

Estimate the number of mollusc individuals at a given concentration of substrate calcium

David Zelený & Po-Ju Ke

Introduction

Molluscs (snails, bivalves) are invertebrate animals that usually build external calcareous shell from calcium (Ca) available in the habitat. It seems that the concentration of Ca in the water (or soil) is a good predictor of mollusc abundance (and sometimes also mollusc species richness).

Use the dataset about molluscs on spring fens provided below and estimate the number of mollusc individuals at the concentration of Ca = 200 mg/l in water.

Dataset: <https://www.davidzeleny.net/wiki/doku.php/recol:data:molluscs>

What to do

1. Import the `molluscs-fens.txt` and `env-fens.txt` data into R from <https://www.davidzeleny.net/wiki/doku.php/recol:data:molluscs>, using the R code in section “Script for direct import of data to R”. This will create objects `moll` and `env`. The `moll` contains a data frame with mollusc species (in columns) and plots (in rows), and each cell of the data frame represents *the number of mollusc individuals* of given species in a given plot. The `env` data frame contains environmental variables measured in each plot, including concentration of Ca in fen water.
2. First, calculate the total number of mollusc individuals for each plot (rows in `moll` data frame).
3. Calculate the relationship between *the number of mollusc individuals* and the concentration of Ca in the spring fen water (variable `Ca` in `env` data frame). Since both variables have right-skewed distribution of values, you need to log-transform them first (use \log_{10} function on both the number of mollusc individuals and Ca concentration).
4. Calculate linear regression between the log-transformed number of mollusc individuals (dependent variable) and the log-transformed concentration of Ca in fen water (independent variable).
5. Predict the estimated number of mollusc individuals for the concentration of Ca = 200 mg/l.

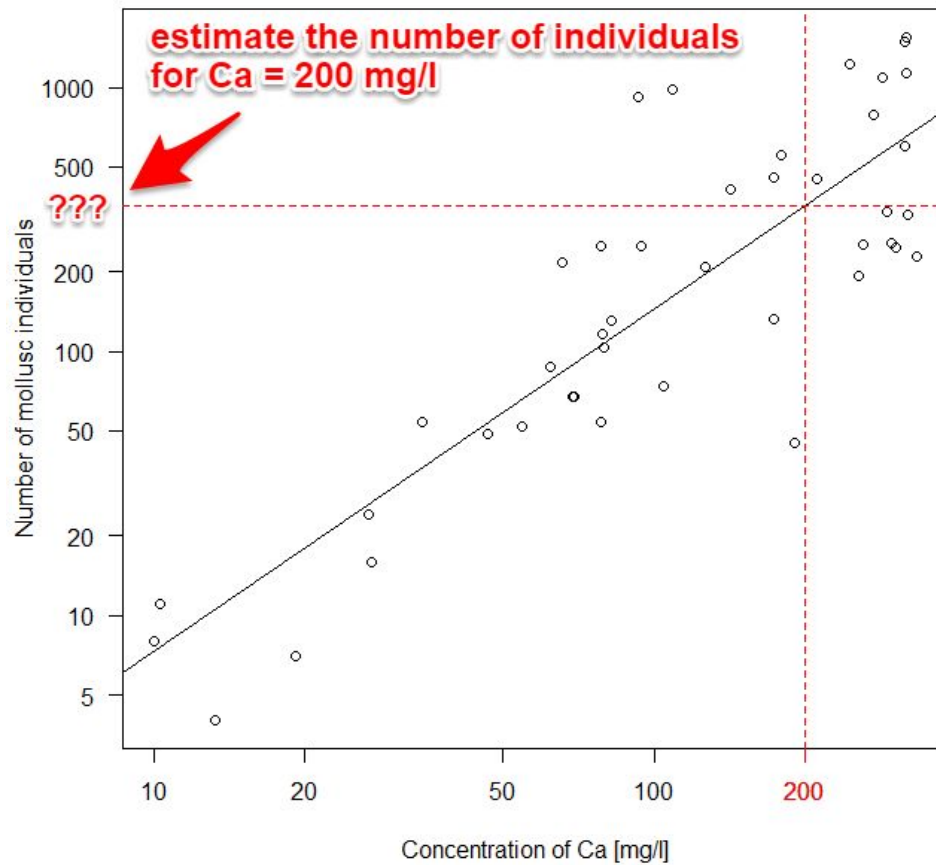
Copy the following code at the end of your R code and replace ?? with calculated values:

```
# R2 = ??  
# F-value = ??  
# P = ??  
# NO.IND_Ca200 = ?? (See the note below)
```

Note: `NO.IND_Ca200` is the number of individuals predicted by the linear model for the concentration of Ca equal to 200 mg/l. Report the real count of individuals, not the logarithmic value which is predicted by the model. The individual value will be larger than 100 and lower

than 500; if the value is lower, then you perhaps forgot to recalculate the logarithm into the exponential form.

The prediction can be visualized using the following schema (note that x- and y-axes are on a log scale, and the ??? is the value you should calculate). You can try to draw also this figure if you want (you get no extra credit for that, just a good feeling that you can accomplish that :)



Hints

1. Import data directly from the link on Internet (using provided code in the Data description).
2. Use `rowSums` (remember that we are not interested in *the number of species*, but in *the number of individuals*).
3. Use `log10`.
4. Use `lm`.
5. Apply function `predict` on results of `lm`, and modify argument `newdata`. Remember that both *number of individuals* and Ca values are log-transformed, and you need to first calculate $\log_{10}(200)$ to log-transform Ca concentration, and then you use this value in `predict` function. The predicted value is \log_{10} of the number of individuals - you need to transform this log-value back into the real number of individuals ($10^{\log.no.ind}$).