A standard procedure for the field monitoring of cataracts in farmed Atlantic salmon and other species

Ireland's EU Structural and Investment Funds Programmes 2014 - 2020
Co-funded by the Irish Government and the European Union

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Department of Agriculture, Food and the Marine

EUROPEAN UNION
This measure is part-financed by the European Maritime and Fisheries Fund

BIM Ireland's Seafood Development Agency

Cataract morphology and aetiology

Fish eyes differ from those of mammals. The lens is spherical rather than ellipsoid; it focuses by movement of the lens rather than by change in lens shape; the cornea is closer to the lens. A cataract is an opacity in the lens tissue which can affect vision. Cataracts can vary in size, shape and density and, thereby, in severity. There are many cataract types and many possible causes, including genetic, environmental, physical, osmotic and nutritional. Morphological descriptors can be used to record cataract position and progress. However, this is not necessary for field monitoring which can employ simpler techniques. The one described below uses a notional assessment of the loss of visual acuity resulting from the cataract, on a scale of0-4 for each eye. This takes account of both the area and the density of the cataract. In recent years, a particular type of cataract has been recorded in farmed salmon throughout Europe but especially in Ireland, Norway, Scotland and also in Chile. This type forms primarily at the posterior cortex of the lens, as a variable opaque disc or cup. Its periphery can extend forwards to the equatorial cortex of the lens. At its most advanced (most dense) stage, this cataract type can also invade the perinuclear area (the area surrounding the lens nucleus). Anterior cataracts are sometime seen associated with this syndrome but they can also arise from other causes, such as post-transfer osmotic problems, or physical damage. Because of the proximity of the cornea to the lens, it can sometimes be difficult to see whether an opacity is in the anterior part of the lens or in the cornea. Progressive morphology and field scores or posterior cataracts are indicated in the accompanying photographs and line drawings.

Sampling farmed fish stocks for cataract monitoring

The best way to monitor cataracts is by regular, serial sampling of the stock. Ideally, this should be carried out prior to start of feeding for the day, when samples are easiest to collect. For general sequential monitoring, sample size should be 30-60 fish per cage or tank. For single rather than serial examinations, at least 100 fish should be examined. To make sampling from cages as random as possible, s small, weighted ring net, box net or seine net should be used. This is hauled across the cage from depth to the sampling point and then secured to retain the fish for examination. Fish should not be attracted to a sampling point with feed unless absolutely unavoidable. If this method has to be used, the fact should be recorded. Small numbers of fish are transferred from the sampling net to a bin containing fresh, clean oxygenated seawater, dosed with an appropriate quantity of fish anaesthetic. Benzocaine, 2-phenoxythanol and clove oil are all suitable. The anaesthetic water should be changed regularly. Avoid leaving the fish in anaesthetic for longer than necessary, as this may reduce survival and can lead to changes in eye tissues. Once, anaesthetised, fish are withdrawn from the bin by hand, examined and returned as quickly as possible to fresh, clean, oxygenated water in a recovery bin, prior to their return to the cage or tank. In the case of salmon at sea, the sampling should start about one month post-transfer and continue until late autumn at which point this type of cataract generally stabilises. After this, it is likely that new lens growth will continue outside the cataracted area. This may restore vision to some degree by enabling the fish to “see round” the cataract, which reduces in size relative to the growing lens overall. Salmon can also suffer from similar cataracts in their second year and may also need to be monitored then. Periods of cataract development appear to coincide with periods of most rapid fish growth, related in the main to high ambient temperature or rapid temperature rise. Sampling frequency should be based on the rate of cataract development. Generally, sampling on a monthly or, at the most, two-weekly basis is adequate.

Equipment

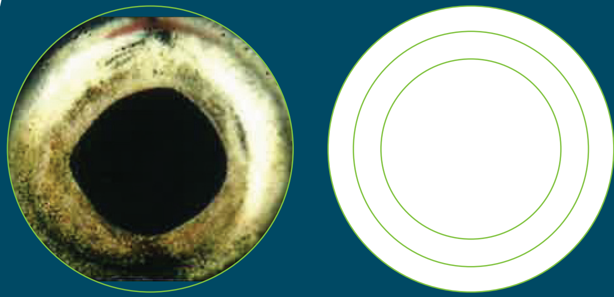
From the cheapest to the most expensive and offering an increasing ability to detect detailed changes, fish eyes can be examined by:

1. Naked eye, with optional use of a penlight torch, depending on natural light conditions.
2. Otoscope or auroscope (normally used for ear examination in humans and mammals).
3. Head-mounted binocular magnifier with built-in light source, with optional hand-held lens
4. Hand-held slit lamp microscope.

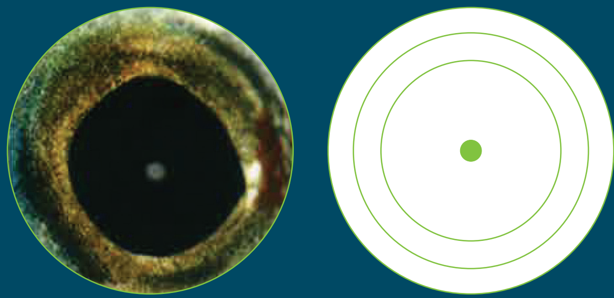
An otoscope is perhaps the best option for field examination. This enables small cataracts (cataract score 1-2), not always easily visible to the naked eye, to be identified. The otoscope has a built-in, battery-powered light source, a low magnification eyepiece and a funnel at the objective end. Use of the funnel is an option, which excludes external light from the fish lens and may improve viewing for some users. This should be held up to, but not touch the cornea. Note that, except by use of sophisticated equipment (Option 4), the depth of a cataract in the lens is difficult to judge with any accuracy. This, however, is not and essential element of the field scoring method suggested. With all methods of examination, reflected light from the cornea must be recognised and discounted. Depending on the type of equipment used, cataracts can appear as shadows (from light reflected from the retina) or as direct images. Obviously correct interpretation of the image seen is paramount to the accuracy of the method and may take some practice.

Examination

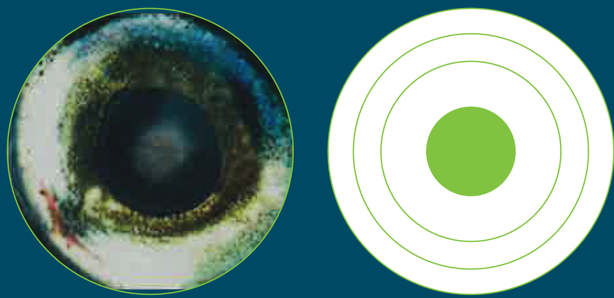
This guide is intended only as a brief introduction to cataract monitoring. Expert tuition in the correct reading of cataracts is advisable. The fish should be fully anaesthetised prior to examination. For optimal sampling consistency, the same person should examine stock over time. At best, individual fish weight and length should be recorded along with eye data. Examine each eye in turn, firstly with the naked eye. Any visible cataract, as well as other abnormality, such as swelling or cloudiness of the lens, (both possible signs of an emerging cataract), physical damage or haemorrhage, should be noted. Use the otoscope to score and cataract visible. The suggested field scoring index (which is illustrated here with dense cataracts) is intended as a guide only, since scoring is based on a notional assessment of loss of visual acuity resulting from the extent of cataract damage. Cataracts can affect visual acuity both by their size and their density. Thus a large, filamentous cataract or extensive cloudiness (presumptive cataract) can be judged to reduce visual acuity by a similar amount to a small, dense cataract and can, therefore, justify the same field score. If serial examinations indicate rapidly developing or high-scoring cataracts, the assistance of a veterinary practitioner or cataract expert should be sought.



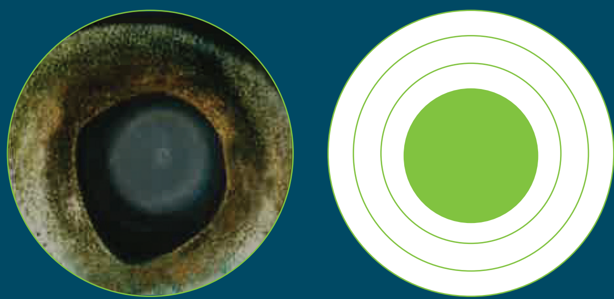
Cataract score zero (0)
No cataract



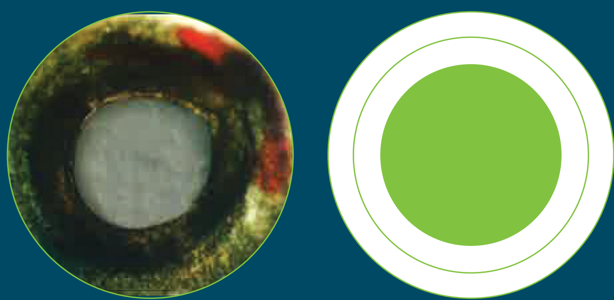
Cataract score 1
Cataract covers less than 10% of lens diameter



Cataract score 2
Cataract covers 10-50% of lens diameter



Cataract score 3
Cataract covers 50-75% of lens diameter



Cataract score 4
Cataract covers over 75% of lens diameter