

# Australia's national management strategy for carp control

Jim Barrett

Murray-Darling Basin Commission, G.P.O. Box 409, Canberra City, ACT 2601, Australia.

## ABSTRACT

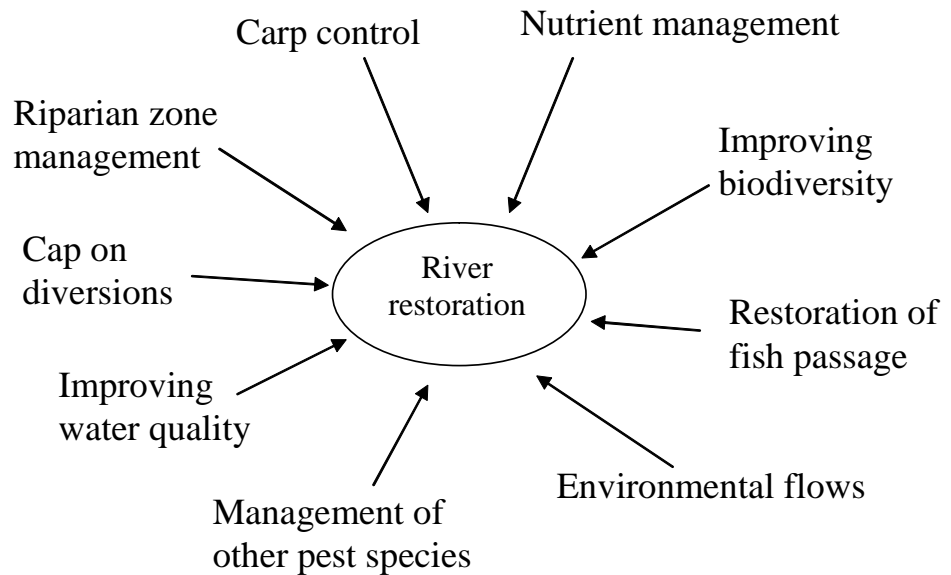
In Australia, carp are but one issue among a range of environmental concerns that need to be addressed in order to achieve riverine rehabilitation. The Carp Control Coordinating Group (CCCG) is a response from the Murray-Darling Basin Commission to take a leading role in the coordination of appropriate action for the control of carp. In its two year tenure, the CCCG has produced a National Management Strategy for Carp Control (NMS) and a Strategic Research Plan ('Future directions for research into carp'). A third document, 'Ranking areas for action: a guide for carp management groups', is a guide to the practical, on-ground implementation of carp management. All three documents have been developed under the principles of vertebrate pest management, acknowledging that eradicating carp across the continent is unachievable with current technology, although ongoing improvements in pest control technologies could provide the means to eradication in the future. The critical goals of the NMS include the prevention of further spread of carp and a reduction of its impact to acceptable levels. Successful implementation of the NMS will require the use of a range of control techniques, together with the identification and development of new techniques, and the integration of environmental rehabilitation work with regional carp plans. The roles of all stakeholders are identified in the NMS.

## 1. BACKGROUND

Carp have been part of Australia's riverine environment since their introduction during the 1850s and subsequent releases in the 1870s and the 1960s. The first releases of carp appear to have had limited impact. However, the release of the 'Boolara' strain in the 1960s led to a rapid expansion of carp distribution, especially in the Murray-Darling Basin. Over the last 30 years it has become the predominant biomass in some systems (Koehn et al. 2000).

During the 1990s, the community's view of carp as a nuisance fish and environmental pest increased dramatically. A number of forums and workshops were held in regional centres around the Basin resulting in the formation of the National Carp Task Force (NCTF), which is owned and driven by the

Figure 1. Action required for river restoration indicating the relative role of carp in river degradation.



community through the Murray-Darling Association. The Association is a local government/community-based organisation with membership of 90 councils in four states.

The National Carp Task Force terms of reference are to:

- provide a focus for local government and community participation in the management and control of carp in the Murray-Darling Basin;
- provide an effective forum to seek community input on ways to mitigate the carp problem with a particular emphasis on the waterways within the Murray-Darling Basin;
- seek a coordinated approach to carp management and control through research, education, information and commercial opportunities;
- encourage the exploitation of carp for commercial uses;
- support the development of business plans to reduce the impact of carp on Australian waterways;
- encourage and support community concept plans and initiatives designed to reduce the impact of carp on Australian waterways;
- increase community awareness of the carp problem by developing a range of quality carp education materials;
- assess the impacts of carp mitigation activities; and
- monitor, collect and document anecdotal reporting of carp.

An underlying principle of the National Carp Task Force was that carp had to be managed as part of an overall integrated catchment management process, not simply as a fisheries issue (Fig. 1).

At the same time, and partly as a result of community concern and the emerging work of the National Carp Task Force, state agencies began to focus on carp issues. In the past, carp control activities were carried out by individual state agencies. This, however, has proven to be an inadequate way of managing an aquatic pest that has the capacity to move beyond the management boundaries of any one state. In recognition of this and in response to lobbying by the NCTF, the Commonwealth Government in 1997 announced funding for the formu-

lation of the Carp Control Coordination Group (CCCG) to provide national leadership and coordination in the development and implementation of management and control initiatives.

## 1.1 The Carp Control Coordination Group

The terms of reference of the CCCG were to:

- review available information to determine the impact of carp;
- develop a national strategic research plan for carp control and management that establishes research needs and priorities for:
  - defining the economic and ecological impacts of carp; and
  - developing carp control methodologies;
- review current management strategies, prepare an interim national management strategy and recommend on appropriate management plans for the long-term control of carp;
- advise (and work with) the National Carp Task Force on the preparation of material to inform the community on carp related issues;
- promote effective liaison between groups conducting carp research, management or control;
- report to the relevant Ministerial Councils (Murray-Darling Basin Ministerial Council (MDBMC), Ministerial Council for Fisheries, Forestry and Agriculture (MCFFA), Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) and Australian and New Zealand Environment and Conservation Council (ANZECC)) with a national strategic research plan and an interim management strategy.

This initiative recognised and prescribed roles for the range of stakeholders interested in carp management. These include government land, water, fisheries, environment protection and nature conservation agencies; R&D organisations; catchment management groups; recreational anglers; rivercare/landcare groups; landholders; commercial fishers; conservation groups; researchers; local government and individuals.

This depth of stakeholders is reflected in the composition of the CCCG (Fig. 2). The Group comprised representatives of:

- The Murray-Darling Basin Commission (Chair and Secretariat);
- Relevant commonwealth, state and territory fisheries agencies;
- National Carp Task Force;
- Fisheries Research and Development Corporation;
- (MCFFA) Fish Environment and Health Committee;
- Environment Australia;
- Cooperative Research Centre for Freshwater Ecology;
- Centre for Research on Introduced Marine Pests (CSIRO).

A measure of the complexity of the carp issue in Australia, including the perception of the issue, is reflected in the reporting arrangements for the Group's outcomes. The Group was required to report to no less than four Ministerial Councils: MDBMC, ANZECC, ARMCANZ, MCFFA.

Figure 2. Stakeholders in carp management in Murray–Darling Basin.



The expected outcomes of the CCCG were the:

- development of a national management strategy;
- development of a national strategic research plan;
- promotion of effective liaison among all groups involved in carp control, management and research in the Murray-Darling Basin; and
- informing the community on carp related issues, including the conservation and rehabilitation of native fish habitat.

Funding of \$200,000 pa was provided for 2 years under the Commonwealth Government's FishRehab Programme. This programme was formulated to undertake a suite of projects aimed at:

- improving river flow management;
- progressively combating carp;
- improving viability of native fish species; and
- improving knowledge and understanding of the relationship between key elements of the riverine ecosystem and water flow.

The CCCG was asked to provide a consistent approach to carp management across commonwealth and state agencies. It worked in partnership with the National Carp Task Force and was able to use its expertise and network of community contacts to assist in the implementation of carp management and control at a regional level. In the development of a National Management Strategy, the CCCG paid attention to the effects of other environmental problems and how they affect, or are being affected by, carp control measures.

## 1.2 National Management Strategy for Carp Control

The draft National Management Strategy was developed by the CCCG over a period of 9–12 months during 1999–2000; the draft Strategy underwent a public comment phase in October/November 1999. Public notices inviting comments on the draft document were inserted in major daily and regional newspapers, numerous radio interviews were conducted and explanatory articles featured in certain 'natural resource management'-type magazines. The National Carp Task Force also widely promoted the draft and helped community groups develop responses.

One of the outcomes of all of this activity was a growing awareness by the community of not only carp, but also the state of native fish, the need to improve opportunities for native fish habitat and the relationship between fish and land and water management. Thus, a series of 'show and tell' presentations on both carp and on the emerging Native Fish Management Strategy for the Basin, which was also being developed at that time, were conducted in Adelaide, Melbourne, Albury, Canberra, Brisbane and Sydney. In response to the above measures, c. 30 written submissions were received and taken into account in the finalisation of the Strategy.

The goals of the National Management Strategy are to:

- prevent the spread of carp;
- reduce the impacts of carp to acceptable levels;
- promote environmentally and socially acceptable application of carp eradication and control programmes;
- improve community understanding of the impacts of carp and the management strategies to counteract those impacts;
- promote the cost-efficient use of public resources in carp eradication and control programmes.

Key principles in relation to carp control, which are outlined in the Strategy include:

- carp control should be based on best practice management and underpinned by scientific evidence and pest management principles;
- any practice that makes it easy for carp to move around should be discouraged;
- the presence of carp is not conducive to the enhancement of biodiversity;
- eradication with current technologies is not achievable on a national scale;
- commercial use should not compromise the maintenance and restoration of biological diversity nor result in the development of de facto property rights that may compromise the development of more efficient control methods; in this sense 'extraction', while a commercial opportunity, is not a long-term control option; and
- while recognising existing measures, this Strategy must seek a new vision to progress beyond the status quo.

As well as these goals and principles, the strategy contains a suite of key messages that are crucial to effective carp control in Australia. These can be summarised as follows.

- Carp possess the usual biophysical attributes of a successful invasive species.
- Eradication of carp in Australia is not feasible with current technologies.
- Effective carp control will require a combination of techniques, applied as a 'package'.
- Direct carp control will be ineffective if applied in isolation from other restorative measures—that is carp have to be managed as part of an overall integrated catchment management process, not simply as a fisheries issue.
- Management plans should focus on reducing *impacts*, not merely *density*, of carp to acceptable levels.
- It is imperative to prevent the further spread of carp.

- It is difficult to distinguish the impacts of carp from other (largely human-induced) damage.
- The direct and indirect interactions between carp and other aquatic fauna remain poorly understood.
- There are private, as well as public, benefits in controlling carp.
- Management should be based upon a catchment or sub-catchment approach where the outcomes are clearly defined and related to the desired environmental and primary industry outcomes for the area.

### 1.3 Other outputs

As well as the Strategic Research Plan 'Future directions for research into carp' and 'Ranking areas for action: a guide for carp management groups' (see below), the CCCG also produced a legislation database that highlighted both the similarities and anomalies in laws administered by the various jurisdictions, and a catalogue of carp research current at that time. With the National Carp Task Force, the CCCG also produced a comprehensive colour poster and contributed to a range of quality awareness and education publications that have been widely distributed across Australia.

At the same time as the CCCG work, the Bureau of Resource Sciences produced 'Managing the Impacts of Carp', one of a series of pest animal management guidelines that contains a comprehensive review of the history and biology of carp in Australia, stakeholder attitudes to them and their possible impacts within the context of the entire ecosystem.

### 1.4 Implementation

It is recognised that the pragmatic implementation of the Strategy will be achieved at the catchment scale, typically through catchment management organisations. To this end, the CCCG commissioned the development of a set of guidelines designed to achieve two primary goals:

- provide a stepwise procedure for ranking areas for action; and
- provide guidelines for developing regional management plans for carp control.

The resulting document, 'Ranking areas for action: a guide for carp management groups', is discussed below.

Implementation of carp management and control measures are the responsibility of all stakeholders and must be undertaken through a community/government partnership. Four broad groups are targeted by the National Management Strategy:

- natural resource users: individuals, communities, industry groups;
- natural resource managers: catchment management authorities, local government, state and territory governments;
- natural resource advisers and funders: state and territory governments, Commonwealth Government, research and development funding agencies, researchers and scientists; and
- the broader Australian community: individuals, communities.

Each group has a part to play in the successful implementation of the Strategy.

While the stakeholders involved in successful carp control include the Commonwealth, state and local governments, the focus on attacking the problem 'on-the-ground' should be at the regional or catchment (or sub-catchment) level. In this sense it is envisaged that implementation of this Strategy should in effect happen at the 'community' level, involving especially catchment management or river management groups.

There is a certain irony in that the impetus for the Strategy came from the community, through the NCTF. However, the 'standout' implication of the Strategy is that its implementation will only realistically be achieved through the committed involvement of the community at the catchment or sub-catchment scale, defining the real objectives that need to be achieved, involving all stakeholders, integrating with other natural resource management plans, recognising that 'wide-scale' eradication is usually impossible, and not relying on a single control technique.

While the primary goals of the Strategy are to manage carp (including local eradication where possible) and to reduce carp impacts, some initial strategies may be aimed at reducing the visible carp population in certain 'high profile' locations. The primary aim in these cases would be to develop public awareness of the scale of the problems associated with carp, including an appreciation of the broader range of issues that need to be addressed for long-term control.

## **1.5 Conclusions**

The successful spread and high abundance of carp have probably been assisted by, as well as contributed to, the degraded aquatic habitats that are found in many parts of Australia. Thus, rehabilitating Australia's river systems and regenerating native fish populations require a range of actions of which carp management is just one. Carp management alone will not lead to the recovery of threatened species, improved water quality or decreases in bank erosion. Rather, it needs to be set within a broader context of aquatic habitat rehabilitation (Fig. 1).

The Strategy takes a holistic approach with its concern for the whole riverine environment. This is evident in its approach to the carp problem as one of vertebrate pest management rather than simply fisheries management. A holistic approach is also evident in the involvement of the community as a whole, in examining perceptions of the problem and in developing the required solutions. It is encouraging to report that since the establishment of the NCTF and the CCCG, there has been a shift of emphasis in the community from talking about 'eradication' of carp to focusing on the 'management' of carp. Hopefully, the community will harness its energies to that end.

The Strategy recognises that the specific measures needed to reduce the impacts caused by carp will differ in both their nature and level of application, according to circumstances. As such, it is not an action plan that attempts to prescribe rigorous and narrow activities, which would therefore date very quickly.

The Strategy will succeed only if all key stakeholders are involved in its further development and cooperate in its implementation. The NCTF was of considerable assistance in the development of the Strategy and a similar body will be



needed to provide community input for the plan's implementation. The NCTF is currently building on the success of its activities and is refocusing itself as a group interested in the management of all exotic pest fish in the Murray-Darling Basin.

The regional and local implementation of the Strategy will best be achieved through the application of the 'Ranking areas for action: a guide for carp management groups' used in conjunction with the Bureau of Resource Sciences publication 'Managing the impacts of carp'. These documents provide the necessary technical and practical foundation for achieving on-ground success.

In short, successful carp control is going to involve:

- a combination of techniques directly aimed at the fish itself; and
- the effective integration of these techniques with other restorative measures for river rehabilitation into regional carp management plans.

## 2. 'RANKING AREAS FOR ACTION—A GUIDE FOR CARP MANAGEMENT GROUPS' (THE GUIDE)

### 2.1 Background

The Carp Control Coordinating Group (CCCG) recently developed the National Management Strategy for Carp Control (CCCG 2001) to provide a coordinated approach to managing carp. While it sets the principles and broad approach to managing carp, the national Strategy is of limited value to local groups wanting to develop and implement a local carp management plan. In recognising the importance of local groups, the CCCG commissioned the development of a user-friendly, step-by-step guide for local carp management groups. The Guide incorporates the key principles of the Strategy, namely that carp are only one of many factors that affect the health of waterways and their associated plant and animal wildlife; and that effective management of carp requires integrating carp management into relevant regional and local catchment and sub-catchment management plans.

The Guide consists of two main complementary sections. The first describes a method of identifying and prioritising areas (management units) for carp management. There are insufficient resources to manage carp across all areas where they occur. To make best use of the available resources, managers need to prioritise areas for management. The second outlines a four-step process to assist the development and implementation of an effective plan for managing carp within the unit(s) identified by the first process.

The Guide incorporates ideas from four initiatives, viz:

- New Zealand's Department of Conservation work on managing feral goat and possum damage;
- Australia's Cooperative Research Centre for Catchment Hydrology ideas on how to set priorities for stream ecology;
- Australia's Bureau of Resource Sciences guidelines on principles of vertebrate pest management and criteria for eradication; and
- Greening Australia, work on how catchment groups can effectively participate in natural resource management planning and action.



Attitudes towards pests and their management change over time and from place to place. What may be a pest to one group may be seen as a resource or no problem to another group. To accommodate these variable attitudes, the Guide outlines a structured but flexible approach that can assist decision-making about carp management. A significant premise behind the document is that, as well as contributing to the decline in aquatic habitats, the successful spread of carp has probably been assisted by the degraded aquatic habitats that are found in many parts of Australia. Hence, carp can be considered both a cause and a symptom of degraded water systems. Consequently, the restoration of the riverine environment, including the regeneration of native fish populations require that several factors be addressed in association with managing carp. These additional factors may include altered water temperature and flow regimes, increased salinity and nutrient levels and barriers to fish movement. For example, if the goal is to reduce turbidity, carp management needs to be integrated with the other factors identified in the catchment plan that address turbidity. These may include restoration of riparian vegetation and restricting stock access to the river. Carp management alone is unlikely to lead to the desired reduction in turbidity.

In other words, the Guide treats carp control as just one aspect of an integrated approach to the management of aquatic systems. It stresses the need to assess carp management within the context of the Regional or Local Catchment Management Plan. It also recognises that, because there is a limited range of control techniques and resources currently available, carp management will not be practicable in some areas. Part of the process is to identify these areas.

Hobbs & Norton (1996) argue that methods developed for restoration projects have been largely ad hoc and site-specific, and there has been little attempt to generalise from one site to another, or to conduct restoration across entire landscapes. Also, there has seldom been much effort directed at incorporating restoration into broader land-use management and planning strategies. Restoration should form part of an overall strategy for regional and local land management, rather than take place independently. Finally, it is suggested that many restoration projects are focused on unattainable goals relating to restoring some historic natural condition, an approach that is unrealistic, unachievable and static. Some of these issues are now starting to be addressed in Australia, particularly in the Murray-Darling Basin. The Guide also addresses these issues.

## **2.2 Prioritising areas for action**

The proposed approach has three main elements. These are to:

- determine management units for aquatic systems and assess and rank their conservation and water quality status;
- assess and rank the threat of carp in each of the units; and
- assess the likelihood that an effective programme to manage carp damage can be implemented.

Ultimately, other factors such as urgency for action, ease of implementation and level of cooperation may mean that lower ranked areas are treated in preference to higher ranked areas. Nevertheless, the method is a systematic and transparent process that involves stakeholders at each step. The aim is to provide a

structured process to assist decision-making. It can be modified to suit the particular needs of the management group. Therefore, it is usually necessary to implement management across a wide area and work to boundaries, such as weirs, waterfalls and other barriers to carp movement.

It is important to stress that the Guide is only a tool. The group should drive the process, not the document. If necessary the group can modify the process and the steps to suit the situation.

It is often tempting to direct efforts at those areas that are most degraded, such as where carp are most abundant. However, highest priority should be given to preventing carp from spreading to new areas and to controlling them where the damage they have caused is still minimal. It is usually more effective to protect the parts of a stream that remain in good condition, than to spend large amounts of money to rehabilitate sections that are already badly damaged. Similarly, it is often more efficient to stop a stream from deteriorating than to try and fix it later when it has become further degraded.

The key steps in ranking areas for carp management action and developing carp management plans follow.

***Is there a sufficiently powerful trigger for action?***

What is the pressure or trigger to undertake carp management? For example, is there strong community or political pressure for action on carp and an expectation that carp should be controlled? A powerful trigger and support is essential to drive the process.

***Is there a key group to take responsibility for assessing the area (e.g. the local catchment management organisation)?***

Effective management is unlikely unless there is a local, committed group that is willing to take responsibility for developing and implementing the plan. Who will own it and ensure that the necessary resources are obtained and the required actions undertaken?

***Identify and describe the area***

***Gather the necessary information***

***Review the information to determine the key areas within the catchment for further action***

***Plan the workshop to assess the identified priority areas***

***Conduct the workshop***

The workshop should cover the following steps:

- Describe the area and determine the management boundaries for the Local Management Units (LMUs)  
These may be weirs, dam walls, waterfalls or other suitable boundaries that managers can work to
- Define the problem
- Determine the water uses and the broad conservation goal for each LMU
- Rank each LMU for water quality and conservation value

In relation to water quality, the units are ranked according to the quality or use of water for human consumption, recreation, irrigation or hydroelectricity. The ranking system is similar to that used by some agencies to rank management within water catchments. The unit is scored as high (6) or of little or no value (10) for water use. When ranking management units for conservation value, the aim is to score the management unit for the conservation value of its plants and animals. A unit is scored from 6 (high) to 1 (little or no value) depending on its significance as habitat for native plants and animals.

- Determine or estimate the threat of carp to achieving the conservation goal or to the water use

This is probably the most difficult step in the whole process, primarily because there is little sound documented information on the damage that carp cause. Generally damage from carp is inferred from observations and international studies. Therefore, many of the threats listed in this next step are based on assumptions and they may need to be changed as knowledge improves.

- Determine the overall rank

The overall ranking of each unit is determined by adding the three scores, the conservation ranking, the water quality ranking and the rank for threat from carp.

- Apply the reality check to the rank by asking a set of feasibility, acceptability and cost-benefit questions

Just because a management unit has high conservation and/or water quality value, and carp are a significant threat, does not mean that carp control is either desirable or possible. For example, the impact on non-target wildlife or other aspects of the system from the use of carp management techniques may be unacceptable.

- Decide which LMUs need to go to the next stage and develop a carp management plan

### ***Develop the carp management plan for each LMU***

### ***Collate the plans for each LMU***

### ***Implement the plan***

### ***Monitor and assess against the goals and objectives for the local carp plan and for the Local Catchment Plan***

If some of the treatment units have a high rank and the management approach meets the feasibility and acceptability criteria, the next step is to develop and implement a management plan for the local management unit.

## **2.3 Preparing regional plans**

Once priorities for management have been determined, Part III of the Guide can be used to plan and implement an effective programme to manage carp.

Developing and implementing an effective plan for managing carp within the Local Management Unit involves the following steps:

- defining the problem;
- developing the plan;
- implementing the plan; and
- monitoring and evaluating the outcomes.

Community involvement and regular reporting to all stakeholders are inherent in these steps.

Carp are just one of many factors that influence the health and sustainable use of water systems. Hence, the guide advocates that regional carp management plans are integrated with other local management plans, in particular, Integrated Catchment Management (ICM) plans. Consultation is important, to ensure that the carp management plan is consistent with the objectives of these other plans and initiatives and that it is acceptable to relevant stakeholders. The document also recommends that an integrated package of carp control techniques is considered, progress is systematically monitored and evaluated, results are reported routinely to the relevant local authority and stakeholders are kept informed.

## 2.4 Testing the document

To test the usefulness of the approach described in the Guide, three regional workshops were held in Forbes (NSW), Renmark (SA) and Beaudesert (QLD) in May–June 2000. The objectives of the workshops were to:

- test the overall strengths and weaknesses of the document;
- determine management units for the ‘test’ area and prioritise them for action; and
- develop a draft regional management plan for carp control for priority management units.

The workshops were run by a professional facilitator and comprised relevant stakeholders including commonwealth, state and local government officers, catchment and local action planning groups, the National Carp Task Force, the CCCG, relevant community groups, commercial and recreational fishing groups and conservation groups. The CCCG Secretariat collected and synthesised the necessary resource information prior to each workshop in order to maximise the use of the time at the workshop. Attendees were asked to assemble local knowledge, especially maps or other data which:

- indicated the position of dams, weirs, waterfalls and other potential or real carp barriers (to assist in drawing boundaries around Local Management Units); and
- provided information on the presence/absence of carp.

Each workshop produced a draft local action plan for carp management, and identified a key group of ‘champions’ to drive the plan to fruition. They also identified the resources needed to implement the plan. Importantly, the workshops provided useful feedback to the authors on the process and method detailed in the Guide—this information was subsequently used to refine the guide.

## 2.5 Conclusions

The ultimate success of these guidelines for regional carp management, and the effective control of carp in Australia, will depend on:

- the commitment of key stakeholders, and especially community and catchment groups, to provide ownership of the plan;
- the support and encouragement of government at all levels;
- a commitment to a community–government partnership;
- a critical mass of ‘showcase’ local carp management plans that are implemented and that provide a set of ready precedents for other catchments; and
- integration with other plans, in the spirit of integrated catchment management.

Requirements for effective action at the local or regional level include:

- a group approach;
- ownership of the problem;
- knowledge of the scope and nature of carp impact;
- planning at the *catchment* level;
- a clear, unambiguous goal;
- integration of carp control with other restoration measures;
- accountability/reporting to community and stakeholders;
- adequate facilitation and training.

## 3. AUSTRALIA’S CARP STRATEGIC RESEARCH PLAN

### 3.1 Background

The original ‘contractors’ to the establishment of the CCCG foresaw the development of a strategic research plan (SRP) as one of the key outcomes of the Group’s work.

The means to eradicate carp in open systems does not yet exist; therefore, the emphasis is on halting the spread of carp, effective regional control and—wherever possible—local, targeted eradication. The plan provides the basis for commissioning research to address critical knowledge gaps for understanding such issues as carp biology, population dynamics, impacts and behaviour. It concentrates on those aspects which will enable control options to be applied most effectively to reduce the impacts of carp. The plan also addresses the development and trialing of control options, the evaluation of carp impacts and of management options in environmental, social and economic terms, and the optimum use of carp as a resource.

### 3.2 How the SRP will work

The purpose of this Plan (‘Future directions for research into carp’) is to focus carp research on the information needs of the National Management Strategy for Carp Control (and hence the regional management plans that will be developed) and on the priority areas indicated by the Strategy.

For maximum effectiveness, resources must be directed to where the carp problem can be solved. To do this, we need to first establish where carp are having a major environmental impact. Adaptive management is the preferred management framework for identifying relative priorities and allocating resources. For this purpose, adaptive management means that processes may need to be modified in response to further information and experience.

The SRP will be reviewed periodically to reflect changing knowledge and circumstances. It will:

- provide the basis for funding applications to both state and Commonwealth government departments and thus achieve a coordinated and consistent approach to funding; and
- provide a pragmatic basis for the selection of academic research.

### **3.3 Information gaps**

In formulating the SRP the CCCG arrived at nine key information gaps that need to be addressed in order to improve our baseline knowledge on carp control in Australia. These gaps are:

- Biology and ecology
- Distribution and stock structure
- Impact
- Control
- Commercial use
- Environmental rehabilitation
- Social issues
- Decision support system
- Evaluation and monitoring

For each information gap, the Group focused on:

- Background to the issue
- Outcomes—i.e. what extra information will the research give us, and how can it be used to provide pragmatic outcomes?
- Critical issues—what areas of research with management applications are important/useful here, and do some of these take priority?
- Considerations—what are the constraints to undertaking this work, or what are the community expectations?
- Actions—what are the generic measures that need to be undertaken?

### **3.4 Prioritising the knowledge gaps**

The nine information gaps outlined in this report are listed in no particular order. However, at its last meeting in April 2000 the CCCG employed a pairwise comparison technique (the Analytical Hierarchy Process) in order to assign some sense of priority, in terms of what is currently impeding carp control. Members were asked, first individually and then as a member of a group, to compare knowledge gaps on the basis of the question 'Which knowledge gap is inhibiting our ability to control the impact of carp the most?' The ranking process resulted in the knowledge gap 'control' being considered by the group

as the most important, with 'evaluation and monitoring', 'environmental rehabilitation' and 'impact' being rated equal second.

This type of methodology is often used as a tool to measure the consensus and stability of group opinion. It is a process that enables decision making to be insulated from the limitations of group decision-making, e.g. over-dominant group members, political lobbying or 'bandwagonism'.

### **3.5 Linkage to the National Management Strategy**

The purpose of 'Future directions for research into carp' is to focus carp research on the information needs of the National Management Strategy (and hence the regional management plans that will be developed) and on the priority areas indicated by the Strategy.

As the direction and major emphases of the National Management Strategy change over time, so will the management information needs and research and development priorities and, hence, the major direction and priorities for 'Future directions for research into carp'. In turn, its findings will inform the National Management Strategy. At all times, however, the main focus will be on the eradication or improved control of carp populations and their impacts. Achieving a comprehensive understanding of the biology and ecological impacts of carp could consume extraordinary amounts of research resources over a long period and is not the goal of the Research Plan.

Because of the clear links between them, the review and revision processes established for the National Management Strategy and 'Future directions for research into carp' must be closely tied together. This will require a coordinated national approach that meshes with the strategic management and research review processes set up at state and regional levels.

### **3.6 Conclusions**

The role of carp in riverine degradation is difficult to separate from that of other mitigating factors such as river regulation, habitat modification and pollution and, unlike native fish, carp are remarkably tolerant of environmental decay. Thus, it is debatable to what extent carp constitute an environmental threat and whether they are as much a symptom of general deterioration of the environment as a cause. Because of this uncertainty and the scale of the problem, the CCCG recognises that any carp control initiative will have to be undertaken as a component of a broad programme of environmental management.

'Future directions for research into carp' is not meant to be prescriptive, with the risk that it will 'age' quickly. Rather it is designed to provide the fastest pathway to the knowledge we need to make an impact on a major problem.

## **4. REFERENCES**

- Hobbs, R.J.; Norton, D.A. 1996: Towards a conceptual framework for river restoration. *Restoration Ecology* 4(2): 93–110.
- Koehn, J.; Brumley, A.; Gehrke, P. 2000: Managing impacts of carp. Bureau of Resource Sciences, Canberra. 247 p.