EDUARD SZÖCS

QUANTITATIVE ECOTOXICOLOGY

WITH R!

This document was created using LaTeX, knitr and the tufte book class.

Copyright © 2013 Eduard Szöcs

This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 3.0 Unported License.

First draft, October 2013

Contents

1 *Introduction* 9

2 *The Measurement Process* 11

2.1 *Winsorized Mean and Standard Deviation* 11

2.2 *Probability Plotting* 12

3 *Bioaccumulation* 13

4 *Tests for Detection of Chronic Lethal and Sublethal Stress* 15

5 *Lethal and Other Quantal Responses to Stress* 17

5.1 *Fitting dose-response models* 17

6 *Population and Metapopulation Effects* 19

7 *Community Effects* 21

7.1 *Species Richness* 21

7.2 *Analysing mesocosm data* 21

7.3 *Species Sensitivity Distributions* 21

R Session Info 23

List of Figures

2.1 A histogramm of the so4 data. 11

List of Tables

1
Introduction

```
require(devtools)
install_github("qetx", "EDiLD")
```

```
require(qetx)
```

2
The Measurement Process

2.1 *Winsorized Mean and Standard Deviation*

The following sulfate concentrations (mg/L) were measured during a routine water quality survey of the Savannah River (South Carolina). The data is available in the `qetx` package [1]:

[1] Note that in this case you do not have to assign the data to a name.

```
data(so4)
```

```
so4

##  [1] 1.3 2.3 2.6 3.3 3.5 3.5 3.6 4.0 4.1 4.5 5.2 5.6
## [13] 5.7 6.1 6.2 6.5 6.9 7.1 7.7 7.9 9.9

length(so4)

## [1] 21

mean(so4)

## [1] 5.119

sd(so4)

## [1] 2.137
```

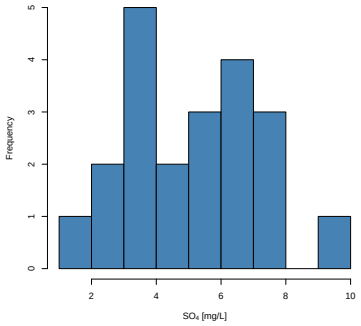

Figure 2.1: A histogramm of the so4 data.

So there are 21 measurements with a mean of 5.1 mg/L and a standard deviation of 2.1 mg/L.

Suppose we have a detection limit of 2.5 mg/L and want to winsorize values below LOD.

To compute winsorized values we use `winsor` function from the `qetx` package. This function takes a vector of values and a second argument specifying how many values should be winsorized (either by giving a LOD-value or the number of values on each side) [2].

[2] Take a look what computations are performed by looking at the source of this function - type the function name into the console

```
so4_w <- winsor(so4, lod = 2.5)
so4_w
```

```
##  [1] 2.6 2.6 2.6 3.3 3.5 3.5 3.6 4.0 4.1 4.5 5.2 5.6
## [13] 5.7 6.1 6.2 6.9 6.5 7.1 7.7 7.7 7.7
## attr(,"width")
## [1] 2
```

```
mean(so4_w)
```

```
## [1] 5.081
```

```
sd(so4_w)
```

```
## [1] 1.792
```

```
sd_winsor(so4_w)
```

```
## [1] 2.24
```

2.2 *Probability Plotting*

3
Bioaccumulation

4
Tests for Detection of Chronic Lethal and Sub-lethal Stress

5
Lethal and Other Quantal Responses to Stress

5.1 Fitting dose-response models

6
Population and Metapopulation Effects

7
Community Effects

7.1 Species Richness

7.2 Analysing mesocosm data

7.3 Species Sensitivity Distributions

R Session Info

```
sessionInfo()

## R version 3.0.2 (2013-09-25)
## Platform: x86_64-pc-linux-gnu (64-bit)
##
## locale:
##  [1] LC_CTYPE=en_US.UTF-8
##  [2] LC_NUMERIC=C
##  [3] LC_TIME=en_US.UTF-8
##  [4] LC_COLLATE=en_US.UTF-8
##  [5] LC_MONETARY=en_US.UTF-8
##  [6] LC_MESSAGES=en_US.UTF-8
##  [7] LC_PAPER=en_US.UTF-8
##  [8] LC_NAME=C
##  [9] LC_ADDRESS=C
## [10] LC_TELEPHONE=C
## [11] LC_MEASUREMENT=en_US.UTF-8
## [12] LC_IDENTIFICATION=C
##
## attached base packages:
## [1] stats     graphics  grDevices utils     datasets
## [6] methods   base
##
## other attached packages:
## [1] qetx_0.0.1 knitr_1.5
##
## loaded via a namespace (and not attached):
## [1] evaluate_0.5.1 formatR_0.9    highr_0.2.1
## [4] stringr_0.6.2  tools_3.0.2
```