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Global population status of the migratory Holarctic species Arctic Skua *Stercorarius parasiticus*

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Summary

Data on species' demography are essential to detect changes in population size, identify drivers of population change, motivate conservation plans, or evaluate the effectiveness of management. The Arctic Skua *Stercorarius parasiticus* is a seabird with a circumpolar distribution, which is listed as "Endangered" on the International Union for Conservation of Nature (IUCN) European Red List, although listed as "Least Concern" globally. It is both a predator and a kleptoparasite reliant on marine and terrestrial prey, and undertakes migrations from northern breeding habitats to temperate and tropical marine environments. Most studies of breeding populations originate from North Atlantic populations where Arctic Skuas are primarily kleptoparasitic. However, a large proportion of the global breeding population occupies remote coastal and inland tundra of Arctic regions where Arctic Skuas are more generalist in foraging modality and the range of prey taken. Here, we collated and summed national/regional population estimates to provide an updated global estimate of breeding population size and trends. We reviewed drivers of population change and knowledge gaps, and their implications for the conservation of this species. We estimated a minimum breeding population of 185,131–395,315 pairs combining Alaska, Canada, Greenland, and Europe; we extrapolated that at least 40,000 pairs could be found in Asian Russia, where no estimates were available. We noted differential trends, with substantial declines in typically kleptoparasitic populations of the North Atlantic where data quality was higher, whereas for populations in the Nearctic, trend data were scarce and geographically restricted. Various threats were identified as potential drivers of population change, including bottom-up processes, fisheries, heat stress, and interspecific competition/predation. Given the large uncertainty around abundance and population trends for much of the Arctic Skua's range, the current global conservation status of Least Concern may be better designated as "Data Deficient", and we encourage the implementation of a range of approaches to improve monitoring of population trends and demography globally.

Introduction

In the face of global environmental change and the wide range of anthropogenic threats that animal populations face, collecting data on species' distributions, demography, and abundance is essential to inform wildlife conservation and management strategies. Species-specific information is used to detect changes in population dynamics, assess anthropogenic threats or evaluate the effectiveness of conservation measures (Butchart et al. 2010; Danielsen et al. 2005). Furthermore, the classification of species in terms of extinction risk or conservation needs in various national and global assessments (e.g. Birdlife International 2021), which are catalysts for policy changes and the allocation of resources to species conservation, relies on robust information on the abundance of species and changes in population sizes over time (Betts et al. 2020). Consequently, considerable effort is invested within the field of animal ecology and conservation towards monitoring the distribution and abundance of animal populations (McComb et al. 2010; Walsh et al. 1995).

The Arctic Skua or Parasitic Jaeger *Stercorarius parasiticus* (Figure 1) is a migratory seabird with a Holarctic breeding distribution throughout the circumpolar Arctic and some northern

Figure 1. Arctic Skuas in their breeding grounds in Fair Isle, Scotland (left), and chasing Black-legged Kittiwakes in the subarctic (right). (Photographs by Alex Penn and Kate Persons for Smithsonian Institution, Nome, Alaska)

temperate regions, falling within the jurisdictions of USA, Canada, Greenland, Iceland, the Faroe Islands, UK, Norway, Sweden, Finland, and Russia (Figure 2). Arctic Skuas nest in both coastal and inland areas in a spectrum of open habitats such as peatland, low-lying marshes, tundra, and rock-dominated polar landscapes (Furness 1987; Wiley and Lee 2020). At a species level, Arctic Skuas are generalists, breeding in different biomes and exploiting diverse prey. However, regionally they often exhibit different foraging strategies. In inland tundra (and some coastal tundra), Arctic Skuas may nest in low densities, establishing large all-purpose individual territories where they generally have a broad prey base and can be either kleptoparasitic or direct foragers of both terrestrial and

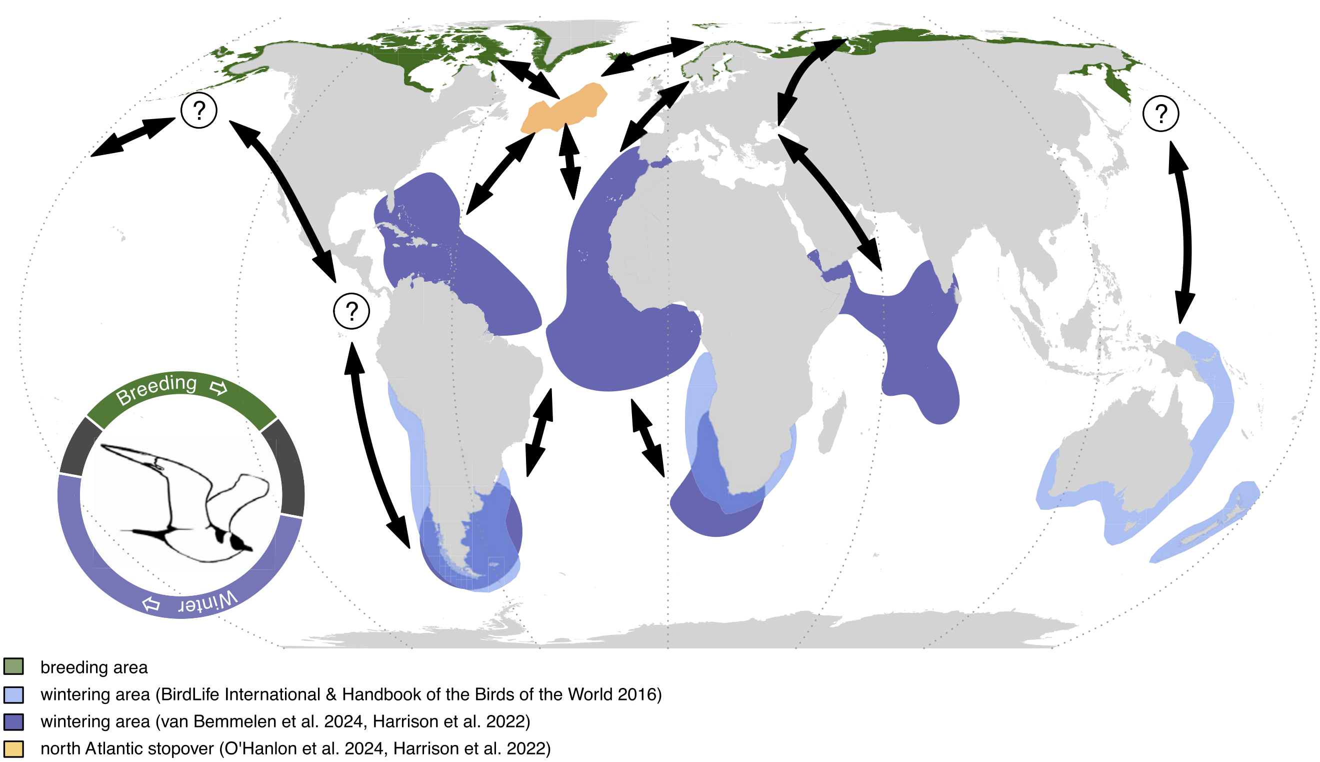

Figure 2. Global breeding and non-breeding distributions of the Arctic Skua *Stercorarius parasiticus*. Known, recently described flyways and stop-over sites are presented. Connectivity between non-breeding areas, stop-over sites, and breeding areas are depicted with arrows. Additional potential flyways based on unpublished data or expert opinion in the Pacific populations are indicated by question marks. The annual cycle schematic indicates the proportion of time spent in each area and is based on van Bemmelen et al. (2024) with 1 January at the centre bottom.

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aquatic prey (hereafter "generalist populations"). Conversely, some coastal populations are high-density, rely more heavily on marine resources, and are largely kleptoparasitic (hereafter "kleptoparasitic populations") during all or part of the breeding season, engaging in aggressive aerial chases where they steal food, predominantly forage fish, from other seabirds as their main foraging strategy (Andersson 1976; Furness 1987; Phillips 2001) (Figure 1). In this group of kleptoparasitic populations, we include populations that have historically formed colonies of c.100–250 breeding pairs in proximity to large breeding aggregations of other seabirds and that appear to be limited to the North Atlantic, usually on small islands in Scotland, the Faroe Islands, and Norway, but may also be found as single pairs or small colonies (Furness 1987; O'Donald 1983; van Bemmelen et al. 2021).

As with many seabirds, knowledge of the foraging and movement ecology of Arctic Skuas during the non-breeding period is scant compared with the breeding period. The miniaturisation and advancement of telemetry devices have revealed migration routes and wintering areas of Arctic Skuas from a range of breeding populations, mainly from the north-eastern Atlantic, demonstrating that Arctic Skuas spend the boreal winter in pelagic waters around the Mediterranean, the tropics, and productive seas around South America, Africa, Australasia, and in the north-western Indian Ocean (Figure 2) (Harrison et al. 2022; O'Hanlon et al. 2024; van Bemmelen et al. 2024): a larger wintering distribution than previously described (Furness 1987; Isenmann et al. 2010; Simeone et al. 2014). Less is known about their diet and foraging behaviour during this time, but kleptoparasitism of several seabird species has been observed at sea during migration, together with evidence of other prey types such as cephalopods, barnacles, and fish (Bélisle and Giroux 1995; Furness 1987; Spear et al. 2007; Wiley et al. 1999).

The Arctic Skua is currently classified as "Least Concern" in the global International Union for Conservation of Nature (IUCN) European Red List of Threatened species, but it is "Endangered" in Europe, with declines recorded in recent decades (Birdlife International 2018, 2021; Burnell et al. 2023; Perkins et al. 2018; Snell et al. 2025). However, the availability and quality of monitoring and ecological data for Arctic Skuas are patchy across most of its breeding range. Collating existing knowledge about Arctic Skuas at a global scale is necessary to identify where knowledge gaps lie regarding their ecology and population status and trends, and thus research and conservation priorities. Hence, we formed a collaboration of seabird ecologists to collate and evaluate relevant literature, data, and expert opinion on Arctic Skuas with the following aims: (1) to provide an updated global estimate of breeding population size and best possible population trends by country/region; (2) to identify and summarise drivers of population change; (3) to identify immediate knowledge gaps and their implications for the conservation of Arctic Skuas.

Data sources and quality

Estimates of breeding population size and trends, and demographic parameters presented in this study were collated from published literature, national databases, expert consultation or, in few cases, were provided by the authors of this study either from unpublished data at their study sites or calculations based on best available information. Further searches in Google Scholar and Web of Science ensured greater coverage of potentially useful information using the search terms Arctic Skua OR Parasitic Jaeger OR *Stercorarius parasiticus* with population OR abundance OR colony OR breeding OR survey OR survival OR breeding success OR productivity. We also searched the available literature in Russian separately using the term "Короткохвостый поморник" (the common name of Arctic Skua in Russian) in Google Scholar. Additionally, articles were retrieved from the Cyberleninka (cyberleninka.org) and Elibrary (elibrary.ru) libraries.

To provide a measure of the quality of population estimates presented in this study, we classified population estimates according to Birdlife International criteria relevant to IUCN Red List assessments (https://datazone.birdlife.org/species/spcquality) with slight amendments to their definitions. These categories were:

A = Based on reliable and complete or representative quantitative data;
B = Based on reliable but incomplete or partially representative quantitative data;
C = Based on qualitative information, potentially unreliable/unrepresentative quantitative data, or quantitative data extrapolated from regions with similar habitats and breeding densities.

Breeding population

The level of monitoring effort achieved across the large and diverse range of jurisdictions where Arctic Skuas breed is highly variable, resulting in heterogeneous and regionally specific knowledge of population status and trends. A large proportion of the breeding distribution of Arctic Skuas is found across vast Arctic landscapes with limited facilities (e.g. roads, airports) which, in combination with low nesting densities, makes large-scale monitoring logistically challenging and expensive (e.g. for the Canadian Arctic; Mallory et al. 2018), and for some parts of the range, unfeasible due to financial, logistical or legal constraints (Gallo-Cajiao et al. 2023). As a result, the most comprehensive census data are from smaller countries (e.g. UK, Faroe Islands, Finland, Sweden), where breeding sites of Arctic Skuas are more accessible, but which only cover small proportions of the entire breeding range (Burnell et al. 2023; HELCOM 2018; Snell et al. 2025). Some countries derived national estimates from modelled regional abundance, including a recently completed survey of the avifauna of the Canadian Arctic, which has added a new source of large-scale data to describe the status of Arctic Skuas. Additionally, long-lived seabirds such as skuas may skip breeding in some years, and a large proportion of their populations is composed of juvenile and immature birds that rarely attend breeding colonies (Hamer et al. 2002), thus only part of the population is monitorable at the breeding grounds. Previous global estimates were primarily based on expert opinion. For example, Furness (1987) speculated that the Arctic Skua is the most numerous skua species, arriving at a figure of 500,000–1,000,000 breeding pairs, though this is "little more than a guess!". More recently, Birdlife International (2021) and the *European Breeding Bird Atlas 2* (Keller et al. 2020) reported a global population of 400,000–599,999 mature individuals, of which 20% are estimated to breed in Europe. Below, we summarise and review the most recent data on breeding population size from all countries where Arctic Skuas breed and combine these to produce an updated global population estimate.

Alaska

There are no estimates of breeding population size for Alaska as a whole, but several regions of Alaska have been surveyed as part of the Program for Regional and International Shorebird Monitoring

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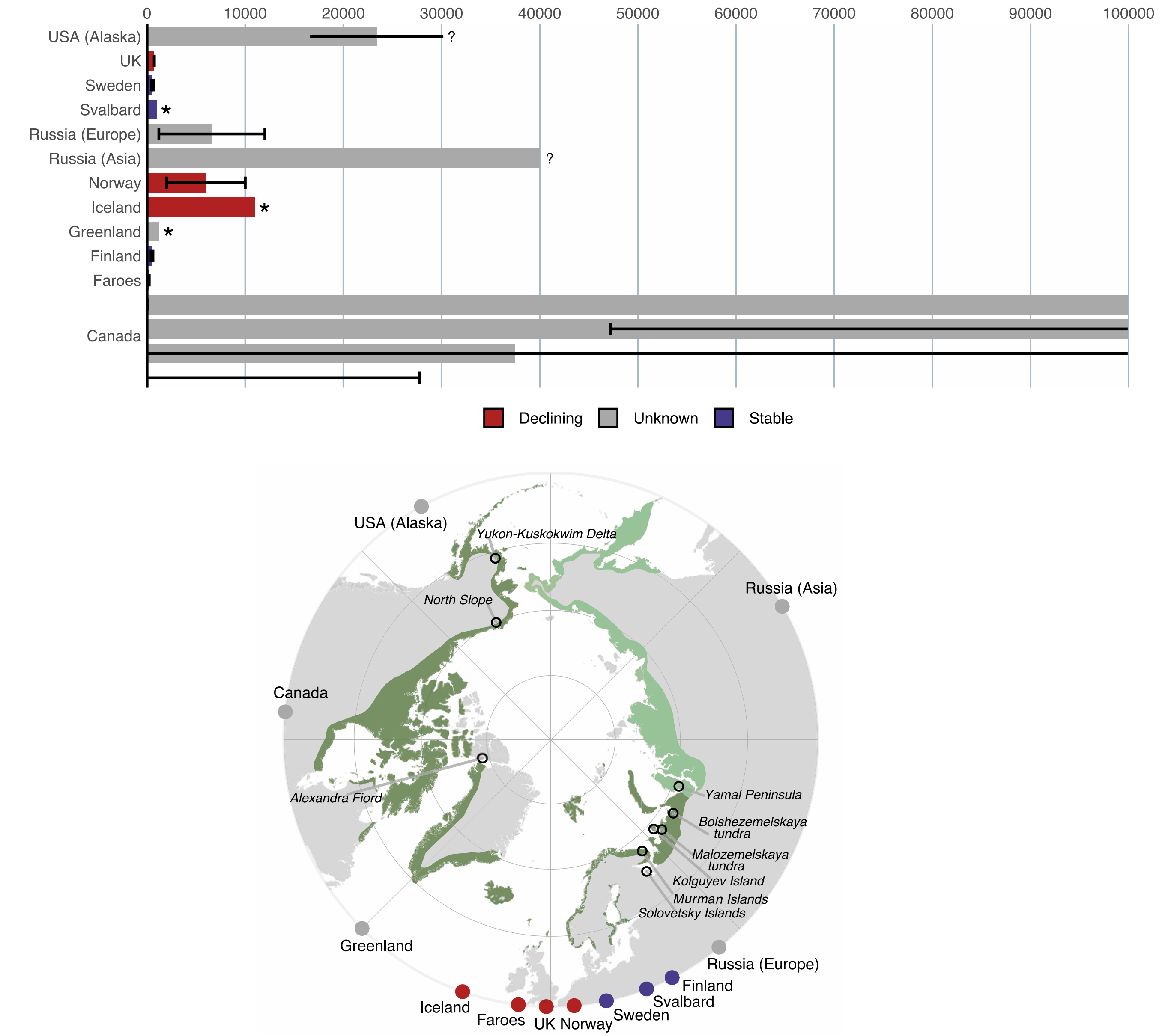

Figure 3. Summary of estimated Arctic Skua breeding populations sizes and trends per country. The top panel plots the estimated size of the breeding population (number of breeding pairs) and colour-coded according to population trajectory. Where a range is given, either as a range estimate, known variance or standard error (SE) calculated from coefficient of variance (CV), this is indicated by whiskers (census data are plotted with a variance of 0). Where a single figure estimate has been published, range is unknown, indicated by *. The bottom panel maps the breeding range of Arctic Skuas (BirdLife International 2016), where pale green indicates Asian Russia where abundance is uncertain. National population trends are colour coded by population trajectory. The location of study sites where Arctic Skua numbers are monitored in countries where no population trends are available at a national scale are indicated.

(PRISM) (Bart and Johnston 2012). In the mid-twentieth century, breeding densities ranged from 0.01 to 0.1 nesting pairs/km^2 at various study sites across the North Slope (141–166°W; Figure 3), that included coastal and inland sites with nesting pairs or single birds sometimes separated by several kilometres, where Arctic Skuas forage within their own territories on eggs, birds, berries, invertebrates, small mammals, and fish (Andersson 1973; Maher 1974). Plot-based surveys across the North Slope of Alaska covered >50,000 km^2 of suitable breeding habitat between 1992 and 2005. Extrapolation across the study area yielded an estimated 46,761 (CV = 0.29) individuals (potentially including some non-breeding birds), simplistically equivalent to 23,380 pairs (SE = 16,600–30,160) of Arctic Skuas (Bart and Johnston 2012) (Table 1 and Figure 3). These were primarily found as single birds in low densities in wetland and moist areas, as has been previously reported locally (Maher 1974). Aerial transect surveys across the North Slope, during 2007–2024, estimated breeding and total count indices for skuas, but did not distinguish among the three Alaskan skua species and should be used as an assessment of relative abundance only (see Population trends section; Amundson 2019; Wilson et al. 2025). Surveys were also conducted in Western Alaska (Selawik National Wildlife Refuge, the central portion of the Yukon–Kuskokwim Delta, and Alaska Peninsula and Maritime region) under the PRISM program, albeit with lower intensity (McCaffery et al. 2012). These surveys yielded only two observations of Arctic Skua, suggesting that the species is not common in

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Table 1. Estimates of Arctic Skua breeding population per country. Data quality categories are based on slightly tweaked Birdlife International data quality criteria used in IUCN Red List assessments as follows: A = Based on reliable and complete or representative quantitative data; B = Based on reliable but incomplete or partially representative quantitative data; C = Based on qualitative information, potentially unreliable/unrepresentative quantitative data, or quantitative data extrapolated from similar populations. AOTs = Apparently Occupied Territories. * Norway - coast only.

Country	Year/s	Estimate	Scale	Unit	Data quality	Source
Alaska (North Slope)	1992–2005	23,380 (CV = 0.29)	Regional	Breeding pairs	B	Bart and Johnston (2012)
Canada	1994–2018	237,500 (CV = 0.38)	National	Breeding pairs	A	Smith et al. (2025)
Greenland	2004–2016	1,200	National	Breeding pairs	B	Boertmann et al. (2020); unpublished data
Iceland	2016	11,000	National	Breeding pairs	B	Skarphéðinsson et al. (2018)
Faroe Islands	2017–2018	207	National	AOTs	A	Snell et al. (2025)
Norway (mainland)	2015	5,000–10,000 (2,000)*	National	Breeding pairs	B	Shimmings and Øien (2015); Anker-Nilssen et al. (2015)*
Svalbard	2015	1,000	National	Breeding pairs	B	Shimmings and Øien (2015); Anker-Nilssen et al. (2015)
Sweden	2012	447–671	National	Breeding pairs	A	Ottosson et al. (2012)
Finland	2006–2010	500–600	National	Breeding pairs	A	Valkama et al. (2011)
UK	2015–2021	727	National	AOTs	A	Burnell et al. (2023)
Russia (Europe)	2021	1,200–12,000	National	Breeding pairs	B	Kalyakin and Voltzit (2020); Keller et al. (2020)
Russia (Asia)	2022	40,000–600,000	National	Breeding pairs	C	Extrapolated estimate based on BirdLife International (2016) and Ryabitsev and Ryzhanovski (2022)
Estimate of breeding population (excluding Asian Russia)	–	185,131–395,315	Global (excluding Asian Russia)	Breeding pairs/AOTs	–	–
Estimate of breeding population (including Asian Russia)	–	225,131–995,315	Global	Breeding pairs/AOTs	–	–

these regions (unpublished data). Historically, up to six pairs were found nesting on islands of the Alaska Peninsula during ground-nesting surveys 1977–1981 (Bailey and Faust 1984). A ground-nesting marine bird survey in Glacier Bay (Southeast Alaska), 2003–2005 (Arimitsu et al. 2007) recorded four nests distributed across three inlets of the bay (2003, $n = 1$; 2004, $n = 1$; 2005, $n = 2$). Given that encounters outside the North Slope are low, mostly unsystematic, and certainly orders of magnitude less than the North Slope population, we use this estimate as representative of Alaska in global estimates. However, it is possible that substantial numbers breed in unsurveyed areas of their large Alaskan breeding range. For example, the Aleutian Islands were historically reported to have large populations by Murie (1959). On-going efforts to survey Alaska with the PRISM program (e.g. Lyons et al. 2024) may yield additional abundance estimates for Arctic Skua in the years to come.

Canada

The continuous breeding range, totalling c.3 million km^2 (BirdLife International 2016) (Figure 2), of the Arctic Skua in tundra habitats along coasts and inland regions of Canada and Alaska supports a large proportion of the global breeding population. Plot-based surveys were carried out across Arctic Canada under the PRISM program between 1994 and 2018, where 2,528 plots (12–16 ha) were surveyed across a 2.6 million km^2 study area (Smith et al. 2025). This area encompasses the entire range of the Arctic Skua in Canada, with the exception of northern Labrador, along the north Atlantic Coast. The surveys recorded 102 Arctic Skuas, yielding a national population estimate of 475,000 (CV = 0.38) individuals (potentially including some non-breeding birds) (Table 1 and Figure 3). A simplistic conversion of individuals to breeding pairs, assuming that all individuals encountered were breeding birds, yields 237,500 pairs (SE = 147,250–327,750) (Smith et al. 2025). Densities in wet habitat were 2.5 birds/km^2, in contrast to 0.4 birds/km^2 and 0.2 birds/km^2 in moist and dry habitats, respectively (Smith et al. 2025). While densities were lower in the latter habitats, 61% of the population was estimated to occur here due to the vast extent of this habitat in northern Canada. The areas of high densities in coastal wetlands are often associated with large populations of nesting Snow Geese *Anser caerulescens* and Ross's Geese *Anser rossii* which provide more feeding opportunities, especially through the stealing of eggs (Flemming et al. 2019; Martin and Barry 1978; Parmelee et al. 1967). The national estimate for Canada is likely an underestimate given that northern Labrador was not surveyed. However, given the uncertainty in the estimates and the small size of northern Labrador compared with the provinces surveyed, it is unlikely that the exclusion of northern Labrador would greatly alter the estimate.

Greenland

The distribution of Arctic Skuas in Greenland is exclusively coastal, occupying snow- and ice-free lowlands and archipelagos across most of the latitudinal gradient of the country (Boertmann et al.

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1994, 2020). Similarly to Alaska and Canada, breeding densities are low with mostly isolated pairs, although small (≤5 pairs) and loose colonies are found in some of the extensive archipelagos (Boertmann et al. 2020). Wiley and Lee (2020) reported between 5,000 and 10,000 breeding pairs for the whole country. However, ground and aerial surveys undertaken between 2004 and 2016 suggest a much smaller breeding population, with an estimated 200 breeding pairs in North and East Greenland (i.e. along more than half of the Greenland coastline; Boertmann et al. 2020), and an estimated 1,000 pairs possibly breeding along the west coast (unpublished data). While these surveys did not cover all potential breeding sites, the breeding population of Arctic Skuas in Greenland is likely much smaller than suggested by Wiley and Lee (2020) (Table 1 and Figure 3).

Iceland

A handful of whole-country estimates of breeding population size have been published since the 1970s, the most recent being in 2016 where the density of breeding Arctic Skuas was modelled across habitat types yielding an estimate of 11,000 breeding pairs (Skarphéðinsson et al. 2016) (Table 1 and Figure 3). Arctic Skuas are widespread throughout coastal and inland regions. Breeding densities are generally low at approximately 1 pair/km^2 in lowland areas and much less at higher elevations (Skarphéðinsson et al. 2016). However, higher densities are found in some areas of east Iceland which hold large proportions of the country's population (Guðmundsson et al. 2001).

Faroe Islands

Arctic Skuas have historically bred throughout the islands in dense colonies: range 47–181 Apparently Occupied Territories (AOTs)/ km^2 (dos Santos 2018). The most recent comprehensive census of breeding Arctic Skuas was undertaken in 2017 and 2018 through nest counts and vantage point surveys, where all historical and extant skua colonies were visited and mapped, yielding a total of 207 AOTs for the entire archipelago (Snell et al. 2025) (Table 1 and Figure 3). Arctic Skuas were found in seven sites on seven islands, forming colonies of between 9 and 49 AOTs (dos Santos 2018).

Norway

No comprehensive national censuses have been carried out in Norway. Arctic Skuas breed both along the coast and inland in mountainous regions, which are often challenging to reach. In mainland Norway, Arctic Skuas have historically formed large colonies at coastal sites next to large aggregations of other seabirds, such as Slettnes and Hjelmsøya in Finnmark, where c.250 breeding pairs of Arctic Skua were present in 1997–1998 in an area of c.5.5 km^2, and 220 breeding pairs were present in 2006 in an area of c.1 km^2, respectively (van Bemmelen et al. 2021; unpublished data). However, most colonies are smaller, comprising 20–30 pairs (unpublished data). The most recent estimates for mainland Norway, though with large uncertainties, are 5,000–10,000 (Shimmings and Øien 2015) and 2,000 breeding pairs (coastal population only; Anker-Nilssen et al. 2015) (Table 1 and Figure 3).

Svalbard

In Svalbard, Arctic Skuas are found in relatively low densities ranging from 0 to 4 nests/km^2 (Kongsfjorden; unpublished data), similar to Alaska, Canada, and Greenland. An estimated 1,000 breeding pairs are found and this estimate includes 100 pairs on Bjørnøya and approximately 50 on Jan Mayen (Anker-Nilssen et al. 2015; Shimmings and Øien 2015) (Table 1 and Figure 3). Suitable habitat is extensive along the coast and in valleys, and Arctic Skuas are found breeding around the entire archipelago. Given the breeding density found in Kongsfjorden, the total population estimate of 1,000 pairs for Svalbard is in all likelihood an underestimate.

Sweden

Arctic Skuas breed along the Baltic coasts of Sweden with lower numbers along the Swedish west coast. Most pairs breed on offshore skerries in low densities (Ottosson et al. 2012). The most recent estimate for Sweden, 564 (447–671) breeding pairs, is from 2012 and is based on complete regional surveys mainly conducted between 2000 and 2010 (Ottosson et al. 2012) (Table 1 and Figure 3).

Finland

In Finland, Arctic Skuas are found in low densities along south-western and western coasts, also on offshore skerries (HELCOM 2018), with a total breeding population of 500–600 pairs estimated in 2006–2010 (Valkama et al. 2011) (Table 1 and Figure 3).

UK

A comprehensive census of all breeding seabirds in the UK was undertaken between 2015 and 2021 (Burnell et al. 2023). For Arctic Skuas, 727 AOTs were found in Scotland through ground counts and vantage point surveys (Table 1 and Figure 3). The bulk of the population was in the archipelagos of Shetland, Orkney, and the Western Isles, which respectively held 295, 237, and 133 AOTs, while the remaining territories were on the Scottish mainland or small islands off the west coast (Burnell et al. 2023). Similarly to the populations of the Faroe Islands and some Norwegian sites, Arctic Skuas were largely distributed in colonies, some of largest (19–27 AOTs) being those on Fair Isle and Foula (Shetland), Handa (Sutherland), and Papa Westray (Orkney) (Burnell et al. 2023).

Russia

Arctic Skuas breed along northern coastal and inland areas of Russia. The European Russia (west of the Ural Mountain range, c.66°E; Figure 3) population size is estimated at between c.1,200 and 12,000 breeding pairs (Kalyakin and Voltzit 2020; Keller et al. 2020), and 20,000–60,000 individuals (Mischenko 2017), although the authors of the latter point out that the quality of the data is poor. There are no estimates of the breeding population size for the Asian region of Russia. Breeding density appears low where data are available, such as in the Yamal Peninsula and near Ob' forest tundra, with an estimated 0.02–0.3 pairs/km^2, depending on latitude and lemming abundance (Ryabitsev and Ryzhanovskiy 2022). Given the complete lack of population data for Asian Russia, a crude estimation can be made based on these breeding densities (in line with those of the Nearctic), and the Russian breeding area east of the Urals (c.66°E–170°W; Figure 3) of around 2 million km^2 (BirdLife International 2016) (Figure 2), suggesting the breeding population size could range between 40,000 and 600,000 pairs (40,000 being conservative), although this is little more than speculation (Table 1 and Figure 3). Similarly to the Nearctic, a large proportion of the global breeding population of Arctic Skua is expected to breed in Russia due to the apparent large extent of suitable breeding habitat along Arctic coasts and inland regions (BirdLife International 2016).

Global breeding population

Where breeding population data are available, these are presented in the literature as individuals, breeding individuals, breeding pairs or AOTs, which we have combined to present global figures as breeding pairs. However, we acknowledge that surveys that only report individuals may include non-breeding birds (e.g. Alaska and Canada), and thus our conversion to breeding pairs is simplistic and may slightly overestimate the number of breeding pairs for those areas. Given the extreme uncertainty in the Asian Russia breeding estimate, it would not be appropriate to combine it with higher quality estimates that were reached through surveys and modelling in the rest of the breeding range. Therefore, we present a global breeding population as two estimates, one covering Alaska, Canada, Greenland, and Europe, yielding a minimum of 185,131–395,315 breeding pairs, and an extrapolated conservative estimate for Asian Russia of 40,000 breeding pairs (Table 1).

Population trends

As the second half of the twentieth century was a key period for the establishment of seabird monitoring across countries, and thus most available data globally is from the 1970s onwards, here we collate known changes in the breeding population of Arctic Skuas over the last 50 years.

Alaska

Annual aerial surveys undertaken between 1992 and 2016 along the North Slope of Alaska, covering 90,000 km² between the Chukchi and Southern Beaufort Seas and the Canadian border, suggested that the populations of all skua species combined (Arctic Skua, Long-tailed Skua *Stercorarius longicaudus*, and Pomarine Skua *S. pomarinus*) remained stable over this time (Amundson et al. 2019). A recent update of results from this same survey scheme includes estimates from 2017 to 2024 (Wilson et al. 2025) and demonstrated with high statistical confidence that skua numbers had declined from a long-term average (2007–2024) of 8,174 (SE = 602) to a three-year average (2022–2024) of 5,833 (SE = 484). This decline is equivalent to an annual growth rate of 0.96 (CI = 0.94–0.98) (Wilson et al. 2025). Similar aerial surveys carried out at the Yukon–Kuskokwim Delta reported a decline of 34% in the long-term average between 1988 and 2008) (Platte and Stehn 2009). Overall, the large-scale aerial surveys undertaken over much of Alaska demonstrated with high confidence that skua species have declined in recent decades. However, surveys were conducted during the first three weeks of June and thus may be skewed toward Long-tailed Skuas which are the earliest of the three species to arrive and lay. Trend data derived from ebird, which account for changes in the observation process typical of community science data, reported a median decline in relative abundance of 16.6% between 2012 and 2022 along coastal regions of Alaska, during the early breeding season (14–28 June) (Fink et al. 2023) (Table 2 and Figure 3). Given the relatively scarce and geographically limited observations of this species in ebird, it is not possible to confidently determine the population trend of Arctic Skuas, or disentangle trends from other skua species in this region.

Canada

In Canada, the Arctic Skua is considered to be a Data Deficient species with no information on national population trends (Environment and Climate Change Canada 2019). Regionally, at the study site of Alexandra Fiord, Ellesmere Island, the abundance of Arctic Skuas did not change between 1980 and 2008 (Trefry et al. 2010). Ebird trend data reported a (non-significant) median decrease of 3% in relative abundance between 2012 and 2022 (14–28 June), although data are limited to very few coastal areas in Hudson Bay and Nunavik (Fink et al. 2023) (Table 2 and Figure 3) and thus cannot be considered representative at a national scale.

Greenland

Although based on few pairs, the only time series available on breeding Arctic Skuas comes from East Greenland where the Groupe de Recherche en Ecologie Arctique has been monitoring seabirds at several sites since 1979 (see details in Boertmann et al. 2020). In this region, where coastal Arctic Skuas only breed in single pairs, four breeding sites have been regularly visited over the last 15–45 years. In the Karupelv Valley (study area of 20 km²) and Hochstetter Forland (18 km²), where uninterrupted monitoring has been carried out since 1988 and 2010, respectively, numbers have remained stable, with 1–3 pairs per year in the Karupelv Valley and one pair at Hochstetter. It should be noted that a pair was already breeding at the first site in 1979, while at the second site the species was not breeding in 1976 (Meltofte et al. 1981). At Ymers Ø (8 km²) and Mestersvig (5 km²), where observations have been undertaken for more than 10 years, the number of pairs (1–3) has remained stable (unpublished data) (Table 2 and Figure 3). While the quality of the monitoring data at these sites is high, since they are based on absolute counts of breeding pairs, their spatial extent is very limited. As such, they provide only a localised snapshot of trends in parts of north-east Greenland and cannot be considered representative of population trends across Greenland as a whole.

Iceland

At least three national estimates of breeding population size have been published since the 1970s, and available estimates have been relatively consistent, ranging between 4,000 and 12,000 breeding pairs (Asbirk et al. 1997; Bengston and Owen 1973), with the most recent one from 2016 estimating 11,000 breeding pairs (Skarphéðinsson et al. 2016). However, these have employed different methodologies and the first two have large uncertainty around the estimates. Consequently, direct comparisons among them are problematic, and they may not provide a reliable indicator of population trends at a national scale. More localised monitoring at breeding sites – such as Úthérað in east Iceland and Mýri in south-west Iceland – has indicated population declines, although the magnitude of change for these regions is not reported (Skarphéðinsson 2018; Skarphéðinsson et al. 2016). At the smaller study site of Hróarstungu in north-east Iceland, breeding numbers fluctuated between 0 and 40 pairs from 2005 to 2011, with a net loss of 25 pairs over the study period (Stefansson 2012) (Table 2 and Figure 3). Overall, these limitations imply that robust national-scale population trends cannot be reliably inferred from the currently available data.

Faroe Islands

Two comprehensive censuses of breeding Arctic Skuas have been undertaken in the Faroe Islands in recent decades with the aim of quantifying changes in population size, the first in 1981 (Benston and Bloch 2003) and most recently in 2017–2018 (Snell et al. 2025). During the second census, all historical and extant breeding colonies were visited and Arctic Skuas were surveyed following

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Table 2. Trends in Arctic Skua populations

Country	Scale	Region	Time period	Trend	Reference
Alaska	*Regional*	*Yukon–Kuskokwim Delta*	*1988–2008*	*Decreasing*	*Platte and Stehn* (2009)
		North Slope	*1992–2016*	*Stable*	*Amundson et al.* (2019)
		North Slope	*2007–2024*	*Decreasing*	*Wilson et al.* 2025
Canada	*Regional*	*Alexandra Fiord, Ellesmere Island*	*1980–2008*	*Stable*	*Trefry et al.* (2010)
Greenland	*Regional*	*North-east Greenland*	*1988–2024*	*Stable*	*Unpublished data*
Iceland	*Regional*	*Úthérað*	*2000–2014*	*Decreasing*	*Skarphéðinsson et al.* (2016)
		Mýri	*? –2006*	*Decreasing*	*Skarphéðinsson et al.* (2016)
		Hróarstungu	*2005–2011*	*Decreasing*	*Stefansson* (2012)
Faroe Islands	National	–	1981–2017/2018	Decreasing	Snell et al. (2025)
Norway (mainland)	*Regional*	*Slettnes, Finnmark*	*1997/1998–2019*	*Decreasing*	*van Bemmelen et al.* (2021)
		Sogn og Fjordane, Vestland	*1984–2020*	*Decreasing*	*Larsen* (2021)
		Hjelmsøya, Finnmark	*2006–2023*	*Decreasing*	*Unpublished data*
Svalbard	*Regional*	*Kongsfjorden*	*2010–2024*	*Stable*	*Unpublished data*
Sweden	National	–	1991/2000–2023	Stable	HELCOM (2018); Green et al. (2024); Haas and Green (2021)
Finland	National	–	1991/2000–2011/2018	Stable	HELCOM (2018)
UK	National	–	1998/2002–2015/2021	Decreasing	Burnell et al. (2023)
Russia (Europe)	*Regional*	*Solovetsky Islands, White Sea*	*1994–2014*	*Stable*	*Cherenkov et al.* (2014)
		Malozemelskaya tundra, mainland	*1970s–2000s*	*Stable*	*Mineev and Mineev* (2009)
		Bolshezemelskaya tundra	*1970s–2000s*	*Stable*	*Mineev and Mineev* (2012)
		Kolguyev Island, Barents Sea	*1995–2019*	*Decreasing*	*Morozov and Syroechkovsky* (2004)*; Glazov et al.* (2021)
		Murman Islands	*1988–2024*	*Decreasing*	*Krasnov et al.* (2025)
Russia (Asia)	*Regional*	*Yamal Peninsula, Yamalo-Nenets*	*1970s–2000s*	*Stable*	*Ryabitsev and Ryzhanovskiy* (2022)

protocols in the *Seabird Monitoring Handbook* developed for Britian and Ireland (Walsh et al. 1995), revealing a decline from 1,145 to 207 AOTs (-82%) (Snell et al. 2025) (Table 2 and Figure 3). Over this period, many colonies were lost, from over 60 across most of the archipelago to just seven, with large-scale losses of breeding pairs occurring uniformly across large and small colonies (dos Santos 2018).

Norway

Arctic Skuas are currently classified as "Vulnerable" for mainland Norway in the Norwegian Red List of Species (Strøm et al. 2021). This status is due to assumed strong declines in coastal populations in all parts of the country (Table 2 and Figure 3). Few Arctic Skuas are left in the south and west (Strøm et al. 2021). The number of breeding individuals in Sogn og Fjordane on the west coast declined from 62 in 1984 to just two in 2020 (Larsen 2021). It is also evident that breeding numbers in Finnmark, a northern region where most Arctic Skuas breed, are declining: the colony at Slettnes declined from an estimated 250 breeding pairs in 1997–1998 to 112 AOTs in 2019 (van Bemmelen et al. 2021). Furthermore, only 37 active nests of the 112 AOTs were located in 2019 (van Bemmelen et al. 2021). On the island of Hjelmsøya, breeding pairs declined from 220 in 2006 to just 10 in 2023 (unpublished data). While no national-scale population trends have been estimated, these absolute counts of Arctic Skua territories at key breeding sites along Norway's coast provide a strong indication that substantial population declines have occurred at a national scale, at least in the coastal population, which is reflected in the Norwegian Red List of Species.

Svalbard

In Svalbard, Arctic Skuas are classified as "Least Concern" in the Norwegian Red List of Species, and the population is assumed to be stable (Strøm et al. 2021). In Kongsfjorden, where uninterrupted monitoring has been carried out since 2010 in an area of c.18 km^2 of suitable habitat, the number of active nests has hovered at around 20, with 18 recorded in 2024 and no linear trend detected between 2010 and 2024 (unpublished data) (Table 2 and Figure 3). However, while these data are of high quality (annual counts of territorial pairs), they are limited to a single site, and therefore these observations provide only a localised snapshot; caution is warranted when assuming that Arctic Skuas are stable across Svalbard.

Sweden and Finland

At a Baltic Sea scale, which includes parts of both Sweden and Finland, annual monitoring of 585 breeding sites during two periods (1991–2000 and 2011–2018) showed a slight increase in Arctic Skua abundance. During the second survey period, the abundance index was above one in all years of the survey, with a mean annual population growth rate of 1.011 (SE = 0.009) (HELCOM 2018; Ottosson et al. 2012; Valkama et al. 2011). In Sweden, the national population size has been stable between 2015 and 2023 (Green et al. 2024), but differing trends are found between the north and south-west of the country. In the Gulf of Bothnia, there was a slight increase in population size between 2010 and 2020 (Haas and Green 2021). However, along the Swedish west coast Arctic Skuas have declined by >80%, from around 80 to 15 breeding pairs between 2002 and 2021 (Åhlund 2023) (Table 2 and Figure 3).

UK

Since 1985 there have been three comprehensive censuses of Artic Skua populations (Burnell et al. 2023; Lloyd et al. 1991, Mitchell et al. 2004). Declines have been recorded in the number of AOTs, falling from 3,388 AOTs in 1985–1988 to 2,141 AOTs in 1998–2002, followed by a steeper decline to 727 AOTs in 2015–2021 (Table 2 and Figure 3). Additionally, annual estimates of population abundance of Arctic Skua from the Seabird Monitoring Program at selected seabird colonies (n = 10–11) demonstrated a consistent decline in the number of AOTs since 1992, to a low of 83% below the 1986 baseline in 2023 (Harris et al. 2024). Almost complete coverage of all sites surveyed during Mitchell et al. (2004) was achieved by Burnell et al. (2023) using the same methodology. Therefore, confidence about population changes presented in Burnell et al. (2023) is high. The Arctic Skua is the fastest declining seabird in the UK, warranting its inclusion in the UK Red List of Birds of Conservation Concern (Stanbury et al. 2024).

Russia

The national population trend of breeding Arctic Skuas is unknown for both European and Asian Russia (Mischenko 2017). Regionally, on the Solovetsky Islands in the White Sea, and on the mainland of the European Russian Arctic, the population is considered stable at 0.02–2.29 pairs/km^2 (Cherenkov et al. 2014; Mineev and Mineev 2009, 2012). In contrast, on Kolguyev Island in the Barents Sea, the density of breeding pairs was considered stable between 1995 and 2006–2008, after which a decrease from 0.50 to 0.14 pairs/km^2 between 2006 and 2019 was reported (Glazov et al. 2021; Morozov and Syroechkovsky 2004). In the Yamal peninsula, Asian Russia, Arctic Skua populations are reportedly stable (Ryabitsev and Ryzhanovskiy 2022) (Table 2 and Figure 3). On Kharlov Island (Murman Islands), a 71% decline by 2024 was recorded, whereas in coastal tundras of Western Murman the population remained relatively stable at 1–2 pairs per 10 km of survey route during 2010–2023, and in Eastern Murman (Gavrilov Islands area) local disappearances were noted in 2017–2023 (Krasnov et al. 2025) (Table 2 and Figure 3). These data provide only a localised snapshot of a few study sites and cannot be considered representative of population trends at a national scale.

Summarising the global population trend

In the UK and the Faroe Islands, where comprehensive national censuses have been conducted, Arctic Skua populations have declined by more than 80% in recent decades. Similarly steep declines have been reported at key sites along Sweden's west coast, parts of Iceland, and the Norwegian coast; regions that share the North Atlantic basin and where Arctic Skuas exhibit comparable kleptoparasitic foraging strategies during the breeding season. No nationally representative trend data exist for Canada, Russia or Greenland, where monitoring is restricted to very few sites, although populations appear broadly stable at these locations. In Alaska, large-scale population declines have been documented over recent decades; however, these surveys did not differentiate among skua species, limiting the ability to assess trends specifically for Arctic Skua breeding abundance. Overall, there is a clear cluster of declining populations in the North Atlantic, where data quality is higher. Substantial knowledge gaps remain for many inland and coastal Arctic populations, which may be more stable, but this inference could be the result of low power to detect change from limited evidence (Table 2 and Figure 3).

Drivers of population change

Seabirds are one of the most threatened taxonomic groups globally due to direct and indirect anthropogenic pressures: 56% of the 362 species for which there are trend data are in decline, including several species currently classified as Least Concern in the IUCN Red List (Phillips et al. 2023). The major threats seabirds face are environmental change, overfishing, invasive species, hunting, disease, pollution, and habitat loss/disturbance (Dias et al. 2019; Phillips et al. 2023). The Arctic Skua, as a long-distance migratory species which inhabits vast terrestrial and marine regions of the Holarctic during the breeding season, and largely global pelagic and coastal waters during non-breeding, is likely exposed to a range of these anthropogenic threats (Figures 2 and 4).

Food availability and environmental change

Understanding the impacts of environmental change and food availability on the population dynamics of Arctic Skuas is complex due to the different ecoregions Arctic Skuas inhabit and the composition and abundance of the wide range of prey species they exploit (De Korte 1972; Furness 1987; Hussell 1972; Løvenskiold 1964; Perkins et al. 2018; Salter et al. 1980; Taylor 1974; Wiley and Lee 2020). Based on a diet study spanning coastal and inland areas of Alaska, Arctic Skuas across inland areas of Canada and Russia may feed predominantly on other birds, including passerines, shorebirds, and the eggs and chicks of waterfowl and shorebirds, as well as small mammals (Maher 1974; Young et al. 2021). In years with an abundance of lemmings, voles, and other small mammals, these can make up the bulk of the diet, although the reliance of Arctic Skuas on mammals is less than that of Long-tailed and Pomarine Skuas which are highly specialised (Maher 1974). In areas of shrubby tundra, the density of Willow Ptarmigan *Lagopus lagopus* may be a determinant of Arctic Skua abundance (Glazov et al. 2021). In coastal populations of the Arctic, Arctic Skuas may directly predate a range of species or may kleptoparasitise other seabirds and waterfowl if these are abundant, or a combination of the two (PAS, personal observation 2025). In the North Atlantic, Arctic Skuas are predominantly kleptoparasites of other seabirds, stealing forage fish (e.g. *Ammodytes*, Clupeidae, Gadidae, and Osmeridae) from auks, gulls, and terns to feed themselves and their offspring throughout the breeding period, sometimes supplemented with terrestrial prey items (Furness 1987; Ruffino et al. 2016). Consequently,

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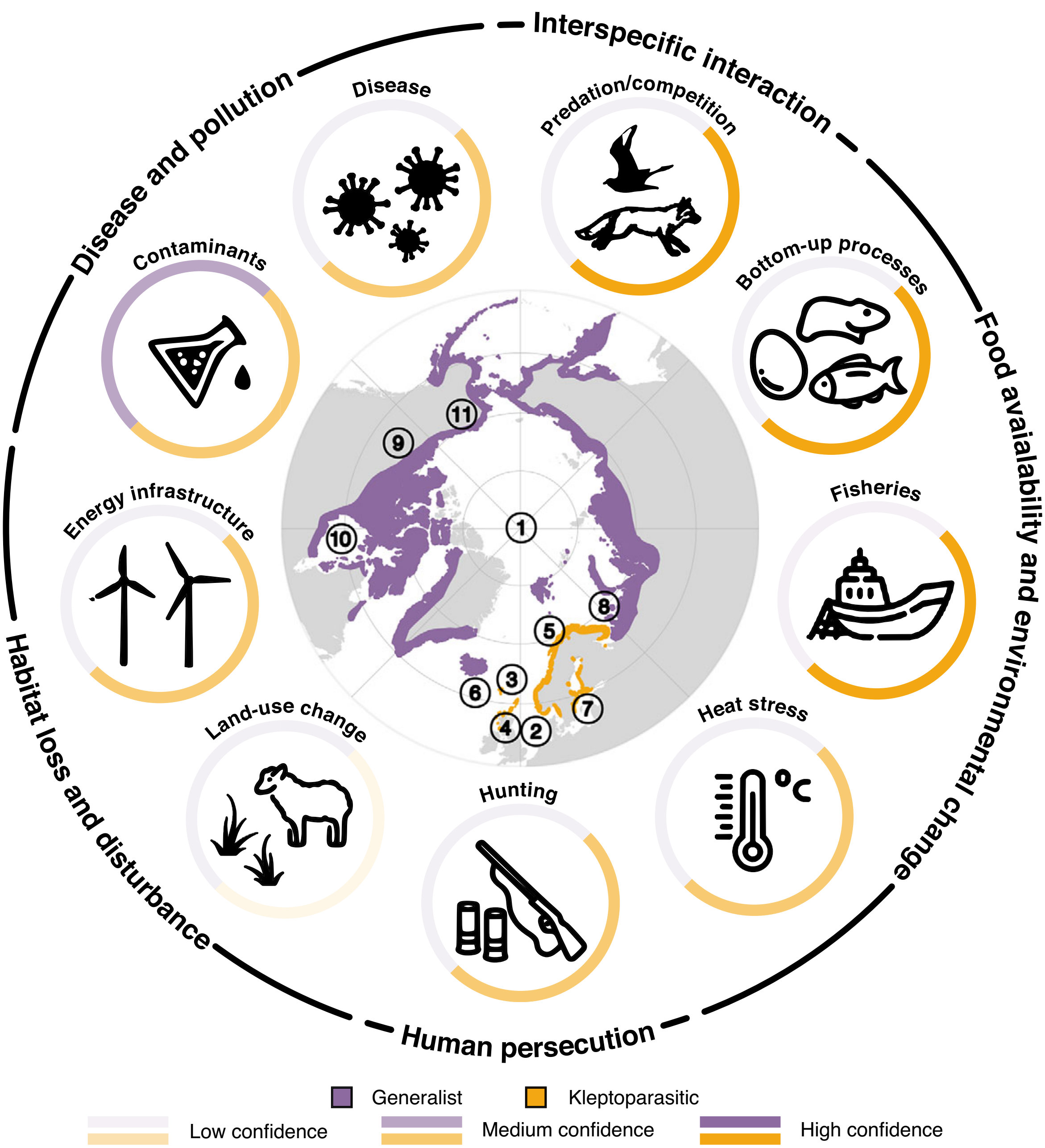

Figure 4. Schematic representation of the range of known and potential anthropogenic threats faced by Arctic Skuas. Ranges of low density, generalist foraging populations (purple) and coastal, largely kleptoparasitic populations (orange) based on the literature herein, are a simplified stratification for visualising purposes (see Introduction). Confidence of threat on population trends has been assigned as follows: High – empirical evidence supporting a driver of Arctic Skua population level processes; Medium – empirical data for a proximate mechanism of population change; Low – expected effect based on studies in similar species, or speculated.
Region of study: [1]Arctic breeding range; [2]North Sea; [3]Faroe Islands; [4]Scotland; [5]Norway and Svalbard; [6]Iceland; [7]Baltic Sea; [8]Russia; [9]Nearctic; [10]Canada; [11]Alaska.
References by region and threat group: Bottom-up processes – Gauthier et al. (2024)[1], Davis et al. (2005)[2], Snell et al. (2025)[3], Ruffino et al. (2016)[5], Glazov et al. (2021)[8]; Maher et al. (1974)[11], Pearce et al. (2022)[11], Smith et al. (2023)[11]; Fisheries and Bottom-up processes – Furness and Tasker (2000)[2], Monaghan (1992)[2], Rindorf et al. (2020)[2], Perkins et al. (2018)[4], Fauchald et al. (2015)[5], van Bemmelen et al. (2021)[5], Skarphéðinsson (2018)[6]; Heat stress – Snell et al. (2024)[3]; Predation/competition – Perkins et al. (2018)[4], Veitch et al. (2019)[4], van Bemmelen et al. (2021)[5], Nordström et al. (2003)[7], Birt and Cairns (1987)[10], Birkhead and Nettleship (1995)[10]; Hunting – Merkel and Barry (2008)[1], Hammer et al. (2014)[3], Priest and Usher (2004)[9]; Land-use change – Furness (1987)[4], Ims and Henden (2012)[5]; Energy infrastructure – Furness et al. (2013)[2]; Disease – Dias et al. (2019)[1], Harvell et al. (2002)[1], Gorta et al. (2024)[1]; Contaminants – Bustnes et al. (2025)[1].

environmental change and resulting shifts in prey availability are likely to have differential effects on specialised marine kleptoparasitic populations and more generalist populations that exploit both terrestrial and marine prey during the breeding season.

The drivers of population change of Arctic Skuas are better understood in the kleptoparasitic populations of the North Atlantic which have been studied over several decades. Here, bottom-up processes relating to changes in the hydroclimatic conditions of the ocean due to global warming, alongside industrial fishing, have impacted the life history and abundance of key forage fish, causing food shortages for seabirds (Furness and Tasker 2000; Krasnov et al. 2025; Monaghan 1992; Perkins et al. 2018; Rindorf et al. 2020). Consequently, substantial declines in key host species such as Arctic Tern *Sterna paradisaea*, Black-legged Kittiwake *Rissa tridactyla*, Common Guillemot *Uria aalge*, Razorbill *Alca torda*, and Atlantic Puffin *Fratercula arctica* throughout much of their North Atlantic breeding range similarly impact Arctic Skua populations as kleptoparasitism opportunities decline with decreasing forage fish and seabird numbers (Fauchald et al. 2015; Krasnov et al. 2025; Perkins et al. 2018; Skarphéðinsson 2018; van Bemmelen et al. 2021). Dwindling marine resources is a primary driver of low breeding success in several European populations of Arctic Skuas, underpinning most observed population declines (Perkins et al. 2018; van Bemmelen et al. 2021).

Little is known about the demographic responses of more generalist populations to potential fluctuations in prey availability in Alaska, Canada, and Russia, which hold most of the breeding population. As the abundance and distribution of tundra-dwelling biota change in response to environmental conditions (Smith et al. 2020; van Beest et al. 2021), populations with different foraging strategies will likely have different outcomes, as has been observed between marine kleptoparasitic populations and more generalist populations (Perkins et al. 2018; Trefry et al. 2010). Even among generalist populations, different trends may be expected given the variability of population trajectories among prey species such as the massive fluctuations in numbers of breeding geese in the Canadian Arctic, declining populations of shorebirds throughout the Nearctic, or stochastic cycles of abundance in small mammals (Gauthier et al. 2024; Lehikoinen et al. 2019; Maher 1974; Pearce et al. 2022; Smith et al. 2023). Cyclic fluctuations in small mammals are a central driver of predator abundance and breeding success in tundra ecosystems, particularly for specialised avian predators (Korpimäki 1994). However, there is growing evidence that environmental change has disrupted these cycles, largely through changes in climatic and vegetation dynamics (Henden et al. 2017; Ims et al. 2008; Kausrud et al. 2008). Whilst Arctic Skuas are not as specialised on small mammals as Pomarine or Long-tailed Skuas (Maher 1974), they may still be affected by reduced abundance or dampened cycles of small mammals in Arctic habitats.

Food availability during the breeding period can have a positive relationship with the inter-annual survival of Arctic Skuas (see supplementary feeding experiments by Davis et al. 2005). In the Faroe Islands, capture-mark-recapture (CMR) survival models indicated long-term declines in the survival of all Arctic Skua age classes, with environmental conditions in their wintering range influencing first-year survival. While the ultimate drivers of this relationship remain unknown, food availability and migratory conditions were speculated to underlie this trend (Snell et al. 2025).

Arctic regions, which hold most of the Arctic Skua breeding distribution, are warming faster than most other areas of the planet (Rantanen et al. 2022), and polar seabirds may have little plasticity to cope with direct and indirect consequences of such warming during the breeding season when they are geographically constrained by incubation, chick rearing, and central-place foraging (Choy et al. 2021; Whelan et al. 2022). Near the southern limit of their breeding range, Arctic Skuas initiated energetically expensive thermoregulatory panting at relatively low air temperatures while incubating (Snell et al. 2024). Heat stress is increasingly reported in other seabirds, including Great Skuas *Stercorarius skua*, and may result in reduced chick guarding or increased time spent bathing, leading to higher predation risk and ultimately lower productivity through egg loss or chick mortality (Lewden et al. 2024; Olin et al. 2024; Oswald et al. 2008). Indirectly, a warming Arctic may trigger changes in snow and rainfall patterns, altering when breeding grounds become available to Arctic Skuas and their prey. Increases in the likelihood of extreme weather events and flooding may cause nest/chick losses, predator–prey mismatches, and increases in thermoregulatory costs for Arctic Skuas (Chmura et al. 2018; Demongin et al. 2010; Descamps et al. 2015). Furthermore, increasing temperatures are leading to the northwards shift of marine and terrestrial species in the Arctic, including Arctic Skua prey species, with potential consequences for the energetics and movements of seabirds such as skuas (Clairbaux et al. 2019; van Beest et al. 2021).

Interspecific interactions

Mortality of Arctic Skua adults, chicks, and eggs due to interspecific competition and predation impact population sizes at regional and local scales. Invasive species pose one of the primary threats for seabirds globally (Phillips et al. 2023), and their removal from offshore islands has proven highly beneficial to breeding seabirds and shorebirds, including Arctic Skuas in the Baltic Sea (Nordström et al. 2003; Veitch et al. 2019). In Scotland, predation or injury of Arctic Skuas by native Great Skuas, which increased rapidly throughout the twentieth and twenty-first centuries, was associated with lower Arctic Skua breeding success (Perkins et al. 2018; Phillips et al. 1998). Great Skuas also indirectly reduce feeding opportunities for Arctic Skuas by predating/kleptoparasiting host species such as Black-legged Kittiwakes and auks, and they outcompete Arctic Skuas from breeding territories due to their larger size and earlier arrival at breeding colonies (Church et al. 2019; Dawson et al. 2011). Consequently, the abundance and breeding success of Arctic Skuas in some colonies is modulated by both the abundance of Great Skuas and availability of forage fish and host seabirds for feeding opportunities (Dawson et al. 2011; Perkins et al. 2018). In Slettnes, Norway, predation of clutches by red foxes *Vulpes vulpes* was a significant driver of breeding outcome, causing almost total breeding failure between 2015 and 2019 (van Bemmelen et al. 2021). The Hjelmsøya colony (Norway) declined from 220 breeding pairs in 2006 to just 10 in 2023 (unpublished data), attributed to declining numbers of Black-legged Kittiwakes (from 40,000 pairs in 1985 to 100 pairs in 2024), which the Arctic Skuas kleptoparasitise (unpublished data). In the Nearctic, it has been suggested that mammalian predators, notably Arctic foxes *Vulpes lagopus* and polar bears *Ursus maritimus*, may drive low densities of Arctic Skua territories at coastal sites where large numbers of potential host seabirds are present (Birt and Cairns 1987; Birkhead and Nettleship 1995; Burke et al. 2011).

Hunting

Hunting and egg harvesting of Arctic Skuas are legal in Iceland, although only carried out to protect breeding Eiders *Somateria mollisima* (Merkel and Barry 2008). In 2025 Arctic Skuas were excluded from legally hunted species in the Faroe Islands (Faroe Islands Law Database 1954). Approximately 17% of all recoveries of ringed Arctic Skuas in the Faroe Islands were shot birds (Hammer et al. 2014), which suggests the number of birds killed was not trivial. Arctic Skuas were shot in numbers in Scotland until the 1950s–1960s, as it was thought they impacted the ability of sheep to graze in productive areas, leading to possible illegal killing in Shetland in the late twentieth century (Furness 1987). Despite the likely elimination of this threat since, over the last 50 years, numbers of breeding birds have continued to decline, suggesting that hunting is no longer a current driver of change in Scotland. In Alaska and Canada, subsistence harvest by indigenous peoples is legal, but the species is protected from harvest by non-indigenous people under Federal legislation. No numerical estimates of indigenous harvest for skuas

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are available (Naves 2018), but a study of wildlife harvest in Canada has no records for skuas, suggesting that they are not targeted, and that harvest is minimal (Priest and Usher 2004). Throughout the circumpolar Arctic, other seabirds such as murres, auklets, sea ducks, and gulls are the primary targets of hunters, whereas the number of skuas killed appears much lower (Merkel and Barry 2008), likely due to Arctic Skuas breeding at low densities and migrating away during the non-breeding period.

Habitat loss and disturbance

The human distribution and breeding Arctic Skua distribution have little overlap as Arctic Skuas occupy vast swathes of tundra and sparsely populated coastlines. However, some populations in Europe have been exposed to land-use changes from sheep farming and increases in human footfall. Human–Arctic Skua conflicts are known to occur in the UK, Faroe Islands, and Iceland, although these tend to be extensions from conflicts of humans with Great Skuas, and have occasionally been perceived to negatively impact sheep farming (see Hunting above; Furness 1987).

The transformation of breeding habitats through agriculture and the introduction of grazing animals has significantly reduced vegetation cover in coastal and mountainous regions (Ims and Henden 2012). Such changes have resulted in disturbed landscapes with reduced biodiversity with negative impacts that also overspill into open habitats with ground-nesting birds (Ims and Henden 2012). While these changes may not directly affect the ability of Arctic Skuas to nest, on-going declines in ground-nesting birds and other skua prey species within coastal and inland Arctic Skua territories may result in reduced feeding opportunities (Lehikoinen et al. 2019). Furthermore, sheep and ungulates may kill Arctic Skua chicks and eggs through disturbance, trampling, and predation (Barton et al. 2025; Furness 1988).

Human infrastructure can cause additional Arctic Skua mortality, particularly of juveniles; lethal collisions with powerlines have been regularly recorded near colonies such as in Slettnes (Norway) and Akraberg (Faroe Islands) where lines have now been removed (Karl-Birger Strann, personal communication; unpublished data Faroe Islands National Museum), and Unst (UK) (David Cooper, personal communication). At sea, the construction of offshore wind farms may result in direct mortality of seabirds through collisions, or they may increase energy expenditure through displacement and "barrier effects" where wind farms block foraging grounds or are placed on commuting routes between foraging and breeding grounds (Drewitt and Langston 2006). While there is limited information about the sensitivity of Arctic Skuas to these developments due to their low at-sea densities and lack of GPS tracking studies, skuas share similar habitats and flight traits to at-risk species such as gulls and may thus be susceptible to the impacts of wind farms (Furness et al. 2013).

In the Arctic, climate-driven reductions in sea ice have consequences for seabird population dynamics due to the change of resting habitats and foraging grounds (Amélineau et al. 2019). Similarly, sea level rise and flooding events due to ice melt are predicted to flood coastal plains and low-lying breeding grounds making them unsuitable for nesting (Haverkamp et al. 2022).

Disease and pollution

Diseases are frequent in wild bird populations but, until recently, only 15 seabird species were considered to be threatened by them, albeit with high mortality rates in many cases (Dias et al. 2019). However, since 2021, a new strain of Highly Pathogenic Avian Influenza (HPAI) H5N1 has spread throughout all continents, killing seabirds at a rate and scale never documented before (Gamarra-Toledo et al. 2023; Lane et al. 2024; Pohlmann et al. 2023). Great Skuas, where they breed in sympatry with Arctic Skuas, were heavily impacted (Camphuysen et al. 2022), but surprisingly, negligible mortality of Arctic Skuas was recorded in these colonies due to HPAI. Arctic Skuas, however, may be susceptible to further strains of avian flu given they are predators and kleptoparasites of many bird species (Furness 1987; Gorta et al. 2024; Maher 1974). Additional diseases and pathogens that impact seabirds at large scales include botulism, caused by the toxin *Clostridium botulinum*, which causes mortality in waterfowl and large gulls that associate with water-bodies or scavenge food that carries the toxin (Ortiz and Smith 1994). Avian cholera is also widespread across seabird species, causing large outbreaks with high mortality. For example, it is one of the primary drivers of population declines of albatrosses and penguins on Amsterdam Island, Southern Indian Ocean, and is found in skua species in the subantarctic (Jaegar et al. 2018). However, no skua mortality has been observed at a long-term study site in Arctic Canada (East Bay, Nunavut), where eiders and gulls have been confirmed to have died from cholera and avian influenza. While there is no published literature on the impacts of disease on Arctic Skuas, diseases affect other skua species in both hemispheres and thus Arctic Skuas may also be susceptible to them. Furthermore, the potential for disease impacts on wild birds and other wildlife is expected to increase with global warming and continued poor practices in aviculture farming (Harvell et al. 2002; Lane et al. 2024).

As apex predators, seabirds are susceptible to the bioaccumulation of chemical pollutants in their tissues that enter the environment through anthropogenic industrial activities (Cherel et al. 2018). Such accumulation may have sublethal consequences for seabird physiology, for example, impacting endocrine function and limiting an individual's ability to carry out reproductive and feeding activities efficiently, reducing breeding success and survival (Mills et al. 2022). Great Skuas, and to some extent Arctic Skuas, have been the focus of several studies involving the measurement of halogenated organic contaminants, heavy metals, plastics, and persistent organic pollutants (Albert et al. 2022; Leat et al. 2019). The accumulation of these compounds in Arctic Skuas is variable according to foraging strategy, breeding grounds, and wintering grounds, with differences in their concentration among individuals and populations (Bustnes et al. 2025). However, few detectable consequences for physiological function that are then translated into consequences for egg hatching success, breeding success, DNA damage or other markers of health have been detected in skua species (Albert et al. 2022; Bourgeon et al. 2012; Haarr et al. 2018; Leat et al. 2019).

Population processes

The drivers of population change described above (some demonstrated, some potential) ultimately impact the survival and breeding success of Arctic Skuas, both of which underpin population dynamics. Arctic Skuas have an extended immature phase, high adult survival rates, and low reproductive outputs (they can fledge up to two chicks per season if conditions are good) (Furness 1987). The estimation of these rates alongside population counts are key to building population models that can predict trends and identify where conservation actions are best placed (Lewison et al. 2012; Schaub and Abadi 2011; Shaffer 2019). However, estimating breeding success and survival is labour intensive, requiring more complex analytical methods based on the monitoring of adequate samples of nesting attempts and the marking/recapture or resighting of individual birds over several years with leg rings/bands for CMR analysis,

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respectively (Horswill et al. 2018). Productivity is often reported for discrete colonies, but it is rare that enough of these are monitored throughout the geographical area of a country to be representative at a national scale. Long-term, representative monitoring of productivity and survival is key when investigating the population dynamics of long-lived species whose productivity and survival respond to environmental stochasticity (Perkins et al. 2018; Snell et al. 2025; van Bemmelen et al. 2021).

In the coastal breeding populations of the UK and the Faroe Islands, the annual breeding success of Arctic Skuas has fluctuated considerably between years: ranging from 0 to 1, and 0.57 chicks per breeding pair, respectively (modelled mean since 1986, UK, and yearly weighted average since 2017, Faroe Islands), with increasingly frequent periods of very poor breeding success (<0.2 chicks per pair) or total failure (Harris et al. 2024; dos Santos 2018). In Slettnes, Norway, where nest survival and, to some extent, breeding success has been monitored since 2014, breeding success was clearly above zero only in 2014, whereas in 2015–2019 (virtually) no chicks fledged in the study area (van Bemmelen et al. 2021). Although there is no national estimate of productivity for Russia, breeding success appears to be recorded at some sites (Soloviev and Tomkovich 2025), but the only reported productivity was from 1983 at Khanovey field station, where productivity was 1.09 (12 clutches) (Ryabitsev and Ryzhanovskiy 2022) and from Kharlov Island in 1991–1995, where monitoring of 21 clutches (39 eggs) showed 15.4% loss and a breeding success of 1.6 chicks per pair (Krasnov et al. 2025). In Alaska, Maher (1970) reported that fledging success ranged from 50% to 75% in 18 nests spread over six years. Overall, monitoring in Arctic regions appears to be very low, probably due to the large effort required to monitor an adequate sample of Arctic Skuas breeding at low densities in difficult-to-access areas.

Few studies have estimated Arctic Skua survival. In Slettnes, Norway, mean annual adult apparent survival was 0.89 (95% CI = 0.84–0.93) between 2014 and 2019, a value considered sufficient to maintain a stable population if productivity exceeded 0.48 females fledged per breeding pair (van Bemmelen et al. 2021). In the UK, average survival of Arctic Skuas on Fair Isle between 1973 and 1975 was 0.88 when not persecuted by local crofters (Furness 1987). On Foula, survival was 0.89 between 1992 and 1999 (Phillips 2001). In the Faroe Islands, there was support for a decline in survival between 1985 and 2008, from 0.93 ± 0.05 to 0.77 ± 0.09 in adults and from 0.60 ± 0.19 to 0.26 ± 0.14 in juveniles (Snell et al. 2025). Reductions in survival are concerning in long-lived species with low reproductive outputs such as skuas, particularly when associated with periods of low breeding success (Sandvik et al. 2005). We were unable to find published estimates of survival from populations in the Nearctic and Russia.

The declines observed in North Atlantic populations due to low breeding success and potentially decreasing annual survival may also be self-driven by positive density-dependence mechanisms. Indeed, in kleptoparasitic colonies of Arctic Skuas, areas of higher nest density showed greater productivity (Phillips et al. 1998; dos Santos 2018). Thus, it is possible that many colonies reached a tipping point, leading to the collapse of the colony due to the limited ability of birds to dissuade or fend off predators, for example.

Knowledge gaps and research priorities

(1) National estimates of population size and trends of Arctic Skuas are critical to assess their global conservation status. Currently, few population counts exist from Russia, and, to some extent Alaska, where large proportions of the breeding population are believed to occur. Here, absolute counts are economically and logistically unfeasible given the vast distribution and low nesting density of Arctic Skuas. A combination of aerial and ground surveys such as those by Bart and Johnston (2012) could provide an index of relative abundance and the possibility to monitor changes in such abundance over large areas in the Arctic if carried out at regular intervals, as is currently being undertaken in parts of the Nearctic. Recent analyses of such data have shown even relatively small changes in population trends can be detected with high confidence despite the large-scale approach to their monitoring (Wilson et al. 2025). Alternatively, comprehensive species distribution models may be used to extrapolate occurrence or density data to total abundance (Elith and Leathwick 2009). Citizen science platforms such as eBird may offer opportunities to monitor changes in Arctic Skua abundance at breeding grounds or during the non-breeding period (Walker and Taylor 2017), although eBird observations are scant in the Arctic. At-sea seabird surveys could also be used, although sample sizes are small given the low densities of Arctic Skuas at sea. Standardised migration counts from seawatching hotspots have already proven useful to estimate changes in bird abundance assuming these represent real changes in population size, as has been used to assess the impacts of HPAI on Great Skuas (Macgregor et al. 2024). Lastly, aerial surveys using drones equipped with thermal imaging cameras may prove useful to detect skua nests and increase monitoring in open habitats, as has been demonstrated for other species in Arctic regions (Frederiksen et al. 2025).

(2) Additional long-term demographic rate data from Arctic Skua populations, particularly breeding success and survival (all age classes), is necessary to build population models and understand the demographic drivers of population change. However, such data are currently collected at very few sites, primarily in the North Atlantic, with no long-term financial support. A larger sample of demographic data representative of populations with different foraging strategies is thus a priority, particularly from Arctic populations where the bulk of the global population breeds and where trends appear to differ from the North Atlantic. These data should be collected using established protocols to allow comparison across regions (e.g. Walsh et al. 1995).

(3) Further foraging ecology studies (diet and behaviour) are required to understand differences in population trends and predict likely impacts of climate change. We reviewed evidence for declines in the kleptoparasitic populations in the North Atlantic but potentially more stable populations in coastal and inland regions in the Arctic. Environmental change is expected to influence these populations differently. While there is some understanding of the foraging ecology of specialised kleptoparasitic populations, less is known about how the diet, foraging behaviour, and specialisation of more generalist populations affect their demography, particularly in the Arctic where environmental change is occurring rapidly. Similarly, data on the general ecology during the non-breeding period are largely lacking.

(4) An understanding of bird movements throughout their annual cycles is critical to assess sensitivity to anthropogenic threats and design conservation and management strategies. The creation of conservation legislation such as the European Union Birds and Habitats Directives, improved fisheries legislation, and the establishment of Marine Protected Areas (MPAs) with enforced management are key for the conservation of Arctic Skuas and other seabirds at their breeding grounds and at sea (Péron et al. 2013). In addition, far-ranging seabirds that undertake trans-oceanic

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migrations often travel beyond protected areas (O'Hanlon et al. 2024). Therefore, management of marine resources and mitigation of anthropogenic threats are required at oceanic scales to protect the habitats Arctic Skuas and other seabirds use year-round and limit direct mortality from anthropogenic activities (Oppel et al. 2018; Yorio 2009). Informing such conservation actions requires a better understanding of the foraging ecology and migratory movements of all age classes of Arctic Skuas throughout the full annual cycle, as migratory flyways have only been revealed for a portion of the breeding populations/range using telemetry data (Harrison et al. 2021; O'Hanlon et al. 2024; van Bemmelen et al. 2024). Migratory connectivity has not yet been studied for populations that spend the non-breeding period in the Indian and Pacific Oceans. Furthermore, all Arctic Skuas spend the non-breeding period at sea, and thus their foraging behaviour will differ to when breeding inland. As the non-breeding period modulates their survival (Snell et al. 2025), identifying the areas and habitats Arctic Skuas use for feeding during migration and wintering, their diet, and the threats they face during this time is key to building a global picture of drivers of population change and informing conservation actions beyond their breeding grounds.

Conclusions

As a result of this exercise, we estimated that the minimum global breeding population of Arctic Skua comprises 185,131–395,315 breeding pairs across Alaska, Canada, Greenland, and Europe, whilst Asian Russia could potentially hold an estimated further 40,000–600,000 breeding pairs. While national population estimates (with varying levels of uncertainty) are now available for most countries where Arctic Skuas breed, virtually no information exists on the population of Arctic Skuas breeding in Asian Russia, which likely holds a large proportion of the global population, perhaps at a similar or larger scale to Canada.

We found that the high-density populations of the North Atlantic that specialise on stealing fish from other seabirds during the breeding period have undergone steep declines in recent decades. However, there is evidence that more generalist populations with a wider prey base, typical of Arctic regions, are currently a stronghold for this species in the Nearctic and other Arctic areas, albeit information about population trends in these regions is scarce. The current limited evidence about population trends beyond the North Atlantic hampers our ability to adequately assess the conservation status of the Arctic Skua at a global scale; considering the species as Data Deficient at a global scale may therefore be more appropriate than Least Concern. Given the variable foraging traits exhibited by Arctic Skuas throughout their breeding range, which may condition their population trend, understanding their ecology and demography beyond the North Atlantic, covering coastal and inland regions of the Arctic, is a priority. This information is key to building a global picture of the drivers of population trends and helping to assess their sensitivity to environmental change and other anthropogenic threats which currently impact the species' strongholds.

The Arctic Skua is one example among many species that share traits which make them challenging to monitor at a global scale: (1) they have large geographical breeding and non-breeding ranges coupled with long-distance migrations; (2) they occur in economically and logistically difficult-to-access regions, leading to deficient abundance and demographic data; (3) they may exhibit variable foraging ecologies due to occupying highly disparate regions. Species- and region-specific data are required in a conservation context to assess the status of populations, and to monitor changes in response to threats or conservation actions. Thus, approaches to species monitoring that account for the shortcomings highlighted for Arctic Skuas in this study would significantly improve our baseline knowledge of Arctic Skuas and many other circumpolar species with similar traits.

Kleptoparasitic Arctic Skuas are inextricably linked to the ecology of their host species, while Arctic Skuas that directly predate on songbirds, and seabird eggs and chicks, may contribute to regulating their prey species. Therefore, in addition to the intrinsic importance of Arctic Skuas as a species in its own right, its wider study can be leveraged as a powerful indicator of change in seabird assemblages, marine food webs, and terrestrial and marine environments throughout their range.

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