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BLACK GUILLEMOT (CEPPHUS GRYLLE)

BREEDING POPULATION CENSUS ON VIGUR ISLAND: 2022-2023

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Front page photo: Three black guillemots on the shore of Vigur, taken by Ingrid Bobeková May 2023.

Forsíðumynd: Þrjár teistur við strönd Vigur, mynd tók Ingrid Bobeková, mai 2023.

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ÚTDRÁTTUR/ABSTRACT:

Black guillemots (*Cepphus grylle*) were counted around Vigur Island in Ísafjarðardjúp during the pre-laying period in April of 2022, and May 2023 with the aim of estimating the breeding population on the Island. 1,206 individuals were counted in a single survey in 2022 and between 731-1671 individuals were counted over 4 surveys in 2023. We estimate a maximum of 605 and 765 (SE ± 40) of breeding pairs of black guillemots on Vigur Island in 2022 and 2023, respectively. This is likely the biggest colony of this species in Iceland. Reasons for variance in counts are discussed, and recommendations for future monitoring are put forth.

Teista (*Cepphus grylle*) var talin meðfram ströndum og í sjó umhverfis eyjuna Vigur í Ísafjarðardjúpi í apríl árið 2022 og maí 2023. Talningar fóru fram áður en varp byrjaði og var markmið þeirra að meta varp stofn teistu í eyjunni. Ein talning var gerð árið 2022 og í henni sáust 1,206 fuglar en árið eftir voru talningarnar 4 og fjöldi fugla milli 731 og 1671. Áætlað var að varp pör teistu í Vigur væru að hámarki 605 og 765 (SE ± 40) fyrir árið 2022 annars vegar og 2023 hins vegar. Eyjan er því líklega stærsta varp tegundarinnar á landinu. Ástæður breytileika í niðurstöðum talninga eru ræddar og ráðleggingar gefnar varðandi framtíðar vöktun varpsins.

Signature of project manager/Undirskrift verkefnastjóra:	**Reviewed by/Yfirfarið af:** Cristian Gallo

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INTRODUCTION

This study is part of the project, "Bird Monitoring in the Westfjörds" ("Fuglavöktun á Vestfjörðum"), which is funded by the Icelandic Ministry of Environment, Energy and Climate (URN). In 2019 Náttúrustofa Vestfjarða (NAVE) secured funding directly through URN specifically allocated towards the monitoring of birds in the Westfjords by Nave. The Bird Monitoring project includes monitoring of the Glaucous gull (Larus hyperboreus), Guillemots (Uria aalge and Uria lomvia), Razorbill (Alca torda), Kittiwake (Rita tridactyla), Fulmar (Fulmarus glacialis) on two bird cliffs, the Arctic tern (Sterna paradisaea), the black Guillemot (Cepphus grille), and birds in winter (Vetrafuglatlningar). In this report we focus specifically on the monitoring of black guillemots (Cepphus grylle) on the island of Vigur.

Located in the Ísafjarðardjúp fjord system, the Island of Vigur is currently thought to hold the largest population of *C. grylle* in Iceland (Æ. Petersen, personal communication, 2023). As this species is declining and listed as endangered in Iceland (Skarphéðinsson, 2018), this provokes an interest in monitoring this population over the coming years. Such monitoring is especially important considering infrastructure developments and activities in the fjord system in which the island is situated, such as increases in aquaculture operations (Arctic Sea Farm hf., 2020; Háafell ehf., 2020) and extraction of maerl (Kjartan Thors ehf. & VSÓ Ráðgjöf, 2019).

Consistent data on the population and breeding performance of black guillemots has not been collected over the past decades. In 2022, Náttúrustofa Vestfjarða began addressing this knowledge gap by surveying guillemots on the island. This work continued in 2023 and will continue as long as funding allows, with the aim of developing the first long-term monitoring program of black guillemots in the Ísafjarðardjúp fjord system. This monitoring program will be further expanded in the future through the collection of data on other metrics and populations in the fjord system.

The principal aim of the study described here is to estimate the number of breeding pairs in the black guillemot colony on the Island of Vigur by using population census methods during the pre-laying season.

BACKGROUND

Black guillemots in Iceland

In the year 2000 the black guillemot population in Iceland was estimated at roughly 10,000-15,000 pairs, showing a steady decline around the country from an estimated 30,000-50,000 in the 1990s (Skarphéðinsson, 2018; Umhverfisráðuneytið, 1992). For instance, on the island of Flatey in Breiðafjörður, which is arguably the most well-studied guillemot population, there were 530 breeding pairs in 1987; by 2016, only 80 breeding pairs remained (Petersen, 2001; Petersen et al., 2016). Similarly, winter bird counts indicate a continuous decline since 1985 (Náttúrufræðistofnun Íslands, unpublished data; Skarphéðinsson, 2018). This population decline is thought to be linked to a combination of factors, including changes in prey availability, increased predation pressure (mink, Arctic fox, rat, etc.), as well as increased mortality due to fishing net entrapment (Jóhannsson & Guðjónsdóttir, 2004; Frederiksen & Petersen, 1999; Petersen, 1981; Petersen, 2001).

Due to these substantial declines, the species is listed as Endangered (EN) on the Icelandic Red List 2018, uplisted from Least Concern (LC) in 2000 (Skarphéðinsson, 2018). Approximately 27% of the population is thought to nest within designated Important Bird Areas (IBAs) of Iceland (Skarphéðinsson, 2018). Despite a few localised studies, general data on the population dynamics of black guillemots in Iceland is lacking (Skarphéðinsson, 2018). With continued monitoring on the island of Vigur we hope to provide important insight into the population dynamics of this species in the Ísafjarðardjúp fjord system.

Study site

Vigur is a small island located in the Ísafjarðardjúp fjord system in the Westfjords of Iceland (Figure 1). The shoreline topography of the island is mostly pebble beaches, rocky crags, and cliffs. A distinctive aspect of the island is the absence of mammalian predators, being both Arctic fox and mink-free (F. Aston & G. Jónsson, personal communication, 2023). Vigur is recognised as an Important Bird Area in Iceland, being host to colonies of Arctic terns (*Sterna paradisaea*), Atlantic puffins (*Fratercula arctica*), common eiders (*Somateria mollissima)*, and numerous other seabirds and passerines (BirdLife International, 2023; Skarphéðinsson, 2018). A survey estimated Vigur to host 200 breeding pairs of black guillemots in the year 2000, providing the sole numerical information available on the island's breeding population of guillemots (Skarphéðinsson, 2018).

Currently, one family inhabits Vigur year-round, also overseeing the common eider farm. The island has manmade structures, serving both incidentally and purposefully as nesting places for black guillemots. The residents of the island have actively worked to create and enhance nesting features around the island in recent years. This makes Vigur an ideal refuge for the numerous bird species which rely on the high productivity of the sub arctic summer season to rear and fledge their chicks.

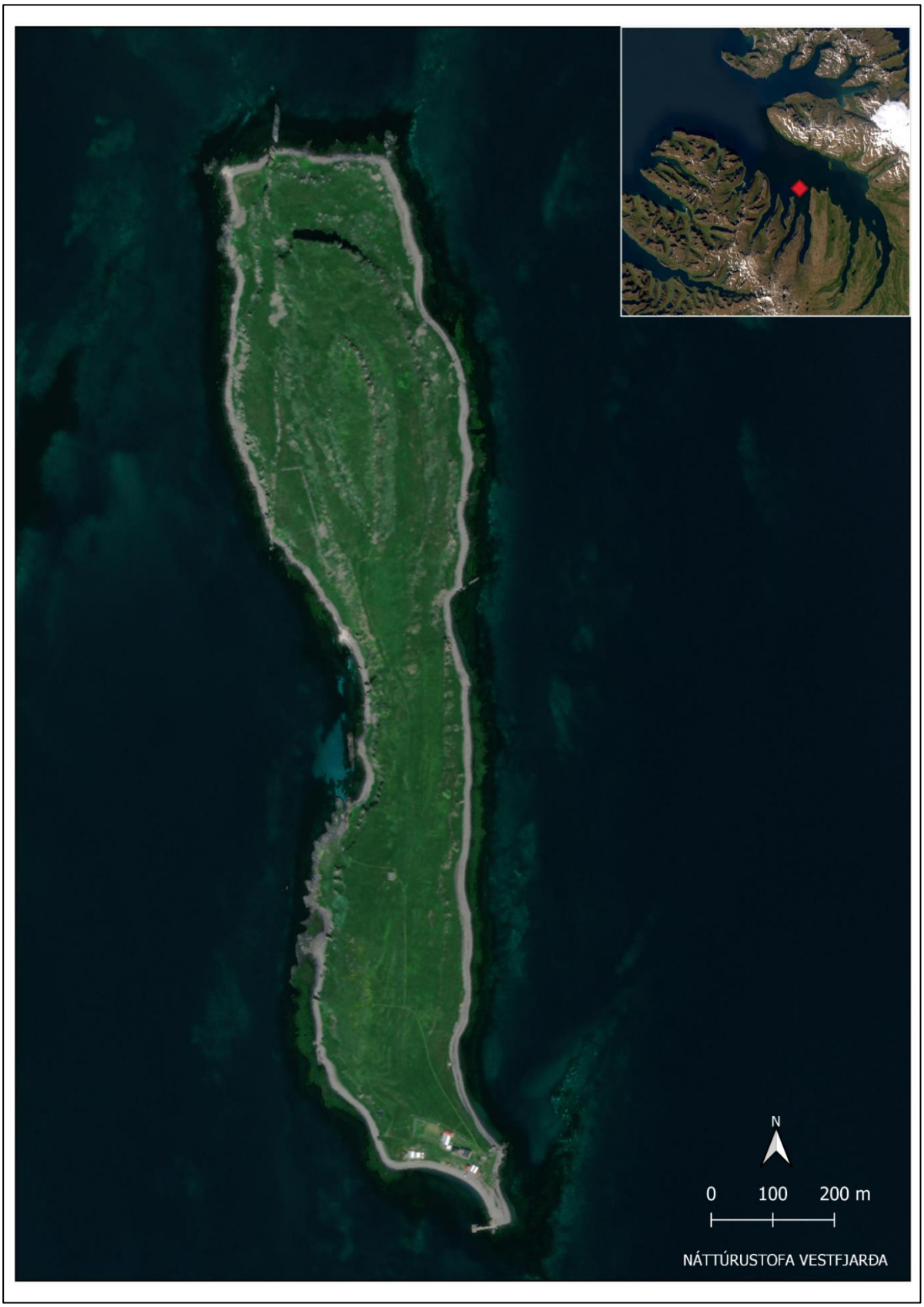

Figure 1. *Vigur Island, and its position in Ísafjarðardjúp, Westfjords.*

Breeding ecology and considerations for breeding population census

Black guillemots typically nest in small, scattered groups or as single pairs along coastlines. Accurately quantifying their nests proves challenging due to their scattered and often inaccessible distribution. Attempting to count apparently occupied nests is impractical and likely leads to underestimation. Therefore, rather than counting individual nests, tallying the number of individuals during a carefully timed pre-nesting period tends to provide a more accurate estimate of breeding pairs in the colony (Hildén, 1994; Petersen, 1981; Walsh et al., 1995).

During the pre-laying stage, black guillemots exhibit several distinct social behaviours that can be utilised to gain an accurate estimate of the number of breeding pairs. They form 'rafts' or mass aggregations below nesting areas, engaging in communal social activities, and emitting characteristic high-pitched vocalisations (Petersen, 1981). The reason for this aggregating behaviour during the breeding season remains not well understood in its biological significance. Hildén (1994) posits that it functions as social display, where the birds participate in chasing, fighting, and courtship. These daily interactions may assist in synchronising the time of nesting, selection of mates, strengthening pair bonds, copulation, defence of nesting sites, and regulating the colony size (Hildén, 1994).

The aggregations start approximately 9-10 weeks prior to egg laying (the 3rd week of May in Flatey, Iceland). After the first day of aggregations, guillemots attend this flock daily (Petersen, 1981). This period is optimal for counting, as later in the breeding season, many adults may be hidden in nests while their partners are further offshore feeding, potentially leading to population underestimation (Hildén, 1994; Petersen, 1981; Walsh et al., 1995).

As counts should aim to capture the peak number of birds present (Hilden, 1994; Petersen, 1981; Walsh et al., 1995), it is important to understand the drivers of variation in the attendance of guillemots in these daily aggregations. The peak number of birds grouping together occurs in the early morning and evening. Petersen (1981) found that morning and evening aggregation counts are relatively similar, with slightly more birds in the morning. The evening peak's duration is shorter than the morning peak (Figure 2). However, differences between evening and morning attendance vary between populations; Hildén (1994) observed much smaller evening peaks in a Baltic Sea population.

Furthermore, the maximum number of individuals attending can fluctuate diurnally based on weather and environmental conditions such as tides (Petersen, 1981). Air temperature and wind influencing the sea state also significantly impact attendance. Low temperatures and a rougher sea state results in fewer attending birds, who are likely seeking shelter outside the aggregation areas. The duration of low tide also impacts attendance, with longer tides yielding fewer birds subsequently.

The timing of the first birds arriving in the evening, for instance, can be indicative of how many birds will be present at the peak – the earlier the first birds arrive, the more birds are likely to be present at the peak. If individuals start arriving later, the maximum peak tends to be lower (Petersen, 1981). The peaks are also strongly linked with daylight hours – earlier in the season during hours of darkness of the night, the guillemots mostly leave the area, and aggregate once more with the return of the light. However, with continuous dusk in the near-arctic summer season in Iceland, many birds will stay in the breeding area throughout the night (Petersen, 1981).

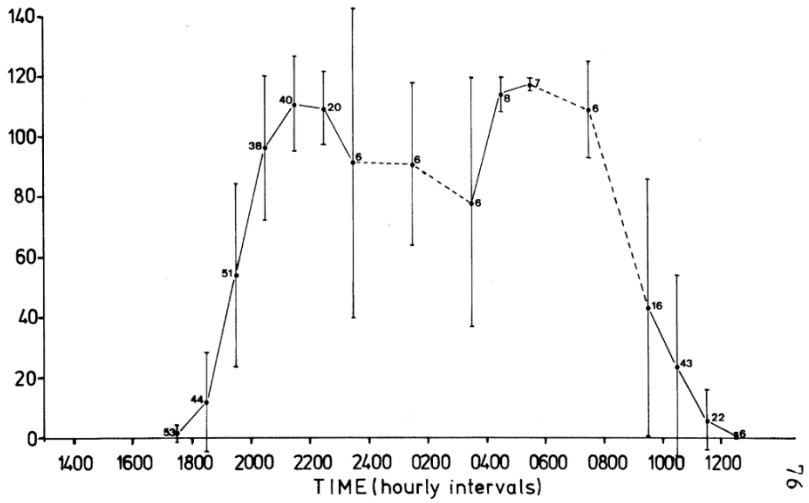

Figure 2. *The attendance and diurnal variation of black guillemots in adult plumage at one nesting area in Flatey (Figure from Petersen, 1981).*

It must be noted though that an excess of individuals attending aggregations are non-breeding. Non-breeding black guillemots freely mingle and interact with breeding individuals on both sea and land (Petersen, 1981). Estimating the proportion of non-breeding to breeding individuals, except yearlings identifiable by their plumage, is challenging. Thus, counts inevitably include non-breeding individuals, a factor to consider during result interpretation.

METHODOLOGY

The methodology employed followed the guidelines outlined in the *Seabird Monitoring Handbook for Britain and Ireland* (Walsh et al., 1995), as well as methods described in work by Petersen (1981) and Hildén (1994). Widely recognised as the most reliable approach for quantifying black guillemot populations, this method is frequently utilised (e.g., Booth & Wolsey, 2019; Mitchell et al., 2004; Petersen, 2009; Swann, 2014), and is considered particularly suitable for comprehensive coastline counts (Walsh et al., 1995). The counting of adult birds occurs prior to nesting, during their assembly in flocks near nesting sites, with the basic unit of measurement being birds in adult plumage associated with the colony (Walsh et al., 1995).

To understand the diurnal rhythm of guillemots and determine the optimal survey timing, consultation took place with literature, scientists, and Vigur Island residents. Trips were scheduled during favourable weather conditions, with a wind speed of less than 6-8 m/s (Walsh et al., 1995). In 2022, one trip with a single count was conducted on Vigur Island, and in 2023, two trips with four separate counts were carried out (Table 1). Before the initial survey, preparatory work involved exploring the island's topography, identifying ideal viewing areas, and understanding bird distribution.

The survey aimed to coincide with the peak assembly time of guillemots around the island. Since the timing and magnitude of guillemot presence can vary day to day and based

on environmental conditions, observers were ready before the expected start, commencing counting when a substantial number of guillemots had arrived. Counts encompassed guillemots up to 300 m offshore and onshore, categorising them as a) adult birds in adult plumage (2 years and older), and b) birds in non-adult plumage (1st year birds, grey birds, or birds with dark streaks in wing spots).

Observers divided the island into sections, employing natural features as divisions to avoid double counting (Figures 6-10, Tables 5-6). Observers walked the perimeter of the island, pausing to count once in each section and moving forward, as timeliness was of the essence. An observer also remained on the south shore, where the largest guillemot flock is known to assemble daily (F. Aston & G. Jónsson, personal communication, May 2023). This observer re-counted every 10 minutes to determine the peak number of guillemots in this section, except for the count on April 19, 2022, where in which the south shore was counted just once.

The times of counting at each section were documented. Binoculars and clickers were employed as counting aids. Going forward, these methods (seasonal and diurnal timing, route around the island, and method of counting) will be consistent to provide comparable data between years.

When making year-to-year comparisons, Walsh et al. (1995) advise using averages for a more accurate assessment. This includes comparing the average values of multiple counts in one year to a single count in another year if it is the only data available, as is the case in this study for 2022. However, this method should be applied cautiously, ensuring that there is no valid reason to favour one count over another. Failure to adopt this approach may result in an overestimation of counts in a year with multiple assessments, introducing potential bias to the comparisons. Additionally, counts conducted under unfavourable conditions, such as deteriorating weather or increased sea-swell after the counts have started, should be excluded from mean calculations (Walsh et al., 1995).

Table 1*. Survey dates, times, and observers. The counts were conducted by the following individuals: Silla Sigurðardóttir (SS), Ingrid Bobeková (IB), Sigurður Halldór Árnason (SHÁ), Leonie Riebel (LR), Verlee van Merwijk (VVM).*

Date of count	Time of count	Shift	Observers
19-Apr-22	05:30-08:30	Morning	SS, SHÁ
3-May-23	22:05-23:30	Evening	IB, SHÁ, LR, VVM
4-May-23	06:00-08:35	Morning	IB, SHÁ, LR, VVM
10-May-23	22:45-23:50	Evening	IB, LR
11-May-23	07:23-09:40	Morning	IB, LR

RESULTS

In 2022 a total of 1,206 guillemots in adult plumage were counted at the beach or in the sea within 300 m of the land on the island of Vigur (summarised in Table 2). In 2023, the number ranged between 731-1,671 individuals over the 4 separate counts (summarised in Table 3) or averaged to 1,330 (SE ± 208) individuals. If the low value of May 10 is excluded from the sample, then the average is 1,530 (SE ± 69) and the variance between the counts is reduced considerably. Halfling the values provides a maximum of 605 breeding pairs for 2022, and

665 (SE ± 104) breeding pairs in 2023 (765 (SE ± 40) if the May 10 value is excluded). Note that the true number of breeding pairs is likely less, and this will be discussed further below.

In 2022, the proportion of individuals which were removed from the count (as they were deemed in either non-adult plumage or were observed feeding and not participating in social activities), was larger than that of 2023; (12.8% vs. 0.06-1.7%, respectively). However, this number of 'non-breeding' adults should be treated with caution; in the latter year, all guillemots within 300 m of the shore and onshore were counted, displaying any behaviour. This was based on a correction that even non-breeding birds *can* display social / breeding behaviour while breeding birds don't necessarily *always* display such behaviours during aggregations. This means that the numbers in 2022 could have been slightly underestimated. In 2023, only birds in non-breeding plumage were removed from the count, however these were relatively few.

Morning counts yielded a larger number of individuals. In both years, the densest aggregations of black guillemots were in the southern beach portion of Vigur Island, reaching over 600 individuals over a 200 m section of shore directly in front of the residential buildings and pier (Figure 3). The total number of guillemots spread along the western coast was larger in comparison to the eastern coast across all surveys. Complete data sheets and maps used during the survey are available in the Appendix (Figures 5-9).

Table 2. *Summary of individual black guillemots in adult plumage observed in a single count on Vigur Island, 2022.*

Date	Segment	Count	Observer
4/19/2022	*West*	660	SS
Morning	*North*	35	SS
	East	264	SS
	South	247	SS
	Total Vigur	**1,206**	

Table 3. *Summary of individual black guillemots in adult plumage observed over 4 separate counts on Vigur Island, 2023.*

Date	Segment	Count	Observer
5/3/2023	*West*	616	IB
Evening	*North*	20	IB, SHÁ
	East	304	SHÁ
	South	455	LR, VVM
	Total Vigur	**1,395**	
5/4/2023	*West*	693	IB
Morning	*North*	17	IB, SHÁ
	East	349	SHÁ
	South	612	LR, VVM
	Total Vigur	**1,671**	
5/10/2023	*West*	259	IB

Evening	*North*	19	IB
	East	191	LR, IB
	South	262	IB
	Total Vigur	**731**	
5/11/2023	*West*	750	IB
Morning	*North*	66	IB
	East	172	IB
	South	538	LR
	Total Vigur	**1,526**	

Figure 3. *Large numbers of black guillemots aggregate on the southern shore segment (approx. 200m long) of Vigur Island. 2022, Sigurðardóttir.*

DISCUSSION

Despite being considered the most practical method of measuring the population of black guillemots, this method relies on the observers to understand the optimal time—seasonally and diurnally—of when attendance of the flock by colony members is at its peak, while variance is also the lowest (Hildén, 1994). This introduces the risk of underestimating the colony size if the timing is mismatched due to human error and the inherent variability in animal behaviour, impacted by various factors. Despite this inevitability, multiple peak

counts can provide a more comprehensive view of the population, with Petersen (1981) suggesting that achieving an acceptable confidence level, due to fluctuating numbers, requires at least six peak counts, with diminishing returns beyond that point (Figure 5). According to this figure, four counts, as were done in 2023, would yield approximately 10-12% accuracy.

Petersen (1981) notes that large fluctuations in numbers can be avoided through well informed timings of the peak counts (i.e., ideal weather, tidal, and daylight conditions), and thus this would reduce the number of counts required for higher accuracy. The reason for the high variance seen in the 2023 data is influenced by the low count of May 10. The reason for this low count, which appeared to be island-wide, is uncertain, however it was remarked by the island's residents that there had been a recent shift in the behaviour of the guillemots; they have started to remain aggregated on the south shore later into the day than in previous weeks (F. Aston & G. Jónsson, personal communication, May 2023). This may have contributed to the guillemots' diminished—or belated—return in the subsequent evening.

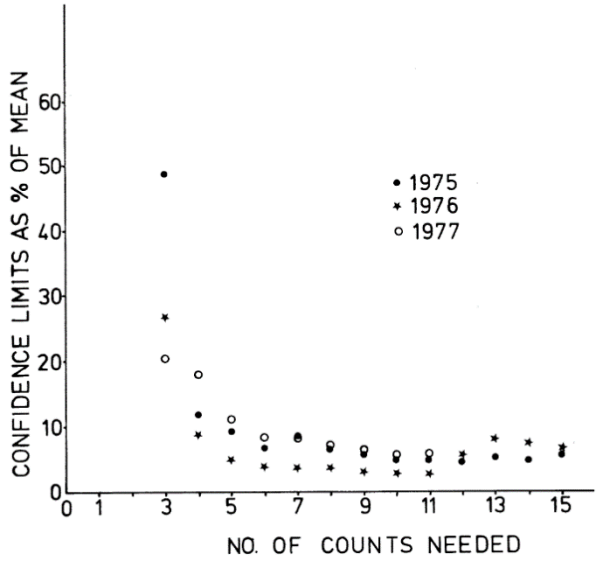

Figure 4. *The number of counts required to achieve a given accuracy, indicated as confidence limits as % of the mean (figure from Petersen, 1981).*

The numbers obtained over the last two years give the maximum estimate of breeding pairs around Vigur, when considering the observed individuals divided in half. Determining the proportion of non-breeding to breeding individuals is challenging and counts inevitably include non-breeding individuals. Counts during peak aggregations, as was the method used in this survey, typically yield higher numbers than are the actual breeding birds in the area. Petersen (1981) found that 3-17% *more* birds attended the nesting area than were counted as actual breeders on average, and even more so (23-39%) on high attendance days. Conversely, on very low attendance days, 6-33% *fewer* birds were present than were found breeding later in the season.

Other studies indicate the possibility of even higher numbers of non-breeders present in the aggregations, exceeding 50% (e.g., Preston, 1968; Ramsey, 1976; Winn, 1950). Petersen (1981) suggests that the fluctuations in peak individual counts are likely due to variable

attendance of non-breeders rather than breeders. However, environmental conditions can create situations where not even all breeders are accounted for in the flock (Petersen, 1981). The reason for attendance of non-breeders in the flocks during the early breeding season is also not fully understood and is unique to black guillemots; immature common guillemots (*Uria aalge*), razorbills (*Alca torda*), and Atlantic puffins (Fratercula arctica), for instance, do not begin to arrive to the colonies until around the beginning of egg laying (Ashcroft, 1979; Birkhead & Hudson 1977; Lloyd 1974; Petersen, 1981).

Accurate correction factors applied to the number of breeding pairs require a specialised study of individual breeding groups and is impractical for most general surveys (Æ. Petersen, personal communication, 2023; Walsh et al., 1995). Due to the high variability of the attendance of non-breeders, estimates of breeder-to-nonbreeder proportions in Flatey, for instance, cannot be extrapolated to other populations such as Vigur (Cairns, 1979; Petersen, 1981). One can only be sure of the proportion of non-breeders by undertaking extensive nest counts later in the season and subtracting number of actual breeding birds from the aggregation counts during pre-laying period of the colony to find the surplus non-breeding individuals (Petersen, 1981). The proportions are likely to vary according to the colony. Even with conservative estimates of the proportion of non-breeding individuals, the numbers indicate an increase compared to counts from the year 2000, when the breeding population was estimated at around 200 breeding pairs (Skarphéðinsson, 2018), or a minimum of 400 individuals.

CONCLUSION & RECOMMENDATIONS

These results indicate that the island of Vigur most likely holds the largest population of black guillemots in Iceland. Estimates of the breeding population from pre-laying counts, despite their limitations, are very valuable for monitoring the population and detecting changes over time (Petersen, 1981; Walsh et al., 1995). Furthermore, as this is just one method of measuring the potential breeding output, it would be beneficial to the study to be accompanied by other metrics, such as measuring the breeding success of a sample of nests, to give a better understanding of clutch size, hatching success, and fledging success. Future years of survey should also continue to aim at multiple counts (4-6) during the pre-breeding season to reduce the degree of uncertainty.

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Vigur Island, May 3, 2023. Bobeková.

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APPENDIX

Table 4. *Detailed data from a single count of black guillemots on Vigur island, 2022.*

Date	Time	Area	Total individual count	…of which nonbreeding*	Difference	Observer
19-Apr-22	-	South	262	15	247	SS
19-Apr-22	-	West	172	30	142	SS
19-Apr-22	-	West	88	0	88	SS
19-Apr-22	-	West	90	0	90	SS
19-Apr-22	-	West	200	40	160	SS
19-Apr-22	-	West	13	10	3	SS
19-Apr-22	-	West	80	20	60	SS
19-Apr-22	-	West	127	10	117	SS
19-Apr-22	-	North	35	0	35	SS
19-Apr-22	-	East	110	0	110	SS
19-Apr-22	-	East	56	20	36	SS
19-Apr-22	-	East	54	30	24	SS
19-Apr-22	-	East	14	0	14	SS
19-Apr-22	-	East	0	0	0	SS
19-Apr-22	-	East	40	2	38	SS
19-Apr-22	-	East	21	0	21	SS
19-Apr-22	-	East	21	0	21	SS

* Birds which appeared to be feeding were excluded.

Table 5. *Detailed data from four counts of black guillemots on Vigur Island, 2023.*

Date	Time	Area	Total individual count	…of which nonbreeding	Difference	Observer
05/03/23	22:05	East	13	0	**13**	SHÁ
05/03/23	22:15	East	60	0	**60**	SHÁ
05/03/23	22:25	East	9	0	**9**	SHÁ
05/03/23	22:30	East	43	0	**43**	SHÁ
05/03/23	22:40	East	37	0	**37**	SHÁ
05/03/23	22:45	East	62	0	**62**	SHÁ
05/03/23	22:50	East	80	0	**80**	SHÁ
05/03/23	23:00	North	15	0	**15**	IB
05/03/23	23:00	North	5	0	**5**	SHÁ
05/03/23	22:00	South	443	9	434	LR, VVM
05/03/23	22:10	South	402	11	391	LR, VVM
05/03/23	22:20	South	411	4	407	LR, VVM
05/03/23	22:30	South	377	10	367	LR, VVM
05/03/23	22:40	South	434	10	424	LR, VVM
05/03/23	22:50	South	462	7	**455**	LR, VVM
05/03/23	23:00	South	396	5	391	LR, VVM

05/03/23	23:10	South	370	2		368	LR, VVM
05/03/23	23:23	South	294	1		293	LR, VVM
05/03/23	23:30	South	275	1		274	LR, VVM
05/03/23	22:05	West	263	0		**263**	IB
05/03/23	22:15	West	108	0		**108**	IB
05/03/23	22:29	West	85	0		**85**	IB
05/03/23	22:41	West	78	0		**78**	IB
05/03/23	22:55	West	82	0		**82**	IB
05/04/23	6:00	East	238	0		**238**	SHÁ
05/04/23	-	East	91	0		**91**	SHÁ
05/04/23	-	East	20	0		**20**	SHÁ
05/04/23	7:35	North	6	0		**6**	IB
05/04/23	7:35	North	11	0		**11**	SHÁ
05/04/23	6:27	South	584	2		582	LR, VVM
05/04/23	6:39	South	614	2		**612**	LR, VVM
05/04/23	6:51	South	450	3		447	LR, VVM
05/04/23	7:00	South	495-394	1		494-393	LR, VVM
05/04/23	7:12	South	407	0		407	LR, VVM
05/04/23	7:22	South	420	0		420	LR, VVM
05/04/23	7:37	South	383	2		381	LR, VVM
05/04/23	7:47	South	479	0		479	LR, VVM
05/04/23	8:00	South	452	1		451	LR, VVM
05/04/23	8:20	South	435	1		434	LR, VVM
05/04/23	8:35	South	370	2		368	LR, VVM
05/04/23	-	South	80	0		80	LR, VVM
05/04/23	6:25	West	98	0		**98**	IB
05/04/23	6:36	West	132	0		**132**	IB
05/04/23	6:54	West	187	0		**187**	IB
05/04/23	6:54	West	101	0		**101**	IB
05/04/23	7:06	West	61	0		**61**	IB
05/04/23	7:15	West	53	0		**53**	IB
05/04/23	7:25	West	61	0		**61**	IB
05/10/23	22:50	East	7	0		**7**	LR
05/10/23	22:55	East	14	0		**14**	LR
05/10/23	23:02	East	34	1		**33**	LR
05/10/23	23:14	East	6	0		**6**	LR
05/10/23	23:22	East	8	0		**8**	LR
05/10/23	23:30	East	24	0		**24**	LR
05/10/23	23:41	East	10	0		**10**	LR
05/10/23	23:44	East	40	0		**40**	IB
05/10/23	23:48	East	19	0		**19**	LR
05/10/23	23:50	East	30	0		**30**	IB
05/10/23	23:33	North	9	0		**9**	IB
05/10/23	23:39	North	10	0		**10**	IB

05/10/23	22:45	South	273	11	262	IB
05/10/23	22:51	West	21	1	**20**	IB
05/10/23	22:56	West	23	0	**23**	IB
05/10/23	23:04	West	106	0	**106**	IB
05/10/23	23:10	West	26	0	**26**	IB
05/10/23	23:17	West	12	0	**12**	IB
05/10/23	23:22	West	12	0	**12**	IB
05/10/23	23:30	West	60	0	**60**	IB
05/11/23	8:54	East	15	0	**15**	IB
05/11/23	9:00	East	2	0	**2**	IB
05/11/23	9:06	East	10	0	**10**	IB
05/11/23	9:12	East	44	0	**44**	IB
05/11/23	9:25	East	27	0	**27**	IB
05/11/23	9:34	East	54	0	**54**	IB
05/11/23	9:40	East	20	0	**20**	IB
05/11/23	8:31	North	39	0	**39**	IB
05/11/23	8:37	North	27	0	**27**	IB
05/11/23	7:23	South	415	0	415	LR
05/11/23	7:36	South	492	0	492	LR
05/11/23	7:52	South	492	0	492	LR
05/11/23	8:04	South	405	0	405	LR
05/11/23	8:22	South	520	0	520	LR
05/11/23	8:36	South	517	0	517	LR
05/11/23	8:54	South	454	0	454	LR
05/11/23	9:08	South	532	0	532	LR
05/11/23	9:24	South	538	0	**538**	LR
05/11/23	9:38	South	494	0	494	LR
05/11/23	7:37	West	144	1	**143**	IB
05/11/23	7:43	West	84	0	**84**	IB
05/11/23	7:51	West	131	0	**131**	IB
05/11/23	8:00	West	97	0	**97**	IB
05/11/23	8:11	West	137	0	**137**	IB
05/11/23	8:20	West	158	0	**158**	IB

***Figure 4**. April 18, 2022 census of guillemots in adult plumage on Vigur Island. Note: subdivisions were drawn by observers during the survey to aid with counting while moving systematically around the island. They were not intended to serve as delineations for comparison of groups.*

Figure 5. *May 3, 2023 census of guillemots in adult plumage on Vigur Island. Note: subdivisions were drawn by observers during the survey to aid with counting while moving systematically around the island. They were not intended to serve as delineations for comparison of groups.*

Figure 6. *May 4, 2023 census of guillemots in adult plumage on Vigur Island. Note: subdivisions were drawn by observers during the survey to aid with counting while moving systematically around the island. They were not intended to serve as delineations for comparison of groups.*

Figure 7. *May 10, 2023 census of guillemots in adult plumage on Vigur Island. Note: subdivisions were drawn by observers during the survey to aid with counting while moving systematically around the island. They were not intended to serve as delineations for comparison of groups.*

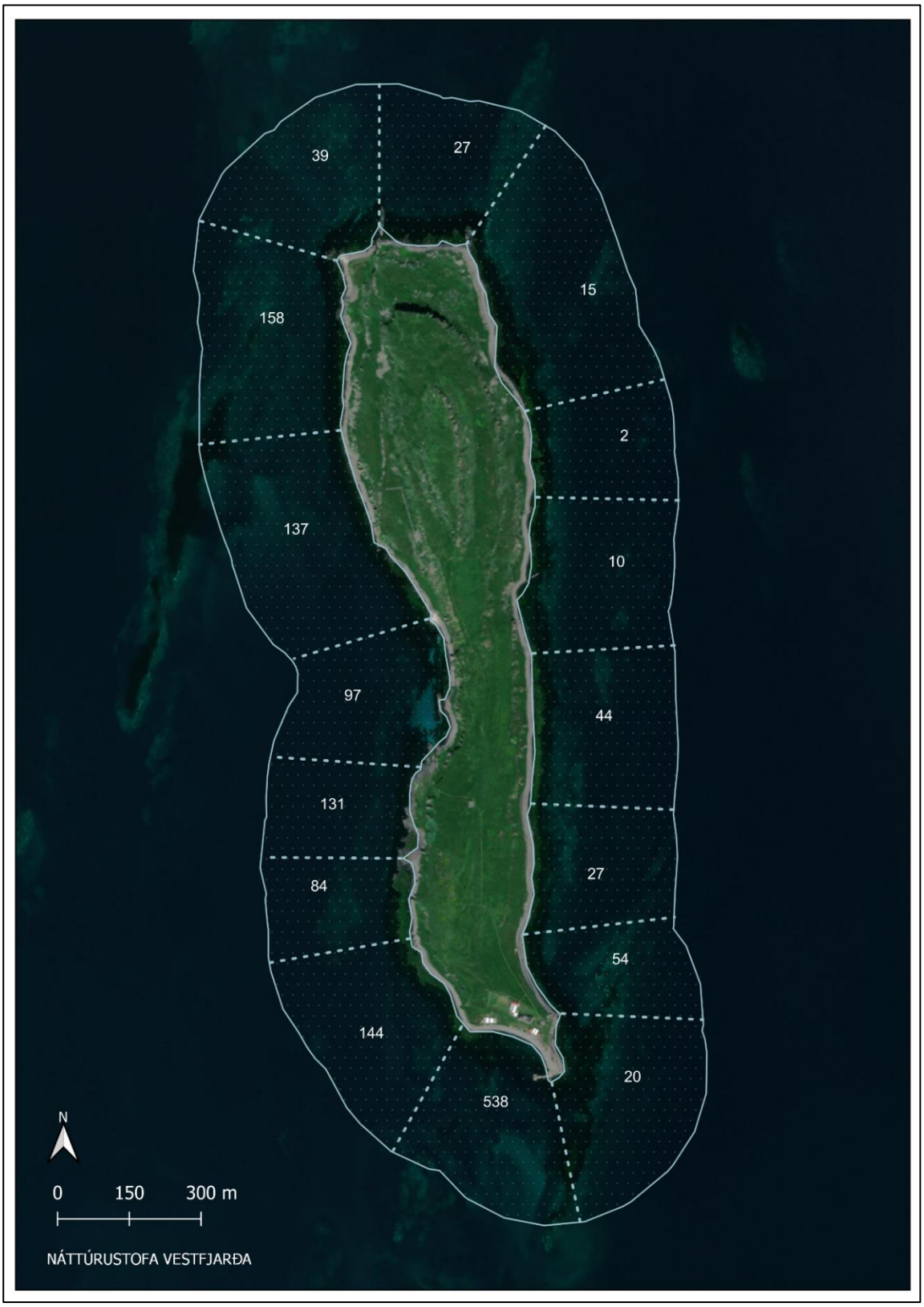

Figure 8. *May 11, 2023 census of guillemots in adult plumage on Vigur Island. Note: subdivisions were drawn by observers during the survey to aid with counting while moving systematically around the island. They were not intended to serve as delineations for comparison of groups.*