Dolphin 110610

November 16, 2021

```
Dolphin10 <- read.csv('110610-Behavior_QC.csv')
glimpse(Dolphin10)
```

```
## Rows: 1,434
## Columns: 25
## $ X           <int> 3, 4, 5, 6, 7, 8, 9, 10, 14, 15, 16, 17, 18, 19, 20, 21, 2~
## $ DeployID    <chr> "Tt0021", "Tt0021", "Tt0021", "Tt0021", "Tt0021", "Tt0021"~
## $ Ptt         <int> 110610, 110610, 110610, 110610, 110610, 110610, 110610, 11~
## $ DepthSensor <lgl> NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA~
## $ Source      <chr> "Transmission", "Transmission", "Transmission", "Transmiss~
## $ Instr       <chr> "Mk10", "Mk10", "Mk10", "Mk10", "Mk10", "Mk10", "Mk10", "M~
## $ Count       <int> 6, 6, 6, 6, 6, 6, 6, 6, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1~
## $ Start       <chr> "8/31/16 22:47", "8/31/16 22:55", "8/31/16 23:00", "8/31/1~
## $ End         <chr> "8/31/16 22:55", "8/31/16 23:00", "8/31/16 23:07", "8/31/1~
## $ What        <chr> "Dive", "Surface", "Dive", "Surface", "Dive", "Surface", "~
## $ Number      <int> 1, NA, 1, NA, 1, NA, 1, NA, 1, NA, 1, NA, 1, NA, 1, NA, 1,~
## $ Shape       <chr> "U", "", "U", "", "U", "", "U", "", "U", "", "V", "", "U",~
## $ DepthMin    <dbl> 420, NA, 364, NA, 260, NA, 174, NA, 284, NA, 85, NA, 117, ~
## $ DepthMax    <dbl> 427.5, NA, 371.5, NA, 267.5, NA, 177.5, NA, 291.5, NA, 86.~
## $ DurationMin <int> 537, 267, 429, 207, 481, 101, 425, 95, 353, 141, 215, 947,~
## $ DurationMax <int> 539, 269, 431, 209, 483, 103, 427, 97, 355, 143, 217, 949,~
## $ Shallow     <int> NA, 268, NA, 208, NA, 102, NA, 96, NA, 142, NA, 887, NA, 2~
## $ Deep        <int> NA, 0, NA, 0, NA, 0, NA, 0, NA, 0, NA, 61, NA, 679, NA, 0,~
## $ start       <chr> "2016-08-31 18:47:00", "2016-08-31 18:55:00", "2016-08-31 ~
## $ end         <chr> "2016-08-31 18:55:00", "2016-08-31 19:00:00", "2016-08-31 ~
## $ t.diff      <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0~
## $ flag        <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0~
## $ divenum     <int> 1, 1, 2, 2, 3, 3, 4, 4, 5, 5, 6, 6, 7, 7, 8, 8, 9, 9, 10, ~
## $ depth       <dbl> 423.75, NA, 367.75, NA, 263.75, NA, 175.75, NA, 287.75, NA~
## $ duration    <int> 538, 268, 430, 208, 482, 102, 426, 96, 354, 142, 216, 948,~
```

```
wide_dolph_dives <- Dolphin10 %>%
  pivot_wider(names_from = What,
              # variables listed in values_from are ones you want to keep/use
              # that are DIFFERENT for dive and surfacing
              values_from = c(X, Number, Shape, DepthMin, DepthMax, DurationMin, DurationMax,
                              Count, Shallow, Deep, Start, End, start, end, t.diff, flag,
                              depth, duration)
  ) %>%
  # remove variables that are all NA
  janitor::remove_empty(which = 'cols') %>%
  # make datetime variables datetime objects - will be easier for plotting
  mutate(across(Start_Dive:end_Surface, lubridate::mdy_hm))
glimpse(wide_dolph_dives)
```

```
## Rows: 717
```

```
## Columns: 35
## $ DeployID            <chr> "Tt0021", "Tt0021", "Tt0021", "Tt0021", "Tt0021", ~
## $ Ptt                 <int> 110610, 110610, 110610, 110610, 110610, 110610, 11~
## $ Source              <chr> "Transmission", "Transmission", "Transmission", "T~
## $ Instr               <chr> "Mk10", "Mk10", "Mk10", "Mk10", "Mk10", "Mk10", "M~
## $ divenum             <int> 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15,~
## $ X_Dive              <int> 3, 5, 7, 9, 14, 16, 18, 20, 25, 27, 29, 31, 35, 37~
## $ X_Surface           <int> 4, 6, 8, 10, 15, 17, 19, 21, 26, 28, 30, 32, 36, 3~
## $ Number_Dive         <int> 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,~
## $ Shape_Dive          <chr> "U", "U", "U", "U", "U", "V", "U", "Square", "Squa~
## $ Shape_Surface       <chr> "", "", "", "", "", "", "", "", "", "", "", "", ""~
## $ DepthMin_Dive       <dbl> 420, 364, 260, 174, 284, 85, 117, 300, 284, 146, 1~
## $ DepthMax_Dive       <dbl> 427.5, 371.5, 267.5, 177.5, 291.5, 86.5, 118.5, 30~
## $ DurationMin_Dive    <int> 537, 429, 481, 425, 353, 215, 149, 491, 533, 309, ~
## $ DurationMin_Surface <int> 267, 207, 101, 95, 141, 947, 3507, 265, 255, 289, ~
## $ DurationMax_Dive    <int> 539, 431, 483, 427, 355, 217, 151, 493, 535, 311, ~
## $ DurationMax_Surface <int> 269, 209, 103, 97, 143, 949, 3509, 267, 257, 291, ~
## $ Count_Dive          <int> 6, 6, 6, 6, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,~
## $ Count_Surface       <int> 6, 6, 6, 6, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,~
## $ Shallow_Surface     <int> 268, 208, 102, 96, 142, 887, 2829, 266, 256, 290, ~
## $ Deep_Surface        <int> 0, 0, 0, 0, 0, 61, 679, 0, 0, 0, 0, 27964, 43, 61,~
## $ Start_Dive          <dttm> 2016-08-31 22:47:00, 2016-08-31 23:00:00, 2016-08~
## $ Start_Surface       <dttm> 2016-08-31 22:55:00, 2016-08-31 23:07:00, 2016-08~
## $ End_Dive            <dttm> 2016-08-31 22:55:00, 2016-08-31 23:07:00, 2016-08~
## $ End_Surface         <dttm> 2016-08-31 23:00:00, 2016-08-31 23:11:00, 2016-08~
## $ start_Dive          <dttm> NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, N~
## $ start_Surface       <dttm> NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, N~
## $ end_Dive            <dttm> NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, N~
## $ end_Surface         <dttm> NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, N~
## $ t.diff_Dive         <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 12600, 0, 0, 0~
## $ t.diff_Surface      <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,~
## $ flag_Dive           <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0,~
## $ flag_Surface        <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,~
## $ depth_Dive          <dbl> 423.75, 367.75, 263.75, 175.75, 287.75, 85.75, 117~
## $ duration_Dive       <int> 538, 430, 482, 426, 354, 216, 150, 492, 534, 310, ~
## $ duration_Surface    <int> 268, 208, 102, 96, 142, 948, 3508, 266, 256, 290, ~
```

```
cluster_data <- wide_dolph_dives %>%
  select(depth_Dive, duration_Dive) %>%
  mutate(depth=scale(depth_Dive),
         duration=scale(duration_Dive))
```

```
c_out <-cluster::clara(cluster_data, k=2, metric = c("euclidean"))
glimpse(c_out)
```

```
## List of 10
##  $ sample    : int [1:44] 10 24 47 68 81 92 94 107 147 150 ...
##  $ medoids   : num [1:2, 1:4] 359.75 97.75 464 266 0.373 ...
##   ..- attr(*, "dimnames")=List of 2
##   .. ..$ : NULL
##   .. ..$ : chr [1:4] "depth_Dive" "duration_Dive" "depth" "duration"
##  $ i.med     : int [1:2] 92 541
##  $ clustering: int [1:717] 1 1 1 2 1 2 2 1 1 2 ...
##  $ objective : num 102
##  $ clusinfo  : num [1:2, 1:4] 486 231 465 207 106 ...
```

```
##   ..- attr(*, "dimnames")=List of 2
##   .. ..$ : NULL
##   .. ..$ : chr [1:4] "size" "max_diss" "av_diss" "isolation"
##  $ diss      : 'dissimilarity' num [1:946] 79.7 126 218 400.7 262 ...
##   ..- attr(*, "Size")= int 44
##   ..- attr(*, "Metric")= chr "euclidean"
##  $ call      : language cluster::clara(x = cluster_data, k = 2, metric = c("euclidean"))
##  $ silinfo   :List of 3
##   ..$ widths         : num [1:44, 1:3] 1 1 1 1 1 1 1 1 1 1 ...
##   .. ..- attr(*, "dimnames")=List of 2
##   ..$ clus.avg.widths: num [1:2] 0.595 0.563
##   ..$ avg.width      : num 0.584
##  $ data      : num [1:717, 1:4] 424 368 264 176 288 ...
##   ..- attr(*, "dimnames")=List of 2
##   .. ..$ : NULL
##   .. ..$ : chr [1:4] "depth_Dive" "duration_Dive" "depth" "duration"
##  - attr(*, "class")= chr [1:2] "clara" "partition"
```

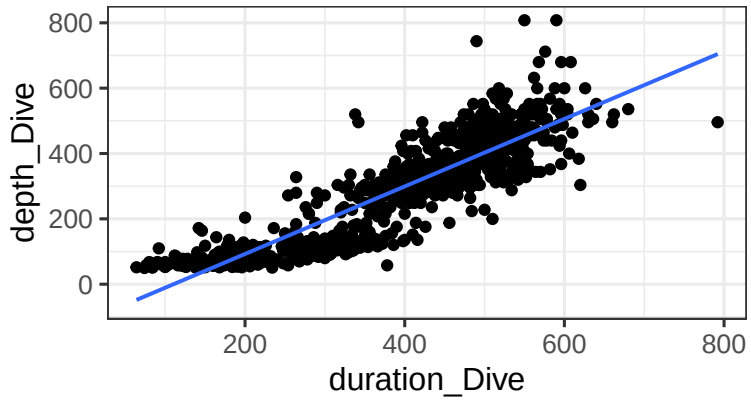
```
wide_dolph_dives <- wide_dolph_dives %>%
  mutate(dtype=c_out$clustering)
glimpse(wide_dolph_dives)
```

```
## Rows: 717
## Columns: 36
## $ DeployID            <chr> "Tt0021", "Tt0021", "Tt0021", "Tt0021", "Tt0021", ~
## $ Ptt                 <int> 110610, 110610, 110610, 110610, 110610, 110610, 11~
## $ Source              <chr> "Transmission", "Transmission", "Transmission", "T~
## $ Instr               <chr> "Mk10", "Mk10", "Mk10", "Mk10", "Mk10", "Mk10", "M~
## $ divenum             <int> 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15,~
## $ X_Dive              <int> 3, 5, 7, 9, 14, 16, 18, 20, 25, 27, 29, 31, 35, 37~
## $ X_Surface           <int> 4, 6, 8, 10, 15, 17, 19, 21, 26, 28, 30, 32, 36, 3~
## $ Number_Dive         <int> 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,~
## $ Shape_Dive          <chr> "U", "U", "U", "U", "U", "V", "U", "Square", "Squa~
## $ Shape_Surface       <chr> "", "", "", "", "", "", "", "", "", "", "", "", ""~
## $ DepthMin_Dive       <dbl> 420, 364, 260, 174, 284, 85, 117, 300, 284, 146, 1~
## $ DepthMax_Dive       <dbl> 427.5, 371.5, 267.5, 177.5, 291.5, 86.5, 118.5, 30~
## $ DurationMin_Dive    <int> 537, 429, 481, 425, 353, 215, 149, 491, 533, 309, ~
## $ DurationMin_Surface <int> 267, 207, 101, 95, 141, 947, 3507, 265, 255, 289, ~
## $ DurationMax_Dive    <int> 539, 431, 483, 427, 355, 217, 151, 493, 535, 311, ~
## $ DurationMax_Surface <int> 269, 209, 103, 97, 143, 949, 3509, 267, 257, 291, ~
## $ Count_Dive          <int> 6, 6, 6, 6, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,~
## $ Count_Surface       <int> 6, 6, 6, 6, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,~
## $ Shallow_Surface     <int> 268, 208, 102, 96, 142, 887, 2829, 266, 256, 290, ~
## $ Deep_Surface        <int> 0, 0, 0, 0, 0, 61, 679, 0, 0, 0, 0, 27964, 43, 61,~
## $ Start_Dive          <dttm> 2016-08-31 22:47:00, 2016-08-31 23:00:00, 2016-08~
## $ Start_Surface       <dttm> 2016-08-31 22:55:00, 2016-08-31 23:07:00, 2016-08~
## $ End_Dive            <dttm> 2016-08-31 22:55:00, 2016-08-31 23:07:00, 2016-08~
## $ End_Surface         <dttm> 2016-08-31 23:00:00, 2016-08-31 23:11:00, 2016-08~
## $ start_Dive          <dttm> NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, N~
## $ start_Surface       <dttm> NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, N~
## $ end_Dive            <dttm> NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, N~
## $ end_Surface         <dttm> NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, N~
## $ t.diff_Dive         <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 12600, 0, 0, 0~
## $ t.diff_Surface      <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,~
## $ flag_Dive           <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0,~
```

```
## $ flag_Surface        <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,~
## $ depth_Dive          <dbl> 423.75, 367.75, 263.75, 175.75, 287.75, 85.75, 117~
## $ duration_Dive       <int> 538, 430, 482, 426, 354, 216, 150, 492, 534, 310, ~
## $ duration_Surface    <int> 268, 208, 102, 96, 142, 948, 3508, 266, 256, 290, ~
## $ dtype               <int> 1, 1, 1, 2, 1, 2, 2, 1, 1, 2, 2, 1, 1, 1, 1, 1, 1,~
```

Looking at the distribution of dive depths and duration

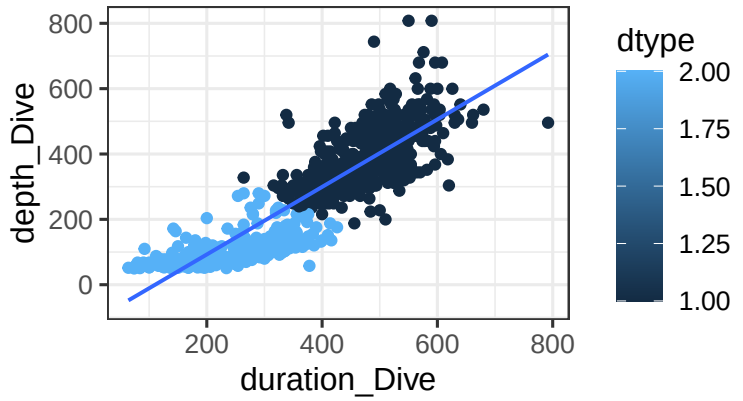
```
gf_point(depth_Dive ~ duration_Dive,
 data = wide_dolph_dives) %>%
 gf_lm()
```



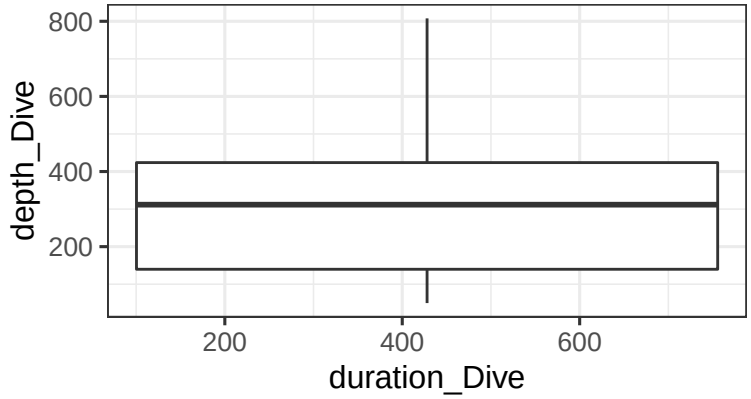

```
dives.lm <- lm(depth_Dive ~ duration_Dive,
 data = wide_dolph_dives)
summary(dives.lm)
```

```
##
## Call:
## lm(formula = depth_Dive ~ duration_Dive, data = wide_dolph_dives)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -222.87  -50.77   -0.86   51.95  353.48
##
## Coefficients:
##                 Estimate Std. Error t value Pr(>|t|)
## (Intercept)   -114.15511    9.24201  -12.35   <2e-16 ***
## duration_Dive    1.03350    0.02185   47.31   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 77.44 on 715 degrees of freedom
## Multiple R-squared:  0.7579, Adjusted R-squared:  0.7576
## F-statistic:  2238 on 1 and 715 DF,  p-value: < 2.2e-16
```

```
gf_point(depth_Dive ~ duration_Dive,
 data = wide_dolph_dives,
 color= ~dtype) %>%
 gf_lm()
```

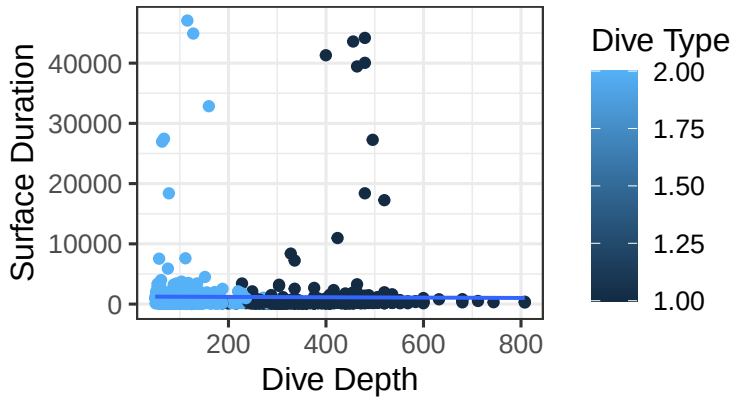



```
gf_boxplot(depth_Dive ~ duration_Dive,
       data = wide_dolph_dives,
       color = ~dtype)
```

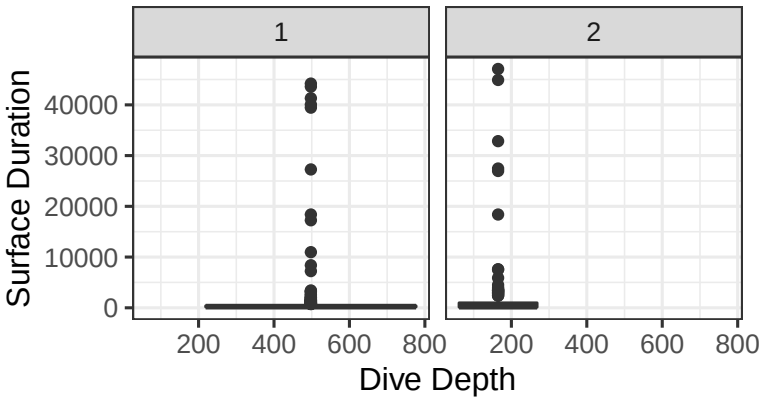


Looking at Surface Duration and duration of the dive

```
gf_point(DurationMax_Surface ~ depth_Dive, data = wide_dolph_dives, color = ~dtype) %>%
  gf_lm() %>%
  gf_labs( x = 'Dive Depth',
           y = 'Surface Duration') %>%
  gf_theme(scale_color_continuous('Dive Type'))
```




```
gf_boxplot(DurationMax_Surface ~ depth_Dive | dtype, data = wide_dolph_dives) %>%
  gf_labs( x = 'Dive Depth',
           y = 'Surface Duration')
```


1
2
Surface Duration
40000
30000
20000
10000
0
200
400
600
800
200
400
600
800
Dive Depth