**For/Website:** The Conversation (Australia)

**Headline:** Quantifying consumption of little penguins by fur seals to resolve wildlife conflict in southeastern Australia

Hook(s) / Most interesting context first:

[Super broad view of this work] Conflicts between iconic species are increasing globally with mounting pressures during the Anthropocene. New monitoring tools and fresh impacts assessments are needed in collaboration with long-term monitoring programs to arrive at sound diagnoses of conflicts, impacts, and magnitude of wildlife conflicts, to produce effective management objectives and successful conservation outcomes.

[Local problem] We face an emerging wildlife conflict in southeastern Australia between two species of conservation concern – through the consumption of the culturally important little penguins by recovering long-nosed fur seal populations. Both species are federally protected (EBPC Act 1972/1999), culturally and ecologically valuable. Both are vulnerable to climatic, forage community, and land-use changes in near-shore, coastal and offshore ecosystems.

[On penguins] Little penguin populations have been particularly sensitive to decline due to invasive land predators (foxes, cats, dogs) and land-use change. The visible remains of penguin carcasses and remains from fur seal consumption on coastal landscapes in southeastern Australia (or occasionally confronting observations of fur seal attacks on penguins) have galvanised public emotion and attention towards what could be the last straw (and ‘not-another-predator’ reaction) but arguably just a scape-goat for broader conservation and management issues for this species.

[Link back to seals] Fur seals are also frequently seen to compete with recreational, sport-fishing and large-scale commercial operations for baitfish through to large trophy fish species. The perception of this conflict by fishermen and that with penguins by the public in southeastern Australia has resulted in repeated calls to cull the fur seals.

[Seal recovery] Fur seals (note there are 2 species in SE Aus) are recolonizing their former range in Bass Strait and surrounding southern Australia after they were decimated by fur trade through the 1800’s and culling into the late 1900’s due to perceived competition for resources with fishermen.

[The knowledge gap] While it is realistic to expect high levels of predation to affect prey population size or behaviour, persistent campaigning to cull the long-nosed fur seal population in South Australia are growing in a total vacuum of quantitative information on the true impacts (+magnitude) of this predator to little penguins.

[What we really need] Up-to-date and comprehensive risk assessments are required to properly assess impacts on penguins and seabird populations of large predator population recoveries in addition to a complex environment of massive changes to ecosystems through anthropogenic climate change, land-use practices and resource extraction likely directly competing with penguins for fish/prey. Indeed, one penguin population has crashed in since this study began in 2016 – the causes are not known and the recommendations we provide herein are critical step towards better monitoring and management of this conflict.

[The tool - DNA] The key goals of investigating predator prey interactions involves determining prey inter- and intra-specific diversity, dietary proportions, and abundances or biomass consumed by the predator).: (i) identifying prey ideally to species level, (ii) estimating their relative importance to predator diets in time and space (reconstructing biomass and abundances of prey); and the holy grail – (iii) using wildlife forensics approaches to identify prey to individuals (intraspecific genetic diversity) within environmental samples enabling estimates of numbers consumed... These goals are demonstrably being achieve through rapid developments in environmental DNA (eDNA) extraction and metabarcoding techniques.

[Our work] We apply a reproducible and modular framework for wildlife interaction surveillance by combining traditional morphological and modern DNA metabarcoding assays to quantify predation incidence by fur seals and impacts to a vulnerable prey species – little penguins. Specifically, we offer: (i) a multi-assay method for comparison of target species identification – producing more reliable and nuanced predation estimates than that offered by the traditional assay alone; (ii) a reproducible protocol for DNA metabarcoding analyses for identifying target prey species from predator scat samples; and (iii) a compelling exploration of haplotype polymorphism for genetic diversity and enabling a probable estimate for abundances of target species consumed from eDNA.

[Results] We estimate the incidence of predation on seabirds by recovering and protected long-nosed fur seals (*Arctocephalus forsteri*) ranges from 9–29% of samples and included up to 6 prey species. The most common seabird prey – the culturally valued little penguin (*Eudyptula minor*) occurred in 6–25% of samples. This is higher than previously reported from traditional morphological assays alone. DNA metabarcoding proved more sensitive in identifying additional seabird taxa and provided relative quantitative information where multiple prey species occur within a sample.

[Results some more] Where previous research has battled with the inability to identify any numerical abundance information from hard-parts, especially feathers, we were able to identify a minimum of 16 individual penguins consumed across 10 fur seal scat samples using a polymorphism analysis of consumed little penguin DNA (which identified five distinct mitochondrial haplotypes). Out of 99 samples, just 10 contained large abundance of penguin DNA, representing likely just 10% of the fur seal population at any point in time may engage in penguin predation, and of those individuals the level of specialisation and impacts on penguins varied.

[Management & research recommendations] Our results demonstrate a need for research and development of techniques at the nexus of population genetics and environmental sampling – including screening for predator genetic diversity to identify individuals in a population contributing to predation of a sensitive or valuable species. For this local issue, we recommend rapid uptake and development of cost-effective genetic techniques and broader spatiotemporal sampling of fur seal diets to further quantify predation incidences and hotspots of concern for wildlife conflict management. This research provides a critical step towards an up-to-date cumulative impact assessment for threats to little penguins in southern Australia.

Additional content/phrasing:

* We provide critical quantitative information for the management of a contentious wildlife conflict in southern Australia, between two species of conservation concern – the recovering long-nosed fur seal and the culturally important little penguin.
* This conflict has resulted in repeated calls to cull the fur seal, recolonizing their former range and predation assessments are required to predict impacts on seabird populations.
* [Write up about eDNA and great descriptor for it](https://theconversation.com/dna-barcodes-sci-fi-tech-to-safeguard-environment-79391).