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Agenda Item 4.6: Disturbance to small cetaceans due to seismic surveys

Report on information on seismic survey activities by the United Kingdom 1997-2003

Submitted by: United Kingdom

NOTE:
IN THE INTERESTS OF ECONOMY, DELEGATES ARE KINDLY REMINDED TO BRING THEIR OWN COPIES OF THESE DOCUMENTS TO THE MEETING

Department of Trade and Industry

Report

on

Information on Seismic Survey Activities by the United Kingdom 1997-2003

Working paper
presented to the 12th meeting of the Advisory Committee to ASCOBANS

March 2005

Department of Trade and Industry
Licensing and Consents Unit
Offshore Environment and Decommissioning

CONTENTS

1 INTRODUCTION

The United Kingdom is a Party to The Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas (ASCOBANS).

ASCOBANS has *inter alia* been developing its approach to the conservation of small cetaceans with respect to seismic surveys. This includes requesting Parties to introduce mitigation measures, such as those used in the UK and commended by ASCOBANS, and to introduce monitoring systems and also inviting Parties to report on high energy seismic surveys. Currently, the UK reports all seismic surveys via the UKDEAL portal (www.ukdeal.co.uk).

At the 7th meeting of the Advisory Committee to ASCOBANS (March 2000) it was decided that collection of seismic survey data in the Agreement area should continue. Clarifications on the data to be reported were documented at the 4th Meeting of the Parties in the Report of Working Group II (August 2003) (Annex 8 and Annex 13).

It was agreed that the following information should be collected and reported:

- Shot point density information per 1º by 1º rectangle
- Data resolved for each month and year since 1997
- Size/power of survey gun (if easily obtainable)
- Use of marine mammal observers (if easily obtainable)

As a pilot, in March 2003, the UK made a draft submission on seismic activities to the 10th meeting of the Advisory Committee that presented data in an agreed format but which was based on incomplete data. Germany has made its submission in respect of the above to the 11th meeting of the Advisory Committee in April 2004.

This report is the UK's submission in respect of the above, covering the period 1997-2003 inclusive. Preliminary data for 2004 has also been included where available.

2 BASIS OF CALCULATION

Shot point density is obtained by dividing the number of seismic shot points per quadrant by the offshore sea area within each quadrant up to the median line (land, islands and coastal waters are subtracted). Given this, and the curvature of lines of longitude, quadrants are all of varying sizes.

The following methodology was used to calculate shot point density, which is identical to the methodology used for the 2003 UK draft study and the 2004 Germany study.

- For 2D seismic surveys the average shot point interval is assumed to be 25 metres. This results in a shot point count of 40 SP/km.
- For 3D seismic surveys the average shot point interval is assumed to be 25 metres, with an average line spacing of 50 metres. This results in a shot point count of 800 SP/km^2. It is assumed that shot point density is uniform within the outline polygon of the survey area.

For 2D seismic, the navigation tracks were overlaid on the quadrant polygons and the number of line kilometres per quadrant per year was calculated. The number of shot points per quadrant per year was then calculated using the assumption of 40 SP/km. For 3D seismic, the 3D seismic polygon areas were intersected with the quadrant polygons and the survey area per quadrant per year was calculated. The number of shot points per quadrant per year was calculated using the assumption of 800 SP/km^2. The 2D and 3D values were then added together and the shot point density calculated by dividing the number of shots per quadrant per year by the offshore area of each quadrant.

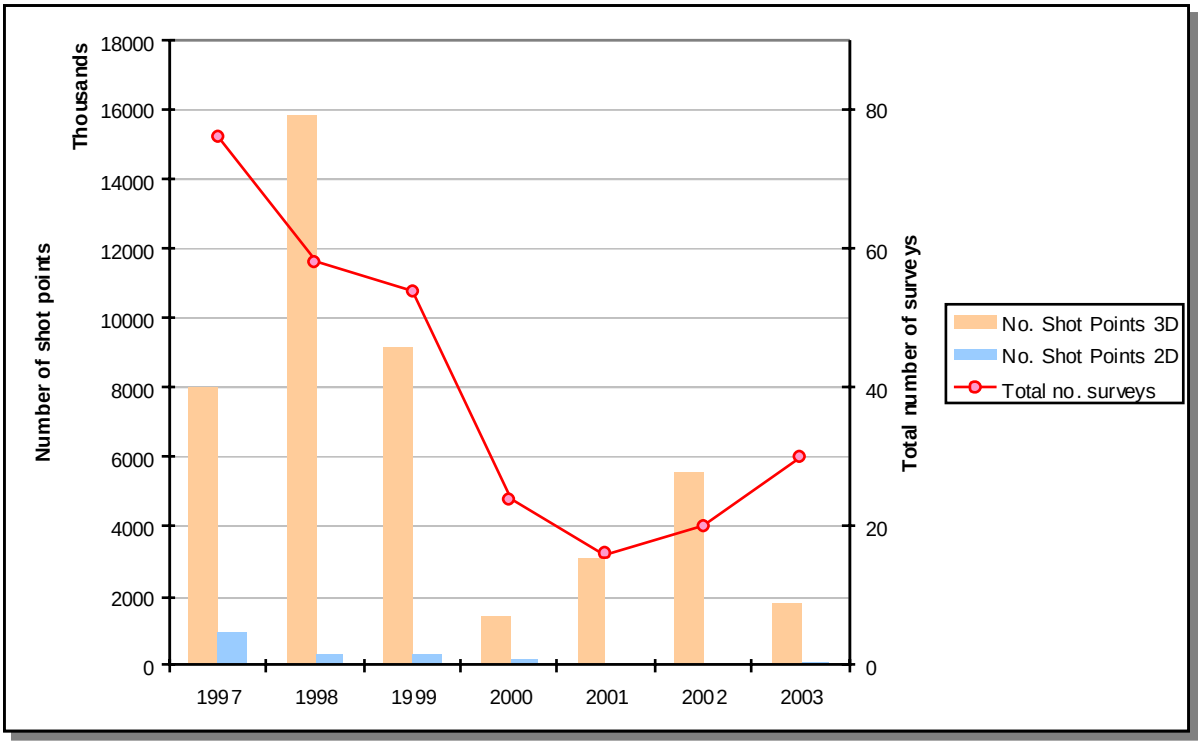
The data gaps identified in the 2003 UK draft report have been addressed.

3 RESULTS

3.1 Overall

A summary of 2D and 3D seismic survey activity is shown in **Figure 3-1**. The great majority of survey activity (measured by shot points) is 3D. Activity has fallen overall over this 7-year period but it is clearly very variable year-on-year. There is no obvious correlation between the number of surveys and the number of shot points, indicating that survey size is also very variable.

Figure 3-1 Overview of survey activity 1997-2003



The 2D vectors and 3D polygons of all the surveys are plotted on maps of the UKCS in **Figure 3-2** and **Figure 3-3**.

3.2 Shot Point Densities

The shot point densities are plotted on maps of the UKCS for each of the years 1997-2003. A summary plot of all the years is shown in **Figure 3-4**. .

The maximum shot point density over a quadrant was 600 SP/km^2.

Figure 3-2 2D Seismic surveys 1997-2003

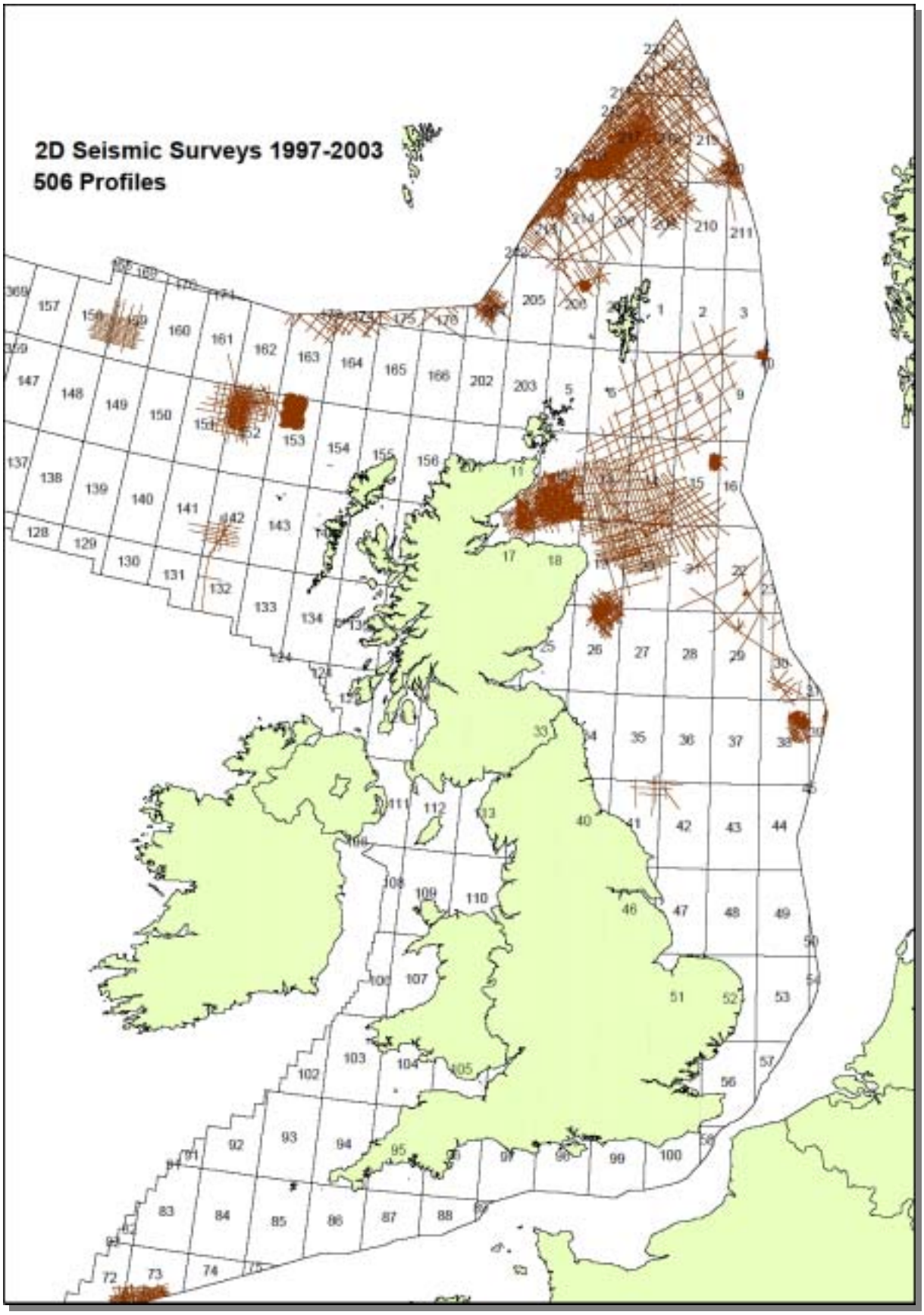


Figure 3-3 3D Seismic surveys 1997-2003

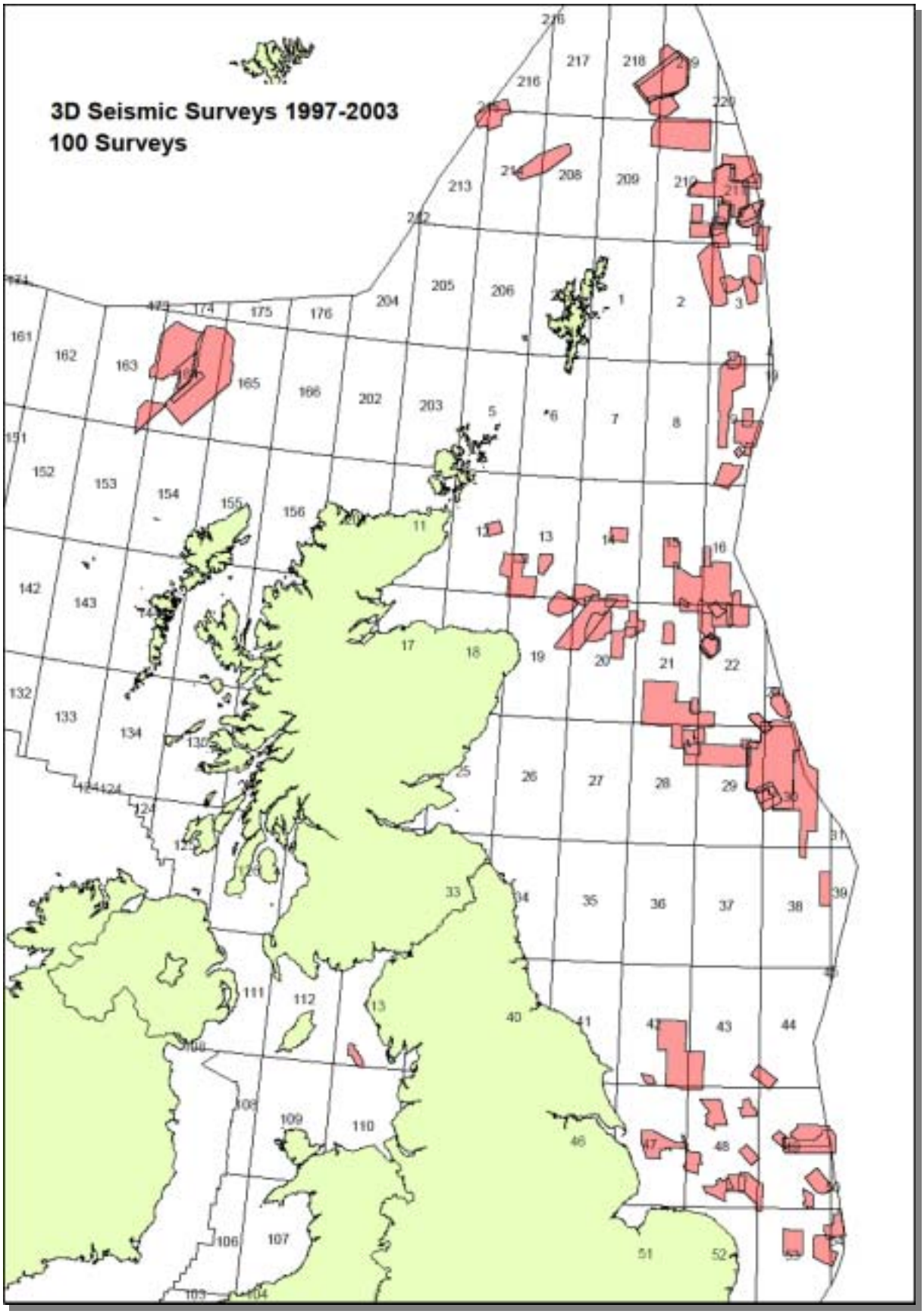
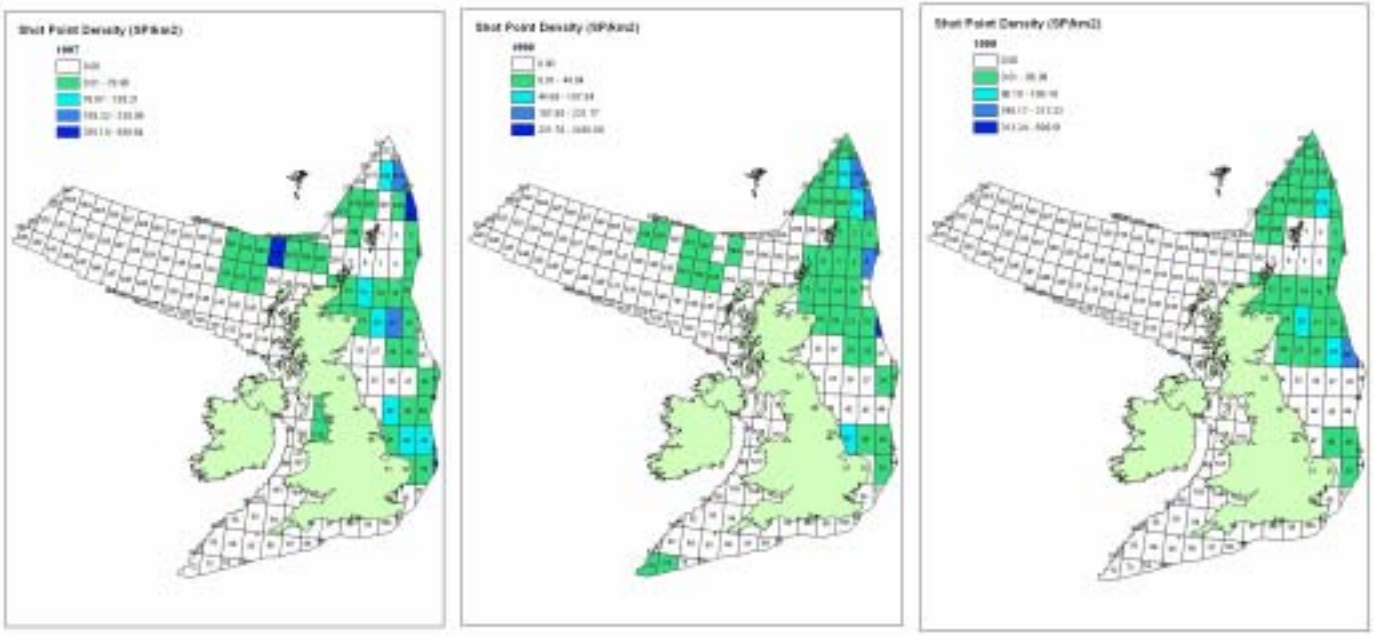


Figure 3-4

Summary of annual seismic survey activity in UKCS 1997-2003



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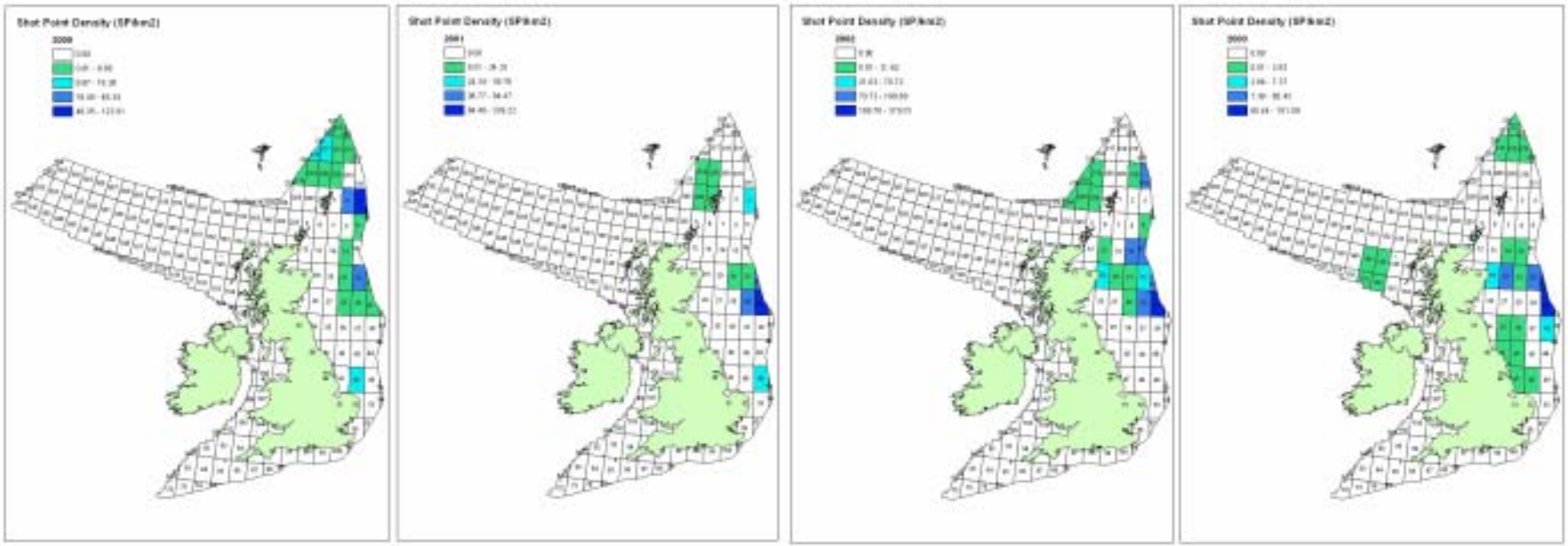
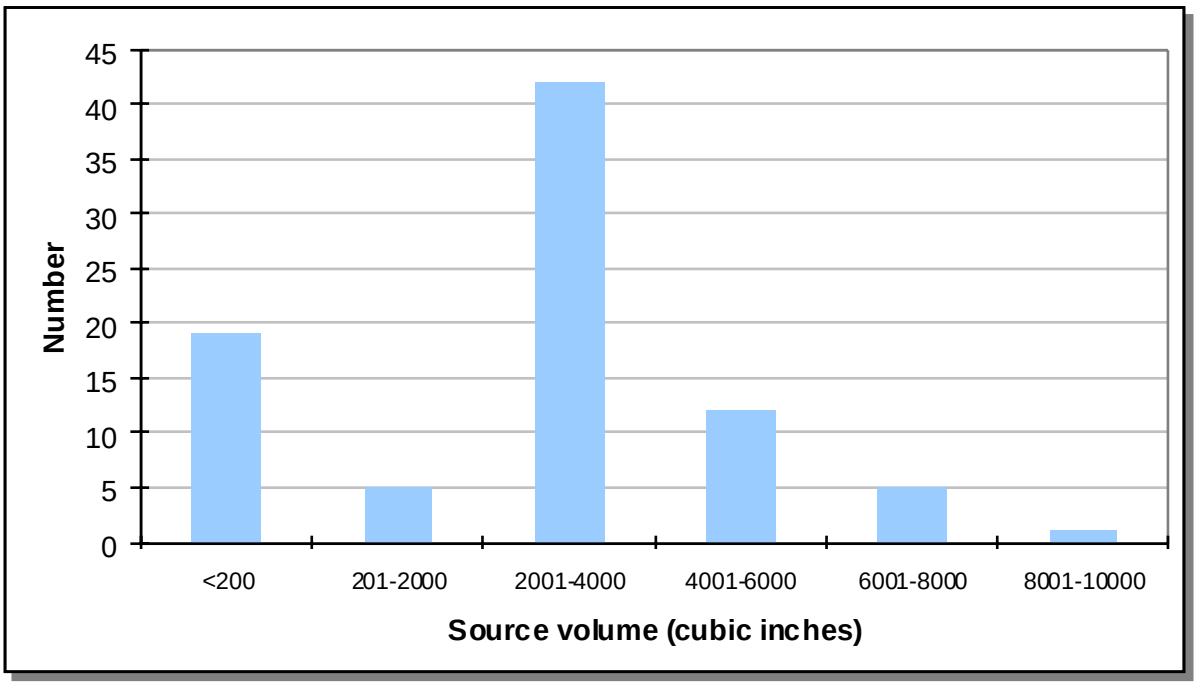


3.3 Airgun power

Details of airgun power (measured by cubic inches) were taken from database of PON14 records (the form used to apply for permission to conduct a seismic survey) submitted to the DTI between 2001 and 2003. Airgun sizes could not be ascertained for six out of the 91 surveys in this period.

A wide range of airgun sizes was employed in these surveys ranging from 120 cubic inches to one survey quoting 5 000-10 000 cubic inches. A histogram of the airgun sizes is shown in **Figure 3-5**. Clearly the most common range is 2000-4000 cubic inches accounting for over half of the surveys.

Figure 3-4 Distribution of airgun sizes 2001-2003



3.4 Use of Marine Mammal Observers

Recommendations for Marine Mammal Observers (MMOs) are based on the size of the airguns being used and on the sensitivity of the location. In general, dedicated MMOs will be recommended for all seismic surveys (2D/3D/4D and Ocean Bottom Cabling or OBC surveys). For further information on the advice provided to DTI by JNCC on the use of Marine Mammal Observers please refer to the JNCC Guidelines:
http://www.jncc.gov.uk/pdf/Seismic_survey_guidelines_200404.pdf

JNCC also publish reports on the analysis of the sightings and effort data provided by the MMOs used on oil and gas related seismic surveys. Please refer to http://www.jncc.gov.uk/page-1534#1785 for copies of the reports.

3.5 Monthly analysis

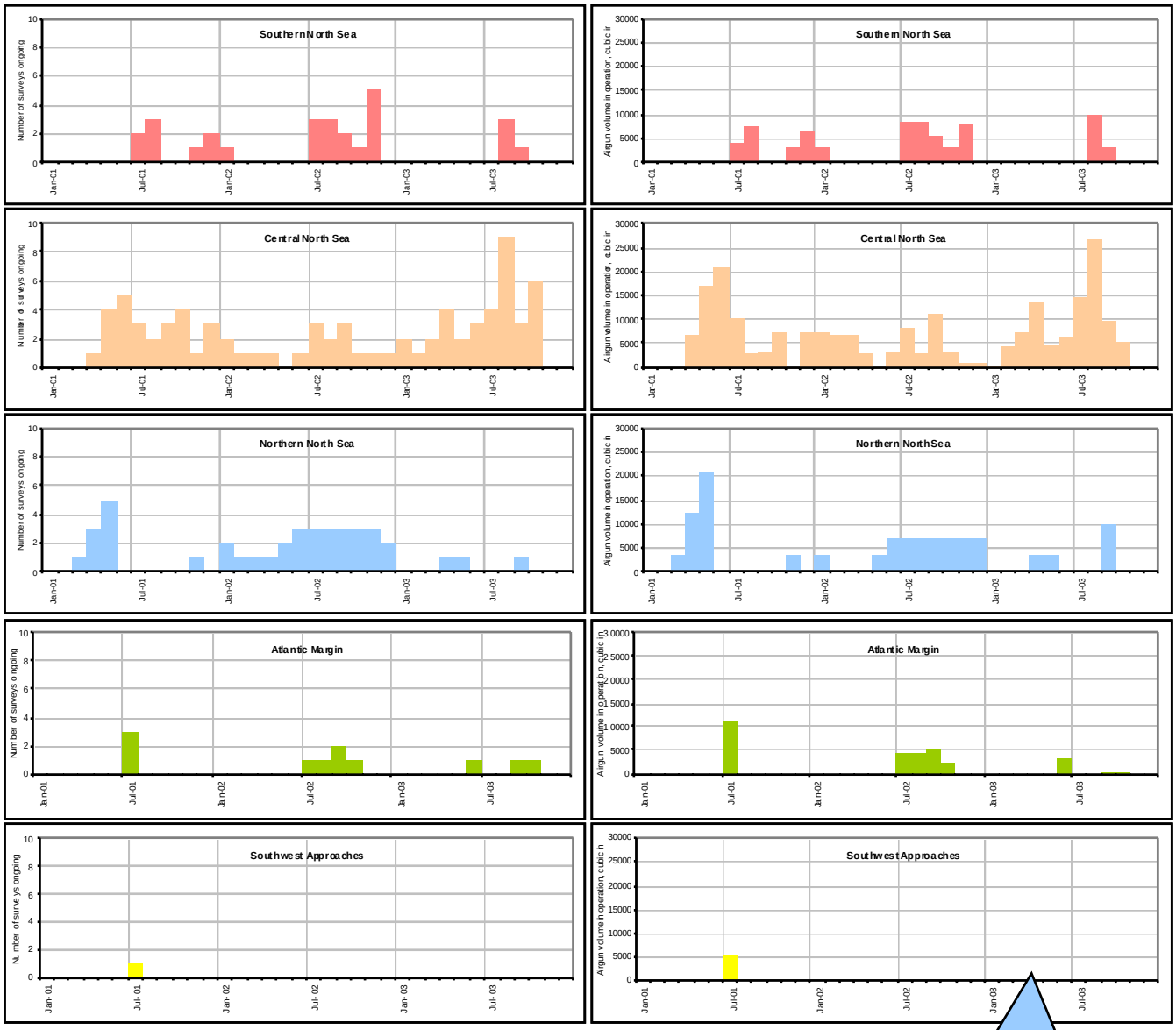
An aspiration stated in the 2003 UK draft submission was to resolve data to a monthly level. This has been achieved in two ways:

- Monthly plots of shot point density by quadrant have been constructed from the post-survey reports submitted to the DTI and JNCC, for the years 2003-2004. This is shown in **Appendix C**.
- The PON14 database has been analysed to identify both the number of surveys being carried out concurrently and the combined size of airguns in use concurrently for different regions of the UKCS. This is shown in **Figure 3-6**.

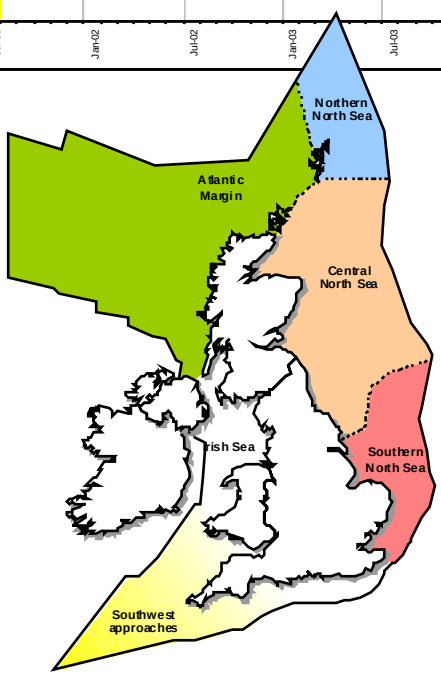
The data resolution is to the month in which the survey started. If a range of days or airgun sizes is stated, the higher end of the range is taken. Four surveys in 2001 were omitted as the airgun size was not accurately known, and two surveys in 2002.

In general, it can be seen that there is a tendency for more surveying during summer versus winter, but there is a wide variation. In the UK, surveying is not normally permitted at times of fish spawning, although this varies considerably with species and location and it is not clear whether this restriction has an influence on overall monthly surveying effort.

Figure 3-5 Monthly number of surveys and volume of airguns in operation



Note (see map):
SNS = Southern North Sea (south of Dogger Bank)
CNS = Central North Sea (Dogger Bank - south of Shetland)
NNS = Northern North Sea (east and north of Shetland)
Atlantic Margin = West of Shetland and West of Hebrides
Southwest Approaches = southwest of UK



APPENDIX A - SHOT POINT DATA

1997

Quadrant	Area (km^2)	3D (km^2)	2D (km)	SP's	SP Density
3	5823	83	376	303884	52
4	51	27	0	1084	21
9	5265	81	399	322212	61
10	73	18	0	712	10
11	2907	522	0	20860	7
12	5800	2886	224	294464	51
13	6500	94	902	725344	112
14	6496	33	339	272752	42
15	6493	477	393	333632	51
16	3971	63	224	181388	46
17	2096	428	0	17112	8
18	2221	416	5	20336	9
19	6302	24	51	42012	7
20	6679	58	752	604012	90
21	6675	1	1832	1465256	220
22	6616	0	399	319200	48
28	6856	0	318	254720	37
29	6853	113	22	22180	3
38	7030	1186	0	47452	7
39	1736	140	0	5580	3
42	7211	0	1435	1148000	159
43	7208	0	503	402400	56
44	6299	0	183	146000	23
47	6049	0	50	39760	7
48	7381	0	913	730400	99
49	7133	0	1419	1135040	159
50	273	0	6	5040	18
52	3044	0	4	2800	1
53	7037	0	431	344480	49
54	716	0	300	240080	335
110	4446	0	6	4400	1
113	2541	0	149	118960	47
151	6587	537	0	21480	3
152	6573	1082	0	43268	7
153	6560	225	17	22760	3
161	6394	9	0	372	0
162	6202	61	0	2452	0
163	6287	423	347	294832	47
164	6359	266	4427	3552228	559
165	6337	94	576	464544	73
166	6339	10	0	380	0
173	94	11	0	428	5
174	697	155	0	6188	9
175	1324	95	0	3780	3
176	1906	120	0	4780	3
202	6332	2	0	68	0
206	6118	3	0	104	0
208	5938	0	390	311840	53
210	5932	0	585	467840	79
211	4000	49	2569	2057168	514
212	39	2	0	68	2
213	3625	89	0	3540	1
214	5942	25	322	258456	43
218	5744	30	885	708968	123
219	5103	62	1572	1259776	247
220	564	19	0	744	1

1998

Quadrant	Area (km^2)	3D (km^2)	2D (km)	SP's	SP Density
1	4945	3	0	104	0
2	6121	151	0	6032	1
3	5823	41	92	75304	13
5	4710	5	0	180	0
6	5926	255	0	10204	2
7	6311	665	0	26580	4
8	6308	603	0	24120	4
9	5265	148	1518	1220392	232
12	5800	159	152	127860	22
13	6500	1998	0	79908	12
14	6496	1162	200	206488	32
15	6493	143	0	5716	1
18	2221	2	0	96	0
19	6302	456	0	18256	3
20	6679	779	0	31144	5
21	6675	0	94	74800	11
22	6616	0	2	1440	0
23	1156	0	36	28800	25
28	6856	0	270	215840	31
29	6853	0	135	108240	16
38	7030	0	286	229040	33
39	1736	0	23	18320	11
47	6049	0	578	462000	76
48	7381	0	412	329520	45
49	7133	0	118	94320	13
53	7037	0	0	160	0
72	4592	316	0	12640	3
73	4899	1039	0	41576	8
151	6587	92	0	3696	1
152	6573	1401	0	56032	9
153	6560	15	0	616	0
158	5667	359	0	14360	3
159	6423	693	0	27712	4
161	6394	42	0	1692	0
162	6202	37	0	1468	0
164	6359	0	317	253200	40
208	5938	339	0	13556	2
209	5935	1235	0	49380	8
210	5932	167	451	367300	62
211	4000	36	1143	915744	229
213	3625	64	0	2576	1
214	5942	310	0	12408	2
216	2433	609	0	24344	10
217	5604	3906	0	156244	28
218	5744	1162	716	619424	108
219	5103	432	1133	923748	181
220	564	222	0	8880	16
221	1100	163	0	6504	6
222	3905	543	0	21712	6
223	708	73	0	2924	4

1999

Quadrant	Area (km^2)	3D (km^2)	2D (km)	SP's	SP Density
3	5823	0	53	42560	7
9	5265	0	40	32160	6
11	2907	288	0	11524	4
12	5800	2001	0	80040	14
13	6500	5	0	204	0
14	6496	600	39	55420	9
15	6493	704	7	33924	5
16	3971	24	40	33260	8
17	2096	372	0	14868	7
18	2221	33	0	1308	1
19	6302	440	183	164148	26
20	6679	165	926	746992	112
21	6675	273	50	51152	8
22	6616	18	794	635684	96
23	1156	0	94	75440	65
26	6865	1107	0	44260	6
27	6860	24	0	956	0
28	6856	0	242	193840	28
29	6853	0	1681	1344400	196
30	5103	0	1998	1598240	313
48	7381	0	406	324640	44
49	7133	0	114	91120	13
53	7037	0	408	326320	46
205	6137	62	0	2468	0
206	6118	490	0	19580	3
208	5938	458	0	18304	3
209	5935	159	152	127712	22
210	5932	0	1266	1012960	171
211	4000	37	309	248776	62
213	3625	718	120	124400	34
214	5942	898	252	237844	40
215	4	2	3	2464	600
216	2433	878	116	127508	52
217	5604	1057	0	42288	8
218	5744	398	4	19052	3
219	5103	93	96	80200	16
220	564	117	0	4680	8
221	1100	49	0	1940	2
222	3905	9	0	344	0

2000

Quadrant	Area (km^2)	3D (km^2)	2D (km)	SP's	SP Density
2	6121	370	0	14796	2
3	5823	895	0	716320	123
9	5265	56	0	44640	8
15	6493	25	0	19760	3
21	6675	18	0	14560	2
22	6616	250	29	201308	30
23	1156	0	35	1404	1
28	6856	0	7	296	0
29	6853	0	34	1364	0
30	5103	0	105	4216	1
48	7381	170	0	135760	18
208	5938	0	89	3540	1
209	5935	0	12	484	0
213	3625	0	638	25536	7
214	5942	0	436	17456	3
215	4	0	2	64	16
216	2433	0	872	34872	14
217	5604	0	1650	65984	12
218	5744	0	1243	49716	9
219	5103	0	294	11740	2
221	1100	0	151	6044	5
222	3905	0	403	16136	4
223	708	0	92	3664	5

2001

Quadrant	Area (km^2)	3D (km^2)	2D (km)	SP's	SP Density
3	5823	282	0	225680	39
21	6675	0	94	3760	1
22	6616	124	160	105840	16
23	1156	118	2	94080	81
29	6853	801	168	647436	94
30	5103	2161	56	1730892	339
49	7133	313	0	250080	35
50	273	8	0	6640	24
206	6118	0	340	13596	2
207	3048	0	71	2844	1
208	5938	0	11	424	0
214	5942	0	17	680	0

2002

Quadrant	Area (km^2)	3D (km^2)	2D (km)	SP's	SP Density
9	5265	142	0	113840	22
13	6500	45	0	35840	6
15	6493	764	0	611200	94
16	3971	991	0	792960	200
19	6302	327	0	261680	42
20	6679	24	0	18880	3
21	6675	160	0	127760	19
22	6616	574	216	467840	71
23	1156	128	0	102320	89
28	6856	34	0	27280	4
29	6853	855	0	683920	100
30	5103	2360	0	1888000	370
204	3968	0	840	33604	8
205	6137	0	2	60	0
206	6118	0	23	920	0
210	5932	30	0	24160	4
211	4000	512	0	409840	102
213	3625	0	66	2656	1
214	5942	0	17	660	0

2003

Quadrant	Area (km^2)	3D (km^2)	2D (km)	SP's	SP Density
14	6496	0	176	7044	1
15	6493	0	4	172	0
19	6302	0	779	31148	5
20	6679	508	763	436996	65
21	6675	2	275	12680	2
22	6616	294	4	235132	36
23	1156	231	0	184480	160
30	5103	1142	262	924004	181
31	338	0	8	312	1
35	7039	0	18	712	0
36	7034	0	2	76	0
38	7030	63	36	51848	7
41	4687	0	214	8544	2
42	7211	0	142	5680	1
47	6049	18	0	14640	2
48	7381	6	0	4400	1
131	3817	0	2	80	0
132	4603	0	110	4392	1
141	6778	0	62	2460	0
142	6763	0	444	17776	3
217	5604	0	122	4888	1
218	5744	0	80	3212	1
219	5103	0	75	2980	1
220	564	0	5	184	0
222	3905	0	62	2468	1

APPENDIX B - SEISMIC SURVEY DATA FROM PON14 DATABASE 2001-2003

2001 Data

Year	Area Location	Survey Type	Proposed Start date	Duration *days*	Quadrant/Block	Source Volume	No. of MMOs	DTI Ref.
2001	Northern North Sea	2D	May	4	9/14a & 9/14b	22 x 65ci		12
		2D	Dec	60	21A	3500ci	1	189
		3D	May	60	2,3,210,211	4000ci		2
		3D	April	15	2/3,4,5,9,10,14,15,20, 3/1,2,6,7,8,11,12,13,14,16,17,18,19,21,22,23, 210/28,29,30, 211/26	3510ci		3
		3D	May	35	211/7A, 7B, 8B, 11A, 12A, 12B, 13B, 17	2 x 3400ci		5
		3D	Jun	20	211/19	22 x 65ci		19
		3D	Jun	1	8/3,4,5,8,9,10, 9/1,2,6,7	1695ci		57
		2D	Jun	5	9/8,9,10	2 x 3400ci		27
	Central North Sea	2D	June	14	21/23a, 23b, 24, 25, 27a, 27c, 28b, 29a, 29b, 30, 22/14a, 15, 17b, 18a, 18b, 19a, 21, 22a, 24a, 24d, 26a, 29, 30a, 30b, 29/10, 15, 17, 18, 1b, 2a, 2c, 5a, 5b, 5c, 8a, 9a, 9b, 30/11a, 11b, 12b, 17b, 18, 1f,	4140ci	2	44
		2D	Sept	5	19/5,10 & 20/1 & 6	3392ci	1	135
		2D	Oct	1	21/4, 21/5, 15/30, 16/26, 16/27, 16/22, 16/23	4140ci		173
		2D	Dec	120	22/24b	3500 ci		197
		2D	Dec	60	22/24b	3500 ci	1	188
		2D or 3D	Oct	90	19/8-10, 19/13-15, 19/19-20, 20/1, 20/2a, 20/2c, 20/3c, 20/6, 20/7a, 20/7b, 20/8-9, 20/10b,	?		167
		3D	May	35	22/30A,30B, 23/21,26,27 29/5B 30/1E,1F	2 x 3400ci		4
		3D	Jun	35	16/28, 23S, 22, 27, 22/2B, 3B	2 x 3400ci		6
		3D	Apr	35	22/30A, 30B, 23/21, 26,27, 5B, 30/1E,1F	2 x 3400ci		17
		3D	May	150	16/16,17,18,21,22,23,26,27,28,	?		18
		3D	Sept	60	29/15,20, 30/11,16,17,21	?	1	97
		3D	Oct	28	15/18, 19, 20, 24a,24b, 25a, 25b	3270ci	1	170
		3D	May	110	14/12,13,14a,14b,15a, 15b, 17, 18a, 18b, 18c, 19, 19-F1, 19F2, 20a, 20b,20b-F1, 20b-F2, 22, 23, 24a,24b, 25a, 25c, 15/11a, 11b, 12b,12c, 13a, 13b, 13c, 16a, 16b, 17, 17-F1, 17-F2, 18a, 18b, 21a, 21a-F1, 21b, 22, 22-F1, 22-F2, 23a,	3090ci		11
	Southern North Sea	3D	Jul	35	49/24,25,29,30, 50/21	?		69
		3D	Jul	35	49/24,25,29,30, 50/21	4140ci		81
		3D	Aug	2	48/14,19,15,20	3390ci		101
		3D	Nov	60-90	43/21, 43/22b, 43/23, 43/24b, 43/26c, 43/27a,b, 43/28, 43/29, 48/2b, 48/3, 48/4, 48/5b, 48/9a, 43/25b, 43/30b	3090ci		175
		3D	Dec	30	48/3, 4, 5b, 9a	3090 ci		200
	St Georges Channel	2D	Jul	8	103/1	4x40ci		84
	West of Shetland (white Zone)	2D	Jul	14	204/14,15,19a,19b,20a,20b,22a,23a,24a,24b,25a,25b,26,27a,27b,28,29b,30a	5595ci	2	82
		2D	Jul	14	206/1,2,4,6,7a,8,9NW,9SE,11a,12,13a	5595ci	2	83
	Faroes	2D	Jul	1	204/17, 18, 19a, 24a, 25b	5595ci		92

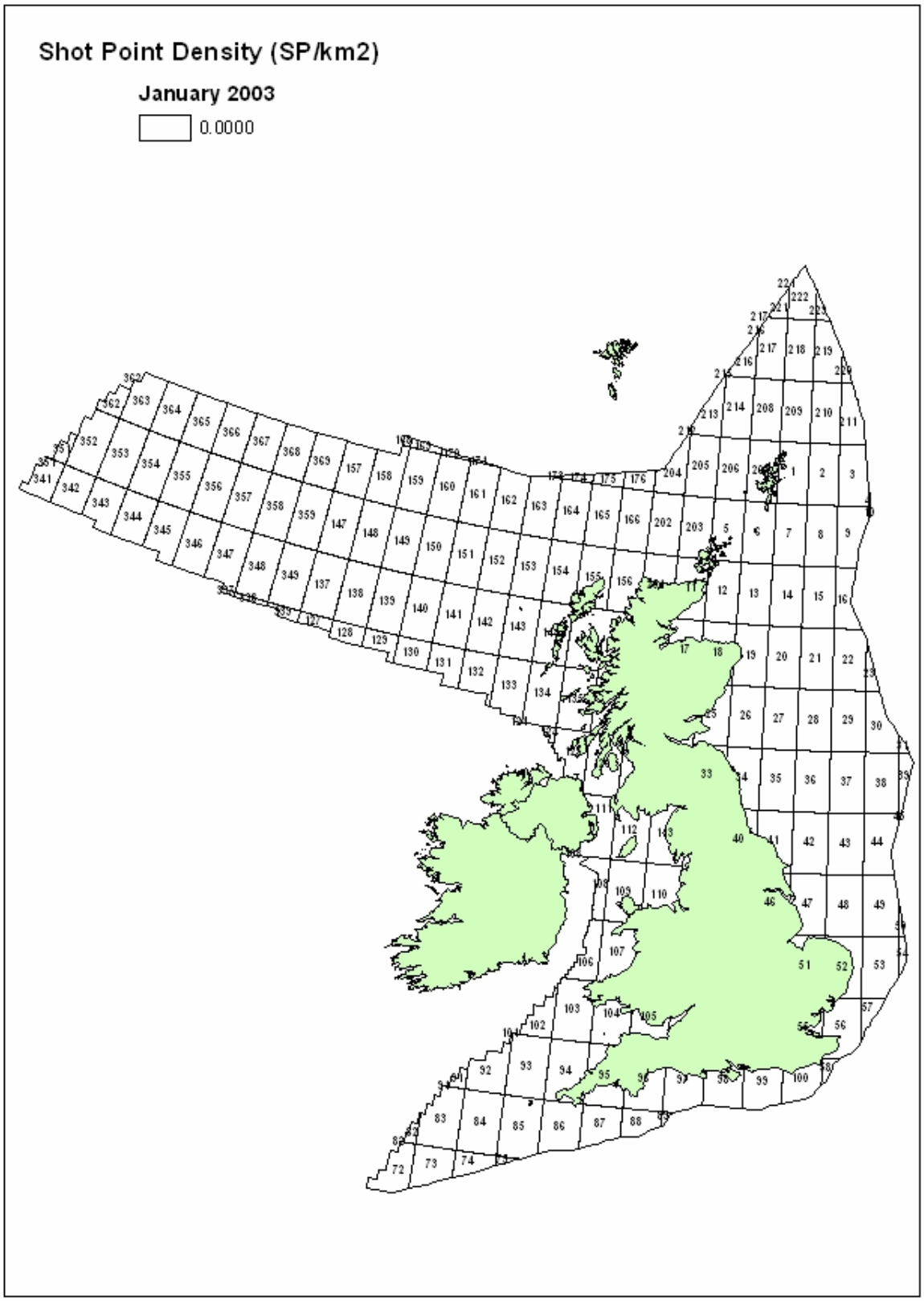
2002 Data

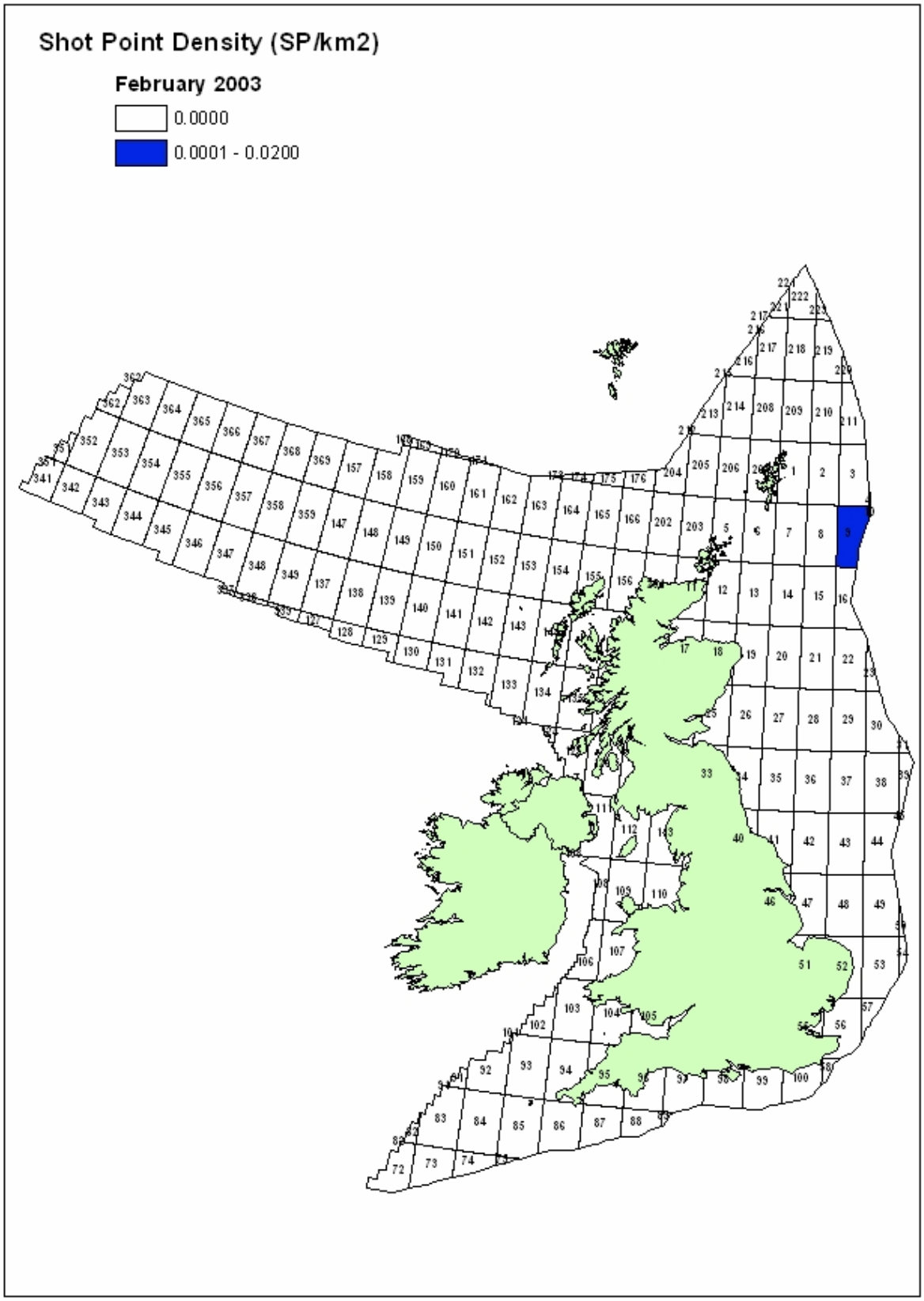
Year	Area Location	Survey Type	Proposed Start date	Duration *days*	Quadrant/Block	Source Volume	No. of MMOs	DTI Ref.
2002	Central North Sea	2D	Nov	6	14/19	140 ci		320
		2D	Aug	10	19-20, 24-25, 29-30, 21, 26, 3-5, 10, 14-15, 19-20, 11-12, 16-19, 21-, 24-25, 16-17, 21-25, 27-30, 26-27, 2-5, 1, 6-7	?	2	277
		2D	Jun	21-30	12,13	3090 ci	2	265
		3D	Jul	30	9/14	22x65 ci	2	257
		3D	Sept	42	19/4, 5, 13/29, 30, 20/1	3390 ci	2	280
		3D	Sept	15	22/5, 10, 23/6	3210 ci	2	274
		3D	Feb	90	16/29aF1 & 29c	3090 ci	1	209
		2D	Nov	60	19/1-25, 28-30, 20/6-23, 26, 3-5, 11	880 ci	1	331
		3D	Jun	35	19/5, 10, 20/1, 6.	3392 ci	2	211
	Faroes-Shetland basin	2D	Sept	20	176/25, 204/16, 21, 205/1, 2, 4, 206/1, 2, 7, 8, 9, 11, 12, 13, 207/1, 213/5, 18, 19, 20, 23, 24, 25, 26, 27, 28, 29, 214/, 1, 6, 7, 8, 9, 11, 16, 17, 21, 22, 27	4240 ci	2	290
		3D	Jul	60	176/20, 204/16, 21, 22, 26, 17	3090 ci	2	270
		2D	Aug	30	204/12-29, 205/16-21	?	2	279
	Northern North Sea	3D	Aug	105	211/24, 29, 30	3090 ci	2	284
		3D	Jul	75	9/13a-e, 14a	2250ci	2	263
		3D	Jul	15	Sep-23	3090ci	2	245
	Southern North Sea	2D	Jul	34-55	53	3090 ci	1	266
		2D	Nov	4-5	41,42,43,44,48,49	4240ci	1	321
		2D	Nov	3	48/18, 19	160 ci	1	261
		2D	Nov	23	48/10, 15, 20, 49/16	140 ci		328
		2D	Nov	3	44/22b	140 ci		330
		3D	Sept	8	47/15a, 48/11b	3080 ci	1	294
		3D	Sept	42-56	44/11,12,13	2200 ci	1	291
		3D	Jul	60	16/7a,b,c 8a,b,c 12a,b, 13a,b,d	4500 ci	2	256

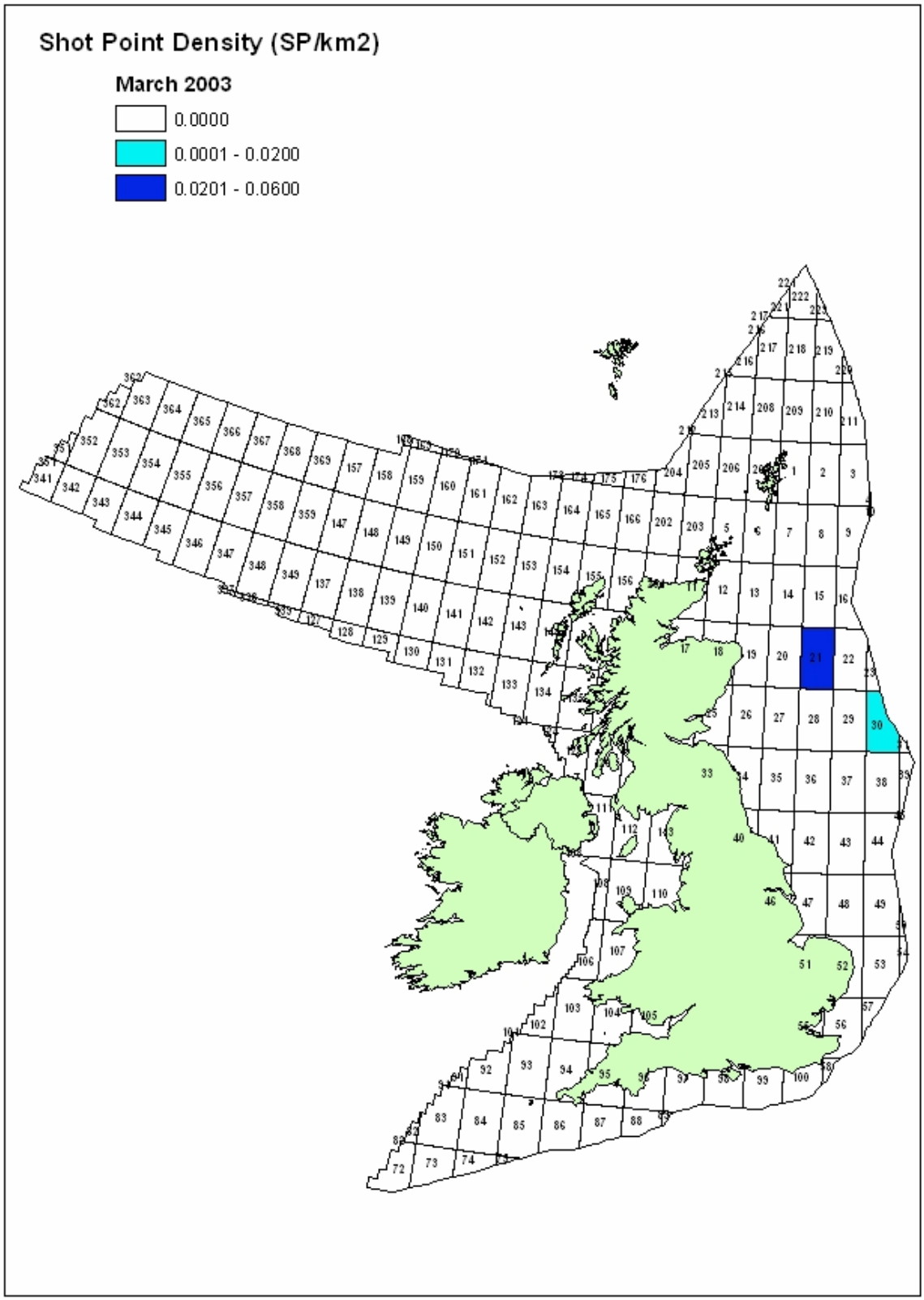
2003 Data

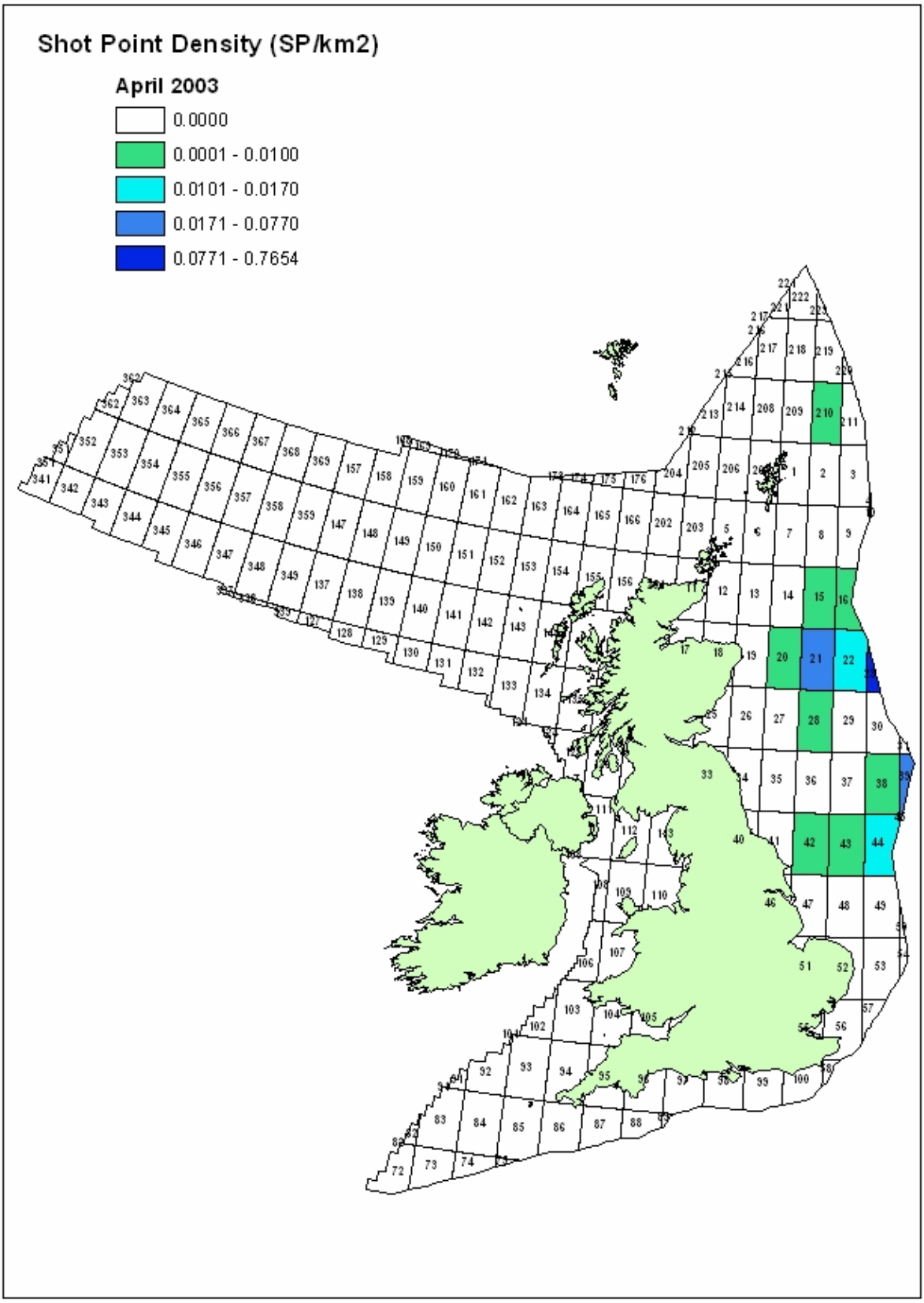
Year	Area Location	Survey Type	Proposed Start date	Duration *days*	Quadrant/Block	Source Volume	No. of MMOs	DTI Ref.
2003	Northern North Sea	3D	Apr	54	3	3530 ci	2	372
		2D	Sept	14	208, 209, 214, 216, 217, 218, 219, 221, 222	5,000 -	?	455
	Central North Sea	2D	May	60	16/29C	120 ci		366
		2D	?	3	15	160 ci		371
		2D	May	4	9	150 ci		382
		3D	Jul	60	9	3090 ci	2	383
		3D	Jun	30	20	2250 ci	2	391
		2D	Jun	4	28/5a-F	140 or 160 ci		399
		3D	Jul	30	13/22a	2098 ci	2	406
		3D	Jun	44	22, 29	3960 ci	2	410
		3D	Jul	40	9/8, 9 & 10	3000 - 5200	2	411
		3D	Aug	30	15 &16	3335 ci	2	424
		2D	Aug	30	14 and 20	3500 ci	2	426
		2D	Aug	30	30, 38and 31	3500 ci	1	427
		2D	Aug	30	21	3500 ci	2	428
		3D	Sept	4	9/8 & 9/9	3000-4000 ci	?	459
		3D	Oct	4	19/15 & 19/10	140 or 160 ci	?	460
		3D	Oct	4	19/8 & 19/9	140 or 160 ci	?	461
		3D	Oct	4	20/6 & 20/11	140 or 160 ci	?	462
		3D	Oct	4	19	140 or 160 ci	?	463
		3D	Aug	30	15 and 16	3335 ci	2	430
		2D	Aug	40	11, 12, 13, 14, 17, 18, 19, 20	1220 ci		431
		2D	Jan	6	15	140 ci		342
		2D	Jan	6	21	140 ci		343
		3D	Feb & Jul	100	30	4450 ci	1	351
		3D	Apr	30	23	3510 ci	2	358
		3D	Sept	45	38 & 39	4450 ci	?	450
		2D	Oct	10	26/6a	160 ci	?	472
		3D	Mar	45	21	3000 ci	2	361
	Southern North Sea	3D	Apr	21	42, 47	2620 ci	1	365
		2D	Jul	2	49/2a, 49/1	160 ci	?	437
		2D	Aug	30	41 and 42	3500 ci	1	429
	Northern North Sea - Central North Sea	2D	Aug	6	16/27a, 27b, 28, 22/1, 1a, 2a, 2b, 3, 3a, 4, 4a, 7, 8, 9, 22/23b, 26a, 27a, 27b, 28a, 28b, 28c, 28d, 29/1, 2a, 2c, 2, 3a, 3b, 4b	3000 ci	2	435
		2D	Mar	100	210, 211, 2, 3, 7-9, 14-16, 20-23, 28-30, 37, 38, 42, 43, 47.	3500 ci	2	362
	UKCS	2D	Aug	10	141/20, 24, 25, 142/16, 17, 18, 19, 21, 22, 23, 24, 26, 27, 131/10, 132/1, 6, 7, 8, 11, 16, 17	3090 ci	?	439
	Central & Southern	2D	Sept	5	49/20a	160 ci	?	468
	West of Shetland	2D	Oct	12	206/1a	180 ci	?	471
	West of Hebrides	2D	Jun	10	141, 142, 131, 132	3090 ci		395

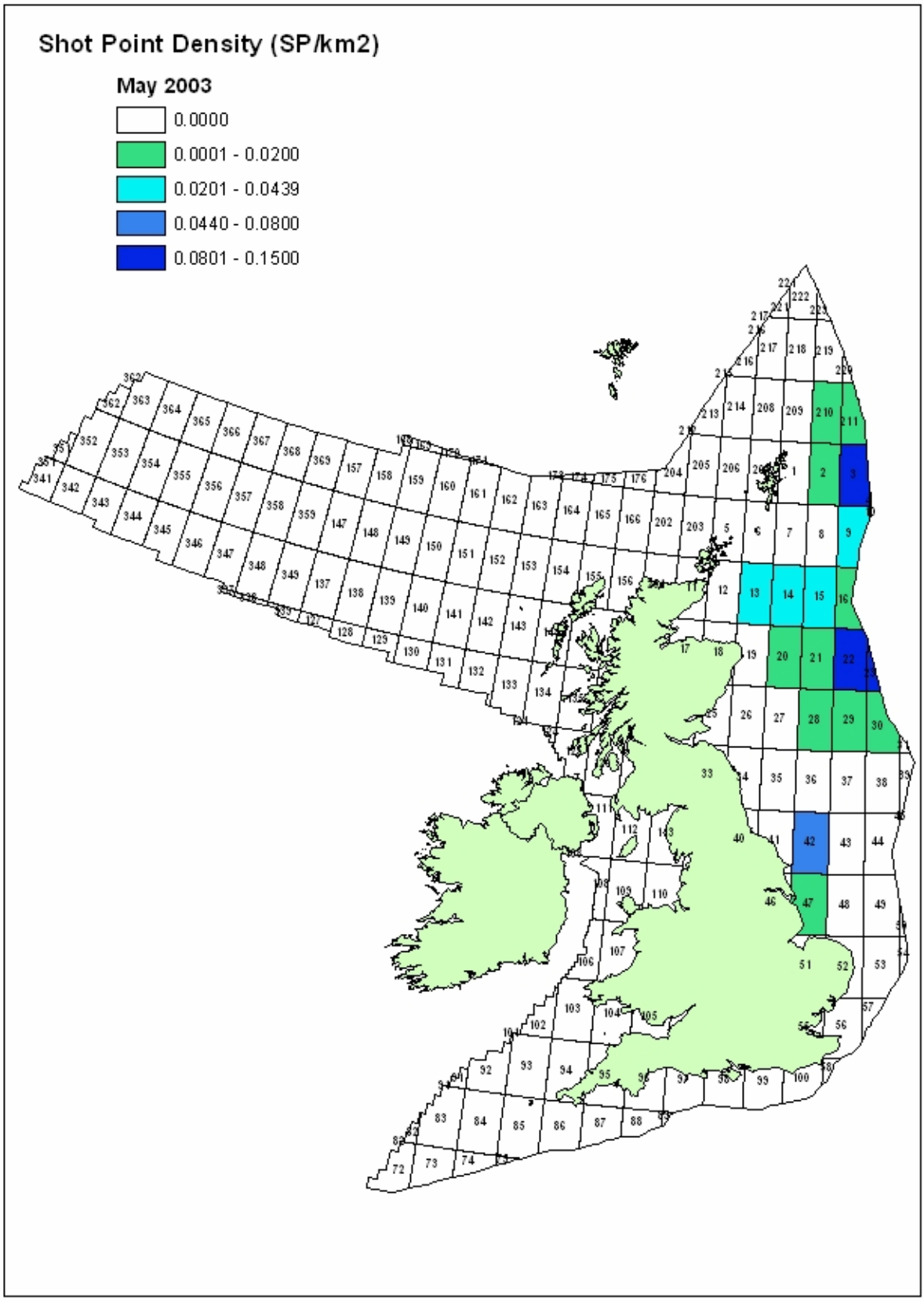
APPENDIX C - MONTHLY SEISMIC SURVEY PLOTS 2003-2004

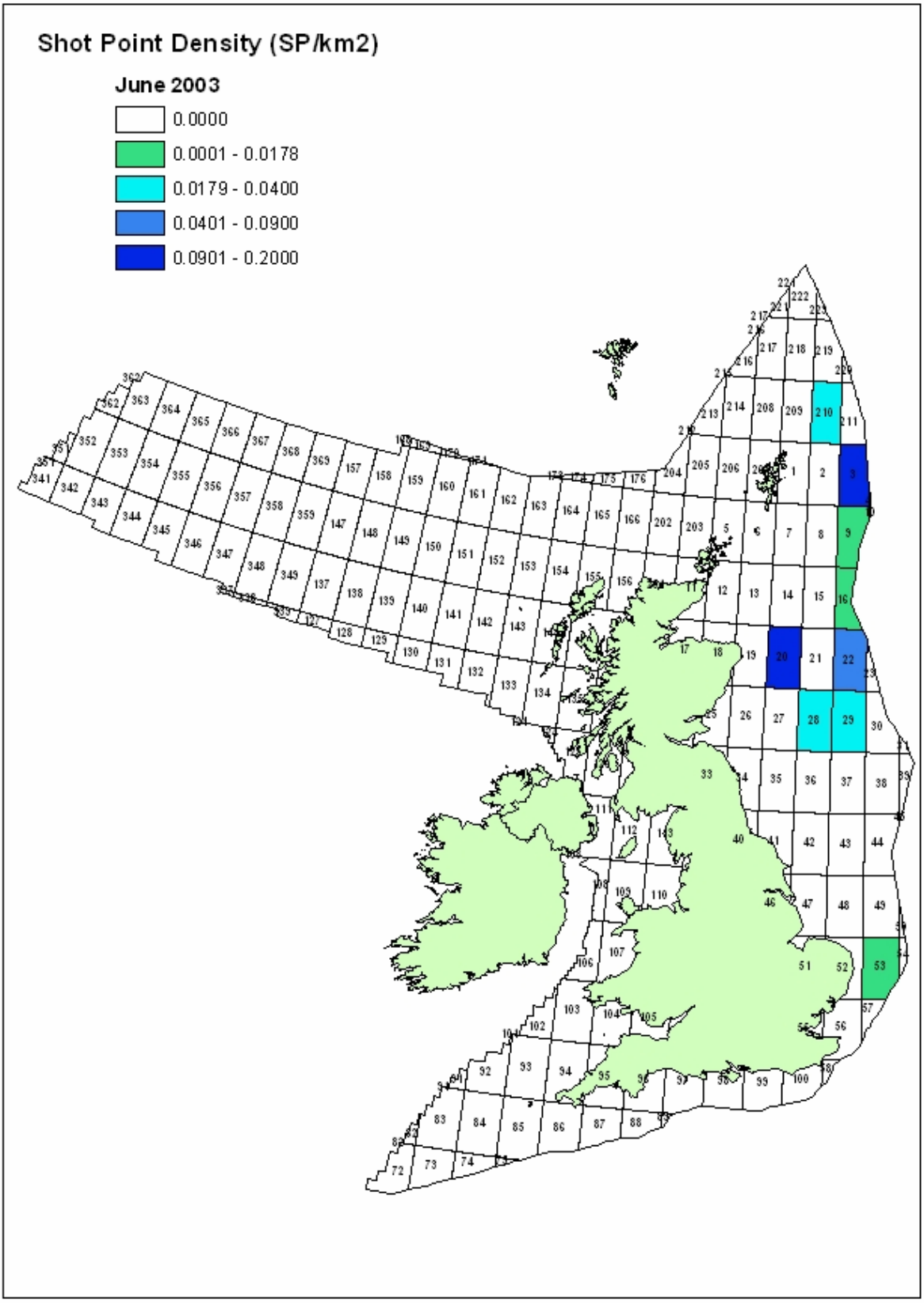

Shot Point Density (SP/km2)
January 2003
0.0000

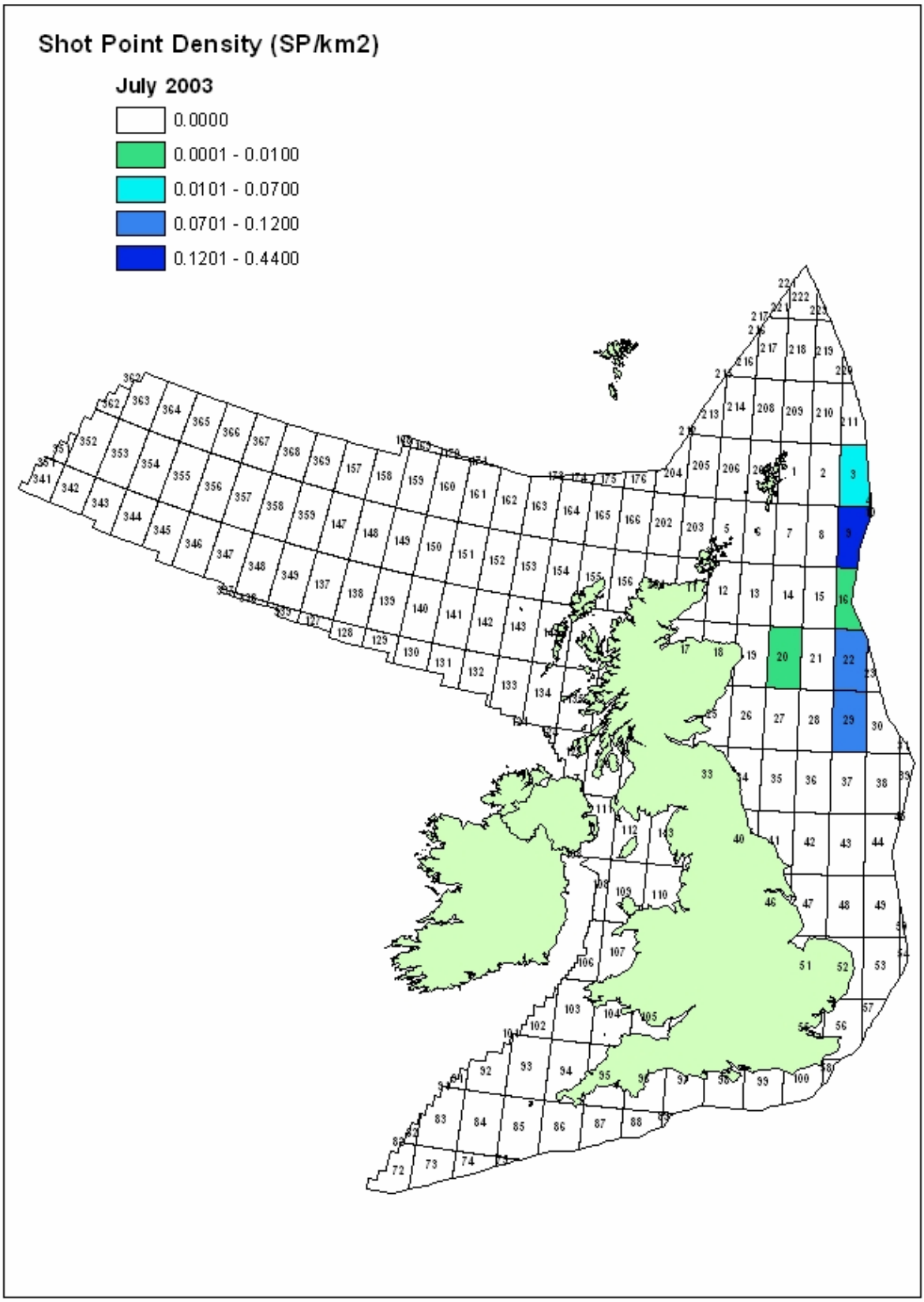

Shot Point Density (SP/km2)
February 2003
0.0000
0.0001 - 0.0200

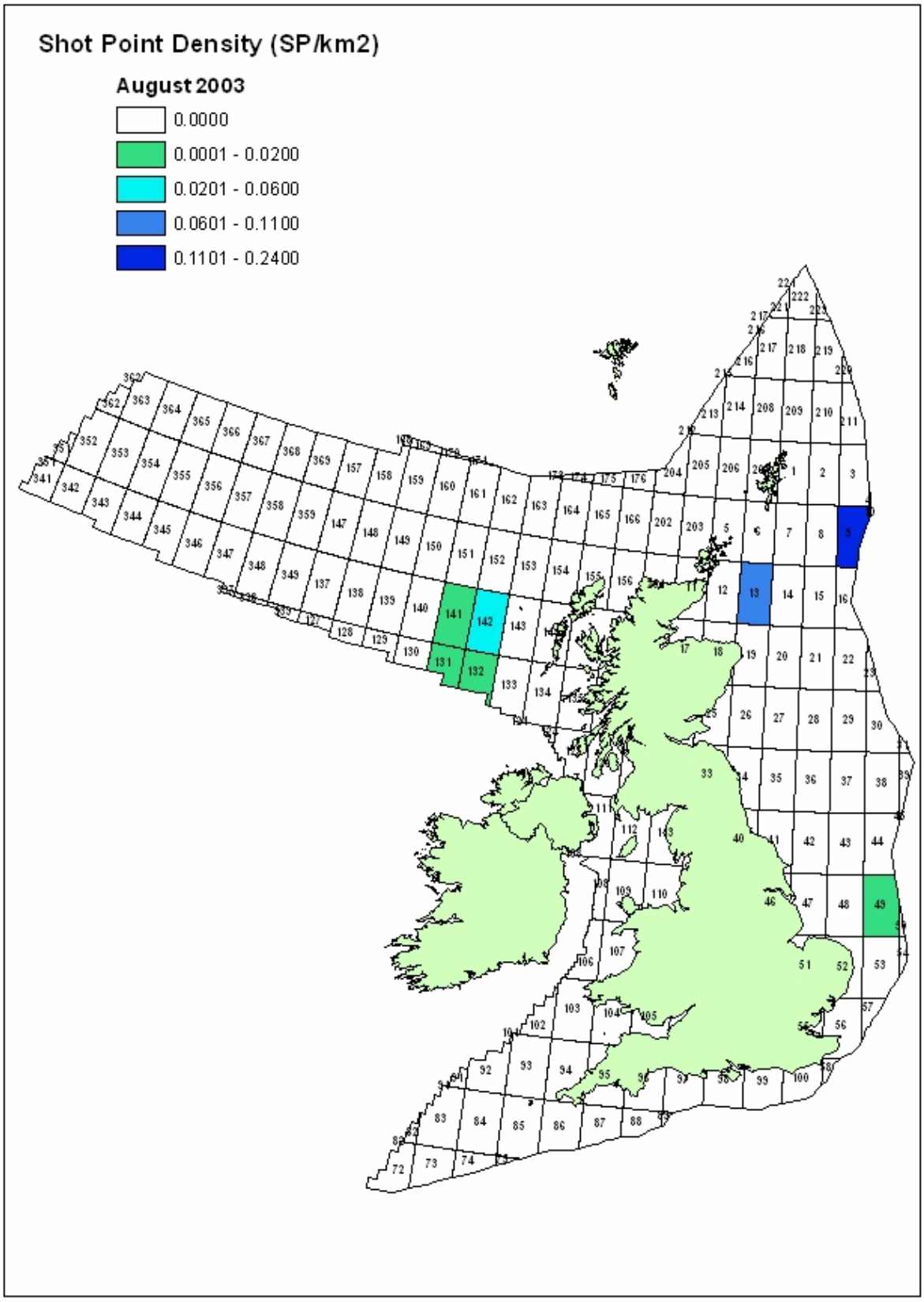

Shot Point Density (SP/km2)
March 2003
0.0000
0.0001 - 0.0200
0.0201 - 0.0600

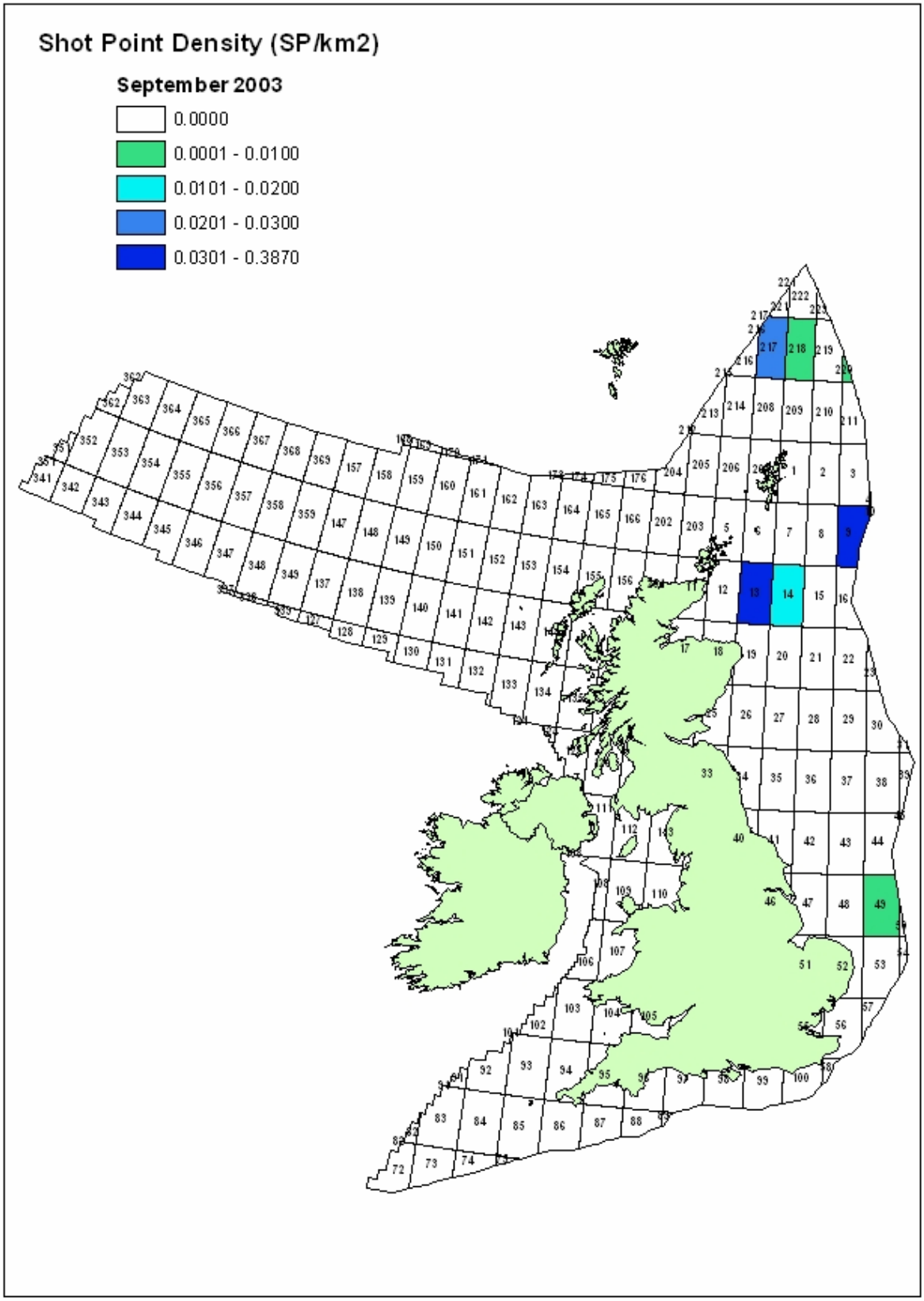

Shot Point Density (SP/km2)
April 2003
0.0000
0.0001 - 0.0100
0.0101 - 0.0170
0.0171 - 0.0770
0.0771 - 0.7654

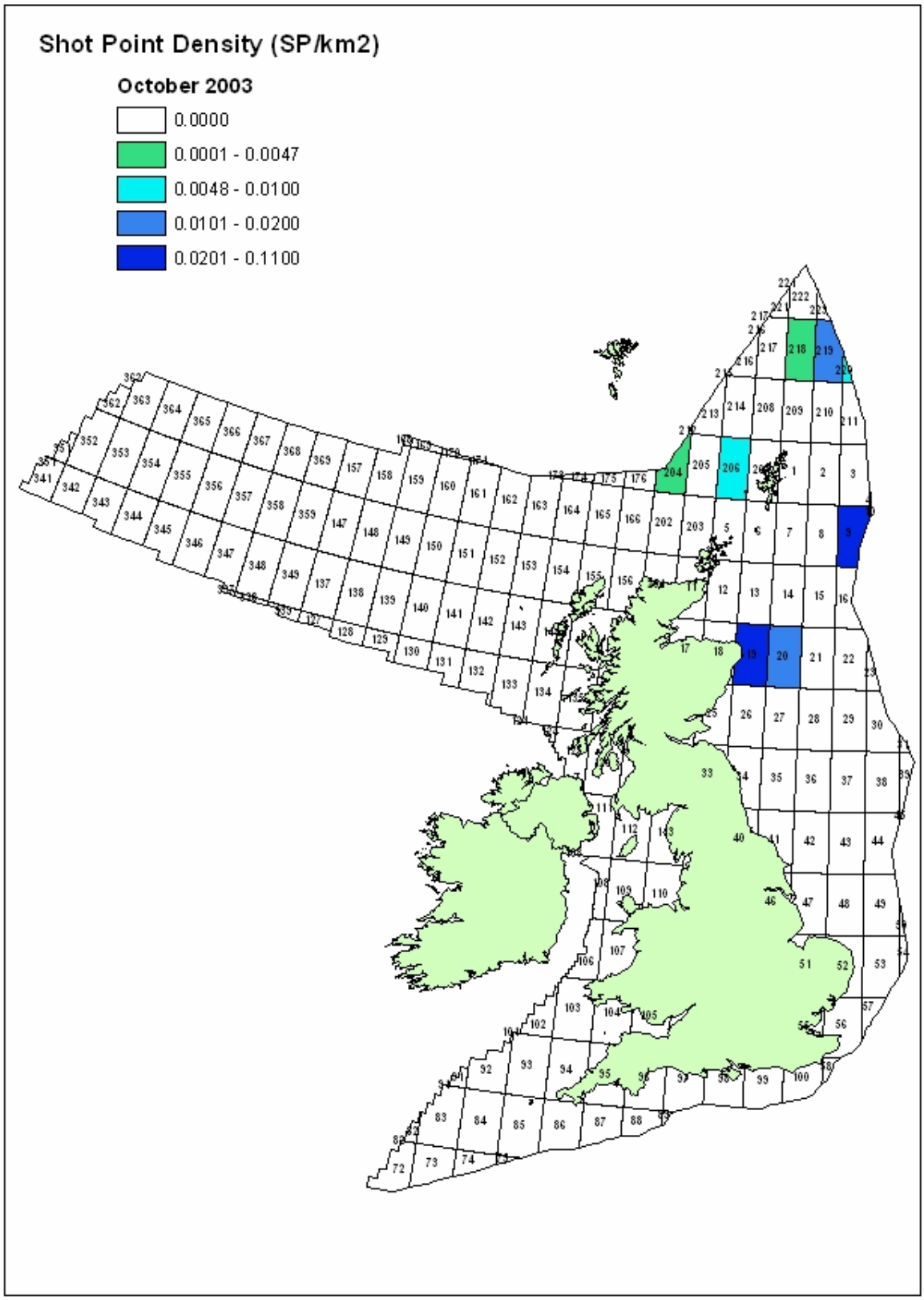

Shot Point Density (SP/km2)
May 2003
0.0000
0.0001 - 0.0200
0.0201 - 0.0439
0.0440 - 0.0800
0.0801 - 0.1500

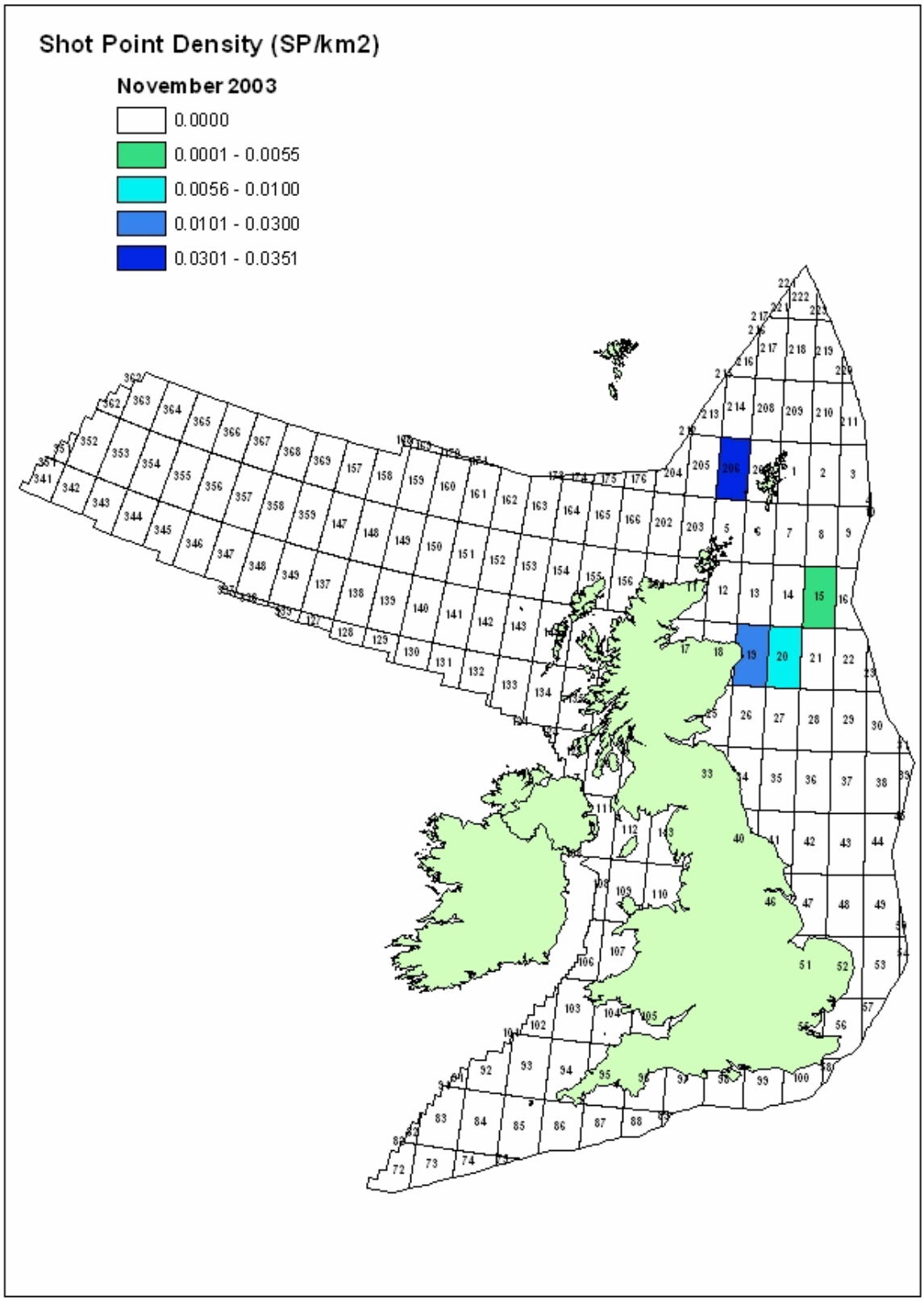

Shot Point Density (SP/km2)
June 2003
0.0000
0.0001 - 0.0178
0.0179 - 0.0400
0.0401 - 0.0900
0.0901 - 0.2000

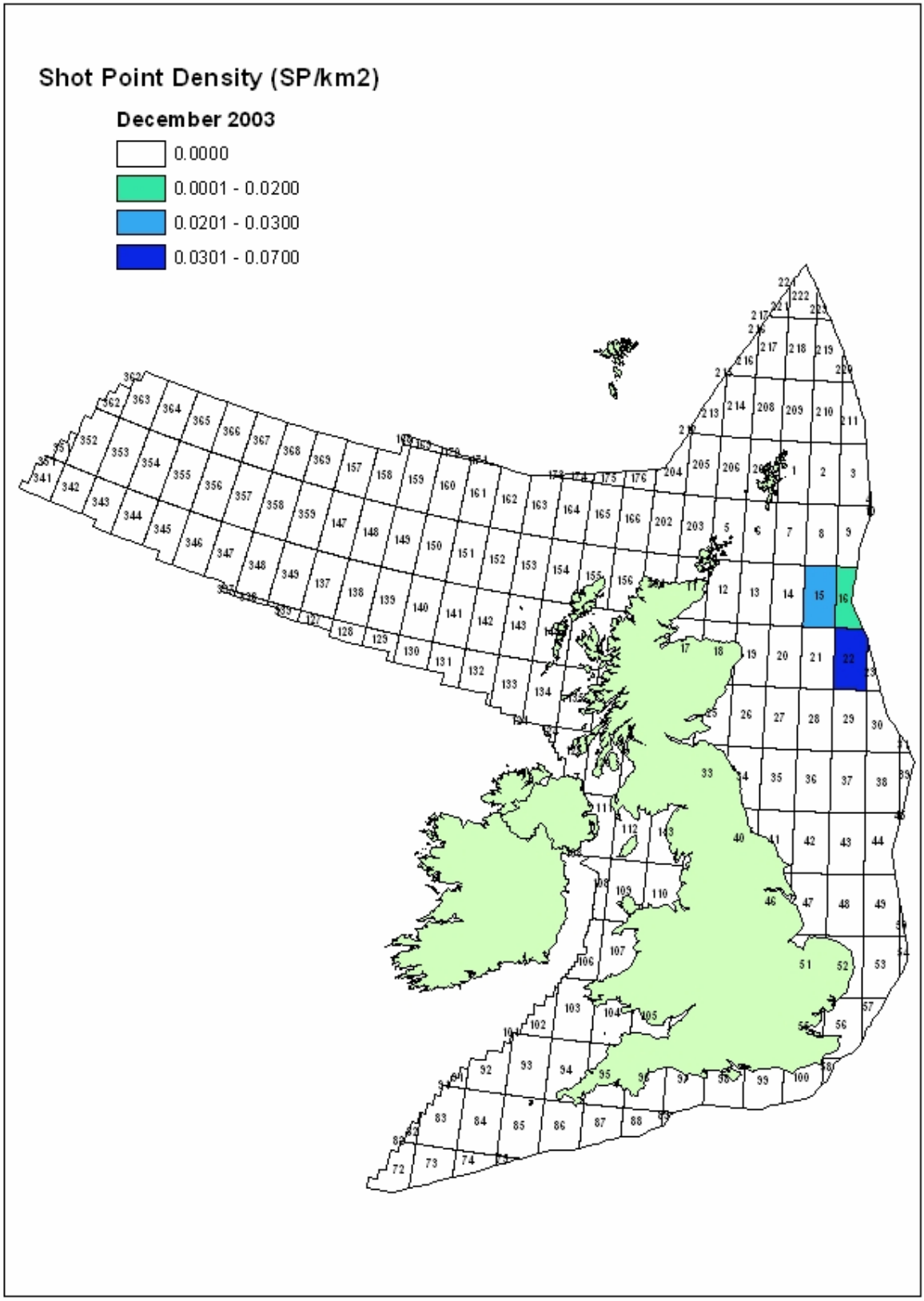

Shot Point Density (SP/km2)
July 2003
0.0000
0.0001 - 0.0100
0.0101 - 0.0700
0.0701 - 0.1200
0.1201 - 0.4400

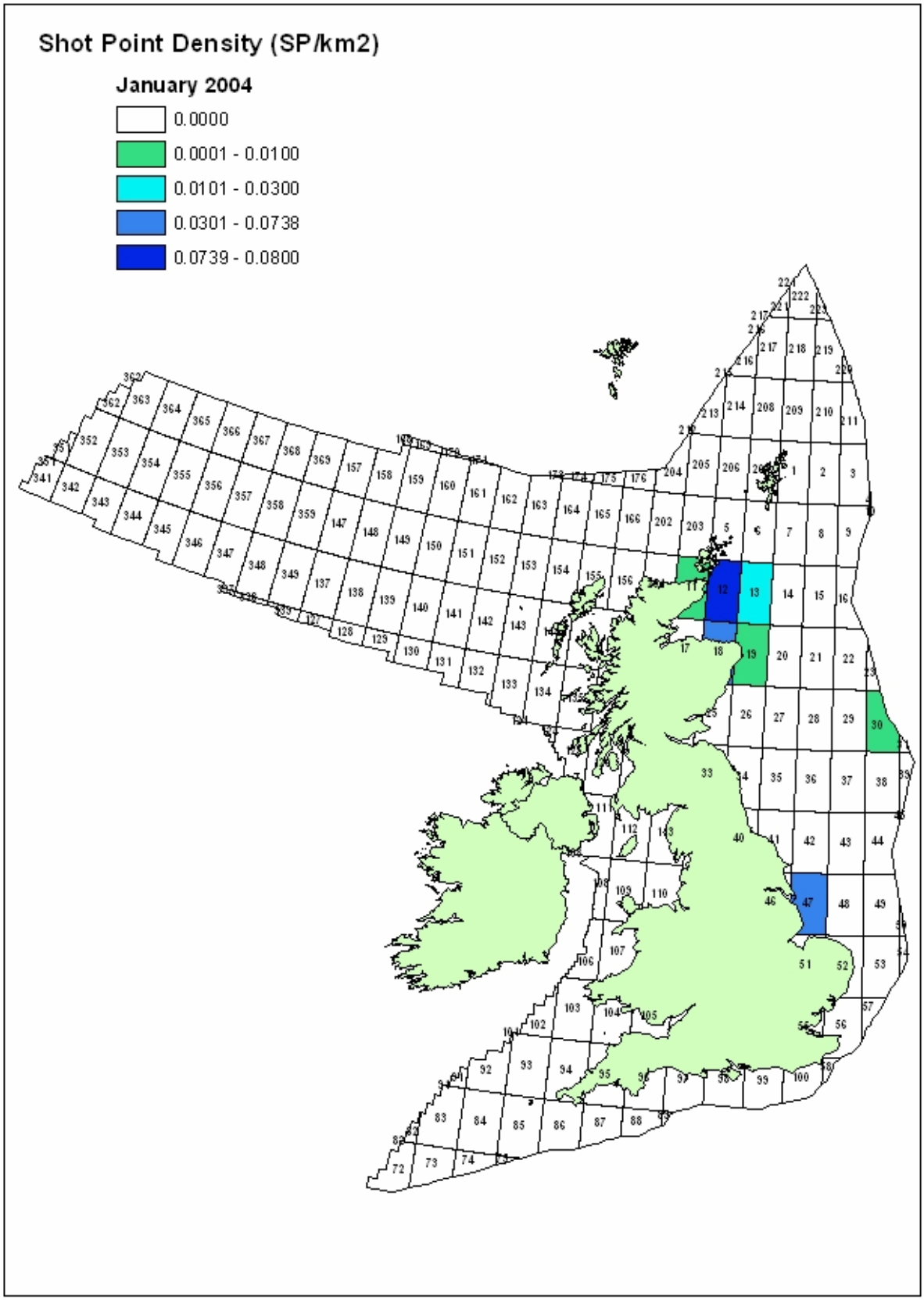

Shot Point Density (SP/km2)
August 2003
0.0000
0.0001 - 0.0200
0.0201 - 0.0600
0.0601 - 0.1100
0.1101 - 0.2400

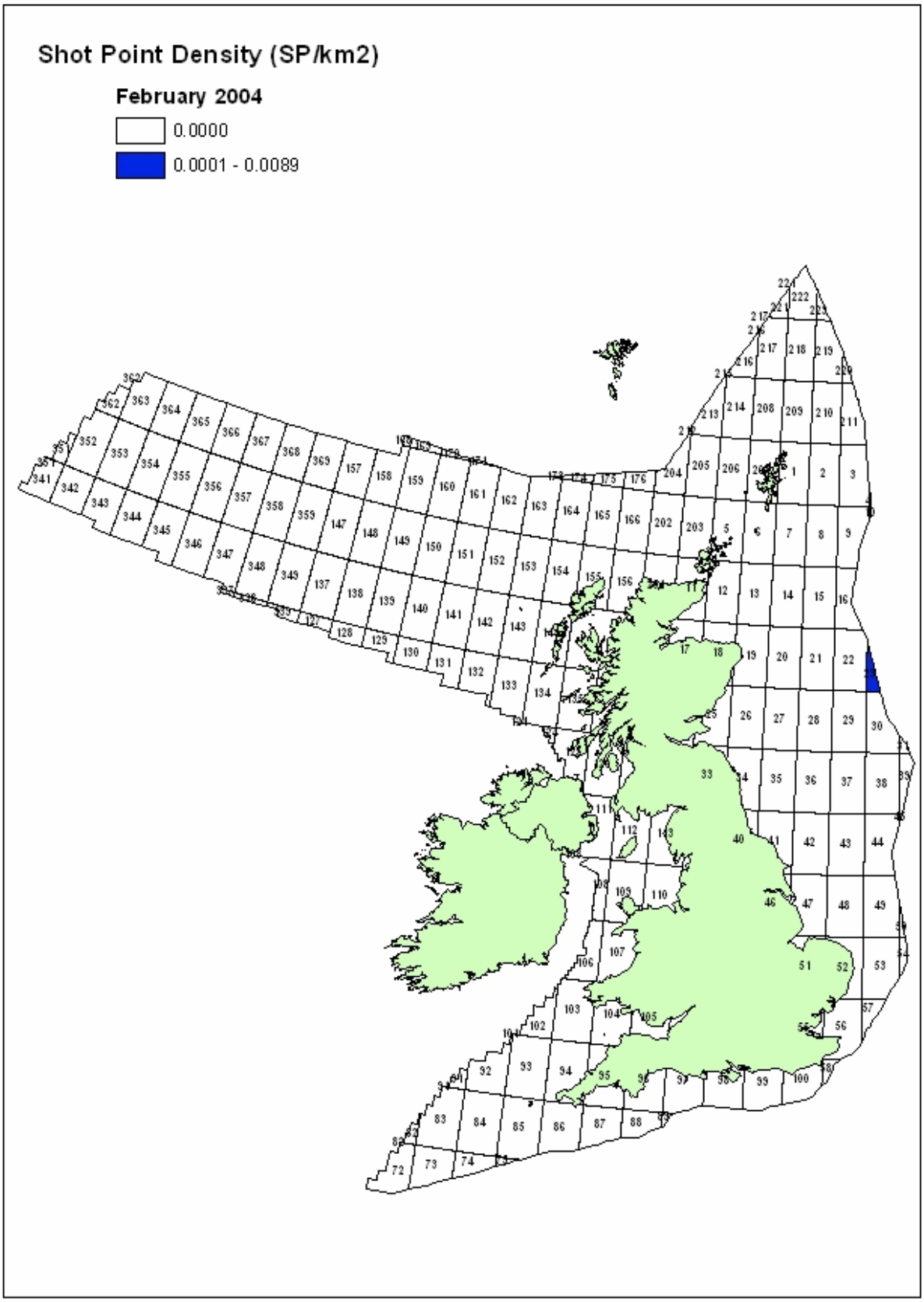

Shot Point Density (SP/km2)
September 2003
0.0000
0.0001 - 0.0100
0.0101 - 0.0200
0.0201 - 0.0300
0.0301 - 0.3870

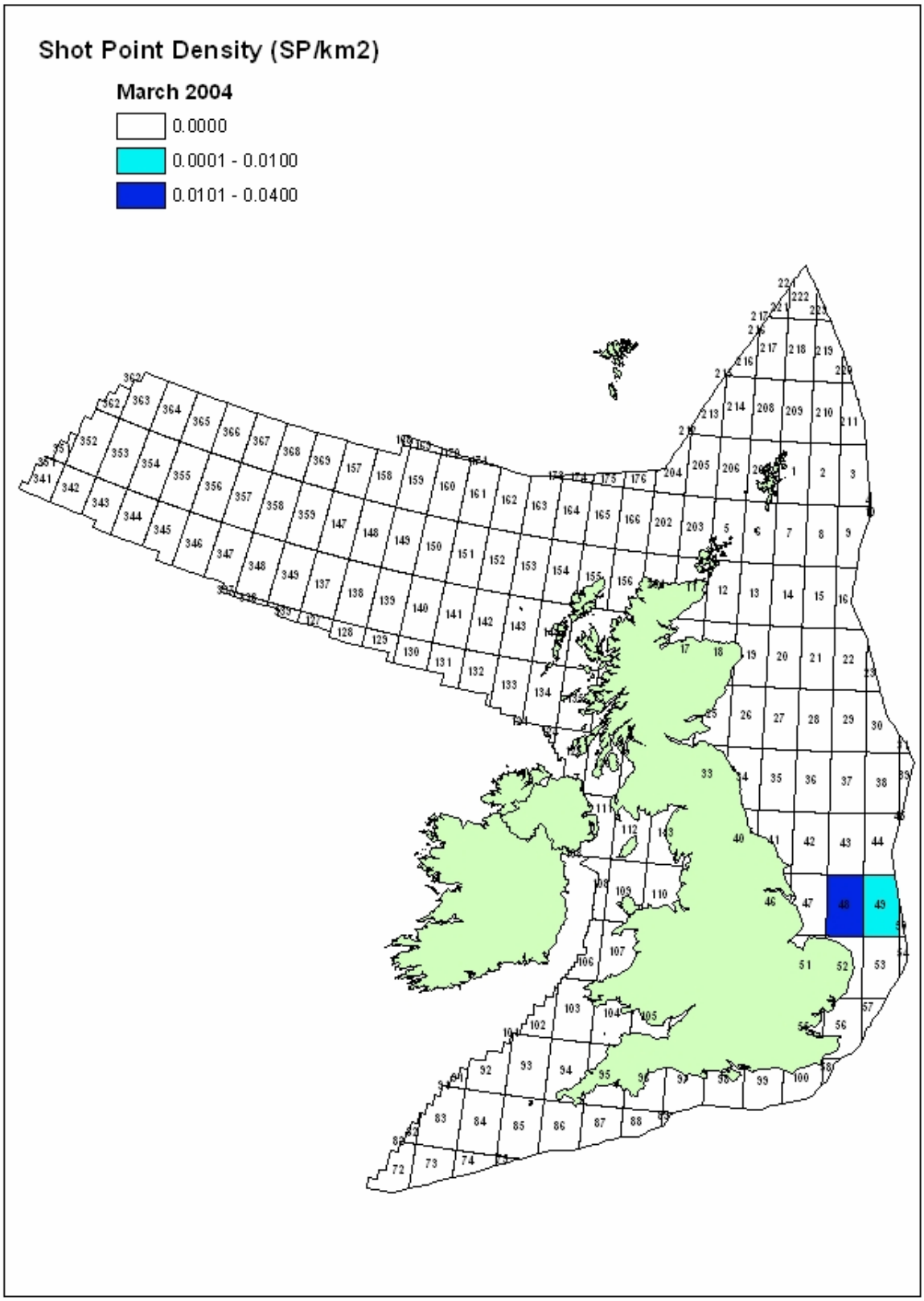

Shot Point Density (SP/km2)
October 2003
0.0000
0.0001 - 0.0047
0.0048 - 0.0100
0.0101 - 0.0200
0.0201 - 0.1100

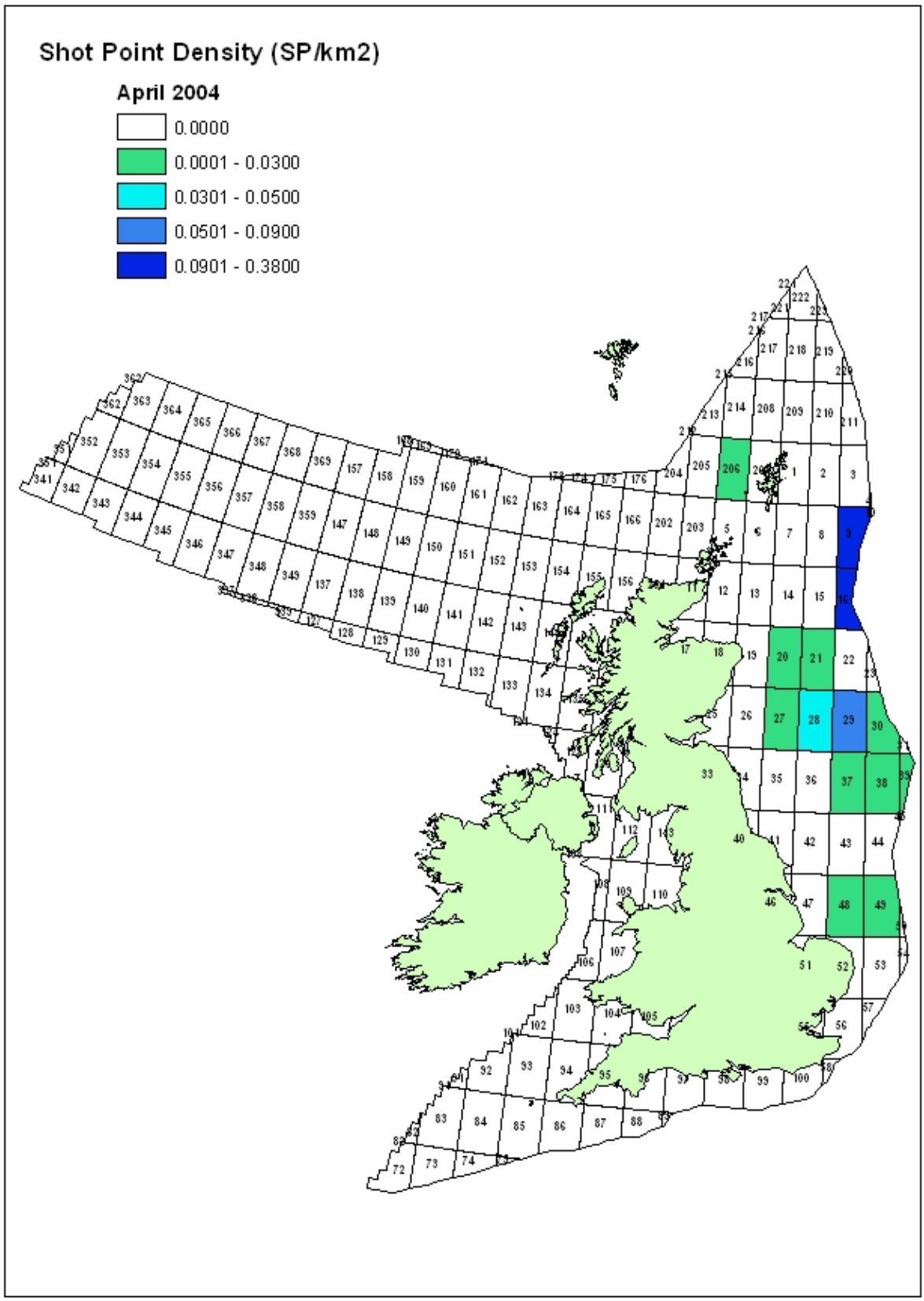

Shot Point Density (SP/km2)
November 2003
0.0000
0.0001 - 0.0055
0.0056 - 0.0100
0.0101 - 0.0300
0.0301 - 0.0351

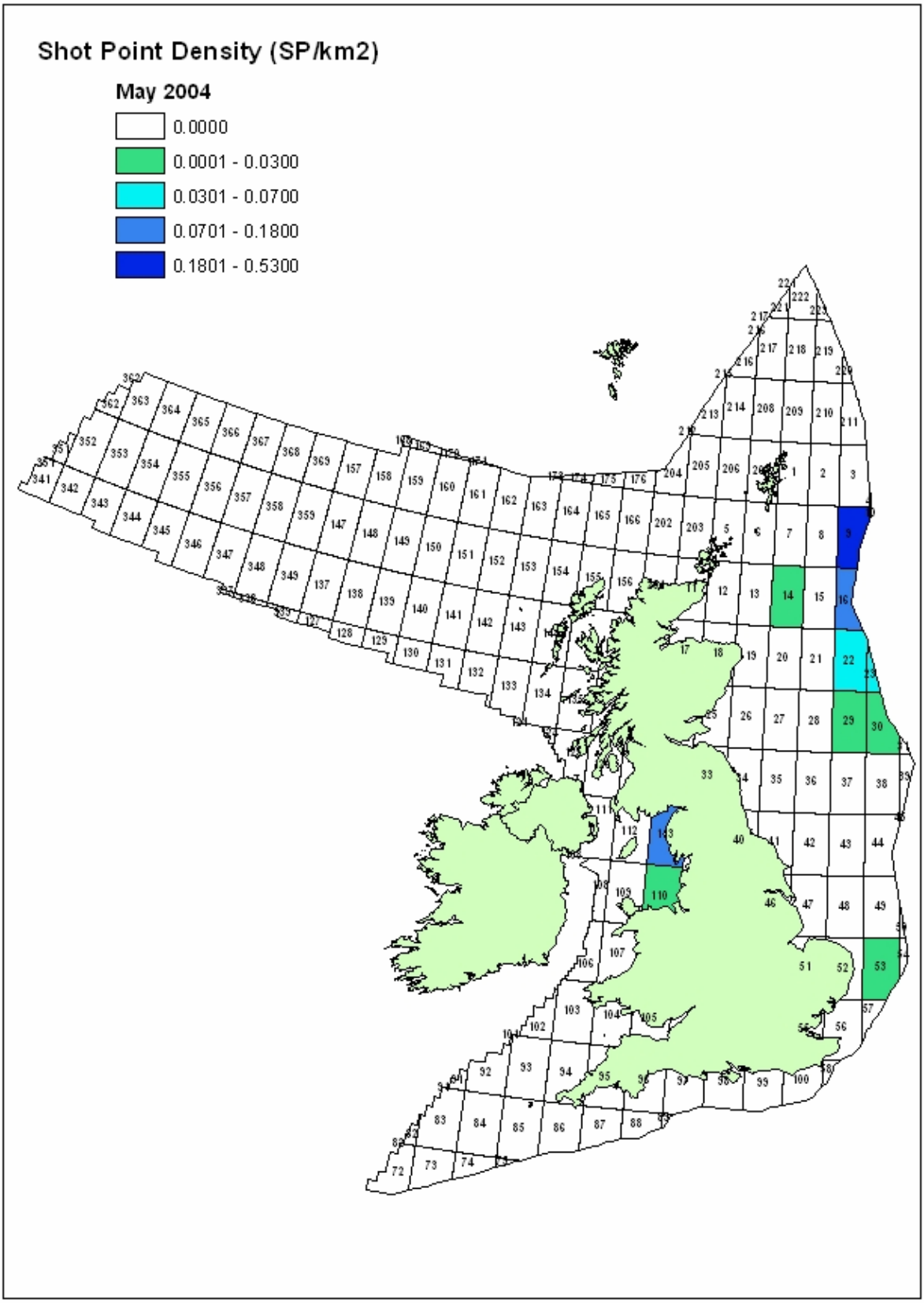

Shot Point Density (SP/km2)
December 2003
0.0000
0.0001 - 0.0200
0.0201 - 0.0300
0.0301 - 0.0700

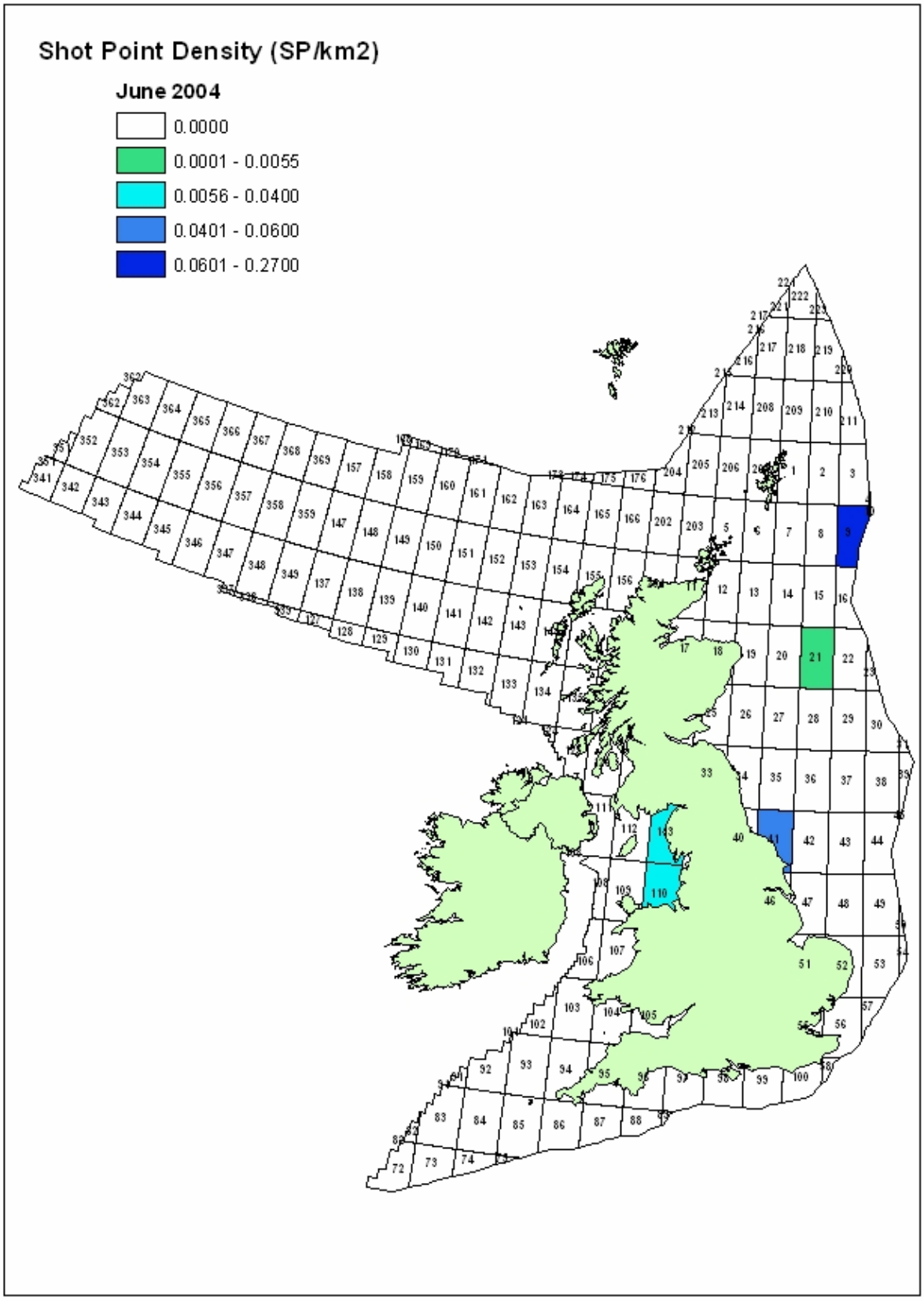

Shot Point Density (SP/km2)
January 2004
0.0000
0.0001 - 0.0100
0.0101 - 0.0300
0.0301 - 0.0738
0.0739 - 0.0800

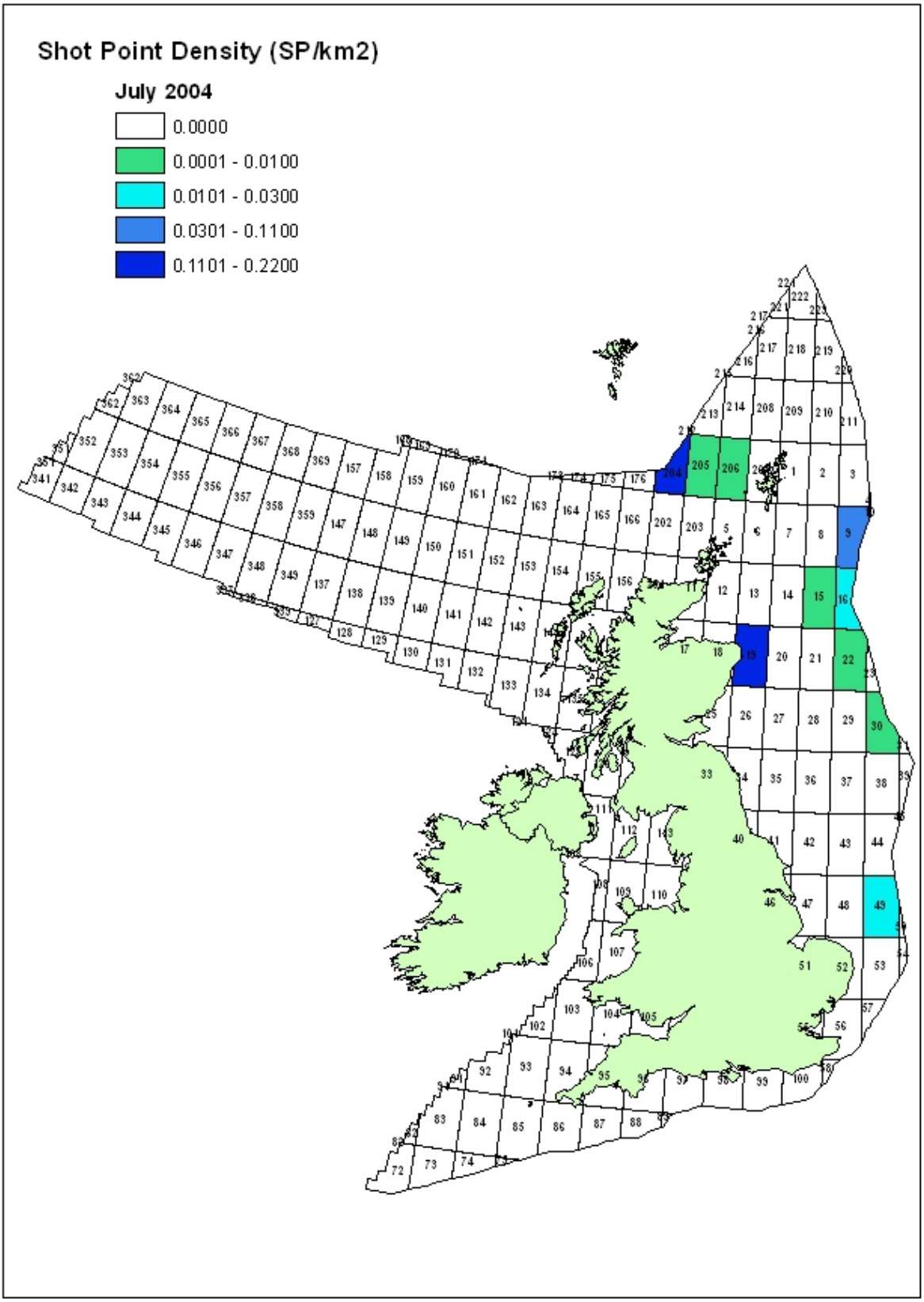

Shot Point Density (SP/km2)
February 2004
0.0000
0.0001 - 0.0089

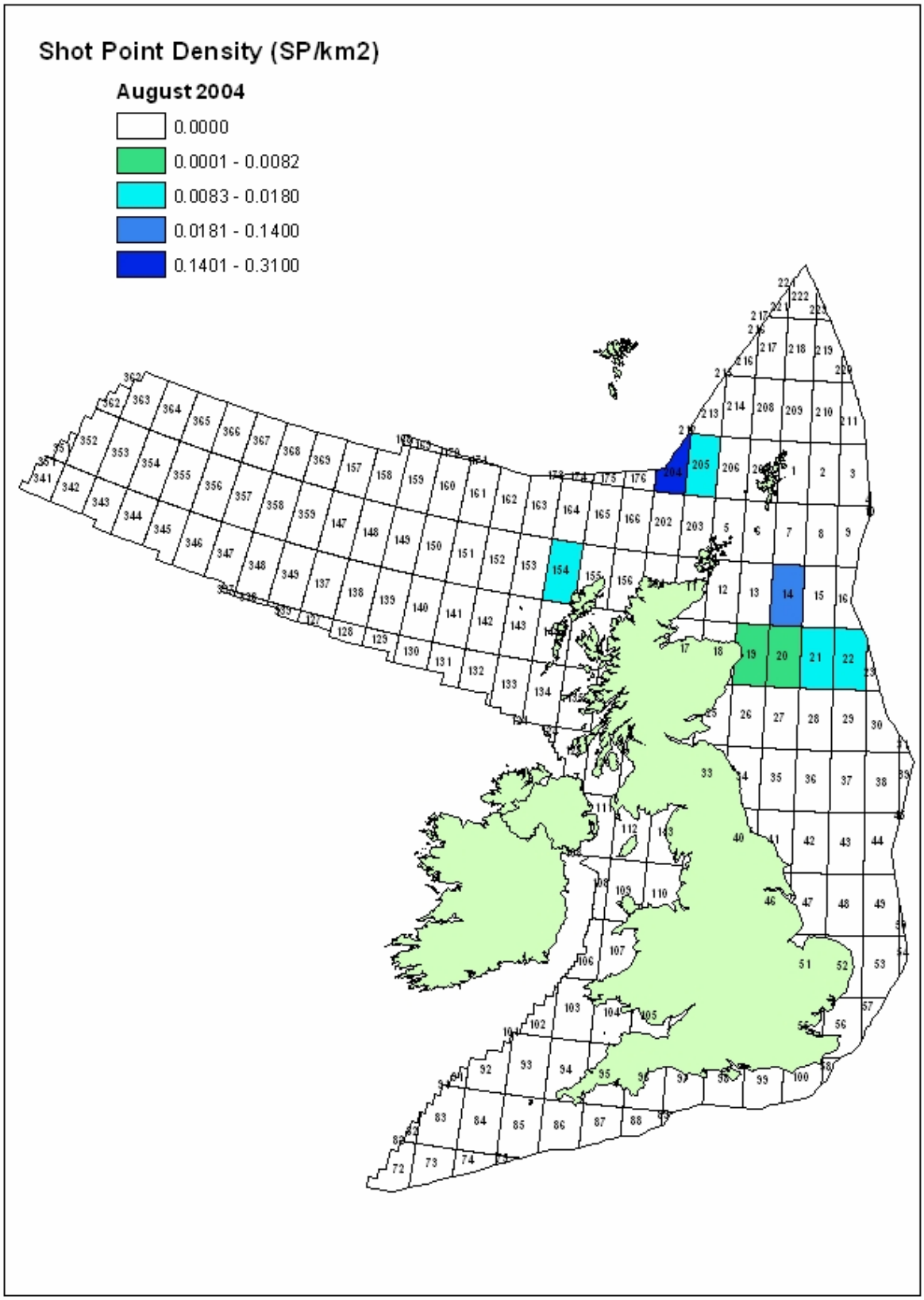

Shot Point Density (SP/km2)
March 2004
0.0000
0.0001 - 0.0100
0.0101 - 0.0400

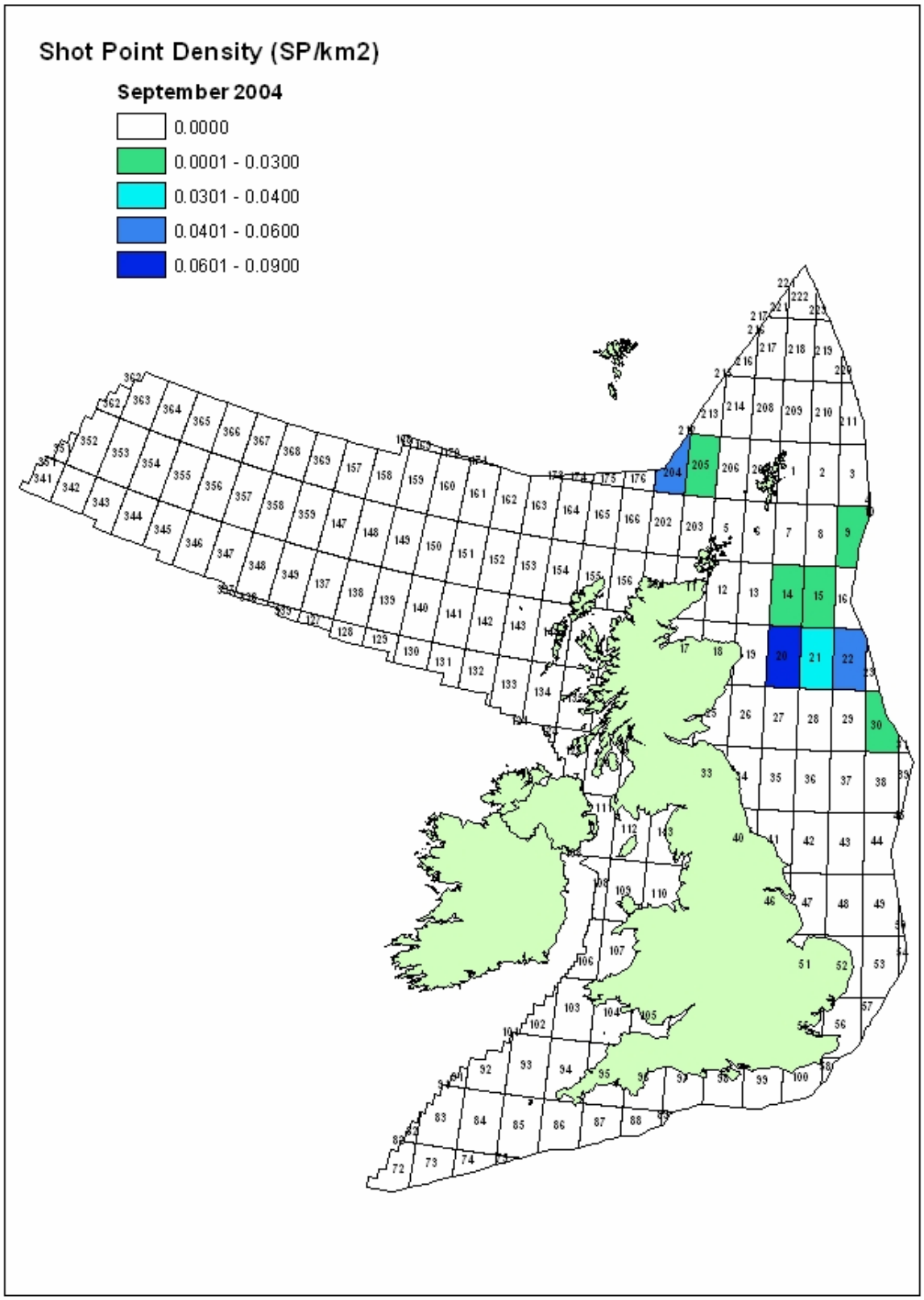

Shot Point Density (SP/km2)
April 2004
0.0000
0.0001 - 0.0300
0.0301 - 0.0500
0.0501 - 0.0900
0.0901 - 0.3800

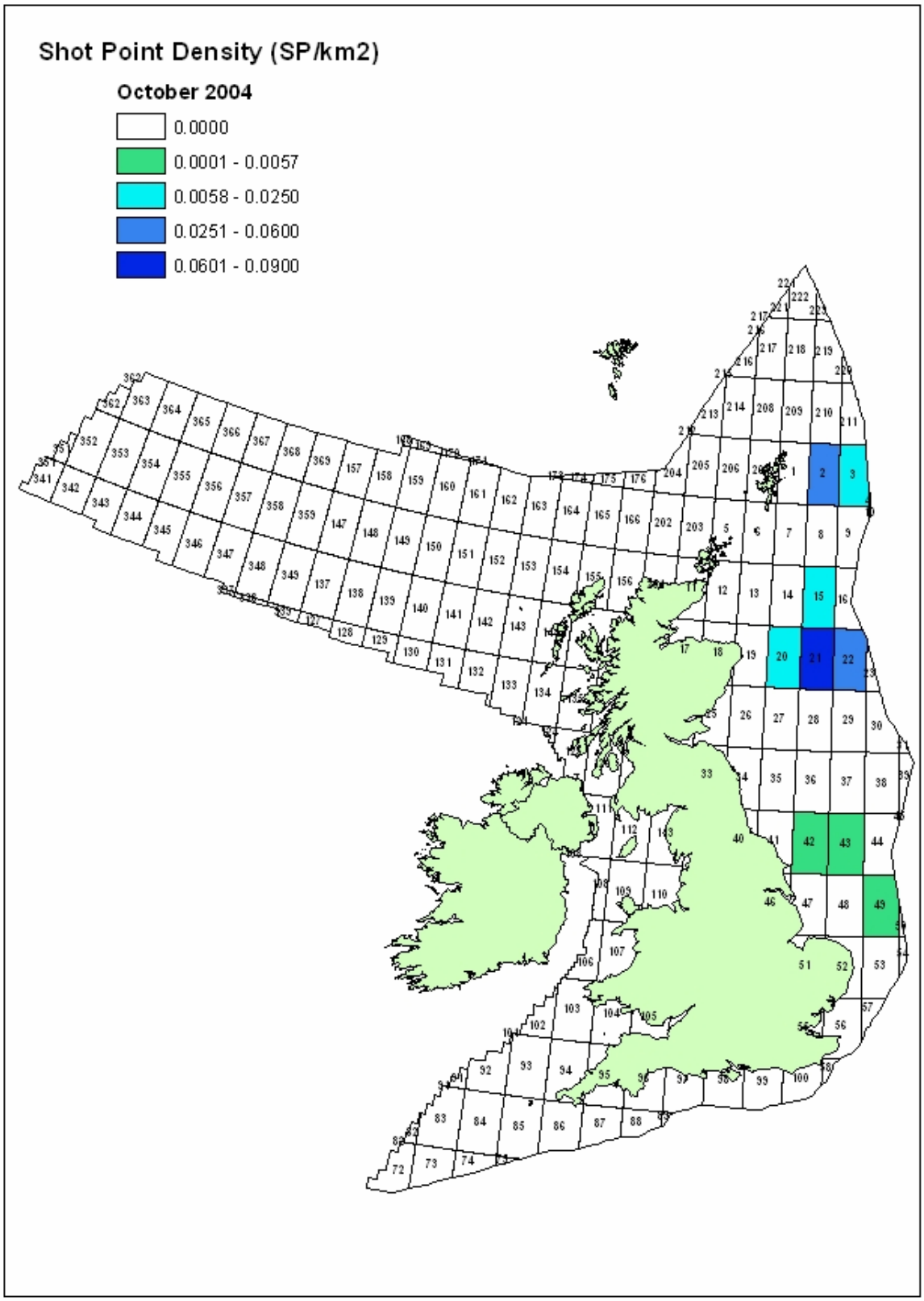

Shot Point Density (SP/km2)
May 2004
0.0000
0.0001 - 0.0300
0.0301 - 0.0700
0.0701 - 0.1800
0.1801 - 0.5300

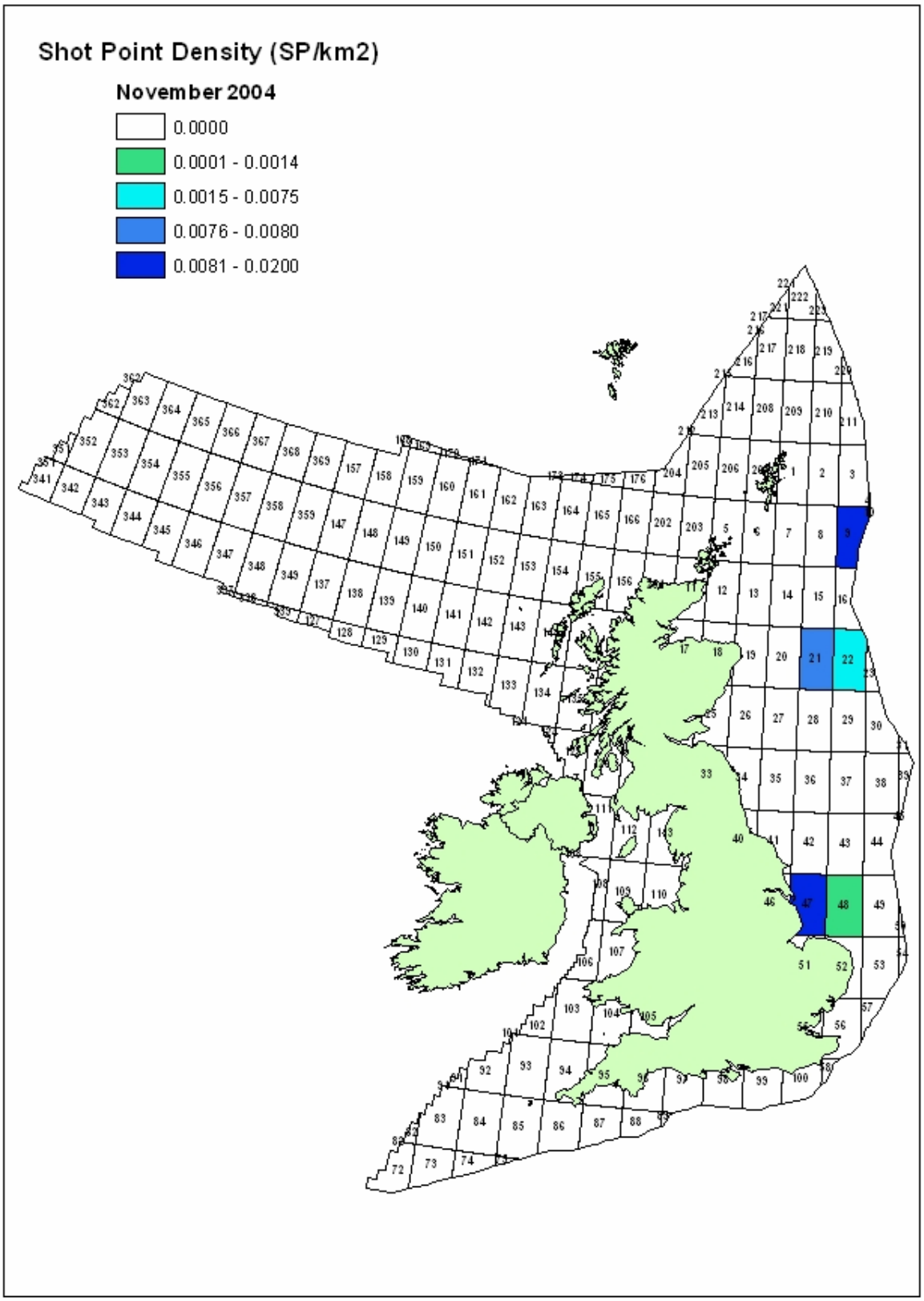

Shot Point Density (SP/km2)
June 2004
0.0000
0.0001 - 0.0055
0.0056 - 0.0400
0.0401 - 0.0600
0.0601 - 0.2700

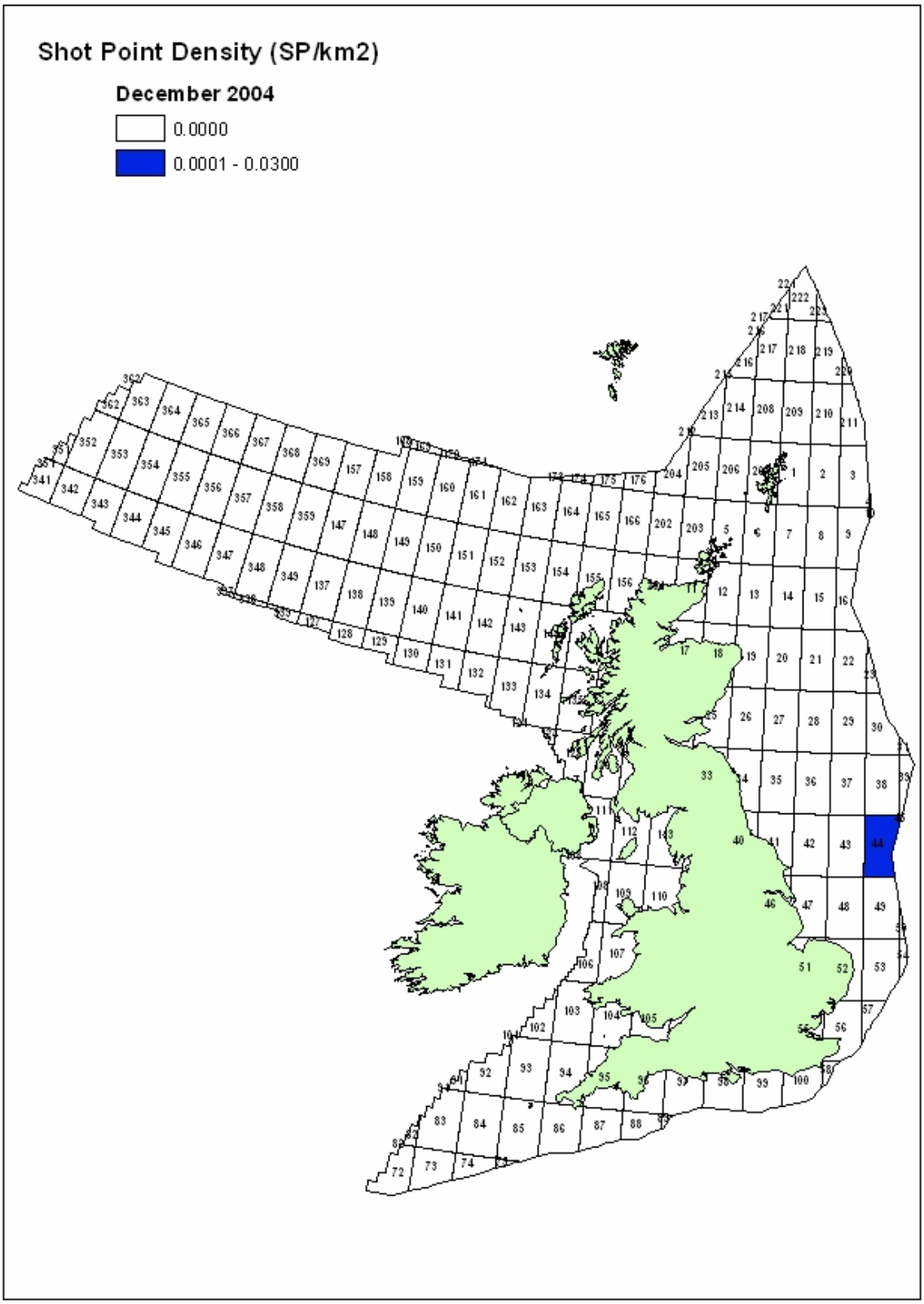

Shot Point Density (SP/km2)
July 2004
0.0000
0.0001 - 0.0100
0.0101 - 0.0300
0.0301 - 0.1100
0.1101 - 0.2200


Shot Point Density (SP/km2)
August 2004
0.0000
0.0001 - 0.0082
0.0083 - 0.0180
0.0181 - 0.1400
0.1401 - 0.3100


Shot Point Density (SP/km2)
September 2004
0.0000
0.0001 - 0.0300
0.0301 - 0.0400
0.0401 - 0.0600
0.0601 - 0.0900


Shot Point Density (SP/km2)
October 2004
0.0000
0.0001 - 0.0057
0.0058 - 0.0250
0.0251 - 0.0600
0.0601 - 0.0900


Shot Point Density (SP/km2)
November 2004
0.0000
0.0001 - 0.0014
0.0015 - 0.0075
0.0076 - 0.0080
0.0081 - 0.0200


Shot Point Density (SP/km2)
December 2004
0.0000
0.0001 - 0.0300