title:
"Tarea_diplomado_Paula"
author:
"Dra.
Paula
Celis-
Plá"
date:
"2022-
10-04"
output:
pdf_document:
default
html_document:
default
editor_options:
markdown:
wrap:
72

Evaluación de las respuestas fisiológicas y ambientales del alga *Lessonia spicata* en la Bahía de Valparaíso en prescencia de Cambio Climático

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Descripción del Trabajo

La data actual corresponde a valores de variables fisiológicas y ambientales para el alga parda *Lessonia spicata.*

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Este estudio tiene por objetivo, evaluar la diferencias estadísticas de las variables fisiológicas y variables ambientales respecto a las variables categóricas estación del Año con 4 niveles; Otoño, Invierno, Primavera y Verano, y tiempo

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Las variables fisológicas analizadas en este estudio fueron Clorofila a o Cla (expresada en microgramos * gramos-1 de peso seco), Clorofila c = Clc (expresada en microgramos * gramos-1 de peso seco), Carotenos o Car (expresada en micro-

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Habilita Librerias

Variables categóricas Seasons, time y replicate asigna factor

Transforma variables a factores

```r
Datos_Proyecto <- read_excel("Datos_Proyecto.xlsx")
summary(Datos_Proyecto)
```

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```
## Seasons time Chla Chlc
## Length:108 Length:108 Min. :0.6730 Min. :0.01000
## Class :character Class :character 1st Qu.:0.9888 1st Qu.:0.06775
## Mode :character Mode :character Median :1.1660 Median :0.09500
## Mean :1.1856 Mean :0.09365
## 3rd Qu.:1.3813 3rd
```

```yaml
---
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author:
"Dra.
Paula
Celis-
Plá"
date:
"2022-
10-04"
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html_document:
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---
```

```r
r
Datos_Proyecto$Seasons
<-
as.factor(Datos_Proyecto$Seasons)
Datos_Proyecto$time
<-
as.factor(Datos_Proyecto$time)
summary(Datos_Proyecto)
```

```
---
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output:
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  html_document: default
editor_options:
  markdown:
    wrap: 72
---
```

Seasons   time   Chla   Chlc   Car
Autumn:27   day 1:36   Min.   :0.6730   Min.   :0.01000   Min.   :0.4190
Spring:27   day 2:36   1st Qu.:0.9888   1st Qu.:0.06775   1st Qu.:0.6240
Summer:27   day 3:36   Median :1.1660   Median :0.09500   Median :0.7520
Winter:27   Mean   :1.1856

---
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72

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```r p1
<- gg-
plot(Datos_Proyecto,
aes(Chla))
+
geom_histogram(bins
= 8,
color
="blue",
fill="blue")+
labs(title="Histograma
de Clo-
rofila
a",
x="Clorofila
a",
y="Frecuencia")
```

9

```yaml
---
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date: "2022-10-04"
output:
  pdf_document: default
  html_document: default
editor_options:
  markdown:
    wrap: 72
---
```

```r
p2 <- ggplot(Datos_Proyecto, aes(Chlc)) +
geom_histogram(bins = 8, color ="red", fill="red")+
labs(title="Histograma de Clorofila c",
x="Clorofila c",
y="Frecuencia")
p3 <- ggplot(Datos_Proyecto, aes(Car)) +
geom_histogram(bins = 8, color ="green", fill="green")+
labs(title="Histograma de Carotenos",
x="Carotenos",
y="Frecuencia")
p4 <- ggplot(Datos_Proyecto, aes(PC)) +
geom_histogram(bins = 8,
```

```
---
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date: "2022-10-04"
output:
  pdf_document: default
  html_document: default
editor_options:
  markdown:
    wrap: 72
---
```

gridExtra::grid.arrange(p1, p2, p3, p4, p5, ncol = 2) ```


```r
gridExtra::grid.arrange(p6, p7, p8, p9, ncol = 2)
```


4. Datos balanceados y tablas de frecuencia

** Los datos estan balanceados

```r
str(Datos_Proyecto)
```

11

---
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editor_options:
  markdown:
    wrap: 72

```
## tibble [108 x 11] (S3: tbl_df/tbl/data.frame)
## $ Seasons : Factor w/ 4 levels "Autumn","Spring",..: 1 1 1
1 1 1 1 1 1 1 ...
## $ time    : Factor w/ 3 levels "day 1","day 2",..: 1 1 1
1 1 1 1 1 1 2 ...
## $ Chla    : num [1:108] 1.04 1.6 1.52 1.48 1.14
```

12

```
---
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output:
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  html_document: default
editor_options:
  markdown:
    wrap: 72
---
```

```r
knitr::kable(table(Datos_Proyecto$Seasons,
Datos_Proyecto$time),
caption = "Tabla de contingencia")
```

Table: Tabla de contingencia

	day 1	day 2	day 3
Autumn	9	9	9
Spring	9	9	9
Summer	9	9	9
Winter	9	9	9

---
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10-04"
output:
pdf_document:
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72

5.
Relación
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categóri-
cas.
`r`
`summary(Datos_Proyecto)`

---
title: "Tarea_diplomado_Paula"
author: "Dra. Paula Celis-Plá"
date: "2022-10-04"
output:
  pdf_document: default
  html_document: default
editor_options:
  markdown:
    wrap: 72

```
## Seasons      time          Chla            Chlc           Car
## Autumn:27   day 1:36   Min.   :0.6730   Min.   :0.01000   Min.   :0.4190
## Spring:27   day 2:36   1st Qu.:0.9888   1st Qu.:0.06775   1st Qu.:0.6240
## Summer:27   day 3:36   Median :1.1660   Median :0.09500   Median :0.7520
## Winter:27              Mean   :1.1856
```

---
title:
"Tarea_diplomado_Paula"
author:
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Celis-
Plá"
date:
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10-04"
output:
pdf_document:
default
html_document:
default
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tor_options:
mark-
down:
wrap:
72
---

5. Graficas de correlación de variables continuas (pearson)

```r
pairs.panels(Datos_Proyecto[,3:11],
method
=
"pearson",
hist.col
=
"blue",
density
=
TRUE,
font=4)
```

---
title:
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author:
"Dra.
Paula
Celis-
Plá"
date:
"2022-
10-04"
output:
pdf_document:
default
html_document:
default
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72

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relación
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ables
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uas

```r
pairs.panels(Datos_Proyecto[,3:7],
method
=
"pearson",
hist.col
=
"blue",
density
=
TRUE,
font=2)
```

---
title:
"Tarea_diplomado_Paula"
author:
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Celis-
Plá"
date:
"2022-
10-04"
output:
pdf_document:
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html_document:
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wrap:
72

** Se
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gundas
4 vari-
ables
contin-
uas

```r
pairs.panels(Datos_Proyecto[,8:11],
method
=
"pearson",
hist.col
=
"blue",
density
=
TRUE,
font=2)
```

---
title:
"Tarea_diplomado_Paula"
author:
"Dra.
Paula
Celis-
Plá"
date:
"2022-
10-04"
output:
pdf_document:
default
html_document:
default
edi-
tor_options:
mark-
down:
wrap:
72
---

5. Relación entre variables continuas y factores (boxplot)

```r
ggplot(Datos_Proyecto,
aes(x=
Seasons,
y=Chla))+geom_boxplot(fill="olivedrab1")+labs(title
=
"BoxPlot",
x=
"Seasons",
y=
"Clorofila
a")
```

```
---
title:
"Tarea_diplomado_Paula"
author:
"Dra.
Paula
Celis-
Plá"
date:
"2022-
10-04"
output:
pdf_document:
default
html_document:
default
edi-
tor_options:
mark-
down:
wrap:
72
---
```

```r
ggplot(Datos_Proyecto,
aes(x=
Seasons,
y=Chlc))+geom_boxplot(fill="red")+labs(title
=
"BoxPlot",
x=
"Seasons",
y=
"Clorofila
c")
```



```r
ggplot(Datos_Proyecto,
aes(x=
Seasons,
y=Car))+geom_boxplot(fill="blue")+labs(title
=
"BoxPlot",
x=
"Seasons",
y=
"Carotenos")
```

---
title:
"Tarea_diplomado_Paula"
author:
"Dra.
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Celis-
Plá"
date:
"2022-
10-04"
output:
pdf_document:
default
html_document:
default
edi-
tor_options:
mark-
down:
wrap:
72
---

r
ggplot(Datos_Proyecto,
aes(x=
Seasons,
y=PC))+geom_boxplot(fill="green")+labs(title
=
"BoxPlot",
x=
"Seasons",
y=
"Compuestos
fenólicos")

r
ggplot(Datos_Proyecto,
aes(x=
Seasons,
y=DPPH))+geom_boxplot(fill="brown")+labs(title
=
"BoxPlot",
x=
"Seasons",
y=
"DPPH")

---
title:
"Tarea_diplomado_Paula"
author:
"Dra.
Paula
Celis-
Plá"
date:
"2022-
10-04"
output:
pdf_document:
default
html_document:
default
edi-
tor_options:
mark-
down:
wrap:
72

```r
ggplot(Datos_Proyecto,
aes(x=
Seasons,
y=Temperature))+geom_boxplot(fill="blue")+labs(title
=
"BoxPlot",
x=
"Seasons",
y=
"Temperatura")
```



```r
ggplot(Datos_Proyecto,
aes(x=
Seasons,
y=pH))+geom_boxplot(fill="green")+labs(title
=
"BoxPlot",
x=
"Seasons",
y=
"pH")
```


22

---
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author:
"Dra.
Paula
Celis-
Plá"
date:
"2022-
10-04"
output:
pdf_document:
default
html_document:
default
edi-
tor_options:
mark-
down:
wrap:
72

```r
ggplot(Datos_Proyecto,
aes(x=
Seasons,
y=Salinity))+geom_boxplot(fill="brown")+labs(title
=
"BoxPlot",
x=
"Seasons",
y=
"Salinity")
```



```r
ggplot(Datos_Proyecto,
aes(x=
Seasons,
y=PAR))+geom_boxplot(fill="yellow")+labs(title
=
"BoxPlot",
x=
"Seasons",
y=
"Radiación
PAR")
```

---
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author:
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Celis-
Plá"
date:
"2022-
10-04"
output:
pdf_document:
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html_document:
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6.
Identi-
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cación
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existen
errores,
datos
fal-
tantes
o error
atípico

---
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author: "Dra. Paula Celis-Plá"
date: "2022-10-04"
output:
  pdf_document: default
  html_document: default
editor_options:
  markdown:
    wrap: 72

** En la variable Salinidad, existe poca dispersión de los datos en las estaciones de primavera y verano, se registran datos muy similares, por ellos se observó poca dispersión.

---
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10-04"
output:
pdf_document:
default
html_document:
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tor_options:
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** No
existen
datos
fal-
tantes
para
cada
vari-
able.
** Los
errores
típicos
en las
vari-
ables se
identifi-
can a
contin-
uación;

---
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date: "2022-10-04"
output:
pdf_document: default
html_document: default
editor_options:
markdown:
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Variable Chlc : para la estación winter se registra un outlier Variable Car : para la estación summer se registra un outlier Variable PC : se registran 2 valores en Spring Variable Temperature: 3 valores en spring Variable pH : 5 valores en

---
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pdf_document:
default
html_document:
default
edi-
tor_options:
mark-
down:
wrap:
72
---

7. Resumen de los datos con tablas y estadística descriptiva

```r
Datos_Proyecto
<-
read_excel("Datos_Proyecto.xlsx"
,
sheet=
1)
head(Datos_Proyecto)
```

```
---
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output:
  pdf_document: default
  html_document: default
editor_options:
  markdown:
    wrap: 72
---
```

```
## # A tibble: 6 x 11
##   Seasons time  Chla  Chlc   Car    PC  DPPH Temperature    pH Salinity  PAR
##   <chr>   <chr> <dbl> <dbl> <dbl> <dbl> <dbl>       <dbl> <dbl>    <dbl> <dbl>
## 1 Autumn  day 1  1.04 0.095 0.605  9.12  7.58        12.3  7.84     33.7 594.
## 2
```

---
title:
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Plá"
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10-04"
output:
pdf_document:
default
html_document:
default
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wrap:
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```r
select(Datos_Proyecto,
Chla,
Chlc,
Car,
DPPH)
```

---
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Paula
Celis-
Plá"
date:
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10-04"
output:
pdf_document:
default
html_document:
default
edi-
tor_options:
mark-
down:
wrap:
72

```
## # A
tibble:
108 x
4 ##
Chla
Chlc
Car
DPPH
##
<dbl>
<dbl>
<dbl>
<dbl>
##  1
1.04
0.095
0.605
7.58
##  2
1.60
0.155
0.954
6.08
##  3
1.52
0.143
0.931
7.81
##  4
1.48
0.152
0.905
7.02
##  5
1.14
0.108
0.694
7.20
## 6
```

---
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output:
  pdf_document: default
  html_document: default
editor_options:
  markdown:
    wrap: 72

```r
Datos_tab <- Datos_Proyecto %>%
group_by(Seasons) %>%
summarize(n = n(),
Promedio_Chla = mean(Chla),
Maximo_Chla = max(Chla),
Promedio_Chlc = mean(Chlc),
Maximo_Chlc = max(Chlc),
Promedio_Car = mean(Car),
Maximo_Car = max(Car),
Promedio_PC = mean(PC),
```

---
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10-04"
output:
pdf_document:
default
html_document:
default
edi-
tor_options:
mark-
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wrap:
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Datos_tab

"'

```
---
title:
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Plá"
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10-04"
output:
pdf_document:
default
html_document:
default
edi-
tor_options:
mark-
down:
wrap:
72
---
## # A
tibble:
4 x 20
##
Seasons
n
Promed~1
Maxim~2
Prome~3
Maxim~4
Prome~5
Maxim~6
Prome~7
Maxim~8
##
<chr>
<int>
<dbl>
<dbl>
<dbl>
<dbl>
<dbl>
<dbl>
<dbl>
<dbl>
## 1
Autumn
27
1.28
1.70
0.117
0.166
0.790
1.07
16.5
30.4
## 2
Spring
27
```

---
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output:
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  html_document: default
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```r
knitr::kable(Datos_tab, caption = "Tabla de medidas resumen")
```

Table: Tabla de medidas resumen

---
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editor_options:
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wrap: 72

|Seasons | n| Promedio_Chla| Maximo_Chla| Promedio_Chlc| Maximo_Chlc| Promedio_Car| Maximo_Car| Promedio_PC| Maximo_PC| Promedio_DPPH| Maximo_DPPH| Promedio_Temperature| Maximo_Temperature| Promedio_pH| Maximo_pH| Promedio_Salinity| Maximo_Salinity| Promedio_PAR| Maximo_PAR|

|:———-

```r
Datos_tab2 <- Datos_Proyecto %>%
group_by(time) %>%
summarize(n = n(),
Promedio_Chla = mean(Chla),
Maximo_Chla = max(Chla),
Promedio_Chlc = mean(Chlc),
Maximo_Chlc = max(Chlc),
Promedio_Car = mean(Car),
Maximo_Car = max(Car),
```

```r
Promedio_PC =
mean(PC),
```

---

title:
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Plá"
date:
"2022-
10-04"
output:
pdf_document:
default
html_document:
default
edi-
tor_options:
mark-
down:
wrap:
72

Datos_tab2
"`

---
title:
"Tarea_diplomado_Paula"
author:
"Dra.
Paula
Celis-
Plá"
date:
"2022-
10-04"
output:
pdf_document:
default
html_document:
default
edi-
tor_options:
mark-
down:
wrap:
72

```
## # A
tibble:
3 x 20
##
time
n
Promedio~1
Maxim~2
Prome~3
Maxim~4
Prome~5
Maxim~6
Prome~7
Maxim~8
##
<chr>
<int>
<dbl>
<dbl>
<dbl>
<dbl>
<dbl>
<dbl>
<dbl>
<dbl>
## 1
day 1
36
1.12
1.62
0.0892
0.155
0.707
1.01
14.4
34.6
## 2
day 2
36
```

---
title:
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Paula
Celis-
Plá"
date:
"2022-
10-04"
output:
pdf_document:
default
html_document:
default
edi-
tor_options:
mark-
down:
wrap:
72

```r
knitr::kable(Datos_tab2,
caption
=
"Tabla
de
medidas
resumen")
```

Table:
Tabla
de me-
didas
re-
sumen

---
title: "Tarea_diplomado_Paula"
author: "Dra. Paula Celis-Plá"
date: "2022-10-04"
output:
  pdf_document: default
  html_document: default
editor_options:
  markdown:
    wrap: 72

|time |n| Promedio_Chla| Maximo_Chla| Promedio_Chlc| Maximo_Chlc| Promedio_Car| Maximo_Car| Promedio_PC| Maximo_PC| Promedio_DPPH| Maximo_DPPH| Promedio_Temperature| Maximo_Temperature| Promedio_pH| Maximo_pH| Promedio_Salinity| Maximo_Salinity| Promedio_PAR| Maximo_PAR|
|:——|—

---
title: "Tarea_diplomado_Paula"
author: "Dra. Paula Celis-Plá"
date: "2022-10-04"
output:
  pdf_document: default
  html_document: default
editor_options:
  markdown:
    wrap: 72
---

8. Utiliza Paquetes para importar datos a R como readxl o similar y paquetes tidyr, dplyr, ggplot2

```r
messy <- read_excel("Datos_Proyecto.xlsx")
Datos_Proyecto$Seasons <- as.factor(Datos_Proyecto$Seasons)
Datos_Proyecto$time <- as.factor(Datos_Proyecto$time)
summary(Datos_Proyecto)
```

```
---
title: "Tarea_diplomado_Paula"
author: "Dra. Paula Celis-Plá"
date: "2022-10-04"
output:
  pdf_document: default
  html_document: default
editor_options:
  markdown:
    wrap: 72
---
```

```
##   Seasons        time          Chla              Chlc               Car
## Autumn:27   day1:36   Min.   :0.6730   Min.   :0.01000   Min.   :0.4190
## Spring:27   day2:36   1st Qu.:0.9888   1st Qu.:0.06775   1st Qu.:0.6240
## Summer:27   day3:36   Median :1.1660   Median :0.09500   Median :0.7520
## Winter:27             Mean   :1.1856
```

---
title:
"Tarea_diplomado_Paula"
author:
"Dra.
Paula
Celis-
Plá"
date:
"2022-
10-04"
output:
pdf_document:
default
html_document:
default
edi-
tor_options:
mark-
down:
wrap:
72

```r
summary(messy)
```

```
---
title: "Tarea_diplomado_Paula"
author: "Dra. Paula Celis-Plá"
date: "2022-10-04"
output:
  pdf_document: default
  html_document: default
editor_options:
  markdown:
    wrap: 72
---
```

Seasons time Chla Chlc

```
##   Seasons             time                Chla             Chlc
##  Length:108        Length:108        Min.   :0.6730   Min.   :0.01000
##  Class :character   Class :character   1st Qu.:0.9888   1st Qu.:0.06775
##  Mode  :character   Mode  :character   Median :1.1660   Median :0.09500
##                                        Mean   :1.1856   Mean   :0.09365
```

```
##                                        3rd Qu.:1.3813   3rd
```

---
title: "Tarea_diplomado_Paula"
author: "Dra. Paula Celis-Plá"
date: "2022-10-04"
output:
  pdf_document: default
  html_document: default
editor_options:
  markdown:
    wrap: 72
---

9. Proponer hipótesis y realiza análisis estadístico de los datos, incluye evaluación de supuestos si corresponde

---
title: "Tarea_diplomado_Paula"
author: "Dra. Paula Celis-Plá"
date: "2022-10-04"
output:
pdf_document: default
html_document: default
editor_options:
markdown:
wrap: 72

Hipótesis Nula: Existe una estructura de grupos separados por las variables categoricas estacionalidad y día.

Hipótesis alternativa: No existe una estructura de grupos separados por las variables categoricas estacionalidad y día.

---
title:
"Tarea_diplomado_Paula"
author:
"Dra.
Paula
Celis-
Plá"
date:
"2022-
10-04"
output:
pdf_document:
default
html_document:
default
edi-
tor_options:
mark-
down:
wrap:
72

```r
library(readxl)
library(ggplot2)
library(dplyr)
library(knitr)
library(pander)
library(psych)
#
Graficas
de
correlación
library(factoextra)
#
distancia
euclideana
##
Welcome!
Want
to
learn
more?
See
two
factoextra-related
books
at
https://goo.gl/ve3WBa
```

---
title:
"Tarea_diplomado_Paula"
author:
"Dra.
Paula
Celis-
Plá"
date:
"2022-
10-04"
output:
pdf_document:
default
html_document:
default
edi-
tor_options:
mark-
down:
wrap:
72

```r
library(vegan)
#
Community
Ecology
Package:
Ordination,
Diversity
and
Dissimilarities
##
Loading
required
package:
permute
##
Loading
required
package:
lattice
##
This
is
vegan
2.6-4
r
library(dendextend)
#
extiende
opciones
de
visualización
```

---
title:
"Tarea_diplomado_Paula"
author:
"Dra.
Paula
Celis-
Plá"
date:
"2022-
10-04"
output:
pdf_document:
default
html_document:
default
edi-
tor_options:
mark-
down:
wrap:
72

```
##
Registered
S3
method
overwritten
by
'dendextend':
##
method
from
##
rev.hclust
vegan
```

```
---
title: "Tarea_diplomado_Paula"
author: "Dra. Paula Celis-Plá"
date: "2022-10-04"
output:
  pdf_document: default
  html_document: default
editor_options:
  markdown:
    wrap: 72
---
```

Welcome to dendextend version 1.16.0

Type citation('dendextend') for how to cite the package.

Type browseVignettes(package = 'dendextend') for the package vignette.
The github page is: https://github.com/talgalili/dendextend/

Suggestions and bug-reports can be submitted at: https://github.com/talgalili/dendextend/issues
You

```
## ##
Attaching
package:
'dendextend'
## The
following
object
is
masked
from
'package:permute':
## ##
shuffle
## The
following
object
is
masked
from
'package:stats':
## ##
cutree
# Im-
portar
datos
proyecto.
r
datos_PCA
<-
read_excel("Datos_Proyecto.xlsx",
sheet
= 1)
summary(datos_PCA)
```

```
##   Seasons              time                Chla             Chlc
##   Length:108         Length:108        Min.   :0.6730   Min.   :0.01000
##   Class :character   Class :character   1st Qu.:0.9888   1st Qu.:0.06775
##   Mode  :character   Mode  :character   Median :1.1660   Median :0.09500
##                                         Mean   :1.1856   Mean   :0.09365
##                                         3rd Qu.:1.3813   3rd
```

```
title:
"Tarea_diplomado_Paula"
author:
"Dra.
Paula
Celis-
Plá"
date:
"2022-
10-04"
output:
pdf_document:
default
html_document:
default
edi-
tor_options:
mark-
down:
wrap:
72
```

```r
datos_PCA$Seasons
<-
as.factor(datos_PCA$Seasons)
datos_PCA$time
<-
as.factor(datos_PCA$time)
head(datos_PCA[,3:11])
%>%
pander(caption
="Variables
ecofisiologicas
y
ambientales
en
Lessonia
spicata")
```

Chla	Chlc	Car	PC	DPPH	Temperature	pH	Salinity	PAR
1.04	0.095	0.605	9.12	7.578	12.29	7.84	33.74	594

1.597 0.155 0.954 13.87 6.085 12.29 7.84 33.74 594

1.521 0.143 0.931 15.83 7.812 12.29 7.84 33.74 594

1.479 0.152 0.905 19.89 7.015 12.29 7.85 17.87 1563

1.139 0.108 0.694 19.81 7.201 12.29 7.85 17.87 1563

1.166 0.115 0.752 21.64 5.119 12.29 7.85 17.87 1563

Table: Variables ecofisiologicas y ambientales en Lessonia spicata

```
str(datos_PCA)
```

```
## tibble [108 x 11] (S3: tbl_df/tbl/data.frame)
##  $ Seasons    : Factor w/ 4 levels "Autumn","Spring",..: 1 1 1 1 1 1 1 1 1 1 ...
##  $ time       : Factor w/ 3 levels "day 1","day 2",..: 1 1 1 1 1 1 1 1 1 1 2 ...
##  $ Chla       : num [1:108] 1.04 1.6 1.52 1.48 1.14 ...
##  $ Chlc       : num [1:108] 0.095 0.155 0.143 0.152 0.108 0.115 0.148 0.105 0.102 0.134 ...
##  $ Car        : num [1:108] 0.605 0.954 0.931 0.905 0.694 0.752 0.884 0.659 0.62 0.937 ...
##  $ PC         : num [1:108] 9.12 13.87 15.83 19.89 19.81 ...
##  $ DPPH       : num [1:108] 7.58 6.08 7.81 7.02 7.2 ...
##  $ Temperature: num [1:108] 12.3 12.3 12.3 12.3 12.3 ...
##  $ pH         : num [1:108] 7.84 7.84 7.84 7.85 7.85 7.85 7.88 7.88 7.88 7.84 ...
##  $ Salinity   : num [1:108] 33.7 33.7 33.7 17.9 17.9 ...
##  $ PAR        : num [1:108] 594 594 594 1563 1563 ...
```

```
datos_PCA_mat <- as.matrix(datos_PCA[,-c(1:2)])
str(datos_PCA_mat)
```
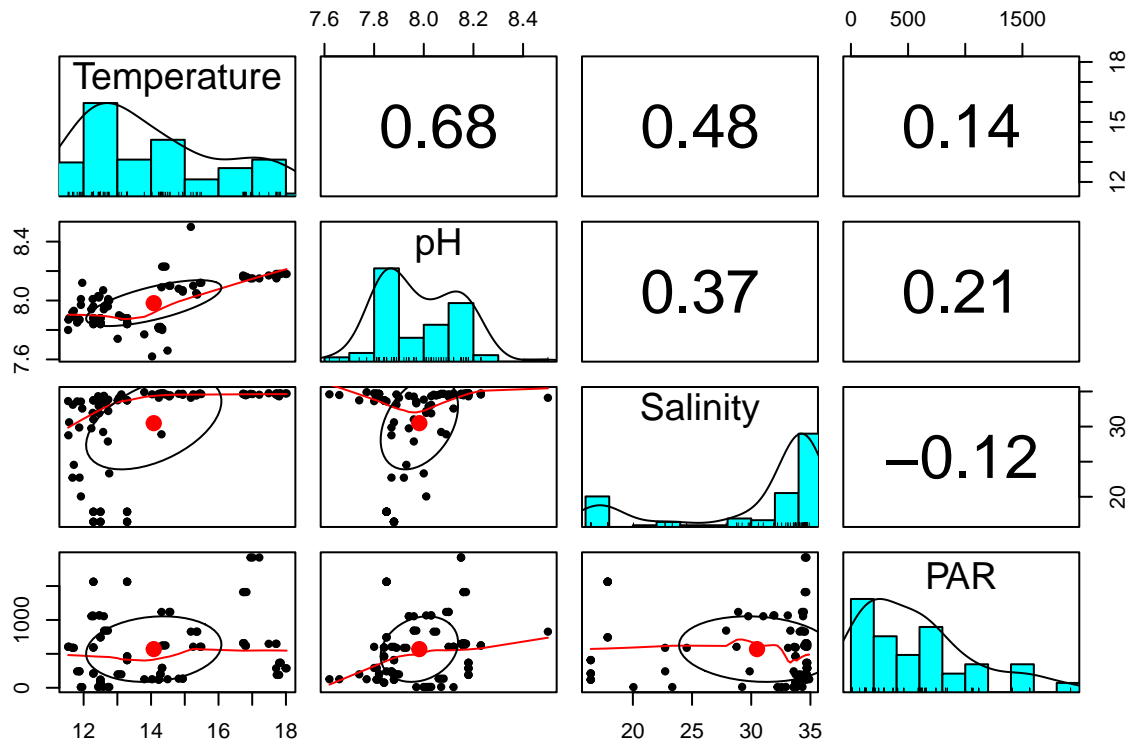
```
##  num [1:108, 1:9] 1.04 1.6 1.52 1.48 1.14 ...
##  - attr(*, "dimnames")=List of 2
##   ..$ : NULL
##   ..$ : chr [1:9] "Chla" "Chlc" "Car" "PC" ...
```

Correlación entre variables

```
pairs.panels(datos_PCA_mat[,1:5], method = "pearson")
```
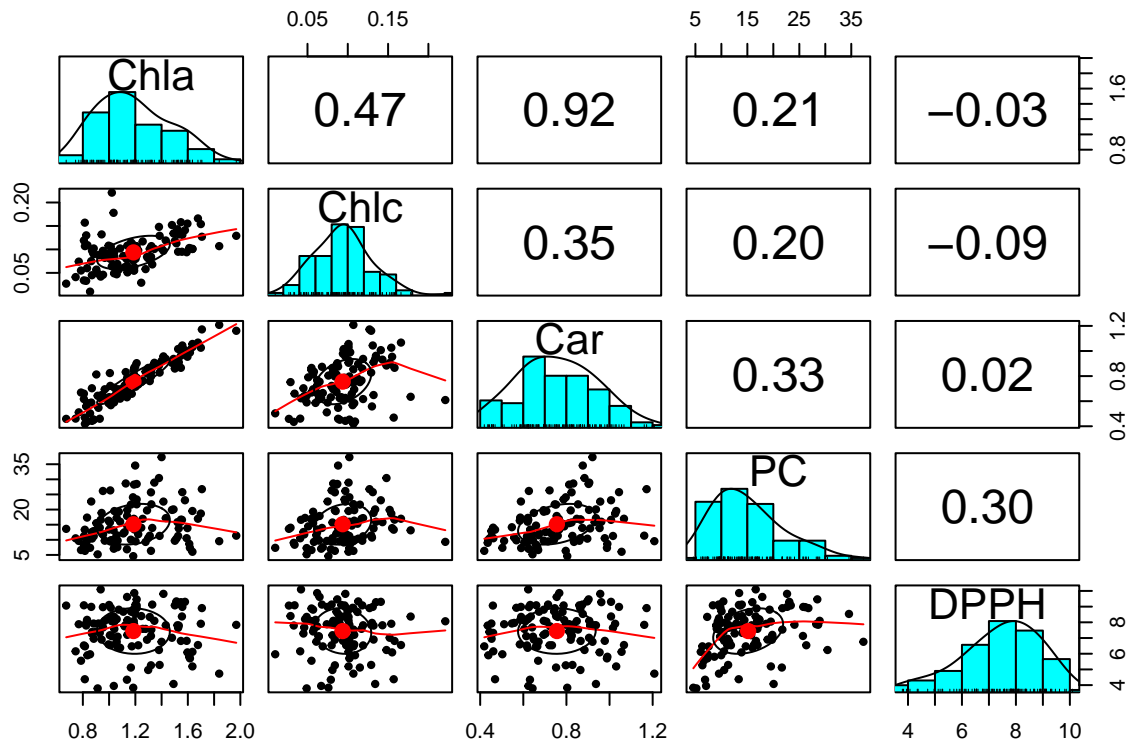


```
pairs.panels(datos_PCA_mat[,6:9], method = "pearson")
```

Realiza PCA

```
PCA_Lesso <- prcomp(datos_PCA_mat, scale = TRUE)
PCA_Lesso
```

```
## Standard deviations (1, .., p=9):
## [1] 1.6906902 1.4143173 1.0817007 1.0174003 0.8313044 0.7367822 0.6898727
## [8] 0.4164170 0.2298930
##
## Rotation (n x k) = (9 x 9):
##                     PC1          PC2         PC3         PC4         PC5
## Chla          0.4568817 -0.34350662  0.22454424  0.12629866 -0.24706846
## Chlc          0.1751132 -0.51747885 -0.06730790  0.04046899  0.08370557
## Car           0.5000382 -0.24411934  0.17696923  0.15742553 -0.18111272
## PC            0.3194451 -0.03579808 -0.58459611  0.09918040  0.54291925
## DPPH          0.1367811  0.22149655 -0.67868393  0.10946599 -0.60014662
## Temperature   0.4805548  0.32225376  0.01808790  0.01615086  0.17659091
## pH            0.3229442  0.39571168  0.17996698 -0.28930770  0.29540096
## Salinity      0.1609386  0.48974551  0.27345642  0.27704648 -0.25120508
## PAR           0.1693368 -0.06321772 -0.06223532 -0.88039424 -0.25032258
##                      PC6         PC7         PC8          PC9
## Chla          0.169407469 -0.11620759  0.09036154  0.7039032070
## Chlc         -0.815836745  0.05543266 -0.09303314 -0.1051605698
## Car           0.304511115 -0.01829578  0.17626415 -0.6908936552
## PC            0.177673023  0.35675969  0.27987993  0.1146503236
## DPPH         -0.132467634 -0.28410415  0.03181368 -0.0135873412
## Temperature   0.006091989 -0.01917040 -0.79563051 -0.0038316299
## pH           -0.265955836 -0.52941888  0.42981859  0.0031091494
## Salinity     -0.302870960  0.60840260  0.23442065  0.0526626327
```

```
## PAR           0.036995683  0.35254795 -0.00638049 -0.0006879714
```

Varianza explicada

```
get_eigenvalue(PCA_Lesso)
```

```
##       eigenvalue variance.percent cumulative.variance.percent
## Dim.1 2.85843341        31.760371                    31.76037
## Dim.2 2.00029353        22.225484                    53.98585
## Dim.3 1.17007637        13.000849                    66.98670
## Dim.4 1.03510343        11.501149                    78.48785
## Dim.5 0.69106702         7.678522                    86.16638
## Dim.6 0.54284803         6.031645                    92.19802
## Dim.7 0.47592430         5.288048                    97.48607
## Dim.8 0.17340312         1.926701                    99.41277
## Dim.9 0.05285079         0.587231                   100.00000
```

```
fviz_eig(PCA_Lesso)
```


Scree plot
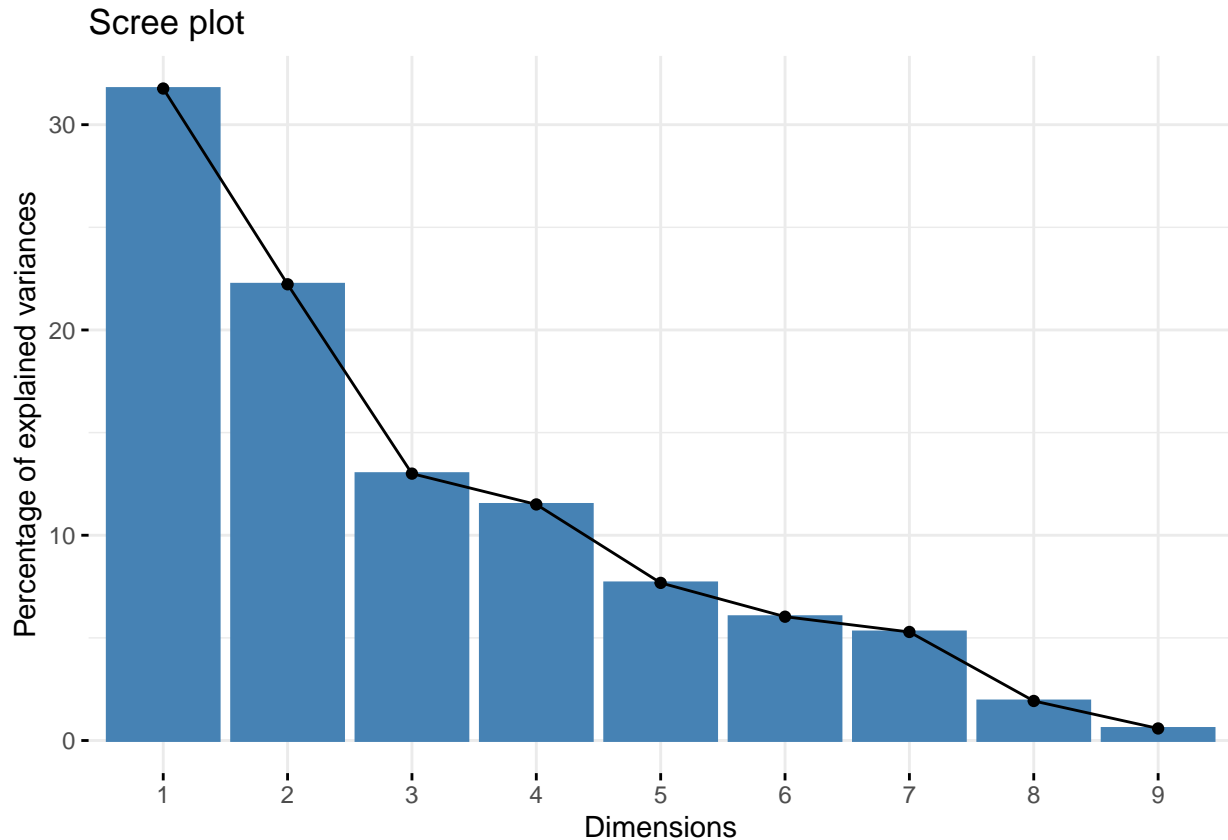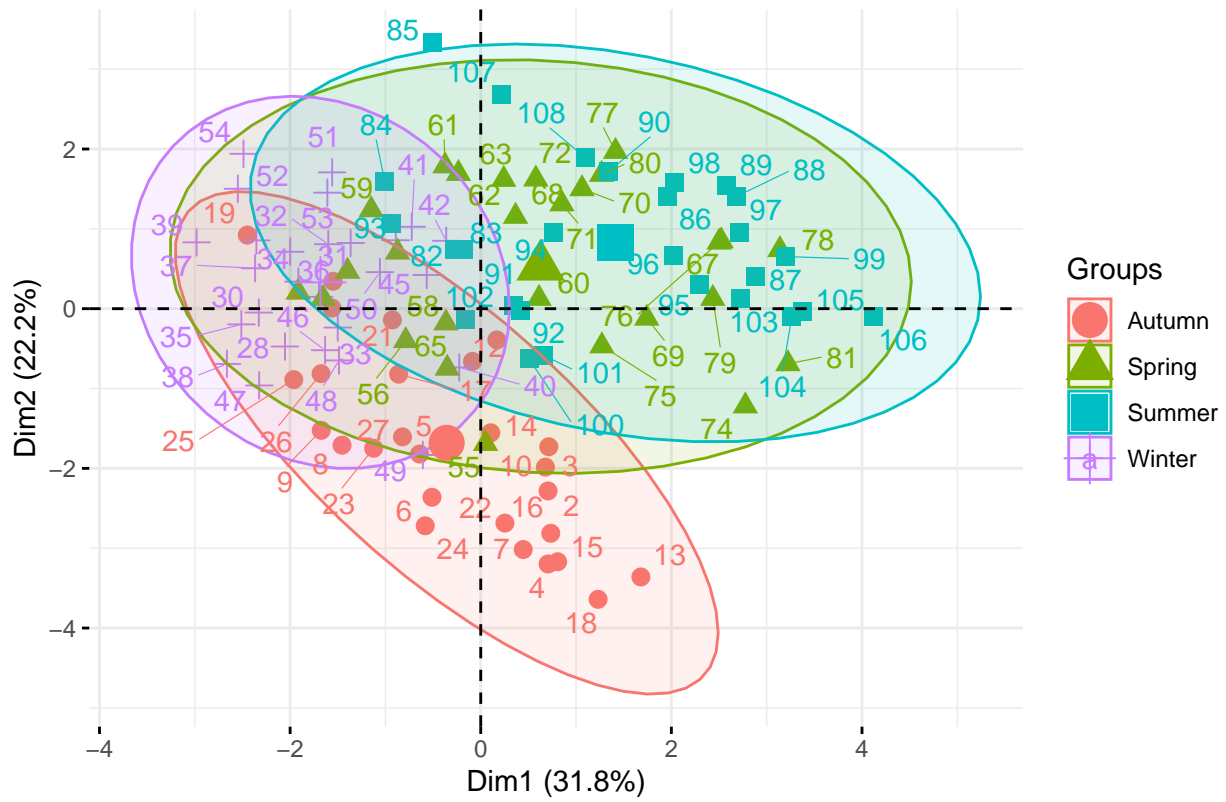
```
# Grafica por sitio
```

```
fviz_pca_ind(PCA_Lesso,
            repel = TRUE,
            habillage = datos_PCA$Seasons,
            addEllipses = TRUE,
            pointsize = 3)
```
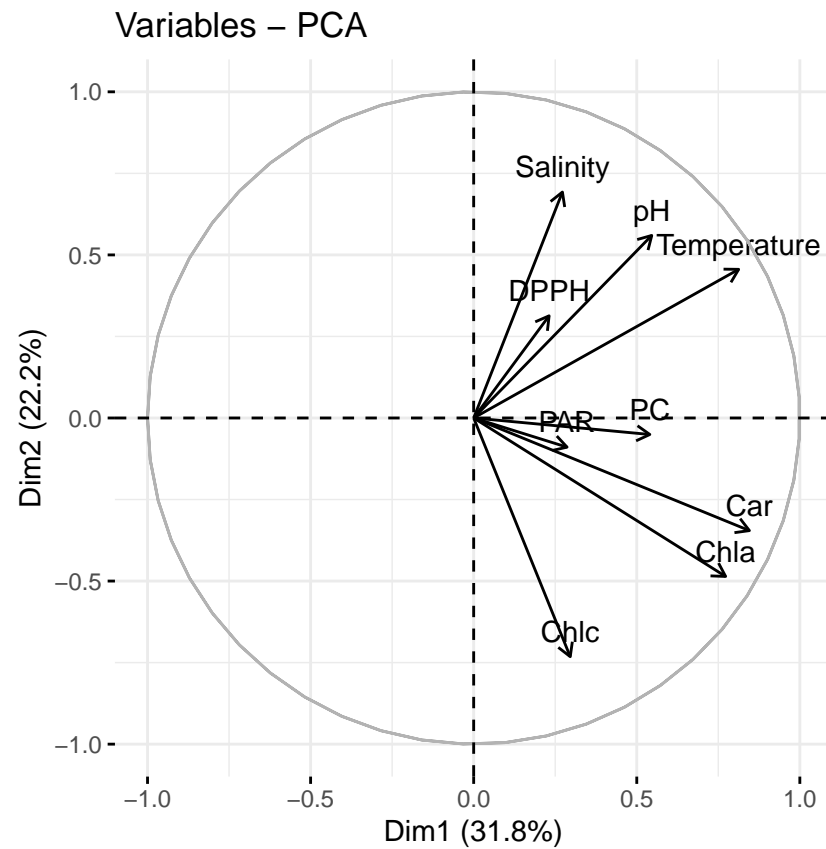
```
## Warning: ggrepel: 10 unlabeled data points (too many overlaps). Consider
```

Individuals – PCA

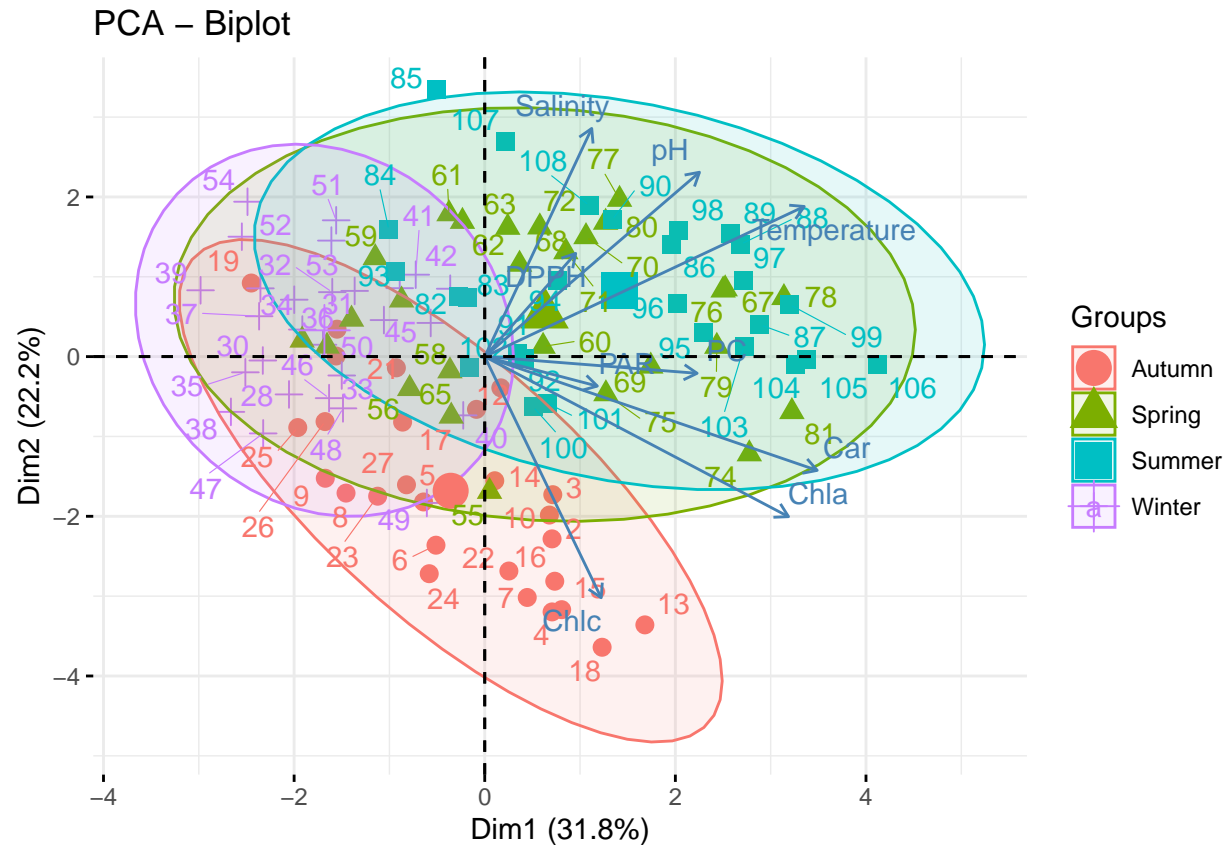```
fviz_pca_var(PCA_Lesso)
```

Variables – PCA

```
fviz_pca_biplot(PCA_Lesso,
                repel = TRUE,
                habillage = datos_PCA$Seasons,
                addEllipses = TRUE,
                pointsize = 3)
```

```
## Warning: ggrepel: 10 unlabeled data points (too many overlaps). Consider
## increasing max.overlaps
```

PCA – Biplot

Crea nuevas variables estandarizadas

```
val_estandarizado <- datos_PCA %>%
  select(Chla, Chlc, Car, PC, DPPH, Temperature, pH, Salinity, PAR) %>%
  mutate(Chla1 = (Chla - mean(Chla)) / sd(Chla),Chlc1 = (Chlc - mean(Chlc)) / sd(Chlc), Car1 = (Car - me
    PC1 = (PC - mean(PC)) / sd(PC), DPPH1 = (DPPH - mean(DPPH)) / sd(DPPH), Temperature1 = (Temperature
```

Calcula matriz de distancia

```
dist_euclidea <- dist(val_estandarizado[10:18]) #distancia euclidiana
```

Realiza PERMANOVA

```
permanova <- adonis2(dist_euclidea ~ Seasons*time , method = "bray", data=datos_PCA, permutations=999)

permanova %>% pander()
```

Table 3: Permutation test for adonis under reduced model

	Df	SumOfSqs	R2	F	Pr(>F)
Seasons	3	319.2	0.3315	18.78	0.001
time	2	27.95	0.02903	2.466	0.01
Seasons:time	6	71.83	0.07459	2.113	0.002

	Df	SumOfSqs	R2	F	Pr(>F)
Residual	96	544	0.5649	NA	NA
Total	107	963	1	NA	NA

```
dist_euclidea <- stats::dist(val_estandarizado[10:18], method = "euclidean")
```

10. Presenta, interpreta resultados y realiza conclusión