Visualizing the data

2024-09-01

Let's load in the `terra` package necessary for handling GIS data with R.

```
library(terra)
```

```
## terra 1.7.78
```

read in the csv data

```
hanko1 <- read.csv("../data/hanko1/velmu.to.Obama.2023-06-19.csv", header = TRUE,sep=",")
hanko1[1:5,1:5]
```

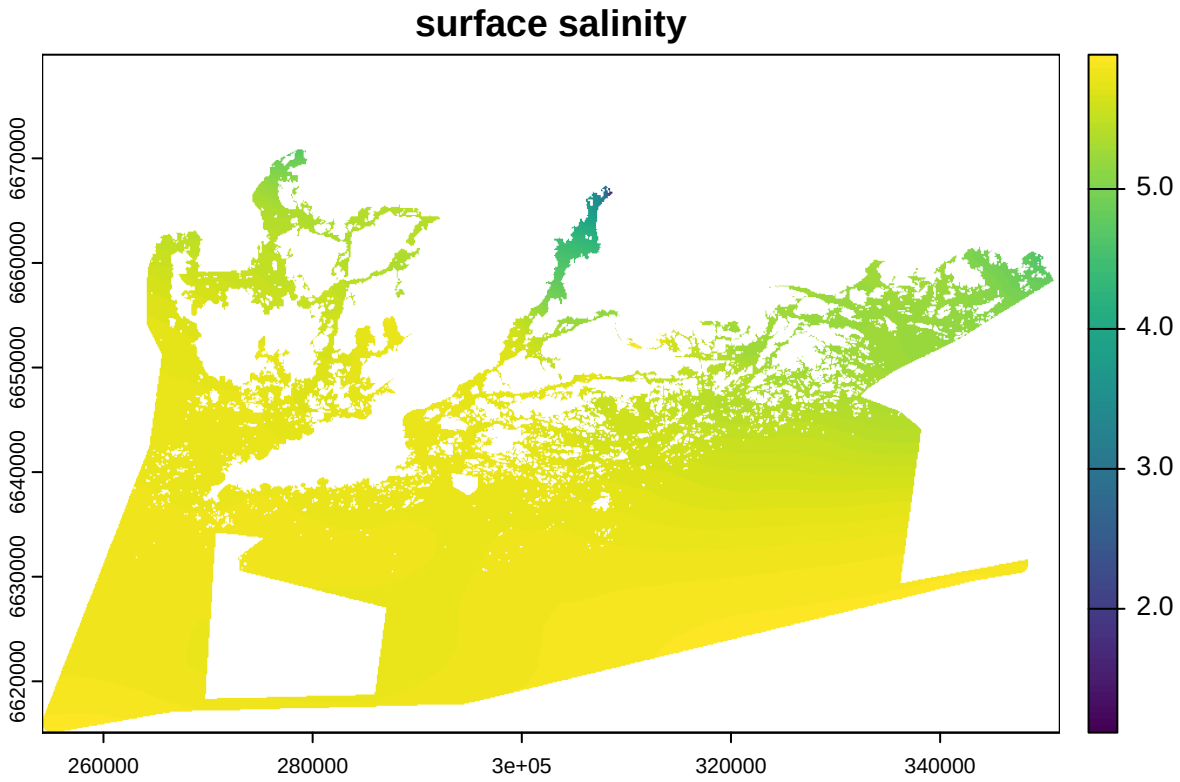
```
##       X ID      sal surf_expo     turb
## 1 53311  1 5.290101      2012 2.492146
## 2 53312  2 5.289857      1994 2.491140
## 3 53313  3 5.290559      1942 2.491786
## 4 53314  4 5.290802      1948 2.492746
## 5 53315  5 5.290930      1943 2.503943
```

Visualize the raster layers

```
sal.rast <- rast("../data/hanko1/sal_rasters_Obama.2023-06-19.tif")
sal.rast
```

```
## class       : SpatRaster
## dimensions  : 3241, 4865, 1  (nrow, ncol, nlyr)
## resolution  : 20, 20  (x, y)
## extent      : 254136, 351436, 6615091, 6679911  (xmin, xmax, ymin, ymax)
## coord. ref. : ETRS89 / TM35FIN(E,N) (EPSG:3067)
## source      : sal_rasters_Obama.2023-06-19.tif
## name        :       sal
## min value   : 0.1084427
## max value   : 5.9600401
```

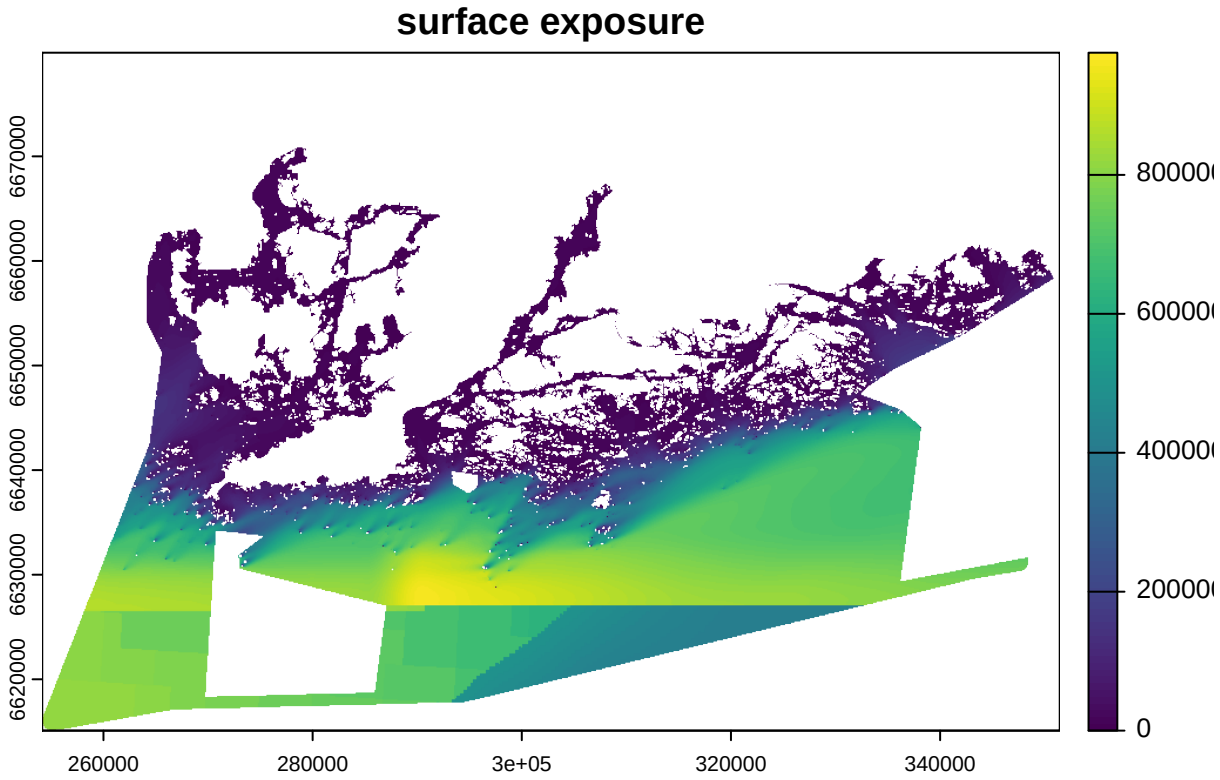
```
plot(sal.rast, main = "surface salinity")
```




```
surf_expo.rast <- rast("../data/hanko1/surf_expo_rasters_Obama.2023-06-19.tif")
surf_expo.rast
```

```
## class       : SpatRaster
## dimensions  : 3241, 4865, 1  (nrow, ncol, nlyr)
## resolution  : 20, 20  (x, y)
## extent      : 254136, 351436, 6615091, 6679911  (xmin, xmax, ymin, ymax)
## coord. ref. : ETRS89 / TM35FIN(E,N) (EPSG:3067)
## source      : surf_expo_rasters_Obama.2023-06-19.tif
## name        : surf_expo
## min value   :       0.0
## max value   :  976221.9
```

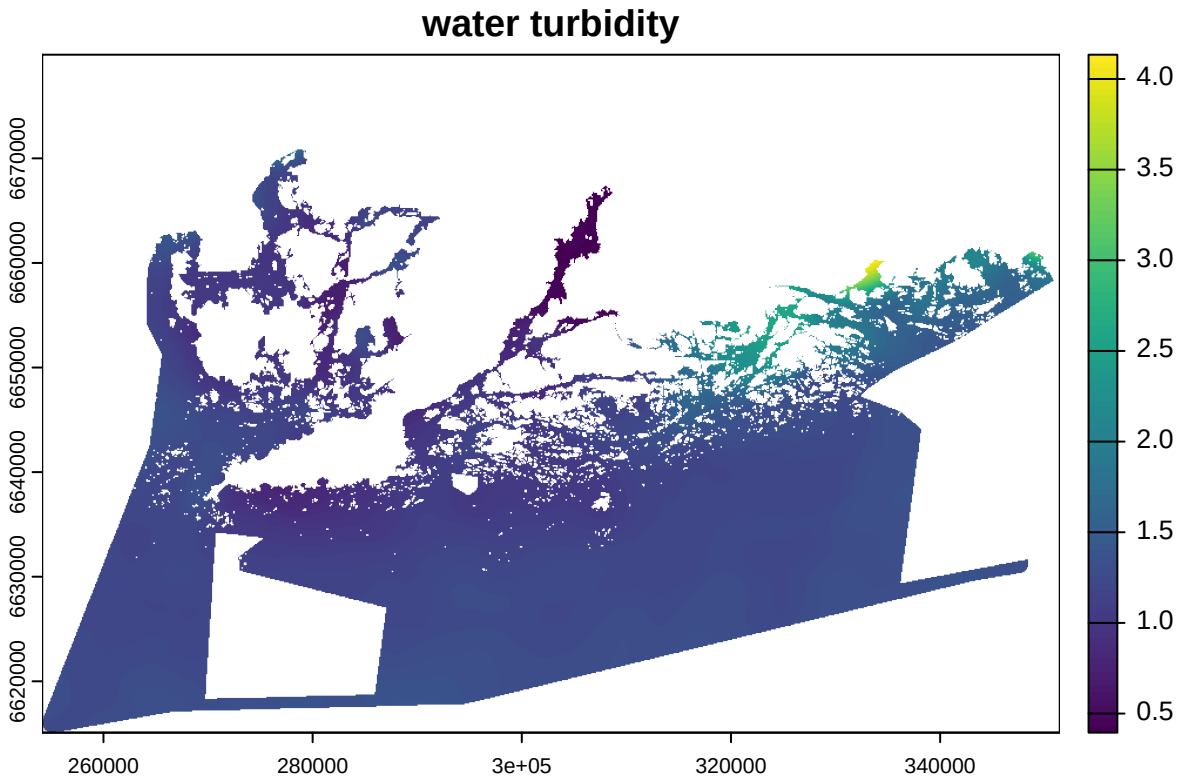
```
plot(surf_expo.rast, main = "surface exposure")
```




```
turb.rast <- rast("../data/hanko1/turb_rasters_Obama.2023-06-19.tif")
turb.rast
```

```
## class       : SpatRaster
## dimensions  : 3241, 4865, 1  (nrow, ncol, nlyr)
## resolution  : 20, 20  (x, y)
## extent      : 254136, 351436, 6615091, 6679911  (xmin, xmax, ymin, ymax)
## coord. ref. : ETRS89 / TM35FIN(E,N) (EPSG:3067)
## source      : turb_rasters_Obama.2023-06-19.tif
## name        :      turb
## min value   : 0.3948421
## max value   : 4.1482997
```

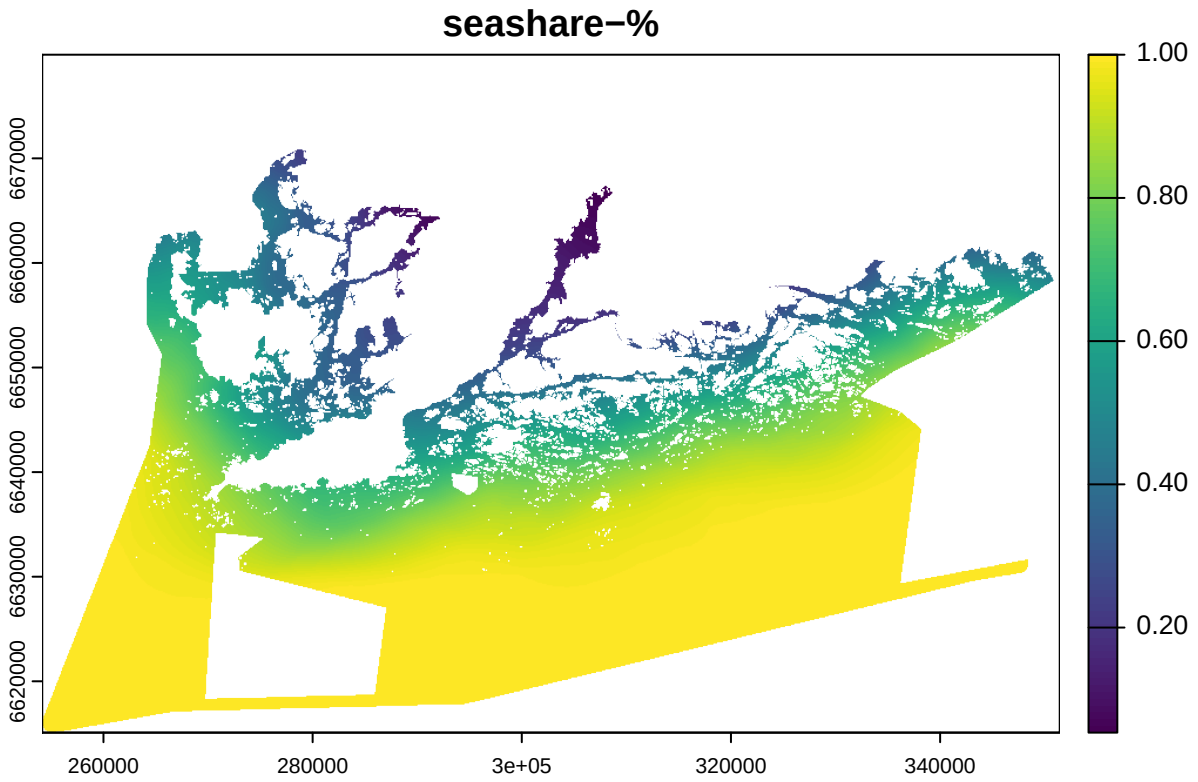
```
plot(turb.rast, main = "water turbidity")
```




```
seashare.rast <- rast("../data/hanko1/seashare_rasters_Obama.2023-06-19.tif")
seashare.rast
```

```
## class       : SpatRaster
## dimensions  : 3241, 4865, 1  (nrow, ncol, nlyr)
## resolution  : 20, 20  (x, y)
## extent      : 254136, 351436, 6615091, 6679911  (xmin, xmax, ymin, ymax)
## coord. ref. : ETRS89 / TM35FIN(E,N) (EPSG:3067)
## source      : seashare_rasters_Obama.2023-06-19.tif
## name        :   seashare
## min value   : 0.05313689
## max value   : 1.00000000
```

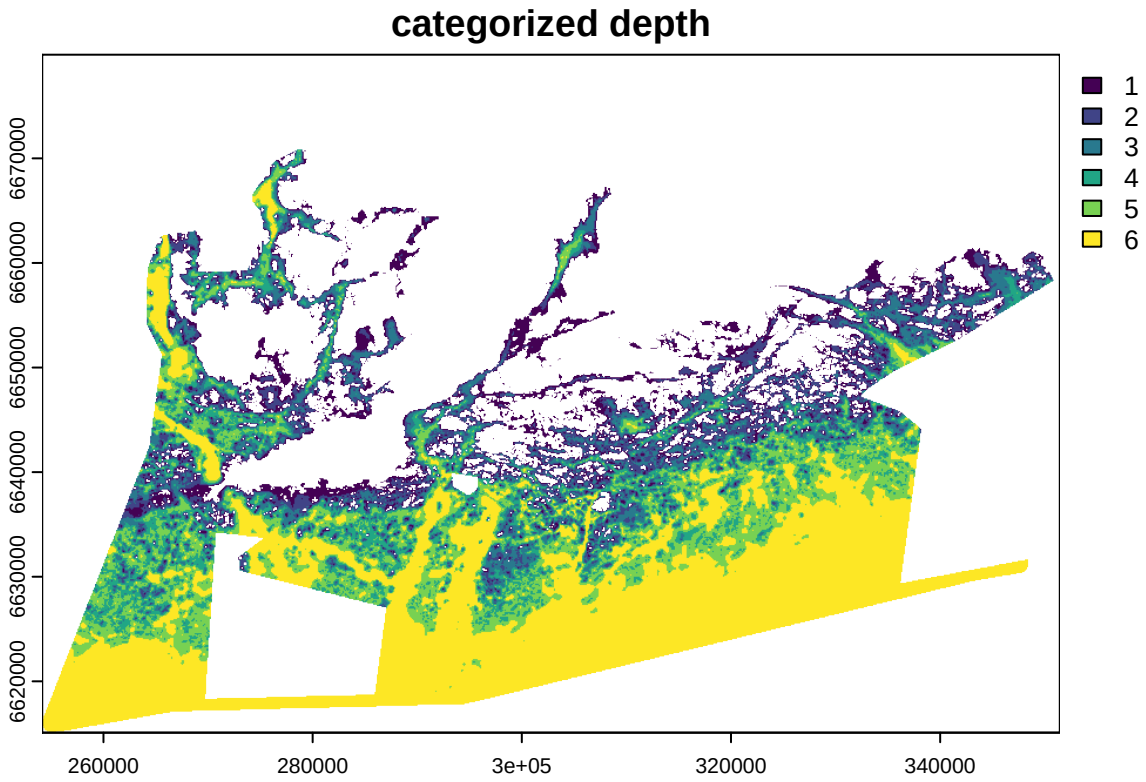
```
plot(seashare.rast, main = "seashare-%")
```




```
depth_class.rast <- rast("../data/hanko1/depth_classes_rasters_Obama.2023-06-19.tif")
depth_class.rast
```

```
## class       : SpatRaster
## dimensions  : 3241, 4865, 1  (nrow, ncol, nlyr)
## resolution  : 20, 20  (x, y)
## extent      : 254136, 351436, 6615091, 6679911  (xmin, xmax, ymin, ymax)
## coord. ref. : ETRS89 / TM35FIN(E,N) (EPSG:3067)
## source      : depth_classes_rasters_Obama.2023-06-19.tif
## name        : depth_classes
## min value   :             1
## max value   :             6
```

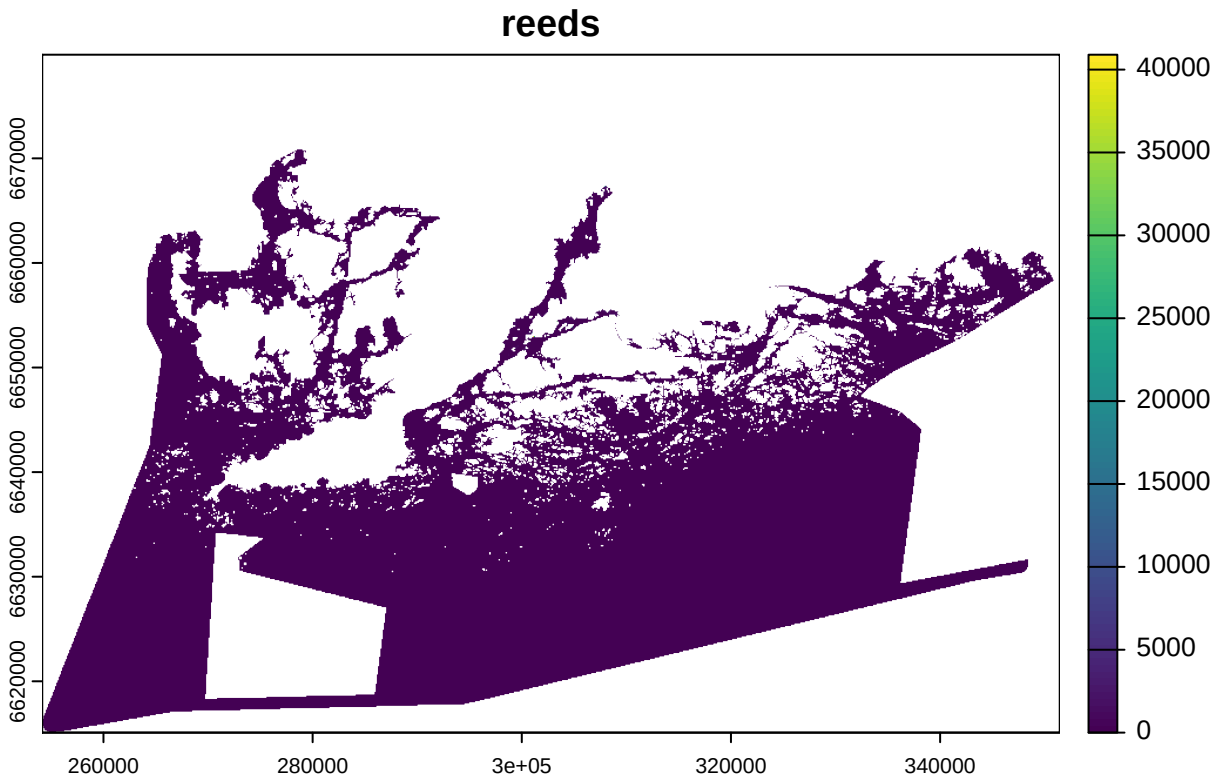
```
plot(depth_class.rast, main = "categorized depth")
```




```
ruov.data <- rast("../data/hanko1/ruov_rasters_Obama.2023-06-19.tif")
ruov.data
```

```
## class       : SpatRaster
## dimensions  : 3241, 4865, 1  (nrow, ncol, nlyr)
## resolution  : 20, 20  (x, y)
## extent      : 254136, 351436, 6615091, 6679911  (xmin, xmax, ymin, ymax)
## coord. ref. : ETRS89 / TM35FIN(E,N) (EPSG:3067)
## source      : ruov_rasters_Obama.2023-06-19.tif
## name        :     ruov
## min value   :     0.00
## max value   : 44061.34
```

```
plot(ruov.data, main = "reeds")
```



See where the sampling locations are. First convert the data to vector data.

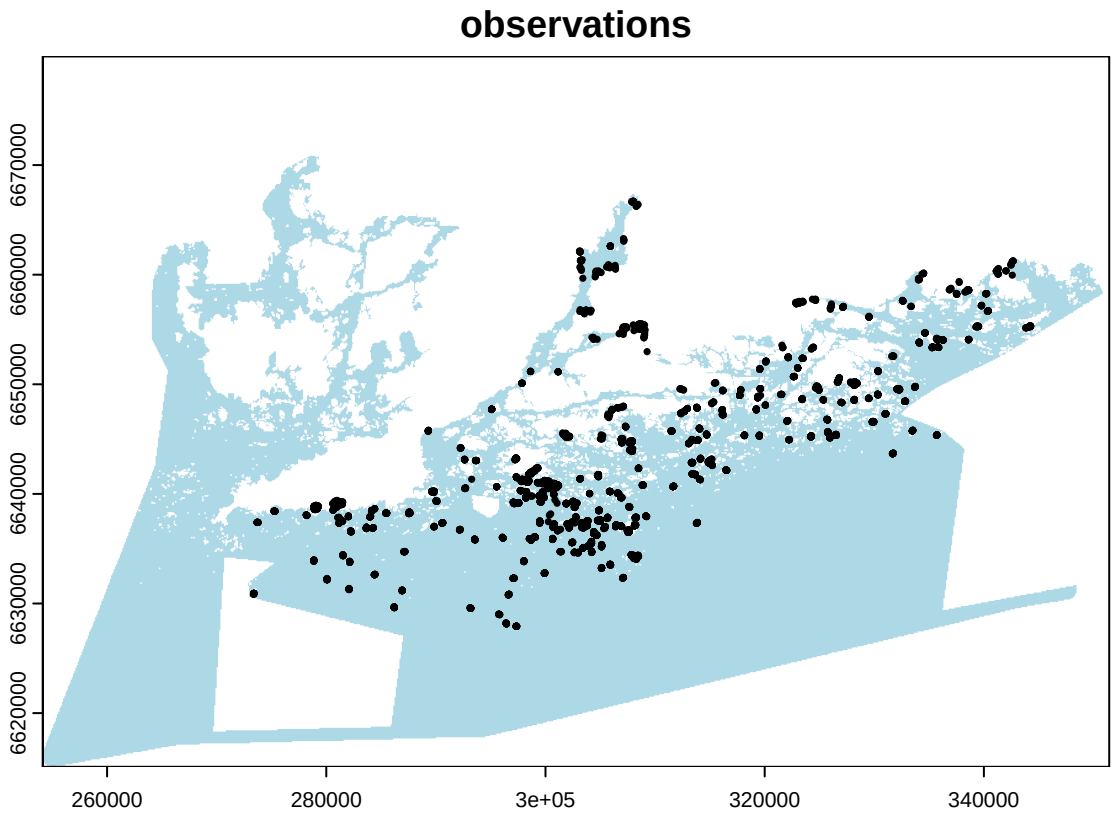
```
hanko1.vect <- vect(hanko1,geom=c("X_coord","Y_coord"),crs=crs(sal.rast))
hanko1.vect
```

```
##  class       : SpatVector
##  geometry    : points
##  dimensions  : 4232, 83  (geometries, attributes)
##  extent      : 273356.6, 344270.5, 6627918, 6666705  (xmin, xmax, ymin, ymax)
##  coord. ref. : ETRS89 / TM35FIN(E,N) (EPSG:3067)
##  names       :     X    ID   sal surf_expo  turb seashare depth_classes  ruov
##  type        : <int> <int> <num>     <num> <num>    <num>         <int> <num>
##  values      : 53311     1  5.29      2012 2.492   0.3306             1     0
##                53312     2  5.29      1994 2.491   0.3316             1     0
##                53313     3 5.291      1942 2.492   0.3334             1     0
##  Alisma.plantago.aquatica Bolboschoenus.maritimus (and 73 more)
##                       <num>                   <num>
##                           0                       0
##                           0                       0
##                           0                       0
```

```
# save the observations if e.g. preferred to visualized in GQIS
writeVector(hanko1.vect, filename = "../shape_files_observations/hanko1/observations.shp", overwrite = T
```

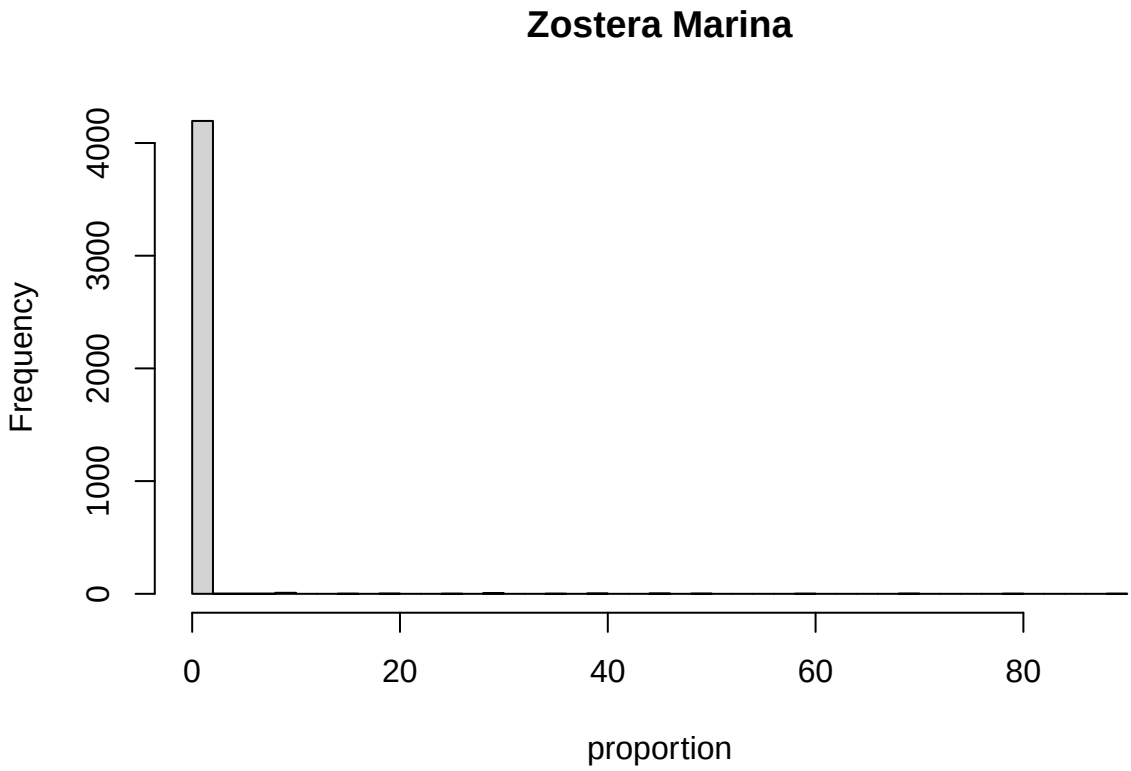
Visualize and add the sampling locations with red.

```
plot(sal.rast, main = "observations", col = "lightblue", legend = FALSE)
plot(hanko1.vect, add = TRUE, col="black",cex = 0.5)
```



Examine one species of interest.

```
hist(hanko1[,"Zostera.marina"],breaks=40,
     main = "Zostera Marina", xlab = "proportion")
```

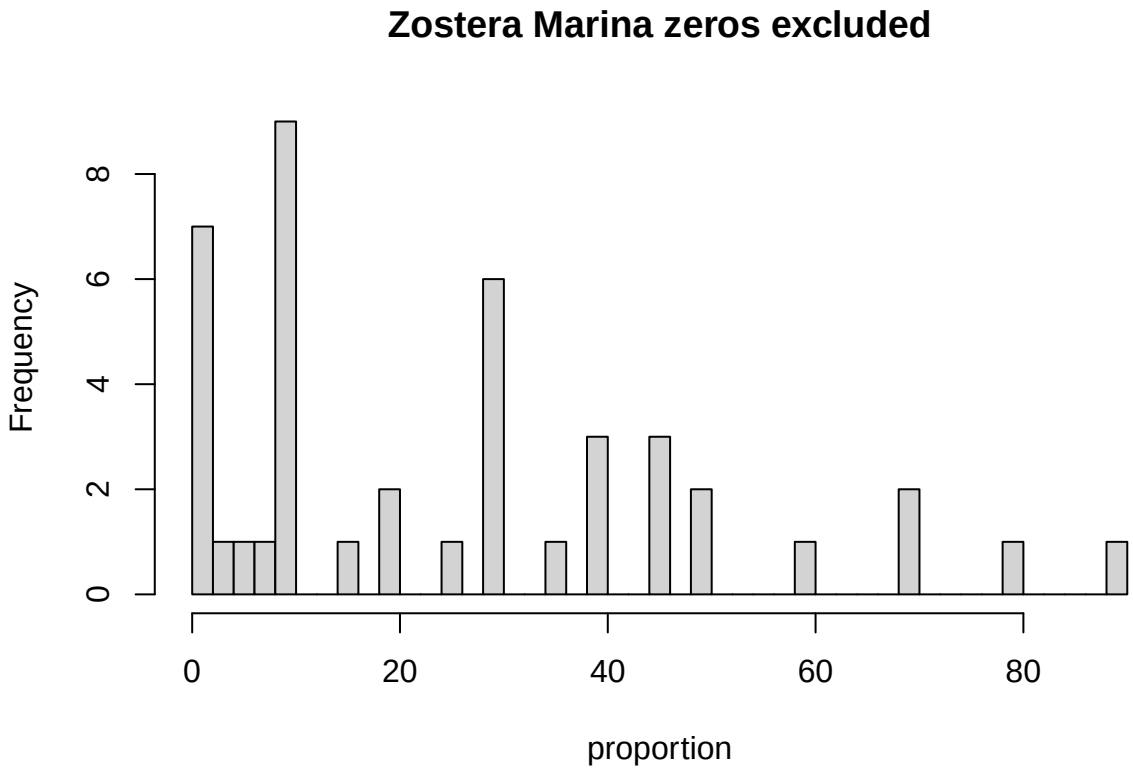


Seems to be mostly zeroes in the data, let's see more accurately.

```
mean(hanko1[,"Zostera.marina"] == 0)
```

```
## [1] 0.9898393
```

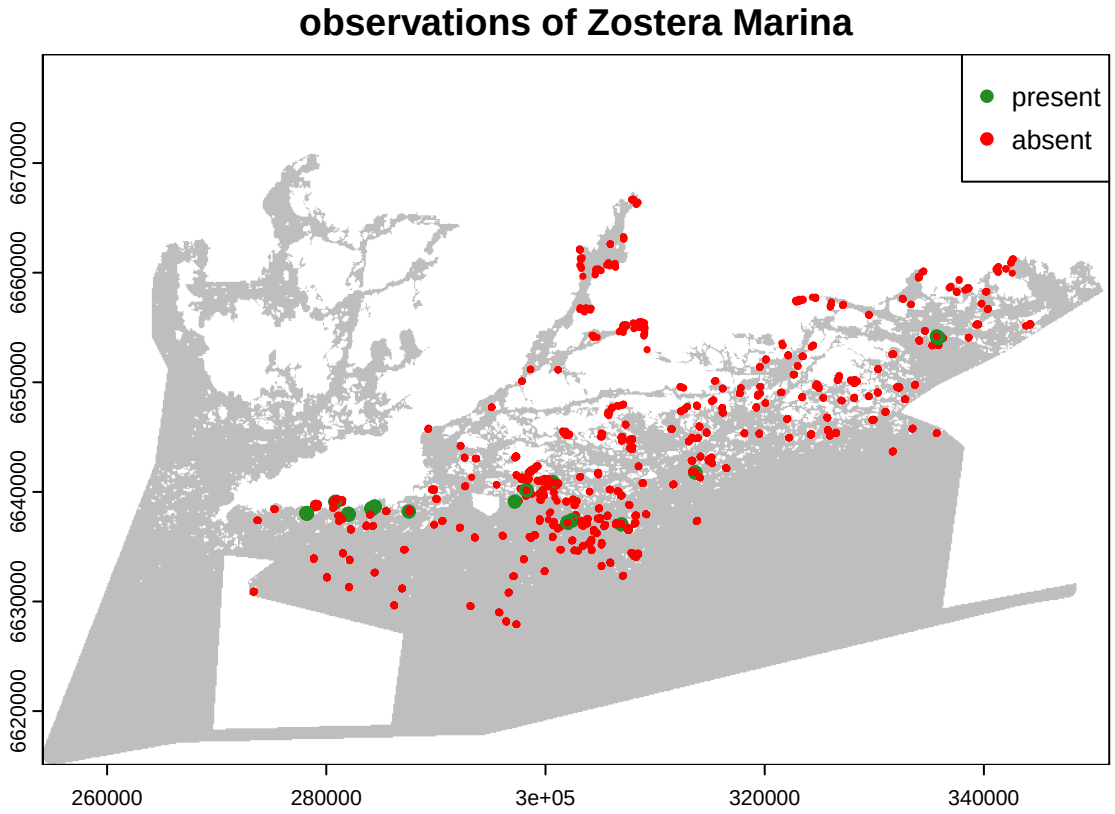
```
hist(hanko1[hanko1[,"Zostera.marina"] != 0,"Zostera.marina"],breaks=40,
     main = "Zostera Marina zeros excluded", xlab = "proportion")
```



Definitely, almost 99% is zero proportions, excluding those give a nice set of proportions from $\approx 0\%$ to $\approx 90\%$

Plot and color with the level of abundance for the certain species

```
plot(sal.rast, main = "observations of Zostera Marina", col = "grey", legend = FALSE)
plot(hanko1.vect, col = c("forestgreen","red")[(hanko1[,"Zostera.marina"] == 0) + 1],
     cex = c(1,0.5)[(hanko1[,"Zostera.marina"] == 0) + 1], add = TRUE)
legend(338000,6680000, legend = c("present","absent"), pch = 19, col = c("forestgreen","red"), cex = 0.8
```



Check what generally are the prevalences of the species?

```
apply(hanko1[,9:80], 2, function(col) (100*mean(col != 0)))
```

```
##       Alisma.plantago.aquatica        Bolboschoenus.maritimus
##                     0.18903592                     0.09451796
##             Butomus.umbellatus                Calla.palustris
##                     0.04725898                     0.02362949
##    Callitriche.hermaphroditica          Callitriche.palustris
##                     0.63799622                     0.09451796
##               Caltha.palustris         Ceratophyllum.demersum
##                     0.09451796                     8.15217391
##                  Chara.aspera                   Chara.baltica
##                     2.19754253                     0.28355388
##                 Chara.canescens                Chara.globularis
##                     1.20510397                     0.73251418
##                 Chara.tomentosa                  Chara.virgata
##                     0.51984877                     0.25992439
##           Eleocharis.mamillata           Eleocharis.palustris
##                     0.02362949                     0.07088847
##             Eleocharis.parvula           Eleocharis.uniglumis
##                     0.09451796                     0.21266541
##               Elodea.canadensis              Equisetum.arvense
##                     0.14177694                     0.02362949
##           Equisetum.fluviatile             Equisetum.palustre
##                     0.04725898                     0.04725898
##              Hippuris.vulgaris           Iso.tes.echinospora
##                     0.09451796                     0.14177694
##                    Lemna.minor                   Lemna.trisulca
```

```
##                   0.07088847                   0.66162571
##           Lysimachia.maritima        Lysimachia.thyrsiflora
##                   0.09451796                   0.47258979
##           Lysimachia.vulgaris    Myriophyllum.alterniflorum
##                   0.35444234                   0.11814745
##        Myriophyllum.sibiricum         Myriophyllum.spicatum
##                   3.37901701                  12.59451796
##    Myriophyllum.verticillatum                 Najas.marina
##                   0.47258979                   4.22967864
##          Nitella.wahlbergiana            Nitellopsis.obtusa
##                   0.04725898                   0.44896030
##                 Nuphar.lutea                 Nymphaea.alba
##                   0.54347826                   0.16540643
##              Nymphaea.candida           Persicaria.amphibia
##                   0.25992439                   0.02362949
##         Persicaria.hydropiper          Phragmites.australis
##                   0.04725898                   4.08790170
##       Potamogeton.berchtoldii           Potamogeton.friesii
##                   0.04725898                   0.18903592
##         Potamogeton.gramineus            Potamogeton.natans
##                   0.02362949                   0.04725898
##      Potamogeton.obtusifolius       Potamogeton.perfoliatus
##                   0.14177694                  11.90926276
##       Potamogeton.praelongus          Potamogeton.pusillus
##                   0.02362949                   0.33081285
##           Potamogeton..nitens           Ranunculus.baudotii
##                   0.04725898                   1.51228733
##         Ranunculus.circinatus             Ranunculus.repens
##                   2.36294896                   0.02362949
##     Ranunculus.schmalhausenii               Ruppia.maritima
##                   0.14177694                   0.70888469
##              Ruppia.spiralis       Sagittaria.sagittifolia
##                   0.54347826                   0.28355388
##      Schoenoplectus.lacustris Schoenoplectus.tabernaemontani
##                   0.21266541                   0.63799622
##          Stuckenia.filiformis           Stuckenia.pectinata
##                   0.18903592                  18.33648393
##            Subularia.aquatica                     Tolypella
##                   0.02362949                   1.22873346
##           Triglochin.maritima           Typha.angustifolia
##                   0.02362949                   0.33081285
##              Typha.latifolia          Utricularia.vulgaris
##                   0.04725898                   0.07088847
##          Utricularia.neglecta            Zannichellia.major
##                   0.02362949                   1.20510397
##        Zannichellia.palustris                Zostera.marina
##                   2.69376181                   1.01606805
```