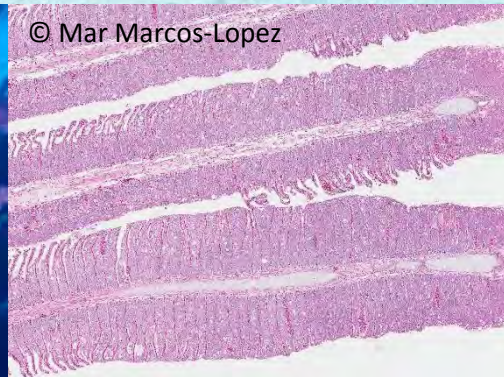


# GILL HEALTH IN IRELAND

Mar Marcos-López, Hamish Rodger, Susie Mitchell

Gill Health Initiative, Galway 16<sup>th</sup> April 2015

[www.vetaquainter.com](http://www.vetaquainter.com)



# Vet-Aqua International

- Clients in Ireland, UK and other countries
- Disease diagnosis
- Health management
- Consultancy
- Training
- Research
- [www.vetaquainter.com](http://www.vetaquainter.com)



Dr. Hamish Rodger



Dr. Susie Mitchell



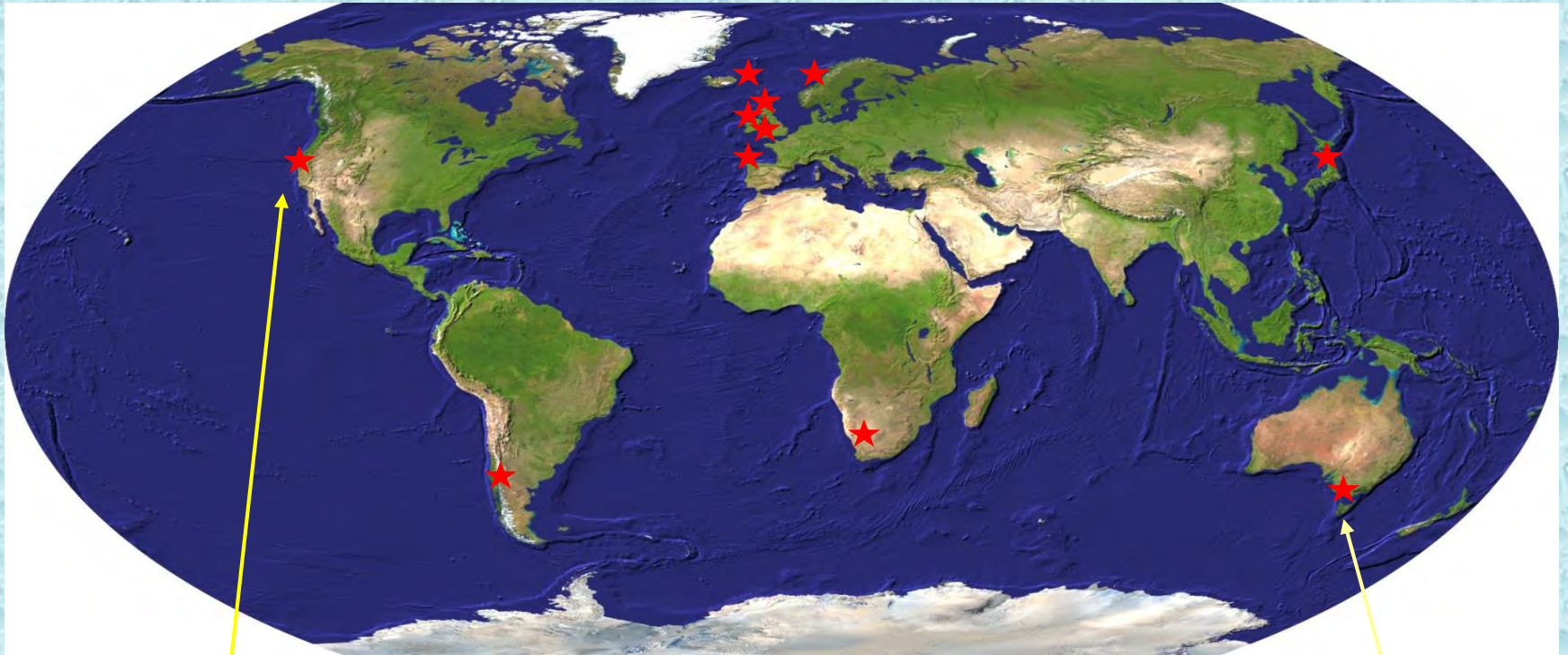
Mar Marcos Lopez



FishVet  
Group



# AGD history and evolution



Kent et al. 1988



© Hamish Rodger

Munday 1986

# Atlantic salmon farming in Ireland



22 active marine sites in 2014

~12.000 T annual production

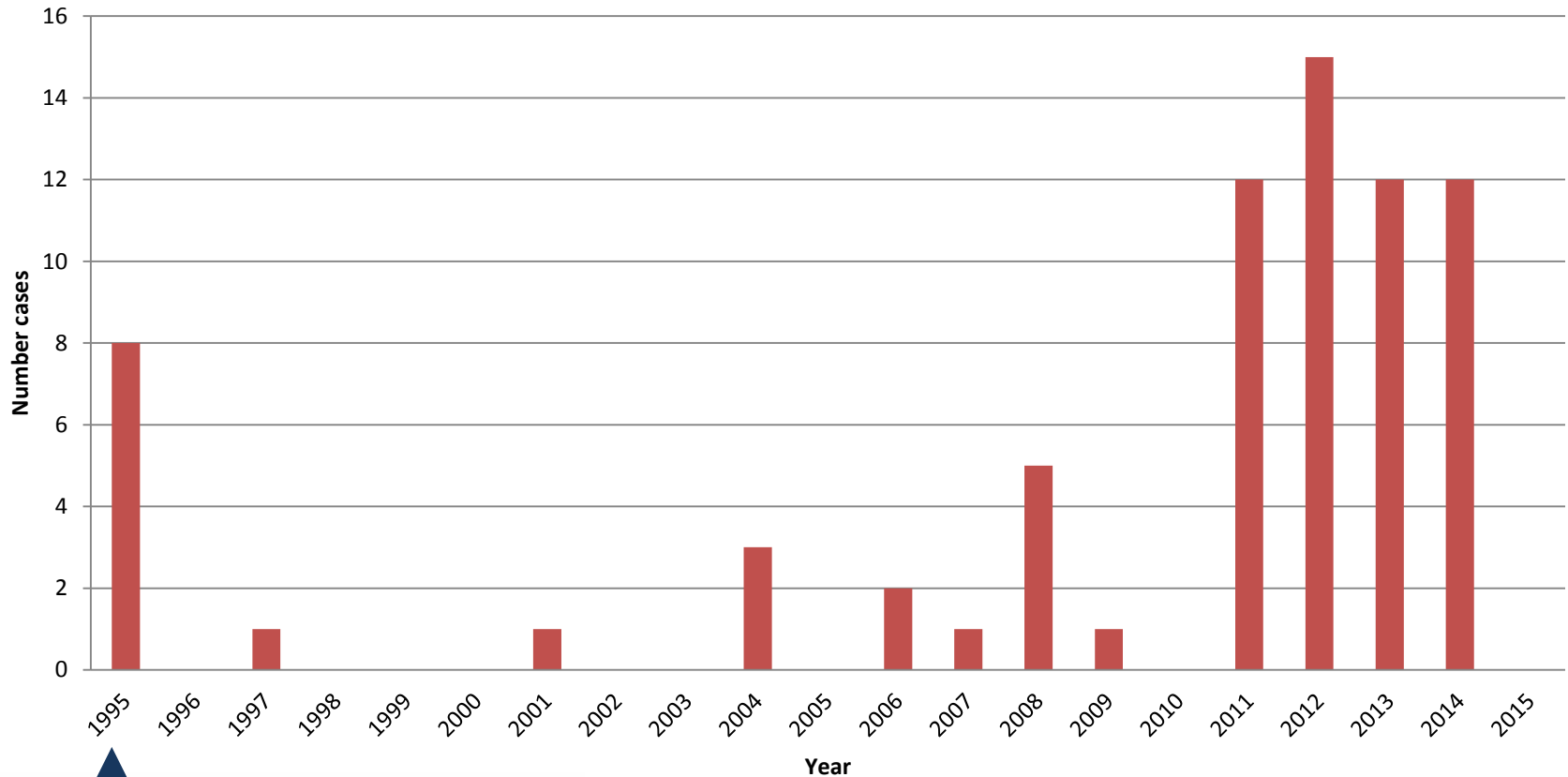
Mostly certified organic

Temperature range 5-18°C



# 20 years of AGD in Ireland

AGD positive salmon farms (new cases) 1995 to 2015



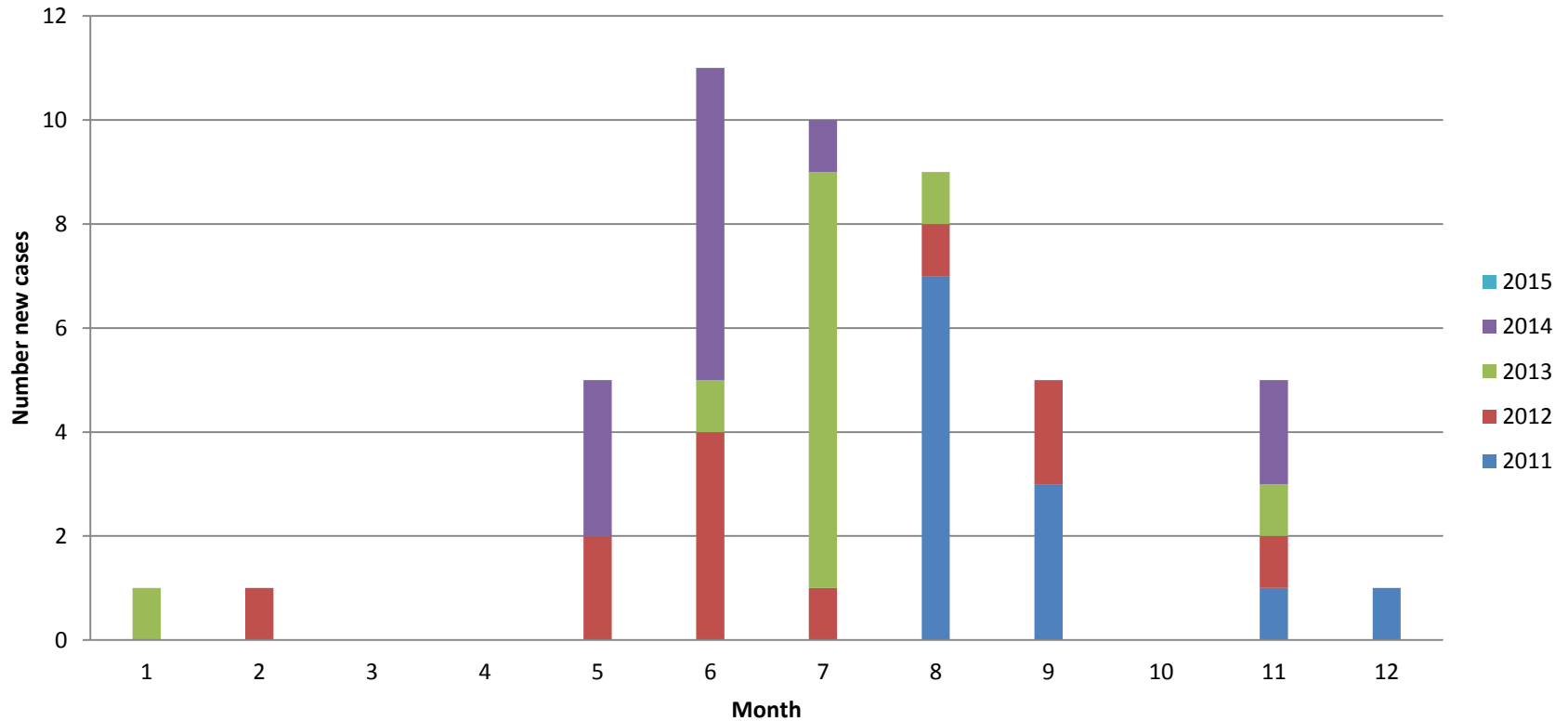
An outbreak of amoebic gill disease  
in Ireland

H. D. Rodger, J. F. McArdle

*Veterinary Record* (1996) **139**, 348-349

# Annual AGD evolution

Month of AGD confirmation (new cases) Ireland 2011-2015



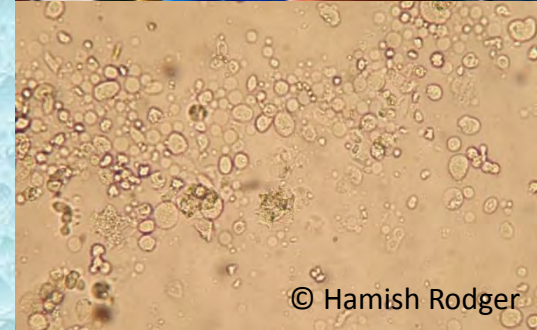
Spring { May: 3 cases (S1s)  
June: 6 cases (5 S1s and 1 S0s)  
July: 1 case (S1s)

Autumn { November: 2 cases (S0s)

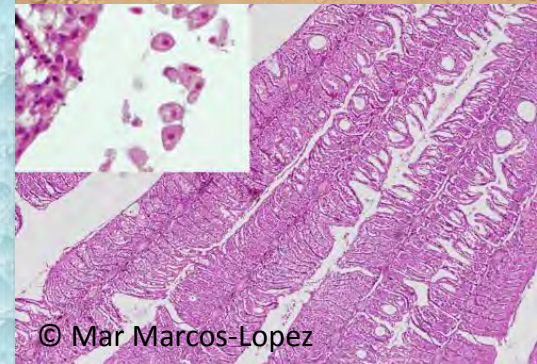
# Monitoring & Surveillance

- **Gill scores weekly**
  - On-site monitoring, early detection, decision treatment date
- **Fresh microscopy on any lesions**
  - Confirmation, amoeba burden, treatment efficacy
- **Histopathology monthly**
  - Confirmation, severity lesions, treatment efficacy, other diseases
- **PCR**
  - Early warning, agent confirmation, treatment efficacy, non-lethal monitoring (swabs)

© Hamish Rodger



© Hamish Rodger

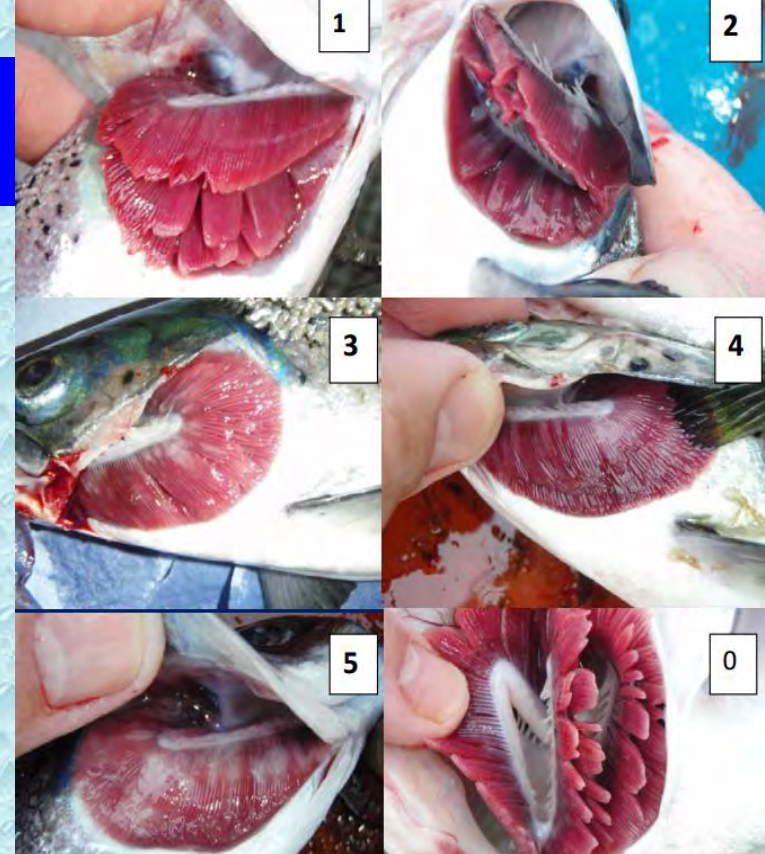


© Mar Marcos-Lopez





# AGD GILL SCORING



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

*Adapted from Taylor et al. 2009*



# AGD mortalities in Ireland 2014

- AGD is still one of the main causes of mortality.
- Overall mortalities lower than previous years.
- Data from 15 sites (4 companies)
  - 73% = 1-5% mortalities
  - 7% = 5-10% mortalities
  - 20% = >10% mortalities

# AGD mortalities in Ireland 2014

- Significant impact of mortalities during/after treatment.
  - Stress / low oxygen during and after treatment
  - Physical damage during treatment
  - Presence concomitant diseases (e.g PD)  
(fish more susceptible to stress)
  - Gill health prior treatment

FW treatment



PD affected fish





# Treatments

- Mostly freshwater baths (3h, <3ppt)
- Mostly wellboats but also PVC tarpaulins
  - Limited availability wellboats
  - Tarpaulins limited by access to freshwater and weather conditions
- Early treatment ( $GS \leq 1$ )
  - Less losses from clinical disease
  - Less losses from treatment
  - Better amoeba clearance
  - Greater time period between treatments

# AGD impacts

- All new inputs got infected.

*Can we still talk about risk factors for AGD in Ireland or should we say impact accelerators...?*

- Mortalities
- Loss in growth
- Mortalities at sea lice bath treatments
- Increased susceptibility to other diseases/stress
- Increased economic cost (e.g. treatments)



# CHALLENGES

- All year-round disease - Multiple treatments
- Access to freshwater and equipment (wellboats)
- Increasing water temperatures (disease/treatment)
- Concomitant diseases (stress treatment)
- No alternative treatments
- Economic sustainability
- Differential diagnosis – histopathology

# OTHER GILL DISEASES

## Environmental

- Harmful phytoplankton
- Harmful zooplankton

Low oxygen, toxicity,  
gill irritation, mechanical damage



Necrosis, haemorrhages, tissue disruption



Vascular disturbances, inflammation,  
necrosis, epithelium hyperplasia/fusion

Summer / Autumn months

2013 - High mortality due to *P. noctiluca*  
2014 - Background health challenge in most  
farms. Moderate impact in two sites

Diagnostic challenge



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© Hamish Rodger



# OTHER GILL DISEASES

## Infectious

- *Desmozoon lepeophtherii*



Thickened, mucus, pale/haemorrhagic(?)



Gill epithelium proliferation and necrosis  
Other gill changes?

Can be systemic

Autumn months

High prevalence at low levels

Challenge analysis PCR results

Challenge routine histology diagnosis

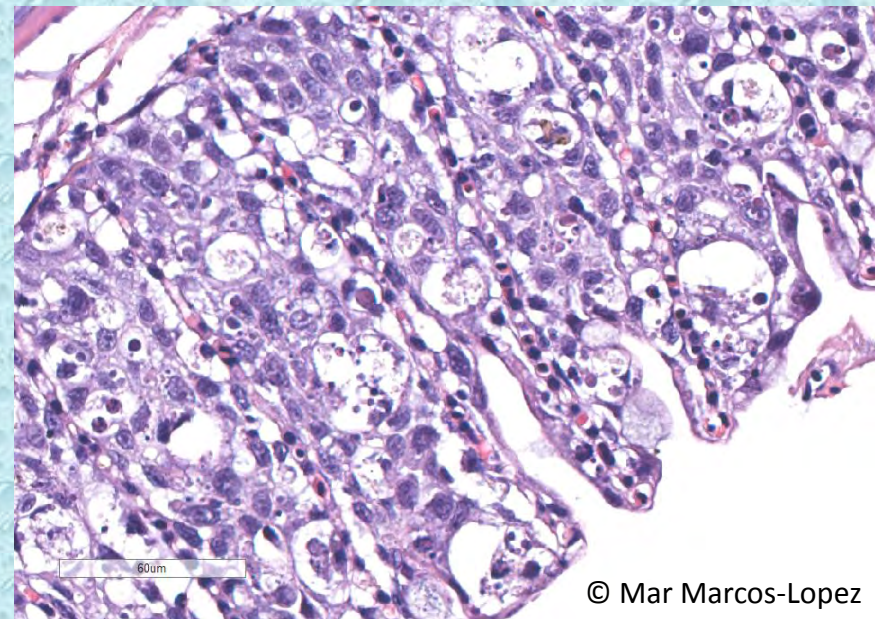
2013 – 1 case (Ct value ~ 18)

2014 – 1 case (Ct value ~ 15-18)

Need for further research



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# OTHER GILL DISEASES

- Other parasites  
(*Ichthyobodo* sp., *Trichodina* sp.)

Minimal/negligible impact

- *Tenacibaculum* sp.

Mostly secondary  
Mechanical damage  
Jellyfish damage

- Epitheliocystis  
(*P. salmonis*, *B. cysticola*)

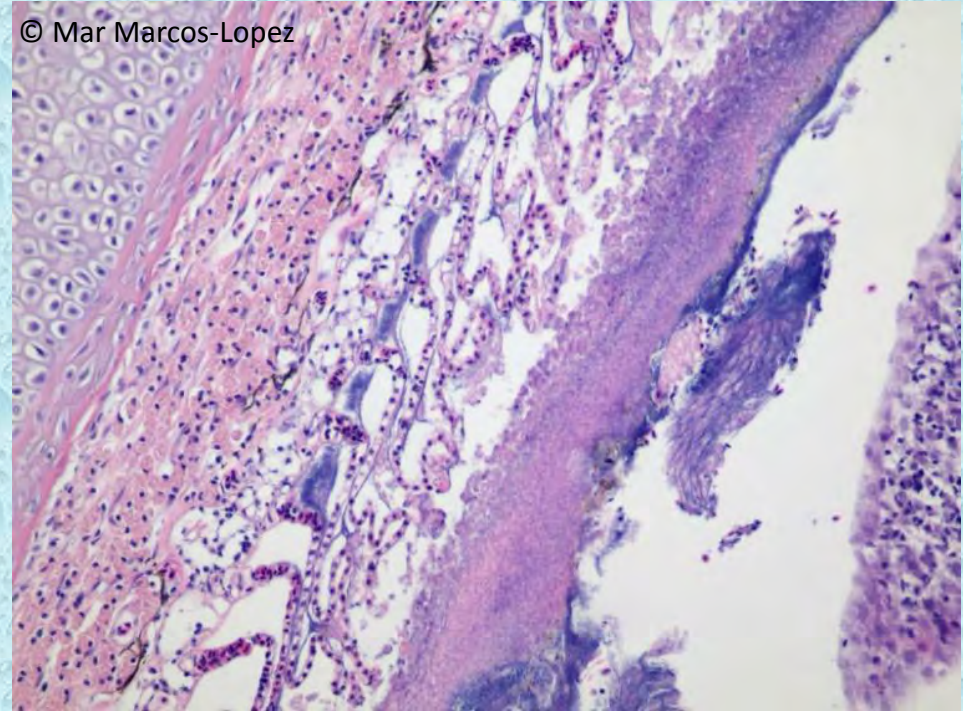
Can be associated to gill proliferation.  
Incidental histopathology finding

- Viruses?

\* Concurrent/sequential diseases  
\* Multifactorial aetiology



# OTHER GILL DISEASES



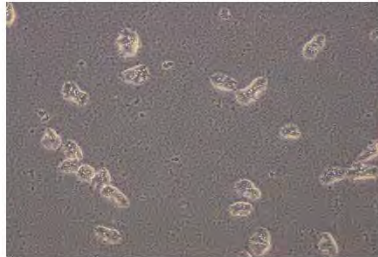
Jellyfish gill damage with  
*Tenacibaculum* involvement



# AGD RESEARCH IN IRELAND

## Treatment trials

### In vivo challenges



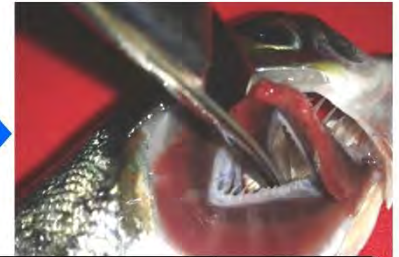
*N. perurans* in culture  
Marine Malt Yeast Agar, 18°C



Bath challenge  
1800-3000 cells/L, 4h



Disease development is assessed through gill scores, fresh smears, histology and PCR. Progression depends on water temperature, stocking density and initial infection dose.



### Treatment strategies

#### MODE OF ACTION

##### Targeting the parasite

- Disinfectants
- Antiprotozoals

##### Targeting the host

- Immunomodulators
- Mucolytics

##### Targeting the gill microbiome

- Antibactericide

#### ROUTE

Bath

Oral

#### TIMING

Prophylactic

Therapeutic

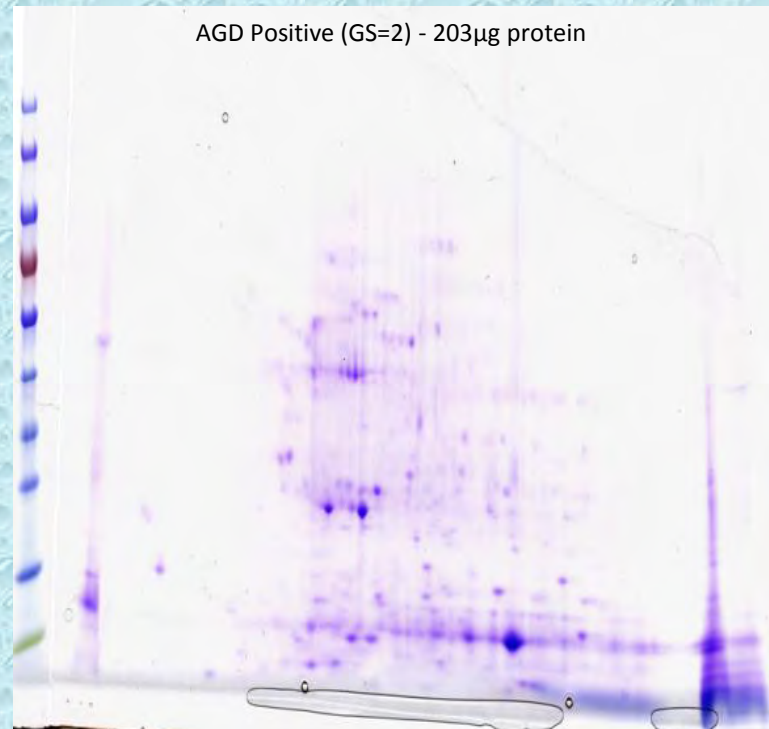
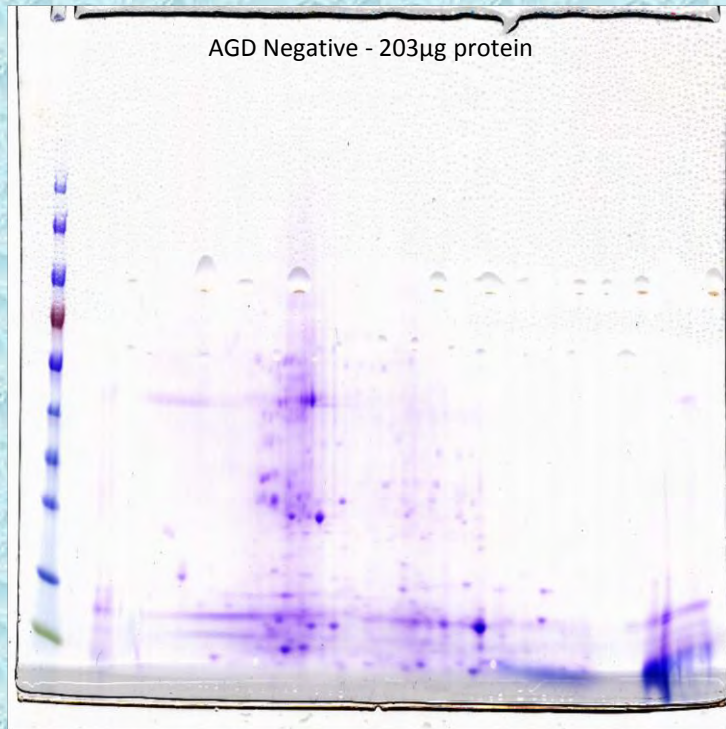


# AGD RESEARCH IN IRELAND

## PhD (GMIT, VAI – funded IRC)

### Immunological approach to the development of diagnostic tools and treatments for AGD

- Student: Mar Marcos-López - Supervisors: E. McCarthy, H. Rodger, I. O'Connor
- Main aim: Use of proteomics to study AGD pathogenesis and immunity.



# AGD RESEARCH IN IRELAND

## PhD (GMIT, MI, VAI)

Coffee break 10.35 – 11.00

The *Parafishcontrol* project

James Bron (Stirling Univ.)

11.00 – 11.10

Longitudinal study of AGD on a marine Atlantic salmon farm in Ireland

Jamie Downes (Marine Institute/GMIT)

11.10 – 11.30

Development of new diagnostic assays

Richard Paley (CEFAS)

11.30 – 11.50

Results from AGD surveillance in Norway

Vidar Aspehaug (Patogen)

11.50 – 12.10

Longitudinal study of AGD on three Atlantic salmon farms in Norway

Sigurd Hytterød (Norwegian Veterinary Institute)

12.10 – 12.30



# ACKNOWLEDGMENTS

- Salmon farms staff Ireland
- BIM (Dr. T. O'Carroll)
- AFBI (P. Savage)
- DOMMRS (C. Smith, D. Evans, Dr. J. Maguire )
- GMIT (Dr. E. McCarthy, Dr. I. O'Connor)
- MI (Jamie Downes)
- University of Glasgow (Dr. M. Braceland, Dr. D. Eckersall)
- FVG (Dr. M. Pearson, T. Turnbull, D. Cox, Dr. M. McLoughlin)



Bord Iascaigh Mhara  
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Marine Research Station

