Pathogens, welfare & consequences

- Pathogens are a major limiting factor in aquaculture systems.
- They impact on:
  - Mortality
  - Growth
  - Welfare
  - Quality
  - Trade
  - Saleability
- Great research emphasis on prevention & control
Pathogen modelling

1. Facilitate outbreak investigations.
2. Direct surveillance.
3. Assess pathogen impact.
4. Understand the processes.
5. Estimate values for missing parameters.
6. Facilitate control & management.
7. Make predictions (trends vs. exact outcomes).
8. Inform policy & economic assessment.
Model development

- Understanding the industry/systems is key.
  - Stakeholder engagement and observation.

- Knowledge of the pathogen life-cycles.
  - Experimental and field studies.

- The influence of the environment.
  - Stakeholders, and experimental/field studies.

- Different approaches may be required at the different levels.
  - Fish-to-fish vs. farm-to-farm transmission.
Within Site Epidemics

1. Infection
2. Incubation
3. Infection
4. Recovery
5. Reproduction

S → I → R

Th → C → To

Cefas
Within Site Epidemics

- I.D. knowledge gaps
- Assess impact = 20% mortality.
- Predict the peak of the epidemic - height & time.
- Determine site infectivity e.g. downstream spread.
- Assess the sensitivity of the system to different variables.
- Evaluate controls
Scaling up: limitations

- Epidemic models can be scaled up to study farm-to-farm spread.
- Often over predict the speed and impact of an epidemic.
- This is due to the assumption of random mixing/infection.
- Which gives each unit an equal probability of infection.
Network models
Combined models
Combined models
Combined models
Combined models
Conclusions

• Pathogens can have a significant impact on aquaculture and wild stocks.

• Modelling provides a way of assessing:
  - Impact
  - Conditions conducive to disease.
  - Influence of anthropogenic change.
  - Management and control options.

• To do this we must understand:
  - The system.
  - Pathogen life-cycle.
  - Networks.
THANK YOU