

Carp herpesvirus as a biological control for carp

Introduction:

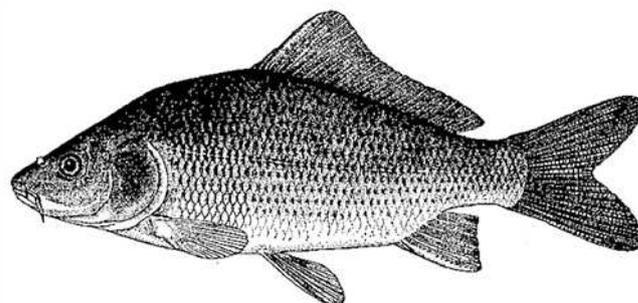
Carp (*Cyprinus carpio*) are not native to Australia, but they now dominate fish communities throughout many inland waterways. Widespread eradication of these established populations would be difficult, costly and complicated. Recently, cyprinid herpesvirus 3, commonly known as the carp herpesvirus (CyHV-3), has been proposed as a potential biological control method for carp in Australia¹. It has the potential to substantially reduce Australian carp populations, with impacts likely to be increased when used in an integrated carp management control program.

“Carp herpesvirus has the potential to substantially reduce Australian carp numbers”

About CyHV-3:

CyHV-3 is highly specific to carp, including the ‘koi’ ornamental variety, and only causes death in carp, with no other fish known to be affected, even the closely related goldfish. Carp-goldfish hybrids appear to be much less susceptible to CyHV-3 than pure carp. Australia does not have any native fish species that are closely related to carp², so they are not susceptible to CyHV-3. There are approximately 100 other known herpesviruses in other species, with at least one herpesvirus for each species studied. Most people would have been infected by at least one of the eight known human herpesviruses, such as the one that causes common cold sores. CyHV-3 does not affect humans.

CyHV-3 first appeared in Israel in 1998, although it may have appeared in the United Kingdom or Germany a little earlier. It spread rapidly to other parts of the world including Japan, Indonesia and North America. Mortality



Common carp, *Cyprinus carpio*, the species-specific target of carp herpesvirus CyHV-3.

(death) rates of 70-100% were recorded in all age groups of carp in several countries³. It now has a worldwide distribution with the exception of South America, Australia and New Zealand.

CyHV-3 is a water-borne virus and is highly contagious. Viral particles in water may be active for up to three days. New outbreaks of the disease can be expected when fish are stressed or in large aggregations. Clinical signs of disease, including mortality, are most common when water temperatures are 18°-28°C. There is little, or no disease above 30°C or below 15°C.

The first clinical signs of CyHV-3 infection are reddening of the gills, excess mucus on the gills and skin, darkening of the skin, and eventually patches of skin necrosis (tissue death). Signs of disease occur within 7-14 days of infection (depending on water temperature), and death then occurs within a day or so³.

Carp that survive infection are infected for life, and, when stressed, may die or show signs of disease again. These fish are capable of spreading CyHV-3 to other carp. There is no evidence that the virus can multiply in other fish, although virus may be inadvertently transported on the surface of other fish for a short period of time.

Current research:

The use of CyHV-3 as a potential carp biological control agent is being assessed by researchers at CSIRO's Australian Animal Health Laboratory with funding from the Invasive Animals Cooperative Research Centre.

This research has a number of objectives:

- confirming that CyHV-3 is lethal to carp in Australia
- confirming that CyHV-3 does not threaten Australian native species (thirteen native species of fish have



Gill necrosis, a symptom of CyHV-3 infection. Image: Associated Koi Club of America

been tested, along with rainbow trout, and a variety of other animals that might live in, or drink, virus-infected water. None of these animals are affected, or infected, by the virus)

- confirming that CyHV-3 acts on all sizes of carp (although it is known that young carp are extremely sensitive to the virus)
- confirming that the virus is transmitted directly from infected carp to non-infected carp
- investigating the effect of environmental conditions (eg changes in water temperature) on the potency of the virus
- investigating any possible cross reactions due to other related viruses that may already be present (such as cyprinid herpesvirus CyHV-1 or CyHV-2)
- investigating characteristics of the likely spread of the virus to help plan a program for its release into the environment.

Planning for CyHV-3 release:

CyHV-3 has the potential to be an effective biological control agent for carp. However, before CyHV-3 can be released it must go through a formal evaluation process coordinated by the Australian Pesticides and Veterinary Medicines Authority (APVMA). This will require more detailed scientific assessment and the development of a release and monitoring strategy. The plans for further work to begin in July 2016 are as follows:

- Science to support the release of CyHV-3 in Australia – CSIRO will test a few further native species for susceptibility to CyHV-3. CSIRO will also develop methods to monitor the spread of the virus if it is eventually released into natural waterways. It will also be important to develop other control methods

to complement the activity of the virus. These may include genetic strategies for carp control, but new generations of CyHV-3 will also be required.

- CyHV-3 release and monitoring strategy – A release strategy will be designed to take advantage of known vulnerabilities of carp. For example, the onset of the disease is related to temperature and to stress levels in the fish, so it will be important to choose the right time and the right site for release of the virus. Fish massing in large numbers for spawning would be an ideal target for the virus. A monitoring and evaluation strategy will be designed to track the spread and impact of the virus.
- CyHV-3 registration application package – Through close liaison with the APVMA, the information requirements for registration of CyHV-3 will be determined. All of the information needed will be assembled and the package will go through the APVMA risk evaluation and consultation process. Approval for CyHV-3 release in Australia will depend on funding and research progress. If approvals are granted, the target for release of CyHV-3 is within the 2017-2019 time-frame.

Further information:

1. Saunders G, Cooke B, McColl K, Shine R and Peacock T (2007). Modern approaches for the biological control of vertebrate pests: An Australian perspective. [*Biological Control* 52:288-295.](#)
2. McColl, KA, Sunarto A, Williams LM and Crane M (2007). Koi herpesvirus: Dreaded pathogen or white knight? [*Aquaculture Health International* 9:4-6.](#)
3. Bretzinger A, Fischer-Scherl T, Oumouna M, Hoffman R and Truyen U (1999). Mass mortalities in koi carp, *Cyprinus carpio*, associated with gill and skin disease. [*Bulletin of the European Association of Fish Pathologists* 19:182-185.](#)
4. McColl KA, Cooke BD, and Sunarto A (2014). Viral biocontrol of invasive vertebrates: lessons from the past applied to cyprinid herpesvirus 3 and carp (*Cyprinus carpio*) control in Australia. [*Biological Control* 72:109-117.](#)

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