

Amoebic Gill Disease (AGD)

Dr. Hamish Rodger,
Vet-Aqua International,
Oranmore, Co. Galway, Ireland



www.vetaquainter.com

Outline

- Background & brief history
- The parasite
- Clinical signs & diagnosis
- Treatment/s and control
- Prevention & monitoring





- Clients in Ireland, UK, rest of world
- Disease diagnostics
- Health management
- Consultancy
- Training
- Research



Brief history of amoebic gill disease (AGD) in marine salmon

- Australia since 1980s
- WA, USA (1985 –)
- Ireland 1995 (8 sites), sporadic since until 2011 outbreak (12 sites)
- France & Spain (1995)
- Scotland (2006 – 7 [2 sites] & 2011 [26 sites])
- Norway 2006 (4 sites)
- Chile (2007 -)

AGD impact - Australia

- 10% stock loss/week untreated in Australia
- Reduced growth
- Freshwater baths prophylactic (13 x in 15 month cycle)
- 50 – 75 litre FW/smolt
- Adds 10 – 20% production cost
- 80c – AUD\$1/kg COP

AGD impact – Scotland & Ireland

- Mortalities
- Loss in growth
- Increased percentage poor condition
- Increased susceptibility to disease
- Mortalities at sea lice bath treatment
- Emergency/early harvests

AGD risk factors

- High salinity (> 32ppt)
- High water temperature
- Infected sites in area
- Blooms or swarms?
- Prior gill disease?
- Biofouling?
- Smolt quality/size?
- Farming area/site?



AGD 2011 Europe – 1st indications

- France – July
- Ireland – August (and re-emerged October)
- Scotland – September
- Why?



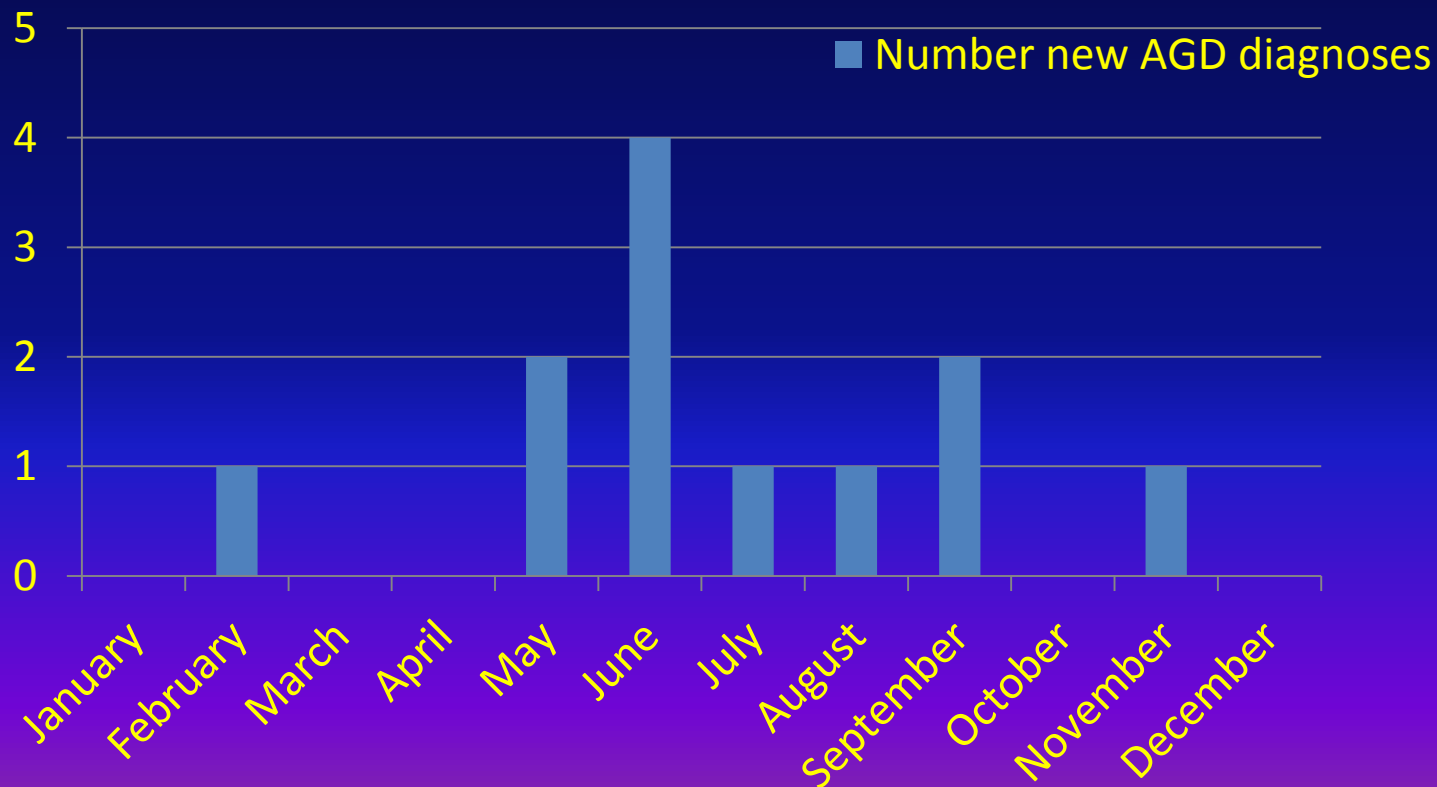
2012

- Continued in sites from 2011
- France, Ireland & Scotland
- Orkneys, Shetland (August onwards)
- Norway (November)



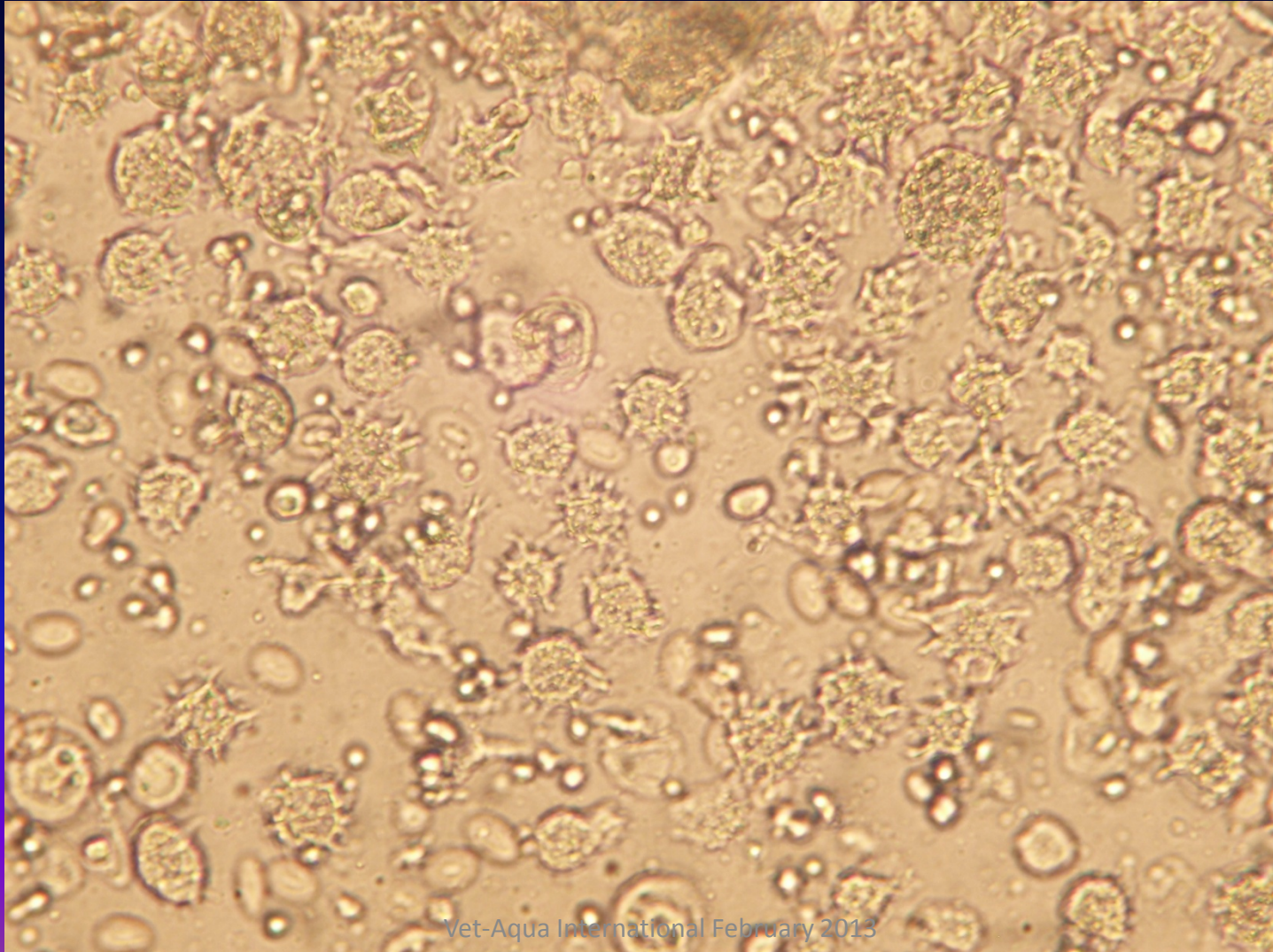
AGD 2012 Ireland

- 15/20 marine sites had AGD (some from 2011)
- All had mortalities



The parasite (*Neoparamoeba perurans*)

- high burden on gill smear



Neoparamoeba perurans

- *Paramoeba pemaquidensis*
- *Neoparamoeba pemaquidensis*
- Then confirmed new species
- *N. perurans*
- parasome



Neoparamoeba sp.

Free living & parasitic

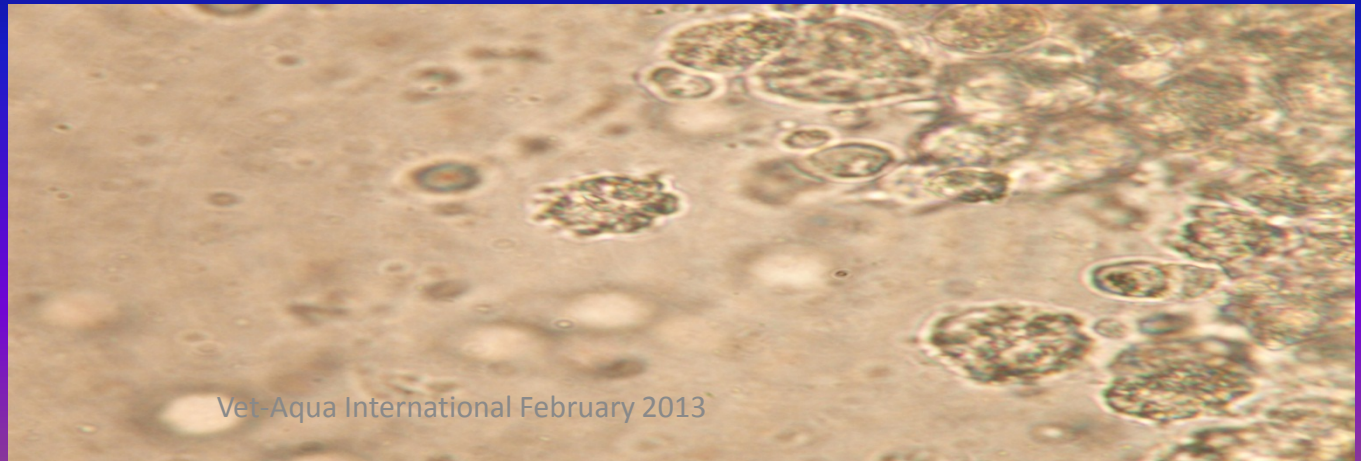
Survives in sediment & net pens

Spread in seawater (>1km)

Survives in seawater at least 14 days

Mean generation time 16 hours

N. perurans now cultured (Crosbie *et al.* 2012)



Clinical signs & diagnosis



Gill scores (0 – 5)

AGD gross pathology

-May under/over estimate AGD

-Smaller fish worst affected

- Support with fresh smears and histology



Gross gill score system

(from Taylor *et al.* 2009)

Infection level	Gill score	Description
Clear	0	Healthy red colour
Very light	1	1 white spot, light scarring or undefined necrotic streaking
Light	2	2 – 3 spots/small mucus patch
Moderate	3	Thick mucus patch or spot groupings (up to 20% gill area)
Advanced	4	Up to 50% of gill area
Heavy	5	Majority of gill surface

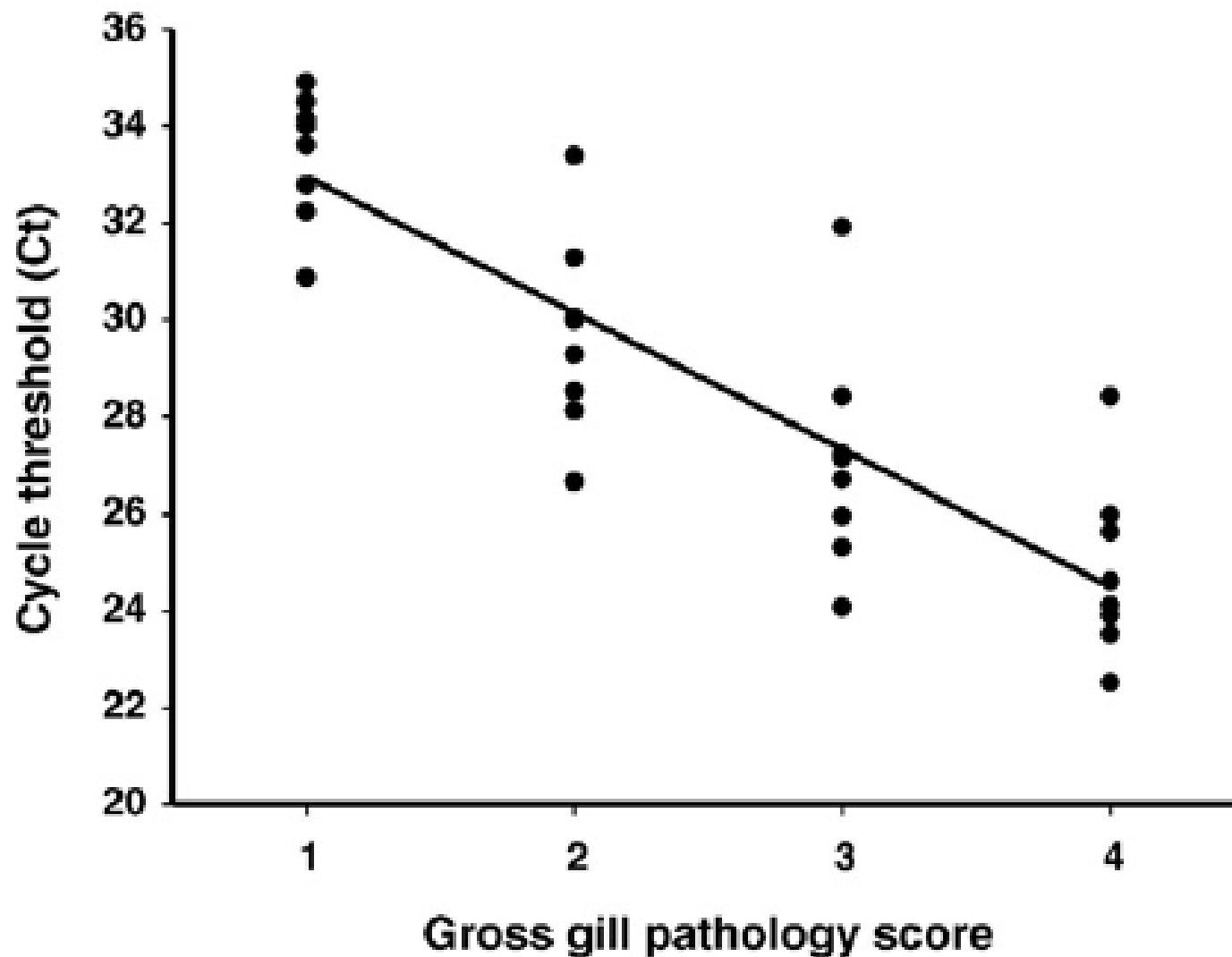


Fig. 3. Relationship between gross gill score as determined by salmon farmers and PCR results for gill swabs.

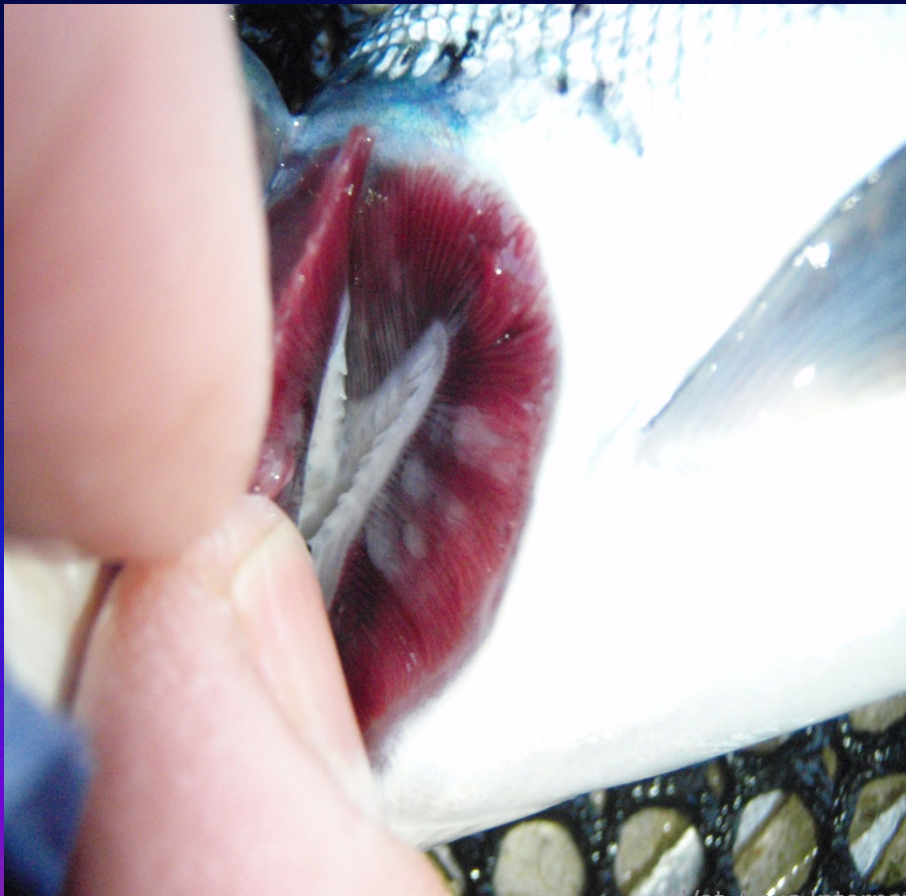
Gill monitoring

- Weekly exam (with lice exam)
- Gill score
- Fresh microscopy (sample lethargic, check nodules, etc.)
- Histopathology (ditto)
- PCR



AGD pathology

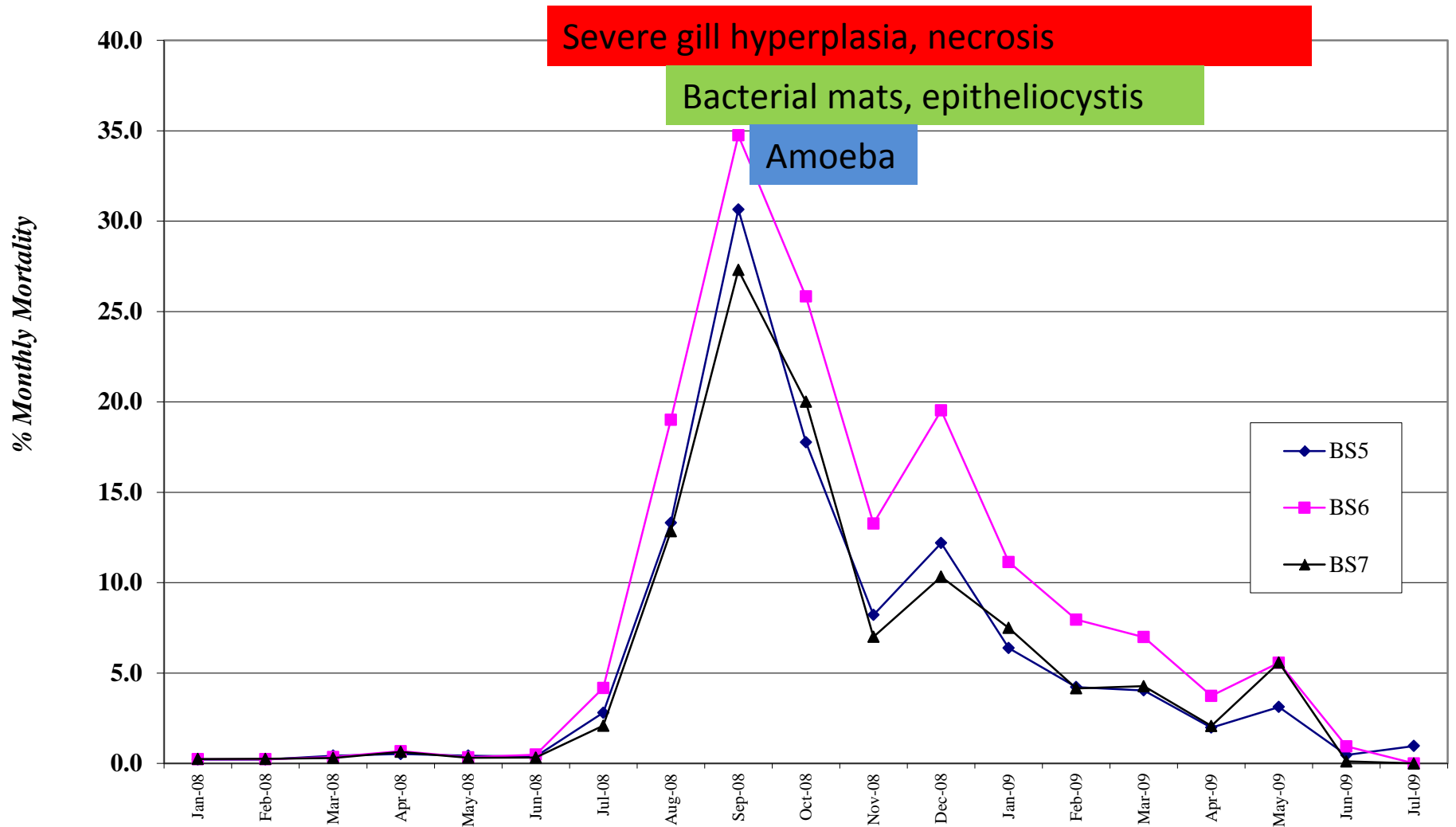
Early stage lesions



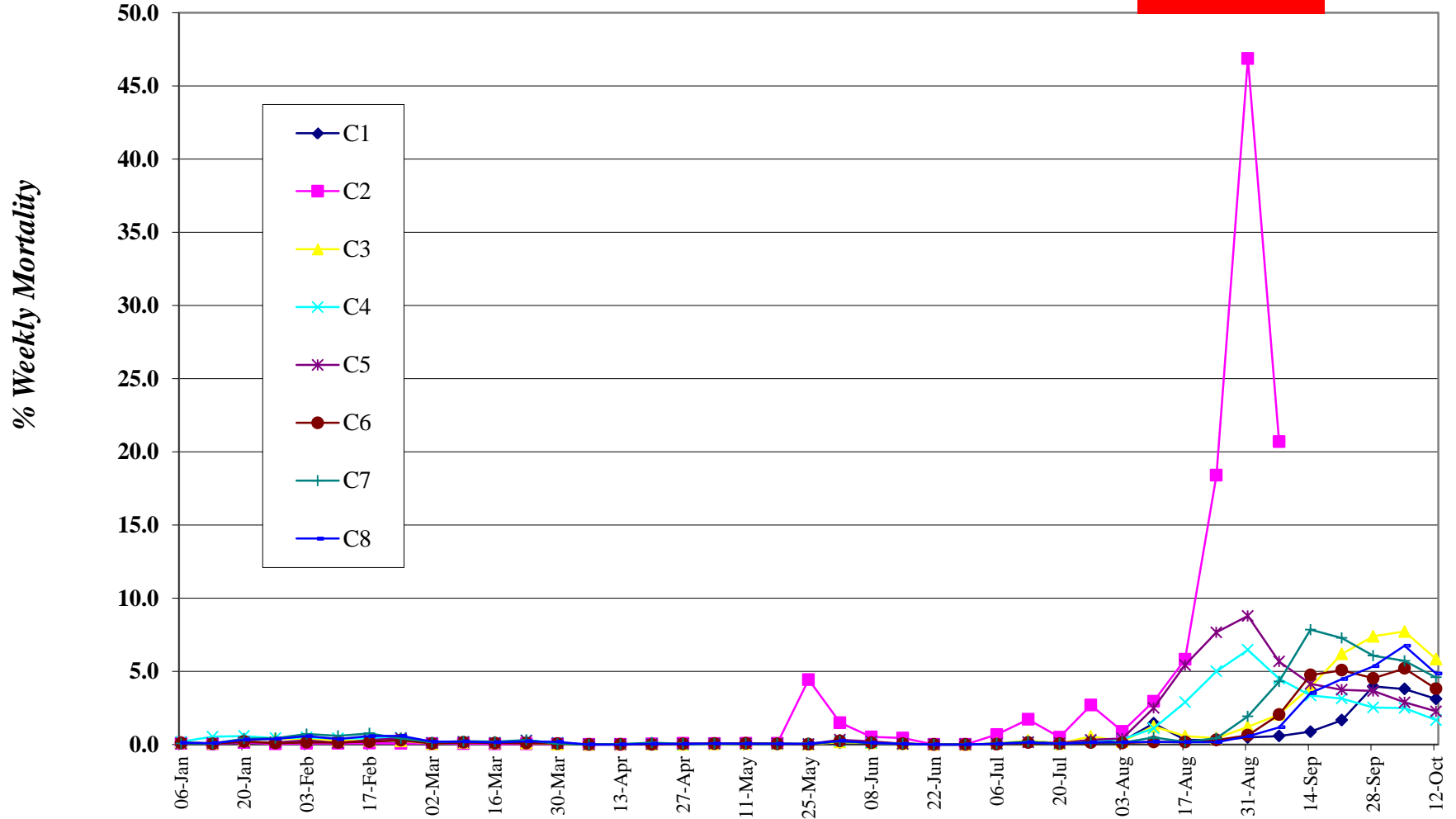
Healing (adaptive, post treatment)

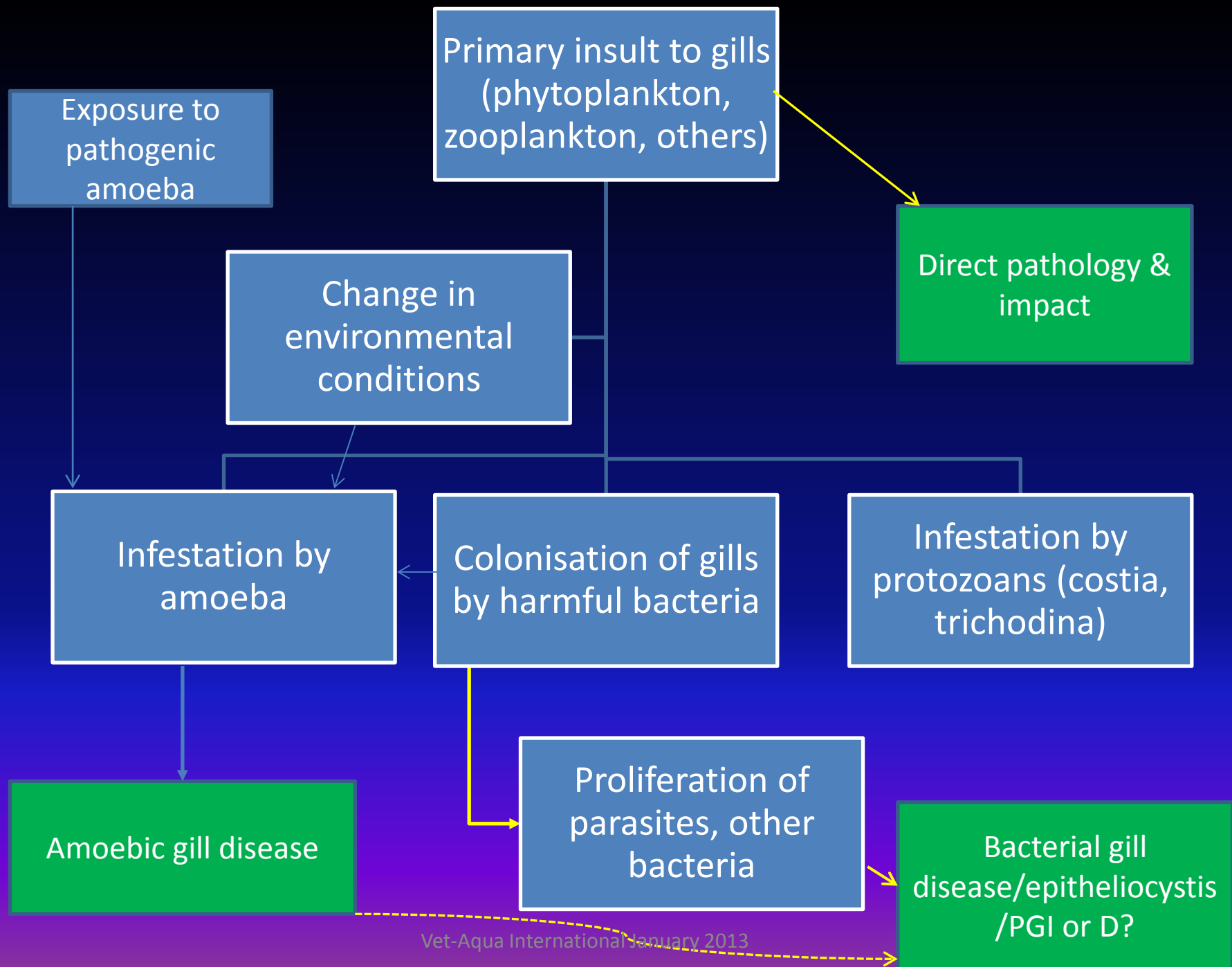


Site C 07GS0 Mortality Per Pen



Site B 07GS0 Mortality Per Pen



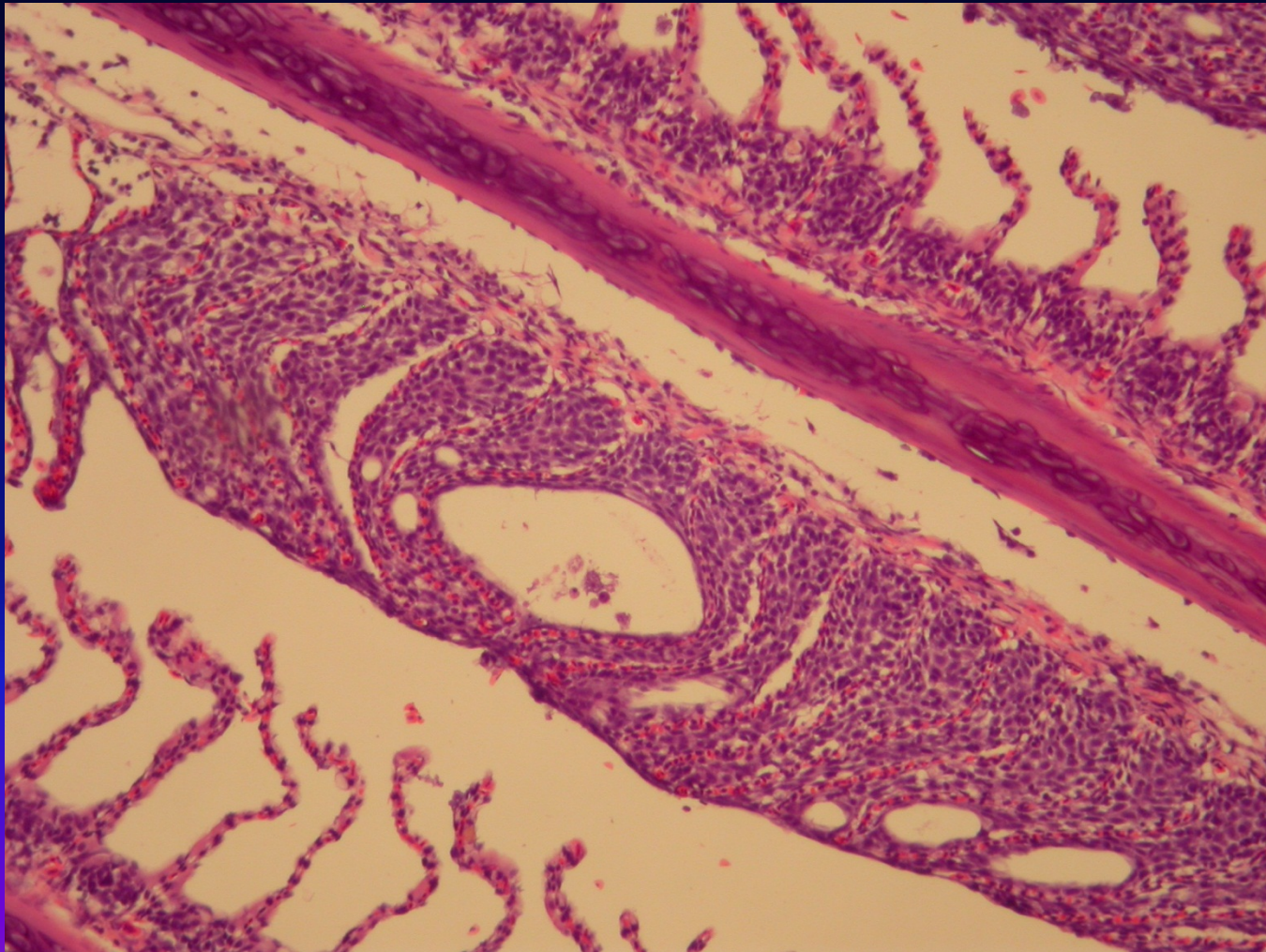


Diagnosis

- Clinical signs
- Fresh gill smears (technique)
- Stained smears
- Histology
- Molecular (PCR)



AGD histopathology



Treatment & control

- Freshwater baths (2 – 3 hours), <3ppt
Softer freshwater better
- Hydrogen peroxide (1000 – 1400ppm, 20 – 30 minutes), temperature...
 - Formalin?
 - Chloramine T?
 - In-feeds?

Freshwater bath treatments (Tasmania), courtesy of Dr. R. Taylor



An aerial night photograph showing a fish transfer operation. Two large, circular, illuminated pens are visible, connected by a narrow channel. A small boat is positioned in the channel between the pens. The water is dark, and the pens are brightly lit from below, creating a strong contrast. The text "Fish crowded from donor pen" is overlaid on the right side of the image, and "Transfer by triple or quadruple airlift - 100+ t/hr" is overlaid on the left side. A red light is visible in the lower pen.

**Transfer by triple or
quadruple airlift - 100+ t/hr**

Fish crowded from donor pen


**Bath 2+ hours in
freshwater liner, 3.5
Megalitre (40-60
kg/m³ density)**

Crowding of fish for treatment



2

Empty cage is towed back ashore for
liner insertion and freshwater filling

An aerial photograph of a water treatment facility. Three large, circular, light-colored tanks are arranged in a triangular pattern. In the center is a rectangular building with a flat roof. A yellow line originates from a point in the lower-left area of the image and points towards the central building. One of the circular tanks, located in the upper right, contains a long, dark, cylindrical object.

Liner is slung in empty pen and refilled

**Freshwater pipeline
from local river
(7km) and dams (100
MI capacity)**

Transfer of fish to treatment pen



Freshwater treatments in wellboat - Ireland



Freshwater pen treatment - Ireland



Hydrogen peroxide in pens - Ireland



Scotland

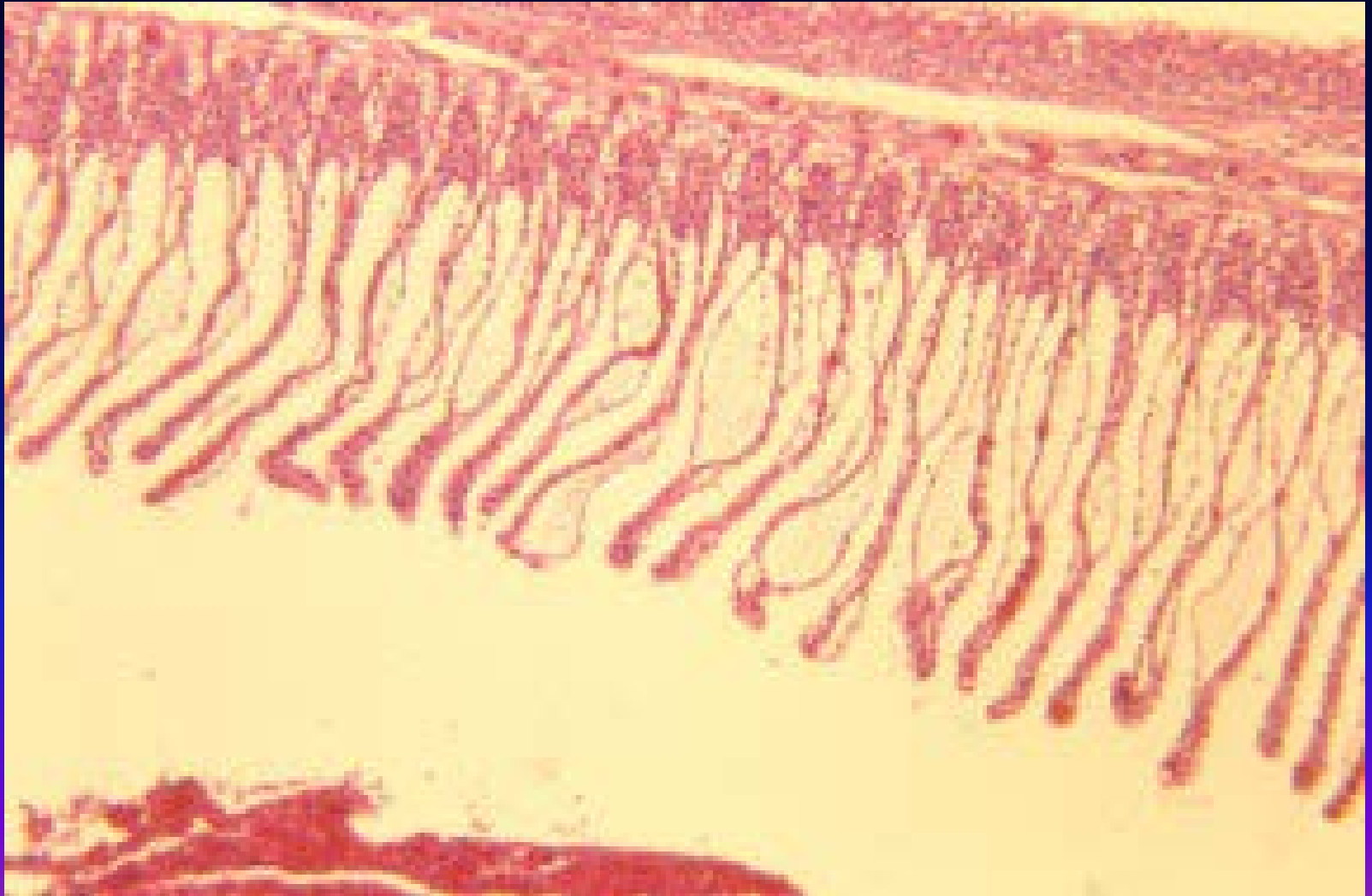
- Hydrogen peroxide (1000 – 1400ppm, 20 – 30 minutes)
- Well-boats & tarpaulins
- New experiences for some!
- Some sites now treated 6x for AGD
- Only partial clearance at many treatments
- Some mortalities
- Up to 15°C

Variables with peroxide

- Water temperature (beware)
- Gill condition (scores)
- Organics (algae) in water
- Size of fish & biomass
- Mixing, dilution & monitoring



H₂O₂ gill pathology – lice treatment



Treatments - Ireland

- Freshwater in well-boats or treatment pens
- 8 to 17°C
- 2 to 3 hour baths
- Only mortalities if oxygen low
- Excellent clearance and improvement



Treatments - Ireland

- Hydrogen peroxide
- Well-boats & tarpaulins
- 600 – 1200ppm, 18 – 22 minutes
- 8 to 17°C
- Very high mortalities in some (temperature, gills)
- Only partial clearance



Prevention & monitoring

- Weekly gill checks for signs (beware)
- plus fresh microscopy
- Regular histopathology (& PCR)
- Early treatment (be prepared)
- Staff training and awareness
- Net cleanliness & hygiene
- Mort removal
- Fallowing

Training

Vet Aqua 
INTERNATIONAL

Gill scoring

Fresh microscopy

Amoeba identification

**5 practical workshops for Scotland
in 2012**



Future

- Single bay management & fallowing
 - Improved bath treatments
 - Alternative treatments
 - Genetics
 - Vaccine?
 - In-feed treatments?
 - Functional feeds?
-
- Will AGD recur?....
 - Major research focus required

Screening of wild flora & fauna



Mackerel (*S. scombrus*) & Lumpsucker (*Cyclopterus lumpus*) positive for *N. perurans* - Scotland



Summary

- AGD major challenge for marine salmon farms
- Has caused significant losses in Europe
- Early detection & preparedness crucial
- Be prepared

Acknowledgements

- Dr. R. Taylor, CSIRO, Tasmania
- Dr. S. Mitchell, Vet-Aqua Inter.
- Salmon farmers, vets & biologists in Ireland & Scotland
- The Faroese Fish Farmers Association