

Aerial survey of harbour (*Phoca vitulina*) and grey seals (*Halichoerus grypus*) in Scotland in 2016: Orkney and the North Coast, the Moray Firth and part of East Scotland



RESEARCH REPORT

Research Report No. 1005

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and grey seals (*Halichoerus grypus*) in
Scotland in 2016: Orkney and the North
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Scotland**

For further information on this report please contact:

Morven Carruthers
Scottish Natural Heritage
Great Glen House
INVERNESS
IV3 8NW
Telephone: 01463 725018
E-mail: morven.carruthers@nature.scot

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RESEARCH REPORT

Summary

Aerial survey of harbour (*Phoca vitulina*) and grey seals (*Halichoerus grypus*) in Scotland in 2016: Orkney and the North Coast, the Moray Firth and part of East Scotland

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Background

The Sea Mammal Research Unit (SMRU) aims to complete Scotland-wide August surveys of harbour and grey seals on an approximate five-year cycle. Over the last 15 years, SMRU surveys have documented a continuing decline of more than 75% in counts of harbour seals in Orkney and a continuing decline of over 90% in the Firth of Tay & Eden Estuary. In marked contrast, harbour seal numbers on the west coast of Scotland have increased. Harbour seal numbers in the Western Isles appeared to be declining until a high count in August 2011.

The previous round Scotland survey was completed between 2011 and 2015. This survey was carried out in 2016 and represents the start of a four year cycle to complete a new round-Scotland survey. The 2016 aerial surveys of moulting harbour seals and of grey seal summer distribution covers Orkney, the North Coast, the Moray Firth and part of East Scotland, from Fraserburgh to North Queensferry on the Firth of Forth.

Main findings

- The harbour seal count for Orkney was **1,240**, continuing the declining trend in numbers in Orkney. This was the lowest count recorded since the mid-1980s, compared with 1,865 counted in 2013 and 8,522 counted in 1997. The lowest count was recorded in 14 out of the 21 subregions comprising Orkney. On the North Coast, **109** harbour seals were counted in 2016 compared with 73 counted in 2013 and 207 counted in 1997. Combining these totals, **1,349** harbour seals were counted in the Orkney and North Coast Management Area compared with 1,968 counted in 2013 (representing a decline of 33.5% over 3 years or of 13% annually) and 8,729 counted in 1997.
- In Sanday SAC, **74** harbour seals were counted in 2016 compared with 114 counted in 2013 and 1481 in 1997. This is the lowest count of harbour seals in Sanday SAC.

- In the part of the Moray Firth that is surveyed annually (Helmsdale to Findhorn), **892** harbour seals were counted compared with 705 counted in 2015, representing an increase of 27%. In the Moray Firth Seal Management Area, **940** harbour seals were counted compared with the previous count of 745 (2013 & 2015).
- In the Dornoch Firth SAC, **85** harbour seals were counted in 2016 compared with 120 counted in 2015. This is SMRU's lowest count of harbour seals in the Dornoch Firth.
- In Culbin and Findhorn, **484** harbour seals were counted in 2016, compared with 330 counted in 2015. This is SMRU's biggest count of harbour seals at Culbin and Findhorn.
- In the Firth of Tay and Eden Estuary SAC, **51** harbour seals were counted in 2016 compared with 60 in 2015.
- The estimate of the minimum size of the harbour seal population around Scotland following the 2016 surveys is **25,149**. This is the number of hauled-out harbour seals counted during surveys carried out between 2011 and 2016 and is similar to the previous round-Scotland total of 25,399.

For further information on this project contact:

Morven Carruthers, Scottish Natural Heritage, Great Glen House, Leachkin Road, Inverness, IV3 8NW.

Tel: 01463 725018 or morven.carruthers@nature.scot

For further information on the SNH Research & Technical Support Programme contact:

Research Coordinator, Scottish Natural Heritage, Great Glen House, Leachkin Road, Inverness, IV3 8NW.

Tel: 01463 725000 or research@nature.scot

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1. INTRODUCTION

SMRU undertakes routine surveys of harbour and grey seals around Scotland and in part of England. These surveys provide the basis of the information the Natural Environment Research Council is obliged to submit to the Scottish Government and to the Department of the Environment, Food and Rural Affairs (Defra) under the Marine (Scotland) Act 2010 and the Conservation of Seals Act 1970 respectively, on the size, distribution and status of UK seal populations. The most recent advice can be found at: <http://www.smru.st-andrews.ac.uk/research-policy/scos/>. The surveys also provide information required by Scottish Natural Heritage to satisfy obligations under the EU's Habitats Directive on reporting the conservation status of seals within Special Areas of Conservation (SACs) and more broadly across Scotland.

In the UK, harbour seal population surveys are carried out during their annual moult, in August. In Scotland, the seven Scottish Seal Management Areas (Figure 1) making up the entire coast are surveyed approximately on a five-year cycle, although surveys are carried out annually in the Moray Firth and the Firth of Tay & Eden Estuary (Figure 2). Harbour seals in part of the Moray Firth are also surveyed annually during their breeding season, between mid-June and mid-July.

Grey seals hauled ashore are counted during all harbour seal surveys. Grey seal numbers can be highly variable from day to day during the summer months but these surveys do provide useful information on their summer distribution. The August grey seal counts are also used as an independent estimate to inform a more detailed population estimate that is derived from counts of pups born during the autumn grey seal breeding season (Lonergan *et al.*, 2011; Russell *et al.*, 2017)

This report summarises the results from August 2016 surveys of harbour and grey seals in Orkney, on the north coast of Scotland, in the Moray Firth and on the east coast of Scotland (from Fraserburgh to North Queensferry, including the Firth of Tay and Eden Estuary). The surveys were carried out to obtain updated estimates of the numbers of harbour and grey seals in the seven Scottish Seal Management Areas (Figure 1) and form the start of a new round-Scotland survey. The previous round-Scotland survey was carried out between 2011 and 2015 (Duck & Morris, 2012; 2013; 2014; 2015; 2016). The results from the 2016 survey are presented within the context of the previous survey results from 2011 to 2015 and within the longer term trends.

2. METHODS

The Sea Mammal Research Unit (SMRU) carried out most surveys of harbour seals by helicopter using a thermal imaging camera. In estuarine areas (Moray Firth and Firth of Tay & Eden Estuary), a small fixed-wing aircraft without a thermal imaging camera was used. Oblique high-resolution digital images were taken during all flights, and all surveys followed the standard SMRU survey protocol:

- Surveys were restricted to within two hours either side of low tides occurring between 12:30 and 19:30 (approximately).
- Surveys were restricted to the August harbour seal moult.
- There was no surveying on rainy days.
- High resolution digital photographs were taken of almost all groups of seals on shore.
- During the helicopter surveys, initial counts were made in real time and subsequently confirmed or corrected by reviewing the thermal image footage in conjunction with the high-resolution digital images.

All maps were produced using Manifold System 8.0 Ultimate Edition. The coastlines were drawn using Global Self-consistent, Hierarchical, High-resolution Shoreline data (Wessel & Smith, 1996), available to download from the National Geophysical Data Center website and high-resolution Scotland mean high and low water shape-files based on Ordnance Survey data (Pope, 2011).

2.1 Helicopter & thermal imager surveys in August 2016

Figure 3 shows the sections of coasts that were surveyed on different days:

- 1 Aug 2016: south Orkney
- 2 Aug 2016: mid and south Orkney
- 3 Aug 2016: weather day, low cloud
- 4 Aug 2016: north Orkney
- 5 Aug 2016: north Scotland, north and mid Orkney
- 9 Aug 2016: part Moray Firth, part east Scotland
- 10 Aug 2016: part Moray Firth

3. RESULTS

3.1 Scotland - composite

Figure 2 shows the years in which different segments of the Scottish coast were surveyed most recently, between 2011 and 2016. (Note that a small section of the north Moray Firth coast, from Wick to Duncansby Head, was last surveyed in 2008 when only one harbour seal and seven grey seals were counted).

- 2008: Duncansby Head to Wick
- 2011: Western Isles, Moray Firth (Wick to Helmsdale section)
- 2013: East Scotland (Aberlady Bay to North Queensferry section), West Scotland (Cape Wrath to Ullapool section)
- 2014: West Scotland (Ullapool to Scarba in the Firth of Lorn section)
- 2015: East Scotland (border to Aberlady Bay section), West Scotland (Firth of Lorn to southern tip of the Mull of Kintyre section), South-west Scotland, Shetland
- 2016: Orkney and North Coast, Moray Firth (Helmsdale to Fraserburgh section), East Scotland (Fraserburgh to North Queensferry section)

Figure 3 shows the sections of coast surveyed in August 2016.

The distribution of harbour seals in Scotland from these most recent August surveys is shown in Figure 4. Counts have been aggregated by 10 km squares in order to show the general August distribution more clearly. The numbers of harbour seals counted in Seal Management Areas in Scotland are given in Table 1. From the most recent surveys of the Scottish coast, a total of **25,149** harbour seals were counted between 2008 and 2016 (Duck & Morris, 2012; 2013; 2014; 2015).

The total count is similar to the previous round-Scotland total of 25,399 (2011-2015; Duck & Morris 2016), and is lower than the 1996-1997 total of 29,514, following large declines in northern and eastern areas. West Scotland is now by far the most important Management Area in terms of number of harbour seals in Scotland.

Figure 5 shows the summer distribution of grey seals in Scotland. In 2011, there was a very low grey seal count for the Monach Isles, off North Uist, which was likely due to the sunny day and high ambient temperatures (Duck & Morris, 2012). Large numbers of grey seals were observed in the water close to haul-out sites but, because they were not on land, were

not included in the count. Since this consistently high count was 'missing' in 2011, data for the Monach Isles from a fixed-wing survey of the more distant offshore islands carried out in August 2014 (SMRU unpublished data) are used here instead.

The numbers of grey seals counted in Seal Management Areas in Scotland are given in Table 2. The numbers of grey seals hauling out can be highly variable in the summer months and caution is advised when interpreting August counts of grey seals. None the less, these counts are used elsewhere to refine estimates of the size of the UK grey seal population (Lonergan *et al.*, 2011; Russell *et al.*, 2017).

Figure 6 shows the trends in numbers of harbour seals counted in all Seal Management Areas in Scotland since 1996. Three points have been added for 2016: for Orkney and the North Coast, for the Moray Firth and for East Scotland. Most plotted points are an amalgamation of counts from different years. New points are added only in years when significant new data are available. There is a marked difference in the trajectories of counts from the west of Scotland (general increase) compared with counts from Orkney and the north and east coasts of Scotland (general decline).

3.2 Area summaries

3.2.1 Orkney and North Coast

Orkney and the north coast of Scotland were surveyed between 1st and 5th August 2016. In Orkney, 1,240 harbour seals were counted (Table 3; Figure 7) with 109 counted on the north coast of Scotland (Table 3). The 2016 harbour seal count for Orkney was the lowest recorded by SMRU and was 34% lower than the previous (2013) count of 1,865, equivalent to an average annual decline of 13%. The 2016 count is 85% lower than the (1997) highest count of 8,522. Counts of harbour seals in subregions of Orkney and the North Coast are in Table 3. In 14 of the 21 subregions in Orkney, SMRU counted the lowest numbers of harbour seals since 1985; four of these were zero counts (Table 3). Three of the remaining seven subregions had single figure counts (Table 3). The decline in harbour seal numbers in Orkney, first noticed in 2006 (Lonergan *et al.*, 2007), is clearly continuing. Figure 8 shows a comparison of numbers of harbour seals counted in Orkney in 1997 (highest count) and in 2016 (lowest count).

The distribution of grey seals in Orkney is shown in Figure 7 with subregion counts from Orkney and the North coast in Table 4. Counts of grey seals in Orkney do not show any great change, other than the very low count in 2001, which was likely due to a period of prolonged wet weather.

3.2.2 Sanday, Orkney

Sanday was surveyed on 4th August 2016. Figure 9 shows the distribution of harbour and grey seals on Sanday in August 2016. A total of 83 harbour seals were counted on Sanday, the lowest count recorded by SMRU (Table 3 & Table 5). Of these, 74 were within Sanday SAC (Table 5; Figure 9). The 2016 harbour seal count represents a decline of 27% since 2013 (114) for the whole of Sanday and a decline of 25% within the SAC (99).

A total of 506 grey seals were counted on Sanday in August 2016, of which 486 were within the harbour seal SAC (Figure 9; Table 4 & Table 6).

3.2.3 Moray Firth

The greater part of the Moray Firth, from Helmsdale to Fraserburgh, was surveyed on 9th and 10th August 2016. The distribution of harbour and grey seals in the Moray Firth is shown in Figure 10. The numbers of harbour seals counted in different parts of the Moray Firth are

in Table 7 and are shown as histograms in Figure 11. A total of **940** harbour seals were counted in the Moray Firth compared with 745 counted in 2015. New lowest counts of harbour seals were recorded in the Dornoch Firth and Morrich More SAC (**85**) and in the Beaulay and Inverness Firths (**30**), while highest counts were recorded at Culbin and Findhorn (**484**) and between Burgh Head and Fraserburgh (**47**).

Detailed counts of grey seals in the Moray Firth are in Table 8 and a histogram of these counts in Figure 12.

3.2.4 East Scotland

The coast of East Scotland, from Fraserburgh to North Queensferry was surveyed on 9th August. The survey was curtailed at North Queensferry by rain approaching from the upper reaches of the Firth of Forth. Combined with data from 2013 (Aberlady Bay to North Queensferry) and 2015 (Border to Aberlady Bay) surveys, 368 harbour seals were counted in the East Scotland Seal Management Area (Table 1). Of these, 51 were in the Firth of Tay and Eden Estuary SAC (Table 1), approximately 8% of the mean count between 1990 and 2002 (641). Detailed counts of harbour seals within the Firth of Tay and Eden Estuary SAC are in Table 9 with counts of grey seals in Table 10. A map showing the distribution of harbour and grey seals in the Firth of Tay and Eden Estuary is in Figure 13. Histograms of harbour seal counts are in Figure 14 and of grey seal counts in Figure 15.

3.3 Harbour seal SACs

Three harbour seal SACs were counted in 2016: Sanday, the Dornoch Firth and Morrich More, and the Firth of Tay and Eden Estuary. August counts of harbour seals in SACs in Scotland are in Table 11 with the trajectories of the counts in Figure 16. With the exception of the three SACs in West Scotland (South-east Islay Skerries, Lismore and Ascribs & Dunvegan), the numbers of harbour seals counted in Scottish harbour seal SACs has declined considerably since the sites were first designated. Mousa in Shetland, Sanday in Orkney, the Dornoch Firth and Morrich More and the Firth of Tay and Eden Estuary show the biggest declines. The most recent individual counts for each of these SACs are less than 100.

4. DISCUSSION

This report provides the results of the first year of a four year programme of surveys that aim to cover the entire coastline of Scotland to provide the most up-to-date assessment of the harbour seal population.

The 2016 counts indicate that the decline in harbour seal numbers in Orkney continues, whilst numbers in the Moray Firth show a modest increase from the previous count, and numbers in east Scotland remain at historically low levels. Within SACs designated for harbour seals, new counts were obtained for Sanday SAC, the Dornoch Firth and Morrich More SAC, and the Firth of Tay and Eden Estuary SAC.

Areas to be surveyed by SMRU in 2017 and 2018 include West Scotland, Western Isles, South-West Scotland, and part of East Scotland Management Units. In August 2019, SMRU propose to survey Shetland and Orkney to complete the four year programme of surveys covering the entire Scottish coastline. Once all the fieldwork and analyses are completed, the results from the full cycle of surveys (2016– 2019) will be collated in a single report.

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ANNEX 1: TABLES

Table 1. August counts of harbour seals in Scottish Seal Management Areas. Totals are also given for subdivisions of some of the SMAs. In 1996 and 1997, harbour seals were fairly evenly spread between Shetland, Orkney and West Scotland. Since then, West Scotland has supported an increasing proportion of the Scottish population while the proportion in Shetland and Orkney has declined. Data from aerial surveys carried out by the Sea Mammal Research Unit.

Seal Management Unit / Country	Harbour seal counts		
	2008-2016	2007-2009	1996-1997
1 Southwest Scotland	1,200 (2015)	923 (2007; 2009)	929 (1996)
2 West Scotland ^a	15,184 (2013-2015)	10,626 (2007-2009)	8,811 (1996-1997)
2a West Scotland - South	7,645 (2014-2015)	5,930 (2007; 2009)	5,651 (1996)
2b West Scotland - Central	6,424 (2014)	4,004 (2007; 2008)	2,700 (1996)
2c West Scotland - North	1,115 (2013; 2014)	692 (2008)	460 (1996-1997)
3 Western Isles	2,739 (2011; 2014)	1,804 (2005; 2008)	2,820 (1996)
4 North Coast & Orkney	1,349 (2016)	2,979 (2008-2009)	8,787 (1997)
4a North Coast	109 (2016)	112 (2008)	265 (1997)
4b Orkney	1,240 (2016)	2,867 (2008-2009)	8,522 (1997)
5 Shetland	3,369 (2015)	3,039 (2009)	5,994 (1997)
6 Moray Firth	940 (2008; 2011; 2016)	776 (2007-2009)	1,409 (1997)
7 East Scotland	368 (2013; 2015-2016)	283 (2007; 2010)	764 (1997)
7.1 Fraserburgh to Carnoustie	53 (2016)	24 (2007)	15 (1997)
7.2 Tay & Eden SAC	51 (2016)	111 (2009)	633 (1997)
7.3 St Andrews to border	264 (2013; 2015-2016)	148 (2007)	116 (1997)
SCOTLAND TOTAL	25,149 (2008; 2011; 2013-2016)	20,430 (2007-2009)	29,514 (1996-1997)

Table 2. August counts of grey seals in Scottish Seal Management Areas. Totals are also given for subdivisions of some of the SMAs. Unlike harbour seals (Table 1), the relative proportion of grey seals within each area of Scotland has remained fairly constant over these three intervals. Data from aerial surveys carried out by the Sea Mammal Research Unit.

Seal Management Unit / Country	Grey seal counts		
	2008-2016	2007-2009	1996-1997
1 Southwest Scotland	374 (2015)	233 (2007; 2009)	75 (1996)
2 West Scotland ^a	5,064 (2013-2015)	2,526 (2007-2009)	3,435 (1996-1997)
2a West Scotland - South	3,618 (2014-2015)	1,788 (2007; 2009)	2,125 (1996)
2b West Scotland - Central	1,056 (2014)	561 (2007; 2008)	931 (1996)
2c West Scotland - North	390 (2013; 2014)	177 (2008)	379 (1996-1997)
3 Western Isles [*]	4,065 (2011; 2014)	3,808 (2005; 2008)	4,062 (1996)
4 North Coast & Orkney	9,714 (2016)	8,525 (2008-2009)	9,427 (1997)
4a North Coast	414 (2016)	504 (2008)	597 (1997)
4b Orkney	9,300 (2016)	8,021 (2008-2009)	8,830 (1997)
5 Shetland	1,558 (2015)	1,536 (2009)	1,724 (1997)
6 Moray Firth	1,252 (2008; 2011; 2016)	1,113 (2007-2009)	551 (1997)
7 East Scotland	3,812 (2013; 2015-2016)	1,238 (2007; 2010)	2,328 (1997)
7.1 Fraserburgh to Carnoustie	2,265 (2016)	400 (2007)	145 (1997)
7.2 Tay & Eden SAC	936 (2016)	450 (2009)	1,891 (1997)
7.3 St Andrews to border	611 (2013; 2015-2016)	388 (2007)	292 (1997)
SCOTLAND TOTAL	25,839 (2008; 2011; 2013-2016)	18,979 (2007-2009)	21,602 (1996-1997)

Table 3. Numbers of harbour seals counted in Orkney and the north coast of Scotland in August 2016. The highest completed counts for each subregion are in green and the lowest counts in red. The lowest harbour seal count since 1985 was recorded in all but seven subregions and in all seven exceptions the count was close to the lowest previously recorded. Data from aerial surveys carried out by the Sea Mammal Research Unit.

SMRU subregions		1985	1989	1993	1997	2001	2006	2007	2008	2010	2012	2013	2016
1	Mainland, East & North	558	686	950	592	349	435	313	314	254		229	207
2	Mainland, South & West	131	273	131	708	384	387	283	186	281		267	144
3	South Ronaldsay & Burray	212	275	377	390	511	132	100	62	104		111	87
4	Hoy	227	304	341	530	419	204	178	158	114		112	68
5	Flotta, Cava, Rysa, Fara, Barrel of Butter	855	690	801	575	596	359	258	164	180		154	122
6	Shapinsay	204	308	287	185	125	118	83	89	93		64	53
7	Rousay, Egilsay, Wyre, Scockness, Eynhallow	1,098	1,087	185	853	769	393	356	323	377		169	53
8	Graemsay	3	0	8	17	13	33	13	0	0		15	8
9	Stronsay	398	487	659	658	657	399	328	271	257	161	123	39
10	Eday & Calf of Eday	44	43	55	76	184	59	66	65	62		25	46
11	Sanday	738	1,108	1,661	1,670	1,247	519	470	312	131	220	114	83
12	Westray & Papa	597	586	776	825	1,326	487	385	339	304	195	222	156
13	Auskerry	271	13	75	271	75	3	2	0	0	2	3	0
14	North Ronaldsay	244	264	417	478	341	246	205	275	195	129	133	138
15	Green Holms, M & L	0	0	1	2	2	49	30	15	19	25	27	2
16	Sweynholm, Gairsay, Grass Holm	317	421	180	104	37	156	89	108	187		58	11
17	Little Linga, Huip, Linga Holm, Spurness	48	63	47	35	12	9	0	1	0	0	0	3
18	Faray, Holm of Faray & Rusk Holm	6	3	6	9	14	10	9	1	0	0	0	0
19	Copinsay	0	0	1	9	8	0	0	0	0	0	0	0
20	Switha, Swona, Stroma	704	526	914	535	683	240	206	184	129		39	20
21	Pentland Skerries	0	0	1	0	0	0	0	0	0		0	0
Orkney TOTALS		6,655	7,137	7,873	8,522	7,752	4,238	3,374	2,867	2,687		1,865	1,240
Pentland Firth					141	208	73		83			59	81
Tongue					124				29			14	28
North Coast TOTALS					265				112			73	109
Orkney & North Coast Seal Management Area TOTALS					8,787				2,979			1,938	1,349

Table 4. Numbers of grey seals counted in Orkney and the north coast of Scotland in August 2016. The highest completed counts for each subregion are in green and the lowest counts in red. Data from aerial surveys carried out by the Sea Mammal Research Unit.

SMRU subregions		1989	1993	1997	2001	2006	2007	2008	2010	2012	2013	2016
1	Mainland, East & North	37	173	679	96	432	167	258	223		673	291
2	Mainland, South & West	2	58	165	41	10	36	53	76		86	87
3	South Ronaldsay & Burray	73	99	124	0	58	39	38	231		217	272
4	Hoy	41	248	214	143	307	218	365	264		293	485
5	Flotta, Cava, Rysa, Fara, Barrel of Butter	73	14	146	1	263	165	111	105		330	544
6	Shapinsay	4	41	204	45	250	30	88	43		119	87
7	Rousay, Egilsay, Wyre, Scockness, Eynhallow	175	93	298	94	393	386	437	253		212	129
8	Graemsay	2	0	3	14	16	3	0	0		10	41
9	Stronsay	131	525	1,788	553	1,336	949	1,665	1,430	1,345	1,286	1,323
10	Eday & Calf of Eday	51	236	223	225	70	255	230	111		114	155
11	Sanday	255	1,182	1,888	88	462	646	452	107	769	525	506
12	Westray & Papa	122	374	764	347	419	879	1,057	704	918	509	584
13	Auskerry	20	79	99	20	133	100	69	188	219	121	5
14	North Ronaldsay	148	637	474	397	1,076	1,028	385	235	741	382	889
15	Green Holms, M & L	40	27	23	67	21	95	23	32	17	41	71
16	Sweynholm, Gairsay, Grass Holm	282	58	123	31	28	27	171	83		69	5
17	Little Linga, Huip, Linga Holm, Spurness	158	340	743	121	220	224	290	647	332	932	517
18	Faray, Holm of Faray & Rusk Holm	81	129	165	427	529	486	506	283	388	452	296
19	Copinsay	15	98	244	11	160	151	208	390	362	196	206
20	Switha, Swona, Stroma	1,029	1,438	29	117	2,216	494	705	1,268		390	1,566
21	Pentland Skerries	520	972	434	75	1,180	737	910	2,410		883	1,241
Orkney TOTALS		3,259	6,821	8,830	2,913	9,579	7,115	8,021	9,083		7,840	9,300
	Pentland Firth			0	36	223		66			86	149
	Tongue			597				278			109	194
North Coast TOTALS				597				344			195	343
Orkney & North Coast Seal Management Area TOTALS				9,427				8,365			8,035	9,643

Table 5. Numbers of harbour seals counted in Sanday Special Area of Conservation, Orkney. Subareas are numbered in Figure 9. The highest completed counts for each subarea are in green and the lowest counts in red. Data from aerial surveys carried out by the Sea Mammal Research Unit.

Section of Sanday coast	1985	1989	1993	1997	2001	2006	2007	2008	2009	2010	2012	2013	2016
1 Holms of Ire	286	272	417	440	328	179	153	59	99	20	64	24	14
2 The Riv	0	0	34	0	35	6	0	0	0	0	0	0	3
3 Whitemill	8	0	122	37	69	82	67	39	0	16	6	25	0
4 Otterswick	131	278	313	314	200	26	48	48	82	32	34	20	22
5 Taings	23	67	118	213	194	28	40	45	17	7	20	2	12
6 Tofts	45	78	96	127	78	36	2	12	45	8	23	14	8
7 Start Point	30	85	217	218	113	98	87	43	42	18	19	4	8
8 Lopness	8	0	1	2	0	0	0	0	0	1	0	1	1
9 Tres Ness	26	30	36	31	46	10	7	0	0	0	4	2	0
10 Els Ness	89	126	148	98	59	14	31	14	23	13	23	7	4
11 Kettletoft	0	5	2	1	30	0	0	0	7	1	3	0	2
TOTAL Sanday SAC	646	941	1,504	1,481	1,152	479	435	260	315	116	196	99	74
12 Quoy Ness	60	113	147	121	13	24	16	22	13	11	12	3	2
13 Spur Ness	0	0	0	0	0	3	5	0	0	0	0	0	0
14 Lamba Ness	32	54	10	68	71	12	14	30	21	4	12	7	5
15 Brough	0	0	0	0	11	1	0	0	0	0	0	5	2
TOTAL Sanday	738	1,108	1,661	1,670	1,247	519	470	312	349	131	220	114	83

Table 6. Numbers of grey seals counted in Sanday Special Area of Conservation, Orkney. Subareas are numbered in Figure 9. The highest completed counts for each subarea are in green and the lowest counts in red. Data from aerial surveys carried out by the Sea Mammal Research Unit.

Section of Sanday coast	1989	1993	1997	2001	2006	2007	2008	2009	2010	2012	2013	2016
1 Holms of Ire	1	0	76	4	33	92	0	54	0	24	52	43
2 The Riv	4	201	255	58	0	31	1	0	0	15	72	75
3 Whitemill	2	0	195	0	69	0	55	40	0	25	30	29
4 Otterswick	2	0	30	0	42	78	7	22	0	7	5	14
5 Taings	2	24	80	0	47	16	27	3	0	111	216	97
6 Tofts	113	393	271	5	21	111	42	98	9	79	25	10
7 Start Point	1	101	97	16	47	139	139	58	6	316	10	134
8 Lopness	3	10	15	0	0	13	22	22	14	27	15	12
9 Tres Ness	105	172	481	2	127	141	113	57	44	74	45	51
10 Els Ness	1	137	171	3	9	4	15	14	4	35	11	14
11 Kettletoft	0	0	0	0	0	0	0	0	0	0	1	7
TOTAL Sanday SAC	234	1,038	1,671	88	395	625	421	368	77	713	482	486
12 Quoy Ness	18	142	215	0	67	19	31	20	28	43	35	16
13 Spur Ness	0	0	0	0	0	0	0	0	0	0	0	0
14 Lamba Ness	3	0	0	0	0	2	0	5	2	13	7	4
15 Brough	0	2	2	0	0	0	0	0	0	0	1	0
TOTAL Sanday	255	1,182	1,888	88	462	646	452	393	107	769	525	506

Table 7. August counts of harbour seals in the Moray Firth Seal Management Area. Mean values are given for areas surveyed more than once in a single season (2004-2008); red = lowest (mean) count for given area, green = highest (mean) count. Figure 10 is a distribution map of harbour and grey seals counted in the annually surveyed section of the Moray Firth in August 2016. A histogram of the counts in this Table is shown in Figure 11. Data are from aerial surveys by the Sea Mammal Research Unit.

Area		1992	1993	1994	1997	2000	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Survey method		fw	fw	fw	ti	fw	fw & ti	fw	2fw	2fw & 1ti	fw & ti	fw & ti	fw & ti	fw	fw	ti	fw	fw	fw	fw	fw
(MEAN) COUNTS	Duncansby Head to Helmsdale		2		1					1			1								
	Helmsdale to Brora		92		193		188			113	150	54	73	19	101	87	102	70	1	21	40
	Loch Fleet		16		27	33	59	56	64	71	80	83	82	65	114	113	133	135	156	144	145
	Dornoch Firth (SAC)	662		542	593	405	220	290	231	191	257	144	145	166	219	208	157	143	111	120	85
	Cromarty Firth	41		95	95	38	42	113	88	106	106	102	90	90	140	101	144	63	100	22	72
	Beaully Firth (incl. Milton & Munlo	220		203	219	204	66	151	178	127	176	146	150	85	140	57	60	30	37	34	30
	Ardersier (incl. Eathie)			221	234	191	110	205	202	210	197	154	145	277	368	195	183	199	28	34	36
	Culbin & Findhorn			58	46	111	144	167	49	93	58	79	92	73	123	163	254	218	260	330	484
	Burghead to Fraserburgh			0	1					3		0				29		39			47
TOTALS	Dornoch Firth to Ardersier			1,061	1,141	838	438	759	699	634	736	546	530	618	867	561	544	435	276	210	223
	Loch Fleet to Ardersier				1,168	871	497	815	763	705	816	629	612	683	981	674	677	570	432	354	368
	Loch Fleet to Findhorn				1,214	982	641	982	812	798	874	708	704	756	1,104	837	931	788	692	684	852
	Helmsdale to Findhorn				1,407		829			911	1,024	762	777	775	1,205	924	1,033	858	693	705	892
	Moray Firth SMA	*			1,409		831			915	1,028	763	778	776	1,206	954	1,063	898	733	745	940

* For years where only the main area was surveyed (i.e. Helmsdale to Findhorn), the most recent counts for the outlying areas are used to give a total for the Moray Firth Seal Management Area.
fw, fixed-wing survey; ti, thermal imager helicopter survey; SMA, Seal Management Area.

Table 8. August counts of grey seals in the Moray Firth Seal Management Area. Mean values are given for areas surveyed more than once in a single season (2004-2008); red = lowest (mean) count for given area, green = highest (mean) count. Figure 10 is a distribution map of harbour and grey seals counted in the annually surveyed section of the Moray Firth in August 2016. A histogram of these grey seal counts is shown in Figure 12. Data are from aerial surveys by the Sea Mammal Research Unit.

	Area	1992	1993	1994	1997	2000	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
	Survey method	fw	fw	fw	ti	fw	fw & ti	fw	2fw	2fw & 1ti	fw & ti	fw & ti	fw & ti	fw	fw	ti	fw	fw	fw	fw	fw
(MEAN) COUNTS	Duncansby Head to Helmsdale *		33		0					59			9			15					
	Helmsdale to Brora				3		6			111	102	52	449	72	635	156	316	81	27	161	28
	Loch Fleet		0		0	0	0	0	0	0	1	3	1	0	7	7	20	18	7	10	31
	Dornoch Firth (SAC)	233		903	456	121	321	79	473	431	748	516	523	819	717	679	74	604	127	716	387
	Cromarty Firth	9		0	0	0	0	0	0	0	1	0	0	0	1	2	1	3	1	0	1
	Beaully Firth (incl. Milton & Munc	8		2	3	8	0	0	0	0	3	4	0	0	2	3	1	5	2	0	2
	Ardersier (incl. Eathie)			36	24	85	0	3	44	55	142	74	142	94	331	74	24	109	2	14	28
	Culbin & Findhorn			0	0	0	0	10	0	11	11	28	75	58	58	179	121	218	93	743	717
	Burghead to Fraserburgh			30	65					205		61				18		258			43
TOTALS	Dornoch Firth to Ardersier			941	483	214	321	82	517	486	894	594	665	913	1,051	758	100	721	132	730	418
	Loch Fleet to Ardersier				483	214	321	82	517	486	895	597	666	913	1,058	765	120	739	139	740	449
	Loch Fleet to Findhorn				483	214	321	92	517	497	906	625	741	971	1,116	944	241	957	232	1,483	1,166
	Helmsdale to Findhorn				486		327			608	1,008	677	1,190	1,043	1,751	1,100	557	1,038	259	1,644	1,194
	Moray Firth SMA	†			551		392			872	1,272	797	1,260	1,113	1,821	1,133	590	1,311	532	1,917	1,252

* In 2011, Duncansby Head to Wick was not surveyed. Therefore the 15 grey seals given for the northern most area in 2011 include 7 counted in 2008.

† For years where only the main area was surveyed (i.e. Helmsdale to Findhorn), the most recent counts for the outlying areas are used to give a total for the Moray Firth Seal Management Area.

fw, fixed-wing survey; ti, thermal imager helicopter survey; SMA, Seal Management Area.

Table 9. Counts of harbour seals in the Firth of Tay & Eden Estuary SAC. Mean values are given for areas surveyed more than once in a single season; red = lowest (mean) count for given area, green = highest (mean) count. A distribution map for 2016 data is shown in Figure 13 and a histogram of the harbour seal counts in this Table is in Figure 14. Data are from aerial surveys by the Sea Mammal Research Unit.

Area	1990	1991	1992	1994	1997	2000	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Survey method	1fw	1fw	1fw	1fw	1ti	1fw	1fw	1fw	1fw	2fw,1ti	1fw	1fw,1ti	2fw	1fw	1fw	1fw	1fw	1ti	1fw	1fw	1fw
Upper Tay	27	73	148	89	113	115	51	83	134	91	91	63	49	45	41	16	40	36	21	51	41
Broughty Ferry	77	83	97	64	35	52	0	90	55	51	31	27	13	28	15	18	16	3	0	2	4
Buddon Ness	13	86	72	53	0	113	109	142	66	25	96	64	27	8	23	11	8	10	1	3	0
Abertay & Tentsmuir	319	428	456	289	262	153	167	53	126	63	34	31	50	8	9	0	5	0	0	0	1
Eden Estuary	31	0	0	80	223	267	341	93	78	105	90	90	83	22	36	32	19	1	7	4	5
SAC total	467	670	773	575	633	700	668	461	459	335	342	275	222	111	124	77	88	50	29	60	51

fw, fixed-wing survey; ti, thermal imager helicopter survey; SAC, Special Area of Conservation

Table 10. Counts of grey seals in the Firth of Tay & Eden Estuary SAC. Mean values are given for areas surveyed more than once in a single season; red = lowest (mean) count for given area, green = highest (mean) count. A distribution map for 2016 data is shown in Figure 13 and a histogram of the grey seal counts in this Table is in Figure 14. Data are from aerial surveys by the Sea Mammal Research Unit.

Area	1990	1991	1992	1994	1997	2000	2002	2003	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Survey method	1fw	1fw	1fw	1fw	1ti	1fw	1fw	1fw	2fw,1ti	1fw	1fw,1ti	2fw	1fw	1fw	1fw	1fw	1ti	1fw	1fw	1fw
Upper Tay	0	0	18	20	61	64	78	50	42	22	27	26	55	98	16	39	127	62	115	132
Broughty Ferry	0	3	0	9	0	0	0	16	0	8	1	8	0	0	2	3	0	2	0	0
Buddon Ness	0	0	1	104	0	101	0	33	11	25	85	7	0	12	22	13	18	0	2	0
Abertay & Tentsmuir	912	1,546	1,191	1,335	1,820	2,088	1,490	1,560	763	1,267	1,375	483	395	1,406	1,265	1,111	323	531	687	738
Eden Estuary	0	0	16	0	10	0	25	4	27	57	31	33	0	39	17	36	14	39	32	66
SAC total	912	1,549	1,226	1,468	1,891	2,253	1,593	1,663	843	1,379	1,519	557	450	1,555	1,322	1,202	482	634	836	936

fw, fixed-wing survey; ti, thermal imager helicopter survey; SAC, Special Area of Conservation

Table 11. August counts of harbour seals in Special Areas of Conservation (SACs) designated for the protection of harbour seals. Red = lowest count for a given area, green = highest count. Data are from aerial surveys by the Sea Mammal Research Unit. Information on the criteria for selecting SACs and on the grading system can be found in Pinn (2009).

Harbour seal SAC	Grade	1996	1997	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
South-east Islay Skerries	B	552		812							741		666						1,087	
Lismore/ Eileanan agus Sgeiran Lios mór	B	603		453							325		498					380		
Ascrib, Isay & Dunvegan	B	656		968				664	678		719							434		
Sound of Barra	C	576		276		249	201			179		92			116					
Sanday	B		1,458		1,148					478	425	260	308	107		180	92			74
Mousa	B		402		235					83			93						23	
Yell Sound Coast	B		501		351					212			168						205	
Dornoch Firth & Morrich More	B		593	405		220	290	231	191	257	144	145	166	219	208	157	143	111	120	85
Firth of Tay & Eden Estuary	B		633	700		668	461	459	335	342	275	222	111	124	77	88	50	29	60	51

ANNEX 2: FIGURES

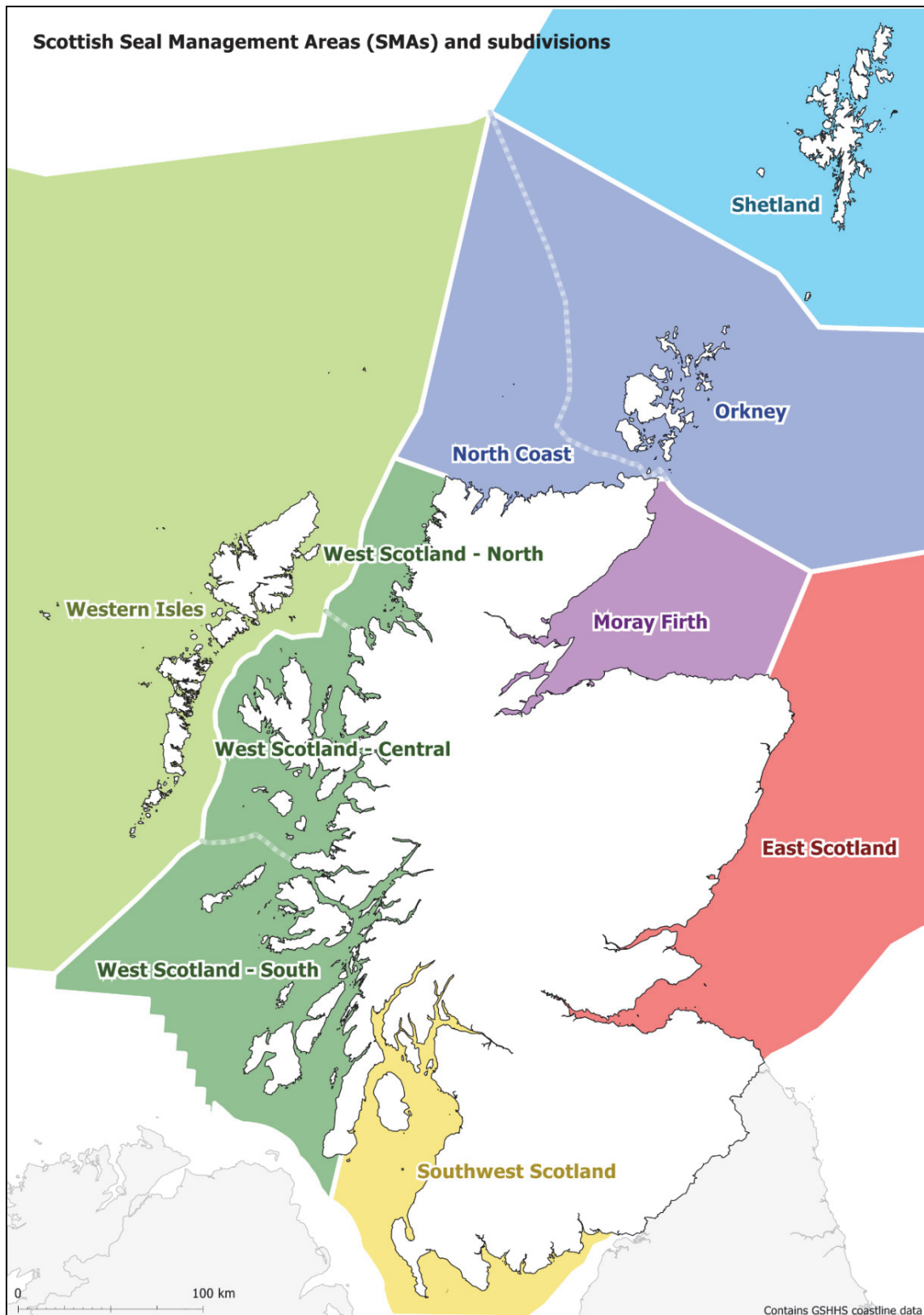


Figure 1. Scottish Seal Management Areas and subdivisions (dotted lines).

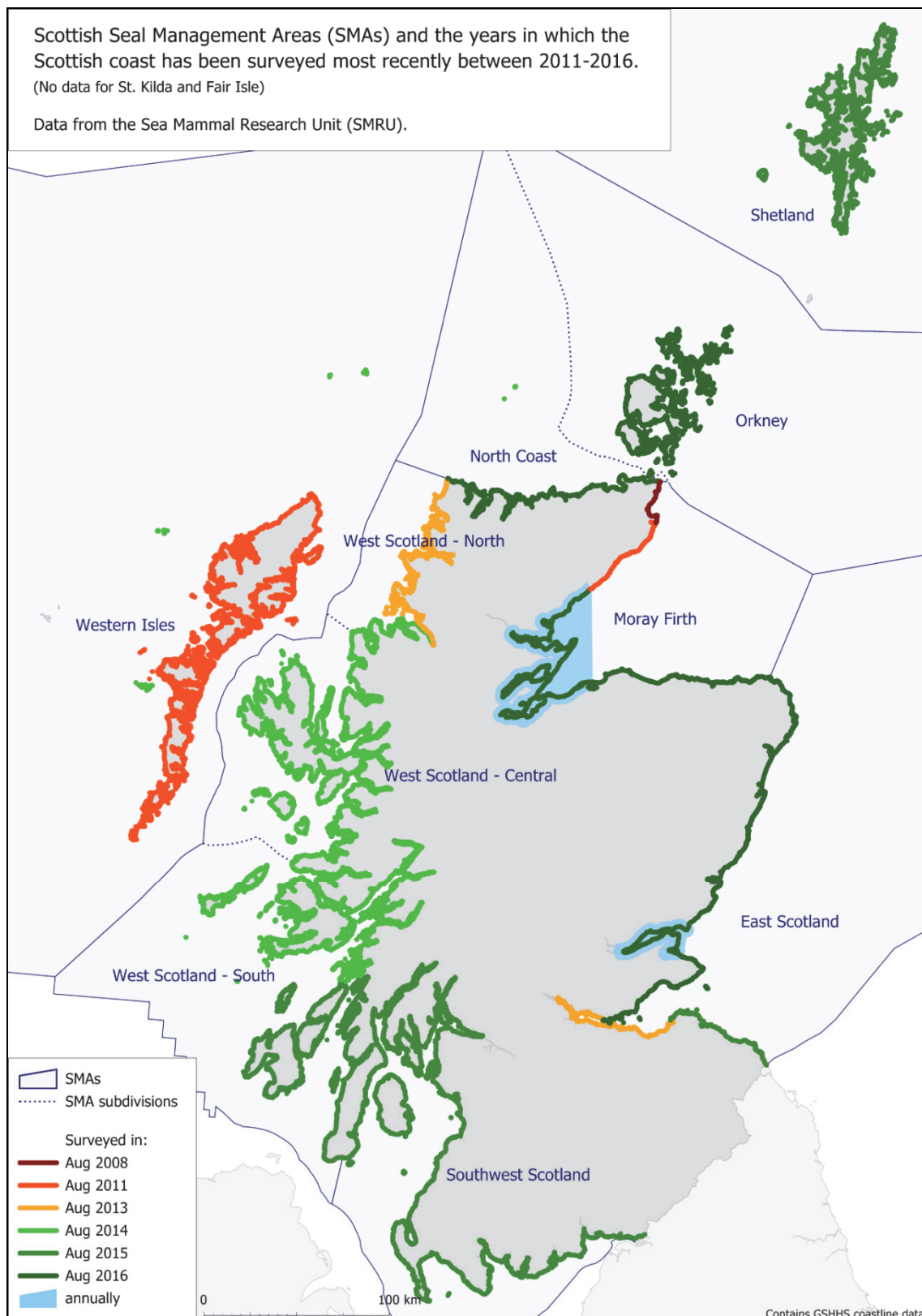


Figure 2. Map of Scotland showing the years that different areas were most recently surveyed for harbour and grey seals.

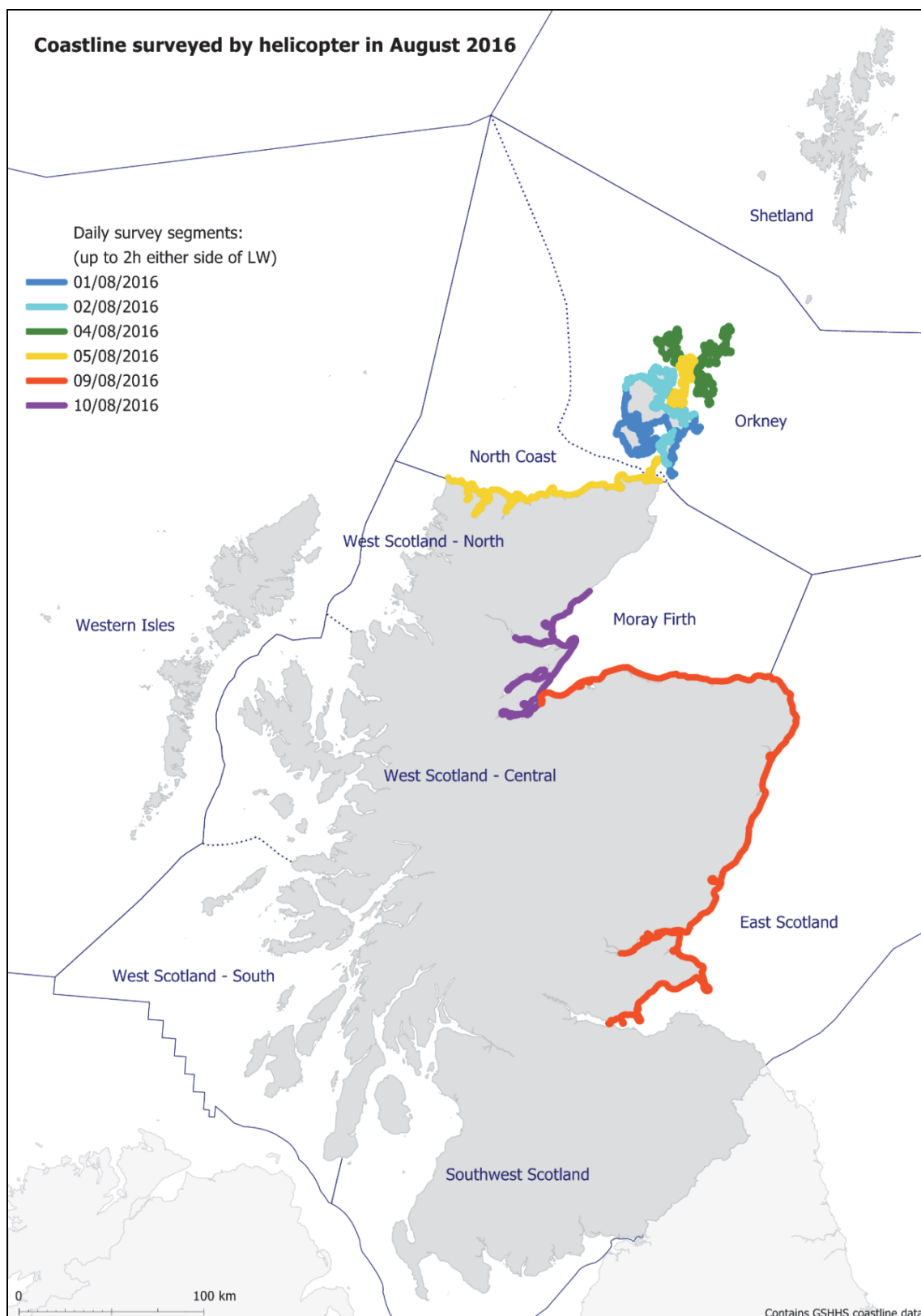


Figure 3. Map of Scotland showing the dates of survey of different areas in August 2016.

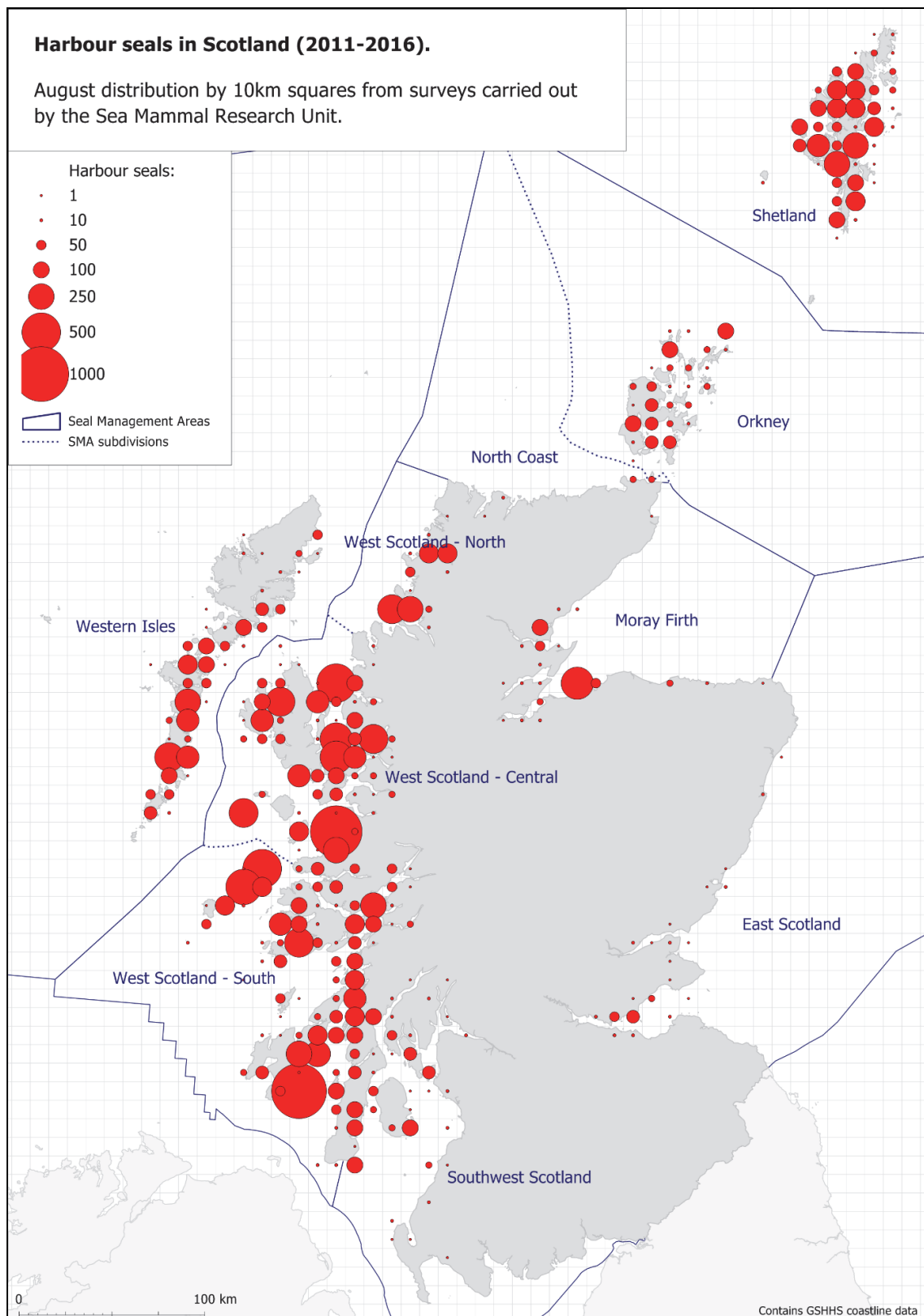


Figure 4. The number and summer distribution of harbour seals at haul-out sites in Scotland by 10 km squares. Seal Management Areas (SMAs) and subdivisions (dotted lines) are outlined.

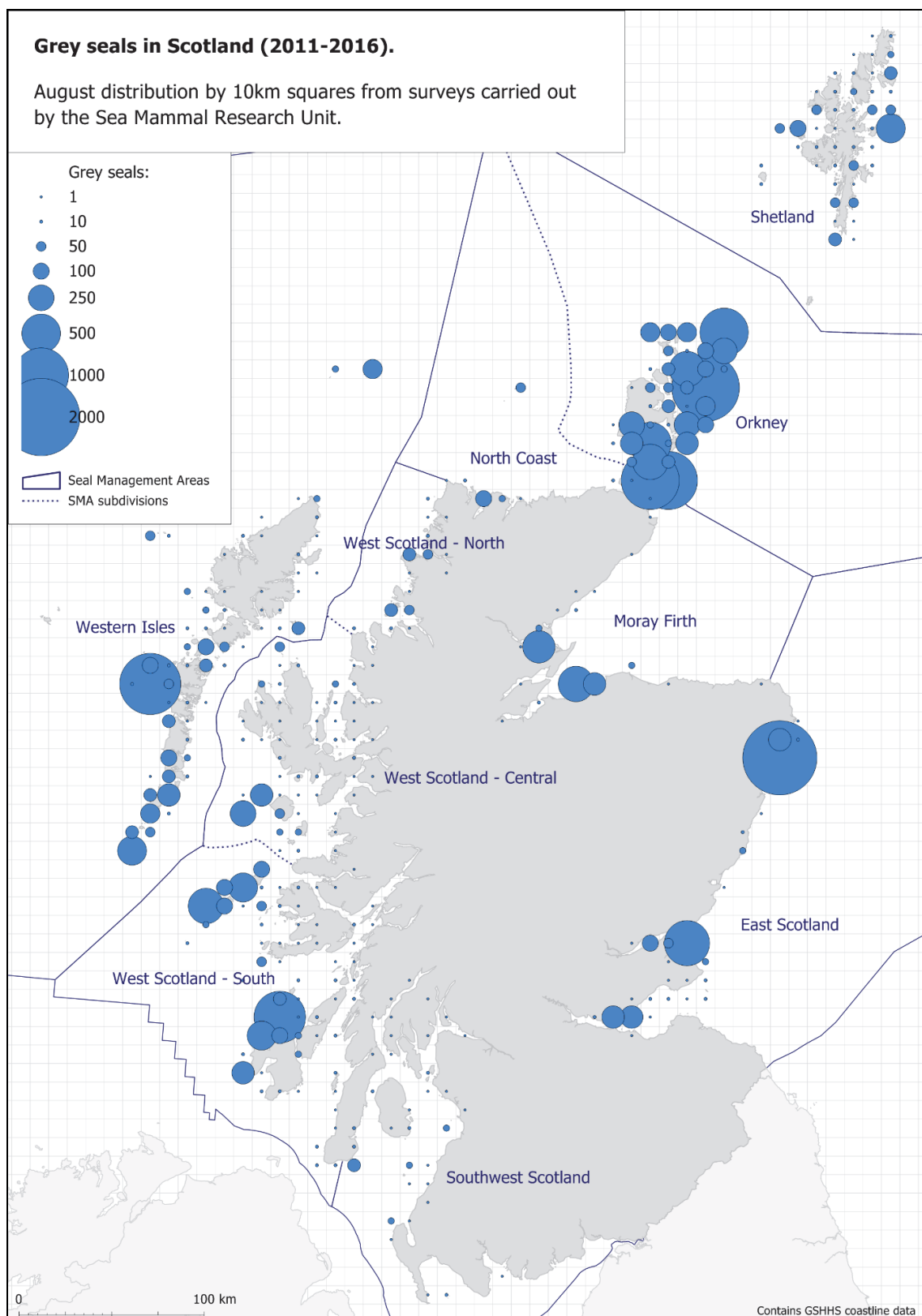


Figure 5. The number and summer distribution of grey seals at haul-out sites in Scotland by 10 km squares. Seal Management Areas (SMAs) and subdivisions (dotted lines) are outlined.

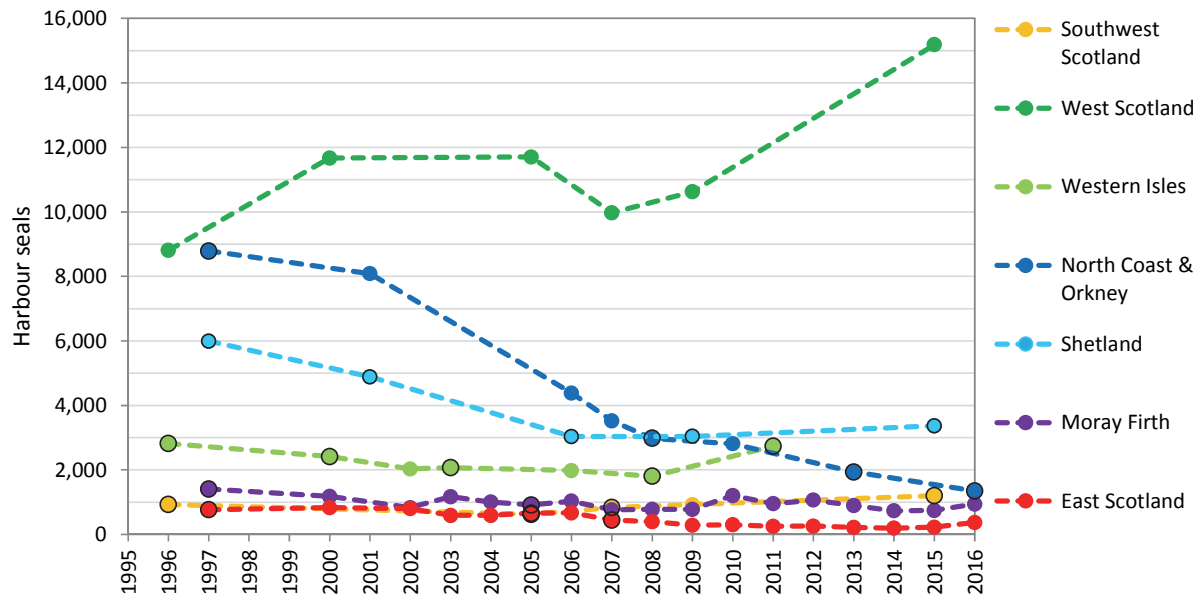


Figure 6. A comparison of August counts of hauled-out harbour seals in Scottish Seal Management Areas from 1996 to 2016. All surveys were carried out by the Sea Mammal Research Unit. Since 2006, thermal image counts have been verified using digital still images where possible. Note that because these data points represent counts of harbour seals distributed over large areas, individual data points may not be from surveys from only one year. Points are only shown for years in which a significant part of the SMA was surveyed. Points with a black outline are counts obtained in a single year.

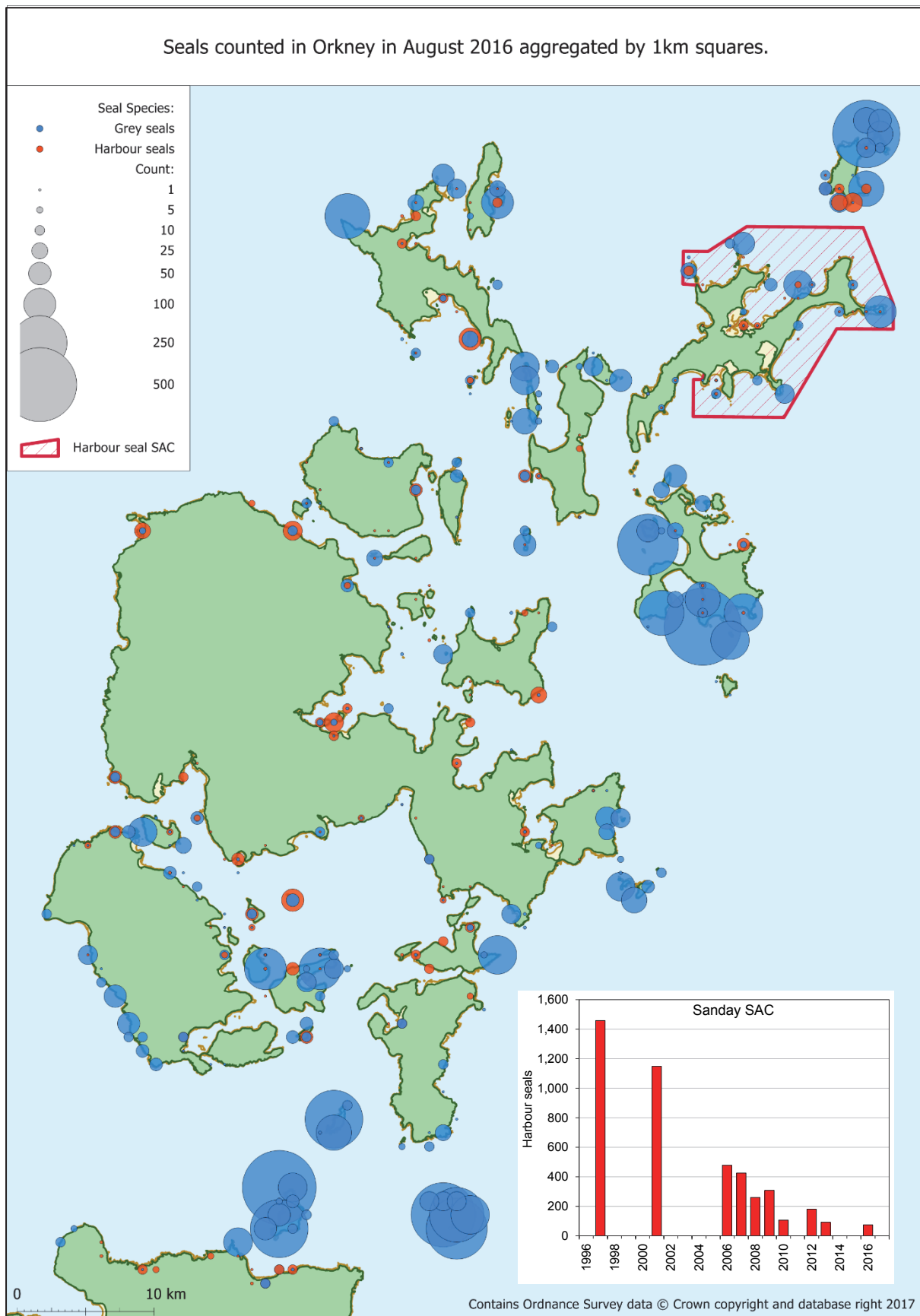


Figure 7. The distribution of harbour (red) and grey (blue) seals in Orkney in August 2016. The Sanday SAC is outlined in red.

Harbour seals counted in Orkney by 1km squares in August 2016 compared to the count in 1997.

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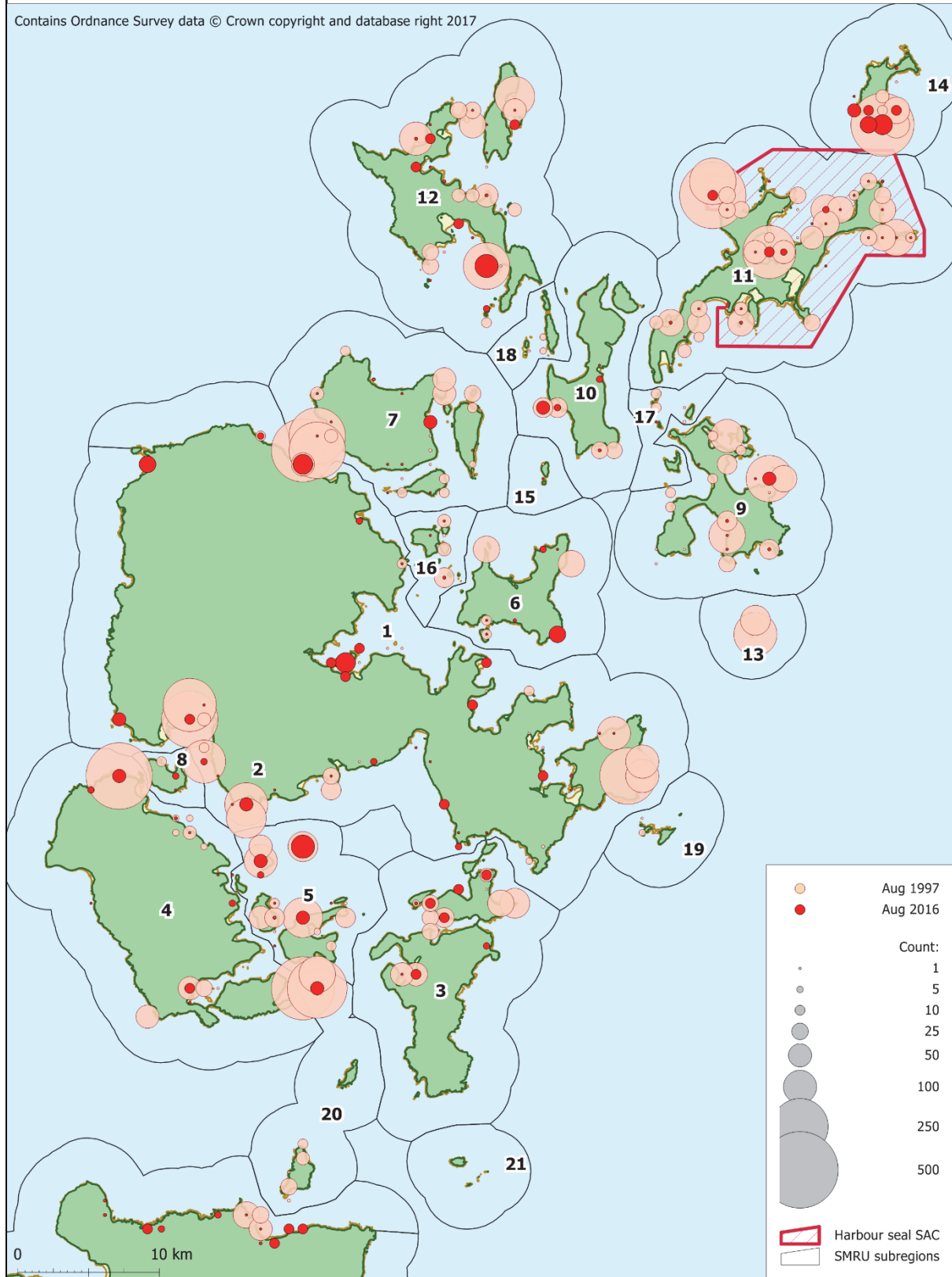


Figure 8. Harbour seals counted in Orkney in August 2016 compared with the highest count in August 1997. The number of harbour seals counted in Orkney in August 2016 was 85% of the number counted in August 1997.

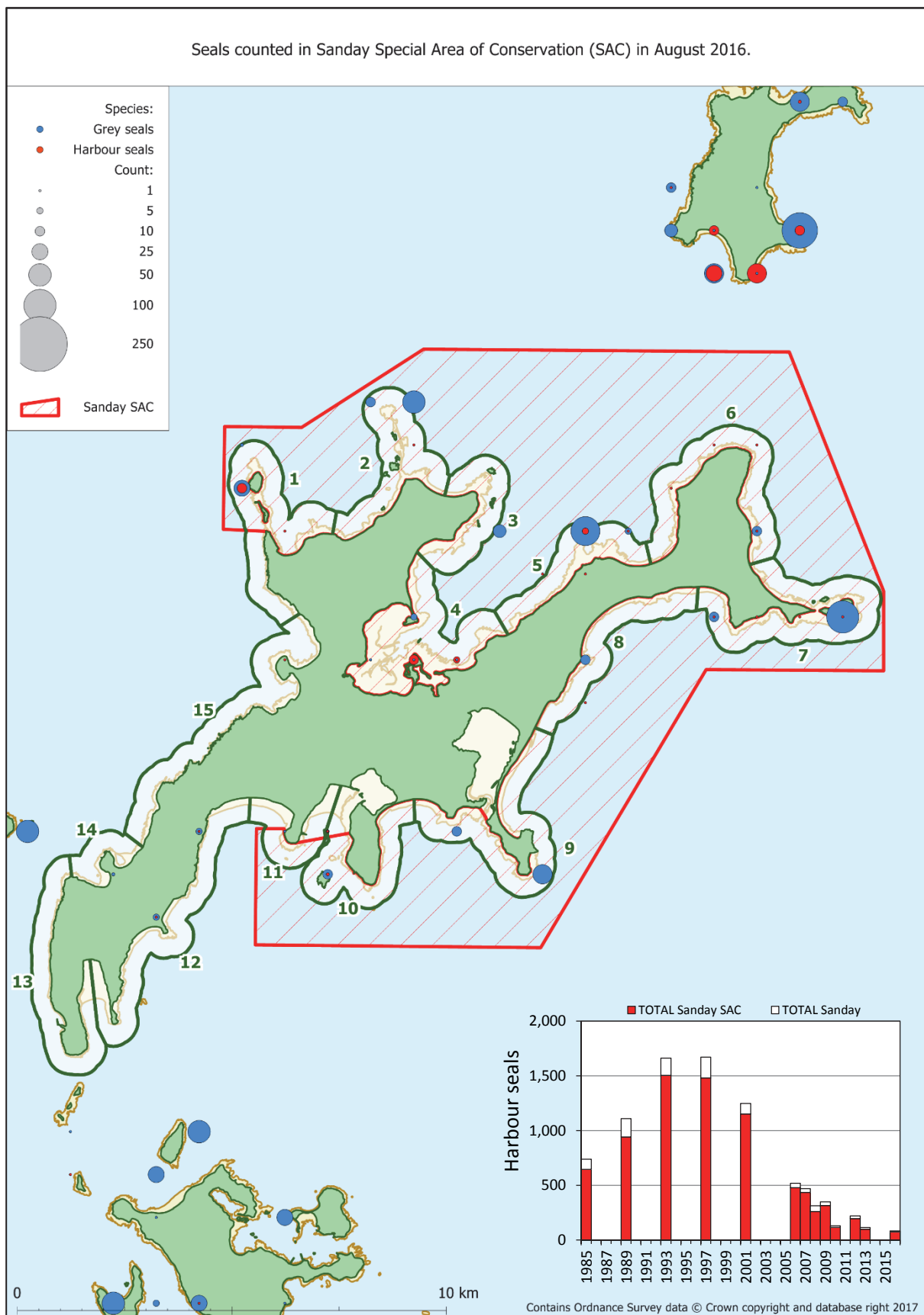


Figure 9. Harbour and grey seals counted on Sanday, Orkney, in August 2016. The harbour seal SAC is outlined in red. Detailed counts for the numbered areas are in Table 5 (harbour seals) and Table 6 (grey seals).

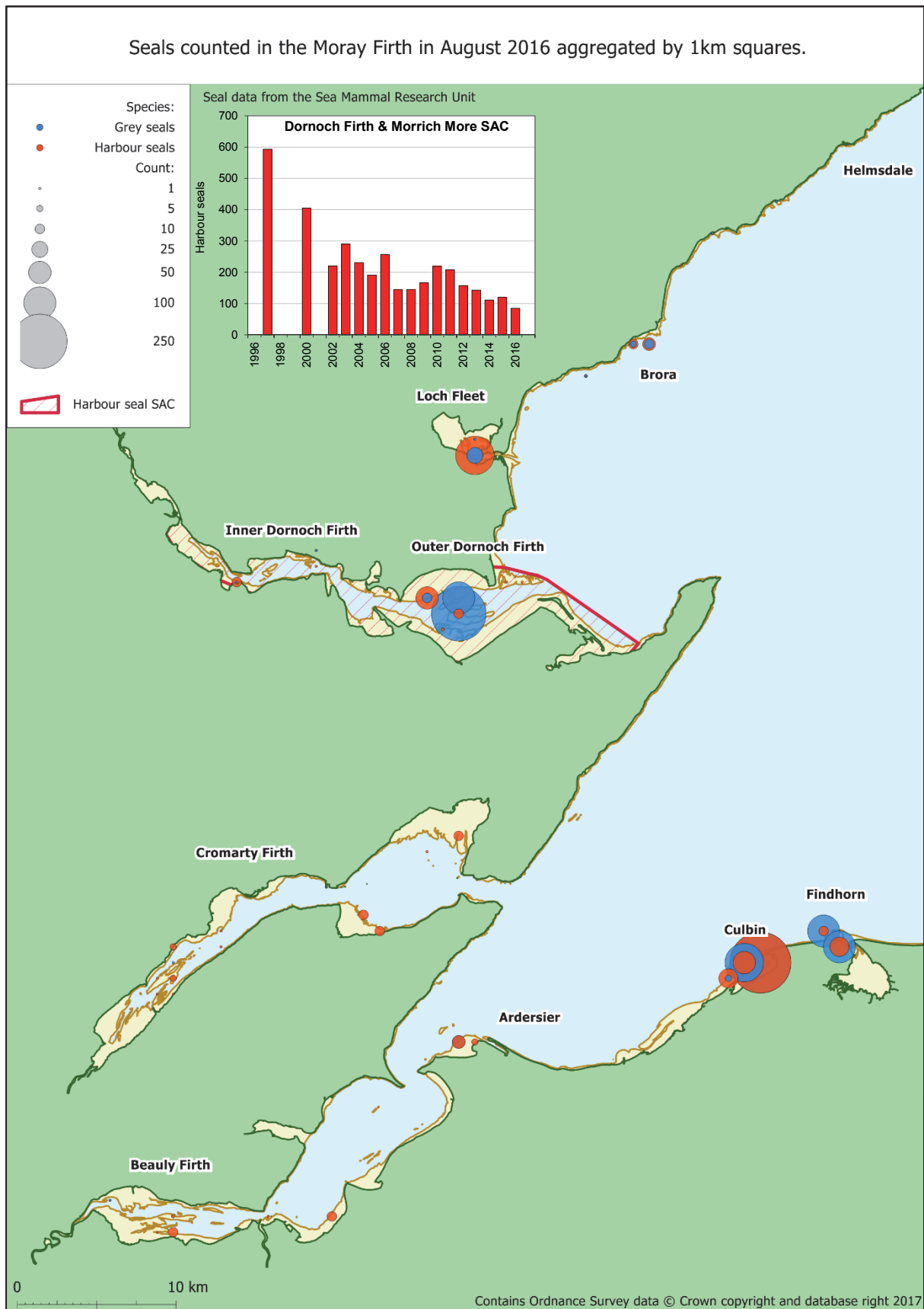


Figure 10. The distribution of harbour and grey seals counted in the Moray Firth in August 2016. Detailed counts of harbour seals are in Table 7 and of grey seals in Table 8. The Dornoch Firth and Morrich More harbour seal SAC is outlined in red.

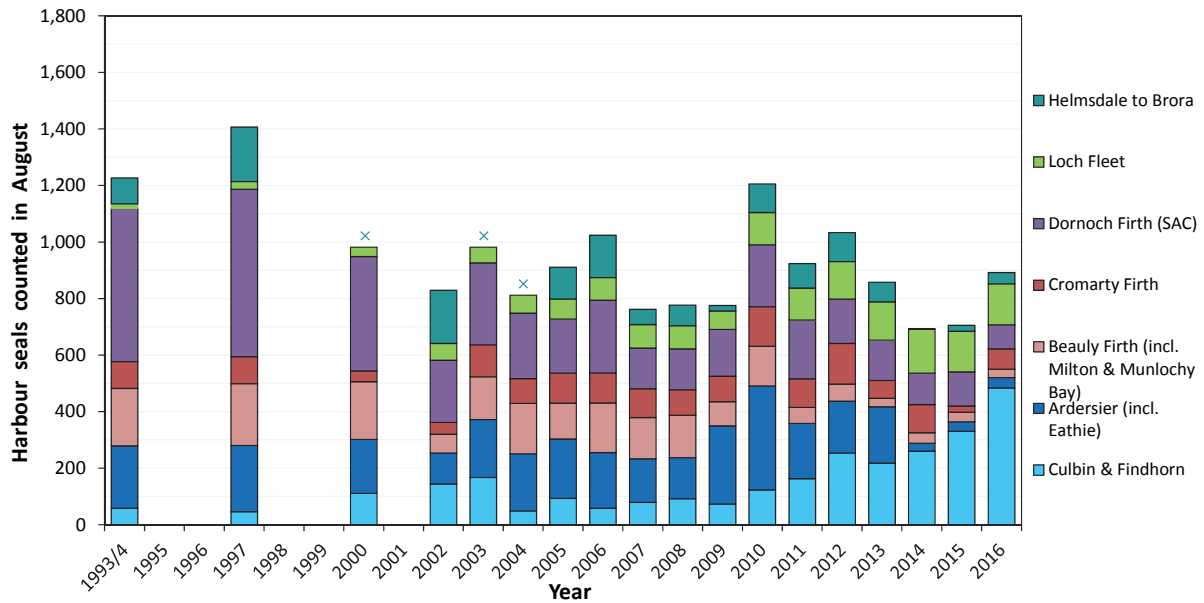


Figure 11. August counts of harbour seals in parts of the Moray Firth from 1994 to 2016. Detailed counts are in Table 7. Mean values were used for areas surveyed more than once in a single season (2002, 2004-2008). Helmsdale to Brora and Loch Fleet were not surveyed in 1994, so 1993 counts were used for these areas. Other years where Helmsdale to Brora was not surveyed are indicated by x. The Dornoch Firth and Morrich More is a harbour seal SAC. Data are from aerial surveys by the Sea Mammal Research Unit.

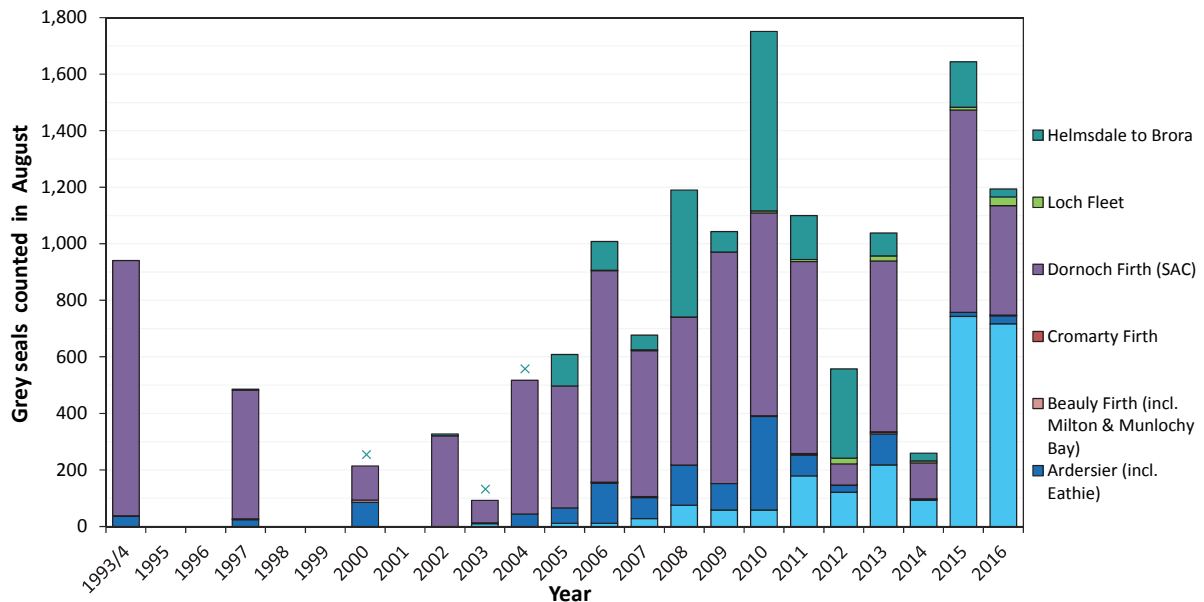


Figure 12. August counts of grey seals in parts of the Moray Firth from 1994 to 2016. Detailed counts are in Table 8. Mean values were used for areas surveyed more than once in a single season (2002, 2004-2008). Helmsdale to Brora and Loch Fleet were not surveyed in 1994, so 1993 counts were used for these areas. Other years where Helmsdale to Brora was not surveyed are indicated by x. The Dornoch Firth and Morrich More is a harbour seal SAC. Data are from aerial surveys by the Sea Mammal Research Unit.

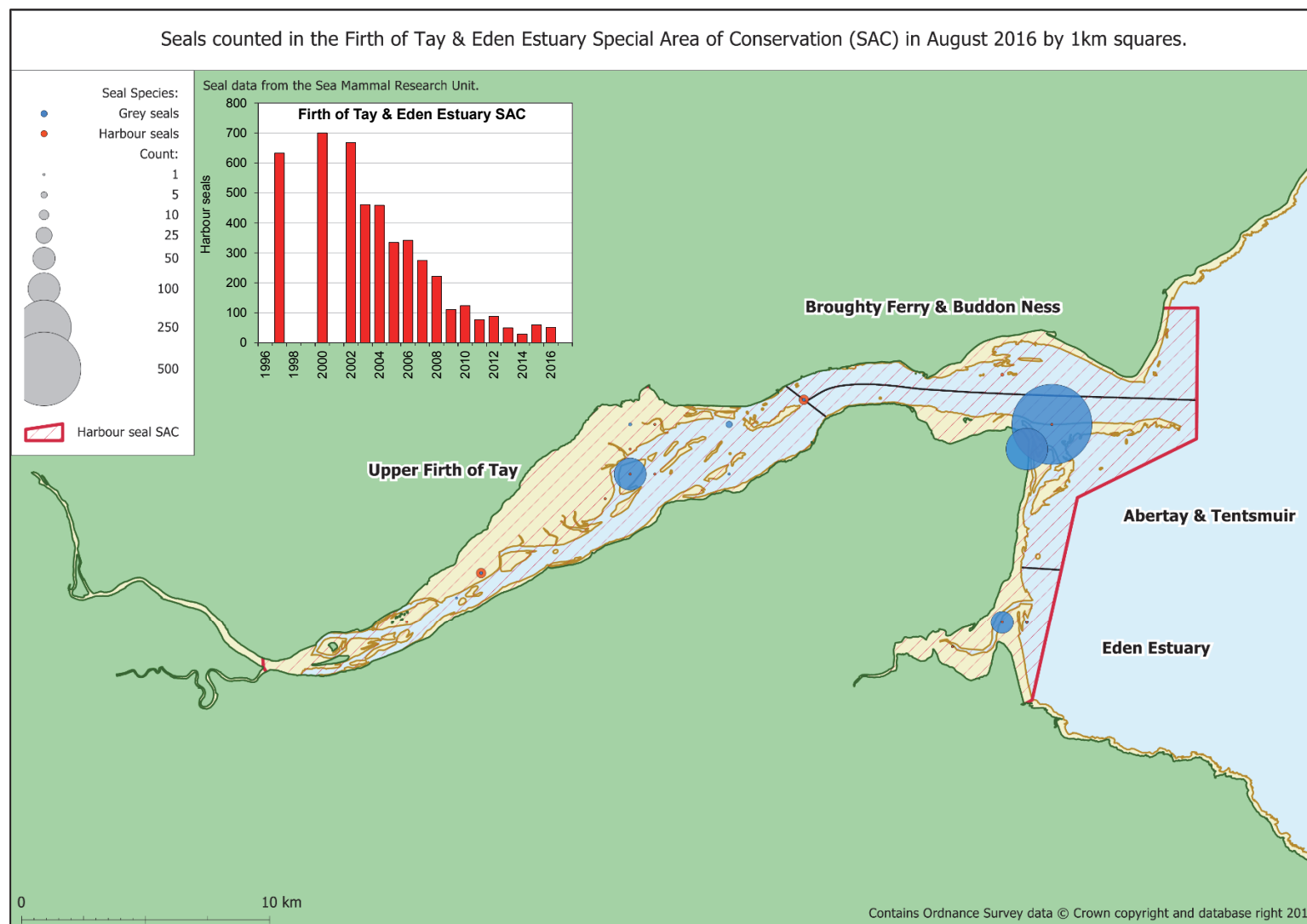


Figure 13. The distribution of harbour and grey seals counted in the Firth of Tay and Eden Estuary SAC in August 2016. Detailed counts of harbour seals in the SAC are given in Table 9 and of grey seals in Table 10.

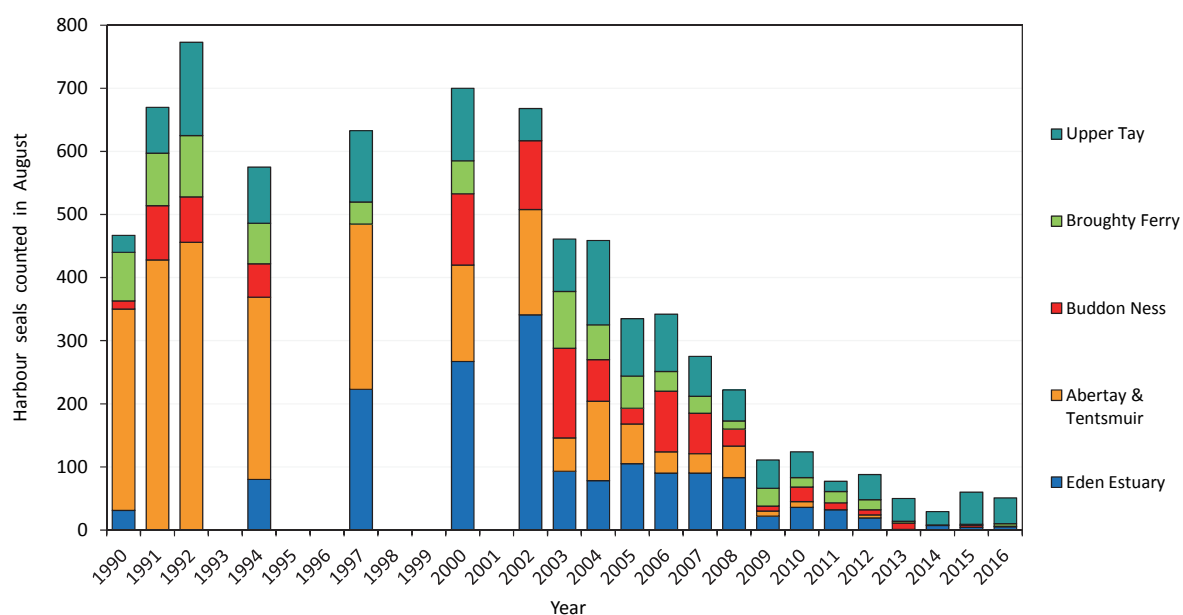


Figure 14. August counts of harbour seals in the Firth of Tay & Eden Estuary harbour seal SAC from 1990 to 2016. Mean values are given for areas surveyed more than once in a single season (2005, 2007, 2008). Detailed counts for each subarea are given in Table 9, and a distribution map for 2016 counts is shown in Figure 13. Data are from aerial surveys by the Sea Mammal Research Unit.

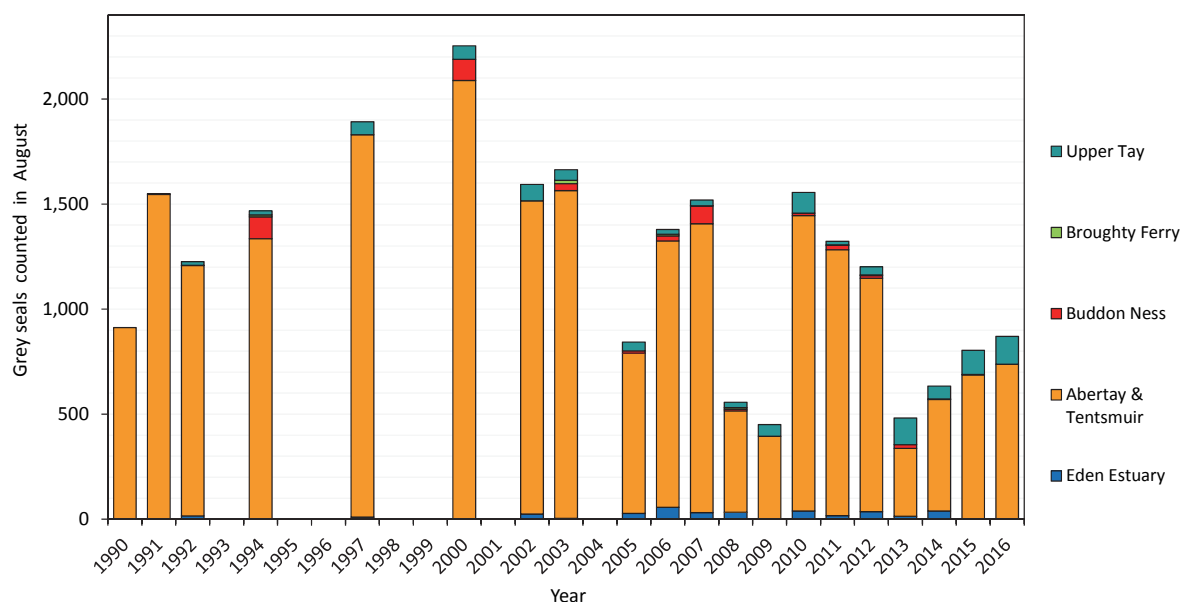


Figure 15. August counts of grey seals in the Firth of Tay & Eden Estuary harbour seal SAC from 1990 to 2016. Mean values are given for areas surveyed more than once in a single season (2005, 2007, 2008). Detailed counts of grey seals in each subarea are given in Table 10, and a distribution map for 2016 counts is shown in Figure 13. Data are from aerial surveys by the Sea Mammal Research Unit.

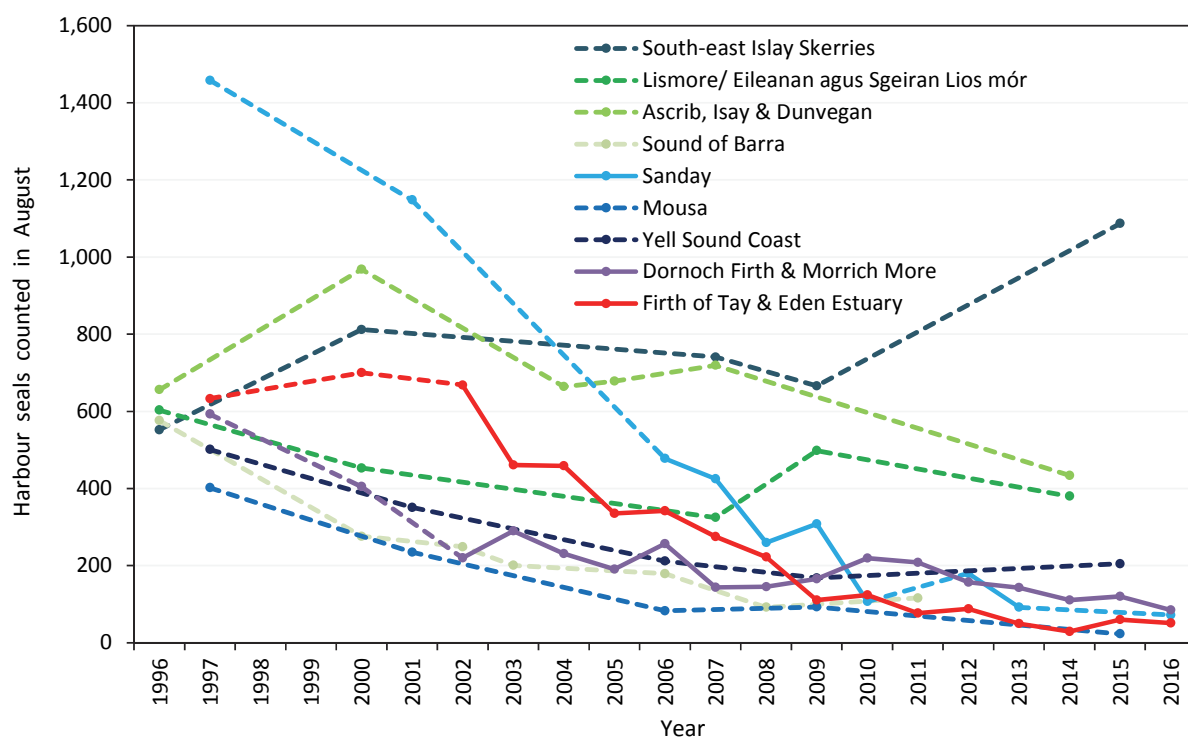


Figure 16. A comparison of harbour seal counts in Special Areas of Conservation in Scotland, designated for the protection of harbour seals, from 1996 to 2016. Detailed counts for each SAC are given in Table 11. Dotted lines indicate intervals of two or more years between surveys.

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Great Glen House, Leachkin Road, Inverness, IV3 8NW
T: 01463 725000

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