Background - Microcystins in Fish

The Science, Evidence and Research Division of the FSA produced initial technical advice on cyanobacteria and cyanotoxins in fish. The majority of available data on cyanotoxins in fish affected by cyanobacterial blooms related to microcystins, which can cause liver damage. They are mostly found in the gastrointestinal tract of fish but can also accumulate in the liver. Microcystins can also be present in fish muscle, but it was highly uncertain how the concentrations in edible flesh would relate to concentrations in the water and the prey and other feed of the fish.

The FSA produced risk management advice for businesses and consumers. Fish that were dead, or show any signs of sickness, in the area of a bloom should not be caught or eaten. The risk could be managed by removing the parts that the toxins accumulate in, especially the liver. Food businesses may be able to manage the risks, but there was an increased risk to consumers preparing and handling fish in the home.

The FSA worked with the Centre for Environment, Fisheries and Aquaculture Science (Cefas) to develop sampling and testing of water samples from within cyanobacterial bloom in the Lough and of fish from the Lough for cyanobacterial toxins. Brown trout were not currently being fished, but samples were taken of eels, roach, perch, pollan and bream. These include planktivorous species, which are reported to accumulate higher concentrations of cyanobacterial toxins than carnivorous species (Falfushynska et al., 2023).

Each sample comprised 10 fish, and overall five samples were taken of each species, except for bream for which a single sample was collected. The most frequently reported and studied cyanobacterial toxins in freshwater cyanobacterial blooms are the microcystins. However, it was agreed to test for a range of cyanobacterial toxins for which methods were available. The cyanobacterial toxins tested for included microcystins, nodularins, anatoxin, cylindrospermopsin and saxitoxin. The microcystin analyses were of the free toxins only and did not include protein-bound toxin. Therefore, Cefas also sent a number of subsamples of the same samples to another laboratory, which had a method to analyse total free + protein-bound microcystins in fish.

Microcystins were measured at high levels in the water samples. The other cyanobacterial toxins were not detected. The fish were dissected and the edible flesh, intestine, liver, roe, gonad and/or gills analysed separately. Free microcystins were measured at a range of concentrations in various of the fish samples in intestine, liver roe and/or gills. No microcystins were detected in the edible flesh of any of the fish samples. None of the other toxins were detected in any fish sample.

A total of 22 fish tissue samples, including nine fish flesh samples, were analysed for total (free + protein-bound) microcystins. The viscera tissue samples chosen for further analysis were those with the highest concentrations of the free toxins, while the fish flesh samples included 2-3 samples each of eels, roach, pollan and perch. Concentrations of total microcystins in viscera samples were approximately one order of magnitude higher than the concentrations of free microcystins. However, no microcystins were detected in any of the edible flesh samples.

While microcystins were not detected in any of the edible flesh samples, microcystins have been reported in the scientific literature to occur also in fish flesh, at lower levels than in intestine or

liver. Therefore, it is possible that microcystins were present in edible flesh at levels below the limits of detection for the analytical methods.