Geodatabases and Visualisation

There are plenty of different ways to tap resources on the internet, merge them, plot them, map them. There is thus no right or wrong way, but some are more flexible and extendable than others.

Accessing databases can be done in two ways: download everything and work locally, or send queries to the database and let it do the data munging. The former is more convenient with small data sets (say, up to a few Gbs), while the latter is better for larger and constantly updated databases (that is: the better way overall). However, it makes sense to develop all stats and mapping locally before drowning the data server in half-baked queries.

Interfaces to data bases are often specific (and are called API for "application programming interface") and *here* we shall not bother with developing, only with using them.

Some generally useful R resources for data bases, for plotting and for maps:
ALWAYS have a look at **CRAN task views**:

- "web technologies" for handling information on web pages: https://cran.r-project.org/web/views/WebTechnologies.html
- "spatial" for analysing and visualising spatial data: https://cran.r-project.org/web/views/Spatial.html

Data base interfaces are in constant flux, and there is no single entry point. Here are some options:

- http://www.datacarpentry.org/R-ecology-lesson/05-r-and-databases.html
- https://db.rstudio.com/
- https://cran.r-project.org/web/packages/dbplyr/vignettes/dbplyr.html
- https://www.ibm.com/developerworks/data/library/techarticle/dm-1402db2andr/

Mapping

- cengel.github.io/rspatial/4_Mapping.nb.html
- https://cran.r-project.org/web/packages/tmap/vignettes/tmap-nutshell.html
- https://rstudio.github.io/leaflet/
- leaflet interactive with shiny (https://rstudio.github.io/leaflet/shiny.html)

(Links do not imply that the resource or products are endorsed!)

Project 1: Sea around us (SAU)

"Sea around us" is a "big data fishery" initiative of the UBC, providing global data on fish population sizes, catch, fishing gear, environment and so forth. SAU offers various visualisation tools on their homepage.

This project shall attempt to provide analysis and visualisation for some ecological questions.

Sources: www.seaaroundus.org provides the API to SAU
R-packages: **seaaroundus** on github (ropensci)

Possible questions:

1. Visualize who is catching how much globally:

   Plot a stacked chart of all catches ("tonnes") over the years, grouped by "fishing_entity"→ compare to the plot on the website. Realize, that it is hard to read and sum up countries, who fish less than an average of 2,000,000 tonnes per year to a group, called "Other countries".

2. Quantify by-catch ratios:

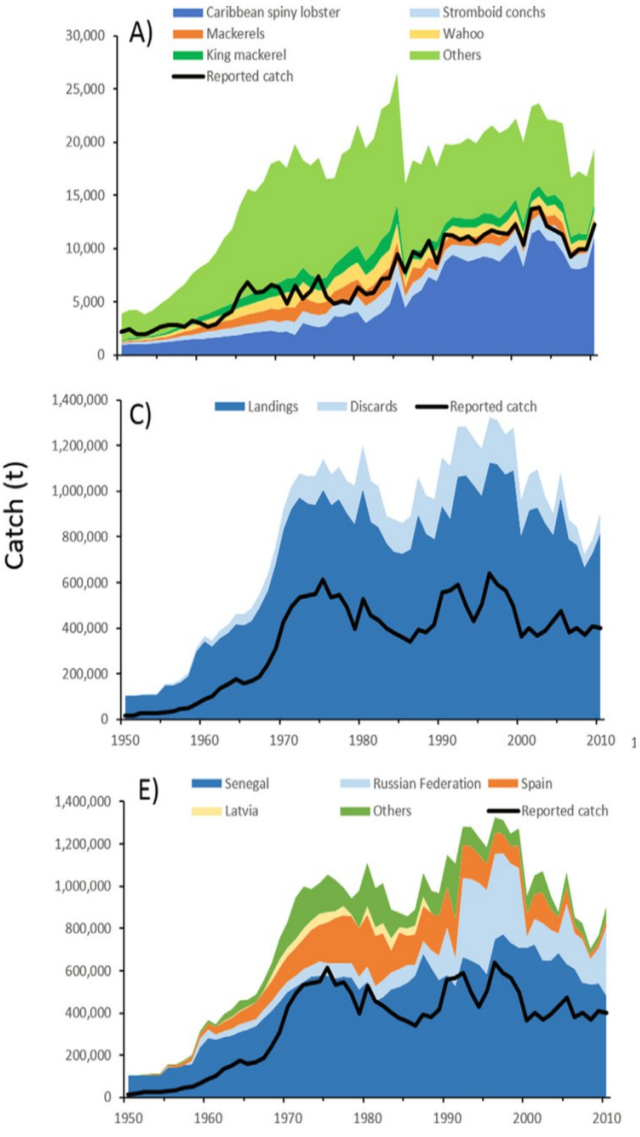
   Plot again, this time grouped by "catch_type" and with a percentage scale on the y-axis (instead of tonnes): landings vs. discards. Years on the x-axis.

3. Filter data for the *fishing_entity* "Germany".

   Plot it´s *fishing_sector* compositions over the years, from 1960-2010. Exclude "Industrial" from the plot to see smaller sectors better.

4. Filter data for the *fishing_entity* "Germany".

   Plot it´s *area_name* compositions over the years, in order to visualize where the german fleet is fishing how much.



Zeller, D. et al. (2016) Still catching attention: Sea Around Us reconstructed global catch data, their spatial expression and public accessibility. *Marine Policy*, 70, 145–152

Project 2: Marine mammal threats

In her PhD thesis, Isabel Avila produced a database of reported threats to marine mammals (Avila et al. 2018). It lists, for each of >100 species, threats in different categories (e.g. fishery, pollution, traffic). The data are spatially organised according to countries and so-called Longhurst cells (which define marine ecoregions).

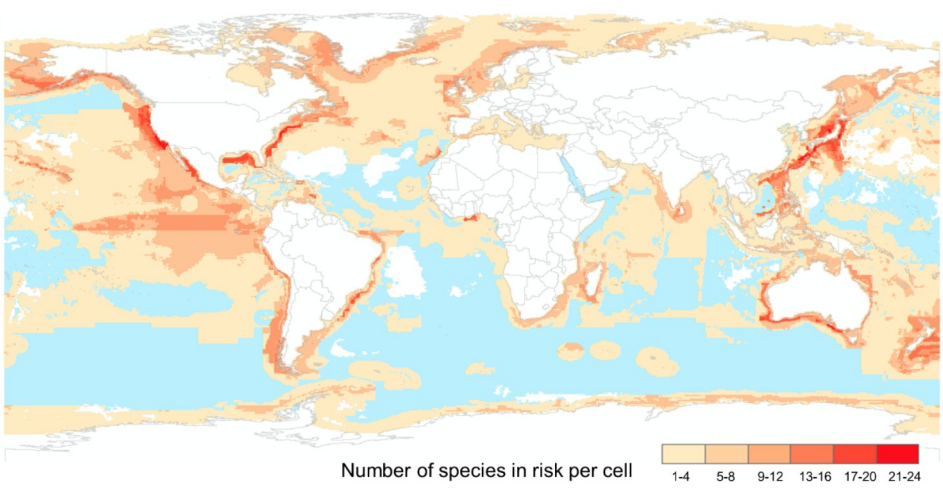
This project shall provide automatised maps of threats by species, either by country, by Longhurst cell, or their combination. To do so, the distribution of each species has to be taken into account!

Sources:

http://www.biom.uni-freiburg.de/MarineMammalThreatDatabase/Database_Excel/view

Aquamaps (distribution information): http://aquamaps.org/

Longhurst regions and EEZ (= countries): http://www.marineregions.org/downloads.php



Avila, I., Kaschner, K., & Dormann, C.F. (2018) Current global risks to marine mammals: taking stock of threats. *Biological Conservation*, accepted for publication

SEAAROUNDUS

Note: Github mentions issues for plotting functions on Windows.

Examples: https://github.com/ropensci/seaaroundus

```
#install required packages
install.packages("devtools")
devtools::install_github("ropensci/seaaroundus")


#load the seaaroundus package
library(seaaroundus)


#list the assigned IDs for each Exclusive Economic Zone (EEZ). NB: The EEZ is the zone adjacent to the coast, in which the corresponding country has the sovereign right to fish.
listregions('eez')


#pick e.g. Cuba´s ID from the list and print catch data in tonnes, grouped by commercial taxon groups
catchdata("eez",192,measure= "tonnage",dimension = "commercialgroup")


#..or it´s value in US dollar
catchdata("eez",192,measure="value",dimension = "commercialgroup")


#see which country is fishing how much within the EEZ of Cuba
catchdata("eez",192,measure = "tonnage",dimension = "country")


#plot Cuba´s catch data via chart-function
catchdata("eez",192,measure="tonnage",dimension = "commercialgroup", chart=TRUE)


#see reporting status (visualize illegal, unreported and unregulated fishing activities)
catchdata("eez",192,measure = "tonnage",dimension = "reporting-status")


#see sector distributions:
#Industrial: large ships, commercial.
#Artisanal: small-scale, small boats, commercial (local markets, etc.).
#Recreational : Fishing for pleasure, small-scale.
#Subsistence: Fishing for food, no commercial interest.
catchdata("eez",192,measure = "tonnage",dimension = "sector")


#plot a map of Cuba´s region
regionmap("eez", 192)
```