**Environmental Biosecurity Office**

**The next phase for carp biocontrol**

May 2024Presented by:

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* Dr Toby Piddocke, Manager of External Partnerships, Fisheries Research and Development Corporation

*[Opening visual of slide with text saying ‘Environmental Biosecurity Webinar, The next phase for carp biocontrol, Thursday 2 May2024’]*

**Dr Bertie Hennecke:** My name is Bertie Hennecke and I'm the Australian Chief Environmental Biosecurity Officer. I’d like to welcome you today to this environmental biosecurity webinar about the carp biocontrol program.

And as I said before, today I'm coming to you from Ngunnawal country here in Canberra. I'd like to begin by acknowledging the Traditional Custodians of the various land on which we all come together. I pay my respects to Elders past, present and emerging, and that respect extends to Aboriginal and Torres Strait Islander people that are attending today.

So, carp, carp is one of the most destructive freshwater aquatic species in the Murray Darling Basin. They destroy the habitats of native fish, reduce water quality, and contribute to harmful blue green algae blooms. But not only do they impact on the environment, they also have significant economic and social impacts.

About eight years ago now, in May 2016, funding was made available to investigate the feasibility of the cyprinid herpesvirus 3, commonly known as the carp virus, as a possible biological control agent for carp. A proportion of the funding was allocated to the Fisheries Research and Development Corporation, the FRDC, to do research on the impact and potential benefits of releasing the virus. This research then informed the development of the National Carp Control plan, which I think most of us would know as the NCCP.

Today our first speaker is Dr Toby Piddocke, from the FRDC. He will cover aspects of that research and the subsequent findings. Following Toby, I will talk about where we are now and what are the next steps that we are investigating to actually determine the feasibility of releasing the virus. Once both presentations are done, there will hopefully be plenty of time for questions. You're welcome to submit your questions at any time to the webinar using the chat function. When submitting your question, please make sure that you add the name of the speaker you would like to direct your question to. Once the presentation has finished, you will be able to raise your hand and ask a question on camera too if that's what you prefer. We will try our best to get through all the questions that we have. But if we're running out of time my team in the Environmental Biosecurity Office will put an email address in the chat where you can direct those questions to, and we will answer them over the next few days.

So now as I mentioned, our first speaker is Dr Toby Piddocke. Toby has a background in fisheries biology, including age and growth and reproductive biology, acoustic telemetry, and freshwater fish surveys. Toby worked on the National Carp Control Plan as a research manager and the technical writer. He is currently employed as a Research Portfolio Manager with the FRDC. So, without saying anymore, Toby, I hand over to you to give us your presentation.

*[Visual of slide with text saying ‘The National Carp Control Plan: Science overview, Environmental Biosecurity Office webinar series, 2 May2024, Dr Toby Piddocke’]*

**Dr Toby Piddocke:** As Bertie mentioned, I'm Toby from the Fisheries Research and Development Corporation and I'll be giving you an overview of the science associated with the NCCP.

*[Visual of slide with two images next to each other. The first is a microscopic image of a virus. The second is of two carp in a body of water.]*

**Dr Toby Piddocke:** I think everyone here is probably aware of this, but the NCCP assessed the feasibility of using this virus *Cyprinid herpesvirus 3* (CyHV-3) to control invasive common European carp in Australia.

*[Visual of slide with the logos of the Invasive Animals CRC and Centre for Invasives Species Solutions. The slide also includes an image of 3 people in a scientific lab.]*

**Dr Toby Piddocke:** Just before we jump in, I'd like to begin by acknowledging some farsighted early investment by the then Invasive Animals CRC, now the Centre for Invasive Species Solutions. It enabled some early work by Ken McColl and his colleagues, Agus Sunarto and Matt Neave, who you can see here, who identified the initial potential of the virus as a biological control agent for carp.

*[Visual of slide titled ‘NCCP research’.*

*Understanding carp virus effectiveness*

1. *Understanding carp virus effectiveness*
2. *Understanding how carp biomass changes over time in wet and dry conditions*
3. *Exploring genetic biocontrol options that could work synergistically with the carp virus*
   1. *Mapping carp aggregations.*
4. *Assessing the carp virus’s capacity to reduce and suppress Australian carp populations*
5. *Refining understanding of virus efficacy*
6. *Clarifying virus transmission pathways*
7. *Investigating the genetics of resistance to the carp virus*
8. *Investigating the role of physical removal as a carp control technique*

*Understanding risk*

1. *Water quality risk assessment of carp biocontrol for waterways*
2. *Understanding whether the virus can affect humans*
3. *How to determine whether the virus affects non-target species*
4. *Additional testing of Murray Cod, Silver Perch, and Rainbow Trout to determine susceptibility to infection by the virus*
5. *Understanding stakeholder views and impacts*
6. *Determining and managing water treatment risks (also falls under ‘Managing Risk’)*
7. *Systemic ecological and social risk assessment (also falls under ‘Managing Risk’)*
8. *Biosecurity risk control measures for the koi industry*
9. *Engineering options for the NCCP*
10. *Lachlan case study*
11. *Murray and Murrumbidgee case study*

*Managing*

1. *Exploring clean-up methods and engineering solutions for fish kills internationally*
2. *Options to utilise dead carp (also falls under ‘Benefits and Costs’)*

*Benefits and Costs*

1. *Predicting medium- and long-term benefits of carp control*
2. *Estimating benefits and costs*

*NCCP outputs*

*National Carp Control Plan (NCCP)*

*Technical Papers:*

1. *Background*
2. *Epidemiology*
3. *Water quality*
4. *Species specificity*
5. *Socio-economic impacts*
6. *Implementation*
7. *Engagement report*
8. *Murray case study*
9. *Lachlan case study]*

**Dr Toby Piddocke:** So, this slide just gives you an overview of the full NCCP research program. Boxes 1-19 each represents a research project. Or, in the case of B, C, D and E planning exercises that looked at how the implementation and roll out might go in particular areas.

The research programme was organised under four main themes: understanding viral effectiveness, understanding risks associated with the biocontrol programme, managing those risks and a preliminary look at benefits and costs. Unfortunately, time constraints today prevent having a look in detail at all the aspects of the research programme, so we'll just have a look at some key pieces of research.

The first is understanding viral effectiveness, which was done using an epidemiological modelling project. Looking at some of the water quality risks and at the risk that the virus could affect non target species.

*[Visual of slide titled ‘Headline messages’*

* *40–80% reductions possible (depending on carp demography)*
* *Initial major outbreaks followed by ongoing seasonal kills of mainly small carp*
* *Suppression through ‘boom’ cycles.*
* *‘Carpageddon’ unlikely, rather;*
  + *A concerted effort required to introduce the virus and initiate outbreaks in targeted carp populations:*
* *WQ risks less than if virus were self-propagating, BUT*
* *Considerable effort likely needed for broadscale rollout, and risk management will require broadscale surveillance.*
* *Broadscale WQ impacts unlikely but could occur in some habitat types.]*

**Dr Toby Piddocke:** So, the headline messages to emerge from the research under the NCCP were that using the virus as a biocontrol agent could drive carp reductions in the order of 40 to 80% depending on carp demography.

Carp in Australia have a really complex population structure, consisting of many separate sub populations that have various degrees of connectivity between them. In the more resilient of those carp populations, the ones that have an inherently high capacity to rebuild following reductions, we could see lower reduction in the order of that sort of 40 to 60% range. In the less resilient populations, we can see greater reductions in that sort of 60 to 80% range. Now those numbers are very general and across the full extent of the species distribution in Australia. We'd likely see both greater and larger reductions. The overall pattern of disease, I guess, that would likely ensue from using the virus as a biocontrol would consist of an initial major outbreak followed by ongoing seasonal kills of mainly small carp.

Suppression caused by the virus is likely to continue through boom cycles. Carp have a quite distinctive sort of boom and bust population structure. Although those booming population cycles would reduce the suppressive effect but not completely remove it.

The ‘Carpageddon’ scenario, wherein the virus essentially just propagates itself throughout the Murray Darling Basin and any coastal catchments where it was introduced and spreads under its own steam, causing more-or-less simultaneous really large outbreaks is actually quite unlikely to result. Rather, the properties of this virus and the way it interacts with carp mean that the challenge is likely to lie in the opposite direction. A quite concerted deployment effort would probably be needed to introduce the virus into targeted populations and subpopulations and initiate outbreaks in those areas of a magnitude you know sufficient to drive population reductions.

This result has a couple of implications. On the positive side, water quality risks are likely to be less than if the virus just self-propagated across the landscape under its own steam. Conversely, though, considerable effort and resourcing would likely be needed for that kind of broad scale roll out. Even though that sort of simultaneous outbreak scenario is quite unlikely. A prudent risk management approach would nonetheless still require broad scale surveillance for unexpected outbreaks.

In terms of water quality impacts, overall negative long term water quality impacts are unlikely. Reductions in dissolved oxygen and potential emergence of Cyanobacteria blooms could occur in some habitat types under higher carp densities. We'll have a little bit more of a look at that soon.

*[Visual of slide ‘Key science (selected): epidemiology*

*‘Primary factors regulating disease outbreaks ad carp suppression: water temperature, physical contact, latency and recrudescence’*

*Image of a single carp swimming in muddy river water*

*Image of large group of carp spawning]*

**Dr Toby Piddocke:** The first piece of science I mentioned that we're going to have a look at is epidemiology. So, the key message from this work, it was a very large complex project, but the key message was that the primary factors regulating disease outbreaks and carp suppression is water temperature. The virus has a relatively narrow water temperature range within sort of variously cited as 18 to 28 or 16 to 26 degrees within which it can infect carp and cause disease. A still narrower range around that sort of 22 to 24 or 26 degrees within which it does so most effectively.

Physical contact between an infectious and a susceptible carp is by far and away the most effective transmission pathway. So, our Lone Ranger down here [points to image on slide of single carp in muddy water], just snuffling along the bottom, is probably not much risk of transmission. These carp [points to image of large group of carp spawning] here in very high density would be ideal for transmission.

**Dr Toby Piddocke:** Latency and recrudescence are really important mechanisms. This virus is a kind of herpes virus and like a lot of those viruses, if an individual survives the initial infection, the virus remains within their system, dormant and when conditions are suitable, it can re-emerge. Now that individual may or may not get sick and die, but regardless of that, it should be secreting infectious virus into the water. And sorry, I should just say that latency and recrudescence is really important for the ongoing suppressive effect of the virus is where it comes into play.

*[Visual of slide ‘Key science (selected): water quality*

*Modelling to understand impacts of decaying carp on dissolved oxygen dynamics and risk of cyanobacterial blooms*

*Assessed impacts across various dead carp loadings*

*Flow and aeration are the two factors that mitigate risk—off-channel habitats present highest risk’*

*Image: chart showing conceptual modelling of water flow and system dynamics]*

**Dr Toby Piddocke:** The next piece of science, we'll have a look at is water quality. This was modelling to understand the impacts of decaying carp on dissolved oxygen dynamics and the risk of Cyanobacteria or blue-green algae blooms.

Now there are obviously other negative impacts that could arise from a large body of decaying fish in a water body, including the emergence of various spoilage bacteria and even the bacteria that cause Botulism. However, those tend to be sort of secondary effects that follow on. So, when you see that dissolved oxygen getting really low and formation of Cyanobacteria blooms, that effectively creates the conditions under which some of those other outcomes could occur.

This work assessed dead carp impacts across various loadings. So, both the expected loadings from the epidemiological modelling and from a carp biomass study that was also conducted under the NCCP. It also looked at much higher loadings to essentially get that worst case scenario situation. This work showed that the flow and aeration are only the two factors that mitigate risk. Under most of the carp densities found in Australian habitats, if the water column is being mixed through river flow or wind action, we're unlikely to see long term negative water quality outcomes. Where those risks can occur, though is in off channel habitat. So, the lakes, lagoons, wetlands and so on where the water column is still. This is particularly so at carp densities of 300 kilos a hectare or greater.

*[Visual of slide ‘Non-target species (NTS) susceptibility’*

* *‘OIE lists carp and carp hybrids as the only species fulfilling its criteria as susceptible to CyHV-3 infection, but notes detection of genomic DNA in several other freshwater fishes and invertebrates*
* *An area of public concern*
* *Initial IACRC/CSIRO trials and additional NCCP trials re-testing Murray Cod and Silver Perch found no evidence of infection (viral MRNA)’]*

**Dr Toby Piddocke:** The next piece of work we'll look at is susceptibility of non-target species to infection by the virus. So, the World Organisation for Animal Health or OIE lists, carp and carp hybrids as the only species that completely fulfil its criteria as susceptible to infection by the virus.

[The OIE] noes detection of the virus's genomic DNA in several other freshwater, fish and invertebrates. Now this detection of the genomic DNA doesn't necessarily imply infection. A lot of these animals have been exposed to quite high concentrations of the virus as part of viral challenge trials to determine if they could be infected. So, finding that the virus is present is not necessarily in itself, you know, an indication of infection. Some of them did raise some questions, though in terms of some of these individuals being able to pass the virus on to susceptible carp when they were cohabited with them. In some of them the genomic DNA was found in them, but reasonable times after exposure. So, sort of seven days and onwards.

This is also an area of considerable public concern. In social research under the NCCP, about 57% of 24,000 people surveyed were concerned about the virus potentially infecting species other than carp.

The initial invasive animal CRC and CSIRO trials that Ken McColl and his colleagues did, you saw them at the beginning of the presentation, didn't find any evidence of infection when they looked for the viruses’ messenger RNA, or mRNA. So as distinct from genomic DNA, messenger RNA is a clear signature of infection. If you're finding the viral mRNA in non-target species, it's a clear indication that the virus has entered the host cells and is replicating there and has truly infected that individual. So, there was no indication of this. Nonetheless, in some of that work there were some results that raised some questions, including some of the test fish experiencing greater mortalities than the control fish that went through the experimental procedures without receiving the virus.

There was some additional testing done under the NCCP looking at Murray Cod and Silver Perch. Again, that found no evidence of infection. But because this is such a sort of fundamental question for a biocontrol agent, and there were some questions there, we've recommended additional work on this.

*[Visual of slide ‘Uncertainties/challenges*

* *Need for additional NTS work (incl Rainbow Trout).*
* *Improved understanding of the emergence of genetic resistance and/or her immunity desirable.*
* *Improved understanding of key epidemiological mechanisms(latency/recrudescence) and parameters (transmission rates—Beta) desirable.*
* *Managing WQ impacts in off-channel and/or vulnerable habitats (e.g. northern MDB ephemeral systems, Chowilla in SA).]*

**Dr Toby Piddocke:** Which moves us on to remaining uncertainties and challenges. The NCCP outlined some areas where perhaps some additional work would be useful. One of those was some additional viral challenge work on non-target species, including rainbow trout. We thought improved understanding of the likely pattern of emergence of genetic resistance and or herd immunity was also desirable. A bit further investigation of some of the key epidemiological mechanisms, particularly that latency and recrudescence phenomenon that I mentioned. This is well supported in the international literature and from some preliminary experimental work under the NCCP, but because it is important, we recommended a little bit of extra work there. Also firming up some of the key epidemiological rates.

Last of all, not so much an uncertainty but a challenge I guess, is managing water quality impacts in some of those off channel habitats that I mentioned where you can begin to see the negative water quality outcomes at higher carp loading. Most states and territories where carp are found have some of these places you know, northern Murray Darling Basin ephemeral systems, Chowilla in Sout Australia and so forth. The logical approach to managing dead cap in these places is physical removal. That is probably easier said than done. A lot of these places are very remote or they're just physically difficult to access. I don't think this is an insuperable challenge, but it is a sort of I guess logistics and operational challenge that needs to be planned for and worked through.

*[Visual of slide ‘Conclusion*

* *Most NCCP research indicates technical feasibility, and there has been no clear indication that consideration of carp biocontrol should be abandoned*
* *BUT, uncertainties remain—some could be addressed through further targeted research*
* *Uncertainties and risks need to be balanced against scale of the problem’]*

**Dr Toby Piddocke:** In conclusion, most work under the NCCP indicates technical feasibility. There's been no clear indication that consideration of this virus as a biocontrol agent should be abandoned. Nonetheless, some uncertainties remain. Some of these could be addressed through a bit of further research. Nonetheless, there will be some [uncertainties] that remain in a programme of this sort of scale. These uncertainties and risks need to be balanced against the scale of the problem. You know, as Bertie mentioned, Carp, are a really major environmental pest and they're certainly not going anywhere anytime soon.

And that brings us to the end of this presentation. Thank you.

**Dr Bertie Hennecke:** Thanks, Toby. A great presentation, giving us a lot of insight into what the research was under the phase one of the NCCP.

*[Visual of slide with text saying ‘Environmental Biosecurity Webinar, The next phase for carp biocontrol, Thursday 2 May 2024, Bertie Hennecke, Chief Environmental Biosecurity Officer’]*

**Dr Bertie Hennecke:** So now I would like to pick up from Toby's presentation and talk about the next phase of the carp biocontrol programme. I will discuss the delivery of the additional research and the legal requirements of gaining regulatory approvals for registering and using the car virus as a bio control agent in Australia.

*[Visual of slide with text saying ‘The problem with carp’*

* Highly invasive pest species with environmental, economic and social impacts
* Climatic conditions leading to increase in carp populations
* Current control methods are inadequate]

**Dr Bertie Hennecke:** As I mentioned earlier, the common carp are one of Australia's worst pest species, affecting freshwater ecosystems across the country with significant social, environmental and economic impacts. Current control measures have been insufficient to manage carp numbers. The carp herpes virus represents, as Toby said, a potential opportunity to manage Carp numbers.

But the risk associated with releasing a virus into the environment must be fully understood and also appreciated. So, these risks must be carefully considered, because the virus cannot be removed once it has been released. Consequently, the Australian government has funded some additional research to address some of these knowledge gaps and uncertainties that Toby actually highlighted.

*[Visual of slide with text ‘Carp Biological Control Program’. The slide includes a road map of past and future work associated with the Carp Biological Control Program. This includes:*

* *2008—Research into the carp virus as a biocontrol begins*
* *2016—the National Carp Control Plan begins*
* *2022—National Carp Control Plan Report released*
* *2023—NCCP review and transition to Phase 2*
* *2024—Priority Research Actions (Field trial planning)*
* *Ministers’ agreement to proceed*
* *Public stakeholder consultation*
* *Legislative and regulatory approvals*
* *Decision whether to release the virus*
* *Integrated carp management (state and territory responsibility)]*

**Dr Bertie Hennecke:** As Toby highlighted, the research completed under the NCCP vastly improved the understanding of the suitability and the feasibility of using the carp viruses as a biocontrol agent. The NCCP research laid basically the foundation of evidence-based decision making and highlighted a set of uncertainties that required further investigations.

So, what does that mean? Where do we go from here? What's next?

So, in 2023, the Environment and Invasives Committee reviewed the NCCP research. And while the NCCP report comprehensively answered many questions, the EIC review agreed with the NCCP report that further funding and further research is needed to address those uncertainties and confidently inform the decision process.

In October last year, the Australian and State and Territory Agricultural Ministers agreed to commence phase two of the National Carp Control Plan to research some of these uncertainties. Phase two will include two main stages and one is addressing the research priority actions raised by the Environment and Invasives Committee review. As well as seeking legislative and regulatory approvals for use of the carp virus as a bio control.

So once these two processes are completed, a final decision can be made by the Agricultural Ministers Meeting on the use of the virus as a bio control agent as part of integrated carp management. There will be stakeholder and public consultation throughout the NCCP phase two.

In March this year, a working group that has been established by the Department of Agriculture, Fisheries and Forestry Secretary and fisheries officials from Victoria, NSW, South Australia and Queensland to consider the development of a proposal for a field trial, a few controlled release of the Carp virus. This work is running parallel to the NCCP phase two work.

*[Slide with text ‘Priority research actions’*

* *Non-target species (Stop go decision point)*
* *Threatened species (Stop go decision point)*
* *Transmissibility (Stop go decision point)*
* *Cost benefit analysis (Stop go decision point)*
* *Efficacy*
* *Epidemiological modelling*
* *Integrated carp management]*

**Dr Bertie Hennecke:** Toby noted the NCCP raised several research uncertainties. Now the EIC review identified 7 priority research areas, highlighted here, and these priority research actions will be addressed in phase two and are necessary before any potential decision can be made of the release of the virus. A programme of research will address each of these priorities, priority actions. The Environmental Biosecurity Office is coordinating this work, which will be supported by a carp scientific advisory group, and that advisory group will provide scientific and technical advice concerning the research generated to address the priority research actions.

Several of the priority research actions are presented as stop and go decision points. They will be used as critical points to decide whether the programme should continue or come to an end. For example, as Toby highlighted, the importance of host specificity and if that is the case and there is significant impact or negative impact on other species, then that's for example a stop and go and the reason for not continuing the programme.

The research and decision point outcomes will be publicly released as they are finalised.

*[Slide with text ‘Regulatory approvals*

*Commonwealth processes*

* *Agricultural and Veterinary Chemicals Code Act 1994*
* *Biological Control Act 1984*
* *Biosecurity Act 2015*
* *Environmental Protection and Biodiversity Conservation Act 1999*
* *Water Act 2007*

*Jurisdictional processes*

* *State and Territory legislation and regulatory approvals’]*

**Dr Bertie Hennecke:** Phase two also includes developing compendiums of research information for submissions to regulatory agencies, and we need to seek their regulatory approvals. Those regulatory approvals are required by legislation before the virus can be released in field trials or released as a biocontrol agent.

Release of the virus depends on meeting requirements under several sets of legislations. This will help to identify and satisfactorily mitigate any potential negative impacts of the release of the virus too. Relevant legislations include the *Environmental Protection and Biodiversity Conservation Act*, the *Agriculture and Veterinary Chemical Code Act*, the *Water Act* and the *Biosecurity Act*. The reasons you know Toby highlighted a few impacts on water quality and these sort of things fall under some of these Acts too.

The carp virus strategic assessment under the *Environmental Protection and Biosecurity Conservation Ac*t will consider the likely impacts of carp virus release on measures protected under that Act. Such as ones that are of matters of national environmental significance, threatened species and wetlands of international significance and how these ones are actually managed.

Outcomes from the strategic assessment will inform other legislative approvals. For example, the *Biological Control Act*, mirror law schemes and relevant state legislations. The *Agricultural and Veterinary Chemicals Code Act,* for example, is administered, by the APVMA. That one will direct assessment of the safety and efficacy of the carp virus for registration to be used as a bio control agent.

Toby mentioned two trade implications stemming from the release of the carp virus and these ones will need to be examined too.

On successful completion of the regulatory approvals that would then be the point where the Agricultural Ministers can decide whether the virus can be released or not. The research and regulatory approval process, the time for all of this will roughly take about three to four years.

*[Slide titled ‘Governance and decision making’*

*Decision making flow chart.*

*The Carp Scientific Advisory Group will report to the Environment and Invasives Committee (Carp Task Group) who report to the National Biosecurity Committee (NBC). The NBC then provide advice to the Agriculture Senior Officials’ Committee, who then provide their own advice to the Agricultural Minister’s Meeting. Stakeholder engagement informs the entire process.]*

**Dr Bertie Hennecke:** To Inform the Minister's decisions, relevant advisory groups and committees will provide advice. Each group has a different skill sets to complete the decision-making process. They include specialist with backgrounds in sociology, science, fisheries, biosecurity environment as well as agriculture. Stakeholder engagement, as well as community consultation, will occur at several points during the programme. We will always be open to community and stakeholder perceptions or perspectives. This is an important part in the decision-making process. So, views that are out there are very important to be included.

Work is under way to consider the development of the proposal for the trial controlled release of the carp virus, which is, as I said before, separate to NCCP phase two. This work is being led by state and territory governments in collaboration with the Federal Agricultural Department. Any field trials involving controlled release of the carp virus cannot occur until regulatory approvals have been completed.

In deciding on whether to proceed with the release of the carp virus, ministers will need to be assured that:

* the virus will not significantly impact on non-target species through the disease
* the virus is likely to be effective in achieving a wide scale reduction in suppression of carp population for the medium to long term
* implementations can be undertaken to manage risk and negative impacts
* they also have to be ensured that there is no unacceptable impacts on the quality of water used for town and water supplies, stock and domestic consumptions ecosystems irrigations as well as cultural and recreational purposes.

Each state and territory jurisdiction will need to progress the proposed carp virus release through the corresponding legislative proposal processes that they have in place in their jurisdictions.

And the carp virus field trial working group, which has been established, will progress the planning of the field trial that will report to the Australian Fisheries Management Forum. This, as I said before, work will run in parallel to the NCCP phase two work.

*[Slide with image and text.*

*Image of person using a net to catch fish from a river*

*Text ‘Integrated carp management—With or without the virus*

* *Other control methods could complement use of the virus*
* *Physical removal, use of exclusion techniques and stocking of native fish*
* *Led by state and territory governments’]*

**Dr Bertie Hennecke:** So, on ground management of established pests is largely the responsibility of state and territory governments and land managers. We have that for all past and present diseases within jurisdictions. It is undertaken in line with states and territory legislations and planning, and options available to control carp may include fishing and netting and the use of exclusion technologies as well as stocking of native fish.

State and territory governments will be responsible for planning and managing implementation in their jurisdiction. If it is decided that the virus can be released, it is likely that any release of the virus will be accompanied by other management methods to assist with efficacy and to manage negative impacts.

*[Slide with text ‘Questions?’*

*For more information contact: carp@aff.gov.au]*

**Dr Bertie Hennecke:** I think that brings us to the end of the presentations. I think it's now good time to come up to questions. Unfortunately, we only have 15 minutes. But at the end of the day, if there are too many questions as I've had before, we're more than happy to take those on board and look potentially at a second webinar if needed. If there are more questions coming up and more, you know, sort of presentations would be useful to inform you. So, I may open it up to questions if people want to pop anything into the chat. And I think there are already a few in there as well as if people want to pop up maybe and ask a question on screen.

We have Peter Thygesen first.

**Peter Thygesen:** I've got a quick question which relates to both presentations. So, in the second presentation, there were the stop-go stars. Cost benefit analysis was a stop-go sitting beside efficacy, which was not a stop-go. The question I had in relation to the first presentation which relates to the overall decision making, which you didn't say explicitly, but I guess this is part of the approach. You're assessing the risk of the control measure, the virus, to potential non-target organisms and in that risk benefit analysis and efficacy analysis presumably there's some trade off there of the risk to those same non-target organisms from the remaining presence of the carp. So, I'll stop talking if you want to comment on that.

**Dr Toby Piddocke:** Thanks for the question,Peter. It's a good question and I may have to take part of it on notice. The look that we had at cost benefit analysis in the NCCP was quite preliminary, sort of necessarily som before we'd worked through a lot of the operational stuff, and it was basically looking at medium- and long-term benefits of carp control. What could the outcomes for native fish and other elements of aquatic biodiversity essentially be and flow on effects to you know, recreational use and tourism use and so on.

Could you restate the last part of your question?

**Peter Thygesen:** So, I guess in the end it's a trade-off of carp has been identified as critical thing to get rid of. Here the potential tool to affect that removal may or may not work really well. So, as you said, Carpageddon is unlikely.

**Dr Toby Piddocke:** Yep. Mm hmm.

**Peter Thygesen:** You have the remaining uncertainties if you like the potential risks of the control effecting something else. And so, if I repackage it, how do you arrive at the decision of? Is the risk of doing something worse than the risk of doing nothing?

**Dr Toby Piddocke:** Yeah, I think that it's largely a more sort of philosophical question and you are dead right that there are risks associated with doing nothing. You know, carp are doing damage now and they're going to continue to do it if nothing's done. So yeah, the benefit and cost work under the NCCP was largely looking more through an economic lens. But you're right, that it is an important consideration. There's that trade off that there will always be some sort of inherent risks in a programme of this sort of scale and magnitude. But it's, trading that off against what the risks are of doing nothing. It's a very difficult thing to quantify, but it's a very important question, maybe sort of the central question in some ways as decision making goes forward. Did you want to add anything to that, Bertie?

**Dr Bertie Hennecke:** Yeah. You know Peter it is a really important question. From a process point of view, I think this is why Australia has very strong, solid and robust processes in place to assess any organism as a biologic control agent. You know, that's what we are in the middle of now. That's why we are doing these sort of biosecurity risk assessments just to minimise that. We can never really be 100% sure that there is no impact once we release the virus into the environment and that there is no negative impact. This is why we can't do any controlled sort of experiments within our unique environment.

But again, you know like generally for biocontrol, if these risks are addressed as good as we can. And the national approach on this is that states and territories all will have to agree that these risks are addressed and there are mitigation aspects in place and they're comfortable to release it. That's the insurance policy, I think at the end of the day to not compensate, but that address some of those uncertainties that may remain forever. I don't know if I made that clear, but I think it's really down to the states and territories to make sure that their risk appetite and their concerns are met and they're comfortable to release the virus. If any of the states and territories or jurisdictions is not comfortable with it then the virus won't be released, and that's again, that goes back to the solid system that we have in place and that has served us well with a lot of the biocontrol agents over many years.

**Peter Thygesen:** Thank you.

**Dr Bertie Hennecke:** Alright, there's no hands up so I will go to the questions in the chat. There's one from Lance: talking about with the bird flu outbreak in the northern hemisphere at the moment and likely arriving in Australia in spring 24, when migratory birds return to Australia. Are you concerned that public sentiment, especially following the COVID pandemic, about releasing a virus, any virus, will be very negative?

I think it's always a concern. The public and social licence [are critical] basically to go ahead with this work. But I think again, this is why we just have to make sure from all angles that the risks that are there are all addressed to a satisfying level. And then the other element, lens that comes in here is probably that we have to be really strong on communication and so far, that hasn't happened. We need to communicate out to the community; this is what's going have going to happen, this where we are up to, [and]These are the risks. Seminars like this will help. I have to admit that some of the communication that have been previously put out have maybe not or have raised the expectation of the community out there. As you raised HPAI and COVID has certainly raised concerns within the broader community [about] how safe are viruses? And so, we are trying to address that and educate and make people aware as we go along some of these risks are assessed and we are as comfortable as we can be, and as confident as we can be that there is there are no significant negative impacts.

Alright. Now let me have a look. Rod: I would like to know what if a seagull eats an infected carp. What about the yabbi? Murray Cray? Even the shrimp? What if birds eat the carp that has died from the virus?

So, a lot of those uncertainties I guess that we that we haven't addressed. Toby, I don't know if maybe something you can talk to that.

**Dr Toby Piddocke:** Yes, yes. So, they’re good questions. That goes to the need for a really rigorous, you know, sort of at high level of confidence in that non-target species testing type work. So, all of those scenarios like you know various predators eating infected carp or dead carp have died from the virus. That's the point of the viral challenge trial. So, these trials expose various non-target species to the virus usually at very high concentrations. You know many, many times the concentration that is generally needed to initiate an infection. So, if there's good evidence, you know that none of those animals develop disease, there's no sign of the virus getting into their cells and replicating, which is the true definition of a viral infection. We can have confidence that however they encounter the virus out in the wild, whether it's through contact with an infected carp or through eating an infected carp, then an infection shouldn't develop.

**Dr Bertie Hennecke:** Yeah, there's another question from Lucy: Thank you for the information. Will the field trials be transparent to stakeholders. Also, will there be support for states and territory governments to deal with water quality and biomass?

The field trials are very much at the beginning of the planning at the moment. As I said before, this is done in consultation or led by some of the states and the Commonwealth is involved. There will be, as I said before, as much information going out to the community as we go along.

Now the other question in terms of support for states and territories to deal with the water quality and biomass. I think that's a whole new question that we have to deal with. As I said before, the implementation of the release of the virus or, you know, managing the virus is up to the states and territories. But this is where I think the National Biosecurity Committee has to come together and look at how do we want to cost share or fund that stage of the release. If we get to that release.

So, it's a little bit early at this stage to sort of pin that down Lucy. But in terms of the field trial transparency, we certainly as we go along will publish or will sort of create broader awareness about the processes and where we're up to as we go along.

Alright, further down where am I? For Toby: you mentioned the appearance of other diseases or risks like Botulism being made to flourish in an environment with decaying carp material. Is there more information on subsequent disease risk and how they would be mitigated for other exposed populations? For example, kettle drinking from infected waterways?

**Dr Toby Piddocke:** Yes. So, the issue of proliferation of other pathogenic bacteria, you know Botulism probably being the most concerning one, but also various other sorts of spoilage type bacteria that could, you know flourish, on decaying fish biomass. As I mentioned it’s largely a function of whether you can control the oxygen levels and the nutrient levels. So, in most Australian waterways and carp biomass that are typical to those habitats, we're unlikely to see those preconditions emerge. Waterway sufficiently mixed and the carp biomass aren't sufficiently high that we see those emerging. So, they should remain more or less within normal parameters. Bear in mind that this occurs sort of against the context of really variable in a lot of inland places in particular really variable sort of background regimes of these things. These places experience, you know, black water events and so forth as part of their current ecology. It is in those sorts of off channels that are still or that are habitats or potentially in places where we could see dead carp accumulating. You know if you have current or wind action sort of piling them up in an area and this is where the operational side of things comes in. And that first slide I showed, we essentially like war gamed how the roll out could look in a bit of a few different catchments. That's all available in the National Cap Control Plan and that look there are a range of options available in terms of physical removal you know use of booms to entrain carp carcasses and so forth. Not necessarily saying that all of those are logistically simple, but there are options there. If this programme were rolled out there's a sort of operational planning phase that would need to be gone through in detail.

So, to get back to the original part of your question, managing those secondary impacts is largely a matter of managing the two sort of headline water quality impacts, I guess. Which is dissolved oxygen and cyanobacteria blooms. Cyanobacteria blooms while they're a concern in themselves, they also contend to set the preconditions for Botulism outbreaks. You get this huge bloom of cyanobacteria, you know it's a very large volume of organic material. Those blooms inevitably die, and when they die, they themselves then form that sort of decaying biomass that can fuel Botulism growth. So, Botulism needs two things. It needs anaerobic conditions, so no oxygen. And it needs a biological substrate, you know, decaying material, essentially to grow from. So yeah, if we can manage dissolved oxygen and manage cyanobacteria the risks of those secondary bacteria should also be reduced.

**Dr Bertie Hennecke:** Thanks, Toby. I notice that we have gone overtime, and a few people have started dropping off. I think Andy Shepherd mentioned in the chat that there is a whole range of frequently asked questions on the NCPP website. People can get some answers there too or have a look there too.

I think giving that people have started to drop off we may actually close the questions here. I’ll make sure that the team and if more questions are coming in are directing their questions to Toby or myself to get answers to you over the next few days. It's just great to see that there's so much interest in and so much engagement happening on carp.

So, with that, Toby, I would like to thank you for giving the presentation today.

We invite everyone's feedback and comments on today's webinar. If you have any specific questions relating to carp biocontrol, please use the Carp email address that we're going to put in the chat.

We are always keen to hear from you with any suggestions for future webinars. So, if you have any particular topics you would like us to talk about or would like to learn about or any speakers you have you would like to suggest giving a presentation, please feel free to let us know too and you can use the CEBO-email that will also pop up in the chat.

If you're not currently registered for the webinars, I would encourage you to register now so you can receive invitations of any future webinars.

The recording of this webinar, as I said before, will be made available shortly and you will find also previous webinars on our website which will be put in the links too. Another way to stay involved in the departmental environmental biosecurity news is to follow me on my LinkedIn. I regularly put information out but also you can subscribe to the Three Chiefs newsletter that's available on the department website and you can register for that too to receive information.

So, thanks again for everyone for listening today. Fantastic webinar and I think we may have put a little bit too short, but there's always the opportunity to have an another discussion on this because I think as we go along with the plan for developing the carp virus, I think the broader community will have an interest and in this, in this important to inform people as much as we can, so they come along on this journey.

Thanks again for your attention and for attending today. And I wish you a good afternoon and see you all next time. Goodbye.

[End of transcript.]