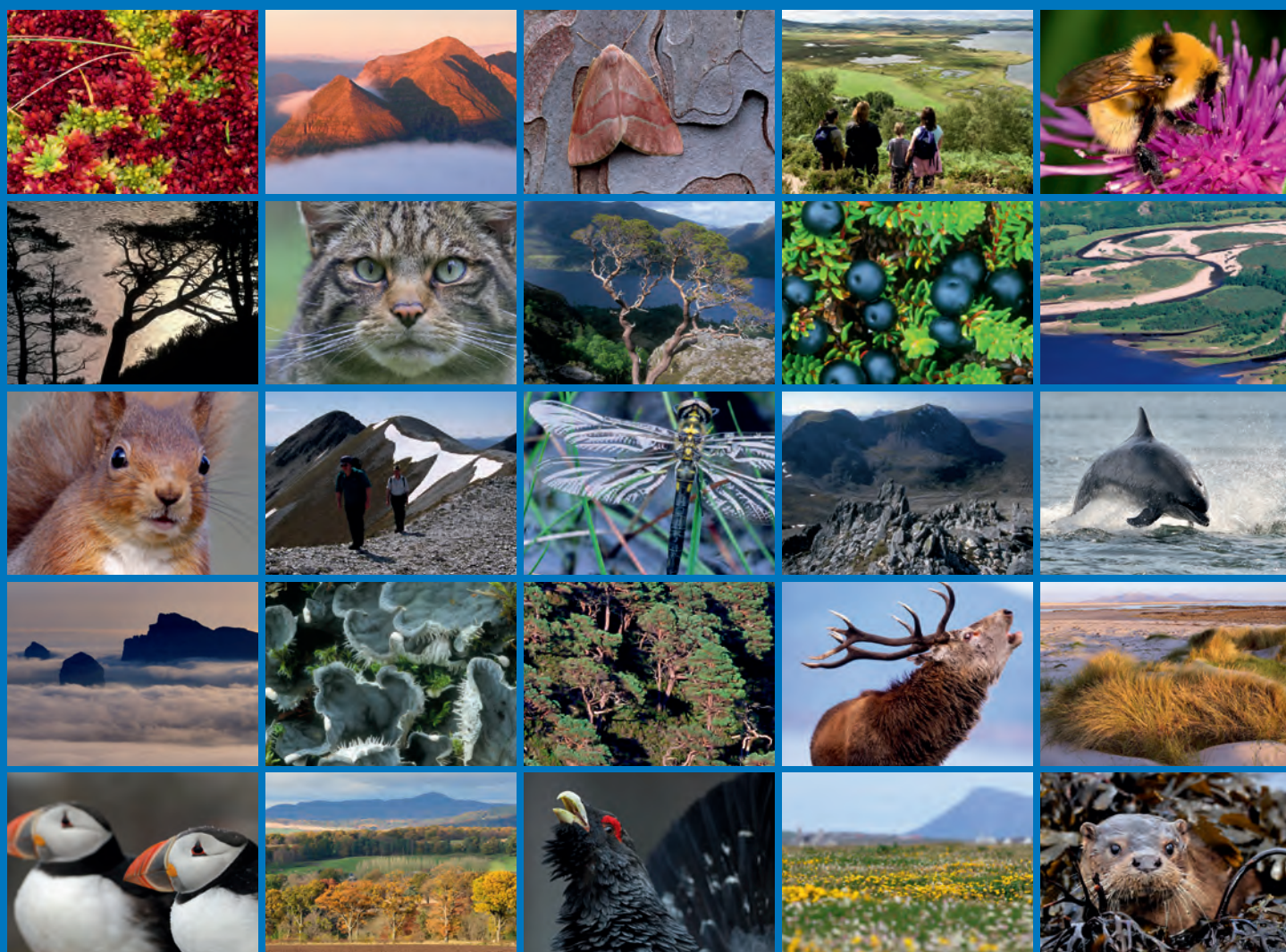


Surveys of harbour (common) and grey seals in Orkney, the north coast of Scotland, the Moray Firth and the Firth of Tay in August 2012





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COMMISSIONED REPORT

Commissioned Report No. 572

**Surveys of harbour (common) and grey
seals in Orkney, the north coast of Scotland,
the Moray Firth and the Firth of Tay in
August 2012**

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COMMISSIONED REPORT

Summary

Surveys of harbour (common) and grey seals in Orkney, the north coast of Scotland, the Moray Firth and the Firth of Tay in August 2012

Commissioned Report No.: 572

Contractor: St Andrews University Sea Mammal Research Unit

Year of publication: 2013

Background

Recent surveys carried out by SMRU have documented a continuing decline of more than 65% in the number of harbour seals in Orkney and a decline of over 80% in the Firth of Tay. The last survey undertaken on Orkney was in 2010 and a further survey was considered necessary to establish if the decline was continuing. The serious decline in the Firth of Tay population meant that a further survey was required here to establish the up-to-date status of this population. The Moray Firth population was also surveyed to compare the trend observed in Orkney and the Firth of Tay with that in the Moray Firth to help try to explain these declines

Main findings

- In August 2012, the Sea Mammal Research Unit, University of St Andrews, planned to carry out aerial surveys of moulting harbour seals in Orkney, along the north coast of Scotland, in the Moray Firth and in the Firth of Tay.
- Weather constraints and restrictions due to helicopter type limited the extent of coast in Orkney and along the north coast that could be surveyed in the time available. Only some of the subregions in the northern part of Orkney were completed and part of the Scottish north coast, from Duncansby Head to Dunnet Head. Elsewhere, the standard parts of the Moray Firth (from Findhorn to Helmsdale) and of the Firth of Tay (from Buddon Ness to St Andrews) were surveyed by small fixed-wing aircraft.
- In Orkney subregions completed in 2012, **732** harbour seals were counted compared with 906 in the same subregions in 2010, a decrease of 19.2%. The completed subregions were Stronsay; Sanday; Westray; Auskerry, North Ronaldsay; the Green Holms; Little Linga and the Holms of Huip, Spurness and Linga; Faray, Holm of Faray and Rusk Holm and Copinsay. In 1997 on these islands, 3,957 harbour seals were counted. Including the coastlines that were surveyed in subregions that were not completed (South Ronaldsay and Burray; North and East Mainland; Rousay, Egilsay, Eynhallow and Wyre; Switha, Swona, Stroma and Eday), **1,089** harbour seals were counted in 2012 compared with 1,486 in the same coastline in August 2010, a decrease of 26.7%. Combining subregions completed in 2012 with the remaining subregions surveyed in 2010 gives a total count of 2,513 harbour seals. Combining the total coastline surveyed in 2012 with the remaining coastline from 2010 gives a total count of 2,290 harbour seals. The

indication from the 2012 partial survey is that harbour seal numbers in Orkney continue to decline.

- In the Inner Moray Firth, **544** harbour seals were counted between Nairn and Dornoch, compared with 561 in 2011 and 861 in 2010. Along the Helmsdale coast, between Dornoch and Helmsdale (including Loch Fleet), **235** harbour seals were counted, compared with 200 in 2011 and 215 in 2010. Along the north coast of Moray, between Findhorn and Nairn, **254** harbour seals were counted compared with 163 in 2011 and 123 in 2010. A large group of harbour seals (169) was found in 2012 on Culbin Sands, between Nairn and Findhorn, where only small groups have been previously recorded. In the Inner Moray Firth, again there were many fewer harbour seals in the Beaully Firth in 2012 than in previous years.
- In the Firth of Tay, **78** harbour seals were counted in August 2012 compared with 77 in 2011 and 124 in August 2010. This low count for the Firth of Tay represents 11.6% of the mean count (670) between 1991 and 2002.
- Using data from the 2012 surveys, the updated estimate of the minimum size of the harbour seal population in Scotland is **21,227**. This is the number of harbour seals counted during surveys carried out in 2007 (west Scotland, part of Inner Hebrides, Firth of Clyde, Solway Firth, Border to Fife Ness, Carnoustie to Fraserburgh), 2008 (north and north-west Scotland, Small Isles), 2009 (Shetland and part of Argyll), 2010 (part of Orkney), 2011 (Outer Hebrides, outer Moray Firth from Helmsdale to Wick and from Fraserburgh to Findhorn) and 2012 (part of Orkney, Moray Firth from Findhorn to Helmsdale and the Firth of Tay).

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1. INTRODUCTION

This report summarises the results from surveys of harbour seals in Orkney, along part of the north coast of Scotland, between Findhorn and Helmsdale in the Moray Firth and in the Firth of Tay. The surveys were carried out to obtain updated estimates of the numbers of harbour and grey seals in the three areas.

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/pageset.aspx?psr=411>. The surveys also provide information to Scottish Natural Heritage that is used to satisfy Scottish obligations under the EU's Habitats Directive on reporting the conservation status of seals within SACs and in Scotland.

In the UK, harbour seal population surveys are carried out during their annual moult, in August. In Scotland, the entire coast is surveyed approximately on a four to five year cycle (Figure 1), although annual surveys are carried out in the Moray Firth and the Firth of Tay. Harbour seals in the Inner Moray Firth are also surveyed during their breeding season, between mid-June and mid-July. Grey seals hauled ashore are counted during all surveys, providing additional information on their summer distribution. Grey seal numbers can be highly variable from day to day during the summer months.

Since 2007, high resolution digital still photographs were taken of most groups of harbour and grey seals and were used to correct numbers and species identity of seals in the haul-out groups. The data provided in this report are obtained from a combination of counts from the thermal images and from digital still images.

2. METHODS

The Sea Mammal Research Unit (SMRU) carried out surveys of harbour seals by helicopter using a thermal imaging camera, or for limited areas (Moray Firth and Firth of Tay) using oblique high-resolution digital images taken from a small light fixed-wing aircraft, following 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 moult.
- There was no surveying on rainy days.
- High resolution digital photographs were taken of most groups of harbour seals on shore and of almost all groups of grey seals.
- 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.

Surveys were carried out on 9 August 2012 in the Firth of Tay, on 11 August in the Moray Firth and between 12 and 15 August in Orkney. Only part of Orkney was surveyed due to a combination of adverse weather conditions, helicopter type and time constraints. This makes comparing the 2012 count with those previous years more complicated. Normally, SMRU reports counts for all subregions that have been completed in their entirety, excluding any that were only partially completed. We continue that method here but also include, for

information, a comparison of the count from all areas of the coast that were counted in 2012 with counts from the equivalent area from previous surveys.

The coastline layers used in the maps were created 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 shapefiles based on Ordnance Survey data (Pope 2011).

3. RESULTS AND DISCUSSION

3.1 Scotland

The distribution of harbour seals in Scotland from the most recent surveys between 2007 and 2011 is shown in Figures 2a & b with grey seal distribution in Figures 3a & b. Please note that both these Figures have not been updated with data from 2012. This is in order to maintain the Orkney data from one complete survey, rather than from partial surveys in different years. Figure 1 shows the years in which different segments of the Scottish coast were surveyed most recently, using a thermal imager.

Figure 2a shows harbour seal distribution in Scotland aggregated into 1km squares. At this scale of map, many points overlap as harbour seal haul-out sites in some areas are close together. You may be able to enlarge Figure 2a to see haul-out sites in more detail. Figure 2b shows the same data aggregated by 10km squares. This map shows the large-scale August distribution of harbour seals around Scotland more clearly but at a more coarse resolution. In both maps, Seal Management Areas are marked with solid lines with Sub-Areas indicated by dotted lines.

Figure 3a shows grey seal distribution in Scotland aggregated into 1km squares. Again, many points overlap and you can zoom in to see grey seal distribution at this resolution in more detail. Figure 3b shows the same data aggregated by 10km squares. This coarser resolution map shows the large-scale August distribution of grey seals around Scotland more clearly.

Figure 4 shows the trends in numbers of harbour seals counted in Seal Management Areas in Scotland since 1990. Two new points for 2012 have been added: the combined 2010 and 2012 estimate for Orkney and the north coast and the count for the wider Moray Firth, between Findhorn and Helmsdale.

3.2 Orkney

Figure 5 shows the Orkney and north coast subregions that were fully surveyed (green), not surveyed at all (red) or were only partially surveyed (pale grey) in August 2012. The coastline that was surveyed is darker than the coastline that was not surveyed.

A combination of adverse weather conditions, helicopter type and time constraints limited the area in Orkney that could be surveyed. In completed subregions, **732** harbour seals were counted compared with 906 in 2010, a decline of 19.2%. Combining these counts with the most recent count (2010) for the remaining subregions, the total harbour seal count for Orkney was **2,513**, compared with 2,687 in 2010, a decline of 6.5% (Table 1).

Along the entire Orkney coastline surveyed in 2012, including uncompleted subregions, 1,089 harbour seals were counted in 2012 compared with 1,486 in 2010, a decline of 26.7%. Combining this total with the 2010 total for the remaining areas gives a total estimate for Orkney of 2,290, compared with 2,687 in 2010 (Table 1) a decline of 14.8%.

Clearly, neither of these alternatives is as informative as a complete survey. The last complete survey of Orkney was in August 2010. Given the likelihood of the decline continuing, as demonstrated by the 2012 partial survey, a full Orkney survey should be completed as soon as possible.

Figure 6 shows the distribution of harbour seals in those parts of Orkney and the north coast that were surveyed in August 2012. Subregions that were fully surveyed are numbered in green, those that were not surveyed are numbered in red and those partially surveyed are numbered in grey (as in Figure 5). Counts of harbour seals in Orkney subregions are in Table 1. The distribution of grey seals in those parts of Orkney and the north coast that were surveyed in August 2012 is shown in Figure 7. Subregion numbers are coloured as in Figure 5. Counts of grey seals in Orkney subregions are in Table 2.

Figure 8 compares the numbers of harbour seals counted in subregions of Orkney from all surveys since 1985. Counts for the areas of grey subregions that were partially surveyed in 2012 are represented by the lower portion of the bisected columns in the histograms. Details of numbers in completed subregions are in Table 1.

Dividing Orkney into three approximately similar-sized subareas shows regional differences in the severity of the decline in harbour seal numbers (Figure 9). The northern outer islands (blue) had the highest counts of harbour seals, peaking in 1997 and showed the greatest decline. Scapa Flow and the southern islands (green) counts also peaked in 1997 and declined thereafter, although counts were lower than in the outer northern islands. The north and east mainland and adjacent islands (purple) showed a different trend, a slow and more gradual decline since the late 1980s. The rate of decline of harbour seals counted on the coastline surveyed in 2012 appears to be more or less constant since 2006 (Figure 10).

3.3 Sanday

Figure 11 compares the number and distribution of harbour and grey seals on Sanday in 2012 (a) and in 1997 (b). Counts of both species are very considerably lower in 2012 than in 1997 (1,670 harbour seals in 1997 compared with 220 in 2012; 1,888 grey seals in 1997 compared with 769 in 2012; Tables 3 and 4). The Sanday harbour seal SAC contributes approximately 90% of the Sanday total for both seal species. Note that counts of grey seals, as well as counts of harbour seals, have declined.

3.4 Moray Firth

The number of harbour seals in the Inner Moray Firth in August 2012, from Ardersier to the Dornoch Firth (SAC), was slightly lower than in 2011 (544 in 2012 compared with 561 in 2011) but higher in the wider Moray Firth, between Findhorn and Helmsdale (1,033 in 2012 compared with 924 in 2011; Table 5). Harbour seal numbers in the Cromarty Firth, Loch Fleet and Findhorn + Culbin were the highest recorded in August by SMRU. In contrast, numbers in the Beaully and Dornoch Firths were close to the lowest August counts recorded by SMRU (Table 5). In the Dornoch Firth harbour seal SAC, 157 harbour seals were counted. The mean Dornoch Firth count between 1992 and 2000 was 551; the mean count between 2003 and 2012 was 201.

Figure 12 shows harbour and grey seal distribution around the Moray Firth in August 2012. Figure 13 shows the contribution to the harbour seal count from different parts of the wider Moray Firth. Counts of grey seals in the Moray Firth are in Table 6.

3.5 Firth of Tay

In the Firth of Tay, 78 harbour seals were counted in August 2012 (Table 7). This is virtually the same as the 2011 lowest count for the Firth of Tay. There is no apparent recovery of the

dramatic decline in numbers in this harbour seal SAC. Figure 14 shows the distribution of harbour and grey seals in the Firth of Tay harbour seal SAC in August 2012 (Figure 14a) and in August 2000 (Figure 14b). Figure 15 shows contribution to the harbour seal count from different areas of the Firth of Tay. Counts of harbour seals from these areas are in Table 7 and of grey seals in Table 8. The 2012 count of harbour seals in the Firth of Tay SAC is 11.6% of the mean count between 1991 and 2002. The difference is obvious when comparing Figures 14a and 14b and also applies, to a lesser extent, to grey seals.

3.6 Surveys planned for 2013

Large sections of the Scottish west and east coasts have not been surveyed since 2007 (Figure 1, in red). These coasts should be surveyed as soon as time and resources permit. In 2013, SMRU will aim to update surveys of the east coast, Orkney, the north coast and part of the west coast of Scotland. The extent of the west coast that can be surveyed will depend on weather and available resources.

SMRU recently were awarded funds from NERC to renew the harbour seal survey thermal imaging equipment. We hope to have this ready to use for the August 2013 survey.

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Table 1. Counts of harbour seals in subregions of Orkney from 1985 - 2012. Counts for subregions that were only partially surveyed in 2012 are shown in brackets. The highest complete count for each subregion is highlighted in green, the lowest in red. See Figure 5 for details on subregion boundaries. See Figure 6 for a map of harbour seal distribution in areas surveyed in 2012 and Figure 8 for individual subregion histograms. Data are from aerial surveys by the Sea Mammal Research Unit, University of St Andrews; 1985 and 1989 surveys were visual surveys in conjunction with the University of Aberdeen. Counts from these two surveys could be lower than if they had incorporated a thermal imager.

Orkney subregions	1985	1989	1993	1997	2001	2006	2007	2008	2009	2010	2012
1 ¹ Mainland, East & North	558	686	950	592	349	435	313	314		254	(99)
2 ² Mainland, South & West	131	273	131	708	384	387	283	186		281	
3 ¹ South Ronaldsay & Burray	212	275	377	390	511	132	100	62		104	(24)
4 ² Hoy	227	304	341	530	419	204	178	158		114	
5 ² Flotta, Cava, Rysa, Fara, Barrel of Butter	855	690	801	575	596	359	258	164		180	
6 ² Shapinsay	204	308	287	185	125	118	83	89	114	93	
7 ¹ Rousay, Egilsay, Wyre, Scockness, Eynhallow	1,098	1,087	185	853	769	393	356	323	390	377	(115)
8 ² Graemsay	3	0	8	17	13	33	13	0		0	
9 Stronsay	398	487	659	658	657	399	328	271		257	161
10 ¹ Eday & Calf of Eday	44	43	55	76	184	59	66	65		62	(30)
11 Sanday	738	1,108	1,661	1,670	1,247	519	470	312	349	131	220
12 Westray & Papa	597	586	776	825	1,326	487	385	339	312	304	195
13 Auskerry	271	13	75	271	75	3	2	0		0	2
14 North Ronaldsay	244	264	417	478	341	246	205	275	204	195	129
15 Green Holms, M & L	0	0	1	2	2	49	30	15	12	19	25
16 ² Sweynholm, Gairsay, Grass Holm	317	421	180	104	37	156	89	108		187	
17 Little Linga, Huip, Linga Holm, Spurness	48	63	47	35	12	9	0	1		0	0
18 Faray, Holm of Faray & Rusk Holm	6	3	6	9	14	10	9	1	3	0	0
19 Copinsay	0	0	1	9	8	0	0	0		0	0
20 ¹ Switha, Swona, Stroma	704	526	914	535	683	240	206	184		129	(89)
21 ² Pentland Skerries	0	0	1	0	0	0	0	0		0	
TOTAL for subregions completed in 2012	2,302	2,524	3,643	3,957	3,682	1,722	1,429	1,214		906	732
TOTAL for all coastline surveyed in 2012	4,032	4,254	5,578	5,871	5,516	2,461	2,110	1,873		1,486	1,089
Proportion of the total count for Orkney	61%	60%	71%	69%	71%	58%	63%	65%		55%	48% or 43%
TOTAL for Orkney	6,655	7,137	7,873	8,522	7,752	4,238	3,374	2,867		2,687	³ 2,290 or ⁴ 2,513

1 Subregions written in grey on a white background were only partially surveyed in 2012.

2 Subregions written in grey on a grey background were not surveyed at all in 2012.

3 This would be the total for 2012 if all coastline surveyed in 2012 was included and all other counts were taken from 2010.

4 This would be the total for 2012 if only completed subregions were used for 2012 and all other subregion counts were taken from 2010.

Table 2. Counts of grey seals in subregions of Orkney from 1985 - 2012. Counts for subregions that were only partially surveyed in 2012 are shown in brackets. The highest complete count for each subregion is highlighted in green, the lowest in red. See Figure 5 for details on subregion boundaries. See Figure 7 for a map of grey seal distribution in areas surveyed in 2012. Data from aerial surveys by the Sea Mammal Research Unit, University of St Andrews; the 1989 survey was in conjunction with the University of Aberdeen.

Orkney subregions	1989	1993	1997	2001	2006	2007	2008	2009	2010	2012
1 ¹ Mainland, East & North	37	173	679	96	432	167	258		223	(169)
2 Mainland, South & West	2	58	165	41	10	36	53		76	
3 ¹ South Ronaldsay & Burray	73	99	124	0	58	39	38		231	(11)
4 Hoy	41	248	214	143	307	218	365		264	
5 Flotta, Cava, Rysa, Fara, Barrel of Butter	73	14	146	1	263	165	111		105	
6 Shapinsay	4	41	204	45	250	30	88	78	43	
7 ¹ Rousay, Egilsay, Wyre, Scockness, Eynhallow	175	93	298	94	393	386	437	314	253	(10)
8 Graemsay	2	0	3	14	16	3	0		0	
9 Stronsay	131	525	1,788	553	1,336	949	1,665		1,430	1,345
10 ¹ Eday & Calf of Eday	51	236	223	225	70	255	230		111	(32)
11 Sanday	255	1,182	1,888	88	462	646	452	393	107	769
12 Westray & Papa	122	374	764	347	419	879	1,057	681	704	918
13 Auskery	20	79	99	20	133	100	69		188	219
14 North Ronaldsay	148	637	474	397	1,076	1,028	385	556	235	741
15 Green Holms, M & L	40	27	23	67	21	95	23	64	32	17
16 Sweynholm, Gairsay, Grass Holm	282	58	123	31	28	27	171		83	
17 Little Linga, Huip, Linga Holm, Spurness	158	340	743	121	220	224	290		647	332
18 Faray, Holm of Faray & Rusk Holm	81	129	165	427	529	486	506	654	283	388
19 Copinsay	15	98	244	11	160	151	208		390	362
20 ¹ Switha, Swona, Stroma	1,029	1,438	29	117	2,216	494	705		1,268	(1,164)
21 Pentland Skerries	520	972	434	75	1,180	737	910		2,410	
TOTAL for subregions completed in 2012	970	3,391	6,188	2,031	4,356	4,558	4,655		4,016	5,091
TOTAL for all areas surveyed in 2012	1,912	4,469	7,008	2,336	6,130	5,132	5,726		5,437	6,477
Proportion of the total count for Orkney	59%	66%	79%	80%	64%	72%	71%		60%	64%
TOTAL for Orkney ²	3,259	6,821	8,830	2,913	9,579	7,115	8,021		9,083	³ 10,123
										⁴ 10,158

1 Subregions written in grey on a white background were only partially surveyed in 2012.

2 Subregions written in grey on a grey background were not surveyed at all in 2012.

3 This would be the total for 2012 if all coastline surveyed in 2012 was included and all other counts were taken from 2010.

4 This would be the total for 2012 if only completed subregions were used for 2012 and all other subregion counts were taken from 2010.

Table 3. Numbers of harbour seals counted on Sanday, Orkney. Highest counts for each area are in green, lowest counts in red. Areas are numbered in Figure 11 which shows the distribution of harbour and grey seals on Sanday in 1997 (left) and in 2012 (right).

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

Table 4. Numbers of grey seals counted on Sanday, Orkney. Highest counts for each area are in green, lowest counts in red. Areas are numbered in Figure 11 which shows the distribution of harbour and grey seals on Sanday in 1997 (left) and in 2012 (right).

Section of Sanday coast	1989	1993	1997	2001	2006	2007	2008	2009	2010	2012
1 Holms of Ire North Bay to Quoy Banks	1	0	76	4	33	92	0	54	0	24
2 The Riv Quoy Banks to Whitemill Bay	4	201	255	58	0	31	1	0	0	15
3 Whitemill Whitemill Bay to Helliehow	2	0	195	0	69	0	55	40	0	25
4 Otterswick Helliehow to Taing of Crudy	2	0	30	0	42	78	7	22	0	7
5 Taings Taing of Crudy to Sandquoy	2	24	80	0	47	16	27	3	0	111
6 Tofts Sandquoy to Saltees	113	393	271	5	21	111	42	98	9	79
7 Start Point Saltees to Lopness	1	101	97	16	47	139	139	58	6	316
8 Lopness Lopness to Fidge	3	10	15	0	0	13	22	22	14	27
9 Tres Ness Fidge to Lang Taing	105	172	481	2	127	141	113	57	44	74
10 Els Ness Lang Taing to Kettletoft Pier	1	137	171	3	9	4	15	14	4	35
11 Kettletoft Kettletoft Pier to Backaskaill Church	0	0	0	0	0	0	0	0	0	0
TOTAL Sanday SAC	234	1,038	1,671	88	395	625	421	368	77	713
12 Quoy Ness Backaskaill Church to Stove	18	142	215	0	67	19	31	20	28	43
13 Spur Ness Stove to Strangquoy Taing	0	0	0	0	0	0	0	0	0	0
14 Lamba Ness Strangquoy Taing to North Mire	3	0	0	0	0	2	0	5	2	13
15 Brough North Mire to North Bay	0	2	2	0	0	0	0	0	0	0
TOTAL Sanday	255	1,182	1,888	88	462	646	452	393	107	769

Table 5. Counts of harbour seals in the Moray Firth. Mean value if there was more than one count in any year; red = lowest count, green = highest count. The distribution of harbour seals in the Moray Firth in 2012 is shown in Figure 12 and a histogram of these data is shown in Figure 13. Data are from aerial surveys by the Sea Mammal Research Unit. Since 2006, all surveys incorporated hand-held oblique digital photography.

fw = fixed-wing aircraft; ti = helicopter thermal image survey.

LOCATION	end															
	Aug 1992	July 1993	Aug 1994	Aug 1997	Aug 2000	Aug 2002*	Aug 2003	Aug 2004	Aug 2005	Aug 2006	Aug 2007	Aug 2008	Aug 2009	Aug 2010	Aug 2011	Aug 2012
Survey Method(n)	fw	fw	fw	ti	fw	fw ti	fw	2 fw	2 fw 1 ti	ti fw	ti	ti fw	fw	fw	ti	fw
Ardersier	154		221	234	191	110	205	202	206	197	154	145	277	362	195	183
Beaully Firth	220		203	219	204	66	151	178	127	176	146	150	85	140	57	60
Cromarty Firth	41		95	95	38	42	113	88	106	106	102	90	90	140	101	144
Dornoch Firth (SAC)	662		542	593	405	220	290	230	191	256	144	145	166	219	208	157
Inner Moray Firth Total	1077		1061	1141	838	438	759	698	630	736	544	530	618	861	561	544
<i>Loch Fleet</i>		16		27	33	62	56	64	71	80	82	82	65	114	113	133
IMF + L Fleet		1093	1077	1168	871	500	815	762	701	815	627	612	683	975	674	677
<i>Findhorn & Culbin</i>			58	46	111	144	167	49	92	58	78.5	92	73	123	163	254
IMF + L Fleet + Findhorn + Culbin			1135	1214	982	644	982	811	793	873	706	704	756	1098	837	931
<i>Brora + Helmsdale</i>		92		214		188			38	150	54	72	19	101	87	102
IMF+LF+FC+BH Total		1185**	1227**	1428		832			831	1023	760	776	775	1199	924	1033

*2002 count very late in tide and numbers may be lower than if closer to low tide.

**Note that the Total counts for 1993 and 1994 both include Loch Fleet data from 1993.

Table 6. Counts of grey seals in the Moray Firth. Mean value if there was more than one count in any year; red = lowest count, green = highest count. The distribution of grey seals in 2012 is shown in Figure 12. Data are from aerial surveys by the Sea Mammal Research Unit. Since 2006, all surveys incorporated hand-held oblique digital photography. fw = fixed-wing aircraft; ti = helicopter thermal image survey.

LOCATION	Aug 1992	end July 1993	Aug 1994	Aug 1997	Aug 2000	Aug 2002	Aug 2003	Aug 2004	Aug 2006	Aug 2007	Aug 2008	Aug 2009	Aug 2010	Aug 2011	Aug 2012
Survey Method	fw	fw	fw	ti	fw	fw ti	fw	2 fw	fw ti	ti	ti fw	fw	fw	ti	fw
Ardersier	0		36	24	85	0	0	62	138	74	117	94	297	74	24
Beaully Firth	8		2	3	8	0	0	2	3	4	0	0	2	3	1
Cromarty Firth	9		0	0	0	0	0	0	1	0	0	0	1	2	1
Dornoch Firth (SAC)	233		903	456	121	321	79	569	748	516	569	819	717	679	74
Inner Moray Firth Total (IMF)	250		941	483	214	321	79	631	890	594	686	913	1017	758	100
<i>Loch Fleet</i>					0	0	0	0	1	2	2	0	7	7	20
IMF + L Fleet					214	321	79	631	891	596	688	913	1024	765	120
<i>Findhorn & Culbin</i>					0	0	10	20	10	28	67	58	58	179	121
IMF + L Fleet + Findhorn + Culbin						321	89	651	902	624	754	971	1082	944	241
<i>Brora + Helmsdale</i>				3		6			102	52	499	72	635	160	316
IMF+LF+FC+BH Total						327			1003	676	1254	1043	1717	1104	557

*2002 count very late in tide and numbers may be lower than if closer to low tide.

Table 7. Counts of harbour seals in the Firth of Tay harbour seal SAC (see Figure 14 for 2012 seal distribution data); highest counts in green, lowest in red. Data are from aerial surveys by the Sea Mammal Research Unit. Since 2006, all surveys incorporated hand-held oblique digital photography. A histogram of these data is shown in Figure 15.
 fw = fixed-wing aircraft; ti = helicopter thermal image survey.

LOCATION	Aug 1990	Aug 1991	Aug 1992	Aug 1994	Aug 1997	Aug 2000	Aug 2002	Aug 2003	Aug 2004	Aug 2005	Aug 2006	Aug 2007	Aug 2008	Aug 2009	Aug 2010	Aug 2011	Aug 2012
SURVEY METHOD	fw	fw	fw	fw	ti	fw	fw	fw	fw	fw,ti	fw	fw, ti	fw	fw	fw	fw	fw
EDEN ESTUARY	31	0	0	80	223	267	341	93	78	105	90	89	83	22	36	32	19
Abertay & Tentsmuir	409	428	456	289	262	153	167	53	126	63	34	31	50	8	9	0	5
Upper Tay	27	73	148	89	113	115	51	83	134	91	91	63	49	45	41	16	33
Broughty Ferry		83	97	64	35	52		90	55	51	127	24	13	28	15	18	16
Buddon Ness		86	72	53	0	113	109	142	66	25	0	67	27	8	23	11	5
Firth of Tay																	
SAC Total	467	670	773	575	633	700	668	461*	459	335	342	274	222	111	124	77	78

*In August 2003 low cloud prevented the use of vertical photography; counts were from photographs taken obliquely and from direct counts of small groups of seals.

Table 8. Counts of grey seals in the Firth of Tay harbour seal SAC (see Figure 11 for 2012 data); highest counts in green, lowest in red. Data are from aerial surveys by the Sea Mammal Research Unit. fw = fixed-wing aircraft; ti = helicopter thermal image survey.

LOCATION	Aug 1990	Aug 1991	Aug 1992	Aug 1994	Aug 1997	Aug 2000	Aug 2002	Aug 2003	Aug 2004	Aug 2005	Aug 2006	Aug 2007	Aug 2008	Aug 2009	Aug 2010	Aug 2011	Aug 2012
SURVEY METHOD	fw	fw	fw	fw	ti	fw	fw	fw	fw	fw, ti	fw	ti	fw	fw	fw	fw	fw
Eden Estuary	0	0	16	0	10	0	25	4		27.3	57	14	33	0	39	17	36
Abertay & Tentsmuir	912	1546	1191	1335	1820	2088	1490	1560		763	1267	1437	483	400	1406	1265	1111
Upper Tay	0	0	18	20	61	64	78	50		42	22	29	26	55	98	16	32
Broughty Ferry	0	3	0	9	0	0	0	0		0	8	1	8	0	0	2	3
Buddon Ness	0	0	1	104	0	101	0	49		11	25	78	7	0	12	22	13
Firth of Tay SAC Total	912	1549	1226	1468	1891	2253	1593	1614		843	1379	1559	557	455	1555	1322	1195

Figure 1. Map showing the years in which different parts of Scotland were surveyed for harbour seals most recently by helicopter using a thermal imaging camera. Most areas were surveyed between 2007 and 2011. Foula, off Shetland, was last surveyed in 2006. The Firth of Tay and the Moray Firth, between Findhorn and Helmsdale, are surveyed every year by fixed-wing aircraft.

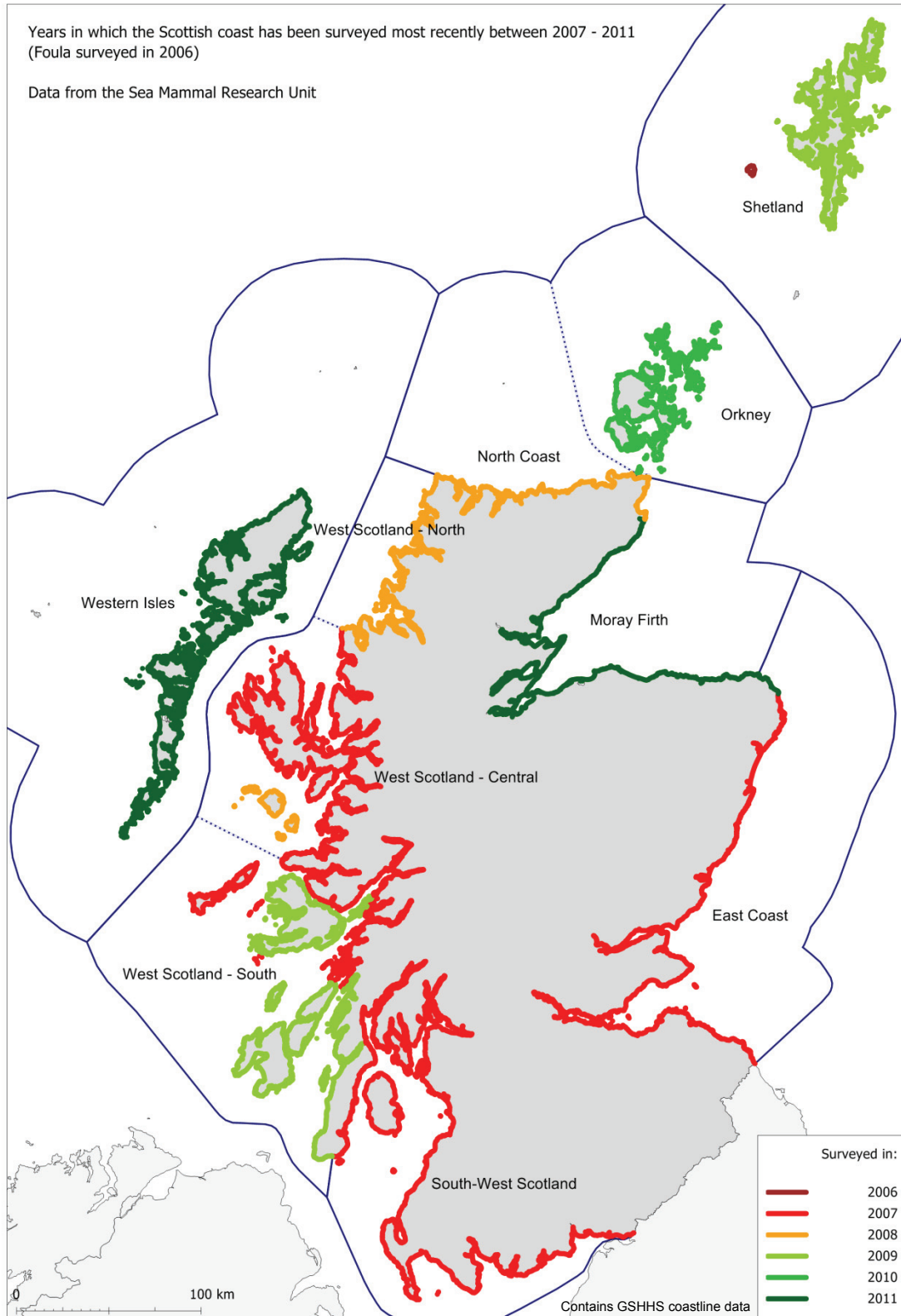


Figure 2a. The number and distribution of harbour seals in Scotland within 1km squares. Seal management areas are outlined. Data are from August surveys between 2007 and 2011, from the Sea Mammal Research Unit. Figures 2 and 3 do not include 2012 data in order to keep all Orkney data from the same year.

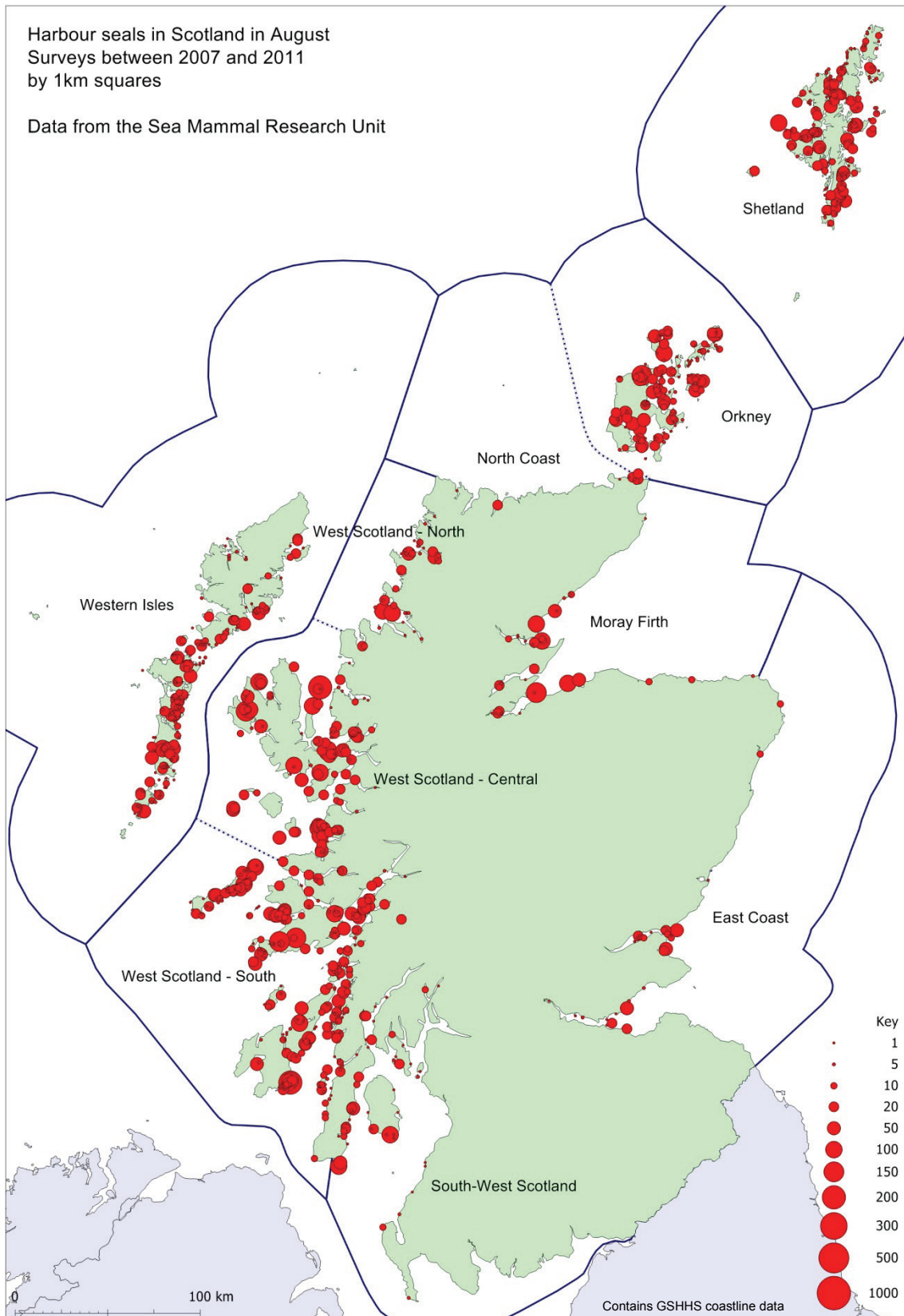


Figure 2b. This map shows the same data for harbour seals in Scotland as Figure 2a but aggregated by 10km squares, removing many overlaps between data points. Data are from August surveys between 2007 and 2011, from the Sea Mammal Research Unit. Figures 2 and 3 do not include 2012 data in order to keep all Orkney data from the same year.

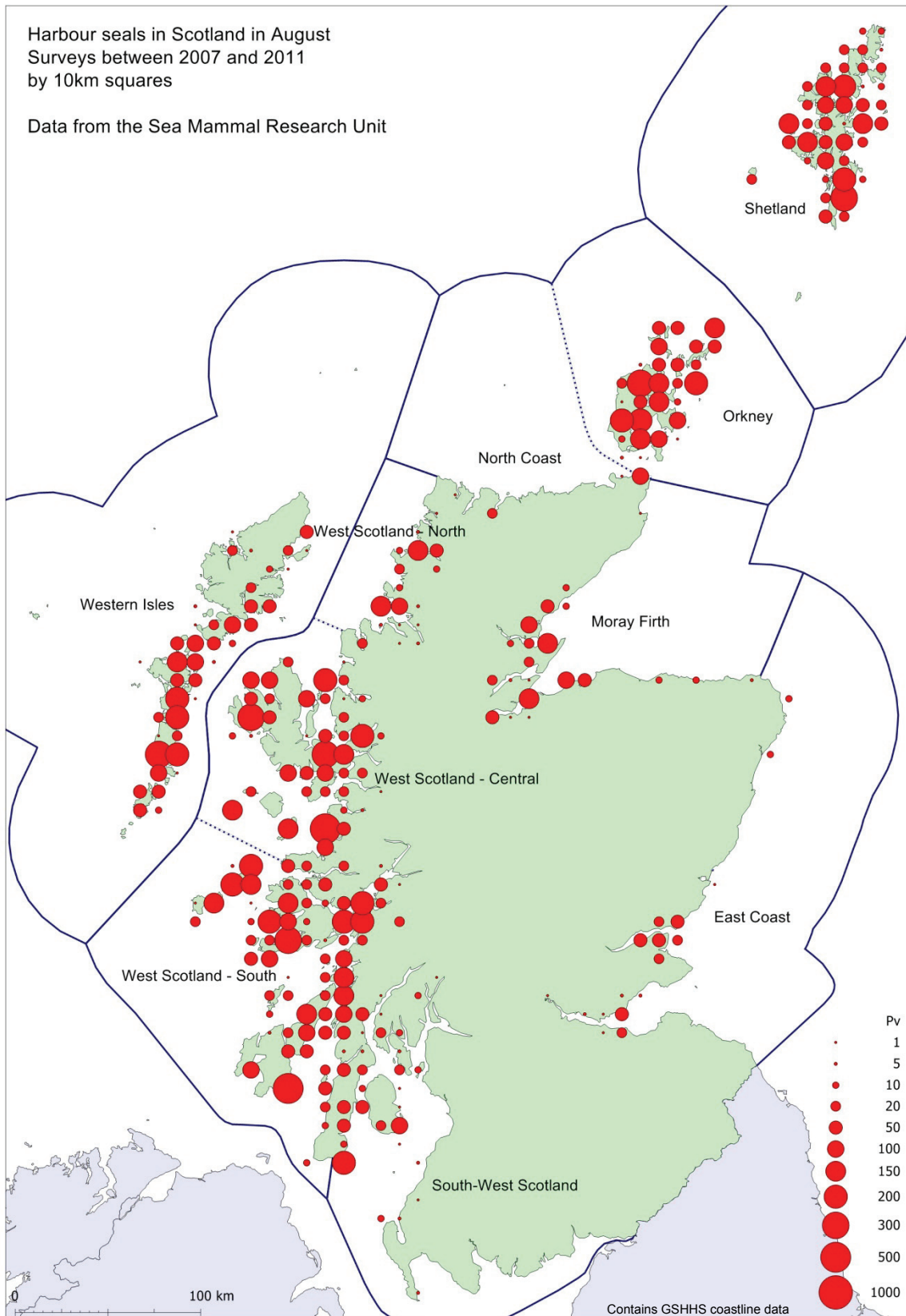


Figure 3a. The number and distribution of grey seals in Scotland within 1km squares. Seal management areas are outlined. Data are from August surveys between 2007 and 2011, from the Sea Mammal Research Unit. Figures 2 and 3 do not include 2012 data in order to keep all Orkney data from the same year.

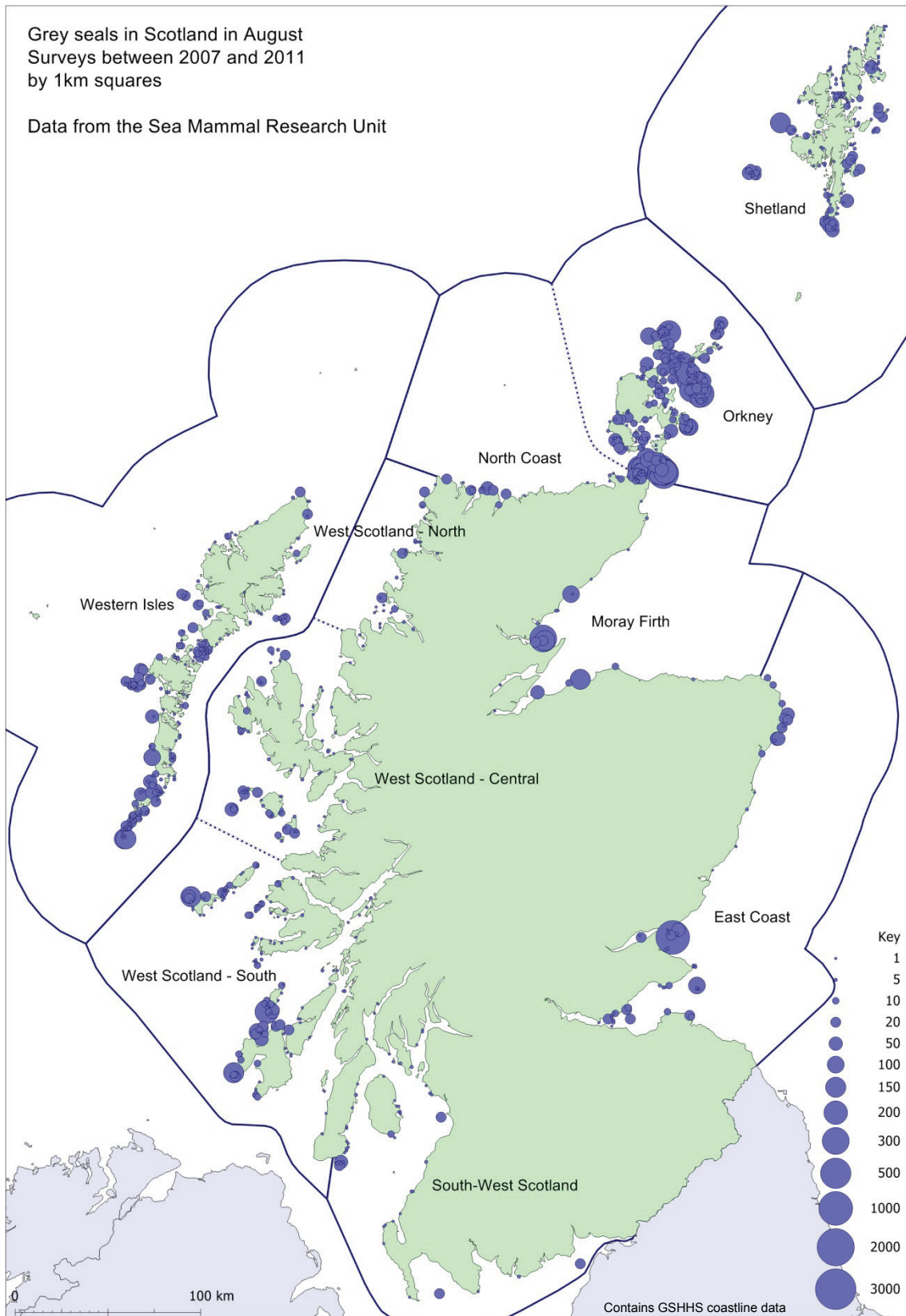


Figure 3b. This map shows the same data for grey seals in Scotland as Figure 3a but aggregated by 10km squares, removing many overlaps between data points. Data are from August surveys between 2007 and 2011, from the Sea Mammal Research Unit. Figures 2 and 3 do not include 2012 data in order to keep all Orkney data from the same year.

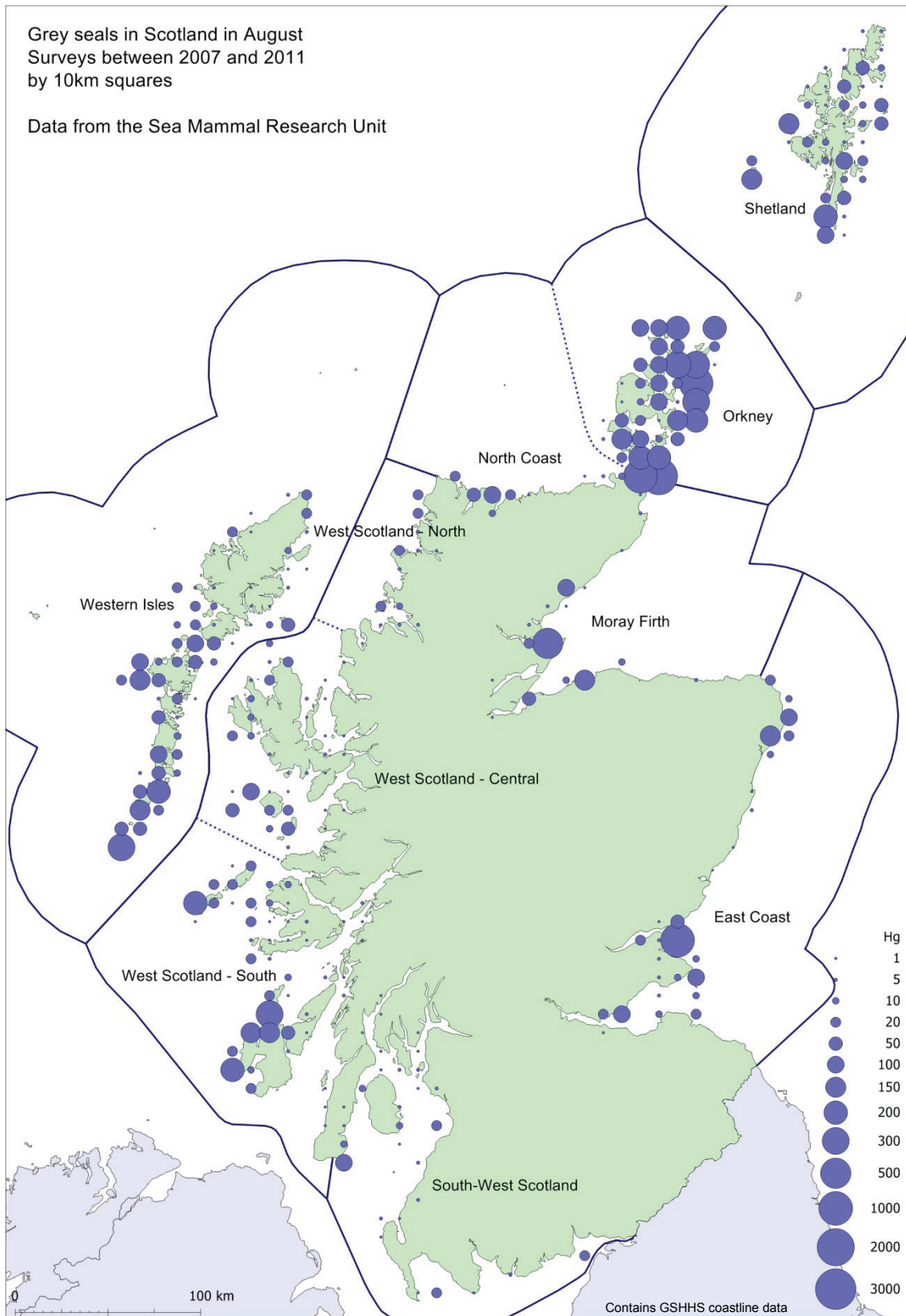


Figure 4. A comparison of counts of harbour seals in the main Seal Management Areas (including Management Area Subdivisions in West Scotland) of Scotland. All surveys were carried out by the Sea Mammal Research Unit. From 2007, thermal image counts have been verified using digital still images where possible. West Scotland Centre + North extends from Cape Wrath to Ardnamurchan Point. West Scotland South extends from Ardnamurchan Point to the tip of the Mull of Kintyre. The North Coast extends from Cape Wrath to Duncansby Head and is included with Orkney. The Wider Moray Firth extends from Findhorn to Helmsdale. The East Coast extends from Fraserburgh to the Border by Berwick upon Tweed and has only been surveyed in its entirety three times. 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 (Filled = from one year, unfilled = over more than one year). This applies particularly to the West Scotland and Orkney and North Coast Management Areas.

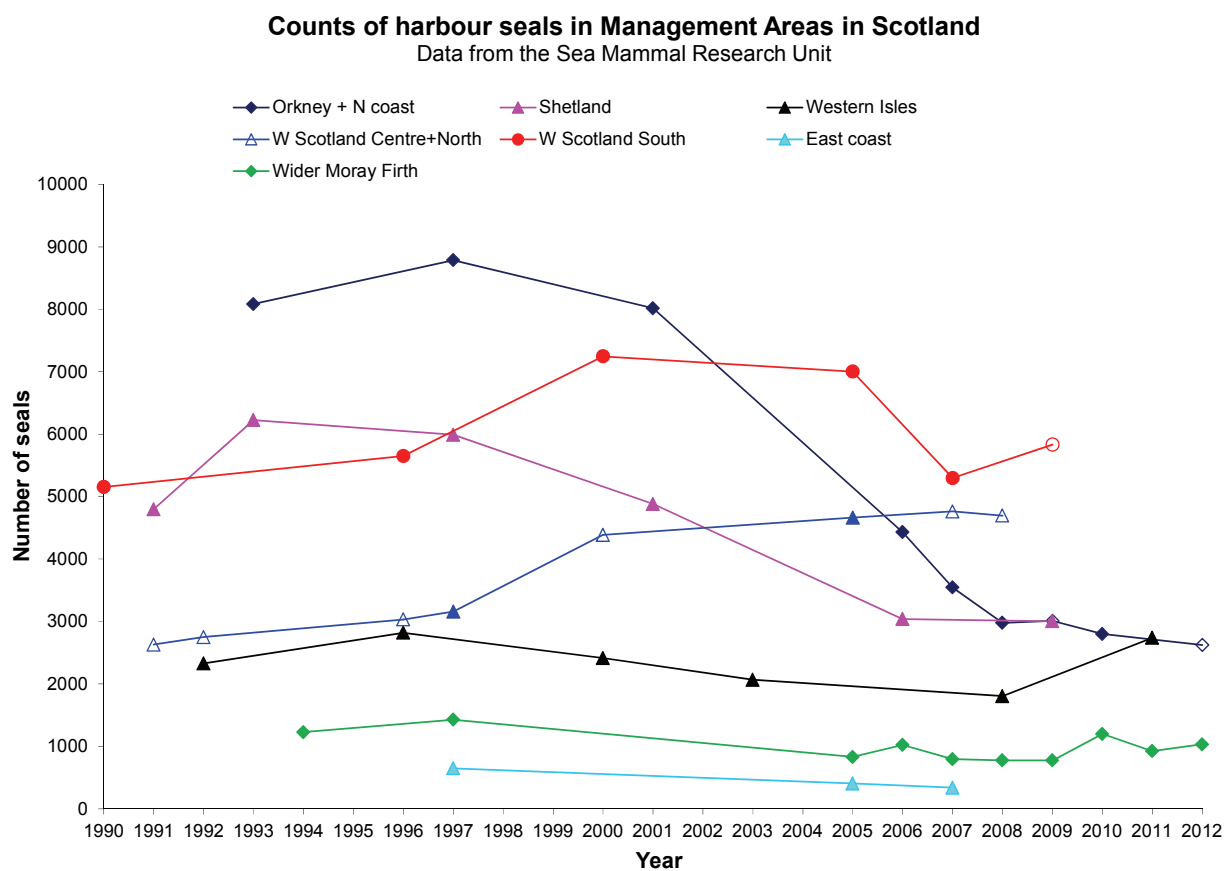


Figure 5. Subregions and areas in Orkney that were surveyed in August 2012.

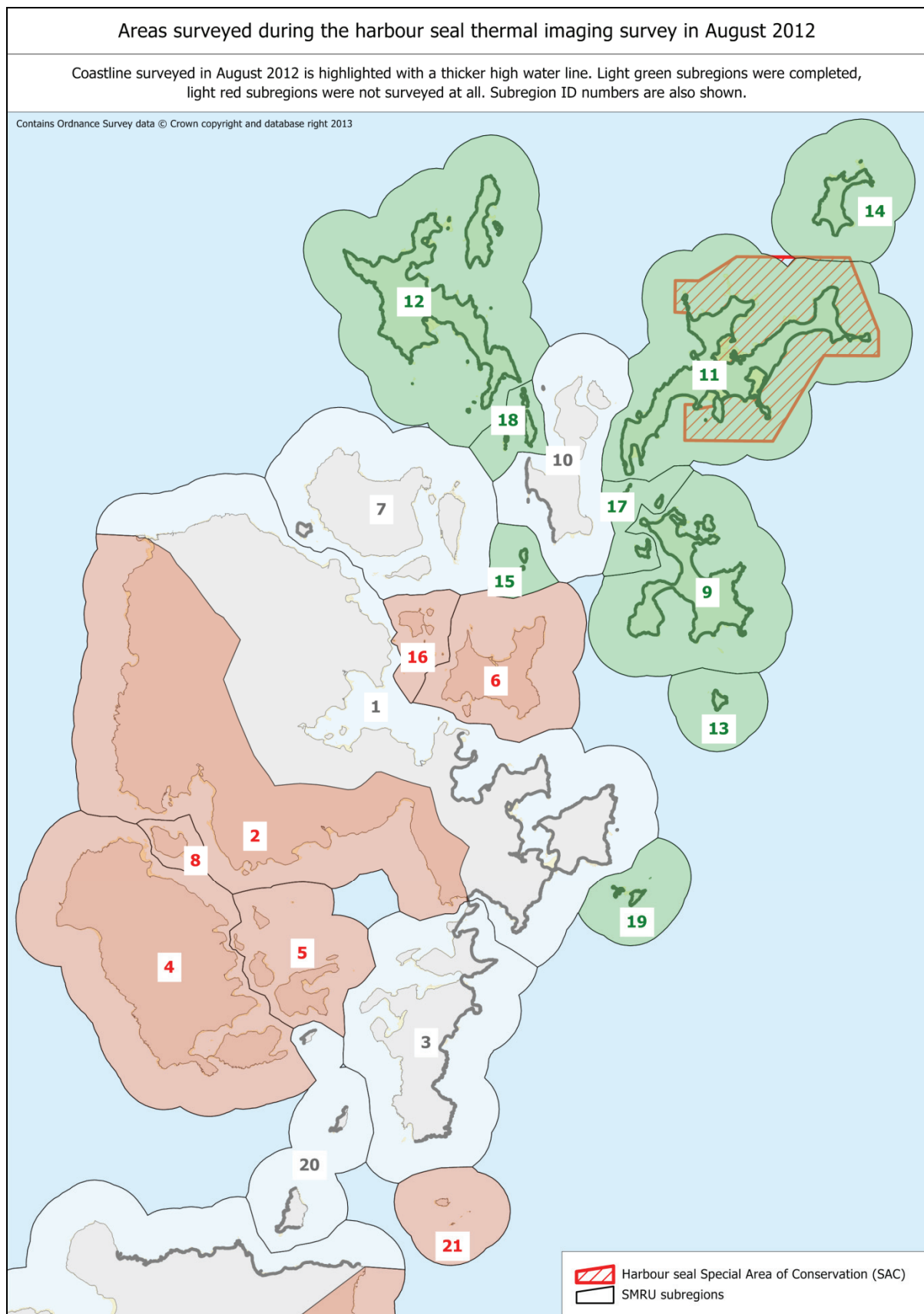


Figure 6. Harbour seals counted in Orkney in August 2012. Data have been aggregated by 1km squares to better display seal distribution. Counts of seals in the numbered subregions are in Table 1.

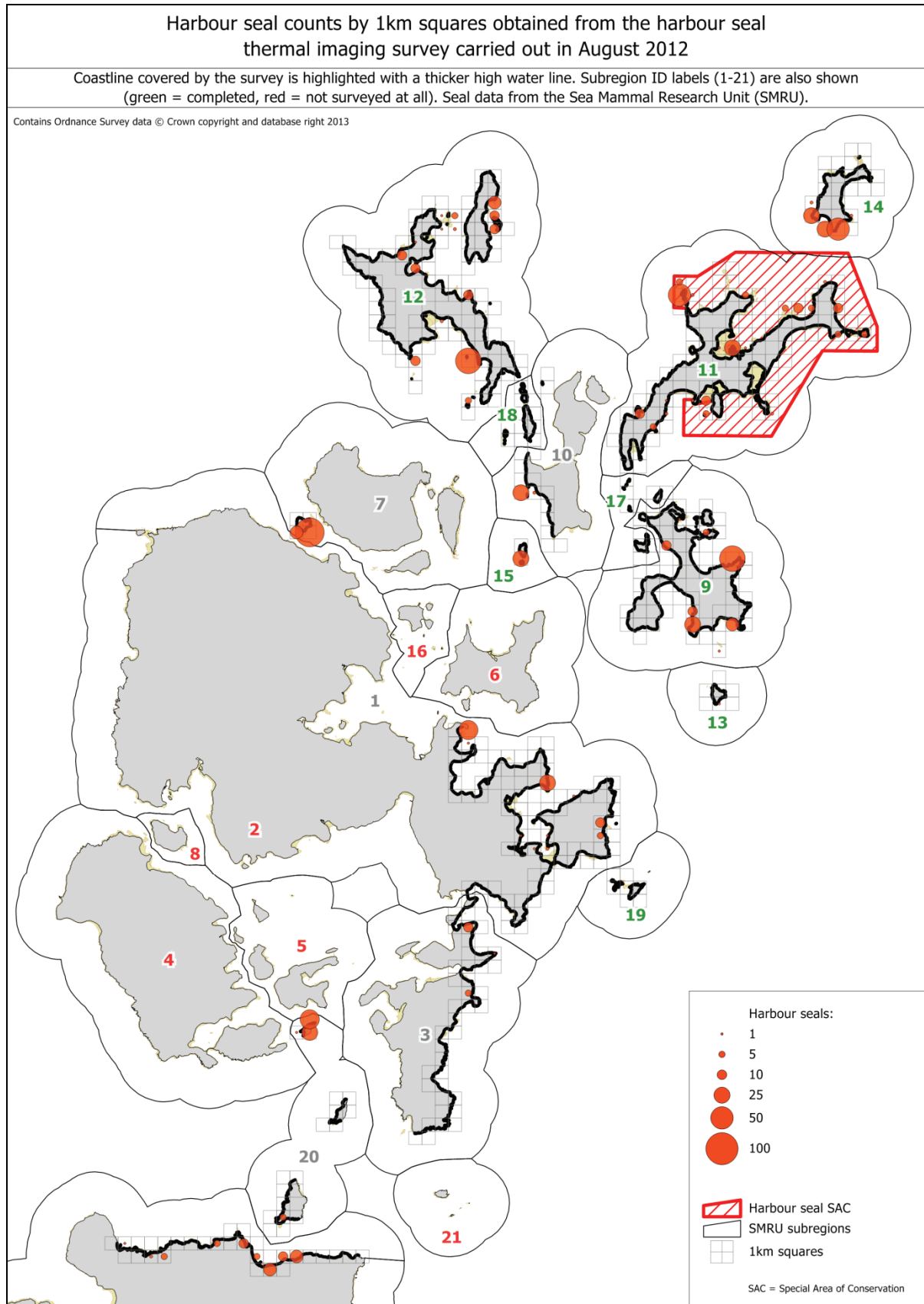


Figure 7. Grey seals counted in Orkney in August 2012. Data have been aggregated by 1km squares to better display seal distribution. Counts of seals in the numbered subregions are in Table 2.

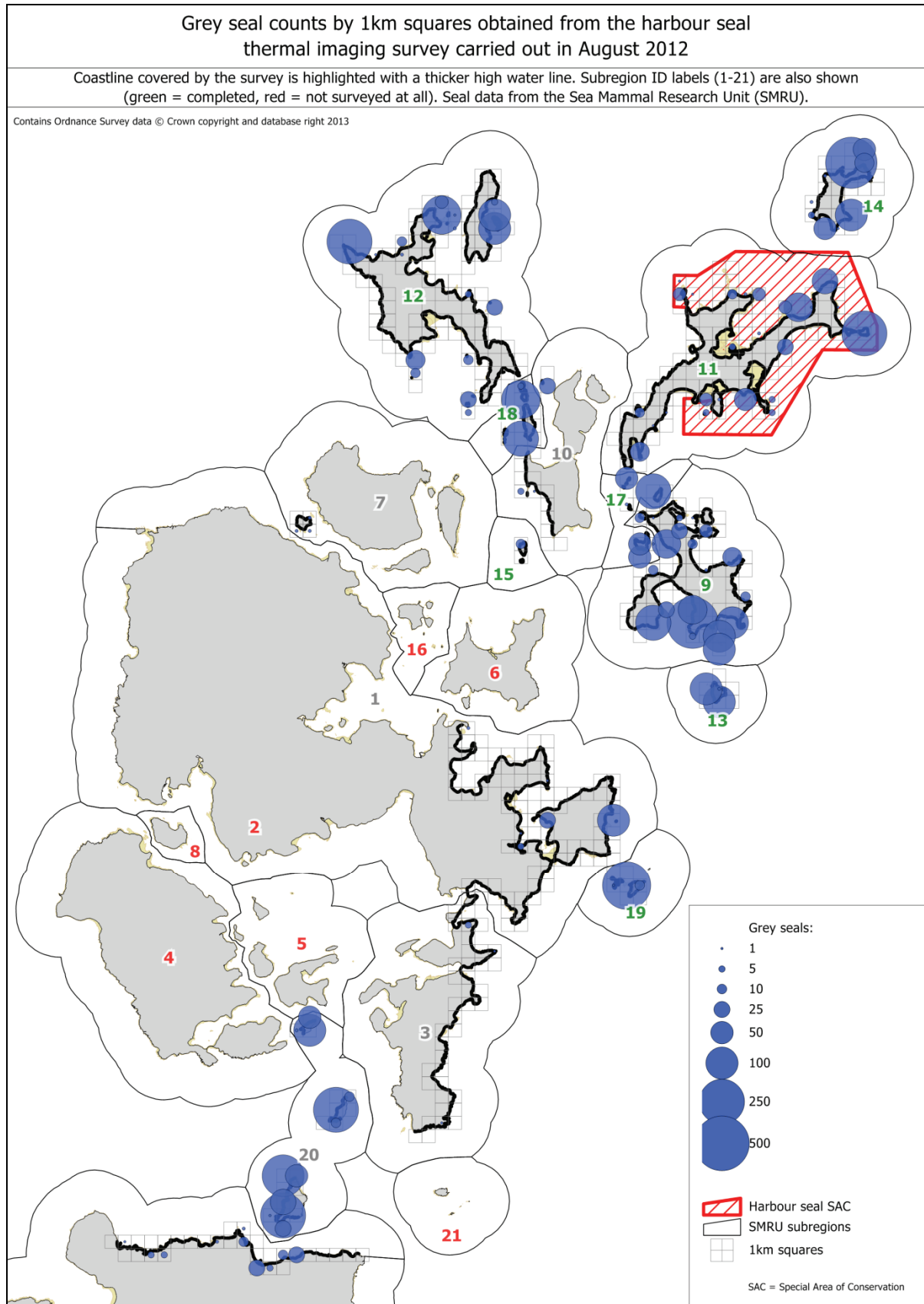


Figure 8. Map comparing the numbers of harbour seals counted in subregions (numbered) of Orkney from surveys carried out between 1985 and 2012. Green subregions were completed in 2012, red subregions were not surveyed at all in 2012. The 1985 and 1989 surveys were visual surveys and did not use thermal imaging. The darker coastline indicates areas surveyed in August 2012. For subregions partially surveyed in 2012, the upper (grey) sections of the histograms represent the areas not surveyed.

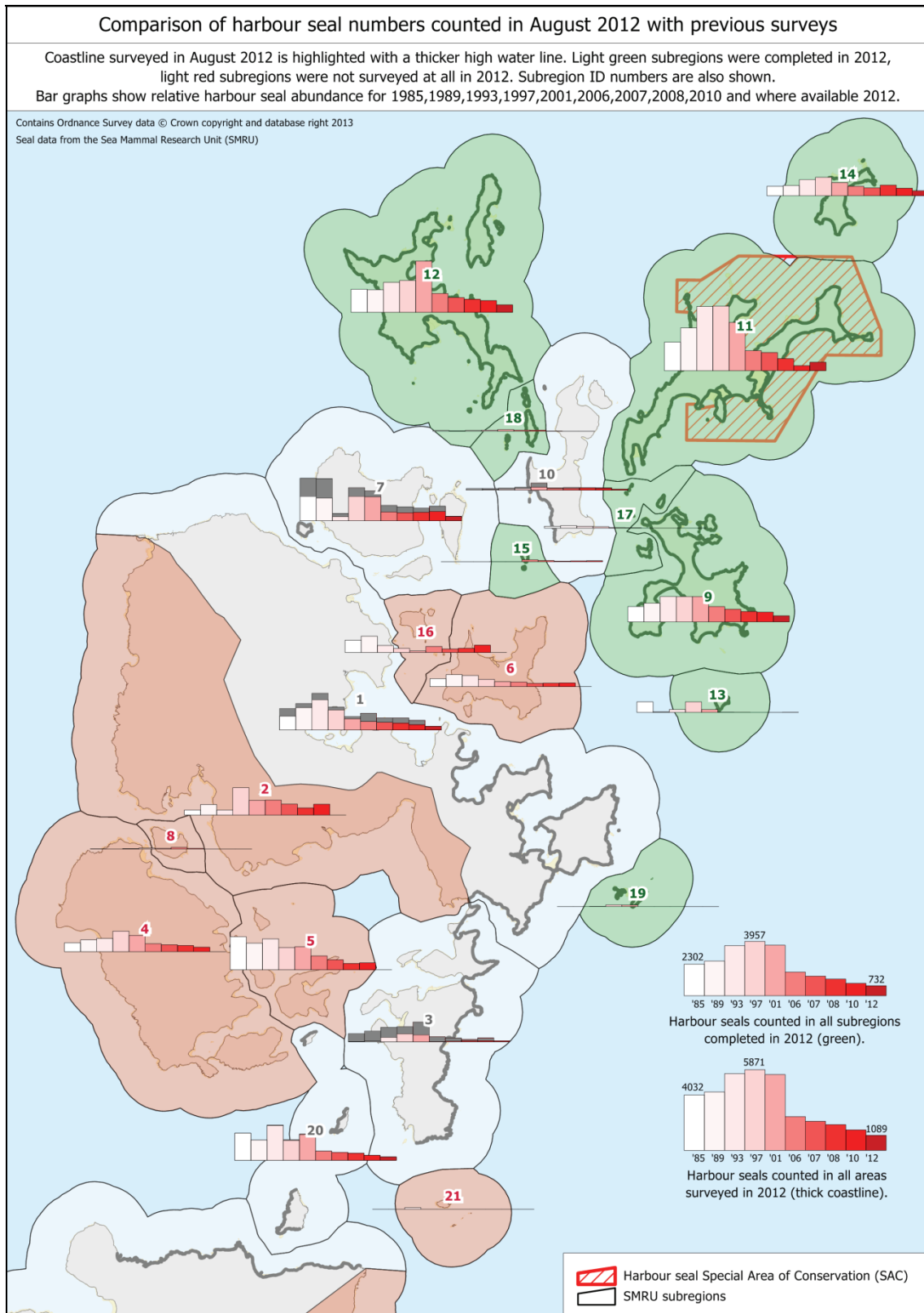


Figure 9. A comparison of the numbers of harbour seals counted in three subareas of Orkney between 1985 and 2012. Subareas were selected to create three approximately similar sized areas using subregion boundaries and to keep the outer islands (blue) in one subarea and to keep Scapa Flow and the southern islands (green) in another. The darker coastline was surveyed in 2012.

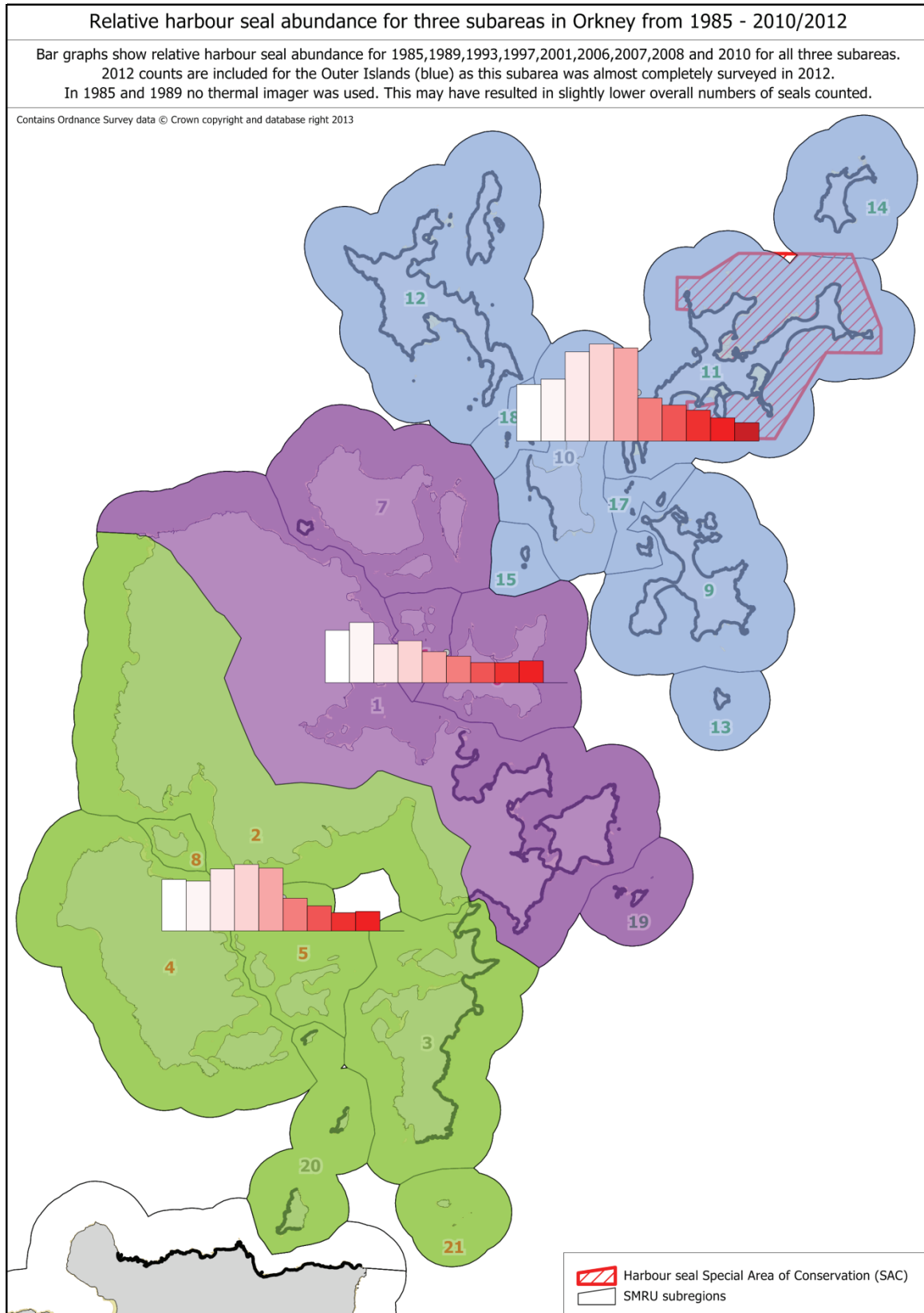


Figure 10. A comparison of the numbers of harbour seals counted along the entire Orkney coastline surveyed in 2012 (see Figures 6, 7 and 9) with numbers counted along the same stretch of coast from previous surveys. The black line represents the total number of harbour seals counted in the 2012 area; the red line is the total harbour seal count for all of Orkney.

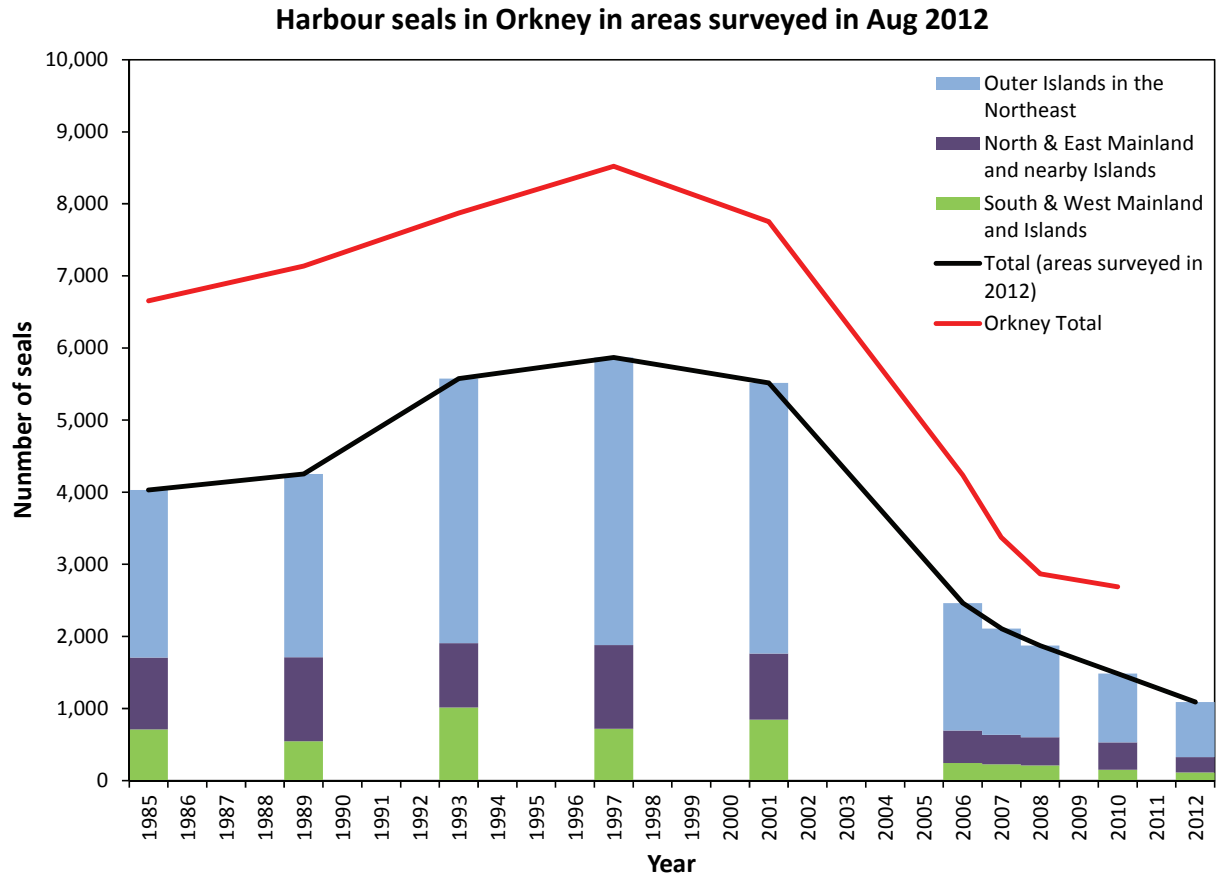


Figure 11. The distribution of harbour and grey seals on Sanday, Orkney showing the difference between 2012 (a) and 1997 (b).



Figure 12. Harbour and grey seals counted in the wider Moray Firth, between Findhorn and Helmsdale from an aerial survey carried out on 9th August 2012. The areas listed in Tables 5 and 6 and also used in Figure 13 are shaded in blue.

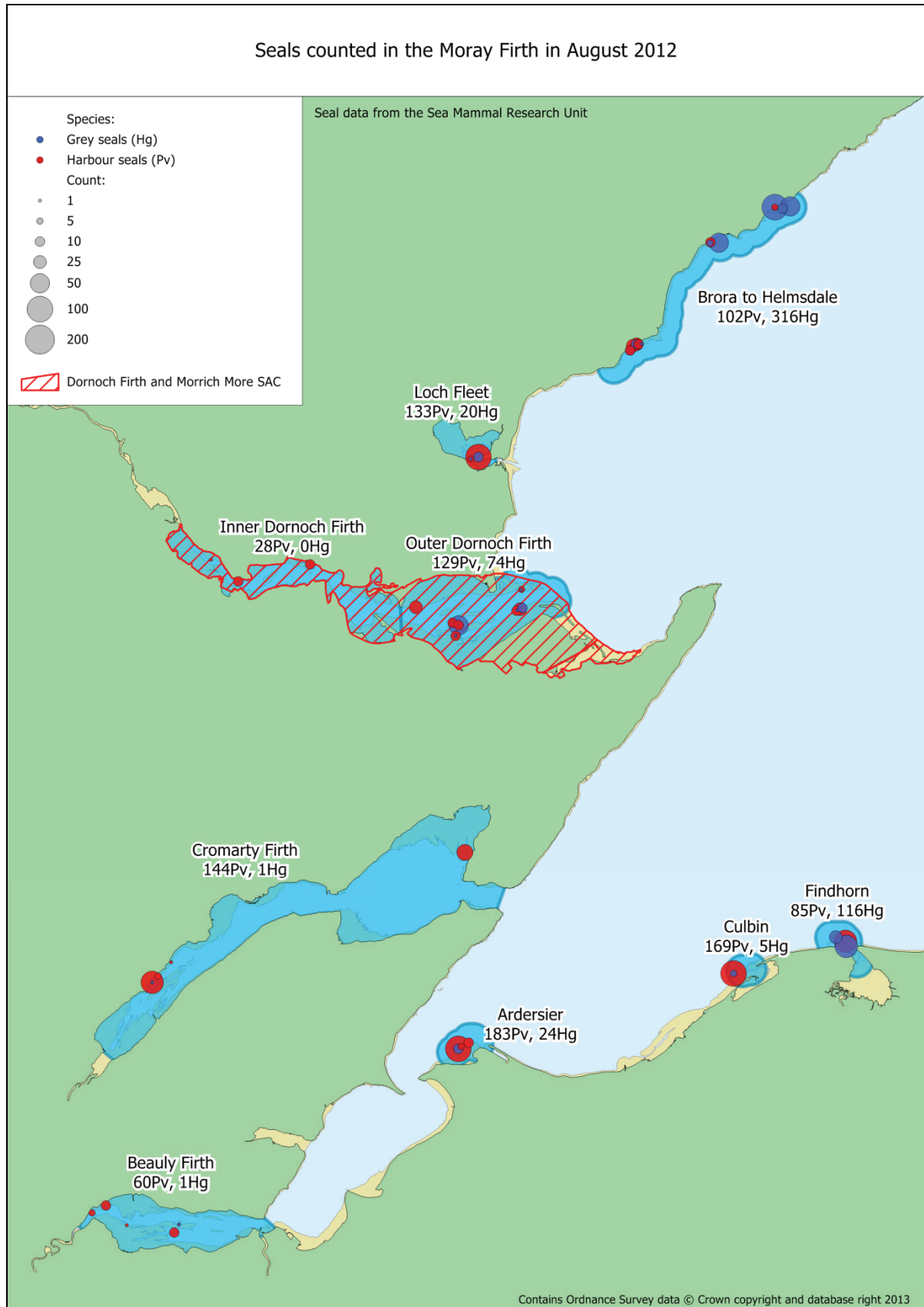


Figure 13. Counts of harbour seals in different parts of the Moray Firth in August (see Figure 12). If more than one count in any year the mean value was used. The Dornoch Firth and Morrich Mhor is a harbour seal SAC. Loch Fleet was not surveyed in 1992 and Brora to Helmsdale was not surveyed in 1992, 2000 and 2004. Data are from the Sea Mammal Research Unit.

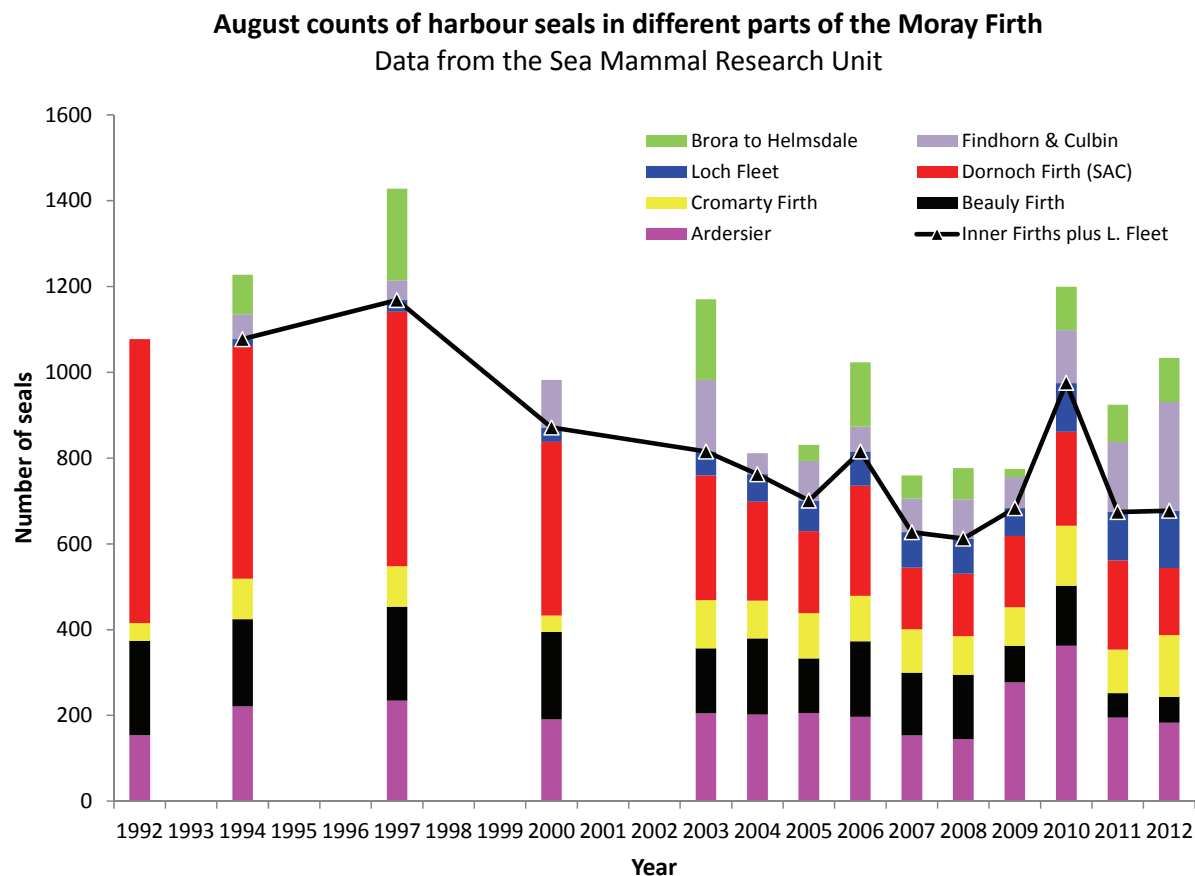
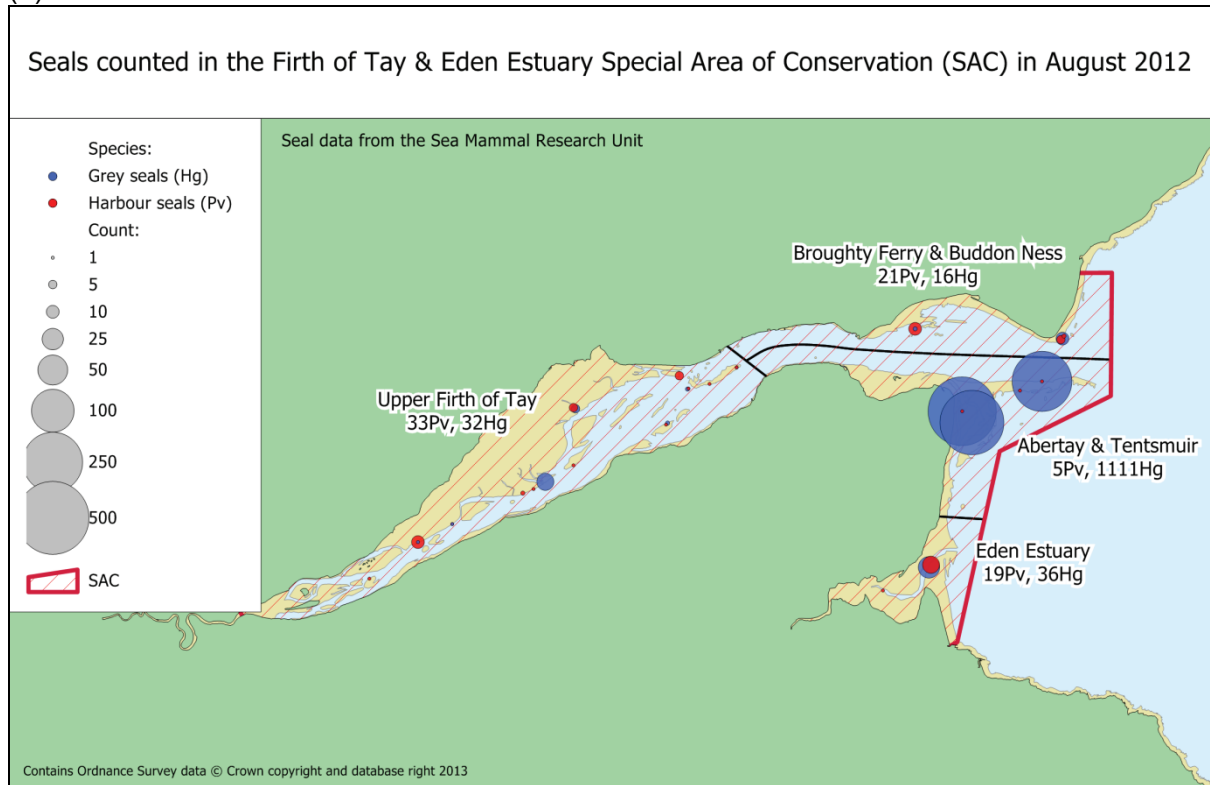


Figure 14. Harbour and grey seals in the Firth of Tay showing the differences between 1st August 2012 (a) and 12 August 2000 (b). Data are from the Sea Mammal Research Unit.

(a)



(b)

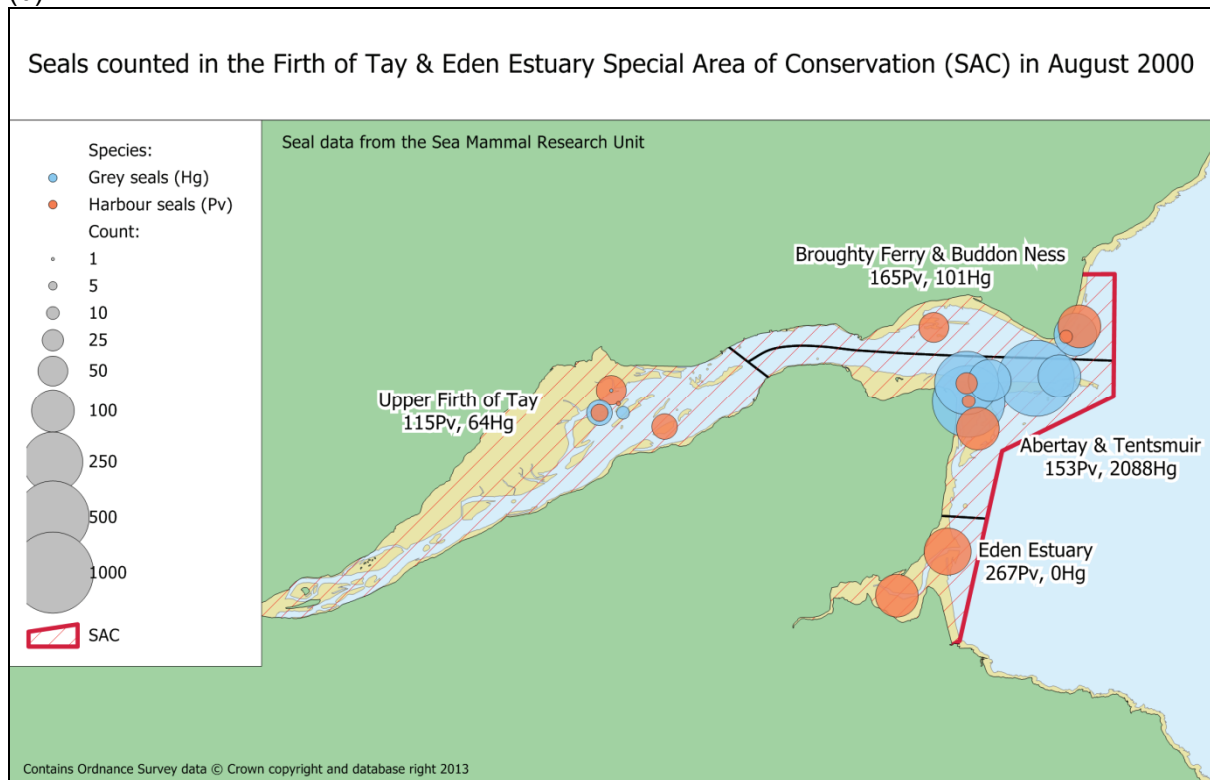
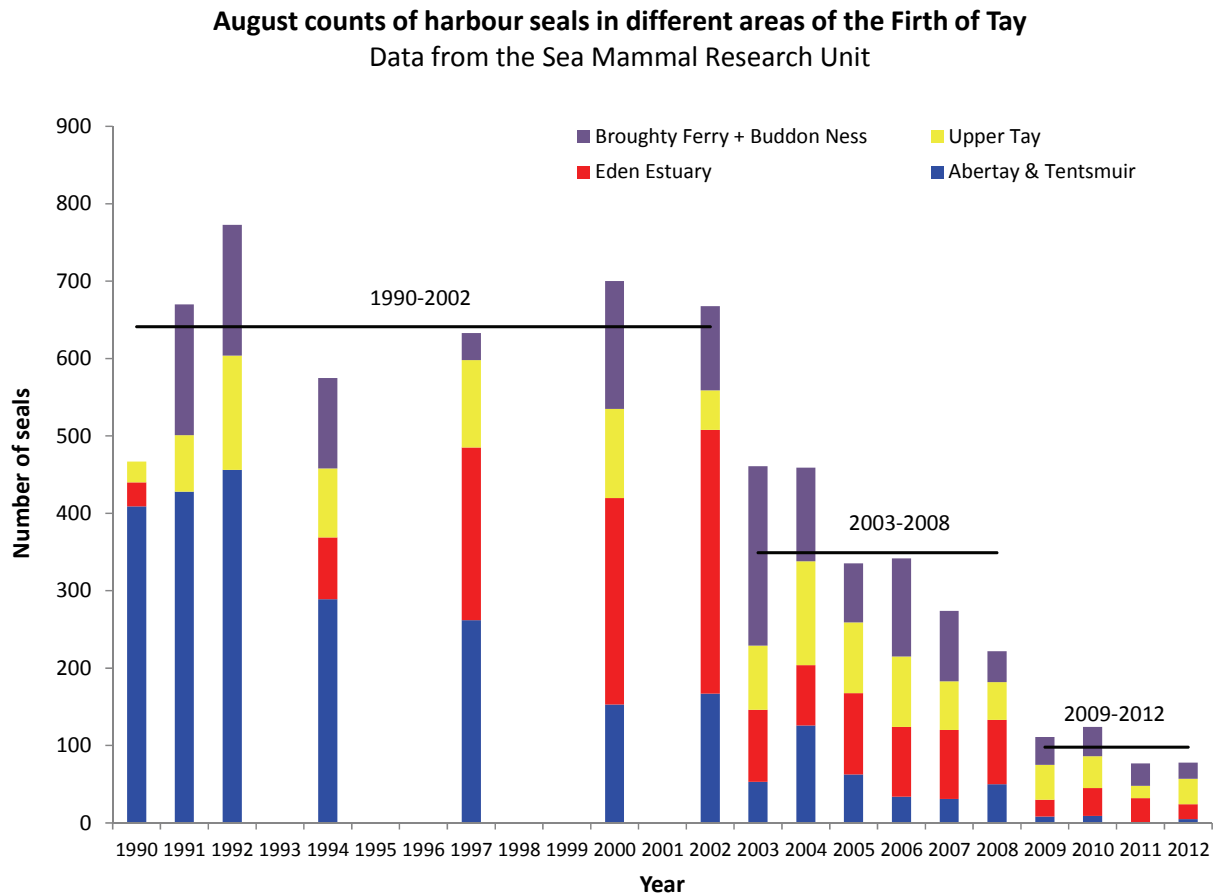


Figure 15. August counts of harbour seals in different areas of the Firth of Tay SAC (see Figure 14). If more than one count in any year the mean value was used. Data are from the Sea Mammal Research Unit.



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