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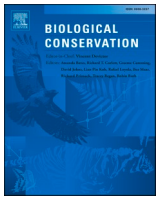

The Antarctic Specially Protected Species conservation management tool: Development, use and future outlook

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ABSTRACT

Protection of specific species, generally through the implementation of an associated action plan, is a conservation tool used commonly in areas under national jurisdiction. The Antarctic Treaty area is under international consensus-based governance through the Antarctic Treaty Consultative Meeting (ATCM), which first provided for the designation of Antarctic Specially Protected Species (SPS) in 1964. Over the past 60 years, only the fur seals (genus *Arctocephalus*) and Ross seal (*Ommatophoca rossii*) have been listed as SPS, with the fur seals subsequently having been de-listed in 2006. The SPS conservation tool has therefore remained little used by the ATCM. The Committee for Environmental Protection (CEP) was established to provide advice on environmental issues to the ATCM. Through its Five-year Work Plan and Climate Change Response Work Programme, the CEP agreed to develop management actions to maintain or improve the conservation status of threatened species, e.g., through SPS Action Plans. To help the CEP in its work, we examined the history of SPS designation under the Antarctic Treaty system, considered the current conservation status of Antarctic species as provided in the IUCN Red List of Threatened Species and considered how the SPS conservation tool might be utilised in the future to safeguard Antarctic biodiversity. Consideration of SPS designation for the macaroni penguin *Eudyptes chrysolophus* population within the Antarctic Treaty area might be appropriate. However, the emperor penguin *Aptenodytes forsteri* should remain a priority for SPS designation in order to minimise further anthropogenic pressures on this climate change-vulnerable species.

1. Introduction

Globally, biodiversity is under increasing pressure from both direct and indirect human impacts (Pimm et al., 2014; Tilman et al., 2017; IPCC, 2023). Antarctic biodiversity too is vulnerable to anthropogenic impacts including damage or destruction of marine, terrestrial and freshwater habitat, displacement of wildlife, pollution and the introduction of invasive species (Tin et al., 2009; Aronson et al., 2011; McCarthy et al., 2019; Hughes et al., 2020). Antarctic birdlife, in particular, has been impacted by incidental mortality (bycatch) in fisheries (Phillips et al., 2024), while many Antarctic whale species have yet to recover from historic whaling activities (Leaper and Miller, 2011). Within terrestrial environments, human footprint continues to expand. Construction of research facilities and increasing tourist visitation, particularly at coastal locations, continues to impact wildlife populations and terrestrial communities (Pertierra et al., 2017; Brooks et al., 2019, 2024; Leihy et al., 2020). Recently, Walshaw et al. (2024) reported that as little as 44.2 km^2 of green vegetation is present across the whole of Antarctica, highlighting the scarcity of these communities and the vulnerability of their constituent species to the impact of increasing human activities.

Some countries afford protection to individual species through national or regional legislation, e.g., the U.S. Endangered Species Act (1973), the Bern Convention on the Conservation of European Wildlife and Natural Habitats (1979), and the European Union Birds Directive (1979) (Directive 2009/147/EC). The Antarctic Treaty area (the area south of latitude 60°S; Fig. 1) is governed through consensus-based decision-making by the 29 Consultative Parties to the Antarctic Treaty

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at the now annual Antarctic Treaty Consultative Meeting (ATCM). All Antarctic species are afforded protection through the Protocol on Environmental Protection to the Antarctic Treaty (agreed in 1991; entered into force 1998) (ATCM, 1991a; Hughes et al., 2023). Article 3.2 of the Protocol states that activities to be undertaken in Antarctica shall be planned and conducted so as to avoid '*detrimental changes in the distribution, abundance or productivity of species or populations of species of fauna and flora*' and '*further jeopardy to endangered or threatened species or populations of such species*' Through the designation of an Antarctic Specially Protected Area (ASPA) (Annex V to the Protocol), higher level protection can be afforded to specific habitats, including representative examples of terrestrial and marine ecosystems, areas with important or unusual assemblages of species, including major colonies of breeding native birds or mammals, and the type locality or only known habitat of any species. However, the existing network of ASPAs has been subject to criticism including its description as 'unrepresentative' and 'inadequate' with regard to the protection of Antarctic biodiversity (Shaw et al., 2014).

As a further mechanism for species protection, the Antarctic Specially Protected Species (SPS) conservation tool was established 60 years ago in 1964; however, its use has been limited, with only one species, the Ross seal (*Ommatophoca rossi*), currently subject to special protection. The Committee for Environmental Protection (CEP) was established to provide advice to the ATCM on the implementation of the Protocol. Recognizing the opportunity to progress species protection, that ATCM recently agreed the revised CEP Five-year Work Plan (5YWP), which included the issue 'Increasing the understanding of Biodiversity knowledge' and the action to 'Consider the conservation

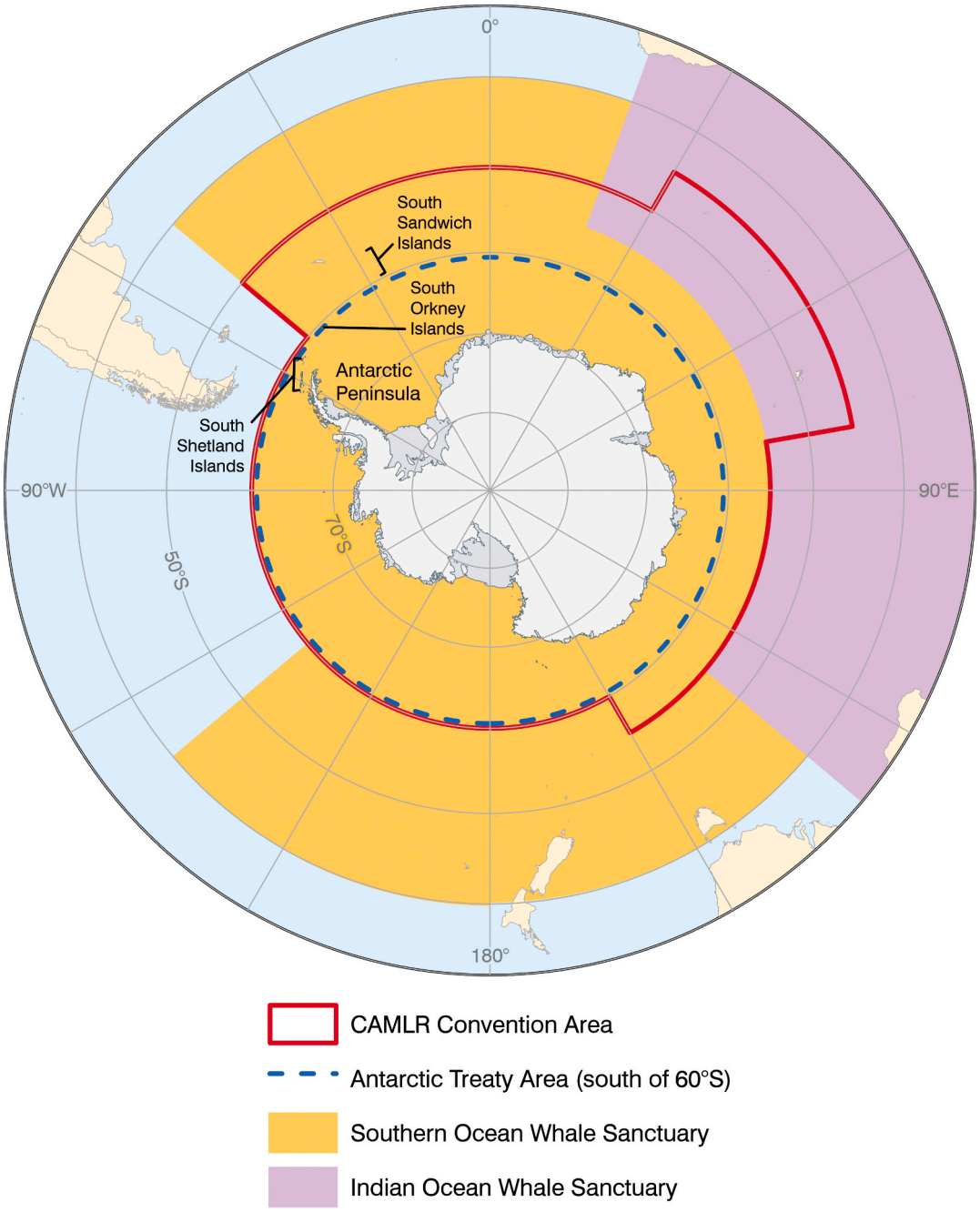


Fig. 1. Map of Antarctica and the Southern Ocean showing the Antarctic Treaty area, CAMLR Convention area, the IWC Southern Ocean Whale Sanctuary and the southern extent of the Indian Ocean Whale Sanctuary.

status of Antarctic species at risk due to climate change' (ATS, 2024). Furthermore, the CEP Climate Change Response Work Programme (CCRWP) includes the topic 'Marine and terrestrial species at risk due to climate change', with identified gaps/needs listed as: (i) understand population status, trends, vulnerability and distribution of key Antarctic species; (ii) improve understanding of effect of climate on species at risk, including critical thresholds that would give irreversible impacts; (iii) develop a framework for monitoring to ensure the effects on key species are identified; and (iv) understand the relationship between species and climate change impacts in important locations/areas (ATS, 2024). Leading on from these gaps/needs, the identified management actions include:

- encouraging policymakers to consider if and how the IUCN Red List criteria can be applied on a regional basis for the Antarctic in the context of climate change;
- the commencement of a rolling programme of status assessments for Antarctic species focusing particularly on those species not currently assessed in the IUCN Red List;
- the review and revision, where necessary, of existing management tools, to consider if they afford the best practical adaptation measures to species at risk of climate change; and
- where necessary, the development of management actions to maintain or improve the conservation status of species threatened by climate change, e.g., through SPS Action Plans.

The academic literature includes many studies that investigate the development and effectiveness of some of the existing Antarctic conservation tools, including designation of Antarctic Specially Protected Areas (Coetzee et al., 2017; Hughes and Grant, 2017, 2018; Hughes et al., 2021; Phillips et al., 2022; Hawes et al., 2023; Roura, 2023), Antarctic Specially Managed Areas (ASMAs) (Yue-Ting et al., 2010; Roura et al., 2018; McGee et al., 2020) and marine protected areas (Brooks, 2013; Brooks et al., 2021; Cordonnery et al., 2015; Smith et al., 2016; Sylvester and Brooks, 2020; Teschke et al., 2021). However, little or no assessment of the Antarctic SPS conservation tool has been undertaken, despite the importance of species protection as communicated in the CEP 5YWP and CCRWP.

In response to the calls of Antarctic policymakers to advance work on the protection of species at risk, here we (1) examine the use of the Antarctic SPS conservation tool over the past six decades, and (2) consider which species might be potential candidates for SPS designation under existing CEP guidance.

2. Methods

2.1. Development and use of the Antarctic Specially Protected Species conservation tool

We undertook a review of available information concerning the development and use of the Antarctic SPS conservation tool. Information was obtained from the academic literature and from documents available on the Antarctic Treaty Secretariat website (https://www.ats.aq/index_e.html). CEP and ATCM Final Reports were available from: https://www.ats.aq/devAS/Info/FinalReports?lang=e.

2.2. Identification of potential candidate species for SPS designation

To inform discussions on the designation of a species as an Antarctic SPS, the ATCM agreed that the threat status of the species, as assigned by the International Union for Conservation of Nature (IUCN), should be taken into consideration alongside the recommendations of the Scientific Committee on Antarctic Research (SCAR). Using IUCN criteria, species can be assessed into one of nine categories, with species assessed as Vulnerable (VU), Endangered (EN), and Critically Endangered (CR) being considered threatened with extinction, with increasing levels of likelihood, respectively. The category Near Threatened (NT) means the species was close to qualifying as Vulnerable for at least one of the IUCN criteria or is likely to qualify for a threatened category in the near future. Data Deficient (DD) categorization means there are not sufficient data upon which to base an assessment of the species' risk of extinction; it does not necessarily mean that the species is not endangered. A species is considered Least Concern (LC) when it has been assessed against the IUCN Red List criteria and does not qualify as CR, EN, VU or NT. Information on the threat status of Antarctic species was obtained from the IUCN Red List of Threatened Species website (https://www.iucnredlist.org). The IUCN Red List webpage for each species includes a map showing the species distribution range, and this was assessed visually to determine whether or not the species was present in the Treaty area and therefore potentially eligible for Antarctic SPS status.

Advanced searches of the IUCN Red List were undertaken for species with the categories of CR, EN, VU and NT within the land region: 'Antarctica' and the marine regions: 'Atlantic – Antarctic', 'Indian Ocean – Antarctic' and 'Pacific Ocean – Antarctic'. Both 'species' and 'subspecies and varieties' were included in the search (searches undertaken in August 2024). The NT category was included in the search following the precedent established in earlier work to review the conservation status of Antarctic species (Resolution 1 (2002)). Furthermore, consideration of NT species may be appropriate when SCAR provides advice on SPS designation to the ATCM. The search output yielded 79 species names; however, 56 species were discounted from the study as their distribution did not extend into the Treaty area, which made them ineligible for SPS designation. The Antarctic blue whale *Balaenoptera musculus*, as a sub-population of the blue whale, was retained in the list and the blue whale entry removed, leaving 22 species.

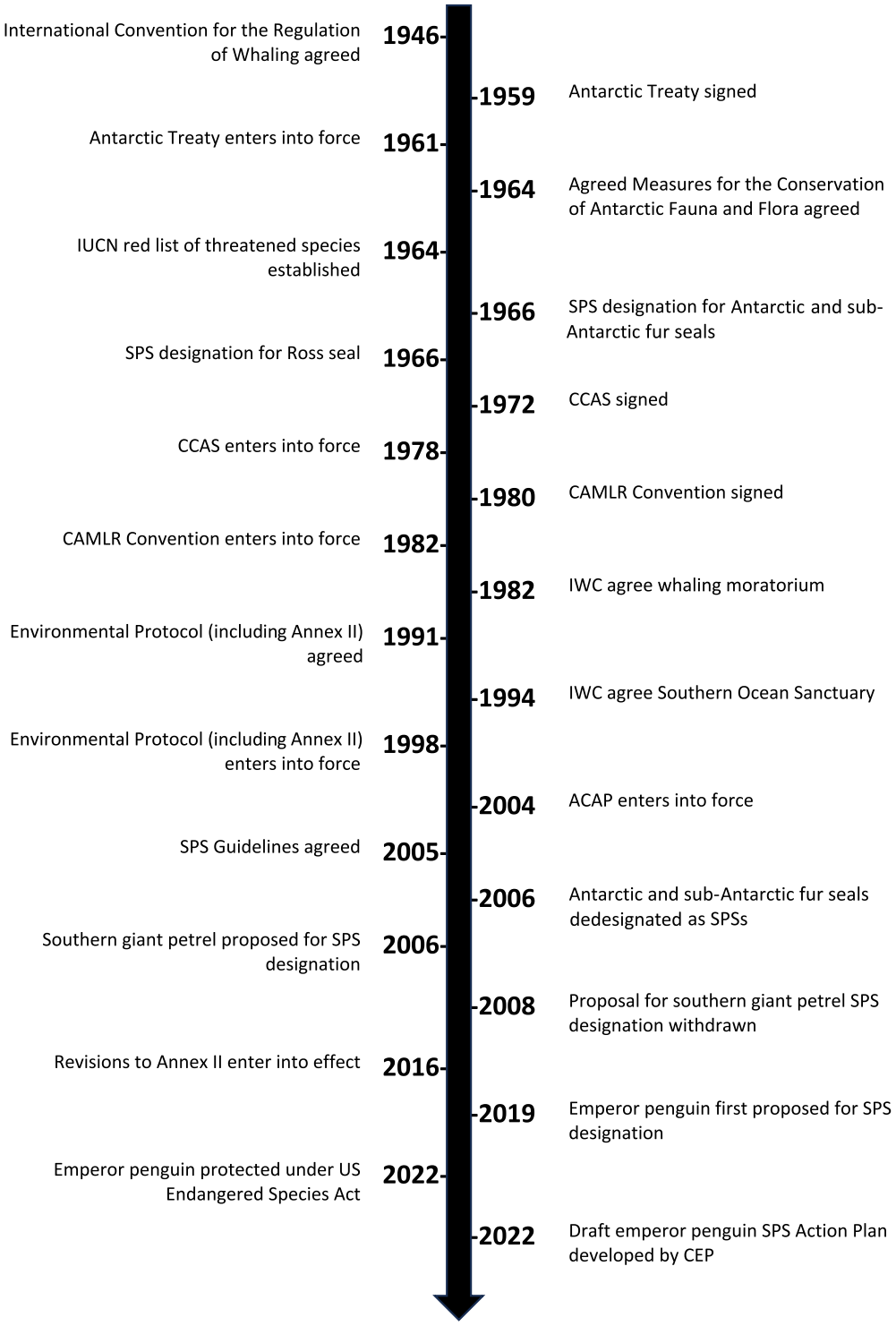
To check that the threat status of relevant species had been adequately considered, an earlier list of Antarctic bird and mammal species generated by experts from the United Nations Environment Programme (UNEP) that was presented to the CEP was consulted (UNEP, 2004). The current threat status and distribution range of each listed species was compared against its entry on the IUCN Red List, which added a further three species to the list. Finally, a general search of the IUCN Red List with the term 'Antarctic' was undertaken, but none of the additional threatened species reported were known from within the Treaty area. Information on the threat status, distribution, breeding status and population trend of each species was obtained from the relevant IUCN Red List webpage for that species. IUCN information for the identified species that were also listed under the Agreement on the Conservation of Albatrosses and Petrels (ACAP) were compared with the relevant ACAP Species Assessment (available at: https://acap.aq/acap-species?lang=en).

Maps of the distribution ranges of the Ross seal *Ommatophoca rossii*, Antarctic fur seal *Arctocephalus gazella*, sub-Antarctic fur seal *Arctocephalus tropicalis*, southern giant petrel *Macronectes giganteus* and emperor penguin *Aptenodytes forsteri* were produced using data provided on the ICUN Red List webpage (Hückstädt, 2015; Hofmeyr, 2015, 2016; BirdLife International, 2018, 2020). The data for the emperor penguin were modified to incorporate known colonies at the front of the Ronne Ice Shelf.

3. Results

3.1. Development and use of the Antarctic Specially Protected Species conservation tool

Over the past two centuries, Antarctic wildlife has been subject to exploitation (sealing, whaling and fishing) and other impacts resulting from human presence in and around the continent. Here we describe progress in the international protection of specific species within the Antarctic Treaty area, with a timeline of events provided in Fig. 2.



Figs. 2. Timeline of events relevant to the international protection of Antarctic fauna and flora (ACAP: Agreement on the Conservation of Albatrosses and Petrels; CCAS: Convention for the Conservation of Antarctic Seals; CEP: Committee for Environmental Protection; CAMLR Convention: Convention for the Conservation of Antarctic Marine Living Resources; IUCN: International Union for Conservation of Nature; Environmental Protocol: Protocol on Environmental Protection to the Antarctic Treaty; IWC: International Whaling Commission; SPS: Specially Protected Species).

3.1.1. Conservation of species under agreements developed outside of the Antarctic Treaty system

While the Antarctic Treaty system (ATS) has responsibility for the governance of the Treaty area, other instruments, agreements and organisation have relevance for species protection within Antarctica.

3.1.1.1. International Convention for the Regulation of Whaling. The protection of whales in Antarctic waters falls under the auspices of the International Convention for the Regulation of Whaling (IWC, 2024a), which sits outside the ATS. Whale species are protected through the commercial whaling moratorium that was agreed in 1982 and took effect during the 1985/86 season (Braulik et al., 2023). In 1994, the International Whaling Commission (IWC) agreed to the designation of the Southern Ocean Sanctuary that surrounds Antarctica, in places as far

north as latitude 40°S, and shares a boundary with the Indian Ocean Sanctuary, thereby affording a high level of spatial protection to whale species (IWC, 2018) (Fig. 1). Nevertheless, some whale species in the Southern Ocean have been subject to scientific whaling (IWC, 2024b), with the ruling against Japan's Antarctic scientific whaling activities in the International Court of Justice in 2013 contributing to Japan's withdrawal from the Convention and resumption of commercial whaling in July 2019 (Konishi et al., 2008; Fisher, 2020).

3.1.1.2. Agreement on the Conservation of Albatrosses and Petrels. The Agreement on the Conservation of Albatrosses and Petrels (ACAP) is a multilateral agreement, which entered into force in 2004, that seeks to conserve listed albatrosses, petrels and shearwaters by coordinating international activity to mitigate known threats to their populations, including the fishing industry (ACAP, 2024a). ACAP lists several bird species that spend part of their time within the Antarctic Treaty area. ACAP covers 22 species of albatrosses, seven species of petrels in the genera *Macronectes* (including two species of giant petrels) and *Procellaria* and two species of shearwaters in the genera *Ardenna* and *Puffinus*. The Agreement works with relevant fisheries management organisations, including CCAMLR, to encourage the adoption of best-practice mitigation measures to reduce seabird mortality in especially longline fisheries in international waters outside national jurisdictions, including through the development of Conservation Guidelines (see ACAP, 2024b).

3.1.1.3. IUCN Red List of Threatened Species. As described earlier, the IUCN Red List of Threatened Species is an assessment tool that, after following a defined set of IUCN criteria, allows for the categorization of a species' level of endangerment, with the hope that the countries where the species is found will take appropriate steps to ensure its protection through their own domestic legislation (Rodrigues et al., 2006; IUCN, 2012, 2022). To date, over 163,000 species have been assessed into one of nine categories. Species assessed as Vulnerable, Endangered, and Critically Endangered are considered threatened with extinction, with those assessed as Near Threatened considered close to qualifying or likely to qualify for threatened status in the near future. As show in this study, IUCN-assessed species classified as Near Threatened or higher include several found within the Antarctic Treaty area, which provides information useful for ATCM discussions and decisions on protection of species (see Table 1).

3.1.2. Agreements and guidelines relevant to species protection through the Antarctic Treaty system.

Here we describe earlier and current ATS legal instruments and non-mandatory guidelines concerning the protection of Antarctic species.

3.1.2.1. The Agreed Measures. In 1964, the ATCM first provided a means for the protection of Antarctic species through the Agreed Measures for the Conservation of Antarctic Fauna and Flora (commonly known as the Agreed Measures) (ATCM, 1964). Article VI prohibited the '*killing, wounding, capturing or molesting of any native mammal or native bird*' unless a permit to do so had been issued by the appropriate national governmental authority. Special protection of native mammals and birds was allowed through their designation as a SPS. A permit to take (i.e., kill) the species was not to be issued unless it was issued for a compelling scientific purpose and the actions permitted would not jeopardise the existing natural ecological system or the survival of that species. Under the Agreed Measures, the southern fur seals (i.e., all species in the genus *Arctocephalus*) and the Ross seal were designated as SPS in 1966 (Table 2). However, no criteria were formally agreed to indicate why or how these species were selected, nor were any SPS Action Plans developed.

3.1.2.2. Convention for the Conservation of Antarctic Seals. In the early 1960s, there was interest in recommencing sealing in Antarctica and exploratory research was undertaken (Øritsland, 1970). To regulate the anticipated sealing industry, and prevent commercial overexploitation of seal populations, the ATCM agreed the Convention for the Conservation of Antarctic Seals (CCAS) in 1972, which entered into force in 1978 (ATCM, 1972). CCAS prohibits the taking of Antarctic seals except under specific circumstances and in accordance with a permit issued by a national governmental authority. It established annual catch limits for the leopard seal (*Hydrurga leptonyx*), Weddell seal (*Leptonychotes weddelli*) and crabeater seal (*Lobodon carcinophagus*). Taking of the southern elephant seal (*Mirounga leonina*) and southern fur seals (*Arctocephalus* spp.) was prohibited as, when the CCAS was drafted, population numbers had not recovered from earlier harvesting. Taking of the Ross seal was also prohibited to ensure consistency across legal instruments (i.e., the Agreed Measures). CCAS also established six sealing zones, three seal reserves and a sealing season (1 September to the end of February). However, the sealing industry failed to develop and CCAS, while still in effect, has only 16 Contracting Parties and is of limited relevance today.

3.1.2.3. Convention for the Conservation of Antarctic Marine Living Resource. In the 1970s, international concerns arose regarding the impact of unregulated increases in the catches of Antarctic krill *Euphausia superba* on Antarctic marine ecosystems, including the seabirds, seals, whales and fish that rely upon krill as a food source. Consequently, in 1980, the Convention for the Conservation of Antarctic Marine Living Resources (CAMLR Convention) was adopted and entered into force in 1982 with the objective of conserving Antarctic marine life. The Convention established the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) as the primary decision-making body responsible for enacting the Convention. The CAMLR Convention areas extends north to a line that roughly approximates to the southern boundary of the Antarctic Circumpolar Current (see Fig. 1). The CAMLR Convention applies to some areas that are subject to the governance of sovereign nations, i.e., the waters around several sub-Antarctic islands. In waters under national jurisdiction, the governing nation can choose whether to abide by CCAMLR decisions.

CCAMLR practises an ecosystem-based management approach that does not exclude harvesting if it is carried out in a sustainable manner and takes account of the effects of fishing on other components of the ecosystem. The Convention applies to all Antarctic populations of fish, molluscs, crustacea and all other species of living organisms found within the Convention area. The Convention does not directly consider the conservation or harvesting of whales and seals, which instead are regulated under the International Convention for the Regulation of Whaling and CCAS, respectively. However, CCAMLR does consider the conservation of these species through, for example, specific regulations and Conservation Measures to mitigate the incidental mortality of seals and whales by fishing vessels and to maintain populations of all krill-dependent predators. CCAMLR can provide protection to individual species under its jurisdiction by closing areas to fishing, reducing the permitted catch levels to zero and monitoring the conservation status of the species.

3.1.2.4. Protocol on Environmental Protection to the Antarctic Treaty. The Agreed Measures were superseded by the Protocol on Environmental Protection to the Antarctic Treaty. Under the Protocol, Parties commit themselves to the comprehensive protection of the Antarctic environment and dependent and associated ecosystems and designate Antarctica as a '*natural reserve, devoted to peace and science*'. The original version of Annex II 'Conservation of Fauna and Flora' to the Protocol, agreed in 1991 (SATCM XI-4-3, Madrid, 1991; ATCM, 1991b), largely repeated the provisions for SPS designation outlined in the Agreed Measures. The only substantial addition was that non-lethal techniques should be used preferentially on SPS, where appropriate.

Table 1
List of Antarctic species with a level of threat of Near Threatened (NT), Vulnerable (VU), Endangered (EN) or Critically Endangered (CR) according to the IUCN (International Union for Conservation of Nature) Red List of Threatened Species database.

Species	Common name	Threat	Population trend	Year published	Date assessed	Extant in Antarctic Treaty area	Distribution according to the IUCN Red List species assessment
Aptenodytes forsteri	Emperor penguin	NT	Decreasing	2020	Aug 2019	Resident	*Aptenodytes forsteri* has a circumpolar range around the entire coast of Antarctica. Future reduction in the suitable breeding habitat is strongly predicted with major changes predicted from the middle of the current century. The breeding habitat of emperor penguins is discontinuous, and only a seasonal feature. Extent, thickness and duration of sea ice are all changing, with regional differences. Refugia may continue to exist in the higher latitude Weddell Sea and Ross Sea, but the areas suitable as breeding habitat are likely to be only a fraction of those currently available.
Ardenna grisea	Sooty shearwater	NT	Decreasing	2019	Aug 2019	Non-breeding	Breeds on islands off New Zealand, Australia and Chile, and the Falkland Islands. The species migrates to the northern hemisphere during the austral winter.
Balaenoptera bonaerensis[1]	Antarctic minke whale	NT	unknown	2018	Jan 2018	Resident	The Antarctic minke whale is considered a Southern Hemisphere species, although there are records north of the equator from Suriname and occasional vagrants as far as the Arctic. In summer they are abundant throughout the Antarctic south of 60°S, occurring in greatest densities near the ice edge, and some remain in the Antarctic in winter.
Balaenoptera borealis[1]	Sei whale	EN		2018	Jun 2018	No classification provided	Sei whales migrate between tropical and subtropical latitudes in winter and temperate and subpolar latitudes in summer. The summer (January–February) distribution in the Southern Hemisphere is mainly in the zone 40–55°S in the South Atlantic and southern Indian oceans, and 45–60°S in the South Pacific, with occasional catches recorded in the high Antarctic.
Balaenoptera musculus ssp. *intermedia*[1]	Antarctic blue whale	CR	Increasing	2018	Jun 2018	Resident	The Antarctic form *B. m. intermedia*, occurs throughout the Antarctic in summer, from the Antarctic Polar Front up to and into the sea ice, and in the sub-Antarctic South Atlantic including the South Georgia area. There is also at least some winter presence in high latitudes. Its winter distribution is not well known, but at least some and possibly most of the population migrates to lower latitudes in winter.
Balaenoptera physalus[1]	Fin whale	VU	Increasing	2018	Feb 2018	Resident	Fin whales occur worldwide, mainly, but not exclusively, in offshore waters of the temperate and subpolar zones. They show some poleward migration in summer but appear to be present at some level throughout their range throughout the year. Fin whales were abundant in summer in the Southern Ocean from 40°S to Antarctica in the southeastern Atlantic and southwestern Indian Ocean sectors, and south of 50°-55°S in other sectors. Some fin whales penetrate into the high Antarctic but are rarely seen in the pack ice.
Chaenocephalus aceratus[1]	Blackfin icefish	VU	Decreasing	2024	Nov 2023	Resident	This species is distributed in the sub-Antarctic region of the Southern Ocean, from South Georgia to the northern part of the Antarctic Peninsula. This area is close to the Polar Front in the South Georgia Province and West-Antarctic and this species does not extend to the Indian sector. It has been recorded in South Bay, Livingston Island in the South Shetlands, Bouvet Island, and Scotia Sea Islands. The depth range is 5–770 m but it is most common shallower than 450 m.
Diomedea antipodensis[2]	Antipodean albatross	EN	Decreasing	2018	Aug 2018	Extant and Origin Uncertain (seasonality uncertain)	This species is endemic to New Zealand, breeding on Antipodes Island, the Auckland Islands group (Adams, Disappointment and Auckland), Campbell Island and Pitt Island in the Chatham Islands. Data from satellite tracking indicate that birds from the Auckland Islands forage mostly west of New Zealand over the Tasman Sea and south of Australia, while those from the Antipodes forage east of New Zealand in the South Pacific, as far as the coast of Chile, and have a larger overall range
Diomedea epomophora[2]	Southern Royal albatross	VU	Stable	2018	Aug 2018	Vagrant	Breeds on Campbell Island (99 % of the total population), on Adams, Enderby and Auckland

(*continued on next page*)

Table 1 (*continued*)

Species	Common name	Threat	Population trend	Year published	Date assessed	Extant in Antarctic Treaty area	Distribution according to the IUCN Red List species assessment
							Islands (Auckland Islands group), and on Taiaroa Head (Otago Peninsula, South Island) New Zealand. Breeding adults forage from the South Island southwards to the Campbell Plateau and north to the Chatham Rise. Non-breeding birds forage on the west and east coast of South America, generally between 30 and 55°S.
Diomedea exulans[2]	Wandering albatross	VU	Decreasing	2018	Aug 2018	Non-breeding	Non-breeding and juvenile birds remain north of 50°S between sub-Antarctic and sub-tropical waters with a significant proportion crossing the Indian Ocean to wintering grounds around the southern and eastern coast of Australia. A significant proportion of the Crozet and Kerguelen populations disperse into the Pacific and the western coast of South America.
Diomedea sanfordi[2]	Northern royal albatross	EN	Decreasing	2018	Aug 2018	Extant and Origin Uncertain (seasonality uncertain)	During the breeding season adults typically forage over the Chatham Rise. Non-breeding and juvenile birds undertake circumpolar traverses in the Southern Oceans and forage in the Humboldt Current and Patagonian Shelf, off the coasts of South America
Eudyptes chrysocome	Southern rockhopper penguin	VU	Decreasing	2020	Aug 2020	Non-breeding	Breeds on islands located in the South Atlantic, Indian and Pacific Oceans, ranging from 46° S in the South Atlantic and South Indian Oceans to Macquarie Island at 54°S in the South Pacific Ocean.
Eudyptes chrysolophus	Macaroni penguin	VU	Decreasing	2020	Sept 2020	Breeding	Breeds in at least 258 colonies at c. 55 breeding sites, including southern Chile, the Falkland Islands, South Georgia and the South Sandwich Islands, the South Orkney and South Shetland Islands, Bouvet Island, Prince Edward and Marion Islands, Crozet Islands, Kerguelen Islands, Heard and McDonald Islands and very locally on the Antarctic Peninsula.
Phoebetria fusca[2]	Sooty albatross	EN	Decreasing	2018	Aug 2018	Vagrant	Breeds on islands in the South Atlantic and Indian Oceans. The pelagic distribution is mainly between 30°S and 60°S in the southern Indian and Atlantic Oceans, with a southern limit of c. 65°S near Antarctica.
Phoebetria palpebrata[2,3]	Light-mantled albatross	NT	Decreasing	2018	Aug 2018	Non-breeding	Circumpolar distribution in the Southern Ocean. It disperses over cold Antarctic waters in summer as far south as the pack ice but ranges north into temperate and sub-tropical seas in winter. It breeds on South Georgia, Auckland, Campbell and Antipodes islands, Amsterdam, St Paul, Crozet and Kerguelen islands, Heard Island, Macquarie Island, and Prince Edward and Marion islands.
Physeter macrocephalus[1]	Sperm whale	VU	unknown	2019	Jun 2008	Resident	It can be seen in nearly all marine regions, from the equator to high latitudes, but is generally found in continental slope or waters deeper than 1000 m that are not covered by ice.
Procellaria aequinoctialis[2]	White-chinned petrel	VU	Decreasing	2018	Aug 2018	Non-breeding	The species breeds on South Georgia, Prince Edward Islands, Crozet Islands, Kerguelen Islands, Auckland, Campbell and Antipodes Islands, and in small numbers in the Falkland Islands. The species forages as far north as equatorial waters and south to the pack-ice edge off Antarctica and is distributed widely in all southern oceans.
Procellaria cinerea[2]	Grey petrel	NT	Decreasing	2021	May 2020	Vagrant	The species has a circumpolar distribution between 32-58°S. It breeds on Gough Island and other islands in the Tristan da Cunha group, Prince Edward and Marion Islands, Crozet, Kerguelen and Amsterdam Islands, Campbell and the Antipodes Islands and Macquarie Island.
Pseudochaenichthys georgianus[1]	South Georgia icefish	EN	Decreasing	2024	Nov 2023	Resident	This species is distributed in the northern part of the Southern Ocean, in the sub-Antarctic region close to the Polar Front in the South Georgia Province and West-Antarctic and Indian Districts and limited to the Western Atlantic Ocean sector. It has a relatively small global range restricted to the island shelves of the Scotia Sea and the northern part of the Antarctic Peninsula. Juveniles are found between 20 and 88 m depth and adults can occur to 475 m.
Pterodroma inexpectata[3]	Mottled petrel	NT	Decreasing	2018	Aug 2018	Non-breeding	Endemic to New Zealand. Migrates to the north Pacific as far as the northern Gulf of Alaska and the southern half of the Bering Sea and in summer can range as far south as the pack ice

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Table 1 (*continued*)

Species	Common name	Threat	Population trend	Year published	Date assessed	Extant in Antarctic Treaty area	Distribution according to the IUCN Red List species assessment
Pterodroma leucoptera	White-winged petrel	VU	Decreasing	2018	Aug 2018	Vagrant	*Pterodroma leucoptera* only breeds in Australia and New Caledonia. Non-breeders forage in the Southern Ocean as far south as the Antarctic coast
Thalassarche chrysostoma[2]	Grey-headed albatross	EN	Decreasing	2018	Aug 2018	Non-breeding	Circumpolar distribution over cold subantarctic and Antarctic waters. It breeds on South Georgia, Islas Diego Ramirez and Ildefonso, Prince Edward and Marion Islands, Crozet Islands, Kerguelen Islands, Campbell Island and Macquarie Island. It ranges at sea while breeding lies largely within or south of the Antarctic Polar Frontal Zone. During the non-breeding season, birds range widely in sub-Antarctic to Antarctic waters.
Thalassarche salvini[2]	Salvin's albatross	VU	Unknown	2018	Aug 2018	?	*Thalassarche salvini* breeds on the Bounty Islands (nine islands and islets), Western Chain islets (Snares Islands), and The Pyramid and The Forty-Fours (Chatham Islands), New Zealand and has bred at least once on Ile des Pingouins (Crozet Islands, French Southern Territories), with four pairs recorded. Observations indicate that the species has a more extensive range than previously thought, although the core range is believed to be between Australasia and the west coast of South America
Thalassarche steadi[2]	White-capped albatross	NT	Decreasing	2018	Aug 2018	?	*Thalassarche steadi* is endemic to offshore islands of New Zealand. This species forages in Tasmania and Southern Africa/Namibia, and immature birds are thought to occur regularly throughout the South Atlantic and south-west Indian Ocean.
Thalassarche impavida[2,3]	Campbell albatross	VU	Increasing	2018	Aug 2018	Vagrant	Breeds only on the northern and western coastline of Campbell Island (111 km^2) and the tiny offshore islet, Jeanette Marie, New Zealand. Its non-breeding range is confined to southern Australian waters, the Tasman Sea and the south Pacific Ocean. Breeding adults forage from South Island, New Zealand, and Chatham Rise southwards to the Ross Sea.

[1] Whale species in the Southern Ocean are under the jurisdiction of the International Whaling Commission (IWC) rather than the Antarctic Treaty system. Icefish come under the jurisdiction of the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR).

[2] Species listed under the Agreement on the Conservation of Albatrosses and Petrels (ACAP). Further information can be obtained from the ACAP species assessments that are available at https://acap.aq/resources/acap-species.

[3] Species that were not returned by the search of the IUCN Red List, but were cross-referenced with the IUCN Red List against UNEP (2004).

Table 2
Antarctic Treaty system Recommendation and Resolutions relevant to species management using the Specially Protected Species (SPS) conservation tool.

Species	Consideration of the species' threat status	SPS designation	SPS de-designation	Current designation
Ross seal (*Ommatophoca rossii*)	–	Recommendation IV-17 (1966)	–	Antarctic SPS
Fur seals (Arctocephalus genus)	–	Recommendation IV-16 (1966)	Measure 4 (2006)	No higher level of protection
Southern giant petrel (*Macronectes giganteus*)	Resolution 4 (2006) Resolution 2 (2007)	–	–	No higher level of protection

Several papers submitted to the CEP highlighted issues with the interpretation, practical implementation and likely effectiveness of Annex II (United Kingdom, 1999; Argentina, 2000; SCAR, 2000). Broad discussion within the Committee resulted in the identification of two lines of work: (i) to more clearly define the criteria for SPS designation and (ii) to review Annex II, including Articles relevant to SPS.

Following two years of CEP intersessional discussion on the criteria for SPS designation, the subsequent report recommended amongst other things that: the IUCN Red List criteria should be used as the basis of SCAR's assessment of the status of species in Antarctica (which was formally agreed by the Committee in CEP V Report, para. 43); the IUCN Red List classification of Vulnerable (at least) be used to evaluate the designation of a SPS; if gaps existed in the IUCN criteria, specific Antarctic criteria may need to be developed; and the characteristics of the species, its status, as well as the nature of human impacts or other threats, be taken into account when addressing likely mechanisms of species protection (Argentina, 2001, 2002). This advice to the ATCM was endorsed through Resolution 1 (2002).

The Committee also took the outcomes of the intersessional discussions into consideration during the revision of Annex II, which was agreed in 2009 (Measure 16 (2009); ATS, 2009) and entered into effect in 2016. Revisions to the Articles of Annex II concerning SPS included the following: the range of species that could be designated as SPS was extended to include native plants and invertebrates; proposals for designation of SPS status could be made to the ATCM by any Party, the CEP, SCAR or CCAMLR; the CEP should provide advice on criteria for proposing SPS; the designation of a SPS was to be undertaken according to agreed procedures and criteria adopted by the ATCM; comments on the designation of a proposed SPS should be sought from the CEP, SCAR, CCAMLR, ACAP and other organisations, as appropriate, and their comments taken into account in any CEP advice on SPS designation to the ATCM.

3.1.2.5. Guidelines for Antarctic SPS designation. In 2005, SCAR

submitted a paper to the ATCM and CEP which built on an earlier agreement that the IUCN's internationally agreed criteria for assessing species endangerment should be used to inform SPS designation (SCAR, 2005a). While it was considered appropriate to be able to designate species in all three threatened categories (Vulnerable, Endangered and Critically Endangered) as Specially Protected Species, SCAR suggested that it may be appropriate to establish monitoring schemes for those species evaluated as Data Deficient or Near Threatened to provide early warning of possible worsening status. SCAR also recommended the development of an Action Plan for a proposed SPS. In response, the CEP agreed the *Guidelines for CEP Consideration of Proposals for New and Revised Designations of Antarctic Specially Protected Species under Annex II to the Protocol* (SPS Guidelines; ATS, 2005), which were endorsed by the ATCM (ATCM XXVIII Final Report, para. 82). Under the SPS Guidelines, a SPS could be proposed through the submission of a scientific justification and a draft protection Action Plan to the CEP. For new designations, if an assessment by SCAR determined that the species was at significant risk of extinction (i.e., the threat status was determined to be Vulnerable or higher), then the CEP should recommend SPS designation to the ATCM and finalise the Action Plan for the species. SCAR suggested four characteristics that are critical for assessing the degree of endangerment of Antarctic species (SCAR, 2007a):

- How large is the population and is it, either globally or regionally, increasing, stable or decreasing?
- Is the geographic spread increasing, stable or decreasing?
- Is the breeding population sufficient to ensure breeding success each year (for an annual breeder)?
- Are there any known threats to the stability of the population?

The SPS Guidelines also provided a template to guide the development of a draft protection Action Plan. For existing species designations, recommendations to the ATCM that the species may be retained on the list of SPS or de-listed would depend upon SCAR's assessment of the species' threat status.

3.1.3. *Threat status reviews of native Antarctic species*

In 1999, the CEP noted that there had been no review of the list of SPS (now contained in Annex II to the Protocol) since it was originally appended to the Agreed Measures by the Consultative Parties in 1966 and that other species should be considered for potential inclusion on the list. Consequently, the Committee asked SCAR, with the input of the IUCN and other bodies, to review the SPS list, using the information contained in the IUCN Red List to help determine the threat status of Antarctic species (Resolution 2 (1999)). Similarly, following the CEP's

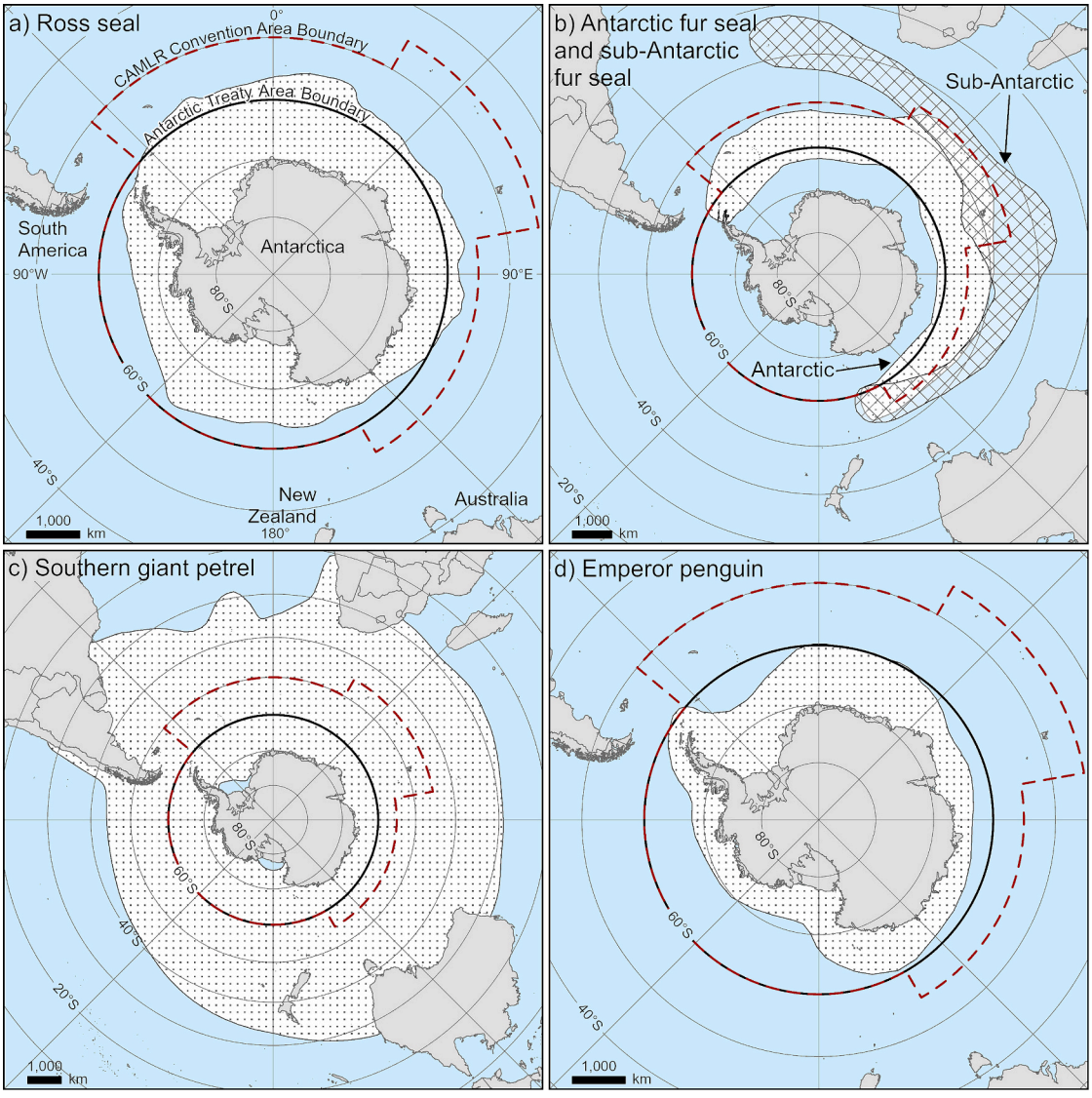

Fig. 3. Distribution range of the (a) Ross seal, (b) Antarctic and sub-Antarctic fur seals, (c) southern giant petrel and (d) emperor penguin. Note that the scales are not consistent across all four maps.

development of criteria for the designation of SPS, the ATCM requested SCAR to review the threat status of Antarctic species classed as Vulnerable, Endangered or Critically Endangered (taking into consideration regional assessments of populations), and review those species classed as Data Deficient or Near Threatened (Resolution 1 (2002)). Since that time, SCAR advice and subsequent CEP discussions on SPS status have concerned predominantly the Ross seal, the fur seals, the southern giant petrel *Macronectes giganteus* and the emperor penguin *Aptenodytes forsteri* which are discussed, in turn, below.

3.1.3.1. Ross seal. The Ross seal is found on pack ice distributed around Antarctica in regions where ships rarely travel (Fig. 3a). Consequently, little is known of the species' distribution, abundance, life history, and basic natural history compared to other Antarctic seal species (Hückstädt, 2018). In 1966, the Ross seal was afforded SPS status under the Agreed Measures as it was considered to be extremely rare and reliable population data were not available (Table 2). When the Protocol entered into force in 1998, SPS status was maintained for the Ross seal without any up-to-date consideration of the species' population level or trend.

In 2007, at the request of the ATCM, SCAR presented to the CEP an assessment of the threat status of the Ross seal following consultation with the SCAR Expert Group on Seals (SCAR, 2007b). Under the IUCN criteria, the threat status of the Ross seal at the time was 'Lower Risk, Least Concern', which was lower than the status of Vulnerable which the ATCM agreed would be suitable for a species' designation as a SPS. However, SCAR recommended that the status of the Ross seal should remain unchanged based on the limited availability of population data across its area of distribution. The approach was in keeping with the recommendation that, in the absence of sufficient data on which to base a scientifically sound decision, no change in status of a species should be made.

3.1.3.2. Fur seals. Two species of the genus *Arctocephalus* are found within the Treaty area: the Antarctic fur seal (*Arctocephalus gazella*) and the sub-Antarctic fur seal (*Arctocephalus tropicalis*) (Fig. 3b). The southern fur seals were added to the list of Antarctic SPS in 1966 through the Agreed Measures (Recommendation IV-16 (1966)) and their SPS status was maintained under the Protocol (Table 2). In the 1960s, fur seal populations were starting to recover after having been reduced almost to extinction through earlier over-exploitation (Hucke-Gaete et al., 2004; Forcada and Staniland, 2009). However, by the end of the millennium, fur seal numbers had recovered with 4.5–6.2 million seals on South Georgia (located outside the Treaty area), c. 10,000 on Signy Island (South Orkney Islands) and c. 21,000 at Cape Shirreff (South Shetland Islands) (Table 1 in SCAR (2005a, 2005b) and, for more recent estimates, Table 1 in Convey and Hughes, 2023).

At CEP III (2000), SCAR reported its initial work with the IUCN to revise the list of SPS (SCAR, 2000). SCAR concluded that the fur seals no longer warranted protection due to the increase in population numbers. At CEP VIII (2005), SCAR presented its assessment of the risk of extinction of the existing SPS, using the most recent IUCN criteria (SCAR, 2005b). SCAR highlighted that special protection should be a temporary designation, which is removed once the species is no longer endangered. Neither *A. gazella* nor *A. tropicalis* were present on the IUCN Red List with a threat status of Vulnerable or higher. Furthermore, global populations of adults were large, pup numbers were generally increasing and *A. gazella* had extended its distribution in the Antarctic Peninsula. SCAR assessed that there was no risk of extinction and recommended that the genus *Arctocephalus* be removed from the list of Antarctic SPS. Initially New Zealand withheld its consensus as, although a different species, the New Zealand fur seal (*Arctocephalus forsteri*) was nationally protected and there were concerns over how fur seal de-listing would be perceived domestically. Only at CEP IX (2006) was consensus reached for fur seals to be removed from the list of SPS, recognizing that fur seals would continue to receive the comprehensive general protection afforded to all species under the Protocol (Table 2) (Jabour, 2008).

3.1.3.3. Southern giant petrel. At CEP VII (2004) SCAR provided information on the global threat status of birds living and breeding in Antarctica or foraging in the Southern Ocean, based largely on the recently published threat status assessment of birdlife by the IUCN (SCAR, 2004) (Fig. 3c). The following year, SCAR reported to CEP the initiation of work to apply the IUCN Red List categories and criteria at a regional level for the 19 bird species that breed in the Antarctic and for eight non-breeding visiting bird species that are of conservation concern outside the region (SCAR, 2005a). SCAR provided data on the southern giant petrel as an example of information that may inform decision-making on special protection.

In 2006, SCAR presented to the CEP a proposal to list the southern giant petrel as a SPS. SCAR suggested that SPS status should be available for all species covered by Annex II, including those migratory species that visit the Antarctic Treaty area on a seasonal basis (SCAR, 2006). The basis of the proposal was that the southern giant petrel was classified as Vulnerable by BirdLife International, on behalf of the IUCN, and it was under consideration as an endangered species by ACAP. However, at CEP IX (2006), SCAR noted that new population data available to ACAP indicated substantially higher populations outside the Treaty area, which could change the level of global threat assessment from Vulnerable to Near Threatened, meaning SPS status would not be justified under agreed procedures (CEP IX Report, paras. 134–139). Concerns were expressed regarding the threat status of Antarctic (i.e., regional) populations of southern giant petrels, irrespective of the global threat status. Through Resolution 4 (2006), the ATCM agreed that SCAR should undertake a further review of the status of the southern giant petrel and all activities in Antarctic be planned to avoid negative impacts upon the species (Table 2). In 2007, SCAR was unable to provide a further review and withdrew their paper to CEP X at short notice, explaining that new, unpublished data on the species in the South Orkney Islands suggested that the designation of the species as Critically Endangered within the Treaty area might require revision (CEP X Report, paras. 235–249). However, SCAR did provide information on the application of IUCN endangerment criteria at the regional level of the Antarctic Treaty area (SCAR, 2007a). The ATCM subsequently agreed Resolution 2 (2007) in which they recognized that the southern giant petrel had been down-listed by the IUCN from Vulnerable to Near Threatened, and recommended that Parties provide relevant scientific data to SCAR and implement new research on the species' population biology. The ATCM also asked SCAR, together with ACAP, CCAMLR and other bodies, to complete a review of the population status and trends of the southern giant petrel in the Antarctic Treaty area. In 2008, SCAR submitted a paper to CEP XI where it concluded that the southern giant petrel population south of 60°S was of Least Concern according to the IUCN Red List categories and criteria and, therefore, the data and analysis did not support southern giant petrel designation as a SPS (SCAR, 2008).

3.1.3.4. Emperor penguin. The only other species to have been subject to substantial discussion within the CEP and ATCM regarding designation as a SPS is the emperor penguin (Fig. 3d). The emperor penguin assessment for the IUCN Red List states: '*The Emperor Penguin is listed as Near Threatened as it is projected to undergo a moderately rapid population decrease as Antarctic sea ice begins to disappear within the next few decades owing to the effects of climate change. By the end of the 20th century, under current levels of CO_2 emission more than 80% of the population is projected to be lost, but major changes to sea-ice prevalence are not projected to begin until after 2050. As such, while declines over the next three generations are not expected to exceed thresholds for listing as threatened, future climate scenarios predict a rapid increase in the rate of population decline, such that without mitigation the species will begin to decline rapidly within one to two*

generations.' (BirdLife International, 2020). In 2019, a paper submitted to the CEP by several Parties, SCAR and the Antarctic and Southern Ocean Coalition (ASOC; which represents a consortium of conservation non-governmental organisations) reported on work by international experts to review the vulnerability of the emperor penguin to climate change (United Kingdom et al., 2019; CEP XXII Report, paras. 198–200; Trathan et al., 2020). The authors noted that species-related management options could be developed to reduce anthropogenic stressors and thereby improve the resilience of the species. In 2021, SCAR introduced two papers which reported that '*emperor penguins are vulnerable in the foreseeable future due to the loss of their breeding habitat*' and that models and analyses '*indicate that the species might best be classified within the IUCN Red List as 'Vulnerable'* (SCAR, 2021a, 2021b). SCAR highlighted the need to designate the emperor penguin as an Antarctic SPS and recommended that the Committee establish a group to review a draft Action Plan prepared by SCAR, in accordance with the SPS Guidelines. The Committee acted on SCAR's recommendation and at CEP XXIV (2022) the UK presented the group's report and its substantially expanded draft SPS Action Plan for the emperor penguin (United Kingdom, 2022). The report recommended that the draft Action Plan, together with SCAR's assessment of the species as 'Vulnerable', should be forward to the ATCM with the recommendation that the emperor penguin be designated a SPS. However, at the same meeting, China submitted a review of the legal framework on SPS and its application within the ATCM and the CEP (China, 2022a, 2022b). China recommended that any SPS designation should be consistent with Annex II and the SPS Guidelines, and particularly the use of the IUCN threat status of "Vulnerable or higher" (as opposed to the assessment of SCAR, as set out in the SPS Guidelines) as the threshold for the consideration of potential designation. It also highlighted the earlier precedent that, where there was data deficiency, no change in species' threat status should result (e.g., as for the Ross seal and southern giant petrel; see above). Rather, the IUCN extinction risk assessment of Near Threatened, as assessed for the emperor penguin, should initiate research and monitoring to obtain adequate scientific information to enable further assessments to be made using the IUCN criteria (China, 2022a, 2022b). China suggested that known or emerging threats to emperor penguins were small or negligible, the threat assessment of climate change and sea ice reduction on the species was uncertain and the threat was predicted to take place only until after 2050. China also suggested that the population of emperor penguins was increasing, but SCAR clarified that this was because new colonies had been discovered, not because existing colony population numbers were increasing (CEP XXIV Report, para. 184–186). In response, other Parties expressed their belief that sufficient information was available to demonstrate the vulnerability of the emperor penguin, and that basing the CEP's recommendations for designation on SCAR's assessment of a species' threat status, rather than the that of the IUCN, was appropriate and in accordance with agreed guidelines (Chown et al., 2024). The designation of the emperor penguin as a SPS received full support from all CEP members except China and therefore, consensus was not reach; these positions were maintained when the topic was discussed later in the week at the ATCM, with many Parties subsequently expressing their disappointment that consensus for protection was not achieved due to the position of a single Party (ATCM XLIV Final Report, para. 94–102; Kubny, 2022).

At CEP XXV (2023) and CEP 26 (2024), discussion of emperor penguin protection continued. In 2023, the US reported its recent recognition of the emperor penguin as a threatened species under the Endangered Species Act (Federal Register: 86 FR 41917) and the provision of additional protection for the species (United States, 2023; Jenouvrier et al., 2021). Australia reported similar plans to afford higher protection under domestic legislation (Australia, 2023). At the same meeting, a paper submitted by a consortium of Parties provided scientific data showing that the land-fast ice, crucial as emperor penguin breeding sites, was vulnerable to break out as predicted by IPCC projections. Furthermore, over the five-year period (2018–2022), 42 % of emperor penguin colonies had likely experienced total or partial breeding failure due to fast-ice break-up in at least one year (Fretwell et al., 2023; United Kingdom et al., 2023). The following year, at CEP 26 (2024), a further paper was submitted reporting a 6 year (2018–2023) assessment of low sea-ice impacts on emperor penguins and showed an increasing level of penguin colony failure with increasing sea ice loss, particularly during 2022 and 2023 when record low Antarctic sea ice extents were recorded (Fretwell, 2024; United Kingdom et al., 2024). SCAR also reported research showing a probable 9.6 % decline in emperor penguin population numbers during the period 2009–2018 (La Rue et al., 2024; SCAR, 2024). At the meeting, a further call for SPS designation for the emperor penguin was made that was strongly endorsed by the IUCN (CEP 26 Report, para. 234; United Kingdom et al., 2024). Despite the provision of further information, China's position has remained unchanged since CEP XXIV (2022). At CEP 26 (2024) the Russian Federation joined China in expressed its concerns (CEP 26 Report, para. 238); however, it remains unclear the degree to which developing global geopolitics played a part in this change of view (Boulègue, 2023). As a consequence, SPS designation for the emperor penguin was not agreed. Nevertheless, many Parties agreed to implement the draft SPS Action Plan in order to afford further protection for the species (e.g. Australia, 2023; CEP 26 Report, paras. 235 and 240).

3.2. Identification of potential candidate species for SPS designation

Existing guidance for Antarctic SPS designation suggests that SCAR should consider the threat status of the species as stipulated in the IUCN Red List when providing advice to the ATCM on a species' designation as a SPS. Analysis of the IUCN Red List revealed major errors in the search facility with many of the search results for 'Antarctica' being species absent from even the broader Antarctic region. Nevertheless, our data indicated that 25 species found within the Antarctic Treaty area have an IUCN category of Near Threatened or higher (seven Near Threatened, eleven Vulnerable, six Endangered and one Critically Endangered) (Table 1). Of the 25 species identified, five species are whales and are therefore outside the jurisdiction of the ATS but, rather, under the jurisdiction of the International Whaling Commission (IWC). Two species were icefish, (i.e., the South Georgia icefish *Pseudochaenichthys georgianus* and blackfin icefish *Chaenocephalus aceratus*) and were under the jurisdiction of the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR).

Eighteen species were birds, with nine classified as vagrant species, entering the Treaty area rarely and in small numbers, or with an uncertain extent. Seven species (i.e., the mottled petrel *Pterodroma inexpectata*, white chinned petrel *Procellaria aequinoctialis*, sooty shearwater *Ardenna grisea*, grey-headed albatross *Thalassarche chrysostoma*, light-mantled albatross *Phoebetria palpebrata*, wandering albatross *Diomedea exulans* and southern rockhopper penguin *Eudyptes chrysocome*) may regularly forage in the Southern Ocean, including within the Antarctic Treaty area, but breed outside the Treaty area. Similarly, the breeding sites of the macaroni penguin *Eudyptes chrysolophus* are located predominantly outside the Treaty area; however, there is a small breeding population (c. 8000 pairs) on the Antarctic Peninsula and offshore islands. The emperor penguin is the only listed bird species that is endemic to the region, where it breeds in colonies located predominantly on fast ice distributed around the continent. Twelve of the identified bird species were listed as ACAP species. When the species distribution range data provided on the IUCN Red List and the ACAP Species Assessment (available: https://acap.aq/acap-species?lang=en) were compared, there was disagreement over the presence of the sooty albatross and southern royal albatross within the Treaty area.

4. Discussion

4.1. Development and use of the Antarctic Specially Protected Species conservation tool

It is a challenge to predict how existing conservation tools, made available under the ATS, will be applied in the future. Our review has shown that the designation of Antarctic SPS has had a long and, at times, complex history. Designation of SPS-status has not always been based on the provision of adequate information, but sometimes has taken a precautionary approach, as in the case of the Ross seal. With the agreement of the SPS Guidelines in 2005, whereby the consideration of SPS designation was linked with a species' status under the IUCN Red List, a further level of complexity was introduced, particularly as IUCN assessments may not take into account the unique environmental conditions found in Antarctica or the specific legal situations presented through the ATS. However, it was agreed through the SPS Guidelines that it should be SCAR's recommendation to the ATCM regarding a species' threat status that should inform subsequent ATCM decision-making on SPS designation.

The recent situation where SCAR's recommendation for the designation of the emperor penguin as a SPS was not acted upon by the ATCM due to the concerns of initially one Party has, to some degree, put the future use of this conservation tool in doubt. It is interesting to consider what factors may have motivated the adoption by China of such a potentially isolating position. China seeks to equally 'protect and utilise' Antarctica, which may be difficult to reconcile with the approach of 'protect first' advocated by many other Antarctic Treaty Parties (China, 2017; Talalay and Zhang, 2022; Boulègue, 2023; Pu and Yan, 2024). Difficulties in reaching consensus for the designation of several Marine Protected Areas under the CAMLR Convention has been attributed to the Russian Federation and China's preference for a less restricted right to fish (Jacquet et al., 2016). The draft SPS Action Plan for the emperor penguin does not provide further spatial protection for the emperor penguin when foraging at sea, but by blocking SPS designation at an early stage, China may be eliminating any related future establishment of possible limitations to marine resources harvesting. Nevertheless, to reduce anthropogenic pressure on the emperor penguin, some regulation of fishing in the foraging area adjacent to colonies may be appropriate (Goetz et al., 2018; Labrousse et al., 2019). Internationally agreed protection through SPS designation would help minimise existing and new regional pressures on the emperor penguin resulting from research activities, tourism and fishing. If the emperor penguin is to be afforded higher protection as a SPS, then the Antarctic Treaty Consultative Parties will need to continue to exchange information and clearly communicate their views and concerns in order for a diplomatic solution to be identified. Until that time, it is likely that many Parties will continue to push for higher protection of the emperor penguin under Annex II and it is possible that further evidence will continue to emerge indicating that special protection is warranted (Fretwell et al., 2023; Fretwell, 2024).

Should the IUCN raise the emperor penguin threat status from Near Threatened to Vulnerable, or higher, then one of the barriers to international agreement on protection might be removed. However, there remains the risk that the topic has become so divisive within the ATCM that progress on the protection of the emperor penguin may not be forthcoming, at least in the short term. Given that the decline in emperor penguin breeding habitat is closely linked to climate change caused by global greenhouse emissions, the greatest conservation benefit is likely to come from Parties' enactment of measures to limit greenhouse gas emissions in compliance with the Paris Agreement (Jenouvrier et al., 2020; Lee et al., 2022). As pointed out by SCAR, the designation of the emperor penguin as an Antarctic SPS would be '*a powerful signal from Parties on their level of concern about the impacts of climate change and the need to reduce greenhouse gas emissions*' and would provide a clear message to global governments and the public at large (ATCM XLIV Final Report, para. 101).

Climate change in the Antarctic region is likely to have impacts upon other Antarctic species, which may be positive or negative, depending upon each species' habitat and life history characteristics (Clucas et al., 2014; Gimeno et al., 2024). For example, as more information becomes available on the population number and distribution of the Ross seal, it may be appropriate that its SPS status is removed at some point; however, this is not a forgone conclusion, as its habitat in the Antarctic pack ice may also be vulnerable to climate change impacts (Wege et al., 2021). On-going and regular assessments of species' status are therefore essential to inform conservation decisions by policymakers operating within the ATS – an action already identified within the CEP CCRWP.

4.2. Identification of potential candidate species for SPS designation

In accordance with the existing guidance for Antarctic SPS designation we identified 18 species assessed by the IUCN Red List as having a threat status of Vulnerable or higher and seven species that had a threat status of Near Threatened.

Through the IWC moratorium on whaling, protection is already afforded to the five identified whale species (Antarctic blue, Antarctic minke, fin, sei, and sperm whales). The nine vagrant bird species are unlikely to be afforded special protection under the ATS due to their low numbers and sporadic presence; similarly, the seven bird species that are regularly present but do not breed in the Treaty area are unlikely to be priorities for protection. However, the protection of species with breeding populations both inside and outside the Treaty area has been discussed within the CEP, with SCAR providing information on species endangerment assessment at a regional level within the Treaty area, based on IUCN criteria (SCAR, 2007a). The breeding sites of species outside the Treaty area will be under the jurisdiction of sovereign states, through which protection can be provided under domestic legislation. Additional coordinated international protection can also be afforded to some bird species through their presence on the ACAP list of species. However, lack of information on the distribution ranges of some of these species puts their very presence in the Treaty area in doubt, as demonstrated by the differing opinions of the IUCN and ACAP regarding the presence of the sooty albatross and southern royal albatross within the Treaty area. Taking these factors into consideration, Antarctic policymakers may choose to prioritise SPS designation for species depending upon their (i) distribution range, (ii) location of breeding populations and (iii) duration of the period spent within the Treaty area as well as their threat status (Table 3).

When we consider the species listed in Table 1, which species might be potential candidates for SPS designation under existing CEP guidance? In 2000, SCAR undertook a review of population data for the Southern Ocean seabirds and concluded that those classed as 'Vulnerable' by the IUCN warranted consideration for designation as SPS (SCAR, 2000). The species proposed were the macaroni penguin, wandering albatross, grey-headed albatross, white-chinned petrel and southern giant petrel, all of which, at the time, were designated as Vulnerable by the IUCN. With the exception of the southern giant petrel (see earlier) designation of the remaining four species has not been considered further by the Committee, despite their on-going designation as Vulnerable or higher by the IUCN (see Table 1). The macaroni penguin is mainly a sub-Antarctic species, with c. 6.3 million pairs found globally, but under IUCN criteria it has been classified as Vulnerable due to a rapidly declining global population (Crossin et al., 2013). The breeding populations in the South Orkney Islands, South Shetland Islands and Antarctic Peninsula region total c. 8000 pairs, are at the southern extent of the species' distribution, and recently noted increases in Antarctic populations may be linked to regional climate change (Hallet and Lynch, 2024). Given the presence of a breeding population of macaroni penguins in Antarctica, SCAR might usefully consider the conservation of the species within the context of the ATS, taking the information provided by the IUCN into consideration. The emperor

Table 3
Proposed prioritisation of species for consideration of their protection as Antarctic Specially Protected Species, based upon their distribution range, breeding population location and duration of presence within the Antarctic Treaty area[1,2].

		Distribution range		Location of breeding populations			Presence within the Antarctic Treaty area		
		Treaty area only	Treaty area and beyond	Treaty area only	Treaty area and beyond	Beyond the Treaty area only	Permanent	Seasonal	Occasional
	Higher priority	✓		✓			✓		
Priority level	↕		✓	✓				✓	
			✓		✓			✓	
			✓			✓		✓	
	Lower priority		✓			✓			✓

[1] These factors are in addition to the threat status of the species, according to the IUCN Red List of Threatened Species, where species assessed to be at a higher level of endangerment would be afforded a higher priority.
[2] Antarctic species afforded adequate protection through international agreements that sit outside the Antarctic Treaty system are not considered here (e.g., the International Convention for the Regulation of Whaling).

penguin is the only bird species listed that is endemic to the region, where it breeds in colonies located predominantly on fast ice distributed around the continent (Trathan et al., 2020). As described earlier, designation of the emperor penguin as a SPS has already been subject to substantial debate within the CEP and ATCM. The two fish species on the list, the South Georgia icefish and blackfin icefish, are found within the CAMLR Convention area and the Antarctic Treaty area. Given that these species fall under the jurisdiction of the CAMLR Convention, it remains to be seen if and how CCAMLR will take account of these very recent IUCN assessments.

4.3. Is the Antarctic SPS conservation tool fit for purpose?

Globally, it is notable that the IUCN Red List focusses predominantly on large or charismatic species, such as birds, mammals, fish, reptiles, amphibian, trees and other higher plants. However, with the exception of the continent's two native higher plants that within the Treaty area are restricted to the maritime Antarctic, all of the aforementioned biological groups are absent from the Antarctic terrestrial environment. IUCN Red List-assessed seabirds, fish and marine mammals comprise only a tiny proportion of the thousands of species found within the Antarctic Treaty area. The threat status of the vast majority of these species is unknown and little or no consideration has been given to their higher protection through SPS designation. For example, Antarctic terrestrial habitats are dominated by cryptogams, such as mosses (Bryophyta), liverworts (Marchantiophyta) and lichens, and invertebrates such as mites (Acari), springtails (Collembola), nematodes (Nematoda) and tardigrades (Tardigrada). However, very few of these Antarctic species have been assessed by the IUCN (but, as an example, see the salt shield lichen *Parmelia saxatilis*) and none have been afforded specific species protection by the ATCM. Given the restricted distribution of some of these species, particularly those associated with scarce habitats such as geothermal area, it is possible that the current application of the IUCN Red List criteria may not be the most appropriate tool for informing the designation of SPS-status for these easily-overlooked species (Cardoso et al., 2011; Dahlberg and Mueller, 2011; Bergamini et al., 2019). Antarctic experts could attempt to undertake assessments of Antarctic terrestrial species using the IUCN criteria, but they might also consider whether a modified or new framework for assessment might be more appropriate for the unique species and conditions found in Antarctica. The revision to Annex II that extended the range of species that could be designated as SPS to include native plants and invertebrates demonstrates the ATCM's awareness of the need for broader species protection. As an alternative solution, the CEP might consider that protection is more effectively afforded using other tools available under the Protocol, such as designation of ASPAs. However, ASPAs often tend to be small, so their usefulness may be in doubt for some more widely dispersed terrestrial species (Hughes and Convey, 2010). Irrespective of the conservation tools available, little progress in species protection will result without sufficient prioritization and investment by the Antarctic Treaty Parties (Convey et al., 2012; Lee et al., 2022).

4.4. Conclusions

The Antarctic SPS conservation tool has had a chequered history of development and implementation over the past six decades and has resulted in little recent practical internationally agreed conservation action. In response to the CEP's call for information to support future work on protection of Antarctic species (as set out in its 5YWP and CCRWP), we reviewed the endangerment risk of those Antarctic species assessed in the IUCN Red List. We found that no species probably merits consideration for SPS status under the Protocol more than the emperor penguin. However, despite discussions over several years, the Parties of the ATCM have failed to reach agreement on SPS status for this iconic species. Potential exists to expand the number of Antarctica species assessed under the IUCN criteria to establish their level of endangerment. The CEP and ATCM may also like to consider if and how the SPS conservation tool might be applied more usefully to often small and non-charismatic species found in Antarctic marine and terrestrial environments.

Declaration of Generative AI and AI-assisted technologies in the writing process

No generative AI or AI-assisted technologies were used in the writing process for this work.

CRediT authorship contribution statement

Kevin A. Hughes: Writing – review & editing, Writing – original draft, Methodology, Investigation, Conceptualization. **A. Beatriz Pais-Fernandes:** Writing – original draft, Investigation. **Ana Hilário:** Writing – review & editing, Validation, Supervision, Funding acquisition. **José C. Xavier:** Writing – review & editing, Validation, Supervision, Funding acquisition.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Data availability

No data were used for the research described in the article.

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