Project Overview

SHORT NAME
Fish Mortality and Predator Data Review

PROJECT MANAGER
[redacted]

PROJECT DURATION
10.2015 ------ 01.2016

PROJECT OBJECTIVES

To review predator data & fish mortality data recorded at Scottish seawater farms between 2011 & 2015 in order to establish the existence of trends and determine causal factors.

PROJECT IMPACT

To understand the efficiency and effectiveness of predator management between 2011 and 2015. Thereby, demonstrating control of predator management and supporting the reduction in both fish mortality & the use of a seal management licence in the future.

PROJECT APPROACH

- Phase 1 aims to describe the historical use of seal management licences and to determine the presence of triggers instigating this use, by looking at seal pressure at individual sites and identifying themes or anomalies between farms.
- Phase 2 intends to describe fish mortality across all the seawater farms and explore the existence, and reasons behind, broader themes. This will enable comparison between sites which have and haven't used a seal management licence.

BACKGROUND

Under the Marine (Scotland) Act 2010 (the Act) it is an offence to intentionally dispatch any seal except under specific licence. Therefore, Scottish companies must apply for a licence if they are required to manage seals which are attacking seawater farms. Data reported as part of the licencing process becomes public information.

The Company has seen a reduction in the number of seals dispatched between 2011 & 2014. However, a rise in numbers in 2015 has triggered internal and external enquires.

A detailed analysis of predator related data is expected to provide knowledge to help explain why this increase has occurred and to help determine if changes can be made to reduce numbers in the future.

Area: Environment & Sustainability	**Sub-area**: Predators

Partners:	**Tot cost:**	**MH direct cost:**	**MH indirect cost:**

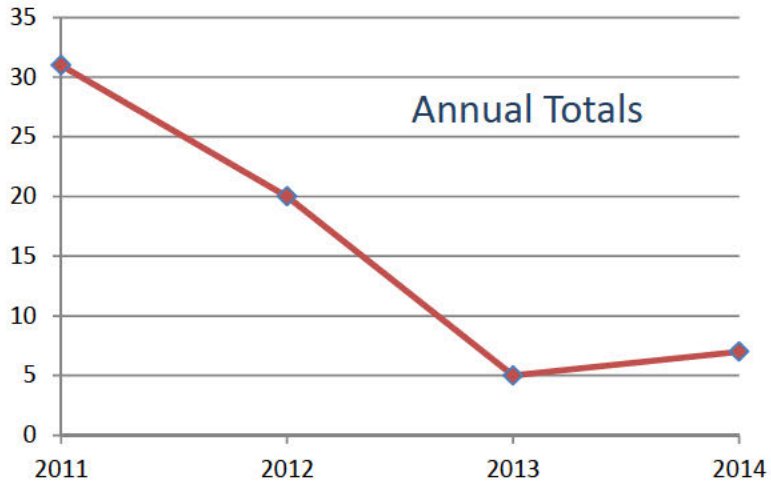
Data Review Topics

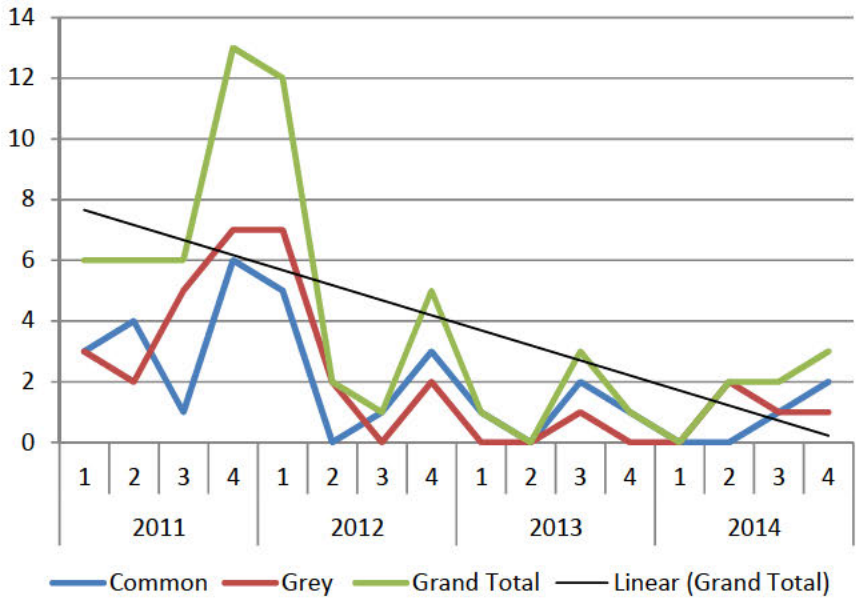
Phase 1 = Descriptive Data Analysis (1st January 2011 until 31st December 2015)

- Reminder of Historical Numbers
- Reminder of Q1 & Q2 2015
- Seal Numbers Update
- Seal Numbers & Active Seal Licences
- Comparison Active and Inactive Licence
- Comparison Seal Numbers, Active Seal Licences, & Active Farming Sites
- Geography – Regions
- Seasonality
- Species
- Squares vs Circles
- Hotspots
- Further work – Phase 2

Historical Numbers (2011-2014)

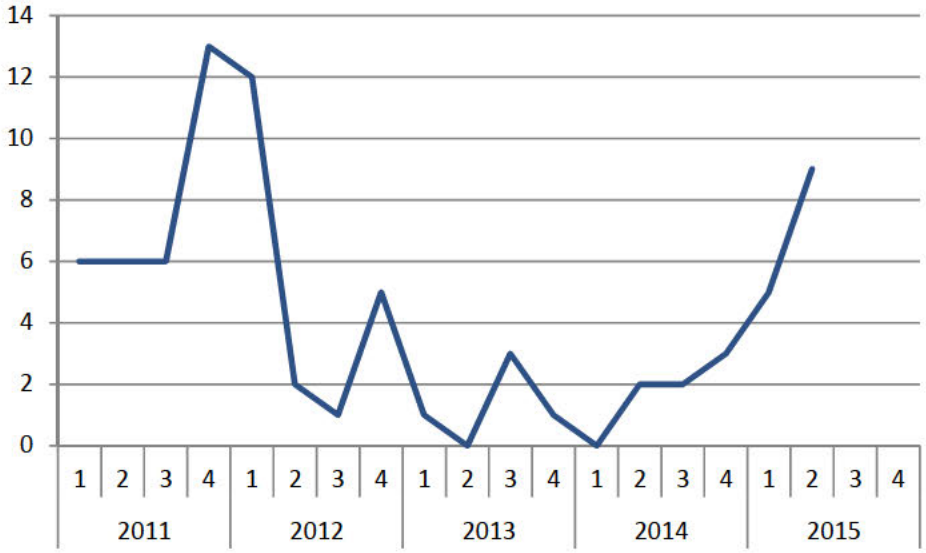
Management practices have contributed to a downward trend reducing total numbers by 77% over 4 years





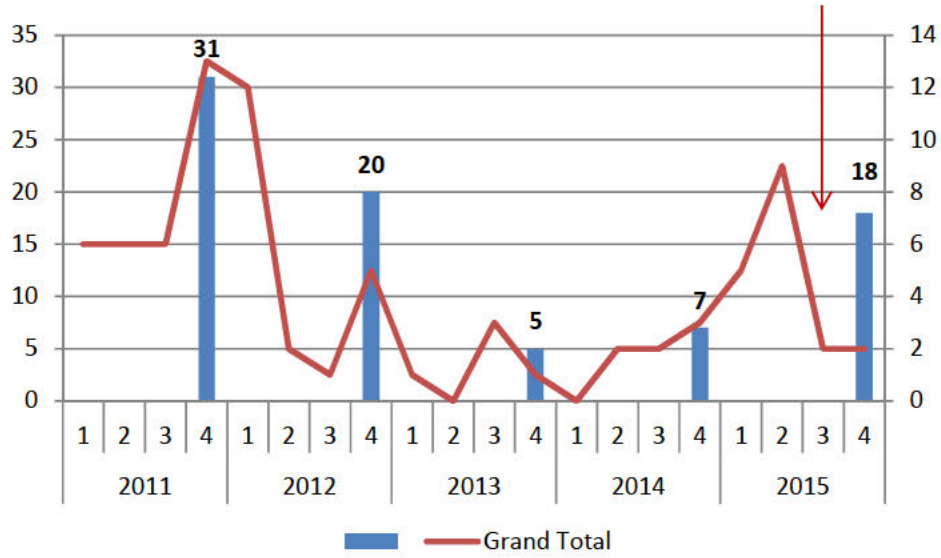
2015 – Q1/Q2

Figures towards the start of 2015 triggered immediate action and the development of an action plan to reduce future numbers, including:-



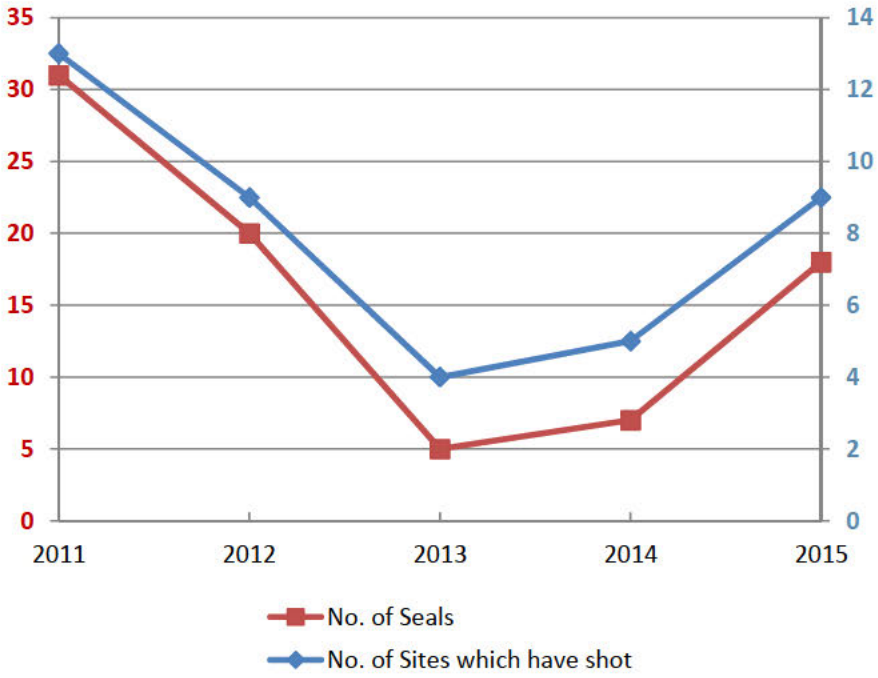
- A review, amendments & redistribution of company policies and protocols relevant to seal management.
- Written Authorisation PRIOR to arranging a marksman
- Review sites which have shot between 2011-2015 including a data review.

Seal Numbers Update



The total number of seal shot in the second half of 2015 (July-Dec inclusive) is 71% lower than at the beginning of the year and lower than numbers recorded during July-Dec in 2012, 2013 & 2014.

HOW MANY? – Seal Numbers & Active Seal Licences



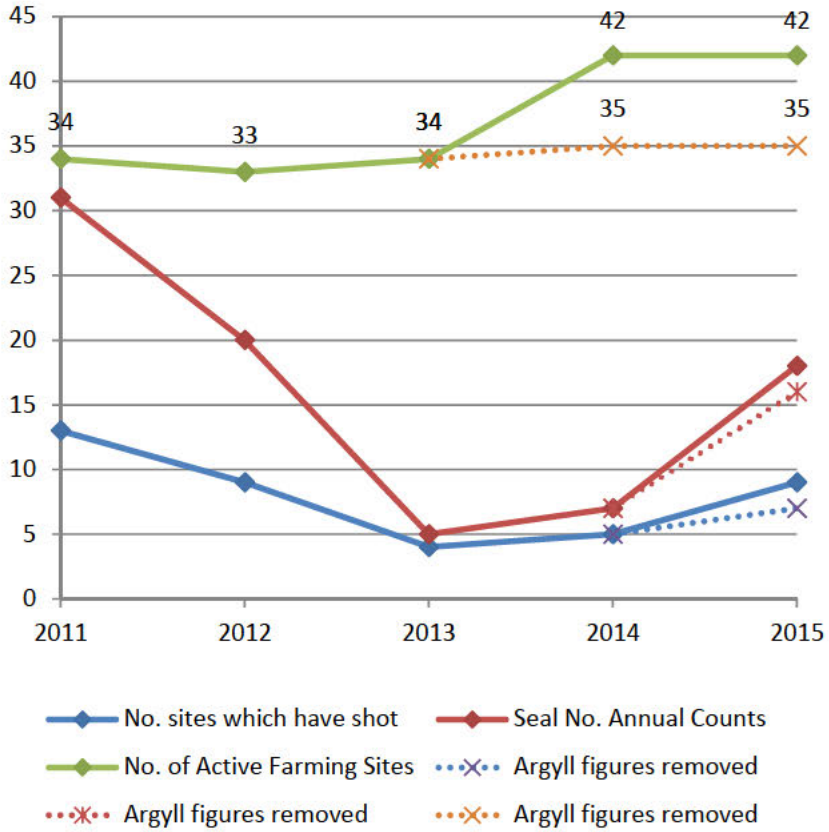
How many farming sites have used a seal licence and how do licence numbers relate to seal counts?

23 sites have used a seal licence over the 5 year period, which suggests the need to do so is not particularly localised.

The number of active seal licences was highest in 2011, thereafter the number of sites is at least 30% lower and differs by 5 sites.

The annual number of seal licences in use rise and fall with annual seal numbers e.g. the seal counts are seen to increase with an increase in active seal licences. Therefore an increase in annual seal counts appears to be the result of more sites shooting oppose to few sites shooting more.

Comparison Seal Numbers, Active Seal Licences, & Active Farming Sites



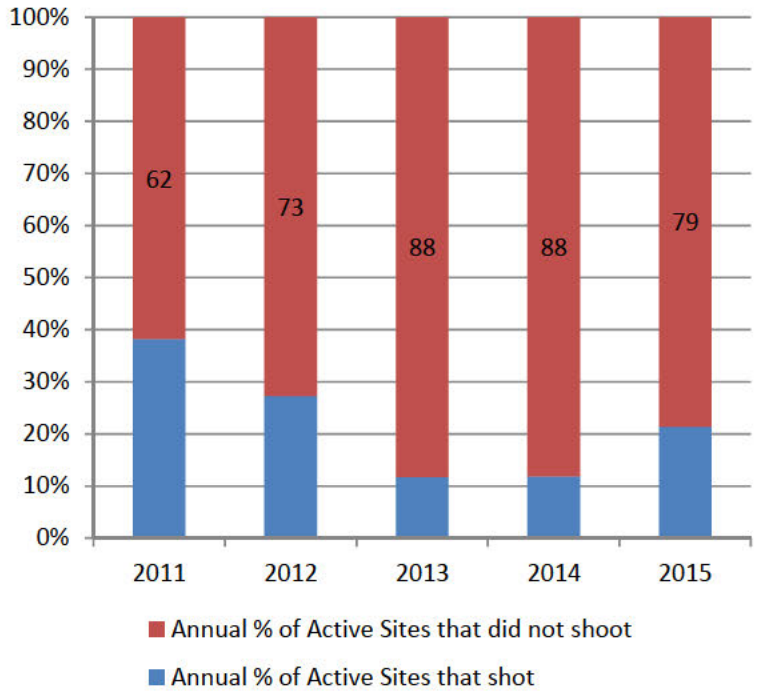
Can fluctuations be attributed to the no. of sites farmed?

The annual no. of active farms remained relatively stable (33-35 locations per year) and thus the number of operational farms is unlikely to have been a significant contributing factor to the observed changes in seal counts.

The number of operational farms increased in 2014 due to a company merger. The new sites equated to 22% of the seal numbers & 22% of the Active Site Licences in 2015.

An increase is seen if the figures for the new sites are removed. Therefore, the increase in farms is considered a contributing factor but is unlikely to be the only influence resulting in the observed trends.

HOW MANY? – Comparison Active & Inactive Seal Licences



What proportion of site use a seal licence & how does this vary annually?

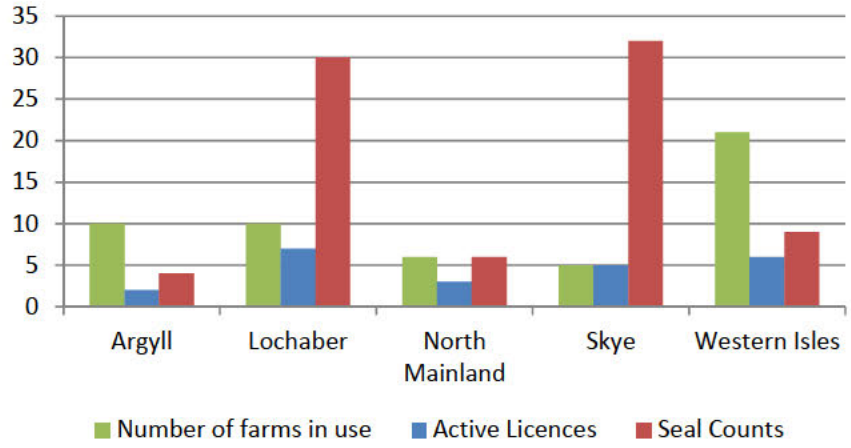
52 different locations have been farmed between 2011-15 of which 46% have used a seal licence during the 5 year study period. This suggests causal factors are not particularly isolated geographically.

However, figures show a large proportion of sites have not utilised a seal licence annually. For example, in 2015, 9 of the 42 sites farmed used a seal licence.

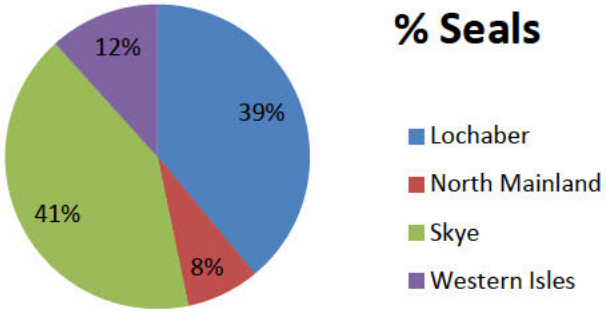
These observations suggest that the spatial distribution of contributory factors may vary from year to year.

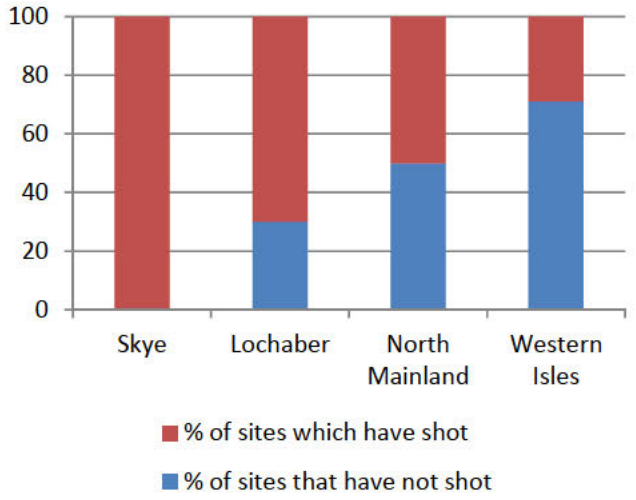
WHERE? - Geographical Regions

How do Seal Counts, Active Seal Licences, and the Proportion of Inactive/Active Seal Licences vary regionally?

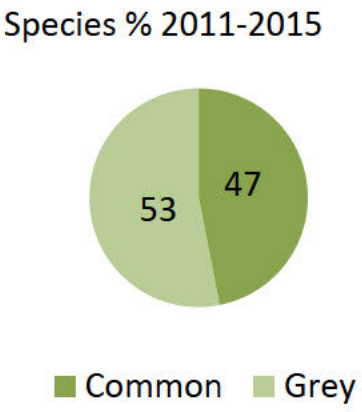


Seal Counts and Active Seal Licences are highest in Lochaber, whereas seal numbers and the proportion of farms using their seal licences is lowest in the Western Isles region.



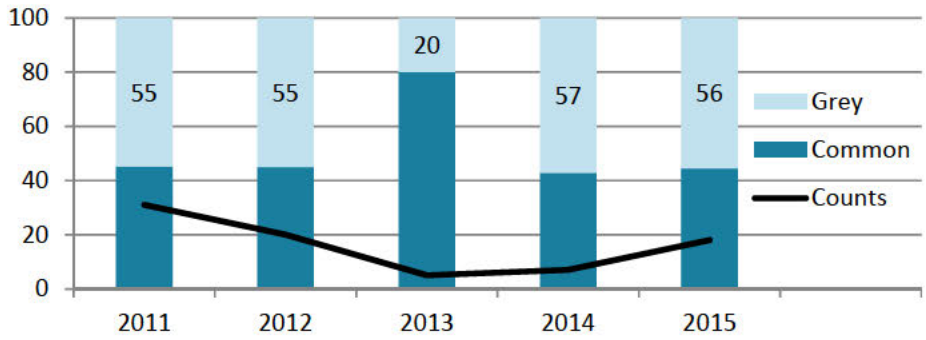


WHAT? - Species Comparison



- Both Common and Grey seals have been shot annually over the 5 year period.
- The difference between species is low (1-3 counts) and average numbers are similar.
- The proportion of each species is also similar annually, although the percentage of Grey seals was higher for 4 out of the 5 years.

These observations suggest there is not a considerable difference between species .



	Common	Grey	Difference
2011	14	17	3
2012	9	11	2
2013	4	1	3
2014	3	4	1
2015	8	10	2
Max	14	17	3
range	11	16	5
Average	7.6	8.6	1

Frequency & Hotspots

Over the 5 year period 32% of the sites dispatched 1 seal and 71% of the site used a licence 4 times or less. 5 of the 7 farms which shot more than 4 seal use square pens.

No. Seals	No. Sites
1	5
2	6
3	3
4 >	7

Hotspot Loch Systems	
Ranked by Seal No.	
Ailort	4
Linnhe	10
Sunart	16
Coal Mhor	26

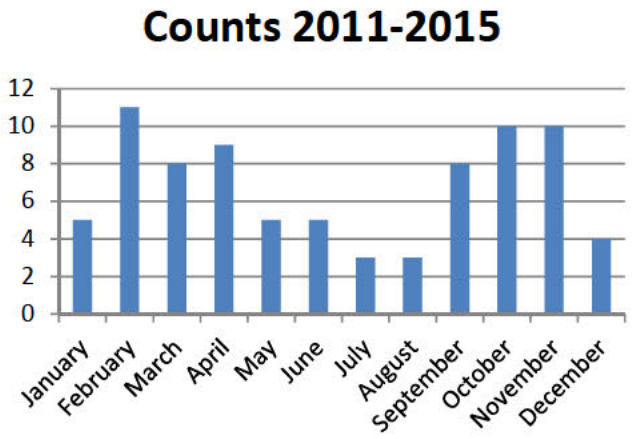
Hotspot farming sites	
Ranked by Seal No.	
Sconser	14
Camas Glas	10
Maol Ban	7
Invasion Bay	6
Cairidh	5
Linnhe	5
Ardnish	4

Hotspots have been identified by ranking the loch systems and individual sites based on the total number of seals shot over the study period. The locations listed in Table 1 & 2 have been identified because at least 4 seals have been shot over the study period.

In general, total numbers for these hotspots are the result of seals being dispatched over multiple years with the exception of one farm where numbers were recorded in a single year.

Questions – Are the mortality figures in these locations statistically higher than farms which are not listed.

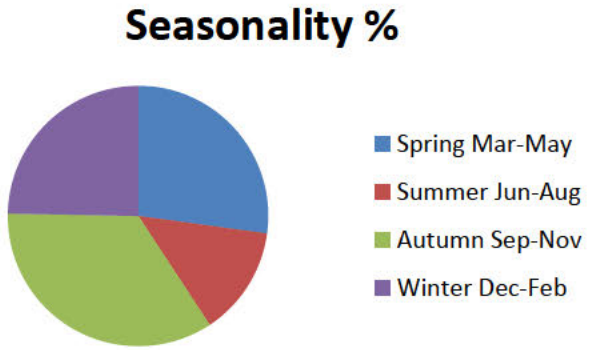
WHEN? - Seasonality

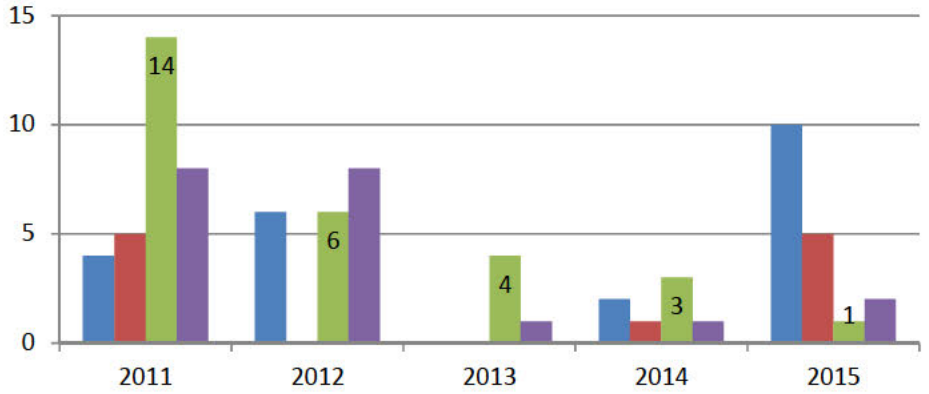


Over the 5 year study period, counts were highest in the months of February, October, and November, with the largest percentage recorded in Autumn.

Annually counts tend to be lowest in the Spring & Summer period, however 2015 is an exception to this trend.

Numbers in Autumn and Winter have also seen a steady reduction and 2015 recorded the lowest numbers for this period.



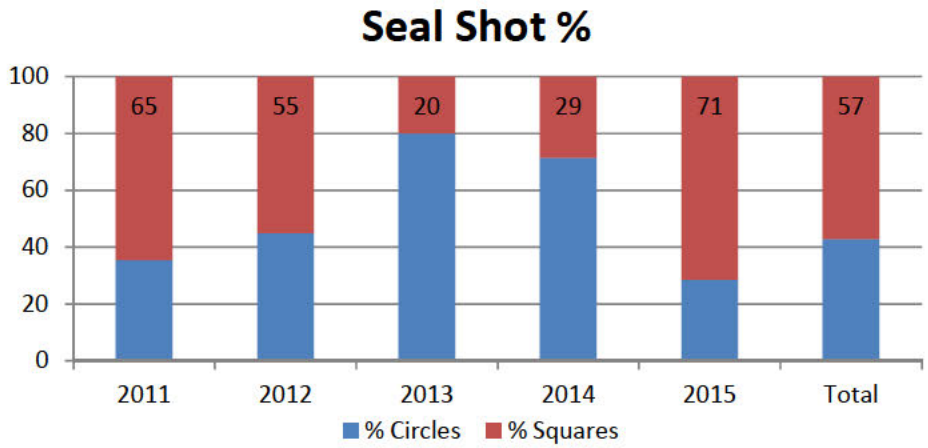


Potential Triggers (Equipment) – Squares vs Circles

21 sites (excluding the Argyll sites) used a seal licence over the 5 year period and 61% of these sites were farming circular pens (13 sites farmed circles & 8 sites farmed squares).

However, it is important to put this into context as during the 5 year study period 34 of the 42 sites farmed circular pens.

61% of the sites farming circular pens did not use a seal licence.
Whereas all of the sites utilising squares used a seal licence.



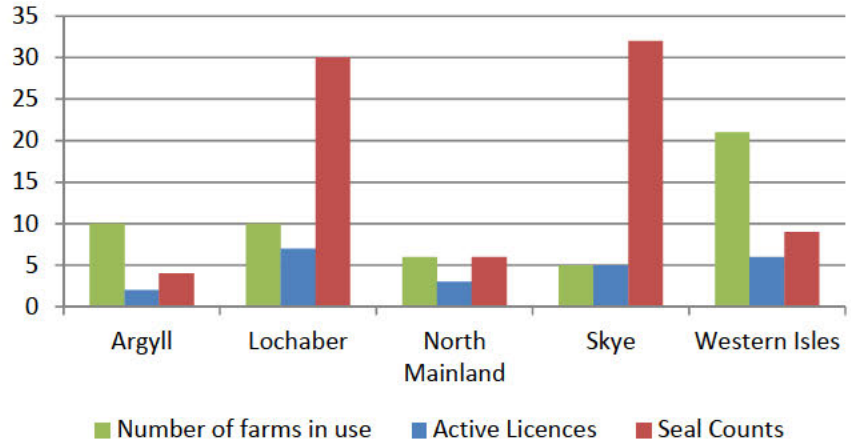
Data Review Topics

Phase 1 = Descriptive Data Analysis (1st January 2011 until 31st December 2015)

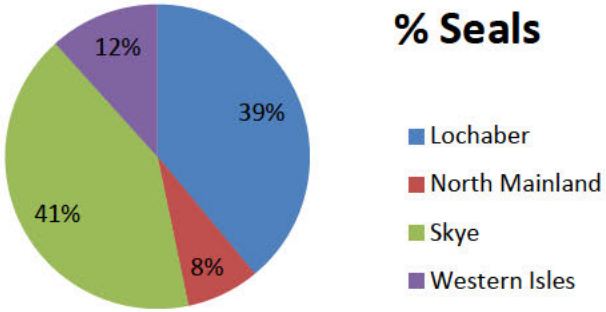
- Reminder of Historical Numbers
- Reminder of Q1 & Q2 2015
- Seal Numbers Update
- Seal Numbers & Active Seal Licences
- Comparison Active and Inactive Licence
- Comparison Seal Numbers, Active Seal Licences, & Active Farming Sites
- Geography – Regions
- Seasonality
- Species
- Squares vs Circles
- Hotspots
- Further work – Phase 2

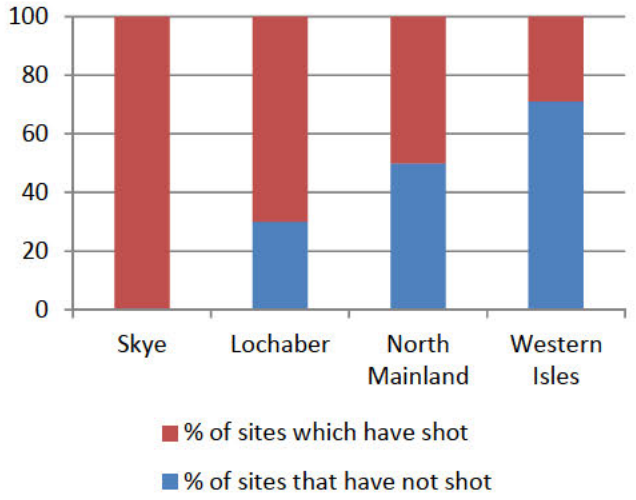
WHERE? - Geographical Regions

How do Seal Counts, Active Seal Licences, and the Proportion of Inactive/Active Seal Licences vary regionally?

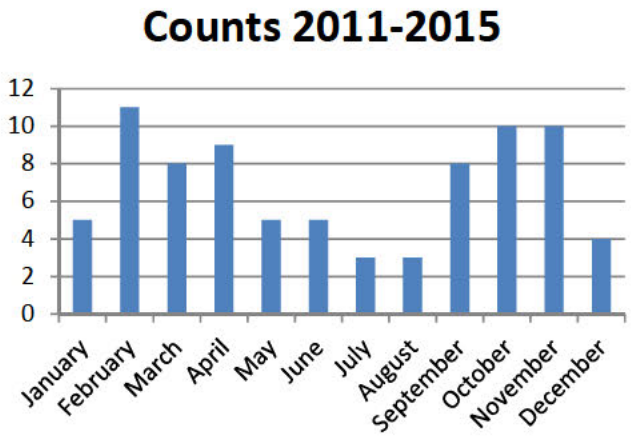


Seal Counts and Active Seal Licences are highest in Lochaber, whereas seal numbers and the proportion of farms using their seal licences is lowest in the Western Isles region.





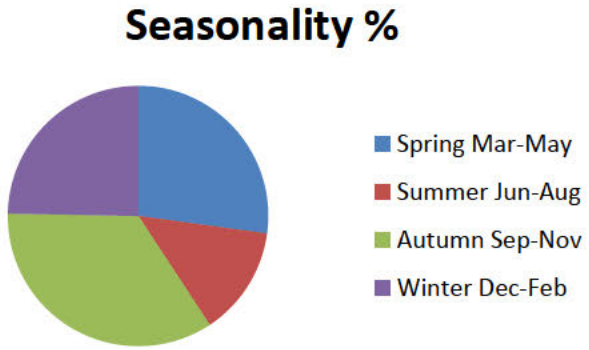
WHEN? - Seasonality

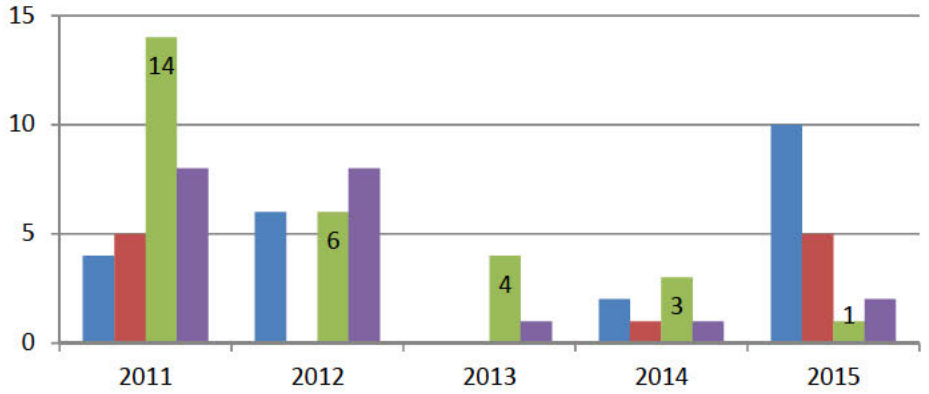


Over the 5 year study period, counts were highest in the months of February, October, and November, with the largest percentage recorded in Autumn.

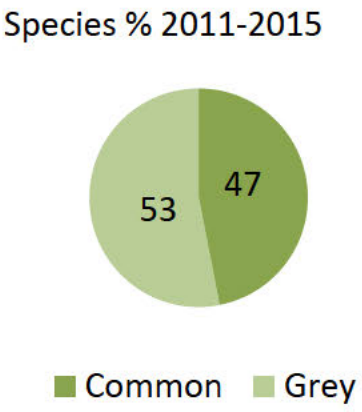
Annually counts tend to be lowest in the Spring & Summer period, however 2015 is an exception to this trend.

Numbers in Autumn and Winter have also seen a steady reduction and 2015 recorded the lowest numbers for this period.



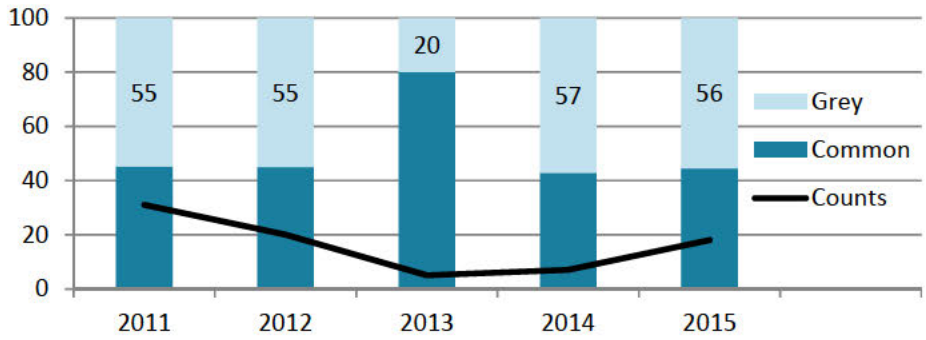


WHAT? - Species Comparison



- Both Common and Grey seals have been shot annually over the 5 year period.
- The difference between species is low (1-3 counts) and average numbers are similar.
- The proportion of each species is also similar annually, although the percentage of Grey seals was higher for 4 out of the 5 years.

These observations suggest there is not a considerable difference between species .



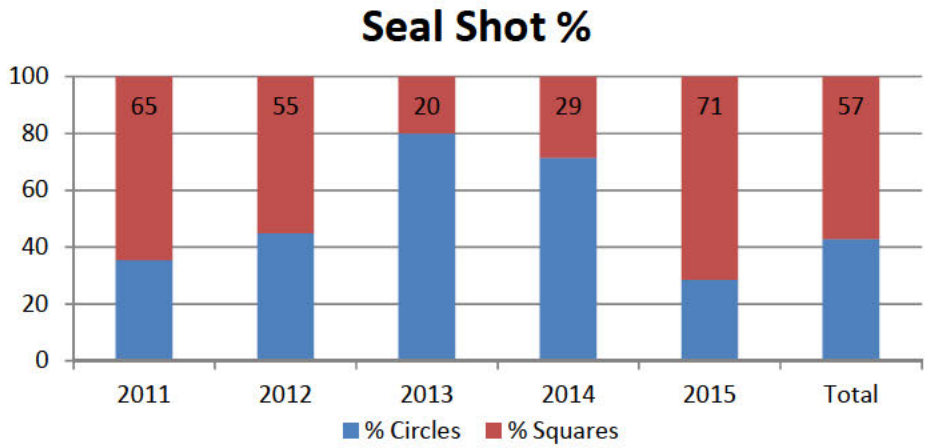
	Common	Grey	Difference
2011	14	17	3
2012	9	11	2
2013	4	1	3
2014	3	4	1
2015	8	10	2
Max	14	17	3
range	11	16	5
Average	7.6	8.6	1

Potential Triggers (Equipment) – Squares vs Circles

21 sites (excluding the Argyll sites) used a seal licence over the 5 year period and 61% of these sites were farming circular pens (13 sites farmed circles & 8 sites farmed squares).

However, it is important to put this into context as during the 5 year study period 34 of the 42 sites farmed circular pens.

61% of the sites farming circular pens did not use a seal licence.
Whereas all of the sites utilising squares used a seal licence.



Frequency & Hotspots

Over the 5 year period 32% of the sites dispatched 1 seal and 71% of the site used a licence 4 times or less. 5 of the 7 farms which shot more than 4 seal use square pens.

No. Seals	No. Sites
1	5
2	6
3	3
4 >	7

Hotspot Loch Systems	
Ranked by Seal No.	
Ailort	4
Linnhe	10
Sunart	16
Coal Mhor	26

Hotspot farming sites	
Ranked by Seal No.	
Sconser	14
Camas Glas	10
Maol Ban	7
Invasion Bay	6
Cairidh	5
Linnhe	5
Ardnish	4

Hotspots have been identified by ranking the loch systems and individual sites based on the total number of seals shot over the study period. The locations listed in Table 1 & 2 have been identified because at least 4 seals have been shot over the study period.

In general, total numbers for these hotspots are the result of seals being dispatched over multiple years with the exception of one farm where numbers were recorded in a single year.

Questions – Are the mortality figures in these locations statistically higher than farms which are not listed.

Data Review Topics

Phase 1 = Descriptive Data Analysis (1st January 2011 until 31st December 2015)

- Reminder of Historical Numbers
- Reminder of Q1 & Q2 2015
- Seal Numbers Update
- Seal Numbers & Active Seal Licences
- Comparison Active and Inactive Licence
- Comparison Seal Numbers, Active Seal Licences, & Active Farming Sites
- Geography – Regions
- Seasonality
- Species
- Squares vs Circles
- Hotspots
- Further work – Phase 2