Dr Edmund Peeler
Vice President Aquatic Animals Commission

Aquatic animal disease control – what lessons can we learn to meet the ongoing challenge?

Aquatic Focal Point meeting, Qingdoa, China, December 12-14
Overview

- Disease as a constraint to production
- Disease and production system classification
- Biosecurity and production systems
- Where has the OIE focused its efforts
- The future of AAH
Aquatic animal health: what is the challenge?
World population 2000 BCE to 2010 CE

Source: IUCN/WWF Living Planet Report
AQUACULTURE PRODUCTION MUST DOUBLE BY 2050 TO SATISFY DEMAND (FAO 2014)

<table>
<thead>
<tr>
<th>Year</th>
<th>World population (billion)</th>
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<tbody>
<tr>
<td>2030</td>
<td>8.5</td>
</tr>
<tr>
<td>2050</td>
<td>9.7</td>
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<tr>
<td>2100</td>
<td>11.2</td>
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Aquaculture - one of the fastest-growing food sectors (6% pa⁻¹)

Aquaculture - 50% of fish for human food in 2012 (62% by 2030)

2012 – 158Mmt produced (136Mmt eaten)

2012 – aquaculture produced 90Mmt ($144bn)

Asian aquaculture produces almost 90% by volume

>600 farmed species (incl. ~40 spp. algae; 25Mmt pa⁻¹)

Wild capture fisheries are level while demand from an emerging global middle class substantially increases
Disease losses in aquaculture >$6bn pa (WB, 2014)
Avoidable losses

maximum net benefit ($D$) from expenditure $E_1$.
Maximum benefit (disease eradication) is shown by the limit $A$.

J.P. McInerney Old economics for new problems - livestock disease: Presidential address
The challenge

How do we achieve maximum net benefits from investment in disease control in aquaculture?

What can OIE to support this ambition?
Classifying disease and production systems

The small part of ignorance that we arrange and classify we give the name of knowledge.
Ambrose Bierce
Classification of disease

- Endemic, ubiquitous (not listed)
  - Production diseases
- Epidemic transboundary
  - Listed diseases
  - Emerging diseases
Fish diseases
- Epizootic haematopoietic necrosis disease
- Infection with Aphanomyces invadans
- Infection with Gyrodactylus salaris
- Infection with HPR-deleted or HPR0 infectious salmon anaemia virus
- Infection with salmonid alphavirus
- Infectious haematopoietic necrosis
- Koi herpesvirus disease
- Red sea bream iridoviral disease
- Spring viraemia of carp
- Viral haemorrhagic septicaemia

Shrimp disease
- Acute hepatopancreatic necrosis disease
- Crayfish plague (Aphanomyces astaci)
- Infection with yellow head virus
- Infectious hypodermal and haematopoietic necrosis
- Infectious myonecrosis
- Necrotising hepatopancreatitis
- Taura syndrome
- White spot disease
- White tail disease

8 viral diseases
1 oomycete
1 parasite
0 bacterial

6 viral diseases
1 oomycete
0 parasite
2 bacterial
Classification production systems

- **Shared water sources**
  - Rivers
  - Estuaries
  - Coastal

- **Epidemiologically isolated**
  - Recirculation
  - Protected water
    - Spring water
    - Off line ponds
  - Geographically remote
Classifying avoidable losses by disease and production system

<table>
<thead>
<tr>
<th>Disease</th>
<th>Production system</th>
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<tbody>
<tr>
<td></td>
<td>Open water</td>
</tr>
<tr>
<td>Endemic</td>
<td>%</td>
</tr>
<tr>
<td>Epidemic</td>
<td>%</td>
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How do we invest to maximise avoidable losses due to disease?
Where have the OIE focused effort?
Sanitary safety & transparency

- OIE focus
  - Reporting of listed diseases
  - Establishment of areas free of listed diseases
    - Countries, zones and compartments
  - Making international trade safe
    - Health certification for live animals
    - Safe products
- How successful has this been?
- Do we now need to focus elsewhere?
Biosecurity is a prerequisite for disease freedom

“Biosecurity is a set of management practices that collectively reduce the potential for the introduction or spread of animal disease-causing organisms onto and between farms"
OIE standards for freedom

BASIC BIOSECURITY CONDITIONS

- the disease is **compulsorily notifiable** to the competent authority
- an **early detection** system (i.e. surveillance) for the disease
- **import restrictions** to prevent the introduction of disease
  - imported susceptible species must be certified as originating from recognized free countries, zones etc.

Requires considerable investment by government
Shared water

Endemic

Isolated

Epidemic

Free zone or country

Free compartment

Management:
Therapeutics
Environmental quality

Free compartment (RAS only)
Costs & benefits of disease freedom

**Costs**
- Infrastructure
- Human resource
- Eradication costs
- Reduced access to overseas stock

**Benefits**
- Decreased production costs
- Improved welfare
- Increased overseas markets
- Protection of wild stocks
Measures of success

- Percentage of production in self-declared disease free areas
  - Lack of data for accurate assessment
  - Finfish >> Shrimp > Molluscs
- Successful eradication campaigns e.g. VHSV in Denmark
- Prevention of spread of a new emerging disease
What does the OIE need to do meet the challenge and realise the vision?
The vision for the next 10 years

Giving farmers tools

- Therapeutics
  - Autogenous emergency vaccines
  - New antimicrobials
- Breeding SPF and disease tolerant stock
- Broader biosecurity
- Early warning & surveillance
  - Use of mobile technology for surveillance
  - Point of care rapid diagnostics
  - Application of HTS to identify changes in the microbiome
Giving farmers tools

- Biosecurity
- Disease early warning
- Pathogen detection
Farm level biosecurity

- Disease freedom not technically or economically feasible for
  - Many pathogens
  - Many production systems
- Need standards to support Member Countries assist farmers to develop appropriate biosecurity
Impact of farm level biosecurity by production system

- RAS
- Protected water
- Open water

Risk of disease introduction
Development of surveillance standards

- A move from input-based to output-based standards
- Recognition of the potential value of surveillance activities that are not based on structured randomised surveys
- Recognising the effect of the accumulation of evidence over time
- Comprehensive consideration of the factors and issues to be taken into account when designing surveillance
Improving disease reporting – a bottom up approach

‘With the sudden availability of unparalleled communication and data management capabilities, many constraints in surveillance have been swept aside’ Angus Cameron

- Obtaining data is now much easier
- The challenge has shifted to rapid analysis of large volumes of near-real time data
Farmer based reporting systems

- iSIKHNAS is Indonesia's integrated real-time information system for collecting, managing, reporting and using data to support animal health and production. It is:
  - **bottom-up and people-focused**: primarily concerned with bringing benefits to field users
  - can be accessed (both in the submission of and demand for information) by SMS, Web, e-mail, instant messaging
  - **fast and powerful**: data is sent directly from the field to the integrated database
  - **Effective**: iSIKHNAS gets the right information, at the right time, to the right people, in the right form to enable good evidence-based decision-making
Can it be developed for aquatic animal diseases?
Pond side testing

Point-of-Care System for Detection of *Mycobacterium tuberculosis* and Rifampin Resistance in Sputum Samples

Pablo Castán, Alicia de Pablo, Natalia Fernández-Ramos, José Miguel Rubio, Benjamin D. Cobb, Jesús Mingorance, Carlos Toro

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Decentralise testing and centralise data
Future - ‘early warning’ tools

Period of detection to outbreak can be very short

Pre-warning of impending disease outbreaks desirable

Emergent technologies (e.g. eDNA) can combine with environmental diagnostics (e.g. remote sensors) to engender a grass-roots approach to early detection of disease

Farmers have data for stop-go decisions on their own farms

Centralised data collection provides information for Government decision making
A new paradigm for surveillance

Staring with aquatic health management by farmers

- Incentivise farmers to report early warning signs, morbidity, mortality & pathogen detection to Government by provision of
  - Advice, information, or visit / treatment

- Processing near real time data (large volume, poor quality) generate information: emerging disease, listed disease, constraints to production

Decision making by farmers

Decision making by government
What role can the OIE play?

What assistance do Competent Authorities need?

- Revised standards for vaccines and use of antimicrobials
- New standards for biosecurity that go beyond establishment of disease free compartments
- Surveillance standards recognise
  - Need for new approaches to analysis of surveillance data
  - New molecular technologies for early warning of disease outbreaks
Conclusions
Conclusion

- Most aquaculture is based in low income food deficit countries
- Aquaculture production must double by 2050 to meet demand
- Disease will continue to be a major constraint
- OIE needs to directed effort at both trade limiting, transboundary diseases and yield limiting endemic diseases
- Research needs to translate to application
Acknowledgements

New Paradigms to Help Solve the Global Aquaculture Disease Crisis

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Thank you for your attention