Bite Rates & Chafing Behavior Poster Figures

Amaris Bellord

Poster Figures

Need 4 graphs for 3 figures:

(Figure 1 is images of fish)

Figure 2: Convict Tang vs. Yellow Tang Mean Bites Per Observation Period

Figure 3a: Convict Tang Bites Per Observation Period By Size Class

Figure 3b: Yellow Tang Bites Per Observation Period By Size Class

Figure 4: Convict Tang vs. Yellow Tang Chafing Behavior Displayed

For most graphs, use geom_jitter and emmeans to create jitterplots with means and confidence intervals.

Dataset & Packages

```
#import dataset from excel sheet, packages
library(readxl)

Initial_Data <- read_excel("C:/Users/amari/Downloads/Convict Yellow Tang Rese
arch Project Data.xlsx",
    sheet = "Summary Data")



library(tidyverse)
library(patchwork)
library(skimr)
library(tidymodels)
library(emmeans)
library(ggsci)
library(RColorBrewer)
library(forcats)
```

Figure 2

Species v. Species Mean Bites

```r
lm_Bites <- lm(Bite_Min ~ Species, data = Core_Data)
lm_Bites
```

```
Call:
lm(formula = Bite_Min ~ Species, data = Core_Data)

Coefficients:
       (Intercept)  SpeciesYellow Tang
             29.35              -20.48
```

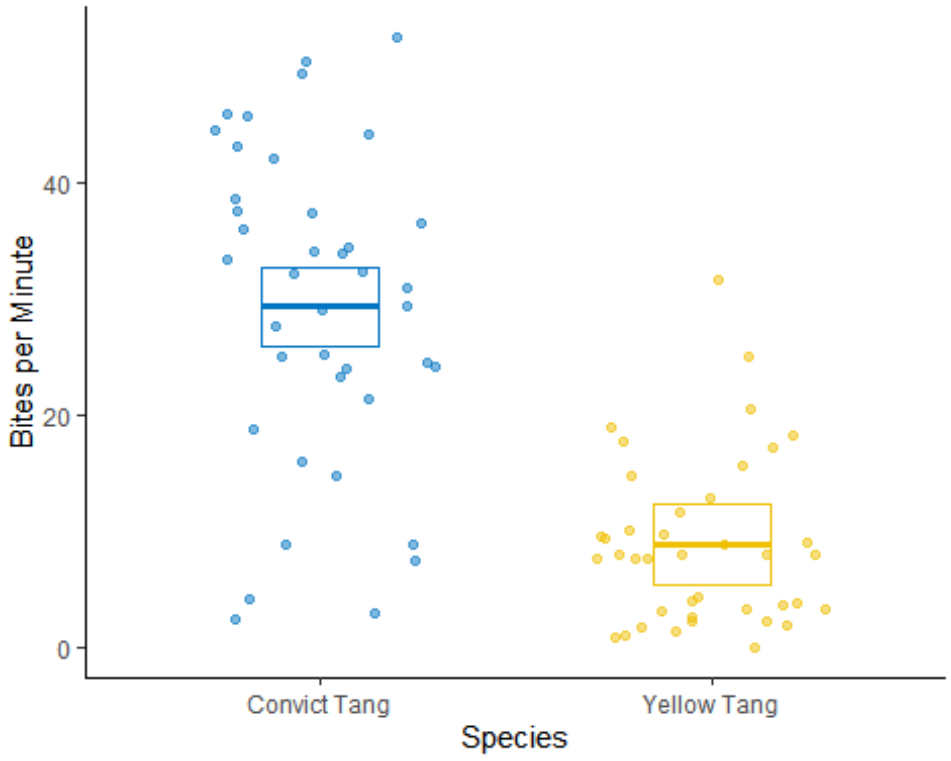
```r
lm_Bites_coef <- tidy(lm_Bites, conf.int = TRUE)
lm_Bites_coef
```

```
# A tibble: 2 × 7
  term               estimate std.error statistic  p.value conf.low conf.high
  <chr>                 <dbl>     <dbl>     <dbl>    <dbl>    <dbl>     <dbl>
1 (Intercept)            29.4      1.73     16.9  7.51e-28     25.9      32.8
2 SpeciesYellow Tang    -20.5      2.45     -8.35 1.93e-12    -25.4     -15.6
```

```r
lm_All_Bites_emm <- emmeans(lm_Bites, ~ Species)
lm_All_Bites_emm
```

```
 Species      emmean   SE df lower.CL upper.CL
 Convict Tang  29.35 1.73 78    25.90     32.8
 Yellow Tang    8.88 1.73 78     5.42     12.3

Confidence level used: 0.95
```

```r
Comparison_Jitter_Plot <- Core_Data |>
  ggplot( aes(x=Species, y=Bite_Min, color = Species)) +
  scale_color_jco() +
  geom_jitter(width = 0.3, alpha = 0.5) +
  ylab("Bites per Minute") +
  xlab("Species") +
  geom_crossbar(data = as_tibble(lm_All_Bites_emm),
                aes(y = emmean,
                    ymin = lower.CL,
                    ymax = upper.CL),
                width = 0.3) +
  theme_classic() +
  theme(legend.position="none")

Comparison_Jitter_Plot
```




```
ggsave("Poster Figure 2 6x6.png", Comparison_Jitter_Plot,
width = 6,
height = 6,
dpi = 600)

lm_All_Bites_pairs<- contrast(lm_All_Bites_emm, method = "pairwise") |>
  summary(infer = TRUE)

lm_All_Bites_pairs
```

```
 contrast                  estimate   SE df lower.CL upper.CL t.ratio p.valu
e
 Convict Tang - Yellow Tang     20.5 2.45 78     15.6     25.4   8.354  <.000
1

Confidence level used: 0.95
```

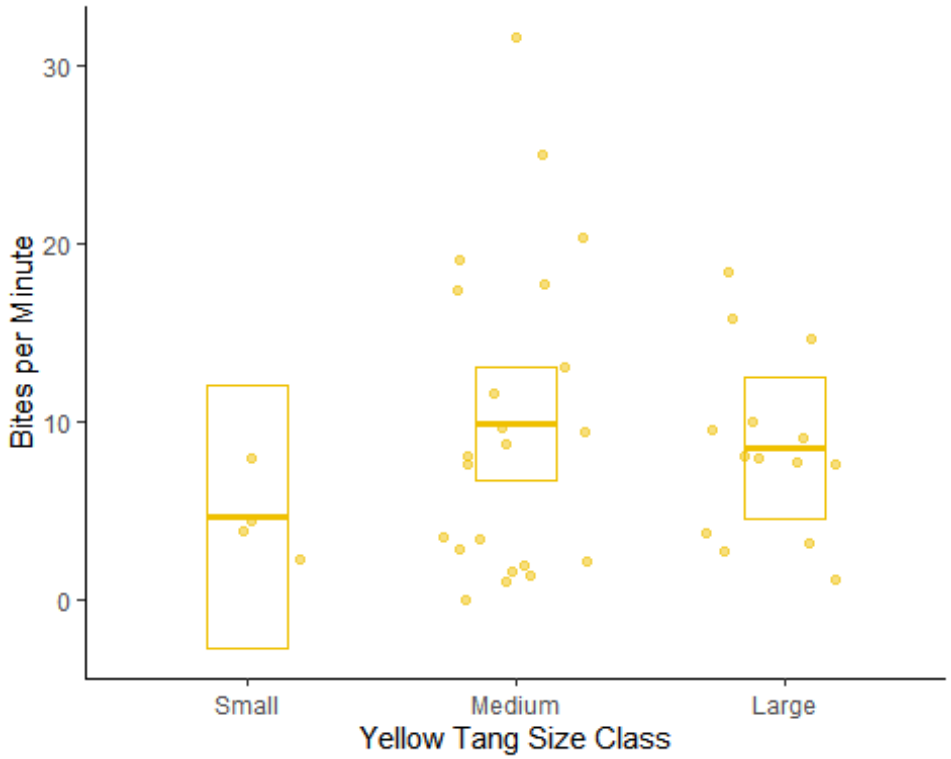
```
#Convict Tang feeding rate (mean: 29.35, 95% CI: 25.90 to 32.8) was 2.3 times
higher (mean difference: 20.5, 95% CI: 15.6 to 25.4, p < .0001) than that of
Yellow Tang (mean: 8.88, 95% CI: 5.42 to 12.3).

#OR: Convict Tang bit 2.3 times more often than Yellow Tang did during 3-minu
te observation periods (mean difference: 61.43, 95% CI: 46.8 to 76.1, p < .00
01), for the abstract.
```

Figure 3a & 3b

Bites by Size Class

```
#yellow tang first
Yellow_Bite_Data <- Core_Data |>
  filter(Species == "Yellow Tang")

lm_Yellow_Bites <- lm(Bite_Min ~ Size_Class, data = Yellow_Bite_Data)
lm_Yellow_Bites


Call:
lm(formula = Bite_Min ~ Size_Class, data = Yellow_Bite_Data)

Coefficients:
     (Intercept)  Size_ClassMedium   Size_ClassSmall
           8.524             1.340            -3.857

lm_Yellow_Bites_coef <- tidy(lm_Yellow_Bites, conf.int = TRUE)
lm_Yellow_Bites_coef

# A tibble: 3 × 7
  term             estimate std.error statistic   p.value conf.low conf.high
  <chr>               <dbl>     <dbl>     <dbl>     <dbl>    <dbl>     <dbl>
1 (Intercept)          8.52      1.94     4.39  0.0000916     4.59     12.5
2 Size_ClassMedium     1.34      2.48     0.539 0.593        -3.69      6.37
3 Size_ClassSmall     -3.86      4.12    -0.936 0.355       -12.2       4.49

Yellow_Bite_Data_Means <- emmeans(lm_Yellow_Bites, ~ Size_Class)
Yellow_Bite_Data_Means

 Size_Class emmean   SE df lower.CL upper.CL
 Large        8.52 1.94 37     4.59     12.5
 Medium       9.86 1.55 37     6.72     13.0
 Small        4.67 3.63 37    -2.70     12.0

Confidence level used: 0.95

Yellow_Size_Jitter_Plot <- Yellow_Bite_Data |>
  ggplot( aes(x=Size_Class, y=Bite_Min)) +
  scale_x_discrete(limits = c("Small","Medium","Large")) +
  geom_jitter(width = 0.3, color = "#efc000", alpha = 0.5) +
  ylab("Bites per Minute") +
  xlab("Yellow Tang Size Class") +
  geom_crossbar(data = as_tibble(Yellow_Bite_Data_Means),
                aes(y = emmean,
                    ymin = lower.CL,
                    ymax = upper.CL),
```

```
                width = 0.3,
                color = "#efc000") +
  theme_classic() +
  theme(legend.position="none")

Yellow_Size_Jitter_Plot
```

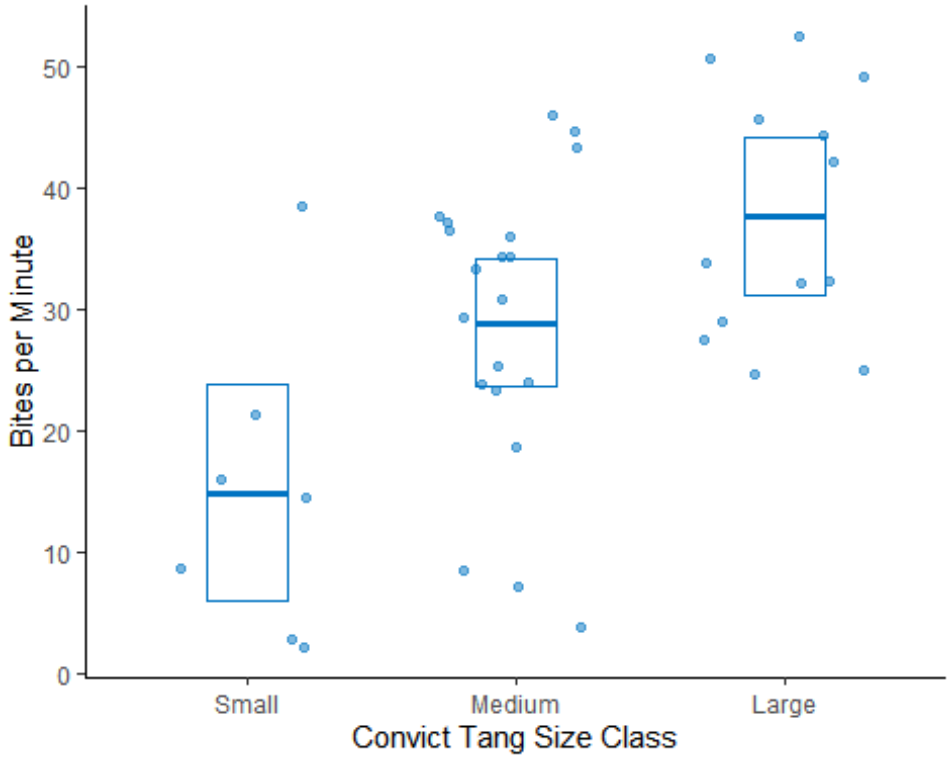



```
ggsave("Tang Poster Figure 3a 6x6.png", Yellow_Size_Jitter_Plot,
width = 6,
height = 12,
dpi = 600)

Yellow_Bite_Data_pairs <- contrast(Yellow_Bite_Data_Means,
                                   method = "pairwise") |>
  summary(infer = TRUE)

Yellow_Bite_Data_pairs
```

```
 contrast       estimate   SE df lower.CL upper.CL t.ratio p.value
 Large - Medium    -1.34 2.48 37    -7.41     4.73  -0.539  0.8526
 Large - Small      3.86 4.12 37    -6.20    13.92   0.936  0.6212
 Medium - Small     5.20 3.95 37    -4.45    14.84   1.316  0.3957

Confidence level used: 0.95
Conf-level adjustment: tukey method for comparing a family of 3 estimates
P value adjustment: tukey method for comparing a family of 3 estimates
```

```
#no significant values, yellow tang size classes seem to all eat about the sa
me amount

#w convict
Convict_Bite_Data <- Core_Data |>
  filter(Species == "Convict Tang")

lm_Convict_Bites <- lm(Bite_Min ~ Size_Class, data = Convict_Bite_Data)
lm_Convict_Bites


Call:
lm(formula = Bite_Min ~ Size_Class, data = Convict_Bite_Data)

Coefficients:
     (Intercept)  Size_ClassMedium   Size_ClassSmall
          37.692            -8.726           -22.740

lm_Convict_Bites_coef <- tidy(lm_Convict_Bites, conf.int = TRUE)
lm_Convict_Bites_coef

# A tibble: 3 × 7
  term             estimate std.error statistic  p.value conf.low conf.high
  <chr>               <dbl>     <dbl>     <dbl>    <dbl>    <dbl>     <dbl>
1 (Intercept)         37.7       3.21     11.7  4.94e-14     31.2    44.2
2 Size_ClassMedium    -8.73      4.13     -2.11 4.13e- 2    -17.1    -0.365
3 Size_ClassSmall    -22.7       5.43     -4.19 1.67e- 4    -33.7   -11.7

Convict_Bite_Data_Means <- emmeans(lm_Convict_Bites, ~ Size_Class)
Convict_Bite_Data_Means

 Size_Class emmean   SE df lower.CL upper.CL
 Large        37.7 3.21 37    31.18     44.2
 Medium       29.0 2.59 37    23.72     34.2
 Small        15.0 4.38 37     6.08     23.8

Confidence level used: 0.95

Convict_Size_Jitter_Plot <- Convict_Bite_Data |>
  ggplot( aes(x=Size_Class, y=Bite_Min)) +
  scale_x_discrete(limits = c("Small","Medium","Large")) +
  geom_jitter(width = 0.3, color = "#0073c2", alpha = 0.5) +
  ylab("Bites per Minute") +
  xlab("Convict Tang Size Class") +
  geom_crossbar(data = as_tibble(Convict_Bite_Data_Means),
                aes(y = emmean,
                    ymin = lower.CL,
                    ymax = upper.CL),
                width = 0.3,
                color = "#0073c2") +
  theme_classic() +
```

```
  theme(legend.position="none")

Convict_Size_Jitter_Plot
```




```
ggsave("Tang Poster Figure 3b 6x6.png", Convict_Size_Jitter_Plot,
width = 6,
height = 12,
dpi = 600)

Convict_Bite_Data_pairs <- contrast(Convict_Bite_Data_Means,
                                    method = "pairwise") |>
  summary(infer = TRUE)

Convict_Bite_Data_pairs
```

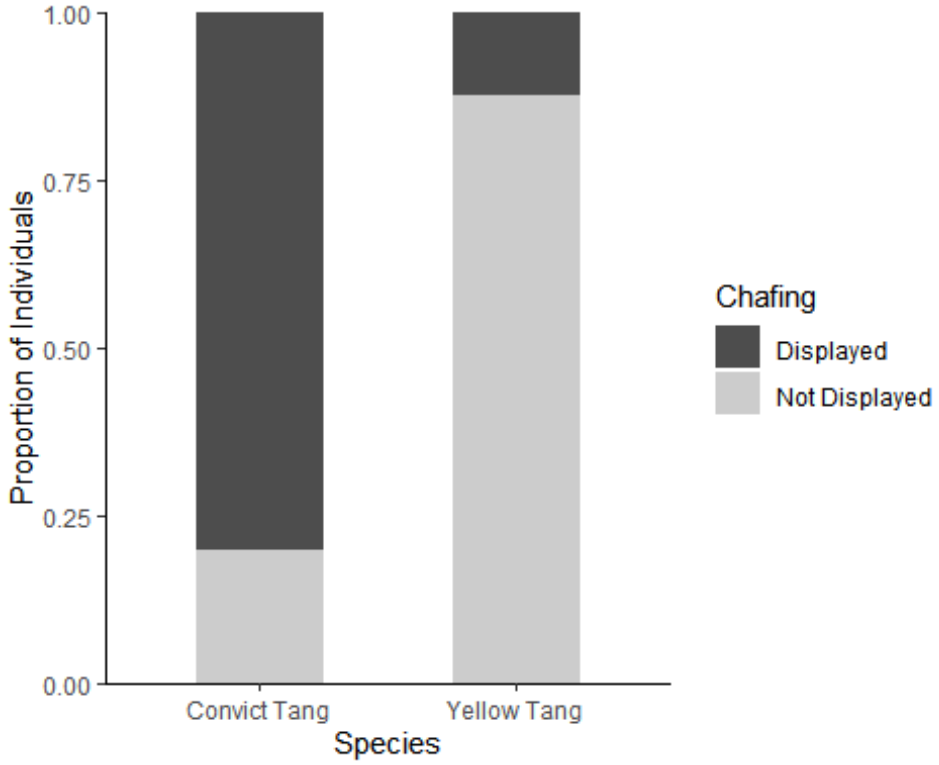
```
 contrast       estimate   SE df lower.CL upper.CL t.ratio p.value
 Large - Medium     8.73 4.13 37    -1.35     18.8   2.115  0.1006
 Large - Small     22.74 5.43 37     9.48     36.0   4.188  0.0005
 Medium - Small    14.01 5.09 37     1.60     26.4   2.755  0.0240

Confidence level used: 0.95
Conf-level adjustment: tukey method for comparing a family of 3 estimates
P value adjustment: tukey method for comparing a family of 3 estimates
```

```
# can clearly see variation in bite rate for convict tang based on size class
. Large vs. Small and Medium vs. Small both significant.
```

Figure 4

Chafing Behavior

```
#behavior displayed vs. no behavior displayed
Behavior_By_Species <- Core_Data |>
  group_by(Species) |>
  count(Chafing)
Behavior_By_Species

# A tibble: 4 × 3
# Groups:   Species [2]
  Species      Chafing           n
  <chr>        <chr>         <int>
1 Convict Tang Displayed        32
2 Convict Tang Not Displayed     8
3 Yellow Tang  Displayed         5
4 Yellow Tang  Not Displayed    35

Percent_Bar_Plot <- Behavior_By_Species |>
  ggplot(aes(fill=Chafing, y=n, x=Species)) +
  geom_bar(position="fill", stat="identity", width = 0.5) +
  scale_y_continuous(expand = c(0,0)) +
  scale_fill_grey(start=0.3) +
  theme_classic() +
  theme()+
  xlab("Species") +
  ylab("Proportion of Individuals")
Percent_Bar_Plot
```




```
ggsave("Tang Poster Figure 4 6x6.png", Percent_Bar_Plot,
width = 6,
height = 6,
dpi = 600)
```