Challenge 7

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R Markdown

This is an R Markdown document. Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents. For more details on using R Markdown see http://rmarkdown.rstudio.com (http://rmarkdown.rstudio.com).

When you click the **Knit** button a document will be generated that includes both content as well as the output of any embedded R code chunks within the document. You can embed an R code chunk like this:

I. All about ggplot2

Data: Palmer Penguins

```
library(tidyverse)
```

```
## ── Attaching core tidyverse packages ──────────────────────── tidyverse 2.0.0 ──
## ✓ dplyr     1.1.2     ✓ readr     2.1.4
## ✓ forcats   1.0.0     ✓ stringr   1.5.0
## ✓ ggplot2   3.4.3     ✓ tibble    3.2.1
## ✓ lubridate 1.9.2     ✓ tidyr     1.3.0
## ✓ purrr     1.0.2
## ── Conflicts ────────────────────────────────────────── tidyverse_conflicts() ──
## ✖ dplyr::filter() masks stats::filter()
## ✖ dplyr::lag()    masks stats::lag()
## ℹ Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to be
come errors
```

```
library(palmerpenguins)
glimpse(penguins)
```

```
## Rows: 344
## Columns: 8
## $ species           <fct> Adelie, Adelie, Adelie, Adelie, Adelie, Adelie, Adel…
## $ island            <fct> Torgersen, Torgersen, Torgersen, Torgersen, Torgerse…
## $ bill_length_mm    <dbl> 39.1, 39.5, 40.3, NA, 36.7, 39.3, 38.9, 39.2, 34.1, …
## $ bill_depth_mm     <dbl> 18.7, 17.4, 18.0, NA, 19.3, 20.6, 17.8, 19.6, 18.1, …
## $ flipper_length_mm <int> 181, 186, 195, NA, 193, 190, 181, 195, 193, 190, 186…
## $ body_mass_g       <int> 3750, 3800, 3250, NA, 3450, 3650, 3625, 4675, 3475, …
## $ sex               <fct> male, female, female, NA, female, male, female, male…
## $ year              <int> 2007, 2007, 2007, 2007, 2007, 2007, 2007, 2007, 2007…
```

a. Start with the penguins data frame,
b. Map bill depth to the x-axis

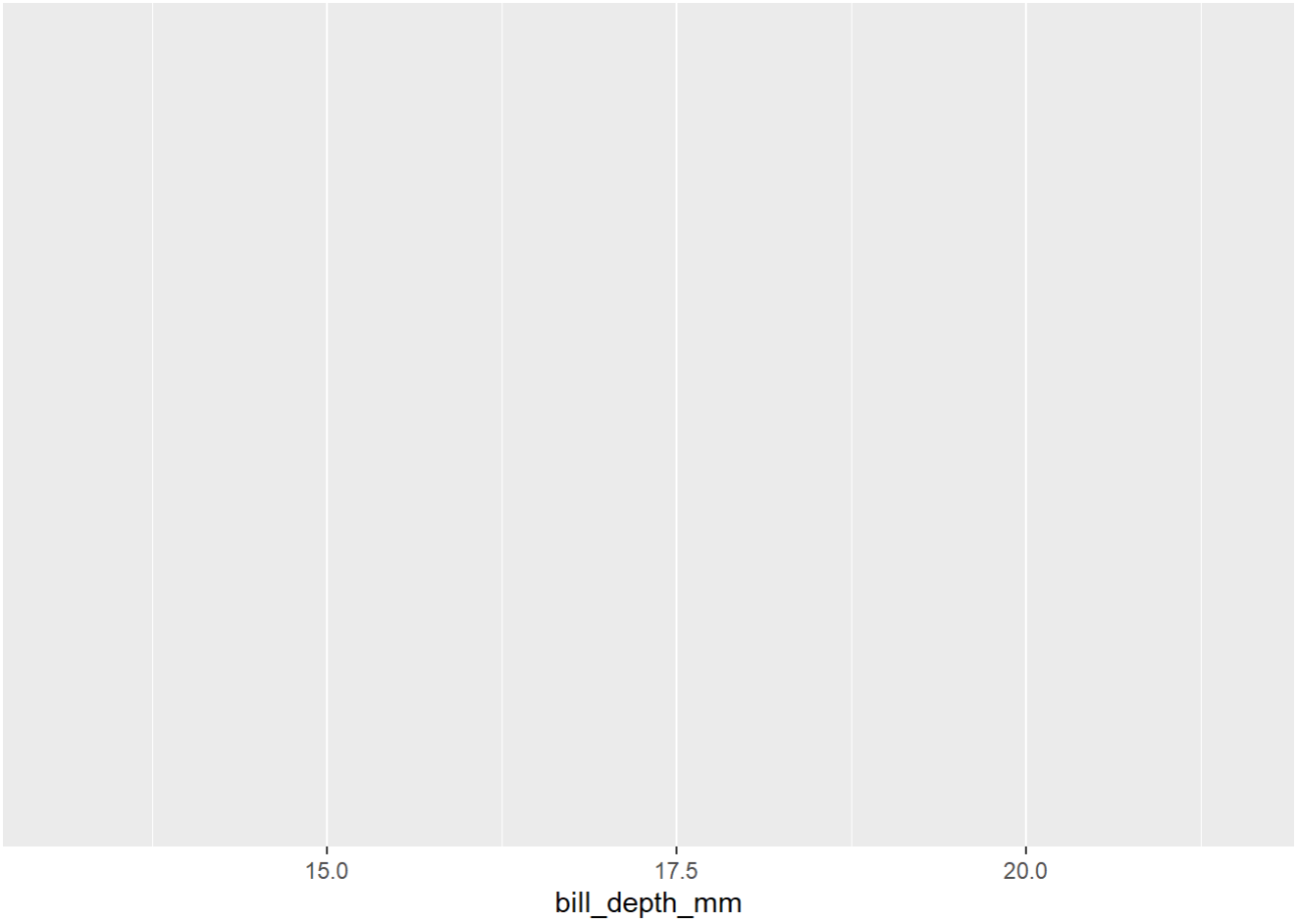
c. Map bill length to the y-axis
d. Represent each observation with a point
e. Map species to the colour of each point
f. Title the plot “Bill depth and length”
g. Add the subtitle “Dimensions for Adelie, Chinstrap, and Gentoo Penguins”
h. Label the x and y axes as “Bill depth (mm)” and “Bill length (mm)”, respectively
i. Label the legend “Species”
j. Add a caption for the data source
k. Finally, use a discrete colour scale that is designed to be

Palmer Penguins: Plot recreation

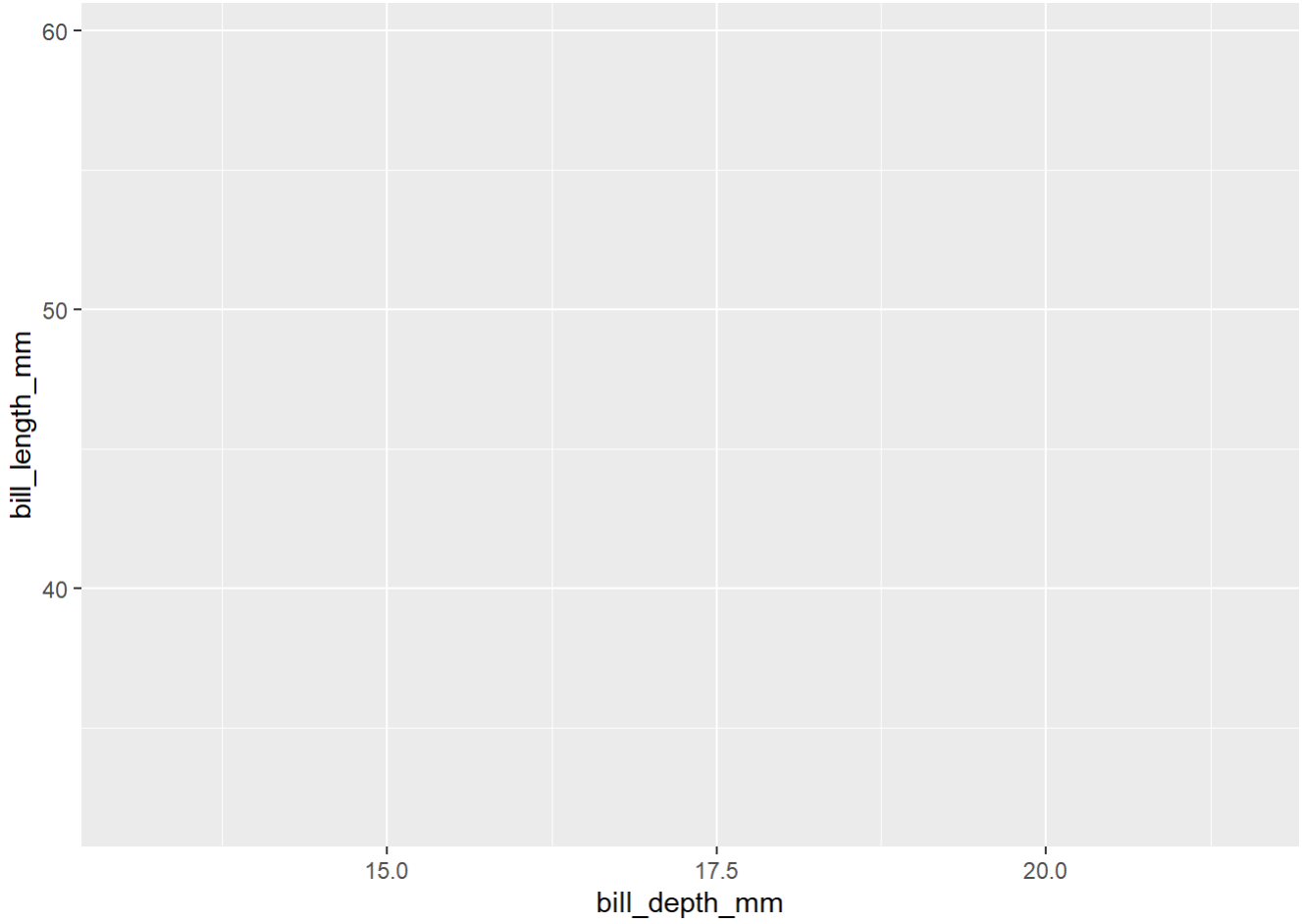
```
# start with penguins data frame
ggplot(data = penguins)
```



```
# Map bill depth to the x-axis
ggplot(data = penguins,
mapping = aes(x = bill_depth_mm))
```

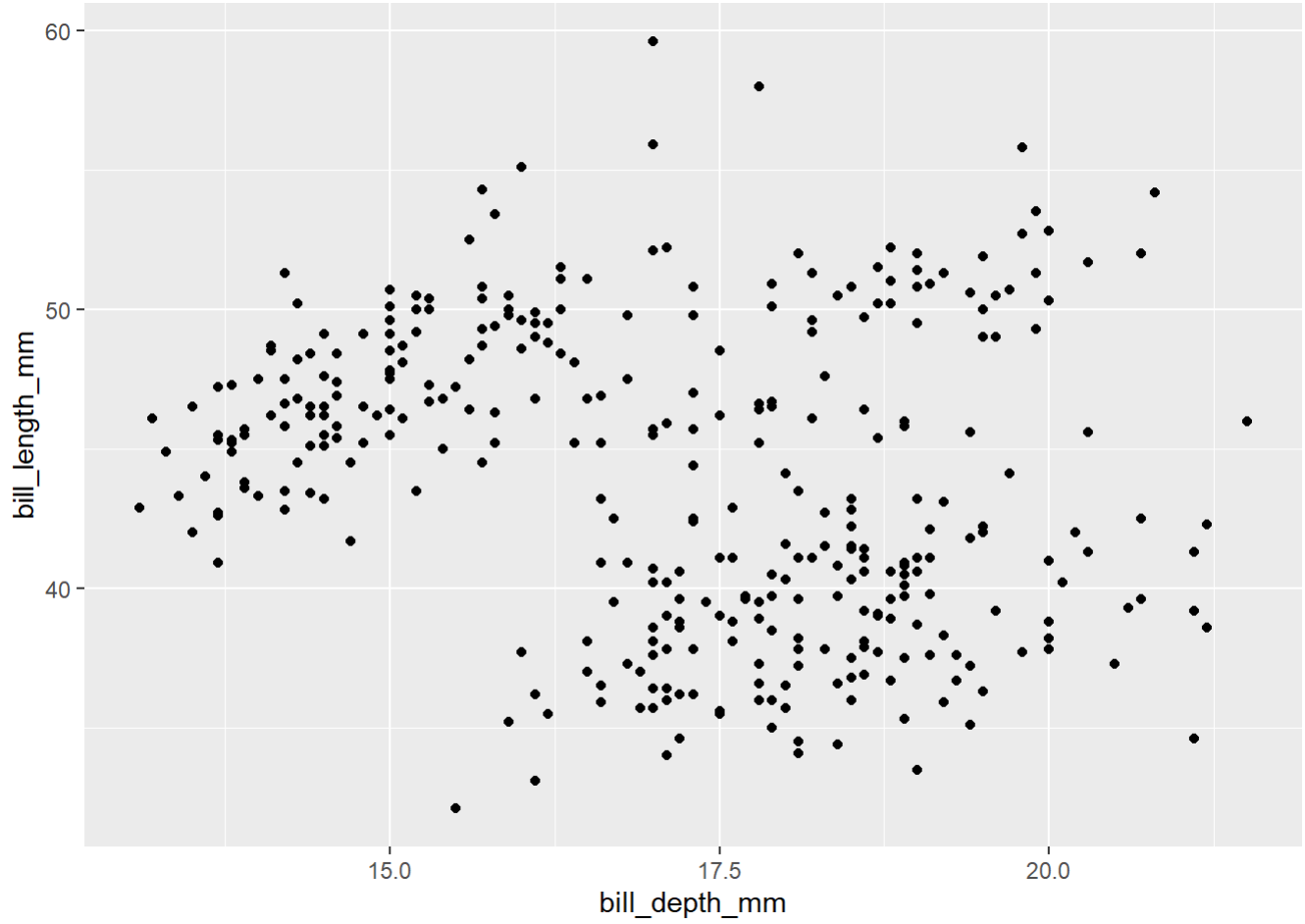



```
# Map bill length to the y-axis
ggplot(data = penguins,
 mapping = aes(x = bill_depth_mm,
 y = bill_length_mm))
```



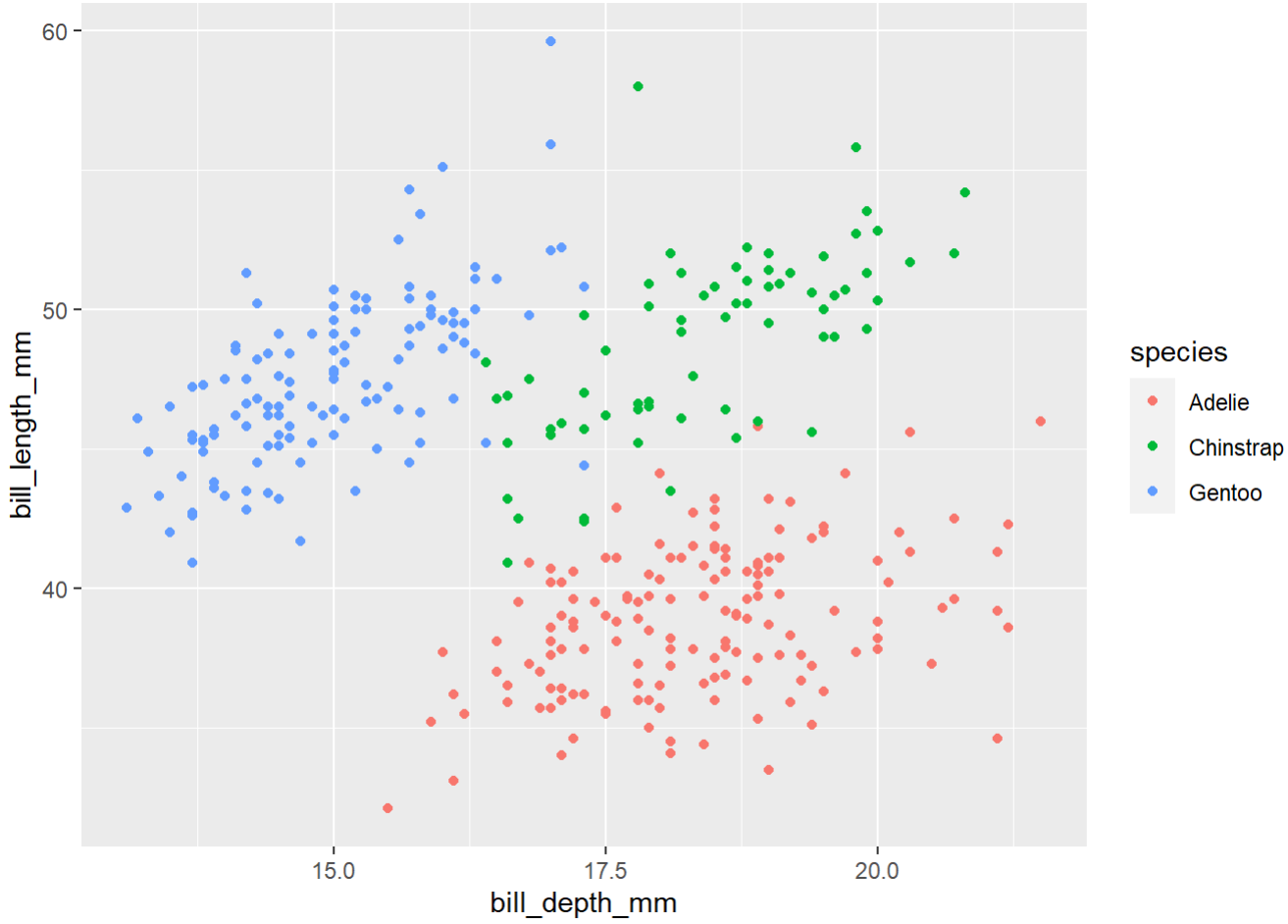

```
# Represent each observation with a point
ggplot(data = penguins,
mapping = aes(x = bill_depth_mm,
y = bill_length_mm)) +
geom_point()
```

```
## Warning: Removed 2 rows containing missing values (`geom_point()`).
```



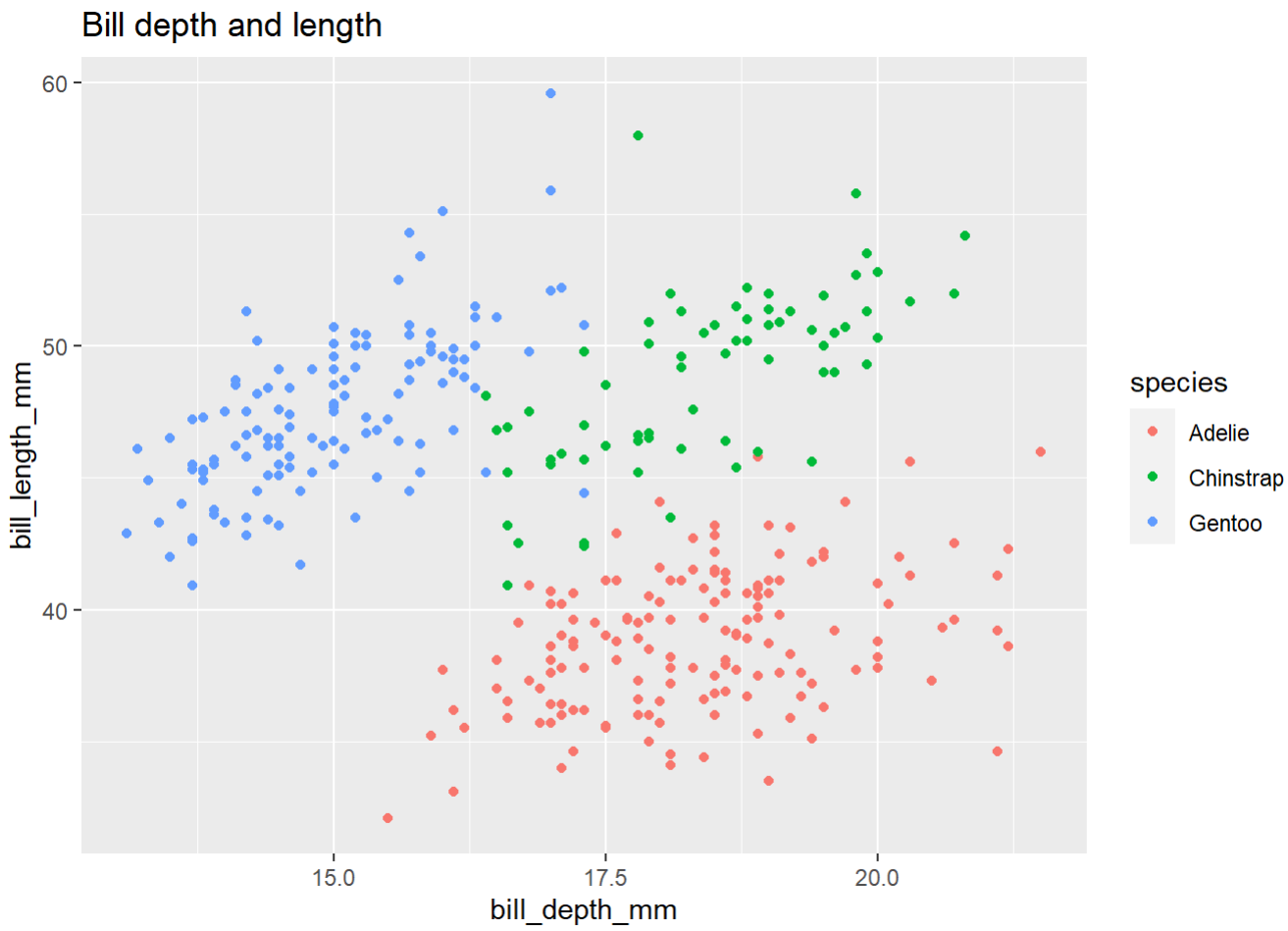

```
# Map species to the color of each point
ggplot(data = penguins,
 mapping = aes(x = bill_depth_mm,
 y = bill_length_mm,
 colour = species)) +
 geom_point()
```

```
## Warning: Removed 2 rows containing missing values (`geom_point()`).
```



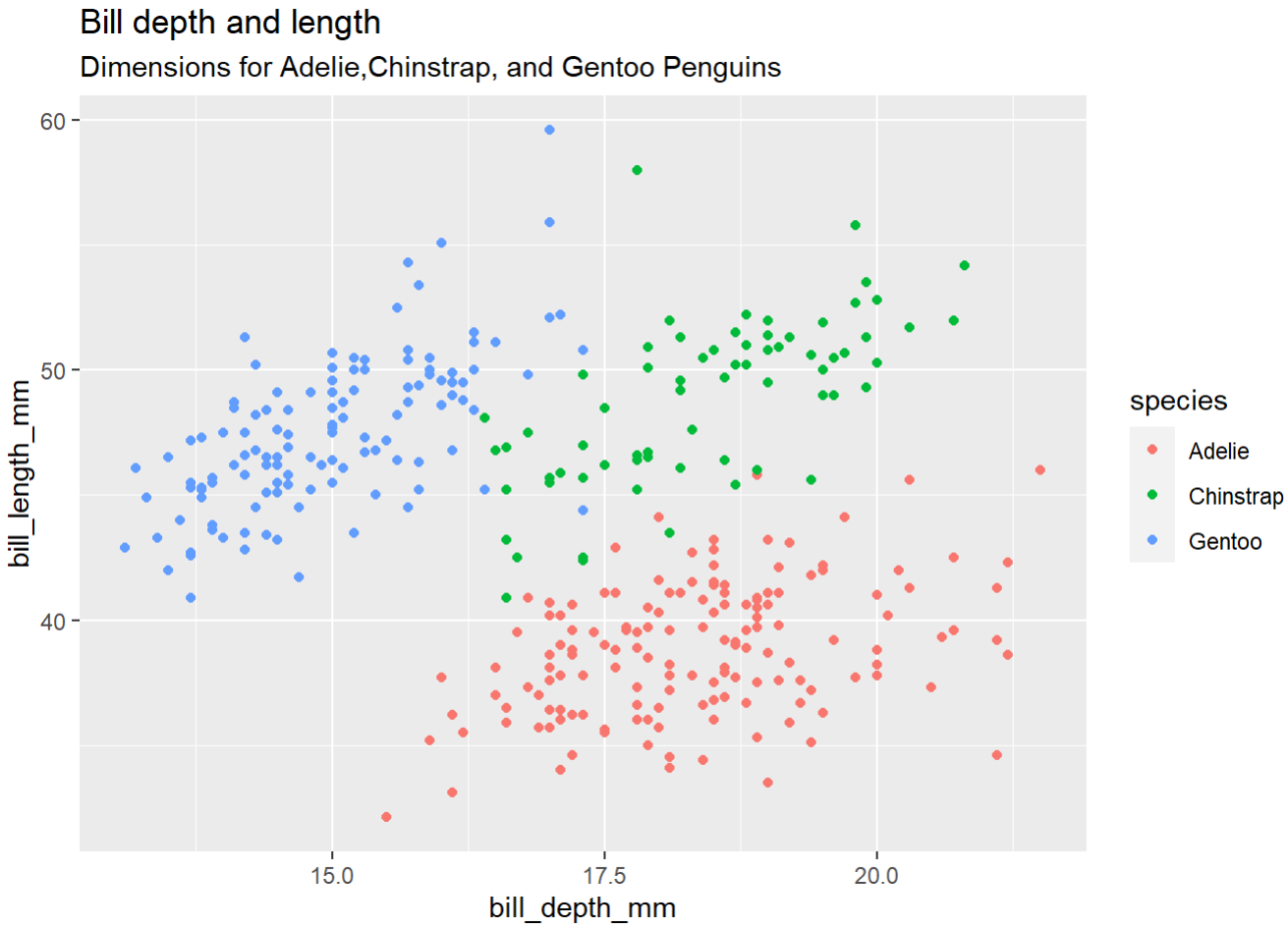

```
# Title the plot "Bill depth and length"
ggplot(data = penguins,
 mapping = aes(x = bill_depth_mm,
 y = bill_length_mm,
 colour = species)) +
 geom_point() +
 labs(title = "Bill depth and length")
```

```
## Warning: Removed 2 rows containing missing values (`geom_point()`).
```



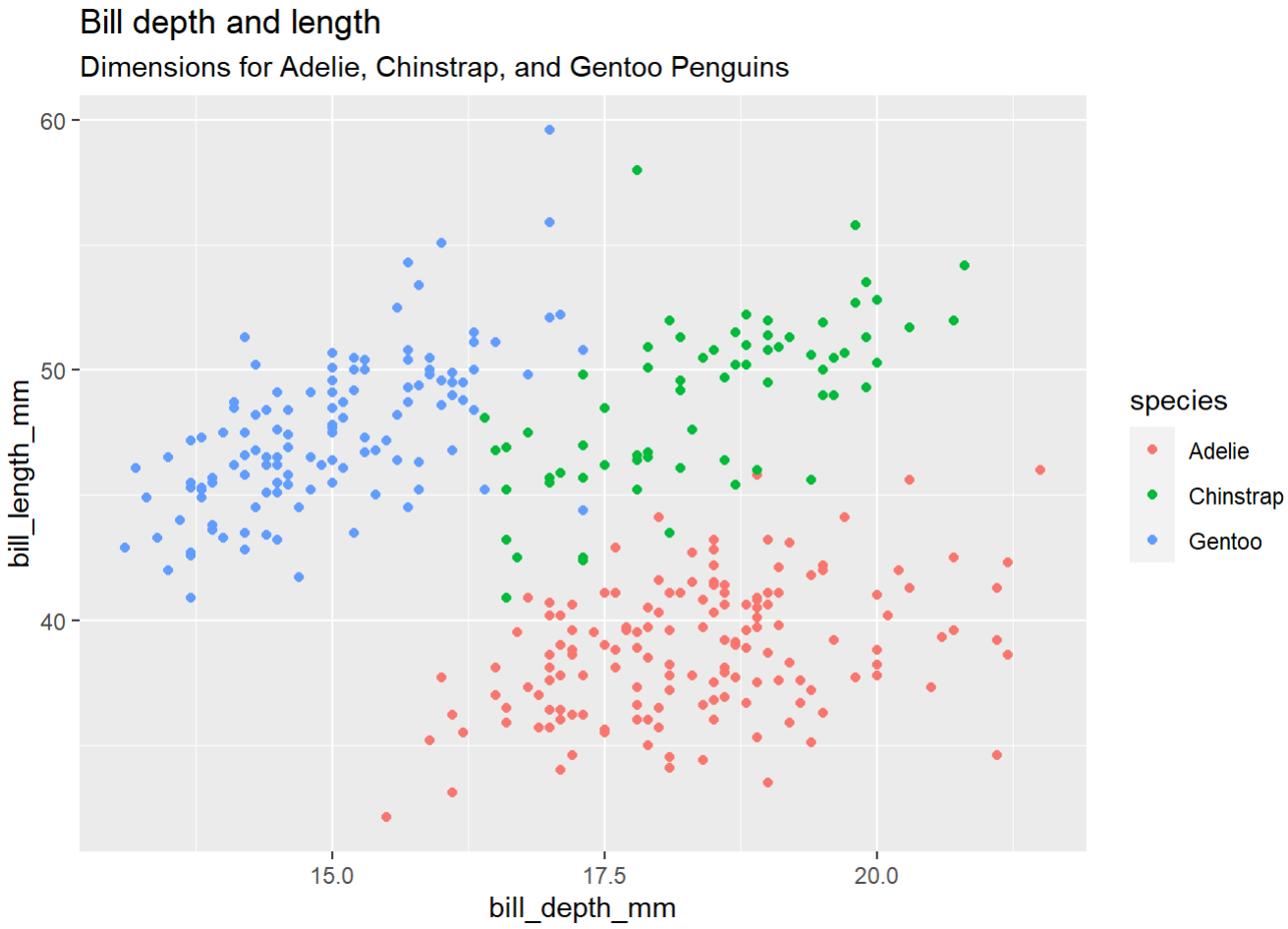

```
# Add the subtitle "Dimensions for Adelie, Chinstrap, and Gentoo Penguins"
ggplot(data = penguins,
mapping = aes(x = bill_depth_mm,
y = bill_length_mm,
colour = species)) +
geom_point() +
labs(title = "Bill depth and length",
subtitle = "Dimensions for Adelie,Chinstrap, and Gentoo Penguins")
```

```
## Warning: Removed 2 rows containing missing values (`geom_point()`).
```




```
# Label the x and y axes as "Bill depth (mm)" and "Bill length (mm)", respectively
ggplot(data = penguins,
mapping = aes(x = bill_depth_mm,
y = bill_length_mm,
colour = species)) +
geom_point() +
labs(title = "Bill depth and length",
subtitle = "Dimensions for Adelie, Chinstrap, and Gentoo Penguins")
```

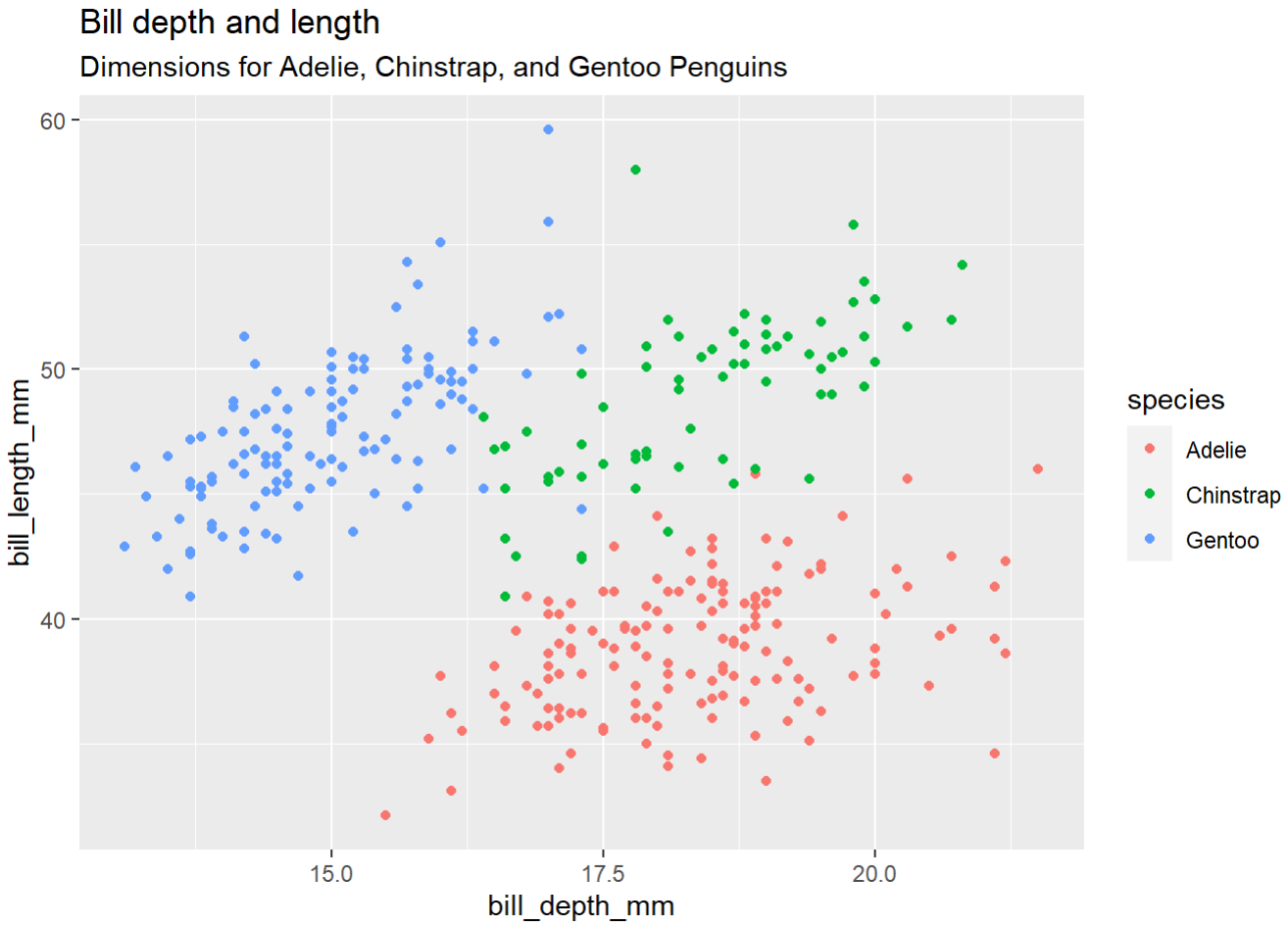
```
## Warning: Removed 2 rows containing missing values (`geom_point()`).
```




```
  x = "Bill depth (mm)"
  y = "Bill length (mm)"

# Label the legend "Species"
ggplot(data = penguins,
mapping = aes(x = bill_depth_mm,
y = bill_length_mm,
colour = species)) +
geom_point() +
labs(title = "Bill depth and length",
subtitle = "Dimensions for Adelie, Chinstrap, and Gentoo Penguins")
```

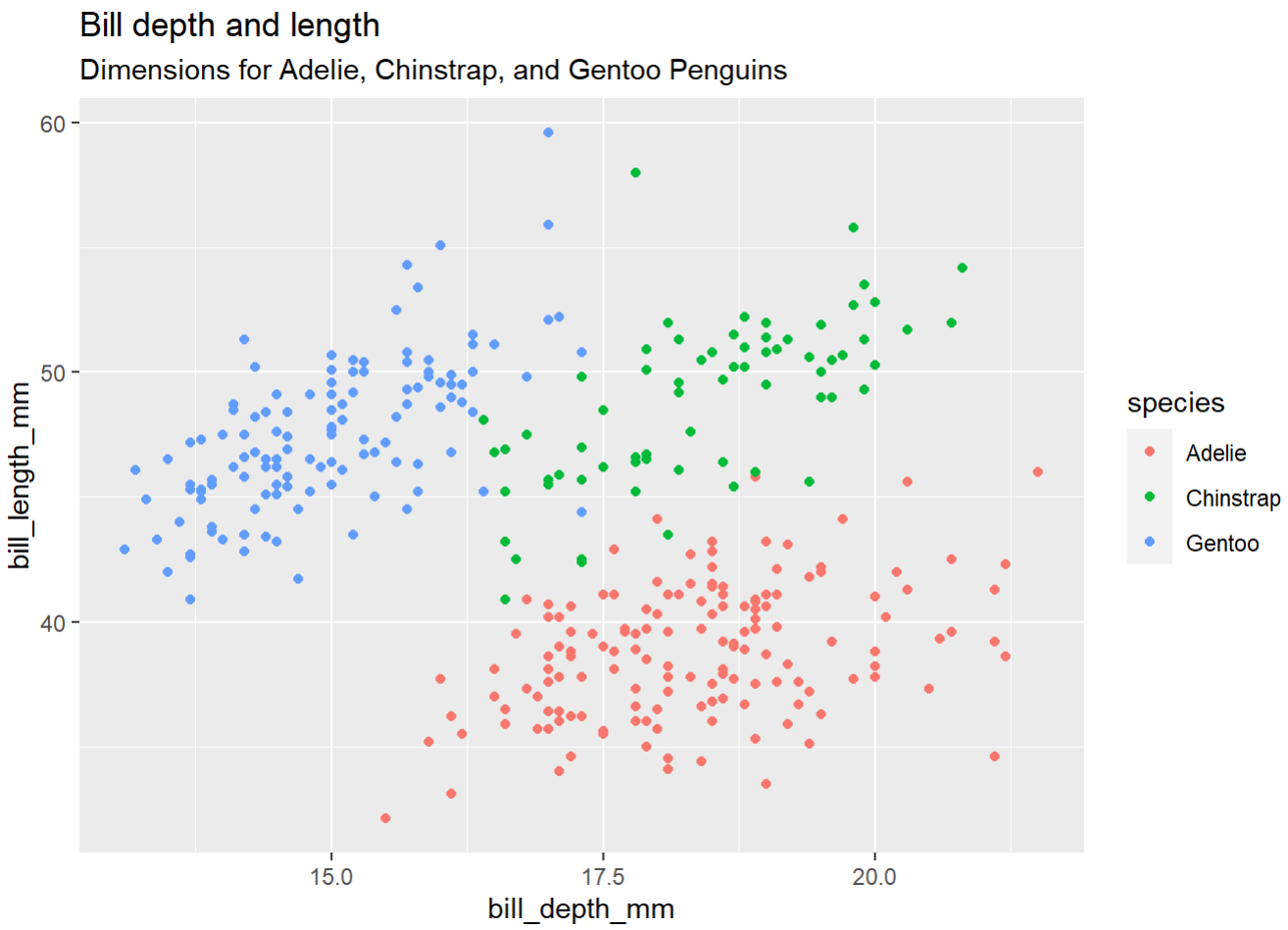
```
## Warning: Removed 2 rows containing missing values (`geom_point()`).
```




```
        x = "Bill depth (mm)"
        y = "Bill length (mm)"
colour = "Species"

# Add a caption for the data source
ggplot(data = penguins,
mapping = aes(x = bill_depth_mm,
y = bill_length_mm,
colour = species)) +
geom_point() +
labs(title = "Bill depth and length",
subtitle = "Dimensions for Adelie, Chinstrap, and Gentoo Penguins")
```

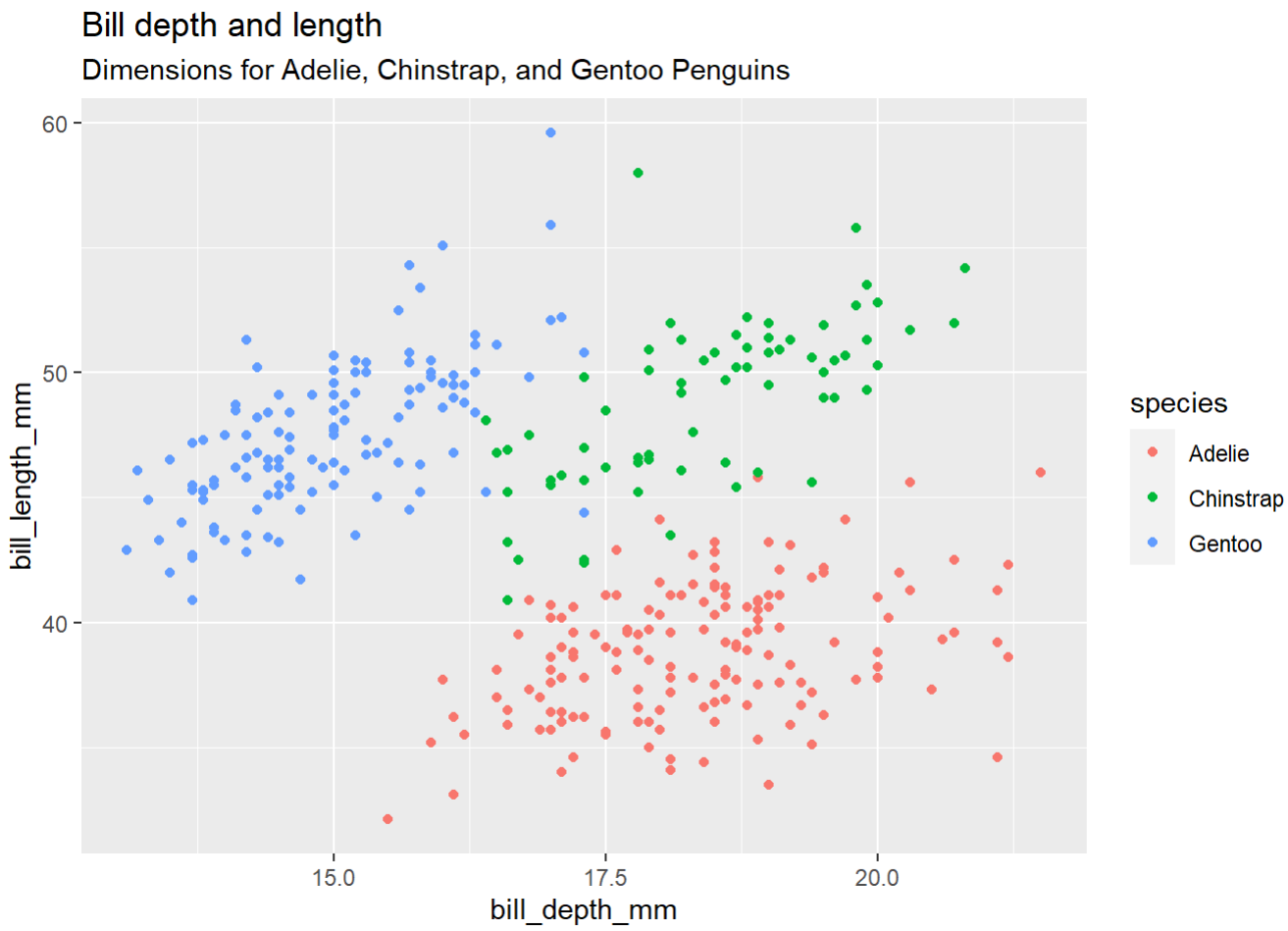
```
## Warning: Removed 2 rows containing missing values (`geom_point()`).
```




```
        x = "Bill depth (mm)"
        y = "Bill length (mm)"
colour = "Species"
caption = "Source: Palmer Station LTER"

#  Finally, use a discrete color scale that is designed to be perceived by viewers with commo
n forms of color blindness.
ggplot(data = penguins,
mapping = aes(x = bill_depth_mm,
y = bill_length_mm,
colour = species)) +
geom_point() +
labs(title = "Bill depth and length",
subtitle = "Dimensions for Adelie, Chinstrap, and Gentoo Penguins")
```

```
## Warning: Removed 2 rows containing missing values (`geom_point()`).
```



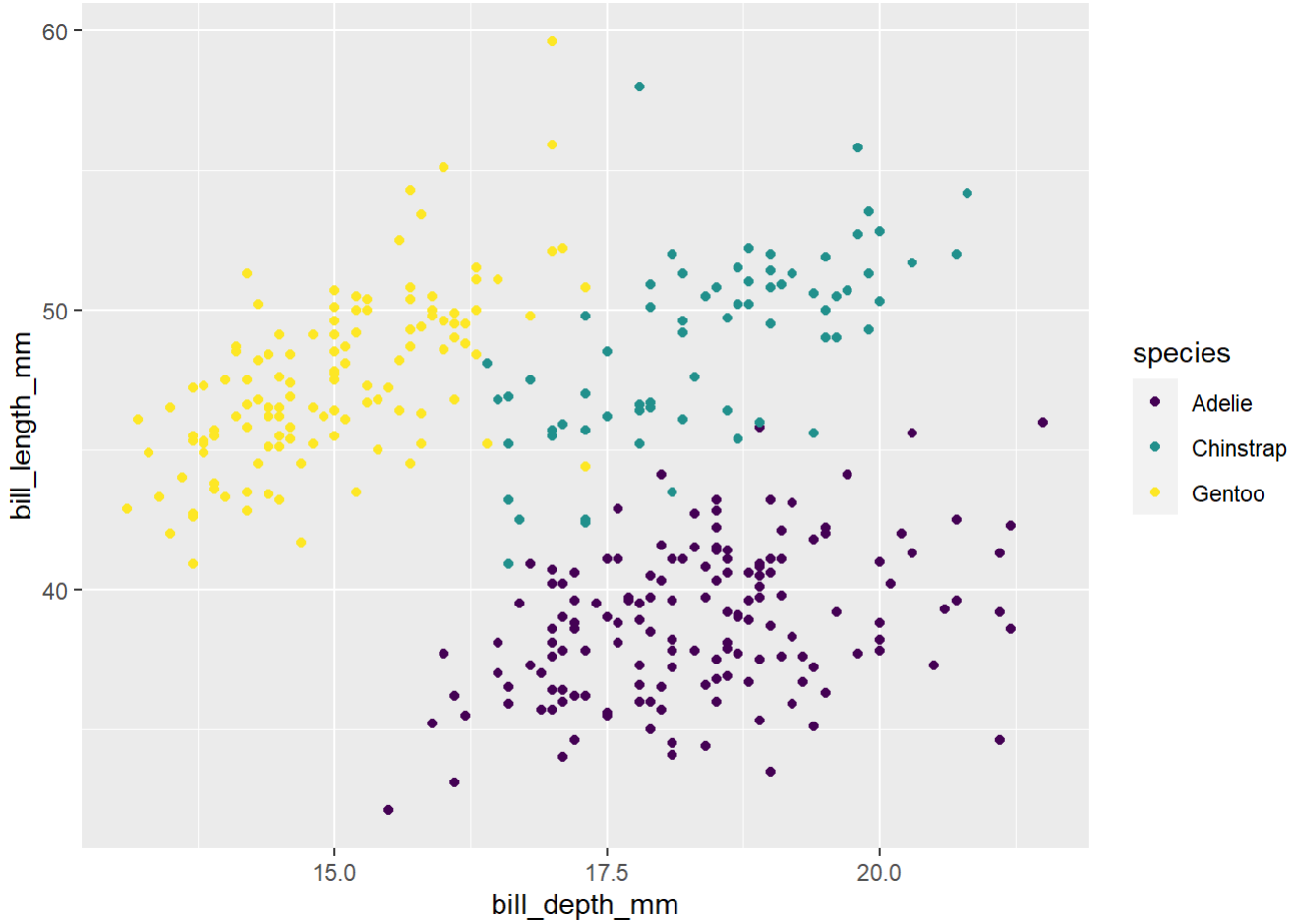

```
        x = "Bill depth (mm)"
        y = "Bill length (mm)"
colour = "Species"
caption = "Source: Palmer Station LTER"
scale_colour_viridis_d()
```

```
## <ggproto object: Class ScaleDiscrete, Scale, gg>
##     aesthetics: colour
##     axis_order: function
##     break_info: function
##     break_positions: function
##     breaks: waiver
##     call: call
##     clone: function
##     dimension: function
##     drop: TRUE
##     expand: waiver
##     get_breaks: function
##     get_breaks_minor: function
##     get_labels: function
##     get_limits: function
##     guide: legend
##     is_discrete: function
##     is_empty: function
##     labels: waiver
##     limits: NULL
##     make_sec_title: function
##     make_title: function
##     map: function
##     map_df: function
##     n.breaks.cache: NULL
##     na.translate: TRUE
##     na.value: NA
##     name: waiver
##     palette: function
##     palette.cache: NULL
##     position: left
##     range: environment
##     rescale: function
##     reset: function
##     scale_name: viridis_d
##     train: function
##     train_df: function
##     transform: function
##     transform_df: function
##     super:  <ggproto object: Class ScaleDiscrete, Scale, gg>
```

Palmer Penguins: Argument names

```
ggplot(penguins) + # Data layer
 aes(x = bill_depth_mm,
 y = bill_length_mm,
 colour = species) + # Aesthetics layer
 geom_point() + # Geometric layer
 scale_colour_viridis_d()
```

```
## Warning: Removed 2 rows containing missing values (`geom_point()`).
```



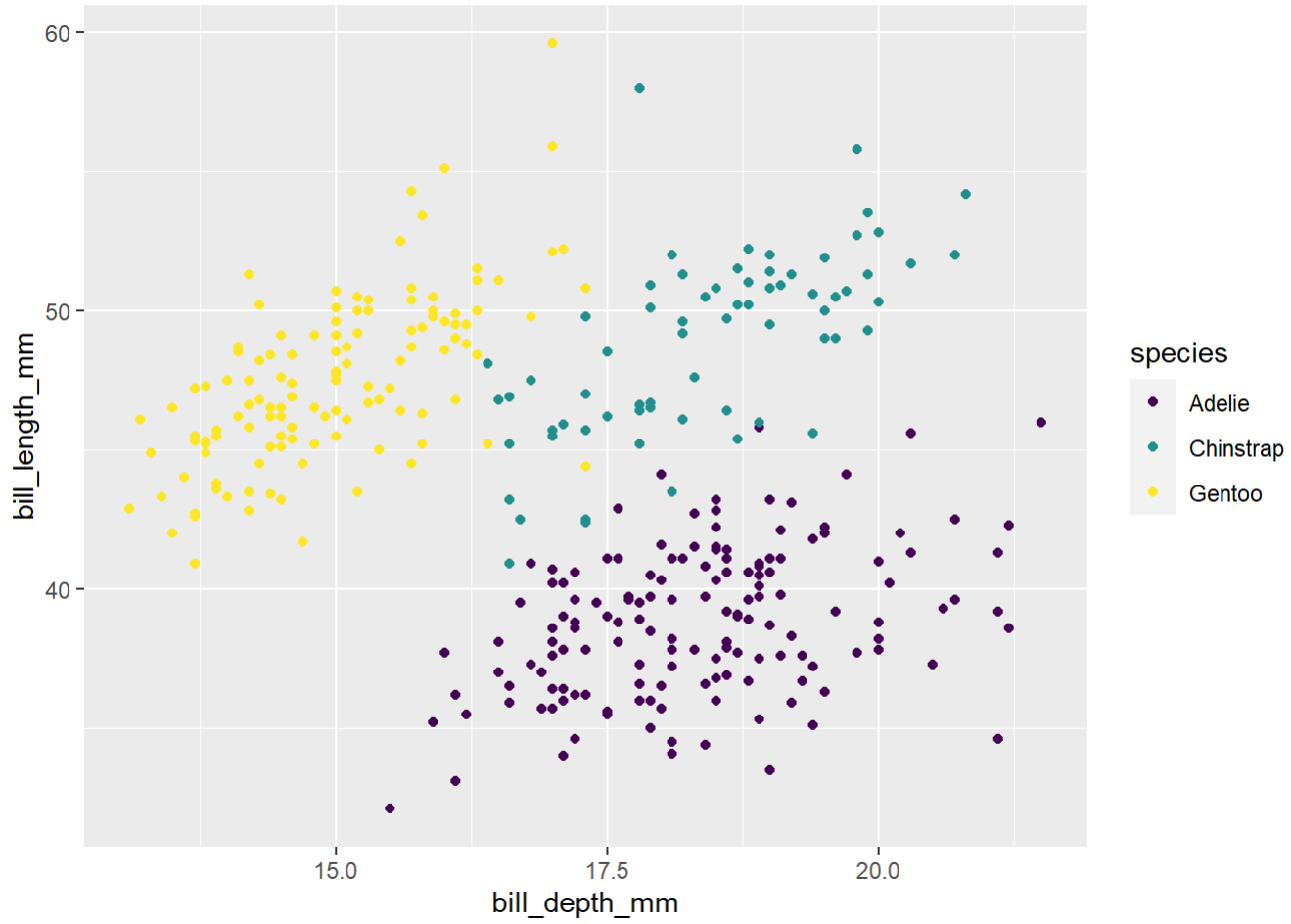
Commonly used features of ggplot that can be mapped to a specific variable in the data are,

color shape size alpha (transparency)

colour, shape, size, alpha (transparency)

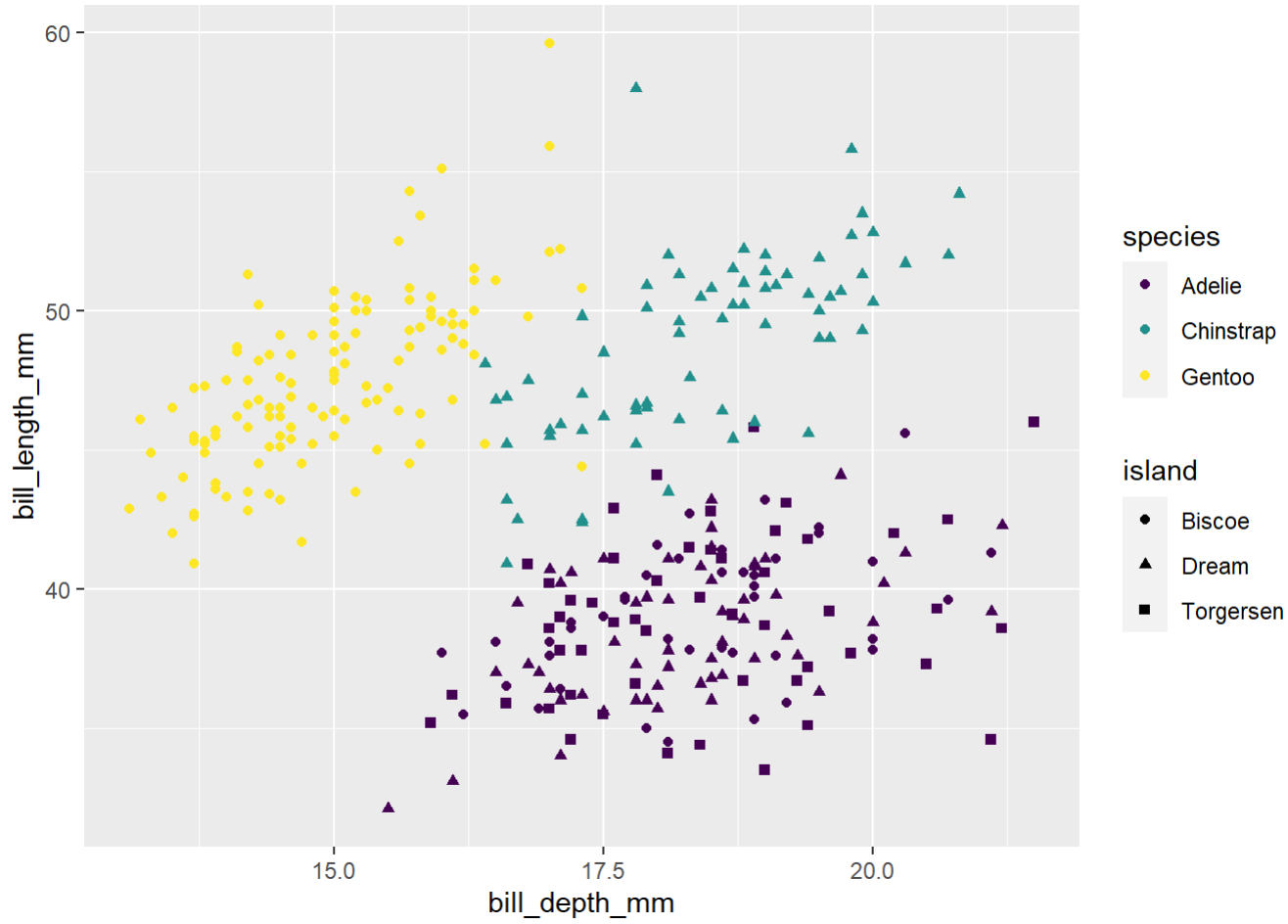
```
# color
ggplot(penguins) + aes(x = bill_depth_mm, y = bill_length_mm,
 colour = species) +
 geom_point() + scale_colour_viridis_d()
```

```
## Warning: Removed 2 rows containing missing values (`geom_point()`).
```



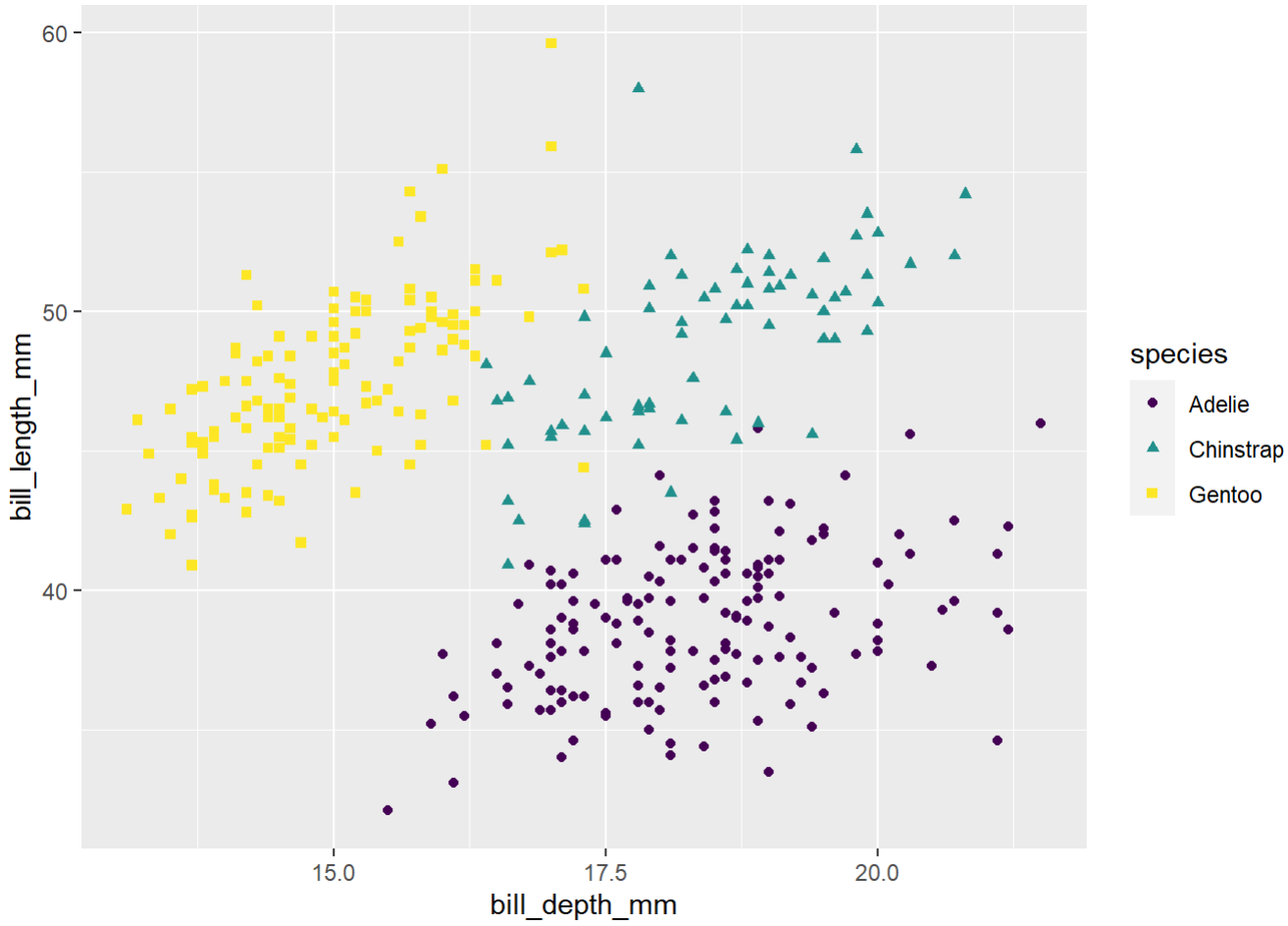

```
# shape
ggplot(penguins, aes(x = bill_depth_mm, y = bill_length_mm, colour = species,
 shape = island)) +
 geom_point() + scale_colour_viridis_d()
```

```
## Warning: Removed 2 rows containing missing values (`geom_point()`).
```



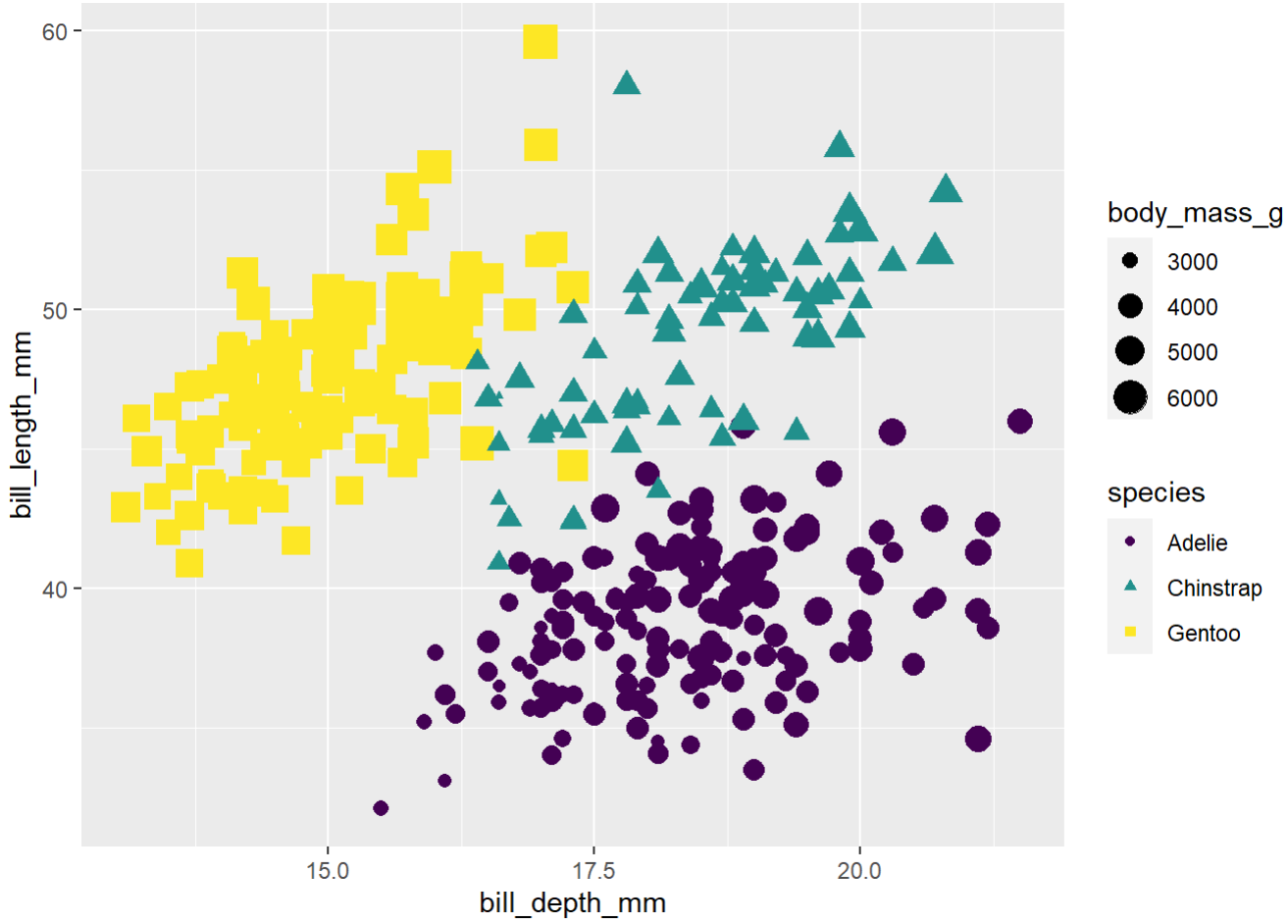

```
ggplot(penguins, aes(x = bill_depth_mm, y = bill_length_mm, colour = species,
 shape = species)) +
 geom_point() + scale_colour_viridis_d()
```

```
## Warning: Removed 2 rows containing missing values (`geom_point()`).
```



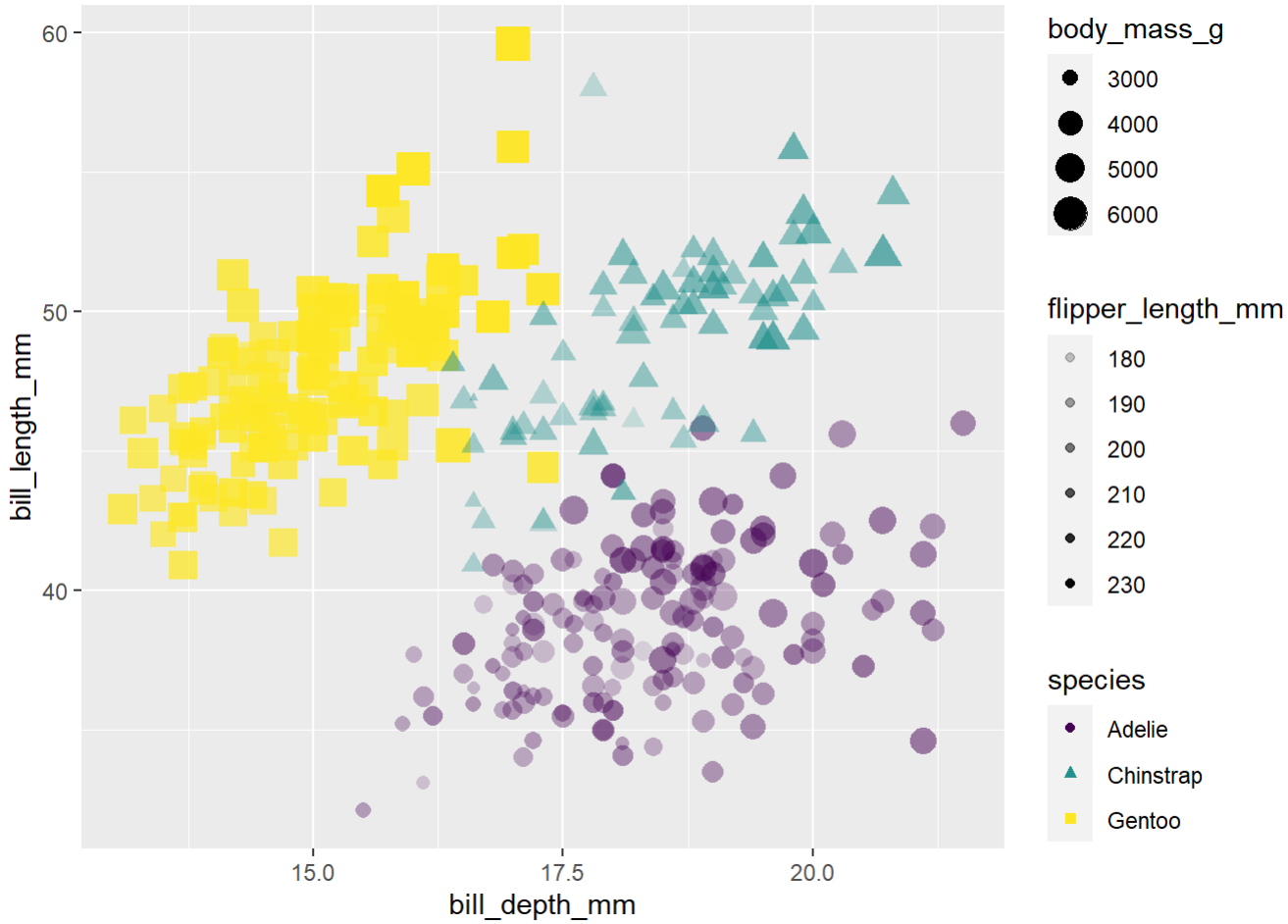

```
# size
ggplot(penguins, aes(x = bill_depth_mm, y = bill_length_mm, colour = species, shape = specie
s,
 size = body_mass_g)) +
 geom_point() + scale_colour_viridis_d()
```

```
## Warning: Removed 2 rows containing missing values (`geom_point()`).
```




```
#alpha
ggplot(penguins, aes(x = bill_depth_mm, y = bill_length_mm, colour = species,
 shape = species, size = body_mass_g, alpha = flipper_length_mm)) +
 geom_point() + scale_colour_viridis_d()
```

```
## Warning: Removed 2 rows containing missing values (`geom_point()`).
```



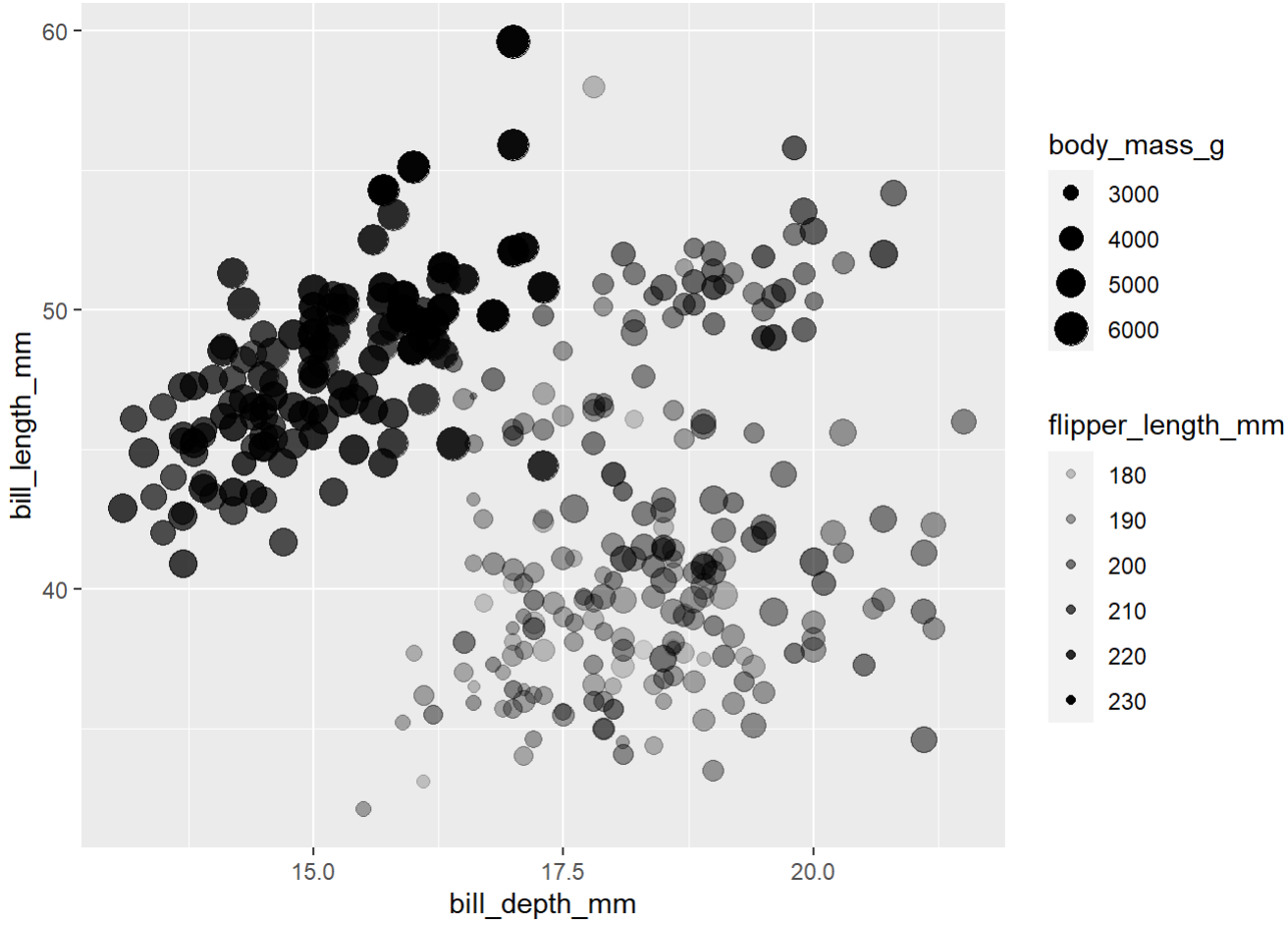
Mapping: Determine the size, alpha, etc. of points based on the values of a variable in the data - goes into aes()

Setting: Determine the size, alpha, etc. of points not based on the values of a variable in the data - goes into geom_*() (this was geom_point() in the previous example, but we'll learn about other geoms soon!)

Mapping vs Setting

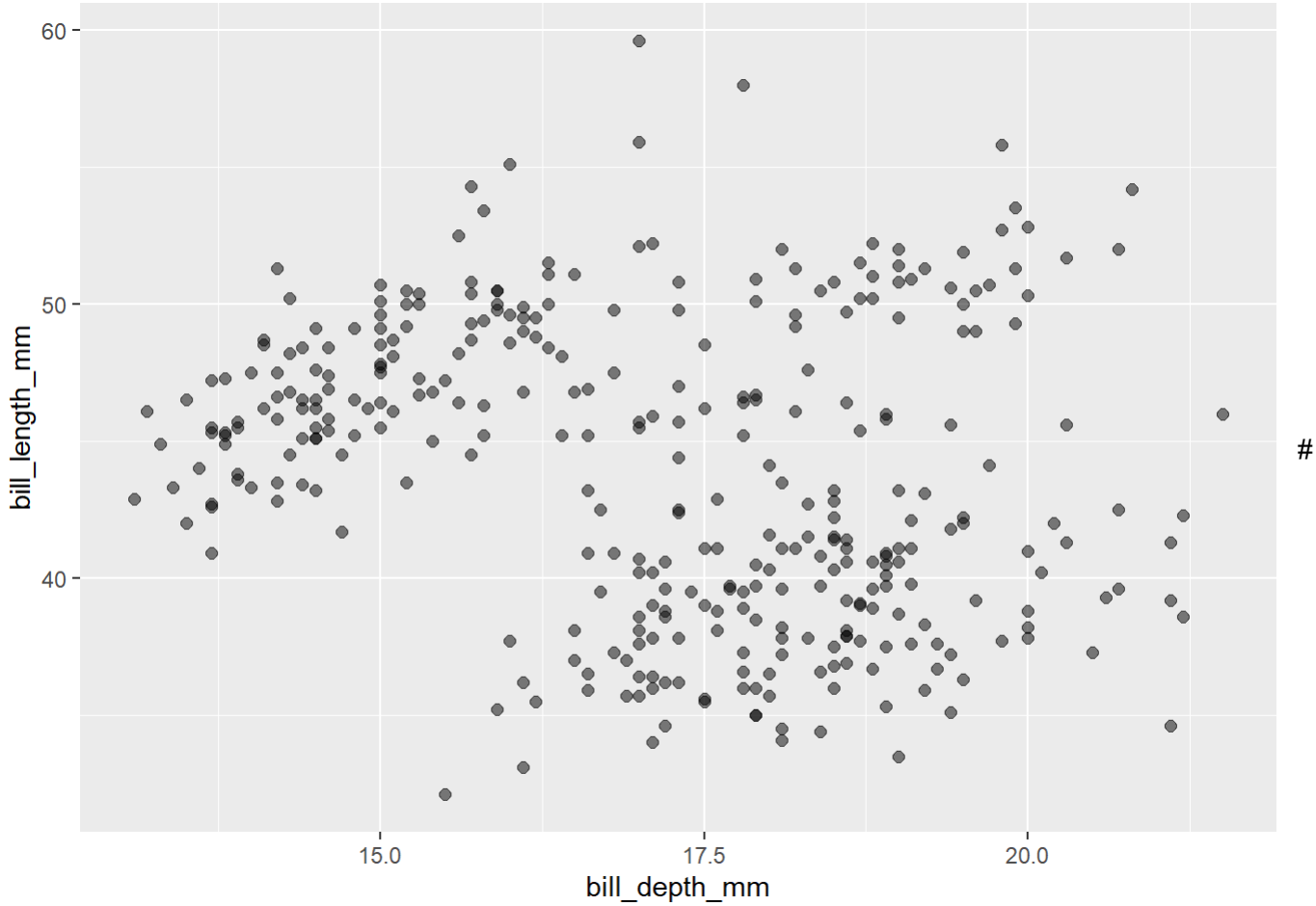
```
# mapping
ggplot(penguins) +
 aes(x = bill_depth_mm,
 y = bill_length_mm,
 size = body_mass_g,
 alpha = flipper_length_mm) +
 geom_point()
```

```
## Warning: Removed 2 rows containing missing values (`geom_point()`).
```




```
# setting
ggplot(penguins) +
 aes(x = bill_depth_mm,
 y = bill_length_mm) +
 geom_point(size = 2, alpha = 0.5)
```

```
## Warning: Removed 2 rows containing missing values (`geom_point()`).
```



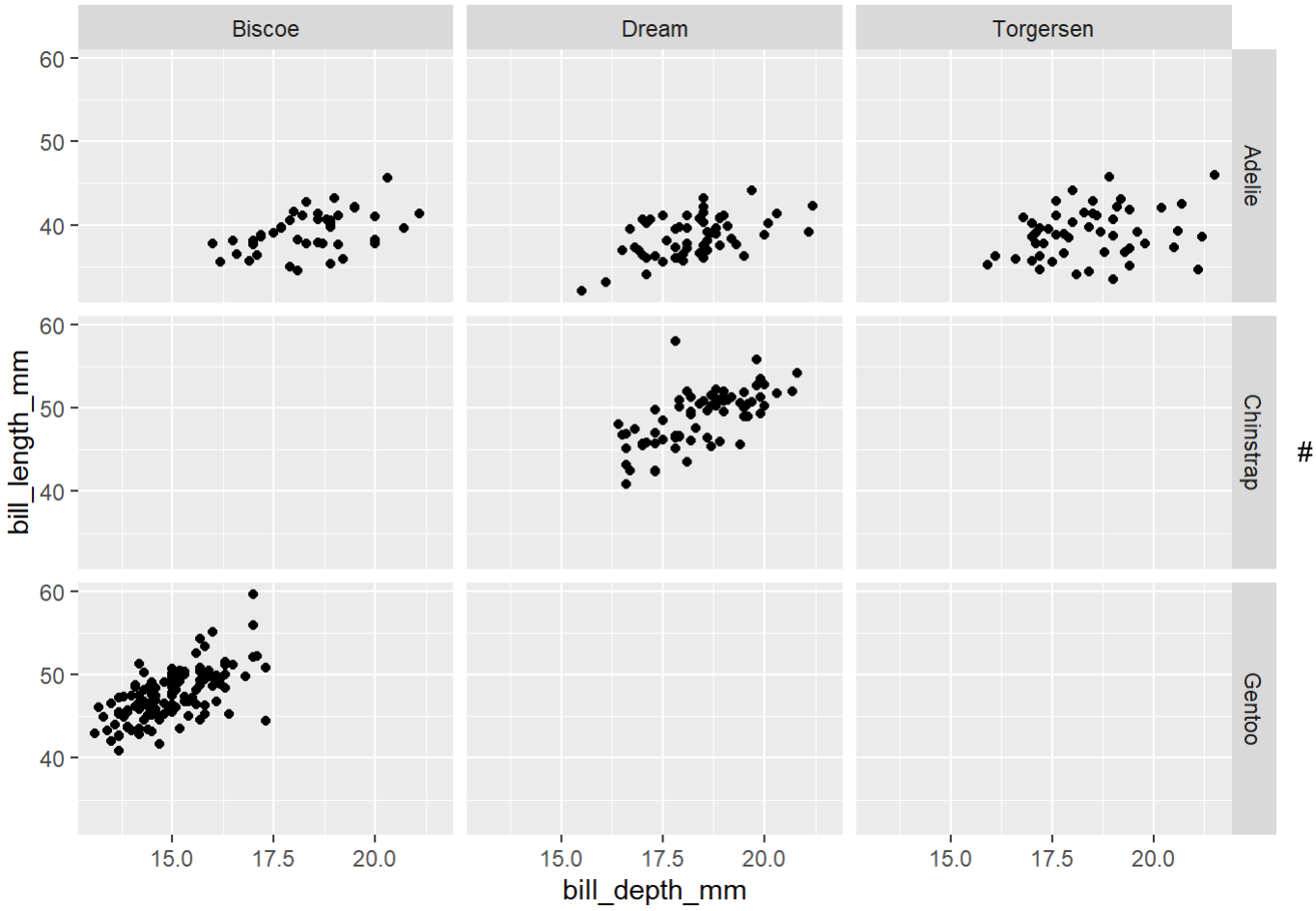
#

Faceting Smaller plots that display different subsets of the data Useful for exploring conditional relationships and large data

Facet 1

```
ggplot(penguins) +
 aes(x = bill_depth_mm,
 y = bill_length_mm) +
 geom_point() +
 facet_grid(species ~ island)
```

```
## Warning: Removed 2 rows containing missing values (`geom_point()`).
```

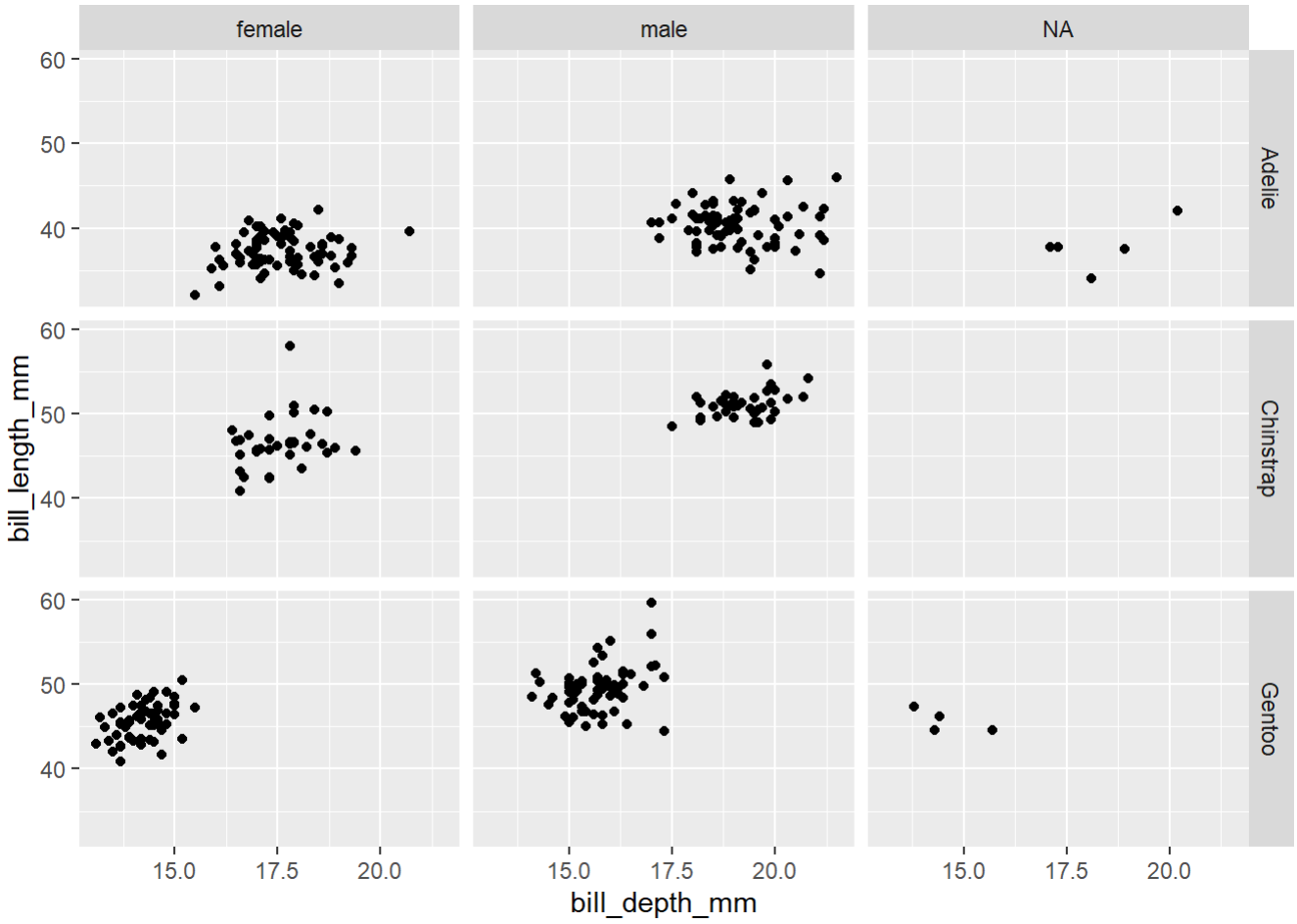


#

Facet 2

```
ggplot(penguins, aes(x = bill_depth_mm, y = bill_length_mm)) + geom_point() +
 facet_grid(species ~ sex)
```

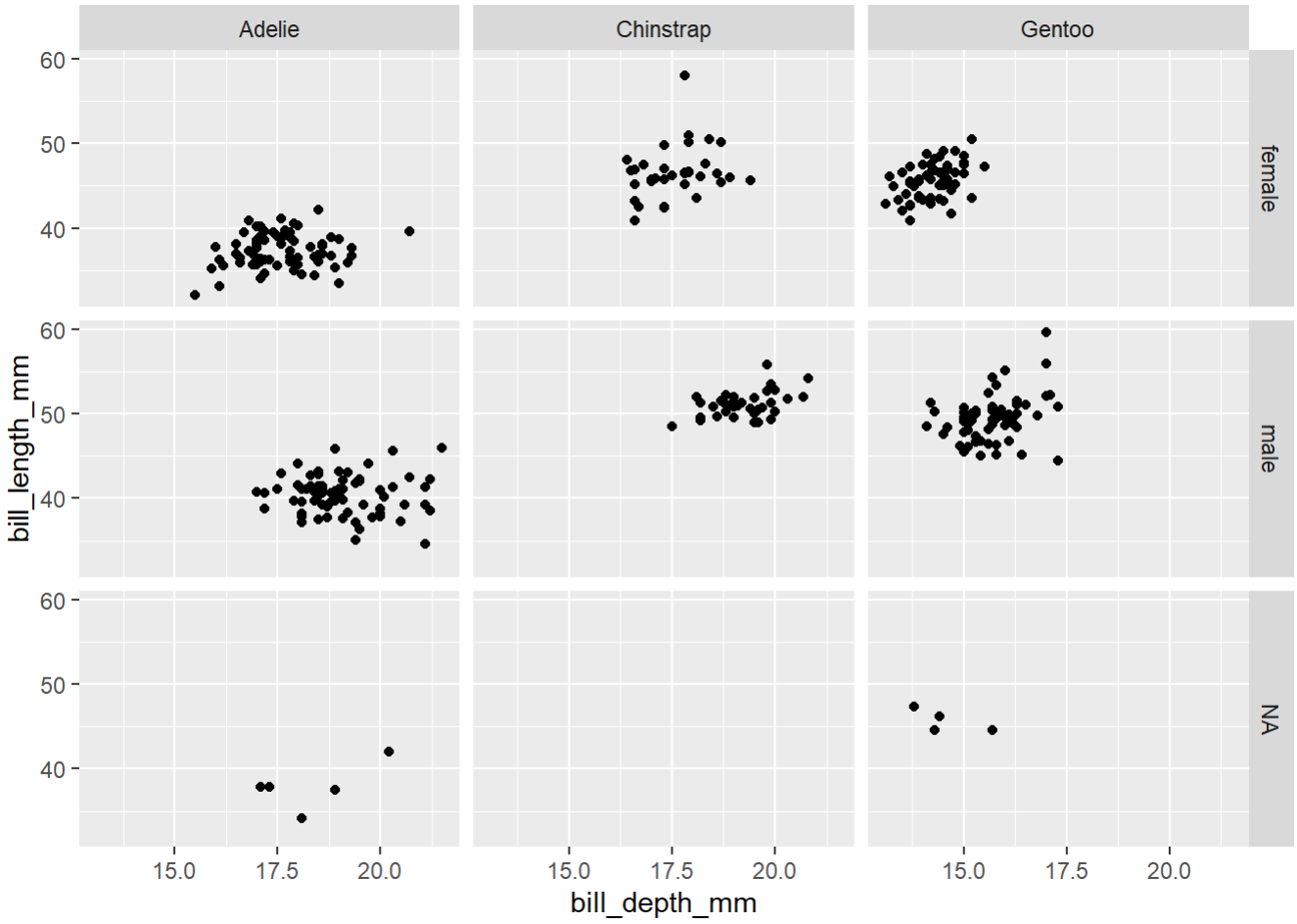
```
## Warning: Removed 2 rows containing missing values (`geom_point()`).
```



Facet 3

```
ggplot(penguins, aes(x = bill_depth_mm, y = bill_length_mm)) + geom_point() +
 facet_grid(sex ~ species)
```

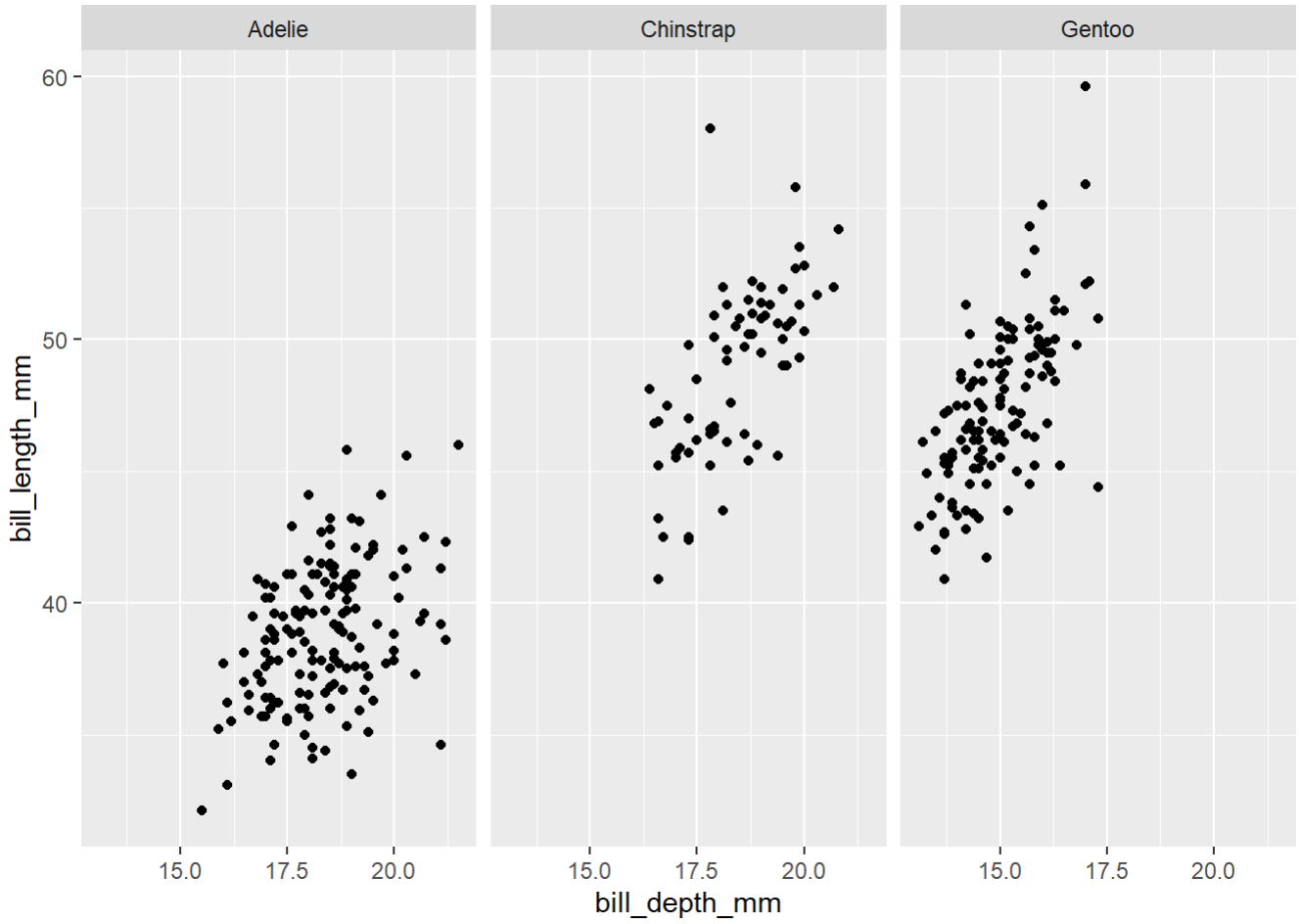
```
## Warning: Removed 2 rows containing missing values (`geom_point()`).
```



Facet 4

```
ggplot(penguins, aes(x = bill_depth_mm, y = bill_length_mm)) + geom_point() +
 facet_wrap(~ species)
```

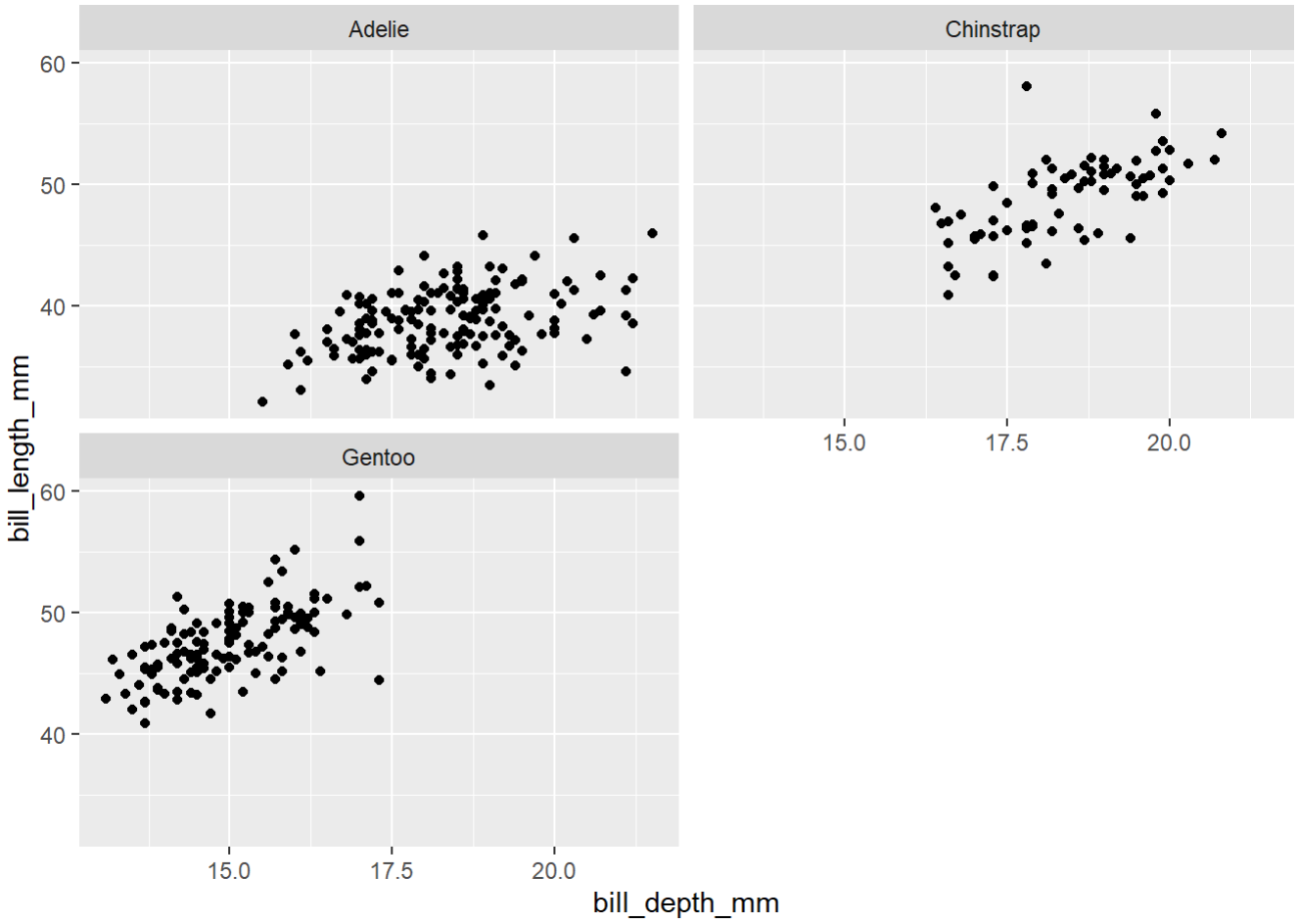
```
## Warning: Removed 2 rows containing missing values (`geom_point()`).
```



Facet 5

```
ggplot(penguins, aes(x = bill_depth_mm, y = bill_length_mm)) + geom_point() +
 facet_wrap(~ species, ncol = 2)
```

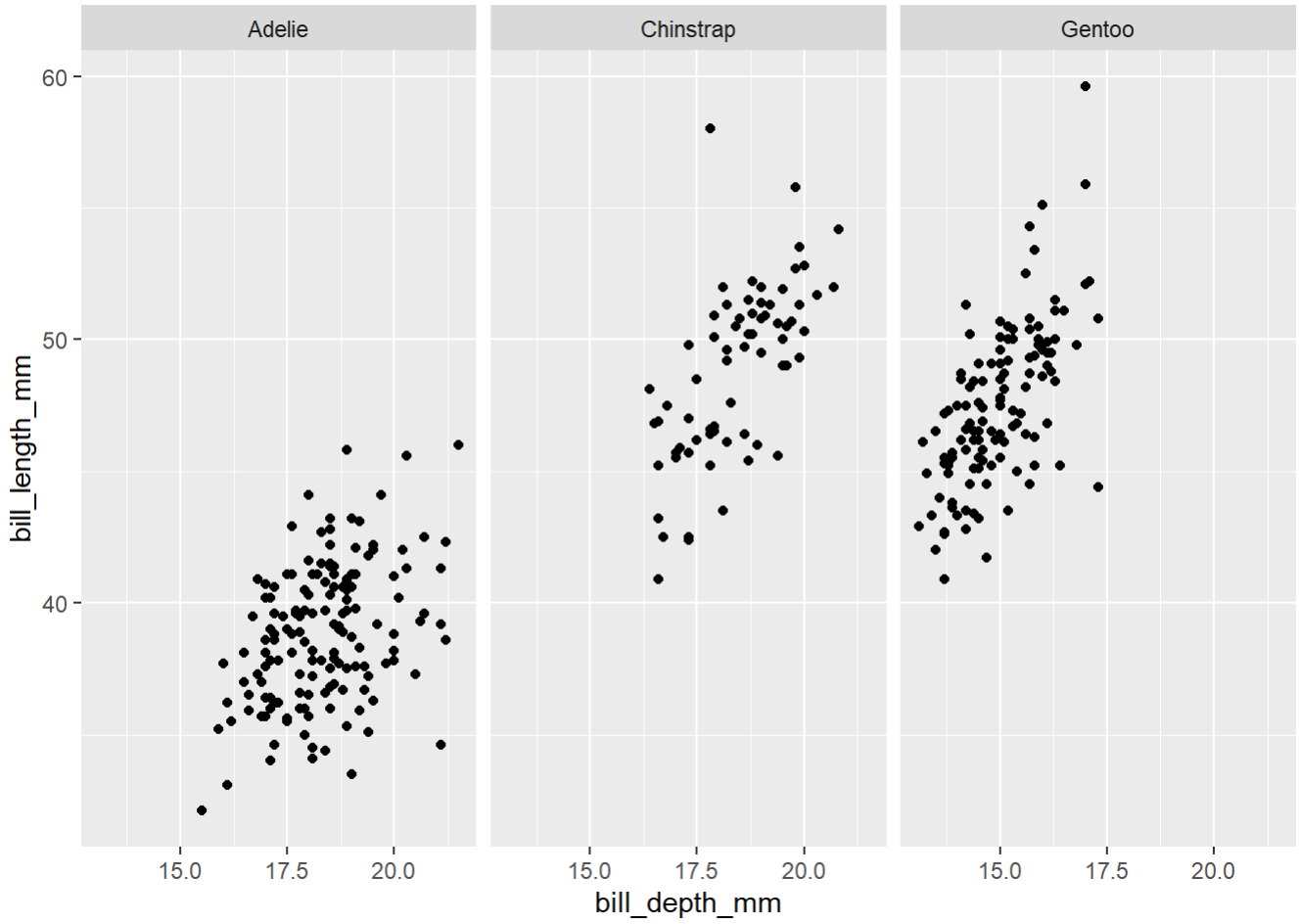
```
## Warning: Removed 2 rows containing missing values (`geom_point()`).
```



Facet 6

```
ggplot(penguins, aes(x = bill_depth_mm, y = bill_length_mm)) + geom_point() +
 facet_grid(. ~ species)
```

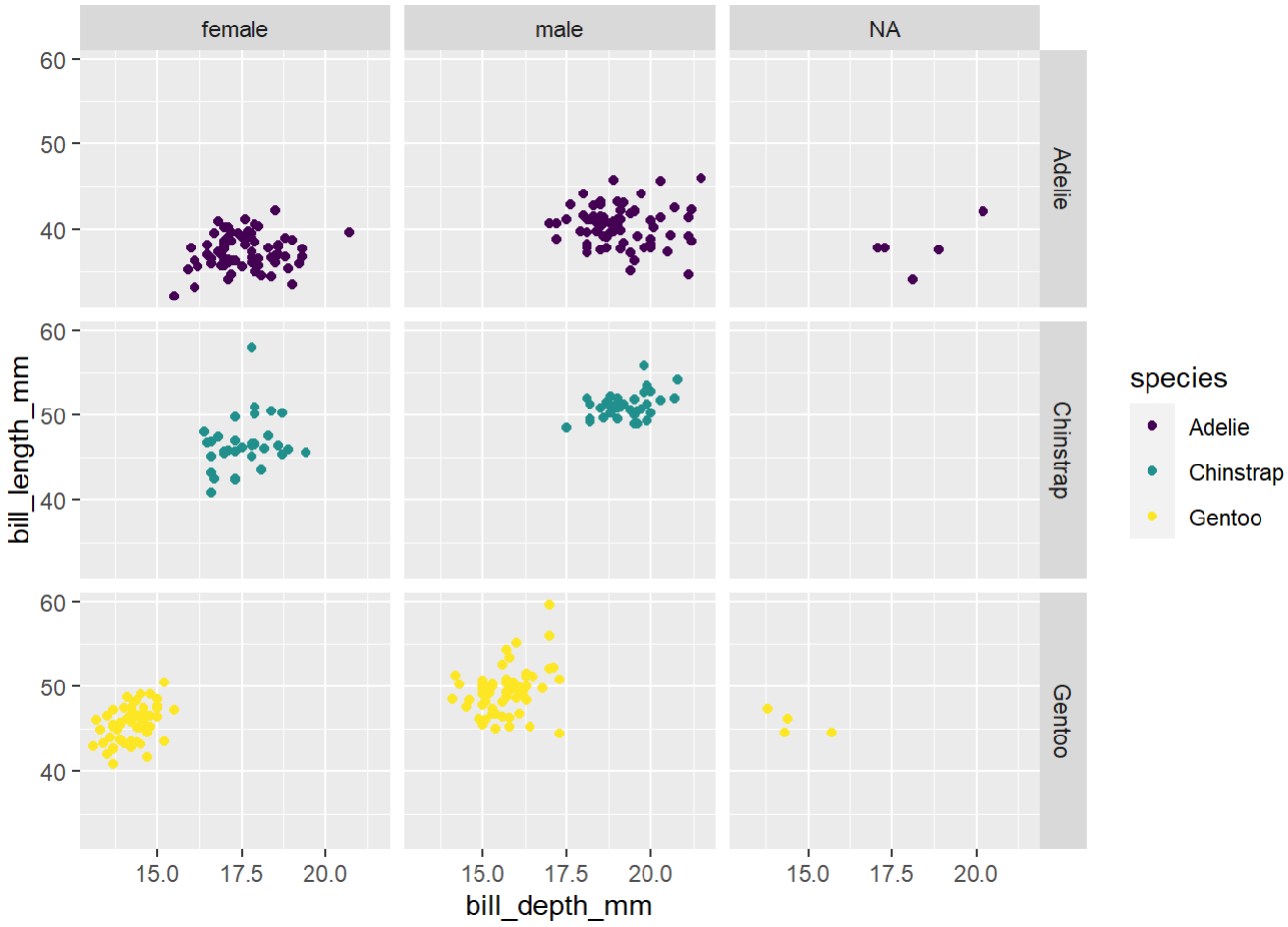
```
## Warning: Removed 2 rows containing missing values (`geom_point()`).
```



Facet and Color

```
ggplot(penguins, aes(x = bill_depth_mm, y = bill_length_mm, color = species)) +
 geom_point() + facet_grid(species ~ sex) + scale_color_viridis_d()
```

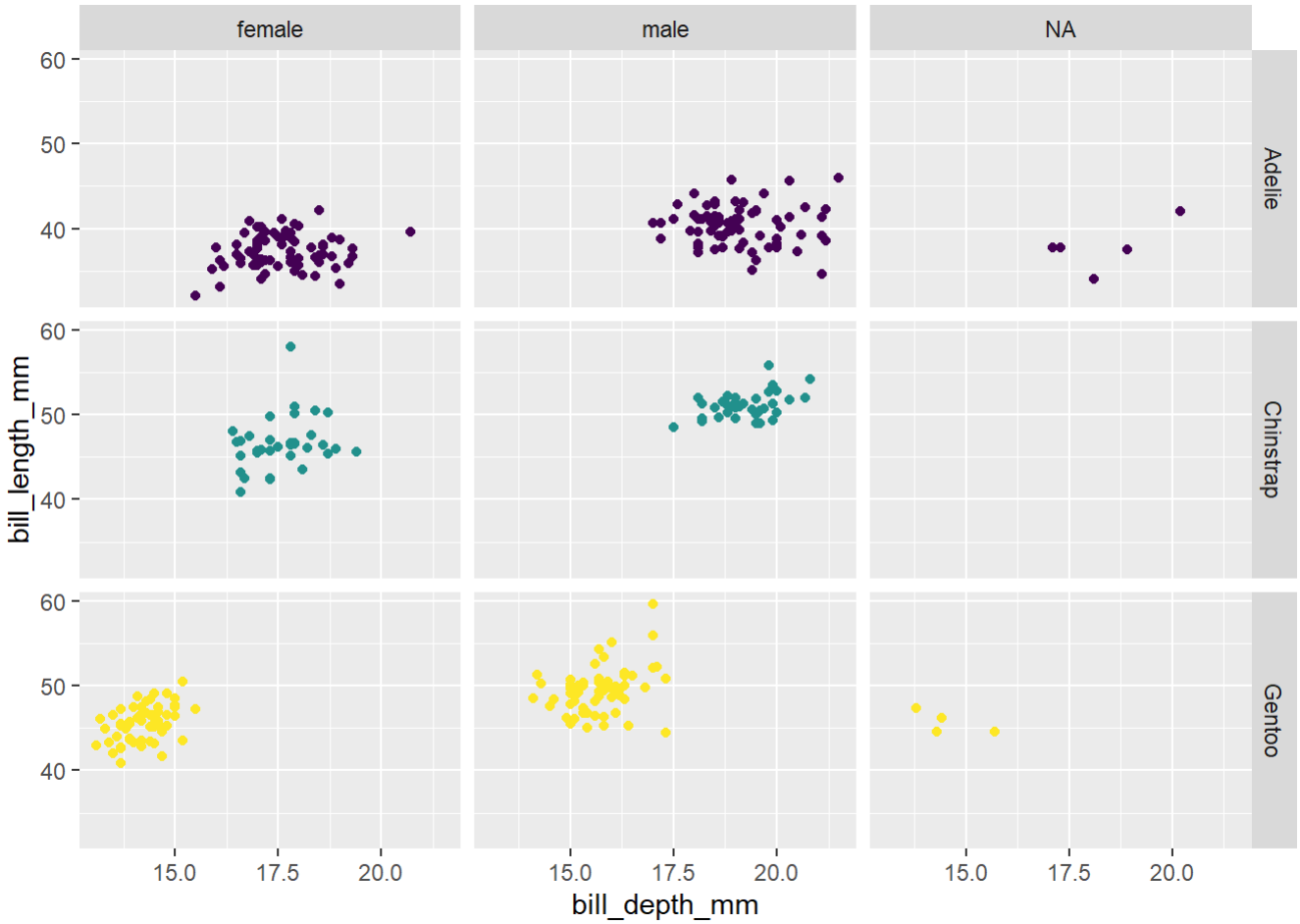
```
## Warning: Removed 2 rows containing missing values (`geom_point()`).
```



Facet and color, no legend

```
ggplot(penguins, aes(x = bill_depth_mm, y = bill_length_mm, color = species)) +
 geom_point() + facet_grid(species ~ sex) + scale_color_viridis_d() +
 guides(color = "none")
```

```
## Warning: Removed 2 rows containing missing values (`geom_point()`).
```



DATASET 2: LENDING CLUB

Take a peek at the data

```
library(openintro)
```

```
## Loading required package: airports
```

```
## Loading required package: cherryblossom
```

```
## Loading required package: usdata
```

```
glimpse(loans_full_schema)
```

```
## Rows: 10,000
## Columns: 55
## $ emp_title                         <chr> "global config engineer ", "warehouse…
## $ emp_length                        <dbl> 3, 10, 3, 1, 10, NA, 10, 10, 10, 3, 1…
## $ state                             <fct> NJ, HI, WI, PA, CA, KY, MI, AZ, NV, I…
## $ homeownership                     <fct> MORTGAGE, RENT, RENT, RENT, RENT, OWN…
## $ annual_income                     <dbl> 90000, 40000, 40000, 30000, 35000, 34…
## $ verified_income                   <fct> Verified, Not Verified, Source Verifi…
## $ debt_to_income                    <dbl> 18.01, 5.04, 21.15, 10.16, 57.96, 6.4…
## $ annual_income_joint               <dbl> NA, NA, NA, NA, 57000, NA, 155000, NA…
## $ verification_income_joint         <fct> , , , , Verified, , Not Verified, , ,…
## $ debt_to_income_joint              <dbl> NA, NA, NA, NA, 37.66, NA, 13.12, NA,…
## $ delinq_2y                         <int> 0, 0, 0, 0, 0, 1, 0, 1, 1, 0, 0, 0, 0…
## $ months_since_last_delinq          <int> 38, NA, 28, NA, NA, 3, NA, 19, 18, NA…
## $ earliest_credit_line              <dbl> 2001, 1996, 2006, 2007, 2008, 1990, 2…
## $ inquiries_last_12m                <int> 6, 1, 4, 0, 7, 6, 1, 1, 3, 0, 4, 4, 8…
## $ total_credit_lines                <int> 28, 30, 31, 4, 22, 32, 12, 30, 35, 9,…
## $ open_credit_lines                 <int> 10, 14, 10, 4, 16, 12, 10, 15, 21, 6,…
## $ total_credit_limit                <int> 70795, 28800, 24193, 25400, 69839, 42…
## $ total_credit_utilized             <int> 38767, 4321, 16000, 4997, 52722, 3898…
## $ num_collections_last_12m          <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0…
## $ num_historical_failed_to_pay      <int> 0, 1, 0, 1, 0, 0, 0, 0, 0, 0, 1, 0, 0…
## $ months_since_90d_late             <int> 38, NA, 28, NA, NA, 60, NA, 71, 18, N…
## $ current_accounts_delinq           <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0…
## $ total_collection_amount_ever      <int> 1250, 0, 432, 0, 0, 0, 0, 0, 0, 0, 0,…
## $ current_installment_accounts      <int> 2, 0, 1, 1, 1, 0, 2, 2, 6, 1, 2, 1, 2…
## $ accounts_opened_24m               <int> 5, 11, 13, 1, 6, 2, 1, 4, 10, 5, 6, 7…
## $ months_since_last_credit_inquiry <int> 5, 8, 7, 15, 4, 5, 9, 7, 4, 17, 3, 4,…
## $ num_satisfactory_accounts         <int> 10, 14, 10, 4, 16, 12, 10, 15, 21, 6,…
## $ num_accounts_120d_past_due        <int> 0, 0, 0, 0, 0, 0, 0, NA, 0, 0, 0, 0, …
## $ num_accounts_30d_past_due         <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0…
## $ num_active_debit_accounts         <int> 2, 3, 3, 2, 10, 1, 3, 5, 11, 3, 2, 2,…
## $ total_debit_limit                 <int> 11100, 16500, 4300, 19400, 32700, 272…
## $ num_total_cc_accounts             <int> 14, 24, 14, 3, 20, 27, 8, 16, 19, 7, …
## $ num_open_cc_accounts              <int> 8, 14, 8, 3, 15, 12, 7, 12, 14, 5, 8,…
## $ num_cc_carrying_balance           <int> 6, 4, 6, 2, 13, 5, 6, 10, 14, 3, 5, 3…
## $ num_mort_accounts                 <int> 1, 0, 0, 0, 0, 3, 2, 7, 2, 0, 2, 3, 3…
## $ account_never_delinq_percent      <dbl> 92.9, 100.0, 93.5, 100.0, 100.0, 78.1…
## $ tax_liens                         <int> 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0…
## $ public_record_bankrupt            <int> 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0…
## $ loan_purpose                      <fct> moving, debt_consolidation, other, de…
## $ application_type                  <fct> individual, individual, individual, i…
## $ loan_amount                       <int> 28000, 5000, 2000, 21600, 23000, 5000…
## $ term                              <dbl> 60, 36, 36, 36, 36, 36, 60, 60, 36, 3…
## $ interest_rate                     <dbl> 14.07, 12.61, 17.09, 6.72, 14.07, 6.7…
## $ installment                       <dbl> 652.53, 167.54, 71.40, 664.19, 786.87…
## $ grade                             <fct> C, C, D, A, C, A, C, B, C, A, C, B, C…
## $ sub_grade                         <fct> C3, C1, D1, A3, C3, A3, C2, B5, C2, A…
## $ issue_month                       <fct> Mar-2018, Feb-2018, Feb-2018, Jan-201…
## $ loan_status                       <fct> Current, Current, Current, Current, C…
## $ initial_listing_status            <fct> whole, whole, fractional, whole, whol…
## $ disbursement_method               <fct> Cash, Cash, Cash, Cash, Cash, Cash, C…
## $ balance                           <dbl> 27015.86, 4651.37, 1824.63, 18853.26,…
## $ paid_total                        <dbl> 1999.330, 499.120, 281.800, 3312.890,…
## $ paid_principal                    <dbl> 984.14, 348.63, 175.37, 2746.74, 1569…
```

```
## $ paid_interest                    <dbl> 1015.19, 150.49, 106.43, 566.15, 754.…
## $ paid_late_fees                   <dbl> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0…
```

selected variables

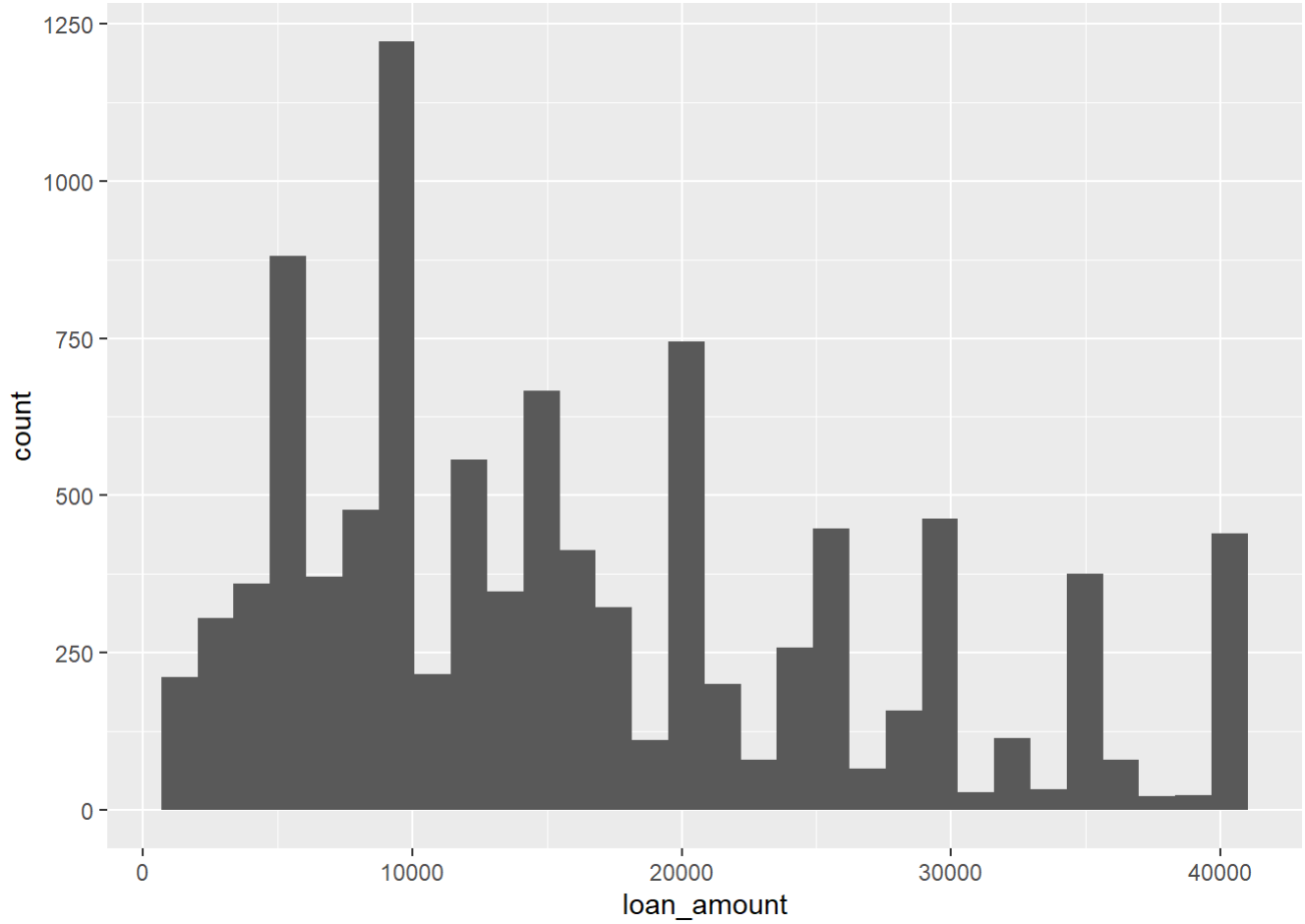
```
loans <- loans_full_schema %>%
 select(loan_amount, interest_rate, term, grade,
 state, annual_income, homeownership, debt_to_income)
glimpse(loans)
```

```
## Rows: 10,000
## Columns: 8
## $ loan_amount    <int> 28000, 5000, 2000, 21600, 23000, 5000, 24000, 20000, 20…
## $ interest_rate  <dbl> 14.07, 12.61, 17.09, 6.72, 14.07, 6.72, 13.59, 11.99, 1…
## $ term           <dbl> 60, 36, 36, 36, 36, 36, 60, 60, 36, 36, 60, 60, 36, 60,…
## $ grade          <fct> C, C, D, A, C, A, C, B, C, A, C, B, C, B, D, D, D, F, E…
## $ state          <fct> NJ, HI, WI, PA, CA, KY, MI, AZ, NV, IL, IL, FL, SC, CO,…
## $ annual_income  <dbl> 90000, 40000, 40000, 30000, 35000, 34000, 35000, 110000…
## $ homeownership  <fct> MORTGAGE, RENT, RENT, RENT, RENT, OWN, MORTGAGE, MORTGA…
## $ debt_to_income <dbl> 18.01, 5.04, 21.15, 10.16, 57.96, 6.46, 23.66, 16.19, 3…
```

histogram

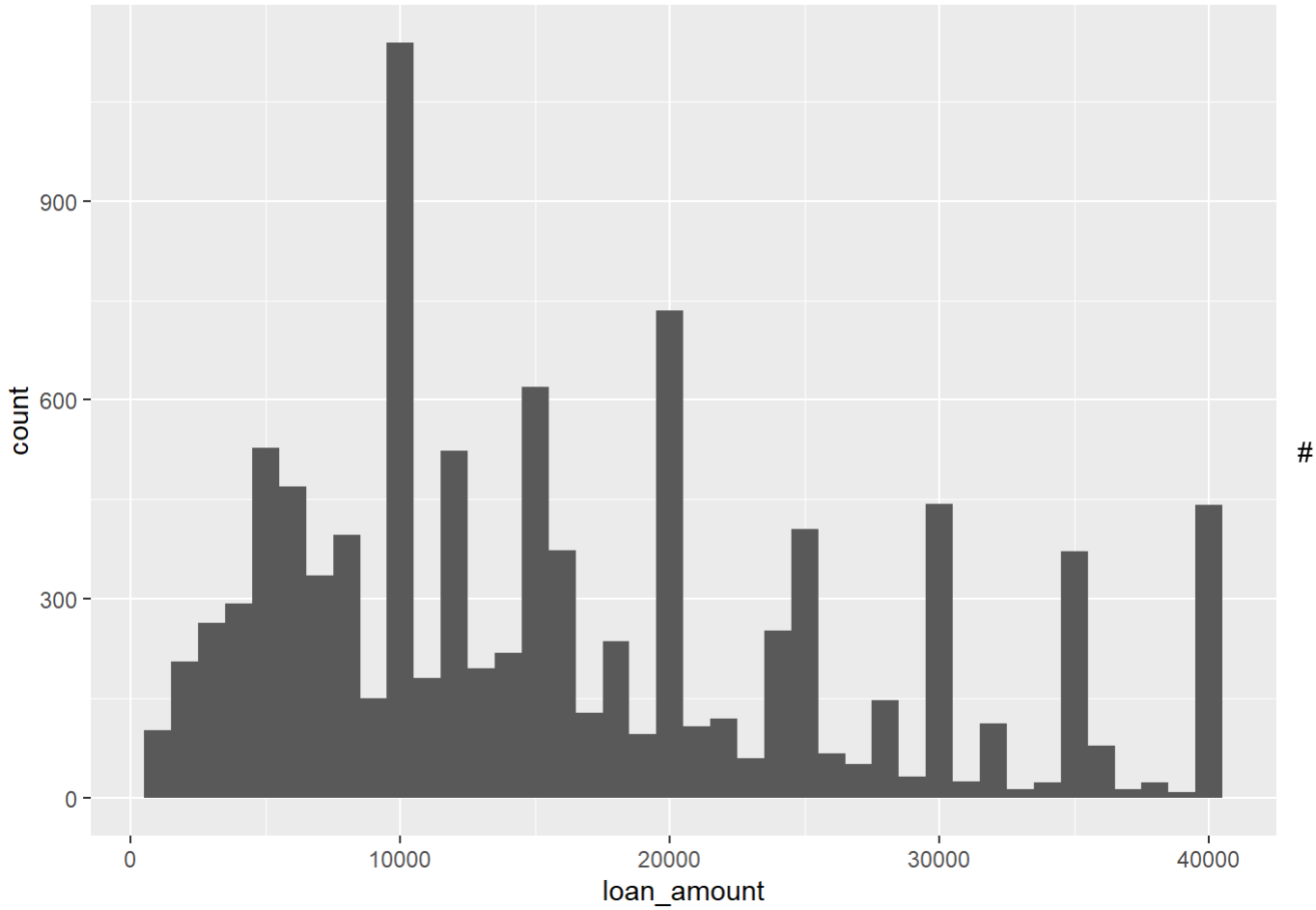
```
ggplot(loans) + aes(x = loan_amount) +
 geom_histogram()
```

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```



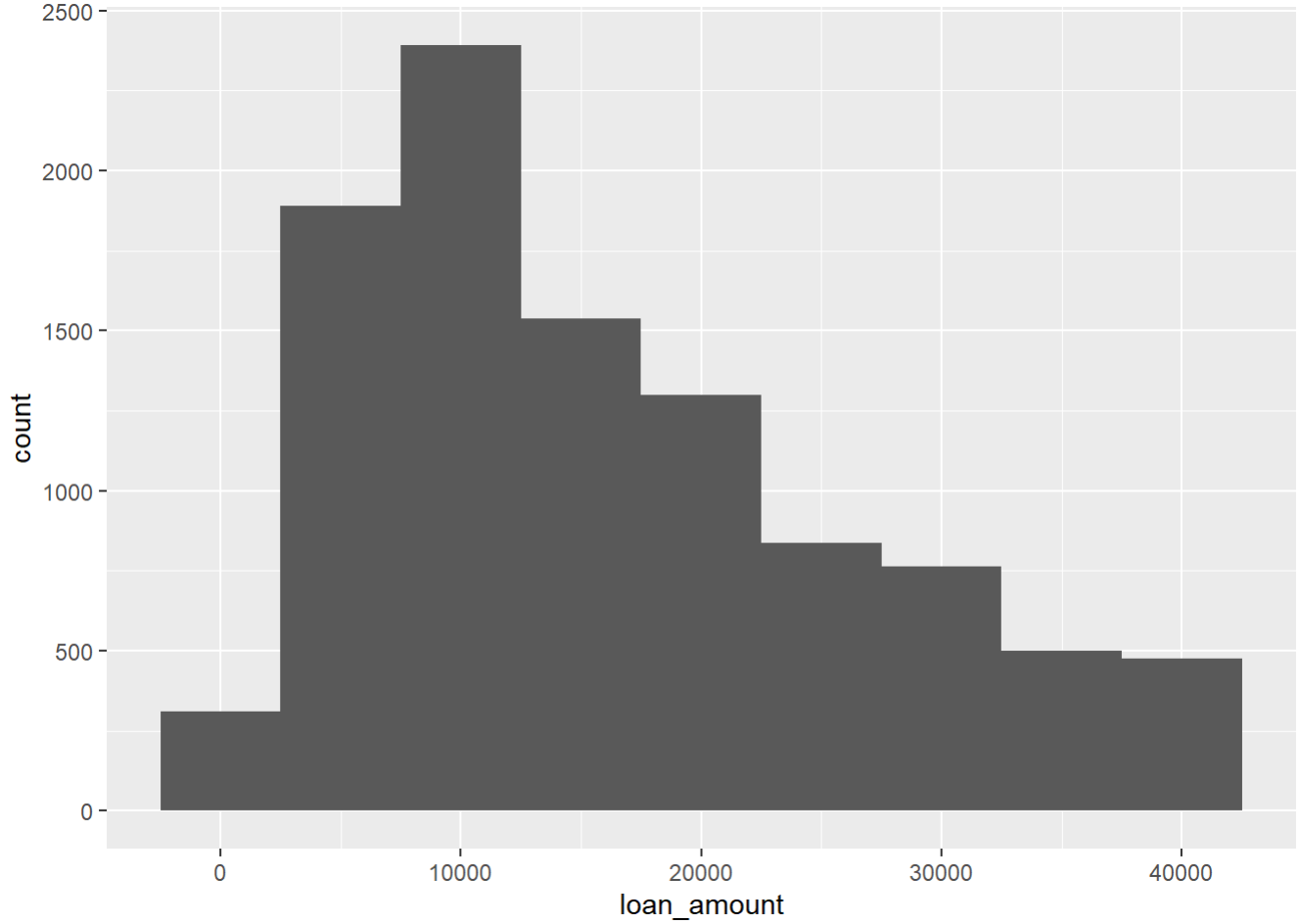
histogram and binwidth=1000

```
# binwidth = 1000
ggplot(loans, aes(x = loan_amount)) +
 geom_histogram(binwidth = 1000)
```



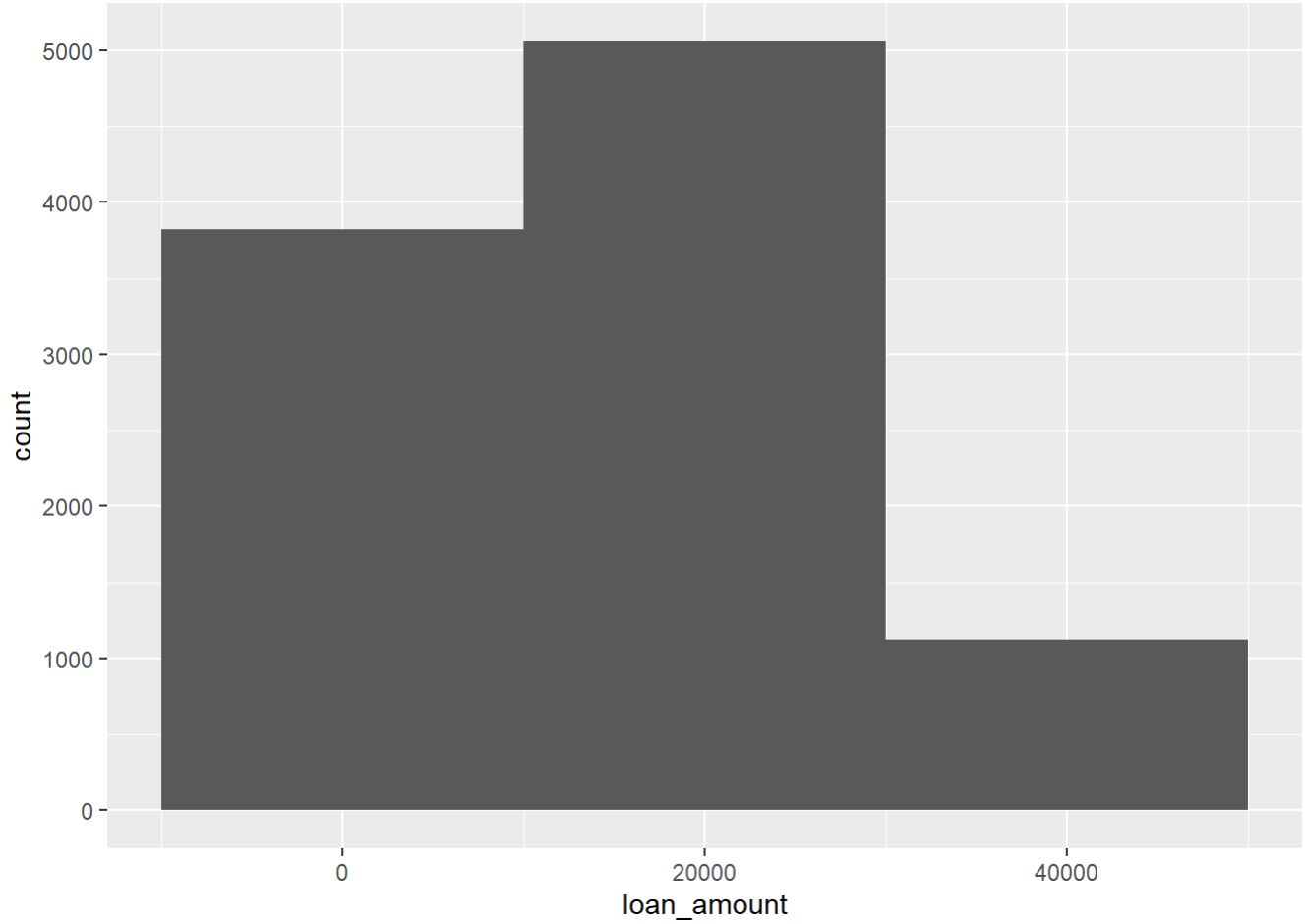
histogram and binwidth=5000

```
# binwidth = 5000
ggplot(loans, aes(x = loan_amount)) +
 geom_histogram(binwidth = 5000)
```



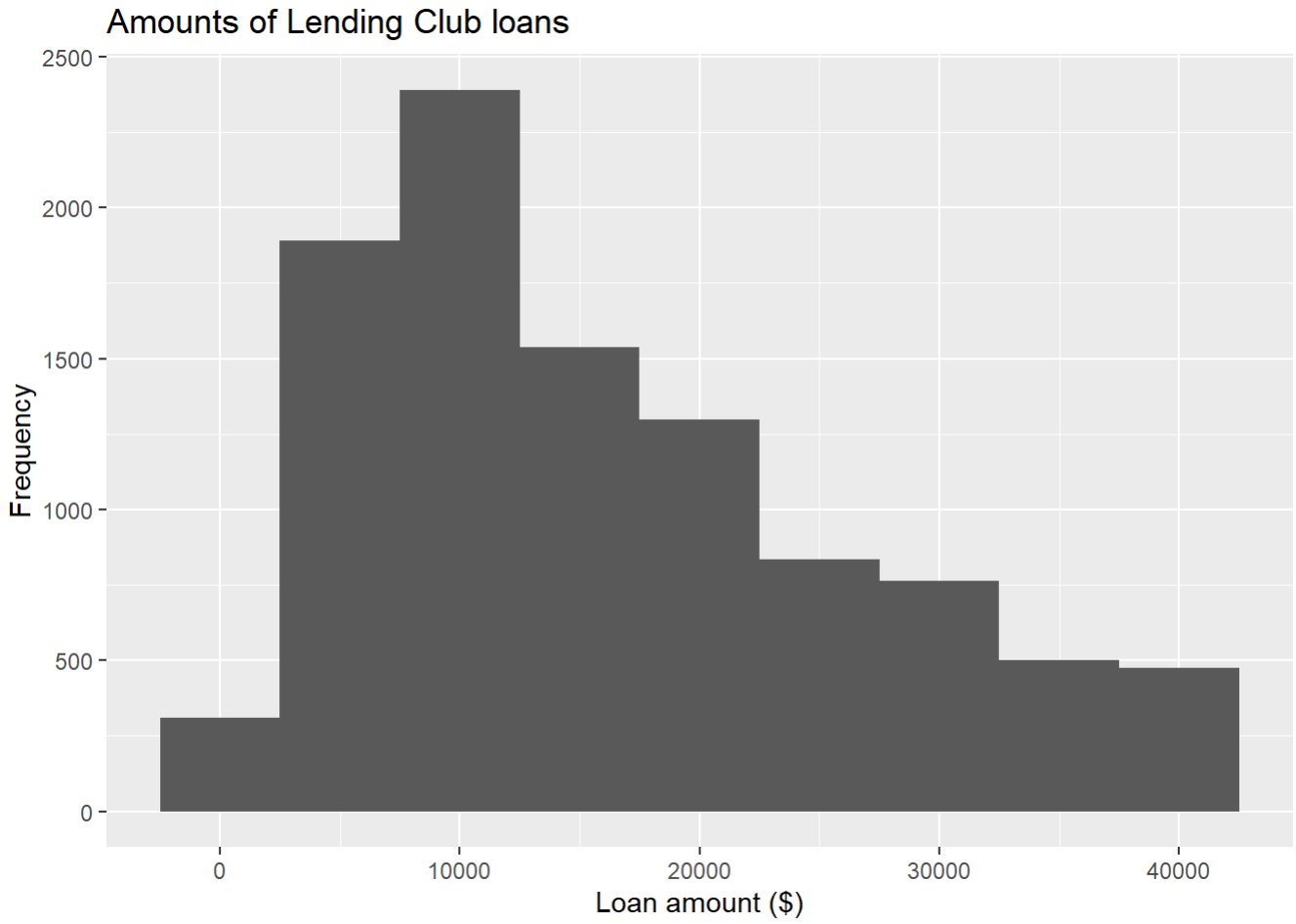
histogram and binwidth=20000

```
# binwidth = 20000
ggplot(loans, aes(x = loan_amount)) +
 geom_histogram(binwidth = 20000)
```



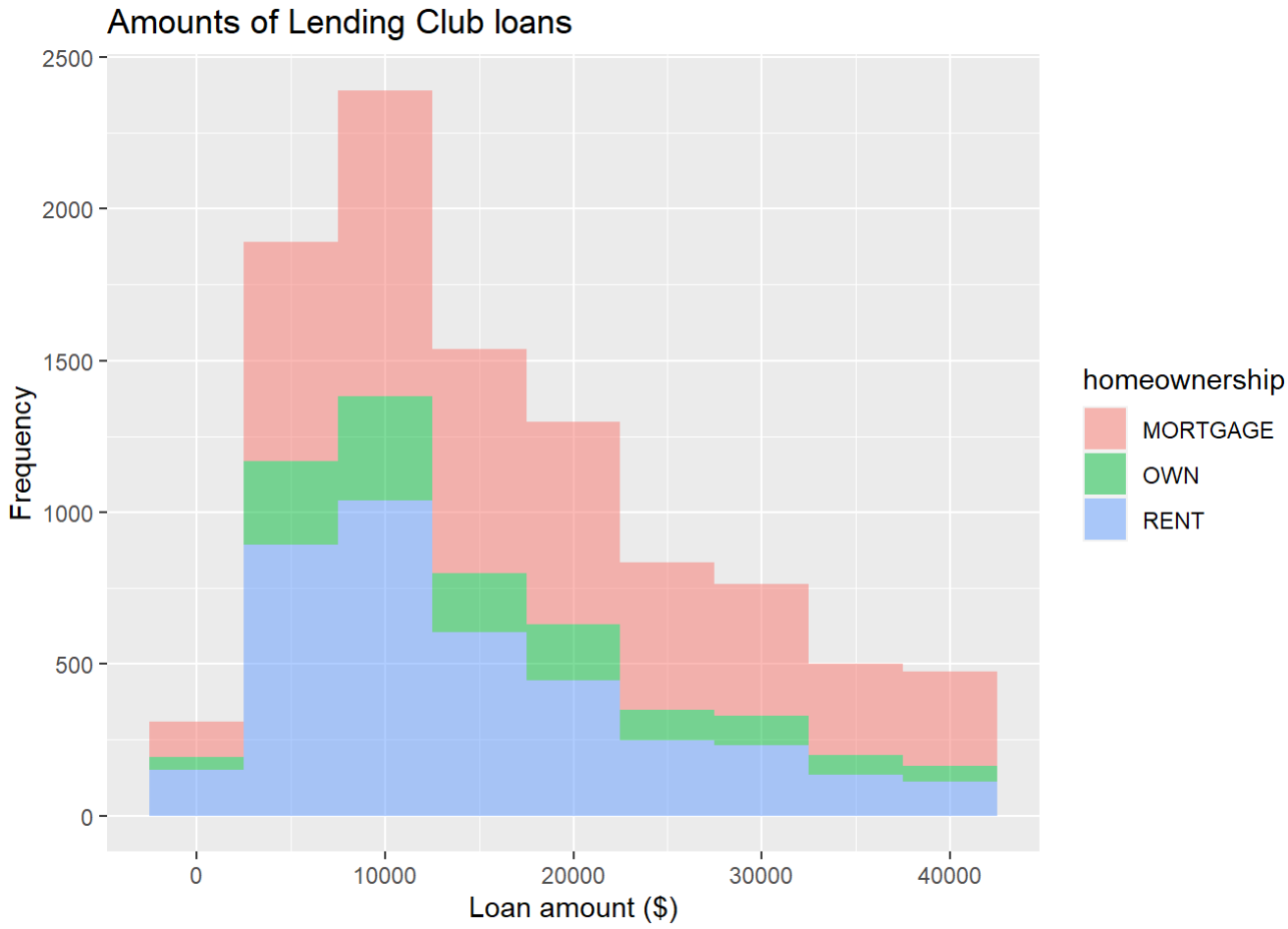
customizing histograms

```
ggplot(loans, aes(x = loan_amount)) + geom_histogram(binwidth = 5000) +
 labs(x = "Loan amount ($)", y = "Frequency", title = "Amounts of Lending Club loans" )
```



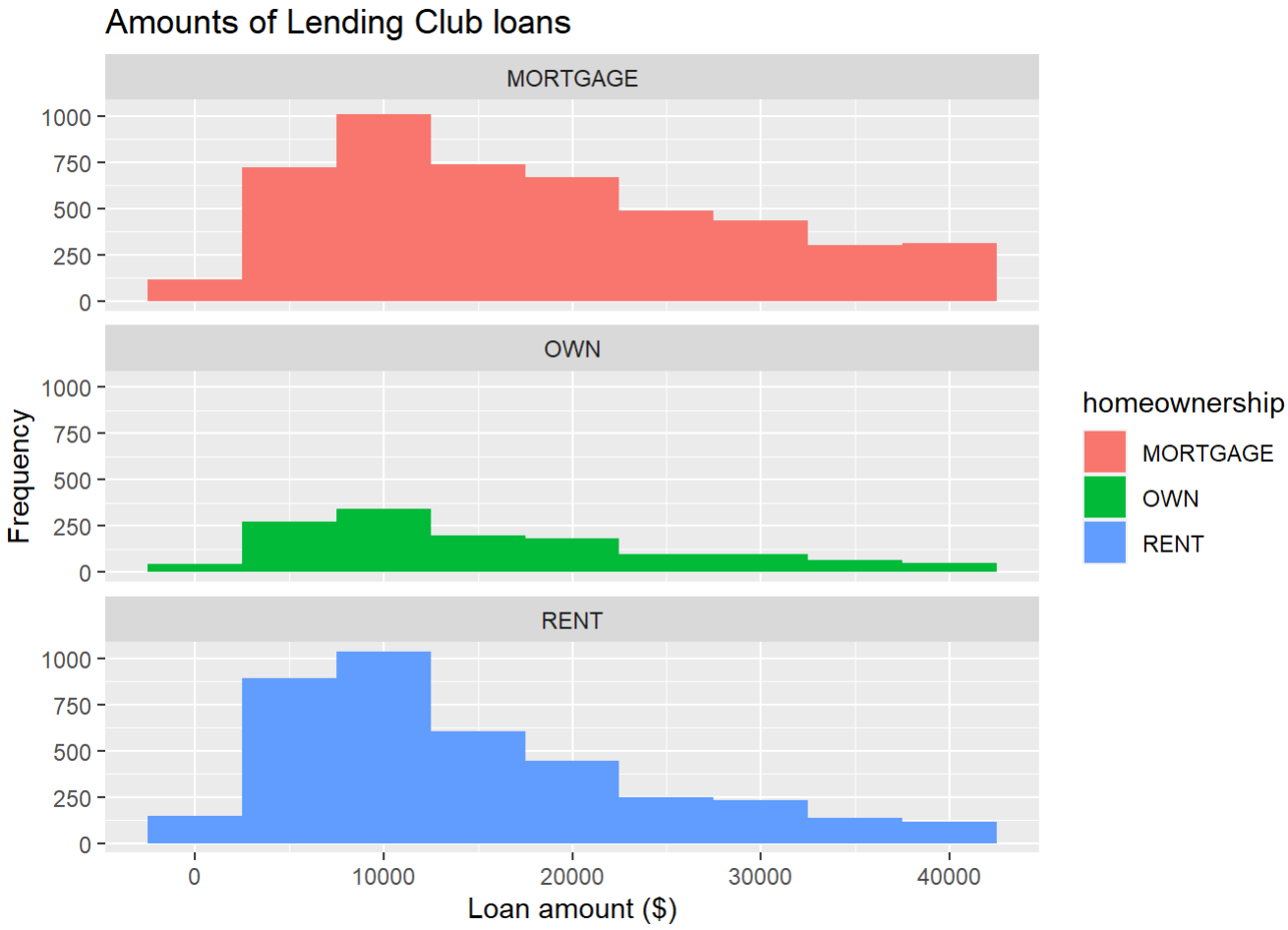
fill with a categorical variable

```
ggplot(loans, aes(x = loan_amount, fill = homeownership)) +
 geom_histogram(binwidth = 5000, alpha = 0.5) +
 labs(x = "Loan amount ($)",y = "Frequency",title = "Amounts of Lending Club loans")
```



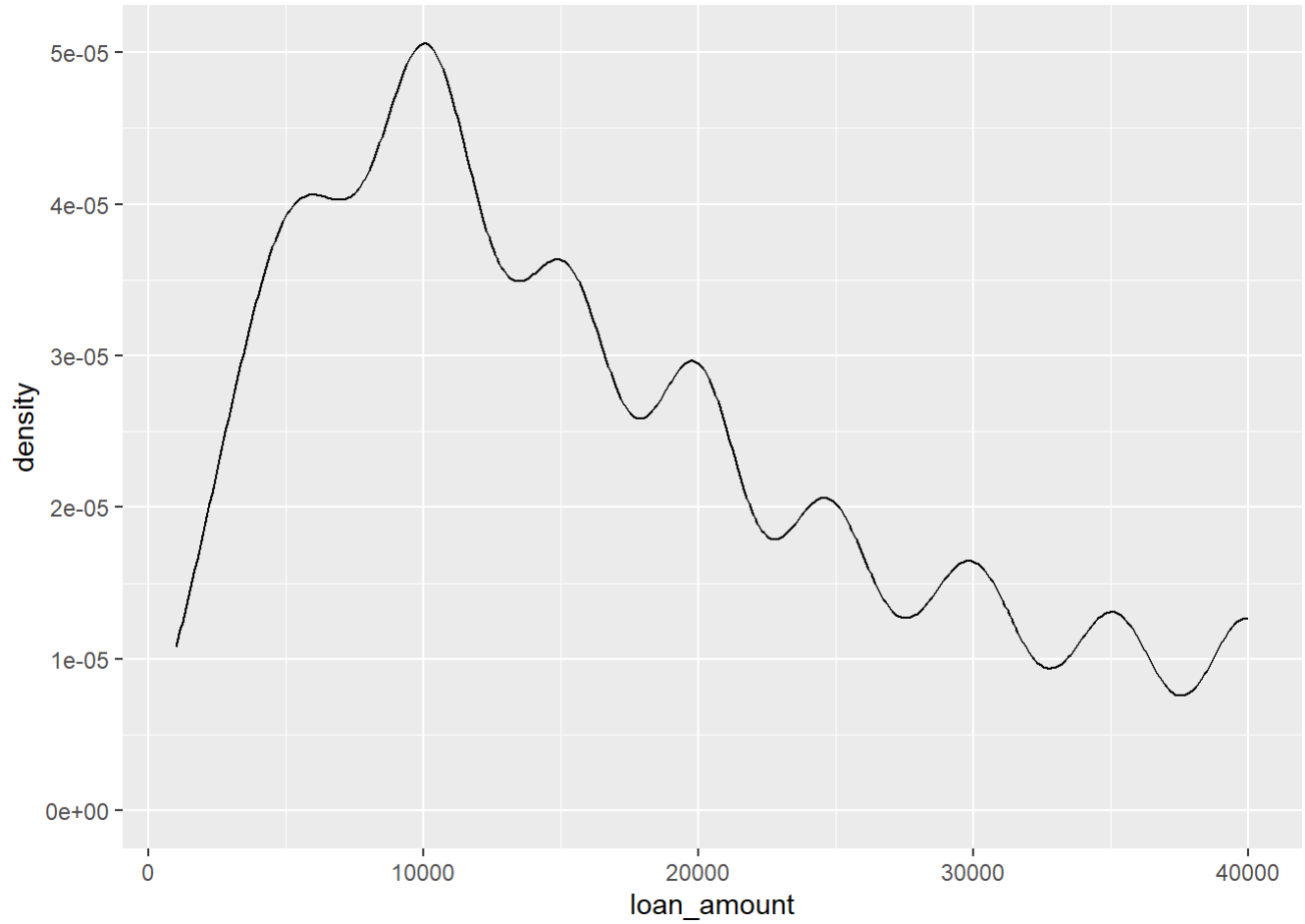
facet with a categorical variable

```
ggplot(loans, aes(x = loan_amount, fill = homeownership)) + geom_histogram(binwidth = 5000) +
 labs(x = "Loan amount ($)",y = "Frequency",title = "Amounts of Lending Club loans") +
 facet_wrap(~ homeownership, nrow = 3)
```



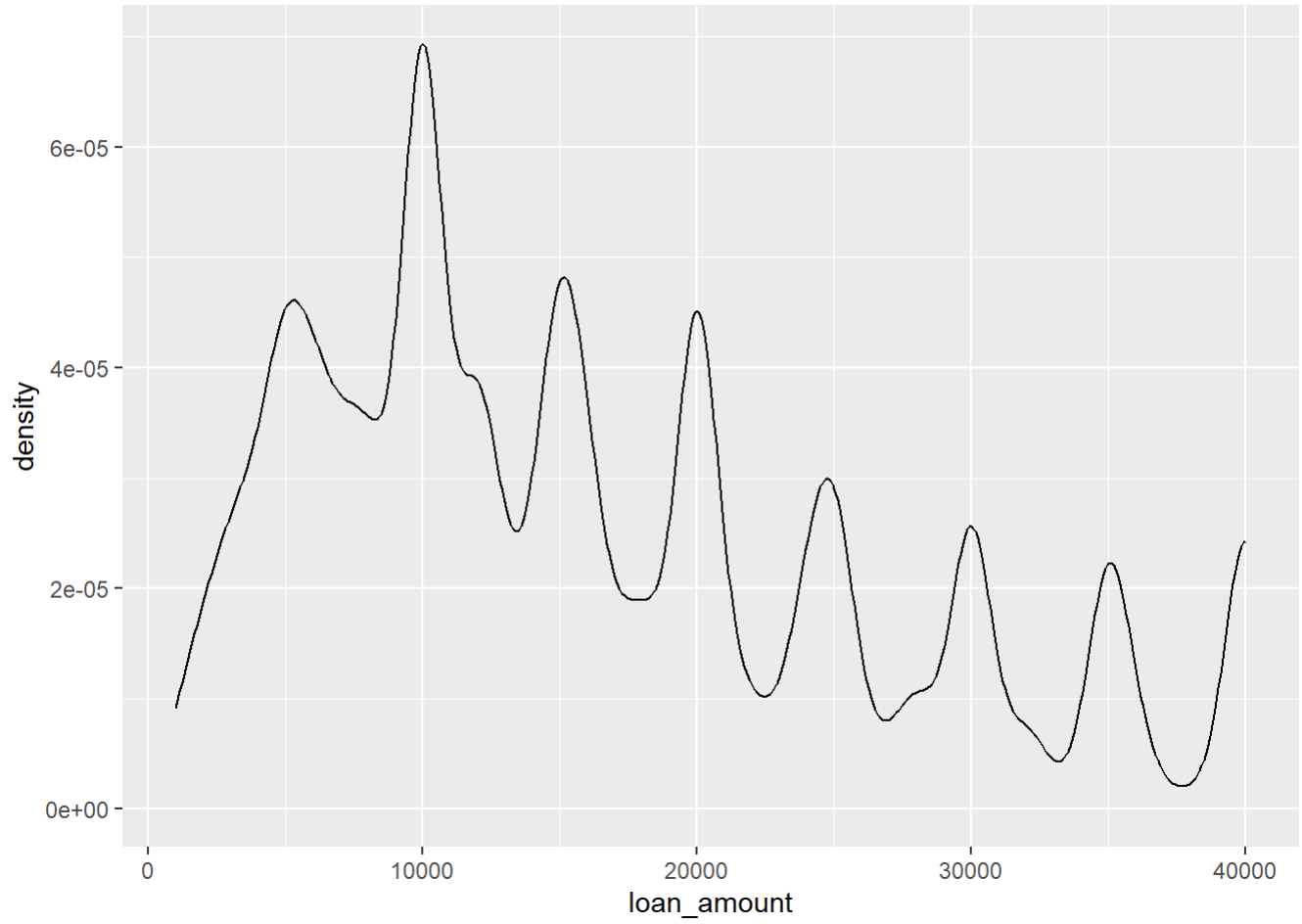
density plot

```
ggplot(loans, aes(x = loan_amount)) +
 geom_density()
```

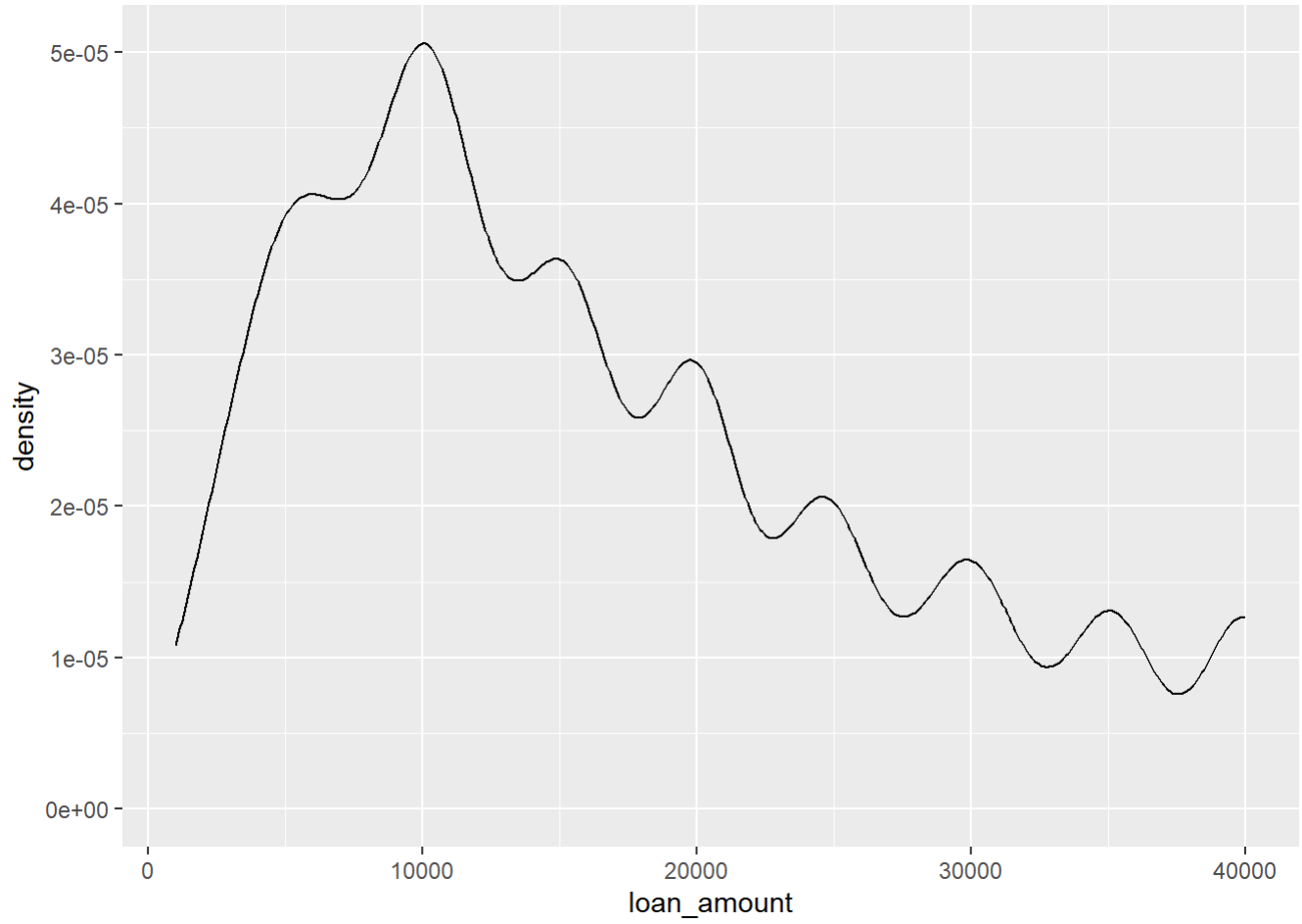


density plots and adjusting bandwidth

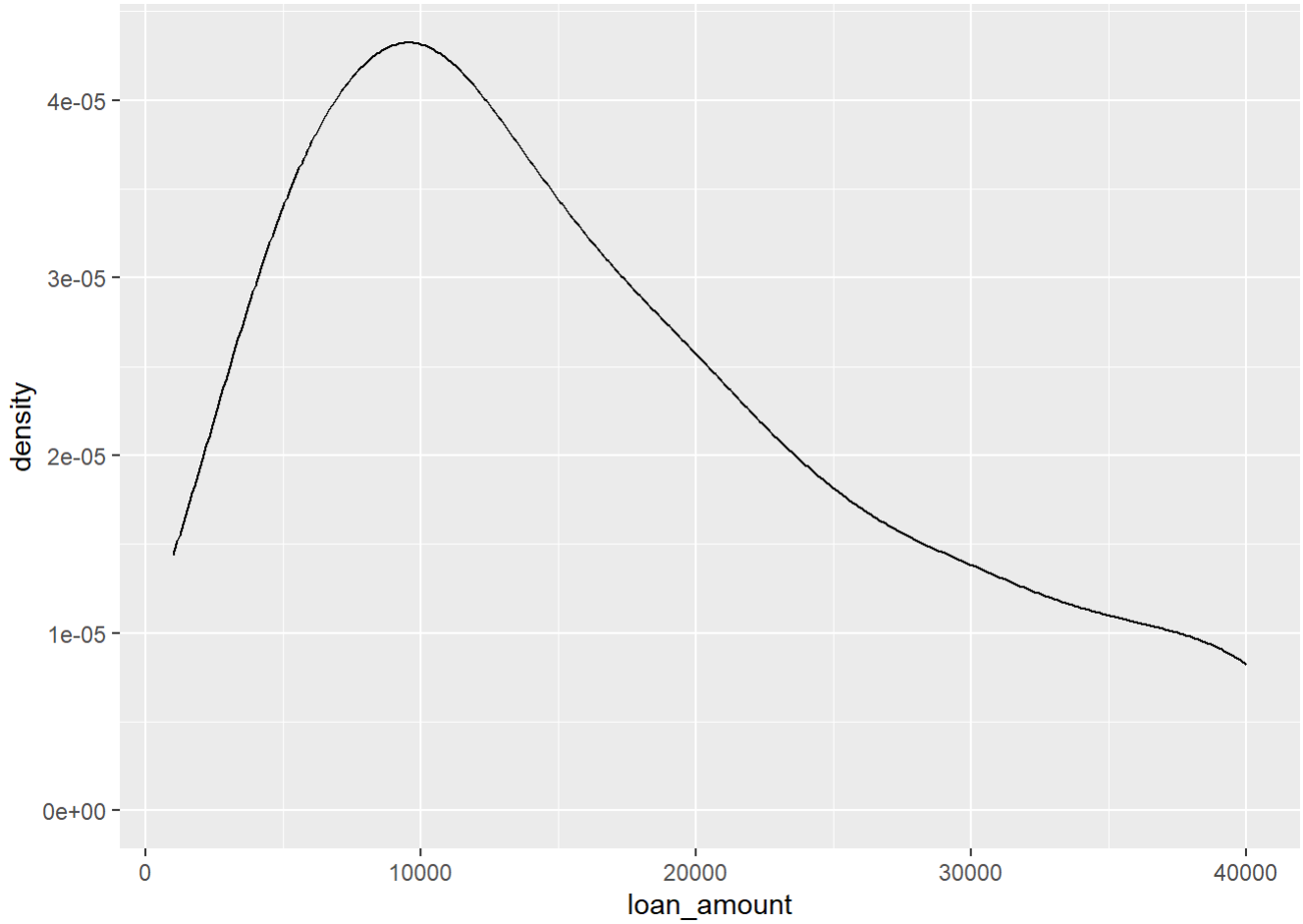
```
ggplot(loans, aes(x = loan_amount)) +
 geom_density(adjust = 0.5)
```




```
ggplot(loans, aes(x = loan_amount)) +
 geom_density(adjust = 1) # default bandwidth
```

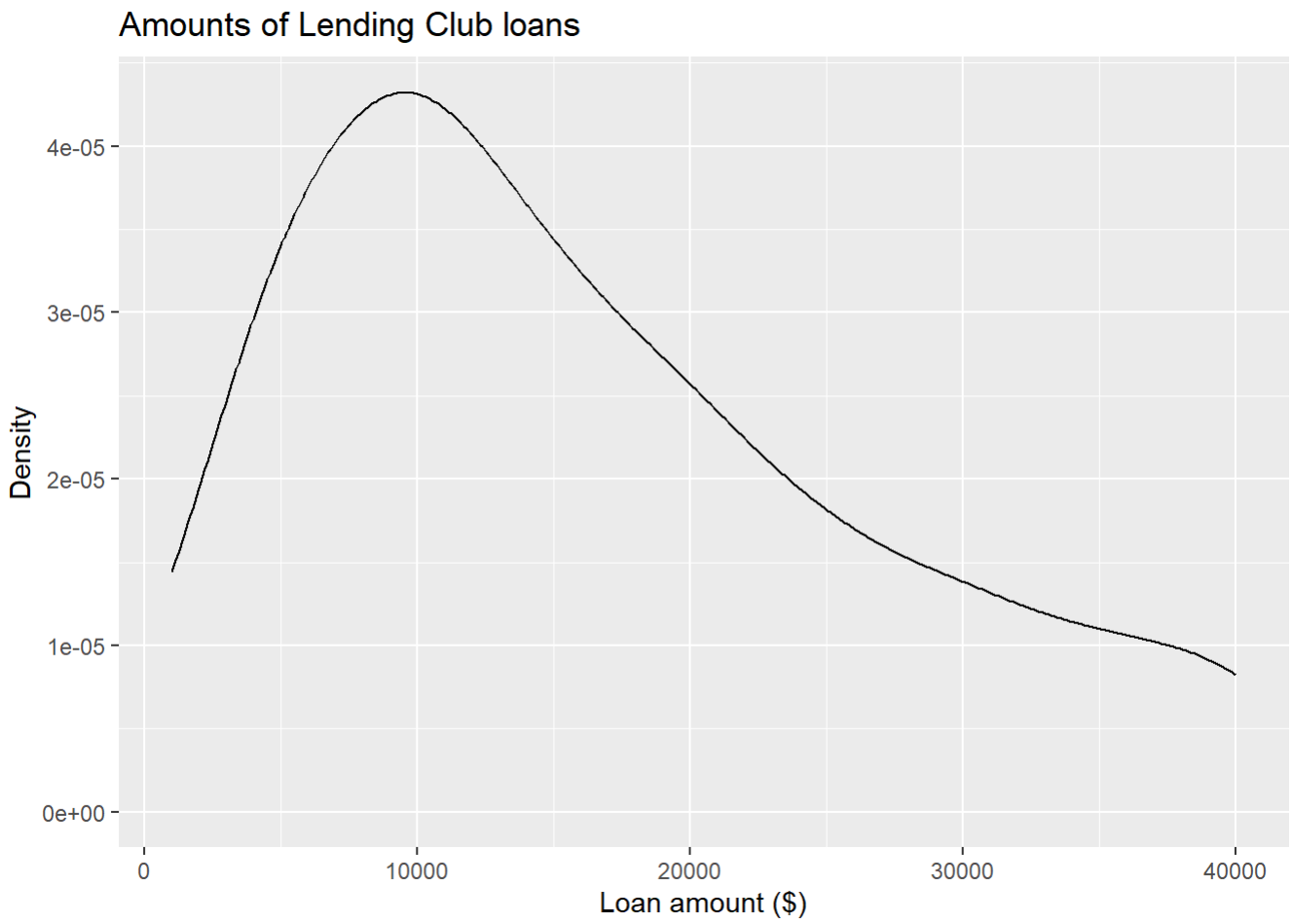


```
ggplot(loans, aes(x = loan_amount)) +
 geom_density(adjust = 2)
```



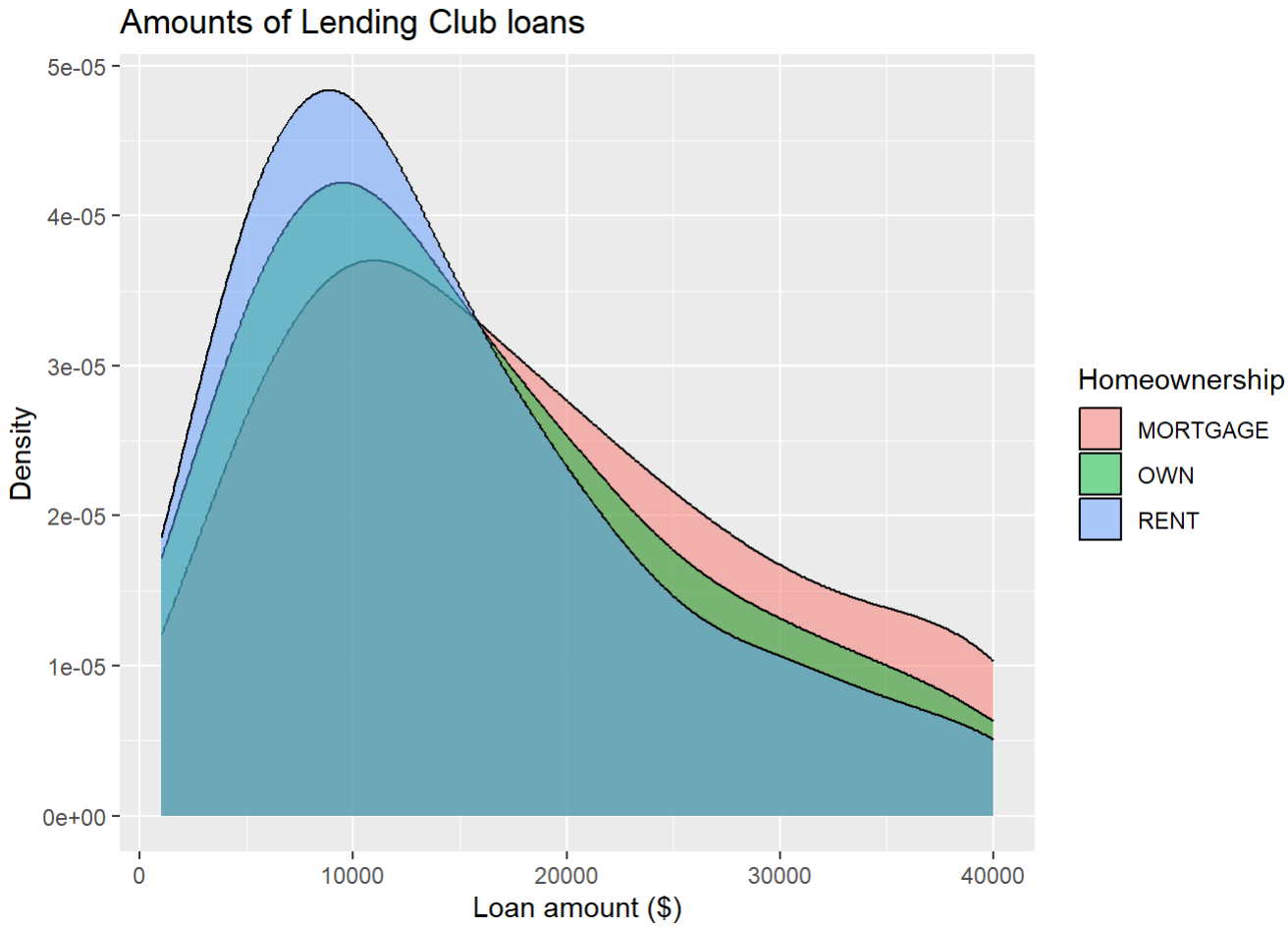
customizing density plots

```
ggplot(loans, aes(x = loan_amount)) +
 geom_density(adjust = 2) +
 labs( x = "Loan amount ($)", y = "Density", title = "Amounts of Lending Club loans" )
```



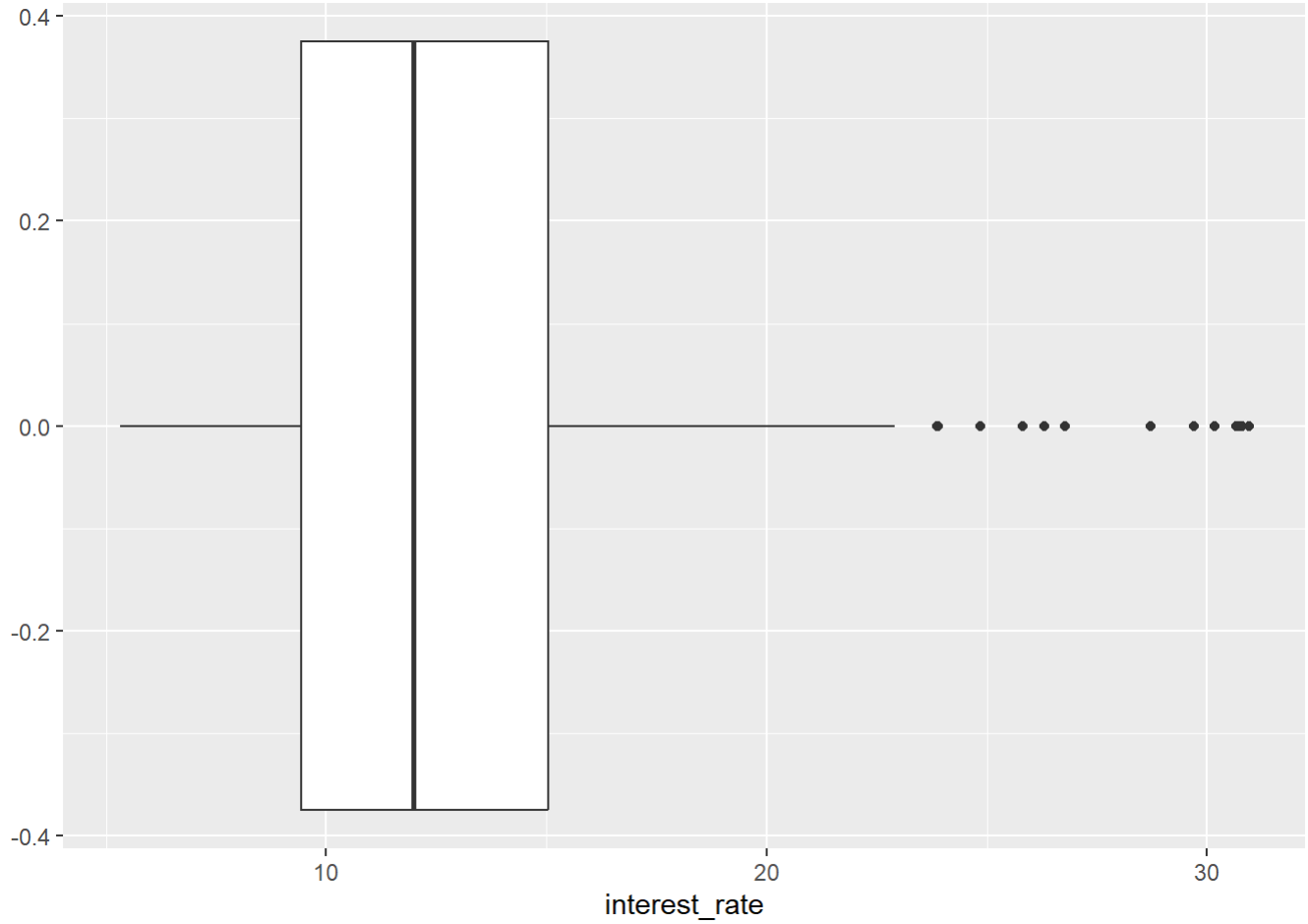
adding a categorical variable

```
ggplot(loans, aes(x = loan_amount, fill = homeownership)) +
 geom_density(adjust = 2, alpha = 0.5) +
 labs(x = "Loan amount ($)",y = "Density",title = "Amounts of Lending Club loans", fill = "Ho
meownership")
```



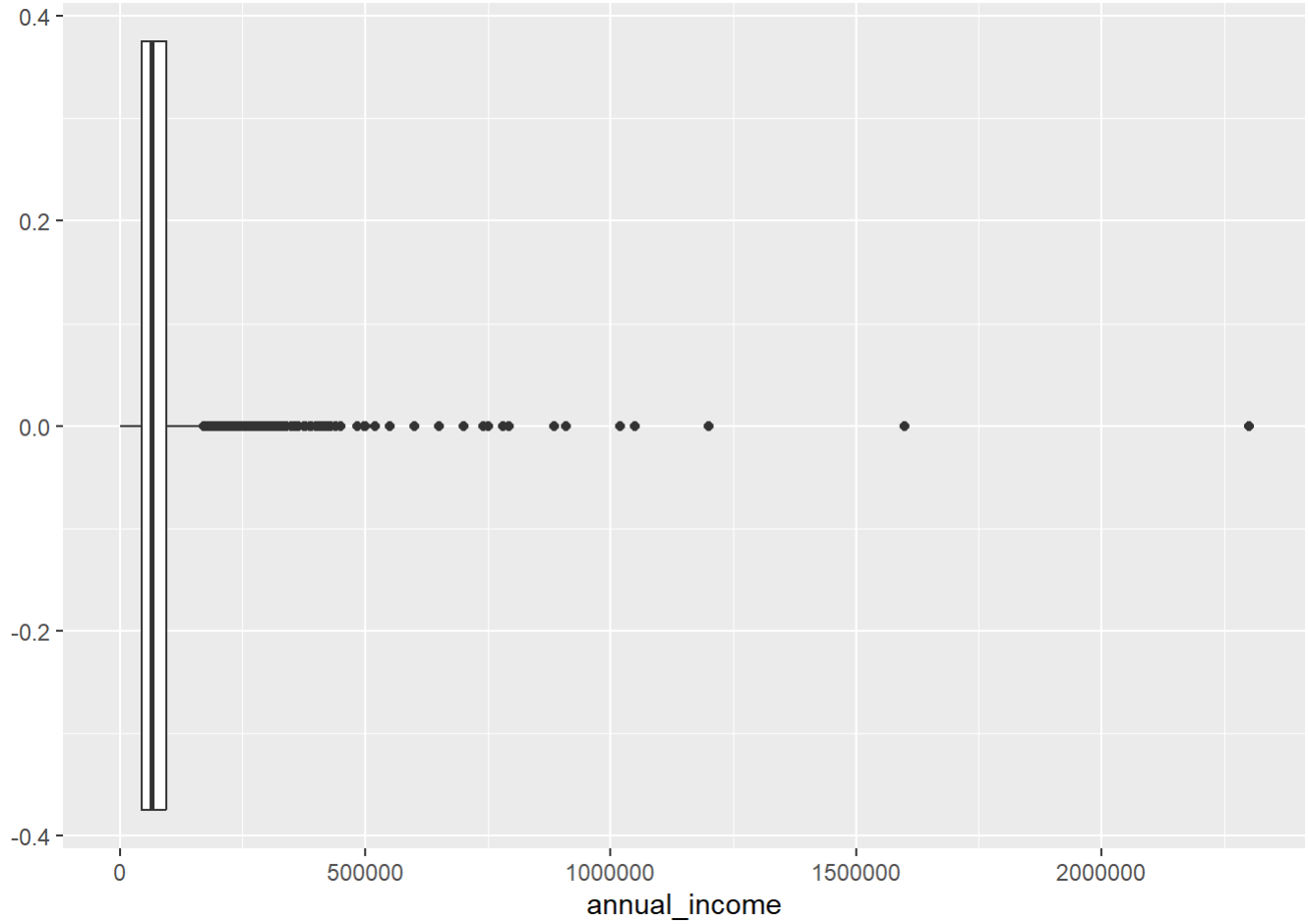
Box plot

```
ggplot(loans, aes(x = interest_rate)) +
 geom_boxplot()
```



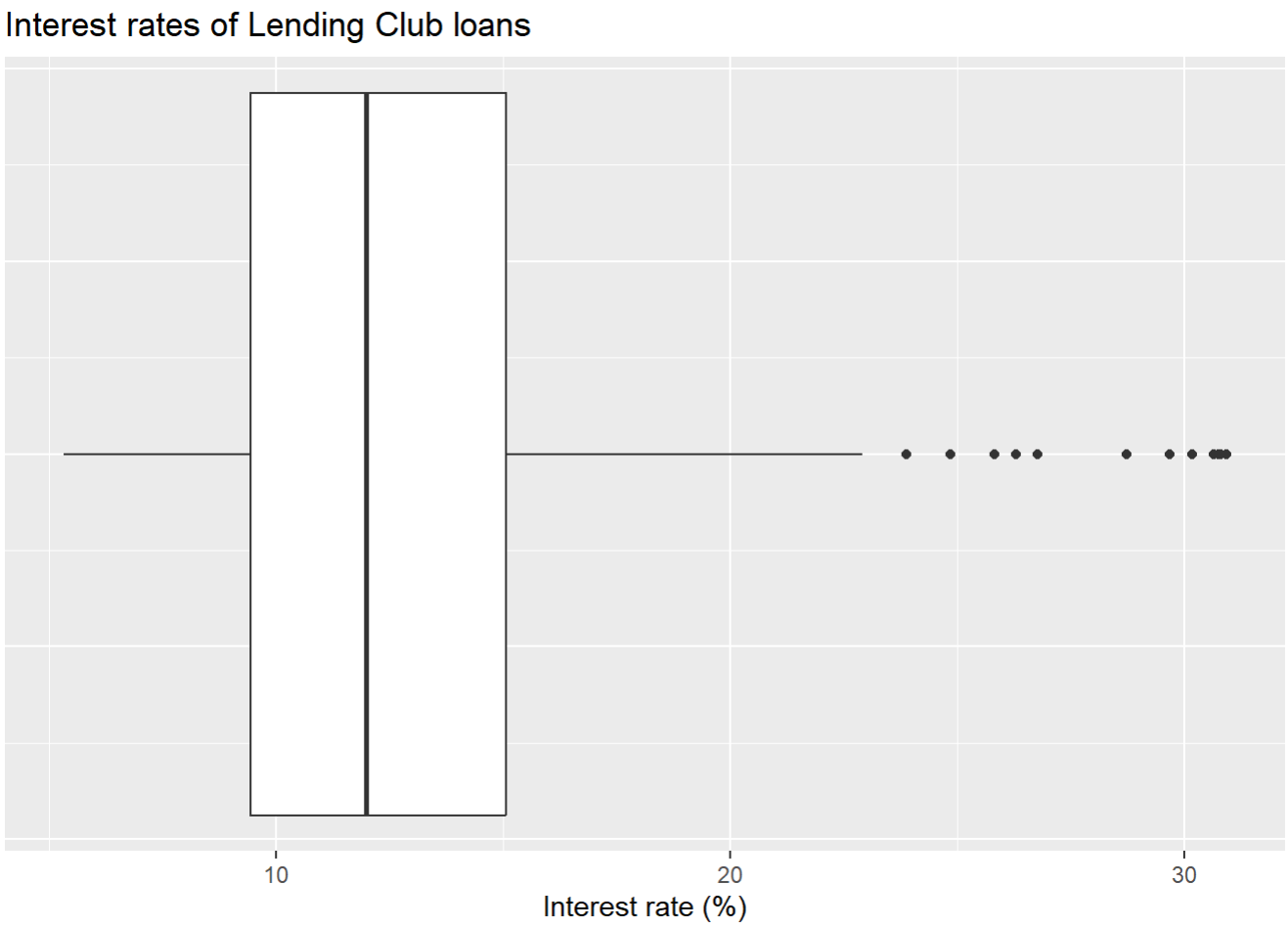
Box plot and outliers

```
ggplot(loans, aes(x = annual_income)) +
 geom_boxplot()
```



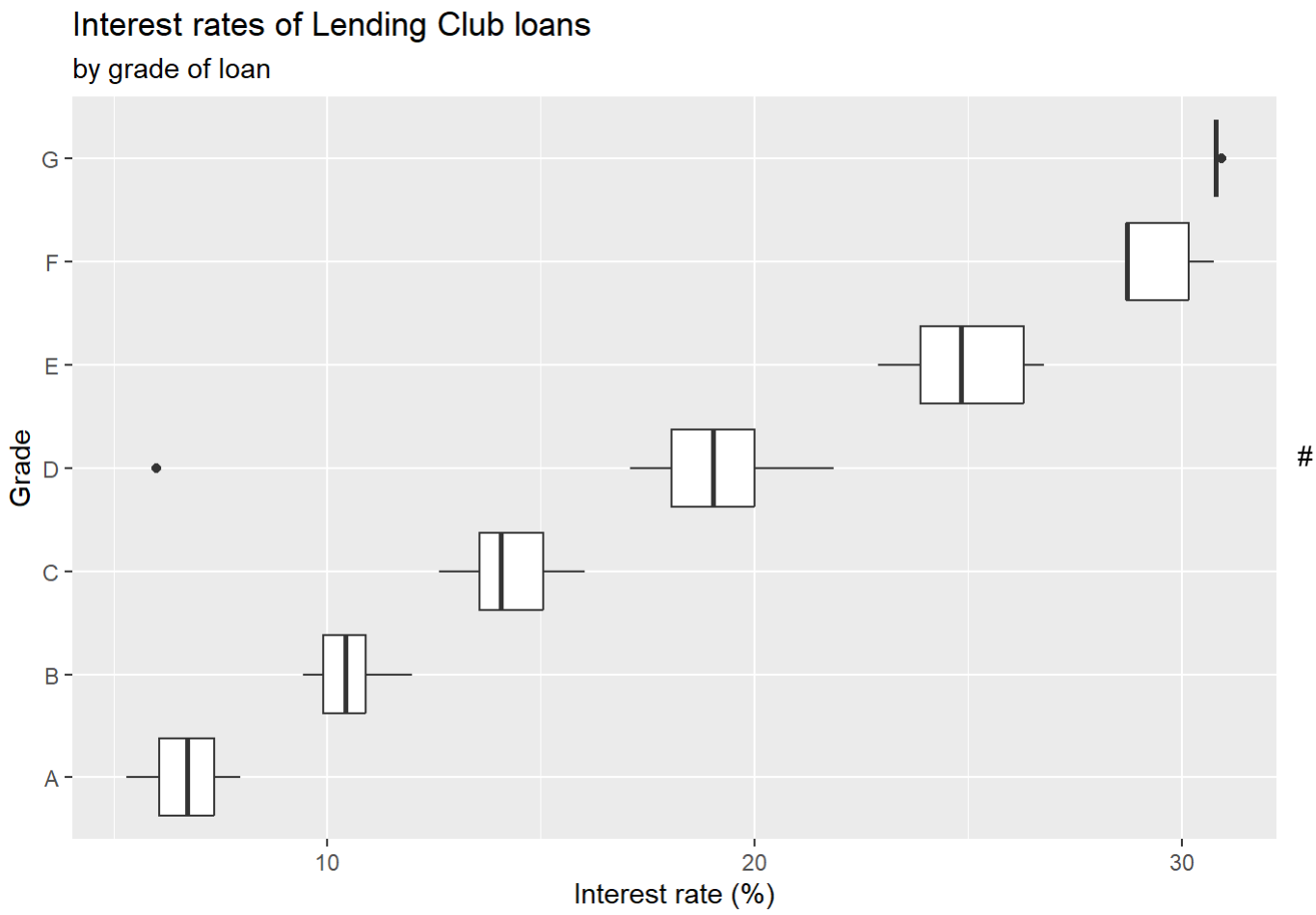
customizing box plots

```
ggplot(loans, aes(x = interest_rate)) +geom_boxplot() +labs(x = "Interest rate (%)",y = NULL,
 title = "Interest rates of Lending Club loans") +
 theme( axis.ticks.y = element_blank(), axis.text.y = element_blank() )
```



adding a categoric variable

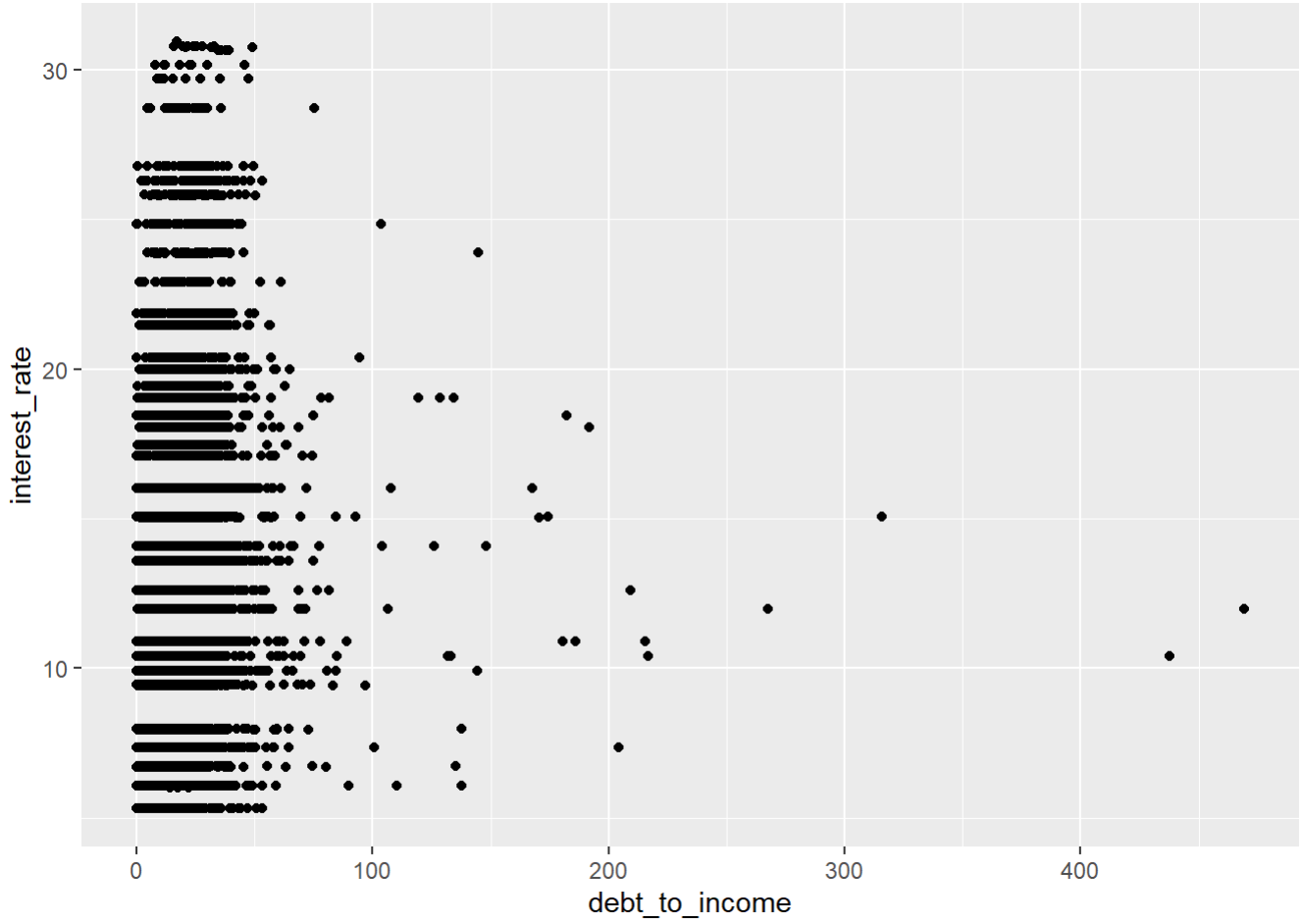
```
ggplot(loans, aes(x = interest_rate,
 y = grade)) +
 geom_boxplot() +
 labs(x = "Interest rate (%)",y = "Grade",title = "Interest rates of Lending Club loans",subt
itle = "by grade of loan")
```



scatterplot

```
ggplot(loans, aes(x = debt_to_income, y = interest_rate)) + geom_point()
```

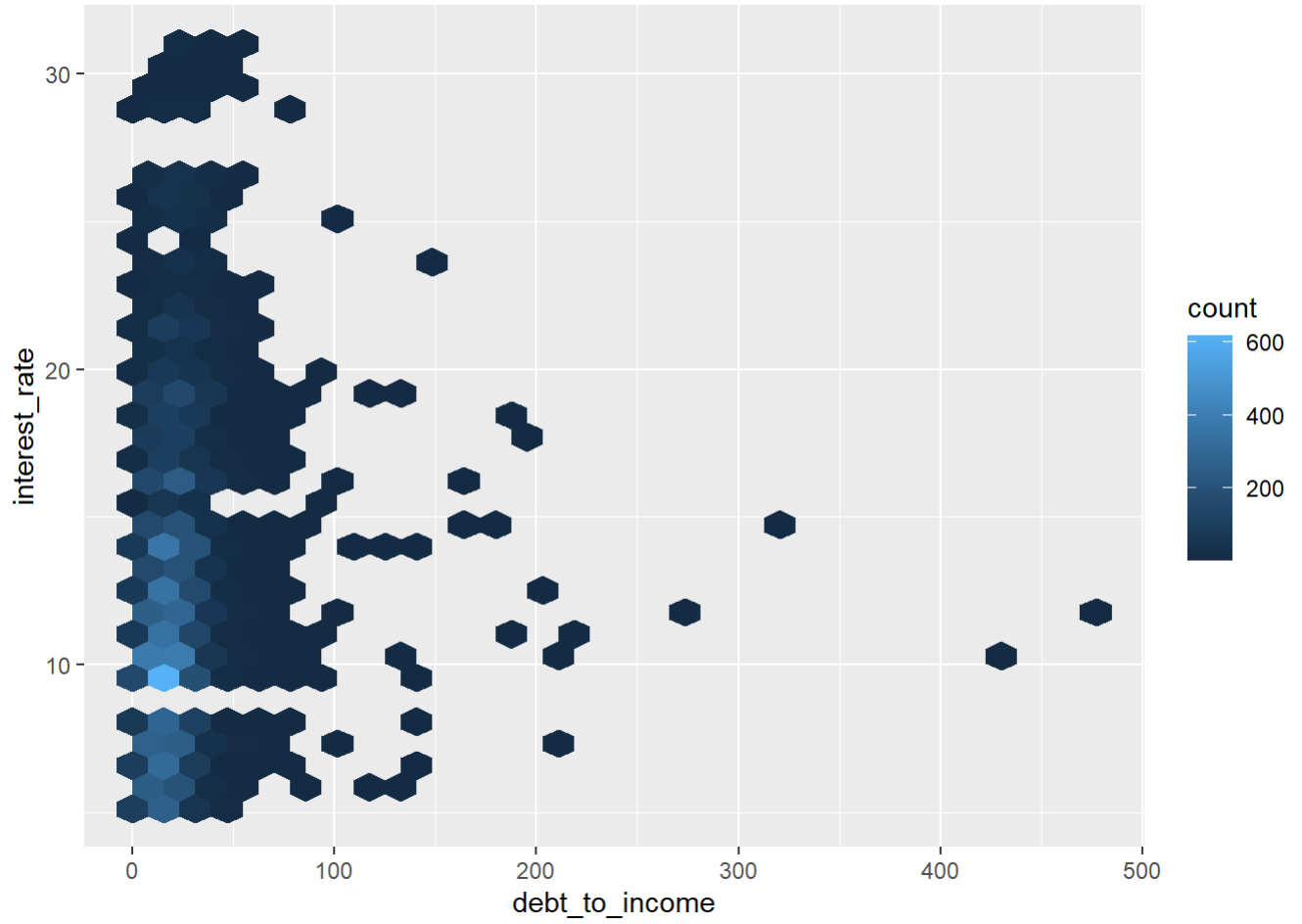
```
## Warning: Removed 24 rows containing missing values (`geom_point()`).
```



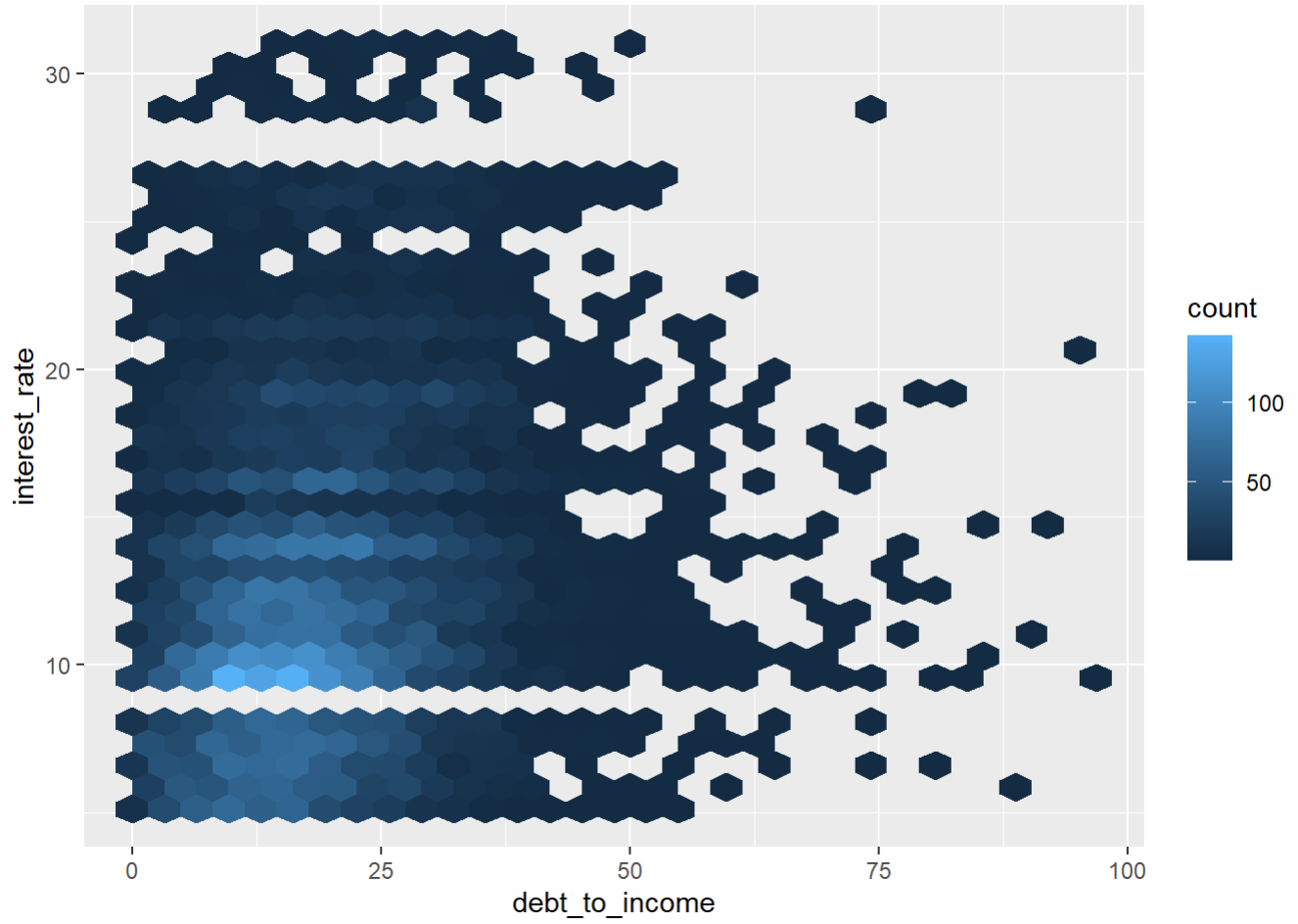
Hex plot

```
ggplot(loans, aes(x = debt_to_income, y = interest_rate)) +
 geom_hex()
```

```
## Warning: Removed 24 rows containing non-finite values (`stat_binhex()`).
```

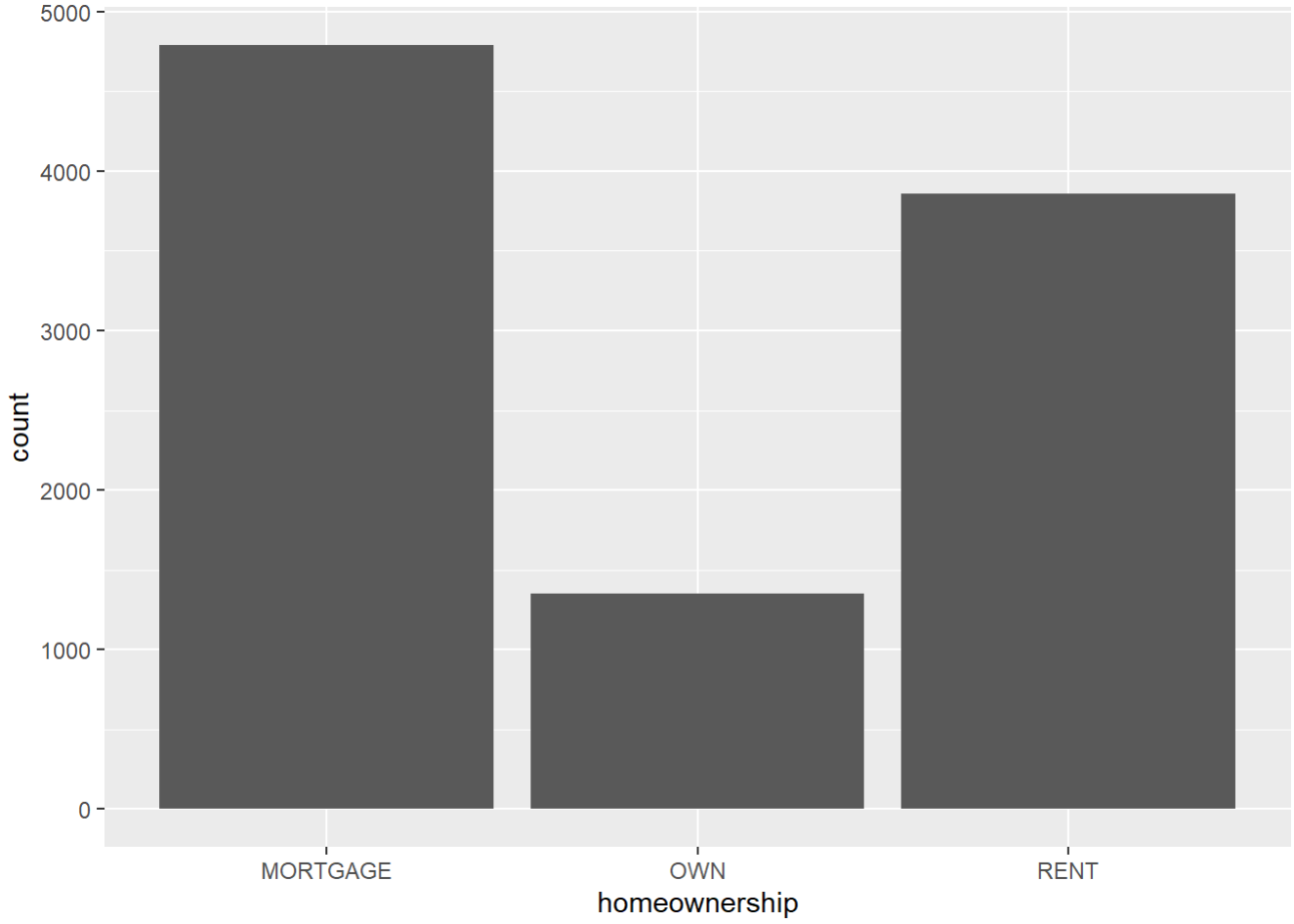



```
ggplot(loans %>% filter(debt_to_income < 100),
 aes(x = debt_to_income, y = interest_rate)) +
 geom_hex()
```



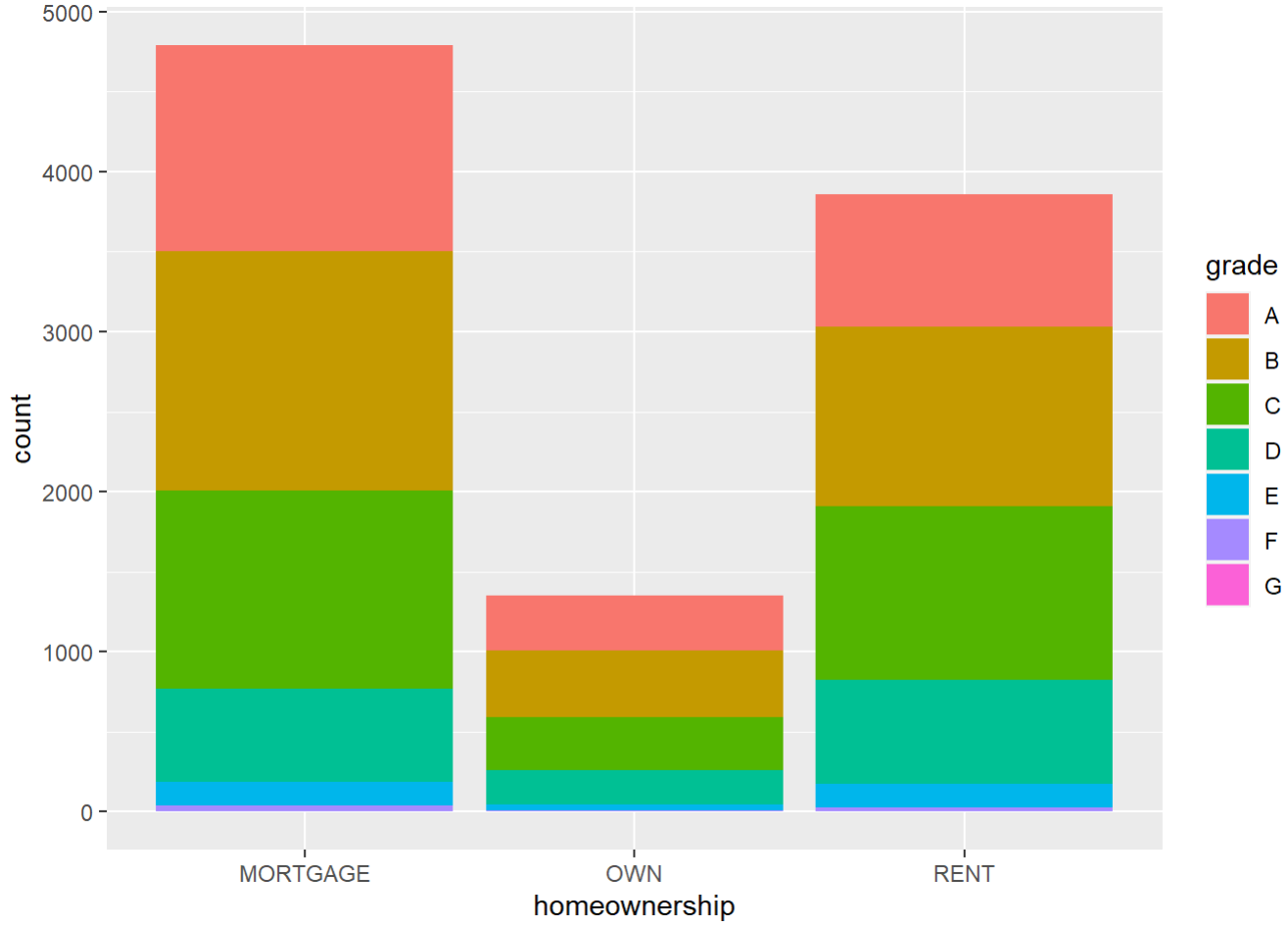
Bar plot

```
ggplot(loans, aes(x = homeownership)) +
 geom_bar()
```



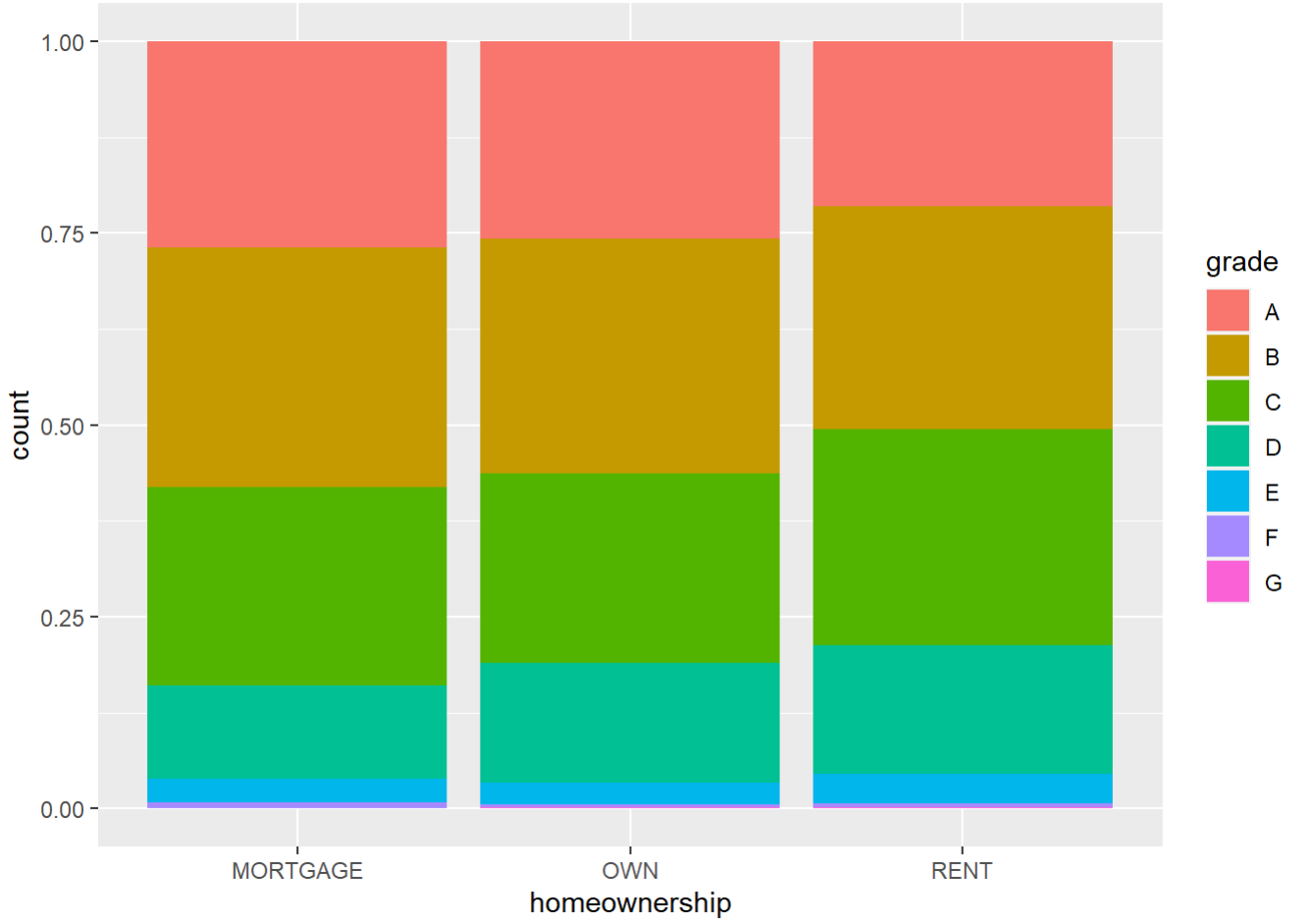
Segmented bar plot

```
ggplot(loans, aes(x = homeownership,
 fill = grade)) +
 geom_bar()
```



Segmented bar plot

```
ggplot(loans, aes(x = homeownership, fill = grade)) +
 geom_bar(position = "fill")
```



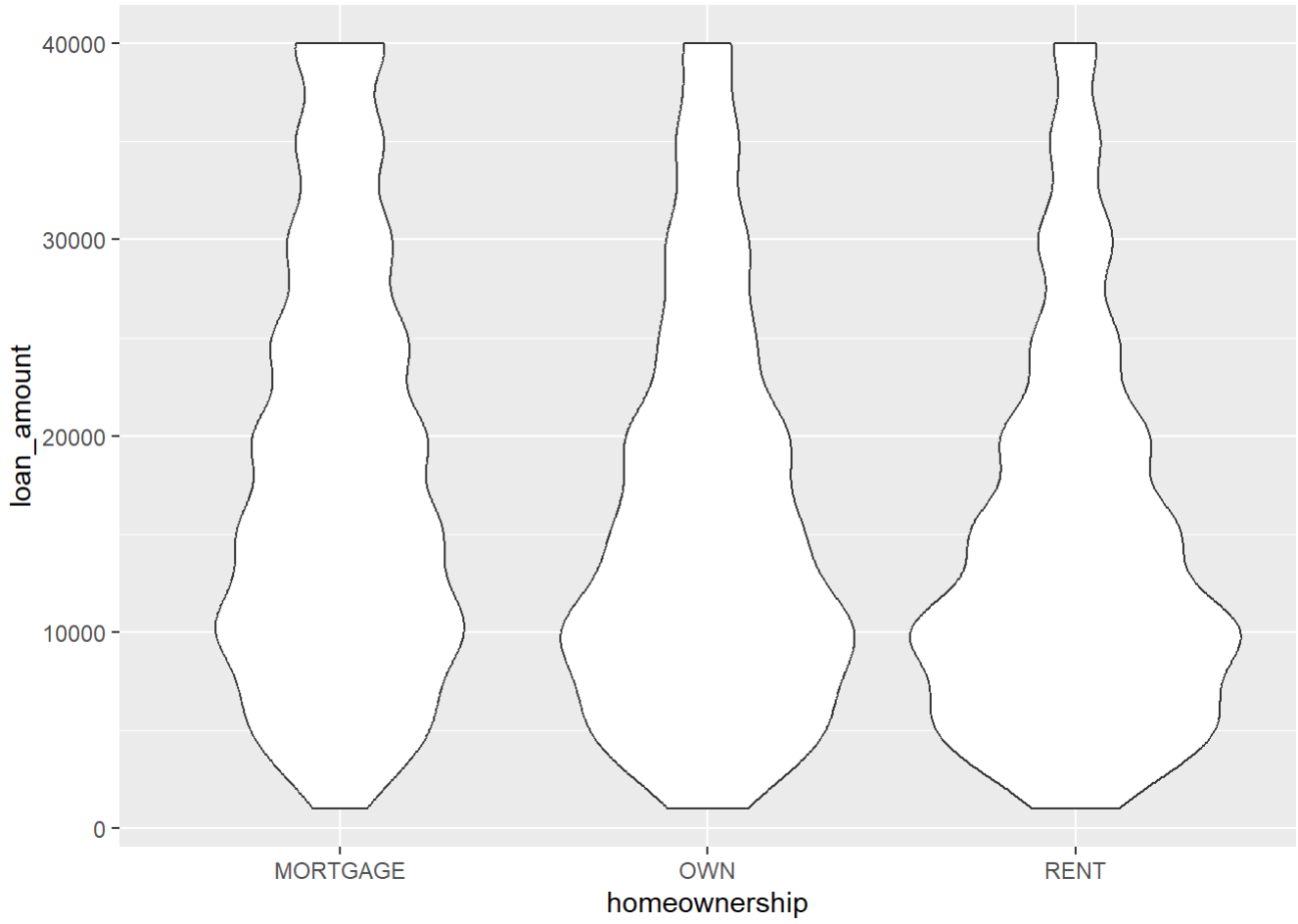
Customizing bar plots

```
ggplot(loans, aes(y = homeownership, fill = grade)) + geom_bar(position = "fill") +
labs( x = "Proportion", y = "Homeownership", fill = "Grade", title = "Grades of Lending Club
loans", subtitle = "and homeownership of lendee")
```

IV. Visualizing variables of varied types

violin plots

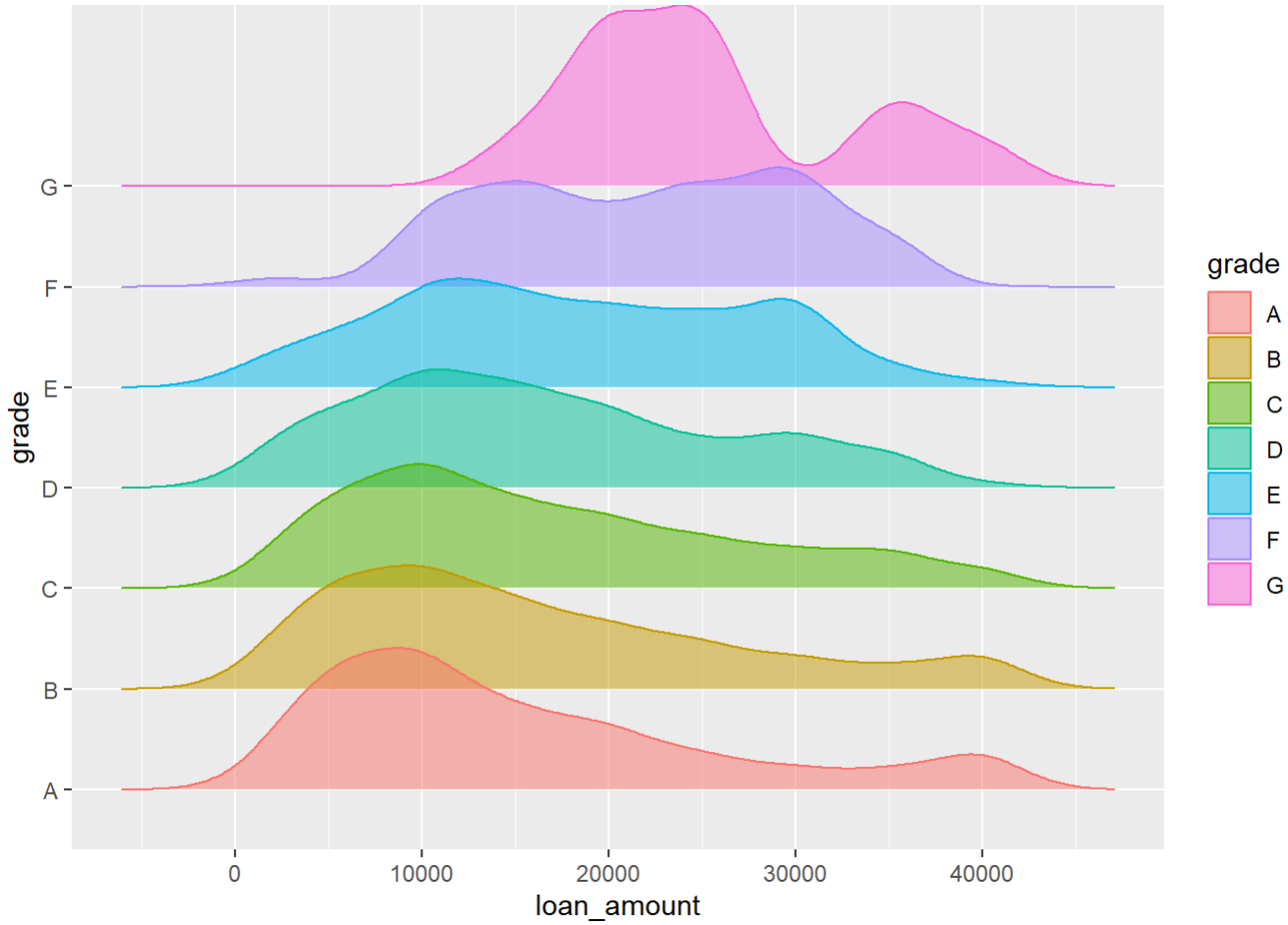
```
ggplot(loans, aes(x = homeownership, y = loan_amount)) +
 geom_violin()
```



Ridge plots

```
library(ggridges)
ggplot(loans, aes(x = loan_amount, y = grade, fill = grade, color = grade)) +
 geom_density_ridges(alpha = 0.5)
```

```
## Picking joint bandwidth of 2360
```


grade
G
F
E
D
C
B
A
0
10000
20000
30000
40000
loan_amount
grade
A
B
C
D
E
F
G