

# Spatial analysis of a *gyrodactylid* surveillance data set

marine scotland  
science

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## Introduction

- The monogean parasite *Gyrodactylus salaris* can severely affect stocks of wild Atlantic salmon (*Salmo salar*)
- Norwegian populations of wild A. salmon have been severely depleted or eliminated from some river systems
- Experimental evidence suggests that Scottish wild A. salmon stocks are susceptible to *G. salaris* which, as yet, has not been reported from the British Isles
- Introduction of *G. salaris* could have catastrophic effects for wild A. salmon
- Surveillance for *G. salaris* has been undertaken (Council Directive 91/67/EC) in Scottish farmed and wild fish since 1997
- In accordance with Council Directive (2006/88/EC) risk based surveillance for aquatic animal disease has been implemented



## Method

- The data set collected between 2000 to 2009 was mapped using the gis tool ArcMap (ESRI UK) (Figure 1)
- A spatial analysis was undertaken using saTScan™ (v8.0) to investigate geographical parasite clustering
- This software analyses spatial, temporal and space-time data using spatial, temporal or space-time scan statistics
- For any clusters identified the model parameters were varied to test the cluster strength

## Results

- No *G. salaris* was found but the presence of other species *G. truttae* and *G. derjavinoidea* was reported
- Statistically significant clusters of “high” and “low” rates of gyrodactylids present were identified e.g. (Figures 1 & 2)
- There was insufficient data on *G. truttae* and *G. derjavinoidea* to undertake a species specific spatial analysis
- There is a large area in the Western Isles (purple outline) where only one gyrodactylid specimen was reported for the entire data set (Figure 1), although this area was not identified as a discrete cluster by the model
- Parameters were modified to “force” the model to recognise this cluster but the process was not successful



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SaTScan v8.2
Program run on: Wed Feb 22 14:59:00 2012
Purely Spatial analysis
Scanning for clusters with high rates
using the Bernoulli model.

SUMMARY OF DATA
Study period.....: 2000/1/1 - 2000/12/31
Number of locations.....: 202
Total population.....: 802
Total number of cases.....: 135

MOST LIKELY CLUSTER
1. Location IDs included.: 157, 401, 576, 702, 254, 454, 593, 72,
793, 253, 460, 694, 459, 656, 73, 69,
233, 397, 47, 545, 661, 114, 251, 417,
590, 789, 612, 406, 45, 539, 664, 230,
    
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502, 647, 778, 294, 449, 53, 611, 773,
225, 38, 393, 540, 710, 149, 676, 198,
273, 385, 429, 52, 599, 745, 746, 122,
297, 616, 743, 170, 141, 336, 489,
606, 791, 394, 547, 717, 92, 140, 282,
473, 577, 121, 298, 452, 505, 615,
742, 102, 495, 621, 777

Coordinates / radius.: (300900,701900) / 116679.56
Population.....: 232
Number of cases.....: 85
Expected cases.....: 39.05
Observed / expected.: 2.18
Relative risk.....: 4.18
Log likelihood ratio.: 41.643331
Monte Carlo rank.....: 1/1000
P-value.....: 0.001

SECONDARY CLUSTERS
2. Location IDs included.: 228, 379, 543, 619, 794
Coordinates / radius.: (320400,999700) / 0
Population.....: 5
Number of cases.....: 5
Expected cases.....: 0.94
Observed / expected.: 5.94
Relative risk.....: 6.13
Log likelihood ratio.: 8.987308
Monte Carlo rank.....: 21/1000
P-value.....: 0.021
    
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Figure 2. Example output from saTScan illustrating a statistically significant ( $p = 0.001$ ) “high rates” cluster; blue highlights in Figure 1

## Conclusions

- From this survey, no *G. salaris* was found and this is important for Scottish wild fisheries
- Although clusters of gyrodactylid high presence were identified these were generally too geographically broad to be of value for the implementation of targeted surveillance
- However, these data are contributing to a water catchment risk analysis, based on the fish movement network, that is being developed at Marine Scotland Science
- The importance of undertaking statistical analysis on “obvious” patterns in parasite distribution is highlighted...

## Future

- Scotland is deemed to be *G. salaris* free (Commission Decision 2010/221/EU), so, as of 2012 no targeted surveillance for this parasite will be undertaken
- However, experience gained in the application of this epidemiological tool has been useful and will facilitate future analysis of Marine Scotland Science disease data
- The findings can feed into other risk factors to facilitate any future risk based surveillance for *G. salaris* should this be desirable

## Acknowledgements:

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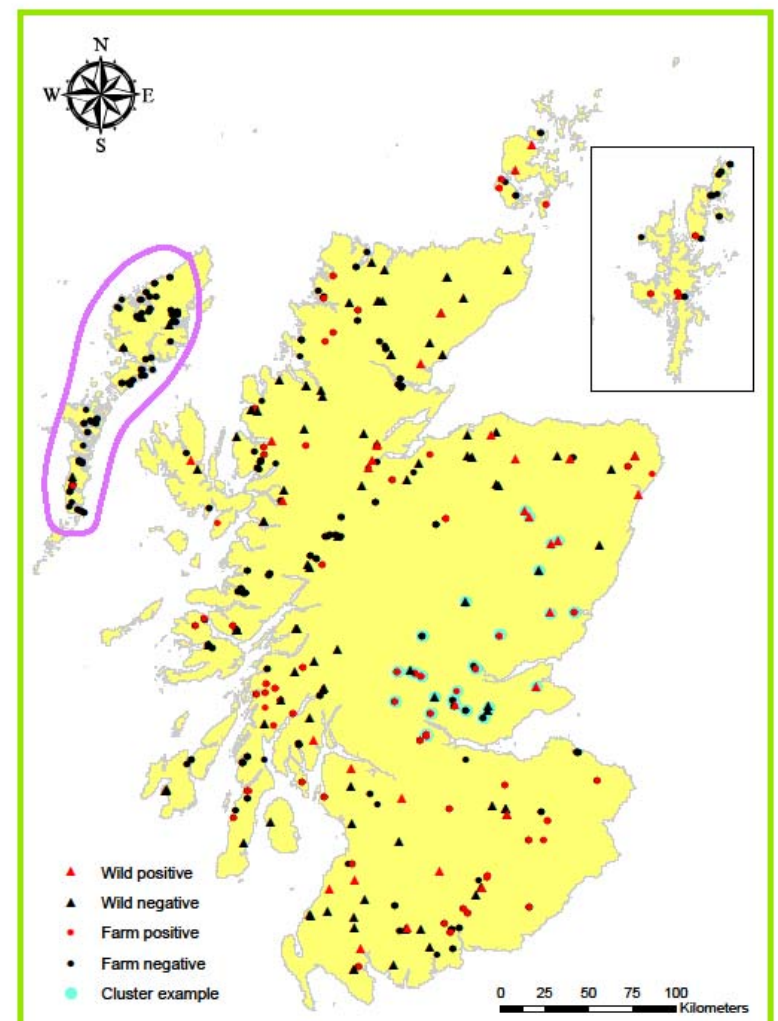


Figure 1. Data map illustrating spatial distributions of farmed and wild sampling locations and results. Western Isles “apparent” cluster (purple) and High rates cluster (pale blue highlight)