Aerial thermal-imaging surveys of harbour and grey seals in Northern Ireland, August 2018

Report for the Department of Agriculture, Environment and Rural Affairs,
Northern Ireland

Contract Title: Aerial thermal-imaging survey for harbour seals in Northern Ireland, August 2018

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1 Summary

In the Augusts of 2017 and 2018, the Sea Mammal Research Unit (SMRU) of the University of St Andrews carried out an aerial thermal-imaging survey of harbour seals (*Phoca vitulina vitulina*) and grey seals (*Halichoerus grypus*) numbers and distribution around Northern Ireland. The survey was funded jointly between the Department of Agriculture, Environment and Rural Affairs, Northern Ireland (DEARA, NI) and the University of St Andrews. This was the third complete survey for seals around the coast of Northern Ireland completed by SMRU. Previous surveys were carried out in August 2002 and in August 2011. All three surveys were coordinated with surveys of the Republic of Ireland.

For convenience, and since the great majority of the coast was surveyed in 2018, the survey reported here will be referred to as the 2018 survey of Northern Ireland, even though a very small section was surveyed in August 2017.

In the 2018 survey, **1,012** harbour seals were counted in Northern Ireland, compared with 948 counted in 2011 (Duck & Morris, 2012) and 1,267 counted in 2002 (Duck, 2003). The 2018 harbour seal count was 7% higher than the 2011 count and 20% lower than the 2002 count (Table 1).

In 2018, **505** grey seals were counted in Northern Ireland compared with 468 counted in 2011 and 104 counted in 2002. The grey seal count in 2017/2018 was 8% higher than the 2011 count and almost four times higher than the 2002 count (Table 1).

The survey results suggest that, overall, harbour seal numbers in Northern Ireland have not changed markedly since 2003, while grey seals numbers have increased. The main concentrations of both harbour and grey seals are in Calingford Lough, Murlough SAC, Strangford Lough SAC, the Outer Ards, the Copeland Islands and on Rathlin Island.

2 Introduction

Harbour seals and grey seals are included in Annex II of the European Union Council Directive 92/43/EEC (1992), commonly known as the Habitats Directive. The Directive's aim is to encourage the maintenance or restoration of biodiversity through the conservation of natural habitats and of wild fauna and flora in the territories of European Union member states. Member states are required to report on the conservation status of such protected species every six years. The surveys described in this report provide part of the information on numbers and distribution of harbour seals and grey seals in Northern Ireland that are required for this reporting. The surveys complement existing monitoring programs for harbour seals and grey seals that are coordinated by DAERA (Department of Agriculture, Environment and Rural Affairs).

In Ireland and the UK, harbour seal population surveys are carried out during their annual moulting period which occurs between July and September (Thompson & Rothery, 1987). Grey seals hauled ashore are also counted during these surveys, providing additional information on their summer distribution although grey seal numbers can be highly variable from day to day during the summer months (SMRU unpublished data; personal observations).

In the Augusts of 2017 and 2018, the Sea Mammal Research Unit (SMRU) carried out a comprehensive aerial survey of harbour seals and grey seals in Northern Ireland on behalf of DAERA. A small section of the River Foyle, by Londonderry, was surveyed in August 2017; most of the coast, from Londonderry to Carlingford Lough, was surveyed in August 2018. This was the third complete survey of seals in Northern Ireland carried out by SMRU. Previous thermal-imaging surveys were carried out in 2002 for the Environment and Heritage Service of Northern Ireland (EHS) and in 2011 for the Northern Ireland Environment Agency (NIEA) (Duck, 2003; Duck & Morris, 2011).

3 Methods

The Sea Mammal Research Unit carried out surveys of moulting harbour seals by helicopter using a multi-camera gyro-stabilised gimbal fitted externally beneath the helicopter cockpit. The gimbal contains a laser range-finder (Vectronix LRF 5020), a colour High Definition digital video camera (Sony FCB-EV7500), a mid-wavelength (3-5µm) thermal-imaging video camera (FLIR µCore-280) and a digital single-lens reflex camera (Nikon D810) equipped with a 300mm telephoto lens (AF-S Nikkor 300mm f4 PF ED VR).

Thermal-imaging surveys follow the standard SMRU harbour seal survey protocol:

- Surveys were restricted to the peak harbour seal moult season, in August and early September.
- Surveys were restricted to within two hours either side of low tides occurring between 12:00 and 19:30 local time.
- There was no surveying on days with moderate, heavy or prolonged rainfall.
- All intertidal areas were searched using the thermal-image video display.
- High-resolution digital photographs were taken of all groups of seals where possible.
- The colour and thermal-image videos were recorded along with the digital still images onto two Microsoft Surface Pro 4 computers.
- The mapping system (TrakkaMap) recorded detailed flight tracks as well as the target centre coordinates for each photograph and video frame.
- Complete flight tracks were recorded on two Garmin Foretrex 401 GPS units.

A screenshot of the mapping software display, showing colour video, thermal-image video and the live mapping system is shown in Figure 1. A close-up from the high resolution photograph of the same group of seals is shown in Figure 2.

Video and still images were reviewed at SMRU's base in St Andrews, in conjunction with a detailed digital map and satellite imagery of Northern Ireland (https://www.spatialni.gov.uk/mapviewer.html). This system enables all groups of seals to be accurately identified, counted and located within a geographic information system (Manifold System 8.0 Ultimate Edition GIS). Maps were produced using the same software. The drawn coastlines were based on Ordnance Survey Northern Ireland shapefiles (https://www.spatialni.gov.uk/mapviewer.html).

A small section of the coast of Northern Ireland, the River Foyle in Londonderry, was surveyed in August 2017 with the main part of the coast of Northern Ireland surveyed in August 2018. A summary of the daily survey schedule is in Table 1. The survey route, and the areas surveyed on each day, are shown in Figure 3.

4 Results & Discussion

4.1 Harbour seals

The number of harbour seals counted in sections of the coast of Northern Ireland in August 2017 and August 2018, and in all previous aerial surveys carried out by SMRU, are in Table 1. Surveys of the entire Northern Ireland coast were carried out in the Augusts of 2002, 2011 and 2018. Surveys between Carlingford Lough and Belfast Lough were carried out in the Augusts of 2006, 2007, 2008 and 2010 and were part of an investigation into the effects on seals in Northern Ireland of a tidal turbine placed in Strangford Narrows.

The distribution of harbour seals from the most recent survey is shown in Figure 4. Note that, for clarity, counts have been aggregated by 1km squares. Numbered sections of the coast in Figure 4 refer to the numbered DAERA Sections in Table 1. One group of harbour seals, resident within Belfast Harbour (DAERA Section 9), was not covered by the survey, due to flight restrictions close to Belfast Airport on the day of survey. This group is not included in the results reported here. DAERA records reported that there were 47 harbour seals in the Musgrave Channel in Belfast Harbour on 15 August 2017 and 50 harbour seals on 28 August 2017 (S. Foster *pers. comm*.).

The distribution of harbour seals in Northern Ireland in the 2011 August survey is in Figure 5. Their distribution in the 2002 August survey is in Figure 6.

Figure 7 compares counts of harbour seals in the DAERA coastal sections from all aerial surveys carried out by SMRU in Northern Ireland. Note that the counts from DAERA coastal sections 8 to 17 have been combined in each of the three years of survey. In these coastal sections, most harbour seals were on Rathlin Island, with increasing numbers seen in Lough Foyle.

General indications are that, while the overall Northern Ireland harbour seal population is relatively stable, there appear to be some changes in different parts of Northern Ireland. The highest counts were from Carlingford Lough, Murlough SAC and Rathlin Island (Table 2, Figure 7).

The increased numbers counted in Lough Foyle in the 2018 aerial survey (Table 2) are similar to recent ground counts (DAERA unpublished data), where 50 plus harbour seals have been counted in recent years. Only three harbour seals were counted in Lough Foyle during the 2002 aerial survey so a significant increase is evident.

In contrast, aerial survey counts of harbour seals in Strangford Lough compare well with with counts by boat in showing a continuous decline in numbers within Strangford Lough.

The results from this survey will form part of SMRU's annual assessment of harbour and grey seals in the UK for the Natural Environment Research Council's Special Committee on Seals in September 2019.

4.2 Grey seals

The distribution of grey seals around Northern Ireland in August 2018 in shown in Figure 8. Again, for clarity at this scale of map, counts have been aggregated by 1km squares. Numbers of grey seals counted within the numbered DAERA Sections of the coast are in Table 2. The main grey seal haul-out sites in August 2018 were in Carlingford Lough, Murlough SAC, Strangford Narrows, North and South Rocks (east of the Ards), the Copeland Islands and Rathlin Island (Figure 8). Smaller numbers were on The Maidens SAC.

Figure 9 shows the 1km distribution of grey seals during the August 2011 survey and Figure 10 grey seal distribution during the August 2002 survey. The numbers counted in DAERA Sections of the coast are in Table 2.

Figure 11 compares the counts in different areas of Northern Ireland from all August aerial surveys carried out by SMRU. DAERA Sections 8 to 17 have been combined. The Outer Ards and the Copeland Islands consistently support significant numbers of grey seals. Since 2006, grey seals were also counted in Carlingford Lough, Murlough SAC and Strangford Lough SAC (mainly in Strangford Narrows).

Grey seal numbers can vary considerably from day to day during the summer months, so some caution should be exercised when considering these August counts. None the less, combined August counts from across the UK are used to provide an independent estimate of the size of the UK grey seal population (Lonergan *et al*., 2011; Russell *et al*., 2016).

5 Acknowledgements

This survey of seal in Northern Ireland was jointly funded by the Department of Agriculture, Environment and Rural Affairs and the University of St Andrews. Grateful thanks to Stephen Foster of DAERA for organising DAERA's support of this project. Thanks also to Captain Tom Kidd and PDG Aviation Services for their expertise in carrying out the aerial survey.

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Table 1 Daily schedule for 2018 thermal-image surveys of seals in Northern Ireland.

Date	Coast surveyed	Conditions
August 2017		
Sun 20	Survey upper L Foyle, River Foyle	Good, overcast
August 2018		
Thurs 23	Position from Cumbernauld. Survey Lough Foyle, north and north-east coast to Belfast Lough, Copeland Islands, to Donaghadee; Strangford Lough	Good, showers before survey start
Fri 24	Survey Donaghadee to Carlingford Lough	Good, overcast, some sun

Table 2. Harbour seals in Northern Ireland. Counts from aerial surveys carried out by the Sea Mammal Research Unit, University of St Andrews. Complete surveys of the Northern Ireland coast were carried out in 2002, 2011 and 2018.

			Harbour seals							Grey seals						
	DAERA Section	Section end points	2002	2006	2007	2008	2010	2011	2018	2002	2006	2007	2008	2010	2011	2018
	Carlingford Lough South	Ballagan Spit to Omeath	37	1	10	0	0	0	12	0	0	0	0	0	1	11
1	Carlingford Lough North	Warrenpoint to Cranfield Point	220	237	317	257	206	255	255	4	34	40	10	15	33	67
2	Mournes coast	Cranfield Point to Glasdrumman	1	0	0	0	0	0	0	0	0	0	0	0	0	1
3	Murlough SAC	Glasdrumman to St John's Point	231	190	218	209	236	235	309	0	31	22	24	8	20	44
4	Sheepland Coast	St John's Point to Guns Island	2	3	0	4	0	0	0	0	0	1	0	0	0	4
5	Strangford Lough SAC	Ballyhornan to Ballyquintin	403	304	284	270	273	156	93	0	25	55	47	54	79	64
6	Outer Ards	Ballyquintin to Donaghadee	108	110	53	61	53	72	59	35	95	98	101	112	186	118
7	Copeland Islands	Copeland Islands	65	95	68	63	77	87	78	46	68	51	42	56	59	134
8	Belfast Lough South	Donaghadee to Hollywood	63	(6)		(8)	(1)	8	14	0	(0)		(0)	(0)	2	0
9	Belfast Harbour	Hollywood to Macedon Point *														
10	Belfast Lough North	Macedon Point to Blackhead Lighthouse	3					2	24	0					1	6
11	Larne Coast	Blackhead Lighthouse to Dunmaul Fort	3					4	2	0					0	3
12	The Maidens SAC	The Maidens	37					1	2	11					67	12
13	Red Bay	Dunmaul Fort to Fair Head	0					0	0	0					0	0
14	Rathlin Island	Rathlin Island	128					98	123	1					20	46
15	Ballycastle Coast	Fair Head to Portballintrae	0					0	0	7					0	1
16	Portrush Coast	Portballintrae to Magilligan Point	0					0	0	0					0	1
17	Lough Foyle East	Magilligan Point to Irish border	3					30	53	0					1	4
	Lough Foyle West	Irish border to Inishowen Lighthouse	2					0	1	0					4	0
	Sections 1-7 Total		1,030	939	940	864	845	805	794	85	253	267	224	245	377	432
	Northern Ireland Total		1,267					948	1,012	104					468	505

* In Musgrave Channel, Belfast Harbour, 47 and 50 harbour seals were counted on 15th and 28th August 2017 respectively (S. Foster, DAERA *pers. comm.*

Figure 1 Screenshot of TrakkaMap software as viewed in real time during a survey, of the coast close to Greencastle, north side of Carlingford Lough. On the left map, red dots show helicopter track, green shaded coast has been scrutinised, blue and red boxes show areas covered by cameras. Upper right is the video image of the coast, lower right shows seals visible on the thermal image.

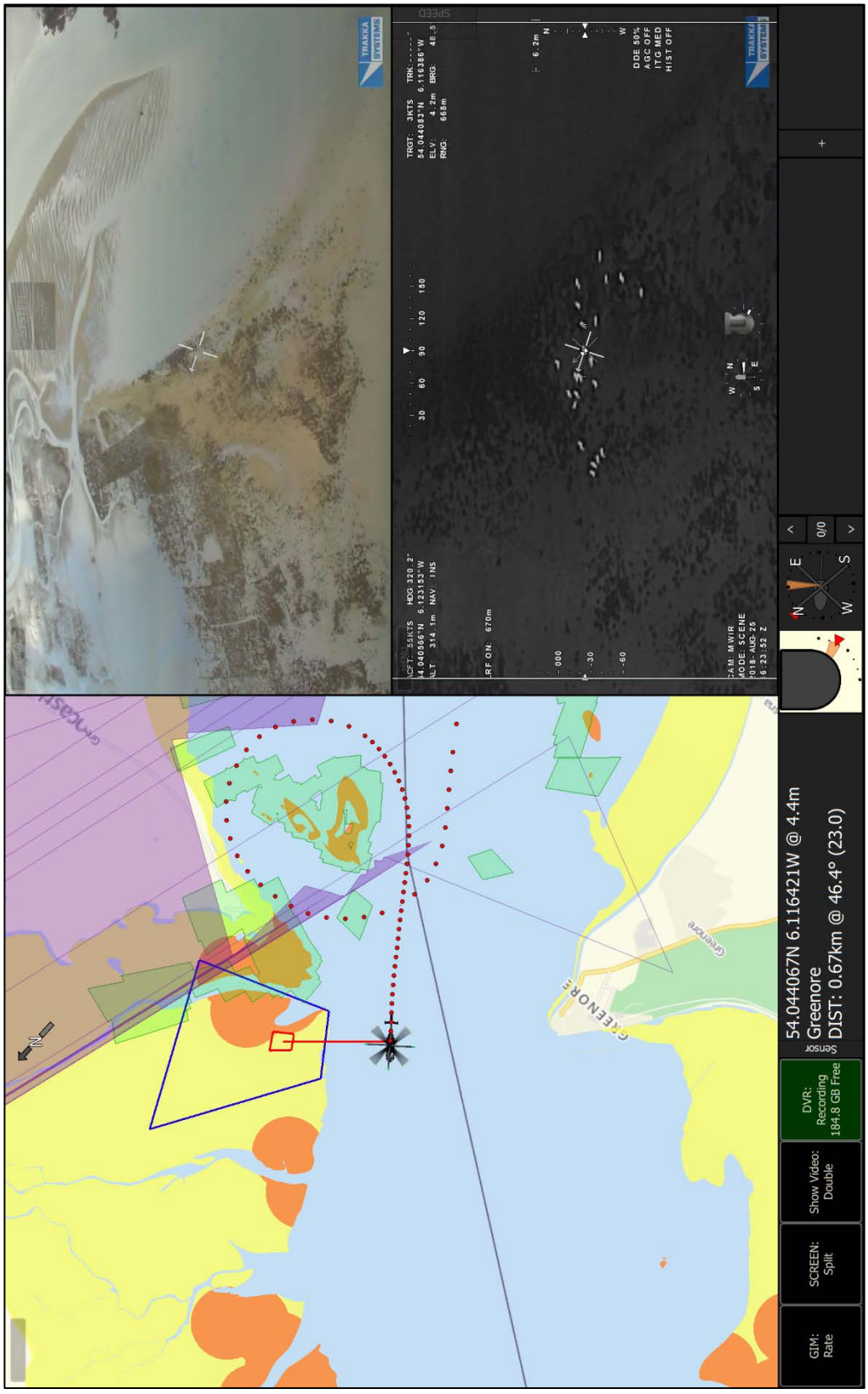

Figure 2 Enlarged detail of the high-resolution digital image of the seals located in Figure 1. Seals are counted and species identified from high-resolution images such as this.

Figure 3 Dates of survey of sections of the coast of Northern Ireland in August 2018. A small section of the River Foyle, by Londonderry, was surveyed on 20th August 2017.

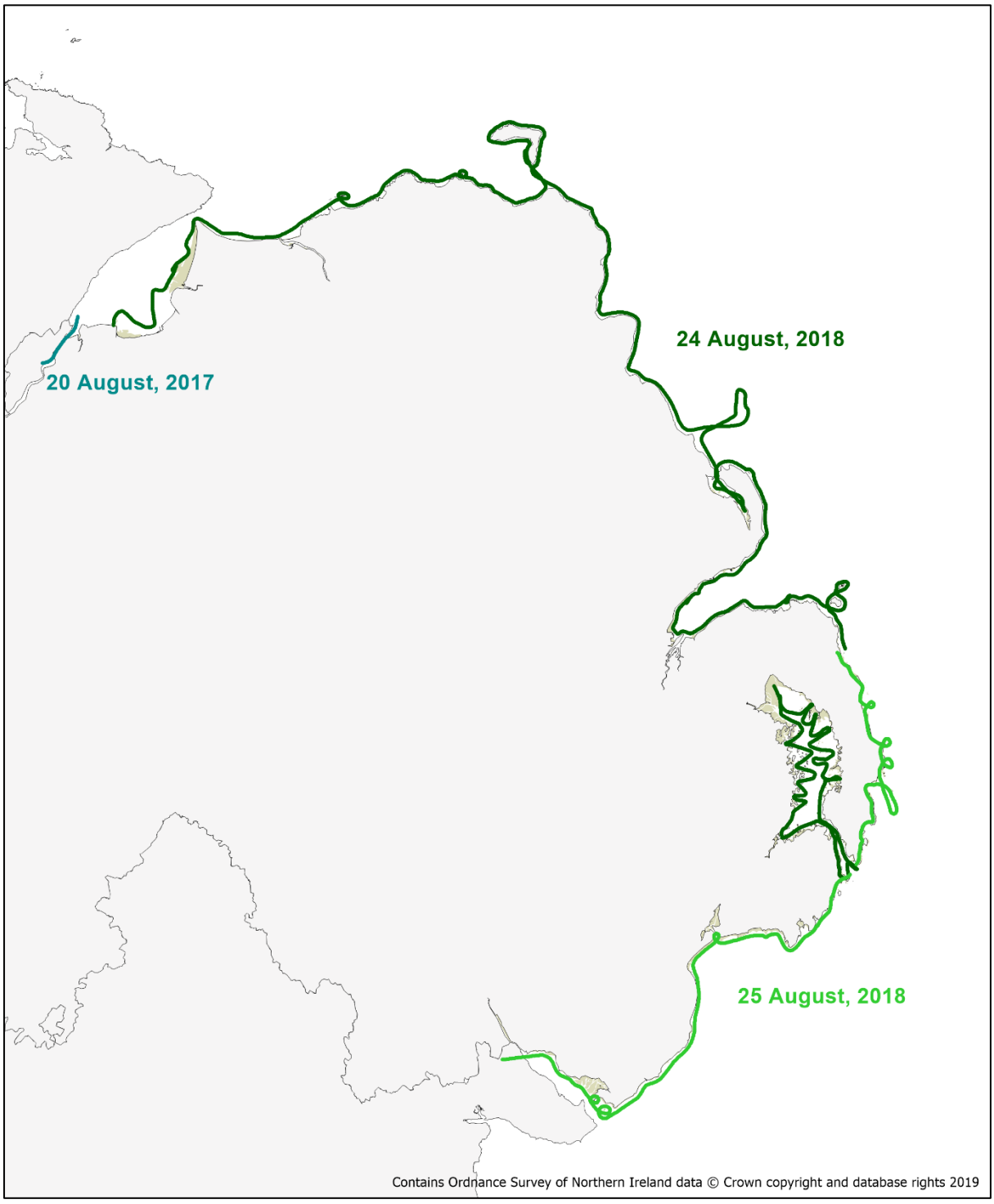

Figure 4 The distribution of harbour seals, by 1km squares, in Northern Ireland in August 2018. A small section of the River Foyle, by Londonderry, was surveyed in August 2017. Harbour and grey seal SACs are outlined. Aerial survey by the Sea Mammal Research Unit.

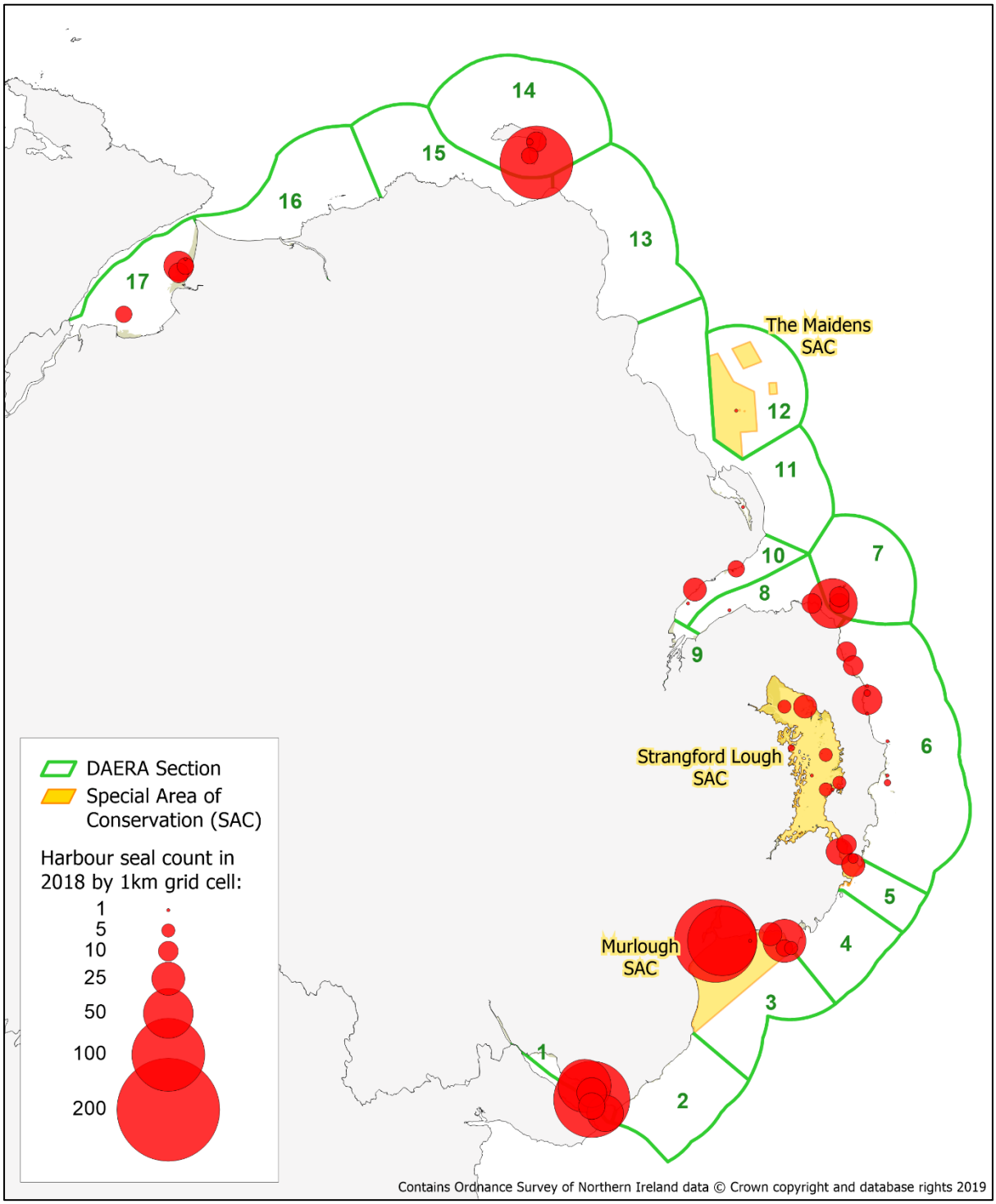

Figure 5 The distribution of harbour seals, by 1km squares, in Northern Ireland in August 2011. Harbour and grey seal SACs are outlined. Aerial survey by the Sea Mammal Research Unit.

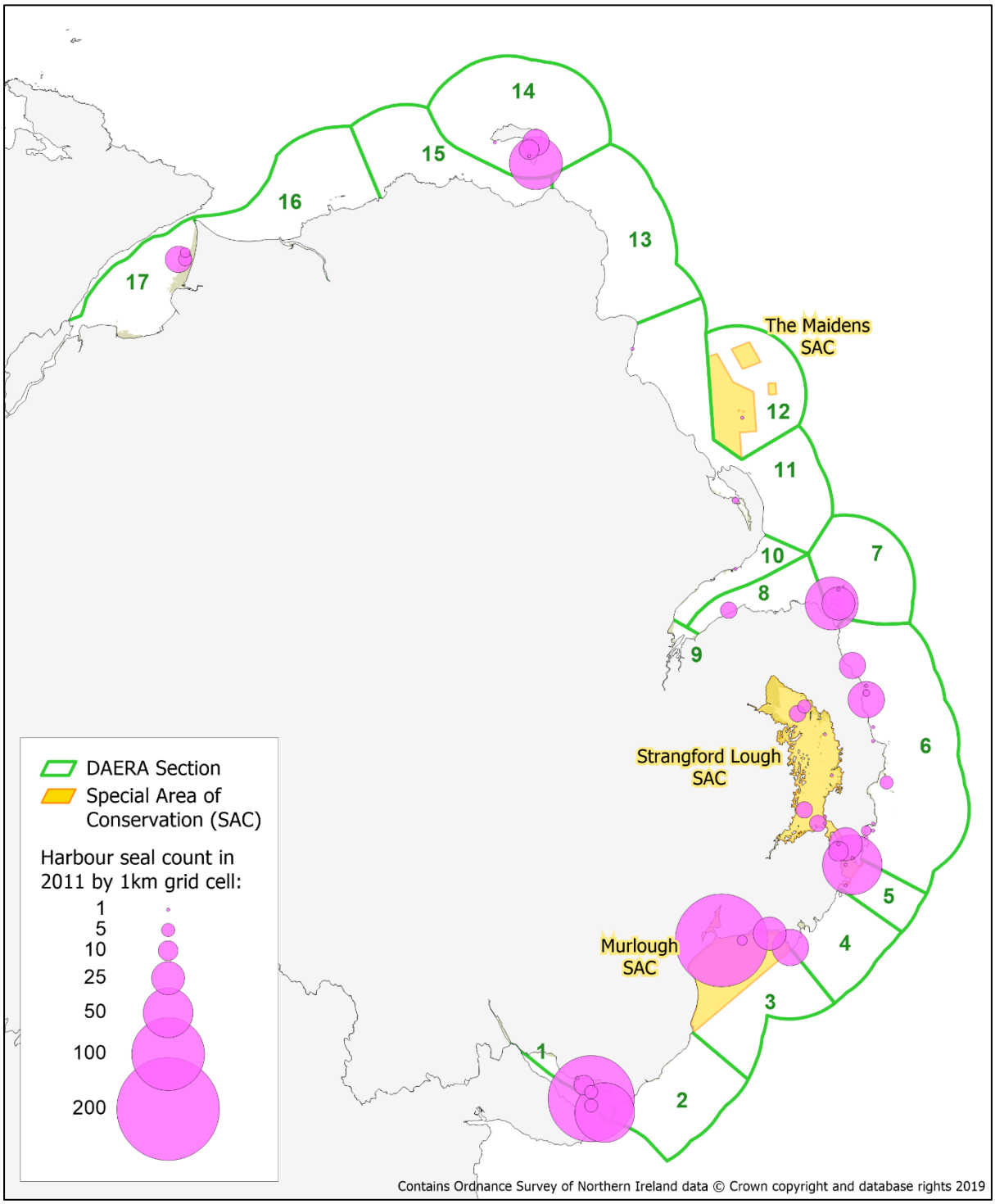

Figure 6 The distribution of harbour seals, by 1km squares, in Northern Ireland in August 2002. Harbour and grey seal SACs are outlined. Aerial survey by the Sea Mammal Research Unit.

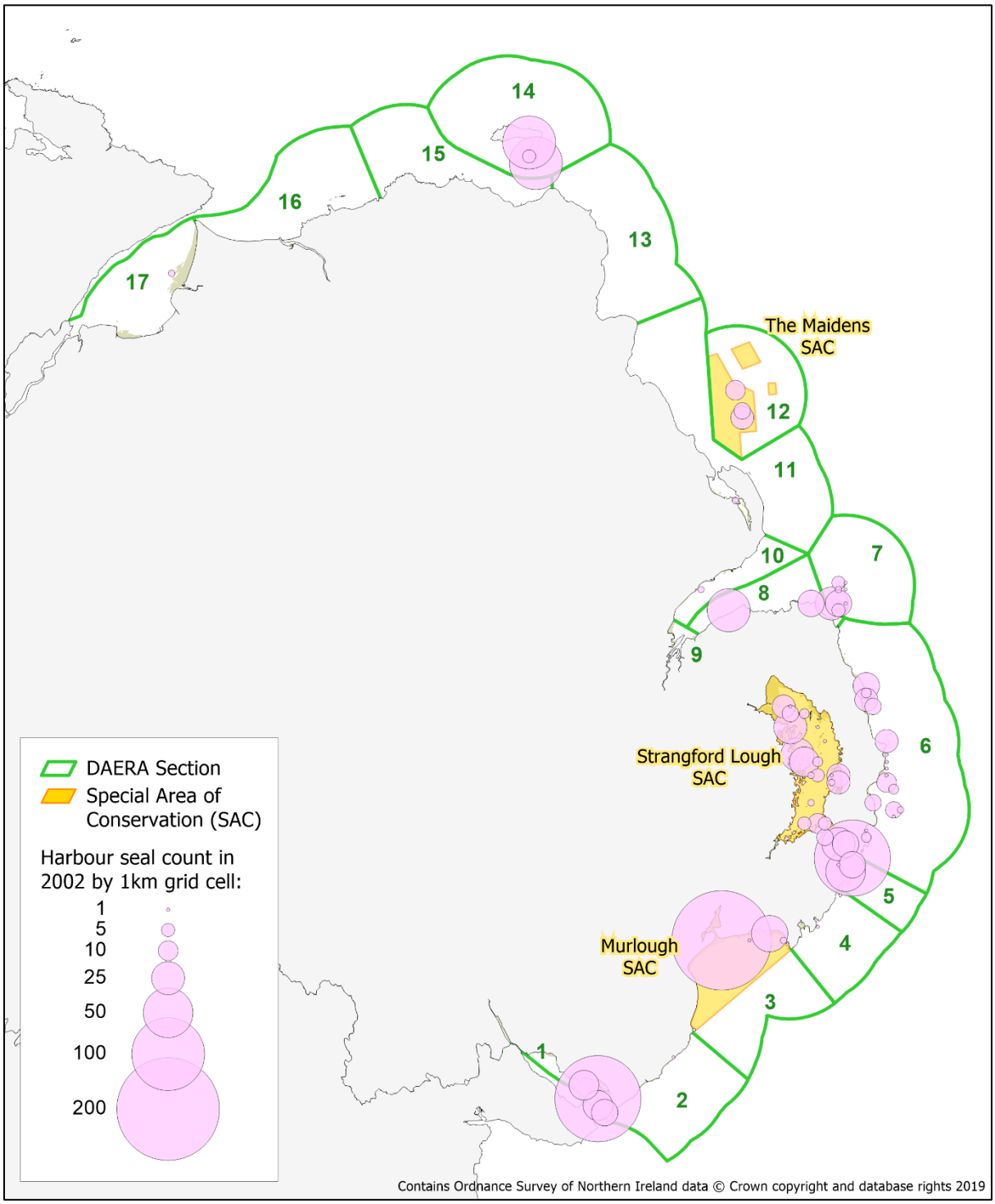

Figure 7 Counts of harbour seals in Northern Ireland from all aerial surveys carried out by the Sea Mammal Research Unit, University of St Andrews. Numbers counted are in Table 2. DAERA Sections 8 to 17 have been combined. Here, the main locations for harbour seals are on Rathlin Island (Section 14) and in Lough Foyle (Section 12). Only very small numbers of seals were seen in Section 2 (The Mournes coast, in yellow)

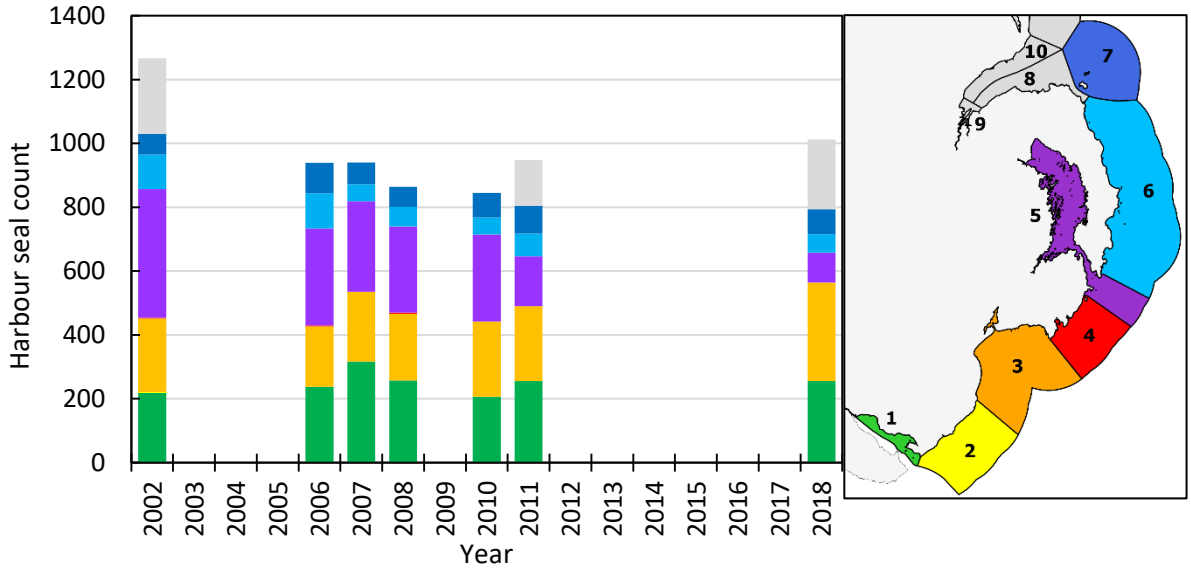

Figure 8 The distribution of grey seals, by 1km squares, in Northern Ireland in August 2018. A small section of the River Foyle, by Londonderry, was surveyed in August 2017. Harbour and grey seal SACs are outlined. Aerial survey by the Sea Mammal Research Unit.

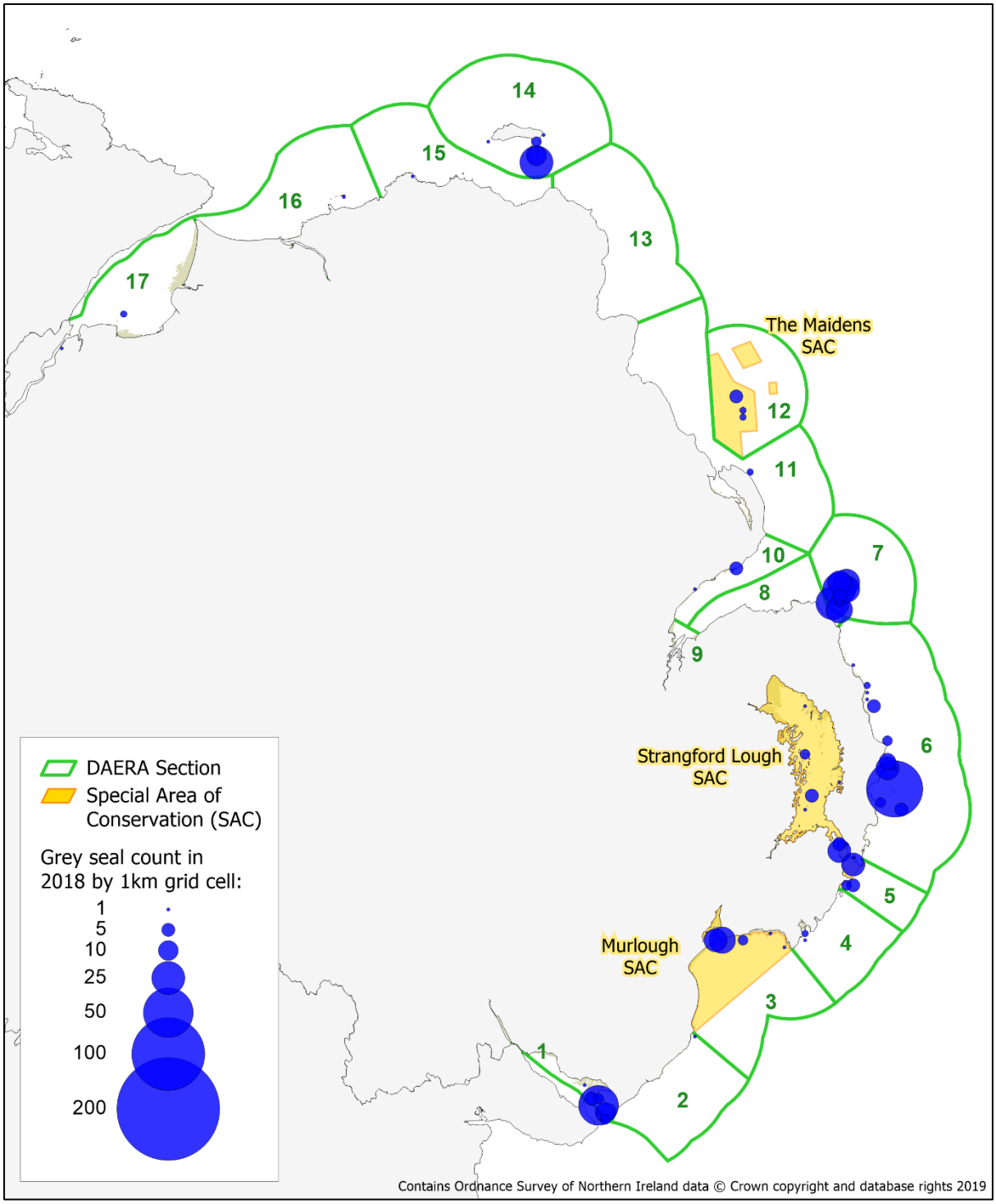

Figure 9 The distribution of grey seals, by 1km squares, in Northern Ireland in August 2011. Harbour and grey seal SACs are outlined. Aerial survey by the Sea Mammal Research Unit.

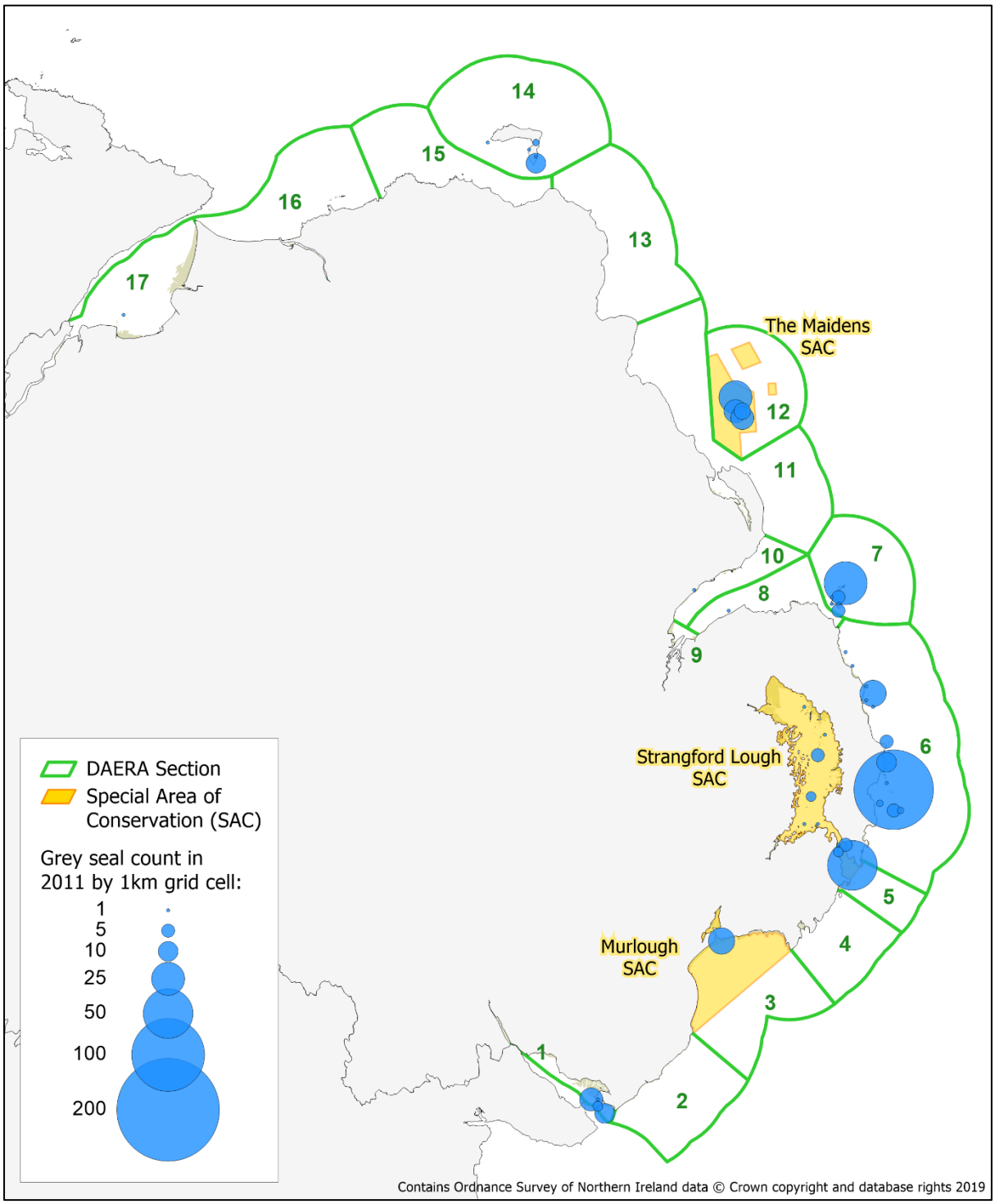

Figure 10.

Figure 10 The distribution of grey seals, by 1km squares, in Northern Ireland in August 2002. Harbour and grey seal SACs are outlined. Aerial survey by the Sea Mammal Research Unit.

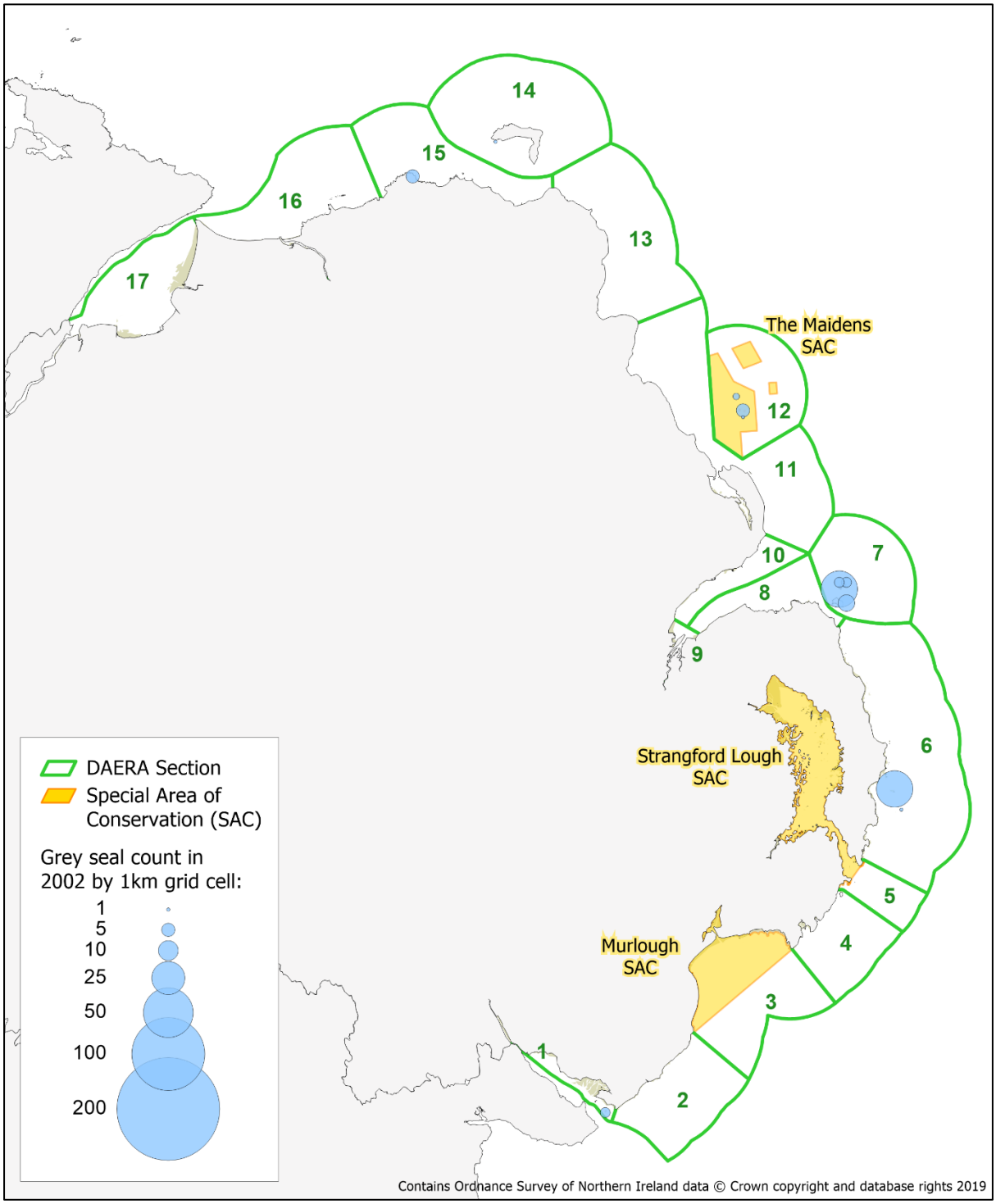

Figure 11 Counts of grey seals in Northern Ireland from all aerial surveys carried out by the Sea Mammal Research Unit, University of St Andrews. Numbers counted are in Table 2. DAERA Sections 8-17 have been combined. There, the main locations for grey seals are The Maidens (Section 12) and Rathlin Island (Section 14).