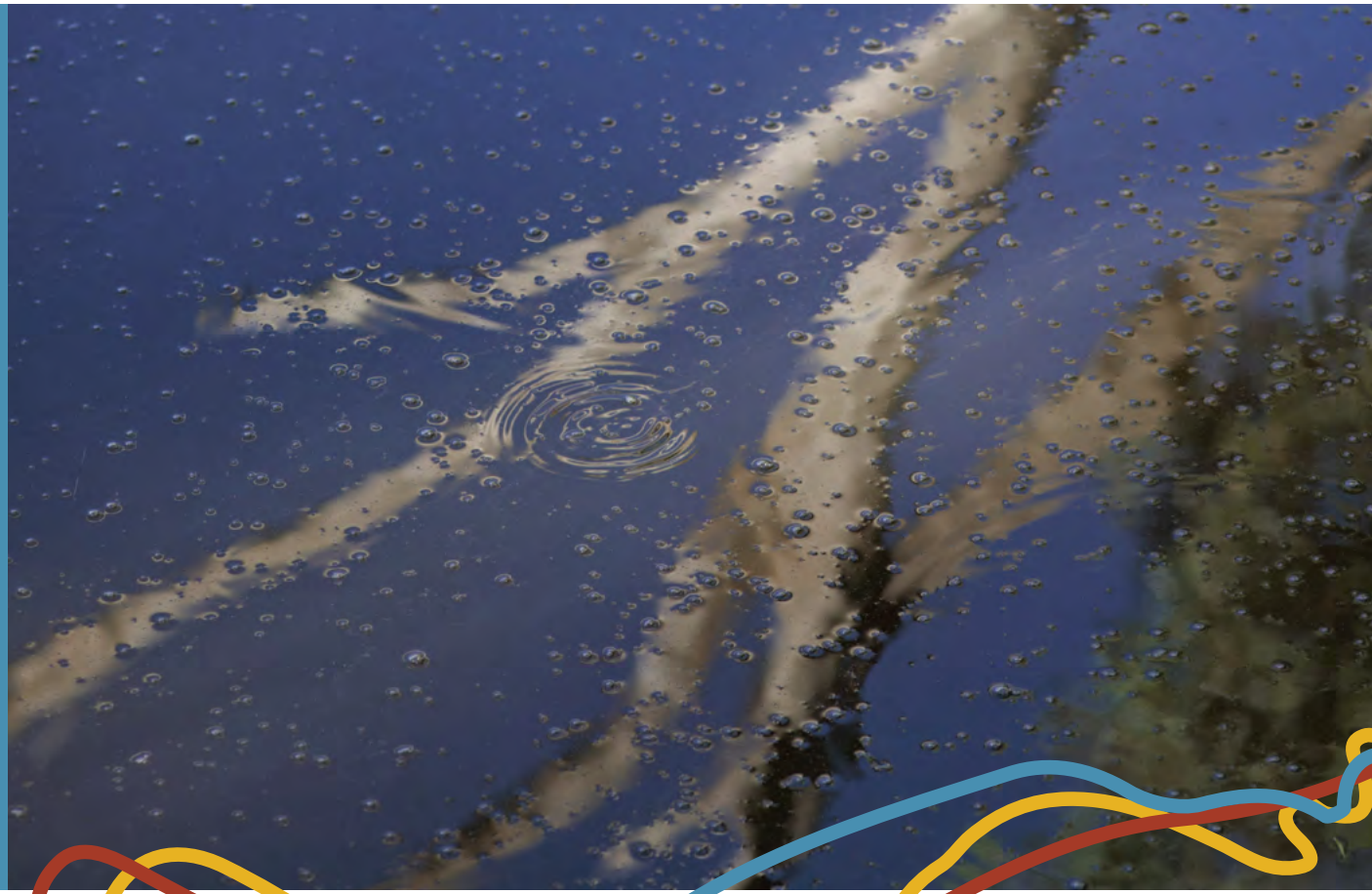
WHAT ARE THE CARP VIRUS BIOCONTROL RISKS AND HOW CAN THEY BE MANAGED?

NATIONAL CARP CONTROL PLAN

The socio-economic impact assessment and stakeholder engagement

APPENDIX 7: Socio-economic impact assessment — recreational fishing sector



This suite of documents contains those listed below.

NCCP TECHNICAL PAPERS

1. Carp biocontrol background
2. Epidemiology and release strategies
3. Carp biocontrol and water quality
4. Carp virus species specificity
5. Potential socio-economic impacts of carp biocontrol
6. NCCP implementation
7. NCCP engagement report
8. NCCP Murray and Murrumbidgee case study
9. NCCP Lachlan case study

NCCP RESEARCH (peer reviewed)

Will carp virus biocontrol be effective?

1. 2016-153: Preparing for Cyprinid herpesvirus 3: A carp biomass estimate for eastern Australia
2. 2018-120: Population dynamics and carp biomass estimates for Australia
3. 2017-148: Exploring genetic biocontrol options that could work synergistically with the carp virus
4. 2016-170: Development of hydrological, ecological and epidemiological modelling
5. 2017-135: Essential studies on Cyprinid herpesvirus 3 (CyHV-3) prior to release of the virus in Australian waters
6. 2020-104: Evaluating the role of direct fish-to-fish contact on horizontal transmission of koi herpesvirus
7. 2019-163 Understanding the genetics and genomics of carp strains and susceptibility to CyHV-3
8. 2017-094: Review of carp control via commercial exploitation

What are the carp virus biocontrol risks and how can they be managed?

9. 2017-055 and 2017-056: Water-quality risk assessment of carp biocontrol for Australian waterways
10. 2016-183: Cyprinid herpesvirus 3 and its relevance to humans
11. 2017-127: Defining best practice for viral susceptibility testing of non-target species to Cyprinid herpesvirus 3
12. 2019-176: Determination of the susceptibility of Silver Perch, Murray Cod and Rainbow Trout to infection with CyHV-3
13. 2016-152 and 2018-189: The socio-economic impact assessment and stakeholder engagement
    Appendix 1: Getting the National Carp Control Plan right: Ensuring the plan addresses community and stakeholder needs, interests and concerns
    Appendix 2: Findings of community attitude surveys
    Appendix 3: Socio-economic impact assessment — commercial carp fishers
    Appendix 4: Socio-economic impact assessment — tourism sector
    Appendix 5: Stakeholder interviews
    Appendix 6: Socio-economic impact assessment — native fish breeders and growers
    Appendix 7: Socio-economic impact assessment — recreational fishing sector
    Appendix 8: Socio-economic impact assessment — koi hobbyists and businesses
    Appendix 9: Engaging with the NCCP: Summary of a stakeholder workshop
14. 2017-237: Risks, costs and water industry response
15. 2017-054: Social, economic and ecological risk assessment for use of Cyprinid herpesvirus 3 (CyHV-3) for carp biocontrol in Australia
    Volume 1: Review of the literature, outbreak scenarios, exposure pathways and case studies
    Volume 2: Assessment of risks to Matters of National Environmental Significance
    Volume 3: Assessment of social risks
16. 2016-158: Development of strategies to optimise release and clean-up strategies
17. 2016-180: Assessment of options for utilisation of virus-infected carp
18. 2017-104: The likely medium- to long-term ecological outcomes of major carp population reductions
19. 2016-132: Expected benefits and costs associated with carp control in the Murray-Darling Basin

NCCP PLANNING INVESTIGATIONS

1. 2018-112: Carp questionnaire survey and community mapping tool
2. 2018-190: Biosecurity strategy for the koi (*Cyprinus carpio*) industry
3. 2017-222: Engineering options for the NCCP
4. NCCP Lachlan case study (in house) (refer to Technical Paper 9)
5. 2018-209: Various NCCP operations case studies for the Murray and Murrumbidgee river systems (refer to Technical Paper 8)

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National Carp Control Plan socio-economic impact assessment: freshwater recreational fishing sector

Report to the 'National Carp Control Plan': Understanding community and stakeholder attitudes and assessing social effects' project

October 2019

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CONTENTS

1. SUMMARY

In 2016 the Australian Government announced a $15 million investment to develop the National Carp Control Plan (Plan). The Plan is being developed through research and consultation with stakeholders and community members. It focuses on evaluating the feasibility of releasing the carp virus Cyprinid herpesvirus-3 (referred to as the 'carp virus' from here) for reducing carp numbers. The Plan will be submitted to the Australian Government in December 2019, and the Government will draw on the Plan recommendations to inform and decide upon the development of future carp control strategies.

Critical to the success of the Plan and use of its recommendations in subsequent carp control actions is support from the diverse range of stakeholders who depend on or have an interest in carp, freshwater health and fisheries, as well as from people living and spending time in the regions where carp control measures will be implemented. Researchers at the University of Canberra were commissioned to develop understanding of community and stakeholder attitudes across these areas and to evaluate anticipatory and potential socio-economic impacts of the Plan, focusing on potential use of the carp virus. This is one of several reports produced from this project. This report examines the potential socio-economic impacts of proposed carp control for the *freshwater recreational fishing sector*, in areas affected by carp.

At the time of this report, Plan research into feasibility of the carp virus was ongoing, and the actions that would be recommended for future carp control were not yet known. Given this, the focus of this report is on identifying *potential* impacts on the freshwater recreational fishing sector, the circumstances under which they could occur, and the types of actions that could increase potential for positive impacts and reduce risk of negative impacts. This follows best practice approaches to socio-economic impact assessment (SEIA), which recommends beginning SEIA as early as possible in order to ensure the design of a project or program incorporates consideration of social and economic impacts at all stages.

This report does not attempt to quantitatively estimate potential impacts in terms of changes in numbers of jobs or economic activity. Instead the overall size of the sector is described as far as is possible together with its likely trajectory in the near future based on recent trends. This provides baseline information relevant to supporting assessment of impacts of future actions once they have been determined.

Thus, the impacts identified in this report should not be assumed to be 'likely' to happen. Whether they occur, and to what extent, will depend on the nature and type of actions ultimately implemented as part of future carp control actions.

Methods

This report is based on implementation of the following: i) research examining the size and nature of the industry, ii) thematic analysis of phone interviews conducted between July and August 2019 with 27 people which included individual freshwater recreational fishers, representatives of peak bodies or fishing clubs and industry organisations and iv) a multi-stakeholder workshop held in June 2019.

Existing conditions

Understanding the current size and nature of an industry's activities can support the evaluation of the extent to which impacts on an industry have potential to flow-on to have broader impacts to people and communities beyond those directly involved in recreational fishing. It also provides insight into the ability of the industry to adapt successfully to change.

Recreational fishing in Australia has been described as one of the larger and most widely dispersed of any other recreational activity that uses a natural resource (Department of Agriculture 2018). The *2000 National Recreational and Indigenous Fishing Survey Across Australia* was the first detailed national survey that measured the size of Australia's recreational fishing sector. In the survey, it established that as at 2000 an estimated 3.36 million Australians aged five or over engage in recreational fishing at least once a year. The value of spending on fishing-related services and items was estimated at $2.8 billion in 2000 (in 2018 prices) supporting direct and indirect employment across fishing-related businesses, retail, tourism and other industries (DAFF 2011; Colquhoun 2015).

Some of the current challenges facing freshwater recreational fishing in areas reported in interviews for this project include increasing limitations to access to recreational fishing sites, environmental pressures and unwanted bycatch of pest species, changing participation and decline in volunteer numbers, and significant resource constraints for peak representative organisations.

The feedback on current opportunities from most of those interviewed was focused around the opportunities arising from conservation-focused activities with outcomes for restoration of habitat and native fisheries. This was proposed as offering significant opportunities for supporting and expanding participation in freshwater recreational fishing with flow-on benefits for regional tourism.

Impacts of developing the Plan

The period in which a proposed action is being developed, but when its exact nature is not yet known, is often associated with social and economic impacts for those who have potential to be impacted by the proposed action. In interviews participants were asked whether they experienced any impacts during the period in which the Plan was being developed.

The feedback across interviews indicated the period of the Plan development has not had any direct impacts on recreational fishing activity or any had any direct financial impact for those operating a business. However, feedback also indicated that the proposed release of the carp virus has been polarising across the sector and contributed to some disharmony in relationships across the sector. The extended period of uncertainty about the carp virus and potential impacts that may arise was described as contributing factor, along with the challenges associated of communicating the inevitable uncertainties associated with assessing the feasibility of the carp virus. Representative bodies have been called upon by the recreational fishing community to help build understanding and advocate across divergent perspectives. This has added to the resource pressures representative organisations currently face.

Potential impacts of the Plan

In interviews participants were asked to discuss their concerns about potential impacts they would experience if the carp herpes virus is released. Respondents raised concerns about potential direct impacts for freshwater recreational fishers as well as broader concerns about potential impacts. These are summarised in the table below:

Socio-economic impacts	Details and circumstances of the impact
Uncertainty about the future for freshwater recreational fishing, with frustration and stress impacting relationships across parts of the recreational fishing sector (negative impact)	This is occurring already. It has impacted some social networks across the sector. It has been influenced by a focus on negative messages about 'problems' associated with the Plan, and limited opportunities for the sector to engage with scientific findings emerging from the Plan, and the resource constraints the sector faces limiting capacity to support meaningful and trusted communications about the Plan across the sector. For recreational fishers who target or enjoy catching carp, the development phase of the Plan has been frustrating and stressful because of the uncertainties it has raised about potential impacts on their recreational fishing future, social networks and competitions.
Opportunities for recreational fisher involvement (positive impact)	This is a potential positive impact. The recreational fishing sector are keen for the opportunity to have a role in carp control. This includes through: i) coordination of sector feedback and review of details of the design and implementation of final Plan delivered to governments, ii) communication and engagement with the sector about the Plan iii) actions such as assisting with monitoring carp numbers in citizen science projects, assisting with clean-up (in specific cases), and iii) assisting with actions to increase likelihood of environmental recovery. To facilitate these opportunities for involvement will likely require additional specific resourcing to the sector.
Reduced native recreational fishing opportunities or fishing activity (negative impact)	The impact would occur if virus release reduced abundance of native or established non-carp fisheries (e.g. trout) due to water quality problems or other issues related to dead carp. This was considered by most of those interviewed to be a short-term impact immediately

	after initial virus release in each area. Most felt would have relatively limited impact on recreational fishers. Some were concerned about potential for longer-term reductions in native fish through shifts in the long-term predator/prey dynamics from reduced carp, or if complementary measures are not implemented to establish habitat conditions to support restoration of native fish. The impact would be extensive and long-term if non-target species are directly susceptible to the carp virus. There is also potential for fishers to reduce fishing activity in areas where the virus has been released due to perceptions that it is unsafe to be in contact with waters or fish in these areas (this is based on survey results reported in Schirmer et al 2019).
Reduction in recreational fishing for carp (potentially negative impact)	Some coarse fishers interviewed who like to fish for carp or who participate in carp-specific fishing competitions were concerned about the impact of significant carp reduction on their hobby and on the regional economies where key carp or coarse fishing competitions are held. Significant carp reductions may also reduce recreational fishing opportunities for people with little experience in fishing who find carp easy to catch and for those who target carp as part of specialised programs supporting people with disabilities. Not all felt this was a concern, given there were expected to be carp available after virus release albeit in smaller numbers, and some felt it would be possible to identify other ways to achieve similar outcomes for fishers who needed easy-to-target fish species.
Increased fishing success and enjoyment for fishers (positive impacts)	Many recreational fishers interviewed who target native fish supported release of the virus because of the potential for long-term improvement in recreational fishing conditions through improved environmental health, increased native fish stocks, and reduction in unwanted catch of carp. Many felt this would result in increased benefits of recreational fishing in the form of enjoyment and wellbeing. In some cases, the potential for positive outcomes was seen as being contingent on implementation of complimentary actions alongside the carp virus.
Increased revenue for fishing-related businesses (positive impacts)	Some felt that the potential for improved environmental conditions would led to increase recreational fishing effort (increased numbers of fishing trips to areas previously affected by carp by larger numbers of fishers). If this occurred, there is potential for positive impact on tourism revenue and revenue for recreational fishing businesses. This impact would occur if carp reduction led to improvement in environmental health, and supported growth in numbers of native or exotic (e.g. trout) fish.
Significant reduction in business activity for some recreational fishing suppliers or guide businesses (negative impact)	This impact is considered unlikely to occur to the extent that significant harm to businesses occurs. Significant impact on businesses would only occur if virus release led to inability to fish in a relatively large area for a relatively long period of time (several months), longer than the typical impacts of existing events such as blue-green algae

	outbreaks, which these businesses have already established mechanisms to cope with.

Recommendations

Based on the assessment in this report, the following actions should be considered as part of the development of future carp strategies and their implementation, with the aim of mitigating potential negative impacts and enhancing positive impacts on the freshwater recreational fishing sector.

Communications: Plan timeframe, research findings and future consultation

- Provide regular updates about likely timelines and processes for future decision-making about carp control and the carp virus, and timing of implementation of carp control actions. This will help reduce uncertainty for the sector. It will also assist the sector in planning and coordination communications to the broader recreational fishing community, and to coordinate feedback from the sector in response to recommendations outlined in the Plan. It will also allow clubs, businesses and other organisations to accommodate any carp control actions into their planning of recreational fishing activities, gatherings and competitions.
- Communication of Plan research findings in a way that is meaningful to and trusted by the recreational fishing facilitated by closely working with peak representative organisations. The communications should focus on providing accessible information across key areas of concern or interest, including: short-term and long-term outcomes expected for water quality and native fish recovery; potential risks to native fish and; cleanup requirements and planning.
- Communicate contingency measures for 'worst case' scenarios under virus release, which ensure protection of key recreational species, such as Murray cod, golden perch and trout.

Consultation and resourcing

- Planning for direct, on-going communication and consultation with the sector. The limited resources available to peak organisations discussed in this research has meant there has been limited capacity to provide the detailed communication necessary to keep the sector informed about the Plan process and scientific findings. Feedback from peak organisations is that direct communication and engagement from the National Carp Control Plan, when it has occurred, has been fundamental to building common understanding across the recreational fishing community about the emerging science and the purpose of the Plan.

- Evaluate need and scope for resources required to support capacity of peak representative organisations to consult with the sector on Plan recommendations, build understanding of the Plan and advocate across divergent perspectives in providing feedback into the Plan recommendations and future carp control decisions.
- It is important that the current constraints and the institutional settings across different states are considered in the Plan recommendations and future consultation as they have significant implications for the capacity of the sector to provide input into the process. Resourcing for engagement will likely be required to provide meaningful opportunities for the sector to engage in the decision-making processes about carp control into the future.
- Consider recommendations for resourcing direct consultation with the sector in relation actions currently being undertaken in environmental and fisheries restoration beyond direct carp control actions: e.g. habitat restoration and responsive strategies to support native fish recovery.
- Consider recommendations for resourcing communication of messages to the broader recreational fishing consumers as part of carp control strategies. This includes recommendations for the planning and resourcing of communicating accurate information about safety of fishing, being in contact with water in areas where virus is released, and consuming catch.

Support for sector participation

- Plan for consultation with the sector once recommendations of the Plan are finalised to Identify opportunities for recreational fisher engagement in programs involving in implementing and monitoring carp control. This also has potential to offset negative impacts of any short-term inability to fish in specific areas through encouraging long-term engagement of fishers in a range of activities. In recognising the significant resource constraints facing peak representative organisations and fishing clubs, financial support will likely to be required to enable participation.
- Engage coarse fishers and others who target carp in citizen science projects tracking change in carp population. Invest in identifying alternative fishing opportunities to carp that can be used by groups who currently target carp.
- Implementation of specific community programs to mitigate the potential social impact of any significant reduction in participation of vulnerable people in the community through community recreational fishing programs.

Planning and provisions for minimising impacts of reduced recreational fishing opportunities and business disruption

- Understanding coarse fishing
- Social programs.
- Provide recommendations in relation to assistance required for those whose business activities are reduced, and, where needed, to support transition to new business activities or employment.

2. INTRODUCTION

THE NATIONAL CARP CONTROL PLAN

In 2016 the Australian Government announced a $15 million investment to develop the National Carp Control Plan (Plan). The Plan is being developed through research and consultation with stakeholders and community members. It focuses on evaluating the feasibility of releasing the carp virus Cyprinid herpesvirus-3 (referred to as the 'carp virus' from here) for reducing carp numbers. The Plan will be submitted to the Australian Government in December 2019, and the Government will draw on the Plan recommendations to make decisions about and inform development of future carp control strategies.

STAKEHOLDER AND COMMUNITY SUPPORT

If the carp virus is found to be a feasible strategy for reducing carp numbers, it would potentially be delivered over a large geographic area, in waterways and waterbodies that are essential to Australia's traditional owners, primary industries, household water consumption, and millions of recreational users each year.

Critical to the success of the Plan and any subsequent use of its recommendations in carp control actions, is widespread support from the diverse range of stakeholders who depend on or have an interest in carp, freshwater health and fisheries, as well as from people living and spending time in the regions where carp control measures will be implemented.

Support for the recommendations made in the Plan, and for action to control carp more broadly, will depend on a range of factors, including:

- The extent to which people believe investing in carp control is an appropriate and effective way of improving environmental health
- Expected benefits versus costs of proposed carp control methods for different groups and communities
- Trust in the processes and evidence used to develop the Plan and subsequent carp control actions, and in the agencies tasked with implementing carp control, and
- The perceived environmental, economic and social risks of actions proposed for carp control.

Researchers at the University of Canberra have been commissioned to develop understanding of community and stakeholder attitudes across these areas and to evaluate anticipatory and potential socio-economic impacts of the Plan, focusing on potential use of the carp virus, while also examining views and preferences about carp control more broadly. This work aims to inform development of recommendations that will have support from communities and stakeholder groups, through guidance on how these actions could be

designed in ways that appropriately address the needs, concerns and priorities of community and stakeholders.

UNDERSTANDING COMMUNITY AND STAKEHOLDER ATTITUDES AND ASSESSING SOCIAL EFFECTS – PROJECT OVERVIEW

The University of Canberra project focuses on:

- Identifying and understanding stakeholder and community needs, concerns and expectations regarding carp control, so these are considered throughout the development of the Plan and integrated in the recommendations under the Plan
- Identifying how best to ensure processes used to develop the Plan meet stakeholder needs and expectations
- Identifying potential socio-economic impacts of carp control for different stakeholder groups and communities, and measures to reduce negative and maximise positive socio-economic impacts, and
- Understanding the types of information, consultation and engagement needed by different stakeholders in the process of developing the Plan.

This work is being used to inform both the process used to develop the Plan (including communication, consultation and engagement with stakeholders and communities) and the content of the Plan. The work will inform evaluation of the feasibility of carp virus and strategies for minimising negative and maximising positive impacts of any carp control actions recommended in the Plan.

This project will also identify a framework for ongoing monitoring and evaluation of socio-economic impacts and community attitudes into the future beyond the life of this project. This is will facilitate capacity for rapid identification of actions needed to address community and stakeholder concerns during any future implementation of the Plan recommendations.

The project has included a focus on identifying stakeholder concerns, views and needs, and identifying the potential impacts of releasing the virus on different groups. An initial round of phone interviews was conducted in 2017 with 23 representatives of stakeholder groups with differing interests in carp control. This included representatives of environmental groups, commercial carp fishers, Traditional Owners, farming groups, koi organisations, water providers, native fish breeders, recreational fishing organisations, tourism businesses, animal welfare organisations, and freshwater scientists. A second round of stakeholder interviews was conducted in 2018 and a multi-stakeholder workshop in June 2019.

The initial round of interviews provided a baseline understanding of the views of stakeholders at the early stage of the Plan development. In the interviews most stakeholders expressed *conditional support* for the Plan, meaning they would support the eventual Plan if the process of developing it and its content adequately addresses their key

questions and concerns. A smaller number of stakeholders actively opposed the Plan, and a similarly small number unconditionally supported the Plan.

In these initial interviews, it was identified that stakeholder support for any future carp control strategy was contingent upon the strategy including the following elements:

- Multiple measures to control carp
- Identification of how to best integrate carp control with other actions to improve environmental health in freshwater and estuary areas
- Development of detailed guidance on the planned timing and management of carp control actions, particularly virus release
- Clear identification of risks and how they will be managed and mitigated, including planning for worst-case scenarios
- Identification and appropriate mitigation of potential social and economic impacts of carp control on specific groups
- Appropriate involvement of different groups in decision making processes
- Sound governance, including clear commitment of funding and other resources to carp control and identification of responsibilities of different agencies
- Development of appropriate monitoring and evaluation strategies to ensure outcomes can be identified.

When discussing the recommendations being developed in the Plan, stakeholders also identified engagement with scientists undertaking research for the Plan as a priority, and to be able to discuss and provide their views on the emerging findings of Plan research. To enable this, in June 2019 a workshop was organised in which stakeholders were both provided with presentations on emerging findings and discussed these findings as well as their views on implications of the emerging findings for future carp control action.

PROJECT REPORTS

This project includes several areas of investigations. These are being produced as separate reports and as chapters of reports for the overall project, in the following form:

- Getting the National Carp Control Plan right: Ensuring the Plan addresses community and stakeholder needs, interests and concerns (stand-alone report, also included as appendix to the Final Report for FRDC Project 'Carp Control: Understanding community and stakeholder attitudes and assessing social effects')
- Ensuring carp control is socially acceptable: Understanding key factors likely to influence social acceptability of carp control measures (journal paper prepared, with key findings also summarised in Final Report for FRDC Project 'Carp Control: Understanding community and stakeholder attitudes and assessing social effects')
- Stakeholder engagement recommendations for the National Carp Control Plan. Rather than being published as a separate report, this work was integrated directly

into the Plan's stakeholder engagement and communications strategies over time (A summary of the work conducted is included in the Final Report for FRDC Project 'Carp Control: Understanding community and stakeholder attitudes and assessing social effects')

- Socio-economic impact assessment: potential impacts and negative impact mitigation strategies for (a) commercial/contract carp fishers, (b) tourism-dependent businesses, (c) native fish breeders and hatcheries, (d) the koi industry and, (e) recreational fishing sector (these have been produced as stand-alone reports, with earlier versions of the first four also included as Appendixes to the Final Report for FRDC Project 'Carp Control: Understanding community and stakeholder attitudes and assessing social effects', and the final versions of all five included as Appendixes to the Final Report for FRDC Project 'NCCP: Socio-economic impact assessment and stakeholder engagement').
- Engaging with the National Carp Control Plan: summary of a stakeholder workshop (stand-alone report, also included as Appendix to the Final Report for FRDC Project 'NCCP: Socio-economic impact assessment and stakeholder engagement')
- Monitoring socio-economic impacts and community attitudes: A framework for ongoing monitoring of the National Carp Control Plan (included in the Final Report for FRDC Project 'Carp Control: Understanding community and stakeholder attitudes and assessing social effects').
- Issues Paper: Understanding potential social and economic impacts of carp control. This was produced as a stand-alone paper and summarises key findings across all the work regarding potential socio-economic impacts of reducing carp using release of the carp virus.

THIS REPORT

This report examines potential socio-economic impacts of a carp virus release and carp control more broadly, for freshwater recreational fishing sector in Australia.

As discussed earlier, this report is one of five examining potential impacts of the Plan for different stakeholder groups. Each of the five reports uses a similar approach, and some text about impact assessment is repeated in each report so each can be read as a 'stand-alone' document.

This report was prepared while the Plan was engaged in ongoing research evaluating feasibility of use of the carp virus, and before recommendations or decisions had been made about the feasibility of the carp virus or optimal approaches to future carp control. This means that the exact actions to be implemented in future to reduce carp numbers were not yet known. Given this, the focus of this report is on identifying *potential* impacts under a carp virus release scenario, the circumstances under which they could occur (and which they would not occur under), and the types of actions that could be implemented as part of

future carp control strategies in order to increase potential for positive impacts and reduce risk of negative impacts. The intent is to identify potential impacts so they can be considered and addressed as part of the design of the Plan recommendations with the goal of preventing or mitigating negative impacts and providing opportunities for positive impacts where possible. Thus, the impacts identified in this report should not be assumed to be 'likely' to happen as whether they occur, and to what extent, will depend on the nature and type of actions ultimately implemented as part of future carp control actions.

This approach to early assessment of potential impacts follows best practice approaches to socio-economic impact assessment (SEIA), which recommends conducting SEIA as an ongoing process that starts before a decision is made so that initial SEIA can inform decisions made about the types of actions to proceed with (Esteves et al. 2012, Schirmer 2017). This is different to traditional impact assessment, which is often undertaken after a proposed set of actions have been finalised - a point at which it is more difficult to make meaningful changes that can prevent or mitigate impacts (Esteves et al. 2012). It addresses concerns such as those raised by Momtaz and Gladstone (2008), who found that negative impacts experienced by fishers from estuarine management introduced by the NSW government could have been reduced if improved impact assessment and consultation processes had occurred during the process of developing the management actions.

This report should be read as an early impact assessment produced to inform Plan development. It includes key questions and identifies important areas of assessment that are needed as the Plan is developed. As it is intended to inform development of the Plan and is not an assessment of the impacts of the Plan: once the specific actions to be included in the Plan are finalised, a formal assessment of their potential impacts should be undertaken.

The assessment has not attempted to quantitatively estimate potential impacts in terms of changes in numbers of jobs or economic activity as the specific actions to be recommended in the Plan, and ultimate decisions made by government about carp control were not known at the time of preparation. Instead, the overall size of the sector is described as far as is possible together with its likely trajectory in the near future based on recent trends. This provides baseline information relevant to enabling assessment of impacts of future actions once they have been determined.

The report first briefly explains the key areas examined. This is followed by a description of assessment methods applied. Findings are then presented, with a focus on understanding (i) current status, constraints and opportunities for the freshwater recreational fishing sector, (ii) impacts of the announcement of the Plan development, (iii) potential impacts of carp control, and (iv) priority areas for further assessment. Finally, next steps for the impact assessment and responding to findings presented in this report are described.

3. SOCIO-ECONOMIC IMPACT ASSESSMENT

Impact assessment can mean different things to different people. This section explains the approach taken in this report, and why this approach is being used at this point of the Plan development.

As noted earlier, best practice in impact assessment involves assessment prior to decisions have been made about a course of action. This increases the scope of proponents to design their proposed action in ways that prevent or mitigate negative impacts and provide opportunities for positive impacts (Vanclay and Esteves 2011; Arce-Gomez et al. 2015). In addition, commencing impact assessment prior to final decisions allows it to form a central part of the decision-making process. When being undertaken along-side the decision-making process, participatory approaches should be used where the people or groups who are potentially impacted have opportunities to contribute to assessment of feasibility of the proposed actions, their potential impacts and to identify prevention and mitigation measures (Vanclay and Esteves 2011; Arce-Gomez et al. 2015).

This report examines four key areas important to early impact assessment that can then inform development of proposed actions:

- Current status, conditions, constraints and opportunities for the native fish aquaculture industry, including baseline trends in size and growth of the industry
- Impacts of the development phase of the Plan on the industry
- Potential impacts of implementation of carp control
- Broader industry concerns about potential impact and Plan development, and
- Recommendations for actions to reduce negative and increase positive impacts as part of future carp control actions.

ASSESSING EXISTING CONDITIONS

Existing conditions, constraints and opportunities experienced are an important starting point for impact assessment as they influence how a policy, program or project can impact people and businesses (Schirmer 2011, Loxton et al. 2013). This part of assessment is important for two key reasons.

First, understanding the current size and nature of an industry's activities enables identification of the extent to which impacts on an industry have potential to flow-on to have broader impacts for the communities in which that industry operates.

Second, the influence of existing conditions on the ability of people, businesses and communities to adapt successfully to change is well recognised in literature across a range of contexts including climate change adaptation (e.g. Loxton et al. 2013). For example, a farmer experiencing drought may be less able to cope with reforms to water access, compared to one who is experiencing normal rainfall conditions (e.g. Schirmer 2017). This

principle is applicable to assessment of the potential effects of the National Carp Control Plan. For example, if businesses are experiencing a change in markets, or expanding or contracting prior to implementation of the Plan, there may be less capacity to adapt to any new conditions that may arise.

ASSESSING IMPACTS OF DEVELOPING THE PLAN – 'ANTICIPATORY IMPACTS'

Many policies, programs and projects can have relatively long development phases which can, themselves, have important 'anticipatory' social and economic impacts. During the development phase of a program, even though it is not known exactly how the proposed action will impact, it is known there is potential for impacts to occur (see for example Loxton et al. 2012, 2013, 2014; Schirmer 2017).

A person anticipating a change they feel is likely to affect them may experience a range of associated impacts which can include mental health impacts such as anxiety and stress-related health problems. These can result from experiencing uncertainty about the future, and associated challenges with decision-making. Major life decisions such as getting married, having a child, or purchasing a house or car may be delayed as a result of uncertainty. Those who manage businesses can find it harder to obtain finance or maintain loans if financial institutions are aware a proposed action may have potential negative impacts on the business in the future. They may also experience changes in their markets as customers switch to other providers in anticipation of the action being proposed (Loxton et al. 2012, 2013, 2014).

'Anticipatory' impacts can be significant and create long-lasting impacts for households and businesses. It is therefore critical to understand how the announcement of the Plan has affected people and businesses involved in the native fish aquaculture industry, and to identify any actions that can be implemented to reduce potential negative impacts during the development of the Plan.

POTENTIAL IMPACTS OF CARP CONTROL

As noted earlier, implementing actions to control carp has potential to cause social and economic impacts – positive and negative – for different native fish aquaculture businesses. This report identifies potential impacts with a focus on understanding the conditions under which they could occur and actions that could increase likelihood of positive impact and reduce likelihood of negative impact.

BROADER INDUSTRY CONCERNS ABOUT POTENTIAL IMPACT AND PLAN DEVELOPMENT

In the interviews and workshops with the native fish aquaculture sector participants raised questions and concern about the proposed carp control under the Plan beyond those that were directly related to impacts on their sector. These are questions and concerns this

group would need answered to be able to decide on their support for specific future carp control actions. This is also important for understanding willingness to accept negative impacts: past studies have documented that many groups are willing to accept some level of negative impact (usually temporary and not threatening their overall household or business viability) if they believe the actions being taken are 'worth it' – in other words, that they will achieve longer-term positive outcomes than justify the shorter-term negative impacts (see for example Gross 2008, 2011). This report includes discussion of the broader questions and concerns that were raised by participants to examine these aspects of willingness to accept impact in more depth.

The report provides recommendations for reducing risk of negative impact and increasing potential for positive impacts, ensuring any negative impacts are 'worth it' in the form of long-term positive outcomes for either the native fish aquaculture or freshwater and estuary health more generally.

4. METHODS

This report is based on a combination of phone interviews conducted between May to August 2019 and feedback from recreational fishers in a multi-stakeholder workshop held in June 2019. A total of 27 recreational fishers were interviewed or participated in workshops held as part of the project.

INTERVIEWS

SAMPLE

It was important that a diversity of representatives across the sector were consulted to ensure the full range of potential impacts could be identified. The participants invited to participate included those most likely to be directly impacted by the implementation of carp control measures. This included representative of peak bodies for the recreational fishing sector, members of fishing clubs, business owners involved in the sector, and individual fishers who participate in recreational fishing in carp affected areas.

Interview participants were identified through several avenues which included 1) referrals from the Plan, 2) referrals from interviewees, 3) past participants in the University of Canberra's Regional Wellbeing Survey database who indicated they live in carp affected areas and participate in recreation fishing, and 4) web-based searches to identify fishing clubs, peak organisations, and industry groups.

The interview sample is outlined in Table 1 and Table 2. The representative sub-groups (Table 1) and geographic representations (Table 2) are reported separately to protect the anonymity of participants. Those interviewed represented private/industry sector, fishing clubs, peak representative organisations for freshwater recreational and sports fishing, and

individual recreational fishers. We were unsuccessful in recruiting representatives of the fishing tackle industry.

Table 1: Interviewee sector representation

Representation	Code used for presenting results	Number of people interviewed across roles	Total number invited
Community fishing club	Club	4	9
Industry/Business	Industry	4	8
Peak organisation	Peak	7	7
Individual fisher	Individual	12	65
	Totals	27	89

Table 2: Interviewee geographic representation

Location	Number of participants
National	2
QLD	2
SA	2
WA	2
ACT	3
NSW	7
VIC	9
Total	**27**

Interviews were conducted until no substantially new information emerged; a point called 'data saturation' which indicates the key issues had been identified which was the goal of this initial assessment of potential impacts. At this point, the number of interviews conducted is considered sufficient because no new themes would be obtained through additional interviews (Guest et al. 2006). However, as no representatives of the tackle industry are included in the sample, we are unable confirm if additional themes would have emerged if a representative of the tackle industry had participated.

INTERVIEW QUESTIONS

A semi-structured open-ended question format was used in interviews, based around a set of questions provided to attendees prior to the phone interview (see Appendix 1). The questions were used as a general guide for the discussion in a flexible format which provided participants the opportunity to raise topics and questions important to their own circumstances and experience, while also ensuring key topics were included in the

discussion. As participants were given the opportunity to review the topics prior to the interview, the topics for discussion were often pre-empted by the participants themselves rather than being prompted by the facilitator. The interviewer asked follow-up questions to gain further insight into different areas raised by participants.

The questions covered topics outlined in the list below:

- History of participating in activities related to freshwater recreational fishing
- Current conditions and challenges for the freshwater recreational fishing sector
- Effects of the announcement of development of a Plan on own business or organisation, personally and household
- Views about the control carp methods
- Views about proposal to release the virus and potential impacts on own business or organisation and the sector more generally
- Views on potential strategies to avoid or mitigate potential impacts from carp virus release.

DATA ANALYSIS

All interviewees provided permission for interviews to be recorded. The recordings were then transcribed. The transcripts were reviewed and thematically coded with a focused on identifying socio-economic impacts and the circumstances under which they arise, and factors affecting the extent to which impacts would occur. Themes around mitigation of potential negative impacts were also explored.

ETHICS

Data collection via interviews and the workshop was approved by the University of Canberra Human Research Ethics Committee, protocol number HREC 17-152.

5. CURRENT CONDITIONS FOR THE SECTOR

As noted earlier, part of the impact assessment included exploring existing conditions because of the importance of these conditions for the capacity to adapt to or cope with a change. In this section, an overview is provided of current conditions, constraints and opportunities for the freshwater recreational fishing sector. This is based on publicly available information on the sector as well as data from interviews conducted as part of this project.

OVERVIEW OF THE SECTOR

PARTICIPATION AND ECONOMIC VALUE

Recreational fishing in Australia has been described as one of the larger and most widely dispersed of any other recreational activity that uses a natural resource (Department of Agriculture 2018). The *2000 National Recreational and Indigenous Fishing Survey Across Australia* was the first detailed national survey that measured the size of Australia's recreational fishing sector. In the survey, it established that as at 2000 an estimated 3.36 million Australians aged five or over engage in recreational fishing at least once a year[1]. The value of spending on fishing-related services and items was estimated at $2.8 billion in 2000 (in 2018 prices) supporting direct and indirect employment across fishing-related businesses, retail, tourism and other industries (DAFF 2011; Colquhoun 2015). This should be recognised as a very conservative estimate of 'total' economic value of the recreational fishing sector as it does not account for the substantial non-market values associated with the fish caught and consumed by recreational fishers or with the fishing experience in terms the social and emotional wellbeing it provides individuals and the broader community.

Freshwater recreational fishing is a key driver of visitation to many inland areas of Australia, contributing to tourism revenue generation in regional areas. Based on the 2000 survey, around 20 per cent of the recreational fishing effort at that time occurred in freshwater dams and rivers across the country. This effort involved an estimated 2.7 million fishing events (trips) in freshwater rivers and 1.9 million fishing events in freshwater lakes or dams annually (Henry and Lyle 2003).

[1] The data detailing the size and participation patterns in recreational fishing will be updated in 2020 with the release of new figures from the 2019-20 National Recreational Fishing Survey; it is expected there has been some decline in recreational fishing participation, but that participation will remain in the millions across Australia.

In the 12-month period covered by the 2000 survey, Carp dominated the number of freshwater fin species harvested (Henry and Lyle 2003). This is most likely a reflection of the relative abundance of carp in key freshwater recreational fishing areas. However, in some cases carp are a target recreational species. In the interviews for this project there were several freshwater recreational fishers (4) who participated who either target carp or see carp as a desirable recreational species to catch. This includes those who enjoy catching carp because they are relatively abundant and fun to catch, as well as those who engage in 'coarse' fishing. Coarse fishing can be defined as fishing that targets fish considered undesirable for consumption or for game fishing, where fish are caught and released back into the water alive. Coarse fishing does not necessarily mean 'carp' fishing, it can involve fishing for any freshwater species that are present, but there are coarse fishers who do target carp. There are also coarse fishing competitions that focus on carp as the target species. There is a small but active coarse fishing community in Australia. Some coarse fishing anglers engage in the sport for leisure and others have a focus on competition fishing. Victoria accounts for around 75% of course angling, and then the rest is split across Western Australia, South Australia and New South Wales, and a small number in Queensland (this is based on interview data in this project).

The interview discussions conducted as part of this project across both recreational fishing and tourism sectors, indicate native freshwater fisheries hold significant value for many recreational fishing communities across Australia. Murray cod and golden perch (often referred to as yellow belly) were the two of most commonly recreational species mentioned as target species for those fishing in inland freshwater areas of New South Wales, Victoria and South Australia. However, a few of those interviewed targeted trout (brown and rainbow) which were introduced into Australia as sport fish and now support freshwater recreational fisheries throughout southeastern Australia. Interviewees reported that trout fisheries in some areas have been significantly impacted by carp invasion.

PARTICIPATION IN CONSERVATION AND CARP CONTROL

The *2000 National Recreational and Indigenous Fishing Survey Across Australia* found that recreational fishers make a significant contribution through volunteer efforts to research and conservation projects (DAFF 2011). This is consistent with findings from interviews conducted as part this research project. In all interviews, participants shared information about the environmental restoration works they have been involved with or are planning. This reflects the close connection between environmental condition and the quality of the angling experience. However, also revealed in interviews was a focus on conservation that extends beyond direct use-values to include many non-use values, such as existence values, associated with native fish and ecosystem health (this is discussed in more detail in Section 7 of this report).

Managing pest species has been one of the focus areas of conservation efforts of the freshwater recreational fishing sector. The sector has engaged for many decades in discussions and actions to raise awareness and educate the community of the invasion of carp and other pest species. This has included, for example, regular community 'carpmuster' competitions in which fishers seek to catch (and remove) as many carp as possible from a given area on the competition day. In Queensland there is an increasing focus on raising awareness about tilapia invasion with cup competitions and other educational activities.

REGULATORY ARRANGEMENTS AND REPRESENTATION

Freshwater recreational fishing occurs within state and territory waters and therefore these governments are responsible for the management and regulation of freshwater recreational fisheries. The regulations governing recreational fishing vary in their detail across states and territories, but they all involve specification of bag limits and legal lengths for removal of native fish. There are also restrictions on catching protected and threatened species as well as rules for disposal of pest fish species if they are caught.

Arrangements for user-access fees vary across the different jurisdictions. There are no fees or licencing arrangements for recreational fishing in either the Australian Capital Territory[2] or in South Australia[3]. In Queensland there is a Stock Impoundment Permit Scheme that applies to 63 impoundments (dams and weirs) that are stocked with native fish specifically for recreational fishing. The funds raised from the permits fund sustained restocking of those impoundments. In New South Wales[4] and Victoria[5] a general fishing fee (NSW) or licence (VIC) applies for those wanting to undertake recreational fishing. The funds raised from these programs are allocated across small and large grant programs that support various projects and programs related to recreational fisheries. This includes support for fishing access and facilities, habitat restoration, education, information and training support participation and safety, research, and restocking.

There are several peak bodies that provide national or state-level representation of the recreational fisher sector. These organisations represent fishing clubs and the broader recreational fishing community in lobbying government on matters concerned with recreational fishing, facilitate communication across the recreational fishing community, assist in decisions about the allocation of community grants (in relevant states), and participate in various community education and environmental conservation activities. Currently, Victoria is the only state that receives dedicated state government funding for a

[2] https://www.environment.act.gov.au/cpr/fish/recreational_fishing_in_the_act/fishing_in_the_act

[3] https://www.pir.sa.gov.au/fishing/recreational_fishing

[4] https://www.dpi.nsw.gov.au/fishing/recreational/recreational-fishing-fee

[5] https://vfa.vic.gov.au/recreational-fishing/fishing-licence

state-level peak recreational fishing body (VRfish). Victoria is the only state that currently has a state-level peak body operating. In other states, there are organisations that work to represent the recreational fishing sector but they do not have the resourcing to coordinate at a state-level. There are also various fishing groups or clubs that have a social focus or who focus on restocking native and non-pest exotic angling fish in rivers and impoundments.

The representation across the sector is largely driven by volunteer effort, and despite the challenges of sustaining this effort there remains significant coordinated representation across the sector:

> *We know most of the people on the other state bodies and email them and compare notes and get their newsletters. So there's a fair bit of cooperation. It started as a grassroots thing, it moved up to clubs representing their people and then those clubs passing up to the umbrella bodies who then represented them. [Peak #4]*

In interviews with representatives of peak bodies, it was noted that the nature of representation and coordination has been changing over the past decade, driven by both availability of resources but also by the influence of social media. The feedback from interviews suggests that increasing use of social media has provided an avenue for individual recreational fishers to voice opinion or contribute to debates independently.

CURRENT OPPORTUNITIES FOR THE SECTOR

The feedback about current opportunities for the sector from those interviewed focused on the opportunities that would arise from conservation-focused activities and outcomes. Significant opportunities were identified for supporting and expanding participation in native freshwater recreational fishing with flow-on benefits for regional tourism:

> *I think that stream fishing and sport fishing for Murray cod on a catch-and-release basis has huge tourist potential. Those fish are very exciting to catch. And as a freshwater species, they're very attractive fish, they can grow quite large. And you can catch amazingly big Murray cod out of very small streams. And for people like wealthy fly fishermen from the United Kingdom, or the United States, or Europe, it's got real potential. [Peak #5]*

An increase in interest and participation in recreational fishing has been observed in areas where restoration of native fisheries has occurred:

> *I think there's been a massive resurgence with our native fish…I think that's what makes people really happy about the sector is that we are seeing these big cod, golden perch, and silver perch [coming back]. We're seeing people wanting to see Macquarie perch, and more blackfish, and trout cod… Fishers want to contribute to their stocks rebounding. For the purpose of maybe fishing for them but not*

necessarily to kill them and eat them, but to admire them and to respect them and continue that moving forward. [Peak #2]

Other opportunities were raised with regarding to non-native freshwater recreational fishing. This included opportunities arising from the implementation of habitat restoration for trout fisheries. Participants involved in coarse fishing raised concerns about the impact of carp control on the opportunities for continuation of the steady growth in coarse fishing participation (this is discussed further in Section 7).

CURRENT CONSTRAINTS

The current constraints raised across interviews are discussed below under three areas i) resource constraints, ii) changing access and participation and, iii) environmental pressures.

RESOURCE CONSTRAINTS

Limited public resourcing for the sector was identified as a significant constraint to the sustainability of the inland freshwater recreational fishing sector. The funding availability across states was described as subject to significant fluctuations with changes in governments or individual ministers, and regulatory arrangements, for example whether there are recreational licences or fees in place as a source of public funding.

The implications of limited resourcing for the industry have been described in terms of limiting opportunities for potential economic development:

Lack of secure long-term funding totally changes the vision and how [industry groups] go about their business in terms of supporting the broader sector and various clubs and the education. [Peak #1]

"One the things we say [in this state], is to create a world-class fishery... it can be done, but it needs funding. It can't be done on no money at all or very little money. When you've got to go cap in hand and beg for money, to do the essentials, and because there's a long history of this for us in [this state], and people start to get disheartened as well, and community groups are struggling to get the younger generation involved." [Peak #1]

Limited resourcing has been experienced over many years and in some cases has resulted in personal costs in attempts to meet the demand for leadership and input into various consultation and decision-making processes. This includes constraints for industry participation in the Plan consultation:

…[T]here's a lot of issues that we see that we just can't do anything about because we don't have the time or money to do it. I'm spending about 65 hours a month unpaid time on recreational fishing, and there's other people in [my organisation] who spend twice that. You cannot expect people to keep doing that year after year and then keep having... the government calling them up and

saying, "Will you sit on this committee and will you come to this meeting? Will you do that?" [Peak #4]

The resource constraints are severe and limit the capacity of peak bodies…We have very limited capacity to spend time on planning or involvement in carp and other pest species and restoration activities. It also limits capacity to engage in the consultation and be proactive in providing input and feedback, communications out to the recreational fishing community and clubs. [Peak #2]

The resource constraints were also identified as a factor limiting the capacity of peak organisations to provide leadership in supporting a cohesive community to work collectively on challenging problems such as pest species and habitat degradation:

What we know about our sector is they do really trust information they get from their peers. If someone has good knowledge about fishing and is well connected with what's happening in the fishing space, from management to other things, then they are trusted people within those communities. If we're not doing work with them and connecting up with them then the communication links are fragmented. [Peak #2]

It is important that these current constraints and the institutional settings across different states that impact on resource are considered in the Plan as they have significant implications for the capacity of the sector to provide input into the process. Resourcing for engagement will likely be required to provide meaningful opportunities for the sector to engage in the decision-making processes about carp control into the future.

CHANGING PARTICIPATION

Changes to recreational fishing participation was discussed across many interviews. There were several factors described as driving changes, which included: aging demographic; time and cost constraints; and changes to access of recreational fishing areas. These are discussed below.

The implication of an aging demographic was raised in relation to declining participation in fish clubs and other recreational fishing organisations. The role of social media may explain the challenges of attracting younger members to organisations. It was noted it is not clear whether declining participation in fishing organisations is reflective of a decline in participation in recreational fishing itself:

I'm 64 and I'm the youngest one on the management committee. The others are all in their early 70's. Pockets of declining participation but hard to tell as club membership has dropped, but this doesn't necessarily mean recreational fishing participation has dropped. [Club 1]

We're finding it really hard to encourage younger generations, and it's not just my organisation. There's a reluctance to get involved in fishing clubs. Fishing

club numbers all around the country are in decline. Again, because you don't need a fishing club. In the old days you went there for camaraderie and to learn how to do that. Now you don't need to do that. You can do all that on social media…You don't need the fishing club infrastructure like you once did. [Peak #3]

In other discussions, it was suggested there have been several factors driving a decline in participation in recreational fishing, or at least the frequency or length of fishing trips. Increasing costs associated with recreational fishing was described as a contributing factor to declines in participation due to increases. For example, increase in fuel costs or opportunity costs associated with taking time for recreational activities:

There's a perception that the fish aren't there…that dams are drying up all up… That stops people going. If they went fishing in the freshwater, they'd probably catch as many fish as they might have 10, 20 years ago. I think one of the things that affects it is the perception that someone takes a few days off and goes fishing, doesn't catch anything. 20 or 30 years ago people would take a week off and go fishing… Now they go in a very narrow time slot because they're time poor, and they don't catch a fish… [Peak #4]

Another factor affecting participation discussed in several interviews concerned public access to recreational fishing areas. Feedback from those living in rural areas was that access has not been an issue for participation, but for those living within or close to urban areas changes to access was raised as a significant issue for participation. A key change to access mentioned in New South Wales, for example, is the privatisation in recent years of crown roads that run across private property:

On the inland side, the biggest problem is loss of access through the loss of crown road access…[Y]ou've got these 'paper' roads that cross people's farms…A few years ago the government accelerated the disposal of those back to landowners. In theory that's all quite fine, except where it blocks public access, not just fishing access but access for kayak people, or if you want to go and have a picnic or go for a swim. There's an agreement now…[where] we can log an objection. But we've lost quite a few important ones. [Peak #4]

In other cases, urban development was described as having impacts on access, for example, foreshore developments:

There's a lot of banks, there's a big stretch of bank where it's all concrete now so you could walk along there quite easily and flick lures but if you wanted to bait fish there's nowhere to stick your fishing rods….So no one thinks about that [Club #1]

A change to social norms was another factor associated with declining access, for example, shifting perceptions of risks of providing access, growing number of

absentee landowners and, in some cases, increase in undesirable behaviour (not only by fishers) such as littering and lighting of fires.

ENVIRONMENTAL CONDITION AND WATER FLOW

The decline in environmental condition and water flow was raised in most interviews as a significant constraint facing the freshwater recreational fishing sector.

Impacts to freshwater fisheries from degradation to riparian and instream habitat was a key issue raised across many interviews:

> *A steady decline in riparian and instream habitat has drastically reduced suitable habitat for both native fish and trout. And at the same time, a warming environment and a huge influx of carp moving into marginal habitat for natives and trout has seen a rapidly declining natural range for both wild trout and iconic native fish. A dwindling resource of wild self-recruiting fish, greater angler numbers, and poor angler access to many rivers are all putting pressure on what can be a potentially be a fantastic and healthy pastime. [Industry #1]*

The management of water flow and decisions about environmental watering were also seen as a significant constraint for freshwater recreational fisheries:

> *If you look at the problems with the western rivers and so on at the moment, well you've got a huge political problem there that people like ourselves can't really tackle the federal government on corrupt water practices. We've just got to sit back and hope that enough government money and community awareness takes care of it in the end. [Peak #4]*

> *… right now with our freshwater fishery, there's obviously a lot of concerns about how water is being used, a lot of confusion about the different allocations and flows…The fish kills in the Darling river in Menindee has highlighted the importance of flows, and how they impact inland fisheries. It is something that peak bodies have been warning governments about for several years, that major fish kills will occur. [Peak #2]*

Concerns about these impacts are in Section 7 in the discussion about concerns raised in interviews about the scope of the Plan, where suggestions were raised for an integrated approach to carp control.

6. IMPACTS OF DEVELOPING THE PLAN

This section looks at impacts of the announcement that a National Carp Control Plan would be developed, and the subsequent period of development. As noted earlier, previous studies have identified that the period in which a proposed action is being developed, but when its exact nature is not yet known, is often associated with social and economic

impacts for those who have potential to be impacted by the proposed action when it is implemented.

At the time of writing this report (September 2019), there had been over a two-year period in which those involved in the freshwater recreational fishing sector were aware a carp control plan was being developed, but in which the exact nature of the recommended actions to be included in that Plan, and the ways proposed actions would affect the sector, was not yet known. This means there had been an extended period of uncertainty around what will be recommended in the Plan and how activities, businesses and organisations related to recreational fishing would be affected by those recommendations. The uncertainty would be expected to continue until the time a Plan was accepted by the government. In the phone interviews, participants were asked if this period of uncertainty had impacted them or the sector more broadly.

The feedback across interviews indicated the period of the Plan development has not had any direct impacts on recreational fishing activity or any had any direct financial impact for those operating a business.

The feedback from interviews also indicates significant interest across the recreational fishing sector in carp control and the proposal for virus release to control carp. This has been led to a significant investment of time and resources from representatives of peak organisations and fishing clubs to understand the potential impacts and outcomes of the carp virus and provide input into the Plan's consultation processes.

In several interviews, the proposed release of the carp virus within the development phase of the Plan was described as polarising for sections of the recreational fishing community and has contributed some disharmony in relationships across the sector. This has been described as driven, in part, by passionate positioning across the recreational fishing community:

> *It has caused significant angst in a number of areas because recreational fishing is a heart first, head second activity. If you believe and have made a public statement that eliminating carp will result in a recovery of the rivers…if someone contradicts you it is striking at your belief system and the reaction is consistent with a challenge to anyone's belief system, not to their intellectual-based argument. And that means that in the pubs around Australia, this [virus] has been debated frequently from a positional perspective… [industry #2]*

In interviews, a range of different perspectives were shared about the possible release of the carp virus. For some, the proposal has stimulated a positive outlook for the recreational fishing sector:

> *When the NCCP was initially muted the freshwater angling community on the whole was ecstatic with the possibilities of bringing back many lakes and streams*

that have simply become drains due to poor stream management and the spread of carp. [Industry #1]

And for others, the level of uncertainty and risk associated with the carp virus is perceived as too high:

There's also a lot of concern that if they get it wrong, we'll end up with no recreational fishery. Won't matter what's in it, there'll be nothing…[T]he kill rates they're talking, nobody can handle that quantity of fish… I don't believe it's practical. And a lot of discussion's been around that and there hasn't been a lot of confidence in any of it. [Club #3]

I don't think that taking carp head on is going to provide the solution, in my opinion…I think investing in community stewardship-based projects, particularly at a time when the community is struggling, is far more constructive than polarizing people over a zero-one decision which could have an outcome ranging from catastrophe to the Y2K bug. [industry #2]

There are many other nuanced perspectives in between these positions. A discussion of the range of perspectives on potential impacts of the carp virus is provided in Section 7.

Some of the disharmony across the sector has also been attributed to the early communication in the development phase of the Plan that had not accurately represented the Plan purpose and process:

There's probably not a lot of appreciation of what the Plan is and what it meant. I guess the communications that they were probably exposed to was, "The government is deciding on whether to release the virus or not, rather than the government is investing money to prepare a Plan on whether to release the virus or not." I think that's been a major issue. [Peak #2]

The challenges have also been attributed to the extended period of uncertainty about potential impacts of the carp virus, and the challenges of communicating scientific findings with the inevitable uncertainties associated with biocontrol. Representative bodies have been called upon by the recreational fishing community to help build understanding and advocate across divergent perspectives. This has added to the resource pressures representative organisations currently face.

For recreational fishers who target or enjoy catching carp, the development phase of the Plan has been frustrating and stressful because of the uncertainties it has raised about potential impacts on their recreational fishing future, social networks and competitions.

At the same time, for those who are supportive of virus release (if certain conditions are met), there has been growing frustration and concern that there will be a 'missed opportunity' to release the virus when carp numbers are relatively low due to the drought

conditions. There is also a related concern for some about carp control dropping in priority if the government decides not to release the carp virus:

> *The other issue which we're sort of creeping into now, due to the uncertainty, is now fishers are going, "Well, this virus, no one is going to sign off on this. What are we going to do, what's our plan B for carp control?... [W]e're getting to that point in time where we can't do nothing about carp… [Peak #2]*

> *"I think there's that concern that if the virus isn't introduced, or it's not effective we still need to be having a whole other range of complimentary activities that need to be happening. Some of them should be happening now perhaps. Now a bit of anger, frustrated, uncertainty, fear and some apathy, so people going, "Oh, look forget about it now. "So we might need to reactivate, mobilize these people once this draft plan is actually released and open for consultation. [Peak #2]*

The limited resources available to peak organisations (as discussed earlier) has meant they have had limited capacity to provide the detailed communication necessary to keep the sector informed about the Plan process and scientific findings. Feedback from several of the peak representative organisations interviewed is that direct communication and engagement from the National Carp Control Plan, when it has occurred, has been fundamental to building common understanding across the recreational fishing community about the emerging science and the purpose of the Plan.

7. POTENTIAL IMPACTS OF THE PLAN

In interviews, participants were asked about potential positive or negative impacts they would experience if the carp virus is released. It was explained that they did not have to be certain the impacts would occur, but just to discuss what they felt was possible.

In most cases (but not all) the recreational fishers who participated in this research felt that carp control and the virus release would have an overall positive impact on the recreational fishing sector. In this, the positive outcomes of carp control for environmental health was often emphasised, and improvements in recreational fishing were often considered a beneficial side-effect.

However, there were also several concerns about the carp virus release raised by recreational fishers in interviews. These related to concerns about direct impacts for recreational fishing but also about impacts more broadly. The feedback from interviews is summarised across these areas is discussed below.

DIRECT POTENTIAL IMPACTS

CONSIDERING NET IMPACTS OF CARP CONTROL

Many of those interviewed felt the control of carp was a high priority due to their negative impacts on the health of waterways and freshwater fisheries. This feedback is also reflected in results from recent large-scale survey of recreational fishers undertaken by one of the peak bodies, reported by an interview participant. In the survey, 'control of pest fish species' was identified as the number one priority out of a list of over 50 issues facing recreational fishing [Peak #2].

Many of those interviewed who identified carp control as a priority also shared the view that the carp virus would have net positive impacts for recreational fishers, conditional on it being safe for non-target fish species:

> *I would expect the impact on water quality, from the fisher's point of view, not talking about public use of the water…if there was a lot of dead fish floating around I'd expect that to be pretty short term, and that instantly you'd get less competition with native fish and with trout." [Peak #4]*

It was acknowledged that short-term negative impacts may be experienced by recreational fishers but that these could be mitigated or would not result in significant or long-term net negative impacts for freshwater recreational fishing:

> *When anything like this happens, there's always pros and cons. But, we've done things for foxes, we've done things for rabbits, we've done things for all sorts of pests. It can only be a good thing. You see the habitat of the river and I think carp do a lot of [negative] things in our river. And I think that the virus can only make things better. [Club #6]*

Many respondents also felt that short-term negative impacts for recreational fishers would be 'worth it' for the expected long-term benefits from a carp virus release. However, this support for virus release was often expressed as being contingent not only upon the safety of the virus for non-target fish species, but also upon implementation of complimentary restoration activities in the short and long term, such as habitat restoration, restocking of native fish and genetic solutions:

> *As long as we can rebuild our waterways with new fish species, particularly native stocks, give nature a hand, I think… [the virus is] a good thing. And if we can encourage more money…into fish habitat rehabilitation… that will be good. I think the freshwater fishery has got great potential. [Peak #3]*

> *Personally, I think [the virus] is a good idea. I'd roll the dice on it. I don't see any other realistic options…I think this is the one and only chance to give something a try, and even if it only reduces the numbers by quite a lot, that'd be something.*

And it would buy a bit of time, for other things, you know, genetic solutions and things to maybe get developed, so personally I'd like to see it released… [Peak #4]

Although most respondents felt there was potential for 'net positive' impacts from the carp virus, there was a diversity of perspectives across the interviews depending on: experience of carp abundance relative to other recreational fish (discussed below); perception of the potential risk of the virus to non-target fish species (discussed below in a later sub-section), and; whether carp are seen as a desirable recreational species (discussed below in a later sub-section).

There were also several respondents who felt carp are often attributed a disproportionate share of the blame for the degradation of water quality and freshwater fisheries in areas with carp. This was a concern raised both by those who believe carp control is not a priority as well as those who are supportive of carp control but perceive the scope of the Plan, with the focus on the carp virus, is inadequate to address the multiple sources of degradation impacting waterways and freshwater recreational fisheries. This is discussed further under 'broader concerns' in this Section.

The experience of carp relative to native fish abundance, and changes to this over time, varied significantly across interviews. In most interviews, respondents drew upon their observations of carp aggregations and recreational fishing catch as the basis for providing feedback on their experience of carp abundance.

There were several respondents who reported experiencing significant reductions in carp in the areas where they fish, along with an increase in the abundance of native fish:

You know [carp] are there so, if you catch them, you knock them on the head and throw them up the bank, and feel you've done a good thing. But like I said, the numbers are better now than what they've ever been. I don't know if the impact is negative or just balanced or neutral or how to describe it. Let's say 20 years ago, here anyway, you'd go and get nothing but carp. You might get the odd yellow belly, whereas now sometimes I'll go out and don't even get any carp. [club #3]

In one case, a participant reported experiencing significant reductions of carp in their area in recent decades to the point they felt carp control was not a priority:

[Carp]…exploded across the 80s. I didn't fish for native fish…all you caught were carp. Now, I think, and a lot of it's got to do with… better management of our native fish, our native fish are seeming to thrive now, compared to what they were… My father always said to me, "Look, the carp will go back to normal."… That's what we find here. If I take my grandkids out, and we go bait fishing, we might catch 10 native fish, to one carp. So it's no longer an issue. [Individual #4]

Whereas, respondents in other areas reported experiencing significant increases in carp:

The carp that are in there now have bred up since 2011, and they've bred up so quick it's unbelievable when we had the floods come through from the [mountains] here, and it's nothing to pull out some big carp now, six, seven years since. There has been good flow through the system as well so that's made a difference too. [Individual #3]

They're overtaking. They're just overtaking everything everywhere. I mean, we've been to four or five different spots and... I'm talking in the last six months or so. And it's all just carp. You just don't even get a bite of anything else. It's just carp after carp. [Individual #2]

Over the past 5 to 10 years I have noticed an increasing number of carp moving up and into what were once regarded as coldwater trout streams. Carp in these streams, or sections thereof, used to be a rarity, not so much these days as these large carp have moved further upstream into traditional cold trout waters and are displacing trout out of some of the best trout habitat. [Industry #1]

As would be expected, the local experience of carp population change had a significant impact on perceived value of the carp virus across interviews, and the balance of expected benefits and costs.

IMPROVED FISHING OPPORTUNITIES AND SUCCESS

The respondents who do not target carp or do not practice coarse fishing[6], described carp as an unwanted bycatch and a negative impact on their recreational fishing experience:

It's disheartening in a lot of aspects. I do take out my young fella…and to be fishing and maybe only catching two fish out of the local creek in three or four hours, but they're both carp….I've been part of the scout group for years in town. Every year we have a family fishing event….There might be 40 fishing lines in the river between all the families and you're probably going to pull out 10 carp, and you may be lucky and pull out a yellow belly, or maybe a catfish if you're really lucky. [Individual #3]

The respondents felt the Plan has the potential to deliver significant benefits to recreational fishing and the broader community through improved fishing opportunities and success:

Just imagine a future with the whole basin with carp under control…I think why many fishers are behind [the Plan] is they're seeing that there's there is work going into the native fish recovery around the state, and just think, jeez if we can

[6] Results in this section do not include feedback from respondents who do not target carp or practice coarse fishing. The results for this group are reported in the next section under 'reduced fishing opportunities'

get rid of these carp, which is just an absolute menace we can really have much brighter future for our fishing. [Peak #2]

We expect if [the virus] is released, wherever it's released, they'll be a big bounce back of native fish. And we think that quality fishing we'll benefit enormously from it. We were inclined to think that would be good for at least a decade. But maybe longer than that and in fact it may be the case that the carp populations never get back to where they were. [Peak #5]

The potential for carp control to support restoration of recreational native fisheries was raised in several interviews as offering opportunities for increased participation in freshwater recreational fishing and improved regional economic development:

…a lot of towns are dying, and the people are leaving, because of the drought and whatever else. Some towns are moving to tourism, but they need something to attract people. They've got to put the facilities in, the infrastructure, for people to want to go and stay there… If we can support the native fishery and improve the number of fish and the quality… then the local councils can start doing something to attract people…If you can catch a six-kilo yellow belly and not a 10 kilo carp. [Peak #1]

…[T]here's probably two or three carp competitions that are going to be depleted, but what a wonderful thing to look forward to, you can have native fish competitions in a couple of years. [Individual #5]

REDUCED FISHING OPPORTUNITIES (CARP)

As mentioned previously, there were recreational fishers interviewed who target carp recreationally, including in competitive sporting events. There are others who might not target carp but catch them along with a range of other fish and do not see them as a nuisance 'bycatch'. Respondents in this group raised concerns about the potential direct negative impacts of reduction in carp populations on recreational fishing opportunities.

The most significant concerns were raised by those who participate in coarse fishing and within this group, those who participate in carp fishing competitions throughout the year. There was concern about the potential direct impact of virus release on carp competitions and the associated financial impact for businesses involved and regional economic activity:

That's the main reason to go…[to regional areas]. Obviously to see friends that I've made through carp fishing but for me there's four trips…that are not going to happen [if the virus is released]. Why would you have a competition if you can't catch carp? [Club #2]

It was argued that different perspectives should be considered in managing wild carp populations. One perspective is that carp provides opportunities for high quality sports fishing, and offers significant future opportunities to generate economic activity:

[C]arp…are very big species in Europe for sport fishing. There's a very large infrastructure set up to support that. So… there's a commercial element. There's a lot of lakes there that specialize in having holiday…or commercial lakes that are stocked with carp for fishermen. And they earn quite a lot of money. There's quite a large industry. And I think that's one of the things that potentially, Australia's got a resource on its doorstep that it's not necessarily utilizing. [Individual #11]

In a few interviews concerns were also raised about potential impact of virus release on social programs for people with disabilities that often targeted carp:

…[There are] a lot of programs in parks for people with disabilities. We take them there to catch fish and we catch carp, because they're easy to catch. We don't know whether or not they're going to put the virus into the park. There's many parks…all around the state where you've got major parklands that have got pondages in them, that have all got carp in them... [Peak #3]

Carp has a long history for inland freshwater recreational fishing and been described by several respondents as also offering a positive experience for young recreational fishers:

It's good sport for kids…[carp] do keep kids interested when they're young. When they're older and want something to keep, fish to eat, they lose interest then in carp, but when they're young, they're interested in carp because it's bit of action. [Individual #1]

…I think just when we were younger, thinking that we're doing our bit. We'd go down, and we'd do the right thing, we'd make sure we took them all out. We used to ride our bikes down, and end up with a backpack full of carp and take it home. It was fun. Dad would put it in the compost heap. It was just me and a few mates had a few good spots that we used to go. It was good for practicing it, and fishing and all that as well. It was great. It was a good learning ground. It was tying knots and all that. It probably wasn't necessarily that we were targeting carp, it was probably that they were easy to catch. Just trying to pass time, more fun. [Individual #3]

The respondents who have discussed the role of carp for social and community groups have suggested that specific community programs would need to be implemented to mitigate the potential social impact of any significant reduction in carp in waterways and local community ponds.

REDUCED FISHING OPPORTUNITIES (NATIVE FISH)

The potential for the carp virus to reduce recreational fishing opportunities was raised in the context of safety of the virus for non-target species. Most participants, regardless of overall support for carp control, raised concerns about the potential direct impacts of the carp virus on recreational native fisheries. These concerns are shared across all stakeholder groups who have participated in this research (see Schirmer et al. 2019).

The concerns are related to three aspects of potential impact of the carp virus on native fish. The first is the potential for water quality decline arising from dead carp to kill native fish, the second is the potential impact on native fish from changes in population dynamics, and the third and most significant concern, is the potential for the carp virus to infect non-target species in its current form or in a mutated form.

As described earlier, most of those interviewed who indicated support for the carp virus release provided this contingent on feeling confident that the risks to non-target species, and native fish especially, have been adequately evaluated:

> *I'm totally in support of the release of the virus so long as every test has been done and proven to be safe for the native fish and animals that still exist in all waterways in Australia. [Industry #1]*

> *If it works as it's supposed to, just kills carp, look it's alright, but if it changes and it kills anything else, …if everything worked, went to schedule and it worked well, people would be very happy I'd say. [Individual #1]*

However, feedback from interviews indicates concerns remain high about the biological safety of the carp virus. This is in part reflective of a starting point of low trust for biocontrol in Australia; the experience of the cane toad has been widely raised in the context of the potential for unexpected negative impacts of the carp virus:

> *With the virus, I suppose you think about cane toads...So we might have some controls out there, but what will be the impact in 50 years time? And will it affect any other species? And I know that they say no, but there's always that worry, isn't there? [Individual #5]*

The perceived adequacy of current research into the risk of the carp virus for native fish was also raised across several interviews:

> *"Look, you're just going to have to do that virus population challenge experimentation, even though it's scientifically robust it doesn't past the pub test." It might cost you a bit extra and a bit more time, but please do it because I think it will add a lot of value from that when we speak to our fishers and the broader community as well....[Peak #2]*

There were also concerns about the potential for native fish to have unexpected susceptibility due to current level of stress from prolonged drought conditions. There were questions raised about whether current research has adequately incorporated this potential risk:

> *Like the native fish were very very down as far as health goes. They weren't really good. And they may pick it up then even if they might be able to fight it off normally. But if they are not very well themselves because of the drought, you*

might knock them off. I'm all for killing off the carp but not everything else. [Individual #9]

In all interviews with peak representative organisations, as well as in several other interviews, there were also concerns raised about risks for native fish arising from the potential for the virus to shift predictor/prey dynamics:

Even under best case scenario, a lot of the people are expressing the fear that if you remove the carp, you'll remove the primary food source [for Murray cod]. And you shift the predator/prey relationship against Murray cod, so they then, for example, will feed preferentially on golden perch and repress the recovery of golden perch. That is real. If you start to weight it up, again, in my opinion, apart from my caution as a scientist, the impacts are high… [industry #2]

… I don't think they fully quantified how much it could affect things in the food cycle. [Club #2]

There was also concern raised about impacts on native fish related to water quality. This is a significant area of interest to recreational fishers; it is a fundamental aspect of conservation works that are undertaken by the recreational fishing sector:

If there's going to be hundreds of thousands of tonnes of dead carp in waterways, we can't leave them there, surely. I wouldn't think that [water] flows would be enough that you would wash all of that out from thousands of rotting dead fish. However, if that's to be, if it works, maybe you've got to take some short-term pain for long term gain, so they say. Whether it's an option or not, I don't know. They would be my two concerns. What happens to the dead fish, who removes them, and can it be contained to just that carp species? [Individual #3]

Even though there was strong support from carp control, and the carp virus, the discussion about the risk to native fisheries indicates support is very much dependent upon the safety of any carp control measures for native fish.

BROADER CONCERNS

The broader concerns about the Plan where typically raised across:

i. Scope of the Plan and actions to increase likelihood of improvement in environmental health alongside the implementation of any carp control activities
ii. Consideration of risk and uncertainty
iii. addressing rebounding of carp populations over time
iv. adequate resourcing and planning of clean-up
v. Communications.

SCOPE OF THE NATIONAL CARP CONTROL PLAN

The Plan is being prepared to show how the virus could be used as a biological control agent for carp, and whether its implementation is feasible. The Plan's terms of reference do not include investigating other carp control measures or investigating complementary measures that could support native fishery restoration and other outcomes in association with any reduction in carp populations. The Plan is investigating a specific approach to carp control rather than developing a final plan for carp control. Nevertheless, the scope of the Plan was an important area of discussion in interviews, and a summary of this discussion is provided below.

In most interviews, the need for integrated and complimentary management actions were discussed as critical for achievement of native fish and biodiversity restoration outcomes across inland waterways infested with carp. This is reflective of feedback across all stakeholder groups who have been engaged in this research, as well as discussions in a multi-stakeholder workshop held in June 2019 (e.g. see Schirmer et al. 2019).

> *Releasing of a virus is probably a band-aid solution to actually a broader issue around, actually, how do you actively manage freshwater environments to ensure that everything is kept in balance? [Individual #11]*

As mentioned previously, concerns regarding the focus on carp control alone was often raised in interviews in the context of multiple factors contributing to the degradation of recreational fisheries and waterway health, alongside carp:

> *... I believe that the carp are there because we've made it suitable for them... We can see the carp, so they get blamed for a lot of things that is pretty much along the lines of propaganda…To me, most of the issues around carp all stem through the Murray Basin region. [Individual #12]*

Some of the other contributing factors to degradation raised in interviews include:

- water pollution from agricultural and other chemicals flowing in waterways
- degradation of riparian vegetation
- regulation of water flow

> *If I had my druthers, I would be subsidising farmers to plant riparian vegetation and to fence off creeks in the mid and upper catchments….So about hundred kilometres west of the Newell Highway is the area of most importance to downstream water quality and native fish production, particularly from a recreational fishing perspective. [Industry #2]*

> *Every new day there's a new issue that comes up that we probably didn't know was a threat to aquatic life and then we find out about it. The most recent one is the PFOS (perfluorooctane sulfonate) and PFAS (polyfluoroalkyl substances) issue.*

That's anywhere you've got an airport. Anywhere you've had any heavy industry on waterways or wetlands or aquifers… In some parts of the world… it's definitely a health risk. [Peak #3]

- Degradation of habitat for native fish (beyond those caused by carp)

The thing that worries me most is when the drought breaks...the areas are inundated, the conditions favour carp, and we get a secondary population explosion without any remedial works on the habitat degradation to favour native fish and then we are no better off than we when the controversy was at its worst. [Industry #2]

… with respect to [decline in] the Macquarie Perch, habitat is about 85% of the problem…They need things like nice clear ripples, clean gravel, deep refuge holes to survive adverse water conditions where the temperature gets too high for them. And both those things were affected by siltation and that goes back to land management [Peak #5]

- Loss of native fish in water extraction pumps, and the need for native fish restocking

…We've been campaigning on for a long time now. We want to put screens on all the exit pump-outs in riverways. We reckon we lose, roughly, probably around 10 million fish a day. They're sucked up through the pipes that feed into the irrigation areas. Not only does it kill all those fish off, but they're only little tiny ones… It also causes major headaches for the farmers because it jams up all the irrigation pumping systems. [Peak #3]

It would be great to remove the carp, but we've got to be doing the next steps. Restoration, decent water flows, but also hatcheries geared up to supply fingerlings in quantities that we can restock all these waterways quickly, to give them a chance to get a toehold and be in a position to compete when the pest fish make a resurgence. [Peak #1]

- recreational wake boats, and

I see a lot of damage, a huge amount of damage caused by things like wake boats. One place that I frequent has absolutely been smashed by wake boats. The banks are so eroded now but it's not from the fish. It's actually from the wake of the boats. [Individual #11]

- thermal pollution from dam discharge.

I think we need to look at here in Australia, which is what they already do in the US, is top- draw down in our dams, because the water is cold all the time, and our natives aren't used to cold water… Especially as you get up closer to the dams, like Dartmouth and the Hume…they're bottom draw downs, so you're getting that less

oxygenated water, and at a lower temperature running into the river. [Individual #4]

In one interview, there was also a discussion about the scope of the Plan being thought of as establishing a model for evaluating the feasibility of biocontrol for other pest fish species, such as Tilapia which was described as expanding its distribution across Queensland with potential to extend into northern areas of New South Wales:

> *…In April 2016 there was mass kills of tilapia in Israel and Ecuador, and they're on opposite sides of the world. It was in the wild and in aquaculture, they had over a 70% kill rate and they identified it as related to the flu virus…I've approached Biosecurity Queensland to say, "Well, you've got this massive project for carp, what are we doing about tilapia?" Their response is, "Well, we're waiting to see how the carp one goes. If it's successful it will be a model." [Peak #1]*

CONSIDERATION OF RISK AND UNCERTAINTY

Unconditional support for the virus release was provided by one respondent, underpinned by a confidence that the Plan has adequately assessed the potential risks and they are low or manageable:

> *I can't wait for you to release it, I'm just extremely hopeful. I think CSIRO etc. in Australia is held in high regard by most of us and so Queensland prickly pear and the cane toad, I think, are history. I trust that you've got it right and calicivirus and that sort of thing has been fantastic for helping vegetation and that type of thing. The few negatives involved with releasing a virus, I think are overblown... [Individual #6]*

But in other interviews concerns were raised about high levels of uncertainty associated with the carp virus and the potential for unexpected impacts to occur, extending beyond those with potential to directly impact freshwater recreational fishing:

> *From my perspective, the downstream and upstream impacts are really unknown. And that's actually quite frightening. It's quite frightening to me as a citizen of Australia... that we've got a Plan which is not fully formed, and actually, really not understood around the upstream and downstream impacts. [Individual #11]*

As discussed previously, the concerns about risk and uncertainty are often raised in the context of Australia's experience with unexpected impacts arising from biocontrol:

> *The only thing, and I know they've obviously done a lot of research around it, but historically we think we're doing the right thing when we try and control an invasive species. But sometimes controls can either lead to damage of other species or degradation of the environment. I guess my only concern would be whether there's something we don't know there that we will damage by going down that track. [Individual #7]*

For some, the uncertainty surrounding potential benefits associated with the virus was perceived to be too high to justify the risks associated with the virus:

> *[The carp virus] is a lucky dip. And I think we all admit that it's a lucky dip. We do not know. It is conjecture on the part of all parties…. The problem is that the actual introduction is a zero-one decision, and if it's introduced, then it will be almost be impossible to put the genie back in the bottle. …At the end of the day, it comes down to risk and reward, and I am in conservative in terms of the risk… using a virus as a remedial agent makes me nervous…We're talking about the largest river system in Australia plus thousands of associated catchments, which are not getting nearly as much attention as they potentially could. [Industry #2]*

> *I'm comparing it in a way to the change in slot size for Murray cod in New South Wales and Victoria in the last few years. And the science behind that seemed fairly rigorous, fairly accurate. And even if turned out to be wrong, it wasn't going to have a huge impact, so it got a lot of support. Whereas with the carp virus, if it turns out to be wrong, we have then created a lot of damage for absolutely no gain. I'm being very conservative on it and I reckon we're better off with what we've got now rather than experimenting with the future. [Club #3]*

In some cases, respondents argued that alternative strategies to the virus should be investigated to identify lower risk opportunities for carp control, such as commercialisation of carp as food:

> *We can make businesses out of this. People in Europe love carp, they love to eat carp. So okay, we've got export businesses there, we have fertilizer businesses, we have electro fishing, we have competitions, Catch the carp. All those sorts of things, where they will take the population down, but not enough to actually harm our own fish, as far as food supply goes. [Individual #4]*

> *If there was a better alternative [to the virus], and I would hope there might be… I'd prefer to see an alternative where we can actually make better use of this fish resource. [Carp is]… the only fish resource I know nationally both in open water and in fresh water…that's growing exponentially because everything is going the other way….People say, "You wouldn't eat that, it's only good for fertiliser." That's not right…Years ago if someone said, "Would you like a piece of tuna, stripped tuna or sardine, even octopus?" People would go, "How can you eat that?" Now, those species are on the top of the culinary table as species…And, when you rang me today, I just come out of the fish market down my way. I went to see how much flathead fillets were selling for today - $59.99 a kilo for flathead fillets. Ten years ago that was a poor man's fish. [Peak #3]*

CARP POPULATIONS RECOVERING OVER TIME

The long-term outcomes predicted for the carp virus suppressing carp populations was another critical concern across the interviews. These concerns were also related to

discussion of the ‘scope of the Plan’ and the need for integrated approach to carp control to achieve long-term restoration outcomes.

As details are emerging about predicted long-term effectiveness of the carp virus, feedback from some peak organisations indicates there has been some reduced support for virus release over the past 12 months from the initial strong support across the recreational fishing community. Concerns about the long-term effectiveness of the carp virus was a key concern across many of the interviews:

> *One of the game changers if you like, in the last year or so…has been the realisation amongst a lot of people who have been very pro the release of KHV …that it's not going to kill them all. That it's just going to knock them back quite a lot, and I think…they've gone, 'Well, if they're not going to kill them all, and if there is a risk of jumping species, and it's this massive cleanup problem that everyone's talking about, well maybe it's not such a good idea' [Peak #4]*

> *We know the kill rate won't be 100 percent. It's not going to be a long-term effective control. It's like myxo and calicivirus, it’s short term. They brought the rabbit numbers right down, but the next generation that survived gained some immunity, and next generation beyond that has gained immunity. So you end up back where you started….That seems like a huge investment for a very short-term result. [Club #3]*

CLEANUP CONSIDERATONS

In all interviews, questions and concerns were raised about planning the and resourcing cleanup of dead carp following potential release of the carp virus. However, there was significant variation in perspectives about the cleanup requirements and potential impacts.

In some interviews, cleanup was perceived as an insurmountable task which would lead to widespread impacts on water quality:

> *Now, that's as an astronomical task to clean that river of those dead fish... A lot of people say, "Oh yeah, I'll help, I'll help." But these are the people that are going to put one load of fish into their boat and go, "No. I'm not doing this anymore." We can see from what's happening in the Darling of late, that we don't really have any way to do that, that is feasible anyway. The cleanup task would be astronomical. [Individual #4]*

In other interviews, it was recognised that cleanup would need to be managed carefully, but that it would be feasible:

> *We know the cleanup's a potential problem, but all the evidence is that such things aren't insurmountable challenges by any means. And I do know that the people involved in the National Carp Plan have actually talked to water managers*

> *overseas who've had to do cleanups after natural outbreaks of the virus. They said, yes, a bit of a challenge, but not a real drama. And that's what happened with that fish kill, courtesy of the state government's water mismanaged recently at Menindee. They were able to clean it up without a huge drama. They were a bit late to get going. But that seems to be the main thing is to have your people ready to deploy quickly, while it's still easy to clean up floating carcasses rather than lose them down on the bottom somewhere where it can be a problem. [Peak#5]*

A respondent with long history as an irrigator on the Murray river basin acknowledged that some short-term water quality decline may occur but that the natural environment will cope:

> *I don't really have a deep knowledge of what the potential impacts might be, but as for the fact that there might be a few thousand tonnes of rotting fish, I have no concerns for that. If there's reasonable flow, and that doesn't have to be very much, all of that will be gone within 2 - 3 weeks. The river's got an amazing capacity to clean itself… There's a bigger goal in mind than a few weeks, two or three weeks, of smell. If we look at the recent events on the Darling where certain politicians were standing there making cries of woe, the death of those fish, the native species, is tragic, but it's part of nature. If it doesn't rain, then then the ephemeral stream turns into pools… [T]he system has been coping with those sort of deaths for millennia. [Individual #6]*

While there is variability in the level of concern about cleanup, questions about cleanup planning and resourcing are of significant interest not only for freshwater recreational fishing sector but across all sectors. It will be critical for the Plan to provide recommendations across some of the key questions raised about cleanup, which include: What process will be put in place to manage the cleanup? Will stakeholders be consulted? Who is going to do it? Will there be opportunities for industry involvement? Who pays? How will cleanup be prioritised? What are the risks and uncertainties?

COMMUNICATIONS WITH THE RECREATIONAL FISHING COMMUNITY

Several respondents provided feedback on areas they felt that should be considered in communications and engagement with the recreational fishing community about the Plan and beyond.

In some cases, concerns were raised about communications which related to either a perceived lack of positive messaging from the Plan, or about specific scenarios that are expected. Suggestions were offered for strategies for improving communication to the sector into the future.

I guess they've just got to become more proactive on selling any successes. For the last 12 months all we've had is bad news. We've had delays, we've had lukewarm government support, we've had intermittent newsletters that are full of, 'We're looking at this problem now, we're looking at that problem, now we're looking at the next problem'. We never seem to get any runs on the board. [Peak #4]

I think they've got to paint a picture for what it's going to be like. No-one knows what it's going to be like. They should say 'We think what will happen is we would go to a river at [this town] one Monday morning, and we'll tip all this stuff in the water, and within two days there'll be dead fish, a few days later there'll be people fishing them out, and the water's going to smell for a week or two or a month or two and then...'. They have never spelt out exactly what happens. It just leaves this huge vacuum that gets filled by ill-informed nonsense. I just think it wouldn't hurt them to describe how they think it will be done. [Peak #4]

It is important this feedback on the communications of key messages is considered carefully, however, it is also acknowledged that there are several constraints to the scope of communications which are related to the Plan's Terms of Reference.

The other consideration raised in interviews relates to support for localised communication across the sector to ensure information is communicated in a way that is appropriate and trusted. The approach to and source of communications was seen as fundamental to trust in the information. The role of peak representative organisations in facilitating communications and engagement with the sector about the science and Plan recommendations was identified as a high priority:

There's great information on the National Carp Control Plan website but no one is really looking at it. If they are, they're sceptical. I guess fishers are looking to us to go well, "How is this going to affect our fishing and is this good, should we be supporting it?" [Peak #2]

At the moment, what I'm reading and hearing, I'm comfortable with where they're going so far, but once the final paper is presented to the feds…we represent [many] freshwater clubs throughout [the state], so I'd like to get that final document out to them for consultation and their view on it. [Peak 1]

However, the limited resources peak bodies are currently operating under was also identified as a significant limitation for their capacity to be actively involved in communications and engagement in relation to the Plan:

I think that we've got that role to play for our fishers, to let them know what the science is saying, what the potential implications and gaps are, and problems are, whether that can be mitigated or not and that's the kind of advice we need to be reporting back to government. Say, "Hey, look we think you need to sharpen the pencil here, and do a bit more extra here, because there's concerns. We're not

quite 100 percent with that….[But] currently right now we can't do anything. The most I can do is maybe get someone to a meeting or send out the draft Plan and ask [fishers] for feedback, and put in a submission, put up a couple of posts on social media. That's about all that we can do with our current resourcing. [Peak #2]

…And its little things, like here's a really good example, the NCCP brochure that comes out every couple of months…it comes to us as a pdf we can open and read, but they don't put it on a website that we can link to. Instead, we've got to take the pdf, mount it on our own website and then put the link in. It's the little things like that…just basic media management would make it so much easier to support. I mean I know that might sound like getting down to tiny details but in the end, when you're doing this in your spare time it makes a difference. [Peak #4]

8. KEY FINDINGS AND RECOMMENDATIONS

This section provides a summary of key findings from the impact assessment and recommendation for consideration for development of the Plan and beyond. We also recommend actions to address the 'anticipatory impacts' and to reduce potential negative and extend potential positive impacts of the development and implementation of future carp control strategies.

KEY FINDINGS FROM IMPACT ASSESSMENT

Socio-economic impacts	Details and circumstances of the impact
Uncertainty about the future for freshwater recreational fishing, with frustration and stress impacting relationships across parts of the recreational fishing sector (negative impact)	This is occurring already. It has impacted some social networks across the sector. It has been influenced by a focus on negative messages about 'problems' associated with the Plan, and limited opportunities for the sector to engage with scientific findings emerging from the Plan, and the resource constraints the sector faces limiting capacity to support meaningful and trusted communications about the Plan across the sector. For recreational fishers who target or enjoy catching carp, the development phase of the Plan has been frustrating and stressful because of the uncertainties it has raised about potential impacts on their recreational fishing future, social networks and competitions.
Opportunities for recreational fisher involvement (positive impact)	This is a potential positive impact. The recreational fishing sector are keen for the opportunity to have a role in carp control. This includes through: i) coordination of sector feedback and review of details of the design and implementation of final Plan delivered to governments, ii) communication and engagement with the sector about the Plan iii) actions such as assisting with monitoring carp numbers in citizen science projects, assisting with clean-up (in specific cases), and iii) assisting with actions to increase likelihood of environmental recovery. To facilitate these opportunities for

	involvement will likely require additional specific resourcing to the sector.
Reduced native recreational fishing opportunities or fishing activity (negative impact)	The impact would occur if virus release reduced abundance of native or established non-carp fisheries (e.g. trout) due to water quality problems or other issues related to dead carp. This was considered by most of those interviewed to be a short-term impact immediately after initial virus release in each area. Most felt would have relatively limited impact on recreational fishers. Some were concerned about potential for longer-term reductions in native fish through shifts in the long-term predator/prey dynamics from reduced carp, or if complementary measures are not implemented to establish habitat conditions to support restoration of native fish. The impact would be extensive and long-term if non-target species are directly susceptible to the carp virus. There is also potential for fishers to reduce fishing activity in areas where the virus has been released due to perceptions that it is unsafe to be in contact with waters or fish in these areas (this is based on survey results reported in Schirmer et al 2019).
Reduction in recreational fishing for carp (potentially negative impact)	Some coarse fishers interviewed who like to fish for carp or who participate in carp-specific fishing competitions were concerned about the impact of significant carp reduction on their hobby and on the regional economies where key carp or coarse fishing competitions are held. Significant carp reductions may also reduce recreational fishing opportunities for people with little experience in fishing who find carp easy to catch and for those who target carp as part of specialised programs supporting people with disabilities. Not all felt this was a concern, given there were expected to be carp available after virus release albeit in smaller numbers, and some felt it would be possible to identify other ways to achieve similar outcomes for fishers who needed easy-to-target fish species.
Increased fishing success and enjoyment for fishers (positive impacts)	Many recreational fishers interviewed who target native fish supported release of the virus because of the potential for long-term improvement in recreational fishing conditions through improved environmental health, increased native fish stocks, and reduction in unwanted catch of carp. Many felt this would result in increased benefits of recreational fishing in the form of enjoyment and wellbeing. In some cases, the potential for positive outcomes was seen as being contingent on implementation of complimentary actions alongside the carp virus.
Increased revenue for fishing-related businesses (positive impacts)	Some felt that the potential for improved environmental conditions would led to increase recreational fishing effort (increased numbers of fishing trips to areas previously affected by carp by larger numbers of fishers). If this occurred, there is potential for positive impact on tourism revenue and revenue for recreational fishing businesses. This impact would occur if carp reduction led to improvement in

	environmental health, and supported growth in numbers of native or exotic (e.g. trout) fish.
Significant reduction in business activity for some recreational fishing suppliers or guide businesses (negative impact)	This impact is considered unlikely to occur to the extent that significant harm to businesses occurs. Significant impact on businesses would only occur if virus release led to inability to fish in a relatively large area for a relatively long period of time (several months), longer than the typical impacts of existing events such as blue-green algae outbreaks, which these businesses have already established mechanisms to cope with.

RECOMMENDATIONS

Based on the assessment in this report, the following actions should be considered as part of the development of future carp strategies and their implementation, with the aim of mitigating potential negative impacts and enhancing positive impacts on the freshwater recreational fishing sector.

Communications: Plan timeframe, research findings and future consultation

- Provide regular updates about likely timelines and processes for future decision-making about carp control and the carp virus, and timing of implementation of carp control actions. This will help reduce uncertainty for the sector. It will also assist the sector in planning and coordination communications to the broader recreational fishing community, and to coordinate feedback from the sector in response to recommendations outlined in the Plan. It will also allow clubs, businesses and other organisations to accommodate any carp control actions into their planning of recreational fishing activities, gatherings and competitions.
- Communication of Plan research findings in a way that is meaningful to and trusted by the recreational fishing facilitated by closely working with peak representative organisations. The communications should focus on providing accessible information across key areas of concern or interest, including: short-term and long-term outcomes expected for water quality and native fish recovery; potential risks to native fish and; cleanup requirements and planning.
- Communicate contingency measures for ‘worst case’ scenarios under virus release, which ensure protection of key recreational species, such as Murray cod, golden perch and trout.

Consultation and resourcing

- Planning for direct, on-going communication and consultation with the sector. The limited resources available to peak organisations discussed in this research has meant there has been limited capacity to provide the detailed communication necessary to keep the sector informed about the Plan process and scientific findings.

Feedback from peak organisations is that direct communication and engagement from the National Carp Control Plan, when it has occurred, has been fundamental to building common understanding across the recreational fishing community about the emerging science and the purpose of the Plan.

- Evaluate need and scope for resources required to support capacity of peak representative organisations to consult with the sector on Plan recommendations, build understanding of the Plan and advocate across divergent perspectives in providing feedback into the Plan recommendations and future carp control decisions.
- It is important that the current constraints and the institutional settings across different states are considered in the Plan recommendations and future consultation as they have significant implications for the capacity of the sector to provide input into the process. Resourcing for engagement will likely be required to provide meaningful opportunities for the sector to engage in the decision-making processes about carp control into the future.
- Consider recommendations for resourcing direct consultation with the sector in relation actions currently being undertaken in environmental and fisheries restoration beyond direct carp control actions: e.g. habitat restoration and responsive strategies to support native fish recovery.
- Consider recommendations for resourcing communication of messages to the broader recreational fishing consumers as part of carp control strategies. This includes recommendations for the planning and resourcing of communicating accurate information about safety of fishing, being in contact with water in areas where virus is released, and consuming catch.

Support for sector participation

- Plan for consultation with the sector once recommendations of the Plan are finalised to Identify opportunities for recreational fisher engagement in programs involving in implementing and monitoring carp control. This also has potential to offset negative impacts of any short-term inability to fish in specific areas through encouraging long-term engagement of fishers in a range of activities. In recognising the significant resource constraints facing peak representative organisations and fishing clubs, financial support will likely to be required to enable participation.
- Engage coarse fishers and others who target carp in citizen science projects tracking change in carp population. Invest in identifying alternative fishing opportunities to carp that can be used by groups who currently target carp.
- Implementation of specific community programs to mitigate the potential social impact of any significant reduction in participation of vulnerable people in the community through community recreational fishing programs.

Planning and provisions for minimising impacts of reduced recreational fishing opportunities and business disruption

- Understanding coarse fishing
- Social programs.
- Provide recommendations in relation to assistance required for those whose business activities are reduced, and, where needed, to support transition to new business activities or employment.

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10. APPENDIX – INTERVIEW SCHEDULE

The following set of questions was provided to attendees prior to the phone interview. These questions were used as a general guide for the discussion.

1. Could you tell me about your involvement in freshwater recreational fishing sector? This could include your participation as a recreational fisher, involvement in supporting your community or club, advocacy for the sector, or business/commercial involvement.
2. Can you tell me a bit about any challenges or barriers you feel the recreational fishing sector currently faces? Are there things that make it challenging to participate in recreational fishing, or to maintain or grow your organisation or business (if applicable)?
3. What do you see as the potential future opportunities for the freshwater recreational fishing sector?
4. Has the announcement that a National Carp Control Plan will be developed had any effects on you, your club/community, organisation or business (where applicable)?
5. What are your views about current effects of carp on freshwater areas in Australia (good and bad)?
6. What are your views about the methods (if any) that should be used to control carp?
7. Are you supportive of the proposal to release the carp virus? Why/why not?
8. If the carp virus is released, what are the potential impacts this may have on you, your community, organisation or business (where applicable), and the freshwater recreational fishing sector more generally? You don't have to be certain they will happen – we'd like to hear about the impacts you worry might happen, and any positive impacts you think might be possible.

a. What are the potential negative outcomes from release of the carp virus for you/your community/organisation/business/sector?
   i. What will influence whether these arise?
   ii. What could be put in place to help avoid/reduce these negative outcomes?

b. What are the potential positive outcomes from release of the carp virus for you/your community/organisation/ business/sector?
   i. What will influence whether these arise?
   ii. What could be put in place to help ensure these positive outcomes are achieved?

9. Next, we would like to ask if you have you have experienced any challenges or opportunities in the past few years related to changes in water quality and fish availability that we haven't already discussed? If so, what have these been? How have any impacts been managed?
10. Are there other people or organisations we should be talking in your sector who are likely to want to share their views about carp control and the potential impacts?
11. Is there anything else you'd like to discuss?

NATIONAL CARP CONTROL PLAN

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