

The following online resource accompanies the article

Global terrestrial distribution of penguins (*Spheniscidae*) and their conservation by protected areas

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Table 1: IUCN PA category names and definitions

Category Ia: Strict nature reserve

Strictly protected for biodiversity and also possibly geological/ geomorphological features, where human visitation, use and impacts are controlled and limited to ensure protection of the conservation values

Category Ib: Wilderness area

Usually large unmodified or slightly modified areas, retaining their natural character and influence, without permanent or significant human habitation, protected and managed to preserve their natural condition

Category II: National park

Large natural or near-natural areas protecting large-scale ecological processes with characteristic species and ecosystems, which also have environmentally and culturally compatible spiritual, scientific, educational, recreational and visitor opportunities

Category III: Natural monument or feature

Areas set aside to protect a specific natural monument, which can be a landform, sea mount, marine cavern, geological feature such as a cave, or a living feature such as an ancient grove

Category IV: Habitat/species management area

Areas to protect particular species or habitats, where management reflects this priority. Many will need regular, active interventions to meet the needs of particular species or habitats, but this is not a requirement of the category

Category V: Protected landscape/seascape

Where the interaction of people and nature over time has produced a distinct character with significant ecological, biological, cultural and scenic value: and where safeguarding the integrity of this interaction is vital to protecting and sustaining the area and its associated nature conservation and other values

Category VI: Managed resource

Areas which conserve ecosystems, together with associated cultural values and traditional natural resource management systems. Generally large, mainly in a natural condition, with a proportion under sustainable natural resource management and where low-level non-industrial natural resource use compatible with nature conservation is seen as one of the main aims

Table 2: Number of protected areas (PAs; including all IUCN categories, Not Applicable ('NA'), Not Reported ('NR'), and Antarctic Specially Protected Areas ('ASPA')) within all species breeding ranges. See Online Resource Table 1 for full description of categories.

Species	Number of PAs	IUCN Categories							NA	NR	ASPA
		Ia	Ib	II	III	IV	V	VI			
<i>Eudyptes schlegeli</i>	1	1	0	0	0	0	0	0	0	0	0
<i>Eudyptes sclateri</i>	1	1	0	0	0	0	0	0	0	0	0
<i>Spheniscus mendiculus</i>	2	2	0	0	0	0	0	0	0	0	0
<i>Eudyptes moseleyi</i>	3	0	0	0	0	0	0	0	2	1	0
<i>Aptenodytes patagonicus</i>	6	1	1	0	0	2	0	0	1	1	0
<i>Aptenodytes forsteri</i>	32	7	2	2	1	4	0	4	1	7	4
<i>Eudyptes pachyrhynchus</i>	34	9	0	0	0	0	0	0	0	0	25
<i>Spheniscus humboldti</i>	37	3	0	2	27	4	0	0	1	0	0
<i>Pygoscelis antarcticus</i>	41	0	0	4	3	21	0	2	0	11	0
<i>Pygoscelis papua</i>	56	2	1	0	0	0	0	1	0	4	48
<i>Spheniscus magellanicus</i>	58	7	1	1	1	0	0	1	1	4	42
<i>Pygoscelis adeliae</i>	66	1	1	5	6	28	2	8	5	10	0
<i>Spheniscus demersus</i>	77	12	0	0	0	0	0	0	0	0	65
<i>Eudyptes chrysolophus</i>	80	0	0	1	0	0	0	0	5	74	0
<i>Eudyptes chrysocome</i>	86	24	1	4	1	3	0	5	1	4	43
<i>Megadyptes antipodes</i>	88	34	2	5	3	11	0	8	1	9	15
<i>Eudyptula minor</i>	113	9	0	1	83	15	1	1	1	2	0
<i>Eudyptes schlegeli</i>	985	151	14	112	307	208	69	94	10	20	0
TOTAL	1766	264	23	137	432	296	72	124	29	1766	264

Table 3: Data for protected area and biodiversity hotspot (HS) coverage across all global penguin species, including all IUCN categories, Not Categorized (sum of Not Applicable ('NA') and Not Reported ('NR')), and Antarctic Specially Protected Areas ('ASPA'). Total coverage does not include overlap between areas. Overlap coverage quantifies the total area which is protected by more than one type of protected area. HS coverage includes areas of the species range covered by a biodiversity hotspot (refer to paper for full description) and HS protection quantifies how much of those hotspots covering each species is protected by a protected area.

Species	IUCN (km ²)	IUCN (%)	NC (km ²)	NC (%)	ASPA (km ²)	ASPA (%)	Total (km ²)	Total (%)	Overlap (km ²)	Overlap (%)	HS (km ²)	HS (%)	HS protection (km ²)	HS protection (%)
<i>A. forsteri</i>	146.10	0.11	0.00	0.00	127.04	0.09	217.64	0.16	0.06	0.00	0.00	0.00	0.00	0.00
<i>A. patagonicus</i>	3479.25	27.06	3592.57	27.95	4.46	0.03	3879.71	30.18	3.20	0.02	88.27	0.69	88.27	100.00
<i>E. chrysocome</i>	29985.90	22.83	22264.14	16.95	91.22	0.07	36800.63	28.01	15.54	0.01	819.29	0.62	819.29	100.00
<i>E. chrysolophus</i>	8090.30	8.73	11573.03	12.48	149.37	0.16	17125.15	18.47	2.69	0.00	88.27	0.10	88.27	100.00
<i>E. moseleyi</i>	60.40	25.34	140.03	58.75	0.00	0.00	140.03	58.75	0.06	0.03	0.00	0.00	0.00	0.00
<i>E. pachyrhynchus</i>	760.88	97.21	570.04	72.83	0.00	0.00	760.89	97.21	0.57	0.07	782.70	100.00	760.89	97.21
<i>E. robustus</i>	0.81	100.00	0.00	0.00	0.00	0.00	0.81	100.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>E. schlegeli</i>	123.05	100.00	0.00	0.00	0.00	0.00	123.05	100.00	0.00	0.00	123.05	100.00	123.05	100.00
<i>E. sclateri</i>	21.12	98.23	0.00	0.00	0.00	0.00	21.12	98.23	0.00	0.00	20.84	96.93	20.84	100.00
<i>E. minor</i>	4604.77	36.97	1862.85	14.96	0.00	0.00	4878.81	39.17	1.59	0.01	3050.90	24.49	910.22	29.83
<i>M. antipodes</i>	259.66	33.56	109.98	14.21	0.00	0.00	256.29	33.12	0.11	0.01	773.80	100.00	773.80	100.00
<i>P. adeliae</i>	60.96	0.06	0.00	0.00	298.63	0.29	312.09	0.30	0.05	0.00	0.00	0.00	0.00	0.00
<i>P. antarcticus</i>	1205.55	3.55	1733.21	5.10	162.73	0.48	1693.89	4.99	1.41	0.00	88.27	0.26	88.27	100.00
<i>P. papua</i>	1386.90	14.05	1587.02	16.07	1076.39	10.90	1713.72	17.36	2.34	0.02	0.00	0.00	0.00	0.00
<i>S. demersus</i>	2262.57	21.77	9577.22	92.16	0.00	0.00	8324.21	80.10	3.52	0.03	6538.81	62.92	6538.81	100.00
<i>S. humboldti</i>	764.02	9.64	406.65	5.13	0.00	0.00	884.65	11.16	0.29	0.00	4712.33	59.45	252.98	5.37
<i>S. magellanicus</i>	14776.76	19.68	22984.98	30.61	0.00	0.00	27121.78	36.12	10.64	0.01	19469.35	25.93	2136.96	10.98
<i>S. mendiculus</i>	0.00	0.00	5176.82	100.00	0.00	0.00	1821.34	100.00	3.36	0.18	1821.34	100.00	1821.34	100.00

Table 4: Penguin hotspots of biodiversity with four or five breeding species at each location.

Colony Location	Number of Species	Name of Species
Falkland Islands	4	<i>A. patagonicus</i> , <i>P. papua</i> , <i>S. magellanicus</i> , <i>E. chrysocome</i>
Tierra del Fuego	5	<i>A. patagonicus</i> , <i>P. papua</i> , <i>S. magellanicus</i> , <i>E. chrosolophus</i> <i>E. chrysocome</i>
South Georgia/South Sandwich Islands*	4	<i>A. patagonicus</i> , <i>P. papua</i> , <i>E. chrysolophus</i> , <i>P. antarcticus</i>
South Shetland Islands	4	<i>P. papua</i> , <i>P. antarcticus</i> , <i>P. adeliae</i> , <i>A. forsteri</i>
Antarctic Peninsula	4	<i>P. papua</i> , <i>E. chrysolophus</i> , <i>P. antarcticus</i> , <i>P. adeliae</i>
French Southern and Antarctic Territories (Crozet and Keurguelen) *	4	<i>A. patagonicus</i> , <i>P. papua</i> , <i>E. chrysocome</i> , <i>E. chrysolophus</i>
Macquarie Island*	5	<i>P. antarcticus</i> , <i>E. chrysocome</i> , <i>E. schlegeli</i> , <i>A. patagonicus</i> , <i>E. chrysolophus</i>

*Fully protected by IUCN/Not Categorized PAs

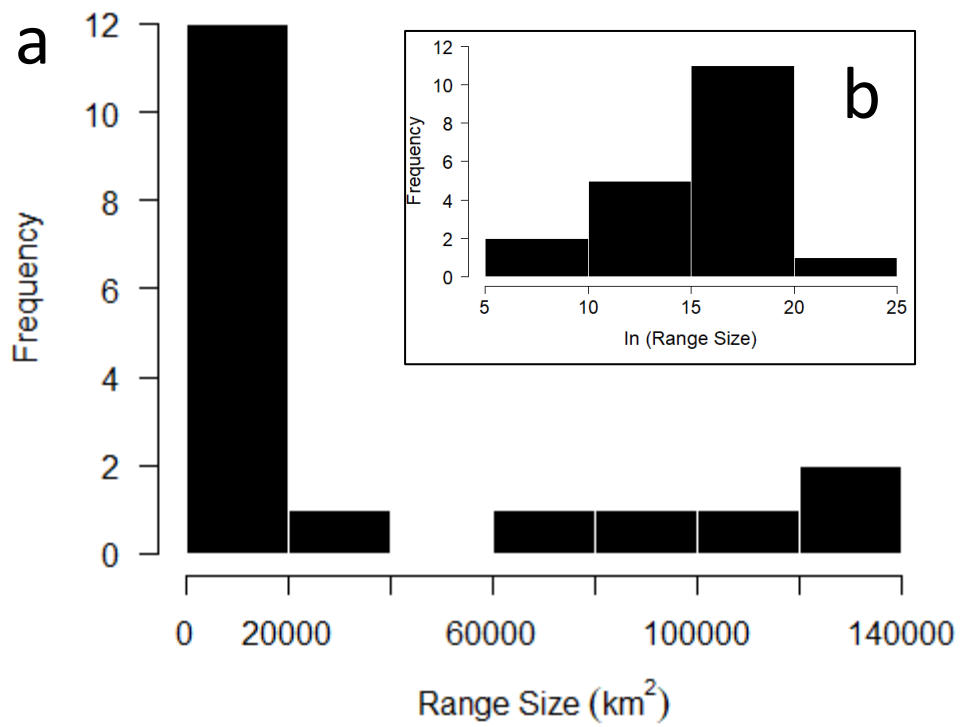


Figure 1: Frequency distribution of (a) the variation in geographic range sizes ($n = 18$) and (b) the same data in their logarithmic scale for penguins.

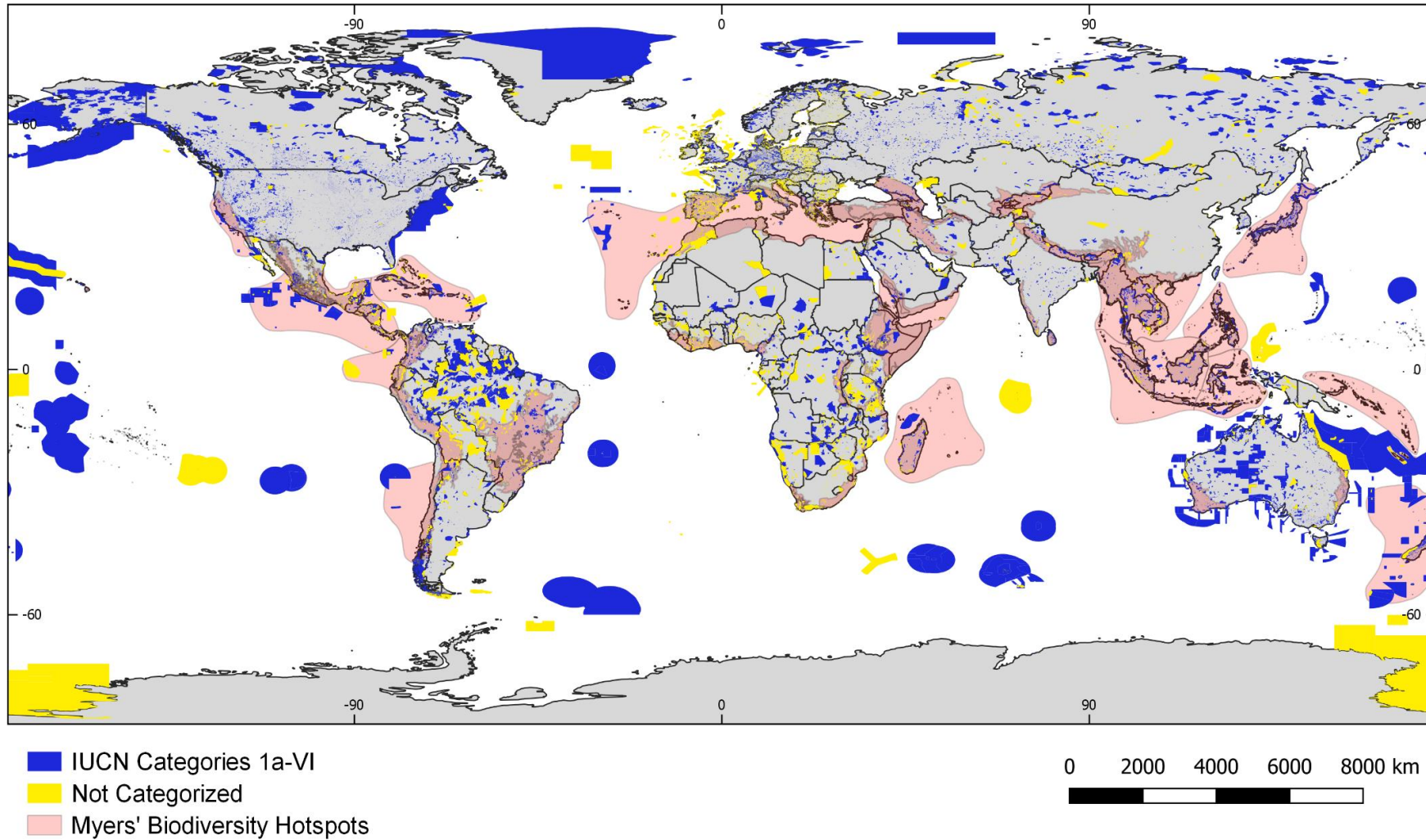


Figure 2: Global protected area (PA) distribution map, including IUCN PAs categories 1a-VI, not categorized PAs (combination of Not Applicable ('NA') and Not Reported ('NR')), and Myers' biodiversity hotspots (Myers et al. 2000). Projected using the World Geodetic System 1984. Basemap from Natural Earth (<http://www.naturalearthdata.com>).

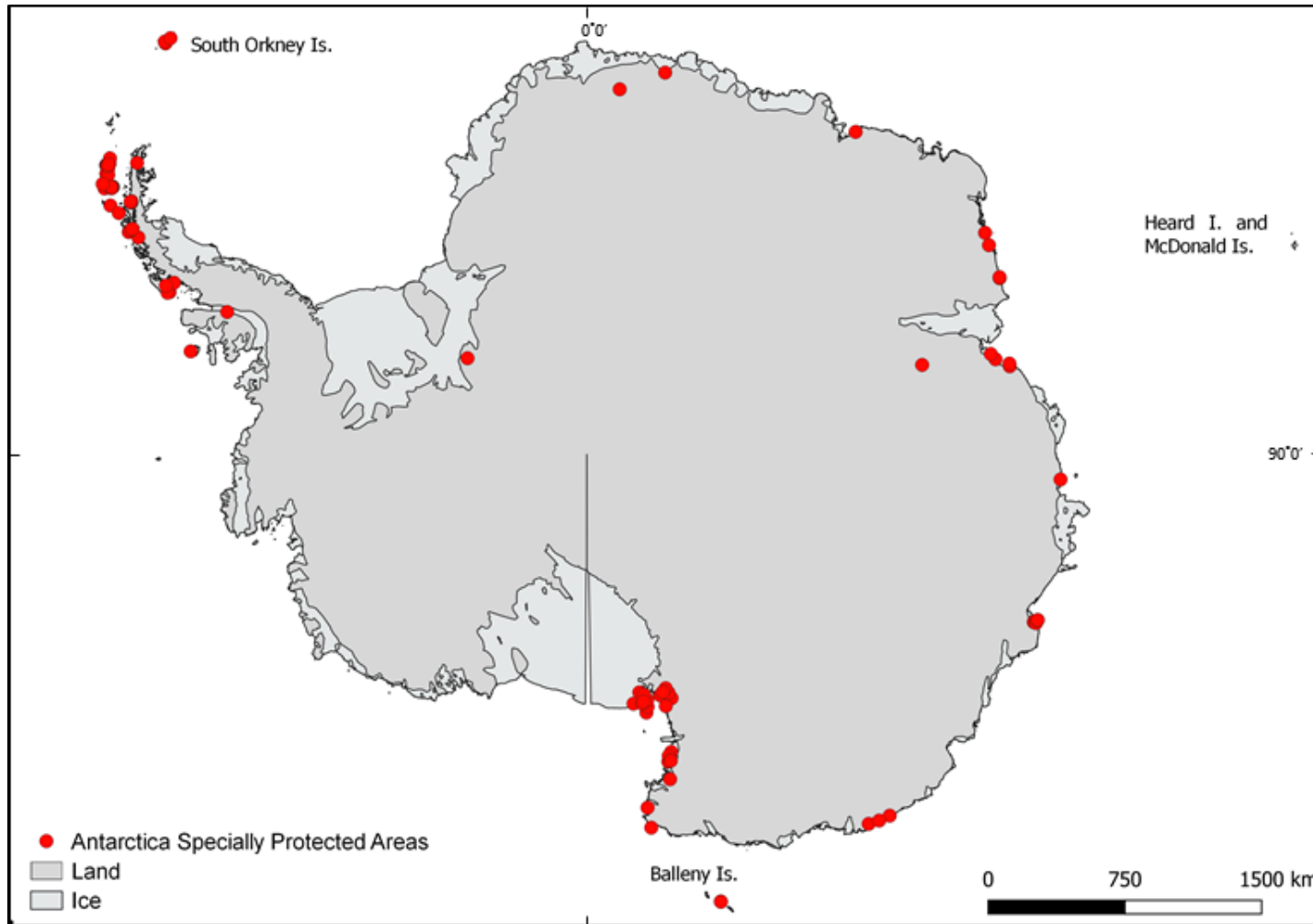


Figure 3: Antarctic Specially Protected Areas (ASPAs) distribution map, projected using South Pole Lambert Azimuthal Equal Area. Basemap from Natural Earth (<http://www.naturalearthdata.com>).

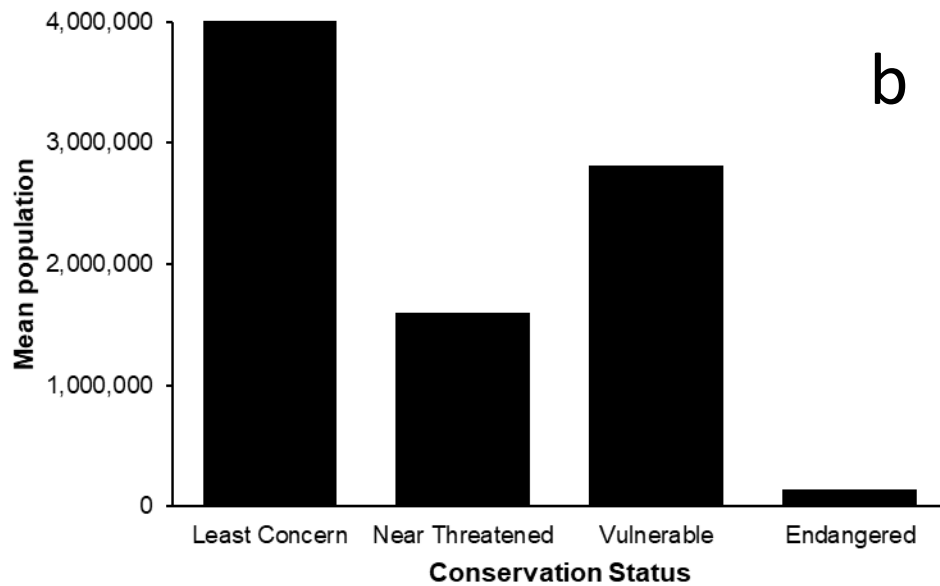
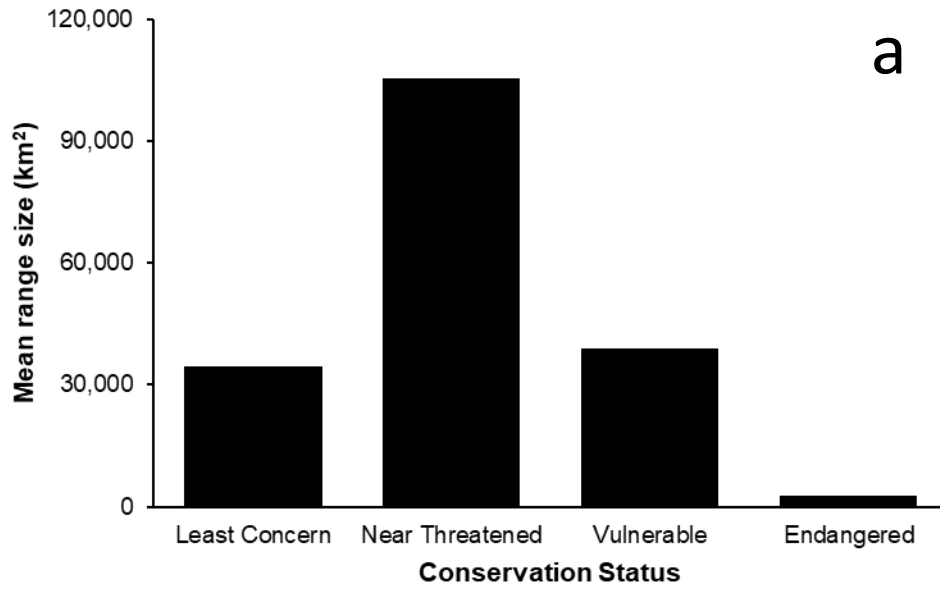


Figure 4: Variation between conservation status and (a) range size (Kruskal Wallis, $X^2 = 4.44$, $n = 3$, $P = 0.22$) and (b) population (Kruskal Wallis, $X^2 = 7.29$, $n = 3$, $P = 0.06$) across all global penguin species to determine if status is influenced by range and population size.