuals. Other benefits include: increased local understanding, awareness and community understanding; whole-of-landscape approach provides opportunity for arresting biodiversity decline; incorporation of conservation measures into local government planning schemes; and identification of previously unknown species (Boyes 2001).

* Clark and Harvey (2002) categorised ecosystem recovery plans as a form of multi-species plan, an approach adopted in the above review table.

Table 1.3 Shortcomings of multi-species recovery plans*

Less time and money spent per species.
Species covered under multi-species plans almost four times less likely to exhibit improving status trends than species covered by single-species plans (Boersma *et al.* 2001).**
Ecosystem approach increases the complexity of required management actions making multi-species plans more difficult and expensive to implement (LaRoe 1993, cited in Clark and Harvey 2002).
Added complexity of biological and political landscapes of multi-species plans may hinder effective recovery planning and actions (Tear *et al.* 1995).
Distribution of some species may extend beyond administrative boundaries of the planning area making management more complex.
Multi-species plans less likely to include species-specific biological information, adaptive management provisions or to be revised (Clark and Harvey 2002).**
Multi-species plans may be overly-ambitious, it may be difficult to assign priorities and responsibilities for implementation (especially where multiple agencies and/or land tenures are involved) (Boyer 2001)
Multi-species plans have fewer tasks completed (Lundquist *et al.* 2002).**
Multi-species plans have less diverse authorship (Schultz and Gerber 2002).**
Money currently not forthcoming to resource landscape plans (Boyes 2001).

* Clark and Harvey (2002) categorised ecosystem recovery plans as a form of multi-species plan, an approach adopted in the above review table. ** Based on comparative analysis with single species plans through the *SCB Project*.

No clear benefits from multi-species planning were identified in the *SCB Project*. The following summary details are from Clark and Harvey's (2002) comparative analysis of single and multi-species plans as part of this Project. By the end of 1998, >55% of all ESA-listed species with recovery plans were covered within multi-species plans (these plans covered 2-66 species). Multi-species plans were longer than single-species plans, although multi-species plans were shorter and gave fewer recovery tasks per species. A greater percentage of single species plans covered vertebrates and a greater percentage of multi-species plans covered plants. The average number of threat factors (threats were placed into one of nine general categories; for example, construction, agriculture) did not differ significantly between plans. However, species in multi-species plans were threatened more often by exotic species, and less often by water diversion, construction, pollution, and interactions with non-exotics. The placement of species in multi-species plans did not appear to be based on biological criteria. Clark *et al.* (2002, 1516) concluded that 'the USFWS needs to carefully re-evaluate its use of multi-species plans to ensure that species recovery is not compromised in the interest of administrative expediency'.

Boersma *et al.* (2001, 647) concluded from the same study, that contrary to their expectations, 'species covered under multispecies plans were *almost four times less likely* to exhibit improving status trends than were species covered by single-species plans' (emphasis added). They suggest that the effectiveness of the former may be limited because less time and money is spent per species. They also speculate that less time and money also results in poorer links between recovery goals and the biology of individual

species.[3] They conclude that to achieve efficiency and effectiveness requires sufficient funding and personnel resources for the recovery planning process that each species in a plan receives adequate attention.

Lundquist *et al.* (2002), as part of the same *SCB Project*, reviewed implementation. They found that multi-species plans had lower levels of task implementation which they noted as consistent with other studies They also note, however, that as multi-species plans are biased towards certain types of species (i.e. plants) differences in effectiveness may be partly due at least to correlations with factors such as taxonomic group (plants vs vertebrates) rather than plan type alone.

Whether the recovery plan is for plants or animals may be as important as the spatial scale of planning. A review of 135 recovery plans, encompassing 96 animal species and 85 plant and lichen species (Schultz and Gerber 2002), found the following:

a) More tasks were specified in animal than plant plans, with animals having more tasks associated with collecting biological information, related to habitat, population biology and behaviour;

b) Animals also had more tasks to address threats than plants. Animals were more often threatened by problems related to water diversion, pollution, and species interactions, whereas plants were more often threatened by exotic species. Both were threatened by construction, agriculture, resource use and alternation to habitat dynamics;

c) Similar numbers of management tasks for plants (more exotics-based tasks) and animals (more habitat and population-based tasks);

d) Recovery plans for plants and animals did not differ significantly in the number of proposed monitoring tasks; and

e) No differences for plant or animal plans in the use of biology to select recovery criteria.

Boyer (2001) compared the benefits for the listed Stock Island Tree Snail of being covered by a single species plan first written in 1982 with its consideration as part of the multi-species recovery plan for South Florida, which covers 68 listed species, 23 natural communities and 65,000 square kilometres. It is apparent from her paper that the benefits given for multi-species planning were a product of more recent approaches to recovery planning (increased focus on habitat, recognition of environmental variability, adaptive management framework) rather than whether the species is addressed in a single or multi-species plan.

Parker (1999) noted that recovery planning takes place in landscapes and local cultural frameworks. Thus, no matter whether a plan is single, multi-species or landscape focused, there must be an awareness of this broader context. Recovery teams will be increasingly required to understand cultural settings and be able to stimulate the needed cultural change. Burbidge *et al.* (1995) flagged recovery teams as the key to developing and implementing recovery plans. Not only should such teams be formed, they should also include members of government agencies and local communities and their landholders (Blyth *et al.* 1995). These authors noted that cooperation between such members was essential for recovery of threatened species.

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[3] These authors have developed a somewhat tenuous argument (p.646) that there is a positive relationship between linking of recovery goals to a species' biology and an improving status trend.

Defining 'Successful Recovery'

Recovery is defined as 'de-listing', not a return to the former total range or levels of former abundance (Burbidge 1996). Parker (1999) defined success as recovery of the species but noted full recovery as a rare event in Australia. To-date, however, few species have recovered and where they have it is through other means, such as the discovery of additional populations (Foin *et al.* 1998).

On this basis of so few species having 'recovered' (i.e. been de-listed), Boersma *et al.* (2001) choose to quantify plan effectiveness using trend categories – improving, stable, declining, extinct or unknown. These are the categories assigned by the US Fish and Wildlife Service when they report to the US Congress. Clark *et al.* (2002, 1514) similarly noted that 'effective recovery plans should lead to improvements in the species' status'. We adopted their categorisation in this project.

As part of the *SCB Project*, Gerber and Hatch (2002) evaluated recovery criteria used in the United States. They grouped recovery criteria into population size (including total population size, number of sub-populations, number of individuals in each sub-population), population trend, habitat fragmentation, species' demography (e.g. age structure of population) and legal and policy (e.g. significance of threats). Population size was the most quantitative and frequently used criterion. Species whose status was improving were more likely to have recovery criteria that had very clear relationships to biological information in contrast to declining species where this relationship was less clear. Species in multi-species plans seemed to have fewer recovery criteria whose selection was very clearly related to biological information. Lastly, they found a strong trend for species with improving status to have more total and more quantitative criteria.

Ancillary benefits of recovery programs include services to other species not covered by the plan, public education, fostering values for environmental health, community empowerment, acquisition of new knowledge, cultural enrichment, environmental health and sustainability (Parker, 1999).

A number of features of recovery planning have been identified in previous studies as crucial elements crucial to or reflecting the success of recovery plans. Summary details on a few of these follow: provisions for monitoring and performance reporting, how scientific knowledge is used and created in recovery planning, provisions for adaptive management, and plan implementation. Where available, this information is given so that it illustrates differences between single- and multi-species plans.

Monitoring and Performance Reporting

Reporting provisions and the associated need for regular monitoring have been identified as a weak point in Australian recovery plans (Parker 1999). Part of this concern is related to the lack of measurable, realistic criteria against which species' recovery can be assessed. Parker (1999) also noted that the achievement of objectives was 'unknown' in most cases due to an inability to measure them. She recommended annual reporting of estimated numbers of individuals for threatened species. Such reporting should be by an individual or organization independent of the recovery team and be publicly posted.

Boersma *et al.* (2001) similarly raised concerns about monitoring in the *SCB Project*. They found that only 55% of the management actions detailed in the 135 recovery plans they reviewed were monitored. In the same study, Schultz and Gerber (2002) found that for only 17% of the species did biological information clearly influence the monitoring protocols. Only about 30% of recovery plans clearly used biology to influence recovery criteria and targets (Schultz and Gerber 2002).

Campbell *et al.* (2002), also as part of the *SCB Project*, assessed the monitoring efforts in recovery plans. They 'considered both the extent to which monitoring tasks were proposed as part of the recovery effort and the extent to which the tasks proposed were actually implemented. In general, tasks devoted to tracking the species' population trend were more likely to be proposed and implemented than were other monitoring activities (e.g., those devoted to the species' demographics, its habitat requirements, or the impacts of predators, competitors, and exotics)…monitoring efforts did not adequately address the specific threats affecting species.'

Scientific Knowledge

Schultz and Gerber (2002) expressed concern that recovery planning has not improved over the last two decades in connecting focal species biology to important features of recovery planning efforts, such as management tasks, monitoring protocols and recovery criteria. This lack of connection makes evaluation of recovery difficult. Species whose recovery goals are well linked to biology appeared more likely to be improving in status (Boersma *et al.* 2001; Gerber and Hatch 2002). Smallwood *et al.* (1999) recommended the use of PVA in recovery plans (less than 15% of recovery plans reviewed in the *SCB Project* did so).

Improving the use of science in recovery plan development and implementation was flagged by Clark *et al.* (2002) as an improvement in recovery planning that was practical to implement and would have immediate benefits. Correcting generic failures in conservation biology was also flagged but would be slower and less easy to achieve. Existing data could be better applied in writing and implementing recovery plans. This could be achieved by making threats a primary focus, specifying monitoring for species status and recovery actions, and ensuring that data on species status are current, quantitative and documented. Threats are often identified but details of how they might be mitigated are not given. Many plans did not request information that would allow the determination of whether recovery tasks *were effective when implemented* (emphasis added) (Clark *et al.* 2002). Data on species' trends, as required in the US for reporting to Congress, is often best guesses. Having these data accurate and accessible is essential for effective recovery efforts (Clark *et al.* 2002).

Clark *et al.* (2002) raised several concerns regarding conservation biology as the central contributing discipline to recovery planning. They suggested that care be taken to avoid the taxonomic bias of favouring vertebrate species for recovery attention.

Adaptive Management

A central issue in recovery planning is what to do in the face of limited scientific knowledge. Currently, interim recovery plans provide a vehicle for protective actions while the much-needed research is undertaken. Parker (1999, 66) advocated an adaptive management approach in all types of recovery plans where 'management actions are deliberate experiments designed to both manage effectively and to generate better information for long-term management'. Foin *et al.* (1998) also called for adaptive management and that its principles be part of the implementation and evaluation of recovery plans. Monitoring is a crucial element of adaptive management. Boersma *et al.* (2001) suggested adaptive management accompany plan revision.

Clark and Harvey (2002) commented that single-species plans were more likely to suggest modification of management actions in response to new information (i.e. adaptive management). A greater percentage of single species plans were revised. However, although more recovery tasks from revised plans were implemented (Lundquist *et al.*

2002), species with revised plans were no more likely than those without revisions to have improving status (Boersma *et al.* 2002).

Recovery Plan Implementation

Lundquist *et al.* (2002) found from the *SCB Project* that an average of 70% of recovery tasks were either partially or completely implemented. For plans written pre-1990, implementation levels were high and relatively uniform. For plans written post-1990, implementation varied with plan and species' attributes. For this latter group, the percentage of tasks implemented was significantly higher for single species and ecosystem plans compared to multi-species plans. Also, the percentage of tasks implemented was significantly higher for plans that had been revised, where critical habitat was designated, a recovery coordinator has been appointed and a recovery database established. Also of interest was plant plans having a significantly lower implementation percentage than vertebrate plans.

2. Methods

2.1 Methods Overview

As described in the Introduction, this project reviewed current recovery plans and drew on the experiences of those involved in recovery planning and research elsewhere to capture some of the lessons learnt in the actioning of recovery plans, particularly when using the newer, multi-species and landscape approaches. To capture these lessons, we adopted a three-staged approach to this project, as described in the following sub-sections. The stages were selecting recovery plans for analysis and reviewing related literature, analysing the selected recovery plans and interviewing associated stakeholders and a final stage of producing the report and associated recommendations. The project and stages were developed in consultation with WWF Australia.

2.2 Plan Selection and Literature Review

Recovery plans were selected that together covered landscape, multi- and single species plans (Table 2.1). Here we defined landscape plans as addressing biodiversity outcomes at a landscape level, where threatened species recovery is one of a number of biodiversity outcomes being sought. Multi-species plans focus on the recovery of more than one species, while single species plans focus on a singles species. In this study we selected plans to collectively reflect the diversity of species covered by recovery planning in Australia – flora and fauna, as well as looking for examples of plans addressing mammals, reptiles, frogs and fish. We also sought examples from all states and the Commonwealth. Of fundamental importance in selecting plans was only using ones for which implementation was underway. This was critical because one of the ways in which we judged plan "success" was the extent of implementation. This made it quite difficult to find landscape plans because a number are in the final stages of completion but have not clearly/explicitly moved into implementation.

Selection of 12 plans was determined by the funding available for this project. Ideally, we would have liked to review four each from landscape, multi- and single species plan types. However, given the difficulty in locating landscape plans, we analysed only three landscape plans, five multi-species (to compensate in part for the smaller number of landscape plans), and four single species plans.

Table 2.1 Plans selected for analysis*

Plan	**State**	**Species**	**Date Impl. Began**	**Responsibility for Implementation**
Landscape plans (3)				
Goulburn-Broken	Vic	>157	2003	State agencies & private landholders
Lockyer	Qld	Flora (48), fauna (50), ecological communities (12)	2000	Gatton and Laidley Shire Council
Shrubland Association on Southern Swan Coastal Plan Ironstone	WA	Plants (54+) within one TEC	1999	DCLM
Multi-species plans (5)				
Recovery plan for the threatened Alpine Flora	NSW	Plants (4)	2001	NSW NPWS
Recovery plan for cave-dwelling bats	Qld	Mammals (3)	2001	QPWS, Department of Mines and Energy
Recovery plan for the stream-dwelling rainforest frogs of the Eungella region of mid-eastern Queensland	Qld	Amphibians (2)	2000	QPWS
Recovery plan for the Pedder, Swan, Clarence, swamp and saddled galaxias	Tas	Fish (5)	1997	Tasmanian Inland Fisheries
Recovery plan for twelve threatened spider-orchids	Vic & SA	Plants (12)	2000	VDNRE
Single species plans (4)				
Recovery plan for the angle-stemmed myrtle (*Austromyrtus gonoclada*)	Qld	Plant	2001	QEPA
Recovery Plan for the Mt Lofty Ranges Southern Emu-Wren	SA	Bird	1999	Private land holders
Noisy Scrub-bird Recovery Plan	WA	Bird	1996	DCLM
A Recovery Plan for the Great Desert Skink	NT	Lizard	2001	Community & govt agencies

TEC – Threatened ecological community. * Full publication details for these plans follow the list of references at the end of this report.

Potential plans for analysis were identified by Dr Nicola Markus (Species Program Manager, WWF Australia) in consultation with Threatened Species Network Coordinators

in each state. This process identified about 15-18 plans which was then refined down to 12 plans based on getting the "right mix" (see above) as well as selecting plans where implementation was underway. The final choice of plans was made by the authors, in consultation (via a teleconference) with Dr Markus and Dr Colleen O'Malley (Threatened Species Network Coordinator – Central Arid Rangelands).

Backhouse *et al.* (1996) commented that involving all participants is essential for a good review of recovery planning. As such, two people per plan were interviewed (App. 1). Initial contact details were sought from the Threatened Species Network and additional respondents sought through discussions with other interviewees. Every effort was made to interview one government agency respondent and one community member as well as covering some one involved in writing the plan and some one involved in implementing it.

Articles in national and international journals focused on the evaluation of recovery plans and planning were reviewed, to provide a context for this project and its findings as well as assisting in the project design. Much of this review material is presented in summary form in the Introduction and is used in the Discussion to place our findings in context.

2.3 Review of Recovery Plans and Interviews

Each recovery plan was analysed using the set of questions in Appendix 2 and summarised in Table 2.2. The questions sought to determine, for each plan, the background and context, biological attributes of and threats to the species covered, and recovery actions and extent of implementation. Given our central interest in comparing the three types of plans – landscape, multi- and single species – the results for each type have been grouped in the results so comparisons can be made between them.

The questions in the table, although drawn from a number of sources, relied heavily on Anon. (2002). This reference is a website providing the data collection instrument used for the *SCB Project.* Additionally, the categories of causes of species endangerment used by Foin *et al.* (1998) helped organise our descriptions of the ecological attributes of species. Lastly, the categories used by Parker (1999), in her audit of Australian recovery plans, were used to organise our evaluation of the background research information and recovery actions, especially those related to plan structure.

A number of questions could only be answered through interviews (Table 2.3, App. 3). Information was sought on the specific recovery plan and species with which respondents were involved as well as the respondents' views regarding recovery planning generally, especially in relation to landscape vs multi- vs single species plans. Interviews were conducted by phone. Notes taken during the conversation were typed up for analysis. Part 5 of Appendix 2 was emailed to respondents to obtain up-to-date information on the degree of implementation of each plan.

Table 2.2 Information collected from each recovery plan (full details given in App. 2)

Focus	**Includes…**
Context & background (Tables 3.1–3.2)	Focus of plan (i.e. landscape, multi-, single species) implementation date, plan author, responsibility for implementation, species' status, taxonomic group, range, range maps available, current number of populations
Structure & approach (Table 3.3)	Recovery goals & objectives, performance indicators & reporting, recovery actions prioritised
Biological/ecological information on focal species included in plan (Table 3.4)	Habitat requirements, population biology, threats, recovery methods
Threats faced by focal species included in plan (Table 3.5)	Construction, resource use, exotic species, habitat dynamics (e.g. altered fire regimes), grazing
Recovery actions included in the plan & extent of implementation* (Tables 3.6–3.11)	Biologically-related actions, threat-related actions, research, monitoring, community involvement & education
Costing included in the plan (Table 3.12)	Annual, administrative

* Extent of implementation determined from interviews.

Table 2.3 Information collected from interviews

Focus	**Topics covered**
Defining 'recovery success' (Table 3.13)	Status (e.g. stable, decreasing) of species
	Number of populations
	How respondents define success
Benefits & shortcomings of plans (Tables 3.14–3.19)	'Best' plan given biology of species & threats faced
	Landscape vs multi- vs single species plans – benefits & shortcomings
	Additional, beneficial, indirect outcomes from recovery plans
	Do all species in multi-species plans need similar management requirements for the plan to work?
	Are there equal benefits for all species in multi-species plans?

2.4 Analysis and Report Preparation

It is timely here to return to the aims of this report. These were to:

1. Identify the *benefits and shortcomings* of a range of different types of recovery plans including single species, multi-species, and landscape/threat-based at a range of scales; and
2. Develop a *set of criteria* that can be used to identify the type of plan most suited to delivering the best conservation outcomes in a given set of circumstances.

Of central importance to these aims was being able to determine recovery success. We sought to define success in four ways:

a) Status of the species as per Part 2 in Appendix 2 (Table 3.2);
b) Extent of implementation (% of recovery actions implemented, as derived from Part 5 in App. 2, Table 3.11);
c) As defined by respondents in the interviews (App. 3, Table 3.13); and
d) Beneficial outcomes beyond the plan's focal species as mentioned by respondents in the interviews (App. 3, Table 3.16).

(a) and (b) were both approaches taken in the *SCB Project*; (c) and (d) were developed specifically for this project.

3. Results

A total of 12 plans were reviewed (Table 2.1). Of these, 3 were landscape, 5 were multi-species and 4 were single-species plans. An associated 24 interviews were conducted (App. 1), with 2 respondents per plan, one each from a government agency and the other from the community. The following results are grouped according to these three plan types.

3.1 Context and Background of the Recovery Plans

Context and background details are given in Tables 3.1 and 3.2. Almost all the plans reviewed were regarded as approved plans, with approval by either the Commonwealth and/or state governments. The number of species covered varied from a mean of 103 species in the landscape plans to single species in the single species plans. The mean implementation date for all plans was 2000. The government had a role in both writing and implementing plans for at least half of the plans at all three levels.

Table 3.1 Plan background and context*

Feature	Landscape plan (3)	Multi-species plan (5)	Single species plan (4)
Approved recovery plan (●=yes)	●●○	●●●●●	●●●●
No. species covered	Range: >54 – >157 Mean: 103	Range: 2 – 12 Mean: 5.2	Range: 1 Mean: 1
Date implementation began	Range: 1999 – 2003 Mean: 2001	Range: 1997 – 2001 Mean: 2000	Range: 1996 – 2001 Mean: 2000
Complete range covered (lack of response taken as 'no') (●=yes)	●●○	●●●●●	●●○○
Lead organization in writing plan: state government [SG], catchment group [CatGp], conservation group [ConGp]**	50% [SG] 67% [CatGp]	100% [SG]	50% [SG] 50% [ConGp]
No. of organizations involved in writing plan	Range: 1 – 3 Mean: 1.7	Range: 1 – 3 Mean: 1.4	Range: 1– 2 Mean: 1.5
Responsibility for implementation: state government [SG], private landholders [PL], local government [LG]**	67% [SG] 33% [PL] 33% [LG]	100% [SG] (n=4)	67% [SG] 33% [PL] (n=3)
Plan coordinator: community or government?	⦿⦿ Government ● Community	⦿⦿⦿⦿ Government (n=4)	⦿ Government ● Community (n=2)
Percentage of area addressed by plan that is privately owned***	Range: >50 – 94 Mean: 68	Range: 0 Mean: 0 (n=2)	Range: 0 – 80 Mean: 40 (n=2)

* Number of dots correlates with number of plans. ** Doesn't sum to 100% because some plans have several lead authors or shared responsibility for implementation. *** It wasn't clear from almost half of the plans what this percentage was – treat this result with caution.

Generally, the status of most of the species addressed in the recovery plans was stable to declining (Table 3.2). No species had increased in number to the extent they had been de-listed. This is to be expected, at least in part, because all are relatively young plans. It was very apparent from the interviews that the status of most species was poorly known, to the extent that the two respondents for each plan gave different information regarding the status of the focal species (Table 3.2, row 3).

Table 3.2 Biological attributes of focal species*

Feature	**Landscape plan**	**Multi-species plan**	**Single species plan**
Species de-listed	0	0	0
Conservation status	Goulburn: EXT 3, CE 1, END 8, VUL 25** Lockyer: END 6, VUL 19 Swan: CE community with 9 DRF & 7 Priority	Alpine flora: VUL 3 Bats: END 1, RARE 1, VUL 1 Frogs: EXT 1, END 1 Fish: END 3, VUL 2 Orchids: END 10, VUL 3	Emu-Wren: CE Desert Skink: VUL Noisy Scrub-Bird: THR *Austromyrtus*: END
General species status***	Goulburn: Variable, inc. stable; decreasing & unknown Lockyer: Variable; decreasing Swan: Increasing, decreasing, unknown	Alpine flora: Unknown-stable; stable, one increasing Bats: Stable; declining Frogs: Extinct & stable; extinct & declining Fish: Stable & increasing; stable & increasing Orchids: Stable, increasing, unknown; unknown	Emu-Wren: Stable; stable Desert Skink: Stable to declining; decreasing from anecdotal evidence Noisy Scrub-Bird: Increasing in Albany Management Zone; increasing *Austromyrtus*: Stable; natural population stable, increasing because of propagation
Taxonomic group	1 All 1 All except plants 1 Plants only	2 Plants 1 Mammals 1 Amphibians 1 Fishes	2 Birds 1 Reptiles 1 Plants
Taxonomic relationships	Numerous groups	All same group	Not applicable
Maps of current range included	●○○	●●●○ (n=4)	●●○○
Current no. of populations included in plan	●○○	●●●●○	●●●○

Table 3.2 Biological attributes of focal species* (cont.)

Current no. of populations***	Goulburn: Unknown; 1-4 populations of focal species Lockyer: 100 listed species, not sure of population numbers Swan: 13 TEC occurrences	Alpine flora: 1-50 populations; 1-32 Bats: 1-100; unknown Frogs: 0-6/10; 4 Fish: 1-16; 1-16 Orchids: unknown, 1 - >10; unknown	Emu-Wren: 25-30; about 20 Desert Skink: 10; 6 areas & 3 populations in Anangu-Pitantjatjara lands Noisy-Scrub Bird: 3; 3 *Austromyrtus*: 8; 25 include. those planted out
Habitat specialist	● (n=1)	●●●● (n=4)	●●●○ [1 generalist]

* Number of dots correlates with number of plans (●=yes**)**. ** Numbers uncertain as different parts of the plan give different numbers. *** Based on interviewees' responses – 2 respondents per plan with the responses separated by a semi-colon. EXT – extinct, CE – critically endangered, END – endangered, VUL – vulnerable, DRF – declared rare flora, Priority – priority-listed flora, RARE – rare, THR – threatened.

3.2 Structure and Approach of the Recovery Plans

Almost all plans included measurable objectives, against which performance was regularly reported (Table 3.3). Goals were included in a fewer number of plans.

Table 3.3 Recovery goals, objectives and performance reporting*

Feature	**Landscape plan**	**Multi-species plan**	**Single species plan**
Goals included in the plan	●○○	●○○○○	○○○○
Recovery goals or performance indicators/targets based on PVA**	○○○	●○○○○	○○○○
Performance indicators/targets based on population size/numbers	●○○	●●○○○	●●●●
Objectives included	●●○	●●●●●	●●●●
Objectives are measurable+	●● (n=2)	●●●○○	●●●●
Performance reported against objectives	●● (n=2)	●●●●○	●●●●
Regular performance reporting (at least annually)	●●●	●●● (n=3)	●● (n=2)
Recovery actions prioritised (either in plan or subsequently)	●●●	●●○○○	●●○○

* Number of dots correlates with number of plans (●=yes**)**. ** PVA – population viability analysis.
+ To receive a "Y", >50% of objectives must be measurable.

3.3 Review of Information in the Recovery Plans

Plans were reviewed to determine the extent to which information was provided on the ecology and biology of the focal species and the threats they faced. More ecological and biological information was included in single species plans than multi-species, and more in multi-species than in landscape plans (Table 3.4). In particular, life history, genetics, behaviour and general ecology were addressed in a greater percentage of the single species plans than in the other two types. The best-covered areas in all three plan types were habitat requirements and threatening processes. The most poorly covered was population biology.

Table 3.4 Information on ecology and biology of focal species included in plan*

Feature	**Landscape plan**	**Multi-species plan**	**Single species plan**
Habitat requirements (includes species' distribution)	●○○	●●●○○	●●●●
Habitat mapping	●○○	●●○○○	●○○○
Critical habitat identified	●○○	●●●○○	●●●●
Population biology (includes species' abundance)	●○○	●●○○○	●●●●
Life history	○○○	●●○○○	●●●○
Genetics	○○○	○○○○○	●●○○
Behaviour	○○○	○○○○○	●●○○
General ecology	●○○	●○○○○	●●○○
Threatening processes	●○○	●●●○○	●●●○
Recovery methods (esp. captive breeding and translocation)	○○○	○○○○○	●●●○

* Number of dots correlates with number of plans (●=yes**)**.

Threats faced by species related to resource use, exotic species and habitat change (Table 3.5). Given the greater number of species addressed in the landscape plans, there were also many more threats, as indicated in Table 3.5 where there are dots in nearly every row against every threat. The most ubiquitous threats were those associated with habitat reduction and dynamics, with most of the landscape and single species plans referring to these types of threats.

Table 3.5 Information on threats to focal species included in plan*

Feature	Landscape plan	Multi-species plan*	Single species plan
Construction (e.g. roads, buildings, dams) identified as a threat in the plan	●○○	●●○○○	●●○○
Resource use (e.g. mining, gravel extraction, logging)	●○○	●●○○○	●○○○
Pollution (e.g. air, water, pesticides)	●○○	○○○○○	●●○○
Water diversion (e.g. dams, groundwater extraction, filling/draining wetlands)	●●○	●○○○○	●●○○
Exotic species – competition (e.g. weeds)	●●●	●○○○○	●○○○
Exotic species – predation (e.g. foxes, cats)	●○○	●●●○○	●○○○
Interactions with other non-exotic species (e.g. predation, competition, parasitism on focal species)	●○○	●○○○○	○○○○
Habitat reduction/fragmentation through clearing	●●●	●○○○○	●●●○
Habitat dynamics – altered fire regimes	●●○	●○○○○	●●●○
Habitat dynamics – dieback introduction and spread	●●●	○○○○○	○○○○
Habitat dynamics – altered hydrological regimes/salinity	●●●	○○○○○	●○○○
Harvesting	●● (n=2)	○○○○○	●○○○
Grazing	●●●	○○○○○	●●○○
Disturbance by visitors (esp. trampling for flora)	---	●●● (n=3)	● (n=1)

* Number of dots correlates with number of plans (●=yes**)**.

3.4 Review of Recovery Actions in the Recovery Plans

All plans had suites of recovery actions including biologically- and threat-related management actions, research and monitoring needs and actions to secure community involvement. The following set of tables (Tables 3.6 – 3.11) review the inclusion of actions in the plans and the extent to which the actions have been implemented. Information on implementation was obtained from the respondent responsible for implementing each plan. The extent of implementation is summarised by: ● for implementation completed; ⊙ implementation underway; ○ not implemented; and ? implementation status unknown. Absence of a symbol means that the action was not included in the plan. For biologically-

related management, habitat management received the most attention in all three plan types (Table 3.6). More attention was given to biologically-related management in multi- and single species plans. Uncertainty and adaptive management were given the most attention in multi-species plans.

Table 3.6 Biologically-related recovery actions in plan & extent of implementation*

Feature	**Landscape plan**	**Multi-species plan**	**Single species plan**
Captive breeding/propagation	⊙	⊙	⊙
Translocation		⊙⊙	●
Other genetic management			○○
Life history		⊙	○
Behaviour			⊙○
Preventing habitat clearing	⊙⊙	⊙⊙	⊙⊙
Protecting/restoring habitat	⊙⊙⊙	⊙⊙⊙	⊙⊙⊙
Environmental variability addressed	⊙	⊙⊙⊙⊙	
Environmental uncertainty addressed	⊙	⊙⊙⊙	
Adaptive management addressed	⊙	⊙⊙⊙⊙	⊙⊙

* Number of dots correlates with number of plans (● implementation completed, ⊙ implementation underway, ○ not implemented).

Recovery plans included an array of threat-related actions (Table 3.7). Threat-related actions received attention in relatively more of the single species plans compared to the multi-species and landscape plans. All three types of plans addressed similar sorts of threats – resource use, exotic species and habitat change.

Table 3.7 Threat-related recovery actions in plan & extent of implementation*

Feature	**Landscape plan**	**Multi-species plan**	**Single species plan**
Preventing/managing construction (e.g. roads, buildings, dams)	⊙	⊙⊙○	⊙⊙
Preventing/managing resource use (e.g. mining, gravel extraction)	⊙	⊙⊙	⊙⊙⊙
Preventing/managing pollution (e.g. air, water, pesticides)	⊙	○	⊙
Preventing/managing water diversion (e.g. groundwater extraction, filling/draining wetlands)	⊙⊙	⊙○	⊙
Removing/managing exotic species – competition (e.g. weeds)	⊙⊙⊙	⊙⊙	⊙⊙

Table 3.7 Threat-related recovery actions in plan & extent of implementation* (cont.)

Managing interactions with non-exotic species (e.g. predation, competition, parasitism)	⊙	⊙	
Managing fire regimes	●⊙⊙	⊙	⊙⊙⊙
Managing dieback introduction & spread	⊙	○	
Managing hydrological regimes/salinity	⊙	⊙	⊙
Preventing harvesting	⊙	⊙	⊙⊙

* Number of dots correlates with number of plans (● implementation completed, ⊙ implementation underway, ○ not implemented).

All plans included research actions (Table 3.8). Habitat requirements and mapping were part of almost all plans' research requirements. Population biology research was recommended in most of the multi-species and single species plans but to a lesser extent in the landscape plans. Overall, research actions received greater attention in the multi- and single species plans. In contrast, monitoring was flagged as a recovery action in almost all of the plans and all plan types (Table 3.9). Included were monitoring of the focal species, threats and habitat.

Table 3.8 Research recovery actions in plan & extent of implementation*

Feature	**Landscape plan**	**Multi-species plan**	**Single species plan**
Habitat requirements (includes species' distribution)	⊙⊙	⊙⊙⊙⊙	⊙⊙⊙
Habitat mapping	⊙⊙	⊙⊙	⊙⊙⊙
Population biology (includes species' abundance)	⊙	●⊙⊙⊙	⊙⊙⊙
Life history	⊙	⊙⊙	⊙○
Genetics		⊙⊙○	○**?**
Behaviour		○	⊙○
General ecology		⊙○	⊙⊙⊙
Threatening processes	⊙⊙	⊙⊙⊙	⊙○
Recovery methods (esp. captive breeding and translocation)		⊙⊙	●
PVA			○
Monitoring methods	⊙⊙	⊙	●

* Number of dots correlates with number of plans (● implementation completed, ⊙ implementation underway, ○ not implemented, ? implementation status unknown).

Table 3.9 Monitoring recovery actions in plan & extent of implementation*

Feature	Landscape plan	Multi-species plan	Single species plan
Monitoring focal species	⦿⦿○	⦿⦿⦿⦿⦿	●⦿⦿
Monitoring threats	⦿○	⦿⦿⦿⦿	⦿⦿⦿
Monitoring habitat	⦿⦿○	⦿⦿	⦿⦿⦿
Recovery database/central repository of information established	●⦿○	⦿⦿	⦿⦿⦿

* Number of dots correlates with number of plans (● implementation completed, ⦿ implementation underway, ○ not implemented).

Community involvement was the last substantial set of recovery actions reviewed (Table 3.10). For more than half of all three types of plans, there was community involvement in plan preparation and administration (i.e. as a member of recovery team). Community leadership was less common, although two of the three landscape plans centred their actions on community leadership.

Table 3.10 Community involvement recovery actions in plan & extent of implementation*[4]

Feature	Landscape plan	Multi-species plan*	Single species plan
Community involvement in plan preparation	●⦿	●●●	●●⦿
Community involvement in plan administration (i.e. member of recovery team)	●●⦿	●●⦿	⦿⦿⦿
Recovery Team meetings	⦿⦿⦿	⦿⦿⦿⦿	⦿⦿⦿
Community involvement in recovery activities	⦿⦿⦿	●⦿⦿⦿	⦿⦿⦿
Community leadership in recovery planning/actions	⦿⦿	⦿	⦿⦿
Education programs	⦿⦿⦿	⦿⦿⦿○	⦿⦿⦿

* Number of dots correlates with number of plans (● implementation completed, ⦿ implementation underway, ○ not implemented).

The results from the preceding tables (Tables 3.6–3.10) were summed, with 'implementation' including implementation underway and completed, to provide summary information on the relative extent of implementation of the three types of plans (Table 3.11). Most actions were being implemented in all three types of plans, although there was a slightly greater extent of implementation for landscape plans relative to multi-species plans, and for multi-species plans relative to single species plans.

[4] There were too many missing data to report on recovery team membership – although teams generally seemed to include scientists, government agency land managers and community members.

Table 3.11 Extent of implementation (%) for recovery plans

Actions	**Landscape plan**	**Multi-species plan**	**Single species plan**
Biologically-related	100	100	71
Threat-related	100	76	100
Research	100	88	77
Monitoring	64	100	100
Community involvement	100	95	100
Total implementation 'score'	***94***	***91***	***89***

A few comments on costing conclude the review of the plans. All of the multi- and single species plans included costings; only one of the three landscape plans did so (Table 3.11). Very few included costings for salaries and administrative overheads. The government was a central player in terms of responsibility and for most of the plans for which information was available, this responsibility was shared with the community.

Table 3.12 Costing & accountability*

Feature	**Landscape plan**	**Multi-species plan**	**Single species plan**
Costing included	●○○	●●●●●	●●●●
Costs such as salaries and administrative overheads included	○○○	●●○○○	●○○○
Cost to implement plan per year included	●○○	●●●●●	●●●○
Responsibility for actions**	⦿○○	⦿⦿○ (n=3)	○○ (n=2)

* Number of dots correlates with number of plans (●=yes). ** Number of dots correlates with number of plans (● community, ⦿ Government, ○ mix).

3.5 Recovery 'Success'

Respondents' views regarding recovery success are listed in Table 3.12. A number of these coalesced around population size and numbers, management of habitat and mitigation of threats. Some respondents provided a planning perspective on success by mentioning performance indicators and targets. Others saw community involvement as being integral. For landscape planning, stability and not wanting to lose species, plus increasing population numbers, were the most frequently mentioned measures of success. For multi-species plans, increases in numbers plus habitat restoration were most mentioned, while for single species plans, habitat restoration was the most mentioned, plus setting targets based on populations and individuals.

Table 3.13 Respondents' views of recovery 'success'*

Feature	**Landscape plan**	**Multi-species plan**	**Single species plan**
Populations & species			
Don't want to lose any species	●●		
Stable (sub) population numbers	●		●
Increase in (sub) population size/numbers	●●●	●●	●
Increase in species' numbers		●●●	●
Increase in area of occurrence	●		
In-situ & ex-situ conservation of species		●	
Natural processes			
Natural recruitment	●		●
Threats/habitat-directed			
Long-term (restoration &) protection of habitat	●	●●●	●●●
Threats-species linked			
Mitigation of threats so there is no long-term decline in species' numbers	●	●	
Species is stabilised so no net loss from threatening processes	●	●●	
More populations in secure habitats			●
Planning-focused			
Based on objectives & performance criteria given in the plan	●		
Upgraded to a better conservation status (e.g. from extinct to endangered)		●	
Species removed from threatened list			●
Targets based on numbers of populations, individuals	●		●●
Community-related			
Good community network interested in & encouraging on-ground outcomes		●	
Landowners valuing their threatened species & associated habitat			●

* ● Indicates comment made by a single respondent.

3.6 Benefits and Shortcomings of Different Types of Recovery Planning

In the interviews, respondents were asked to comment on the benefits and shortcomings of the three different types of recovery planning and their preferences regarding the 'best' type of plan. Also requested were their perceptions regarding additional differences between the three types of plans.

In the interviews, benefits were discussed by respondents in terms of biodiversity contributions, threat and habitat management, community engagement, planning benefits, information management, cost-effectiveness, relationships with other planning and adaptive management (Table 3.14). In terms of biodiversity contributions, landscape plans were seen to benefit biodiversity through protecting the whole environment whereas multi-species plans focus on a defined geographic area (usually smaller than the area covered by a landscape plan) and single species plans provide a biodiversity benefit by focusing on a single species close to extinction. For threat management, landscape plans are best for threat abatement activities across a landscape whereas multi-species plans are best when there are similar threats (and/or species in close proximity, of the same taxonomic group, with similar management requirements or that can be managed by the same agency/group).

For habitat management, landscape and multi-species plans were discussed in interviews as benefiting communities while single species plans have more of a habitat focus (for focal species only?). Although landscape and multi-species plans are noted as being more cost-effective, several respondents commented that it was easier to attract funding for single species plans. In terms of integrating with other planning, the greatest benefits were realised by landscape plans in terms of having multi- and single-species plans nested within them, and being able to integrate with local government planning.

In terms of shortcomings, respondents mentioned very similar areas of interest to their comments about benefits, although the perspective was one of shortcomings rather than benefits (Table 3.15). In addition to the topics covered as benefits, shortcomings related to the potential to miss out management actions, and lack of commitment to monitoring and research. The shortcoming for species conservation at the landscape level was the potential to miss individual taxa whereas in multi-species plans it was the limited focus potentially addressing some species to the detriment of others. For single species plans, the lack of a broader context was flagged as a shortcoming.

Concerns were expressed regarding the complexity of planning at landscape and multi-species levels, plus a related concern about the lack of sufficiently detailed information and incomplete information. Funding was a concern for all types of plans, although the concern was expressed slightly differently for each plan type. For the landscape and multi-species plans, the concern was one of money being spread too thinly combined with a lack of research, while for single species plans, the concern was one of a single species consuming resources while others species languished.

Respondents were asked, not only about the benefits and shortcomings of recovery planning for threatened species, but also whether there were other indirect benefits, such as community involvement and ecological benefits for non-focal species. Responses covered non-focal species benefits, community benefits (including those to Aboriginal people) and research benefits (Table 3.16). All three plan types seemed to raise community awareness and stimulate community involvement.

Table 3.14 Comparative benefits of the different types of recovery plans

Feature	**Landscape**	**Multi-species**	**Single species**
Biodiversity contributions	Considers & aims to protect whole environment, vegetation communities, stable ecosystem function; enables planning at scale recovery needs to happen; enables consideration of different levels of biodiversity; focuses on ecological communities & fauna; flora benefit from site-based or multi-species plans	Deals well with complexity in a defined geographic area, usually smaller than landscape/bioregional scale	Species close to extinction need tight focus possible with a single species plan; single species is an indicator of success (i.e. flagship or indicator species) in fixing the whole system
Threat management	Takes a catchment approach which makes management easier; allows threat abatement across landscape	Best where there are number of species with one or more of the following attributes in common – close proximity, same taxonomic group (e.g. orchids), similar threats, similar management requirements, same management agency; can also be used for species with wide geographic distribution across different landscapes (e.g. galaxias occur in mountains & coastal areas)	Best where different species in the same area have different management requirements (e.g. mulgara which shares the desert skink's habitat requires different fire regime so needs a separate plan) or when there are numerous, diverse threats to a species (e.g. emu-wren) or when the cause of problem (threat) is unknown (e.g for rainforest frogs)
Habitat management	Deals with whole communities, so focus is on habitats & actions	Best way of protecting communities	Strong habitat focus; stabilising & increasing critical habitat & enhancing natural regeneration
Community engagement	Landscape plans 'streets ahead' because recovery of biodiversity needs to include farmers & public landholders, & production lands, not just conservation estate	Efficient as it is easy to work through priorities for action & explain to community; raised awareness among own staff & local community; more likely (than other types of plans) to have species the community can see, get excited about & feel they are doing their bit; helps communication between researchers	High profile single species plans good because they involve many stakeholders with many issues – easier & focus information; easy to understand, communicate, & get recovery team together & focused

Table 3.14 Comparative benefits of the different types of recovery plans (cont.)

Planning benefits	Can act at multiple scales (e.g. farm, local authority); detailed actions & performance indicators can be included	Threats & actions clearly articulated; don't have to decide between species (as you need to do with single-species plan)	Objectives & milestones enable measurement of performance; easy to be clear about objectives; actions achievable, & by community; easier to understand & focus resources
Information management	Brings together all relevant information at time plan is written	Plan pulls together known species information & identifies known threats; identifies additional survey work required	
Cost effectiveness	Saves time & money through grouping species, threats & actions; eligible for NHT funding	Economic, best value for money, easy to explain & get community support; same effort required for 1 as for 5 species – same effort & cost benefits because of management aspects in common	Easier to attract funding when a species is near extinction; easier to get funding & cheaper to run; easier to understand & focus resources, can dedicate all resources to 1 species
Relationship with other planning	Can integrate with other planning, such as local authority planning schemes; multi- & single species plans can nest within these plans	Funding easier if part of a landscape plan	Recovery for 1 species may be detrimental for another – doesn't need to be taken into account in a single-species plan
Adaptive management		Things learnt by managing one species can be transferred to another one covered by the plan	

Table 3.15 Comparative shortcomings of the different types of recovery plans

Feature	**Landscape**	**Multi-species**	**Single species**
Species conservation	Potential to miss individual taxa; not as effective in managing species & threats to species	Need to be focused on a limited geographic area; plan focuses on particular species & doesn't look at the bigger picture; tendency to focus on 1 species to detriment of others; the more species, the more guesswork is involved & the greater the chance of not getting it right; conflicting needs of species difficult/impossible to manage	Does not consider broader context, need to look at whole landscape; does not address non-target species that are declining; may not benefit all species in the landscape
Threat management	EA wants generic threats & actions– need specific ones to recover species, however, need to be general enough that on-ground staff have the flexibility & freedom to make decisions when situations arise	New populations & associated new threats may be found outside the plan boundary; need to have limited & shared threatening processes	Where there are uniform, landscape-wide threats single species plans create huge amount of duplication
Management actions	Potential to miss management actions	Some things could fall through the cracks; problem when management actions for one species disadvantages another	
Monitoring	Lack of a monitoring protocol		Large focus on monitoring but hard to get funding; lack of continuing commitment to monitoring; funding for monitoring can vary from year to year
Community engagement	Need better ways of engaging local government	Won't get community support unless icon species involved; harder to communicate to public than single species plan unless species are well-chosen; labour-intensive & more coordination required between groups	May cover such a large geographical area that the community finds it difficult to action at a local level; good when species is charismatic but doesn't work when less appealing; community may not see point in saving the species, especially if it's a poor socio-economic area with other priorities

Table 3.15 Comparative shortcomings of the different types of recovery plans (cont.)

Planning concerns	Much information (detailed & technical) requiring a sophisticated level of understanding is included in these plans – need to have more 'community-friendly' plans; hard to plan & coordinate at such a complex level; vital information is missing; difficult to determine suitable targets	Few people can deal with the complexity (same as landscape plans) – scale is complex; more complex to write, need to compromise & give more weight to some taxa which may be deleterious to others; plans too brief & full of 'motherhood' statements	Approach can be glib, superficial, simplistic & not holistic; targets set too high; plans lack flexibility so at times technically working outside them; more administrative burden to write single species plans
Information management	Lack of detailed technical data & other information; databases tend to be poor & more research is needed on many species; don't currently have the tools, social or otherwise, & the access to expertise, to deal with these plans	Don't have all the information needed; lack of biological knowledge; hard to get detailed information into multi-species plan	Don't have good information about what is possible; problem when key personnel move
Funding	Limited funding that is not guaranteed; research & survey funding now non-existent; getting funds is difficult because the plan is so broad in terms of delivery & implementation	Limited funding; funding is spread over more species so each gets less units of funding per species; limited funding being spent on community workshops rather than on-ground actions	Single-species plans consume resources & we can lose other non-target species along the way; costly to produce & implement; not every species can be funded as a single species plan
Lack of commitment to research	Commitment to on-ground actions with no research & policy change may be a fatal flaw (NHT2 focuses on on-ground actions); limited money devoted to research & relatively large amount devoted to 'public involvement'		Unable to do enough research
Relationship with other planning & policy making	Difficult to integrate across 3 tiers of government; some actions may require higher level change that is difficult to achieve given bureaucracies involved; limited legislative backing (inc. lack of provision for compensation)		Difficult to coordinate with other recovery plans; can have a number of single species plans at one site – inefficient; may leave out issues which then have to be addressed by other types of plans; don't have ability to link in other species & associated new developments

Table 3.16 Additional, beneficial, indirect outcomes from recovery plans

Beneficial, indirect outcomes	**Landscape**	**Multi-species**	**Single species**
Benefits to non-focal species & broader landscape benefits	Benefits to other species, broader ecological benefits; salinity benefits	Benefits to other species, including threatened ones not covered by plan	Benefits to other species; erosion control, water quality, broader ecological benefits
Threat management & protection of non-focal species		Targeted management of threats such as *Phytophthora* & fire	Strategic threat management (e.g. fire planning); protection of focal species from 'threats' such as fire has protected other species – conversely, may be detrimental to those needing frequent fire
Community cultural change	Community cultural change as the plan works at the individual property level		Community cultural change with focal species being conservation icon; sense of regional social identity constructed around species
Raised community awareness	People more conscious of conserving remnants & having a sense of ownership; aware that a number of species are threatened (not just one as per single-species plans); awareness raised within government; strong commitment from agencies & Landcare groups	Multi-species involves whole community creating ownership for the recovery process; raised community awareness about species & how to manage & protect them	Remnants (e.g. swamps) changed from being poorly to highly regarded; land owners & local planners made aware of biodiversity & conservation on their properties; skilled-up project officers & agency staff more aware of threatened species management
Community involvement in plan development & implementation	Community involvement in plan development & implementation	Demonstrates what can be achieved when the community works together	Plan has brought together people with similar ideals & enabled them to work together in a cooperative environment
Research benefits		Plan results in whole ecosystem being researched	Plan results in whole ecosystem being researched; produces information useful for other species
Benefits for Aboriginal people/threatened species			Aboriginal people trained & paid for predator control, surveying & monitoring techniques; Aboriginal people custodians of focal species

A number of respondents, as well as addressing the benefits and shortcomings of the different types of plans, also gave their plan preference (Table 3.17). Interestingly, of those involved in single species plans, who commented on this question (5 respondents), three gave a preference for landscape plans rather than the type of plan they were currently using.

Table 3.17 Respondents' recovery plan preference*

Plan type in which respondent involved	**Plan preference**		
Landscape plan (n=2 out of 6)	●●		
Multi-species plan (n=6 out of 10)	●	⊙⊙⊙⊙	○
Single species plan (n=5 out of 8)	●●●	⊙	○

* ● landscape plan preference, ⊙ multi-species plan preference, ○ single species plan preference.

Two other sets of responses specifically directed at landscape and multi-species, but not single species plans, conclude this results section. Respondents were asked if all species in multi-species or landscape plans needed to have similar management requirements for the plan to work. Table 3.17 reviews their responses. These mixed responses suggest that similar management requirements, although not essential for success, can make management easier. A similar mixture of responses was given to the question regarding if multi-species or landscape plans gave equally as good outcomes for all the species they covered (Table 3.18). For landscape plans, the outcomes do not appear to be equally as good for all species.

Table 3. 18 Respondents' views regarding management requirements for success

Type of plan	**All species NEED similar management requirements for the plan to work**	**All species DO NOT NEED similar management requirements for the plan to work**
Landscape plan	Yes – because similar threats &/or management actions are required to benefit large number of species	No – can have variable actions
Multi-species plan	Yes – need to share similar threats & same geographic area Yes – if species require the same research, implementation & management Yes – objectives & goals need to be similar Yes –don't want conflicting management requirements	No – could have different threats & still use these plans No – but need to be within a certain geographic area or managed by same agency (i.e. need a common thread) No – but they can't be conflicting No – if they conflict better to have them *within* one plan where they can be sorted out
Landscape and multi-species plans (grouped answers)	Yes – systems with different management requirements (e.g. different fire management) should have separate plans	No – but need enough in common to be cost-effective No – may work better however for plants rather than animals because more likely to have similar requirements No – but should have some shared characteristics such as a threat No – every species is different

Table 3.19 Equally as good outcomes for all species covered by the plan

Type of plan	Outcomes EQUAL for all species	Outcomes NOT EQUAL for all species
Landscape plan	Yes – except where threats are not widespread or common (e.g. egg collecting as a threat to a particular species) Yes – except for 'quirky' species that may not respond as others do to treatment (e.g. one species in a community not responding to phosphite treatment for dieback & all the rest do)	No – benefits species experiencing landscape-based threats rather than site-based ones No – species benefiting from straightforward on-ground actions (e.g. fencing) will get the best outcomes; also where policy change across a wide scale is required (e.g. fox control), outcomes will not be so good No – outcome depends on where species is in landscape: related to degree of economic impact of proposed actions – the greater this impact the 'poorer' the outcome
Multi-species plan	Yes – because there is no inherent bias in these plans Yes – because they are not all in the same location and no – because those closer to you/population centres will get more work done	No – most threatened species gets most attention, also those subject to the most threatening processes or requiring more active management No – will not benefit extinct species; also hard to get funding for extinct species – much easier if 'on it's last legs'

4. Discussion and Recommendations

The following discussion draws on the wealth of previous evaluation work (e.g. Tear *et al.* 1993, 1995; Burbidge 1996; Foin *et al.* 1998; Parker 1999; Hoekstra *et al.* 2002 and others) as well as the results from this Australian-based study. The following sections cover an explicit comparison of the three plan types, a drawing together of the discussion on measures of recovery success and some final comments on selecting the 'best' type of plan to achieve the desired outcomes. Each section includes recommendations.

4.1 Comparison of Single, Multi- and Landscape Plans

Biological Information and Recovery Actions

Evaluations from Tear *et al.* (1995) onwards have considered the presence or otherwise of biological information in recovery plans. A central reason for this interest is evidence that species whose recovery goals are well linked to their biology appear more likely to be improving in status (Boersma *et al.* 2001, Gerber and Hatch 2002). The suite of recovery criteria identified by Gerber and Hatch (2002) and number from this study (Table 3.13), rely on biological information. Examples from this study include population and sub-population sizes, population trends, species' numbers and area of habitat protected. Only if this biological information is known and included in recovery plans (or associated databases), and can be quantified (Gerber and Hatch 2002), is determination of recovery success or otherwise possible. Burbidge (1996) emphasised that research should be part of a recovery plan, not a separate process.

A comparison of landscape, multi- and single species plans reveals some interesting consistencies across the extent and types of biological information included in a plan

(Table 3.4) and the inclusion of biologically-focused recovery and research actions (Tables 3.6 & 3.8). More ecological and biological information was included in single species plans than in multi-species plans and more in multi-species than in landscape plans. Life history, genetics, behaviour and general ecology were addressed in a greater percentage of single species plans than in the other two types. The same trend was apparent in the recovery actions with more attention to biological recovery and research actions in single and multi-species plans than in landscape ones. For example, none of the landscape plans had recovery or research actions addressing genetic management, life history or behaviour, all of which appeared in at least one of the single species plans. Research into recovery methods was not part of landscape plans in contrast to its inclusion in several of the multi- and single species plans. Clark and Harvey (2002), as part of the *SCB Project*, found that multi-species plans reflect a poorer understanding of species-specific biology, a finding complimenting the results reported here.

It seems imperative that biological information on focal species is included in recovery plans or if it isn't available, that research actions require its collection. Such information is essential if species are to be managed to meet their biological requirements and if meaningful recovery criteria are to be determined and measured (such as population size and trends). From this study, single species plans seem to be the best performers in term of including and using biological information, closely followed by multi-species plans. Gerber and Hatch (2002) concluded that multi-species plans seemed to have fewer recovery criteria whose selection was very clearly related to biological information. Our study suggests the underlying reason could be the relative lack of biological information in multi-species, and particularly landscape plans.

Recommendation 1. The inclusion of biological information in recovery plans is strongly encouraged as it can improve planning and have immediate benefits. It also enables biologically meaningful recovery criteria to be determined and quantitatively measured (e.g. population size). Single species plans are the best performers to-date in terms of including and using biological information.

Managing Habitat and Recovery Actions

Information on habitat requirements can be regarded as part of understanding the biology of the focal species. As such, the comments above under *Biological Information and Recovery Actions* apply equally here. Gerber and Hatch (2002) identified the total area of habitat, and its quality and quantity, as one of five categories of metrics for measuring recovery success. Species' habitat requirements were the most comprehensively covered of all the biological features in the plans (Table 3.4). All single species plans included details on habitat requirements compared to one out of the three landscape plans and just over half of the multi-species plans.

All three plan types included actions for preventing habitat clearing and supporting habitat restoration and research. Habitat loss is such a fundamental concern in Australia that it is bound to be prominent in the minds of those involved in nature conservation activities. In interviews, respondents noted that single species plans in particular had a strong habitat focus, with an emphasis on critical habitat.

Recommendation 2. Recognising that while habitat requirements are generally well addressed in all three plan types, single species plans are better suited for focusing on habitat (especially critical habitat requirements) than multi-species plans which in turn are better than landscape plans.

Managing Threats and Recovery Actions

There is widespread agreement among those involved in recovery planning that addressing threats is essential for recovery success. The landscape plans reviewed included a diverse array of threats (Table 3.5). Such a high number of threats is to be expected given the number of species (~54-157) covered in landscape plans and hence the associated number and diversity of threats. Interestingly, however, not all threats mentioned in the landscape plans were accompanied by a recovery action. For example, information on dieback as a threat was included in three plans but recovery actions were only included in one plan (Table 3.7). Parker (1999) identified inconsistencies between plan elements, commenting that les than one third of the plans she audited displayed a clear relationship between actions, goals and objectives.

A lower percentage of the multi- and single species plans, relative to the landscape plans, included information on threats. The reason for is probably the smaller number of species covered in the multi- and single species plans and hence the smaller number of associated threats. In these two types of plans there is more consistency than in the landscape plans regarding information on threats being included and inclusion of associated recovery actions. Although, for several threats, actions were given in a plan with no background information on the threat provided (e.g. for exotic species – competition, managing resource extraction).

Landscape and multi-species plans were identified in interviews as suitable types of plans for addressing threat management – the former for threat abatement across landscapes and the latter for addressing similar threats. Threatening processes were also a focus of research attention in these two plan types (Table 3.8). The only apparent difference in suitability of these two plan types for addressing threats was that multi-species plans appeared 'better' at taking information on threats through to recovery actions. One respondent noted that multi-species plan allowed threats and associated actions to be clearly articulated (see Table 3.14 under *Planning benefits*).

Recommendation 3. All plan types clearly consider threats. Multi-species plans seem the optimal plan type for managing threats: they have the background information on threats and associated, related management actions and can address similar or disparate threats (see 4.3).

Recommendation 4. If possible given the breadth and complexity of landscape plans, the information on threats in these plans should be complemented by related recovery actions. This is a shortcoming in current approaches to landscape planning.

Performance Reporting, Monitoring and Information Management

Almost all of the plans included measurable objectives, against which performance was regularly reported. Monitoring of performance included focal species, threats and habitat. These findings contrast with those of Campbell *et al.* (2002) from the *SCB Project*, where they found monitoring concentrating on the focal species' status while neglecting habitat requirements and threats. Over two-thirds of all plan types had monitoring as a recovery action (Table 3.9).

The importance of information management was raised by a number of respondents in the interviews. Around half of the plans in each plan type had or intended to develop a recovery database or similar repository of information (Table 3.9). Respondents identified landscape and multi-species plans as useful for bringing together information. Concerns regarding information and its management were associated with all three plan types. The

concern was slightly different for each type. For landscape plans it was the lack of availability of detailed information. When such information was available, the lack of skills to deal with the resultant complexity was an issue. For multi-species plans, the concern was lack of information and, if it was available, not being able to include the desired level of detail. For single species plans, the concern was not having 'good' information about what actions were possible (Table 3.15).

Recommendation 5. Every effort should be made, for all plan types, to collate, store and use information at the level of detail and complexity required by the type of plan. A good recovery database can make a significant contribution to implementation.

Community Involvement and Awareness

There was strong community involvement in all three plan types – via plan preparation and administration, team meetings and recovery activities. Implementation of education programs was underway for most plans (Table 3.10). This contrasts strongly with the finding by Tear *et al.* (1995) that although public education programs were mentioned in 92% of plans less than 18% were conducted. In Australia, we have a reasonably long history of community involvement in recovery plan development and implementation (Blyth *et al.* 1995), which has probably made a significant contribution to the apparent commitment to implementing education programs.

Community engagement was of great interest to many of those interviewed (including an equal mix of government and community people) (Tables 3.14 – 3.16). It was perceived in slightly different ways in relation to each plan type. The ability of landscape plans to engage farmers and other landholders was highly regarded. Multi-species plans were identified as helping communication between lots of different people while single species plans make it easy for people to focus and act together.

Recommendation 6. Community members should continue to be engaged, in all three recovery plan types, in the writing of recovery plans, plan administration via recovery teams and other means, and community leadership of recovery planning.

Recommendation 7. The expertise, experience and commitment of government agencies should continue to be engaged, in all three recovery plan types, through similar means to these listed above, while recognising that they may often have statutory responsibilities for areas covered by recovery plans and/or associated species.

Budget and Cost-Effectiveness

Initially we intended to collect funding information so we could make some judgment about the cost-effectiveness per species for each type of recovery plan. However, we were strongly influenced by the advice of Hoekstra *et al.* (2002) from the *SCB Project*. They found, in the early stage of their project, that budgets and cost estimates were 'too variable in format and completeness to reliably include them' (p.639). As such, we did not collect any funding details apart from whether costings were included in the plans. Such costings were included in all multi- and single species plans but in only one of the three landscape plans. One of the compelling arguments for landscape plans is their cost-effectiveness (Brown *et al.* 1996; Burbidge 1996; Boyer 2001).

Recommendation 8. Continue to include detailed costings in multi- and single-species plans while ensuing that this approach is strongly encouraged in landscape planning. Where detailed costings are essential, single and multi-species plans are currently more likely to meet this need than landscape plans.

Recommendation 9. If cost minimisation per species is of central importance then landscape plans are the obvious choice.

Adaptive Management and Uncertainty

There have been a number of calls for adaptive management in recovery planning (e.g. Foin *et al.* 1998; Boersma *et al.* 2001). Multi-species plans were identified in this study as being able address adaptive management, in contrast to landscape and single species plans. A supporting comment from the interviews was that multi-species plans allowed the lessons learned with one species to be transferred to another covered by the same plan.

Recommendation 10. Where adaptive management is regarded as critical (e.g there is poor information, threats and their effects are poorly known, the status of the land and management resources are uncertain), multi-species plans are currently the best choice.

Recommendation 11. Adaptive management seems essential given the increasing complexity of, and uncertainties associated with, recovery of threatened species. As such, efforts should be made in all three plan types, to better understand how adaptive management might be used for recovery planning and management and subsequently integrate such an approach into recovery planning.

General Comparative Comments

Landscape plans were preferred by almost half of our respondents (46%), even though only 15% of them were directly associated with this type of plan. Landscape plans currently have a high profile in Australia, with the associated enthusiasm probably related in large part to the Commonwealth government's current emphasis on regional delivery of natural resource management. The associated reasoning is that landscape plans enable part, or all, of a natural resource management region to be covered by a single recovery plan, with the associated cost and other resource savings. This current view (Moore and Jennings 2000) explains in large part the support for landscape plans.

Evidence from recent evaluations in the United States (e.g. Boersma *et al.* 2001; Hoekstra *et al.* 2002), provides little support for multi-species plans. Associated researchers found that species covered under multi-species plans were almost four times less likely to exhibit improving status trends than were species covered by single species plans. Lundquist *et al.* (2002) noted that multi-species plans have fewer tasks completed, while Clark and Harvey (2002), also drawing on the *SCB Project*, noted that multi-species plans were less likely to include species-specific biological information, adaptive management or to be revised. No clear benefits from multi-species planning were identified from the *SCB Project*.

In addition to the specific comments made in the preceding sections on the benefits and shortcomings of the different types of plans, some more general comparative comments can also be made. All three plan types can contribute to biodiversity outcomes, threat and habitat management, and community engagement, as well as a number of other outcomes. Variations exist, however, between plans for most of these benefits. For example in terms of biodiversity contributions, landscape plans are good at protecting the whole environment, multi-species plans deal well with biological complexity within a defined geographic area, while single species plans are best for focusing attention on a single

species close to extinction. Common shortcomings included lack of funding, and of commitment to research and monitoring, among others. Again, there were differences between plan types. For example, commitment to research was poorer in landscape plans than in the other two.

Recommendation 11. Given the results from the *SCB Project* and this study, landscape plans should be adopted with caution. Clark *et al.* (2002, 1516) noted that 'the USFWS needs to carefully re-evaluate its use of multi-species plans to ensure that species recovery is not compromised in the interest of administrative expediency'.

Recommendation 12. To enhance their potential for success, landscape plans for threatened species should include: biological information on focal species, linked to recovery actions; recovery actions for threats identified, performance reporting and regular monitoring against biologically-related outcomes (such as population size); and sufficient funding and personnel resources for each species in the plan.

4.2 Measures of Recovery 'Success'

We identified first and second order measures of success. These measures were derived from research and practice elsewhere, particularly in the United States, and by asking respondents how they defined recovery success as well as the additional benefits they perceived accruing from recovery planning.

First order measures of success were whether a threatened species has been de-listed, whether its status has improved, for example the population has increased, and if a high percentage of recovery actions are implemented or underway. None of the species in the plans reviewed had been de-listed. In terms of changes in status, there was so much variability in the status reported for the focal species within each plan that this measure could not be used. This problem relates to the lack of accurate information on current numbers of individuals and/or populations. The only general trend apparent was that more of the single and multi-species plans included 'increasing' as a status measure than was apparent from the landscape plans. Boersma *et al.* (2001) were able to use status as trend data were available, noted that species covered under multi-species plans were almost four times less likely to exhibit improving status trends than species covered by single species plans. The only general conclusion that can be drawn is that single and multi-species plans may be more likely to contribute to improving rather than static or declining status trends but there is too little conclusive information to make a definitive statement.

Gerber and Hatch (2002) noted five categories of metrics for defining recovery criteria, all of which rely on quantitatively reporting on status changes. These metrics aim to provide a measure of status. The categories were population size, population trend, habitat quantity and quality, demography (e.g. age structure of population) and legal and policy (e.g. existence/significance of threat). Respondents associated with all three plan types identified species' numbers and population size and numbers, habitat quantity and quality, and extent of threats as measures of success.

In terms of the extent to which recovery actions have been implemented, there was little difference between the three types of plans – 94% of the recovery actions in landscape plans were being implemented, 91% of actions in multi-species plans and 89% in single species plans. The lack of variation in the extent of implementation in our project suggests that no one type of plan is better than any other in terms of the extent to which management actions have been implemented. These findings are different to those of Lundquist *et al.* (2002) reporting on the implementation component of the *SCB Project*. They found that 87% of the recovery actions in ecosystem plans (equivalent to an

Australian landscape plan) were being implemented, 48% of actions in multi-species plans and 76% in single species plans. They concluded that the percentage of tasks implemented was significantly higher in single species and ecosystem plans compared to multi-species plans. Our project showed higher implementation rates for both single and multi-species plans compared to those identified by Lundquist *et al.* (2002). The reasons for these differences between the studies are not clear.

In terms of second order measures of success, a number became apparent from interviews including cost-effectiveness; community awareness, engagement and cultural change; integration with other planning; 'modern' plan structure, integrating existing knowledge; embracing adaptive management; commitment to research and monitoring; and benefits to Aboriginal people (Tables 3.13 & 3.16). As described in the next section, each plan type provides a different relative opportunity for achieving success using these measures.

Recommendation 13. As a matter of highest priority and independent of plan type, quantitative information on key measures of success, such as the total population size, quantity of habitat and existence/significance of threats, should be collected and periodically re-collected. Without this information the success or otherwise of recovery planning can not be determined.

Recommendation 14. Recognise that although achievement of first order measures of success is essential for recovery of a species, the achievement of one or more second order measures are also important outcomes of recovery activities.

4.3 Selecting a Plan to Achieve the Desired Outcomes

A simple way of organising desired outcomes is to consider them as the first and second order measures of success as described above and in Table 4.1. As such, first order outcomes are de-listing, improvements in status, and the percentage of actions implemented (the higher the percentage the better and more 'successful' the plan). Second order outcomes focus on engagement with local communities, efficient planning, adaptive management, and research and monitoring. The following table summarises the relative merits of the three plan types using these outcomes. This analysis should be treated with some caution given the small number of plans reviewed.

A few comments on the ideas in Table 4.1 follow, mainly to make sure their general intent is clear. Species de-listing, extent of implementation and focal species' numbers provides little guidance for differentiating between the plan types either because there is no difference between plans (i.e. for de-listing, extent of implementation) or there are insufficient data to judge the difference (i.e. for status based on focal species' numbers). The usefulness of the remainder of the outcomes are as predicted by respondents in interviews; they are not based on measures of success.

In the interviews, respondents noted that all plan types could potentially increase species' and population numbers. In terms of habitat outcomes, landscape plans can protect the whole environment, while multi-species plans are best for general habitat outcomes and single species plans for addressing critical habitat. In terms of threats, landscape plans are best for threat abatement activities across a landscape whereas multi-species plans are best when there are similar threats (and/or species in close proximity, of the same taxonomic group, with similar management requirements or that can be managed by the same agency/group). The view was also put forward that it is better to include different threats/conflicting management within a multi-species plan to get the issues resolved. Single species plans are useful when there are numerous, diverse threats to a species and/or the cause of the threat is unknown (e.g. as for rainforest frogs).

Table 4.1 Suitability of plan type for achieving desired outcomes

Desired Outcome	**Landscape**	**Multi-species**	**Single species**
First Order Outcomes			
SPECIES DE-LISTED*	No	No	No
EXTENT OF IMPLEMENTATION:			
High percentage of actions implemented or underway*	94%	91%	89%
STATUS: Population size:			
Focal species' numbers*	UU	UU	UU
Focal species' numbers/population stabilised	★		★
Focal species' numbers/population increased	★	★	★
STATUS: Habitat quantity and quality:			
Whole environment protected	★		
General habitat protection & restoration		★	
Critical habitat protection & restoration			★
STATUS: Threat management:			
General threat management	★		
Targeted threat management		★	★
Second Order Outcomes			
Cost effectiveness (saves time & money)	★		
Working with communities:			
Community cultural change	★		★
Increasing community awareness		★	★
Community engagement (inc. ownership)	★	★	★
Planning efficiencies:			
Integration with other planning	★		
'Modern' plan structure+	★	★	★
Integrating existing knowledge	★	★	
Embracing adaptive management		★	
Commitment to research & monitoring		★	★
Benefits to Aboriginal people			★

* Lack of information and/or lack of differentiation between plan types for these outcomes means they can not contribute to selecting the ideal plan type; UU – uncertain/unknown; ★ Ideal plan type to provide outcome based on respondents' comments, + Can incorporate (and effectively use) objectives, detailed actions and performance indicators.

If cost minimisation per species is the objective, then landscape plans are the most cost-effective in terms of grouping species, threats and actions. Community cultural change occurs best in landscape plans where those involved in production activities can recognise the benefits of biodiversity conservation. It can also occur through single species plans where a sense of regional local identity may be constructed around a species. For raising awareness of threatened species, both multi- and single species plans work. They are more likely to work for species that people can see (multi- species plans) or are charismatic (single species plans). All three plan types achieve community engagement in plan development and implementation.

In terms of planning and integration with other planning, whether local government planning schemes or multi- or single species plans, landscape plans were identified as the best. In terms of 'modern' plan structures, all three plan types can incorporate (and effectively use) objectives, detailed actions and performance indicators. Landscape and multi-species plans were regarded as better able to integrate information, and in some cases are using GIS to do so, than single species plans. For adaptive management, multi-species plans offer the best opportunities. Commitment to research and monitoring is greater in multi- and single species plans. Last but not least, if benefits to Aboriginal people are a desired outcome and the species has an association or potential association with Aboriginal people, then a single species plan can potentially contribute to that outcome.

Finally, more than one plan type may be selected. For example, the Stock Island Tree Snail is addressed in a single species plan, plus it is one of the 68 listed species in the multi-species recovery plan for south Florida (Boyer 2001). Several respondents mentioned the value of having a landscape plan within which are embedded multi- and/or single species plans for high priority species.

Recommendation 15. The above table and associated text should be used to assist in determining the 'best' type of plan for achieving the desired outcomes of recovery planning, where these may be either first order outcomes such as de-listing of a species and/or second order outcomes such as community engagement or adaptive management.

Recommendation 16. The benefit of using more than one plan type should be recognised, especially where there are critically endangered species. This may mean that such species are the focus of a landscape plan and then receive more species-specific attention in a multi- or single species plan.

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Appendix 1. Respondents and Affiliation

Plan	Respondent and Affiliation
Landscape	
Lockyer Valley Biodiversity Action Plan	Bruce Boyes, Queensland Parks and Wildlife Service Andrew Davidson, Lockyer Catchment Coordinator*
Goldfields Biodiversity Plan	Geoff Park, Victorian Department of Sustainability and Environment Doug Robinson, Trust Fund for Nature*
Swan Coastal Plain Ironstone Heath Communities	Kim Williams, Western Australian Department of Conservation and Land Management* Shirley Fisher, community representative
Multi-species	
Recovery plan for cave dwelling bats	Bruce Thomson, Queensland Parks and Wildlife Service* Chris Clague, community representative
Stream Dwelling Frogs of the Eungella Region of Mid-eastern Queensland	Richard Retallick, James Cook University* John Clarke, Queensland Environmental Protection Agency
Recovery plan for the Peddar, Swan, Clarence, Swamp and Sadled *Galaxias*	Dr Jean Jackson, Tasmanian Inland Fisheries Commission* Terry Byard, recreational fisherman, community representative
Recovery plan for twelve threatened spider-orchid *Caladenia* R. Br. Taxa of Victoria and South Australia	Andrew Pritchard, Victorian Department of Natural Resources and Environment* Gale Pollard, community representative
Recovery Plan for the threatened Alpine Flora	Keith McDougall, New South Wales National Parks and Wildlife Service* Genevieve Wright, New South Wales National Parks and Wildlife Service
Single species	
Recovery Plan for the Great Desert Skink	Colleen O'Malley, Threatened Species Network* Jackie Bice, community representative
Recovery Plan for *Austromyrtus gonoclada*	Ms Sue Stewart, Logan City Council* Graham McDonnald , community representative
Noisy Scrub-bird Recovery Plan	Alan Danks, Department of Conservation and Land Management Sarah Comer, Department of Conservation and Land Management* Tony Bush, community representative
Recovery plan for the Mt. Lofty Ranges Southern Emu Wren	Vicki-Jo Russell, Threatened Species Network* Penny Paton, chair and part-time co-ordinator for the Southern Emu-wren Recovery Program

* Completed implementation table as part of interview process.

Appendix 2. Guiding Questions for Analysing Plans

"Question" [asked of most recent revision]	Response
1. BACKGROUND AND CONTEXT (derived from Hoekstra *et al.* 2002)	
Single [S], multi- [M] or landscape [L] recovery plan	
"Approved" recovery plan [R] or interim recovery plan [I]	
No. of species covered in the plan (listed and non-listed)	
No. of pages in plan	
Legislative base – State [S], Commonwealth [C], none [N]	
Date plan was published	
Date implementation began	
No. of updates/revisions since first written	
Date of most recent revision	
State where plan was written	
Is complete range of species covered (if not give %)?	
Lead organization in writing the plan	
Authors of plan and their affiliations	
Responsibility for implementation (e.g. state agency, university, community group)	
Percentage of area addressed by plan that is privately owned	
2. BIOLOGICAL ATTRIBUTES OF THE FOCAL SPECIES (derived from Clark 1996, Boersma *et al.* 2001, Hoekstra *et al.* 2002[5])	
Has species (no. of species in multi-species plan) been de-listed since the commencement of recovery planning?	
Conservation status of species in the plan [EA/IUCN designation as per plan]	
Species' status (stable [S], decreasing [D], increasing [I] or unknown [U] *(obtained from interviews)*	

[5] See http://www.nceas.ucsb.edu/recovery/datacollection.html for the complete set of questions used in the *SCB Project* in 1999 (downloadable as a pdf).

Taxonomic group (mammal [M], bird [B], reptile [R], amphibian [A], fish [F], invertebrate [I], other [O – specify]	
For multi-species plans, taxonomic relationship of species	
Size of historic range of species	
Size of current range	
For multi-species plans, degree of geographic proximity (% and no. of species with overlapping, adjacent and disparate distribution shared with at least five other species) [Sue- or what ever other permutation and figures gives some meaningful data]	
Maps of (a) former and (b) current ranges included	
Size of species' home range	
No. of populations when first plan was written	
Current no. of populations *(obtained from interviews)*	
No. of animals in the wild when the first plan was written	
No. of animals in the wild when last surveyed (include number and year surveyed)	
Principal ecotype in which species occurs	
Species a habitat generalist or specialist?	
Does the species occur in more than one state?	
Does the species require a certain successional stage? [Y/N]. If yes, what is it?	
How much of species current range is actively managed to address threats [%]	
Species propagates/breeds in captivity relatively easily	
Species translocates relatively easily	
Details on species' fecundity…(i.e. frequency of breeding, no. of young, % survival (if known))	
3. THREATS FACED BY THE FOCAL SPECIES (derived from Foin *et al.* 1998, Hoekstra *et al.* 2002) [For single species plans – Y/N; for multi-species plans – if Y: % and no. of species to which threat applies]	
Construction (e.g. roads, buildings, dams) identified as a threat in the plan	
Resource use (e.g. mining, gravel extraction, logging)	

Pollution (e.g. air, water, pesticides)	
Water diversion (e.g. dams, groundwater extraction, filling/draining wetlands)	
Exotic species – competition (e.g. weeds)	
Exotic species – predation (e.g. foxes, cats)	
Interactions with other non-exotic species (e.g. predation, competition, parasitism on focal species)	
Habitat reduction through clearing	
Habitat dynamics – altered fire regimes	
Habitat dynamics – dieback introduction and spread	
Habitat dynamics – altered hydrological regimes/salinity	
Harvesting	
Grazing	
Other factors [specify]	
4. RECOVERY PLAN CONTENT (derived from Tear *et al.* 1995, Parker 1999, Hoekstra *et al.* 2002)	
Recovery Goals and Objectives	
Goals included in the plan [Y/N]	
Are recovery goals or performance indicators/targets based on PVA?	
Are recovery goals or performance indicators/targets based on (a) current population size and/or (b) current population numbers? [PS – Y/N; PN – Y/N]	
Objectives included in the plan [Y/N]	
Percentage of objectives which are measurable	
Performance reported against these objectives [Y/N]	
Performance Indicators (Success Criteria)	
Does the plan include performance indicators (success criteria/targets)? What percentage are measurable? Are they given for all species covered?	

Time period given for de-listing? (Tear *et al.* 1995)	
Background Research Information Included	
Habitat requirements (includes species' distribution)	
Habitat mapping	
Critical habitat identified	
Population biology (includes species' abundance) (see pdf for more details)	
Life history (see pdf for more details)	
Genetics (see pdf for more details)	
Behaviour (see pdf for more details)	
General ecology (see pdf for more details) [Sue – may not need this category]	
Threatening processes	
Recovery methods (esp. captive breeding and translocation)	
PVA	
5. RECOVERY ACTIONS AND IMPLEMENTATION **(**derived from Parker 1999, Hoekstra *et al.* 2002, Lundquist *et al.* 2002) Each of the following actions will receive a Y or N. For those receiving a yes, categories of implementation will be assigned based on Lundquist *et al.* (2002): not implemented [NI], underway [U] completely implemented [CI] or implementation status unknown [SU])	
Actions – Further Research	
Habitat requirements (includes species' distribution)	
Habitat mapping	
Population biology (includes species' abundance) (see pdf for more details)	
Life history (see pdf for more details)	
Genetics (see pdf for more details)	
Behaviour (see pdf for more details)	

General ecology (see pdf for more details) [Sue – may not need this category]	
Threatening processes	
Recovery methods (esp. captive breeding and translocation)	
PVA	
Monitoring methods	
Actions – Management	
BIOLOGICALLY-RELATED ACTIONS	
Captive breeding/propagation	
Translocation	
Other genetic management [specify]	
Life history [specify]	
Behaviour [specify]	
Preventing habitat clearing	
Protecting/restoring habitat	
THREAT-RELATED ACTIONS	
Preventing/managing construction (e.g. roads, buildings, dams)	
Preventing/managing resource use (e.g. mining, gravel extraction)	
Preventing/managing pollution (e.g. air, water, pesticides)	
Preventing/managing water diversion (e.g. dams, groundwater extraction, filling/draining wetlands)	
Removing/managing exotic species – competition (e.g. weeds)	
Removing/managing exotic species – predation (e.g. foxes, cats)	
Managing interactions with other non-exotic species (e.g. predation, competition, parasitism on focal species)	

Managing fire regimes for the focal species	
Managing dieback introduction and spread	
Managing hydrological regimes/salinity	
Preventing harvesting	
Other factors [specify]	
Actions – Monitoring	
Monitoring focal species (see pdf for details)	
Monitoring threats	
Monitoring habitat	
Actions – Community Involvement and Education	
Community involvement in plan preparation	
Community involvement in plan administration (i.e. member of recovery team)	
Community involvement in recovery activities % of overall activity)	
Community leadership in recovery planning/actions	
Education programs	
Actions - Administration	
Recovery Team meetings [Y/N and frequency]	
Regular performance reporting [Y/N and frequency]	
Plan coordinator /community or government? [Y/N & C/G]	
Recovery datatabase/central repository of information[6]	

[6] Both this and the previous item, Lundquist *et al.* (2002) identified as important for implementation.

Other Details Regarding Actions	
Have recovery actions been prioritised? How?	
Accountability assigned for recovery actions – community/government mix [if yes, give approx. ratio]	
Environmental variability addressed	
Environmental uncertainty addressed	
Adaptive management addressed	
6. RECOVERY TEAM MEMBERSHIP (derived from Backhouse and Clark 1995, Clark 1996)	
Team includes scientists	
Team includes government agency land managers	
Team includes community members	
7. COSTING	
Costing included?	
Costs such as salaries and administrative overheads included (as per Burbidge 1996: 58)	
Cost to implement plan per year	

Appendix 3. Interview Questions

1. For the species in this plan, is their status stable, decreasing, increasing or unknown?
2. How many populations of the species are there currently?
3. How do you define recovery success in relation to the species being considered?
4. Given the characteristics of this plan's focal species, what type of recovery plan would work best (ideally)?
5. Given the threats faced by these species, what type of recovery plan would work best (ideally)?
6. What are the strengths and weaknesses of this plan in relation to delivering outcomes?
7. What are your views about single versus multi-species versus landscape level plans – their strengths and weaknesses?
8. Do all species in multi or landscape plans need to have similar management requirements for the plan to work?
9. FOR MULTI-SPECIES PLANS ONLY: Will this plan deliver equally as good outcomes for all species addressed? If not, which species will benefit the most and which ones least? Why?

If time permits:

10. What are there outcomes (beneficial or otherwise) not specifically related to the focal species? (For example: benefits to broader ecological communities, other species, community cultural change).