Seabirds in the North-East Atlantic

Climate Change Vulnerability and Potential Conservation Actions

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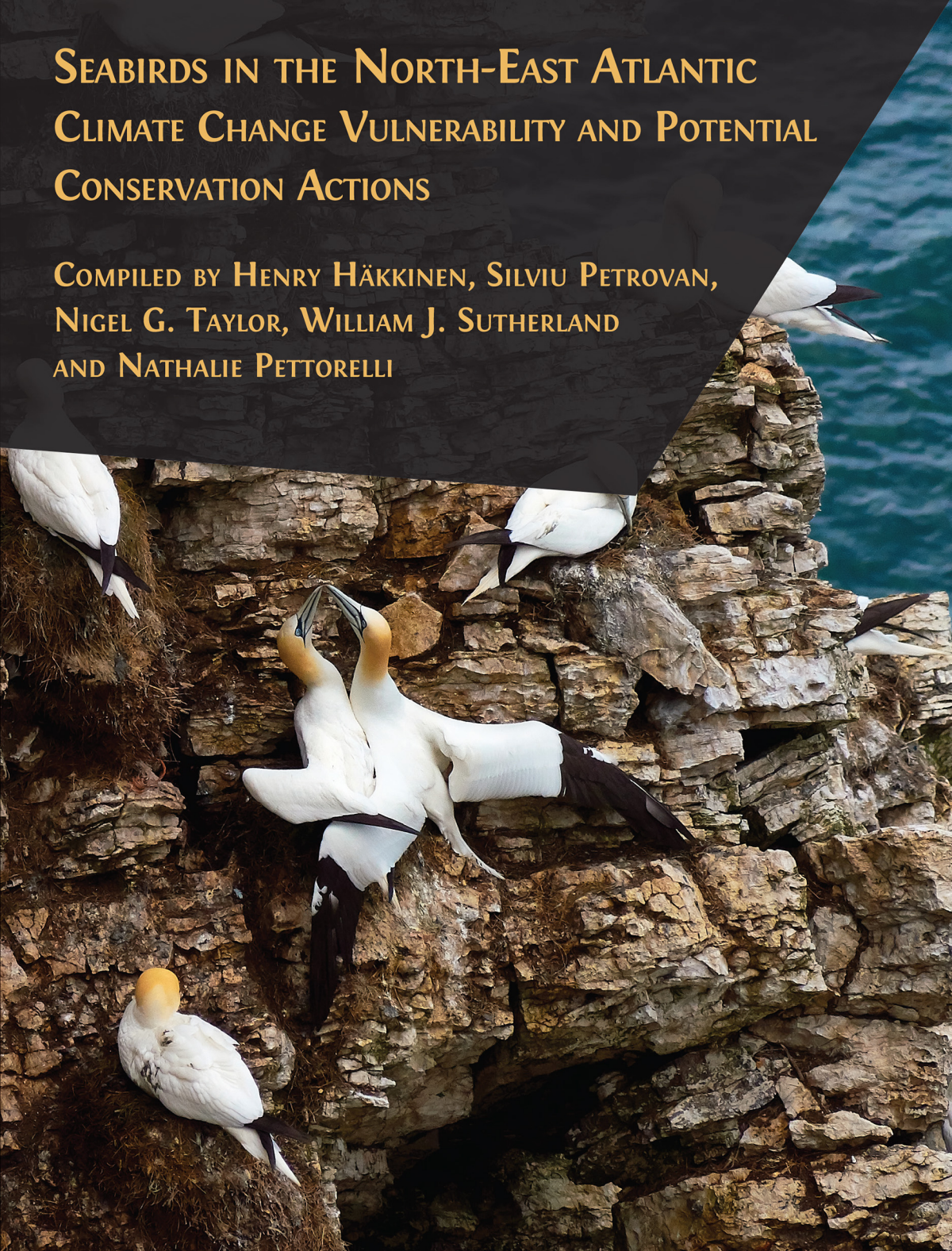

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Skuas

(Stercorariidae)

An assessment of climate change vulnerability and potential conservation actions for skuas in the North-East Atlantic

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1 Great Skua (*Catharacta skua*)

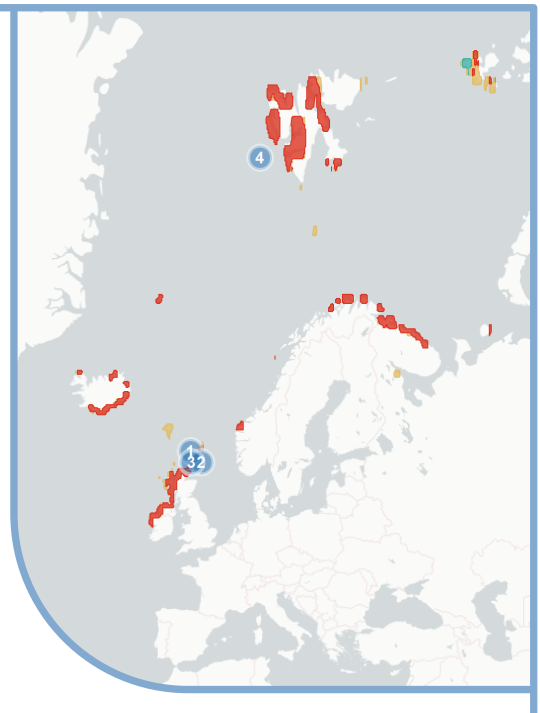
1.1 Evidence for exposure

1.1.1 Potential changes in breeding habitat suitability (by 2100):

Current breeding area that is likely to become less suitable (78% of current range).

Current breeding area that is likely to remain suitable (19%).

Current breeding area that is likely to become more suitable (3%).



1.1.2 Current impacts attributed to climate change:

1 **Negative Impact:** Hotter summers result in increased heat stress in adults and chicks. Adults more frequently leave nests unattended to thermoregulate, which exacerbates chick heat stress.

2 **Negative Impact:** In hotter summers, adults more frequently leave nests unattended due to prey shortages and to thermoregulate, which results in higher chick mortality due to predation.

3 **Negative Impact:** Changes in prey availability during the breeding season have led to decreased fledgling success.

4 **Positive Impact:** Changes in prey availability have led to increased population size.

1.1.3 Predicted changes in key prey species:

No key prey species are predicted to decline for this species.

1.2 Sensitivity

- Skuas are sensitive to high temperatures, and their southern range limit is likely defined by maximum temperature. Climate change is likely to make the southernmost populations unviable in the future.
- Parasitism and predation of seabirds is an important part of skua diets, and climate change may heavily impact their prey species. In addition, they often cannibalise their neighbours, and this behaviour may increase as alternative prey becomes scarce.
- This species has a long generation length (>10 years), which may slow recovery from severe impacts and increases population extinction risk.

1.3 Adaptive capacity

- Great skuas have very varied diets and foraging strategies and will change their diet depending on availability. This flexibility may mean skuas can mitigate the impact of losing key prey species.
- Great skuas are able to establish and colonise new areas, and have already done so at the northern edge of their range. They may be able to shift their range in response to climate change.

Arctic jaeger © Seppo Häkkinen

2 Long-tailed Jaeger

(*Stercorarius longicaudus*)

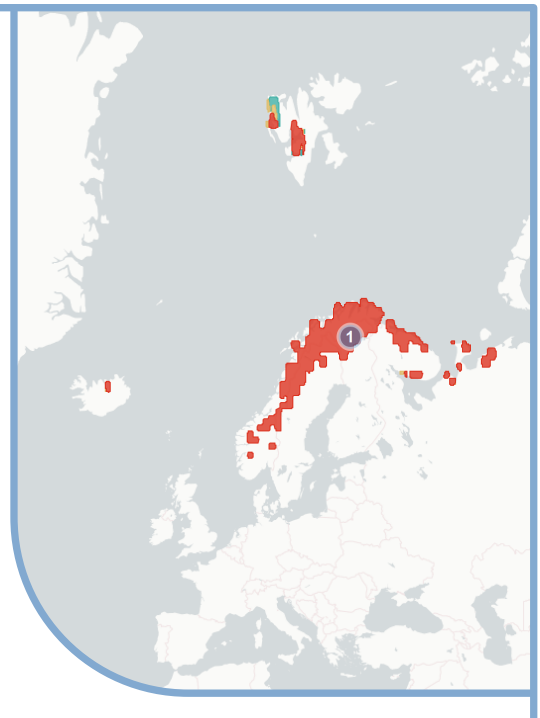
1.1 Evidence for exposure

1.1.1 Potential changes in breeding habitat suitability (by 2100):

Current breeding area that is likely to become less suitable (95% of current range).

Current breeding area that is likely to remain suitable (3%).

Current breeding area that is likely to become more suitable (2%).



1.1.2 Current impacts attributed to climate change:

1 Negative Impact: Southern populations are becoming less populous or going extinct in correlation with rising temperatures. Exact mechanism unknown, probably related to prey availability or heat stress.

1.1.3 Predicted changes in key prey species:

No key prey assessment was carried out for this species.

1.1.4 Climate change impacts outside of Europe:

Long-tailed jaegers have been heavily affected by climate change in Greenland, in particular due to lack of prey and increased predation due to other species prey-switching.

1.2 Sensitivity

- During the breeding season jaegers are heavily reliant on a few species of lemmings and voles, and any impact to these species is likely to heavily affect skua breeding success.
- Long-tailed jaeger populations are highly concentrated in the non-breeding season. >50% of global population congregate during migration in a relatively small area of the central Atlantic. Any negative change to this area is likely to have severe consequences on skua populations.
- Long-tailed jaeger chicks are highly vulnerable to predation by Arctic and red foxes (leading to up to 100% mortality in some years). Any changes in fox abundance (either negative or positive) may have severe impacts on long-tailed jaeger populations.

1.3 Adaptive capacity

- Jaegers are very site-tenacious so any response to change is likely to be very slow, and range shifts in the short term are very unlikely.
- Long-tailed jaegers will skip breeding in years with poor prey availability, which may be adaptive and maximises breeding output over time and help them cope with climate change. Long-tailed jaegers are long-lived and several years of breeding failure or skipped breeding may not have a long-term impact on the population if populations are able to breed successfully in good years.

Arctic jaeger © Seppo Häkkinen

3 Arctic Jaeger (*Stercorarius parasiticus*)

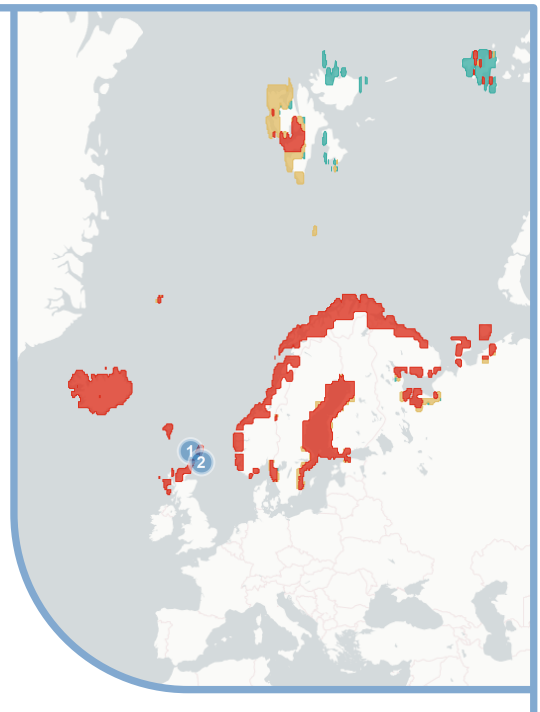
1.1 Evidence for exposure

1.1.1 Potential changes in breeding habitat suitability (by 2100):

Current breeding area that is likely to become less suitable (81% of current range).

Current breeding area that is likely to remain suitable (13%).

Current breeding area that is likely to become more suitable (6%).



1.1.2 Current impacts attributed to climate change:

1 **Negative Impact:** Changes in prey availability have led to declines in key seabird species that Arctic jaegers parasitise, thus leading to population declines.

2 **Negative Impact:** Increased competition and predation from great skuas, due to an increasing population size and prey swapping.

1.1.3 Predicted changes in key prey species:

No key prey assessment was carried out for this species.

1.2 Sensitivity

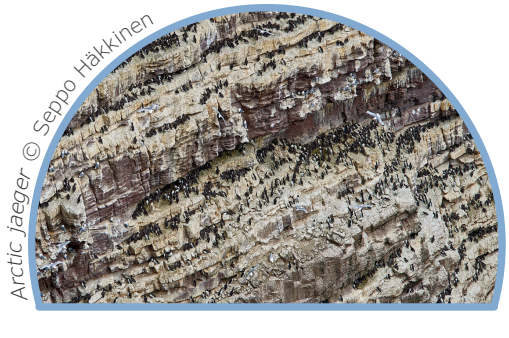
- While Arctic jaegers parasitise a number of seabird species, the breeding success of many populations is closely linked the abundance of key fish species. Severe decreases in Arctic jaeger populations have been linked to prey declines,

and changes in fish distributions due to climate change are likely to have heavy impacts on populations.

- Arctic jaeger populations are sensitive to predation, and several colonies have declined due to increased predation by great skuas and red foxes. Changes in predator abundance or range due to climate change (e.g. the expansion of red foxes in Scandinavia) are likely to have impacts on jaeger populations. In addition, jaeger skuas use co-operative defence which becomes less effective in smaller populations. This may result in a feedback loop where greater predation decreases population size, increasing vulnerability to predation.
- This species has a long generation length (>10 years), which may slow recovery from severe impacts and increases population extinction risk.

1.3 Adaptive capacity

- In most parts of their range Arctic jaegers are a numerous, long-lived, ecologically flexible species, so are likely to be robust to change.
- In some areas, particularly near major seabird colonies, Arctic jaegers have a quite restricted diet based on kleptoparasitism. However in many areas across their range they have a very varied diet, and will feed on the most available food, including birds, eggs, rodents, insects, fish, berries and carrion. This plasticity is likely to increase resilience to climate change, but variably across populations.
- There is considerable variation in migration route and wintering sites in Arctic jaegers, even within a single colony. This will likely provide a buffer to climate change, as changes to any one wintering site are less likely to affect the population as a whole.



Arctic jaeger © Seppo Häkkinen

Potential actions in response to climate change: Skuas (Stercorariidae)

In this section we list and assess possible local conservation actions that could be carried out in response to identified climate change impacts. This section is not grouped by species, but by identified impacts. If an impact or action is specific to one or a few species, this information is included in the action summary or in the footnotes. Effectiveness, relevance, strength and transparency scores are based on the available evidence we collated (see Appendix 2), and therefore all statements regarding limited or a lack of evidence relate to the collated evidence base, and does not infer that no such studies exist.

1 Impact: Increase in avian predation

Summary:
There are a number of available local actions to prevent or mitigate avian predation, some of which have been trialled extensively in seabirds with positive results. Other actions are poorly understood, but could be considered after more investigation. If predation is severe, and is likely to increase due to climate change or species range shifts, then translocation could be considered.

Intervention	Evidence of Effectiveness	R	S	T
Artificial shelters to make nests less visible to aerial predators	This is a hypothetical action. We found no published studies assessing this action's effectiveness for seabirds.	NA	NA	NA
Manage/ eradicate avian predators	Has been trialled with some success on several seabird groups, though has never been trialled for skua conservation. Often carried out as part of a suite of conservation actions, so difficult to assess how effective management is.	2	4	4

Physically protect nests with barriers or enclosures	Has been trialled on many seabird groups, often with notable success. Currently no reports on its effectiveness for skua conservation. A relatively easy, inexpensive method, but dependent on being able to access nest-sites and effectively protect them. As some skuas nest in very low densities across large areas of tundra, its practicality may be questionable.	2	4	4
Reduce predation by translocating predators	Few trials on seabirds, and none for skua conservation. Existing evidence suggests this action can be beneficial and reduce egg/chick predation, and could be a viable action if other forms of predator management are not viable.	1	4	3
Repel predators with acoustic, chemical or visual deterrents	This is a hypothetical action. We found no published studies assessing this action's effectiveness for seabirds.	NA	NA	NA
Use supplementary feeding to reduce predation	Very few trials on seabirds, and none for skua conservation. Likely to be very labour intensive and difficult given the remote and inaccessible breeding colonies of many skuas. More work is needed to examine action's effectiveness on seabirds.	1	4	3

Green = Likely to be beneficial. Red = Unlikely to be beneficial, may have negative impact. Orange = contradicting or uncertain evidence. Grey = Limited evidence.
R = relevance rating. S = strength rating. T = transparency rating. All ratings on a scale of 1 to 5, where 5 is the highest.

Details:

Manage/eradicate avian predators
Relevance (R): 0 studies in the evidence base focus on skuas, 14 on other seabirds

and 2 on other birds. **Strength (S):** The evidence base was comprised of 16 studies. Of these 15 were considered to have a good sample size, and 5 had a clear metric for effectiveness. **Transparency (T):** 16 studies included were published and peer-reviewed, of which 1 were literature reviews or meta-analyses, 0 were from the grey literature, and 0 were anecdotal. Of the studies included, 9 had a published methodology, and 11 justified their rationale.

Physically protect nests with barriers or enclosures
Relevance (R): 0 studies in the evidence base focus on skuas, 12 on other seabirds and 6 on other birds. **Strength (S):** The evidence base was comprised of 18 studies. Of these 16 were considered to have a good sample size, and 12 had a clear metric for effectiveness. **Transparency (T):** 17 studies included were published and peer-reviewed, 0 were from the grey literature, and 0 were anecdotal. Of the studies included, 11 had a published methodology, and 12 justified their rationale.

Reduce predation by translocating predators
Relevance (R): 0 studies in the evidence base focus on skuas, 2 on other seabirds and 2 on other birds. **Strength (S):** The evidence base was comprised of 4 studies. Of these 4 were considered to have a good sample size, and 3 had a clear metric for effectiveness. **Transparency (T):** 4 studies included were published and peer-reviewed, 0 were from the grey literature, and 0 were anecdotal. Of the studies included, 2 had a published methodology, and 3 justified their rationale.

Use supplementary feeding to reduce predation
Relevance (R): 0 studies in the evidence base focus on skuas, 1 on other seabirds and 3 on other birds. **Strength (S):** The evidence base was comprised of 4 studies. Of these 4 were considered to have a good sample size, and 4 had a clear metric for effectiveness. **Transparency (T):** 4 studies included were published and peer-reviewed, 0 were from the grey literature, and 0 were anecdotal. Of the studies included, 1 had a published methodology, and 4 justified their rationale.

2 Impact: Increase in competition

Summary:
Local actions to prevent or mitigate the effects of competition are not well understood, and their effectiveness is unclear. In many contexts they are likely to be difficult or impossible to carry out on large populations. Supporting populations more generally (increasing adult survival, limiting chick mortality) may be a more appropriate strategy.

Intervention	Evidence of Effectiveness	R	S	T
Protect nest sites from competitors	Only trialled on one population of petrels (with limited success), all other examples focus on non-seabird species (many of which were successful). More work is needed to examine action's effectiveness on seabirds.	1	3	2
Reduce competition by removing competitor species	Trialled extensively on terns, but limited trials for other seabird groups, and none for skua conservation. Success is mixed, some trials have found benefits, but many have reported no effect or even negative consequences of this action.	2	3	3
Use supplementary feeding to reduce competition	This is a hypothetical action. We found no published studies assessing this action's effectiveness for seabirds.	NA	NA	NA

Green = Likely to be beneficial. Red = Unlikely to be beneficial, may have negative impact.
Orange = contradicting or uncertain evidence. Grey = Limited evidence.
R = relevance rating. S = strength rating. T = transparency rating. All ratings on a scale of 1 to 5, where 5 is the highest.

Details:

Protect nest sites from competitors

Relevance (R): 0 studies in the evidence base focus on skuas, 2 on other seabirds and 5 on other birds. **Strength (S):** The evidence base was comprised of 7 studies. Of these 5 were considered to have a good sample size, and 2 had a clear metric for effectiveness. T**ransparency (T):** 6 studies included were published and peer-reviewed, 0 were from the grey literature, and 0 were anecdotal. Of the studies included, 3 had a published methodology, and 4 justified their rationale.

Reduce competition by removing competitor species

Relevance (R): 0 studies in the evidence base focus on skuas, 12 on other seabirds and 0 on other birds. **Strength (S):** The evidence base was comprised of 12 studies. Of these 10 were considered to have a good sample size, and 5 had a clear metric for effectiveness. **Transparency (T):** 12 studies included were published and peer-reviewed, 0 were from the grey literature, and 0 were anecdotal. Of the studies included, 8 had a published methodology, and 7 justified their rationale.

3 Impact: Increased thermal stress

Summary:
There are currently no well-researched methods to directly assist seabirds with thermal stress, and more information is needed on how thermal stress can impact seabirds and how local conservation action can mitigate these impacts. If thermal stress becomes so common or extreme that it threatens the viability of a population, then several actions are available to encourage translocation of populations to safer areas.

Intervention	Evidence of Effectiveness	R	S	T
Make new colonies more attractive to encourage birds to colonise	Has been tried extensively on many different seabird groups with frequent, though not universal, success. However, currently there are no reports on this action's effectiveness for skuas.	3	4	3
Provide additional resources to help seabirds thermoregulate (e.g. artificial pools)	This is a hypothetical action. We found no published studies assessing this action's effectiveness for seabirds.	NA	NA	NA
Provide additional shelter or protection from extreme weather (heatwaves)	Very limited number of trials in seabirds, some limited benefits found for providing additional shelter from the sun for cormorants. More work is needed to examine action's effectiveness on seabirds.	2	3	3
Translocate the population to a more suitable breeding area	Known to be beneficial in some seabird groups, but no recorded trials in skuas. Skuas tend to have extremely high territoriality and site-fidelity so translocation of adults is likely to be extremely difficult, if not impossible. Whether translocation is plausible, or beneficial, to skuas is currently unknown and further research is needed.	3	4	4

Green = Likely to be beneficial. Red = Unlikely to be beneficial, may have negative impact. Orange = contradicting or uncertain evidence. Grey = Limited evidence.
R = relevance rating. S = strength rating. T = transparency rating. All ratings on a scale of 1 to 5, where 5 is the highest.

Details:

Make new colonies more attractive to encourage birds to colonise
Relevance (R): 0 studies in the evidence base focus on skuas, 38 on other seabirds and 6 on other birds. **Strength (S):** The evidence base was comprised of 44 studies. Of these 31 were considered to have a good sample size, and 18 had a clear metric for effectiveness. **Transparency (T):** 44 studies included were published and peer-reviewed, of which 1 were literature reviews or meta-analyses, 0 were from the grey literature, and 0 were anecdotal. Of the studies included, 30 had a published methodology, and 22 justified their rationale.

Provide additional shelter or protection from extreme weather (heatwaves)
Relevance (R): 0 studies in the evidence base focus on skuas, 1 on other seabirds and 0 on other birds. **Strength (S):** The evidence base was comprised of 1 study. Of these 1 was considered to have a good sample size, and 1 had a clear metric for effectiveness. **Transparency (T):** 1 study included were published and peer-reviewed, 0 were from the grey literature, and 0 were anecdotal. Of the studies included, 0 had a published methodology, and 1 justified their rationale.

Translocate the population to a more suitable breeding area
Relevance (R): 0 studies in the evidence base focus on skuas, 15 on other seabirds and 0 on other birds. **Strength (S):** The evidence base was comprised of 15 studies. Of these 13 were considered to have a good sample size, and 9 had a clear metric for effectiveness. **Transparency (T):** 14 studies included were published and peer-reviewed, of which 1 were literature reviews or meta-analyses, 0 were from the grey literature, and 0 were anecdotal. Of the studies included, 11 had a published methodology, and 9 justified their rationale.

4 Impact: Reduced prey availability during breeding season

Summary:
Several local actions may assist breeding populations on a small scale, but direct intervention on a large scale is likely to be extremely difficult. General conservation actions to protect fish stocks and local marine areas may be the most effective method. If a population is likely to suffer major losses, even with conservation help, then translocations could be considered.

Intervention	Evidence of Effectiveness	R	S	T
Artificially incubate or hand-rear chicks to support population	Known to be effective for some seabirds, though labour intensive and usually only appropriate for small populations. To our knowledge, there are no examples of skuas being hand-reared successfully, though there are reports of previous ex-situ populations.	2	2	1
Make new colonies more attractive to encourage birds to colonise	Has been tried extensively on many different seabird groups with frequent, though not universal, success. However, currently there are no reports on this action's effectiveness for skuas.	2	4	3
Provide supplementary food during the breeding season	Trialled on several seabird species, with some, though not universal, success. Trialled on only one population of skuas, which found little benefit. Typically very labour intensive and difficult given the remote and inaccessible breeding colonies of many skuas. Probably only plausible for small populations.	3	4	3
Translocate the population to a more suitable breeding area	Known to be beneficial in some seabird groups, but no recorded trials in skuas. Skuas tend to have extremely high territoriality and site-fidelity so translocation of adults is likely to be extremely difficult, if not impossible. Whether translocation is plausible, or beneficial, to skuas is currently unknown and further research is needed.	2	4	4

Green = Likely to be beneficial. Red = Unlikely to be beneficial, may have negative impact. Orange = contradicting or uncertain evidence. Grey = Limited evidence.
R = relevance rating. **S** = strength rating. **T** = transparency rating. All ratings on a scale of 1 to 5, where 5 is the highest.

Details:

Artificially incubate or hand-rear chicks to support population
Relevance (R): 0 studies in the evidence base focus on skuas, 40 on other seabirds and 0 on other birds. **Strength (S):** The evidence base was comprised of 40 studies. Of these 9 were considered to have a good sample size, and 19 had a clear metric for effectiveness. **Transparency (T)**: 26 studies included were published and peer-reviewed, 0 were from the grey literature, and 0 were anecdotal. Of the studies included, 17 had a published methodology, and 4 justified their rationale.

Make new colonies more attractive to encourage birds to colonise
Relevance (R): 0 studies in the evidence base focus on skuas, 38 on other seabirds and 6 on other birds. **Strength (S):** The evidence base was comprised of 44 studies. Of these 31 were considered to have a good sample size, and 18 had a clear metric for effectiveness. **Transparency (T):** 44 studies included were published and peer-reviewed, of which 1 were literature reviews or meta-analyses, 0 were from the grey literature, and 0 were anecdotal. Of the studies included, 30 had a published methodology, and 22 justified their rationale.

Provide supplementary food during the breeding season
Relevance (R): 2 studies in the evidence base focus on skuas, 14 on other seabirds and 0 on other birds. **Strength (S):** The evidence base was comprised of 16 studies. Of these 10 were considered to have a good sample size, and 14 had a clear metric for effectiveness. **Transparency (T):** 16 studies included were published and peer-reviewed, 0 were from the grey literature, and 0 were anecdotal. Of the studies included, 13 had a published methodology, and 4 justified their rationale.

Translocate the population to a more suitable breeding area
Relevance (R): 0 studies in the evidence base focus on skuas, 15 on other seabirds and 0 on other birds. **Strength (S):** The evidence base was comprised of 15 studies. Of these 13 were considered to have a good sample size, and 9 had a clear metric for effectiveness. **Transparency (T):** 14 studies included were published and peer-reviewed, of which 1 were literature reviews or meta-analyses, 0 were from the grey literature, and 0 were anecdotal. Of the studies included, 11 had a published methodology, and 9 justified their rationale.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