Scottish Sanitary Survey Review

Seil Point

AB-245

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id1	22/02/2015	-	Draft for internal review
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1.0	10/04/2015	iv	Amended list of sampling officers in line with comments received from consultees

	Name	Position	Date
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Andy Macleod	Argyll and Bute Council
David Cyster	Harvester

Review Specification and Introduction

Sanitary surveys are used to demonstrate compliance with the requirements stated in Annex II (Chapter II Paragraph 6) of Regulation (EC) 854/2004, whereby if the competent authority decides in principle to classify a production or relay area it must:

- make an inventory of pollution sources of human/animal origin likely to be a contamination source for the production areas;
- examine the quantities of organic pollutants which are released during the different periods of the year, according to the seasonal variations of both human and animal populations in the catchment area, rainfall readings, wastewater treatment, etc.;
- determine the characteristics of the circulation of pollutants by virtue of current patterns, bathymetry and the tidal regime in the production area;
- establish a sampling programme of bivalve molluscs in the production area which is based on the examination of established data, and with a number of samples, a geographical distribution of the sampling points and a sampling frequency which must ensure that the results of the analysis are as representative as possible for the area considered.

The EURL Good Practice Guide (GPG) for the monitoring of bivalve molluscs harvesting areas recommends the re-evaluation of sanitary surveys every six years. Location, extent and nature of fisheries and faecal pollution sources may change over time and the review is conducted to determine whether the sampling plan and/or production area boundaries remain appropriate and protective of public health.

As specified by the Food Standards Agency, this review is comprised of a brief desktop search of publicly available information together with a shoreline survey. No additional data requests are submitted to external bodies. The review is intended to identify significant changes in:

- Historic microbiological data.
- Sewage treatment and sewerage infrastructure.
- Housing and development.
- Harvester operations.

The output of the review is a report identifying any new information that has been obtained and/or whether major elements of the original sanitary survey can be regarded as essentially unchanged. That report includes an overall assessment as to whether the production area/classification zone boundaries and/or RMPs should be modified from those recommended in the original report and if so, a description of the revised boundaries and a revised sampling plan with the boundaries and RMP(s) locations.

A sanitary survey was undertaken in 2008 for the Seil Point production area. The survey was conducted to identify the location, extent and nature of the shellfishery and the potential sources of faecal contamination to the shellfishery, and to recommend boundaries and a sampling plan for the production area. The associated shoreline survey was undertaken in August 2007.

The output of the sanitary survey included a report and recommended sampling plans for the production area. That sampling plan is identified immediately after the contents page along with the recommended changes following the findings from this review.

The present report constitutes a review of publicly available information in order to assess changes that have occurred since the 2008 sanitary survey report (see the Review Specification section for further detail). It is not intended to present detailed information relating to pollution sources that were identified in the previous report. This review should be read in conjunction with the 2008 sanitary survey report.

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APPENDICES

Sampling Plan – Seil Point

	2008 Report	2015 Review	Changes
PRODUCTION AREA	Seil Point		No Change
SITE NAMES	Cyster	Poll a' Bhrochain (Cyster)	Name changed to match that used by harvester
SIN	AB-245-070-13		No Change
SPECIES	Pacific oyster		
TYPE OF FISHERY	Trestle		
NGR OF RMP	NM 7710 1938	NM 7709 1938	Slight change in line with current trestle location
EAST	17710	17709	
NORTH	71938	71938	
TOLERANCE (M)	10 m	20 m	Increased to allow for slightly greater variation in location of stock available for sampling in the vicinity of the RMP
DEPTH (M)	N/A		No change
METHOD OF SAMPLING	Hand		
FREQUENCY OF SAMPLING	Monthly		
LOCAL AUTHORITY	Argyll and Bute Council		
AUTHORISED SAMPLER(S)	Christine McLachlan, William MacQuarrie, Ewan McDougall, Donald Campbell	William MacQuarrie, Ewan McDougall, Heather Harley, Allison Hardie, Christine McLachlan	Change in personnel
RECOMMENDED PRODUCTION AREA	The area inside of the line drawn between NM 7644 2033 and NM 7782 2000		No change

1. Area Description and Fishery

The location of Seil Point is shown in Figure 1.1.

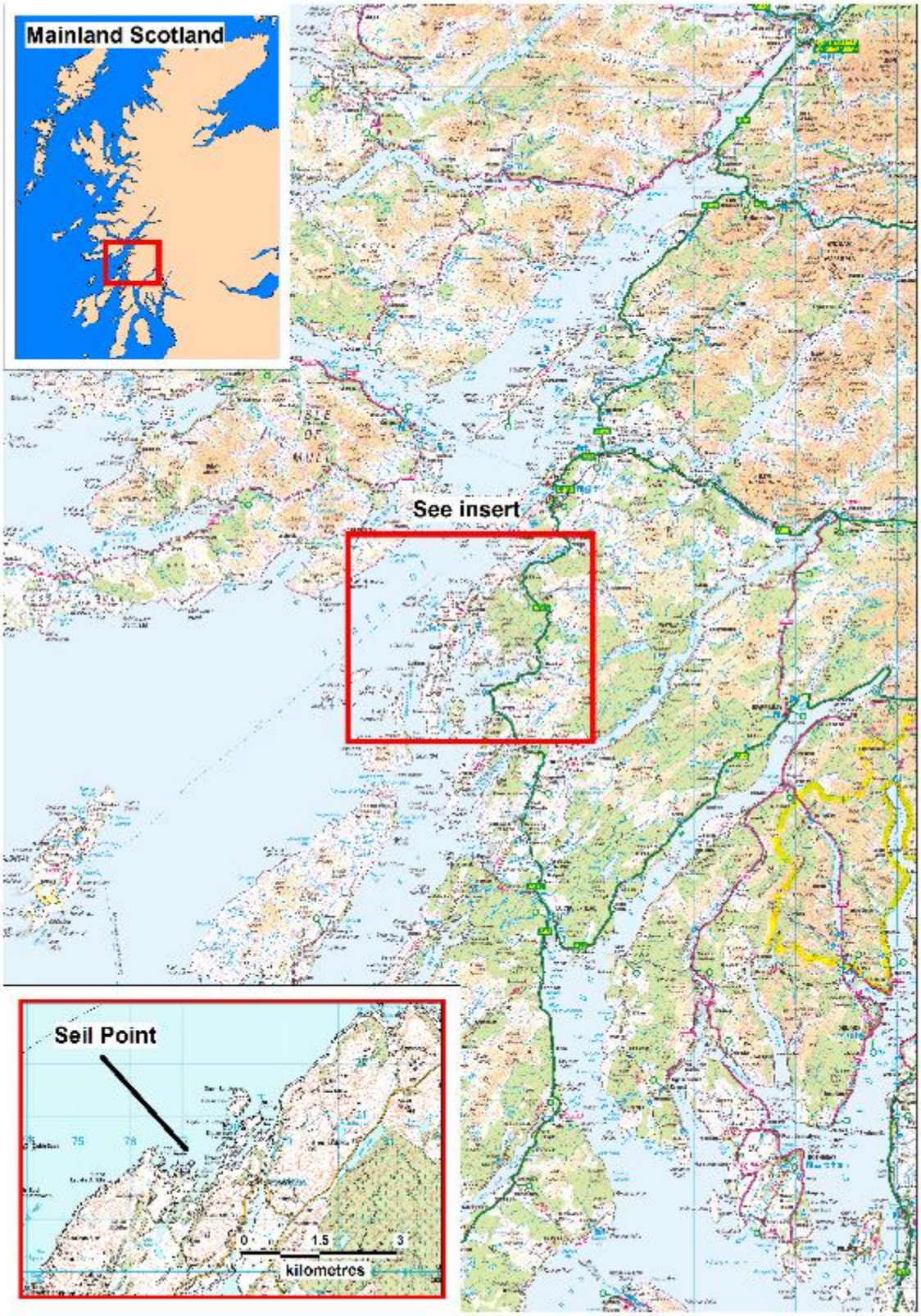

Figure 1.1 Location of Seil Point

The shellfishery still consists of two areas of trestle-grown Pacific oysters with details listed in Table 1.1.

Table 1.1 Currently classified fishery at Seil Point

Production area	Site	SIN	Species	RMP
Seil Point	Ardencaple - Cadzow	AB-245-069-13	Pacific oysters	NM 7709 1938
	Ardencaple - Cyster	AB-245-070-13		

The current FSAS production area remains the same as that recommended in the 2008 sanitary survey report. The current RMP varies slightly from that recommended in 2008 that observed during the 2014 shoreline survey. However, all three locations lie within a 10 m radius of NM 77093 19385. The locations of the current RMP and production area boundaries and the extents of the oyster fishery recorded during the 2007 and 2014 shoreline surveys are displayed in Figure 1.2.

The 2014 survey noted the two main sites remain in operation, though were now referred to as ‘West Bay’ and ‘Poll a’ Bhrochain’. The West Bay array consisted of a single strand of 63 trestles, whilst the Poll a’ Bhrochain array consisted of five groups of trestles arranged in parallel rows and was noted to be accessed by tractor at low spring tides. A third site, identified as Cadzow and consisting of a 7x3 m trestle area with 13 bags, was located in the small inlet east of Poll a’ Bhrochain. Oysters were only present at the Poll a’ Bhrochain site.

The Cadzow site had recently been acquired by Mr Cyster, who reported that he did not have any plans to restock the site. Mr. Cyster noted plans to scrap the low trestles currently in place in West Bay and to install taller trestles at that site.

The shore-base for the oyster sites was observed at the head of the bay near the outlet to Loch of Caithlim.

Oyster seed had been obtained from Connel and spat from Guernsey. Harvested stock is marketed through an oyster grower co-operative for depuration and onward sale. Small numbers of over-sized oysters are also supplied to Loch Fyne Seafoods.

An RMP consisting of a separate trestle adjoining the south side of the Poll a’ Bhrochain site was noted at NM 7709 1939. The harvester noted that it is usually stocked with unmarketable joined oysters.

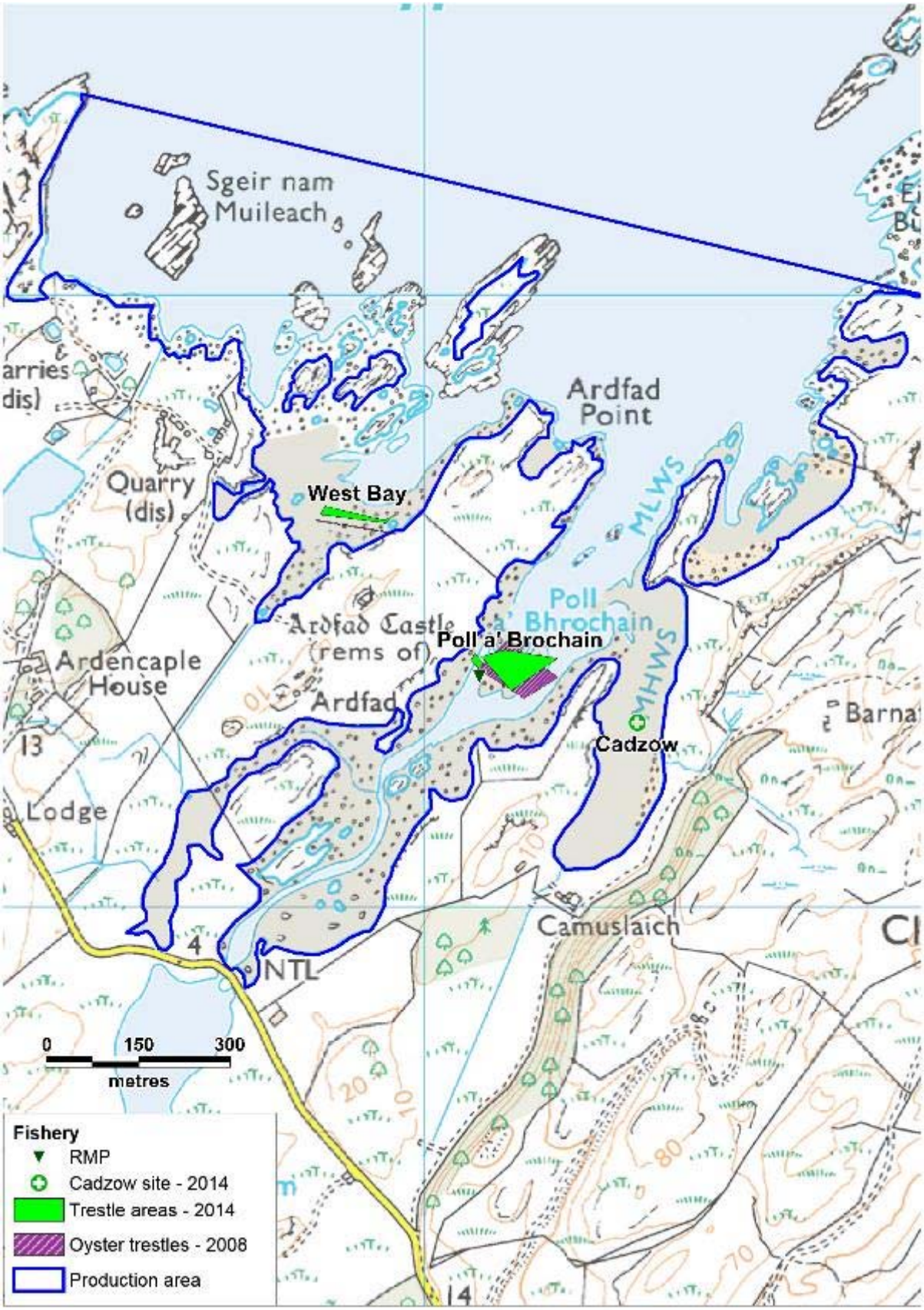

Figure 1.2 Seil Point fisheries

2. Population and Human Sewage Impacts

2.1 Population

Population data from the General Register Office for Scotland from both the 2001 and 2011 censuses are shown in Table 2.1. It should be noted that the number of output areas and the boundaries of some of the areas changed between the two censuses and it is therefore not possible to directly compare the population values for the output areas for the two censuses. The location of the 2011 census areas, shaded by population desnity, together with population-related observations from the 2014 shoreline survey, are shown on the map in Figure 2.1.

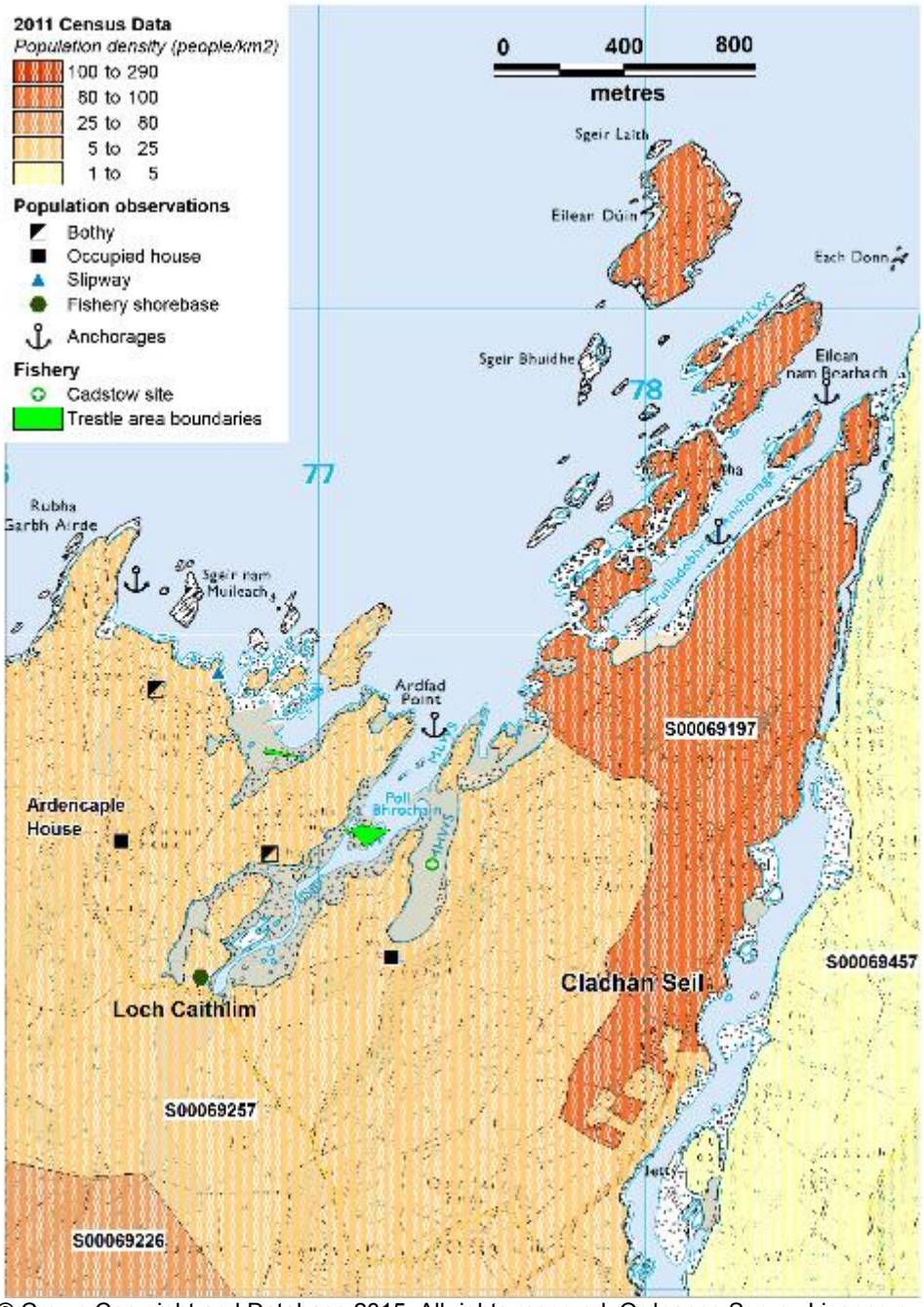

Figure 2.1 Current distribution of human population around Seil Point

Table 2.1 Scottish Government Census data for years 2001 and 2011

2001 Census data		2011 Census data	
Output area	**Population**	**Output area**	**Population**
60QD000079	105	S00069527	88
60QD000080	98	S00069197	109
60QD000081	125	S00069457	117
TOTAL	328	**TOTAL**	314

The land in the vicinity of the production area remains largely uninhabited, with only two permanently occupied houses: Ardencaple House and Camuslaich farmhouse. The 2014 shoreline survey noted that there were three bothies associated with the Ardencaple Estate, however only two of these were directly observed. These were reported to not have any drainage facilities. The nearest centre of population is at Clachan Seil, to the southeast of Seil Point and contamination arising in that area is not expected to directly impact at the production area.

Planning applications were checked for the areas around Seil Point from Argyll and Bute Council planning portal in December 2014. The only applications identified during the search were for locations around Seil Sound and these were not considered relevant to the assessment in this review..

Visitors are expected to use the bothies mainly during the summer, though overall numbers are expected to be low.

There are four anchorages in the vicinity of Seil Point (Clyde Cruising Club, 2007). Puilladobhrain Anchorage lies between tidal islands and the north end of Seil Island, just over 1 km to the northeast of Poll a' Bhrochain. The anchorage is reported to be very popular and heavily used in the summer, when the main pool can fully occupied with small yachts. Larger yachts and those unable to find space at Puilladobhrain anchor further out to the east of Eilean nam Beathach. This anchorage was reported to be in continuous use from May to September.

There are occasional anchorages east of Rubha Garbh Aird (approximately 600 metres northwest of the trestles in West Bay), and east of Ardfad Point (approximately 350 m north-northeast of the Poll a' Bhrochain trestle area).

1.2 Sewage Discharges

The 2008 report concluded that the nearest community discharges in Seil Sound were not anticipated to have much impact on contamination levels at the Seil Point oyster farms. No evidence of sewage outfalls or discharges was seen during the 2014 shoreline survey, which only covered the immediate area around the fishery. However, the harvester identified that the Ardencaple shore base was served by a septic tank discharging to a soakaway nearby.

Local information indicated that the bothies do not have any drainage facilities, therefore visitors to these will be most likely depositing waste into shallow holes dug somewhere nearby.

Conclusions

Overall human population around Seil Point fisheries is not expected to have significantly changed since 2008.

No direct discharges of sewage were identified from dwellings or premises in the vicinity of the oyster farms. Disposal of waste associated with occupation of the bothies may contribute to diffuse contamination arising from around the bothies, depending on where visitors are toileting. Overboard discharges of sewage from yachts may occur when the anchorages are in use, and this is most likely to have a seasonal impact from May to September.

3. Farm Animal Population and Agricultural Impacts

No farm census data was provided by Scottish Government in support of the 2008 sanitary survey report as there were too few farms in the relevant parishes to ensure that farm-specific data could not be ascertained. That report therefore primarily considered the observations from the shoreline survey undertaken between the 13th and 14th August 2007. Evidence of livestock was reported along much of the shoreline, with much of the surrounding land being unimproved grassland and suitable for grazing livestock. Parts of the shoreline were closed from June to September to protect breeding birds, which would limit livestock on the shoreline at that time. A cattle shed and dung heap were noted at Loch Caithlim, where sweepings were also sometimes reportedly dumped on the shoreline. Overall, agricultural impacts were expected to be greatest at the head of Poll a' Bhrochain, which would have the highest impact on the Poll a' Bhrochain site.

For this review, additional information on agricultural based contamination sources has been obtained through a shoreline survey and through a desk-based internet searches. Shoreline survey observations only relate to the time of the survey undertaken on the 7th October 2014 and are displayed in Figure 3.1.

The 2014 shoreline survey recorded a shed and dung heap at Loch Caithlim (as seen in 2007) , where 12 cattle and 41 sheep were also seen. A cattle feeding station was observed near the West Bay site and a pheasant feeder was observed at the Ardencaple shore base.

A small herd of feral goats (12-14 animals) is reported to inhabit Eilean Duin, approximately 1.5 km to the northeast of Ardfad Point (http://www.seilchat.co.uk/viewtopic.php?f=1&t=1522, Accessed 19/02/2015).

From publicly available satellite imagery (Microsoft Corportation, 2014) dated April 2012, there also appeared to be livestock on fields around Ardencaple House as well as around a barn near the road at Loch Caithlim. No further details on livestock at Ardencaple House could be found during internet searches.

Conclusions

Agricultural contamination sources remain concentrated at the head of Poll a' Bhrochain. Agricultural impacts therefore remain highest at the Poll a' Bhrochain site, with some level of impact also expected at the Cadzow site from livestock on land at Camuslaich. There is also expected to be a significant impact from the cattle feeding station located northwest of Ardfad, with the greatest impact from that source expected at the West Bay site.

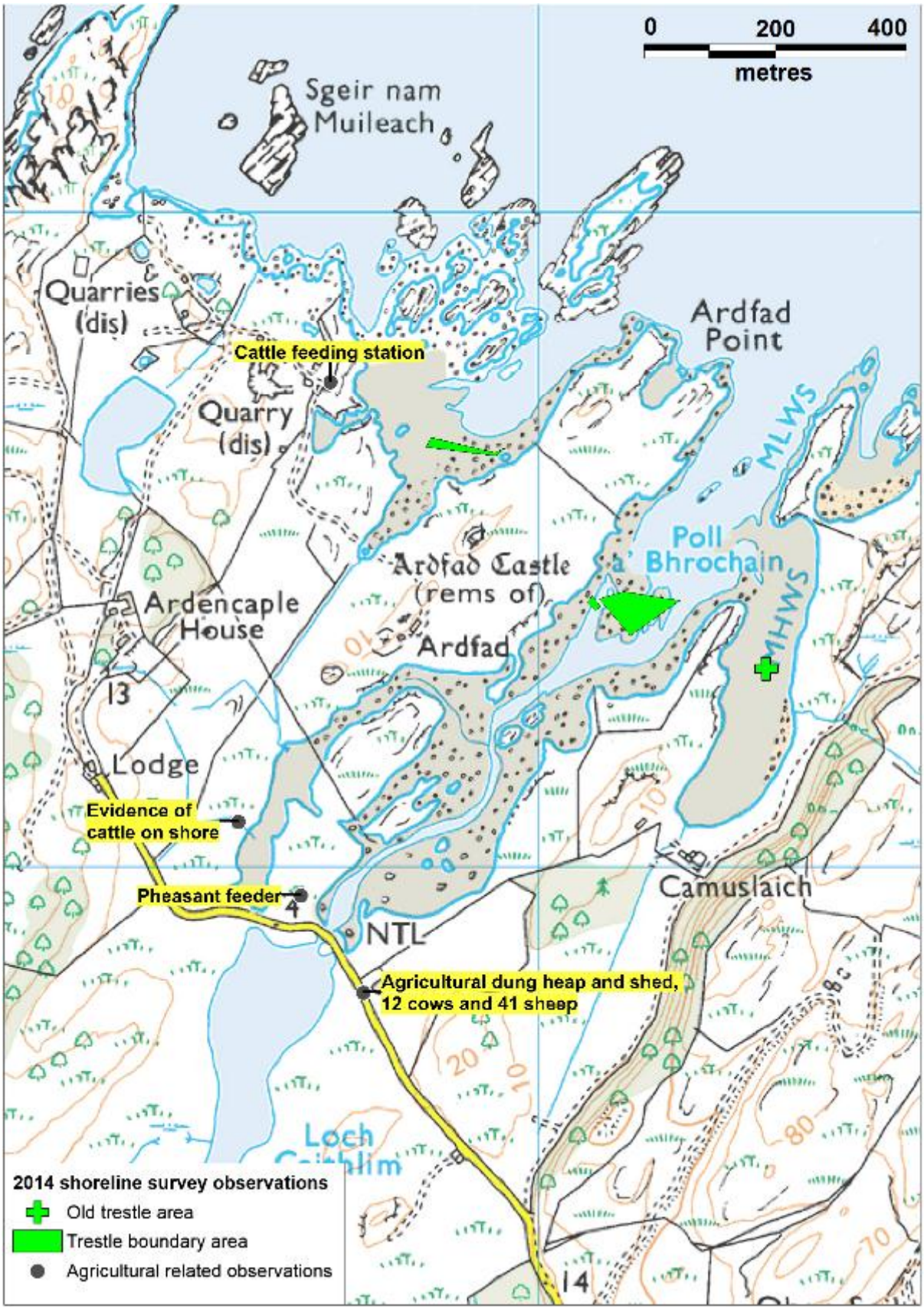

Figure 3.1 Map of farm animal-associated observations made during the 2014 shoreline survey

4. Wildlife

The 2008 sanitary survey report concluded that seals were expected to be the most significant contributor to contamination in the area, owing to their presence during the survey. Dolphins, seabirds, geese, deer, and otters were also expected to be resident in or visit the area, though in smaller numbers. Overall, wildlife impacts were expected to be localised and unpredictable.

For this review, information on pollution sources from wildlife has been obtained from JNCC dataset, through the shoreline survey conducted in 2014, and through a desk-based internet search. Shoreline survey observation information only relates to the time of the survey undertaken on the 7th October 2014. Wildlife observations are displayed in Figure 4.1.

Seals

The Special Committee on Seals report (Special Committee on Seals, 2013) noted that both harbour and grey seals were present around the Seil Point and Seil Sound areas in August surveys between 2007 and 2011.

During the 2014 shoreline survey, 10 seals were seen on the islets off Ardencaple bay, adjacent to the West Bay site.

Dolphins

Since 2008 there have been two sightings of dolphins at the Isle of Seil; three harbour porpoise in 2014 and two unidentified dolphins in 2013 (Hebridean Whale and Dolphin Trust, 2014-15). No dolphins were observed during the 2014 shoreline survey.

Seabirds

Seabird data was downloaded from the collated JNCC dataset from the website (JNCC, 2014) in March 2014. The dataset was then manipulated to show the most recent data where repetitions of counts were present. It should be appreciated that the sources of this data are varied, with some recorded as unknown or estimated, whilst some come from reliable detailed surveys such as those carried out for the Seabird 2000 report by Mitchell *et al.*, (2004). Data applicable for the 5 km area around the fisheries are listed in Table 4.1.

Table 4.1 JNCC data for within 5 km of Seil Point

Common name	Species	Count*	Type	Accuracy
Herring Gull	*Larus argentatus*	40	Occupied nests and territory	Accurate
Great Black-Backed Gull	*Larus marinus*	2	Occupied nests	Unknown
Shag	*Phalacrocorax aristotelis*	130	Occupied nests	Accurate
Common Gull	*Larus canus*	52	Occupied nests	Accurate

*Counts for occupied nests, sites and territory were doubled, with total counts given using adjusted data.

The largest bird colony identified in the JNCC seabird data was located over 2.5 km southwest of the Seil Point production area. Other smaller nesting areas were identified on the small islands in the area and at Ardfad Point. The extent of any impact on the sites at Seil Point would depend on the feeding range of the birds.

Geese

Both resident and migratory Greylag geese (*Anser anser*) are known to be present in Scotland. A survey of summer greylag geese populations was undertaken on behalf of Scottish Natural Heritage in 2008-09 (Mitchell, *et al.* 2010). The report identified that the geese were breeding on small offshore islands around the coast, and 683 Greylag geese were counted in mainland Argyll, though none of these were located on Seil Island. Larger numbers of geese will be present in winter, when migratory animals from Iceland feed and overwinter in Scotland. In recent times, these animals have begun to favour agricultural fields where they feed on grasses and winter crops (Mitchell, 2012). None of the data presented identified feeding animals specifically around Seil Island.

During the 2014 shoreline survey, approximately 50 greylag geese were noted offshore from Ardencaple Bay. Goose droppings were also noted along the shoreline within Poll a' Bhrochain. Other species observed included a gull, a heron, two swans and a curlew.

Otters

No accurate accounts of otters around Seil Point were found for this review.

Deer

There are several areas of woodland on adjacent land which may harbour deer. However, no accurate counts of deer in the around Seil Point were found for this review.

Conclusions

Impacts from wildlife sources remain largely the same as those identified in the 2008 report. However, the presence of geese and large numbers of their droppings observed during the 2014 shoreline survey suggests that geese are may be a

significant source of diffuse faecal contamination to the area when they are present. Their presence at the uninhabited islands adjacent to Ardencaple Bay and evidence of their presence along the shorelines of the intertidal areas to the southwest, suggest their impacts will impact both Cyster sites.

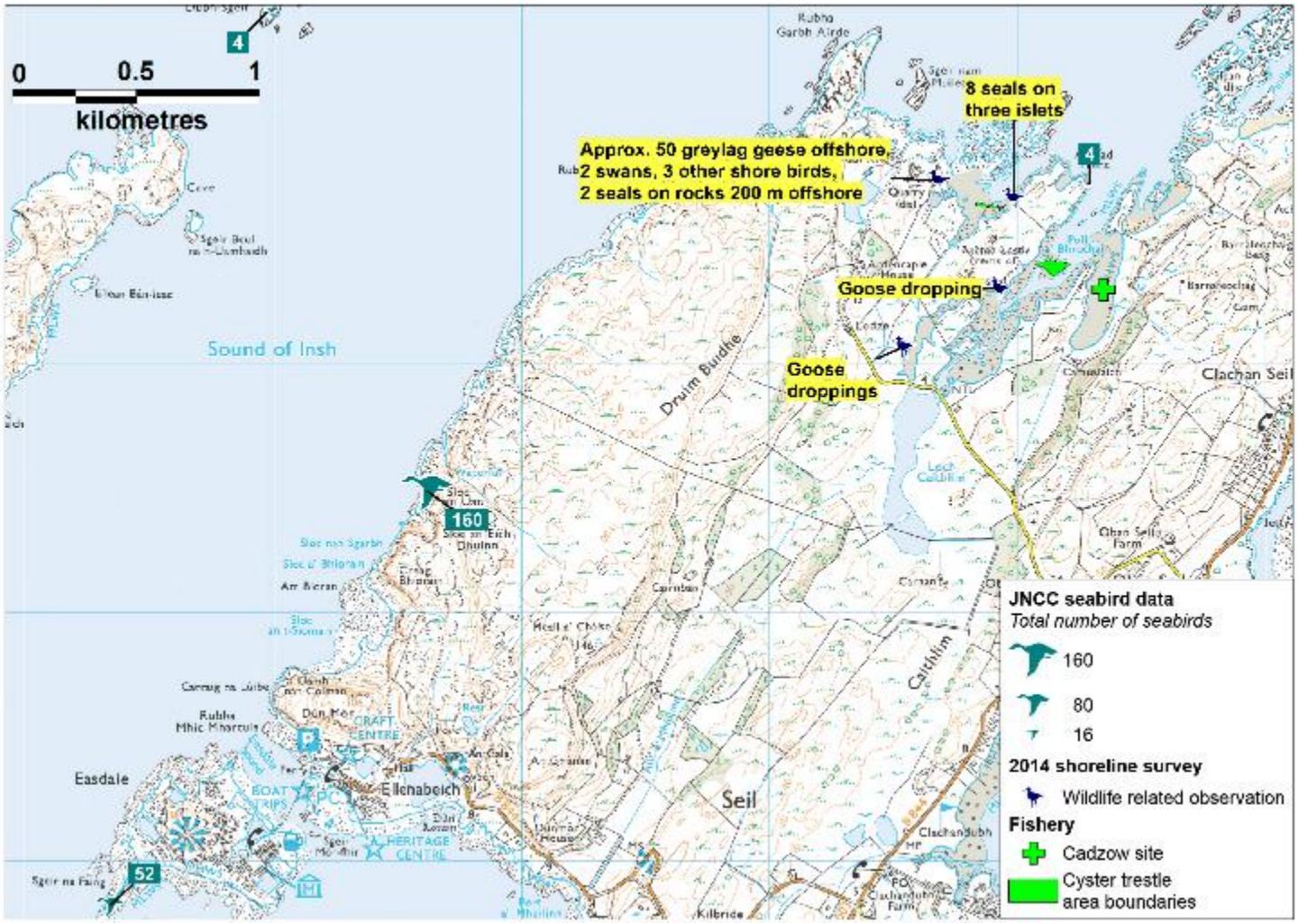

Figure 4.1 Map of wildlife around Seil Point

5. Watercourses

There are no gauging stations on watercourses that enter into the Seil Point area. The only information on flows and microbiological content of watercourses in the area therefore came from observations and samples taken during the shoreline survey.

A comparison of watercourse loadings estimated on the basis of the 2007 and 2014 shoreline survey measurements and *E. coli* concentrations are displayed in Table 5.1. In total five watercourses were measured and sampled in the 2007 survey, two of which were re-sampled in 2014. Sample loadings from the 2014 survey are displayed in Figure 5.1. A full list of recorded flow measurements and sample results from the 2014 shoreline survey can be found in Appendix 2. Weather conditions during the 2007 shoreline survey were dry. Heavy rain fell in the 48 hours prior to the 2014 survey, although no rain fell on the survey day.

Table 5.1 Estimated watercourse loadings to Seil Point - 2007 and 2014

No.	Description	NGR	2007 Loading (*E. coli*/day)	2014 Loading (*E. coli*/day)
1	Unnamed watercourse	NM 7656 1990	1.0×10^{10}	9.4×10^{8}
2	Unnamed watercourse	NM 7673 1949	1.5×10^{10}	6.1×10^{10}
3	Unnamed watercourse	NM 7660 1921	-	2.4×10^{8}
4	Unnamed watercourse	NM 7654 1907	-	6.4×10^{8}
5	Unnamed watercourse	NM 7721 1904	-	3.7×10^{9}
6	Hill Burn	NM 7740 1921	-	2.3×10^{11}

-No loading was calculated

The outflow from Loch Caithlim was sampled as a watercourse during the 2007 survey, but was as this is actually a tidal pond the outflow sampled taken during the 2014 shoreline survey was treated as a seawater sample. The recorded salinity of the sample was 30 ppt, suggesting that the outflow consisted largely of seawater at the time of sampling and therefore the loading was not calculated here as it would not be properly representative of the freshwater component of the outflow. Nevertheless, the loch does receive freshwater input from a series of field drains to its southeast and overland flow from the low lying land immediately around it. A seawater sample taken from the outflow returned a result of 184 *E. coli* cfu/100 ml.

The 2014 loadings indicate that *E. coli* contamination arising from watercourses remains moderate. Loadings for watercourse 1 were higher in 2007 than 2014; with vice versa found in watercourse 2 loadings. The highest loading in 2014 was from Hill Burn, which is located at Camuslaich and would significantly impact the Cadzow site if it is brought back into use in future.

Conclusions

Watercourses remain a significant pathway for contamination at this production area, with watercourses near to the trestle sites posing the greatest risk. Highest loadings were found in watercourses near the West Bay and Cadzow sites. In all cases, the southernmost ends of the farms are likely to receive the greatest impact from these sources.

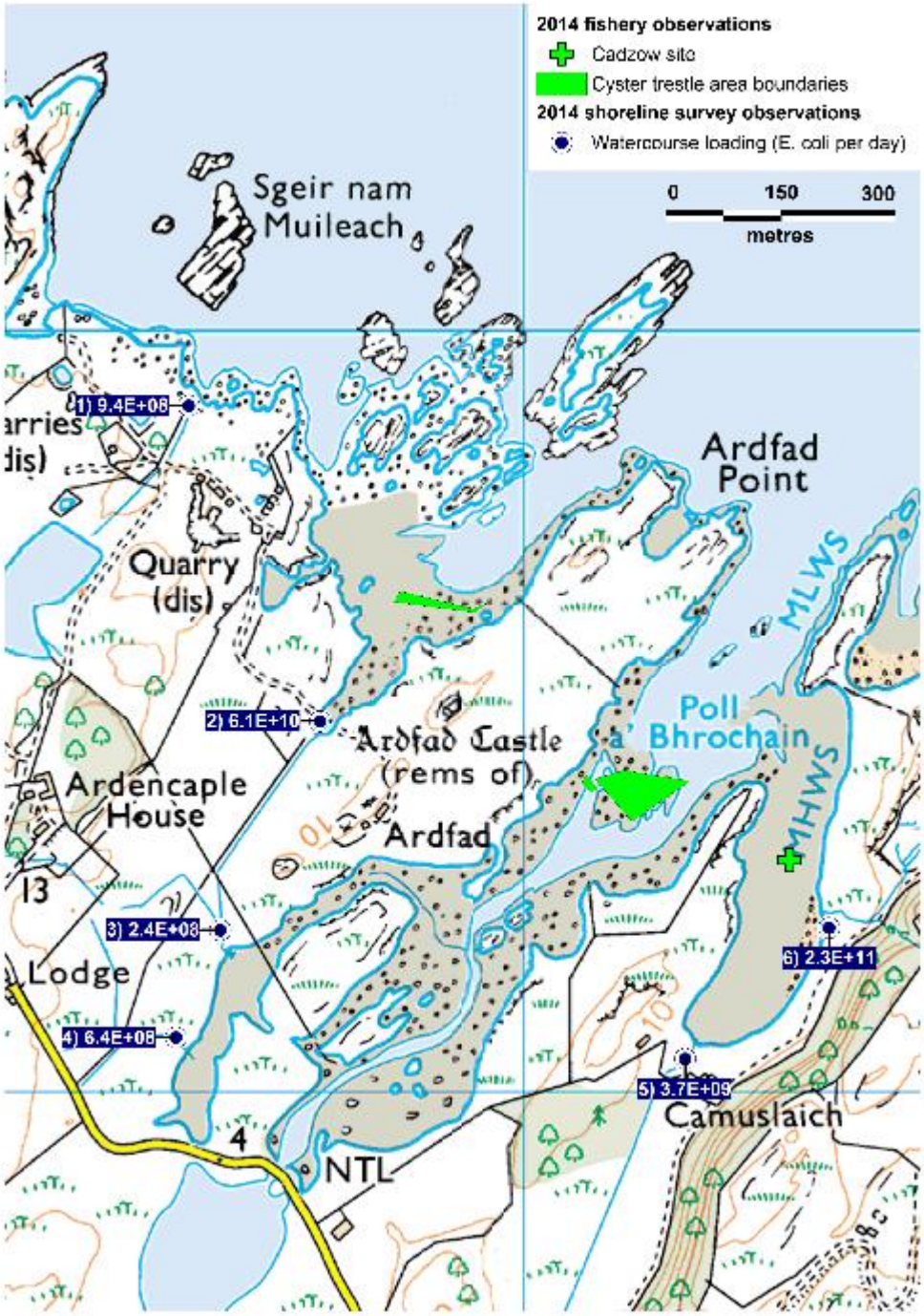

Figure 5.1 Watercourse loadings at Seil Point

Where the bacterial loading is labelled on the map, the scientific notation is written in digital format, as this is the only format recognised by the mapping software. So, where normal scientific notation for 1000 is $1x10^3$, in digital format it is written as 1E+03.

6. Meteorological data

Meteorological data had been purchased from the Meteorological Office for the survey period 01/01/2003-31/10/2006 for the analyses undertaken for the 2008 Seil Point report: rainfall box-plots and wind roses for the 2003-2007 period are presented in that report and have not been reproduced here. Total daily rainfall records (in mm) were obtained from the Kimelford weather station, which lies approximately 8 km southeast of the Seil Point production area. Wind roses were also taken from the Glasgow: Bishopton weather station which lies approximately 80 km southeast of the Seil Point production area.

Meteorological data for this review was purchased from the UK Meteorological Office in April 2014 for the period 01/01/2008-31/11/2013. Rainfall data from Lismore; Frackersaig Farm, located approximately 25 km north of the Seil Point production area, was used in this review. This was due to a large amount of missing data in the Kimelford dataset. However, data for Lismore Frackersaig for the following dates were excluded from the analysis as values were either estimated or accrued across date ranges: 11-14/01/2008, 31/03/2008, 01/04/2008, 04/06/2008, 05/06/2008, 16/06/2008-19/06/2008, 04/05/2009, 05/05/2009, 17/05/2009, 18/05/2009, 10/08/2009, 11/08/2009, 01/12/2010, 02/12/2010, 16/08/2011-20/08/2011, 22/08/2011, 29/10/2011, 30/10/2011, 22/08/2013, 29/10/2011, 30/10/2011, 22/08/2012, 23/08/2012, 04/12/2012 and 05/12/2012. Data was unavailable for the entire month of December 2013.

Wind roses were provided by the Meteorological Office for the Glasgow: Bishopton weather station for the 2004-2013 period.

6.1 Rainfall

Storm events and high rainfall levels are commonly associated with increased faecal contamination of coastal waters through surface water run-off from land where livestock or wild animals are present and through sewer and waste water treatment plant (WWTP) overflows (Mallin, et al., 2001; Lee & Morgan, 2003).

The weather station rainfall dataset for Lismore: Frackersaig Farm for 2008-2013 is presented by year in Figure 6.1 and by month in Figure 6.2.

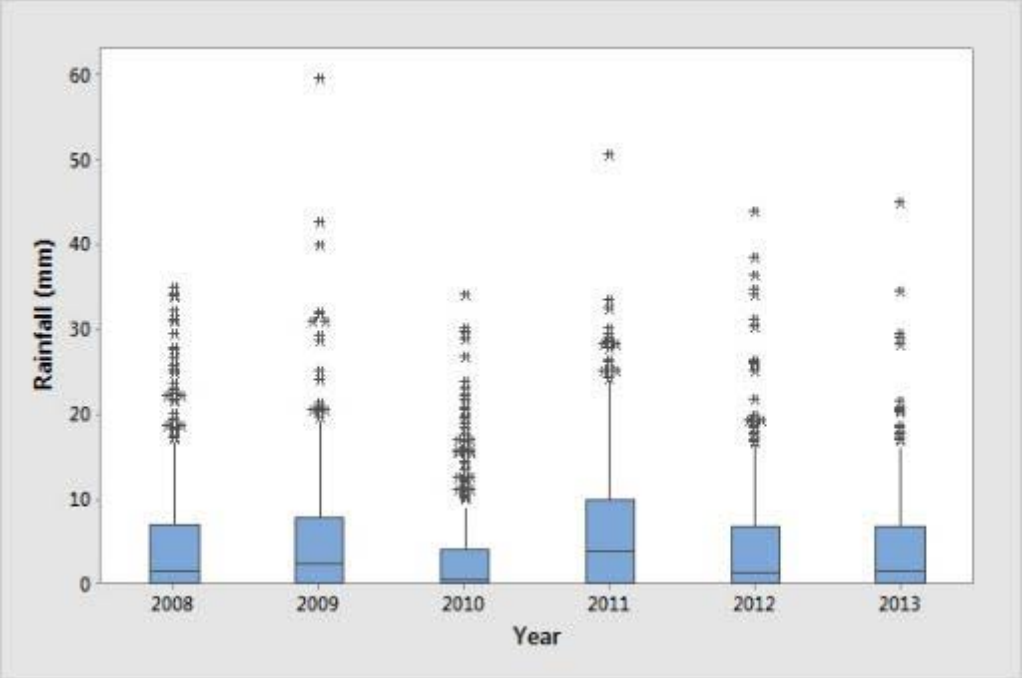

Figure 6.1 Boxplot of daily rainfall at Lismore; Frackersaig Farm (2008-2013)

Daily rainfall totals were mainly below 10 mm per day. Rainfall events of greater than 50 mm/day occurred in 2009 and 2011. Total annual rainfall was highest in 2011 (2354 mm) and lowest in 2010 (1199 mm).

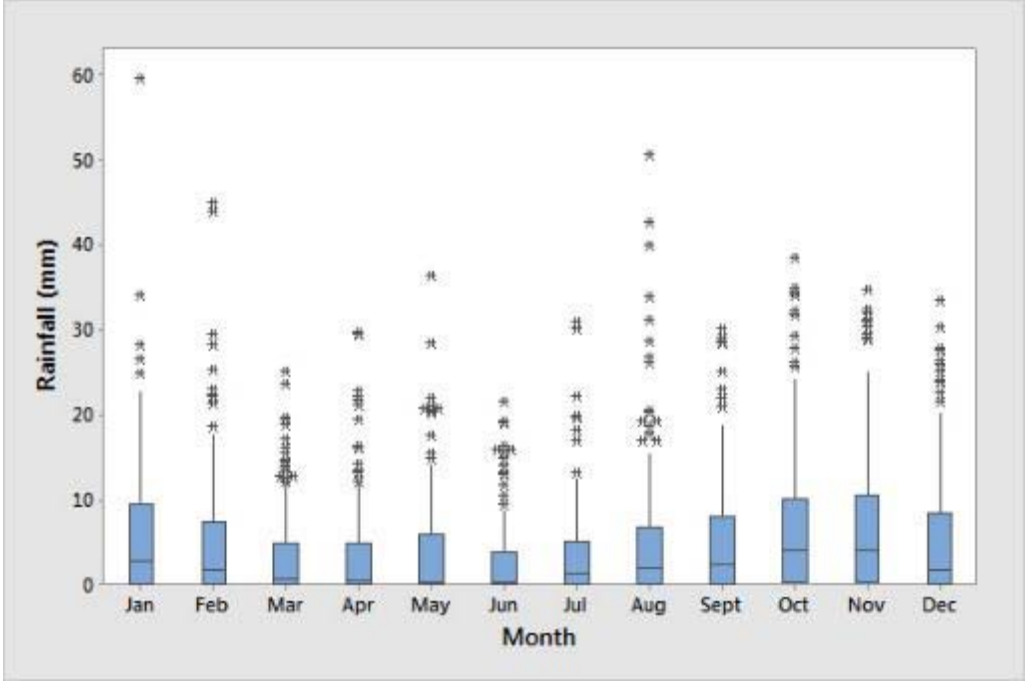

Figure 6.2 Boxplot of daily rainfall by month at Lismore; Frackersaig Farm (2008-2013)

Rainfall events of greater than 50 mm/day were noted in January and August. Highest monthly rainfall totals occurred between from August to February. June was the driest month with a total monthly rainfall of 429 mm.

Care needs to be taken with the assessment of rainfall patterns by both year and month due to the excluded data.

6.2 Wind

Wind speed and direction drive surface water and currents that play an integral part in particulate dispersal. Winds typically drive surface water at ca. 3% of the wind speed (Brown, 1991) so a gale force wind (a minimum of 34 knots/17.2 m/s) would drive a surface water current of about 1 knot or 0.5 m/s.

Figure 6.3 shows seasonal wind roses for Bishopton: Glasgow for the period 2004-2013 while Figure 6.4 shows the annual wind rose for the same period. The local topography of Seil Point is likely to cause a variation in wind patterns compared to those shown in the wind roses.

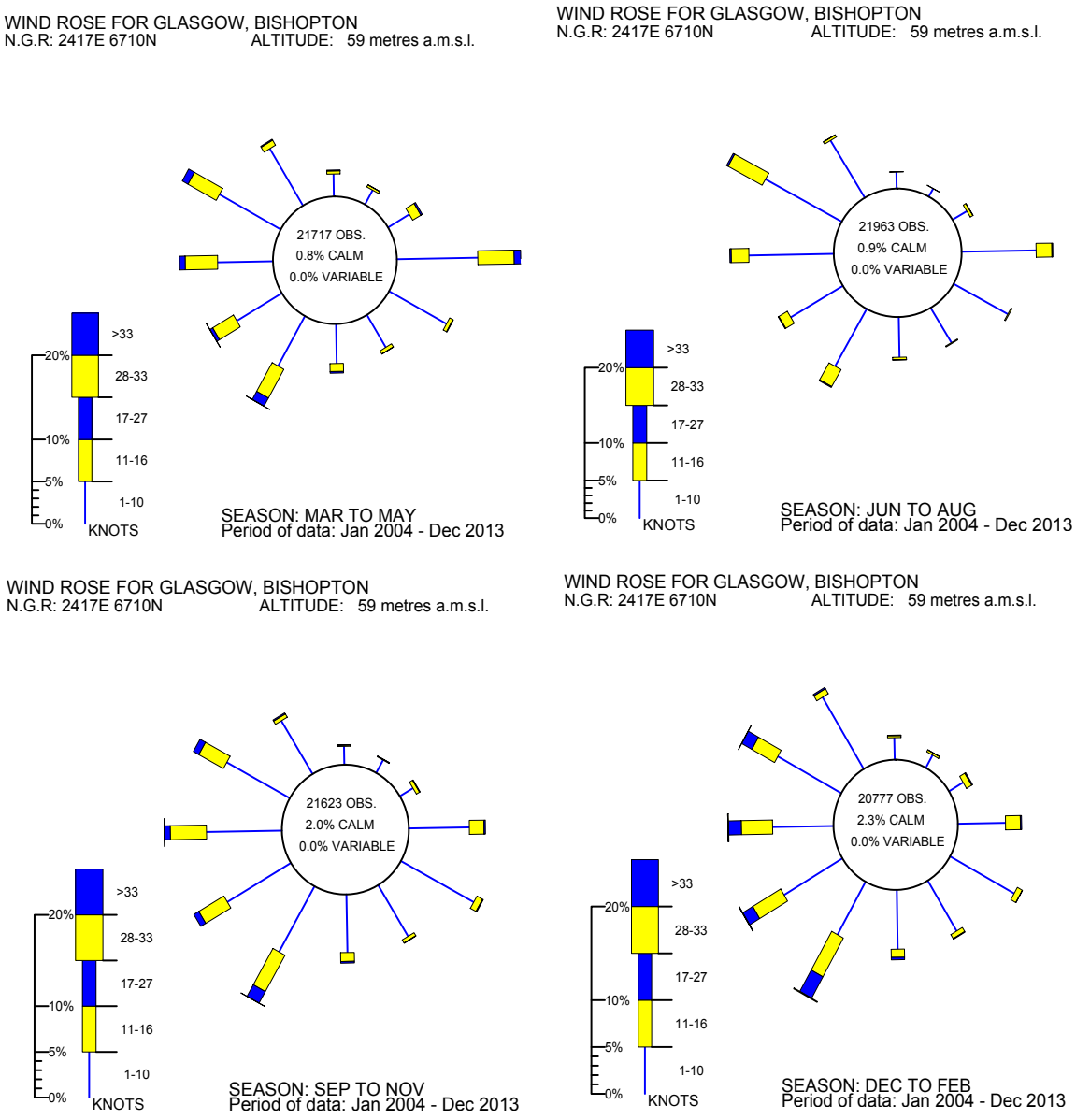

Figure 6.3 Seasonal wind roses for Glasgow: Bishopton (2004-2013)

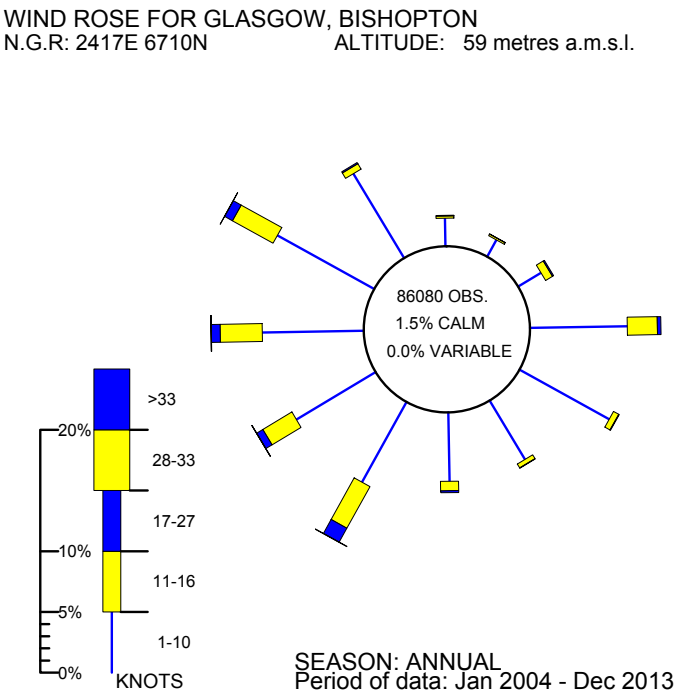

Figure 6.4 Annual wind rose for Glasgow: Bishopton (2004-2013)

Prevailing winds continue to come from the west (between south-southwest and west-northwest). Winds also arise from an easterly direction, mainly during the spring. Winds area strongest during the winter months and weakest during summer. It should be noted that the wind direction at Glasgow: Bishopton will be affected by the orientation of the Firth of Clyde.

7. Historical *E. coli* Data

Results for Seil Point: Cyster between 01/01/2001 and 10/12/2014 were extracted from the FSAS database and validated according to the criteria described in the standard protocol for validation of historical *E. coli* data. Only one result was recorded after 2006 for Seil Point: Cadzow and therefore no results from this site were considered in this review. Data was extracted in December 2014. For the purposes of this report, results from samples pre-dating 2001 were excluded. All *E. coli* results were reported as most probable number per 100 g of shellfish flesh and intravalvular fluid.

At the main Cyster area (Poll a' Bhrochain) sampling was undertaken at two locations: at NM 772 194, on the Poll a' Bhrochain site approximately 100 m east of the current RMP and at NM 769 193, near the small point of land at Ardfad, approximately 200 m to the southwest of the RMP. Duplicate sampling ended in March 2007 and only the sample results reported from the Poll a' Bhrochain site have been used for comparative analysis in this review.

In the 2001-2006 dataset, four samples had sample receipt times before collection times, and a further four samples had reported locations plotting over 100 m outside the production area boundaries. These were excluded from analysis. In the 2007-2014 dataset, two samples that were identified as rejected and two samples whose reported locations plotted more than 100 m outside the production area boundaries were excluded from analysis. The remaining samples were all received at the laboratory within 48 hours of collection and had recorded box temperatures of <8^{o}C.

E. coli results reported as <18 or <20 were reassigned a value of 10 *E. coli* MPN/100 g and the one result reported as >18000 was reassigned a value of 36000 *E. coli* MPN/100 g for the purposes of statistical evaluation and graphical representation.

7.1 Summary of microbiological results

A summary of results for Seil Point Cyster for 2001-2006 and 2007-2014 is displayed in Table 7.1.

Table 7.1 Sampling summary results for Seil Point: Cyster 2001-2014

Sampling Summary				
Production area	Seil Point			
Site	Ardencaple-Cyster			
Species	Pacific oysters			
SIN	AB-245-070-13			
Location	NM 772 194			
Years	2001-2006		2007-2014	
Total no. of samples	48		90	
	2001	1	2007	8
	2002	6	2008	10
	2003	11	2009	12
	2004	11	2010	12
	2005	10	2011	12
	2006	9	2012	12
			2013	12
			2014	12
Results Summary				
Minimum	<20		<18	
Maximum	>18000		9200	
Median	165		170	
Geometric mean	171		194	
90 Percentile	805		2400	
95 Percentile	6085		3500	
No. Exceeding 230/100g	19 (40%)		32 (35%)	
No. Exceeding 1000/100g	4 (8%)		16 (18%)	
No. Exceeding 4600/100g	2 (4%)		2 (2%)	
No. Exceeding 18000/100g	1 (2%)		0	

There was no marked difference between the two periods in the descriptive statistics for the *E. coli* results. The only result exceeding 18000 *E. coli* MPN/100 g occurred during the earlier period.

7.2 Geographical patterns of results

The reported sampling locations of all samples taken at Ardencaple-Cyster since 2007 are plotted in Figure 7.1 with the symbol size proportional to the magnitude of the *E. coli* result. Sampling locations have been reported to the nearest metre since 2008.

All but ten samples were reported to have been taken from within 15 m of NM 77093 19385. The nominal RMP is NM 7709 1938. The location of the designated

RMP trestle, as reported in the 2014 shoreline survey lies approximately 10 m north-northwest of the nominal RMP, and also lies within 15 m of NM 77093 19385.

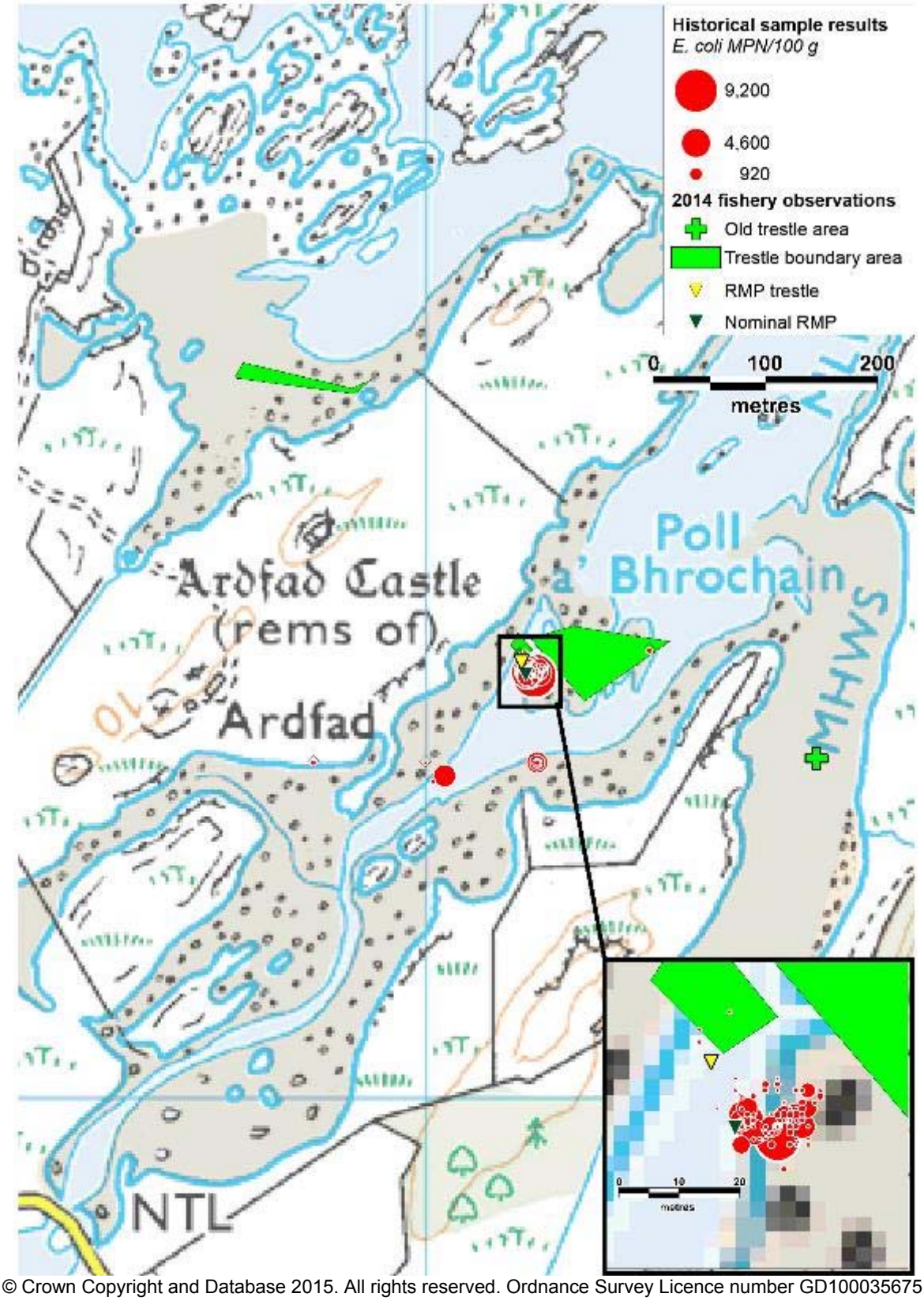

Figure 7.1 Sampling locations at the Cyster Pacific oyster site7.3 Temporal patterns of results

The *E. coli* results for Ardencaple-Cyster against collection date are shown in Figure 7.2. The figure is fitted with a lowess trend line. These allow for locally weighted

regression scatter plot smoothing. At each point in the dataset an estimated value is fitted to a subset of the data, using weighted least squares. The approach gives more weight to points near to the x-value where the estimate is being made and less weight to points further away. In terms of the monitoring data, this means that any point on the lowess line is influenced more by the data close to it (in time) and less by the data further away. A trend line helps to highlight any apparent underlying trends or cycles.

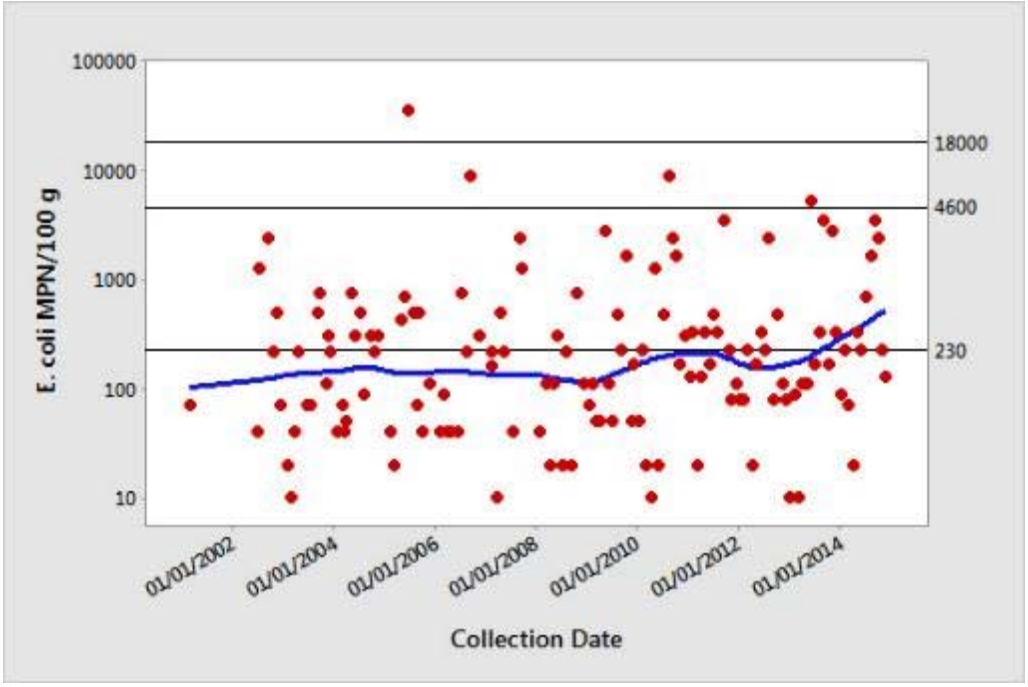

Figure 7.2 Scatterplot of Seil Point: Cyster *E. coli* results by date (2001-2014)

There has been no marked change in the level of *E. coli* results at the site.

Additional analysis was undertaken to compare the *E. coli* results between the previous sampling period (2001-2006) and the current sampling period (2007-2014). A two sample t-test (using $\log_{10}$ transformed *E. coli* data) to used determine whether there was a statistically significant difference in average $\log_{10}$-transformed *E. coli* results between the two sampling periods.

A Fisher's Exact Test was undertaken to test for a significant difference in the proportion of *E. coli* results above the levels of 1000 and 4600 *E. coli* MPN/100 g between the two sampling periods (see Table 7.2). A Fisher's Exact Test was used instead of a Chi-squared test as two cells had expected counts of less than five in the results from both sampling periods.

No significant difference was found between log transformed *E. coli* results from Pacific oysters for the two survey periods (Two sample t-test, t = -0.45, DF = 95, p = 0.655).

Table 7.2 Results above and below 1000 and 4600 *E. coli* MPN/100 g at Seil Point

		***E. coli* MPN/100g**			***E. coli* MPN/100g**		
		≤1000	>1000	**Total**	≤4600	>4600	**Total**
2001-2006	Observed	44	4	48	46	2	48
2007-2014	Observed	74	16	90	88	2	90
	Total	118	20	138	134	4	138

No significant difference was found between sampling results ≤1000 and >1000 *E. coli* MPN/100 g between sampling periods (Fisher's Exact Test, p = 0.203).

No significant difference was found between sampling results ≤4600 and >4600 *E. coli* MPN/100 g between sampling periods (Fisher's Exact Test, p = 0.610).

Conclusions

Regular sampling has taken place at Ardencaple-Cyster since 2003. Since 2008, sampling has been predominantly within 15 m of the currently classified RMP at NM 7709 1938. There has been no significant change in the level of *E. coli* results since 2001.

8. Movement of contaminants

The main conclusions of the 2008 sanitary survey report with respect to movement of contaminants were as follows:

- Currents are slightly stronger on the flood than on the ebb tides.
- Given the open aspect of the oyster harvesting area, water is likely to be completely exchanged daily and contaminants are unlikely to linger in the vicinity of the fishery.
- Depths in the Firth of Lorn are likely to provide significant dilution of contaminants, further reducing the impact of pollution near the oyster farms.
- Although tidal flows in the Firth of Lorn move water up and down the Firth, it is possible that in the bays at Seil Point eddies form at certain times, thereby slowing the exchange of water.

No other information on the hydrography or bathymetry of Seil Point was found during an internet search undertaken for this review.

9. Overall Assessment

This assessment considers the information obtained since the 2008 report and the potential changes in extent and location of faecal contamination.

Human sewage Impacts

The human population around the Seil Point production area remains low. There are two houses, a shorebase, and two bothies in the vicinity. No evidence of discharge pipes was found during the shoreline survey. The harvester reported that his shorebase has a septic tank discharging to soakaway. The two houses are presumed to have septic tanks discharging to soakaway. The two bothies observed during the shoreline survey were reported to lack drainage facilities and therefore visitors using may deposit waste in holes dug in the vicinity or directly into the sea.

The shorebase and one of the bothies are located southwest of the active oyster farm, at the head of Poll a' Bhrochain, while one of the houses is located at Camuslaich, southeast of the active oyster farm. Any impacts from these would affect the oyster farm on the ebb tide. The other bothy is located approximately 100 m inland and adjacent to a watercourse to the northwest of the disused oyster farm at West Bay.

There are popular anchorages in the vicinity of the production area, and the harvester identified concerns about overboard discharges of sewage from these posing a contamination threat to the oyster farms. The nearest of these anchorages is located approximately 300 m northeast of the Poll a' Bhrochain oyster farm, whilst the Puilladobhrain anchorage is located approximately 1.5 km to the northeast of the farm. Impacts from sewage discharged by boats using these anchorages would be highest from May to September, when the anchorages are most heavily used.

Agricultural impacts

The cattle feeding station noted to the northwest of the West Bay site is expected to represent a significant contamination source to the western extent of this site when in use. However, the most significant sources remain concentrated around the southern shoreline, where they are expected to continue to have high levels of impacts on contamination levels crossing the Poll a' Bhrochain and former Cadzow sites.

Wildlife Impacts

New information indicates that faecal contamination from seals utilising the offshore islands adjacent to Ardencaple bay, may have a direct impact at the West Bay site. Additional information also indicates that geese may have an impact at the sites over the late autumn and winter months. Furthermore wading birds and seabirds are likely to use the intertidal areas where they may pose as direct contamination sources to the trestle area. Overall, the assessment of the relative impact from wildlife has

increased although the actual impact is not expected to have changed from that which applied at the time of the 2008 sanitary survey.

Seasonal Variation

Seasonal input of sewage from boats using anchorages in the area is expected, with highest use occurring from May to September. *E. coli* results appeared to show a slight seasonal pattern, with a trend toward higher results from May onward, peaking in September (data not presented here). The highest *E. coli* results occurred during this period. Highest contamination inputs from Greylag geese are anticipated over the winter months, when these geese migrate to Scotland.

Agricultural impacts are expected to remain highest during the spring-summer lambing and calving season. Direct impacts from livestock on the shoreline are expected to be lower in the Poll a' Bhrochain area between June and September when the shoreline is closed to protect breeding birds. However, rainfall runoff may still carry contamination from accumulated faecal material during these months, and the birds themselves will contribute to faecal bacterial loadings arising from the area.

Watercourses

Watercourses remains a significant source of faecal contamination to the shellfishery at Seil Point. Loadings would be expected to increase during periods of heavy or sustained rainfall, with the first flush effect expected to be significant from sources of contamination on land. In particular, watercourses discharging to the heads of inlets or bays in which oyster trestles are sited are likely to carried diffuse contamination from mainly agricultural and wildlife sources to the oyster farms. Loadings were highest from watercourses discharging to the south of the West Bay and Cadzow sites. However, water flowing from tidal Loch Caithlim is most likely to impact the southern end of the active shellfish farm at Poll a' Bhrochain.

Movement of contaminants

No additional information was identified regarding the potential movement of contaminants at the site and therefore no change is suggested to the assessment made in the 2008 report.

Analysis of Results

Historical *E. coli* results

Since 2008, sampling has been predominantly undertaken within 15 m of the currently classified RMP at NM 7709 1938. No statistically significant difference was found in sampling results between the 2001-2006 and 2007-2014 sampling periods. No statistically significant differences were found in the proportion of sample results above and below 1000 and 4600 *E. coli* MPN/100 g between the two sampling periods.

Shoreline Survey results

Three shellfish samples were taken during the 2014 shoreline survey; one common mussel sample was taken from near the northeast end of the West Bay trestle area and returned a result of 330 *E. coli* MPN/100 g. Two Pacific oyster samples were taken from the Poll a' Bhrochain trestle area; one at the RMP which returned a result of 1,700 *E. coli* MPN/100 g and one from the north side of the array, which returned a result of 700 *E. coli* MPN/100 g. Two seawater samples taken from the same locations as the mussel sample and the northern Poll a' Bhrochain sample both returned results of 300 *E. coli* cfu/100 ml.

Two other seawater samples were taken; one at the far northwest end of the survey area (200 *E. coli* cfu/100 ml) and one from the outflow of Loch Caithlim (184 *E. coli* cfu/100 ml).

Conclusions

The conclusions from the 2008 report indicated that the following were the main potential sources of faecal contamination to the fishery at Seil Point:

- Diffuse agricultural inputs and possibly usage of the Puillodobhrain Anchorage
- The cattle shed at the head of the eastern bay.
- Several freshwater inputs enter into the eastern bay.

Findings from this 2015 review suggest that there has been little change in the sources and impacts of faecal contamination to the Seil Point production area.

New information on sewage inputs from a private ST located at the shellfish shore-base and possible contamination associated with the Ardencaple bothies, combined with the identified locations of anchorages, indicate that the highest potential impacts from human sources will be to the Poll a' Bhrochain site.

However, the largest potential source of contamination to the Seil Point production area remains from agricultural inputs that may enter directly or indirectly through surface runoff and watercourses. These sources are also expected to explain in part the relatively high freshwater sample results in watercourses reported in the 2014 survey. Although the cattle feeder and a potentially highly contaminated watercourse will impact the West Bay site, highest inputs continue to enter the area near the Poll a' Bhrochain and Cadzow sites.

Whilst additional information also suggested that the West Bay site may experience higher inputs from seals that use the nearby offshore islets, these inputs are not anticipated to be significant in comparison to the other identified sources. Seabirds

and geese will provide faecal input to the area but there is no evidence on which to base any assessment of differential impact between the oyster sites.

Historical monitoring results also indicate relatively constant levels of contamination over the two sampling periods, with no significant change in results between the two periods. The occurrence of occasional results exceeding 4600 *E. coli*/100 g indicates that, there is occasional relatively high levels of faecal contamination in terms of the low human population in the area.

10. Recommendations

There have been no significant spatial changes in the contamination sources entering into the Seil Point production area, and therefore no changes are recommended to the existing sampling plan.

Production area

It is recommended that the production area boundaries remain the same as those stated in the 2008 report. This is the area inside of the line drawn between NM 7644 2033 and NM 7782 2000.

RMP

It is recommended that the RMP remain at NM 7709 1938.

Tolerance

An increased tolerance of 20 m is recommended to allow for slightly greater variation in location of stock available for sampling in the vicinity of the RMP.

Depth

A sampling depth is not appropriate given the oysters are cultivated on trestles.

Frequency

Sampling frequency is recommended to remain at monthly.

Movement of oysters to a designated sampling trestle

If oysters are moved to a designated sampling trestle from elsewhere, either other locations on the site, from a different site, or from outside the production area, they should be on the sampling trestle for at least two weeks prior to sampling. This is to ensure that they have taken on the microbiological characteristics of that location.

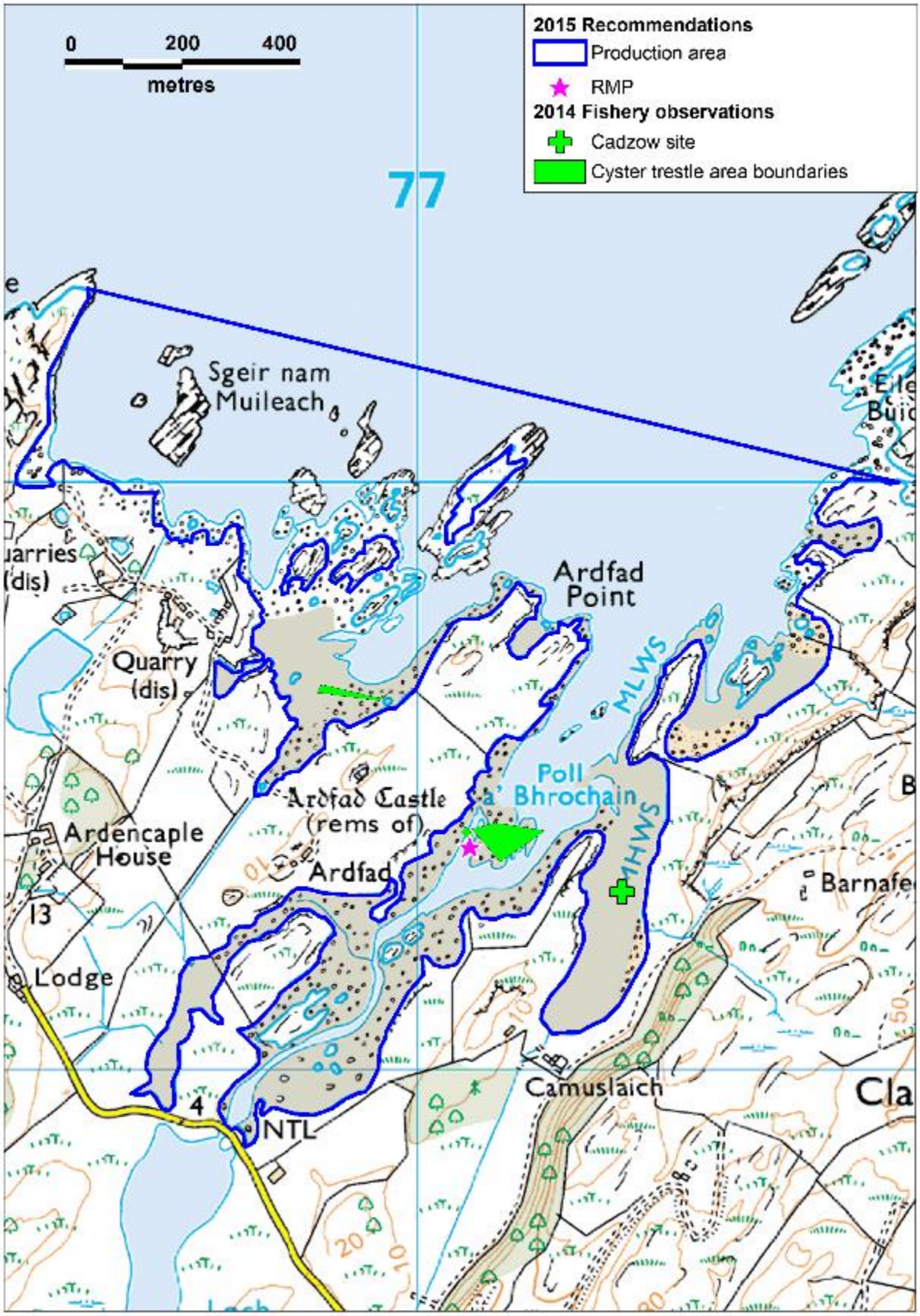

Figure 10.1 Recommended production area boundaries and RMP for Seil Point

11. References

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12. List of Figures and Tables

Appendices

1. Shoreline Survey Report 2014

Appendix 1

Shoreline Survey Report

Report Title	Seil Point Shoreline Survey Report
Project Name	Shellfish Sanitary Surveys
Client/Customer	Cefas
SRSL Project Reference	00561_B0067

Document Number	B0067_Shoreline 0043

Revision History

Revision	Changes	Date
A	Draft issue for internal review	3/11/2014
B	Second issue for internal review	17/11/2014
01	First formal issue to CEFAS	24/11/2014
02	Second formal issue to Cefas incorporating corrections from issue01	12/12/2014

	Name & Position	Date
Author	Peter Lamont, Lars Brunner	03/11/2014
Checked	Andrea Veszelovszki	12/12/2014
Approved	Mark Hart	12/12/2014

SRSL, Scottish Marine Institute, Oban, Argyll, PA37 1QA, tel 01631 559 470, www.samsrsl.co.uk

Production area:	Seil Point
Site name:	Ardencaple – Cadzow
SIN:	AB-245-069-13
Species:	Pacific oysters
Harvester:	David Cyster

Production area:	Seil Point
Site name:	Ardencaple – Cyster
SIN:	AB-245-070-13
Species:	Pacific oysters
Existing RMP:	Ardencaple, NM7709 1938
Harvester:	David Cyster

Local Authority:	Argyll and Bute Council
Status:	Existing areas
Date Surveyed:	7th October 2014
Surveyed by:	Lars Brunner, Peter Lamont
Area Surveyed:	North bays of Seil Island, Argyll

Weather

The night preceding the survey was dry, however the night before (Sunday 5th to Monday 6th) was very windy with persistent heavy rain.

Tuesday 7th October - Dry and cool, cloud cover about 50%, calm conditions becoming sunny later. Temperature 12ºC.

Stakeholder engagement during the survey

The team met with the harvester Mr David Cyster at the Ardencaple site as he was servicing all the sites at Seil Point at the time of the visit. The harvester provided a wealth of information about the site and his plans (detailed in the Fishery section). The regular sampling officer had just left on maternity leave and her replacement was unavailable at the time of the survey.

Fishery

The Seil Point fishery consists of Pacific oysters cultivated in plastic mesh bags on one metre high steel trestles. There were two sites observed: the Ardencaple-Cyster site consisting of ‘west bay’ (north of Ardfad Castle, Fig. 5) and Poll a’ Bhrochain (Fig. 6) and the Ardencaple – Cadzow site located in a smaller, unnamed bay to the east with the house of Camuslaich at its head (Fig. 12). Currently there is no stock at the west bay or Camuslaich. The Poll a’ Bhrochain array consists of five trestle groups (banks) oriented NW-SE within which the trestles are arranged in parallel rows oriented SW-NE (Fig. 6). There is a shore base beside the Ardencaple road at the head of the bay (Fig. 9) and the site is accessed by tractor at low spring tides.

The harvester, Mr David Cyster, informed the team that oyster seed had been obtained from Connel and spat from Guernsey. All normal size products were marketed through an oyster grower's co-operative, being delivered by road to Bellshill, Glasgow for depuration and onward sale. A small number of over-size oysters are supplied to Loch Fyne Seafoods. Currently the Ardencaple site consisted of one metre high trestles and future plans include scrapping the empty, old, shallow trestles in the next bay west (Fig. 5), referred to by the harvester as 'west bay' and substitution with tall trestles in preparation for restocking in 2015. Plans also include trialling wave-activated rocking boxes at Ardencaple for the spat. The team were informed that the Cadzow site in the bay to the east had been acquired by Mr Cyster from Mr Patrick Cadzow (Fig. 13) but that there were no current plans to install any stock. Due to increased cost of trestles, consideration was being given to fabricating these on site. Trestles are cleared of weed by leaving them on the high shore for a period after which the weed falls off. The RMP consisted of a separate trestle (map Fig. 2, Waypoint 26, Fig. 6) adjoining the main area at the south side and usually stocked with joined double oysters which are normally unmarketable.

Sewage Sources

There are few dwellings in the area. The two permanently inhabited dwellings are Ardencaple House and Camuslaich farmhouse. There are three older, shore side cottages belonging to Ardencaple Estate that have been renovated to a basic bothy standard i.e. weather and wind proof but with no drainage facilities according to local information. These include the bothy at Ardfad on the west side of Poll a' Bhrochain (Fig. 7). The fishery base is beside the Ardencaple roadway where Loch Caithlim drains into the sea. The team were informed by the harvester that the fishery shore base premises has a toilet with a septic tank outfall routed into a soakaway towards the small inlet to the west. The team did not observe the tank or outfall due to long vegetation and stored gear in the vicinity (see Fig. 9). The cattle shed and dung heap located in the 2007 survey are still present and in use at the same location (Waypoint 37, Fig. 10 & 11).

Within the yachting and sailing fraternity there is a well-known and popular nearby yacht anchorage at Puilladobhrain, one kilometre to the northeast, which is continuously in use during the sailing season as a shelter from bad weather. The continuous use in season (May to September) of this anchorage constitutes a regular source of raw sewage from vessels staying overnight and this was mentioned by the harvester who had concerns that there might be an effect on the fishery from that source.

Seasonal Population

There are no campsites, caravan parks or holiday homes in the vicinity. Most of the land surrounding the fishery belongs to the Ardencaple Estate. The nearest hotel is the small inn of Tignh an Truish at Clachan Seil by the 'Atlantic Bridge'.

Boats/Shipping

A relatively new, but unused, slipway was observed by the team (Waypoint 5, Fig. 3) and one moored dinghy was seen in Camuslaich (Waypoint 38, Fig. 12) but no other boats were seen on the water or onshore during the survey visit.

Farming and Livestock

Beef cattle are grazed with sheep on some areas adjacent to the shore and also adjoining fields. Ardencaple Estate employs a gamekeeper and the estate rears pheasants for sport shooting. Evidence of cattle, but no animals, was seen between waypoints 6 and 17 consisting of an unused feeding station (Fig. 4) and some recent cattle droppings. There were 12 cows and 41 sheep in the field to the east of the main fishery area at Poll a' Bhrochain fishery (behind the cattle shed on the Ardencaple road, Waypoint 37).

Land Use

The surrounding land adjacent to the fishery is low lying and composed of mostly rough grazing and hill land with some small areas of woodland. Improved grazing is limited to a few fields.

Land Cover

The area surrounding the fishery is composed of mostly rough ground with heather, grasses and soft rushes with some improved grazing. Bracken is common and there are some limited areas of native woodland.

Watercourses

Generally the land is low-lying and there are no substantial watercourses. The tidal drainage from Loch Caithlim runs into Ardencaple Bay to the main oyster cultivation area. This is conducted through a 1 metre diameter pipe under the Ardencaple roadway and is a substantial, tidally augmented flow, with the loch receiving seawater at high tide.

Wildlife/Birds

Pheasants are reared for sport shooting on Ardencaple Estate and the team encountered of the order of about fifty birds during the survey. Grain feeders are sited at several locations for the pheasants (Fig. 8). Offshore, on neighbouring islets to the north, the team observed approximately forty five greylag geese (estimated from the high resolution image of Fig. 4). Numerous droppings between Waypoints 30 and 32 indicated these may roost near the fishery. From the same viewpoint (Waypoint 6) one gull and one heron were seen on the same islet as the geese with a curlew flying nearby and two swans on the sea near the shore. Seals were observed hauled out on the islets and a maximum of eight were counted from Waypoint 15.

Specific observations made during the survey are mapped in Figure 1 and listed in Table 1. Water and shellfish samples were collected at the locations marked on Figure 2. Bacteriology results are given in Tables 2 and 3. Photographs are presented in Figures 3-14.

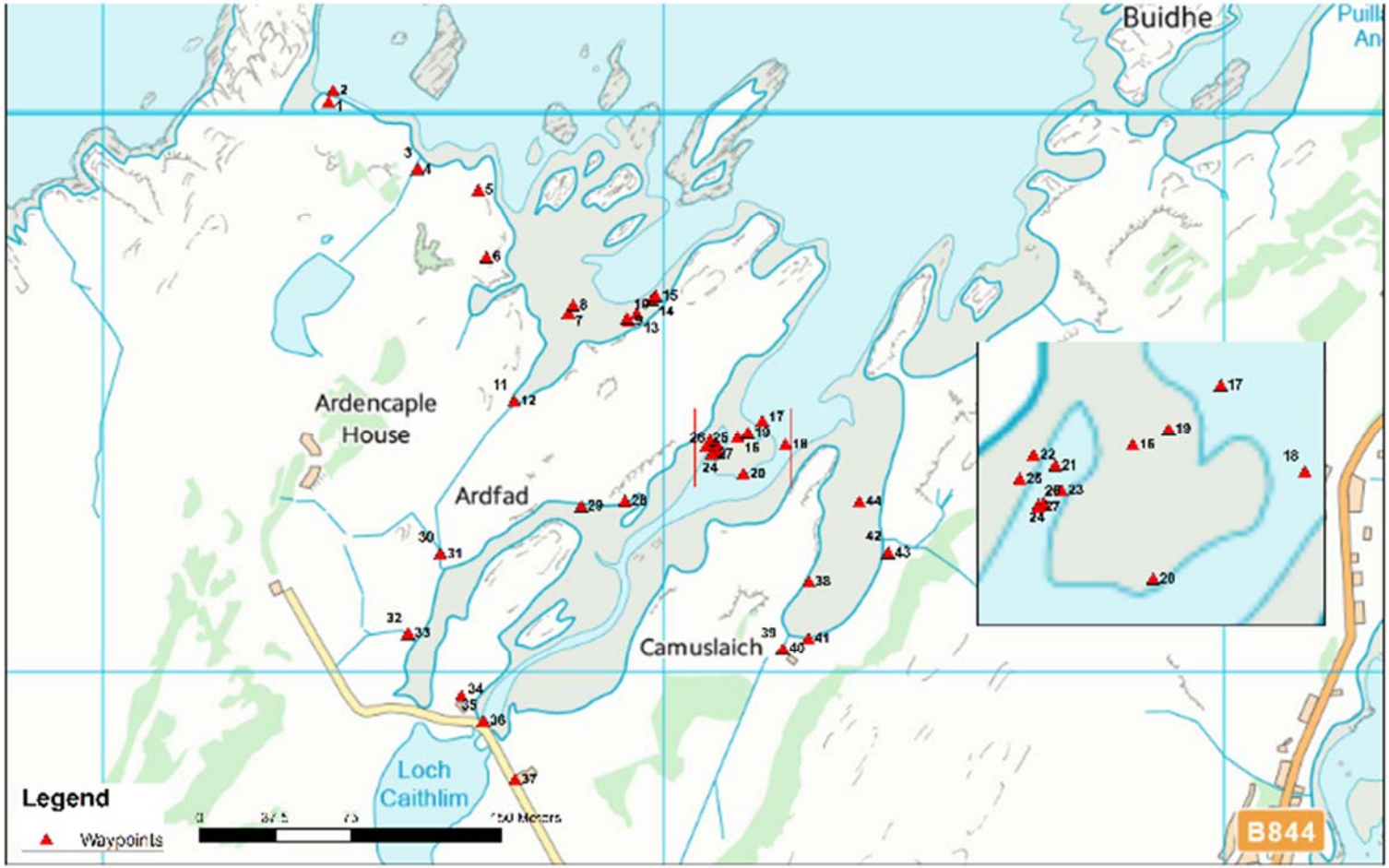

Figure 1. Seil Point waypoints

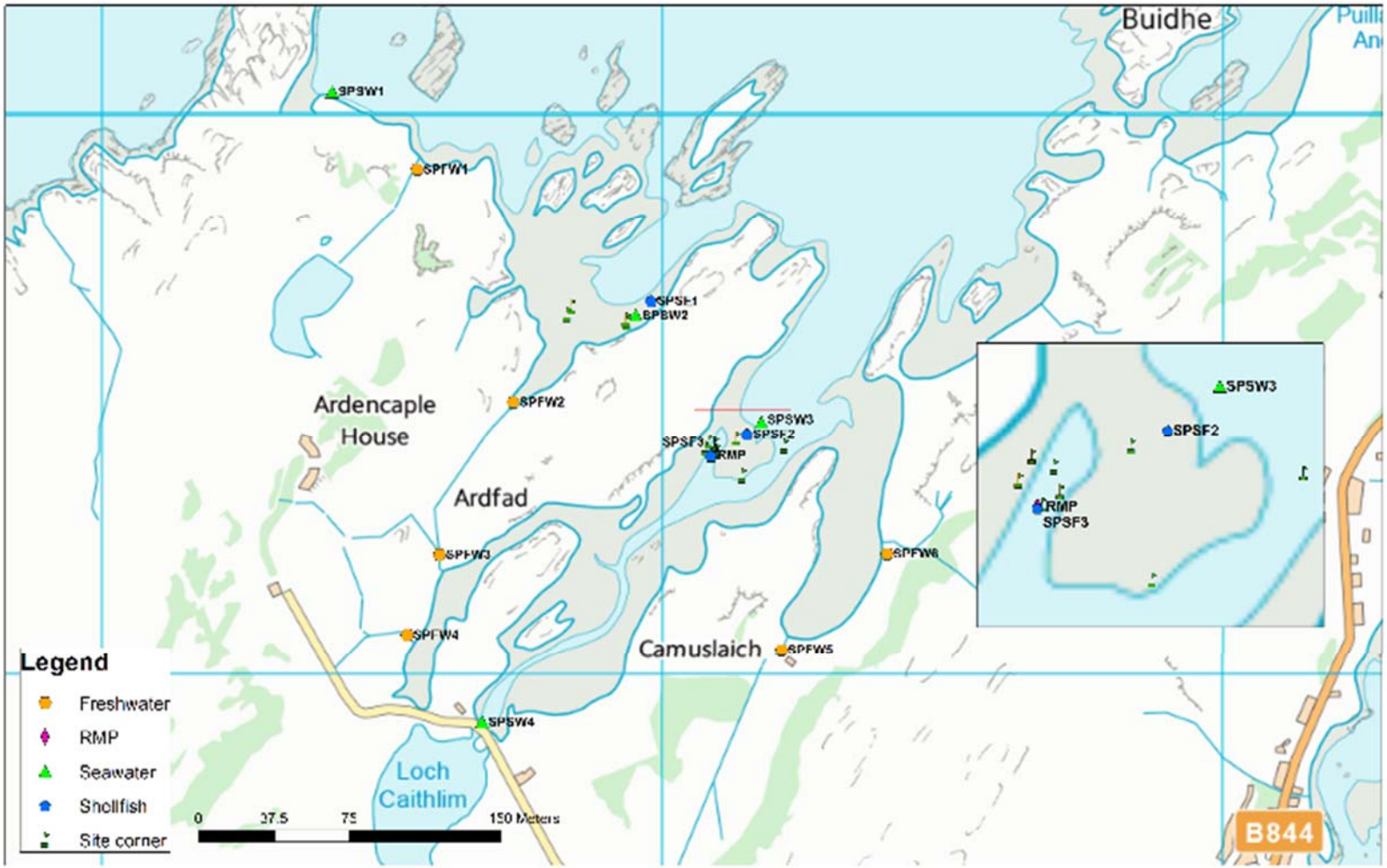

Figure 2. Seil Point samples

Table 1 Shoreline Observations

No.	Date	Time	NGR	East	North	Associated photograph	Associated sample	Description
1	07/10/2014	9:53	NM 76402 20018	176403	720019			Start of Seil Point shore survey.
2	07/10/2014	9:55	NM 76410 20039	176411	720040		SPSW1	Planned seawater sample.
3	07/10/2014	10:06	NM 76561 19901	176562	719901		SPFW1	Planned freshwater sample. Sample associated with waypoint 4.
4	07/10/2014	10:06	NM 76560 19900	176561	719900			Watercourse observations: Width 0.30 m, depth 5 cm, Flow 0.268 m/s, SD 0.010. Bothy and adjacent shed about 100 m above shore.
5	07/10/2014	10:12	NM 76669 19863	176670	719863	Fig. 3		Concrete slipway between natural rock ridges. No sign of recent use (vegetation growing on surface).
6	07/10/2014	10:16	NM 76683 19741	176684	719742	Fig. 4		Cattle feeding station (not presently in use) above old pier. Wildlife: about 50 greylag geese on offshore islets, two swans, one curlew, one gull, one heron and two seals in view on rocks 200 m north of Waypoint 7.
7	07/10/2014	10:24	NM 76830 19641	176830	719642	Fig. 5		SW corner oyster trestle array, Ardfad Bay.
8	07/10/2014	10:25	NM 76838 19655	176838	719656			NW corner of trestle site.
9	07/10/2014	10:27	NM 76936 19628	176937	719628			SE corner.
10	07/10/2014	10:27	NM 76935 19632	176935	719633			NE corner. No bags or loose live oysters. Single line of 63 trestle banks following the shore in a shallow 'V' formation.
11	07/10/2014	10:38	NM 76733 19486	176733	719486		SPFW2	Planned freshwater sample. Sample associated with waypoint 12.
12	07/10/2014	10:38	NM 76733 19486	176733	719486			Watercourse observations: Width 0.39 m, depth 4 cm, Flow 0.225 m/s, SD 0.007. Ardfad Bay.
13	07/10/2014	10:46	NM 76952 19640	176952	719641		SPSW2	Planned seawater sample at NE corner, Ardfad Bay trestle array.

No.	Date	Time	NGR	East	North	Associated photograph	Associated sample	Description
14	07/10/2014	10:51	NM 76979 19666	176979	719666		SPSF1	Unplanned mussel sample as substitute for oysters. Attached to wall about 50 m north of north end of trestle array.
15	07/10/2014	10:56	NM 76985 19672	176986	719673			Wildlife: 8 seals counted on three islets.
16	07/10/2014	11:15	NM 77132 19420	177132	719421			NW corner of array. Oyster trestle array, Ardencaple site, composed of 5 rows (banks) of 1 m high trestles.
17	07/10/2014	11:19	NM 77176 19450	177176	719451		SPSW3	Planned seawater sample.
18	07/10/2014	11:22	NM 77217 19407	177218	719407			NE corner.
19	07/10/2014	11:34	NM 77150 19428	177150	719429		SPSF2	Planned shellfish sample from north side of array.
20	07/10/2014	11:37	NM 77142 19354	177142	719354			SE corner.
21	07/10/2014	11:39	NM 77093 19410	177094	719410	Fig. 6		SW corner.
22	07/10/2014	11:41	NM 77083 19415	177083	719415			NW corner of small, separate adjacent trestle array including the RMP.
23	07/10/2014	11:41	NM 77097 19397	177097	719398			NE corner of separate array.
24	07/10/2014	11:42	NM 77088 19391	177088	719392			SE corner of separate array.
25	07/10/2014	11:42	NM 77076 19403	177076	719404			SW corner of separate array.
26	07/10/2014	11:43	NM 77085 19390	177086	719391			RMP cage on separate trestle.
27	07/10/2014	11:45	NM 77085 19389	177085	719390		SPSF3	Planned shellfish sample taken at RMP.
28	07/10/2014	11:52	NM 76931 19306	176931	719306			Goose dropping.
29	07/10/2014	11:54	NM 76853 19296	176853	719297	Fig. 7		Bothy above shore (Ardfad), no drainage facilities.
30	07/10/2014	12:00	NM 76601 19213	176602	719213		SPFW3	Planned freshwater sample from small watercourse. Sample associated with waypoint 31.

No.	Date	Time	NGR	East	North	Associated photograph	Associated sample	Description
31	07/10/2014	12:00	NM 76601 19212	176602	719212			Watercourse observations: Width 0.12 m, depth 5 cm, Flow 0.117 m/s, SD 0.002
32	07/10/2014	12:08	NM 76544 19070	176545	719070		SPFW4	Planned freshwater sample from watercourse. Sample associated with waypoint 33.
33	07/10/2014	12:08	NM 76544 19071	176544	719071			Watercourse observations: Width 0.36 m, depth 8 cm, Flow 0.128, SD 0.010. Evidence of cattle on shore. More goose droppings (20 to 30) on flat grassy area above shore 50 m south of site of SPFW4.
34	07/10/2014	12:16	NM 76639 18958	176639	718958	Figs. 8 & 9		Pheasant feeder near to Ardencaple shellfish shore base.
35	07/10/2014	12:19	NM 76678 18913	176679	718914		SPSW4	Planned seawater sample from under road pipe draining brackish Loch Caithlim.
36	07/10/2014	12:19	NM 76678 18913	176679	718914			Tidal outflow through pipe. Width 0.9 m, depth 45 cm, Flow 3.783 m/s, SD 0.043.
37	07/10/2014	12:28	NM 76735 18810	176735	718810	Figs. 10 & 11		Agricultural dung heap and shed by roadside. Livestock in field; 12 cows and 41 sheep plus one dead sheep.
38	07/10/2014	12:52	NM 77258 19163	177259	719163	Fig. 12		Camuslaich Bay. Moored boat (dinghy) to the north and Camuslaich house to the south.
39	07/10/2014	12:55	NM 77212 19042	177212	719043		SPFW5	Planned freshwater sample from field drainage forming watercourse into the head of the bay. Sample associated with waypoint 40.
40	07/10/2014	12:55	NM 77212 19042	177212	719043			Watercourse observations: Width 0.40 m, depth 6 cm, Flow 0.9 m/s, SD 0.002.
41	07/10/2014	13:01	NM 77257 19061	177258	719062			Pacific oyster shell midden.
42	07/10/2014	13:04	NM 77400 19214	177400	719215		SPFW6	Planned freshwater sample from hill burn. Sample associated with waypoint 43.

No.	Date	Time	NGR	East	North	Associated photograph	Associated sample	Description
43	07/10/2014	13:05	NM 77401 19214	177401	719215			Watercourse observations: Width 0.65 m, depth 4.5 cm, Flow 0.405 m/s, SD 0.005.
44	07/10/2014	13:10	NM 77349 19304	177349	719304	Fig. 13		Old oyster trestles (7 by 3 m long, formerly Cadzow) with 13 bags but no live oysters. End of Seil Point shore survey.

Photographs referenced in the table can be found attached as Figures 3 – 13.

Sampling

No oyster stock was present at the first site, referred to as 'west bay' by the harvester, but common mussels were found nearby attached to intertidal walling and a sample of these was obtained as a substitute for the two planned oyster samples.

A Biotherm insulated box was used for shipping the samples which were posted at Oban Post Office on the 7th October for next day delivery to Glasgow Scientific Services (GSS) where the sample temperature on arrival was recorded as 1 degree centigrade.

Seawater samples were also tested for salinity by GSS and the results are reported in mg Chloride per litre. These results have been converted to parts per thousand (ppt) using the following formula:

$$\text{Salinity (ppt)} = 0.0018066 \times Cl^{-} \text{ (mg/L)}$$

Table 2. Water Sample Results

No.	Date	Sample	Grid Ref	Type	*E. coli* (cfu/100 ml)	Salinity (ppt)
1	07/10/2014	SPFW1	NM 76561 19901	Freshwater	270	
2	07/10/2014	SPFW2	NM 76733 19486	Freshwater	20,000	
3	07/10/2014	SPFW3	NM 76601 19213	Freshwater	390	
4	07/10/2014	SPFW4	NM 76544 19070	Freshwater	200	
5	07/10/2014	SPFW5	NM 77212 19042	Freshwater	200	
6	07/10/2014	SPFW6	NM 77400 19214	Freshwater	220	
7	07/10/2014	SPSW1	NM 76410 20039	Seawater	200	33.78
8	07/10/2014	SPSW2	NM 76952 19640	Seawater	300	33.78
9	07/10/2014	SPSW3	NM 77176 19450	Seawater	300	30.35
10	07/10/2014	SPSW4	NM 76678 18913	Seawater	184	30.17

Table 3. Shellfish Sample Results

No.	Date	Sample	Grid Ref	Type	*E. coli* (MPN/100 g)
1	07/10/2014	SPSF1	NM 76979 19666	Common mussels	330
2	07/10/2014	SPSF2	NM 77150 19428	Pacific oysters	700
3	07/10/2014	SPSF3	NM 77085 19389	Pacific oysters	1,700

Salinity Profiles

No salinity profiles were required or taken. The fishery is intertidal.

Photographs

Figure 3. Unused slipway. Waypoint 5.

Figure 4. Cattle feeding station, not in use. Waypoint 6.

Figure 5. Low oyster trestle array Ardfad Bay (‘west bay’ Ardencaple-Cyster site). Waypoint 7.

Figure 6. Oyster trestle array at Ardencaple-Cyster site Poll a’ Bhrochain. The RMP is the small area of separate trestles in the centre of the photograph. Associated Waypoint 21, centre left (SW corner of trestle array).

Figure 7. Ardfad bothy above shore. Viewed from Waypoint 29.

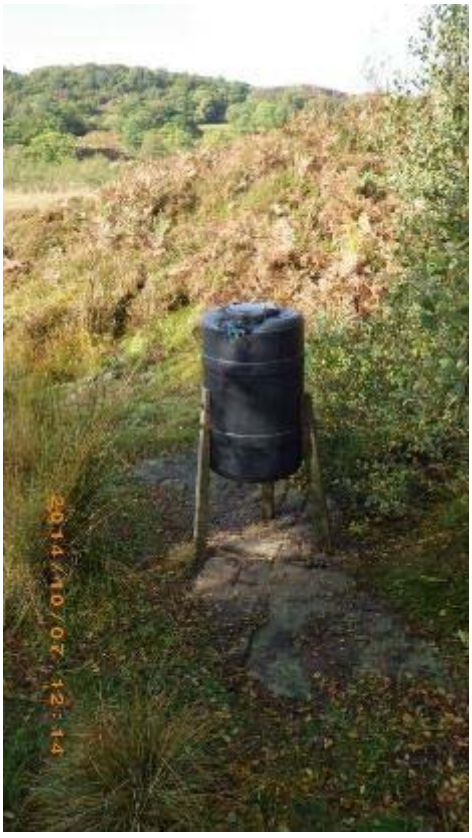

Figure 8. Field grain feeder for pheasants near to Ardencaple oysters shore base. Associated with Waypoint 34.

Figure 9. Ardencaple oysters shore base near Loch Caithlim outlet. Waypoint 34.

Figure 10. Cattle dung heap overlooking Loch Caithlim. Waypoint 37.

Figure 11. Cattle shed across the road from dung heap in Fig. 10. Waypoint 37.

Figure 12. Camuslaich Bay, Ardencaple-Cadzow site. Moored boat in distance (red boat). Disused former Cadzow trestles (Fig. 13) approximately above and slightly left of the red boat, distant. Waypoint 12.

Figure 13. Disused former Ardencaple-Cadzow trestles, Camuslaich Bay. Waypoint 44.