



Amoebic Gill Disease (AGD) in Tasmania

Current annual production is approx. 50,000 Tonnes, mostly Atlantic salmon

Three Growing Regions

South East Region

- AGD all year round

Macquarie Harbour

- No AGD

Tamar River Estuary

- AGD only in certain years – summer only



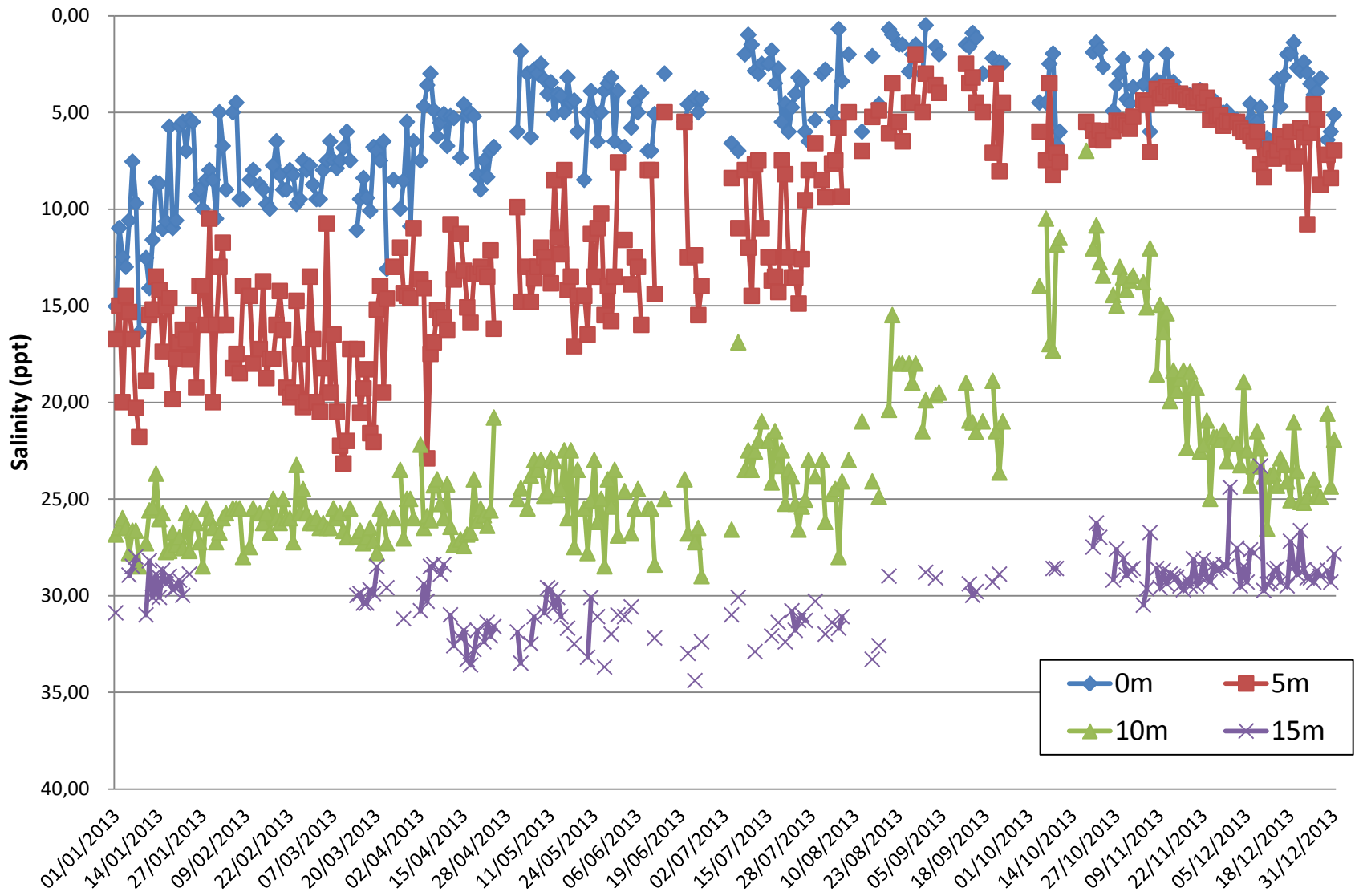
TAMAR RIVER ESTUARY

- AGD has only occurred in certain years
- 1 Lease – system cages
- Year round production
- Water Temperature (9 - 22 degrees)
- Salinity variable depending on rainfall (5 – 35 ppt)
- Strong currents
- No AGD until 2006 when suffered 46% mortality (mainly because the site was unprepared to bath fish in freshwater)
- Only one pen has been bathed for AGD since
- 2006 had very low rainfall in summer resulting in high salinity (in conjunction with high temperatures) on site over an extended period
- Therefore the main factor controlling AGD appears to be regular surface brackish water layer

MACQUARIE HARBOUR

- No AGD (to date)
- 10 Leases (3 companies) in close proximity
- Year round production
- Stratified water column with surface brackish layer. Salinity and depth of brackish water influenced by catchment rainfall and Hydro Dam Management (intermittent release of water to generate electricity)
- Water Temperature (8 – 22 °C)
- Temperature and salinity profiles in the water column can vary significantly over short periods (days)
- The only factor controlling AGD appears to be the regular brackish layer
- Could AGD occur in the future if there was no rain for an extended period over summer and no Hydro Dam water release (Possibly given the Tamar River Experience ??????)

Salinity in Maquarie Harbour at 0, 5, 10 and 15 M depth in 2013



SOUTH EAST REGION

- AGD occurs all year round
- Largest production area
- 25 Leases (2 companies)
- Mixture of river estuaries, bays and coastal/oceanic conditions
- Year round production
- Water temperature (9 - 20°C)
- Mostly consistently high salinity (34 ppt)
- Some sites upstream get surface brackish flushes following rainfall
 - Results in temporary control of AGD
 - Extent of control depends on how low salinity goes and period of flush
 - Brackish flushes are a mixed blessing
 - Clears up lesions or slows progress of lesions which extends period to next bath BUT
 - Synchronises all the impacted pens so they all come down with AGD infection at once and very easy to get behind with freshwater bathing program
- **The rest of the presentation only relates to the south East Region**

Chronological Development of AGD in Tasmania

- ***The very first pen of Atlantic salmon transferred to sea in 1987 came down with AGD – mortality around 90%***
- A range of traditional treatments like formalin were tried without success
- Mortality decreased when brackish water flowed through pens following rainfall – progressed to freshwater baths.
- Despite lots of R&D and experience, control of AGD hasn't changed. Just bigger and better freshwater baths.

Pattern of Infection

- Initially all fish were transferred as Spring Smolt and development of AGD infection was almost like clockwork
 - Bath 1 @ 8 weeks post-transfer
 - Bath 2 @ 6-8 weeks post-first bath
 - Bath 3 occurred in Autumn, but wasn't required in all pens
 - Often fish would be moderately infected in early Autumn, but would recover to having clear gills without a bath as the water temperature decreased into winter
 - No further baths required through to harvest even at the end of the following summer
- Stage 2 – AGD started occurring in large harvest size fish in second summer at sea
- Since then there has been a progressive increase in AGD throughout the year – less required in winter than summer, but freshwater bathing has been a year round part of operations now for many years

Currently bathing populations 7-11 times from smolt transfer to harvest depending on a range of factors

What changed in association with increased AGD incidence?

All the usual factors you might expect would exacerbate a parasitic disease!

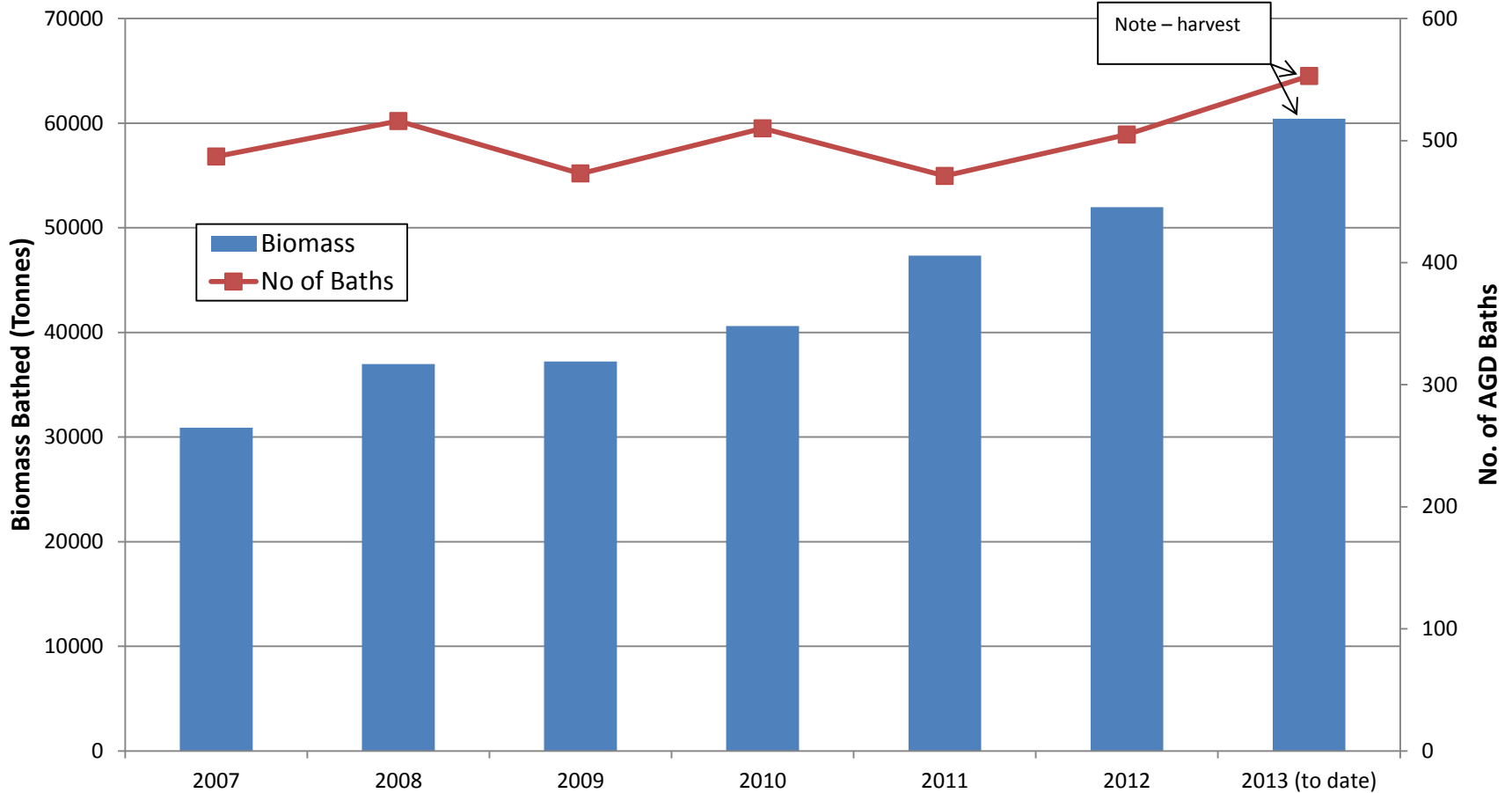
- Increasing numbers of salmon farmed
- Year round smolt transfer and production
- More fish per pen – bigger pens - not increased stocking density
- More leases – closer together
- Bathing program occurs all year round - not possible to bath in blocks
- Environmental changes (??)
- Changes in the amoebae (??)

- Continuous supply of hosts!
- Continuous supply of amoebae for reinfection!
- Build up of amoebae numbers in the environment?



The following slides relate to Huon Aquaculture Company figures only!

Total No. of Baths and Total Biomass (Tonnes) bathed by Year Class (2007-2013)



Note – The biomass of fish bathed has doubled, but the number of baths has stayed relatively stable. This is mainly due to increases in pen size (80M-120M-168M circumference pens)

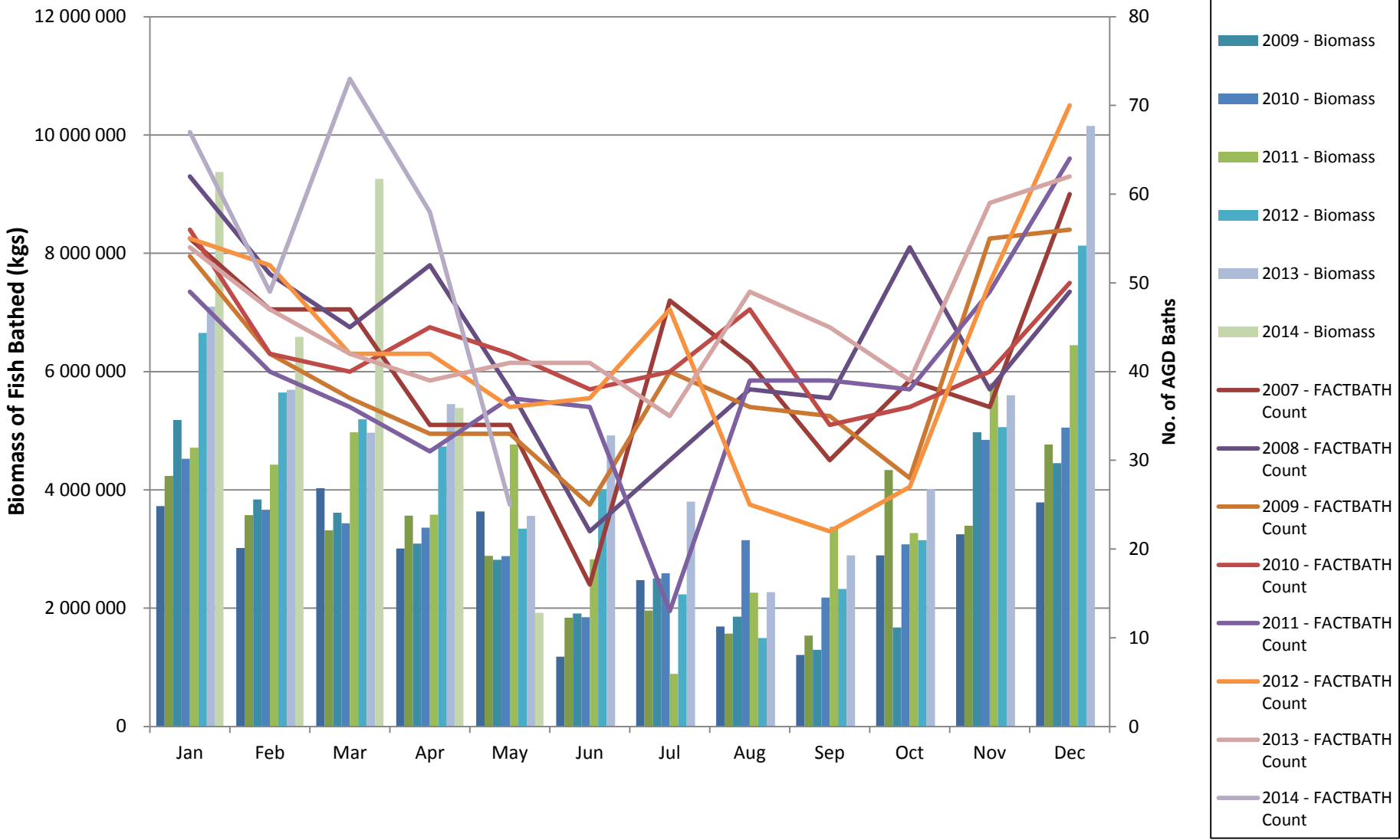
Huon Aquaculture Bathing Strategy

- Try to maintain a proactive bathing schedule
 - Based on historical experience supported by weekly gill checks of upcoming pens
 - Don't use PCR or histology to schedule bathing
 - Period between baths can be as short as 15-20 days in summer and extend out to 80-170 days in winter
 - Aim to bath prior to any rise in mortality or depression of appetite
 - If AGD too advanced at bath, the period to next bath is shorter
 - Can only do 3 freshwater baths per day so can't afford to get behind when
 - Starve fish on day before bath and day of bath. Therefore, at least two days lost feed opportunity at every bath
 - Unless something has gone wrong with the bath, fish should be eating well by the morning after the bath (sometimes fed in the afternoon after the bath)

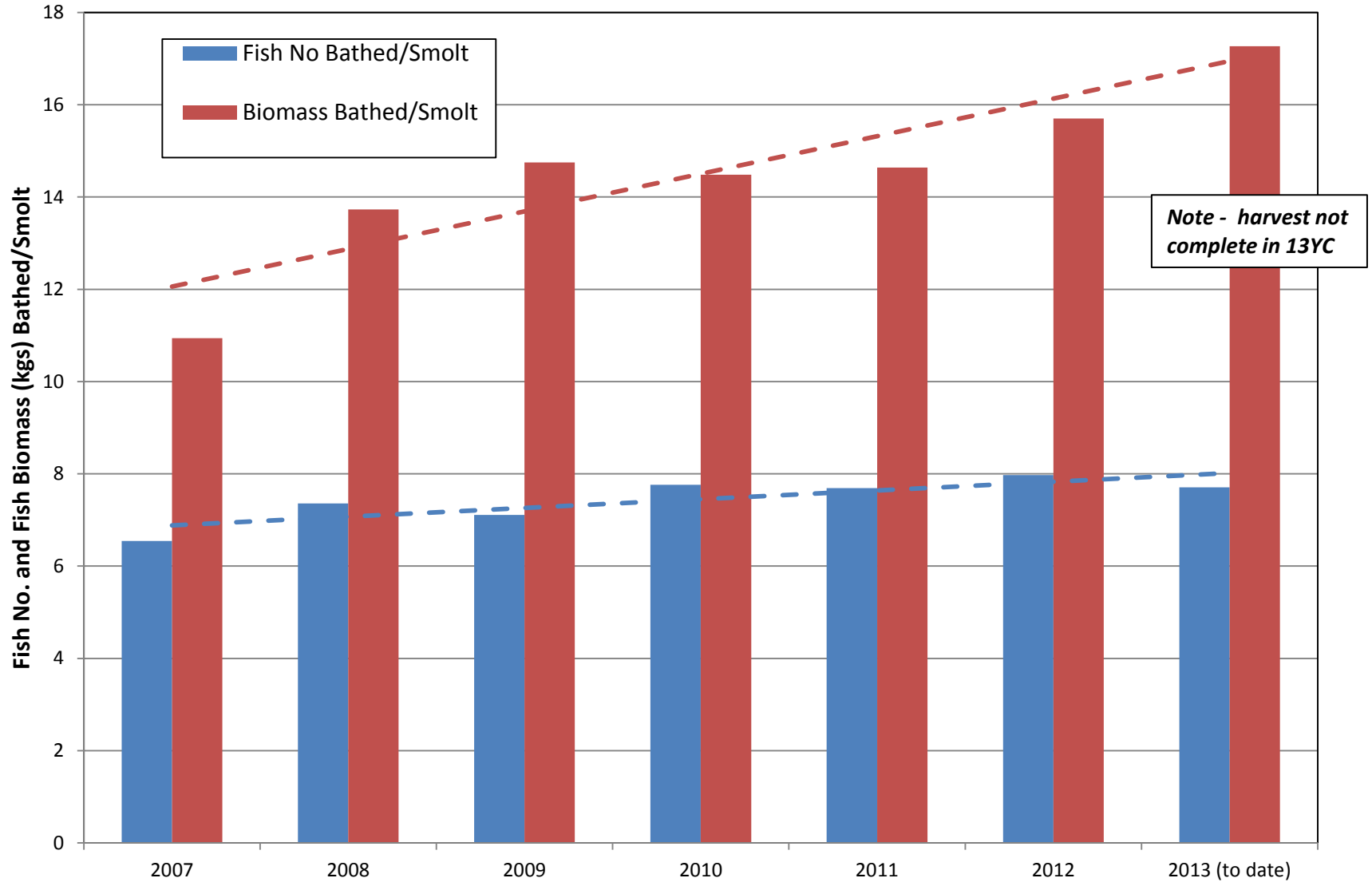
Huon Aquaculture Bathing Strategy

- Bathing Operations
 - All based on transferring fish from the source pen into a liner containing freshwater
 - Bath populations range from 200g – 6 kg average weight
 - Bath up to 370 Tonnes biomass in a single liner
 - Use 120M and 168M circumference freshwater liners
- Bath Criteria
 - Fish stocking density in Liner
 - 50 kg/M³
 - Salinity in liner
 - Target < 1.0 ppt
 - Cancel bath if 4 ppt or over
 - Period in freshwater
 - 3 hrs from last fish entering the freshwater in smaller fish (until after their first summer at sea)
 - 2 hrs from thereon through to harvest
 - A lot of commercial experience and trialing has shown that we don't seem to get any added benefit from extending bath period past 2 hours

Biomass Bathed (kgs) and No. of Baths/ Month by Year Class (2007-2013 to date)

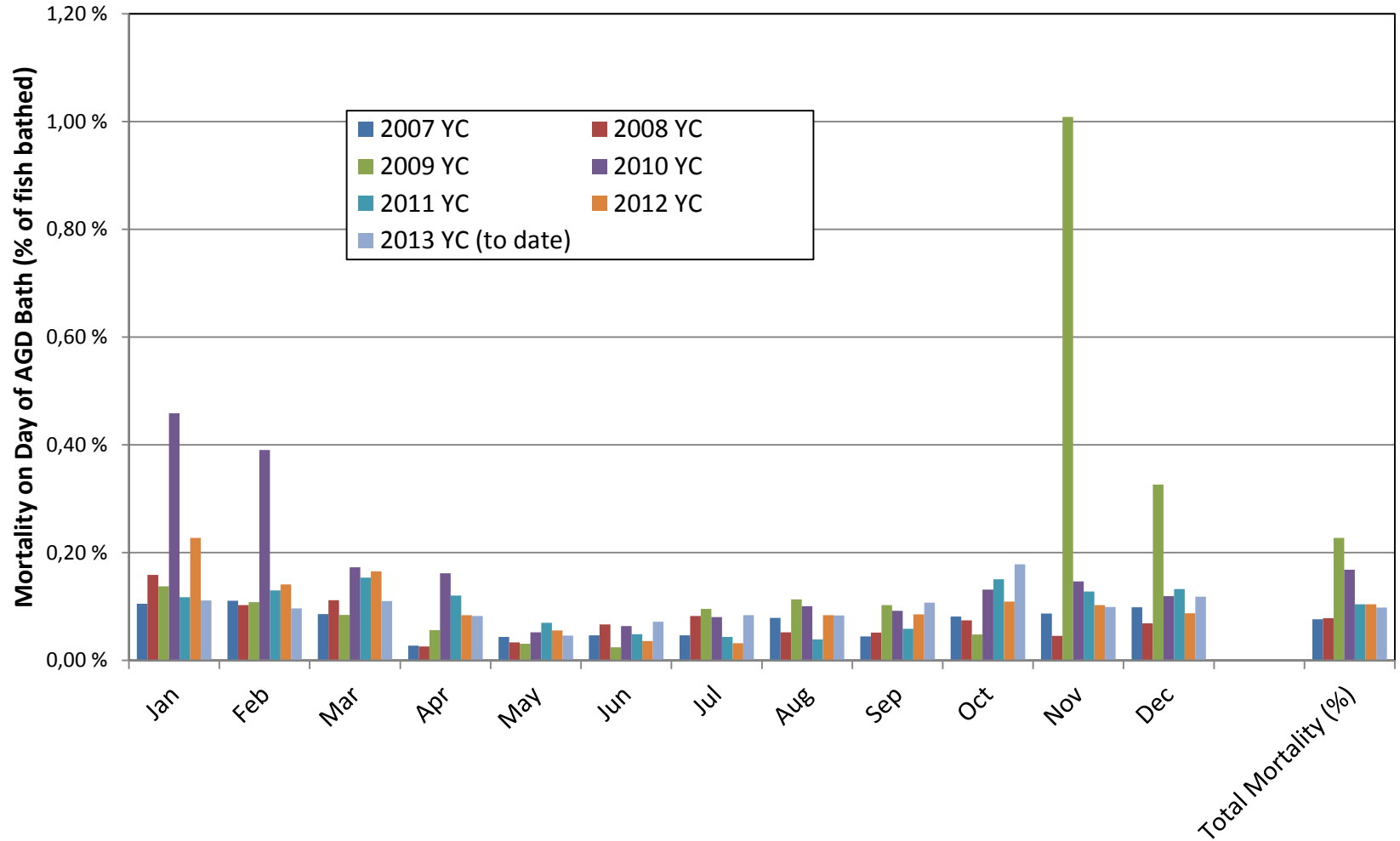


Average No. and Biomass (kg) of fish bathed/ smolt by Year Class (2007-2013)



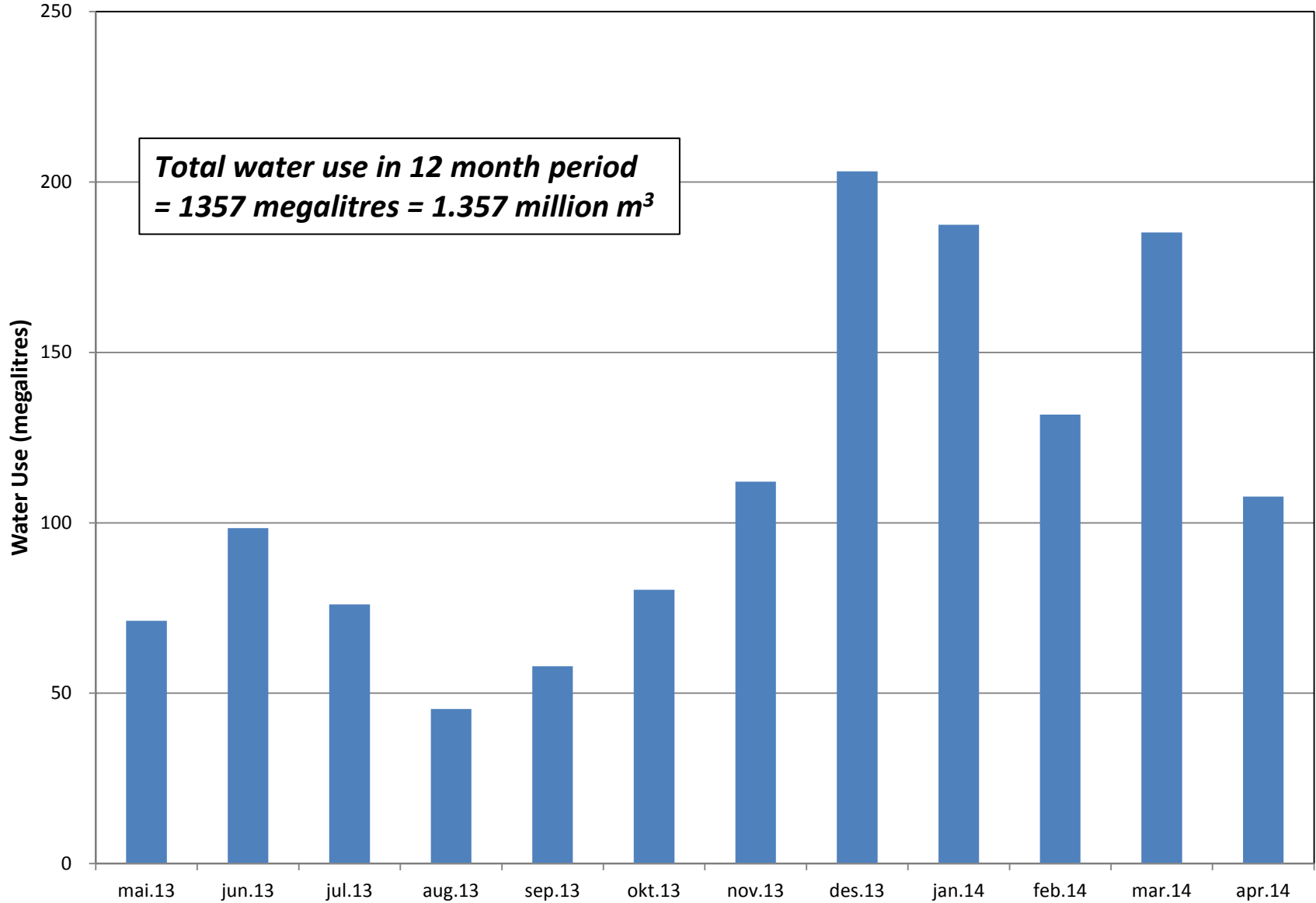
Note – A slight trend upwards over last 7 years

Mortality on day of AGD Bath (% of fish bathed) by Year Class and Month



Note – This includes fish that were going to die anyway even if not bathing

Quantity of water (Megalitres) used for AGD bathing by month



Water supply for bathing:

- Water is stored in numerous dams ranging in size from 30 to 1100ML and taken from two river systems
- Water is pumped through a matrix of pipes and pumping stations from these dams to 6ML liners moored at shored-based fill stations
- These liners are then towed to the leases



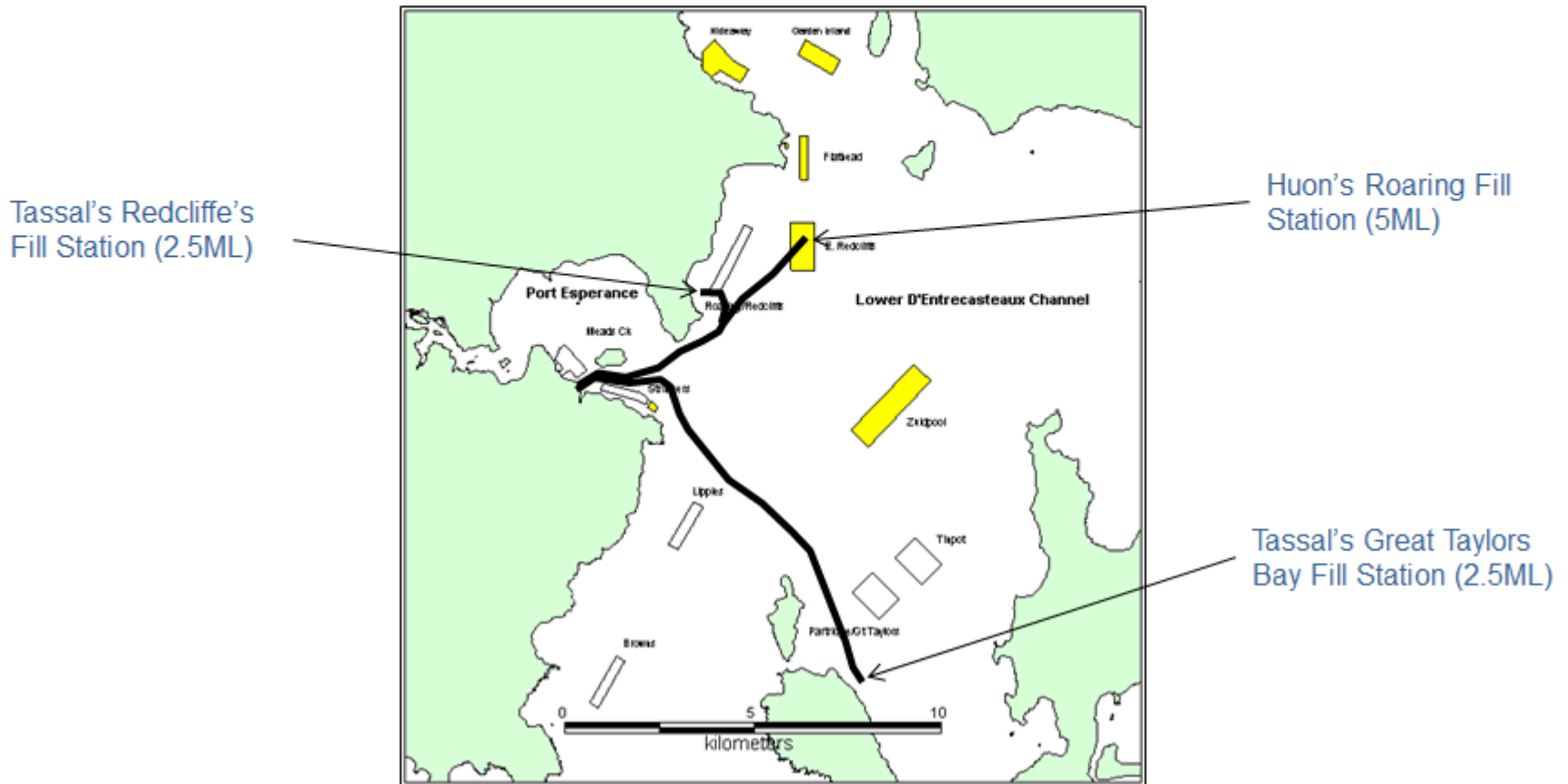
Lower Huon Bathing Scheme:

- Recently a system of pipes and pumps were installed to deliver water right to three offshore leases
- Water is initially pumped 8km from the Esperance River to a 600ML dam
- Total cost of the Industry/Government funded project was \$9M



Lower Huon Bathing Scheme:

- This water is then supplied under gravity to three lease-based, water-filling stations:
 - Redcliffe's – 5ML ML per day
 - Roaring – 9ML per day
 - Great Taylors – 5ML per day
- This system comprises 25 km of 280–355 mm High Density Polyethylene Pipe traversing the sea bottom



Lower Huon Bathing Scheme:

- Water-fill station at Huon's Roaring Lease:



Future Challenges – Offshore farming

- Cost and resources required to tow water to leases becomes prohibitive
- Huon is leasing a 76M Well Boat from Solvtrans for 8 years (crew provided) – arriving Tasmania Sep 14
- 3 x 1000m³ tanks - Recirculating water system – 30,000 m³/ hour
- Huon has been funding trials at the University of Tasmania investigating freshwater/hydrogen peroxide combination treatments at high temperatures – Aim to reduce bath time without compromising efficacy or safety



AGD is not the only challenge!

- Australian fur seals are a protected species, increasing in number and can be > 450 kg weight



Future Challenges – 240 M circumference cages

- First 240 M pen due August 2014
- 560 mm triple-collar, double netted stock protection system, 80M diameter
- Biomass up to 700 Tonnes
- This presents new challenges with regard to the logistics of bathing



Bathing equipment:

- Need to increase the transfer rate for the large biomasses of fish planned in 240M pens
- New twin-vacuum pump from Transvac (USA) capable of transferring > 200T per hour
- 22 Tonnes of water per tank – each tank fills in < 1 minute



Factors impacting onset of AGD incidence

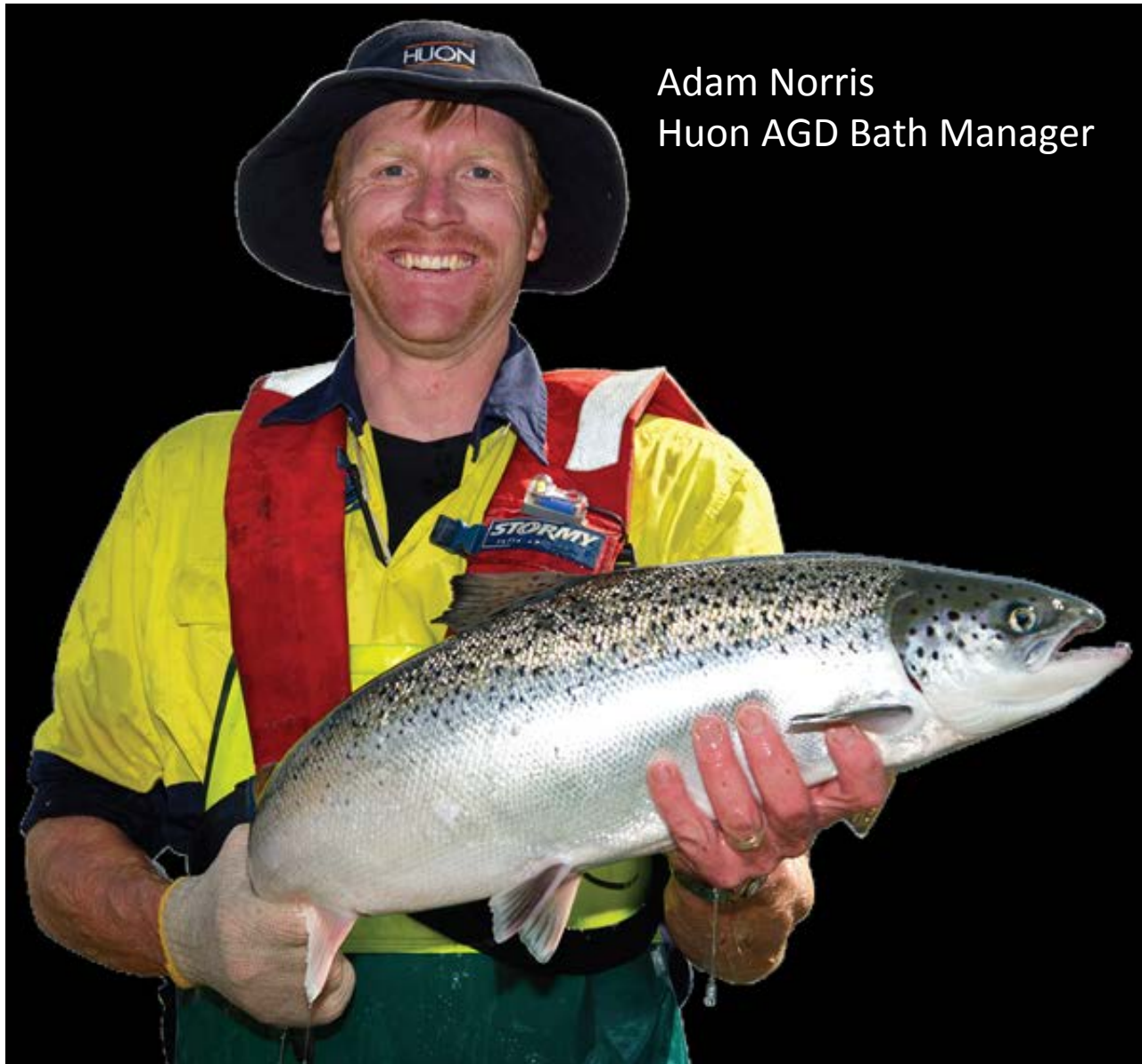
- Increased onset of AGD with:
 - Higher water temperature
 - Presence of irritant algae (eg. barbed *Chaetocerus*, *Pseudonitschia*)
 - Presence of moon jellyfish
 - Hydroids on nets / in situ net cleaning (? Still to be established)
 - Poor water quality (evidence from AGD trial)
 - Higher stocking density (commercial pens cf. trial pens)
 - Fish under lights
 - Diploids cf. triploids
 - Mature fish
 - Fast growing, good condition fish cf. poor condition fish (eg failed smolt)
 - Very close proximity to infected fish (Saltas experience in early 90's) - but not necessarily any difference over longer distances
 - Very heavy infection at bath
- Genetic selection improves resistance

A world without AGD!

Freshwater bathing probably has benefits for farmed salmon in Tasmania over and above controlling AGD.

Therefore, even with successful new control measures (eg. in-feed treatment or vaccine) it is anticipated that a number of freshwater baths (hopefully much fewer) could be beneficial.

Despite all that, our Bath Manager still has a smile on his face!



Adam Norris
Huon AGD Bath Manager