Abstract
Emerging diseases have had a significant impact on development of the Scottish Aquaculture industry, highlighting the importance of preventing their introduction and minimising transmission. Epidemiological research shows that the risk of disease spread is reduced by the implementation of good sanitary practices by fish farmers and fisheries, and the application of effluent disinfection systems in the processing industry.

A qualitative risk assessment of disease transmission was made of work practices on site during: transportation of live or dead fish and equipment; their harvest and processing; effluent discharge, and disposal of waste. Cleaning and disinfection procedures, based upon the current scientific knowledge and practical experience during outbreaks of serious disease and routine farm surveillance were developed for those practices. Effective disinfectant treatments are listed as best practice for each task, to reduce the potential for the introduction and spread of fish disease. Such guidance aims to improve communication at all levels, identify health risks and develop safeguard measures to protect Scottish aquaculture interests.

PREVENT THE INTRODUCTION OF DISEASE

a) Movements of ova, fish and their products pose a high risk to fish health.

b) Certification of ova, pre or post smolts should be of a high standard, ova should be disinfected prior to transportation.

c) Ideally, a water supply to a tank site should be pathogen free or be treated.

d) Each tank should have a separate water supply and outflow.

e) Good fish husbandry and strict bio security measures are Essential to fish health. Inspection for abnormal swimming behaviour or sick fish should be routine as should the removal of mortalities.

THE APPLICATION OF DISINFECTANTS

A list of suitable disinfectants and dose rates for various applications is given in the below table. The optimum conditions for disinfection are based on available literature and the table reflects best practice for the destruction of notifiable disease agents. Exceptional treatments are detailed within the comments box. It is assumed that all equipment is thoroughly cleaned and that effluent is properly filtered or pre-treated, prior to the disinfection process when applying the recommended doses.

<table>
<thead>
<tr>
<th>Disinfectant</th>
<th>Dose</th>
<th>Application</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlorine Dioxide</td>
<td>0.04-0.84%</td>
<td>Tank, net, harvesting, plant</td>
<td>Ensure active free chlorine level of at least 5 mg/l after 10 minutes.</td>
</tr>
<tr>
<td>Iodophor</td>
<td>0.04-0.13%</td>
<td>Fish farm vessels, ancillary</td>
<td>Fading colour, from brown to yellow, will indicate inadequate concentration.</td>
</tr>
<tr>
<td>Hydrogen peroxide</td>
<td>0.08-0.25%</td>
<td>Feed deliveries by boat</td>
<td>pH &lt; 4, 24 hours Ensiling fish waste. Torgersen, 1998. For ISA, BKD &amp; Furunculosis. Not IPN which is particularly resistant (Smail et al., 1993).</td>
</tr>
<tr>
<td>Peroacetic acid</td>
<td>0.04-0.13%</td>
<td>Fish farm vessels, ancillary</td>
<td>pH &lt; 4, 24 hours Ensiling fish waste. Torgersen, 1998. For ISA, BKD &amp; Furunculosis. Not IPN which is particularly resistant (Smail et al., 1993).</td>
</tr>
<tr>
<td>Formic Acid</td>
<td>0.08-0.25%</td>
<td>Harvetsing equipment</td>
<td>pH &lt; 4, 24 hours Ensiling fish waste. Torgersen, 1998. For ISA, BKD &amp; Furunculosis. Not IPN which is particularly resistant (Smail et al., 1993).</td>
</tr>
<tr>
<td>Ozone</td>
<td>0.08-0.25%</td>
<td>Pallets</td>
<td>pH &lt; 4, 24 hours Ensiling fish waste. Torgersen, 1998. For ISA, BKD &amp; Furunculosis. Not IPN which is particularly resistant (Smail et al., 1993).</td>
</tr>
<tr>
<td>UV</td>
<td>290 mJ/cm2/sec</td>
<td>Pallets, mooring, boat, vehicle, equipment, processing plant, building, effluent.</td>
<td>Filtration and pre-treatment are recommended. Treatment must be measurable potential of 600-750 mV. Filtration and pre-treatment are recommended. Treatment must be measurable potential of 600-750 mV.</td>
</tr>
</tbody>
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Guidance, Communication and Compliance is Essential to Maintain High Standards of Biosecurity

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To control the spread of disease, vehicles and equipment should not be used for other purposes. Cleaning and disinfection should be standard practice and only done by trained operators.

HEALTH & SAFETY (H&S)
It is important to follow current health and safety guidelines. Higher concentrations of disinfectant than is necessary can be dangerous to personnel. Label instructions should be followed carefully, referring to the manufacturer’s guidelines, including sell by date. Protective clothing, goggles and respirators should be worn where appropriate. Staff must be aware of the appropriate COSHH and risk assessments and be trained before undertaking any disinfection procedure.

IMPROVE COMMUNICATION

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DISINFECTANT
A disinfectant is an agent, which destroys infection-producing organisms. It is usually applied to inanimate objects and is often toxic or harmful to living tissue. The concentration and contact time are dependent on the conditions and procedure undertaken. Any disinfectant which has past its expiry date should not be used.

CLEANING AND DISINFECTION OF VESSELS AND EQUIPMENT
Clean by removal of all visible organic material using detergent to remove any grease or fats. Select an appropriate disinfectant which is effective against a broad spectrum of disease agents.

Refer to current official guidelines and seek advice, as necessary.

Apply the disinfectant to all surfaces and leave for the recommended time.

RISKS
- Well-boats
- Fish Farm Vessels
- Ancillary Equipment
- Feed Deliveries by Boat
- Pallets
- Nets
- Cages and Moorings
- Divers and diving gear
- Harvesting equipment
- Grading equipment
- Processing Plant effluent
- Waste disposal

WASTE DISPOSAL
Mortalities and fish waste should be collected routinely, be primary treated, e.g. by ensiling on site and be disposed of in containment by an approved method.

References
- Antec website http://www.antecint.co.uk/main/virkaqua.htm
- Liltved et al., 1993. Data only available for ISA.