Appendix 4. Performance code.

```
### Goal: Comparing migratory performance between two populations

### Input: 4_Performance_Data.csv

### Input includes: Three migration timing variable: Departure Date(F.D.Day for fall and S.D.Day for spring),

###  Ocean Crossing Date (F/S.Ocean.Day), Arrival Date (F/S.A.Day); Three performance varaibles:

###  Total migration duration in days(F/S.Duration), Number of stopovers used in number(F/S.ST.num), and average

###  stopover duration (F/S.avg.ST.Duration).

### Output: Figure 4, Figure 5.



Geo_data <- read.csv("4_Performance_Data.csv")


library(dplyr)


# Get descriptive statistics

desc_stats <- Geo_data %>%

 group_by(Site) %>%

 summarise(

  # Sample size

  n = n(),


  # Fall Timing
```

```
F.D.Day_mean = mean(F.D.Day, na.rm = TRUE),
F.D.Day_sd = sd(F.D.Day, na.rm = TRUE),
F.Ocean.Day_mean = mean(F.Ocean.Day, na.rm = TRUE),
F.Ocean.Day_sd = sd(F.Ocean.Day, na.rm = TRUE),
F.A.Day_mean = mean(F.A.Day, na.rm = TRUE),
F.A.Day_sd = sd(F.A.Day, na.rm = TRUE),

# Spring Timing
S.D.Day_mean = mean(S.D.Day, na.rm = TRUE),
S.D.Day_sd = sd(S.D.Day, na.rm = TRUE),
S.Ocean.Day_mean = mean(S.Ocean.Day, na.rm = TRUE),
S.Ocean.Day_sd = sd(S.Ocean.Day, na.rm = TRUE),
S.A.Day_mean = mean(S.A.Day, na.rm = TRUE),
S.A.Day_sd = sd(S.A.Day, na.rm = TRUE),

# Fall Performance
F.Duration_mean = mean(F.Duration, na.rm = TRUE),
F.Duration_sd = sd(F.Duration, na.rm = TRUE),
F.ST.num_mean = mean(F.ST.num, na.rm = TRUE),
F.ST.num_sd = sd(F.ST.num, na.rm = TRUE),
F.avg.ST.Duration_mean = mean(F.avg.ST.Duration, na.rm = TRUE),
F.avg.ST.Duration_sd = sd(F.avg.ST.Duration, na.rm = TRUE),

# Spring Performance
S.Duration_mean = mean(S.Duration, na.rm = TRUE),
S.Duration_sd = sd(S.Duration, na.rm = TRUE),
```

```
  S.ST.num_mean = mean(S.ST.num, na.rm = TRUE),
  S.ST.num_sd = sd(S.ST.num, na.rm = TRUE),
  S.avg.ST.Duration_mean = mean(S.avg.ST.Duration, na.rm = TRUE),
  S.avg.ST.Duration_sd = sd(S.avg.ST.Duration, na.rm = TRUE)
 )

print(desc_stats)

# Run all Mann-Whitney tests and create summary table
run_nonparametric_tests <- function(data) {
 variables <- c("F.D.Day", "F.Ocean.Day", "F.A.Day",
                "S.D.Day", "S.Ocean.Day", "S.A.Day",
                "F.Duration", "F.ST.num", "F.avg.ST.Duration",
                "S.Duration", "S.ST.num", "S.avg.ST.Duration")

 variable_names <- c("Fall Departure", "Fall Ocean Crossing", "Fall Arrival",
                     "Spring Departure", "Spring Ocean Crossing", "Spring Arrival",
                     "Fall Duration", "Fall # Stopovers", "Fall Avg Stopover Duration",
                     "Spring Duration", "Spring # Stopovers", "Spring Avg Stopover Duration")

 results <- data.frame(
  Metric = variable_names,
  Variable = variables,
  W_statistic = NA,
  p_value = NA
 )
```

```
  for(i in 1:length(variables)) {
    var <- variables[i]
    formula <- as.formula(paste(var, "~ Site"))

    # Mann-Whitney U test
    test <- wilcox.test(formula, data = data)
    results$W_statistic[i] <- test$statistic
    results$p_value[i] <- test$p.value
  }


  return(results)
}

# Run all tests
test_results <- run_nonparametric_tests(Geo_data)
print(test_results)
```