

MachairWind Offshore Windfarm

Annex 11.20 Manx shearwater Tracking Work on Lunga in 2025



Manx Shearwater Tracking Work on Lunga in 2025

Report for MachairWind Ltd

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Introduction

Very little is known about the at-sea behaviour of Manx Shearwater *Puffinus puffinus* that breed on the Treshnish isles. No tracking work has ever been undertaken on this species at this site. ScotWind development areas for Offshore wind exist close to the islands (within foraging range of Manx Shearwater (mean max range = 1346.8 (\pm 1018.7) km)). Hence, there is an increased need to understand where birds are foraging, to assess potential interactions between birds and the proposed offshore wind developments.

NTS invited ScottishPower Renewables (SPR) who are developing the MachairWind project (located Northwest of Islay and West of Colonsay), to consider supporting a research project to fill this information gap. SPR provided the funding to purchase remote download GPS tags for the first tracking study of Manx Shearwater on Lunga, during the 2025 breeding season.

The tracking fieldwork was carried out by NTS senior seabird officer, Ellie Owen with participation from the Treshnish Isles Auk ringing group. Data processing, sharing and initial analysis was carried out by NTS Seabird Ecologist, Elizabeth Morgan.

Research Objective

To identify the at-sea distribution and activity of Manx shearwater from the Treshnish Isles (Lunga) during the mid-breeding season as represented by a sample of tracked individuals.

Methodology

Tagging work on Lunga took place between 15th and 26th June 2025. The shearwater population on Lunga has not been the subject of much research and the prevailing thought was that burrows would be too long to reach adults in order to catch them for tag deployment. Upon arrival at Lunga, an extensive search for such suitable burrows was conducted. From a sample of around 120 burrows, eight suitable burrows were found. Small indicator sticks were placed in the burrow entrances to indicate when the incubating bird had changed over with its partner, to allow us to avoid tagging a bird that had potentially recently arrived for a long incubation shift, as this would have wasted some of the tag battery life. During tagging, birds were carefully removed by hand, processed quickly and quietly and then returned to the burrow. The egg was kept safe during removal of the adult by taking it out of the burrow while the adult was removed and then returning it before putting the adult back into the burrow entrance.

Because there were limited burrow with reachable access to adults we also employed a second capture technique where adults were caught on the ground at night when they were returning to their burrows. This was done either by hand or with a handnet. This technique works best on overcast nights and during rainy weather which we had during a night of catching. Breeding was confirmed by looking for an unfeathered brood patch.

Birds were caught under licences from Nature Scot and the British Trust for Ornithology and weighed and ringed before tag deployment. Tags were attached to the feathers on the back in a position between the wings using Tesa cloth-backed tape. The tags were 3.3g remote (UHF) download Picofix GPS tags made by Pathtrack. This attachment method can reasonably be expected to keep the tag attached for 10 days with a tag of this size. Tags recorded data at a frequency of one fix every six minutes and attempted to offload data to the base station every 30 minutes.

One base station was positioned facing the burrow area where all birds were caught which was checked and downloaded daily at the beginning of the tagging and once every couple of days towards the end of the downloading period. GPS data was downloaded from the base station to a laptop in the field using Pathtrack software. <pos> files were converted to <csv> files for analysis in ArcGIS. Trips were classified as at sea locations beyond 4 km from the colony, as rafting birds are likely to congregate within 4 km of a colony (McSorley et al. 2008). Visual examination of the data also showed birds breeding on Lunga appeared to be rafting in an area up to 4 km from the colony. Maximum distances from the colony and minimum distance to the boundary of the Machair Wind Windfarm Development Area (WDA) were calculated by eye for each trip and measured within the Arc GIS software. Kernel density estimates were calculated using all points beyond the colony area to identify hotspots of at sea usage using the planar method with a cell size of 0.01.

Results

Eleven birds were tagged on Lunga between the 16th -17th June 2025 during incubation (see Table 1; Photo 1). One tag was deliberately not deployed onto a bird so that we could use it to simulate a tag that had been deployed by taking it in and out of a 'dummy' burrow. This was to provide information the actual battery life on the deployed tags and also to confirm that the base station was correctly downloading data from the tag that was confirmed to be in range. We were not able to deploy the remaining three tags as the weather had been incredibly wet for this trip which squeezed the amount of time available.

Data were retrieved from all 11 tags, however, due to issues with the number of satellites that tags were able to detect (likely due to birds remaining in burrows for long periods) foraging trip data could only be resolved for seven individuals (see Table 2). One bird had 5.5 days of data downloaded but did not leave the colony during this period. Birds appeared to be rafting in an area up to 4 km from the colony (this area was therefore classified as "at colony" for analyses). Most birds returned to this rafting area between trips, though some birds did not appear to return to land between trips (see Table 3 for details).

Twelve full trips and three partial trips were gained from the seven birds. Birds made trips in all directions from the colony (see Figure 1, Figure 2 and Figure 4). Average trip duration was 34.3 hours (range 15.7 – 116.7 hours) with a mean maximum foraging range of 61.2 Km (range 26.8-121.4) (see Table 3). Beyond the colony area, the densest area of bird usage was an area

between Mull and Tiree, with individuals also showing apparent hotspots (likely to be foraging areas) in the Sound of Jura, North of Coll and an area 25 km South-West of the Machair Wind WDA (see Figure 4).

Birds were using the area within the proposed WDA. Five of the seven birds which had tracks resolved entered the area, some spending up to 4 hours within the WDA (Table 4). Only two birds tracked did not enter the area, one made six trips throughout the tracking period and came within 2.8 km of the WDA at the closest point on a trip, the second bird did not leave the colony so its proximity of at sea distribution to the WDA is unknown. No detailed analysis of bird behaviour was undertaken for this report, however, from visualisation of the raw GPS data, three birds entered the WDA while transiting to/from foraging sites, one was likely to have been foraging within the WDA and one was rafting/resting overnight in the WDA (See Figure 3 & Table 4).

Photo 1 - Details on birds tracked and GPS data obtained in this study



Table 1 - Details on birds tracked and GPS data obtained in this study

Deployment date	Bird ID	burrow contents	Tag ID	Bird mass (g)	time caught	released time	Handling Time (mins)	Capture Method	Note
16/06/2025	EM24224	1 egg	35709	398	17:58	18:09	11:00	Via burrow entrance	
17/06/2025	EM24226	unknown – bare brood patch present	35910	335	13:34	13:55	21:00*	Caught at night on the ground	
17/06/2025	EM24230	1 egg	35941	465	14:14	14:26	12:00	Via burrow entrance	
17/06/2025	EM24232	1 egg	35902	465	17:00	17:07	07:00	Via burrow entrance	
16/06/2025	EM24223	1 egg	35664	428	17:38	17:55	17:00	Via burrow entrance	Partner of EM24222
17/06/2025	EM24225	unknown - bare brood patch present	35659	385	13:20	13:49	29:00*	Caught at night on the ground	
17/06/2025	EM24227	unknown – bare brood patch present	36084	415	13:35	14:00	25:00*	Caught at night on the ground	
16/06/2025	EM24222	1 egg	35881	430	17:37	17:51	14:00	Via burrow entrance	Partner of EM24223
17/06/2025	EM24231	1 egg	35918	500	16:34	16:41	07:00	Via burrow entrance	
17/06/2025	EM24229	1 egg	35947	445	13:34	13:42	08:00	Via burrow entrance	
17/06/2025	EM24228	1 egg	35977	480	13:21	13:29	08:00	Via burrow entrance	

*Handling time slightly longer for birds caught on the ground as they had to be carried to a dry building for processing due to wet weather

Table 2 – Details of data obtained from tags

Tag ID	data downloaded	data extracted	number downloads received	download date(s)	Download Issues PAR (Pathtrack assistance required to extract data)	start data obtained	end data obtained	Duration (days)	n trips recorded
35709	yes	yes	3	22, 23, 24 June	PAR- insufficient satellites for processing for 24th June	06/06/2025 22:03:55	23/06/2025 01:35:34	16.1	1
35910	yes	yes	4	22, 23, 24, 26 June	PAR- insufficient satellites for processing for 26th June	16/06/2025 22:07:34	24/06/2025 21:16:27	8.0	6
35941	yes	yes	2	23, 24, 26 June	PAR- insufficient satellites for processing for 26th June	17/06/2025 22:16:54	24/06/2025 08:09:19	6.4	4
35902	yes	yes	5	18, 19, 20, 21, 22 June	PAR- data recovered	16/06/2025 22:06:57	22/06/2025 08:00:40	5.4	0 (did not leave colony)
35664	yes	yes	2	23, 24 June	PAR- insufficient satellites for processing 24th June	16/06/2025 22:03:04	18/06/2025 14:36:43	1.7	1.5
35659	yes	yes	1	15-Jun		16/06/2025 22:01:29	18/06/2025 11:17:45	1.6	0.5
36084	yes	yes	1	21-Jun		16/06/2025 22:15:05	17/06/2025 06:14:01	0.3	0.5
35881	yes	no	3	18, 19, 20 June	PAR- insufficient satellites for processing	x	x	0.0	0
35918	yes	no	1	19-Jun	PAR- insufficient satellites for processing	x	x	0.0	0
35947	yes	no	1	20-Jun	PAR- insufficient satellites for processing	x	x	0.0	0
35977	No	no	0	x	No communication between tag and base station	x	x	0.0	0

Table 3 – Trip statistics and details of birds' usage and distance to WDA for trips made by individual Manx shearwaters during the study. Partial tracks are highlighted by grey shaded cells and show values which were not included in summary statistics.

bird ID	Trip No.	Complete trip?	start time	end time	duration -hours	Max distance from colony (Km)	Min distance from WDA (Km)	Using WDA	notes
35659	TRIP 1	No	17/06/2025 01:20	18/06/2025 11:17	33.95	301.0	0.0	Yes - transited through area on 17th June	Partial track - stops on return leg from Irish sea
35664	TRIP 1	Yes	17/06/2025 02:14	17/06/2025 18:45	16.53	63.9	0.0	Yes - potential foraging within area and close to boundary 17th June	Returned to raft near colony between trips, but did not return to land
	TRIP 2	No	18/06/2025 02:14	18/06/2025 14:36	12.37	23.4	35.0	No	Partial track - stops after apparent foraging in passage of Tiree
35709	TRIP 1	Yes	17/06/2025 01:29	21/06/2025 22:08	116.65	121.4	0.0	Yes - used area on 18th June - rafting overnight in area, and on 21st June potential foraging in the area	Returned to raft near colony for 30 mins mid trip then left again, returned to colony at end of trip and remained there for rest of tracking period
35902	TRIP 0	No	x	x	0.00		41.0	x	Bird did not leave colony in 5.5 days of data retrieved
35910	TRIP 1	Yes	17/06/2025 01:21	17/06/2025 17:51	16.50	31.5	19.3	No	Returned to raft near colony between trips, but did not return to land
	TRIP 2	Yes	18/06/2025 01:41	20/06/2025 19:44	66.05	111.1	2.8	No	Returned to raft near colony between trips, but did not return to land
	TRIP 3	Yes	21/06/2025 01:36	21/06/2025 18:00	16.41	44.2	32.5	No	Rafting within and beyond 4k from the colony before returning to colony at midnight
	TRIP 4	Yes	22/06/2025 02:28	22/06/2025 18:10	15.69	37.3	34.1	No	Rafting within and beyond 4k from the colony before

<u>bird ID</u>	<u>Trip No.</u>	<u>Complete trip?</u>	<u>start time</u>	<u>end time</u>	<u>duration -hours</u>	<u>Max distance from colony (Km)</u>	<u>Min distance from WDA (Km)</u>	<u>Using WDA</u>	<u>notes</u>
									returning to colony just after midnight
	TRIP 5	Yes	23/06/2025 01:38	23/06/2025 23:34	21.92	43.8	27.8	No	Returned within 4 km travelling south of the colony for a short trip, before returning to the raft and then colony after midnight. C. 16:30-21:00 was likely rafting near colony.
	TRIP 6	Yes	24/06/2025 01:26	24/06/2025 19:32	18.10	81.6	40.1	No	Returned to raft near colony between trips, but did not return to land
35941	TRIP 1	Yes	18/06/2025 02:16	18/06/2025 20:30	18.22	50.8	0.0	Yes - transited through area on 18th June, rafting overnight close to boundary too.	Returned to raft near colony between trips, but did not return to land
	TRIP 2	Yes	19/06/2025 00:46	20/06/2025 23:58	47.19	72.1	7.1	No	Returned to raft near colony between trips, but did not return to land
	TRIP 3	Yes	20/06/2025 02:46	21/06/2025 20:07	41.34	49.5	0.0	Yes - transited through area on 21st June, rafting overnight close to boundary too.	Returned to colony
	TRIP 4	Yes	23/06/2025 02:16	23/06/2025 19:06	16.82	26.8	18.3	No	Returned to colony
36084	TRIP 1	No	17/06/2025 02:25	17/06/2025 06:14	3.81	60.5	0.0	Yes - transited through area on 17th June	Partial track - stopped 10 km SE of WDA near Colonsay

Table 4 – Details of time and behaviour of birds which entered the WDA

Bird/Tag ID	Trip	Date/Time entered of area	Time spent within OWD Area (mins)	Indicative behaviour
35659	TRIP 1	17/06/2025 06:02	32.20	Transit
35664	TRIP 1	17/06/2025 16:17	102.02	Foraging
35709	TRIP 1* (two separate occurrences on different dates within same trip)	*18/06/2025 22:43 & *21/06/2025 06:13	*242.08 *63.98	*Rafting *poss. foraging
35941	TRIP 1	18/06/2025 05:25	24.00	Transit
35941	TRIP 2	21/06/2025 04:40	17.95	Transit
36084	TRIP 1	17/06/2025 05:26	17.98	Transit

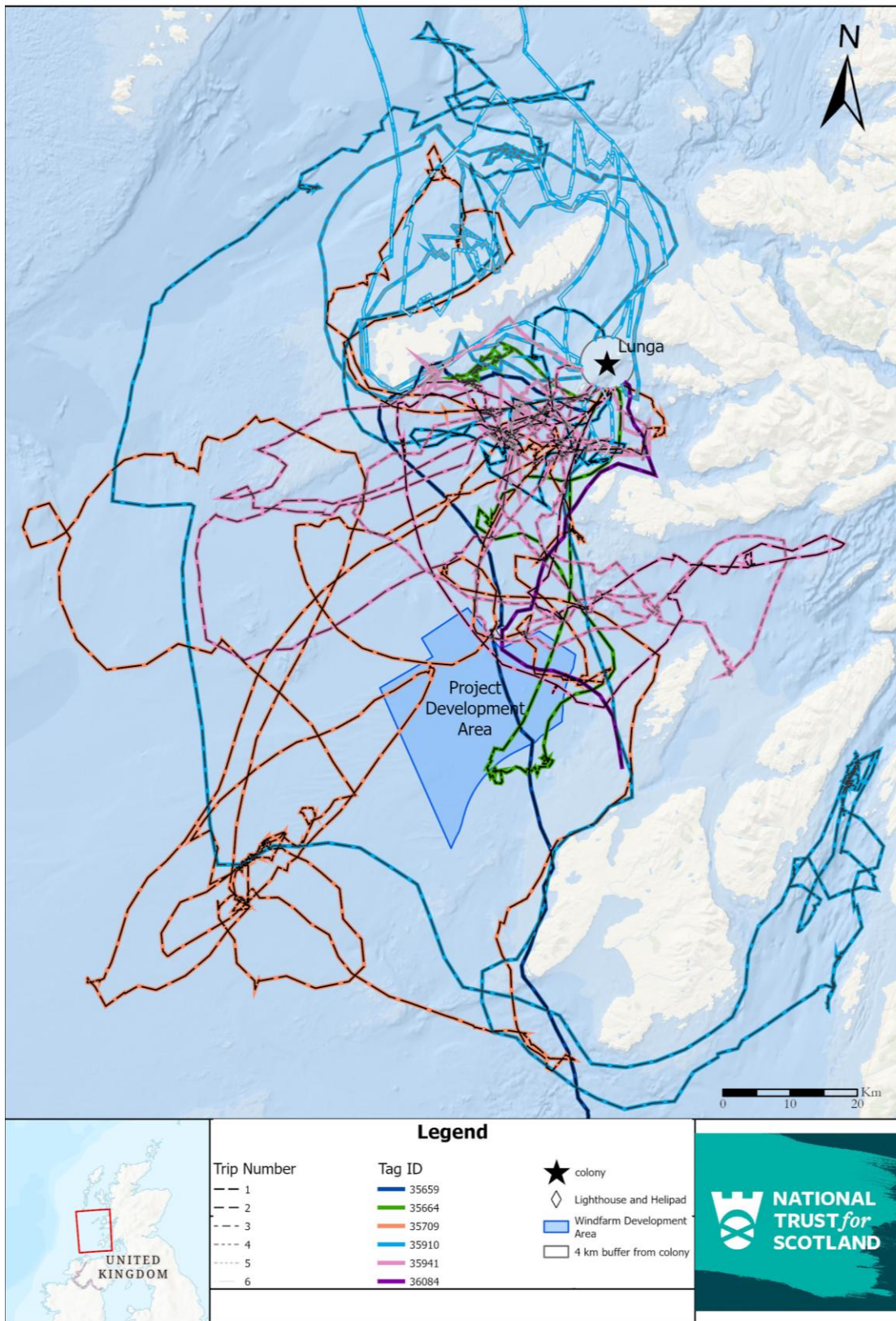


Figure 2 - Map showing tracks for all Manx shearwater tagged on Lunga during incubation, focusing on the main area between the colony and WDA. Individual bird tracks are shown in different colours, consecutive trips made by the same individuals are shown as varying dashed lines.

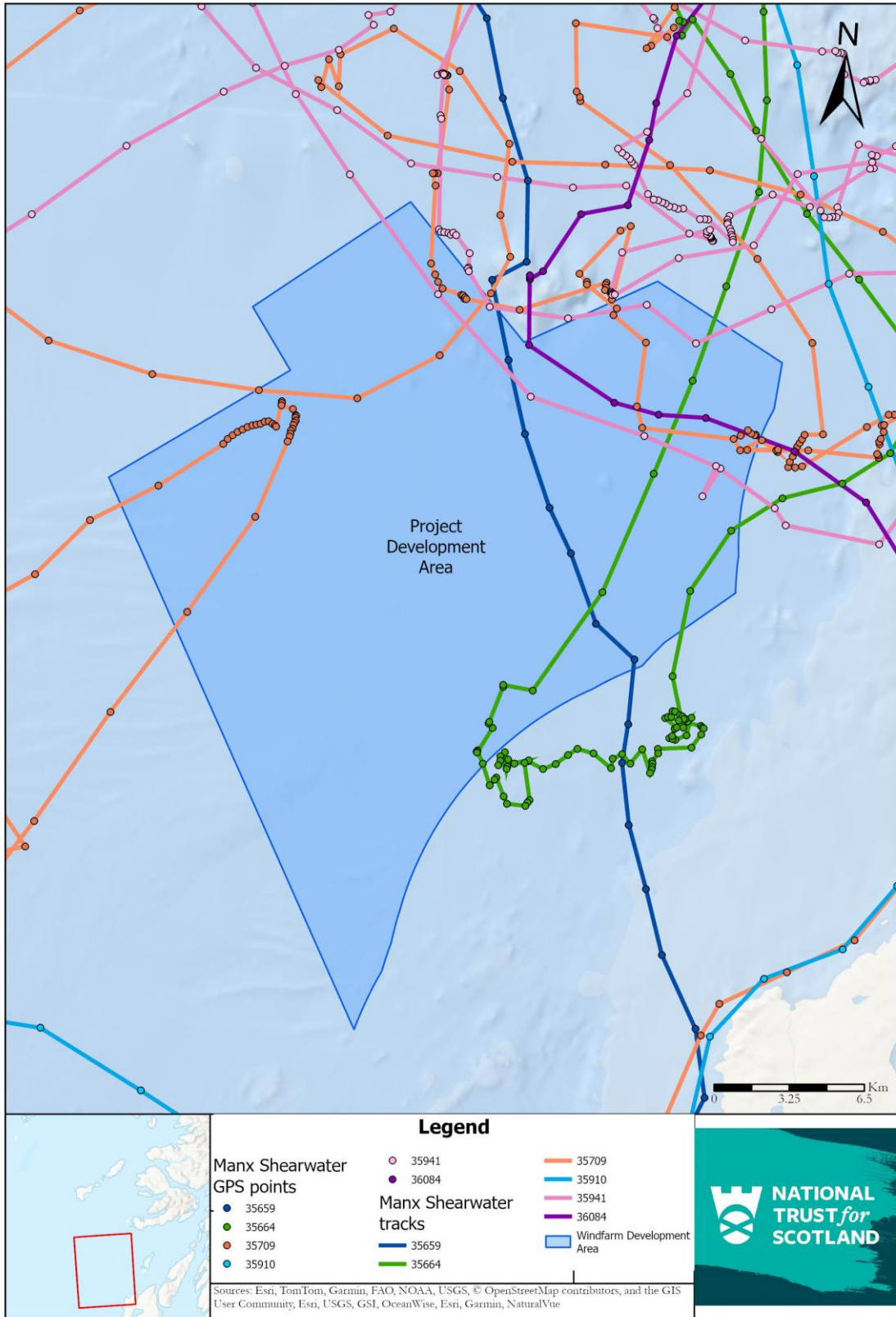


Figure 3 – Map of bird tracks which cross the WDA. Points close together indicate birds are likely to be sat on water and high tortuosity of tracks is likely to indicate foraging behaviour.

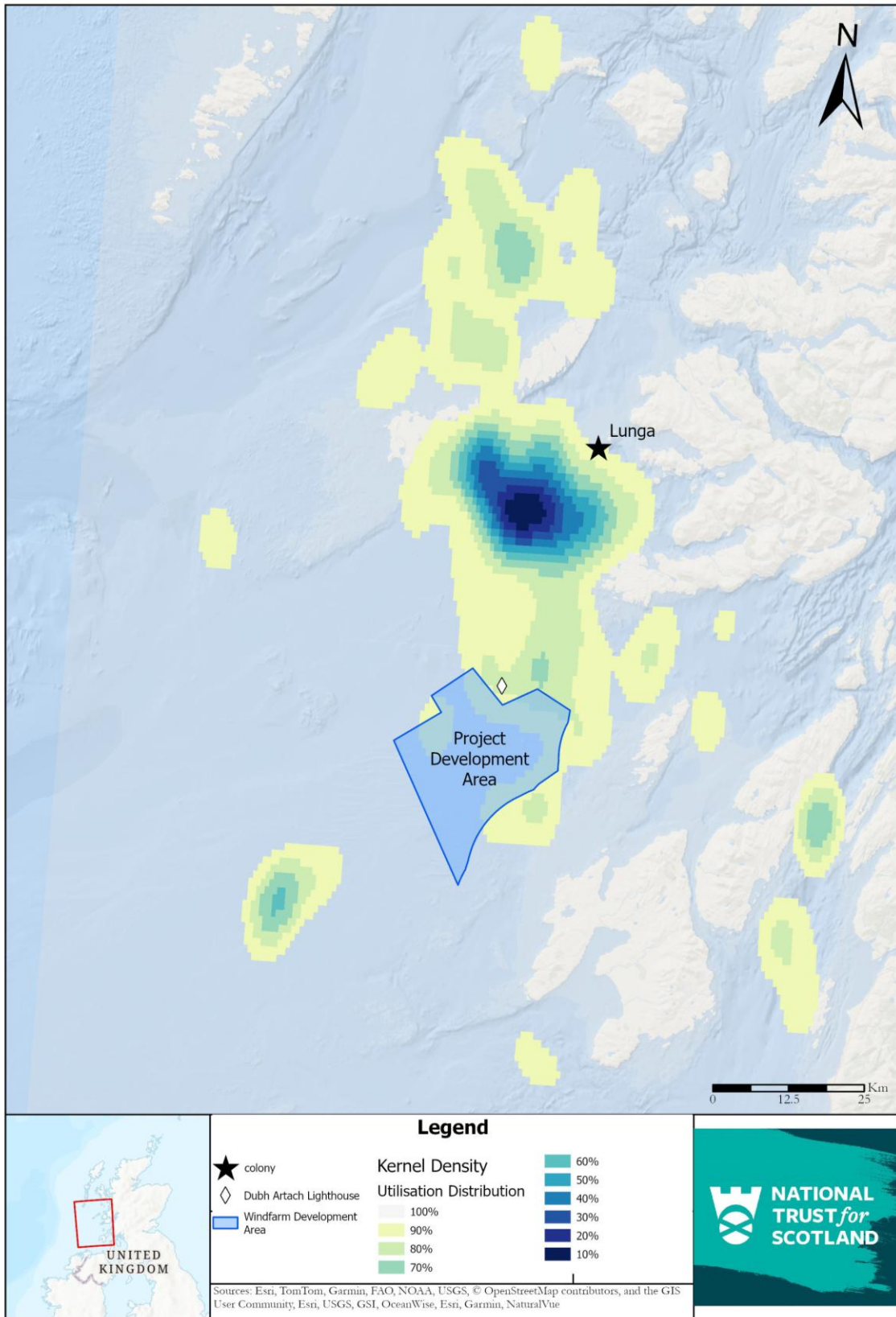


Figure 4 – Map showing at sea utilization distributions (calculated using kernel density analysis) of Manx shearwater tracked on Lunga during incubation.

Discussion

This study shows the first tracking information for the Lunga Manx shearwater population and confirms connectivity with the MachairWind WDA. While no detailed analysis has been carried out for this report, the initial findings suggest that the development footprint was used for both foraging and resting by Lunga Manx shearwaters. The majority of the trips were fairly local in this sample of birds.

There are several important caveats to highlight. Firstly, our sampling is limited to one short window within the breeding season. Further tracking work at different times of the breeding season would give a more complete picture of space use for this population of shearwaters. Secondly, we did not explicitly test for tag effects in this study but took the strategy of using a tag that was five times smaller than similar tags that have been deployed elsewhere without causing noticeable negative effects to the individual birds carrying the tags. Since this is a small pilot study, if further larger scale deployments were needed then a careful parallel study into potential tag effects should be considered.

For future work we recommend refining the downloading strategy for these tags. The tags download data faster if they are closer to the base station. We found that birds were spending less time on the surface than anticipated and so the opportunities for data download were slightly less than what we had planned for. In a parallel study we conducted on St Kilda later in 2025 we adapted our downloading strategy so that base stations were individually deployed at the entrance to each study burrow. This modification gave us 100% download success. On the Lunga study we likely missed out on data collected by the GPS tag because the downloading opportunities were not as long or frequent as hoped, but we did not have multiple base stations available to try a different strategy. Therefore, future tracking with this tag and species might benefit from the purchase of more base stations as part of the project design.

Additional Project Outputs supplied alongside this report

- **GPS Location data** Raw data and mapped location of all individual bird tracks – Raw CSV file and points shapefile