A scenario tree evaluation of surveillance for *Gyrodactylus salaris*, a fish parasite exotic to the UK

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Introduction

Gyrodactylus salaris is a parasite of salmonid fish species, which is currently exotic to the UK. Introduction of the parasite into Norway lead to substantial declines in wild Atlantic salmon populations (Johnsen and Jensen 1991).

Scenario tree modelling allows quantitative analysis of multiple complex data sources to assess the confidence in the overall surveillance applied for a pathogen or disease to support claims of freedom (Martin et al. 2007a). A few studies have been published to date applying the method to surveillance schemes in terrestrial animals (Martin et al. 2007b; Martin 2008).

We used scenario tree modelling to identify requirements to achieve 95% confidence in a surveillance programme to show freedom from infection in England and Wales. It was assumed that sampling of rainbow trout farms was the only surveillance system component available. Rainbow trout are the main aquaculture species in England and Wales. Infection of rainbow trout with *G. salaris* causes no clinical disease, thus detection relies on active surveillance. The effort of checking whole individual rainbow trout is substantial, so our model assumed that only pectoral fins (a known preference site of infection) were examined.

Table 1: Input parameters active surveillance

Node	Name	value	Sample size
1	Farm visited	1 (= 100%)	265
2	Farm status (farm level design prevalence)	0.02 (= 2%) infected	
3	Tank status (tank level design prevalence)	0.1 (= 10%) infected	10
4	Unit (fish) status (fish level design prevalence)	0.05 (= 5%) infected	32
5	Fish sample taken	1	
6	1 pectoral fin sampled	1	
7	Gyros infestation rate per fin	> 1	15; 2
8	Gs prevalence (parasite level)	0.2	
9	Test sensitivity (parasite level)	1	

Method

A scenario tree was constructed to identify the individual steps relevant to determine the sensitivity of the surveillance system (Figure 1).

Each step (or node) within the surveillance system is associated with a probability of a positive or negative outcome. Probability estimates used to calculate the surveillance sensitivity are provided in Table 1. The parameters follow the OIE Aquatic Animal Code recommendations (farm level design prevalence, fish level prevalence) or, due to absence of data, expert opinion (tank level prevalence, Gyrodactylid infection rate per fin, *G. salaris* prevalence among other Gyrodactylid parasites, test sensitivity and specificity at the parasite level). Other node probabilities are determined by the surveillance design (all rainbow trout farms are sampled, sampling of individual fish is limited to one pectoral fin). The number of ponds and fish per pond sampled were varied to obtain a 95% confidence that all rainbow trout farms in England and Wales are free from infection with *G. salaris* when all farms are sampled.

Table 2: Surveillance sensitivity at fish, pond, farm and national level

Level	Sensitivity of surveillance		Probability to detect if 1 unit (at respective level) was selected randomly	
	15 Gyros per fin	2 Gyros per fin	15 Gyros per fin	2 Gyros per fin
Fish	0.96	0.36	9.65×10^{-5}	3.6×10^{-5}
Pond	0.79	0.44	1.6×10^{-3}	9×10^{-4}
Farm	0.56	0.36	1.1×10^{-3}	7.2×10^{-3}
all RBT-farms	0.95	0.85		

32 fish sampled per pond and 10 ponds per farm

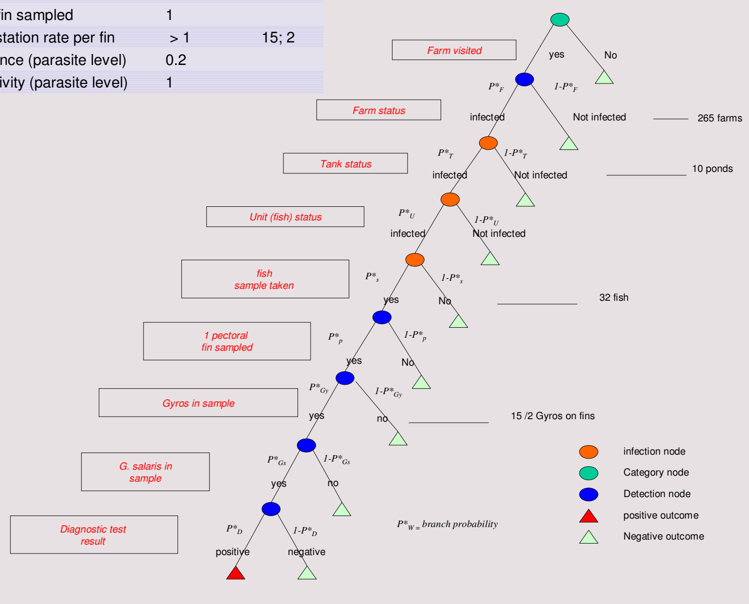

Figure 1: Scenario tree of *G. salaris* surveillance

Results

Assuming all rainbow trout farms are sampled, a 95% confidence that England and Wales are free from infection can be achieved if 10 ponds per farm and 32 fish from each pond are sampled. Increasing the number of ponds sampled has a bigger effect on the confidence level compared to increasing the number of fish sampled per pond.

Variations in fish level prevalence can be expected and Gyrodactylids may have been removed from fish due to ectoparasite treatment. Therefore, the current model represents a simplification of the real situation.

Conclusions

- The sampling effort required would be substantial. Risk based surveillance should be explored to reduce the sampling effort.
- The analysis of surveillance requirements highlighted significant gaps in the data needed to design surveillance programmes to demonstrate freedom from infection.
- The study provides an example of how disease surveillance in aquatic animals could be analysed and designed.
- Significant data gaps also exist for other aquatic animal diseases.

Future work

- Investigation of prevalence of G. salaris infection in single and mixed Gryodactylid infections.
- Further analysis using probability distributions around parameter estimates
- Inclusion of other surveillance components for *G. salaris*.
- Use of different likelihoods that farms / river catchments are infected in the assessment of the surveillance system (i.e. identifying risk categories)
- The surveillance design will be revised once more data are available.

References

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