

**SEA LICE RESEARCH AT
THE INSTITUTE OF AQUACULTURE**

Screening and development of new treatments

- Experimental models to test pharmaceuticals, vaccines & immunostimulants
- GLP/GCP efficacy, safety, residue depletion, environmental risk assessment
- Assessment of the use of alternative lice stages & other model organisms for in vitro bioassay screening (HIE/UoS)

Resistance

- Lab cultures of lice with varying sensitivities to existing treatments at MERL
- In vitro & in vivo techniques for monitoring of resistance developed & compared (publication in preparation)
- Stability of resistance in multiple generations underway (SARF/IntervetSP)
- Commercial studies to optimise existing treatment regimes in less sensitive lice populations eg combination treatments

Markers for resistance genes

- Candidate gene approach (IntervetSP/UoS)
 - Cf. Ivermectin in nematodes
 - e.g. Genes affecting ion channels in parasite nervous system (Slice action)
 - e.g. Genes controlling ABC transporters in epithelia – pump drug out
 - Resistant lice contain less treatment chemical after treatment
- Functional Genomics approach (Moredun/UoS)
 - Look at all genes in susceptible and resistant population
 - Datamining of existing ESTs
 - High throughput “second generation” method – 454 sequencing

Microarray studies

- Understanding of resistance
- Development of new chemotherapeutants
- Targets for vaccines
- Understanding of biological mechanisms

Genetics & Transcriptomics of Host Resistance (DEFRA) (Edinburgh, Glasgow, Stirling, Landcatch)

- In resistant species linked to inflammatory response in skin
- Linked to MHC variability
- IL-1 β & TNF α –like proinflammatory mediators
- Heritable
- Marker-assisted selection
- Affects parasite number not rate of parasite development

Microsporidian infections of Sea Lice and Salmon

- Desmozoon lepeophtheirii hyperparasite of *L. salmonis*. . PCR suggests also in salmon. ? Affect on Salmon
- Also in Norway (Are Nylund's group in Bergen)
- Damages egg production
- No data yet on distribution, life-cycle, transmission & detailed effects on lice and salmon in Scotland
- Other microsporidians often kill invertebrate hosts
- ? Biological control

Factors affecting susceptibility of Salmon to Sea Lice

- MH/UoS funded. PhD about to start
- Fish distribution & behaviour within cages eg light effects
- Lice reaction to salmon under range of environmental conditions
- Management options
- Link with IMR Bergen

FRESH START: THE RENEWED STRATEGIC FRAMEWORK FOR SCOTTISH AQUACULTURE

MINISTERIAL WORKING GROUP ON AQUACULTURE

Including Scottish Government, Industry, Marine Scotland
and other stakeholders

Healthier Fish and Shellfish Working Subgroup

IMMEDIATE PRIORITIES

- Creation of a national system for the collection of sea-lice and mortality data (by end of December 2009).
- Development of an improved strategy for control of sea-lice taking account of integrated sea-lice management approaches including effective sampling protocols and appropriate treatment interventions. (by end of March 2010).
- Delineation of appropriate scale management areas for all of Scotland to allow single year class stocking, simultaneous fallowing and area treatments. (by end of March 2010).

Three smaller scale working subgroups have been established for the above priority areas.

OUTCOMES

DELIVERY OF IMPROVED SUSTAINABILITY OF SCOTTISH AQUACULTURE

- Regulators better informed to allow rapid response to emerging problems
- To be achieved without increasing the regulatory burden
- Farm visits/inspections to be better focussed using a risk assessment approach
- Data to be useful for research purposes
- No new legislation envisaged – use of existing license conditions to ensure compliance

SEA-LICE CONTROL STRATEGIES

ISSUES

- Limited armoury of treatment products
- Lack of discharge consents may prevent alternation of treatment products
- Resistance development has led to major mortalities and welfare problems in some areas

WAY AHEAD

- Reinforcement of ISLM approach.
- Possible re-siting of Aquaculture installations.
- Sharing of knowledge on effective treatment protocols

Sealice Data

Delousing treatment efficacy

- ? Serial 'failed' treatment may indicate decreased sensitivity to medicines used
- Mandatory notification to Marine Scotland if 2 successive treatment efficacies of <50% Lep. removal (all stages)
- Report within 14 days of second treatment

Extraordinary Mortality Event

Seawater phase
From 6 weeks post initial stocking

Site average weight	Weekly mortality maximum	5 week rolling mortality maximum
Under 750 g	1.5%	6.0%
750g +	1.0%	4.0%

Report within 7 days of last reporting week

Co-ordination of farming areas

- 2 systems – COGP, Marine Scotland
Close similarity - modelling approach
- Single year class stocking, fallowing & synchronous lice treatment
- ? Use of 'farm clusters' within an area as interim means of achieving synchronicity
- Well boat treatments off site

Sealice Control Strategy

- Monitoring methodology from existing COGP
- Problems in sites with limited SEPA discharge consents
- Organic farming issues
- ISLM strategy – reporting on sharing & applying best practice

LICE MONITORING

- Based on sound science & statistics
- Weekly. Trained personnel. Random sampling
- > 5 pens/site, 5 fish from each of 5 pens
- < 5 pens, sample all pens. 25 fish total
- All stages of *L. salmonis* counted. Total Caligus
- Detailed records. Minimum requirement :- *Lep. chalimus*, non-gravid, mobiles, adult females

Criteria for treatment

- 1st February to 30th June
Average of 0.5 adult female Leps per fish
- 1st July to 31st January
Average of 1 adult female Lep per fish