

## **SUCCESS FOR ECHO-FUNDED RESEARCH ON KOI HERPESVIRUS (KHV) AT THE CEFAS FISH HEALTH LABORATORY, WEYMOUTH**

The following summary report was presented to the ECHO committee at Sparsholt College on 8<sup>th</sup> February 2005 by Nick Beevers of the CEFAS Weymouth laboratory in Weymouth

Koi herpesvirus (KHV) is an emerging virus that infects common carp *Cyprinus carpio* and its varieties such as mirror, leather, Koi and ghost carp. The disease is of global significance because of the extensive international trade in highly prized and expensive ornamental Koi and the economic importance of common carp as a food fish in countries such as China. Common carp also represent a significant resource in the UK as a major target species for freshwater anglers. Following the initial identification of KHV in the late 1990's the virus has spread across the world. There is now major concern over the potential spread of KHV into our wild stocks of common carp which sustain carp fishing as an industry estimated to be worth over £1.5 billion pounds a year.

Experiments undertaken at CEFAS, Weymouth and supported with funding from the English Carp Heritage Organisation were conducted with a view to increasing the protection of English wild carp stocks. Our studies addressed the issues of how common carp exposed to KHV may become carriers of the virus and thus conceal a covert infection whilst appearing healthy, and also to assess the threat that carrier fish pose to unexposed common carp.

We found that temperature is the predetermining factor that controls whether KHV develops into a lethal infection. Unfortunately suitable temperatures that permit the clinical development of the disease occur in the UK during late spring and summer. This is when we have seen large-scale mortalities of common carp in our fisheries associated with KHV. Our experiments have revealed the presence of KHV in fish that have been previously exposed to the virus but show no evidence of infection.

Common carp exposed to KHV at a permissible temperature for the growth of the virus, and held there suffered a 98% mortality leaving few survivors. Co-habiting the survivors

with fish that had never been exposed to the virus did not appear to spread the disease. However fish exposed to KHV at a permissible temperature of around 20°C and then quickly lowered to a non-lethal temperature showed very little initial mortality. These fish were held at the cool temperature for six months with no mortality. When the temperature was raised to a permissive level for KHV infection, the virus re-appeared in the exposed fish and was transmitted to fish that had not seen the virus before. It is likely that the exposed fish were covertly infected, with viable virus retained in the fish for the six months that they were held at the lower temperature. If such fish were to be stocked into a fishery during the winter, then it is likely that a similar situation of viral re-activation may occur once temperatures increase in the spring resulting in the entire stock of the fishery being exposed to the virus at a permissive temperature.

With the growth of angling in the UK and the demand for larger numbers of expensive, specimen carp, the number of stocking events (which generally occur during the colder months of the year to minimise transport stress) increases the risk of introducing unhealthy fish or fish harbouring covert KHV infections. This creates a problem for the carp fisheries that may not be easily resolved unless detection of covertly infected fish is made possible. Antibodies specific for KHV produced by common carp after exposure to the virus may hold the key to resolving this issue.

Antibodies are a very important defence mechanism against invading microbes and are produced by most vertebrates including fish. Antibodies produced by common carp after exposure to KHV provide a potential screening tool to identify fish previously exposed to the virus, which may be undetectable using existing diagnostic methods. Where KHV is causing mortality in fish and the fish show clear signs of disease, the methods for detecting the virus are very efficient and highly accurate. However, when the fish show no signs of disease, but could be harbouring a covert infection, the detection of the virus itself may be impossible.

Antibodies are easily detectable in fish, and at the beginning of the study we began the development of a test for carp antibodies and the results have been very encouraging. Firstly, carp do produce specific antibodies after exposure to KHV. Secondly, when testing surviving carp that had previously been exposed to KHV, we found that antibodies would reliably detect covertly infected fish. This technique is very promising as a

screening tool to detect fish carrying the infection and so prevent their introduction into fisheries. The test appears reliable and reproducible and the level of antibody produced by individual fish was enough to detect exposed populations. In addition the benefits of using blood samples to detect antibodies to KHV is that the testing is not lethal, an important welfare consideration with valuable specimen carp.

There are more validation steps needed before the test can be employed as a screening tool but the results from this study strongly suggest that antibodies are a good indicator of exposure. The ECHO funded project has stimulated interest in this area of disease diagnosis and research will continue in 2005 with Defra funding.

Until such time as tools are developed to detect the extremely low level of virus in covertly infected fish, detecting antibody to the virus in carp is the best option. It is likely that covert carriers of KHV caused the global spread of the virus and in a similar way our carp fisheries in the UK may be under threat. At present, the KHV research continues at CEFAS, Weymouth and scientists are undertaking a national survey of farms and fisheries to establish the distribution of KHV, which may provide valuable data for fishery managers and carp farmers.

CEFAS would like to sincerely thank ECHO and all its members for funding this research into KHV. The partnership between ECHO and CEFAS was the first of its kind and set a new precedent for tackling important issues in the aquatic environment. The ECHO funded study has confirmed important characteristics of KHV disease that have an enormous potential impact on carp angling in the UK. We are happy to report that Defra have responded to this by giving high priority to KHV research funding in 2005 and beyond.

January 2005



Fig 1: Wild carp showing typical signs of KHV infection



Fig 2: Nick Beevers working on laboratory tests for KHV