

Tutorial 5

Reading libraries

```
library(tidyverse)
library(leaflet)
library(ggmap)
library(readr)
library(mapview)
library(viridis)
library(rgdal)
```

Exercise 1: Data

```
# LTMP data
ltmp <- read_csv(file = "Data/ltmp_hc_sc_a_by_site/ltmp_hc_sc_a_by_site.csv", col_types = cols())
str(ltmp)

## Classes 'spec_tbl_df', 'tbl_df', 'tbl' and 'data.frame': 14860 obs. of 13 variables:
## $ SECTOR      : chr  "CA" "CA" "CA" "CA" ...
## $ SHELF       : chr  "I" "I" "I" "I" ...
## $ REEF_NAME   : chr  "LOW ISLANDS REEF" "LOW ISLANDS REEF" "LOW ISLANDS REEF" "LOW ISLANDS REEF" ...
## $ REEF_ID     : chr  "16028S" "16028S" "16028S" "16028S" ...
## $ SITE_NO     : num  1 1 1 1 2 2 2 2 3 3 ...
## $ LATITUDE    : num  -16.4 -16.4 -16.4 -16.4 -16.4 ...
## $ LONGITUDE   : num  146 146 146 146 146 ...
## $ P_CODE      : chr  "RM" "RM" "RM" "RM" ...
## $ VISIT_NO    : num  1 1 1 1 1 1 1 1 1 ...
## $ YEAR_CODE   : num  199293 199293 199293 199293 199293 ...
## $ SAMPLE_DATE: Date, format: "1993-06-12" "1993-06-12" ...
## $ GROUP_CODE  : chr  "Algae" "Hard Coral" "Other" "Soft Coral" ...
## $ COVER       : num  30.6 24.8 26.8 17.8 35.8 ...
## - attr(*, "spec")=
##   .. cols(
##     .. SECTOR = col_character(),
##     .. SHELF = col_character(),
##     .. REEF_NAME = col_character(),
##     .. REEF_ID = col_character(),
##     .. SITE_NO = col_double(),
##     .. LATITUDE = col_double(),
##     .. LONGITUDE = col_double(),
##     .. P_CODE = col_character(),
##     .. VISIT_NO = col_double(),
##     .. YEAR_CODE = col_double(),
##     .. SAMPLE_DATE = col_date(format = ""),
##     .. GROUP_CODE = col_character(),
##     .. COVER = col_double()
```

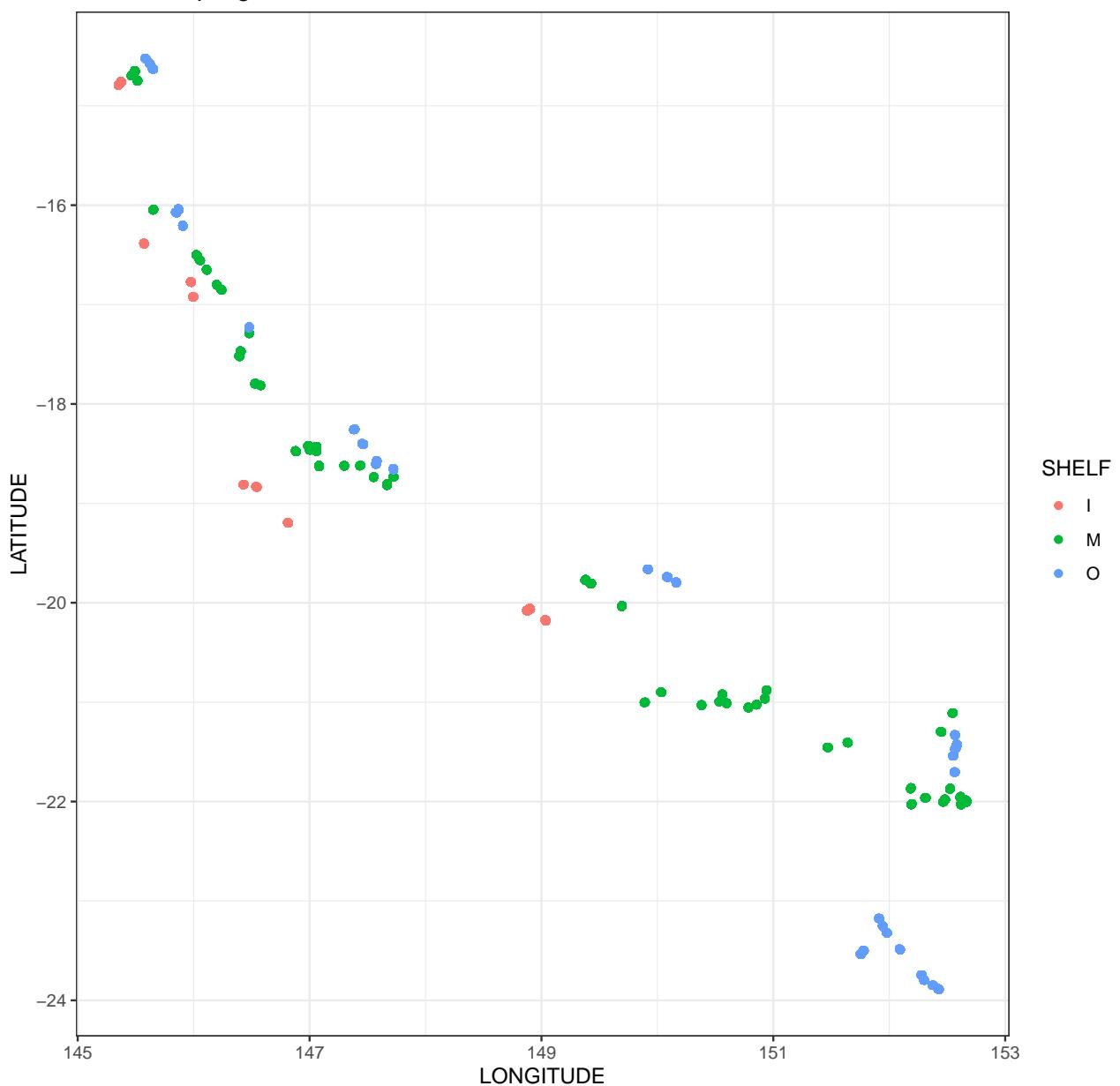
```
##    .. )  
#MMP data  
mmp <- read_csv("Data/mmp_hc_sc_a_by_site/mmp_hc_sc_a_by_site.csv", col_types = cols())
```

Exercise 2: Create a report and read the data

LTMP colored by SHELF

```
ggplot(data = ltmp,  
       aes(  
             x = LONGITUDE,  
             y = LATITUDE,  
             color = SHELF)  
       ) +  
  geom_point() +  
  theme_bw() +  
  ggtitle("LTMP sampling locations")
```

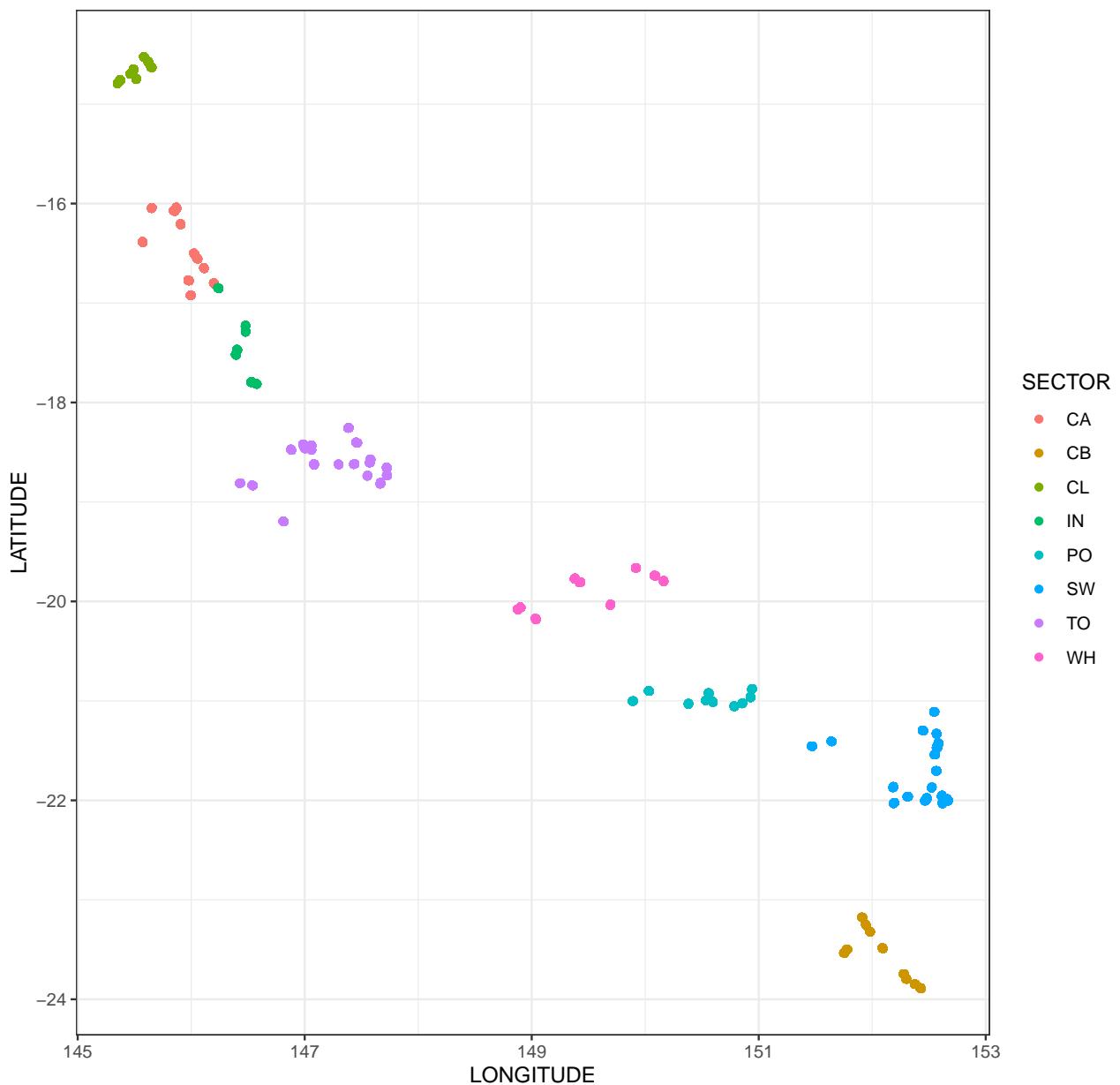
LTMP sampling locations



LTMP colored by SECTOR

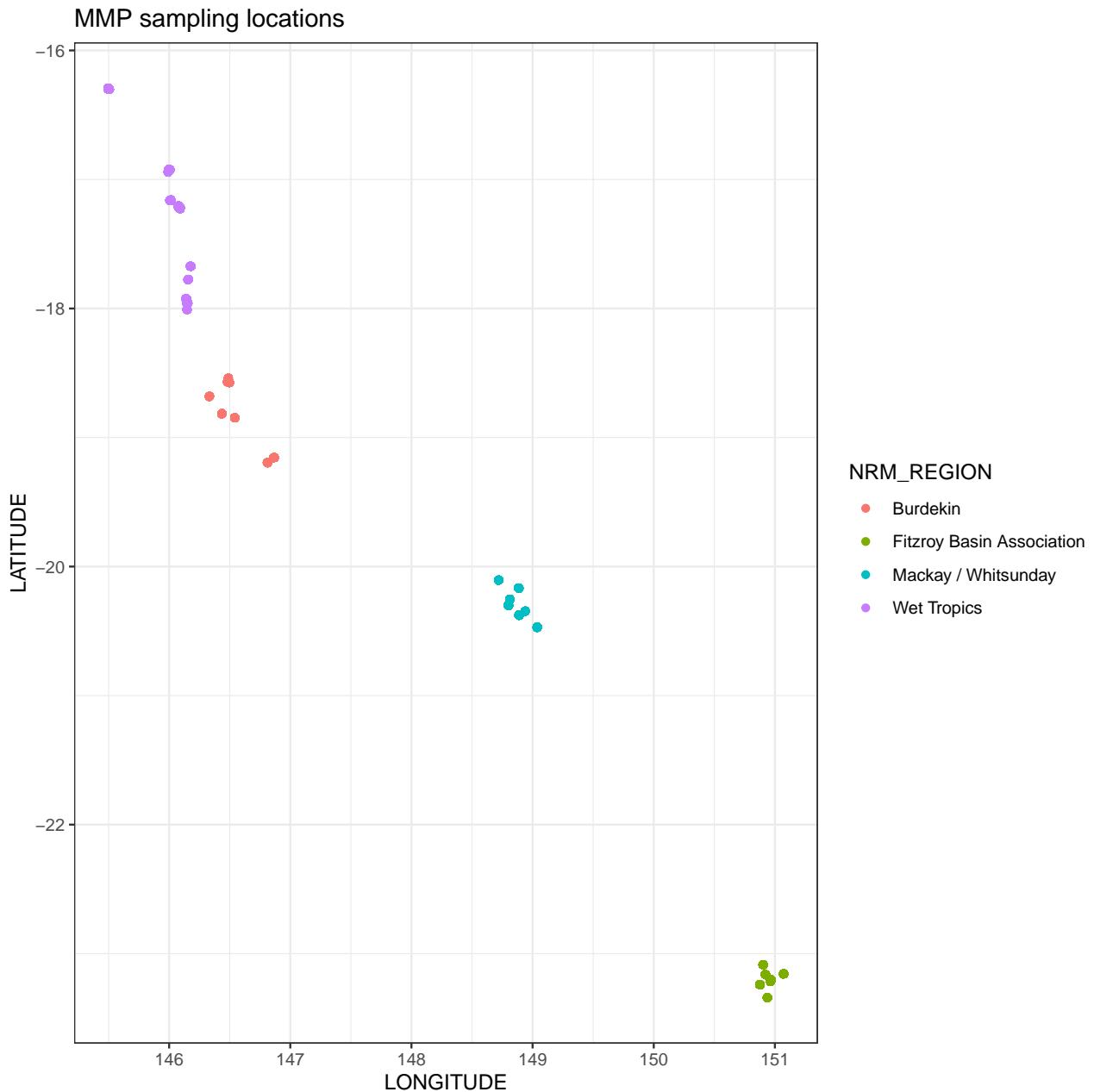
```
ggplot(data = ltmp,
       aes(
         x = LONGITUDE,
         y = LATITUDE,
         color = SECTOR)
       ) +
  geom_point() +
  theme_bw() +
  ggtitle("LTMP sampling locations")
```

LTMP sampling locations



MMP

```
mmp <- read_csv(file = "Data/mmp_hc_sc_a_by_site/mmp_hc_sc_a_by_site.csv", col_types = cols())
ggplot(data = mmp,
       aes(
         x = LONGITUDE,
         y = LATITUDE,
         color = NRM_REGION)
     ) +
  geom_point() +
  theme_bw() +
  ggtitle("MMP sampling locations")
```



Exercise 3: Creating maps using leaflet

MMP

```
# Map for MMP sampling locations
cb_bbox <- make_bbox(lon = mmp$LONGITUDE,
                      mmp$LATITUDE, f = 0.9)

mmp_locations = leaflet(data = mmp) %>%
  # Base group
  addProviderTiles(providers$Esri.WorldImagery, group="Satellite") %>%
  # Add receiver location data
  addCircles(
```

```
  lng = mmp$LONGITUDE,  
  lat = mmp$LATITUDE,  
  fill=TRUE, color="yellow",  
  weight= 2,  
  radius = 2,  
  #color = ~pal(col),  
  stroke = FALSE, fillOpacity = 0.8)
```

```
mmp_locations
```



Leaflet | Tiles © Esri — Source: Esri, i-cubed, USDA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGN, IGP, UPR-EGP, and the GIS User Community

```
mapshot(mmp_locations, file = paste0(getwd(), "/Tutorial5_Images/mmp_locations.png"))
```

```
##LTMP
```

```

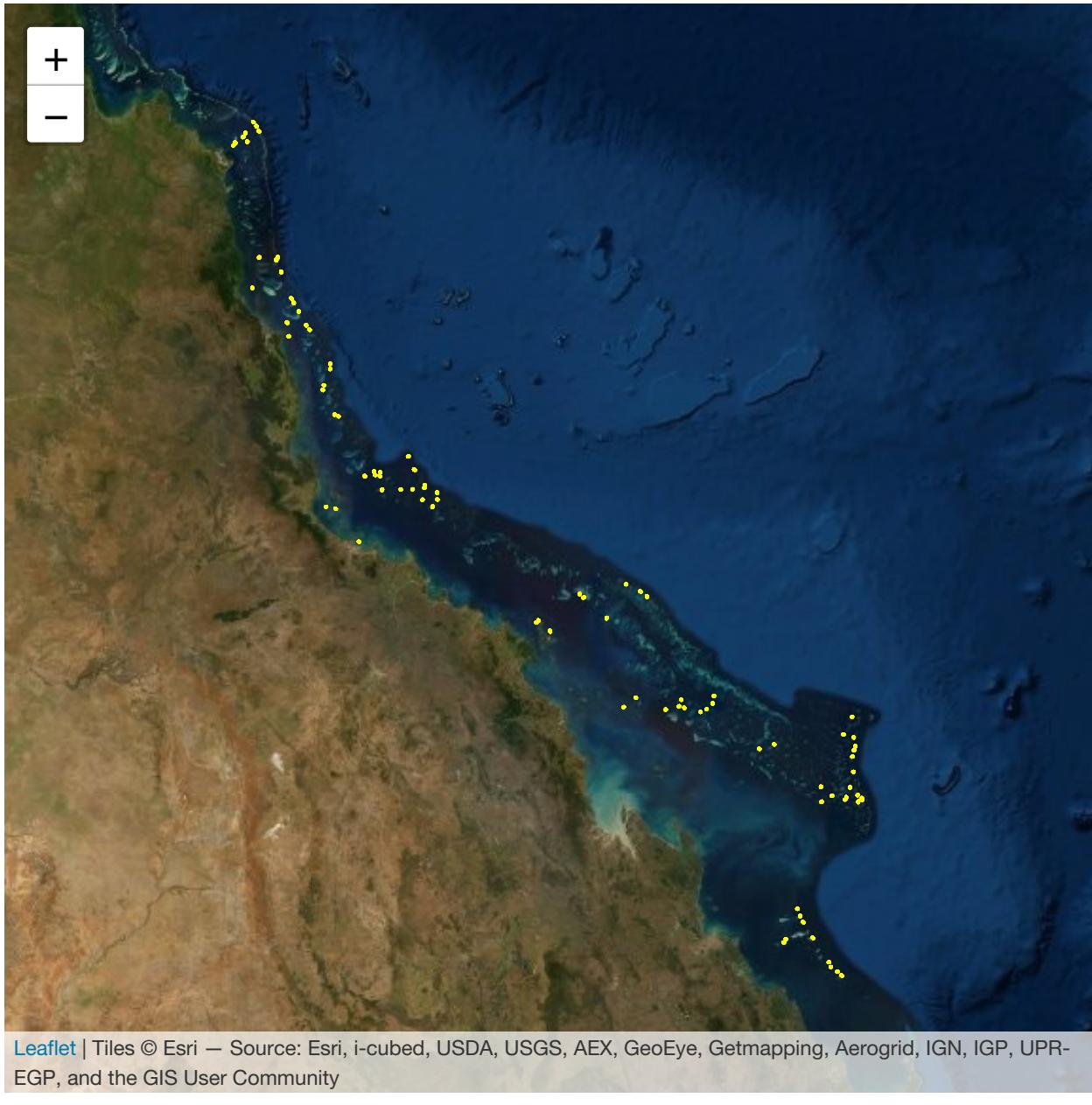
# Map for MMP sampling locations
cb_bbox <- make_bbox(lon = ltmp$LONGITUDE,
                      ltmp$LATITUDE, f = 0.9)

#pal <- colorNumeric(c("red", "green", "blue"), 1:10)

ltmp_locations = leaflet(data = ltmp) %>%
  # Base group
  addProviderTiles(providers$Esri.WorldImagery, group="Satellite") %>%
  # Add receiver location data
  addCircles(
    lng = ltmp$LONGITUDE,
    lat = ltmp$LATITUDE,
    fill=TRUE, color="yellow",
    weight=2,
    radius = 2,
    #color = ~pal(col),
    stroke = FALSE, fillOpacity = 0.8)

ltmp_locations

```



Leaflet | Tiles © Esri — Source: Esri, i-cubed, USDA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGN, IGP, UPR-EGP, and the GIS User Community

```
mapshot(ltmp_locations, file = paste0(getwd(), "/Tutorial5_Images/ltmp_locations.png"))
```

Exercise 4: Creating maps using shape files

Maps with Great Barrier Reef Marine Park Boundary

```
shp <- readOGR(dsn = file.path(paste0(getwd(),"/Data"), sep=""), "Great_BARRIER_Reef_Marine_Park_Boundary")

## OGR data source with driver: ESRI Shapefile
## Source: "/Users/pmen0008/Google Drive/ETC5512/wcd/labs/Data/Great_BARRIER_Reef_Marine_Park_Boundary...
## with 1 features
## It has 12 fields
## Integer64 fields read as strings:  OBJECTID
```

```

#shp <- readOGR(dsn = file.path("/Users/pmen0008/Google Drive/ETC5512/Wild_Caught_Data/Demo data", "Gre
summary(shp@data)

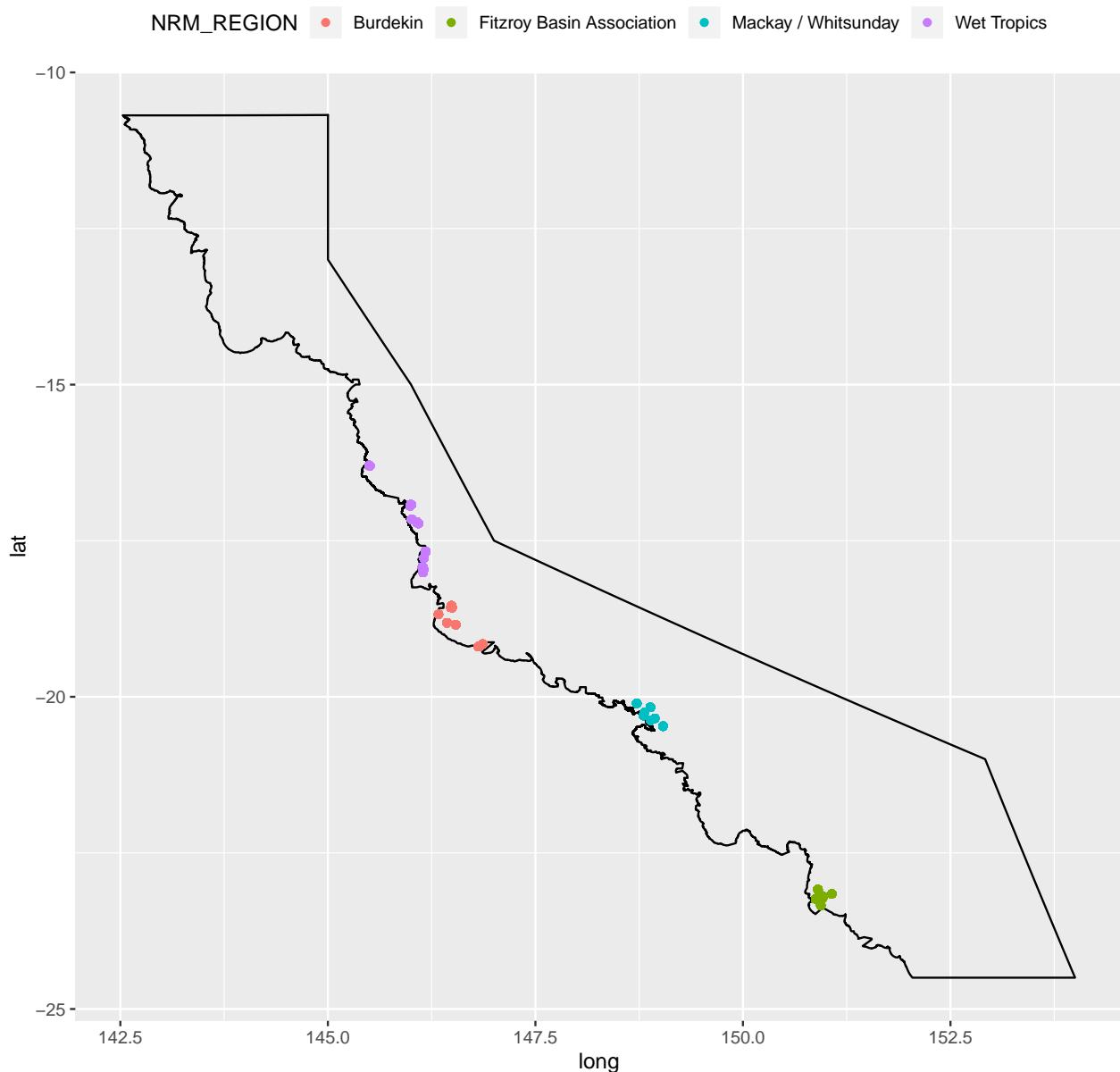
##      OBJECTID          GIS_AREA       sdc_extern      HECTARES
## Length:1      Min. :344827  Min. :3.457e+11  Min. :34574798
## Class :character  1st Qu.:344827  1st Qu.:3.457e+11  1st Qu.:34574798
## Mode  :character   Median :344827  Median :3.457e+11  Median :34574798
##               Mean   :344827  Mean   :3.457e+11  Mean   :34574798
##               3rd Qu.:344827  3rd Qu.:3.457e+11  3rd Qu.:34574798
##               Max.  :344827  Max.  :3.457e+11  Max.  :34574798
##      UNIQUE_ID        LOC_TYPE_S      LOC_NAME_S      LOC_NAM_L
## Length:1      Length:1      Length:1      Length:1
## Class :character  Class :character  Class :character  Class :character
## Mode  :character   Mode  :character  Mode  :character  Mode  :character
##
##
##
##      SHAPE_Leng      GlobalID      Shape_area      Shape_len
## Min.   :54.68  Length:1      Min.   :3.878e+11  Min.   :6265071
## 1st Qu.:54.68  Class :character  1st Qu.:3.878e+11  1st Qu.:6265071
## Median :54.68  Mode  :character  Median :3.878e+11  Median :6265071
## Mean   :54.68                Mean   :3.878e+11  Mean   :6265071
## 3rd Qu.:54.68                3rd Qu.:3.878e+11  3rd Qu.:6265071
## Max.   :54.68                Max.   :3.878e+11  Max.   :6265071

ggplot() +
  geom_polygon(data = shp, aes(x = long, y = lat, group = group), colour = "black", fill = NA) +
  geom_point(data = mmp, aes(x = LONGITUDE, y = LATITUDE, color = NRM_REGION)) +
  theme(legend.position="top") +
  ggtitle("MMP sampling locations")

## Regions defined for each Polygons

```

MMP sampling locations



```

require(rgdal)
require(ggplot2)

shp <- readOGR(dsn = file.path(paste(getwd(),"/Data", sep="")), "Great_BARRIER_Reef_Marine_Park_Boundary")

## OGR data source with driver: ESRI Shapefile
## Source: "/Users/pmen0008/Google Drive/ETC5512/wcd/labs/Data/Great_BARRIER_Reef_Marine_Park_Boundary..
## with 1 features
## It has 12 fields
## Integer64 fields read as strings:  OBJECTID
summary(shp@data)

```

##	OBJECTID	GIS_AREA	sdc_extern	HECTARES
----	----------	----------	------------	----------

```

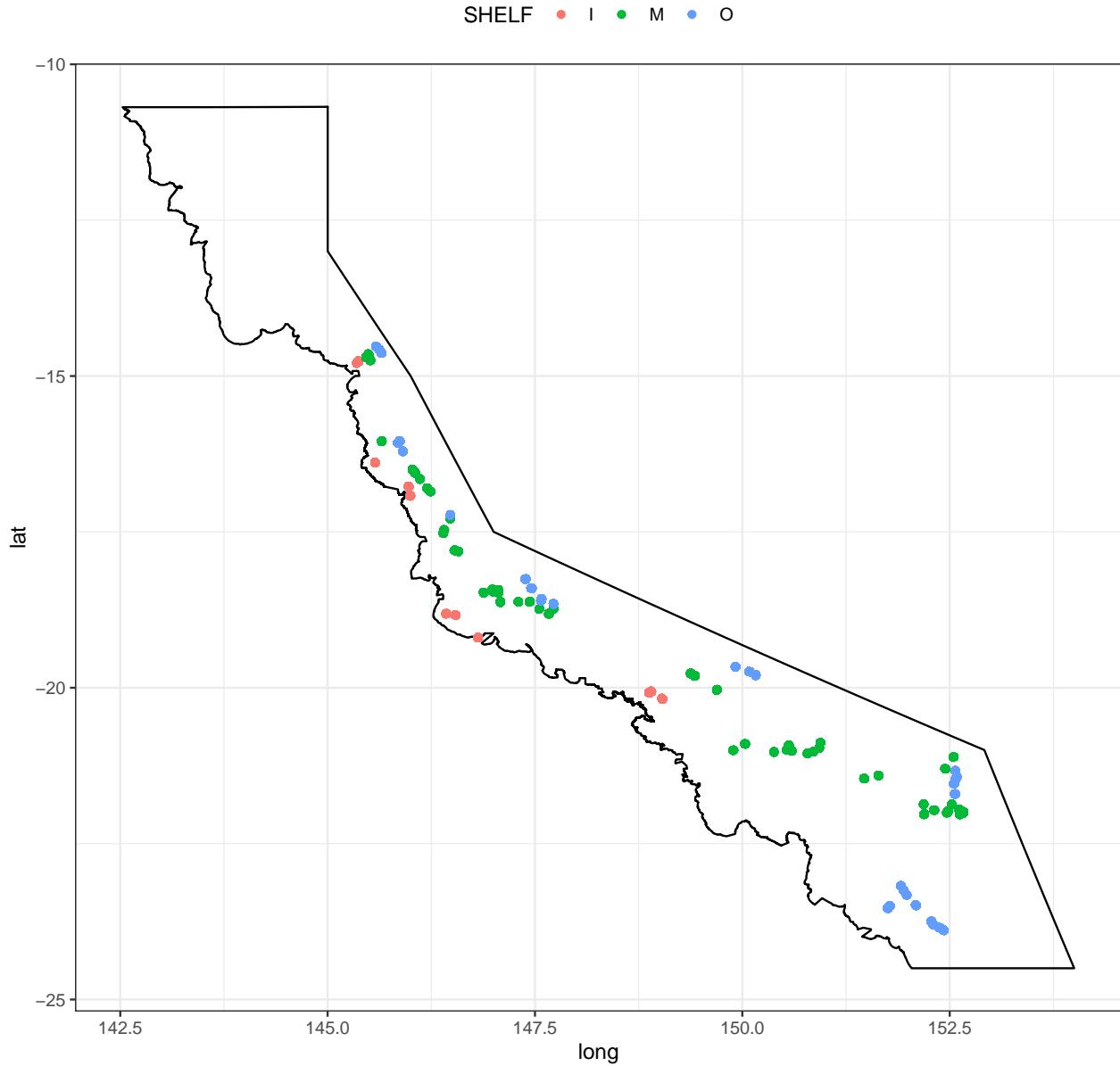
##  Length:1           Min.   :344827   Min.   :3.457e+11   Min.   :34574798
##  Class  :character  1st Qu.:344827   1st Qu.:3.457e+11   1st Qu.:34574798
##  Mode   :character  Median :344827   Median :3.457e+11   Median :34574798
##                           Mean   :344827   Mean   :3.457e+11   Mean   :34574798
##                           3rd Qu.:344827   3rd Qu.:3.457e+11   3rd Qu.:34574798
##                           Max.   :344827   Max.   :3.457e+11   Max.   :34574798
##  UNIQUE_ID          LOC_TYPE_S      LOC_NAME_S      LOC_NAM_L
##  Length:1           Length:1       Length:1       Length:1
##  Class  :character  Class :character  Class :character  Class :character
##  Mode   :character  Mode  :character  Mode  :character  Mode  :character
##
##
##
##    SHAPE_Leng     GlobalID        Shape_area      Shape_len
##  Min.   :54.68   Length:1       Min.   :3.878e+11   Min.   :6265071
##  1st Qu.:54.68  Class :character  1st Qu.:3.878e+11   1st Qu.:6265071
##  Median :54.68  Mode  :character  Median :3.878e+11   Median :6265071
##  Mean   :54.68                    Mean   :3.878e+11   Mean   :6265071
##  3rd Qu.:54.68                    3rd Qu.:3.878e+11   3rd Qu.:6265071
##  Max.   :54.68                    Max.   :3.878e+11   Max.   :6265071

ggplot() +
  geom_polygon(data = shp, aes(x = long, y = lat, group = group), colour = "black", fill = NA) +
  geom_point(data = ltmp, aes(x = LONGITUDE, y = LATITUDE, color = SHELF)) +
  theme_bw() +
  theme(legend.position="top") +
  ggtitle("LTMP sampling locations")

## Regions defined for each Polygons

```

LTMP sampling locations



Maps with Great Barrier Reef Features

```
shp2 <- readOGR(dsn = file.path(paste(getwd(),"/Data", sep="")), "Great_BARRIER_Reef_Features.shp") , st

## OGR data source with driver: ESRI Shapefile
## Source: "/Users/pmen0008/Google Drive/ETC5512/wcd/labs/Data/Great_BARRIER_Reef_Features.shp", layer:
## with 5363 features
## It has 20 fields
## Integer64 fields read as strings:  OBJECTID FEATURE_C
summary(shp2@data)

##      OBJECTID           SORT_GBR_I          LABEL_ID          SUB_NO
##  Length:5363    Length:5363    Length:5363    Min.   :100.0
```

```

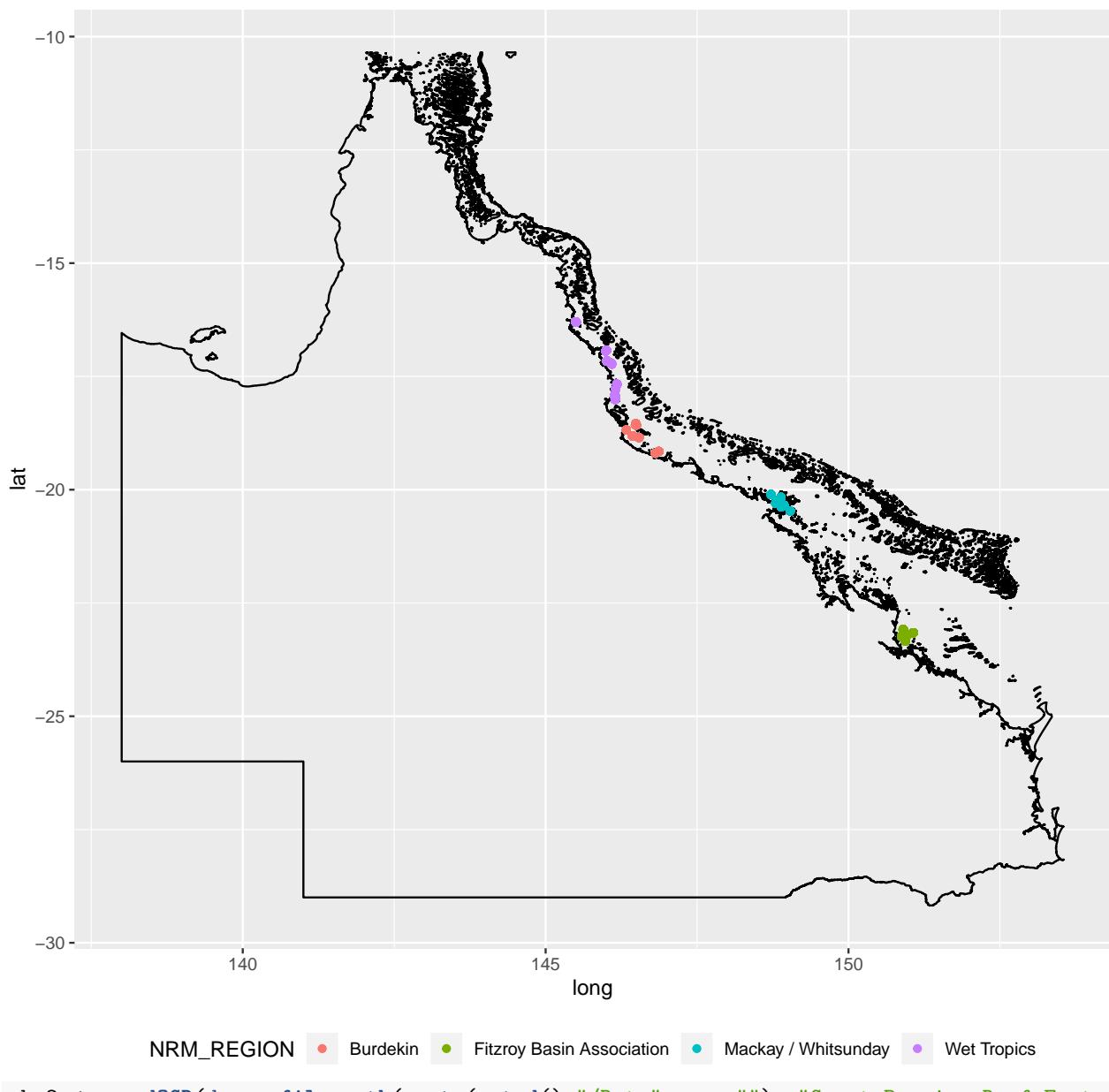
##  Class :character  Class :character  Class :character  1st Qu.:100.0
##  Mode  :character  Mode   :character  Mode   :character  Median :100.0
##                                         Mean   :100.7
##                                         3rd Qu.:100.0
##                                         Max.   :124.0
##      CODE          UNIQUE_ID        FEATURE_C       GBR_NAME
##  Length:5363      Length:5363      Length:5363      Length:5363
##  Class :character  Class :character  Class :character  Class :character
##  Mode  :character  Mode   :character  Mode   :character  Mode   :character
##                                         Mean   :100.7
##                                         3rd Qu.:100.0
##                                         Max.   :124.0
##      FEAT_NAME      QLD_NAME       X_LABEL        GBR_ID
##  Length:5363      Length:5363      Length:5363      Length:5363
##  Class :character  Class :character  Class :character  Class :character
##  Mode  :character  Mode   :character  Mode   :character  Mode   :character
##                                         Mean   :100.7
##                                         3rd Qu.:100.0
##                                         Max.   :124.0
##      LOC_NAME_S     LOC_NAME_L      X_COORD       Y_COORD
##  Length:5363      Length:5363      Min.   : 0.0  Min.   :-27.55
##  Class :character  Class :character  1st Qu.:144.4 1st Qu.:-21.31
##  Mode  :character  Mode   :character  Median :149.0  Median :-20.06
##                                         Mean   :147.9  Mean   :-18.04
##                                         3rd Qu.:150.8 3rd Qu.:-14.16
##                                         Max.   :153.5  Max.   : 0.00
##      Area_HA        GlobalID       Shape_STAr      Shape_STLe
##  Min.   : 0.00  Length:5363      Min.   :1.200e+01  Min.   :    14
##  1st Qu.: 0.00  Class :character  1st Qu.:8.916e+04 1st Qu.: 1362
##  Median : 32.19  Mode  :character  Median :5.114e+05  Median : 3512
##  Mean   : 464.49                         Mean   :3.871e+08  Mean   : 10903
##  3rd Qu.: 234.06                         3rd Qu.:2.939e+06 3rd Qu.: 9045
##  Max.   :85813.79                         Max.   :2.041e+12  Max.   :15693192

ggplot() +
  geom_polygon(data = shp2, aes(x = long, y = lat, group = group), colour = "black", fill = NA) +
  geom_point(data = mmp, aes(x = LONGITUDE, y = LATITUDE, color = NRM_REGION)) +
  theme_gray() +
  theme(legend.position="bottom") +
  ggtitle("MMP sampling locations")

## Regions defined for each Polygons

```

MMP sampling locations



```
shp2 <- readOGR(dsn = file.path(paste(getwd(),"/Data", sep="")), "Great_BARRIER_Reef_Features.shp") , st
```

```
## OGR data source with driver: ESRI Shapefile
## Source: "/Users/pmen0008/Google Drive/ETC5512/wcd/labs/Data/Great_BARRIER_Reef_Features.shp", layer:
```

```
## with 5363 features
```

```
## It has 20 fields
```

```
## Integer64 fields read as strings: OBJECTID FEATURE_C
```

```
summary(shp2@data)
```

	OBJECTID	SORT_GBR_I	LABEL_ID	SUB_NO
##	Length:5363	Length:5363	Length:5363	Min. :100.0
##	Class :character	Class :character	Class :character	1st Qu.:100.0
##	Mode :character	Mode :character	Mode :character	Median :100.0
##				Mean :100.7

```

##                                     3rd Qu.:100.0
##                                     Max.   :124.0
##             CODE          UNIQUE_ID        FEATURE_C        GBR_NAME
## Length:5363      Length:5363      Length:5363      Length:5363
## Class :character  Class :character  Class :character  Class :character
## Mode  :character  Mode  :character  Mode  :character  Mode  :character
##
##                                     3rd Qu.:100.0
##                                     Max.   :124.0
##             FEAT_NAME      QLD_NAME       X_LABEL        GBR_ID
## Length:5363      Length:5363      Length:5363      Length:5363
## Class :character  Class :character  Class :character  Class :character
## Mode  :character  Mode  :character  Mode  :character  Mode  :character
##
##                                     3rd Qu.:100.0
##                                     Max.   :124.0
##             LOC_NAME_S     LOC_NAME_L      X_COORD       Y_COORD
## Length:5363      Length:5363      Min.    : 0.0  Min.   :-27.55
## Class :character  Class :character  1st Qu.:144.4 1st Qu.:-21.31
## Mode  :character  Mode  :character  Median  :149.0  Median  :-20.06
##                                     Mean   :147.9  Mean   :-18.04
##                                     3rd Qu.:150.8 3rd Qu.:-14.16
##                                     Max.   :153.5  Max.   : 0.00
##             Area_HA        GlobalID      Shape_STAr      Shape_STLe
## Min.   : 0.00  Length:5363      Min.   :1.200e+01  Min.   :    14
## 1st Qu.: 0.00  Class :character  1st Qu.:8.916e+04 1st Qu.: 1362
## Median : 32.19  Mode  :character  Median :5.114e+05  Median : 3512
## Mean   : 464.49                         Mean   :3.871e+08  Mean   : 10903
## 3rd Qu.: 234.06                         3rd Qu.:2.939e+06 3rd Qu.:  9045
## Max.   :85813.79                         Max.   :2.041e+12  Max.   :15693192

gplot() +
  geom_polygon(data = shp2, aes(x = long, y = lat, group = group), colour = "grey", fill = NA) +
  geom_point(data = ltmp, aes(x = LONGITUDE, y = LATITUDE, color = SHELF)) +
  theme_light() +
  theme(legend.position="bottom") +
  scale_color_viridis(discrete=TRUE) +
  ggtitle("LTMP sampling locations")

## Regions defined for each Polygons

```

LTMP sampling locations

