Nephrocalcinosis in rainbow trout reared in recirculation aquaculture system – a case study

Ivana Papežíková, Hana Minářová, Miroslava Palíková

Department of Ecology and Diseases of Game, Fish and Bees, Faculty of Veterinary Hygiene and Ecology, University of Veterinary and Pharmaceutical Sciences Brno, Palackého tr. 1946/1, 612 42 Brno, Czech Republic

INTRODUCTION

Nephrocalcinosis is a chronic inflammatory degenerative disease characterized by formation of calcium salt deposits in kidney and other tissues. In fish it develops mostly as a consequence of prolonged increased CO₂ levels in water. Another cause could be nutritional imbalances (magnesium deficiency or high selenium concentration in diet).

CASE HISTORY

• Czech Republic, 49°29'18” N, 16°19'52” E, altitude 335 m.
• Recirculation aquaculture system, intensive farming of rainbow trout (Oncorhynchus mykiss)
• Water source: ground water disinfected by ozone
• Low growth rates of fish and sporadic mortalities reported by owner
• All fish stocks were affected independently of age and origin

CLINICAL SYMPTOMS

• Enlarged body cavity
• Skin hemorrhages, rough areas on skin
• Behavioral changes (staying near water surface)

GROSS PATHOLOGY

• Distended swim bladder
• Patchy and swollen gills
• Distended ureters, enlarged Stannius bodies
• Enlarged kidneys

LABORATORY EXAMINATIONS AND FINDINGS

• Kidney smears (staining + microscopy) to exclude bacterial kidney disease (Renibacterium salmoninarum): NEGATIVE
• Histopathology (kidney + ureters): CONGESTION, VACUOLIZATION, CRYSTAL-LIKE TUBULAR DEPOSITS, INFLAMMATORY INFLTRATION
• Hematological examination: ANEMIA, LEUKOPENIA
• Von Kossa staining (kidney): CALCIUM DEPOSITS
• Blood calcium – NOT ELEVATED

FINDINGS TYPICAL FOR NEPHROCALCINOSIS

<table>
<thead>
<tr>
<th></th>
<th>farm with NC</th>
<th>reference farm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature (°C)</td>
<td>14.4</td>
<td>15.5</td>
</tr>
<tr>
<td>O₂ (%)</td>
<td>129.3</td>
<td>102.4</td>
</tr>
<tr>
<td>CO₂ (mg/l)</td>
<td>10.88</td>
<td>1.05</td>
</tr>
<tr>
<td>pH</td>
<td>6.97</td>
<td>7.85</td>
</tr>
</tbody>
</table>

DISCUSSION AND RECOMMENDED MEASURES

Nutritional imbalance was excluded as aetiological factor, as all fish stocks were affected despite of provided diet. Impaired water quality (mainly elevated CO₂ level) was probably the cause of the disease. It was recommended to elevate water pH and to decrease organic loads by reducing fish stock density, as high concentration of organic materials favors the increase of water CO₂ and the development of the disease.

ACKNOWLEDGEMENTS

This work was supported by NAZV1510077VFU