Workshop 5.4: Mapping in R

Murray Logan

18 Jul 2016

Section 1

Preparation

Important spatial packages

Package	Description
sp	Defines sp data classes
maptools	Routines for reading shapefiles and other mapping data
mapdata	Hi-resolution world and regional maps
raster	Routines for loading and processing raster data
rgeos	A range of spatial manipulation functions
rgdal	An R interface to the engine behind complex spatial calculatio
ggplot2	Plotting maps
ggmap	Google maps

Preparation

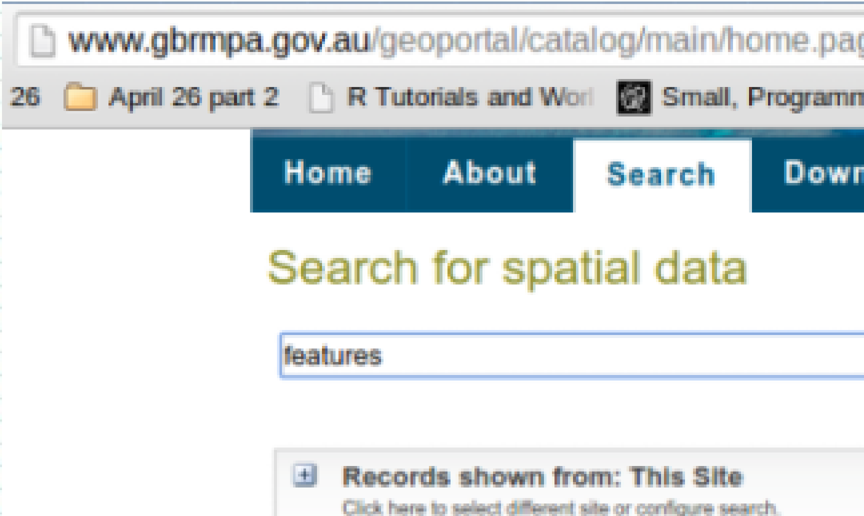
http://www.flutterbys.com.au/stats/downloads/Rscripts/spatialFunctions.R

http://www.flutterbys.com.au/stats/downloads/data/uthicke.csv

//Pearl/Temp/Murray/GBR.zip

GBRMP shapefiles

http:
//www.gbrmpa.gov.au/geoportal/catelog/main/home.page



www.gbrmpa.gov.au/geoportal/catalog/main/home.pag

Search for spatial data

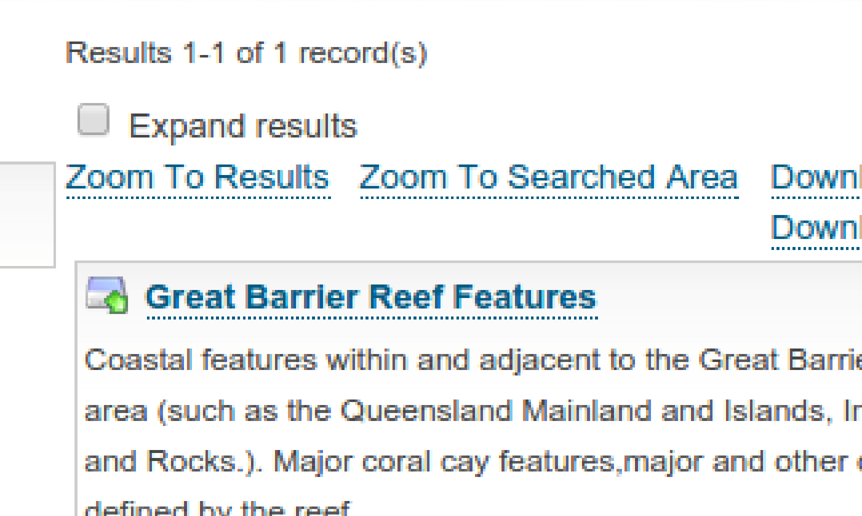
features

⊞ Records shown from: This Site

Click here to select different site or configure search.

GBRMP shapefiles

http:
//www.gbrmpa.gov.au/geoportal/catelog/main/home.page



Results 1-1 of 1 record(s)

□ Expand results

Zoom To Results Zoom To Searched Area Downl

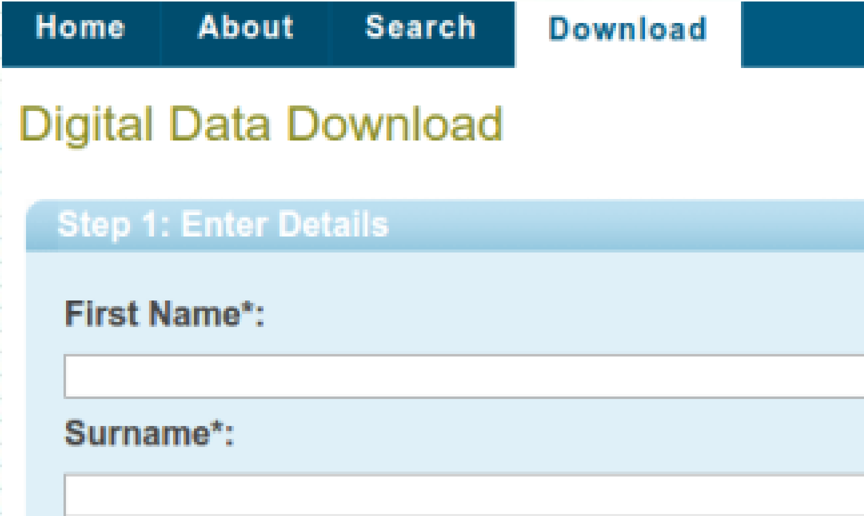
Downl

Great Barrier Reef Features

Coastal features within and adjacent to the Great Barrie
area (such as the Queensland Mainland and Islands, In
and Rocks.). Major coral cay features,major and other
defined by the reef

GBRMP shapefiles

http://www.gbrmpa.gov.au/geoportal/catelog/main/home.page



Digital Data Download

Step 1: Enter Details

First Name*:

Surname*:

Preparation

GEOS from http://trac.osgeo.org/geos/

GDAL ⍰= 1.6.3, library from http://trac.osgeo.org/gdal/wiki/DownloadSource

PROJ.4 (proj ⍰= 4.4.9) from http://download.osgeo.org/proj/

Important spatial packages

```
> library(sp)
> library(raster)
> library(mapdata)
> library(maptools)
> library(rgeos)
> library(ggplot2)
> library(ggmap)
> library(dplyr)
> library(ggrepel)
>
> source('../Rscripts/spatialFunctions.R')
```

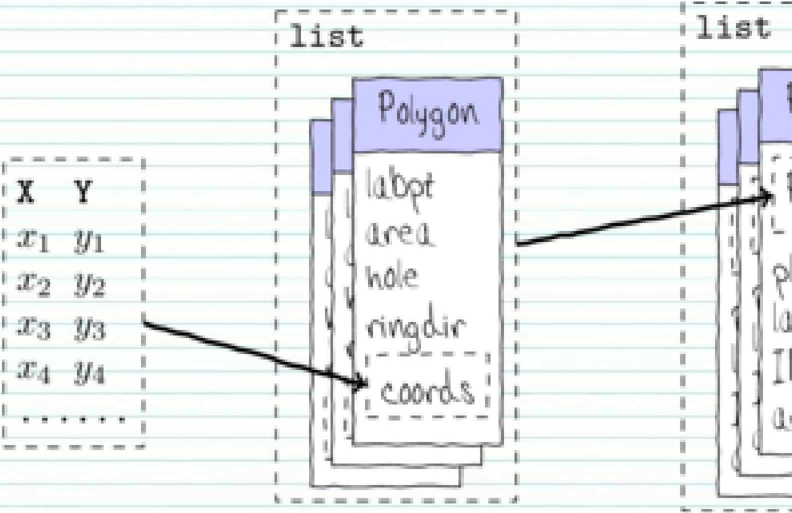
Section 2

Spatial data classes

Spatial data

- Vectors - points, lines
  - sp package
- Rasters - pixels
  - raster package

Vectors

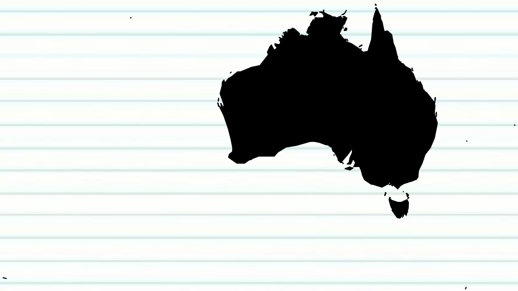


X	Y
x_1	y_1
x_2	y_2
x_3	y_3
x_4	y_4
......	

Importing spatial data

`mapdata` - hi-res world maps

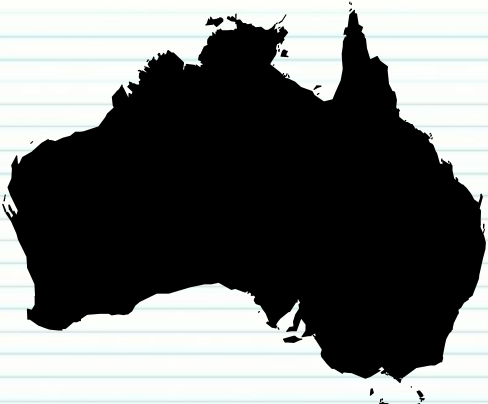
```
> library(mapdata)
> aus <- map("worldHires","Australia", fill=TRUE)
```



Importing spatial data

mapdata - hi-res world maps

```
> library(mapdata)
> aus <- map("worldHires","Australia", fill=TRUE, xlim=c(110,160),
+              ylim=c(-45,-5), mar=c(0,0,0,0))
```



Importing spatial data

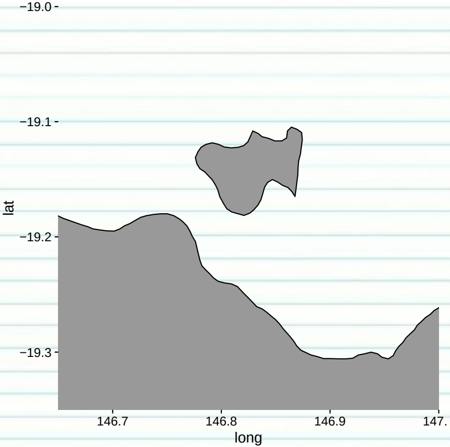
mapdata - hi-res world maps

```
> library(mapdata)
> library(maptools)
> library(sp)
> library(ggplot2)
> aus <- map("worldHires","Australia", fill=TRUE, xlim=c(110,160),
+              ylim=c(-45,-5), mar=c(0,0,0,0), plot=FALSE)
> aus.sp <- map2SpatialPolygons(aus, IDs=aus$names,
+                                    proj4string=CRS("+proj=longlat"))
> library(broom)
> ggplot(tidy(aus.sp), aes(y=lat, x=long, group=group)) + geom_polygon()
```

Importing spatial data

mapdata - hi-res world maps

```
> ggplot(tidy(aus.sp), aes(y=lat, x=long, group=group)) +
+     geom_polygon(fill='gray60', color='black') +
+     coord_map(xlim=c(146.65,147), ylim=c(-19.35,-19))
```

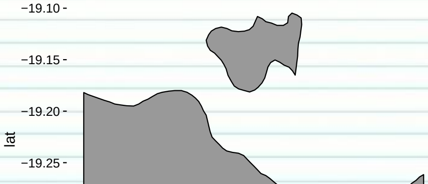


Importing spatial data

mapdata - hi-res world maps

CROPPING

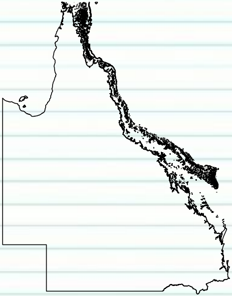
```
> library(rgeos)
> x <- c(146.65,147,147,146.65)
> y <- c(-19.35,-19.35,-19,-19)
> reg=SpatialPolygons(list(Polygons(list(Polygon(cbind(x,y))),ID=1)))
> proj4string(reg) <- CRS('+proj=longlat')
> aus.sp.crop <- gIntersection(aus.sp, reg)
> ggplot(tidy(aus.sp.crop), aes(y=lat, x=long, group=group)) +
+     geom_polygon(fill='gray60', color='black') +
+     coord_map()
```



Importing spatial data

Shapefiles

```
> gbr.sp<- readShapeSpatial(
+     "Great Barrier Reef Features/Great_Barrier_Reef_Features.shp",
+     proj4string = CRS('+proj=longlat +ellps=WGS84'),
+     repair=TRUE,force_ring=T,verbose=TRUE)
> plot(gbr.sp)
```



Importing spatial data

Shapefiles and ggplot

```
> names(gbr.sp)
```

```
 [1] "OBJECTID"   "SORT_GBR_I" "LABEL_ID"   "SUB_NO"     "CODE"       "UNIQUE_ID"  "
 [8] "GBR_NAME"   "FEAT_NAME"  "QLD_NAME"   "X_LABEL"    "GBR_ID"     "LOC_NAME_S"
[15] "X_COORD"    "Y_COORD"    "Area_HA"    "GlobalID"   "Shape_STAr" "Shape_STLe"
```

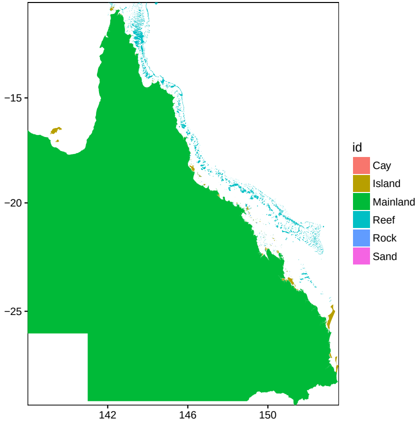
```
> levels(gbr.sp$FEAT_NAME)
```

```
[1] "Cay"      "Island"   "Mainland" "Reef"     "Rock"     "Sand"
```

Importing spatial data

Shapefiles and ggplot

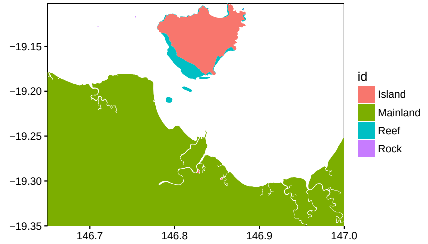
```
> gbr.df <- tidy(gbr.sp, region='FEAT_NAME')
> ggplot(gbr.df, aes(y=lat, x=long, fill=id, group=group)) +
+     scale_x_continuous('', expand=c(0,0)) +
+     scale_y_continuous('', expand=c(0,0)) +
+     geom_polygon() + coord_map() + theme_classic() +
+         theme(panel.background=element_rect(fill=NA,color='black'))
```



Importing spatial data

Shapefiles - cropping

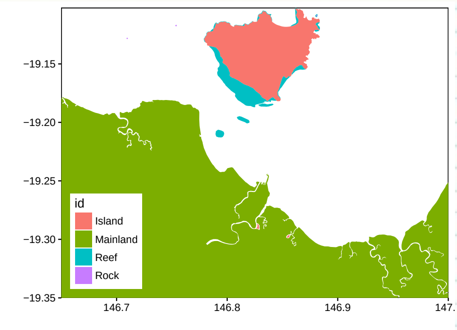
```
> #gbr.sp.crop <- gIntersection(gbr.sp, reg, byid=TRUE) # does not honor da
> gbr.sp.crop <- raster::intersect(gbr.sp, reg)
> gbr.tsv.df <- tidy(gbr.sp.crop, region='FEAT_NAME')
> ggplot(gbr.tsv.df, aes(y=lat, x=long, fill=id, group=group)) +
+     scale_x_continuous('', expand=c(0,0)) +
+     scale_y_continuous('', expand=c(0,0)) +
+     geom_polygon() + coord_map() + theme_classic() +
+     theme(panel.background=element_rect(fill=NA,color='black'))
```



Importing spatial data

Shapefiles - cropping

```
> ggplot(gbr.tsv.df, aes(y=lat, x=long, fill=id, group=group)) +
+     scale_x_continuous('', expand=c(0,0)) +
+     scale_y_continuous('', expand=c(0,0)) +
+     geom_polygon() + coord_map() + theme_classic() +
+         theme(panel.background=element_rect(fill=NA,color='black'),
+               legend.position=c(0,0), legend.justification=c(0,0))
```



Section 3

Mapping data

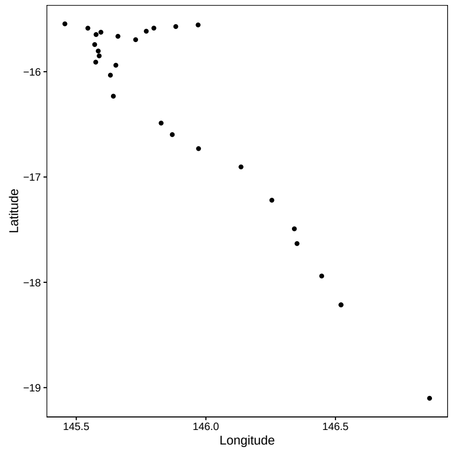
Data frame

```
> cots <- read.csv("../data/uthicke.csv",strip.white=T)
> summary(cots)
```

```
   Station      Latitude        Longitude          Larvae
 COT002 : 1   Min.   :-19.10   Min.   :145.5   Min.   : 0.000
 COT003 : 1   1st Qu.:-16.98   1st Qu.:145.6   1st Qu.: 0.000
 COT004 : 1   Median :-15.92   Median :145.8   Median : 4.450
 COT005 : 1   Mean   :-16.43   Mean   :145.9   Mean   : 8.964
 COT006 : 1   3rd Qu.:-15.64   3rd Qu.:146.2   3rd Qu.:11.400
 COT012 : 1   Max.   :-15.55   Max.   :146.9   Max.   :55.300
 (Other):22
```

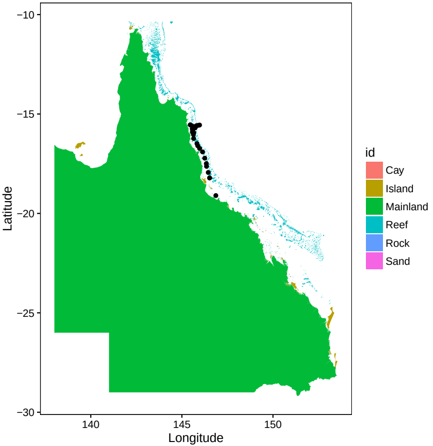
Mapping data

```
> ggplot(cots, aes(y=Latitude,x=Longitude)) +
+     geom_point() + theme_classic() +
+         theme(panel.background=element_rect(fill=NA, color='black'))
```



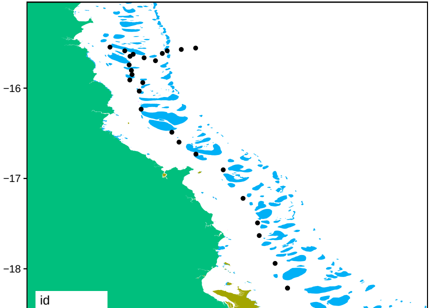
Mapping data

```
> ggplot(cots, aes(y=Latitude,x=Longitude)) +
+     geom_polygon(data=gbr.df, aes(y=lat, x=long, fill=id, group=group)) +
+     geom_point() + theme_classic() +
+         theme(panel.background=element_rect(fill=NA, color='black'))
```



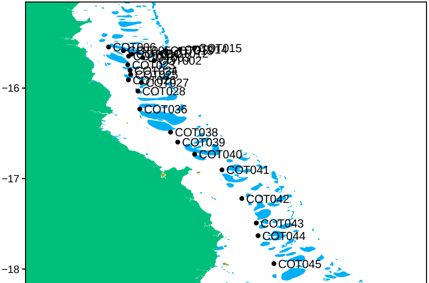
Mapping data

```
> bb = as(raster::extent(cbind(cots$Longitude,cots$Latitude))+1,
+     "SpatialPolygons")
> gbr.cots.sp <- raster::intersect(gbr.sp, bb)
> gbr.cots.df <- tidy(gbr.cots.sp, region='FEAT_NAME')
> ggplot(cots, aes(y=Latitude,x=Longitude)) +
+  geom_polygon(data=gbr.cots.df, aes(y=lat, x=long, fill=id, group=group))
+  geom_point() +
+  geom_rect(aes(ymin=-Inf, xmin=-Inf, ymax=Inf, xmax=Inf),
+              fill=NA, color='black')+
+  scale_x_continuous('', expand=c(0,0)) +
+  scale_y_continuous('', expand=c(0,0)) +
+  theme_classic() +
+  theme(legend.position=c(0,0), legend.justification=c(0,0))
```

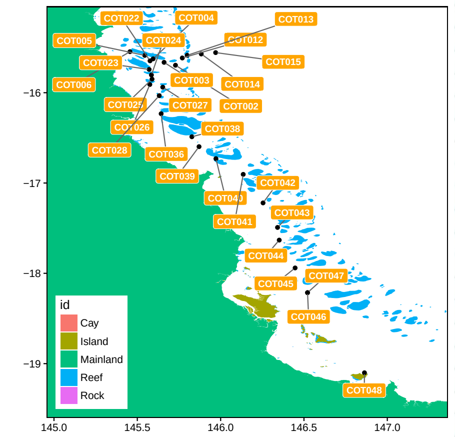


Mapping data

```
> bb = as(raster::extent(cbind(cots$Longitude,cots$Latitude))+1,
+     "SpatialPolygons")
> gbr.cots.sp <- raster::intersect(gbr.sp, bb)
> gbr.cots.df <- tidy(gbr.cots.sp, region='FEAT_NAME')
> ggplot(cots, aes(y=Latitude,x=Longitude)) +
+  geom_polygon(data=gbr.cots.df, aes(y=lat, x=long, fill=id, group=group))
+  geom_point() +
+  geom_text(aes(label=Station),hjust=-0.1) +
+  geom_rect(aes(ymin=-Inf, xmin=-Inf, ymax=Inf, xmax=Inf),
+              fill=NA, color='black')+
+  scale_x_continuous('', expand=c(0,0)) +
+  scale_y_continuous('', expand=c(0,0)) +
+  theme_classic() +
+  theme(legend.position=c(0,0), legend.justification=c(0,0))
```

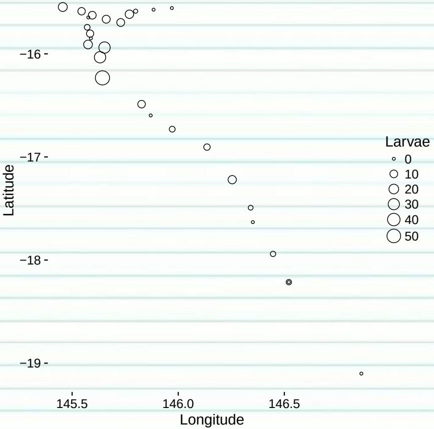


Mapping data



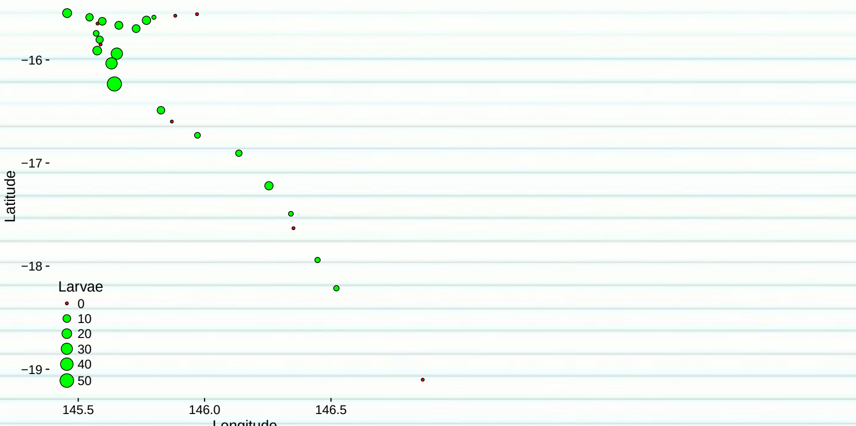
Mapping data

```
> ggplot(cots, aes(y=Latitude,x=Longitude)) +
+     geom_point(aes(size=Larvae), pch=21) +
+         theme(panel.background=element_rect(fill=NA, color='black'))
```

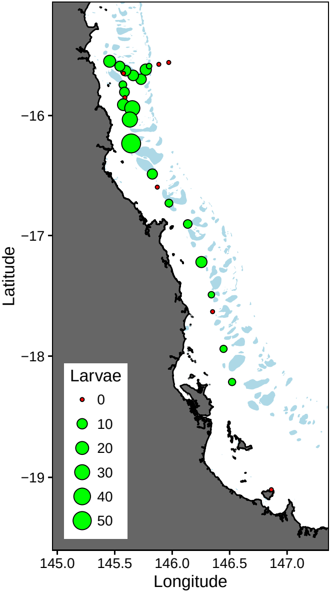


Mapping data

```
> cots = cots %>% mutate(Present=ifelse(Larvae==0,'N','Y'))
> ggplot(cots, aes(y=Latitude,x=Longitude)) +
+   geom_point(aes(size=Larvae, fill=Present), pch=21) +
+   scale_fill_manual(values=c('red','green'),guide=FALSE)+
+   guides(size=guide_legend(override.aes=list(fill=c('red',rep('green',5))
+   theme(plot.background=element_rect(fill=NA,color='black'),
+         panel.background=element_rect(fill=NA, color='black'),
+         legend.position=c(0,0),legend.justification=c(0,0))
```

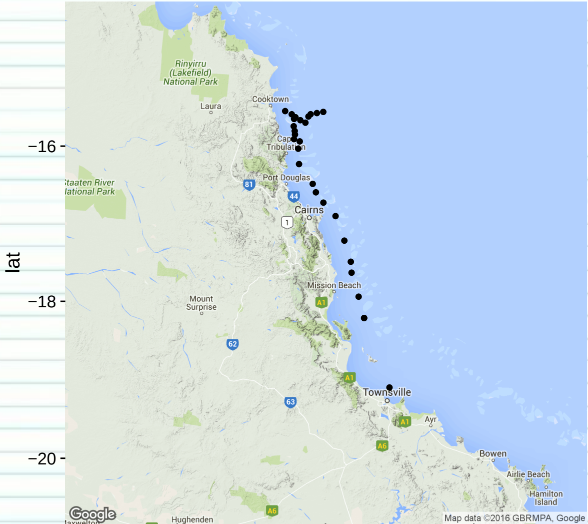


Mapping data



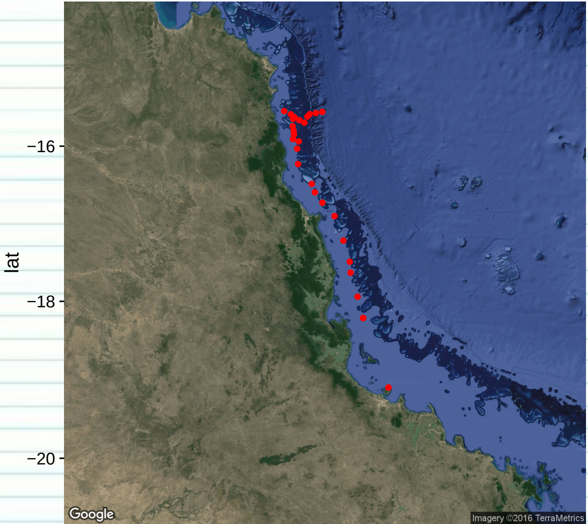
Rasters

```
> library(ggmap)
> terrain <- get_map(location=c(146,-17.5), zoom=7, maptype="terrain")
> ggmap(terrain) +
+     geom_point(data=cots, aes(y=Latitude,x=Longitude))
```



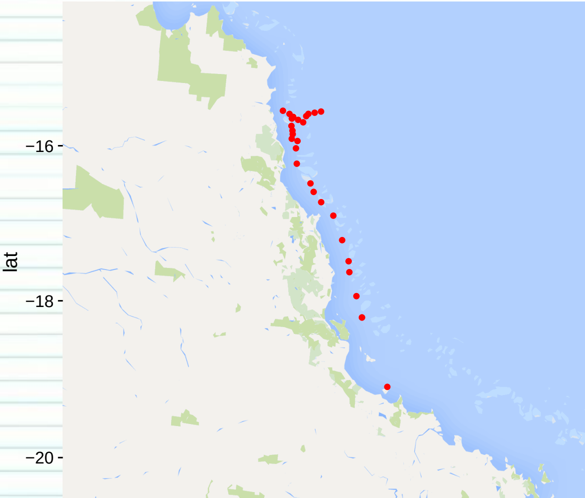
Rasters

```
> library(ggmap)
> satellite <- get_map(location=c(146,-17.5), zoom=7, maptype="satellite")
> ggmap(satellite) +
+     geom_point(data=cots, aes(y=Latitude,x=Longitude), color='red')
```

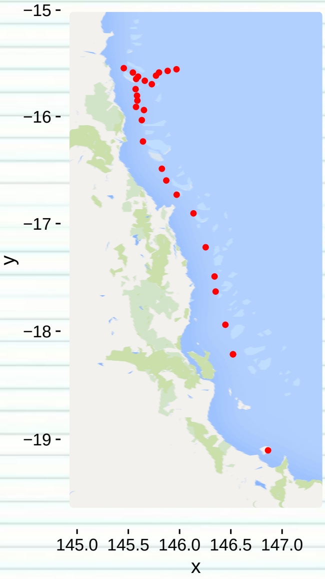


Rasters

```
> library(ggmap)
> map <- get_googlemap(center=c(146,-17.5), scale=2,zoom=7, maptype="roadma
+   style='feature:road|visibility:off&style=element:labels|visibility:off
> ggmap(map) +
+   geom_point(data=cots, aes(y=Latitude,x=Longitude), color='red')
```

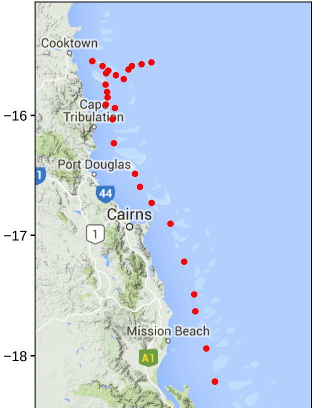


Rasters

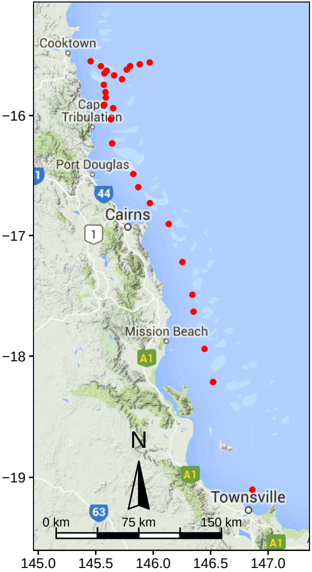


Rasters

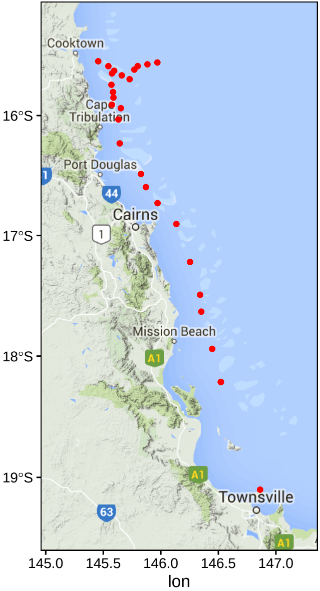
```
> library(ggmap)
> ggmap(terrain) +
+     geom_point(data=cots, aes(y=Latitude,x=Longitude), color='red')+
+         geom_rect(aes(ymin=-Inf, xmin=-Inf, ymax=Inf, xmax=Inf),
+                   fill=NA, color='black')+
+             scale_x_continuous('',expand=c(0,0))+
+                     scale_y_continuous('',expand=c(0,0))+
+             coord_map(xlim=c(144.956, 147.363), ylim=c(-19.601, -15.0455)
+                 theme_classic()
```



Rasters


Cooktown
Cape Tribulation
Port Douglas
Cairns
Mission Beach
Townsville
44
1
A1
63
N
0 km
75 km
150 km
−16
−17
−18
−19
145.0
145.5
146.0
146.5
147.0

Rasters


Cooktown
Cape Tribulation
Port Douglas
44
Cairns
1
Mission Beach
A1
A1
Townsville
63
A1
16°S
17°S
18°S
19°S
145.0
145.5
146.0
146.5
147.0
lon