Natural England

Ornithological and Marine Mammal Baseline Characterisation Surveys for the POSEIDON project

January (Seasonal) Report – Northern Isles

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1. Executive Summary

This report constitutes the second seasonal (January 2024) report outlining results from digital aerial surveys conducted in January 2024 within the Northern Isles under the POSEIDON project and commissioned by Natural England. Surveys were undertaken using APEM's high-resolution camera system to capture digital still imagery of birds and marine megafauna within the Survey Area.

The survey was successfully carried out across one day in January 2024. A total of 4,579 observations were recorded during the survey in January 2024, of which 4,571 were observations of birds and 8 were observations of marine mammals. APEM will continue to monitor the site for these species and others during the remaining seasonal surveys.

2. Introduction

2.1 Background

APEM has been originally contracted by Natural England for the supply of three seasonal Digital Aerial Surveys (DAS) within the Northern Isles, commencing from September 2023. As of March 2024, a contract variation to undertake an additional spring survey was processed, totalling the survey programme to four DAS. The surveys form part of the POSEIDON project which is led by Natural England and funded through The Crown Estates Offshore Wind Evidence and Change (OWEC) programme. Analysis of existing seabird and marine mammal data for English, Welsh and Scottish waters identified gaps in the evidence base for the Survey Area. The main purpose of the survey programme is to address these evidence gaps through providing baseline information on the abundance, distribution and behaviour of birds and marine mammals within the Survey Area.

The Survey Area is located within the Northern Isles to the north, east and south of Shetland, Scotland (**Figure 1**) and covers an area of 21,594 square kilometres (km^2). The survey method has been designed to optimise the data collection for all bird, marine mammal, and other marine megafauna species using a transect-based survey design at 1.5 centimetre (cm) resolution to achieve a minimum of 3% captured and 3% analysed coverage using a twin-engine aircraft. These surveys have been carried out to meet the aims and objectives of the work by Natural England and the POSEIDON project.

This report describes the seasonal (January 2024) survey, undertaken in January 2024, as part of the survey programme.

2.2 Aim of Report

The report presents information on marine birds, mammals, and other megafauna, which includes the following:

- Description of, and rationale for, survey methods and design.
- Map of survey route and coverage.
- Survey details as actually flown (including dates/times, weather and other relevant conditions).
- Raw count observations for behaviours of all avian and marine mammal species, as well as any other marine megafauna recorded per month within the Survey Area.
- Bird flight heights and direction.
- Spatial distribution maps of avian, marine mammal, and other marine megafauna species.

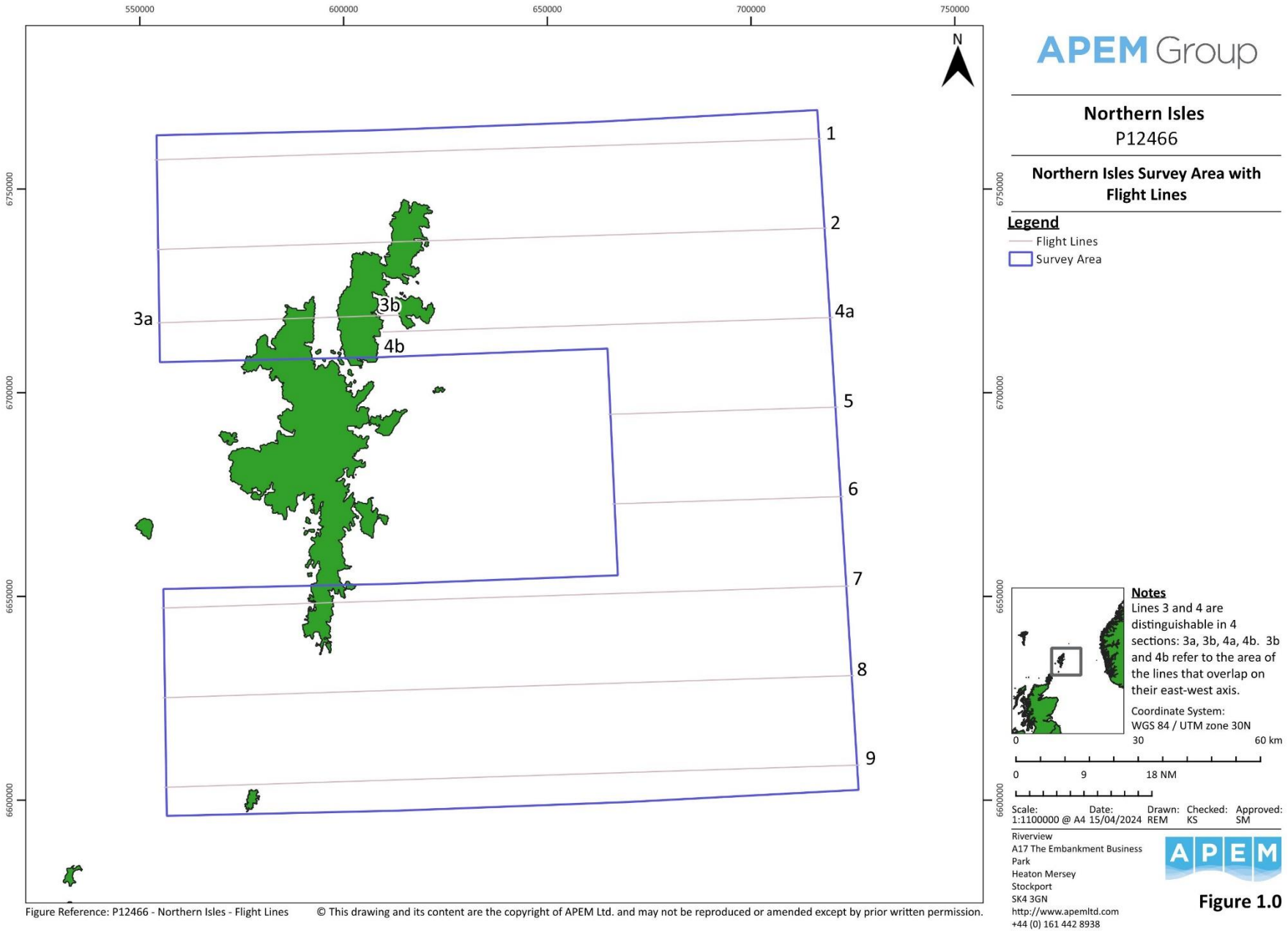

Figure 1 Location of Northern Isles Survey Area.

3. Survey and Analysis Methodologies

3.1 Digital Aerial Survey Methods

The survey was conducted using APEM's bespoke camera system, termed "Shearwater V", customised by in-house specialists for surveying the offshore environment. The camera system is integrated with custom flight planning software that allows each survey flight line to be accurately mapped before the aircraft leaves the ground. Each image capture node is precisely defined, allowing the system to fire the camera exposures at exactly the right location. This ensures that each survey is flown with the same orientation and the camera is triggered at the same position within set tolerances (**Table 1**). APEM's flight planning software enables tolerances along survey lines to be set, meaning the camera system would automatically abort data capture should the aircraft drift away from the planned flight line. The process of automatically aborting data capture is called a 'cutout'. Should this occur, the plane is required to revisit and resurvey the affected section of the survey line.

APEM's on-board camera technician continually monitored the imagery as it was collected to ensure data collected was fit for purpose. The camera technician would make the decision to cease data collection should conditions become unsuitable for surveying or data collection. Subsequently, the survey would then be resumed at the next earliest opportunity. All completed surveys therefore maintained conditions conducive to successful surveying.

Favourable conditions for surveying were defined as: a cloud base (lowest altitude of the visible portion of the cloud) of at least 1,300 ft, according to a geoidal model, to ensure there is no cloud below the planned altitude of the aircraft, visibility of greater than 5 km, wind speed of less than 30 knots, and sea state of 4 (moderate) or less. Naturally, the cloud base may vary in altitude, but aircraft will always fly lower than the lowest cloud level, if cloud base is lower than the planned aircraft altitude the survey would not take place. Whilst the image footprint and GSD both increase with altitude, the flight plan tolerances and focus of the camera lenses ensures no discernible differences occur within the range of altitudes potentially flown. Wind speed was recorded at the same altitude as the aircraft, whereas sea state was determined from the appearance of the sea surface recorded by the onboard aerial survey technician. The two measures therefore do not necessarily correlate. For safety reasons, no surveying can take place in icing conditions. Due to areas of high terrain, part of line 7 was planned at a higher geoidal altitude of 1,365 ft and lines 3 and 4 were split. Lines 3 and 4 are distinguishable in 4 separate sections: 3a, 3b, 4a, 4b. Lines in 3b and 4b refer to the area of the lines that overlap on their east-west axis.

Data capture comprised digital still images of an average 1.5 cm GSD. Images from each of the three cameras are processed at each node, resulting in slight variation in GSD across the swath width. GSD is smaller than 1.5 cm GSD at the nadir and increases with distance from the nadir, resulting in an average GSD of 1.5 cm. Image resolution is therefore clearest at the nadir, although the variation is small. Images were collected in a continuous transect-based design along a single line covered by three overlapping cameras, using a Global Positioning System (GPS) linked, bespoke flight management system to ensure the tracks were flown with a high degree of accuracy. The aircraft's internal GPS and Inertial Motion Unit (IMU) systems record to an accuracy of +/- 3 to 5 m as standard.

The flights occurred on the 11th of January 2024. The first aircraft surveyed lines 1 to 5 (take off at 08:47, landing at 13:56). The second aircraft surveyed lines 8 and 9 (take off at 08:40, landing at 11:38) stopping to refuel and continued with lines 6 to 8 (take off at 12:10, landing at 14:30), respectively.

The camera system captured abutting imagery along nine survey flight lines spaced approximately 22 km apart within the Survey Area (**Figure 1**). The total Survey Area was 21,594 km^2. The aircraft collected the data at an average altitude of approximately 1,463 ft (446 m) according to the ellipsoid model as recorded by GPS, equivalent to 1,301 ft (397 m) above geoidal mean sea level, and at a speed of approximately 120 knots. On line 1 and 5, there was a dark overcast. On line 1 this dark overcast,

caused by low sun angle and cloud cover above the plane, resulted in darker images being captured. These images have been reviewed post-flight by our Image Analysis team, who have deemed it of a lower quality but still suitable for image analysis. Images were collected continuously along the survey flight lines with slight overlap between image nodes. To avoid double-counting due to image overlap, all image footprints are merged into a single file, for which total area is calculated. A total of 7,833 nodes were initially captured. Of these, 7,584 were used for analysis. The difference reflects nodes removed during clipping to the boundary area. Total analysed coverage was calculated to be 3.42% generated from 7,584 image nodes. (**Table 2**). The target coverage of 3% was achieved including a redundancy of an additional 0.42%, which is over 10% contingency with respect to the target coverage.

Effort data is calculated as the area (km^2) per image footprint using trigonometric methods and the pinhole camera model (the mathematical relationship between the coordinates of a point in three-dimensional space, and its projection onto the image plane of an ideal pinhole camera). Effort is dependent on altitude, camera angle and aircraft position (pitch, roll and yaw), accounting for variation both between image nodes and individual cameras at each node. Effort data is only calculated for analysed images. It is therefore possible that some images have an effort value of zero. The effort values provided in the GPS log reflect the total footprint of each image and do not account for overlap. Therefore, summing these values for a survey would result in an overestimate of effort. The true effort for a given survey is calculated geospatially by creating polygons for each image footprint and removing the overlapping areas. Summing the analysed footprints and comparing against entire survey area gives the percentage analysed.

Imagery was captured in raw format and post-processed to ensure optimal quality for the subsequent stage of image analysis, to extract information on marine fauna or other notable occurrences. The darker imagery was processed post-flight to mitigate the effects of the dark conditions and make it the best quality for target detection and identification. Although, please note that adjustments can only be made to a certain level of improvement. When a survey was completed, data were checked to ensure the number of lines and the number of images collected was correct, and that the quality of the imagery was acceptable. Once image analysis was completed, further quality assurance (QA) processes took place (see **Section 3.3**).

Survey conditions are summarised in **Table 3**. Weather conditions are defined in **Table 4**. Weather conditions during the survey were conducive to collecting and analysing imagery for the purposes of providing data on the identification, distribution, and abundance of bird species and marine fauna within the Survey Area.

Measures were taken to minimise glint and glare, such as avoiding surveying when the sun angle had the greatest potential to impact image quality. Furthermore, data collected provided coverage of 3.42%, thus exceeding the 3% coverage required, enabling sufficient coverage to be collected should images be affected by glint or glare.

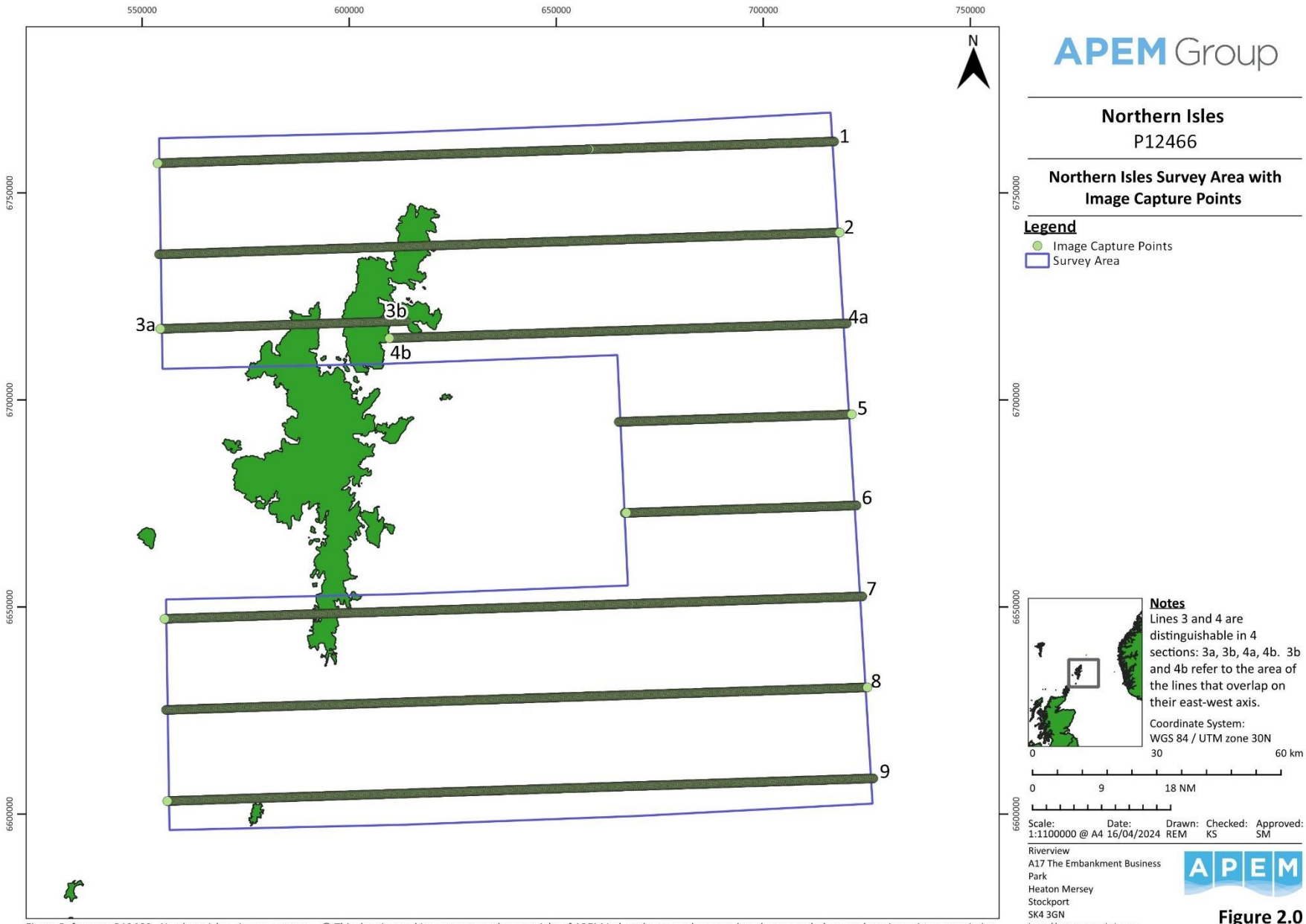

Figure 2 Individual image capture points during the January 2024 (January 2024) survey.

Table 1 Lateral and vertical camera tolerances (m). A 'cutout' is the process of automatically aborting data capture. Should this occur, the plane is required to revisit and resurvey the affected section of the survey line.

Survey Tolerances	Warning	Cutout	
Lateral Tolerance	30	60	m
Vertical tolerance	15	30 (No auto cutout)	m

Table 2 Image capture and other observations during the January 2024 seasonal survey (January 2024).

Survey line	Transect length (km)	N cameras capturing image	N image nodes (captured)	N image nodes (analysed)	Camera issues*	Shipping observations	Anecdotal observations	Health and Safety
1	162.48	3	1,144	1,135	-	-	**Dark overcast	-
2	163.48	3	1,151	1,097	-	-	-	-
3***	58.79	3	416	299	-	-	-	-
4***	109.55	3	773	768	-	-	-	-
5	55.20	3	394	387	-	-	**Dark overcast	-
6	55.90	3	396	389	-	-	-	-
7	167.62	3	1,180	1,144	-	-		-
8****	168.48	3	1,186	1,179	-	-	-	-
9	169.49	3	1,193	1,186	-	Cargo vessel	-	-

*Due to the vast number of capture points collected during a survey it is not uncommon for camera systems to sometimes miss capture points. Typically, the number of missed capture points is low and random across the site. APEM collected additional data to ensure the required coverage was captured. Additionally, APEM's onboard camera technician monitored data as it was being captured. Surveys are aborted or lines re-surveyed if camera issues impact data collection.

**Dark overcast on line 1 and 5. Line 1 captured darker images due to the low sun angle and cloud cover. These images have been checked post-flight and have been deemed suitable for image analysis.

***Thirty image nodes each from line 3 and 4 overlapped on their 3b and 4b subsections, on the east-west axis (**Figure 2**). However, they were offset from each other on the north-south axis so that image nodes were not repeated.

****On the first attempt, line 8 was partially surveyed due to the aircraft needing refuelling. The air crew returned to line 8 once the aircraft was refuelled, and the remaining nodes were successfully captured. All details for line 8 within this report refer to the combination of the two capture events.

Table 3 Survey conditions during the January 2024 seasonal survey (January 2024).

Survey line	Date	Time (UTC) on line (Start / End)	Ground speed (knots)	Cloud cover (%)	Visibility (km)	Outside temperature (°C)	Wind speed (knots)	Wind direction	Sea state (Douglas)	Turbidity
1	11/01/2024	12:44 / 13:26	118	100	>10	4	20	340	2	2
2	11/01/2024	11:53 / 12:36	118	100	>10	4	20	340	2	1
3	11/01/2024	11:32 / 11:48	119	100	>10	4	21	350	2	2
4	11/01/2024	10:59 / 11:28	118	100	>10	4	21	350	2	2
5	11/01/2024	10:37 / 10:52	129	100	>10	4	21	350	1	1
6	11/01/2024	13:02 / 13:17	123	100	>10	3	24	0	3	2
7	11/01/2024	13:33 / 14:18	125	100	>10	3	24	0	3	2
8	11/01/2024	11:22 / 11:32, 12:16 / 12:49	118, 121	100	>10	3-4	18-19	340-350	2-3	1-2
9	11/01/2024	10:28 / 11:14	122	100	>10	4	24	0	3	1-2

Table 4 Explanation of weather conditions.

Wind (Beaufort Scale)			Douglas Sea State			Cloud cover (%)		Turbidity	
Scale	**Description**	**Mean wind speed (knots)**	**Scale**	**Description**	**Wave height**	**% Cover**	**Description**	**Scale**	**Description**
0	Calm	0	0	Calm (glass)	No wave	0	Clear	0	Clear
1	Light air	2	1	Calm (rippled)	0 – 0.10 m	1-10	Few	1	Slightly Turbid
2	Light breeze	5	2	Smooth	0.10 – 0.50 m	11-50	Scattered	2	Moderately Turbid
3	Gentle breeze	9	3	Slightly Moderate	0.50 – 1.25 m	51-95	Broken	3	Highly Turbid
4	Moderate breeze	13	*Surveys not typically flown at sea states > 3.*			Overcast	96-100		
5	Fresh breeze	19	4	Moderate	1.25 – 2.50 m				
6	Strong breeze	24							
7	Near gale	30							
8	Gale	37							

3.2 Species Identification

The images were analysed to enumerate birds and marine mammals to species level where possible. Targets identified from the images were 'snagged' (i.e., located within the images) and categorised.

There were occasions when it was not possible to identify an individual in the digital aerial survey imagery to the species level and the individual was therefore identified as belonging to a higher-level taxonomic group (e.g., 'small gull species' or 'dolphin / porpoise species'). The possible groups and the individual species attributed to them are listed in **Table 5** for birds and **Table 6** for marine mammals.

Table 5 Avian species included higher-level taxonomic groups for the January 2024 seasonal survey period (January 2023).

<table>
<tr><th>Species</th><th>Group Level 1</th><th>Group Level 2</th><th>Group Level 3</th><th>Group Level 4</th></tr>
<tr><td>Common Eider</td><td colspan="2">-</td><td>Wildfowl species</td><td rowspan="15">Unidentified Bird species</td></tr>
<tr><td>Curlew</td><td colspan="3">Wader species</td></tr>
<tr><td>Kittiwake</td><td colspan="2" rowspan="2">Small Gull species</td><td rowspan="5">Gull species</td></tr>
<tr><td>Common Gull</td></tr>
<tr><td>Greater Black-backed Gull</td><td>Black-backed Gull species</td><td rowspan="3">Large Gull species</td></tr>
<tr><td>Glaucous Gull</td><td></td></tr>
<tr><td>Herring Gull</td><td></td></tr>
<tr><td>Little Auk</td><td colspan="2" rowspan="5">Auk species</td><td rowspan="5"></td></tr>
<tr><td>Guillemot</td><td rowspan="2">Guillemot or Razorbill</td></tr>
<tr><td>Razorbill</td></tr>
<tr><td>Black Guillemot</td><td></td></tr>
<tr><td>Puffin</td><td colspan="2"></td></tr>
<tr><td>Red-throated Diver</td><td colspan="3" rowspan="2">Diver species</td></tr>
<tr><td>Great northern Diver</td></tr>
<tr><td>Fulmar</td><td colspan="3">Fulmar / Gull species</td></tr>
<tr><td>Gannet</td><td colspan="4"></td></tr>
<tr><td>Hooded crow</td><td colspan="3">Corvid</td><td></td></tr>
</table>

Table 6 Marine mammal species included within higher-level taxonomic groups for the January 2024 seasonal survey period (January 2024).

Species	Group Level 1	Group Level 2
Risso's Dolphin	Dolphin species	Dolphin / Porpoise
White-beaked Dolphin		

3.3 Summary of Quality Assurance

Internal QA was carried out on the data collected during the survey. This consists of two steps:

The first step in the QA process, referred to as Blank QA (Image Screening QA), reviewed percentage agreement between two sets of analysts for images identified as positive (containing at least one target of interest) and those identified as blank (not containing any targets of interest). A random sample of 20% of the survey imagery were subjected to a QA audit review, in which agreement in positive images should reach 90% agreement versus the main analysis of the whole survey. Where 90% agreement was not reached, a complete re-analysis of the survey data was undertaken. This consists of analysing each image from the survey again, and extra positives from the re-analysis and QA audit are included in the data. For the current survey, the initial image agreement was 97%. No re-analysis was required on this occasion.

Prior to the second step in the QA process, the tagged data underwent initial data checks, which are a series of discretionary sense checks carried out by QA Analysts. No fixed metrics are associated with these checks, this step provides an additional layer of checks to ensure the tagged data is as accurate as possible. This process involves sense checking tagged images for missed targets such as images or areas containing large aggregations of birds, pods of marine mammals and anthropogenic structures. A selection of images was checked for accuracy in target duplication and a sample of blank images were also checked for potential missed targets around busy areas of the survey.

The second step of the QA process, referred to as Species ID QA, reviewed species identifications. Target (snag) identifications made by Image Analysts were reviewed by our dedicated QA team and an agreement rate determined. If the original identification made by the Image Analyst matched that made by the QA Analyst, this was considered an agreement. Agreement was also made if the original and the QA identifications were both within the same taxonomic grouping, for example an initial identification of guillemot / razorbill, and a QA identification as guillemot. This method was adopted by BTO's method of species identification QA. As the current standard, 100% of the identifications were checked to ensure data accuracy. All data underwent a final review by a Technical Specialist. For the current survey, the identification agreement rate was 97% for all snags recorded. Additional checks on behaviour, age, sex and flight height suitability were also reviewed.

3.4 Species Distribution Maps

Each animal recorded during the surveys was geo-referenced, enabling locations to be related to the boundary of the Survey Area. Corresponding coordinates for each observation were accurate to ±/- 3 to 5 m. Spatial distribution maps for birds and other marine megafauna within the Survey Area have been produced using QGIS by separating individual species records during the surveys and representing these as symbols on a map. Symbols are determined by the species group, with a relevant icon and a unique colour assigned on a per species basis, the latter of which allows for a differentiation across the board between species that use the same icon. Icons in the distribution map will appear to overlap when individuals recorded during the surveys are in close proximity to each other.

3.5 Species Flight Height

Bird flight heights were estimated from the digital still images. using a size-based methodology developed by APEM from techniques described by Johnston and Cook (2016)[1]. They were determined using bespoke APEM software that applies a set of rules developed in-house and trigonometry to provide an estimate of flight height above mean sea level (MSL). The accuracy of the application of the trigonometric rules varies depending on the size and position of the bird. The trigonometric calculation is based on species-specific bird measurements (based on reference lengths taken from the literature), image GSD (the distance between pixel centres), the known height of the aircraft as the image was taken, and the pitch, roll, and yaw of the aircraft. These parameters are entered into APEM's flight height calculator to estimate the height of each individual bird captured in survey images. Flight height estimates are less reliable for birds that are diving or turning sharply (this affects the measurement of body length and wingspan from the image) or other aspects that may affect the body length measurement. Such birds are removed from the sample used to calculate flight heights. Flight height data is included within the separate raw data files.

[1] Johnston, A. and Cook, A.S.C.P., 2016. *How High Do Birds Fly?: Development of Methods and Analysis of Digital Aerial Data of Seabird Flight Heights*. British Trust for Ornithology.

4. Abundance and distribution

4.1 Abundance

A total of 4,571 birds were recorded in the Survey Area during the January 2024 seasonal (January 2024) survey. Of those, 2,795 were in flight, 1,768 were in sitting on the water, 5 were perched and 3 were deceased (**Table 7**)**.**

A total of 8 marine mammals were recorded in the Survey Area (**Table 8**). Scientific names and taxonomy of species recorded are provided in **Appendix I Scientific Names and Taxonomy**.

Table 7 Total number of individuals of birds by species or species group recorded during the January 2924 seasonal survey period (January 2024).

Species Group	Species	Flying	Sitting	Perched	Diving	Taking off	Deceased	Total
Wildfowl	Common Eider	-	4	-	-	-	-	**4**
Waders	Curlew	35	-	-	-	-	-	**35**
Gulls	Kittiwake	81	28	-	-	-	-	**109**
	Common Gull	2	-	-	-	-	-	**2**
	Small gull species	-	1	-	-	-	-	**1**
	Great Black-backed Gull	46	81	1	-	-	-	**128**
	Glaucous gull	-	1	-	-	-	-	**1**
	Herring Gull	37	1	3	-	-	-	**41**
	Large Gull species	1	6	-	-	-	-	**7**
	Gull species	1	-	-	-	-	-	**1**
Auk	Little Auk	-	1	-	-	-	-	**1**
	Guillemot*	1	111	-	-	-	-	**112**
	Razorbill*	-	70	-	-	-	-	**70**
	Guillemot / Razorbill	-	774	-	-	-	-	**774**
	Black Guillemot	-	66	-	-	-	-	**66**
	Puffin	-	13	-	-	-	-	**13**
	Auk species	-	58	-	-	-	-	**58**
Diver	Red-throated Diver	-	1	-	-	-	-	**1**
	Great Northern Diver	-	1	-	-	-	-	**1**
	Diver species	-	2	-	-	-	-	**2**
Fulmar	Fulmar	2,523	426	-	-	-	-	**2,949**
Fulmar / Gull	Fulmar / Gull species	-	1	-	-	-	-	**1**
Gannet	Gannet	59	111	-	-	-	2	**172**
Cormorant or Shag	Cormorant / Shag	3	1	1	-	-	-	**5**
Corvid	Hooded crow	1	-	-	-	-	-	**1**

Species Group	Species	Flying	Sitting	Perched	Diving	Taking off	Deceased	Total
Unidentified Bird species	Unidentified Bird species	5	10	-	-	-	1	**16**
Total		**2,795**	**1,768**	**5**	**-**	**-**	**3**	***4,571***

* Please note, January is one of the most difficult months to distinguish between guillemots and razorbills due to the similarities in their winter plumage. Identification rates tend to be lower in this month as we do not feel confident identifying to species level in a lot of cases. Additionally, auk identification is also subject to lighting and image quality. The darker imagery captured may have affected identification rates in some cases.

Table 8 Total number of individuals of marine megafauna by species or species group recorded during the January 2024 seasonal survey period (January 2024).

Species Group	Species	Deeply Submerged*	Submerged**	Surfacing	Bottling***	Hauled Out	Deceased	Total
Seal	Seal species	-	-	-	-	1	-	**1**
Dolphin	Risso's Dolphin	-	1	-	-	-	-	**1**
	White-beaked Dolphin	-	3	-	-	-	-	**3**
Dolphin / Porpoise	Dolphin / Porpoise	-	1	2	-	-	-	**3**
Total		**-**	**5**	**2**	**-**	**1**	**-**	***8*******

*The target is far beneath the surface so that many features are difficult to distinguish. Deeply submerged targets may be difficult to identify to species level.

**The target is wholly underwater, within the first few metres of the surface. Features use to aid identification are usually visible.

***Applies to seals, where the head is positioned above the surface and the rest of the body is submerged vertically.

****Please note, marine mammal detection rates are dependent on lighting, water clarity and sea state. It is likely that the lower image quality in the darker images may have reduced the ability to detect submerged and deeply submerged marine mammals.

4.2 Spatial Distribution

Figure 3 and **Figure 4** show the locations of all birds and marine megafauna, respectively, recorded in the Survey Area. Birds were recorded across the Survey Area. Marine mammals were scattered across the Survey Area, with the majority of records in the north. **Figure 5** to **Figure 15** show distributions of more abundant birds by species, whilst **Figure 16** shows the distribution of less frequently recorded bird species**. Figure 17** shows distribution of vessels and abiotic structures in the Survey Area.

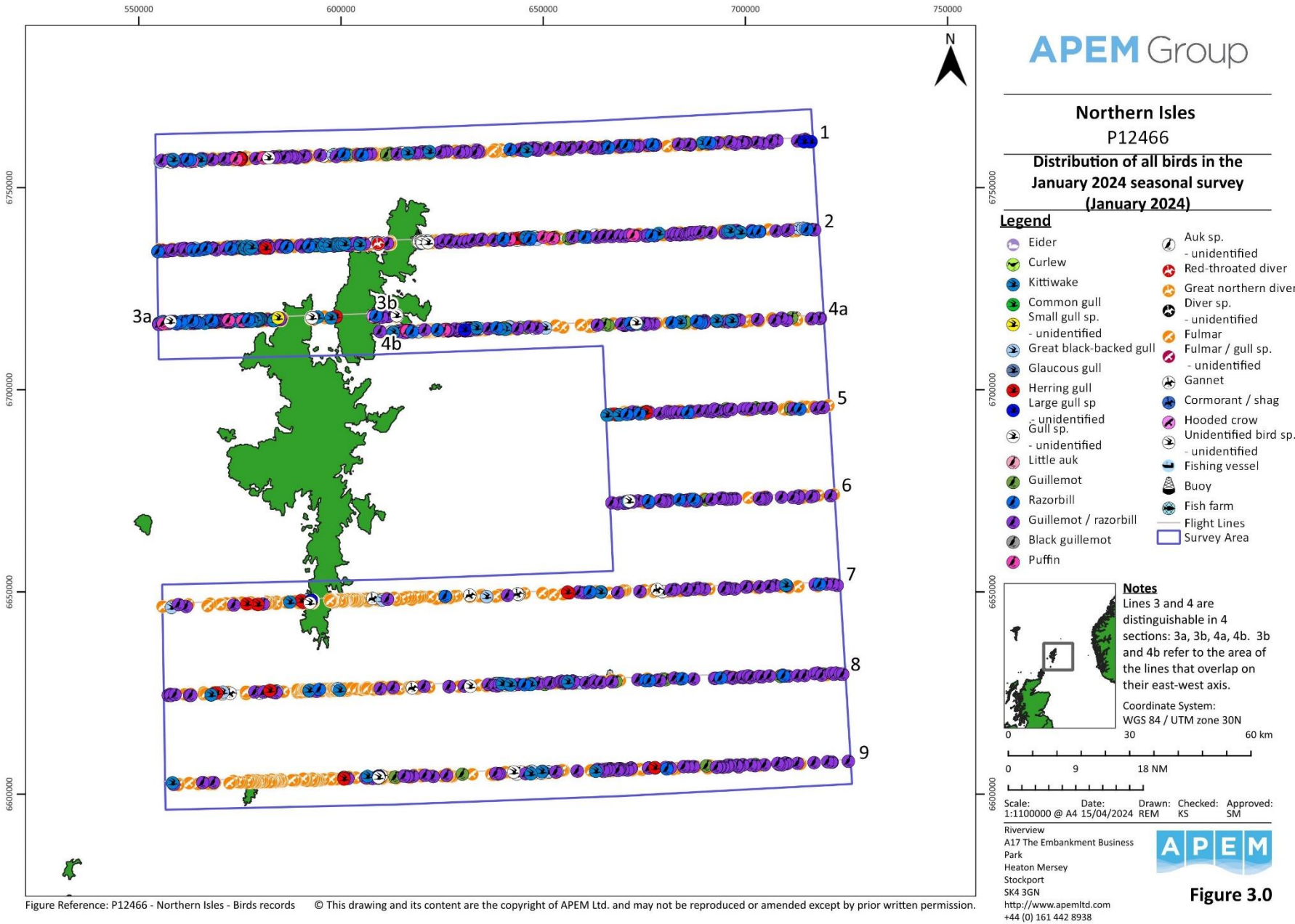

Figure 3 Distribution of all birds recorded in the January 2024 seasonal survey (January 2024).

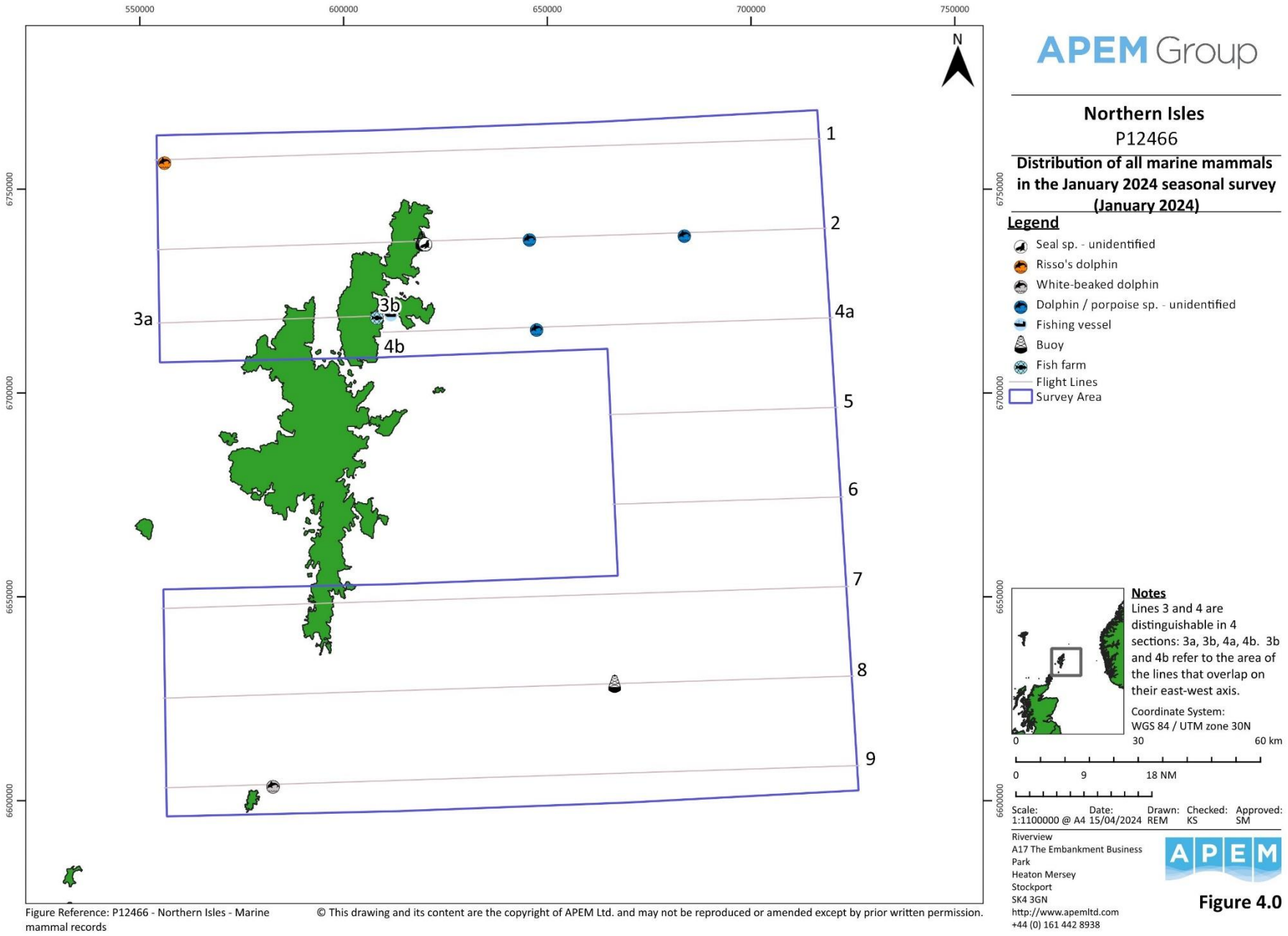

Figure 4 Distribution of all marine megafauna recorded in the January 2024 seasonal survey (January 2024).

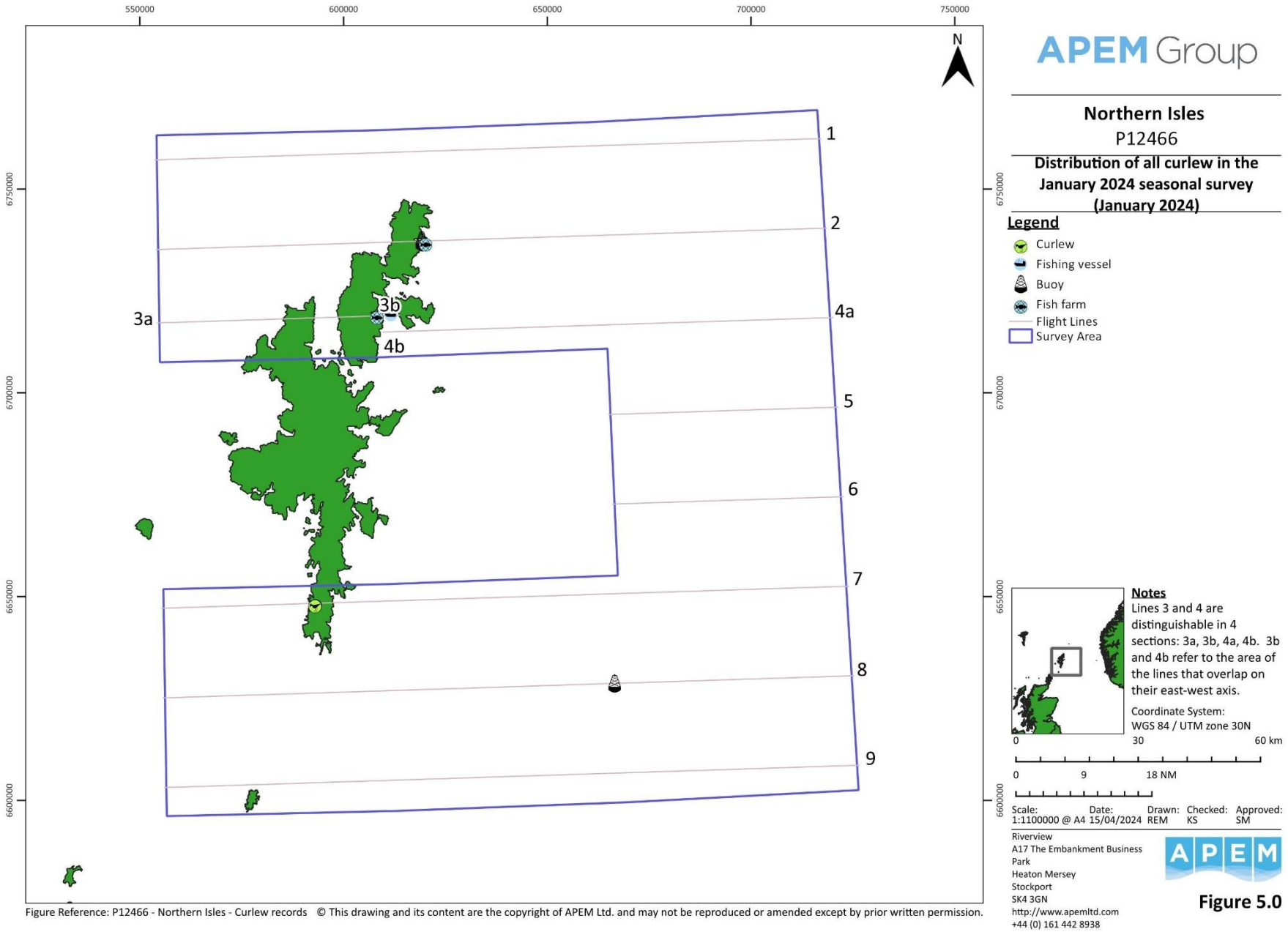

Figure 5 Curlew distribution recorded in the January 2024 seasonal survey (January 2024).

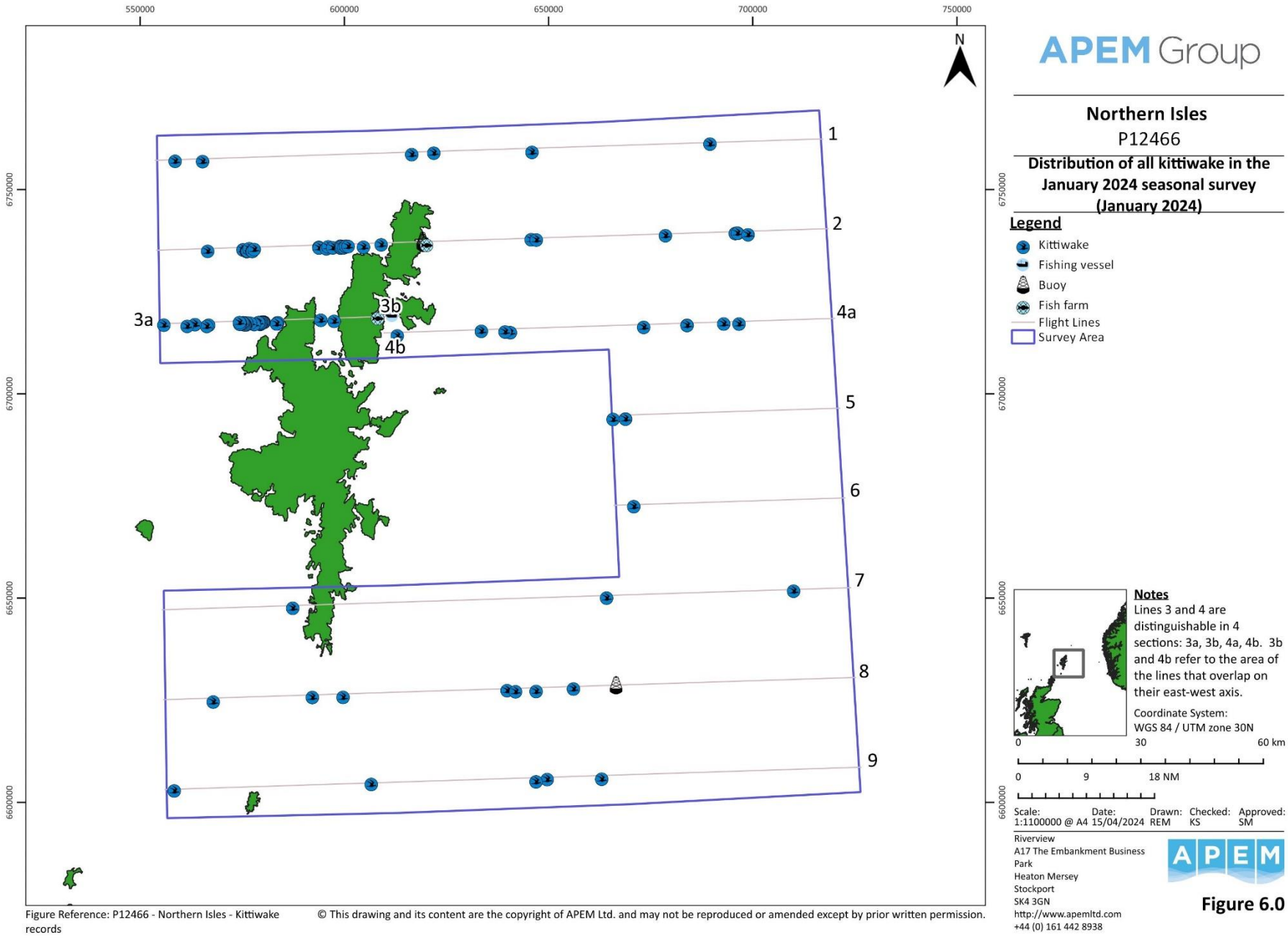

Figure 6 Kittiwake distribution recorded in the January 2024 seasonal survey (January 2024).

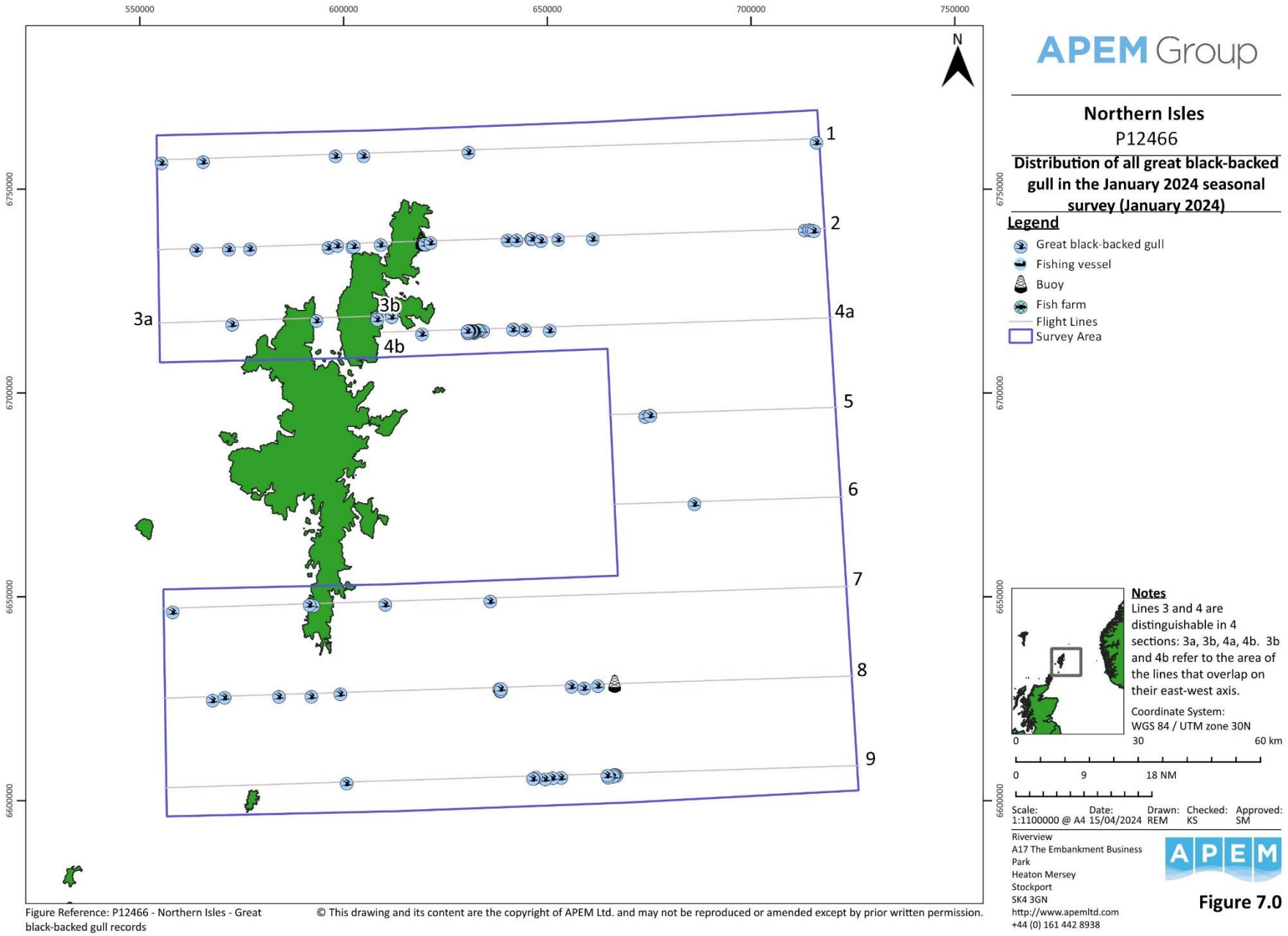

Figure 7 Great black-backed gull distribution recorded in the January 2024 seasonal survey (January 2024).

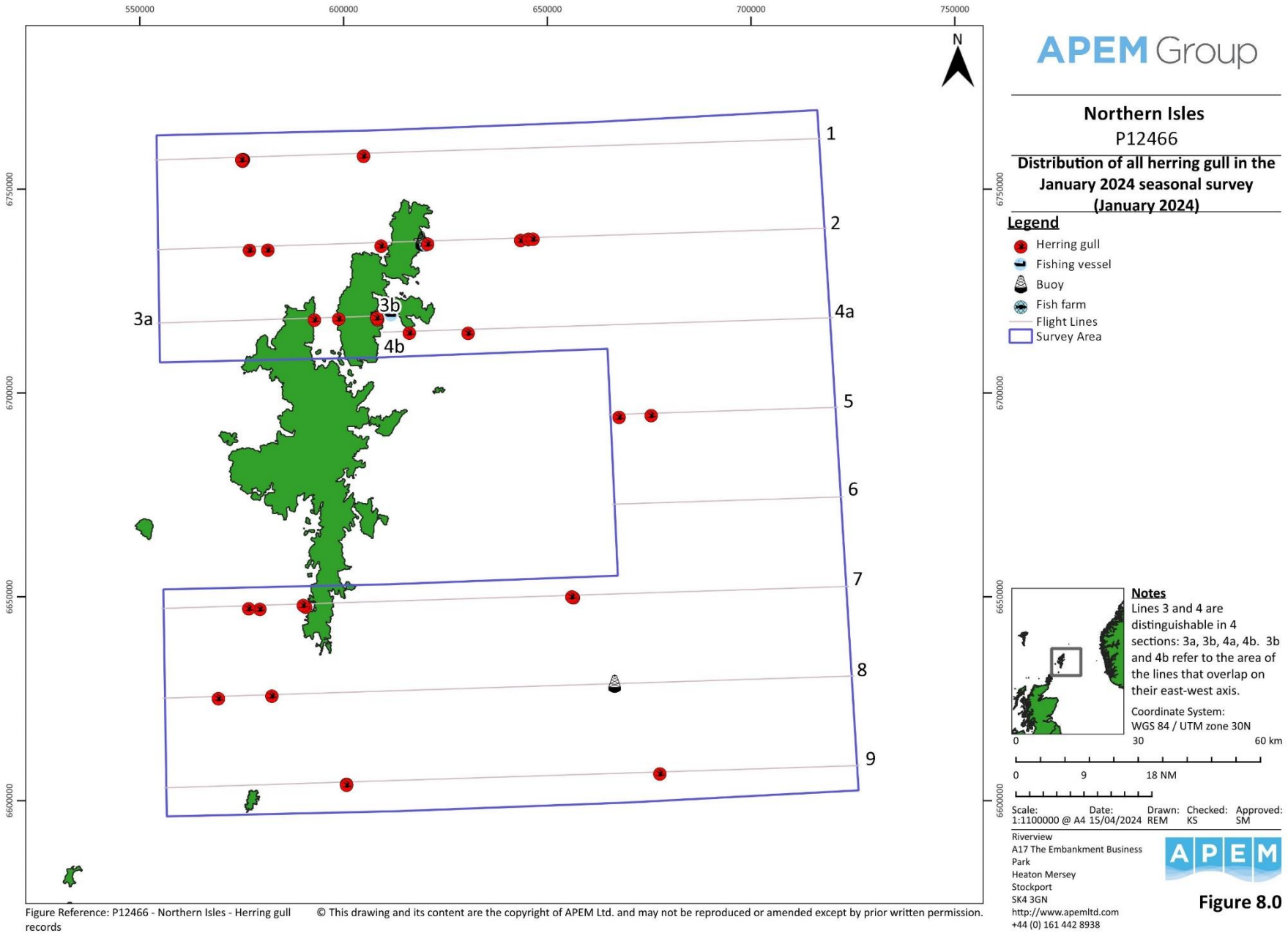

Figure 8 Herring gull distribution recorded in the January 2024 seasonal survey (January 2024).

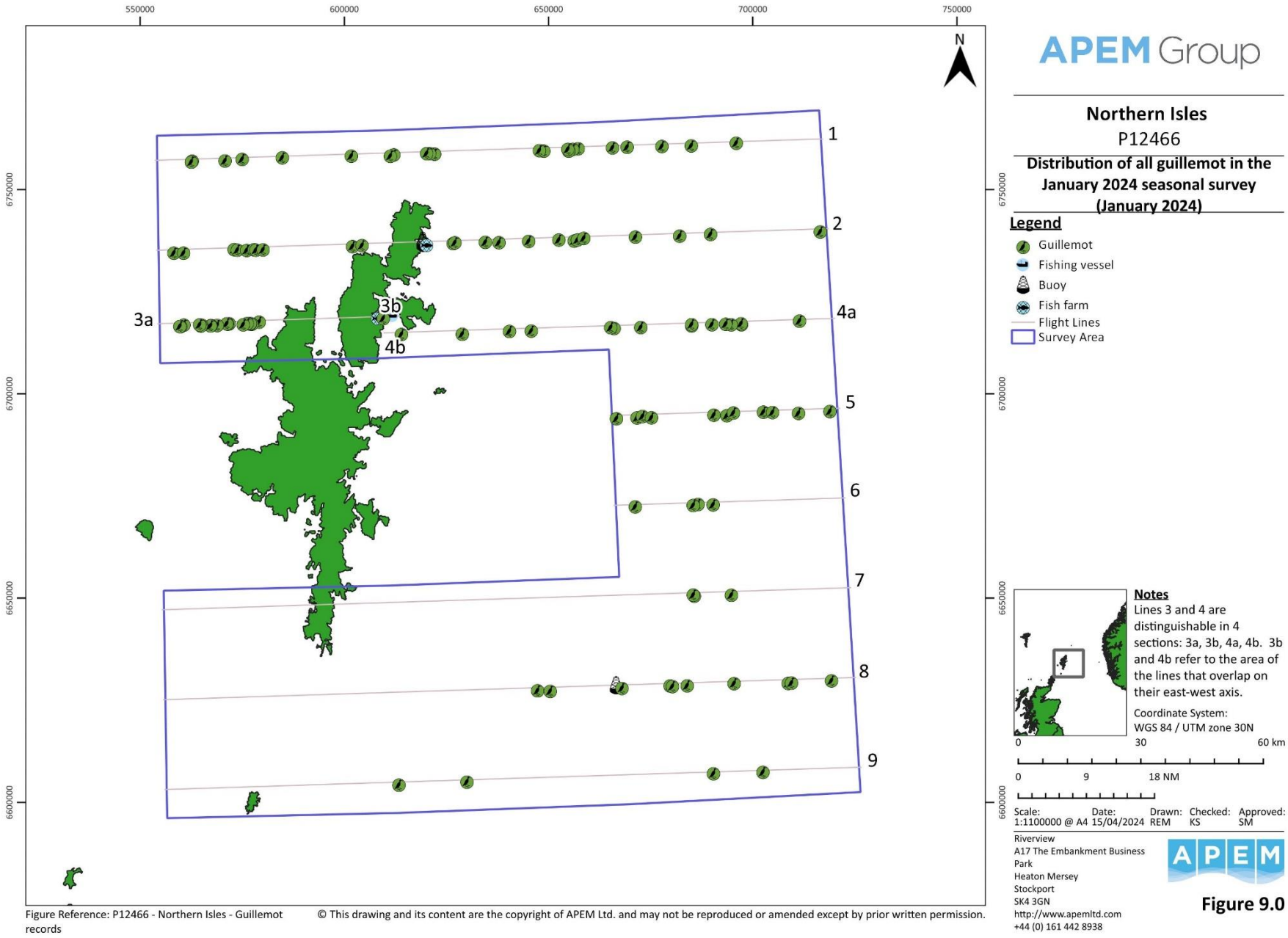

Figure 9 Guillemot distribution recorded in the January 2024 seasonal survey (January 2024).

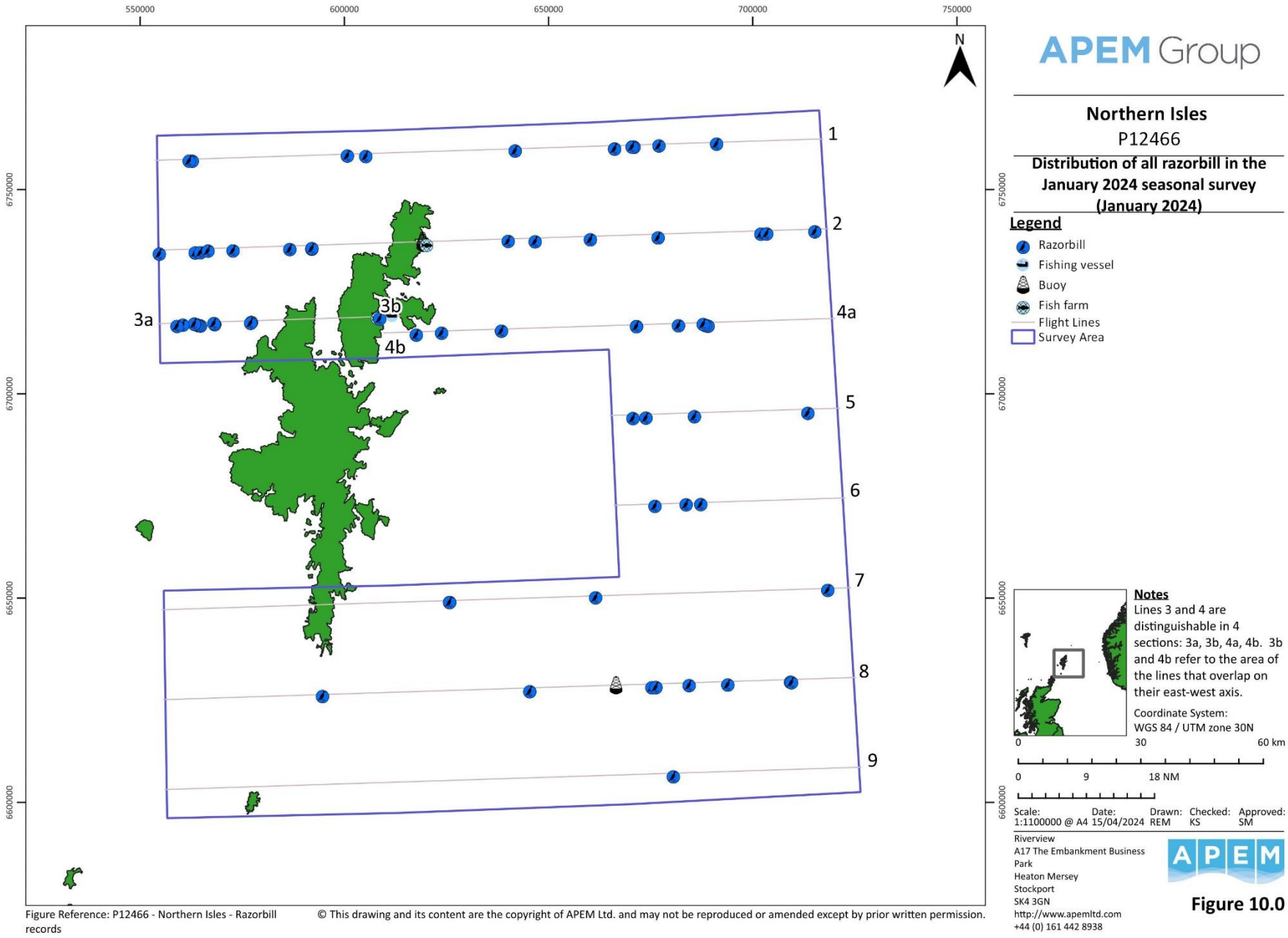

Figure 10 Razorbill distribution recorded in the January 2024 seasonal survey (January 2024).

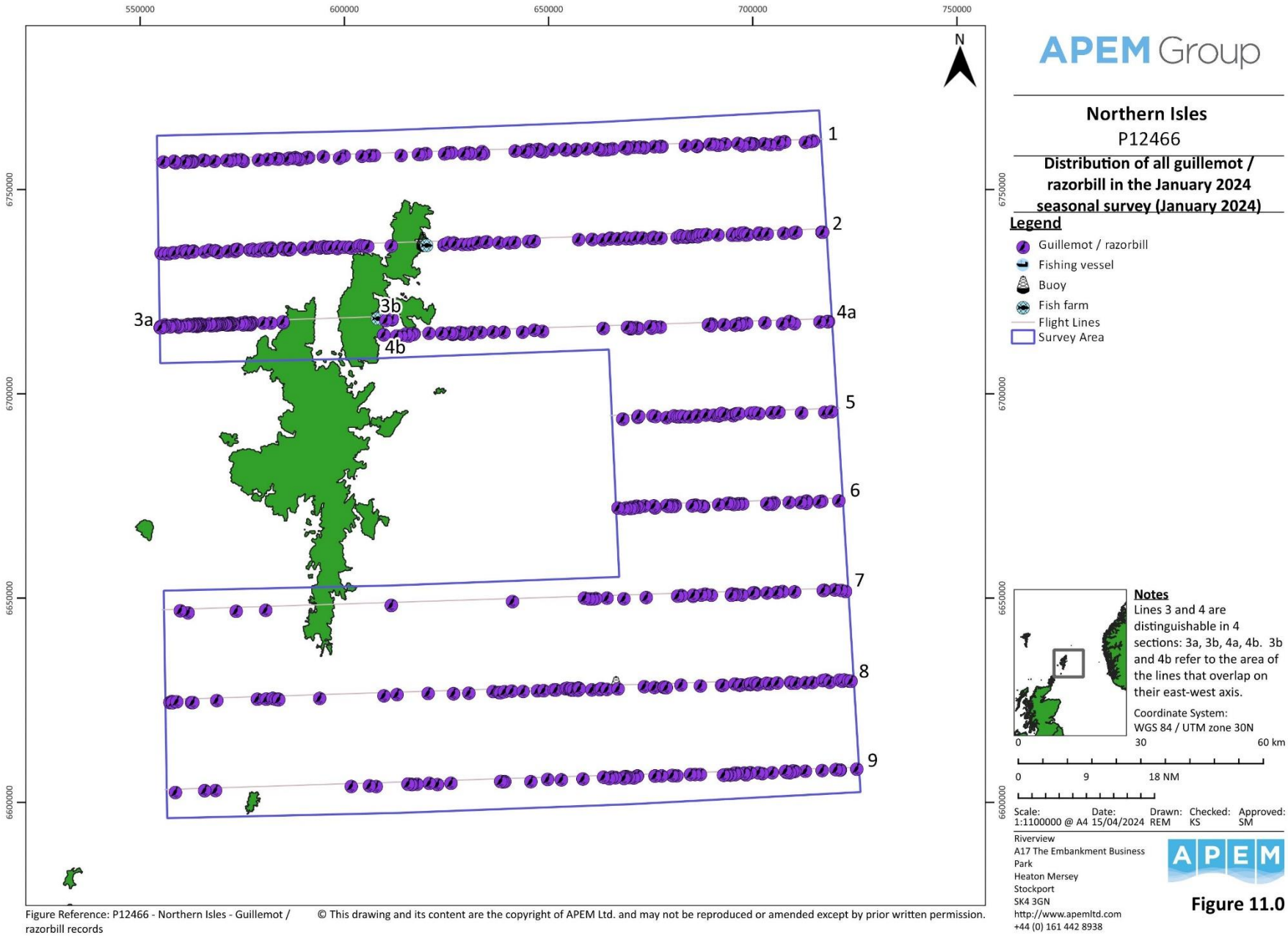

Figure 11 Guillemot / razorbill distribution recorded in the January 2024 seasonal survey (January 2024).

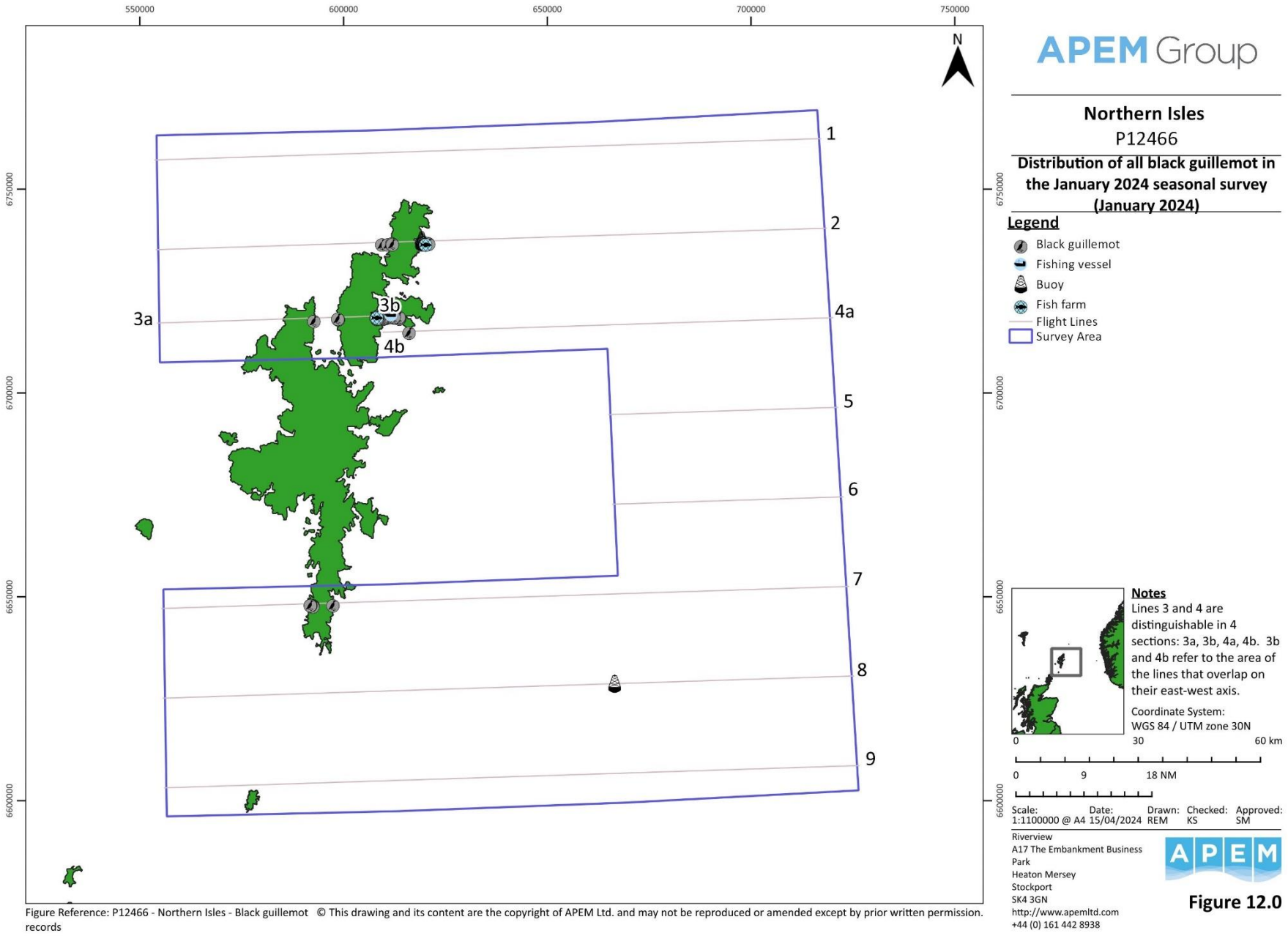

Figure 12 Black guillemot distribution recorded in the January 2024 seasonal survey (January 2024).

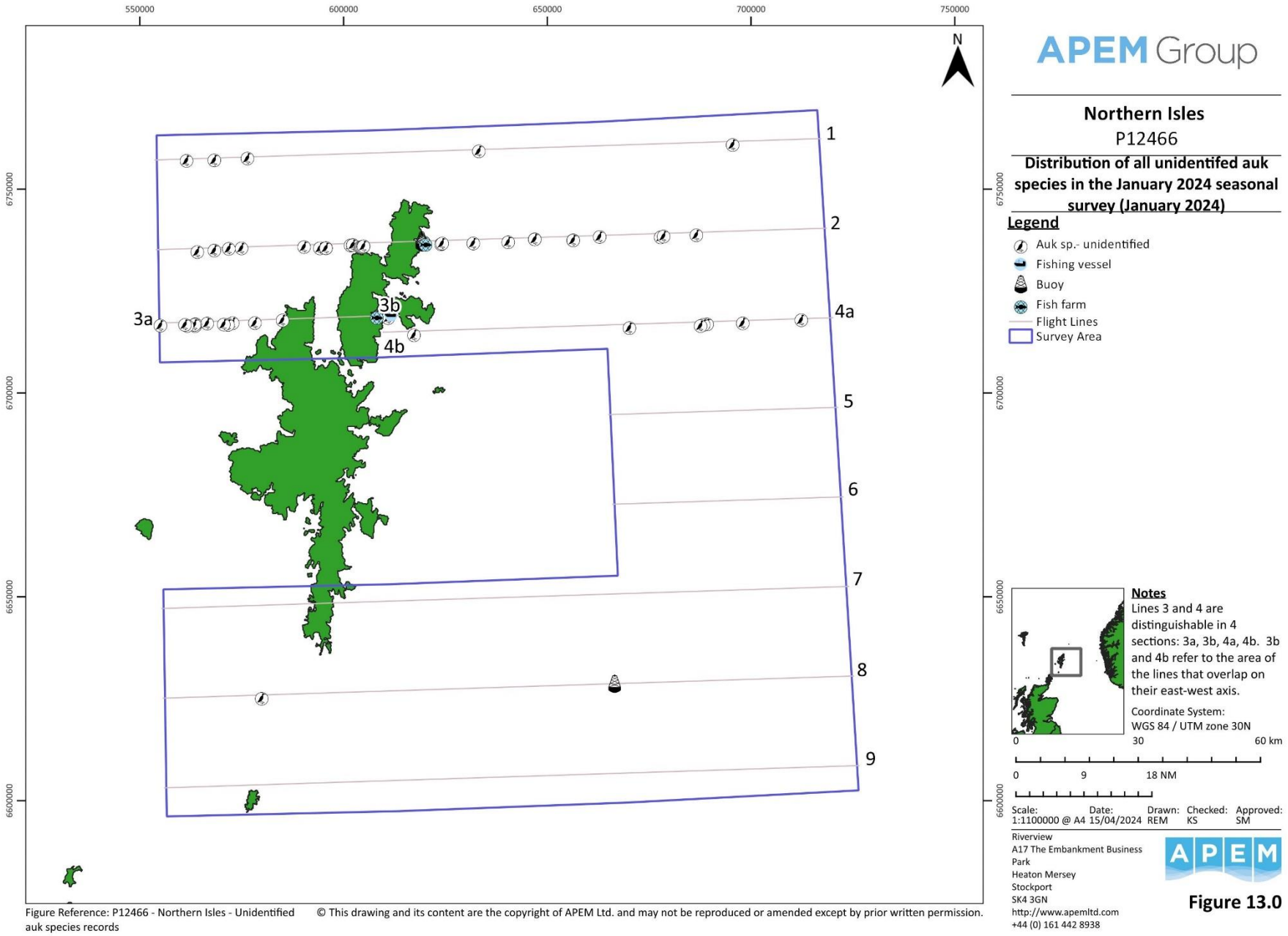

Figure 13 Unidentified auk species distribution recorded in the January 2024 seasonal survey (January 2024).

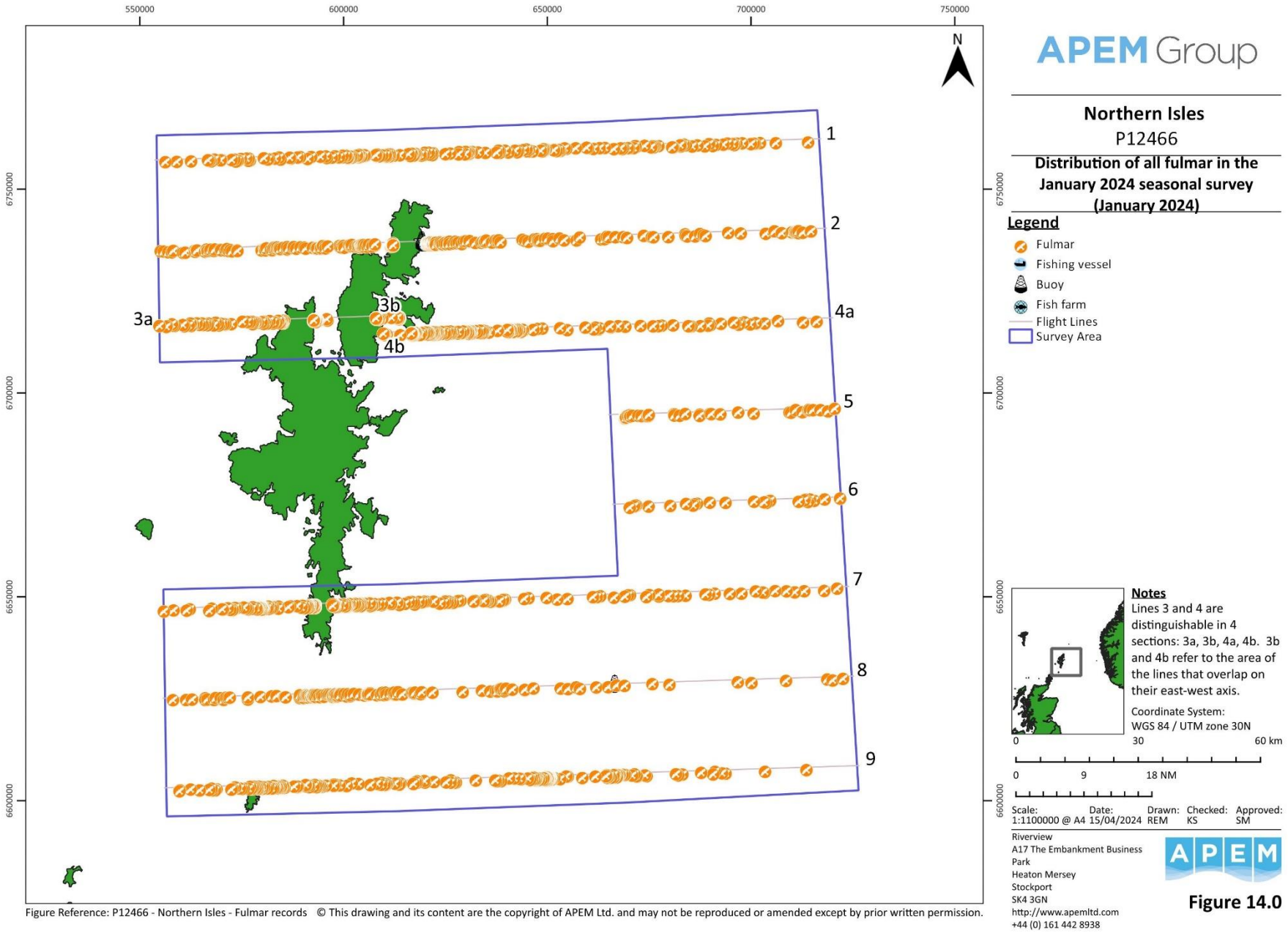

Figure 14 Fulmar distribution recorded in the January 2024 seasonal survey (January 2024).

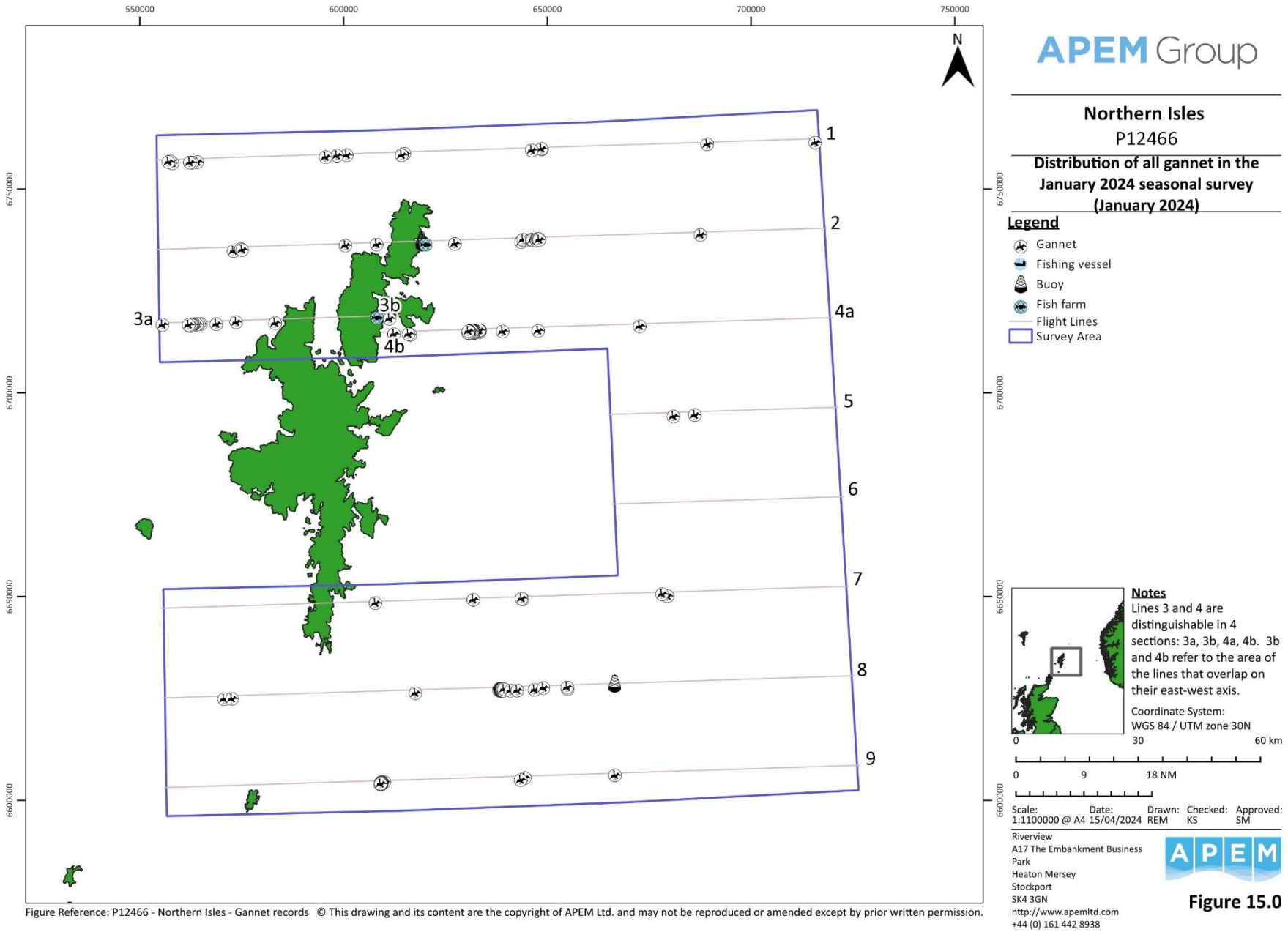

Figure 15 Gannet distribution recorded in the January 2024 seasonal survey (January 2024).

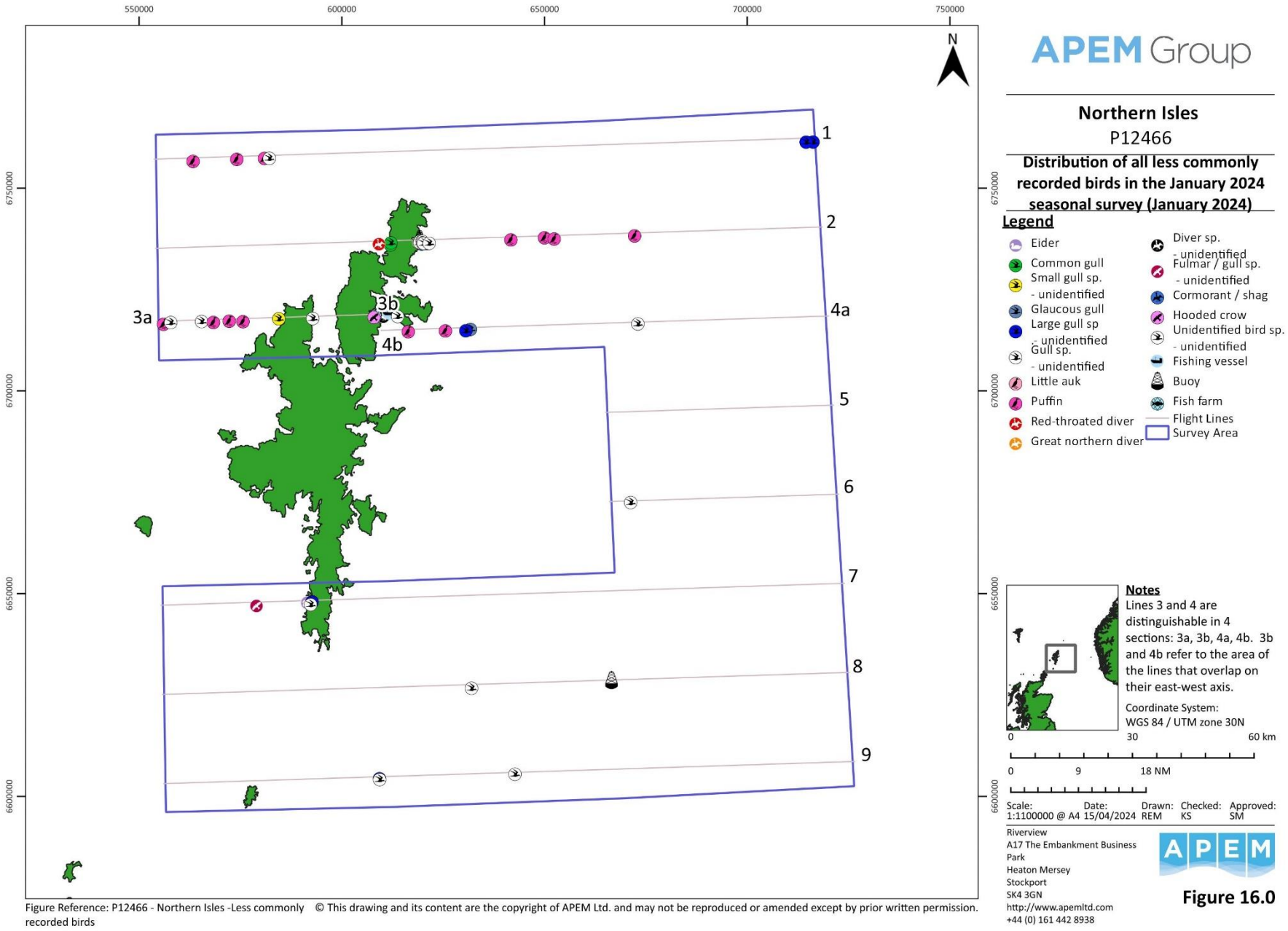

Figure 16 Distribution of less abundant birds in the January 2024 seasonal survey (January 2024).

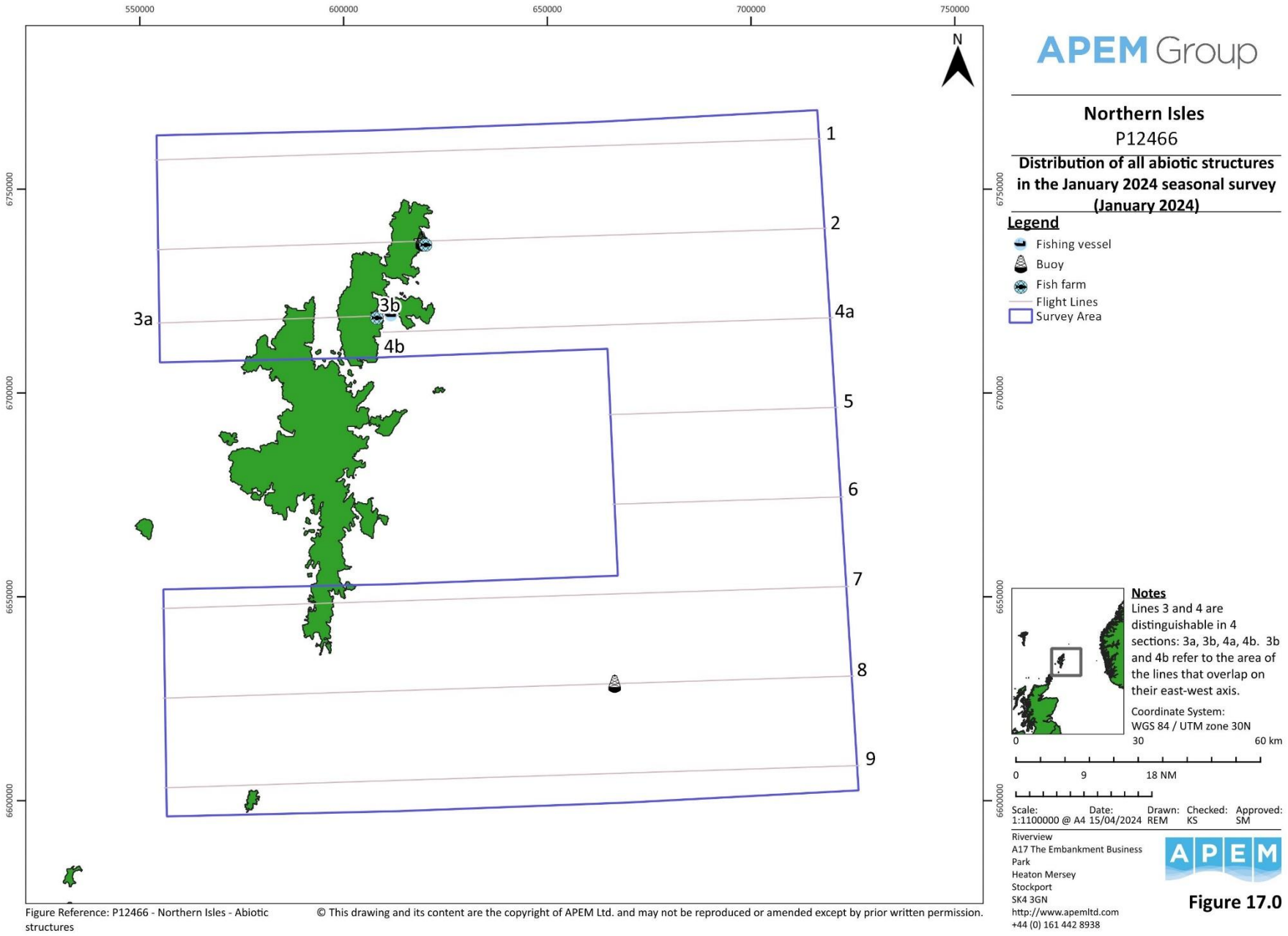

Figure 17 Distribution of abiotic structures and vessels recorded in the January 2024 seasonal survey (January 2024).

5. Abiotic Structures and Observations

The following abiotic structures were observed within the imagery:

Two buoys and a fish farm were present on line 2; another fish farm was present on line 3a; another buoy was present on line 8; and a single fishing vessel was present on line 3b. The fishing vessel was observed heading toward the south.

In addition, a cargo vessel was sighted at 10:43 during the survey, near to line 9. The cargo vessel was not captured in imagery.

Appendix I Scientific Names and Taxonomy

Scientific names and taxonomy for all species can be found in the below appendix.

Species	Scientific Name
Common Eider	*Somateria mollissima*
Curlew	*Numenius Arquata*
Kittiwake	*Rissa tridactyla*
Common Gull	*Larus canus*
Great Black-backed Gull	*Larus marinus*
Glaucous Gull	*Larus hyperboreus*
Herring Gull	*Larus argentatus*
Little Auk	*Alle alle*
Guillemot	*Uria aalge*
Razorbill	*Alca torda*
Black Guillemot	*Cepphus grylle*
Puffin	*Fratercula arctica*
Red-throated Diver	*Gavia stellata*
Great Northern Diver	*Gavia immer*
Fulmar	*Fulmarus glacialis*
Gannet	*Morus bassanus*
Hooded Crow	*Corvus cornix*
Risso's Dolphin	*Grampus griseus*
White-beaked Dolphin	*Lagenorhynchus albirostris*

Appendix II Example images (snags) of birds and marine mammals

Images are jpeg files of a lower resolution than those used by image analysts when performing identifications.

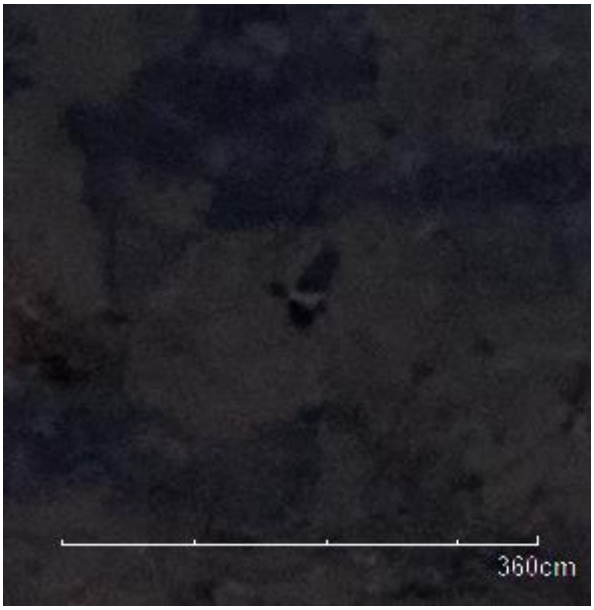

Figure 18 Hooded crow in flight.

Figure 19 Curlew in flight over foamy sea.

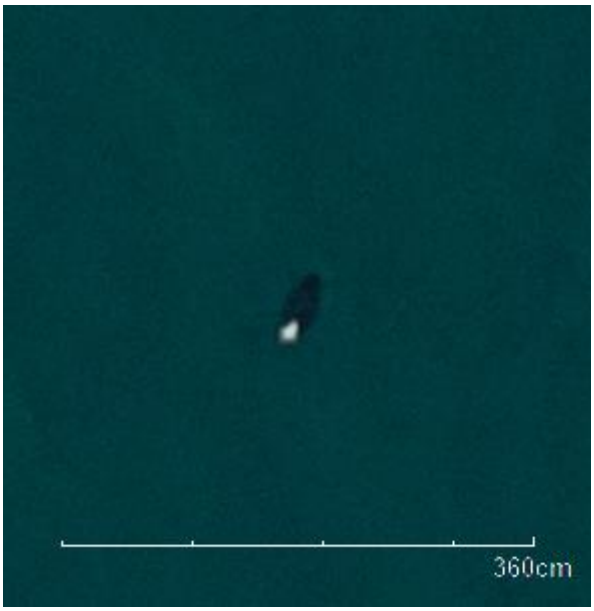

Figure 20 Great northern diver.

Figure 21 Gannet in flight.

Figure 22 Fulmar in flight.

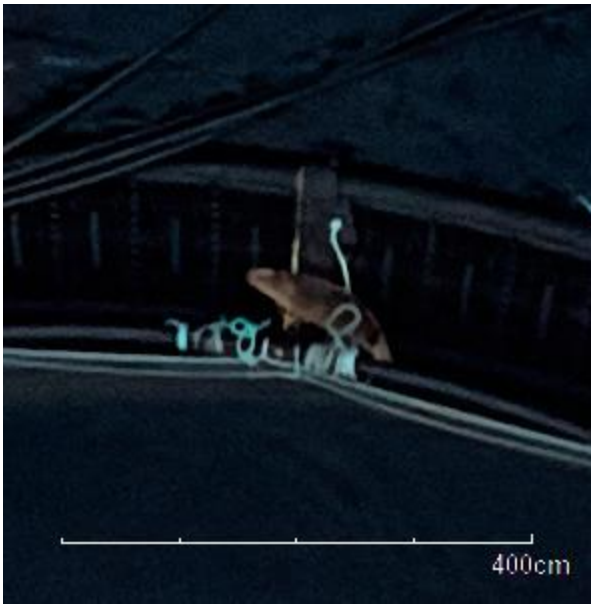

Figure 23 Seal species on holding pen of a fish farm.

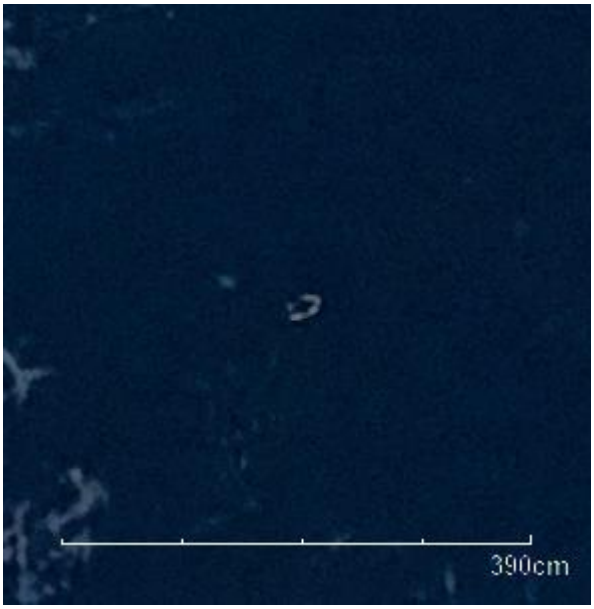

Figure 24 Guillemot / razorbill.

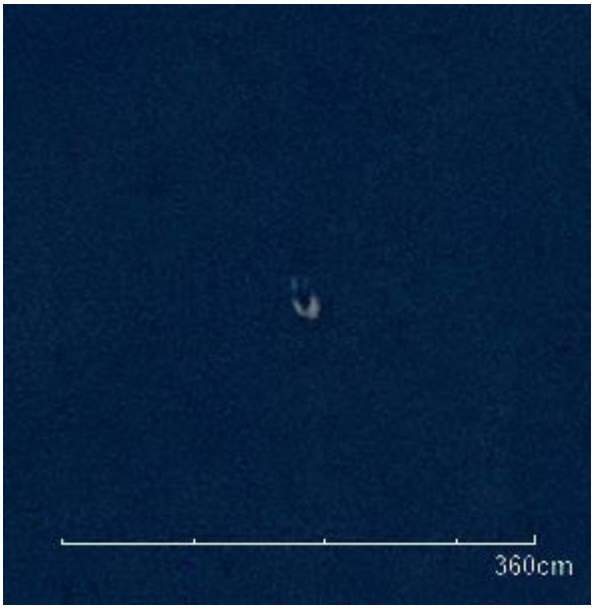

Figure 25 Guillemot / razorbill.

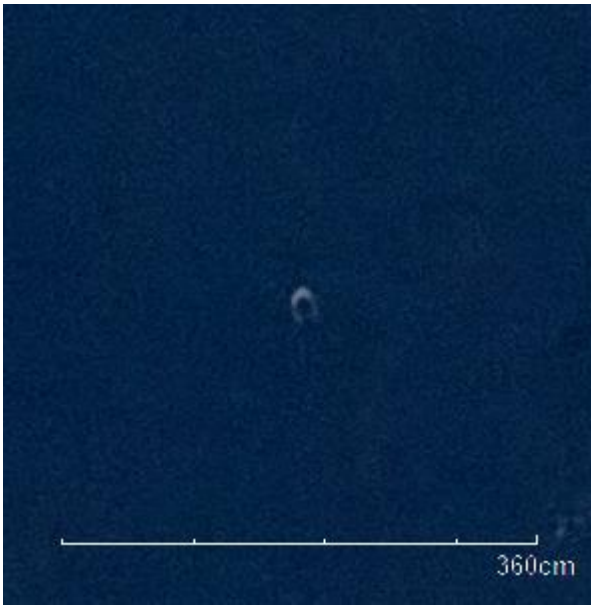

Figure 26 Guillemot / razorbill.

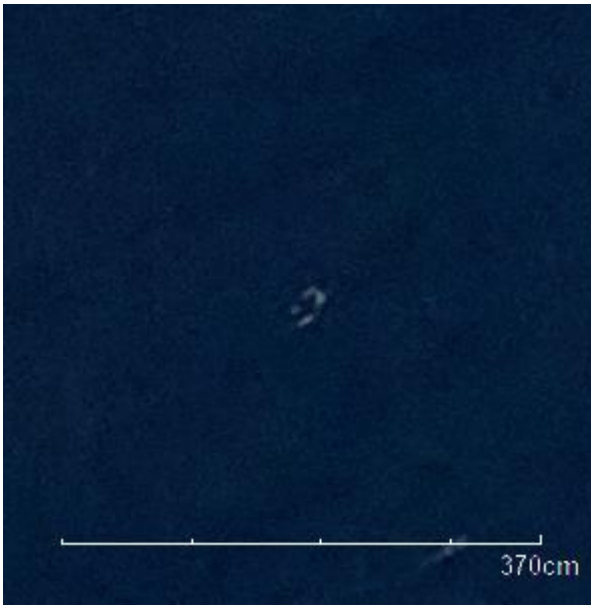

Figure 27 Guillemot / razorbill.

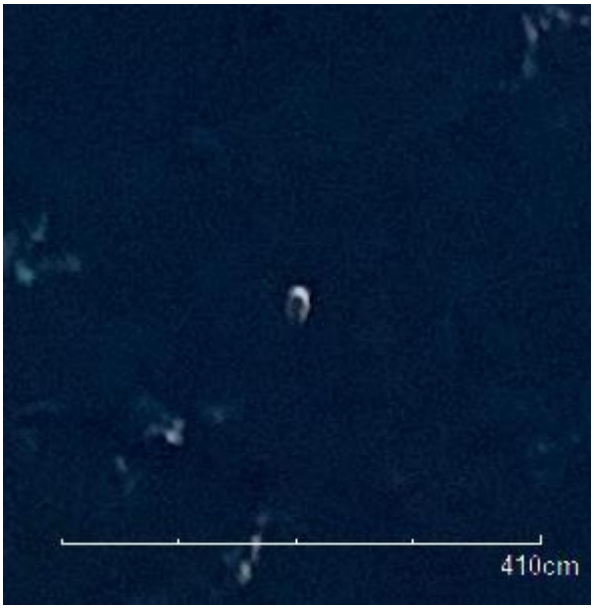

Figure 28 Guillemot.

Figure 29 Razorbill.

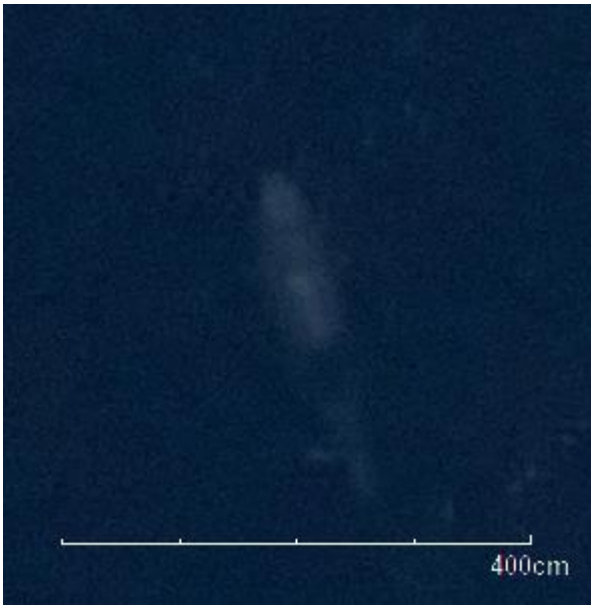

Figure 30 Submerged Risso's dolphin.

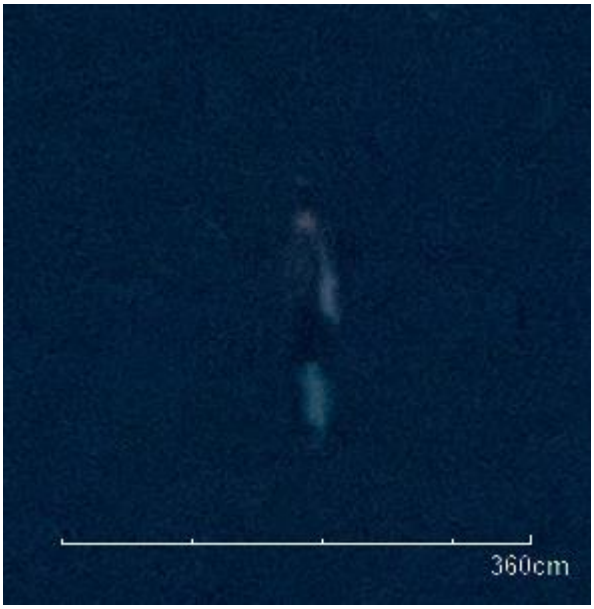

Figure 31 Submerged white-beaked dolphin.

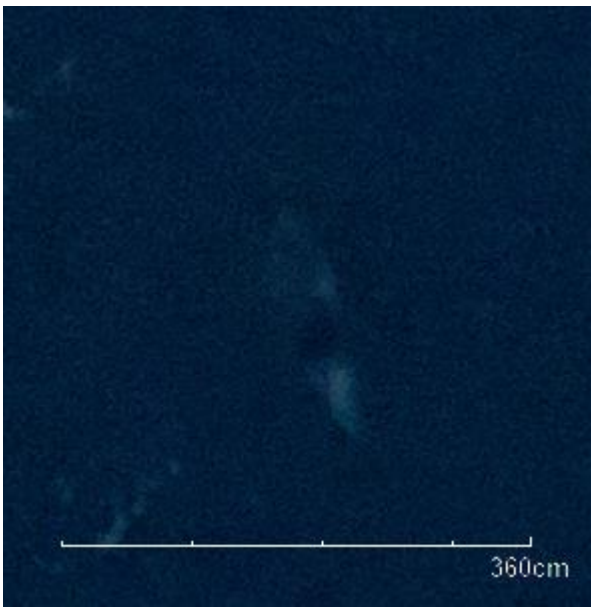

Figure 32 Submerged white-beaked dolphin.

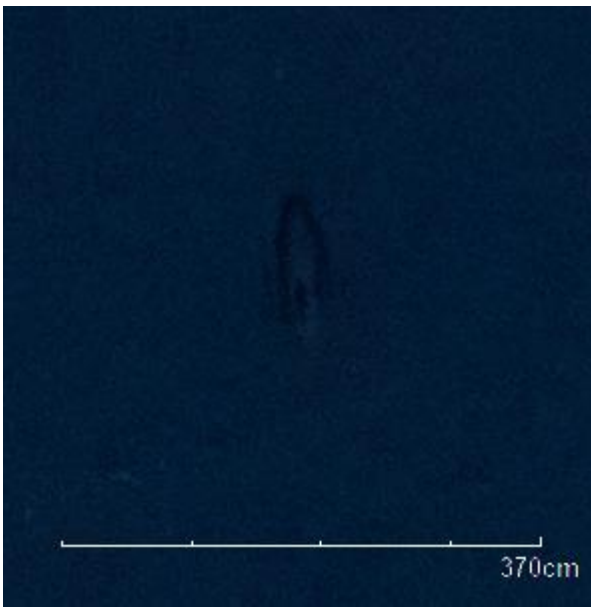

Figure 33 Submerged dolphin / porpoise.