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TITLE: Pollution, habitat loss, fishing, and climate change as critical threats to penguins

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ABSTRACT:

Cumulative human impacts across the world's oceans are considerable. We therefore examined a single model taxonomic group, the penguins (Spheniscidae), to explore how marine species and communities might be at risk of decline or extinction in the southern hemisphere. We sought to determine the most important threats to penguins and to suggest means to mitigate these threats. Our review has relevance to other taxonomic groups in the southern hemisphere and in northern latitudes, where human impacts are greater. Our review was based on an expert assessment and literature review of all 18 penguin species; 49 scientists contributed to the process. For each penguin species, we considered their range and distribution, population trends, and main anthropogenic threats over the past approximately 250 years. These threats were harvesting adults for oil, skin, and feathers and as bait for crab and rock lobster fisheries; harvesting of eggs; terrestrial habitat degradation; marine pollution; fisheries bycatch and resource competition; environmental variability and climate change; and toxic algal poisoning and disease. Habitat loss, pollution, and fishing, all factors humans can readily mitigate, remain the primary threats for penguin species. Their future resilience to further climate change impacts will almost certainly depend on addressing current threats to existing habitat degradation on land and at sea. We suggest protection of breeding habitat, linked to the designation of appropriately scaled marine reserves, including in the High Seas, will be critical for the future conservation of penguins. However, large-scale conservation zones are not always practical or politically feasible and other ecosystem-based management methods that include spatial zoning, bycatch mitigation, and robust harvest control must be developed to maintain marine biodiversity and ensure that ecosystem functioning is maintained across a variety of scales.

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