

# Epidemiology of bacterial kidney disease (BKD) in farmed rainbow trout

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## Introduction

Bacterial Kidney Disease (BKD) is caused by *Renibacterium salmoninarum* (Rs) (Sanders & Fryer, 1980). This disease affects wild and cultured salmonids and can cause mortality and reduced growth rates in Scottish farmed fish and mortality in wild fish (Smith 1964). It was first recorded in Scotland from wild Atlantic salmon (*Salmo salar*) in 1930 (Mackie et al. 1933). In recent years the prevalence of BKD in Scottish farmed salmonid fish has been low with sporadic outbreaks since 1990 (Bruno 2004) and now appears to be endemic in several trout farms.

Effective surveillance and control requires information on the transmission of Rs and the rate of development of the prevalence in populations. Our study was implemented to determine the prevalence of Rs on individual fish farms and to assess the potential interactions between farmed and wild fish.

## Trout cages



## Testing farmed trout

- ▶ 3 freshwater rainbow trout cage sites with BKD history selected.
- ▶ Re-stocked with fish screened Rs negative at source sites.
- ▶ 7 cohorts sampled regularly over production cycles.
- ▶ Total of 37,070 fish, pools of 10, tested by real time PCR (qPCR) (Bruno et al, 2007).

## Clinical BKD



## Results of farmed trout testing

- ▶ All batches Rs positive within 1 week to 4 months (Figure 1).
- ▶ Grading effect leading to increased prevalence noted (Fig 1).
- ▶ Data analysed by Generalised Linear Model;  $\ln(\text{BKD}\% + 0.368) = -1.596 + 0.147 \text{ months} - 0.041 \text{ }^\circ\text{C} + \text{site effect}$  (Fig 2).
- ▶ Overall, prevalence of Rs increased significantly with time on site (Fig 2).
- ▶ Site-level differences in prevalence noted (Fig 2).

Figure 1. Prevalence changes with time in the cohorts

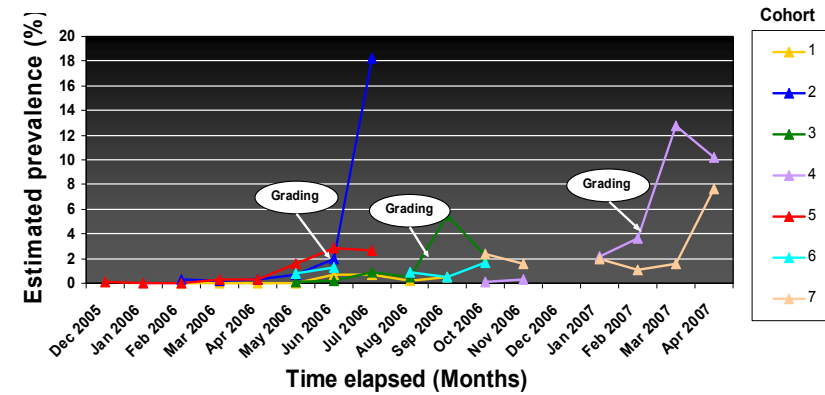
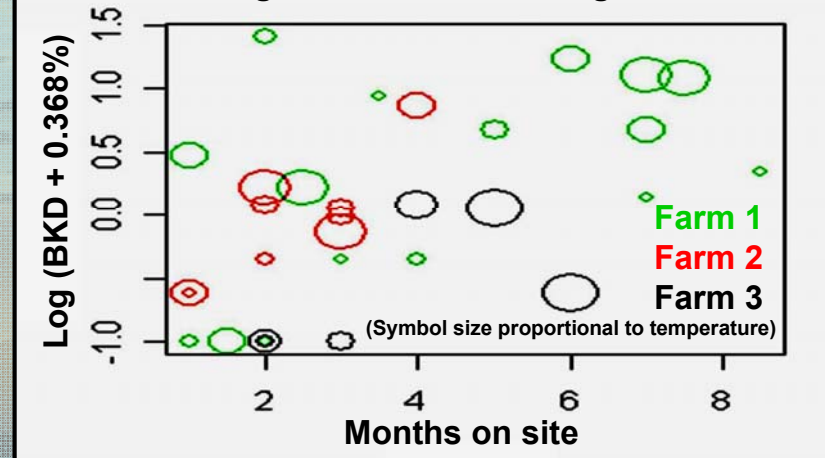






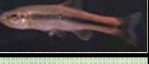

Figure 2. Data modelling



## Wild fish sampling

- ▶ 2703 wild and escaped fish from fish farm catchments sampled (Table 1).
- ▶ Low prevalence & restricted distribution of infection around infected fish farms.
- ▶ First Rs positive qPCR samples in Scotland from the wild non-salmonid species, minnow (*Phoxinus phoxinus*) (1) & 3-spined-stickleback (*Gasterosteus aculeatus*) (2).
- ▶ Potential wild reservoir species identified.
- ▶ 3 Rs positive qPCR's from escaped rainbow trout highlighting the potential for spread of infection to new geographies and other fish farms.

Table 1. Wild & escaped fish tested

Species	Number
Atlantic salmon 	689 (juvenile)
Brown trout ( <i>Salmo trutta</i> ) 	716
Rainbow trout	268 (escapes)
Arctic charr ( <i>Salvelinus alpinus</i> ) 	4
3-spined-stickleback 	599
Minnow 	426
Eel ( <i>Anguilla anguilla</i> ) 	1

## Tissue sampling



## Rainbow trout (*Oncorhynchus mykiss*)



## Conclusions

- ▶ Batches of negatively screened fish are testing positive soon after stocking to our study sites.
- ▶ Possible infection sources could be; on site reservoirs or wild fish, although in view of the low estimated prevalence the latter is perhaps less likely; a low level infection in the source fish that is not detected by previous screening.
- ▶ Future research could focus on determining the source of the infection to better understanding the disease transfer mechanisms within and between aquaculture sites.

## References

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