

Agenda Item 4.4

Priorities in the Implementation of the  
Triennium Work Plan (2010-2012)  
Review of New Information on the Extent of  
Negative Effects of Sound

Document 4-10

**Information on Seismic Activities  
carried out by the United Kingdom in  
2010**

**Action Requested**

- Take note of the report

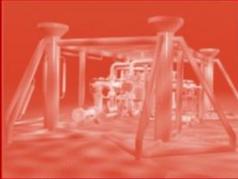
Submitted by

United Kingdom



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## Information on Seismic Activities carried out by the United Kingdom in 2010

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B2	16/03/11	Final report incorporating comments	CB	MOS	CB
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## GLOSSARY

Airgun	A device used for seismic surveying which releases air at high pressure
Array	An arrangement of airguns
Licence Block	UKCS licences are arranged into quadrants and blocks, there are typically 30 licence blocks in a whole quadrant
2D surveys	2-Dimensional surveys that use a single airgun array
3D surveys	3-Dimensional surveys that use a twin array configuration, the subsequent processing of this seismic information builds up a 3-D image of the subsurface
4D surveys	A type of 3-Dimensional survey which is repeated with time, typically used to monitor changes in a reservoir following a period of production
Shot	The release of pressure in an airgun, seismic surveys may consist of thousands of individual shots
Site surveys	Defined as seismic surveys whose volume is either equal or less than 200 cubic inches, these surveys provide information about the upper layers of the seabed surface and are not used to look for hydrocarbons
Shot point density	The number of times an airgun was known to be shot in a given area
Quadrant	For licensing purposes the UKCS is divided up into quadrants of 1 degree longitude by 1 degree latitude, quadrants are not all the same area

## 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](http://www.ukdeal.co.uk)).

At the 12<sup>th</sup> 13<sup>th</sup> and 14<sup>th</sup> meeting of the Advisory Committee to ASCOBANS (March 2005, April 2006 and April 2007), the UK presented data on 2D and 3D seismic survey activity in the UK maritime area for 1997-2003 and 2004-2005, respectively. At the 16<sup>th</sup> meeting the UK presented data on 2D and 3D seismic survey activity in the UK maritime area for 2007 and 2008. This was in accordance with agreements reached at the 7<sup>th</sup> meeting of the Advisory Committee to ASCOBANS (March 2000) and at the 4<sup>th</sup> Meeting of the Parties in the Report of Working Group II (August 2003). The UK seismic data for the year 2008- 2009 was presented to ASCOBANS part of the documents submitted by the UK at the 17<sup>th</sup> Meeting of the ASCOBANS Advisory Committee.

The following agreed information is collected and reported:

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

This report continues the reporting of 2D and 3D seismic survey activity for 2009 to 2010 and for the first time collates information on 4D seismic activity.

This report analyses seismic data from airgun sources from 2D, 3D and 4D surveys that were in excess of airgun volumes categorised as 'site surveys', which are typical surveys of short duration that use small airguns with a volume of less than 200 cubic inches.

The Department of Energy and Climate Change (DECC) has made several changes to the way it records information obtained from seismic surveys and it now collects more detailed information in comparison to previous years on specifics such as the airgun volume, shot point interval and mitigation measures that are required as part of the survey permit. There is now much more scope for conducting further analysis of seismic data at a later stage, if necessary.

This report has conducted a detailed assessment of the yearly distribution of seismic activity for the 'larger' surveys in the UKCS for 2009. There has been no detailed assessment of the types of airgun volumes that were used. There were a small number of surveys that the DECC granted consent which did not utilise airguns as the seismic source and are therefore excluded from this analysis.

## 2. BASIS OF CALCULATION

Shot point density (SP/km<sup>2</sup>) 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 has been to calculate shot point density the methodology below has been applied in previous years reports detailing the seismic activity in UKCS from 1997-2009 and is used as the basis for this report.

- 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<sup>2</sup>. It is assumed that shot point density is uniform within the outline polygon of the survey area.
- The 2D and 3D shots were then added together for each quadrant and the shot point density calculated by dividing the number of shots per quadrant per month and per year by the offshore area of each quadrant.
- For 3D surveys which covered more than one quadrant the total area surveyed per quadrant was calculated by dividing the total area surveyed proportionally by the length of line shot within each quadrant.

4D surveys have been increasingly used by the oil and gas industry to precisely monitor changes in reservoirs and to assist in the optimum production. Previous years reports had omitted 4D data as there had been no agreed methodology to calculate the shot point density. As there were 5 surveys in the UKCS that used 4D surveys omitting this data source would misrepresent the distribution of shot point density from surveys which use 'large' airgun arrays in the UKCS. For the purposes of this report 4D data was treated as if it was 3D data.

### 2.1 SUMMARY OF SEISMIC SITE SURVEYS

A detailed analysis of the temporal and spatial distribution of site surveys was beyond the scope of this report. Detailed information on all types of geophysical surveys, including site surveys is collected as part of the consenting process by DECC, and therefore further analysis of the site survey data including its seasonal distribution across the UKCS is possible from the information available.

During 2009-2010 a total of 63 site surveys were granted consent, of which 10 were postponed and 53 survey were carried out. Of the 53 site surveys carried out 45 close out reports were received (see Section 3.3 Data Gaps). Of the site surveys close out forms received the total distance surveyed was 6175.4 km. Assuming 40 shots per kilometre surveyed, these 45 surveys correspond to 247,016 shot points.

There were other kinds of geophysical site survey undertaken that did not use airguns as their main source and have not been included in the analysis, this included those using Controlled Source Electro-Magnetic (CSEM), side-scan sonar, swathe bathymetry and other forms of geophysical investigations.

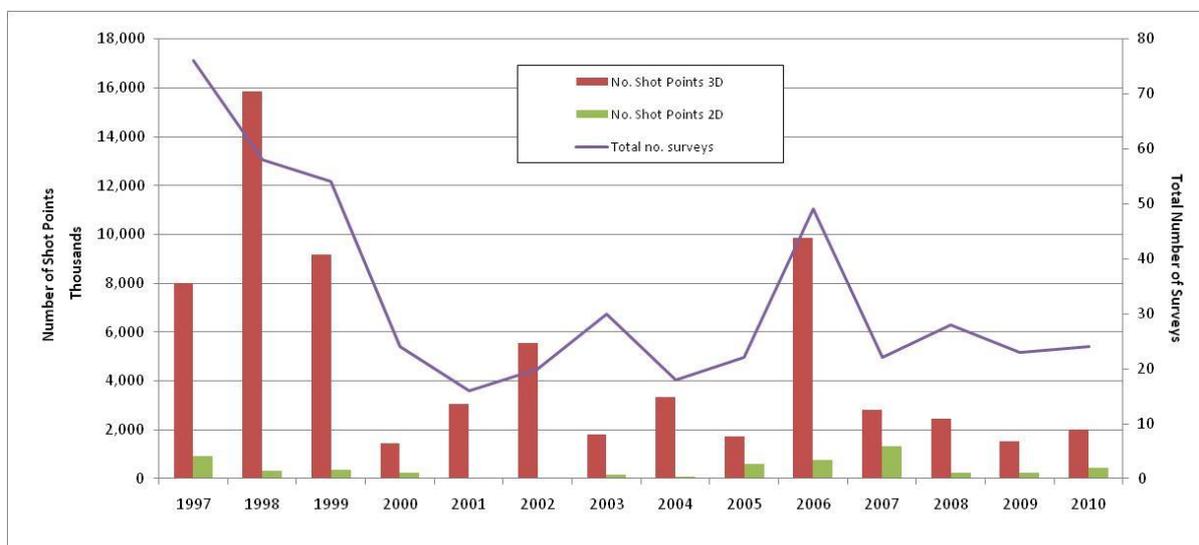
### 3. RESULTS

#### 3.1 OVERVIEW OF RESULTS

A summary of 2D and 3D and 4D seismic survey activity is shown in Figure 1. The data for 4D surveys were combined with 3D surveys. The majority of survey activity (measured by number of shot points) in 2010 was 3D, this is consistent with observations from 1997-2009. The total number of 2D, 3D and 4D seismic surveys which were carried out in the UKCS and for which the close out reports were submitted was 20, the breakdown of the types of survey were 2D surveys (n=8), 3D surveys (n= 7) and 4D surveys (n= 5). The data gaps in the results are discussed in Section 3.3.

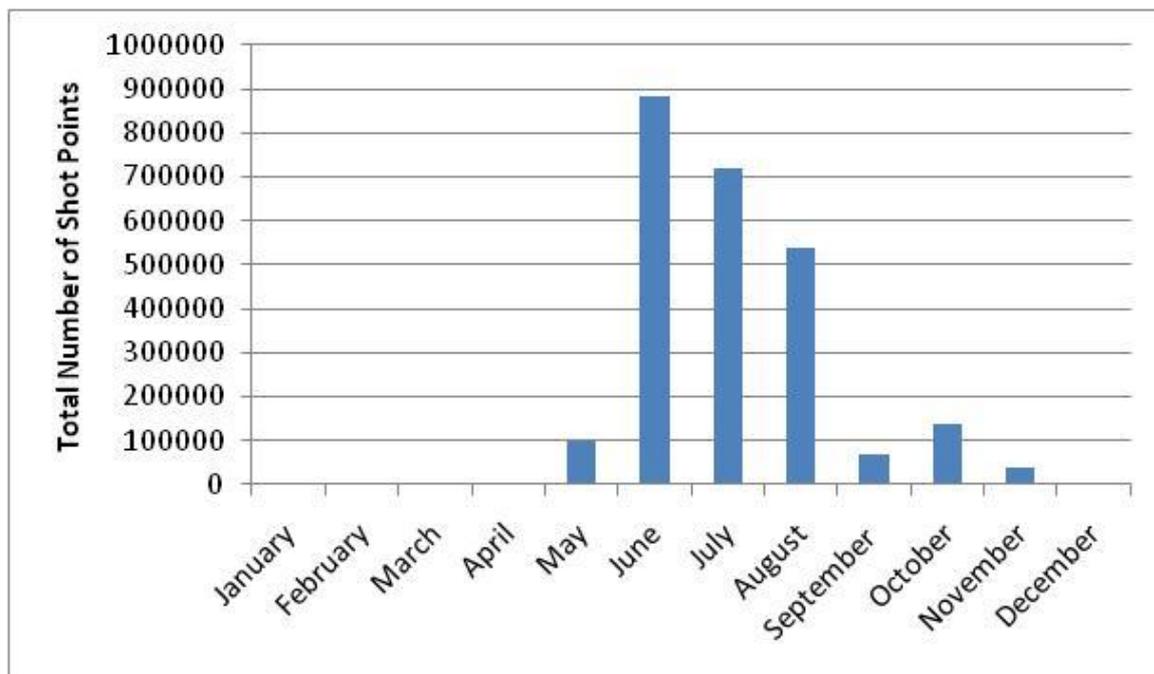
The survey activity for 2010 (n=24) was comparable to 2009 although the total survey activity was considerably lower than the peaks in activity that occurred in the late 90’s and 2006. The total number of shot points that were calculated for 2D and 3D surveys has increased in comparison to 2009. The increase in the number of 3D shot points would also be a reflection of the inclusion of the 4D surveys (n=5).

Figure 1 Overview of Seismic activity 1997 -2010



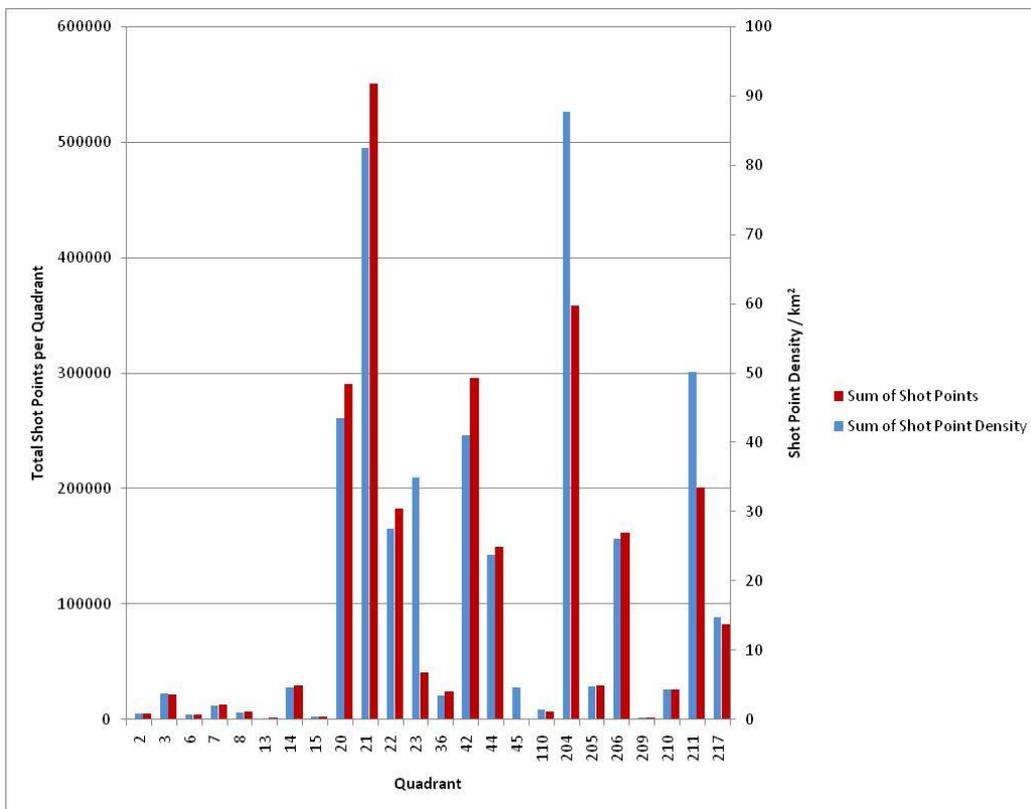
The amount of survey activity can also be represented as the total number of shot points per month (Figure 2). Larger seismic surveys tend to be planned for the summer months when the weather conditions are more favourable for data collection; the months of June had the highest number of shot points followed by July and August. No shot points occurred in the winter months between December until March and a relatively small amount of shot points (3000) occurred in April.

Figure 2 The total number of shot points per month in 2010



The sum of the monthly total number of shot points and the sum of the monthly shot point density has been plotted together for each of the quadrants surveyed for the 2010 period and is shown in Figure 3. The quadrant with the highest amount of seismic activity recorded (using the total number of shot points as the basis) was quadrant 21. Quadrant 204 recorded the highest shot point density of 87.74 Shot Points per km<sup>2</sup> in 2010.

Figure 3 Total Shot Points and Shot Point Density per Quadrant in 2010



### 3.2 MONTHLY SPATIAL ANALYSIS

Monthly plots of shot point density by quadrant have been constructed from the post-survey reports submitted to the DECC and JNCC. These are shown in Appendix A. The quadrant with the highest monthly shot point density was quadrant 204 and this was in June (49.76 shot points per km<sup>2</sup>).

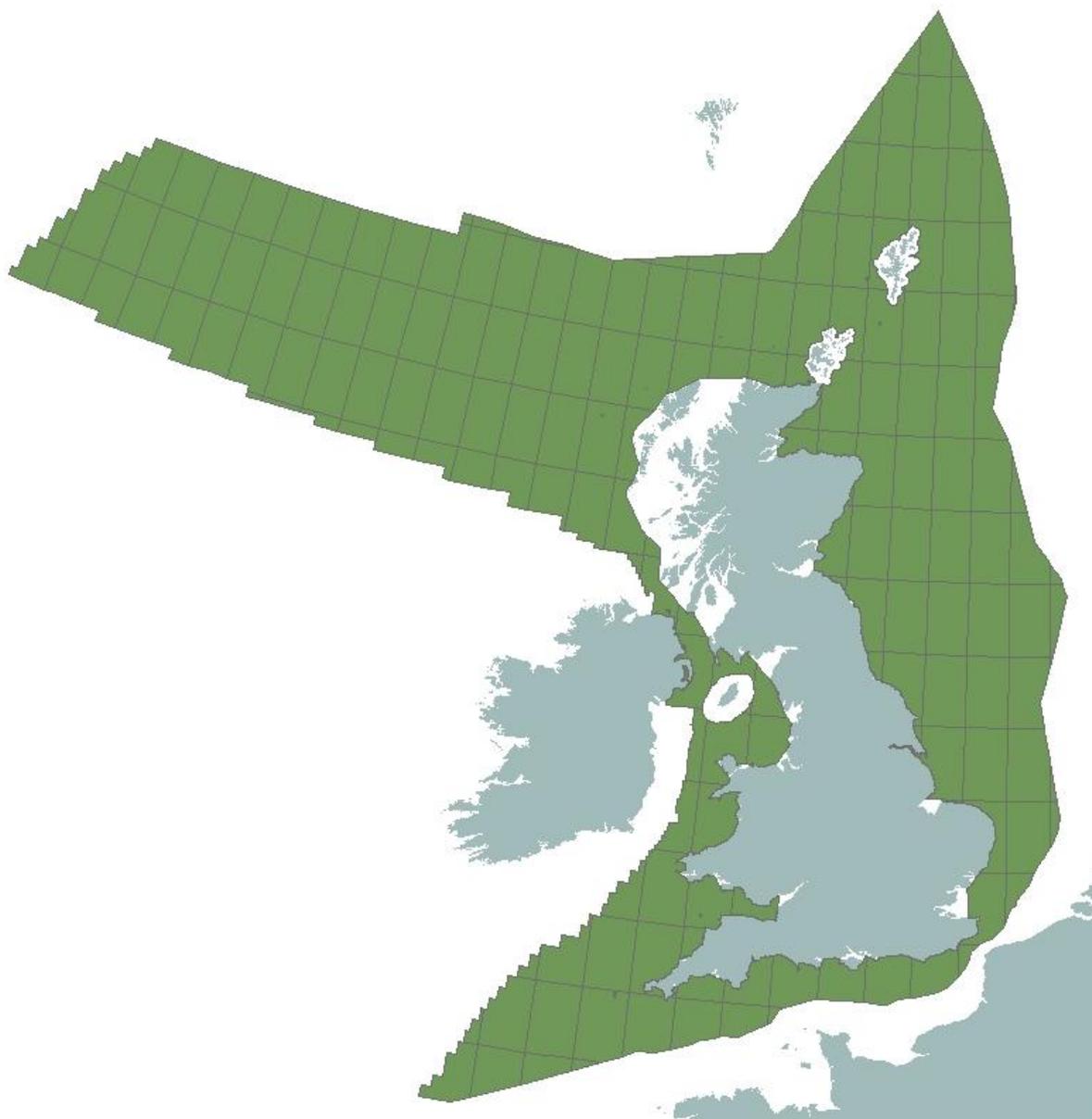
### 3.3 DATA GAPS

Of the 24 large 2D, 3D or 4D surveys that were granted consent in the 2009-2010 period 16 close out forms were received, 4 of these surveys were delayed or partially completed and a further 4 were complete but the close out form had not been received by .

During 2009-2010 there were a total of 63 site surveys were granted consent. Of these 10 surveys were postponed and their close out forms are not due until 2011. From the close out forms that DECC were expecting to receive (n=53) a total of 45 were returned (85%).

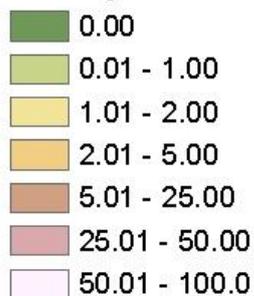
It should be noted this report was prepared at the start of February 2010 and there is a 12 week post-survey period in which operators submit their close-out forms. Thus, additional 2010 close-out forms may be submitted subsequent to the completion of this report which would increase the percentage of post-survey reports completed.

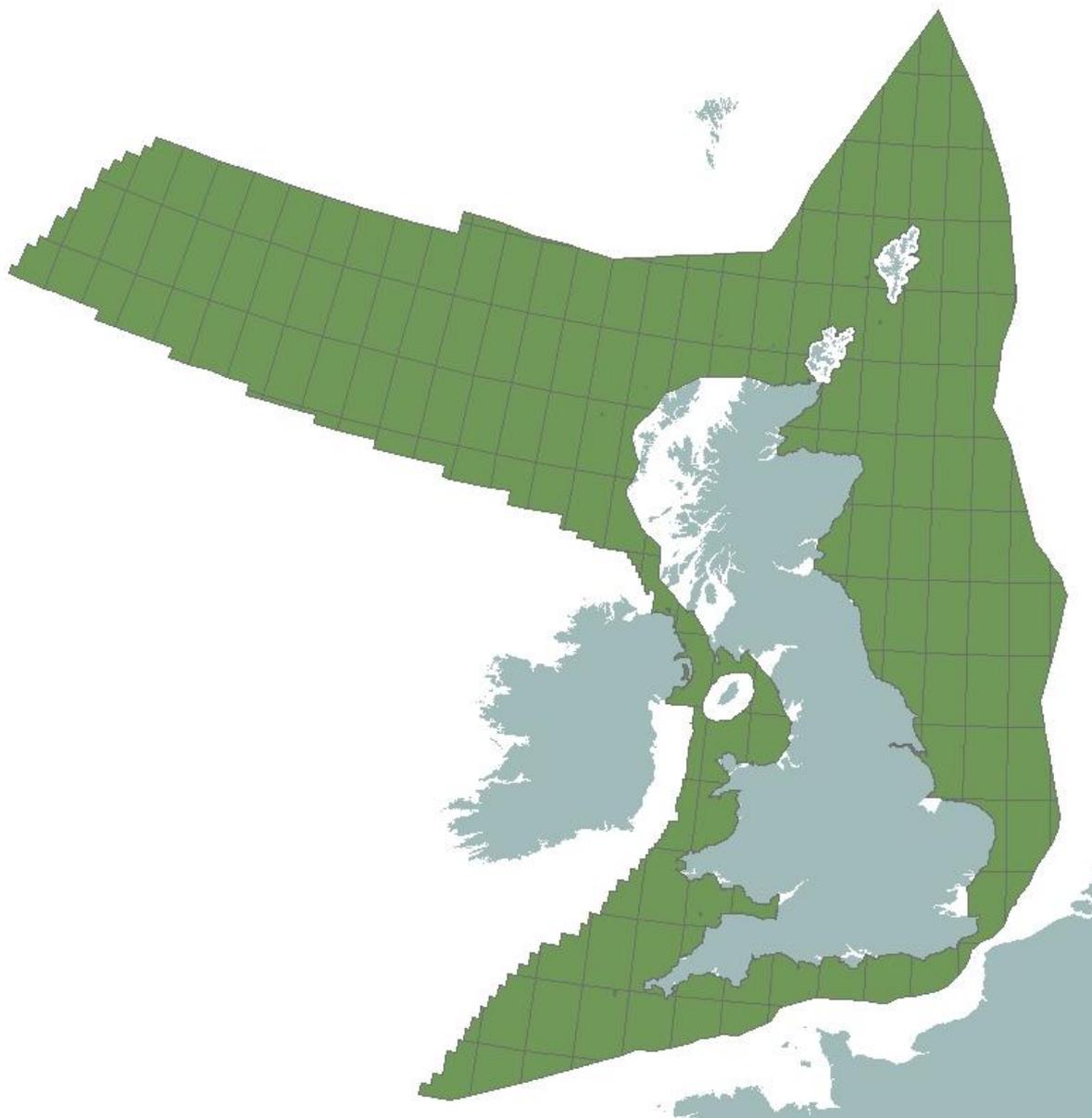
APPENDIX A – MONTHLY SHOT POINT PLOTS 2010



**Shot Point Density 2010 (SP/km<sup>2</sup>)**

**January**

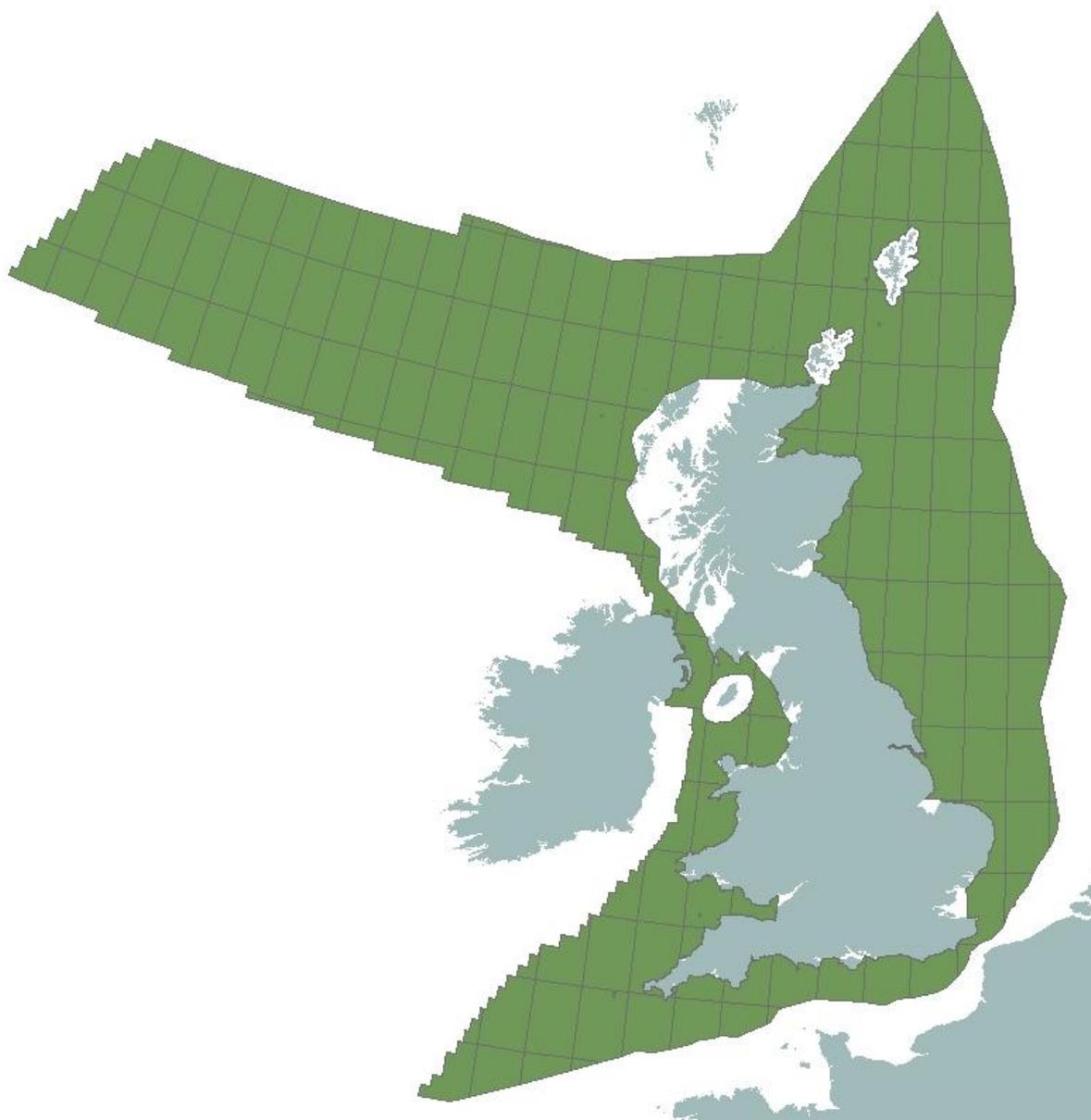




**Shot Point Density 2010 (SP/km<sup>2</sup>)**

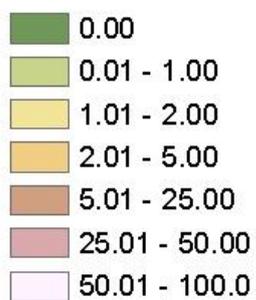
**February**

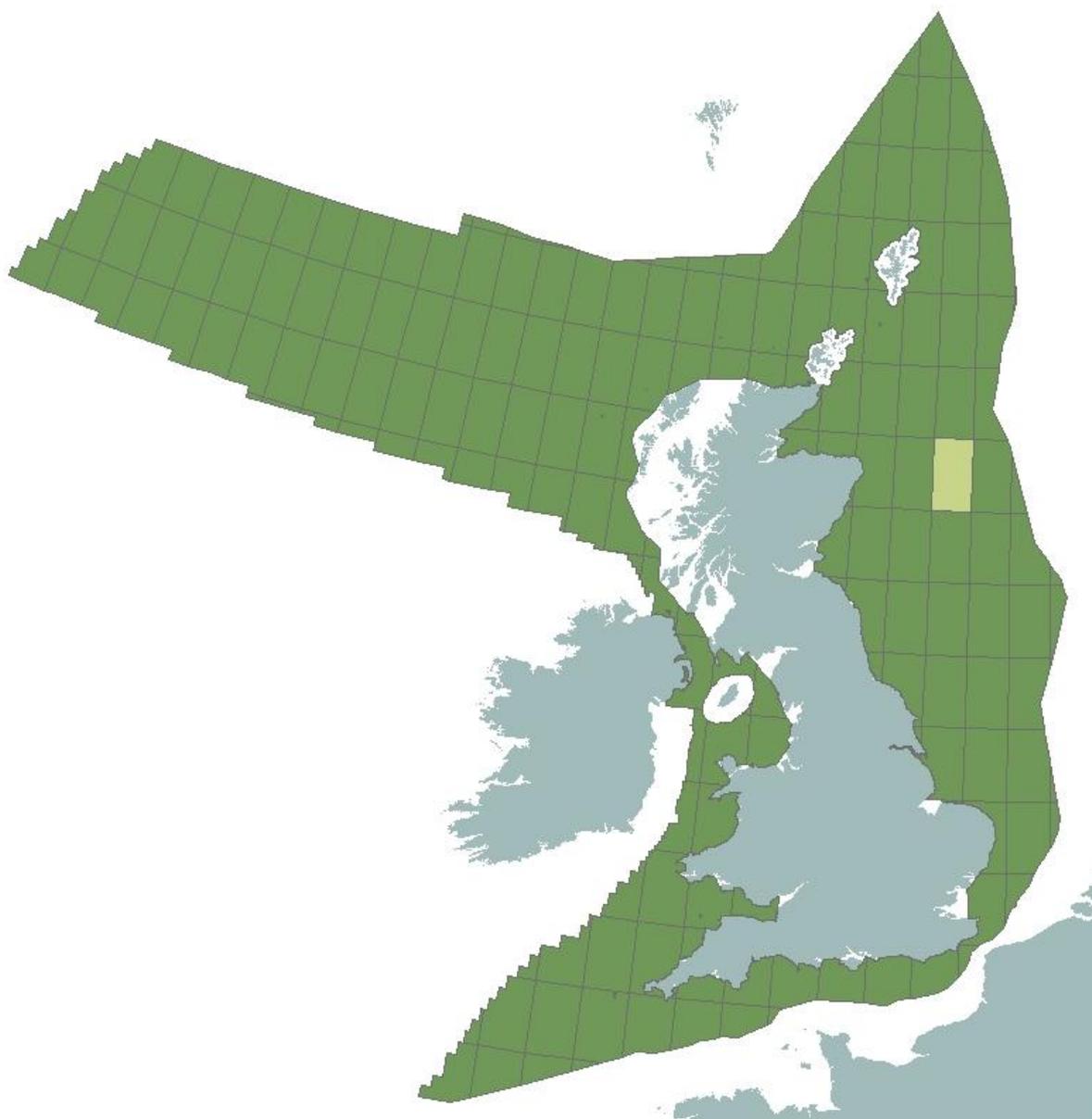




**Shot Point Density 2010 (SP/km2)**

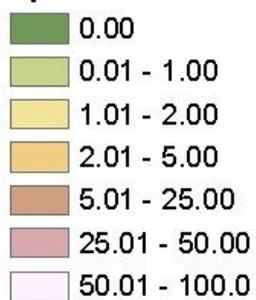
**March**

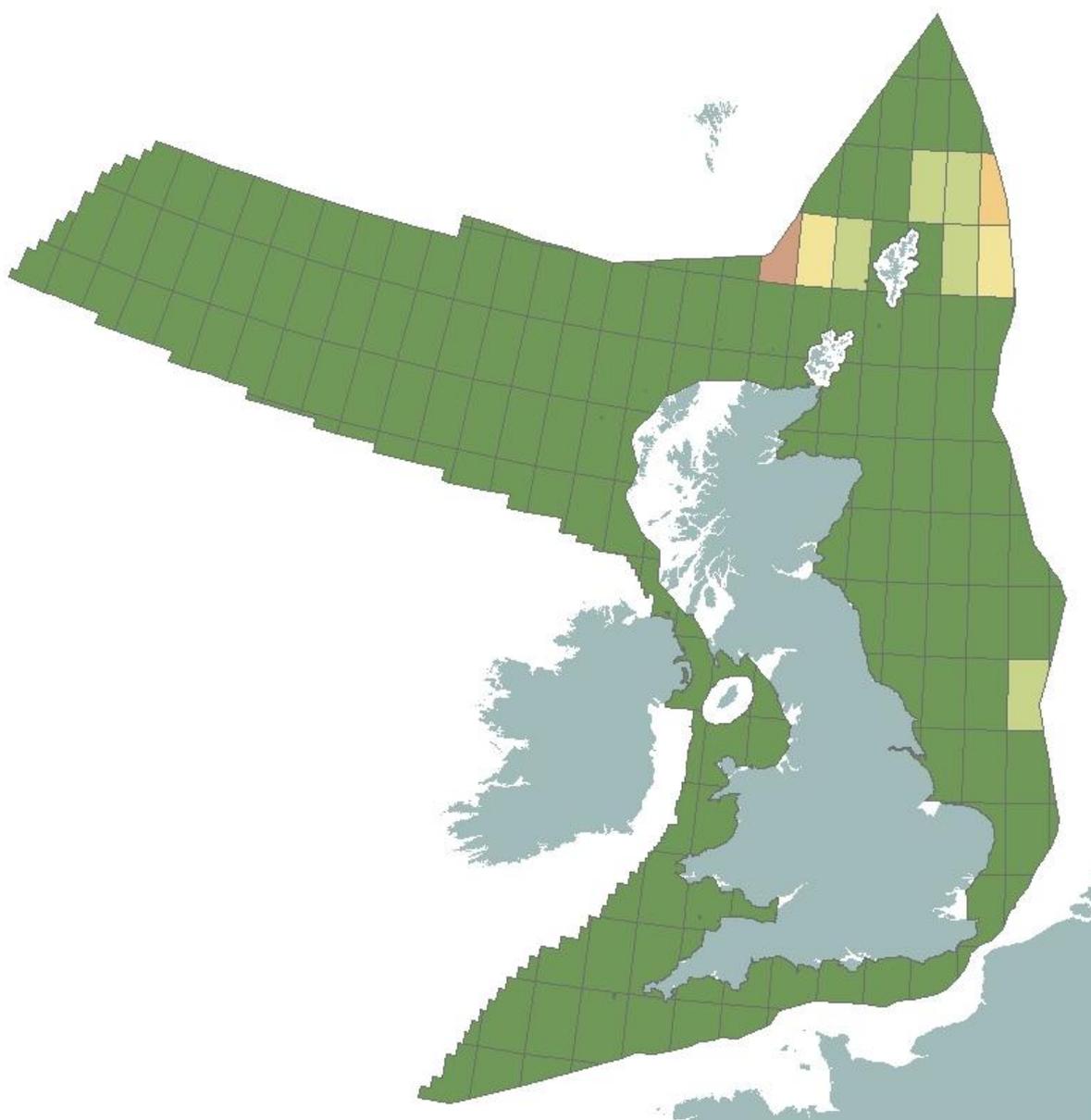




**Shot Point Density 2010 (SP/km2)**

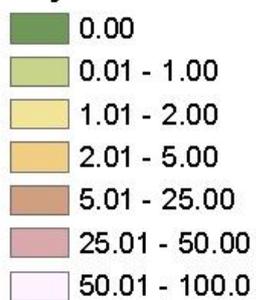
**April**

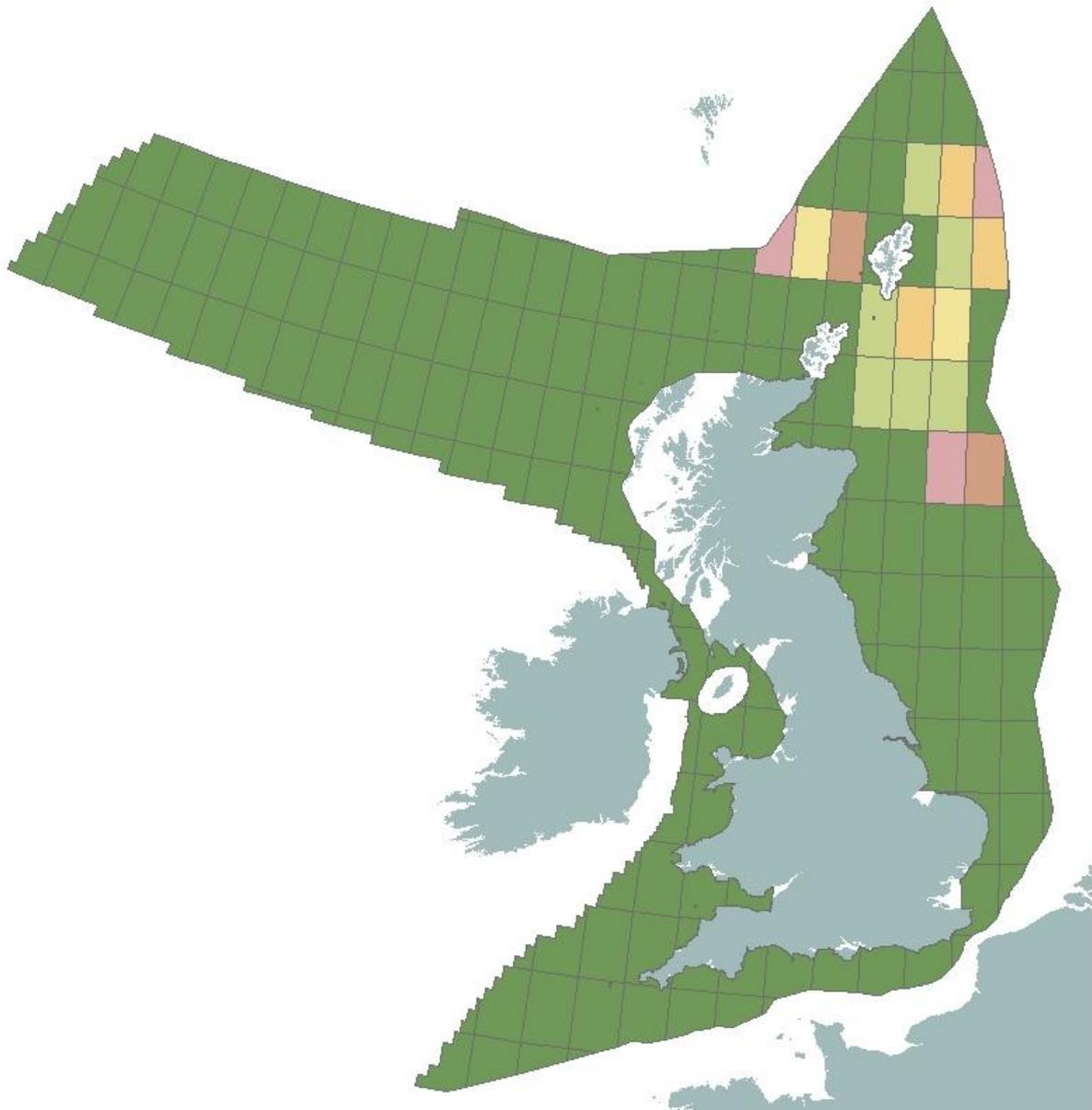




**Shot Point Density 2010 (SP/km<sup>2</sup>)**

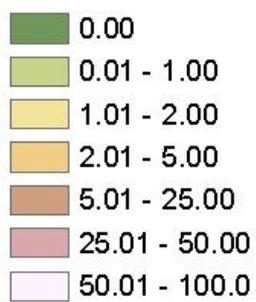
**May**

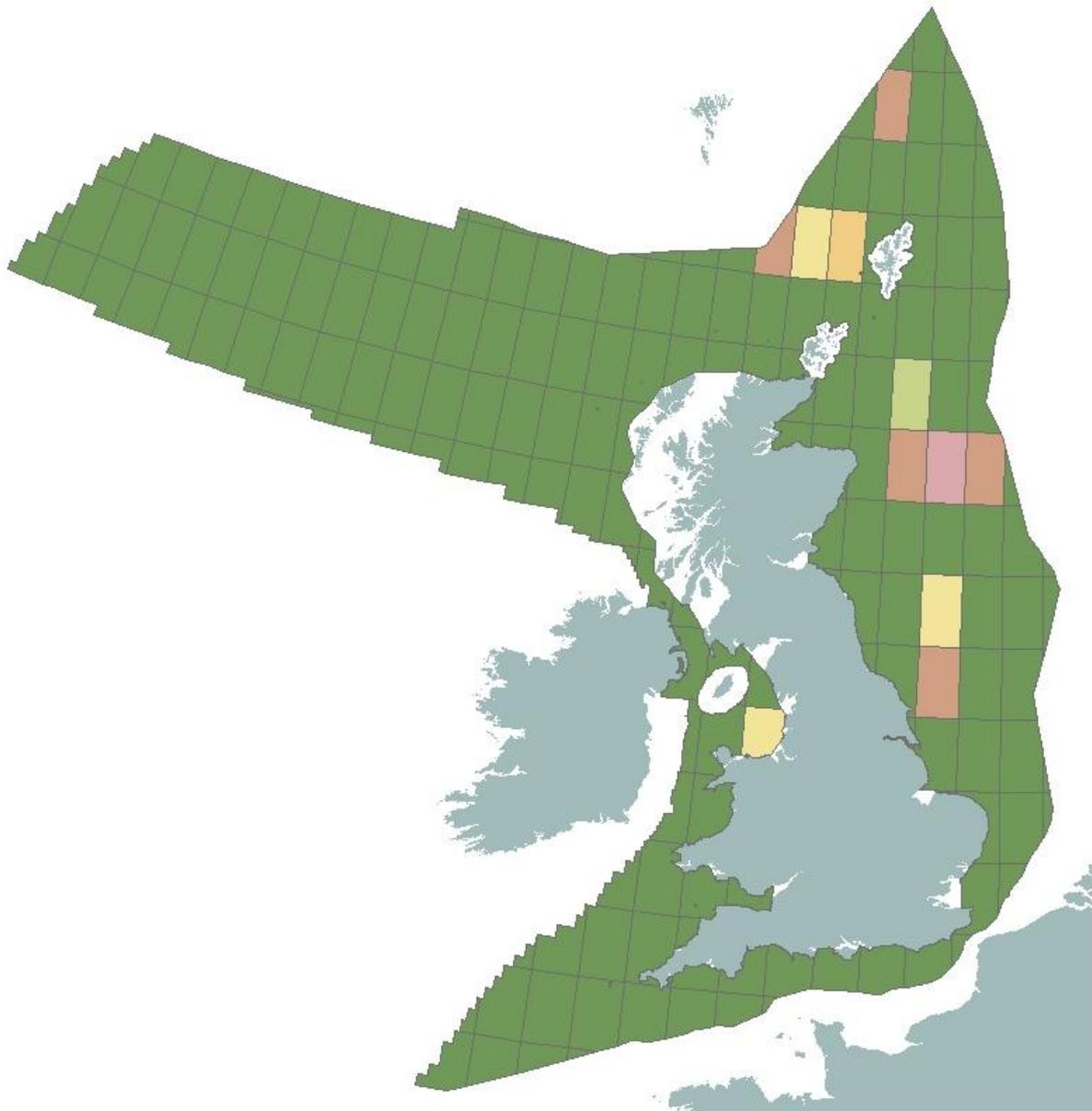




**Shot Point Density 2010 (SP/km2)**

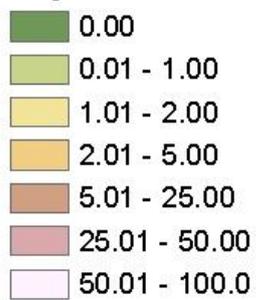
**June**

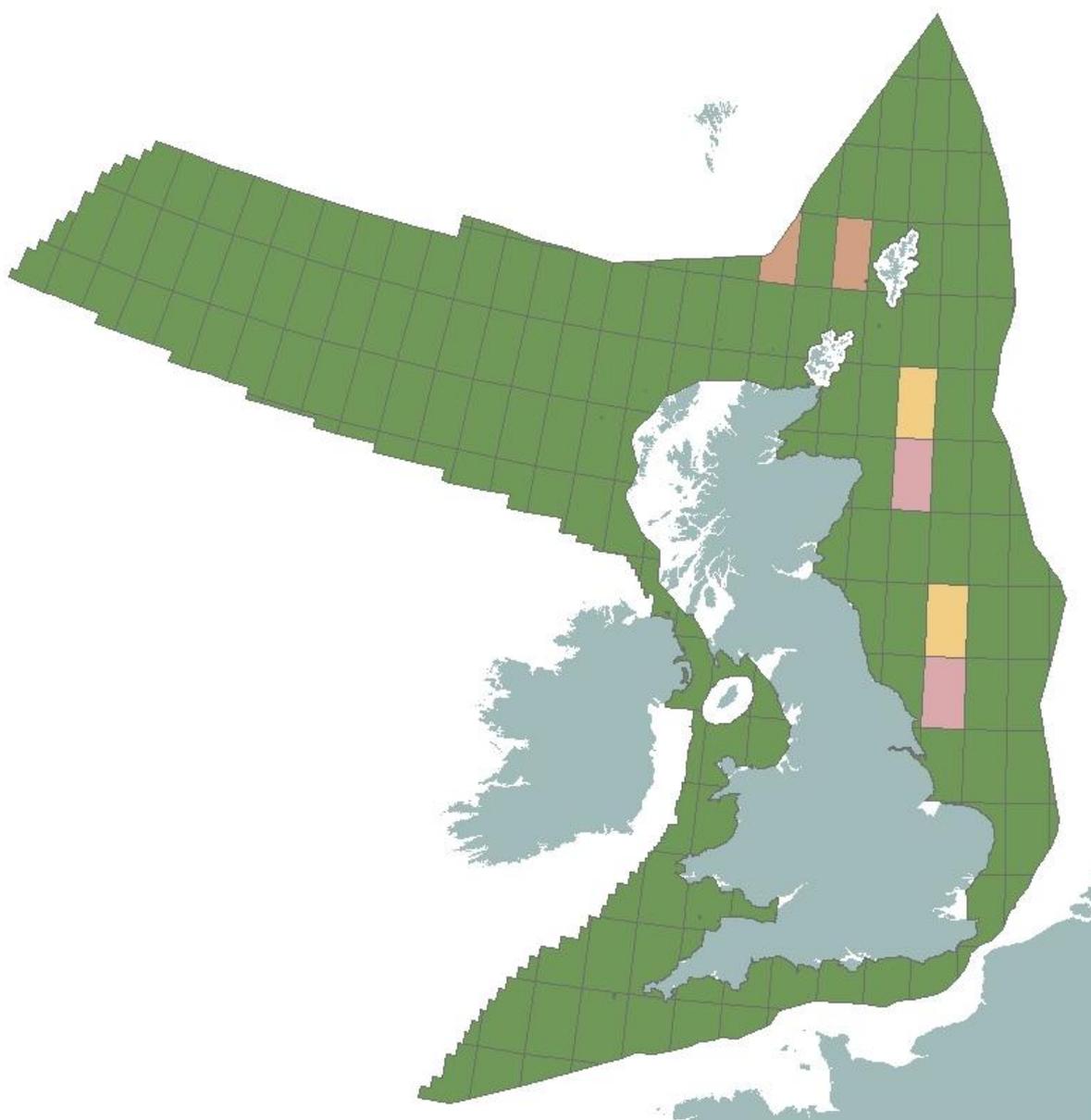




**Shot Point Density 2010 (SP/km2)**

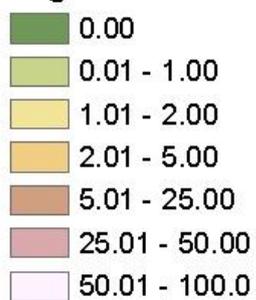
**July**

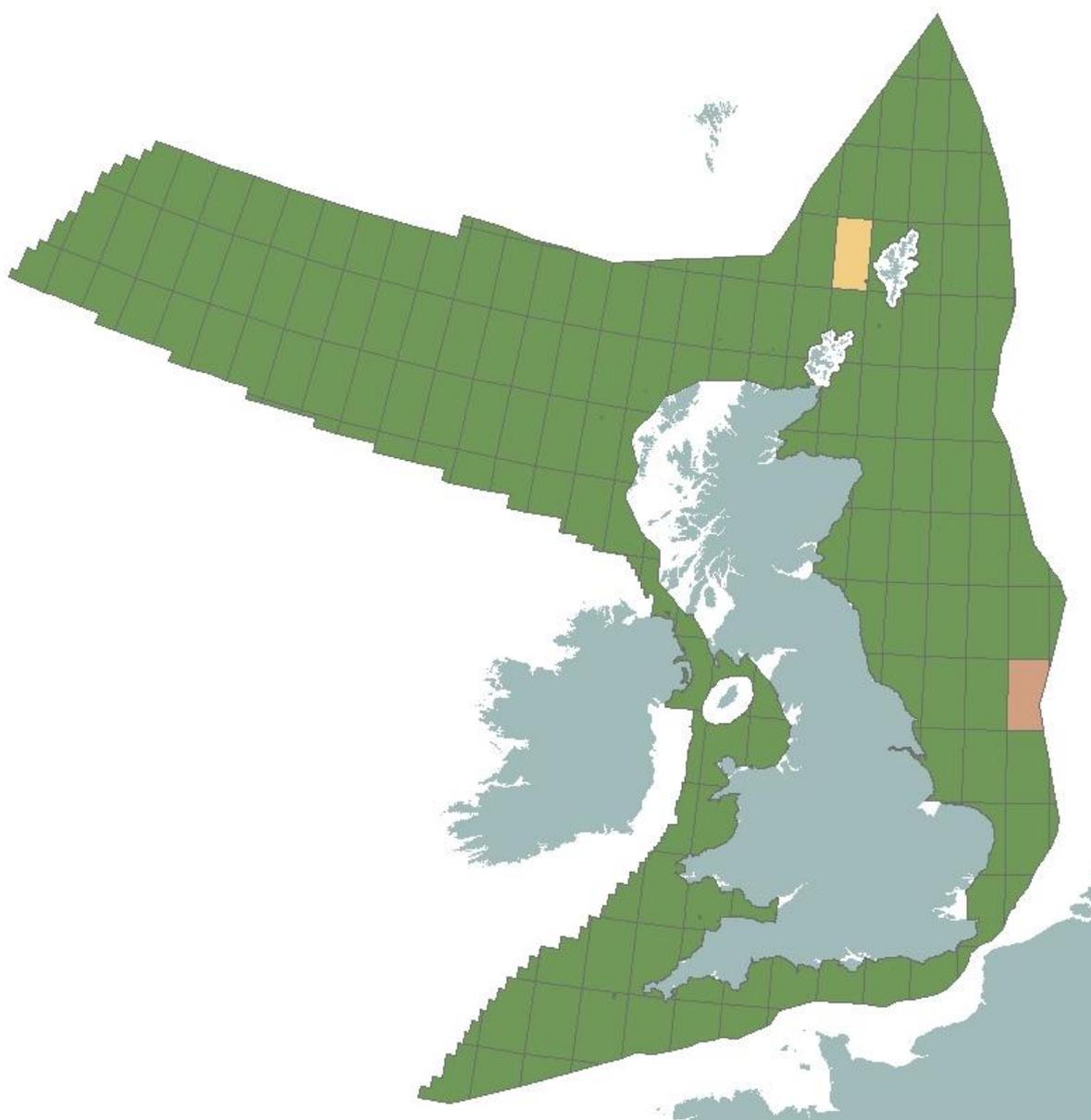




**Shot Point Density 2010 (SP/km<sup>2</sup>)**

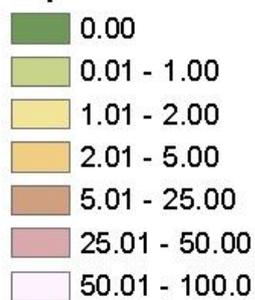
**August**

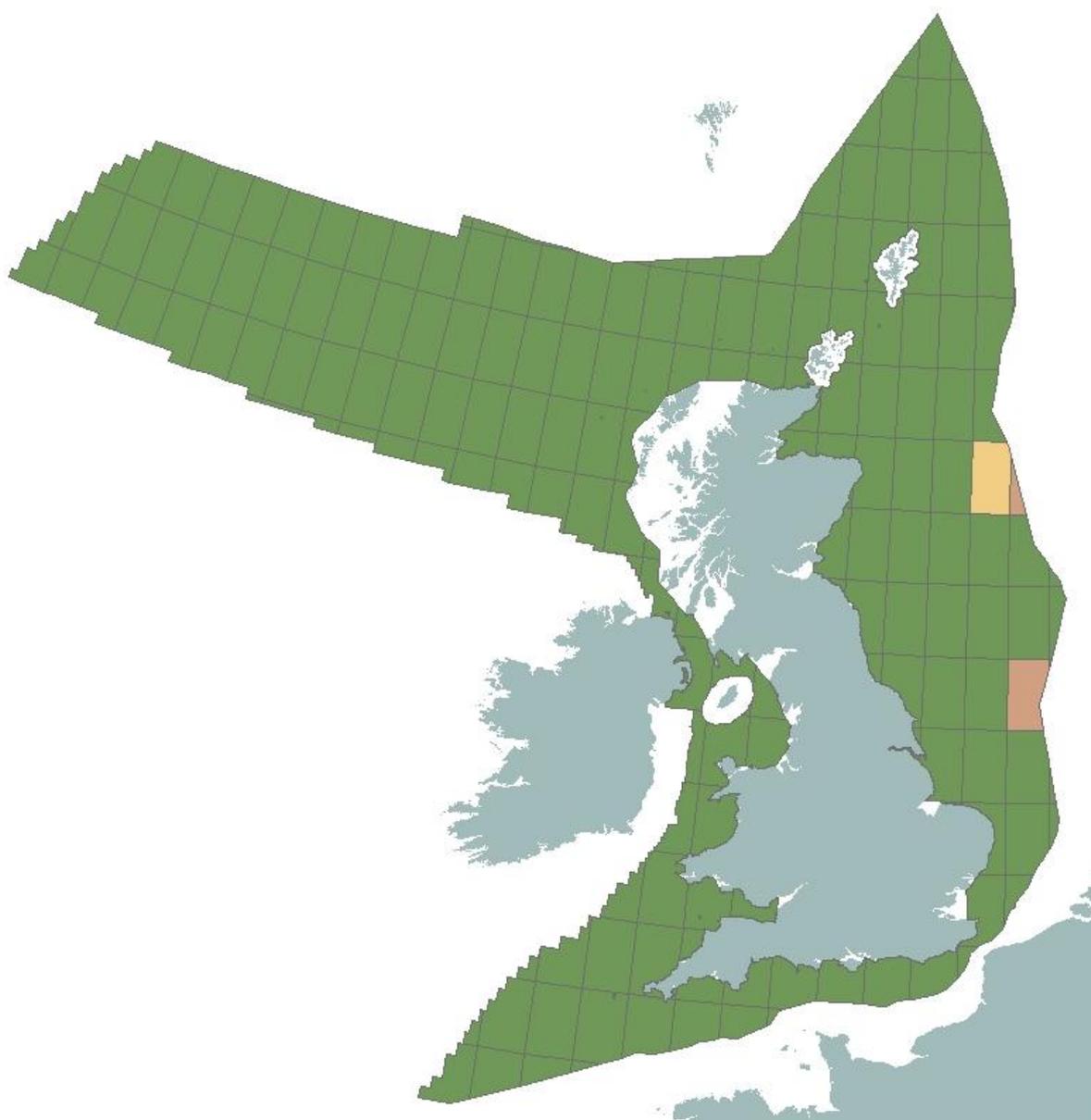




**Shot Point Density 2010 (SP/km2)**

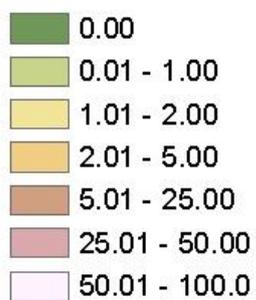
**September**

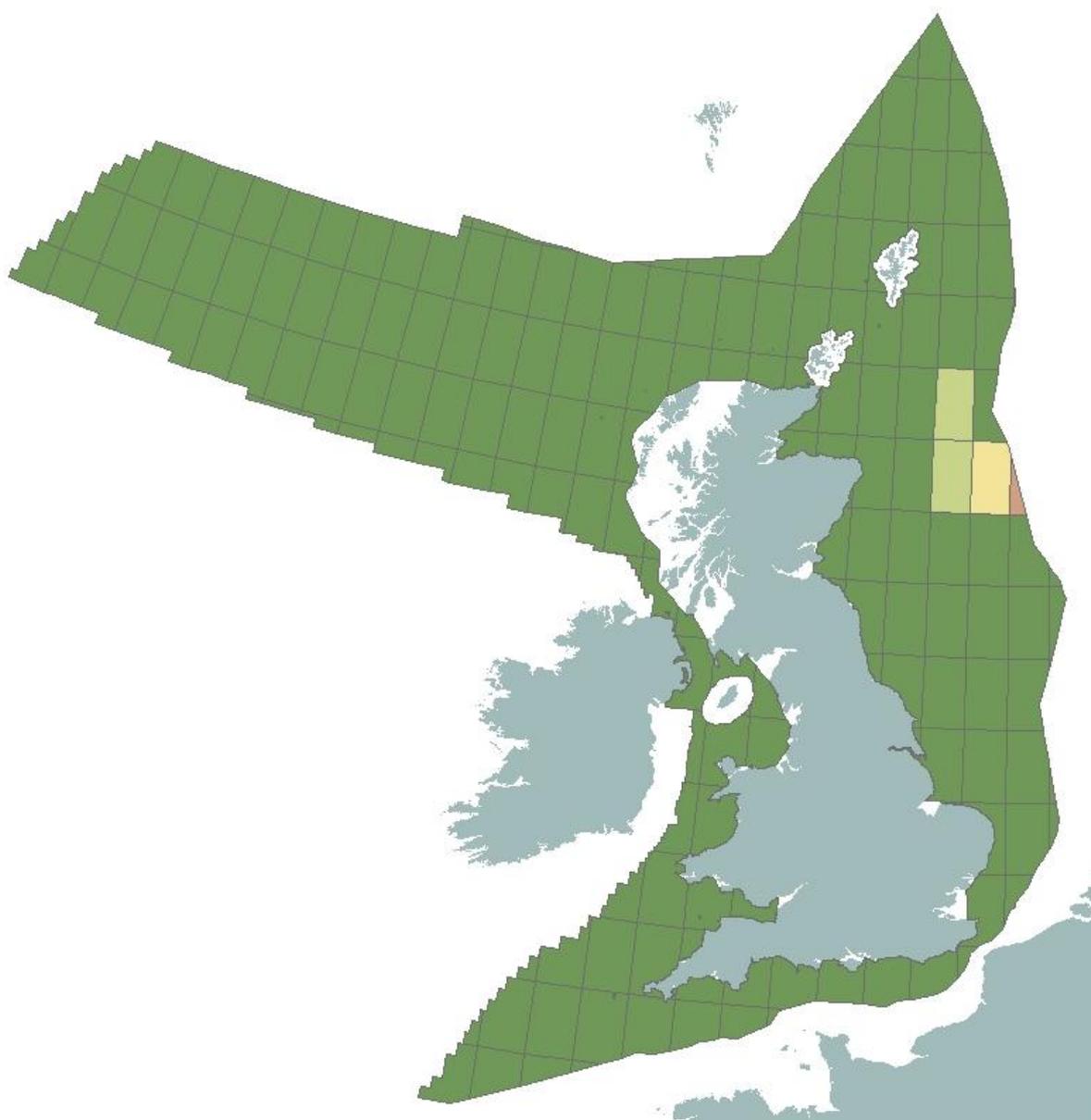




**Shot Point Density 2010 (SP/km2)**

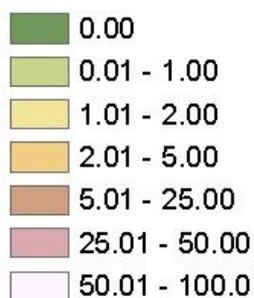
**October**

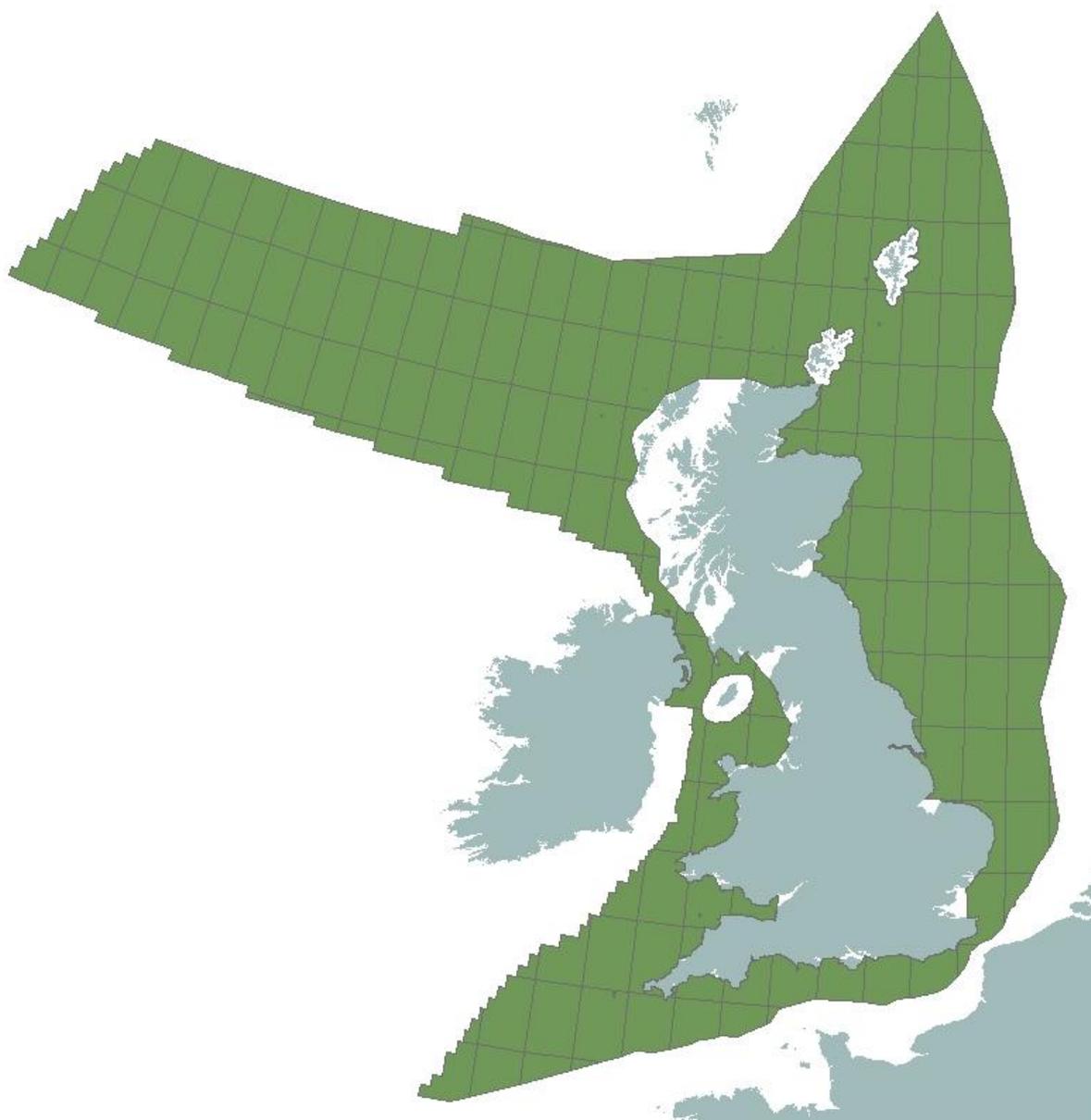




**Shot Point Density 2010 (SP/km2)**

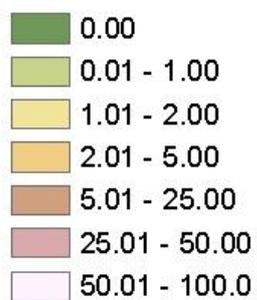
**November**

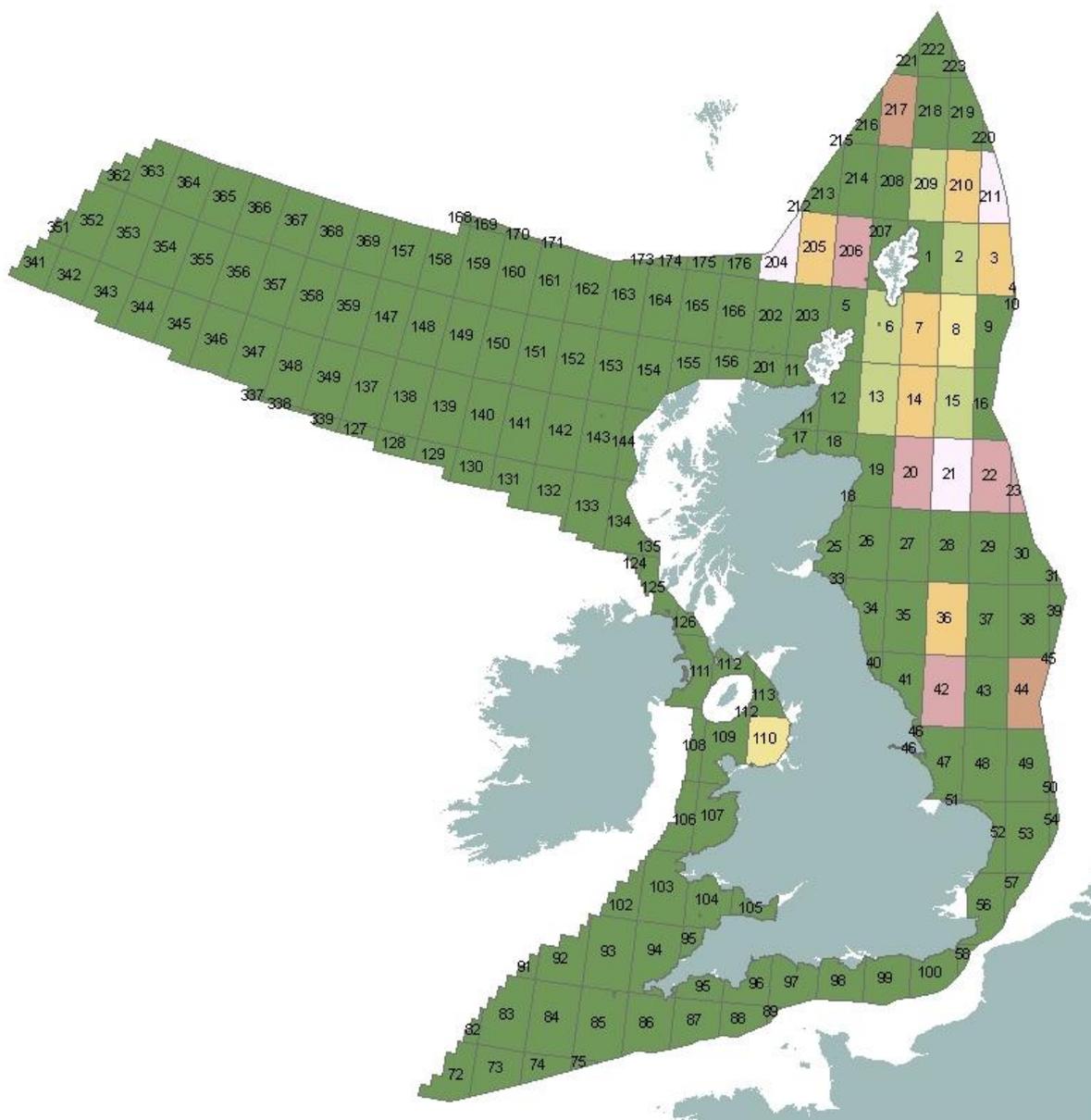




**Shot Point Density 2010 (SP/km<sup>2</sup>)**

**December**





**Shot Point Density 2010 (SP/km2)**

**Sp\_Annual**



## Information on seismic activities carried out by the United Kingdom in 2010



**Table – A-1 Raw data Shot Point Density per Month per Quadrant for 2010**

Quadrant	January	February	March	April	May	June	July	August	September	October	November	December	Total
2	0.000	0.000	0.000	0.000	0.186	0.665	0.000	0.000	0.000	0.000	0.000	0.000	0.851
3	0.000	0.000	0.000	0.000	1.605	2.079	0.000	0.000	0.000	0.000	0.000	0.000	3.684
6	0.000	0.000	0.000	0.000	0.000	0.710	0.000	0.000	0.000	0.000	0.000	0.000	0.710
7	0.000	0.000	0.000	0.000	0.000	2.023	0.000	0.000	0.000	0.000	0.000	0.000	2.023
8	0.000	0.000	0.000	0.000	0.000	1.003	0.000	0.000	0.000	0.000	0.000	0.000	1.003
13	0.000	0.000	0.000	0.000	0.000	0.172	0.000	0.000	0.000	0.000	0.000	0.000	0.172
14	0.000	0.000	0.000	0.000	0.000	0.998	0.591	2.980	0.000	0.000	0.000	0.000	4.569
15	0.000	0.000	0.000	0.000	0.000	0.099	0.000	0.000	0.000	0.000	0.256	0.000	0.355
20	0.000	0.000	0.000	0.000	0.000	0.000	7.175	36.257	0.000	0.000	0.000	0.000	43.432
21	0.000	0.000	0.000	0.449	0.000	39.749	42.217	0.000	0.000	0.000	0.111	0.000	82.526
22	0.000	0.000	0.000	0.000	0.000	12.804	10.243	0.000	0.000	3.004	1.523	0.000	27.574
23	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	13.045	21.945	0.000	34.990
36	0.000	0.000	0.000	0.000	0.000	0.000	1.325	2.147	0.000	0.000	0.000	0.000	3.471
42	0.000	0.000	0.000	0.000	0.000	0.000	15.772	25.218	0.000	0.000	0.000	0.000	40.990
44	0.000	0.000	0.000	0.000	0.215	0.000	0.000	0.000	7.501	15.995	0.000	0.000	23.710
45	0.000	0.000	0.000	0.000	4.667	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4.667
110	0.000	0.000	0.000	0.000	0.000	0.000	1.409	0.000	0.000	0.000	0.000	0.000	1.409
204	0.000	0.000	0.000	0.000	14.841	49.760	16.537	6.603	0.000	0.000	0.000	0.000	87.741
205	0.000	0.000	0.000	0.000	1.640	1.816	1.337	0.000	0.000	0.000	0.000	0.000	4.793
206	0.000	0.000	0.000	0.000	0.676	8.891	4.661	8.609	3.188	0.000	0.000	0.000	26.025
209	0.000	0.000	0.000	0.000	0.226	0.042	0.000	0.000	0.000	0.000	0.000	0.000	0.268
210	0.000	0.000	0.000	0.000	0.757	3.585	0.000	0.000	0.000	0.000	0.000	0.000	4.343
211	0.000	0.000	0.000	0.000	2.004	48.157	0.000	0.000	0.000	0.000	0.000	0.000	50.161
217	0.000	0.000	0.000	0.000	0.000	0.000	14.704	0.000	0.000	0.000	0.000	0.000	14.704
<b>Total</b>	0.000	0.000	0.000	0.449	26.817	172.551	115.970	81.815	10.689	32.043	23.835	0.000	464.169

