

Seabird Grant Report

Conducting a National Census of Iceland's Nocturnal Seabirds

Stephen Hurling, Agricultural University of Iceland

Petrels are one of the most threatened of seabird groups [1], facing a complex variety of threats due to time spent both at breeding colonies and at sea [2, 3]. Of the three species of nocturnal petrel breeding in Iceland, Leach's storm petrel (*Hydrobates leucorhous* - LSP) has been categorized as 'vulnerable' globally since 2016 [4], while population trends for European storm petrel (*Hydrobates pelagicus* - ESP) and Manx shearwater (*Puffinus puffinus* - MS) remain largely unknown due to lack of widespread monitoring [4]. Within Iceland, all three species are range-restricted and so nationally red-listed [5].

The grant I received was to help fund PhD research to conduct a national census of Icelandic breeding populations of LSP, ESP and MS. Establishing the conservation status of any species requires accurate population data; however, nocturnal burrow-nesting seabirds are among the most poorly monitored of bird species globally [6]. They are particularly difficult to survey, nesting on offshore islands, among varied terrain, in burrows that are difficult to access and to which they return only after dark [7, 8; Fig. 1]. In Iceland, population estimates used in conservation decision-making for all three species are incomplete and urgently require updating.



Fig. 1. the difficulties of accessing petrel colonies in the Vestmannaeyjar, Iceland.

The research site is the Vestmannaeyjar archipelago (63°28'N 20°11'W), south Iceland. Colonies in the outer islands are of national and international importance, holding >90% of the total Icelandic population of all three species and the largest breeding colony of LSP in Europe [9]. The last national census, used both in designating important bird areas (IBAs) and helping to inform the red list status of each species, dates from 1991-1992 [4, 5]. More recently, Icelandic LSP survival rates have been found to be significantly low at 0.718 (95%CI) [Calvert, pers. comm], while a 2018 survey of the main LSP colony at Elliðaey estimated a population decline of 40 to 49% [10]. Given the lack of recent data for ESP and MS, plus the possibility that population densities may vary from island to island for all

species [10], there is pressing need to gain accurate census data for each species throughout the archipelago.

Fieldwork began in summer 2021 and is expected to be completed this summer (2023), with a total of six islands to be surveyed. The specific aims of the research are to: 1. test a variety of nocturnal seabird survey methods (including hierarchical distance sampling and conventional playback); 2. establish, based on outcomes of 1., the population and breeding distribution of each species; and 3. evaluate the results from 2. to inform the conservation status and future management of all three species.

Much of our work to date has focused on a hierarchical distance sampling (HDS) survey to establish the Icelandic population of LSP and MS. Research takes place during incubation (June to early July), with playback used to elicit a response from breeding adults in burrows. First developed in the 1980s and 90s [11], use of playback has become standard in population surveys for nocturnal, burrow-nesting seabirds [12]. It has been found to be inexpensive, relatively non-invasive, quick (~30 seconds per burrow), and of particular use in instances where burrow entrances are difficult to locate [11]. Nevertheless, though a bird may be present, they do not always respond to playback; factors such as volume of playback, time of day/night, characteristics of nest site (e.g. burrow length), and sex of call (male, female, both) among others may affect response rate [11, 13]. Such factors can cause bias in occupancy estimates, causing the need for time-consuming, site-specific calibrations of differing habitat and colony types before surveying begins [10]. Crucially, as colony areas can be difficult to establish with certainty, errors in judgement (i.e. regarding the location of survey transects) may lead to under- or overestimates in population.

To address these issues, HDS was selected as the survey method for LSP and MS, in which distance sampling playback is conducted across each island in its entirety. To determine playback points, a grid of numbered GPS points at 16m intervals was created to cover each island (e.g. resulting in a grid of 1,394 points for Elliðaey; Fig. 2), from which points found to be inaccessible were then removed. At each remaining point, playback was conducted for both species. To maximise response rate, separate female / male calls were used for the former (with LSP responding primarily to same-sex calls), with a mixed male / female duet used for the latter. Playback was conducted between 07:00 and 20:00 and, to ensure calls and responses remained audible, playback was carried out only in fair weather conditions (low to zero precipitation, wind <10 m/s); responses within a 4 m radius of the researcher were recorded, while those outside were excluded. To estimate response rate, a number of survey points (~30%) for each island were played more than once. Lastly, an important benefit of gathering data from multiple survey points is the inclusion of possible environmental covariates, such as vegetation type, altitude, slope, and aspect, in models to predict population density. Data analysis is presently ongoing and is intended to yield island-specific estimates and population density maps for both species.

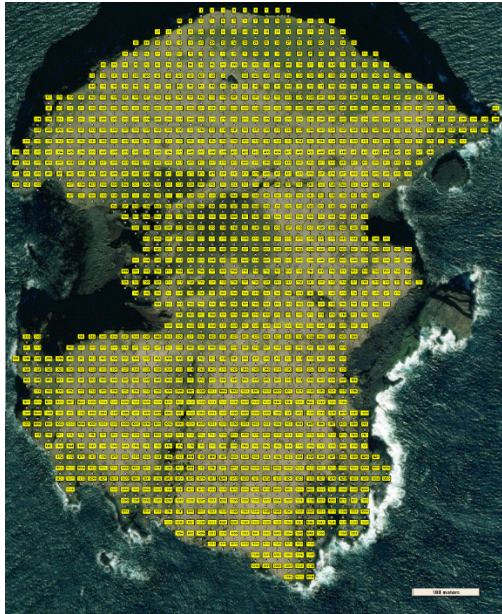


Fig. 2. Map of HDS survey points for Elliðaey, Vestmannaeyjar, Iceland.

This summer, one goal is to conduct a conventional playback survey for ESP [11; Fig. 3]. HDS methodology was considered unsuitable for this species, which, due to its preferences for rocky habitat, is likely to be overlooked in a HDS survey of points at 16m intervals (with smaller intervals proving impractical in terms of effort). In conventional playback, a response rate is obtained from calibration plots in which the number of breeding birds is known; from this a correction factor is then applied to data gathered from colony transects in the wider survey area.



Fig. 3. European storm petrel (*Hydrobates pelagicus*) at the main colony on Elliðaey, Vestmannaeyjar, Iceland.

This study represents the first census of all three species in Iceland since 1991-92, providing a basis to evaluate the extent and nature of population change in Icelandic petrel populations over recent decades. The findings are expected to lend focus to future seabird conservation decisions in Iceland, a particularly pressing need given the downward trend of most seabird populations nationally [14] and the lack of formal legal protection at most IBAs [10], including breeding colonies of international importance in the Vestmannaeyjar [5, 9].

(1,020 words, excluding captions)

1. Winkler, D. W., S. M. Billerman, and I. J. Lovette (2020) "Northern Storm-Petrels (*Hydrobatidae*), version 1.0." In: S. M. Billerman, B. K. Keeney, P. G. Rodewald, and T. S. Schulenberg (eds.) *Birds of the World*. Cornell Lab of Ornithology, Ithaca, NY, USA.
2. Dias, M. P., R. Martin, E. J. Pearmain, I. J. Burfield, C. Small, R. A. Phillips, O. Yates, B. Lascelles, P. G. Borboroglu, and J. Croxall (2019) "Threats to Seabirds: A Global Assessment." *Biological Conservation* 237: 525-37.
3. Croxall, J. P., S. H. Butchart, B. Lascelles, A. J. Stattersfield, B. Sullivan, A. Symes, and P. Taylor (2012) "Seabird Conservation Status, Threats and Priority Actions: A Global Assessment." *Bird Conservation International* 22.1: 1-34.
4. BirdLife International (2021) *IUCN Red List for birds*. Available at: <http://www.birdlife.org> (Accessed: 12 January, 2023).
5. Skarphéðinsson, K. H., B. Katrínardóttir, G. A. Guðmundsson, and S. N.V. Auhage (2016) Mikilvæg fuglasvæði á Íslandi. Fjölrit Náttúrufræðistofnunar Nr. 55. Available at: http://utgafa.ni.is/fjолrit/Fjолrit_55.pdf (Accessed: 09 June, 2022).
6. Paleczny, Michelle, Edd Hammill, Vasiliki Karpouzi, Daniel Pauly, and Martin Krkosek (2015) "Population Trend of the World's Monitored Seabirds, 1950-2010." *PLoS ONE* 10.6:E0129342.
7. Opiel, Steffen, Sandra Hervias, Nuno Oliveira, Tania Pipa, Carlos Silva, Pedro Geraldés, Michelle Goh, Eva Immler, and Matthew Mckown (2014) "Estimating Population Size of a Nocturnal Burrow-nesting Seabird Using Acoustic Monitoring and Habitat Mapping." *Nature Conservation-Bulgaria* 7.7: 1-13.
8. Soanes, Louise M., Robert J. Thomas, and Mark Bolton (2012) "Evaluation of Field and Analytical Methods for Estimating the Population Size of Burrow-nesting Seabirds from Playback Surveys." *Bird Study* 59.3: 353-57.
9. BirdLife International (2022) *Important Bird Areas factsheet: Vestmannaeyjar*. Available at: <http://datazone.birdlife.org/site/factsheet/vestmannaeyjar-iba-iceland> (Accessed: 12 June, 2022).
10. Deakin, Z., Hansen, E. S., Luxmoore, R., Thomas, R. J., Wood, M. J., Padgett, O., ... & Bolton, M. (2021). Decline of Leach's Storm Petrels *Hydrobates leucorhous* at the largest colonies in the northeast Atlantic. *Seabird*, 33, 74-106.
11. Ratcliffe, N., D. Vaughan, C. Whyte, and M. Shepherd (1998) "Development of Playback Census Methods for Storm Petrels *Hydrobates Pelagicus*." *Bird Study* 45.3: 302-12.
12. Mitchell, P. Ian, Stephen Newton, Norman Ratcliffe, and Tim E. Dunn (2004) "Seabird Populations of Britain and Ireland: Results of the Seabird 2000 Census (1998-2002)." London: T & A D Poyser.

13. Perkins, Allan J, Andy Douse, Greg Morgan, Amy Cooper, and Mark Bolton (2017) "Using Dual-sex Calls Improves the Playback Census Method for a Nocturnal Burrow-nesting Seabird, the Manx Shearwater *Puffinus Puffinus*." *Bird Study* 64.2: 146-58.
14. Icelandic Institute of Natural History (n.d.a) *Bird Populations*. Available at: <https://en.ni.is/fauna/birds/bird-populations> (Accessed: 05 April, 2023).