

Supplementary Material for

Adélie penguins north and east of the ‘Adélie gap’ continue to thrive in the face of dramatic declines elsewhere in the Antarctic Peninsula region

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278 A - Differentiating chicks from adults in UAV imagery



Figure S1. An image of Adélie penguins on Devil Island taken by RPAS with chicks marked by yellow dots and adults by red dots. Adults appear black with the occasional white belly visible and are sleeker and narrower than chicks at this stage of the season. Chicks appear gray, more rotund than the adults, and are often seen laying prone. Note that because chick down is quite fluffy, chicks often appear considerably larger than adults.

279 B - Population Model

280 The population trends of the five sites with existing previous survey data were analyzed using weighted linear regression. Each
281 population contains uncertainty due to observation error and, for chick counts converted to equivalent nest counts, the
282 additional uncertainty associated with the number of chicks per nest. Our weighted linear regression weighted each point
283 proportional to the inverse of the variance associated with each population estimate. Distributions of nest counts and chick
284 counts were simulated from a log-normal distribution using the scale parameter σ based on the census accuracy level as
285 described in Che-Castaldo et al.⁵⁷. In censuses where nest counts were conducted, the number of nests represents the number
286 of breeding pairs at the colony. In censuses where chick counts were conducted because the chicks had reached the crèche
287 stage, the number of chicks was divided by the proportion of chicks that reach the crèche stage in order to estimate the number
288 of breeding pairs present at the colony. We doubled the crèche success rate drawn from a Beta distribution with an expected

289 value of 0.46 female chicks per nest as given by Hinke et al.⁵⁸. Because population estimates were log-transformed, the slope
290 of the trend line represents the population growth rate.

291 In years with nest counts:

$$\text{Breeding pairs} \sim \text{LogNormal}(\ln(\text{NestCount}), \sigma)$$

292 In years with chick counts:

$$\text{Breeding pairs} = \text{Number of chicks} / \text{Reproductive success}$$

293 where

$$\text{Number of chicks} \sim \text{LogNormal}(\ln(\text{ChickCount}), \sigma)$$

294 and

$$\text{Reproductive success} \sim 2 * \text{Beta}(\alpha = 4.6184, \beta = 5.4216)$$

295 where sigma is appropriate to the observation error (see Supplementary Materials 1 in Che-Castaldo et al.⁵⁷).

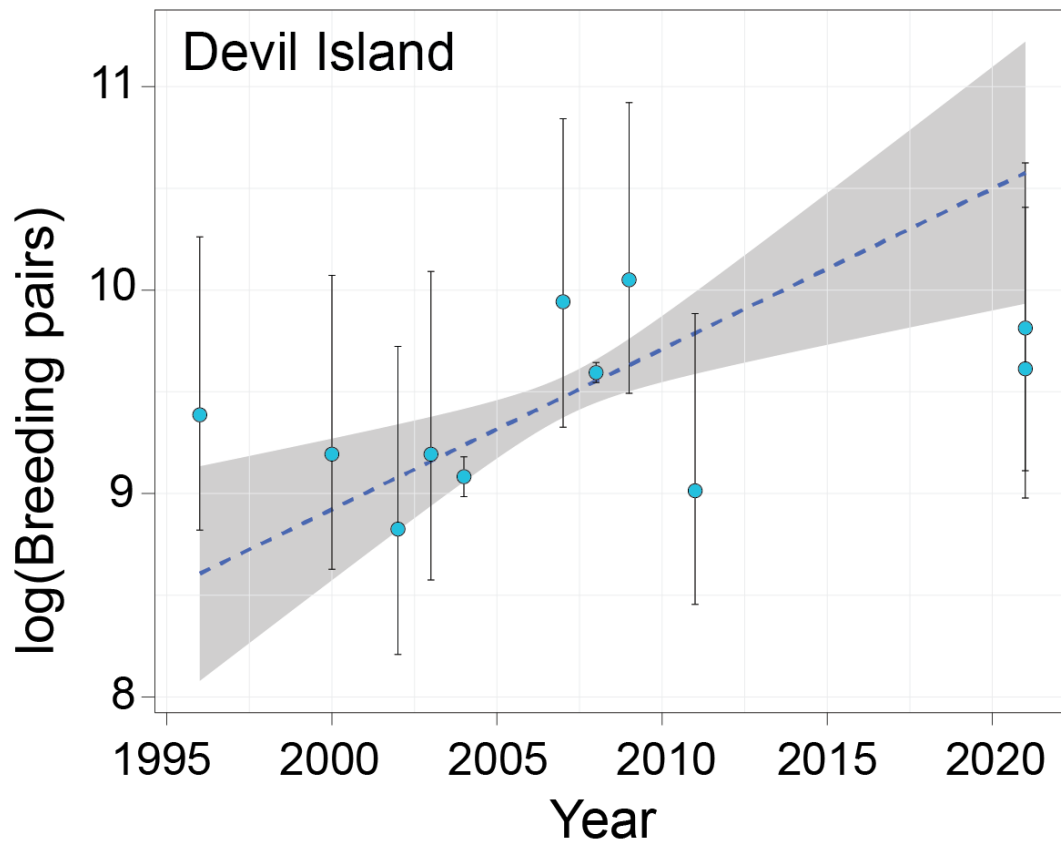


Figure S2. The natural log of the number of breeding Adélie penguin pairs on Devil Island since 1997. The error bars represent the 2.5th and 97.5th percentiles for each year, and the trend line is the weighted linear regression. Note that this plot is the same as shown in the panel to Figure 3; it is provided here in larger format for clarity.

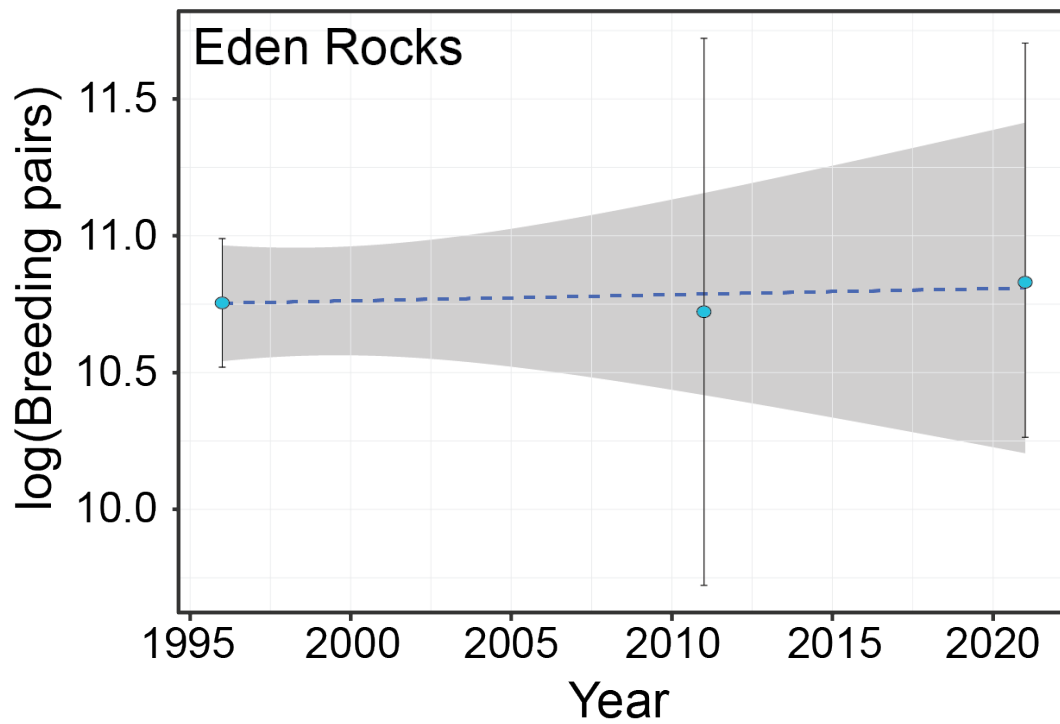


Figure S3. The natural log of the number of breeding Adélie penguin pairs on Eden Rocks since 1997. The error bars represent the 2.5th and 97.5th percentiles for each year, and the trend line is the weighted linear regression. Note that this plot is the same as shown in the panel to Figure 3; it is provided here in larger format for clarity.

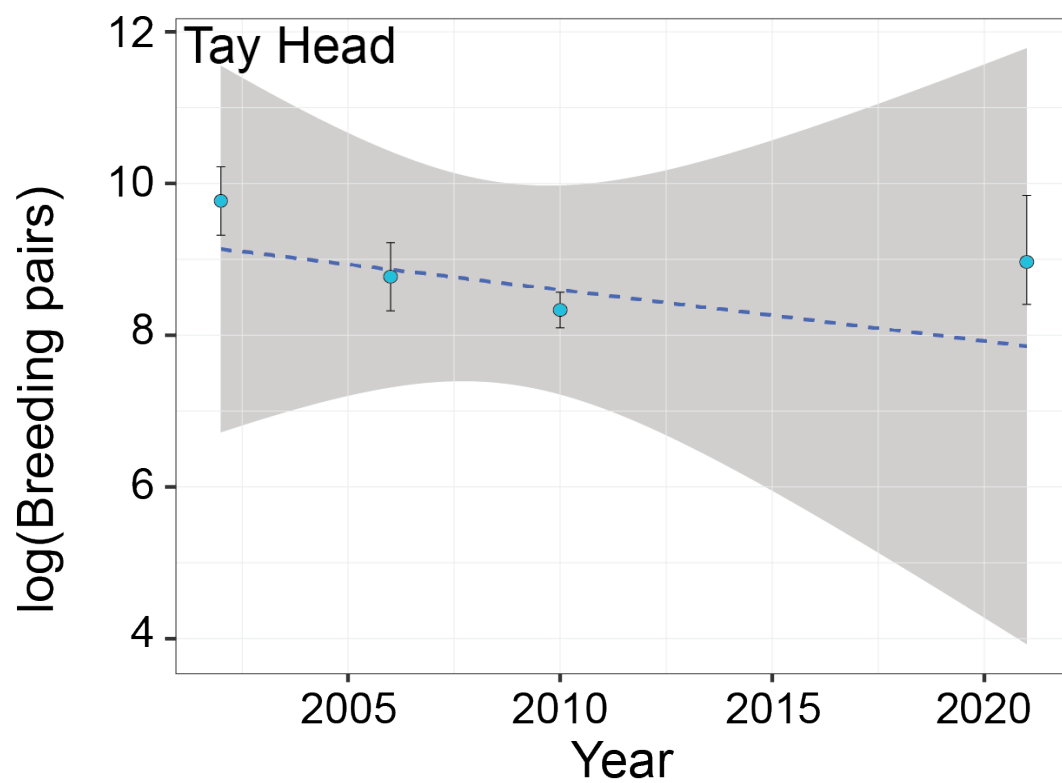


Figure S4. The natural log of the number of breeding Adélie penguin pairs on Tay Head since 2002. The error bars represent the 2.5th and 97.5th percentiles for each year, and the trend line is the weighted linear regression. Note that this plot is the same as shown in the panel to Figure 3; it is provided here in larger format for clarity.

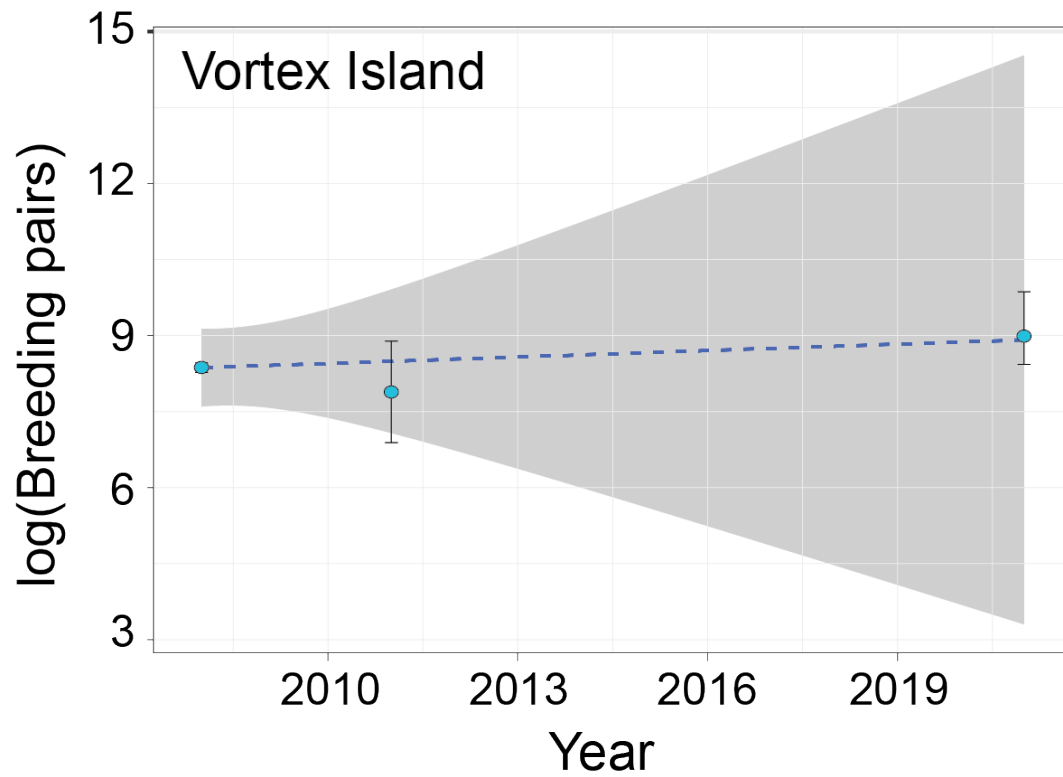


Figure S5. The natural log of the number of breeding Adélie penguin pairs on Vortex Island since 2008. The error bars represent the 2.5th and 97.5th percentiles for each year, and the trend line is the weighted linear regression. Note that this plot is the same as shown in the panel to Figure 3; it is provided here in larger format for clarity.

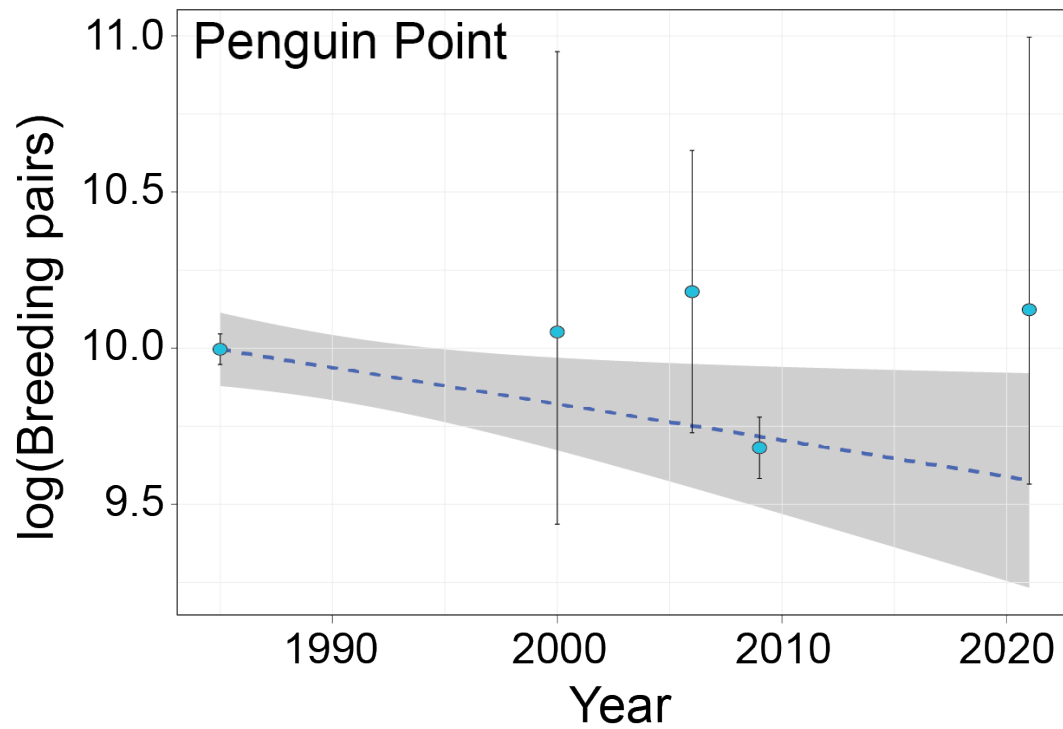


Figure S6. The natural log of the number of breeding Adélie penguin pairs on Penguin Point since 1985. The error bars represent the 2.5th and 97.5th percentiles for each year, and the trend line is the weighted linear regression. Note that this plot is the same as shown in the panel to Figure 3; it is provided here in larger format for clarity.