

The penguins of Antarctica

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25/3/2022

Introduction

There are three main penguin species in Antarctica (*Chinstrap*, *Gentoo*, *Adelie*). You can see them in the following figure:

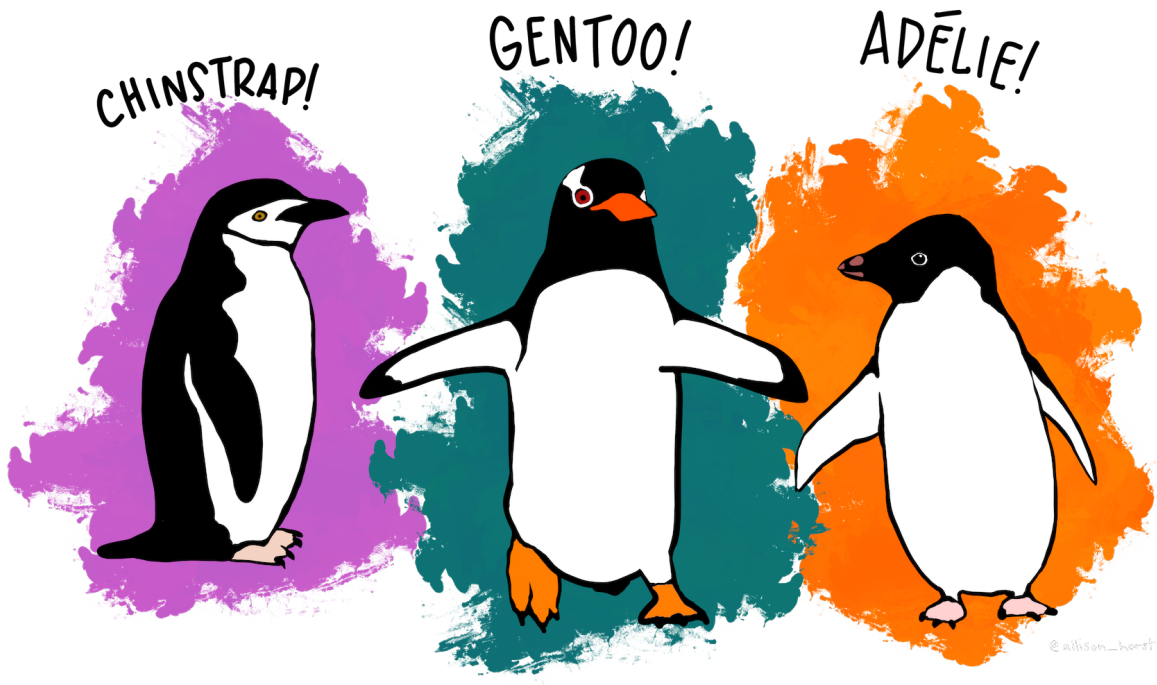


Figure 1: Artwork by Allison Horst

In this paper we want to answer the following questions

1. How bill depth depends on bill length?
2. Which penguin species has the highest body mass?

Methods

The data

The data was collected on islands in Antarctica and published by Gorman et al. (2014). You can find the original paper with the title “Ecological sexual dimorphism and environmental variability within a community

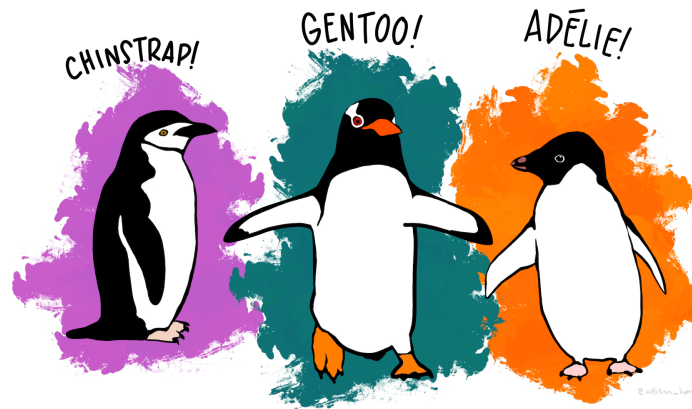


Figure 2: Illustration of the three penguin species by Allison Horst

of Antarctic penguins (genus *Pygoscelis*)” in PLoS ONE¹

The data is published via the `palmerpenguins` R package which you can find on this website.

The data contains (among others) the following measurements:

- bill length
- bill depth
- body mass
- sex
 - male
 - female

The analysis

We did some plots, calculated some summary statistics and a linear model of the form $y = ax + b$

Results

The mean weight of all penguin species is 4202. *Gentoo* penguins have an average weight of 5076 g, *Adelie* penguins of 3701 g and *Chinstrap* penguins of 3733 g.

The figure below shows that *Gentoo* penguins have the highest body mass.

```
ggplot(penguins, aes(x = body_mass_g, fill = species)) +
  geom_histogram(alpha = 0.6) +
  scale_fill_manual(values = c("darkorange", "purple", "cyan4")) +
  theme_minimal()
```

There is a positive relationship between bill length and bill depth for all 3 species, as the figure below shows.

```
ggplot(
  data = penguins,
  aes(
    x = bill_length_mm,
    y = bill_depth_mm,
    color = species,
    shape = species
```

¹paper available here.

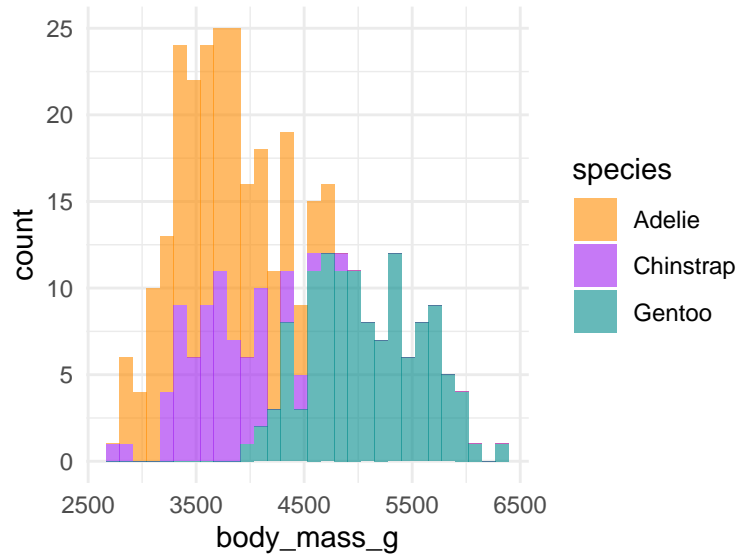


Figure 3: Histogram of weight of the three penguin species.

```
)
) +
  geom_point(size = 3, alpha = 0.8) +
  geom_smooth(method = "lm", se = FALSE) +
  scale_color_manual(values = c("darkorange", "purple", "cyan4")) +
  theme_minimal()
```

In general, it looks like the body characteristics differ between the sexes but also between the penguin species, as the table below illustrates:

```
## # A tibble: 6 x 6
## # Groups:   species [3]
##   species sex    bill_length bill_depth flipper_length body_mass
##   <fct>   <fct>      <dbl>      <dbl>      <dbl>      <dbl>
## 1 Adelie female    37.3       17.6       188.      3369.
## 2 Adelie male     40.4       19.1       192.      4043.
## 3 Chinstrap female  46.6       17.6       192.      3527.
## 4 Chinstrap male    51.1       19.3       200.      3939.
## 5 Gentoo female    45.6       14.2       213.      4680.
## 6 Gentoo male     49.5       15.7       222.      5485.
```

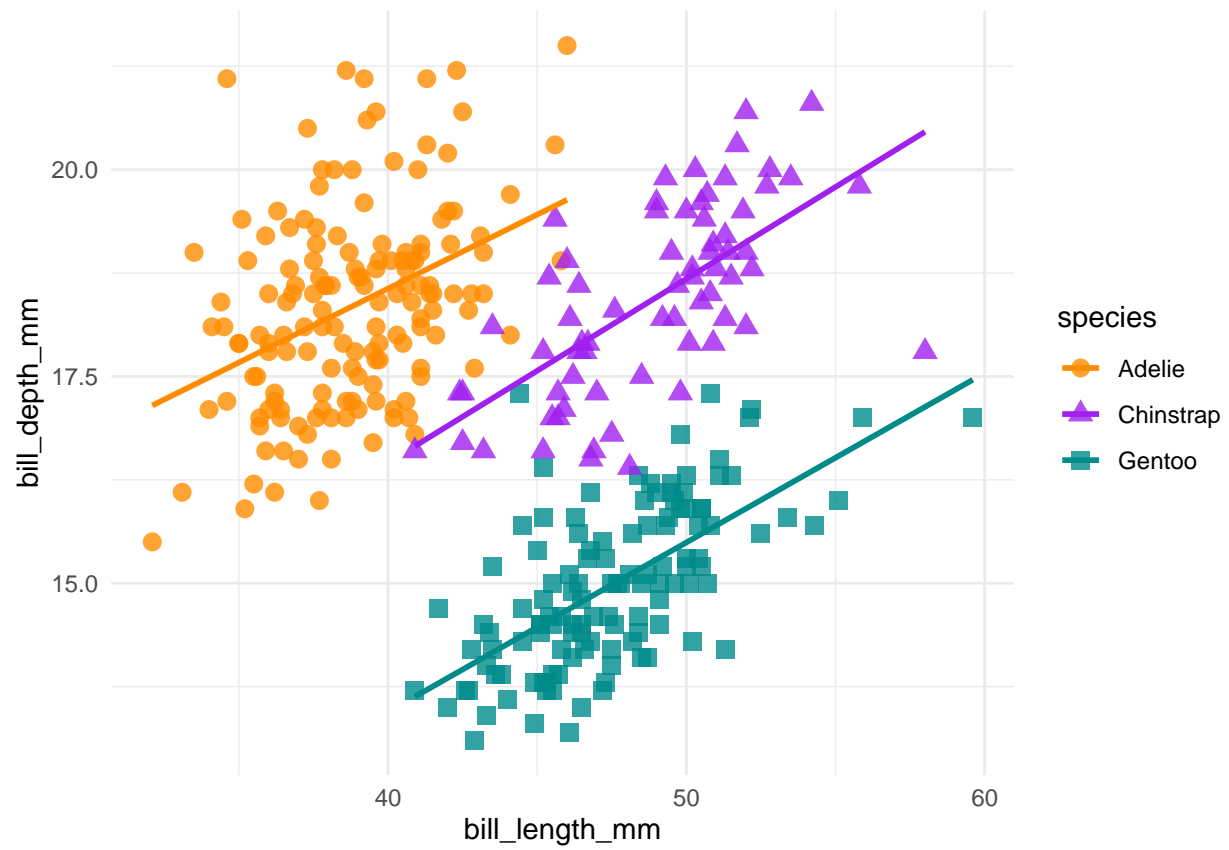


Figure 4: Scatter plot with regression lines showing the relationship between bill length and bill depth for the 3 penguin species