



## Red Mark Syndrome (RMS)

### Introduction

Red mark syndrome (RMS) is a chronic and typically non-lethal skin condition affecting rainbow trout (*Oncorhynchus mykiss*). Red mark syndrome has been observed at several freshwater fish farms in Scotland since December 2003. The condition is characterised by single to multiple skin lesions, typically found on the flanks. These lesions can affect carcass quality, which downgrades the product and lowers its market value. The cause is unknown, and investigations into the aetiology and potential spread of the condition are being carried out by Fisheries Research Services (FRS) and other research organisations.

### Signs of RMS

#### Behavioural signs

There is no evidence of behavioural changes associated with this condition.

#### Temperature

Red mark syndrome is observed at water temperatures typically less than 12°C.

#### Clinical signs

Exophthalmia noted, also skeletal deformity, fin erosion and opercular shortening (see image below).



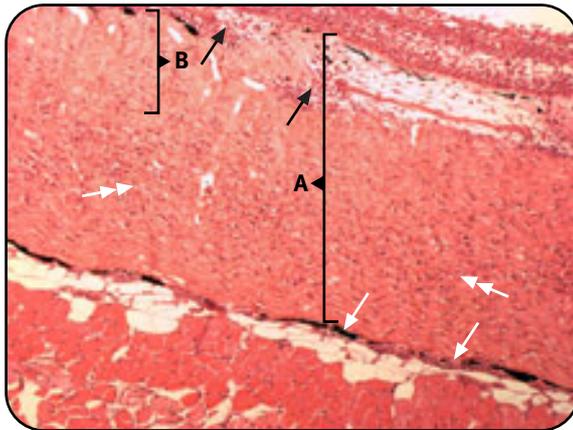
*Rainbow trout exhibiting exophthalmia*

#### Pathological signs

The single and multiple lesions are often perpendicular to the lateral line (see images below). These superficial, slightly raised lesions are usually well demarcated, haemorrhagic and generally appear below the lateral line. Scale displacement is recorded in the centre of the lesion.



*Rainbow trout demonstrating development of RMS lesions*



Rainbow trout skin. Severe dermatitis (A) with fibrosis (B), infiltration underneath the basement membrane, scale pockets (black arrows) and within the dermal layer (double arrow heads). Note also clumping of melanin granules in the underlying dermal melanocyte layer, and inflammatory cells (white arrows).

#### Mortality

Mortality is not directly associated with the condition. However, consequent secondary infection might lead to morbidity and death.

#### Treatment, recovery and withdrawal

Fish affected by RMS can recover without the need for treatment. However, the condition responds positively to antibiotic treatment, suggesting that there may be an infectious aetiology. However, typical withdrawal periods are over 500°C days, leaving treated fish unmarketable within that period.

#### Diagnostic investigations to date

Investigations have been undertaken to diagnose the cause of RMS. Diagnostic techniques include:

##### Bacteriology

Swabs from the lesion and kidney of infected fish have been inoculated onto media which are capable of growing a wide range of bacterium species. Kidney material has also been tested by enzyme linked immunosorbent assay (ELISA) for *Renibacterium salmoninarum*, the causative agent of bacterial kidney disease (BKD) and *Piscirickettsia*

*salmonis* the causative agent of salmonid rickettsial syndrome (SRS).

##### Virology

Kidney, heart, spleen and liver have been sampled to look for a wide range of viruses. Mucous samples have also been analysed for adeno-like viruses.

##### Histology

Samples have been taken for histological evaluation (see left). These included: eyes, gills, lesions, lateral line muscle, brain, heart, hind gut, kidney, liver, pyloric caeca and spleen.

##### Molecular genetics

Kidney samples have been tested to detect the presence of segments of ribo-nucleic acid (RNA) indicative of infectious salmon anaemia virus (ISAv), or salmon alpha virus (SAv).

##### Summary of results

To date, the cause of this condition has not been identified. Red mark syndrome has been confirmed by light microscopy in which infiltrating lymphocytes have been observed within the dermis, also slight fibrosis and an increase in red blood cells.

#### Biosecurity

Farmers should review biosecurity at their sites in accordance with their veterinary health plan (VHP).

#### Information and contacts

To improve our understanding of the spread of this condition, and help us understand its cause, FRS would like to hear from you. If you suspect the presence of RMS in any fish population, please contact the Fish Health Inspectorate (FHI) Duty Inspector at the address below.

Further information on the role of the FHI, and details of notifiable and other fish diseases, are available on the FRS website.

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