Appendix. Surveys of Breeding Cliff-nesting Seabirds, Ground-nesting Seabirds and Burrow-nesting Seabirds in Western Scotland.

Appendix to Report for The Agri-Food and Biosciences Institute as part of the Marine Protected Areas Management and Monitoring Project.

January 2022

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Appendix

Methods

Cliff-Nesting Seabirds

Skye & Lochalsh

The areas with the following tables are those recorded in the SMP database and may not align with current Scottish Council boundaries.

Table A1. List of Skye Sites Surveyed. Sites are listed in alphabetical order

Area	Master Site	Site	Grid Start	Grid End	Site ID	Date
Skye & Lochalsh	East Trotternish	Dun Grianan	NG524598		94192	18/06/2021
Skye & Lochalsh	East Trotternish	Holm Island	NG52435144	NG52435144	78844	18/06/2021
Skye & Lochalsh	East Trotternish	North and South of Rigg	NG52085495	NG52375858	78845	18/06/2021
Skye & Lochalsh	Eilean Creagach and South Ascrib	Eilean Creagach	NG29116542		79283	19/06/2021
Skye & Lochalsh	Eilean Creagach and South Ascrib	South Ascrib	NG29856314		79284	19/06/2021
Skye & Lochalsh	Fladda Chuain to Gearran Island	Rubha Hunish	NG35708156	NG36857936	84085	07/06/2021
Skye & Lochalsh	Kyle of Lochalsh	Eilean a Mhal	NG747280		89116	17/06/2021
Skye & Lochalsh	Kyle of Lochalsh	Eilean Ban	NG74522706		97048	17/06/2021
Skye & Lochalsh	Kyleakin to Portree	Glas Eilean Broadford Bay	NG657235		89391	16/06/2021
Skye & Lochalsh	Kyleakin to Portree	Guillamon Island	NG63722733	NG63722733	80542	17/06/2021
Skye & Lochalsh	Kyleakin to Portree	Longay	NG65453135	NG65453135	80543	17/06/2021
Skye & Lochalsh	Kyleakin to Portree	Pabay	NG674271		110389	17/06/2021
Skye & Lochalsh	Kyleakin to Portree	Scarf Caves	NG50994268	NG51284267	80590	17/06/2021
Skye & Lochalsh	Kyleakin to Portree	Sgeir Dhearg	NG637330		91848	17/06/2021
Skye & Lochalsh	Kyleakin to Portree	Sgeir Dhubh	NG52643622	NG52643622	80589	17/06/2021
Skye & Lochalsh	Leir Mhaodail Skye	Leir Mhaodail	NM57219932			21/06/2021
Skye & Lochalsh	Loch Eishort	Eilean Dubh	NG61551423		85457	22/06/2021
Skye & Lochalsh	Loch Eishort	Eilean G Boreraig	NG62251564		86458	22/06/2021
Skye & Lochalsh	Loch Eishort	Eilean Ruairidh	NG59381230		86459	22/06/2021
Skye & Lochalsh	Rubha Hunish	Creag na h-Eiginn - The Aird	NG46637281	NG43997675	78853	18/06/2021

Skye & Lochalsh	Rubha Hunish	Eilean Flodigarry	NG47677187	NG47677187	78852	18/06/2021
Skye & Lochalsh	Rubha Hunish	Eilean Trodday	NG442786		89204	18/06/2021
Skye & Lochalsh	Rubha Hunish	Sgeir na Eireann	NG480723		110392	18/06/2021
Skye & Lochalsh	Rubha Hunish	South Lub Score	NG37057188	NG38517174	78856	18/06/2021
Skye & Lochalsh	Rubha Hunish	The Aird - Rubha Hunish	NG43997675	NG41117634	78854	18/06/2021
Skye & Lochalsh	Rubha Hunish	Tulm Island	NG40637516	NG40637516	78855	18/06/2021
Skye & Lochalsh	Skye	An Dubh Sgeir	NG191368		110393	20/06/2021
Skye & Lochalsh	Skye	Ard Beag to Ardmore Point	NG22086112	NG21885984	84212	19/06/2021
Skye & Lochalsh	Skye	Biod a Choltraiche to Creag an Fhithich	NG25926519	NG24346673	84208	19/06/2021
Skye & Lochalsh	Skye	Biod a Mhurain to Flossnan	NG21503834	NG23703672	84219	20/06/2021
Skye & Lochalsh	Skye	Biod Ruadh to Stac a Mheadais	NG31682819	NG33262535	84232	21/06/2021
Skye & Lochalsh	Skye	Brandarsaig Bay to Geodha na h-Aibhne	NG25523925	NG25594093	84223	20/06/2021
Skye & Lochalsh	Skye	Camas na h-Uamha to Brandarsaig Bay	NG25333757	NG25523925	84222	20/06/2021
Skye & Lochalsh	Skye	Clett	NG22365833		84215	19/06/2021
Skye & Lochalsh	Skye	Cnoc Dubh Mor to Biod a Choltraiche	NG26936271	NG25926519	84207	19/06/2021
Skye & Lochalsh	Skye	Eas Tardil to Biod nan Laogh	NG31275709	NG29995870	84206	19/06/2021
Skye & Lochalsh	Skye	Eilean Beag (NG35)	NG36335769	NG36335769	84201	19/06/2021
Skye & Lochalsh	Skye	Eilean Mor	NG35675717		84202	19/06/2021
Skye & Lochalsh	Skye	Flossnan to Idrigill Point	NG23703672	NG25023615	84220	20/06/2021
Skye & Lochalsh	Skye	Gob na h-Oa to Rubha nan Clach	NG32113449	NG30513358	84229	21/06/2021
Skye & Lochalsh	Skye	Gob Uisgebrigh	NG32885474	NG32675496	84205	19/06/2021
Skye & Lochalsh	Skye	Harlosh Island	NG27573895		84225	20/06/2021
Skye & Lochalsh	Skye	Hoe Point to Waterfall	NG16654097	NG19253926	84216	20/06/2021
Skye & Lochalsh	Skye	Idrigill Point to Camas na h-Uamha	NG25023615	NG25333757	84221	20/06/2021
Skye & Lochalsh	Skye	Isay	NG21455720		84213	19/06/2021
Skye & Lochalsh	Skye	Lampay	NG219554		89896	19/06/2021

Skye & Lochalsh	Skye	Leum mhic na Bantraich	NG37196038	NG37176008	84200	19/06/2021
Skye & Lochalsh	Skye	Loch Eynort to Loch Brittle	NG35792371	NG38721627	84234	21/06/2021
Skye & Lochalsh	Skye	Maol na h-Airde	NG33655510	NG34105557	84204	19/06/2021
Skye & Lochalsh	Skye	Meall Greepa	NG26324225		84224	20/06/2021
Skye & Lochalsh	Skye	Oronsay	NG31073590		84228	21/06/2021
Skye & Lochalsh	Skye	Rubha Cruinn to Biod Ruadh	NG30493086	NG31682819	84231	21/06/2021
Skye & Lochalsh	Skye	Rubha nan Clach to Rubha Cruinn	NG30513358	NG30493086	84230	21/06/2021
Skye & Lochalsh	Skye	Rubha Riadhain	NG38566189	NG38176151	84199	19/06/2021
Skye & Lochalsh	Skye	Soay	NG42681449		84236	21/06/2021
Skye & Lochalsh	Skye	Soay Sound	NG38721627	NG47031694	84235	21/06/2021
Skye & Lochalsh	Skye	Stac a Mheadais to Sgeir Bheag	NG33262535	NG3455243	84233	21/06/2021
Skye & Lochalsh	Skye	Tarner Island	NG29603895		84226	20/06/2021
Skye & Lochalsh	Skye	Vaternish Point	NG24346673	NG23286708	84209	19/06/2021
Skye & Lochalsh	Skye	Vaternish Point to Waterfall	NG23286708	NG23106420	84210	19/06/2021
Skye & Lochalsh	Skye	Waterfall to Ard Beag	NG23106420	NG22086112	84211	19/06/2021
Skye & Lochalsh	Skye	Waterfall to Biod a Mhurain	NG19253926	NG21503834	84218	20/06/2021
Skye & Lochalsh	Skye	Wiay	NG28403604		84227	20/06/2021
Skye & Lochalsh	Skye - Eilean Maol to Point of Sleat	Camas Daraich	NM57179924	NM57079953		21/06/2021
Skye & Lochalsh	Skye - Eilean Maol to Point of Sleat	Camas Daraich	NM57179924	NM57079953		21/06/2021
Skye & Lochalsh	Skye - Eilean Maol to Point of Sleat	Eilean Maol	NG63950321	NG63950321	86449	16/06/2021
Skye & Lochalsh	Skye - Eilean Maol to Point of Sleat	Rubha Phoil	NG63540359	NG64070348	86448	17/06/2021
Skye & Lochalsh	Skye - Fang nan Each to Lyndale Point	Loch Dunvegan	NG212562	NG192537	97381	19/06/2021
Skye & Lochalsh	Skye - Strathaird	Drinan	NG54621442	NG54551424		22/06/2021
Skye & Lochalsh	Skye - Strathaird	Dun Brugaig South	NG53451211	NG53371193	86468	22/06/2021
Skye & Lochalsh	Skye - Strathaird	Eilean na h-Airde	NG52201128		86470	22/06/2021
Skye & Lochalsh	Skye - Strathaird	Glasnakille North	NG54251373	NG54151317		22/06/2021
Skye & Lochalsh	Skye - Strathaird	Glasnakille South	NG53991287	NG53581251		22/06/2021
Skye & Lochalsh	Skye - Strathaird	Rubha na h-Easgainne	NG53371193	NG52761139	86469	22/06/2021

Skye & Lochalsh	Skye - Strathaird	Suidhe Biorach	NG51751237	NG51411253	86472	22/06/2021
Skye & Lochalsh	Skye - Strathaird	Suidhe nan Eun	NG51411253	NG51301256	86473	22/06/2021
Skye & Lochalsh	Skye: Hoe Point to Meanish	Gob na Hoe to Ramasaig Bay	NG15704226	NG15624329	80889	20/06/2021
Skye & Lochalsh	Skye: Hoe Point to Meanish	Mointeach nan Tarbh to Rubha Ban	NG12894881	NG13345087	80895	20/06/2021
Skye & Lochalsh	Skye: Hoe Point to Meanish	Neist Lighthouse to Mointeach nan Tarbh	NG12694724	NG12894881	80894	20/06/2021
Skye & Lochalsh	Skye: Hoe Point to Meanish	Ramasaig Bay to Ramasaig Cliff	NG15624329	NG15564557	80890	20/06/2021
Skye & Lochalsh	Skye: Hoe Point to Meanish	Ramasaig Cliff to Waterstein Head	NG15564557	NG14464686	80891	20/06/2021
Skye & Lochalsh	Skye: Hoe Point to Meanish	Waterstein Head to Camas na h Annait	NG14464686	NG13124745	80892	20/06/2021
Skye & Lochalsh	Skye: Meanish Pier to Druim Slachaidh	Am Famhair to Gob na Hoe	NG18265583	NG19245413	80922	19/06/2021
Skye & Lochalsh	Skye: Meanish Pier to Druim Slachaidh	Eilean Dubh Eilean Mor Eilean Grianal	NG22424914		80927	19/06/2021
Skye & Lochalsh	Skye: Meanish Pier to Druim Slachaidh	Eilean Glas Eilean Dubh Beag Eilean Traigh Carraig Shleamhuinn	NG21604966		80926	19/06/2021
Skye & Lochalsh	Skye: Meanish Pier to Druim Slachaidh	Garbh Eilean	NG23524960	NG23524960	80928	19/06/2021
Skye & Lochalsh	Skye: Meanish Pier to Druim Slachaidh	Geodha a Gamnha to Guala Mhor	NG15965120	NG15535265	80917	20/06/2021
Skye & Lochalsh	Skye: Meanish Pier to Druim Slachaidh	Gob na Hoe to Uig	NG19245413	NG19935225	80923	19/06/2021
Skye & Lochalsh	Skye: Meanish Pier to Druim Slachaidh	Guala Mhor to Geodha nan Each	NG15535265	NG15525400	80918	20/06/2021
Skye & Lochalsh	Skye: Meanish Pier to Druim Slachaidh	Uamh a Phrionsa to am Famhair	NG17215670	NG18265583	80921	19/06/2021
Skye & Lochalsh	Skye: Meanish Pier to Druim Slachaidh	Uig to Colbost	NG19935225	NG21104996	80924	19/06/2021
Skye & Lochalsh	Staffin	Staffin Island - East side only	NG48956961	NG49336899	78850	18/06/2021

The team consisted of Richard Inger, Kerry Mackie, Liam Langley from the University of Exeter, Roddy Mavor an independent ornithological consultant and drone pilots James Duffy and Leon DeBell from Somerset Wildlife Trust. The survey was carried out on a 12m vessel, the Cygnus 'Cyfish' with twin 320HP Engines. The Cyfish was charted from Minch Adventures of

Mallaig (www.minchadventures.co.uk), skippered by Billy Simmonds with 35 years and thousands of hours of experience in the waters around Skye with Paul Simmonds acting as crew. The vessel was selected as it has a large outdoor decking area, spacious interior with a navigation table, had the capacity to carry out a full circumnavigation of Skye, and provided a very stable platform for performing cliff-nesting seabird counts. The survey route was; Day One (17/6) Armadale to Portree, Day Two (18/6) Portree to Uig, Day Three (19/6) Uig to Dunvegan, Day Four (20/6) Dunvegan to Carbost, Day Five (21/6) Carbost to Elgol & Day Six (22/6) Elgol to Armadale.

Lochaber

Rum

Table A2. List of Rum Sites Surveyed. All counts are under the site Rum (Rum SPA). Sites are listed in alphabetical order

Area	Master Site	Site	Grid Start	Grid End	Site ID	Date
Lochaber	Rum	Rum 1	NM 427982	NM 423974	RM 1	17/05/2021
Lochaber	Rum	Rum 2	NM423974	NM419965	RM 2	17/05/2021
Lochaber	Rum	Rum 3	NM419965	NM418956	RM 3	17/05/2021
Lochaber	Rum	Rum 4	NM418956	NM416946	RM 4	17/05/2021
Lochaber	Rum	Rum 5	NM416946	NM 411939	RM 5	17/05/2021
Lochaber	Rum	Rum 6	NM 411939	NM405930	RM 6	17/05/2021
Lochaber	Rum	Rum 7	NM405930	NM394927	RM 7	17/05/2021
Lochaber	Rum	Rum 8	NM394927	NM390917	RM 8	17/05/2021
Lochaber	Rum	Rum 9	NM390917	NM384791	RM 9	17/05/2021
Lochaber	Rum	Rum 10	NM384791	NM372910	RM 10	17/05/2021
Lochaber	Rum	Rum 11	NM372910	NM366914	RM 11	17/05/2021
Lochaber	Rum	Rum 12	NM366914	NM360922	RM 12	17/05/2021
Lochaber	Rum	Rum 13	NM360922	NM350926	RM 13	17/05/2021
Lochaber	Rum	Rum 14	NM350926	NM343933	RM 14	17/05/2021
Lochaber	Rum	Rum 15	NM343933	NM342943	RM 15	17/05/2021
Lochaber	Rum	Rum 16	NM342943	NM339950	RM 16	17/05/2021
Lochaber	Rum	Rum 17	NM339950	NM330956	RM 17	17/05/2021
Lochaber	Rum	Rum 18	NM330956	NM325962	RM 18	17/05/2021
Lochaber	Rum	Rum 19	NM325962	NM320970	RM 19	17/05/2021
Lochaber	Rum	Rum 20	NM320970	NM312977	RM 20	17/05/2021
Lochaber	Rum	Rum 21	NM312977	NM306980	RM 21	17/05/2021
Lochaber	Rum	Rum 22	NM306980	NM299988	RM 22	17/05/2021
Lochaber	Rum	Rum 23	NM299988	NM293995	RM 23	17/05/2021
Lochaber	Rum	Rum 24	NM293995	NM301997	RM 24	17/05/2021
Lochaber	Rum	Rum 25	NM301997	NG307004	RM 25	17/05/2021
Lochaber	Rum	Rum 26	NG307004	NG317014	RM 26	17/05/2021
Lochaber	Rum	Rum 27	NG317014	NG326019	RM 27	17/05/2021
Lochaber	Rum	Rum 28	NG326019	NG329026	RM 28	17/05/2021
Lochaber	Rum	Rum 29	NG329026	NG336032	RM 29	17/05/2021

Lochaber	Rum	Rum 30	NG336032	NG344038	RM 30	17/05/2021
Lochaber	Rum	Rum 31	NG344038	NG351042	RM 31	17/05/2021
Lochaber	Rum	Rum 32	NG351042	NG356042	RM 32	17/05/2021
Lochaber	Rum	Rum 33	NG356042	NG361044	RM 33	17/05/2021
Lochaber	Rum	Rum 34	NG361044	NG365044	RM 34	17/05/2021
Lochaber	Rum	Rum 35	NG365044	NG375049	RM 35	17/05/2021
Lochaber	Rum	Rum 36	NG375049	NG382045	RM 36	17/05/2021
Lochaber	Rum	Rum 37	NG382045	NG382044	RM 37	17/05/2021
Lochaber	Rum	Rum 38	NG382044	NG391036	RM 38	17/05/2021
Lochaber	Rum	Rum 39	NG391036	NG397034	RM 39	17/05/2021
Lochaber	Rum	Rum 40	NG397034	NG399027	RM 40	17/05/2021
Lochaber	Rum	Rum 41	NG399027	NG407024	RM 41	17/05/2021
Lochaber	Rum	Rum 42	NG407024	NG416020	RM 42	17/05/2021
Lochaber	Rum	Rum 43	NG416020	NG420012	RM 43	17/05/2021
Lochaber	Rum	Rum 44	NG420012	NM 427982	RM 44	17/05/2021

Muck

Table A3 List of Muck Sites Surveyed. Sites are listed in alphabetical order

Area	Master Site	Site	Grid Start	Grid End	Site ID	Date
Lochaber	Muck	Eilean nan Each (Eagamol)	NM391815	NM391815	110912	18/05/2021
Lochaber	Muck	Muck A	NM403785	NM392801	83146	18/05/2021
Lochaber	Muck	Muck B	NM416778	NM403785	83147	18/05/2021
Lochaber	Muck	Muck C	NM428786	NM416778	83149	18/05/2021
Lochaber	Muck	Muck D	NM426806	NM428786	83149	18/05/2021
Lochaber	Muck	Muck E	NM399814	NM426806	83150	18/05/2021

The same vessel and crew as used for the Skye surveys were used for Lochaber surveys. The survey team consisted of Prof Stuart Bearhop, Dr Richard Sherley, Tess Handby, Aimee McIntosh, Luke Ozsanlav-Harris, Roz Bown, Freddie Leith, Josh Lynton-Jenkins, all from the University of Exeter, and Lucy Quinn and Rona Sinclair from NatureScot.

Cunninghame

Table A4 List of Little Cumbrae Sites Surveyed. NB On SMP database all data recorded under Site 86768, Little Cumbrae: Little Cumbrae 1. Sites are listed in alphabetical order

Area	Master Site	Site	Grid Start	Grid End	Site ID	Date
Cunninghame	Little Cumbrae	Broad Islands	NS 1543 5190		86768	6/6/21
Cunninghame	Little Cumbrae	Castle Island	NS 1527 5142		86768	6/6/21
Cunninghame	Little Cumbrae	Craig Nebbin	NS 1383 5179		86768	6/6/21
Cunninghame	Little Cumbrae	E Coast	NS 1505 5069		86768	6/6/21
Cunninghame	Little Cumbrae	Gull Point	NS 1458 5018		86768	6/6/21

Cunninghame	Little Cumbrae	Hawk Craig	NS 1490 5261		86768	6/6/21
Cunninghame	Little Cumbrae	Hill of Hills	NS 1436 5224		86768	6/6/21
Cunninghame	Little Cumbrae	Horse Port	NS 1538 5295		86768	6/6/21
Cunninghame	Little Cumbrae	Lighthouse	NS 1368 5156		86768	6/6/21
Cunninghame	Little Cumbrae	Lighthouse Hill	NS 1396 5192		86768	6/6/21
Cunninghame	Little Cumbrae	Long Bay	NS 1465 5247		86768	6/6/21
Cunninghame	Little Cumbrae	Lythe Rock	NS 1482 5035		86768	6/6/21
Cunninghame	Little Cumbrae	South Gellet	NS 1523 5100		86768	6/6/21
Cunninghame	Little Cumbrae	Steadholm Bay	NS 1391 5095		86768	6/6/21
Cunninghame	Little Cumbrae	Steadholm Point	NS 1372 5111		86768	6/6/21

The survey was carried out by Nigel Scriven and members of the Sanda Island Bird Observatory. It is recommend that for future surveys a team be deployed to survey the island by land as the team believed that there could be large numbers of gull nests not visible from the sea.

Western Isles

Table A5 List of Western Isles. NB. Sites are listed in alphabetical order.

Area	Master Site	Site	Grid Start	Grid End	Site ID	Date
Western Isles	Arnol - Lewis	Loch Arnol	NB30094858		112920	12/06/2021
Western Isles	Barra & Vatersay	Bagh Hirivagh	NF70580322		86162	03/06/2021
Western Isles	Barra & Vatersay	Caolis-Tresivick	NL62529750	NL62799565	86165	31/05/2021
Western Isles	Barra & Vatersay	Caragrich-Creagmhor	NL65809616	NL65819586	86166	31/05/2021
Western Isles	Barra & Vatersay	Cleat-Traigh Ealis	NF67320485	NF68970571	86161	31/05/2021
Western Isles	Barra & Vatersay	Earsary	NL70439940		86163	03/06/2021
Western Isles	Barra & Vatersay	Greian Head	NF65820402	NF66630485	86160	31/05/2021
Western Isles	Barra & Vatersay	Orosay	NL70509921		86164	03/06/2021
Western Isles	Barvas - Lewis	Barvas	NB33705075		80806	12/06/2021
Western Isles	Bearasay - Lewis	Bearasay (Whole Island)	NB12164249		80797	17/06/2021
Western Isles	Berneray, Sound of Harris	Aird Ma-Ruibhe	NF91458006		110885	05/06/2021
Western Isles	Berneray, Sound of Harris	Beinn a Chlaidh, Berneray	NF91328073		87557	05/06/2021
Western Isles	Berneray, Sound of Harris	Loch Bhrusda	NF91778248		87559	05/06/2021
Western Isles	Berneray, Sound of Harris	Loch Borve	NF90627998		87558	05/06/2021
Western Isles	Campay - Lewis	Campay	NB14044251		98207	17/06/2021
Western Isles	Causamul, Haskeir, Boreray and Spuir	Boreray (N Uist)	NF85198128		86129	18/06/2021
Western Isles	Causamul, Haskeir, Boreray and Spuir	Causamul	NF65957054		86126	23/06/2021

Western Isles	Causamul, Haskeir, Boreray and Spuir	Haskeir	NF61098204		86128	26/06/2021
Western Isles	Causamul, Haskeir, Boreray and Spuir	Haskeir Eagach Islets	NF59308082		86127	26/06/2021
Western Isles	Causamul, Haskeir, Boreray and Spuir	Spuir	NF85358419		112972	18/06/2021
Western Isles	Coppay	Coppay	NF93309382		86261	06/06/2021
Western Isles	Dun-aarn - Harris	Dun Arn	NG02508046		79119	07/06/2021
Western Isles	Ensay - Harris	Skarri	NF98288510		79116	06/06/2021
Western Isles	Fladday - Harris	Fladday	NA99281522		79121	18/06/2021
Western Isles	Flannan Isles SPA	East Group	NA723469	NA731463	84607	19/06/2021
Western Isles	Flannan Isles SPA	South Group	NA725455	NA726452	84609	19/06/2021
Western Isles	Flannan Isles SPA	West Group	NA694463	NA694463	84608	19/06/2021
Western Isles	Floday - Lewis	Floday	NB12084157		81001	17/06/2021
Western Isles	Gilsay - Harris	Gilsay North	NG018802		91689	07/06/2021
Western Isles	Gilsay - Harris	Gilsay South	NG024795		91688	07/06/2021
Western Isles	Greine Sgeir - Harris	Greine Sgeir	NB00951556		79110	18/06/2021
Western Isles	Groay - Harris	Groay	NF99847950		79168	07/06/2021
Western Isles	Gumersam Bheag - Harris	Gumersam Bheag	NG02108113		79166	07/06/2021
Western Isles	Harsgeir - Lewis	Harsgeir	NB10874086		79322	17/06/2021
Western Isles	Islands South of Barra - Tysties	Inner Heisker - Tysties	NL584866	NL586869	80387	30/05/2021
Western Isles	Killegray - Harris	Killegray	NF96858425		79158	06/06/2021
Western Isles	Langay - Harris	Langay	NG01228169		79156	07/06/2021
Western Isles	Lewis and Harris - Tysties	Gasker - Tysties	NA875115		86251	18/06/2021
Western Isles	Liungaigh - Harris	Liungaigh	NG013790		91656	07/06/2021
Western Isles	Mas Sgeir - Lewis	Mas Sgeir	NB14114398		79379	17/06/2021
Western Isles	Mingulay and Berneray SPA	Berneray	NL55938010		84592	01/06/2021
Western Isles	Mingulay and Berneray SPA	Outer Heisker	NL57228680		86176	30/05/2021
Western Isles	Monach Isles SPA	Ceann Ear 1	NF64726166	NF64316270	83318	22/06/2021
Western Isles	Monach Isles SPA	Ceann Ear 2	NF64316270	NF63636247	83319	22/06/2021
Western Isles	Monach Isles SPA	Ceann Ear 4	NF63366098	NF63986092	83321	22/06/2021
Western Isles	Monach Isles SPA	Ceann Ear 5	NF63986092	NF64726166	83322	22/06/2021
Western Isles	Monach Isles SPA	Ceann Ear 6	NF64056205		83323	22/06/2021
Western Isles	Monach Isles SPA	Ceann Ear 7	NF63656135		83324	22/06/2021
Western Isles	Monach Isles SPA	Ceann Iar 1	NF62536233	NF61106212	83325	22/06/2021
Western Isles	Monach Isles SPA	Ceann Iar 2	NF61106212	NF60986250	83326	22/06/2021
Western Isles	Monach Isles SPA	Ceann Iar 3	NF60986250	NF61766331	83327	22/06/2021
Western Isles	Monach Isles SPA	Ceann Iar 4	NF61766331	NF62176324	83328	22/06/2021
Western Isles	Monach Isles SPA	Ceann Iar 5	NF62176324	NF62536233	83329	22/06/2021
Western Isles	Monach Isles SPA	Ceann Iar 6	NF61526252		83330	22/06/2021

Western Isles	Monach Isles SPA	Shillay	NF59126280		83333	23/06/2021
Western Isles	Monach Isles SPA	Shivinish 1	NF62636202	NF62636202	83331	22/06/2021
Western Isles	Monach Isles SPA	Shivinish 2	NF628621		83332	22/06/2021
Western Isles	Monach Isles SPA	Stockay	NF65956317		83334	23/06/2021
Western Isles	North Rona and Sula Sgeir SPA	North Rona	HW81193252		84653	19/06/2021
Western Isles	North Rona and Sula Sgeir SPA	Sula Sgeir	HW62083062		84590	20/06/2021
Western Isles	North Uist	Cleite Nam Luch	NF95437564		86108	29/05/2021
Western Isles	North Uist	Grodaigh	NF98007324		112902	28/05/2021
Western Isles	North Uist	Hermetray	NF98357395		86098	28/05/2021
Western Isles	North Uist	Narsdraigh	NF97437705		86100	29/05/2021
Western Isles	North Uist	Opsay	NF98047611		87011	29/05/2021
Western Isles	North Uist	Sarstay	NF97297594		86109	29/05/2021
Western Isles	North Uist	Votersay	NF94507622		86107	28/05/2021
Western Isles	Old Hill - Lewis	Old Hill Whole Island	NB11424328		98129	17/06/2021
Western Isles	Pabay Mor	Pabay Mor	NB10373824		79370	17/06/2021
Western Isles	Pabbay	Pabbay 1	NF88318657	NF87168841	86256	18/06/2021
Western Isles	Pabbay	Pabbay 2	NF87168841	NF90198920	86257	18/06/2021
Western Isles	Pabbay	Pabbay 3	NF90198920	NF90948776	86258	18/06/2021
Western Isles	Renish Island - Harris	Renish Island	NG04228151		79148	07/06/2021
Western Isles	Saghay Islands - Harris	Saghay Beg and Mor	NF99688677		79144	06/06/2021
Western Isles	Scaravay - Harris	Scaravay	NG00827806		79138	07/06/2021
Western Isles	Scarp Island - Harris	Scarp Island	NA960160		90905	18/06/2021
Western Isles	Shillay	Shillay	NF87569137		86263	06/06/2021
Western Isles	Shillay - Tysties	Shill - Tysties	NF880913		100360	24/07/2021
Western Isles	Sleicham - Harris	Sleicham	NF99348487		79551	07/06/2021
Western Isles	Sound of Barra	Eilean Leathan	NF78450746		86124	02/06/2021
Western Isles	Sound of Barra	Eileanan Dubha	NF78940775		86123	02/06/2021
Western Isles	Sound of Barra	Fiaray	NF69721021		86114	02/06/2021
Western Isles	Sound of Barra	Flodday	NF74740213		86120	02/06/2021
Western Isles	Sound of Barra	Fuday	NF72500817		86115	02/06/2021
Western Isles	Sound of Barra	Garbh Lingay	NF73900340		86119	02/06/2021
Western Isles	Sound of Barra	Gighay	NF75820488		86121	02/06/2021
Western Isles	Sound of Barra	Greanamul	NF73470556		86116	02/06/2021
Western Isles	Sound of Barra	Hellisay	NF74580416		86122	02/06/2021
Western Isles	Sound of Barra	Lamalum	NF7285703333		113260	02/06/2021
Western Isles	Sound of Barra	Lingay	NF74851166		86113	02/06/2021
Western Isles	Sound of Barra	Lingay Fhada	NF72880380		86117	02/06/2021
Western Isles	Sound of Barra	Lingay Skerry	NF76231180		86112	02/06/2021
Western Isles	Sound of Barra	Sgeirislum	NF73470301		86118	02/06/2021

Western Isles	Sound of Harris	Bhacasaigh	NF97717467		112904	28/05/2021
Western Isles	Sound of Harris	Gousman	NF989789		112564	07/06/2021
Western Isles	Sound of Harris	Greineam	NF995749		112566	28/05/2021
Western Isles	Sound of Harris	near Laimhrig More	NG00988596		86849	07/06/2021
Western Isles	Sound of Harris	Sgeir a'Chail	NF96447935		86847	07/06/2021
Western Isles	Sound of Harris	Sgeir Sine	NF97547884		86848	07/06/2021
Western Isles	Sound of Harris	Sromaigh	NF98748849		112901	06/06/2021
Western Isles	Sound of Harris	Taghaigh	NF96247506		112903	28/05/2021
Western Isles	Sound of Pabbay	Flodday	NL60929252		86173	30/05/2021
Western Isles	Sound of Pabbay	Grianamul	NL61868980		86178	30/05/2021
Western Isles	Sound of Pabbay	Lingay	NL60108966		86174	02/06/2021
Western Isles	Sound of Pabbay	Muldoanich	NL68419413		86179	30/05/2021
Western Isles	Sound of Pabbay	Rosinish	NL61318739		86177	30/05/2021
wWestern Isles	Sound of Pabbay	Sandray	NL62889218		86172	30/05/2021
Western Isles	Suem - Harris	Suem	NF99908580		112343	07/06/2021
Western Isles	Taransay - Harris	Taransay	NB005010		91220	06/06/2021
Western Isles	Toe Head - Harris	Toe Head 3	NF95839376	NF95629477	79127	06/06/2021
Western Isles	Toe Head - Harris	Toe Head 4	NF95629477	NF96599473	79128	06/06/2021

Barra & Sounds of Barra/Pabbay Islands.

All surveys were arranged, coordinated and lead by Jim Lennon. The rest of the team consisted of, Alister Clunas from Shiants Auk Ringing Group, and Nigel Winn, Jenny Weston, Malcolm Priestly and Nigel Saunders (drone pilot). Surveys were carried out on the Boy James, a 10.5 metre boat run by Mingulay Boat Trips (https://www.mingulayboattrips.com) and crewed by the experienced Francis Gillies and his daughter Rebecca. Most of the counts were conducted from the boat, but Barra Head (Berneray 84592) and sites on Barra itself were done from land.

Uists, Harris & Lewis islands.

The team consisted of Jim Lennon, Alister Clunas from Shiants Auk Ringing Group, and Nigel Winn, Mark Smith, Malcolm Priestly and Nigel Saunders (drone pilot). Also, taking part was Robin Reid (RSPB) - who was involved both workwise and as chair of Western Isles RSG – and his colleagues Tom Churchyard & Sarah Lawrence from its Biosecurity for Life (rspb.org.uk) team. They made a significant contribution in helping us with our cliff nesting surveys, and we they in getting them on to their target island SPAs (Monachs, Flannans and North Rona & Sula Sgeir). Surveys were carried out primarily using Sea Harris (http://www.seaharris.com) boat Enchanted Isle, a 17 metre Redbay Stormforce 1650, but also their second smaller boat, Pabbay (skippered & crewed by Seumas Morrison, Iain Angus MacLeod, Keiran MacAulay & Darren MacDonald. Additional sites in Loch Roag and also Flannans SPA were done in RIB 'Jacandra' with Neil Macaulay from Islands of Adventure Boat Hire (http://www.islands-of-adventure.co.uk/index.html).

UAVs

Recommendations and guidelines agreed with NatureScot before the start of fieldwork using UAVs.

Survey – General protocol

Each flight will be conducted with a pilot and a spotter. Both the pilot and spotter will conduct a dynamic risk assessment of any given location prior to preparing for take-off. This will include looking for schedule one bird species that could be disturbed, other wildlife and also physical obstacles that may impair flight safety. The role of the pilot will be to have control of the drone at all times. Visual line of sight will be maintained at all times. The spotter will have two roles. Firstly, they will be keeping visible site of the drone and alerting the pilot of any hazards that may emerge while the drone is airborne - this will include disturbance to any bird species or potential threats to / from raptors. The second role of the spotter will be to view the live video feed from the drone's sensor, on a handheld tablet, and again make the pilot aware of any hazards that emerge during that time. The spotter can also be used to deal with members of the public that may enter the take-off and landing zone. The general protocol for data collection will be that the drone will always maintain a safe distance of at least 50m away from any target bird species. Each flight will be fully logged including details of the site, date, weather conditions, drone model / specification, species surveyed, species present (if identifiable), flight duration, minimum approach distance, behaviour of birds and a record of any incidents.

Survey – Launch from top of cliff protocol

A take-off and landing zone will be established on firm ground, a safe distance away from the edge of the cliff. Optionally a tarpaulin will be secured in this area to provide a dust free/level surface. The initial take-off manoeuvre will involve the drone climbing to a minimum of 50 m above ground, and then flown out towards the sea. The seaward distance from the take-off location will be at least the distance to the edge of the cliff + 40 m. I.e. the drone will be no closer to the face of the cliff than 40 m at any given time. Depending on the geometry/slope of the cliff a further seaward distance from the cliff may need to be used so that the pilot can maintain visual line of sight with the drone, and the pilot will never approach a distance closer than 20 m from any cliff edge. The drone sensor will then be turned to face the cliff and horizontal transects at multiple altitudes will be executed. When the survey is complete the drone will be flown vertically to the altitude of the top of the cliff + 40 m and flown landwards back towards the landing zone.

Survey – Launch from bottom of cliff protocol

The drone will be launched from firm ground at least 40 m from the base of the cliff. As above, a tarpaulin may be used. The drone will be flown vertically to at least 20 m altitude and then towards the cliff face, to a distance no closer than 40 m. Where necessary, the drone will be flown away from the cliff at low altitudes before ascending, to ensure a minimum distance of 40 m is kept between the drones and any target bird species. The sensor will then be pointed toward the cliff and horizontal transects undertaken at multiple altitudes. The drone will not be flown above a maximum altitude of 120 m (400 ft).

Survey – Launch from boat protocol

There may be a small number of occasions when we may require to launch from a boat. This will only be done after carrying out an in-situ risk assessment with the captain of the vessel. Drones will only be launched when it a safe, legal, and practical option. After launch protocols will follow those outlined in the launch from the bottom of cliff protocols.

Curtailing drone flights

Both the pilot and spotter will operate with extreme caution. If either the pilot or the spotter identifies potential conflict with any bird, the drone flight will be aborted. If either the pilot or the spotter identifies agitated behaviour in target and non-target species (characterised by head bobbing, scanning or intention flight movement) then the drone should withdraw to operate at further distance from the cliff. This withdrawal distance should be 75 m (or greater if starting greater than 50 m from the cliff). If birds do not show agitated behaviour at maximum operation distance then a step in to the cliff at 10 m intervals, not beyond 40 m from cliff, may be taken. If birds flush from the cliff (that is many birds leave at once, rather than the regular coming and going of a seabird colony) then the drone should be withdrawn and landed for at least a 10 minute break. Another flight can be attempted after this break, ensuring that the birds are resettled before launch.

This procedure may vary depending on the situation, but will follow a set of common principles. Conflict will be avoided at every instance, prior to take-off, during the mission and upon returning to land. If flight has commenced prior to any conflict event, the first priority will be to manoeuvre the drone away from the scene of the incidence i.e away from the cliff and out towards sea. The second priority will be to manoeuvre the drone back towards the landing site, whilst maintaining the 40 m minimum distance from the incident.

Mission Planning Methodology

ESRI satellite data was loaded into QGIS and a polyline added to follow the coast / cliffs of the transect. The transect was then split into smaller sections of 300-400m. This was then saved as a GPKG (EPSG:27700) file. Regular points were then added every 20m along each line and the file saves a KML. A second line of points was then added going back along the first line was added manually (Using QGIS editor), and the subsequent file again saved as a KML file. The KML file was then uploaded to FlyLitchi https://flylitchi.com/hub. It was then downloaded as a CSV and the altitude manually edited in Excel such that the first half of points were set to 0m altitude and second half to -10m altitude. The Litch app was then used and the mission opened and the following changes were made; Change FPV to waypoint mode, load flight, check waypoints to make sure right altitude, open mission settings ensure heading mode is user controlled / no action on finish / cruising speed is 3.2kmh / max flight speed of ~10kmh, photo capture disabled, default gimbal pitch disabled, rotations direction = manual. The mission was then saved and was ready for the flight to commense.

UAV Flights Undertaken

Table A6. UAV flights undertaken during the Isle of Skye Cliff-nester Surveys

Site	Date	Time	Drone	Images	Aim
Duntulm	17/06/2021	12:20	Mavic 2 Zoom	video	Manual flight
Rubha na h-Aiseng	17/06/2021	15:10	Mavic 2 Zoom	video	Manual flight over low lying site
Bornessketaig	18/06/2021	12:15	Mavic 2 Zoom	video	Manual/auto flight
Bornessketaig	18/06/2021	13:00	Mavic 2 Zoom	video	Auto flight
Bornessketaig	18/06/2021	14:20	Mavic 2 Zoom	video	Auto flight
Bornessketaig	18/06/2021	15:15	Mavic 2 Zoom	video	Auto flight
Bornessketaig	19/06/2021	10:25	Mavic 2 Zoom	video	Auto flight
Bornessketaig	19/06/2021	10:55	Mavic 2 Zoom	video	Auto flight
Bornessketaig	19/06/2021	11:20	Mavic 2 Zoom	video	Auto flight
Bornessketaig	19/06/2021	12:10	Mavic 2 Zoom	video	Auto flight
Bornessketaig	19/06/2021	12:50	Mavic 2 Zoom	video	Auto flight
Bornessketaig	19/06/2021	15:10	Mavic 2 Zoom	image	Auto flight - compare images
Bornessketaig	19/06/2021	15:30	Mavic 2 Pro	image	Auto flight - compare images
Wiay	20/06/2021	15:00	Mavic 2 Zoom	video	Boat launch video
Bornessketaig	21/06/2021	10:30	Mavic 2 Pro	image	Auto flight
Meall Raineach	21/06/2021	12:30	Mavic 2 Zoom	video	Auto/manual
Meall Raineach	21/06/2021	13:15	Mavic 2 Zoom	video	Auto/manual

Ground-nesting Seabirds

The survey team comprised Stuart Bearhop, Fraser Bell, Richard Inger, Kerry Mackie, Luke Ozsanlav-Harris, Steph Trapp from the University of Exeter, Roddy Mavor an independent ornithological consultant, Emma Philips, Alex Robbins and Helen Wade from Nature Scot and Charlie Main from MarPAMM.

Burrow-nesting Seabirds

Details of all the location of each survey point as UK grid references and latitude / longitude can be found in the spreadsheet "Petrels_All_Data.xlsx".

European Storm and Leach's Storm Petrel

North Rona

Table A7. Transects and survey points carried out on North Rona.

Transect	Points	Repeats	Surveys	Transect	Points	Repeats	Surveys
L1	12	3	36	SW03	8	1	8
L2	20	2	40	SW04	19	1	19
L3	20	2	40	SW05	27	1	27
L4	22	2	44	SW06	35	1	35
L5	22	3	66	SW07	41	1	41
L6	22	2	44	SW08	43	1	43
L7	20	2	40	VG1	9	1	9
L8	18	2	36	VG2	9	1	9
K1	18	2	36	VG3	9	1	9
K2	30	2	60	VG4	7	1	7
K3	28	2	56	VG01	30	1	30
K4	26	2	52	C1	94	1	94
L1.5	11	1	11	C2	93	1	93
Flanuis Walls	43	1	43	Carn By Lighthouse	24	1	24
SW01	8	1	8	Village Walls	140	1	140
SW02	14	1	14				

Figure A1. North Rona. Red dots represent distance sampling survey points.

All surveys were arranged, coordinated and lead by Jim Lennon. The survey team consisted of Alister Clunas, Becky Jones, Bob Medland, Carole Davis, Ian Buxton, Robin Reid (RSPB), Sarah Lawrence (RSPB). The same vessel and crew used for the Uists, Harris & Lewis islands cliff-nester surveys was used.

Flannan Isles.

Table A8. Transects and survey points carried out on the Flannan Isles.

Transect	Points	Repeats	Surveys	Transect	Points	Repeats	Surveys
FEM_A1	11	3	33	FET_A1	8	1	8
FEM_A1.5	10	2	20	FET_A2	8	1	8
FEM_A2	10	3	30	FET_A3	8	1	8
FEM_A2.5	11	2	22	FET_A4	8	1	8
FEM_A2.6	11	1	11	FET_B1	5	1	5
FEM_A2.7	11	1	11	FET_B2+	9	1	9
FEM_A2.8	8	1	8	FET_B3+	7	1	7
FEM_A2.9	6	1	6	FET_B4+	8	1	8
FEM_A3	7	3	21	FET_C1	9	1	9
FEM_C1	8	2	16	FET_C2	22	1	22
FEM_E1	11	1	11	FET_Cairn	1	1	1
FEM_E2	4	1	4	FET_Point I (house)	1	1	1
FEM_H1	11	1	11	FR_R1	13	1	13
FEM_H2	8	1	8	FR_R2	16	1	16
FEM_Rock_pile	1	1	1	FR_R3	11	1	11
FEM_Rock_pile	1	1	1	FR_R4	9	1	9
				FR_R5	6	1	6

Figure A2. Flannan Isles, Roairream. Red dots represent distance sampling survey points.

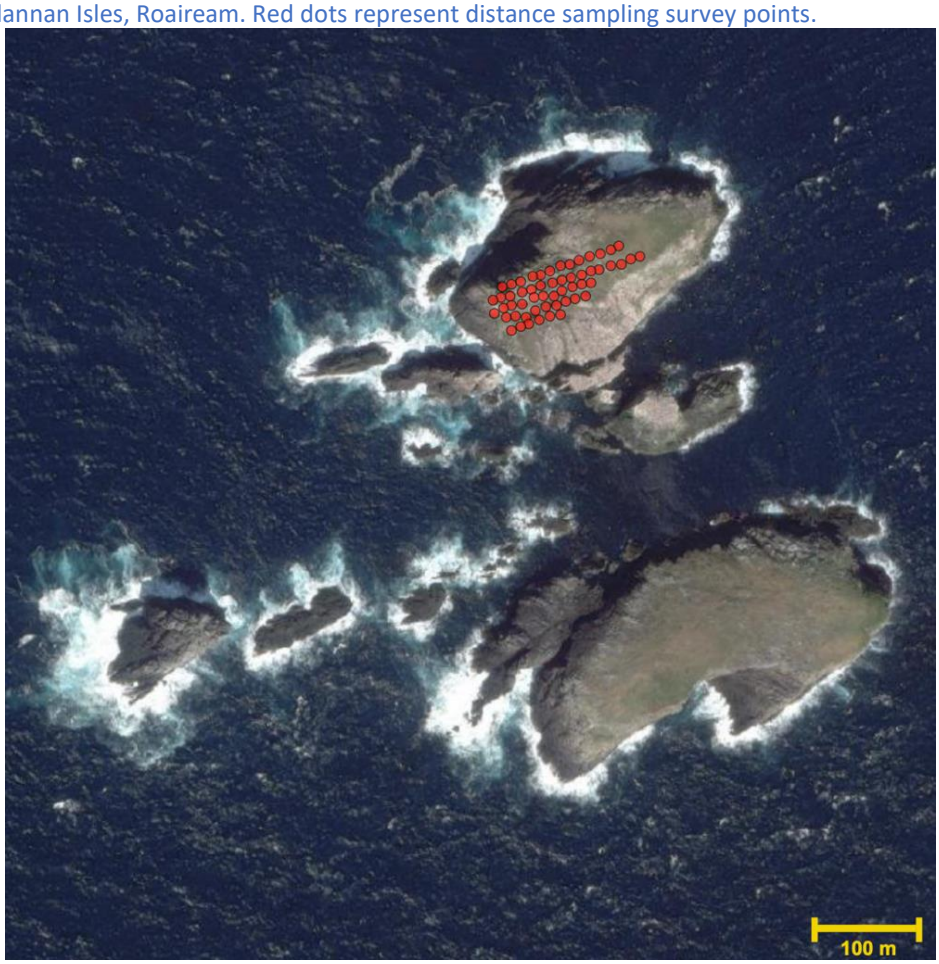


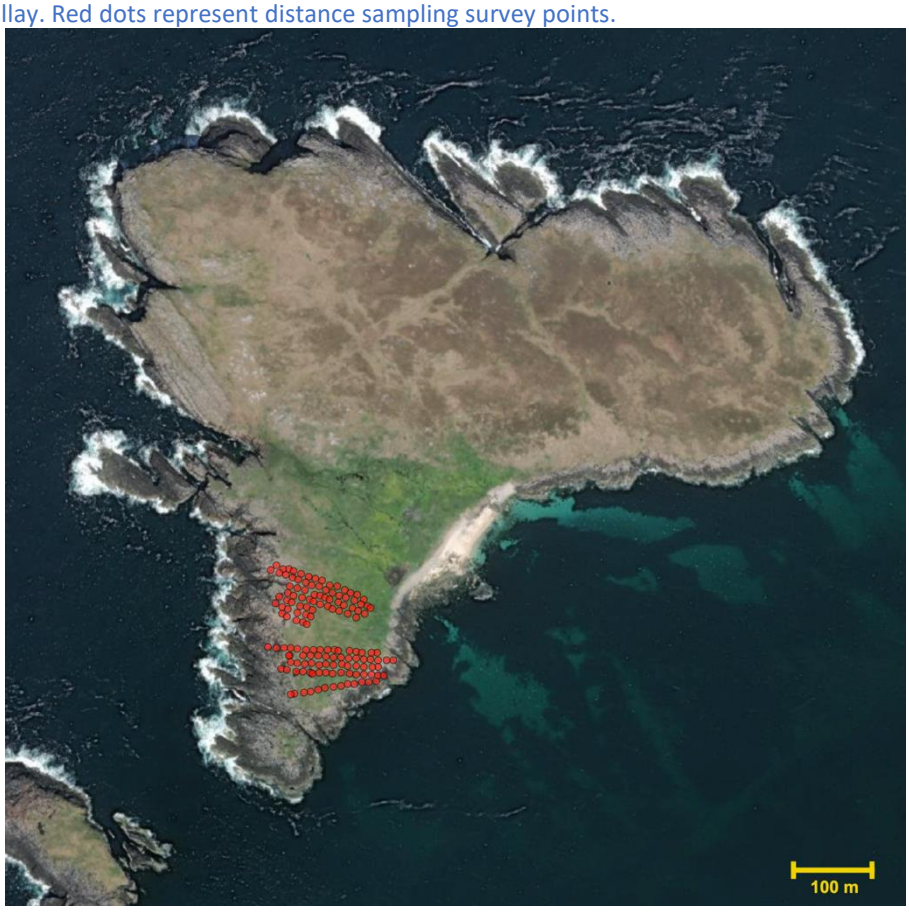
Figure A3. Flannan Isles, Eilean Mor (North) and Eilean Tighe. Red dots represent distance sampling survey points.

Shillay

Table A9. Transects and survey points carried out on Shillay.

Transect	Points	Repeats	Surveys
S1	16	2	32
S1.1	15	2	30
S2	15	1	15
S2.1	15	1	15
S3	12	1	12
S3.1	14	1	14
S4	11	1	11
S4.1	15	1	15
S5	13	1	13
S5.1	6	1	6
S6	6	1	6
K7	5	1	5

Figure A4. Shillay. Red dots represent distance sampling survey points.



All surveys on the Flannan Isles and Shillay were arranged, coordinated and lead by Jim Lennon. The survey team comprised Bob Medland, Dave Dutton, Ian Buxton, Karen Mcdiarmid, Robin Reid, Sarah Lawrence, Vicky Anderson. The vessel used was MV Lochlann from Seatrek (https://www.seatrek.co.uk) skippered by Iain Angus MacLeod.

Sanda Island

Table A10. Transects and survey points carried out on Sanda Island.

Transect	Points	Repeats	Surveys
LGL1	2	3	6
LGL2	6	3	18
LGL3	6	3	18
LGL4	4	3	12
LGL5	3	3	9
LCF	6	3	18
LGW	11	2	22
LBT	4	1	4
LBL	4	1	4
LBW	2	1	2
LQ	4	2	8
ELU	9	2	18
ELL	8	1	8
AV	4	1	4
WRW	10	1	10
WRE	5	1	5
DSW	7	1	7
CHAP	8	1	8
SHAG	5	1	5
FC	4	1	4

Figure A5. Sanda Island. Red dots represent distance sampling survey points.

Surveys on Sanda were led Nigel Scriven with a field team consisting of Rab Morton, Rob Lightfoot and Paul J Baker, all members of the Sanda Island Bird Observation Trust.

Figure A6. Distution of responses by distance band for the European and Storm Petrel surveys.

Detailed Petrel Survey Methods and Protocols

Playback recording

For Leach's storm-petrel (LSP), slightly higher response rates are achieved using a recording containing two female calls followed by an interval and then two male calls. Therefore, this recording has 10 second intervals after the calls of each sex in which to listen for responses. The total duration of the recording is 30 seconds, with a pure tone at the end to indicate the end of the survey period. Follow this with European storm-petrel (ESP) using call provided by Mark Bolton.

Playback method

- Do playback by holding a MIFA A 1 portable speaker (EasyAcc model LX-839 no longer available) facing towards the ground, approximately 1 m above the survey point, and play the recording at maximum volume everywhere (c. 75 dB).
- Only record responses from LSP if they occur within the 30-second survey period for each playback trial.
- Once this period had finished, the observer measures the approximate distance to each response using a bamboo pole marked at 50 cm intervals.

- Record responses in 50 cm distance bands, from 0 m to 4 m. Use bamboo mist net pole (4 m) marked with red & white bands.
- Note any responses beyond 4 m, but do not measure beyond the 4 m radius.
- ESP may respond to LSP call, and vice versa. Do not record these.
- If a high number of responses make it difficult to accurately locate all individual responses, then play the call again to elicit another response, while taking care to only record those individuals that responded on the first playback.
- At each survey point do playback for LSP first, and record responses, before using playback for ESP. Record results for ESP as per Leach's in steps 1 – 6, but avoid duplicating with any that respond to Leach's call as well.

Note: When surveying walls the speaker was held approximately 1m off the ground and approximately 1m away from the wall.

Recording

- Record date, time of day, observer & wind speed (F0-F4).
- Record predominant habitat type within 4 m radius of each playback point i.e. grass/vegetation, rock, scree, earth bank, stone wall.
- Use GPS to record start & finish points of transect with 10 figure grid ref i.e. NA 12345 12345.
- Map areas of suitable petrel habitat that cannot be surveyed i.e. too steep, loose rock, unstable surface (puffin burrows) or disturbance to other seabird species, using landmarks and or GPS.

Timing of surveys

- Carry out fieldwork when both petrels are believed to be either incubating or at brood-guard stage (12 – 28 July 2021).
- Do distance sampling surveys between 0700 and 1900 hours, and only when weather conditions are considered unlikely to impact the detection of bird vocalisations or estimation of distances i.e. not in strong wind, heavy rain, or fog.

Transect set up

- Establish calibration transects start & finish with GPS.
- Layout transects with rope with marker every 10 m. On calibration transects mark playback points with cane to ensure accurate repeatability.
- Use 4 m pole to establish start/finish point of next of adjacent transect and move rope.

Calibration HDSM data

- Select 1- 3 transects that represent the island's habitats (storm petrel response rate can vary by habitat). Ideally, c20% of points should be surveyed 4-5 times and playback points marked.
- Playback must be carried out at the precisely the same point in return visits.
- Survey these daily during the visit or twice daily if only a short visit possible.
- Vary times of day survey is repeated if possible.

Manx Shearwaters

The survey team consisted of Prof Stuart Bearhop, Roz Bown, Jennifer Grigg, Tess Handby, Freddie Leith, Josh Lynton-Jenkins, Aimee McIntosh, Luke Ozsanlav-Harris and Dr Richard Sherley, all from the University of Exeter, and Dr Lucy Quinn and Rona Sinclair from NatureScot.

Detailed Manx Shearwater Methods and Protocols

Phase One. Initial Survey to Define Density Strata

- Teams will consist of 2 fieldworkers
- The colony will be divided into 100m x 100m survey grids
- We will survey 200 of these grids that will be picked at random
- Each team will aim to survey at least 10 grids / day. These will be allocated before the day's surveys commence
- Navigation to the grid squares will be done using the QField GIS app on an Android Smartphone.

Initial Habitat Survey

- All data should be input in the GIS system and also noted down manually in a note book
- Once the survey grid has been located an initial assessment will be made.
    - Is the grid safe to survey? Grids with dangerous cliffs or excessively steep slopes will be eliminated from the survey
    - Is the habitat suitable for Manx Shearwater? For e.g. waterlogged, solid rock and shallow soil grid squares will be eliminated.
    - Record approx. slope of the grid
    - Record approx. % grass cover
    - Record approx. % boulder cover
    - Record approx. % suitable habitat
    - Vegetation height
    - Take a photo of the grid. Photos should be taken from the South East corner of the grid as marked on the GIS system facing North West.
    - Record approx. weather details. Rain (none, light, heavy). Wind (light / medium / strong).

Transects

- 2 x 100m transects will be walked and the total number of burrows within 2m on either side of the transect will be counted.
- Transects 1 should start 25m in from the Eastern Edge of the grid along the Southern edge. Transect 2 should start 25m in from the Western edge
- Transects will need to be measured out using 50m tape measures, GPS data cannot be relied on to measure the length of the transect
- Peg out the transect in 10m sections prior to starting counts
- Transects should be walked Northwards if possible
- Transects should be recorded on the QField GIS app

- Each fieldworker will hold one end of a 4m piece of cord and walk the transect counting the number of burrows within the cord along the length of the transect
- A random selection of 20 burrows will then be tested for occupancy using playback methods. If there are less than 20 burrows do as many as possible.
- The number of occupied burrows along with the number checked and the number of responses to playback should all be noted. All checked burrows should be marked on the GIS system

Playback Methods

- The loudspeaker connected to the MP3 player using the auxiliary cable should be placed at the entrance to the burrow with the speaker pointing into the burrow
- Ensure that both speaker and MP3 player volumes are at Max (approx. 80dB)
- Play the MP3 file of Manx Shearwater call.
    - The call starts with white noise to let you know the playback is about to start
    - The call lasts for 25 sec
    - After this there is a period of 25 sec when responses should be listened for
    - A bleep after this indicates that the playback is complete

Phase Two. Multi-strata Survey

- Each survey grid (after removal of grids deemed unsuitable / unsafe) will be assigned a density based on the initial survey
- We will survey a minimum of 120 survey grids: 80 High Density, 26 Medium Density 14 Low Density. These need to be assigned in proportion to the number of squares in the three sections
- Navigation to the grid squares will be done using the QField app on an Android Smartphone
- Tess has created a second GIS that has points placed in the centre of grid squares and you will use these. From the centre of the survey grid a circle of radius 10m will be marked out using a 10m cord attached to a ground peg in the centre of the grid. The approx. circumference will be marked out with 4 pegs.
- The survey circle should then be divided into 4 quarters.
- Each quarter should be searched in a zig zag pattern for burrows starting at the centre of the circle
- All burrows within the survey circle should be checked for occupancy using playback methods and marked out with a plant marker
- Total number of burrows and total number of occupied burrows should be recorded

Calibration Plots

- 30 survey grids will be selected outside of the main survey grids and used for calibration of playback response
- 2 burrows per grid will be selected for calibration
- Burrows will be checked for occupancy using endoscopes (see below) until 2 occupied burrows per grid are found.
- Once an occupied burrow has been located it should be marked using pegs / plant markers

- GPS position of each calibration burrow should be recorded on the GIS system
- Playback trials should be conducted 10 times at each calibration burrow during the course of the survey
- Day / time / weather conditions should be recorded for each playback
- At the end of the 10 playback trials, each calibration burrow should be checked with an endoscope (see below) again to ensure that the burrow remained occupied during the course of the calibration exercise (and was not abandoned part way through).

Endoscope Protocol

- Inskam LCD handheld digital endoscopes fitted with a 5m scope will be used to check for occupancy.
- The scope will be inserted into the burrow slowly and carefully by one fieldworker while a second fieldworker will constantly monitor the output from the camera on the LCD display.
- Once a bird is seen, the scope will be immediately removed from the burrow.

Results

Cliff-Nesting Seabirds

The raw data from the cliff-nesting seabird surveys is too large to include within this Appendix, therefore it has been provided as an Excel file; "Cliff_Nesters_AllData.xlsx". The file contains data for all the sites surveyed, times and dates, weather conditions, along with the count data for all Cliff-nesting Seabird species.

Ground-nesting Seabirds

Table A11. Great Skua. All data.

Date	AOT/AON	A-D	Count	Location (UK Grid)
25/06/2021	AOT	D	1	NB 47046 59502
25/06/2021	AOT	D	1	NB 48180 59506
25/06/2021	AOT	C	1	NB 52172 59253
25/06/2021	AOT	D	1	NB 52184 59278
25/06/2021	AOT	D	1	NB 53014 57666
25/06/2021	AOT	D	1	NB 53020 57900
25/06/2021	AOT	D	1	NB 55368 57391
25/06/2021	AOT	D	1	NB 55363 57391
25/06/2021	AOT	B	1	NB 56226 55198
25/06/2021	AOT	C	1	NB 56185 55396
25/06/2021	AOT	D	1	NB 56185 55396
25/06/2021	AOT	B	1	NB 56384 55531
25/06/2021	AOT	D	1	NB 56005 56648
25/06/2021	AOT	C	1	NB 56229 56525
25/06/2021	AOT	C	1	NB 56292 56677
25/06/2021	AOT	C	1	NB 56292 56677
25/06/2021	AOT	C	1	NB 56292 56677
25/06/2021	AOT	B	1	NB 56492 56279
26/06/2021	AOT	C	3	NB 50490 42942
26/06/2021	AOT	C	8	NB 50799 42951
26/06/2021	AOT	A	1	NB 50799 42951
26/06/2021	AOT	C	5	NB 50431 42027
26/06/2021	AOT	A	2	NB 51062 42179
26/06/2021	AOT	B	1	NB 51062 42179
26/06/2021	AOT	C	6	NB 51062 42179
26/06/2021	AOT	B	2	NB 51136 42426
26/06/2021	AOT	C	3	NB 51136 42426
26/06/2021	AOT	C	6	NB 51501 42298
26/06/2021	AOT	A	2	NB 51579 42718
26/06/2021	AOT	B	1	NB 51579 42718
27/06/2021	AOT	C	1	NB 53930 32810
27/06/2021	AOT	C	1	NB 53410 33160
27/06/2021	AOT	C	1	NB 53742 36291
27/06/2021	AOT	C	3	NB 54661 32639
27/06/2021	AOT	C	8	NB 54834 32644
27/06/2021	AOT	B	1	NB 54695 32106
27/06/2021	AOT	C	1	NB 54695 32106

27/06/2021	AOT	D	1	NB 54410 32530
27/06/2021	AOT	C	1	NB 54400 32690
27/06/2021	AOT	D	1	NB 54280 32850
27/06/2021	AOT	D	1	NB 54110 32720
27/06/2021	AOT	C	3	NB 54248 33698
27/06/2021	AOT	D	1	NB 54675 34233
27/06/2021	AOT	C	1	NB 54832 46939
27/06/2021	AOT	B	1	NB 54769 46929
27/06/2021	AOT	B	1	NB 54934 47003
27/06/2021	AOT	B	1	NB 54873 47018
27/06/2021	AOT	B	1	NB 54789 47187
27/06/2021	AOT	B	1	NB 54891 47190
27/06/2021	AOT	B	1	NB 54770 47221
27/06/2021	AOT	B	1	NB 54982 47138
27/06/2021	AOT	B	1	NB 54941 47193
27/06/2021	AOT	D	1	NB 54954 47280
27/06/2021	AOT	C	1	NB 55100 32399
27/06/2021	AOT	C	4	NB 55304 32618
27/06/2021	AOT	B	2	NB 55304 32618
27/06/2021	AOT	D	1	NB 55038 47285
27/06/2021	AOT	A	1	NB 55071 47225
27/06/2021	AOT	C	1	NB 55121 47148
27/06/2021	AOT	D	1	NB 55116 47347
27/06/2021	AOT	B	1	NB 55177 47243
27/06/2021	AOT	D	1	NB 55193 47108
27/06/2021	AOT	C	1	NB 55213 47157
27/06/2021	AOT	C	1	NB 55053 47206
27/06/2021	AOT	C	1	NB 55220 47195
27/06/2021	AOT	D	1	NB 55215 47250
27/06/2021	AOT	D	1	NB 55301 47122
27/06/2021	AON	A	1	NB 55189 47036
27/06/2021	AON	A	1	NB 55500 47124
27/06/2021	AON	A	1	NB 55636 47026
27/06/2021	AON	A	1	NB 55943 47009
27/06/2021	AON	A	1	NB 56000 47130
27/06/2021	AON	A	1	NB 56029 47091
27/06/2021	AON	A	1	NB 56119 47094
27/06/2021	AON	A	1	NB 56058 47139
27/06/2021	AOT	B	1	NB 56136 47248
27/06/2021	AOT	C	1	NB 56151 47119
27/06/2021	AOT	D	1	NB 56194 47095
28/06/2021	AOT	B	4	NB 50430 29510
28/06/2021	AOT	C	3	NB 50852 30254
28/06/2021	AOT	D	2	NB 51221 29906
28/06/2021	AOT	B	2	NB 51160 29430
28/06/2021	AOT	D	1	NB 51800 29980
28/06/2021	AOT	B	1	NB 51800 29980
29/06/2021	AOT	D	1	NB 39497 56038
29/06/2021	AOT	C	1	NB 42930 58211
30/06/2021	AOT	C	1	NB 43828 56760
30/06/2021	AOT	D	1	NB 44533 56755

Table A12. Arctic Skua. All data.

Date	AOT/AON	A-D	Count	Location (UK Grid)
18/05/2021	AOT	D	1	NB 505 527
18/05/2021	AOT	D	2	NB 509 521
18/05/2021	AOT	D	2	NB 500 535
19/05/2021	AOT	D	2	NB 468 527
19/05/2021	AOT	D	2	NB 467 524
19/05/2021	AOT	D	2	NB 470 524
19/05/2021	AOT	D	2	NB472 524
19/05/2021	AOT	D	2	NB 476 529
19/05/2021	AOT	D	2	NB 477 524
19/05/2021	AOT	D	2	NB 479 521
19/05/2021	AOT	D	1	NB 471 521
19/05/2021	AOT	D	2	NB 493 538
23/06/2021	AOT	D	1	NB 467 525
23/06/2021	AOT	D	1	NB 469 521
23/06/2021	AOT	D	1	NB484 511
23/06/2021	AOT	D	4	NB 493 514
23/06/2021	AOT	D	1	NB 501 518
23/06/2021	AOT	D	1	NB 502 517
23/06/2021	AOT	D	4	NB 502 514
23/06/2021	AOT	D	2	NB 504 526
23/06/2021	AOT	D	2	NB 484 521
23/06/2021	AOT	D	2	NB 480 525
23/06/2021	AOT	D	2	NB 483 528
23/06/2021	AOT	D	4	NB 485 525
23/06/2021	AOT	D	4	NB 460 526
23/06/2021	AOT	D	1	NB 471 513
23/06/2021	AOT	D	2	NB 471 518
23/06/2021	AOT	D	2	NB 472 515
23/06/2021	AOT	D	1	NB 475 514
23/06/2021	AOT	D	2	NB 477 517
23/06/2021	AOT	D	1	NB 478 513
23/06/2021	AOT	D	1	NB 478 511
25/06/2021	AOT	D	1	NB 47520 57210
25/06/2021	AOT	C	1	NB 50401 55145
25/06/2021	AOT	D	1	NB 51557 54495
25/06/2021	AOT	C	1	NB 52295 55159
25/06/2021	AOT	D	1	NB 52984 57357
25/06/2021	AOT	D	1	NB 52984 57357
25/06/2021	AOT	C	1	NB 53913 56256
25/06/2021	AOT	D	1	NB 53745 57547
25/06/2021	AOT	D	1	NB 54470 57469
25/06/2021	AOT	D	1	NB 55514 55265
26/06/2021	AOT	C	1	NB 45989 44676
26/06/2021	AOT	C	1	NB 45936 44426
26/06/2021	AOT	C	1	NB 46272 46694
26/06/2021	AOT	C	1	NB 49807 46444

26/06/2021	AOT	C	1	NB 49849 46260
26/06/2021	AOT	D	1	NB 49930 51439
26/06/2021	AOT	C	1	NB 49948 53734
26/06/2021	AOT	C	1	NB 50799 42951
26/06/2021	AOT	D	1	NB 50235 46752
26/06/2021	AOT	D	1	NB 50218 46255
26/06/2021	AOT	C	1	NB 50995 46327
26/06/2021	AOT	D	1	NB 50120 46601
26/06/2021	AOT	C	1	NB 50184 51871
26/06/2021	AOT	C	1	NB 50677 52406
26/06/2021	AOT	D	1	NB 50680 52351
26/06/2021	AOT	C	1	NB 50250 52317
26/06/2021	AOT	C	1	NB 51579 42718
26/06/2021	AOT	D	1	NB 51560 52277
26/06/2021	AOT	D	1	NB 51700 53010
27/06/2021	AOT	D	1	NB 42810 45241
27/06/2021	AOT	D	1	NB 45260 44900
27/06/2021	AOT	D	1	NB 45260 44900
27/06/2021	AOT	D	1	NB 45160 46130
27/06/2021	AOT	C	1	NB 46110 43320
27/06/2021	AOT	D?	1	NB 48000 44000
27/06/2021	AOT	C	1	NB 49836 43825
27/06/2021	AOT	C	1	NB 49579 44142
27/06/2021	AOT	C	1	NB 49579 44142
27/06/2021	AOT	C	1	NB 49490 45605
27/06/2021	AOT	C	1	NB 50408 44399
27/06/2021	AOT	C	1	NB 50604 44255
27/06/2021	AOT	C	1	NB 50517 44906
27/06/2021	AOT	C	1	NB 50291 44473
27/06/2021	AOT	C	1	NB 50291 44473
27/06/2021	AOT	C	1	NB 50291 44473
27/06/2021	AOT	C	1	NB 50291 44473
27/06/2021	AOT	C	1	NB 50906 45680
27/06/2021	AOT	D	1	NB 51712 31726
27/06/2021	AOT	C	1	NB 51419 45298
27/06/2021	AOT	C	1	NB 51411 45213
27/06/2021	AOT	C	1	NB 51079 45497
27/06/2021	AOT	C	1	NB 51170 45819
27/06/2021	AOT	D	1	NB 51352 45927
27/06/2021	AOT	C	1	NB 53580 32930
27/06/2021	AOT	C	1	NB 53912 35985
27/06/2021	AOT	C	1	NB 53742 36291
27/06/2021	AOT	C	1	NB 54344 32190
27/06/2021	AOT	D	1	NB 54983 35653
28/06/2021	AOT	D	1	NB 41721 44312
28/06/2021	AOT	D	1	NB 42810 45241
28/06/2021	AOT	D	1	NB 42795 45008
28/06/2021	AOT	C	1	NB 43108 43971

28/06/2021	AOT	D	1	NB 43505 46253
28/06/2021	AOT	C	1	NB 43602 47827
28/06/2021	AOT	C	1	NB 43976 47706
28/06/2021	AOT	D	1	NB 43800 48400
28/06/2021	AOT	C	1	NB 44346 46202
28/06/2021	AOT	D	1	NB 44110 47374
28/06/2021	AOT	D?	1	NB 44000 47500
28/06/2021	AOT	D?	1	NB 44000 47500
28/06/2021	AOT	D	1	NB 44350 48203
28/06/2021	AOT	C	1	NB 50170 29670
28/06/2021	AOT	C	1	NB 50910 29380
28/06/2021	AOT	C	1	NB 50376 30508
28/06/2021	AOT	C	1	NB 50761 30899
28/06/2021	AOT	C	1	NB 50245 31233
28/06/2021	AOT	C	1	NB 51420 29660
28/06/2021	AOT	C	1	NB 51398 30370
28/06/2021	AOT	D	1	NB 51398 30370
28/06/2021	AOT	C	2	NB 51680 30120
28/06/2021	AOT	C	2	NB 51302 30949
28/06/2021	AOT	B/C	1	NB 51072 31166
29/06/2021	AOT	C	1	NB 39018 51091
29/06/2021	AOT	D	1	NB 40695 46479
29/06/2021	AOT	D	1	NB 41213 45996
29/06/2021	AOT	D	1	NB 41609 46869
29/06/2021	AOT	D	1	NB 41614 46534
29/06/2021	AOT	D	1	NB 41614 46534
29/06/2021	AOT	D	1	NB 41614 46534
29/06/2021	AOT	D	1	NB 41614 46534
29/06/2021	AOT	D	1	NB 41455 46011
29/06/2021	AOT	D	1	NB 41085 46004
29/06/2021	AOT	D	1	NB 42000 46500
29/06/2021	AOT	D	1	NB 42000 46000
29/06/2021	AOT	D	1	NB 42000 46000
29/06/2021	AOT	C	1	NB 42990 51818
29/06/2021	AOT	B	1	NB 42251 52934
29/06/2021	AOT	C	1	NB 43027 51862
29/06/2021	AOT	C	1	NB 43094 52415
30/06/2021	AOT	D	1	NB 42833 55748
30/06/2021	AOT	D	1	NB 45532 50642
30/06/2021	AOT	C	1	NB 47710 53510
30/06/2021	AOT	C	1	NB 47710 53520

Table A13. Great Black-backed Gull. All data.

Date	AOT/AON	A-D	Count	Location (UK Grid)
26/06/2021	AOT	D	3	NB 50431 42027
26/06/2021	AOT	A	12	NB 50431 42027
26/06/2021	AOT	C	32	NB 50431 42027
26/06/2021	AOT	C	5	NB 51136 42426
26/06/2021	AOT	A	3	NB 51136 42426
26/06/2021	AOT	C	1	NB 51579 42718
27/06/2021	AOT	C	1	NB 50318 44049
27/06/2021	AOT	D	1	NB 52840 33630
27/06/2021	AOT	C	1	NB 52050 44040
27/06/2021	AOT	D	1	NB 53540 32910
27/06/2021	AOT	C	2	NB 53610 36378
27/06/2021	AOT	C	2	NB 54834 32644
27/06/2021	AOT	D	2	NB 55248 33180
27/06/2021	AOT	D	1	NB 55780 34822
27/06/2021	AOT	C	1	NB 55272 47083
27/06/2021	AOT	C	1	NB 56306 35329
28/06/2021	AOT	C	2	NB 38431 28657
28/06/2021	AOT	A	1	NB 38723 28237
28/06/2021	AOT	C	6	NB 40197 41764
28/06/2021	AOT	C	1	NB 42389 41198
28/06/2021	AOT	C	1	NB 42460 41276
28/06/2021	AOT	C	4	NB 44321 40657
28/06/2021	AOT	B	11	NB 50520 29700
28/06/2021	AOT	A	2	NB 50520 29700
28/06/2021	AOT	C	10	NB 50520 29700
28/06/2021	AOT	C	2	NB 50240 30000
28/06/2021	AOT	D	1	NB 50245 31233
28/06/2021	AOT	B	1	NB 50178 31609
28/06/2021	AOT	B	1	NB 51800 29980
28/06/2021	AOT	C	4	NB 51105 30219
28/06/2021	AOT	D	2	NB 51105 30219
28/06/2021	AOT	A	1	NB 51105 30219
28/06/2021	AOT	C	2	NB 51019 31456
28/06/2021	AOT	A	1	NB 52630 34510
28/06/2021	AOT	D	1	NB 52630 34510
29/06/2021	AOT	C	1	NB 38410 30176
29/06/2021	AOT	D	5	NB 38316 33317
29/06/2021	AOT	C	4	NB 38316 33317
29/06/2021	AOT	A	1	NB 38316 33317
29/06/2021	AOT	D	2	NB 39729 55387

30/06/2021	AOT	C	1	NB 44135 56831
30/06/2021	AOT	C	6	NB 44135 56831
30/06/2021	AON	A	1	NB 44135 56831

Table A14. Lesser Black-backed Gull. All data.

Date	AOT/AON	A-D	Count	Location (UK Grid)
28/06/2021	AOT	C	1	NB 38431 28657
29/06/2021	AON	A	7	NB 35530 28330
29/06/2021	AOT	D	17	NB 35530 28330
29/06/2021	Individuals		37	NB 35530 28330
29/06/2021	AOT	C	22	NB 38410 30176
29/06/2021	AOT	D	2	NB 38316 33317
29/06/2021	AOT	D	4	NB 39805 55566
29/06/2021	AOT	C	16	NB 39729 55387
29/06/2021	AOT	D	16	NB 39729 55387
29/06/2021	Individuals		34	NB 40100 42100

Table A15. Herring Gull. All data.

Date	AOT/AON	A-D	Count	Location (UK Grid)
26/06/2021	AOT	D	18	NB 50431 42027
27/06/2021	AOT	B	1	NB 51990 43950
27/06/2021	AOT	C	1	NB 52849 46853
28/06/2021	AOT	C	51	NB 38431 28657
28/06/2021	AOT	C	1	NB 38723 28237
28/06/2021	AOT	C	4	NB 40197 41764
28/06/2021	AOT	B	1	NB 50520 29700
29/06/2021	AON	A	48	NB 35530 28330
29/06/2021	AOT	D	39	NB 35530 28330
29/06/2021	Individuals		173	NB 35530 28330
29/06/2021	AOT	C	60	NB 38410 30176
29/06/2021	AOT	C	70	NB 38316 33317
29/06/2021	AOT	D	75	NB 38316 33317
29/06/2021	AOT	A	7	NB 38316 33317
29/06/2021	AOT	C	16	NB 39805 55566
29/06/2021	AOT	A	3	NB 39805 55566
29/06/2021	AOT	C	27	NB 39729 55387
29/06/2021	AOT	D	20	NB 39729 55387
29/06/2021	AOT	A	3	NB 39729 55387
29/06/2021	AOT	C	6	NB 40100 42100
29/06/2021	AON	A	11	NB 51900 66400

Table A16. Common Gull. All data.

Date	AOT/AON	A-D	Count	Location (UK Grid)
28/06/2021		D	5	NB 50245 31233
28/06/2021	AOT	B	4	NB 51252 31358
28/06/2021	AOT	C	4	NB 51252 31358
29/06/2021	AOT	D	1	NB 35530 28330
29/06/2021	AOT	D	3	NB 35530 28330
29/06/2021	Individuals		16	NB 36300 48600
29/06/2021	AOT	C	5	NB 43138 58512
29/06/2021	AOT	A	4	NB 43138 58512
29/06/2021	AON	A	12	NB 47969 61274
29/06/2021	AOT	C	2	NB 50424 62694
29/06/2021	AON	NA	1	NB 52750 64330
29/06/2021	AON	NA	3	NB 52515 66193
30/06/2021	AOT	C	1	NB 43653 57190

Table A17. Black-headed Gull. All data.

Date	AOT/AON	A-D	Count	Location (UK Grid)
29/06/2021	AOT	A/C/D	14	NB 41926 54674
29/06/2021	AOT	C	5	NB 50424 62694
29/06/2021	AOT	NA	4	NB 52750 64330

Table A18. Arctic Tern. All data.

Date	AOT/AON	A-D	Count	Location (UK Grid)
29/06/2021	Individuals	NA	**150**	NB 52515 66193

Table A19. Common Tern. All data.

Date	AOT/AON	A-D	Count	Location (UK Grid)
27/06/2021	AOT	C	12	NB 48969 45552
28/06/2021	AON	B	22	NB 38533 28389

Burrow-nesting Seabirds

The raw data from the burrow-nesting seabird surveys is too large to include within this Appendix, therefore it has been provided as Excel files; Petrels "Petrels_All_Data.xlsx". The petrel spreadsheet contains 6 sheets with the raw data for European & Leach's Storm petrels on North Rona and the Flannan Isles and European Storm Petrel data for Shillay and Sanda Island. The data contains details of time and date and GPS location of all the survey points along with the resulting responses to the playback trails in 0.5m bands away from the survey point.

Manx Shearwater raw data camn be found in the following files; "Census_Plots.csv" = Counts of the number of burrows (Number_Burrows), playback trials (Number_Playback), responses (Response_in_Gap), area surveyed (Area_Surveyed) and burrow density (Burrow_per_m2), as well as the associated metadata collected in the 129 survey circles during Phase 2 (the multi-strata survey).

"Calibration_Burrows.csv" = Playback trials and observed responses (Response_binary; 0 = no response, 1 = response) and associated metadata from the 367 playback trials made at 62 burrows in 31 calibration plots. These data were used to estimate the calibration factor to correct for non-responding birds.

"P_dat.csv" = The 3,653 playback trials (pb) and observed response (rig; 0 = no response, 1 = response) made at burrows in the 129 survey circles during Phase 2 (the multi-strata survey). The 3,653 rows in this file correspond to the 3,653 playback trials recorded in "Census_Plots.csv", but have been recoded here into a binary format for modelling purposes. The appropriate metadata collected in each the 129 survey circles have been reproduced here for each row.

"Predicted_densities.csv" = The 'true 'surface area, accounting for the 3D topography ("SurfaceArea"), the predicted mean burrow density ("Pred_dens " in burrows.m^{-2}), and the associated median predicted number of apparently occupied burrows (Pred_AOBs) for each of the 3,419 pixels in the spatial raster covering the Manx shearwater colony on the Isle of Rum.

Full Results From HDS models.

European Storm Petrel

Table A20. Results from HDS models for North Rona. Blank cells are were estimates are not provided or could not be calculated. Neg Bi = Negative binomial. Abundance is a log-scale, Availability is a logit-scale, Detection is a log-scale.

		Abundance				Availability				Detection				AIC
Distribution	**Detection Function**	**Est**	**SE**	**z**	**p**	**Est**	**SE**	**z**	**p**	**Est**	**SE**	**z**	**p**	
Poisson	**Exponential**	-1.72	0.33	-5.15	<0.001	8.91	40.40	0.22	0.83	0.30	0.21	1.42	0.16	532.70
Poisson	**Hazard Rate**	-1.92	0.40	-4.80	<0.001	8.48	33.30	0.26	0.80	0.63	0.27	2.35	0.02	533.00
Poisson	**Half-normal**	-2.23	0.23	-9.62	<0.001	7.59	24.10	0.32	0.75	0.48	0.10	4.60	<0.001	532.22
Poisson	**Uniform**	-2.60	0.28	-9.24	<0.001	-0.13	0.49	-0.26	0.80					561.19
Neg Bi	**Exponential**	-1.27	0.41	-3.13	<0.001	5.26	31.80	0.17	0.87	0.06	0.17	0.34	0.73	461.84
Neg Bi	**Hazard Rate**	-0.64	0.97	-0.66	0.51	5.59	40.10	0.14	0.89	-1.09	0.97	-1.13	0.26	461.77**
Neg Bi	**Half-normal**	-1.91	1.05	-1.83	0.07	1.73	6.92	0.25	0.80	0.41	0.10	4.17	<0.001	467.00
Neg Bi	**Uniform**	-1.91	1.06	-1.81	0.07	-1.17	1.36	-0.86	0.39					498.02

Table A21. Results from HDS models for the Flannan Isles. Blank cells are were estimates are not provided or could not be calculated. Neg Bi = Negative binomial. Abundance is a log-scale, Availability is a logit-scale, Detection is a log-scale.

		Abundance				Availability				Detection				AIC
Distribution	**Detection Function**	**Est**	**SE**	**z**	**p**	**Est**	**SE**	**z**	**p**	**Est**	**SE**	**z**	**p**	
Poisson	**Exponential**	-0.471	1.02	-0.46	0.645	3.92	39.4	0.0995	0.921	-0.683	0.286	-2.39	0.017	103.84
Poisson	**Hazard Rate**	4.21	0.549	7.67	<0.001	5.28	48.1	0.11	0.913	-3.84	0.592	-6.48	<0.001	95.36
Poisson	**Half-normal**	-2.06	0.566	-3.64	<0.001	5.34	38	0.141	0.888	0.123	0.203	0.605	0.545	111.92
Poisson	**Uniform**	-3.07	0.948	-3.24	0.0012	-0.090	1.911	-0.047	0.963					121.53
Neg Bi	**Exponential**	-0.814	0.817	0.107	0.915	-0.516	0.242	-2.14	0.0327	-4.86	0.829	-5.86	<0.001	72.12
Neg Bi	**Hazard Rate**	-0.564	0.78	-0.723	0.47	7.86	38.4	0.205	0.838	-0.994	0.391	-2.54	0.011	68.55***
Neg Bi	**Half-normal**	-1.42	1.82	-0.778	0.436	0.43	4.44	0.0969	0.923	0.111	0.199	0.56	0.575	79.55
Neg Bi	**Uniform**	-1.42	1.82	-0.779	0.436	-2.26	1.88	-1.2	0.23					89.49

Table A22. Results from HDS models for Shillay. Blank cells are were estimates are not provided or could not be calculated. Neg Bi = Negative binomial. Abundance is a log-scale, Availability is a logit-scale, Detection is a log-scale.

		Abundance				Availability				Detection				AIC
Distribution	**Detection Function**	**Est**	**SE**	**z**	**p**	**Est**	**SE**	**z**	**p**	**Est**	**SE**	**z**	**p**	
Poisson	**Exponential**	-3.02	0.378	-7.98	<0.001	10.3	92.9	0.111	0.912	9.15	36	0.254	0.8	97.97
Poisson	**Hazard Rate**	-2.63	0.378	-6.96	<0.001	9.31	62.7	0.148	0.882	-5.98				102.84
Poisson	**Half-normal**	-3.02	0.378	-7.98	<0.001	10.8	120	0.09	0.928	6.55	252	0.026	0.979	97.97
Poisson	**Uniform**	-3.02	0.378	-7.98	<0.001	8.46	36.7	0.231	0.818					95.97***
Neg Bi	**Exponential**	-3.02	-.378	-7.98	<0.001	11.3	150	0.0751	0.94	10.6	74.9	0.142	0.887	99.97
Neg Bi	**Hazard Rate**	-3.02				11				8.2				101.97
Neg Bi	**Half-normal**	-3.02	0.378	-7.98	<0.001	11.2	141	0.0791	0.937	8.54	59.4	0.108	0.914	99.97
Neg Bi	**Uniform**	-3.02	0.378	-7.98	<0.001	8.48	37	0.229	0.819					97.97

Table A23. Results from HDS models for Sanda. Blank cells are were estimates are not provided or could not be calculated. Neg Bi = Negative binomial. Abundance is a log-scale, Availability is a logit-scale, Detection is a log-scale.

		Abundance				Availability				Detection				AIC
Distribution	**Detection Function**	**Est**	**SE**	**z**	**p**	**Est**	**SE**	**z**	**p**	**Est**	**SE**	**z**	**p**	
Poisson	**Exponential**	-2.64	0.707	-3.74	<0.001	4.68	46.6	0.101	0.92	0.901	0.715	1.26	0.208	67.77
Poisson	**Hazard Rate**	-2.66	0.763	-.348	<0.001	0.111	1.58	0.07	0.944	1.21	0.14	8.61	<0.001	67.87
Poisson	**Half-normal**	-2.66	0.763	-3.49	<0.001	1.31	4.42	0.297	0.767	0.759	0.481	1.58	0.115	67.49
Poisson	**Uniform**	-2.66	0.763	-3.49	<0.001	-0.527	1.14	-0.464	0.643					66.65***
Neg Bi	**Exponential**	-2.64	0.708	-3.73	<0.001	4.61	44.9	0.103	0.918	0.902	0.721	1.25	0.211	69.77
Neg Bi	**Hazard Rate**	-2.66	0.763	-3.49	<0.001	0.112	1.59	0.071	1.21	1.21	0.251	4.81	<0.001	69.87
Neg Bi	**Half-normal**	-2.66	0.761	-3.49	<0.001	1.28	4.23	0.303	0.762	0.76	0.477	1.59	0.111	69.49
Neg Bi	**Uniform**	-2.66	0.763	-3.49	<0.001	-0.527	1.14	-0.464	0.643	4.77	41.8	0.114	0.909	68.65

Leach's Strom Petrel

Table A24 Results from HDS models for North Rona. Blank cells are were estimates are not provided or could not be calculated. Neg Bi = Negative binomial. Abundance is a log-scale, Availability is a logit-scale, Detection is a log-scale.

		Abundance				Availability				Detection				AIC
Distribution	**Detection Function**	**Est**	**SE**	**z**	**p**	**Est**	**SE**	**z**	**p**	**Est**	**SE**	**z**	**p**	
Poisson	**Exponential**	-0.215	0.232	-0.925	0.355	6.94	28.3	0.245	0.807	-0.261	0.108	-2.42	0.0154	825.31
Poisson	**Hazard Rate**	0.339	0.567	0.98	0.55	6.56	27.6	0.238	0.812	-1.07	0.473	-2.26	0.237	814.74
Poisson	**Half-normal**	-1.24	0.175	-7.06	<0.001	6.92	24.2	0.286	0.775	0.251	0.068	3.69	<0.001	846.17
Poisson	**Uniform**	1.85	0.352	-5.25	<0.001	-0.424	0.61	-0.694	0.487					931.63
Neg Bi	**Exponential**	-0.079	0.361	-0.218	0.827	4.68	28.5	0.164	0.87	-0.284	0.104	-2.73	0.0063	779.01
Neg Bi	**Hazard Rate**	0.598	0.499	1.2	0.23	5.5	25.3	0.217	0.828	-1.22	0.432	-2.81	0.0049	767.28***
Neg Bi	**Half-normal**	-1.05	0.979	-1.07	0.283	2.34	11.2	0.208	0.835	0.236	0.067	3.55	<0.001	802.96
Neg Bi	**Uniform**	-1.1	1.17	-0.934	0.35	-1.45	1.47	-0.934	0.35	-1.45	1.47	-0.99	0.322	890.079

Table A25. Results from HDS models for the Flannan Isles. Blank cells are were estimates are not provided or could not be calculated. Neg Bi = Negative binomial. Abundance is a log-scale, Availability is a logit-scale, Detection is a log-scale.

		Abundance				Availability				Detection				AIC
Distribution	**Detection Function**	**Est**	**SE**	**z**	**p**	**Est**	**SE**	**z**	**p**	**Est**	**SE**	**z**	**p**	
Poisson	**Exponential**	4.12	2.1	1.96	0.050	-5.81	2.17	-2.67	0.0075	0.752	0.461	1.63	0.103	254.12
Poisson	**Hazard Rate**	4.11	2.54	1.62	0.106	-5.63	2.65	-2.13	0.0334	-0.076	0.848	-0.08	0.929	254.78
Poisson	**Half-normal**	4.11	2.38	1.73	0.0841	-6.37	2.41	-2.64	0.0083	0.903	0.304	2.97	0.003	255.87
Poisson	**Uniform**	4.11	2.16	1.91	0.0564	-6.96	2.17	-3.21	0.0013					256.7
Neg Bi	**Exponential**	1.18	1.17	1.01	0.312	-2.81	1.35	-2.08	0.0379	0.751	0.46	1.63	0.103	248.74***
Neg Bi	**Hazard Rate**	1.18	1.17	1.01	0.312	-2.64	1.46	-1.8	0.0714	-0.0755	0.848	-0.09	0.929	249.39
Neg Bi	**Half-normal**	1.18	1.17	1.01	0.312	-3.4	1.26	-2.69	0.0071	0.903	0.304	2.97	0.003	250.49
Neg Bi	**Uniform**	1.18	1.17	1.01	0.312	-4	1.2	-3.32	<0.001	-1.55	0.692	-2.24	0.0253	251.31

Goodness of Fit Results for HDS Models

Table A26. Freeman Tukey Goodness of Fit Tests. t0 = original stastic computed from data. tB = vector of bootstrap samples. Check for evidence of significant lack of fit of the models p-values (Pr(tB>t0) of greater than 0.05 suggest that the models are an adequate fit to the data.

European Storm Petrel	Model	t0	mean(t0-tB)	StdDev(t0-tB)	Pr(tB>t0)
North Rona	Hazard Neg Binominal	80.1	0.929	17.8	0.475
North Rona	Exponential Neg Binominal	80.1	1.39	19.6	0.455
North Rona	Uniform Neg Binominal	80.8	1.27	18.4	0.436
Flannans	Hazard Neg Binominal	12.6	0.76	4.52	0.200
Flannans	Exponential Neg Binominal	13.7	-9.23	15.1	0.400
Flannans	Uniform Neg Binominal	15	0.992	10.66	0.386
Shillay	Uniform Possion	16	0.34	5.27	0.465
Shillay	Half Normal Poisson	16	0.163	5.74	0.485
Sanda	Uniform Poisson	9.34	-0.488	4.8	0.525
Sanda	Half Normal Poisson	9.32	-0.0258	4.19	0.465
Leach's Storm Petrel	**Model**	**t0**	**mean(t0-tB)**	**StdDev(t0-tB)**	**Pr(tB>t0)**
North Rona	Hazard Neg Binominal	80.1	2.23	18.4	0.485
North Rona	Exponential Neg Binominal	133.9	-1.61	19.6	0.525
North Rona	Uniform Neg Binominal	138	-3.79	23.9	0.564
Flannans	Exponential Neg Binominal	38.9	-1.1	9.81	0.574
Flannans	Hazard Neg Binominal	38.8	-1.7	9.91	0.584
Flannans	Uniform Neg Binominal	38.9	-0.137	9.35	0.485

Table A27. European Storm Petrel and Leach's Storm Petrel abundance calculated using methods analogous to previous surveys. HDS results from the best model with a uniform detection function are included as a comparison. All the abundance estimates fall within the confidence intervals of the HDS estimates, apart from European Storm Petrels on Shillay where the estimate was higher than the upper confidence interval from the HDS results. Abundances and confidence intervals are in bold.

European Storm Petrel										
	Number of responses upto 4m	**Number of surveys**	**Total Area Surveyed**	**Density**	**Adjust for Response Rate**	**Estiamte Total Habitat**	**Abudance**	**HDS Estimate**	**0.025 CI**	**0.975 CI**
North Rona	62	1214	61022	0.0010	0.0024	341540	**822**	**999**	**332**	**11680**
Flannan Isles	10	363	18246	0.0005	0.0013	78140	**101**	**376**	**15**	**7143**
Shillay	15	174	8746	0.0017	0.0041	80334	**326**	**78**	**34**	**151**
Sanda Island	6	190	9550	0.0006	0.0015	8560	**13**	**12**	**3**	**482**
Leach's Storm Petrel										
	Number of responses upto 4m	**Number of surveys**	**Total Area Surveyed**	**Density**	**Adjust for Response Rate**	**Estiamte Total Habitat**	**Abudance**	**HDS Estimate**	**0.025 CI**	**0.975 CI**
North Rona	79	1214	61022	0.0013	0.0037	341540	**1249**	**2269**	**760**	**27013**
Flannan Isles	31	363	18246	0.0017	0.0048	78140	**375**	**5067**	**330**	**24641**

Figure A7. Map of the Isle of Rùm showing the extent of the Manx Shearwater colony. The white outlines show the 450 m contour, which denotes the limit taken as the lowest elevation of the Manx Shearwater colony after Murray et al. (2003) and Jackson (2018).

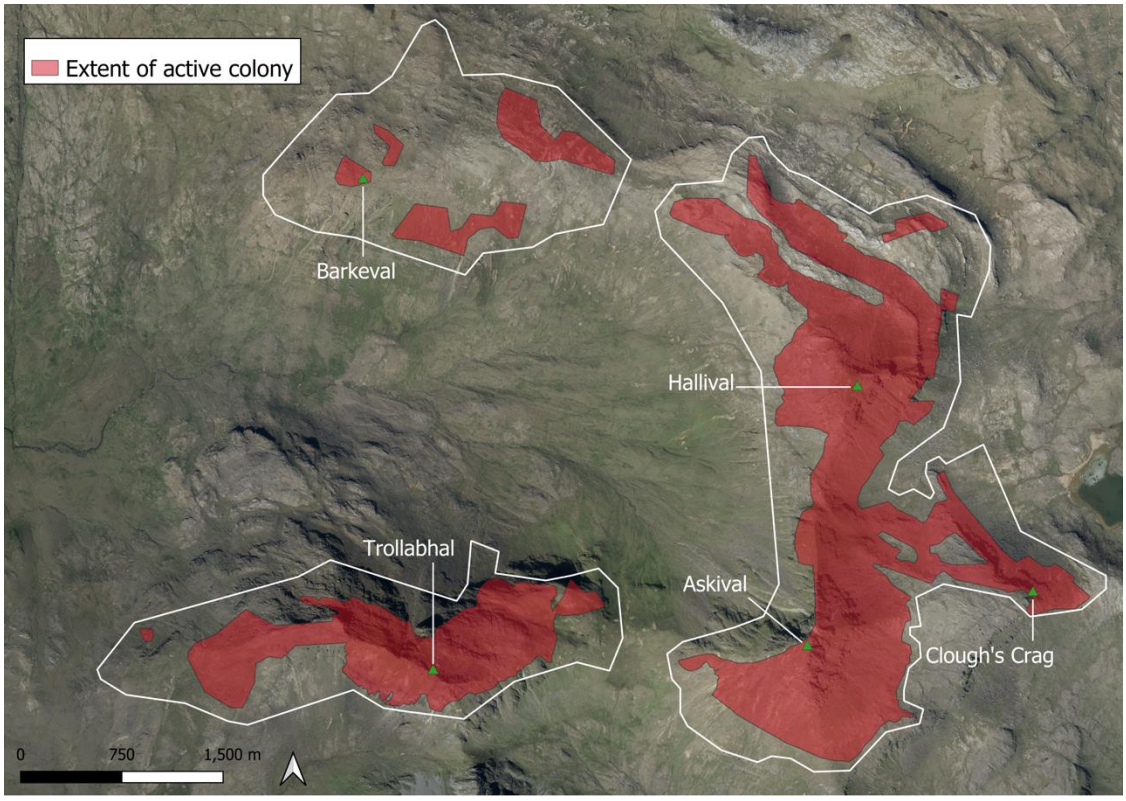
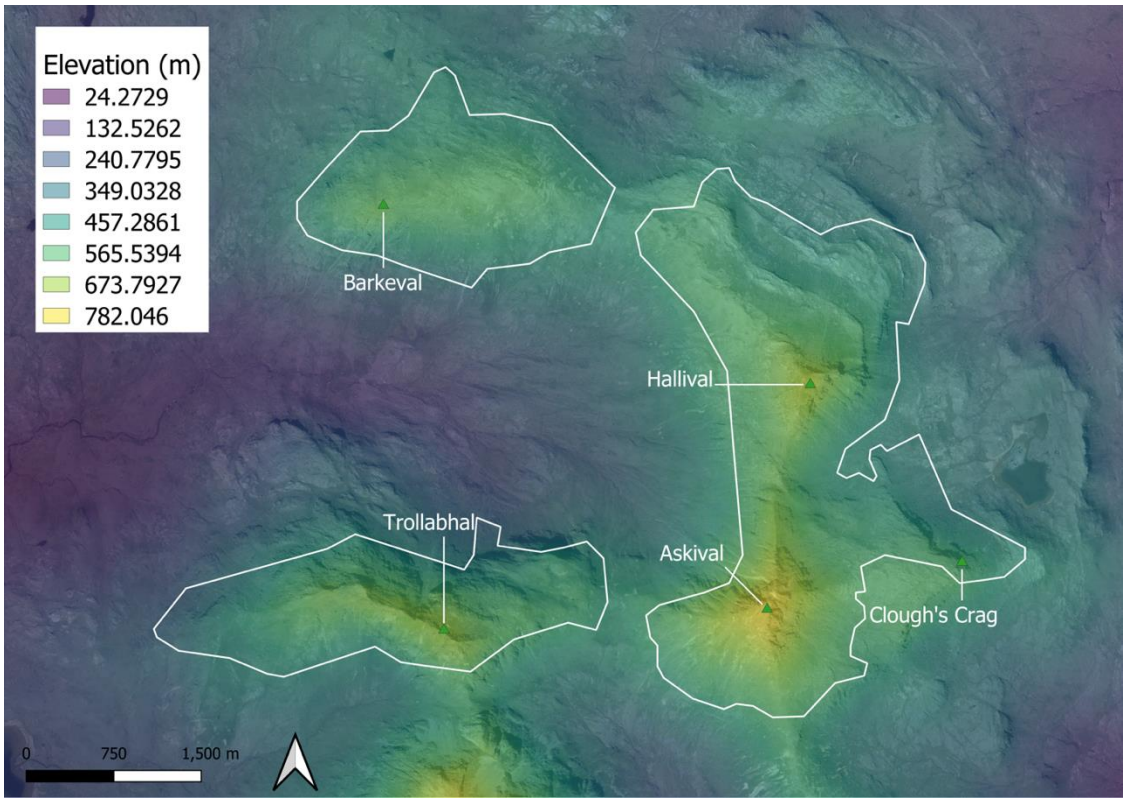



Figure A8 Topgraphic Map of the Isle of Rùm. The white outlines show the 450 m contour, which denotes the limit taken as the lowest elevation of the Manx Shearwater colony after Murray et al. (2003) and Jackson (2018).