

Using industry experience to investigate the epidemiology of salmon pancreas disease in Scottish Atlantic salmon farms

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Introduction

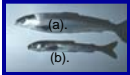
Salmon Pancreas Disease (PD) is an infectious alphaviral disease of Atlantic salmon (*Salmo salar*). In recent years the Scottish salmon farming industry has experienced an increase in PD. The disease can cause significant economic losses within this sector of the industry.



Using The Experiences of Salmon Farmers

Fish farmers inspect fish daily, official visits are occasional. FRS uses analysis of company data and questionnaires to access this experience. Validation of details carried out by internal analysis, discussion with farmers, and through a dedicated PhD student. Progress depends on mutual trust and openness between all parties.

Atlantic salmon smolt infected with PD exhibiting low condition factor (a). Chronically infected Atlantic smolt with PD (b).



Aims

Collect **BASELINE** information on the prevalence and intensity of PD in Scottish Atlantic marine salmon farms and identify **RISK FACTOR** associated with the development of PD and report these findings back to industry.



Methods – Data Source

Postal Questionnaire

240 marine Atlantic salmon farms in Scotland were sent a questionnaire and asked to report on the presence / absence of PD in 2003 – 2005. Respondents were also asked questions on site husbandry, management and environmental parameters e.g. predators and algal blooms. Data collected was analysed using Odds ratio analysis to identify possible risk factors associated with the development of PD.

Industry Database

The production database was that of a major Atlantic marine salmon producer in Scotland. The database contains extensive data sets on reported mortality and mortality causes, production, movement of fish groups and some environmental data (notably temperature data) 2001- 2007. Detailed analysis of the development and survival of >60 million fish over 7 years at 82 production sites 25 of which reported suspected cases of PD.

The Questionnaire (Case – control):

Questionnaire response = 40% (96 /240)

26 (Cases PD positive sites) 70 (Controls PD negative sites)

Weight of (kg) fish at time of PD outbreak

Year	Average weight (kg)	Range (kg)
2003	2.87 (SD ± 0.85)	2.0 – 4.0
2004	2.60 (SD ± 1.36)	0.5 – 4.0
2005	3.38 (SD ± 1.18)	1.6 – 5.0

Annual % Mortality

2003 – 4.4 % mortality
2004 – 21.5 % mortality
2005 – 14.3 % mortality

Odds Ratio (OR) analysis for potential associated RISK FACTORS:

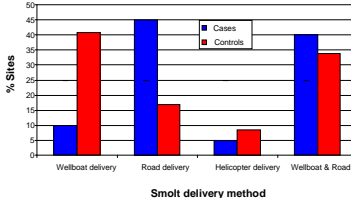
1. Movement of fish ONTO a site during their marine production cycle:

OR = 3.07 - probability of result occurring by chance is 0.04

2. Smolt delivery using wellboat and road deliveries:

OR = 4.72 - probability of result occurring by chance is 0.08

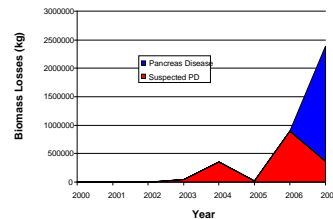
% of sites and smolt delivery methods



Results

An Industry Database:

Biomass losses (kg) attributed to Suspected PD 2001 - 2007 and Diagnosed PD 2007 from the Industry database



■ Moderate biomass losses in 2004 and 2006 attributed to suspected PD.

■ In 2007 there was a change in reporting of PD. PD was reported in the database either as suspected PD or diagnostic PD.

Model of temporal signal in reported PD from the industry database

Factor	Estimate	P- value
Intercept	-3400	0.00291 **
Year-2002	2066	2.60e-10 ***
Season 2 (May-July)	-2416	0.01263 *
Season 3 (Aug-Oct)	4315	1.76e-06 ***
Season 4 (Nov-Jan)	1439	0.14694

● Losses to PD = -3400 + 1742*(year-2002) + season effect

Acknowledgments

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- Marine Harvest Scotland
- Chris Wallace (FRS)

Conclusion

- Considerable information on the experience by farmers on PD have been obtained.
- Scottish marine salmon farmers are experiencing a rise in PD.
- Movement of fish and smolt delivery methods appear to be the most significant risk factor possibly associated with the occurrence of PD from the questionnaire analysis.
- Industry experience need to be used in epidemiological studies of PD and its transmission in Scotland.
- The quantity of data, and the first-hand experience of farmers on the ground, means that the database is an invaluable source of information