Univariate Plots

PH345: Winter 2025

Phil Boonstra

Univariate Plots

Univariate plots are used to visualize the distribution of a single variable.

Examples

- Histograms
- Boxplots
- Barplots

Ultra-runner data (Samtleben, 2023)

$n = 288$ ultra-runners (completing 100km ultra-marathons)

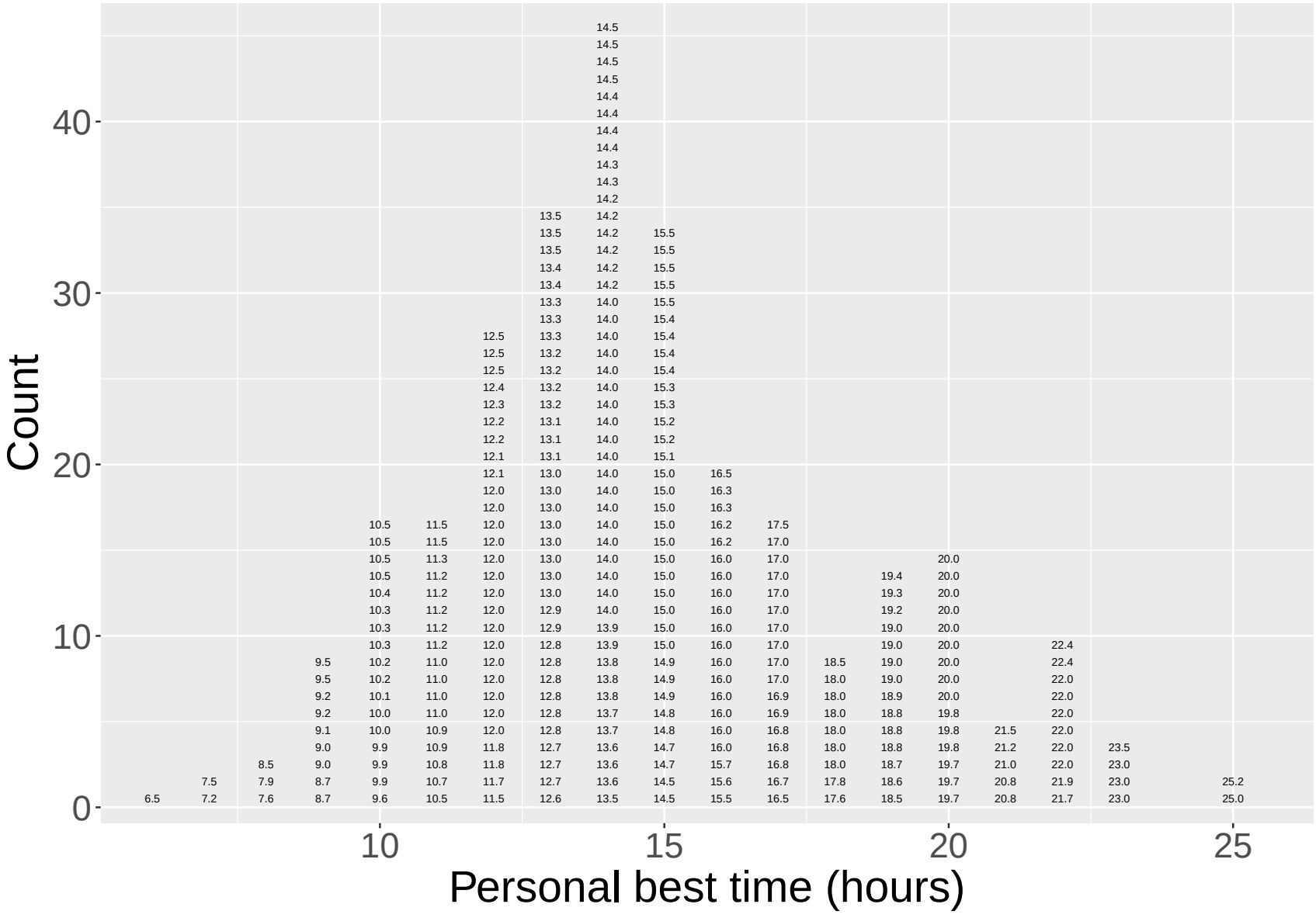
Each runner's personal best (in hours):

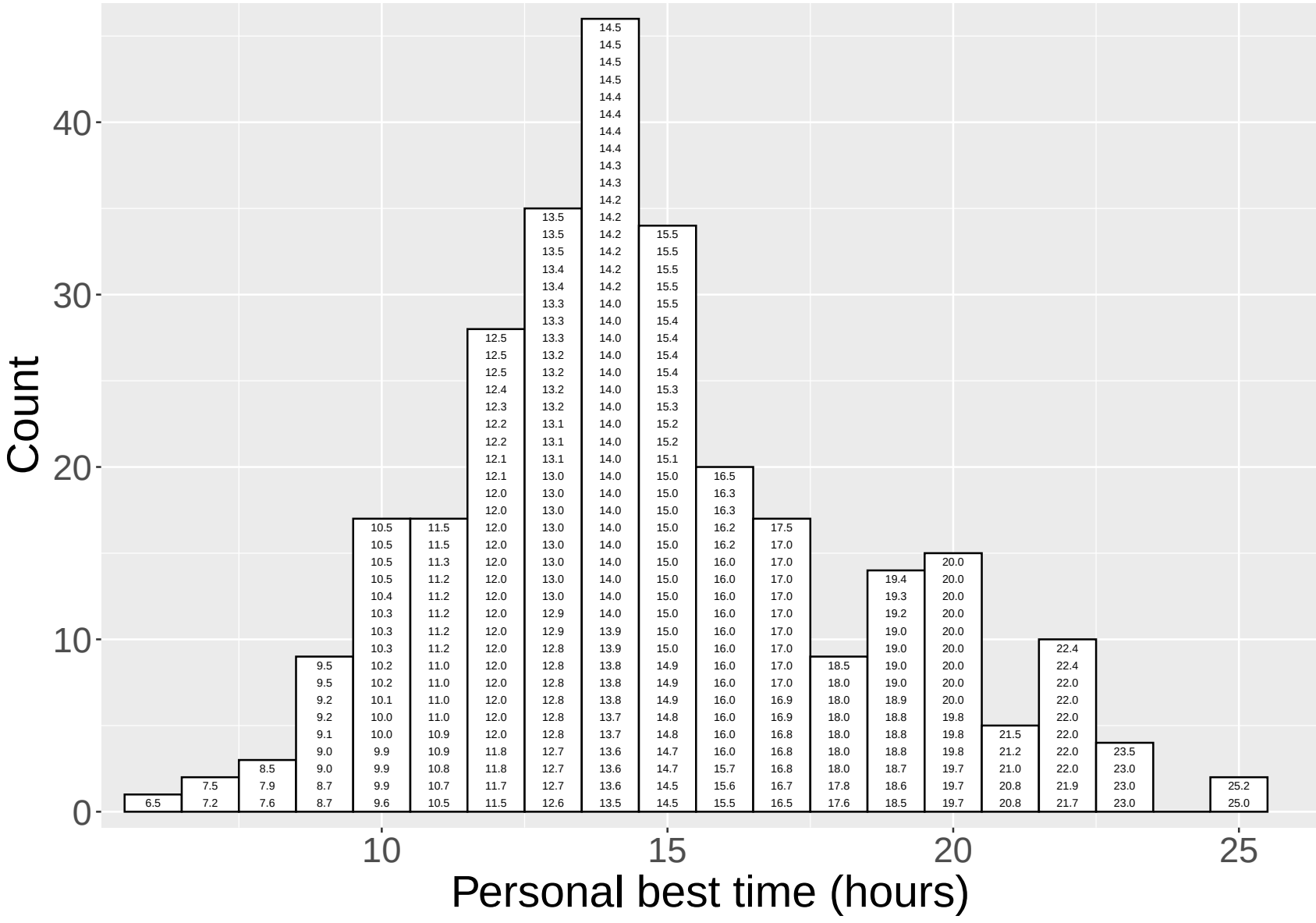
```
14 7.6 14.2 14.33 17 12 16 16.16 9.95 17.55 12.5 23 18.85 8.5 19.33 16 18 12
14.38 15 19.25 14 14.21 14.91 14.5 19 18.5 15 20 12.16 14.82 12.99 13.5 12.98
9.2 10 13.55 14 15 14 22 15.33 15.53 12.26 12 13 10.77 13.98 14 16 12.05 20.83
14 14.3 14.78 13.83 16 12.9 19.67 14 16.67 10.25 15.38 13.35 14 22 7.15 14 12
16 9.5 15.13 12.99 18.77 15 11.25 14 13 14.53 18.75 16 14.5 18.66 15.5 12.77
9.05 16.3 17 22 9.5 15.46 8.7 16.75 12 14.41 10.5 17 11.17 15.5 17 13.86 20
10.45 10.34 13.33 14.5 7.9 11 10.71 12 15.36 19.41 14 9 15.16 12 18.81 10.5 12
14 15 9 20 21.5 11.33 15 21.25 23 22 18.6 21.9 16.16 15.5 13.71 23.5 10.33 8.7
18 12.83 10.49 13.33 14.86 19.99 15.66 22.36 22.4 16 16.52 11.25 13.06 9.6
14.25 20 20 13.75 10.34 12.25 13.25 12 10.95 16.75 13.25 14 13.65 18 18 15 12.7
17.5 19.66 11.51 12.71 12 17 13 6.5 19 19.7 14.25 9.86 23 15.33 14.65 15.6 22
14 14 16.86 14.51 13.51 13.75 18.51 19.75 20.8 15.99 16.34 25 13 16.88 12.95
11.5 12.75 11.16 12.7 10.13 17.01 11.24 12.6 20 14.01 13.05 13.18 12 12 15.38
15 10.52 15.16 9.9 13.5 21.68 20 19 12 14.91 11 14.36 11 17 11.99 12.46 20
15.01 12.41 13.49 14 13.2 13.55 13.96 10.95 16 11.8 17 11.65 13.58 13.09 13.86
16 15 12.08 14.16 11 18 12.85 22 11.5 14.66 10.16 13 7.5 19.84 16.75 12 25.25
15.5 13.36 10 17 12.83 16 12.5 16 9.18 16.5 14.41 14.25 19 15 13.36 17.83 10.5
11.75 12.75 19.75 15.4 21 18 14.46
```

https://causeweb.org/tshs/ultra-running/

Creating a histogram

1. Choose a bin size and a center value, e.g. one hour bins centered at the integers would be denoted as $(5.5, 6.5]$, $(6.5, 7.5]$, $(7.5, 8.5]$, etc. Bins must be non-overlapping, and there should be enough bins to completely cover the data.
2. Assign each runner to a bin, e.g. 12.98 goes into the $(12, 13]$ bin and 12.0 goes in to the $(11, 12]$ bin
3. Plot bars for each bin, with the height of the bar corresponding to the number of runners in that bin


Count
0
10
20
30
40
10
15
20
25
Personal best time (hours)


Count
0
10
20
30
40
10
15
20
25
Personal best time (hours)
6.5
7.2
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7.9
8.5
8.7
9.0
9.1
9.2
9.2
9.5
9.5
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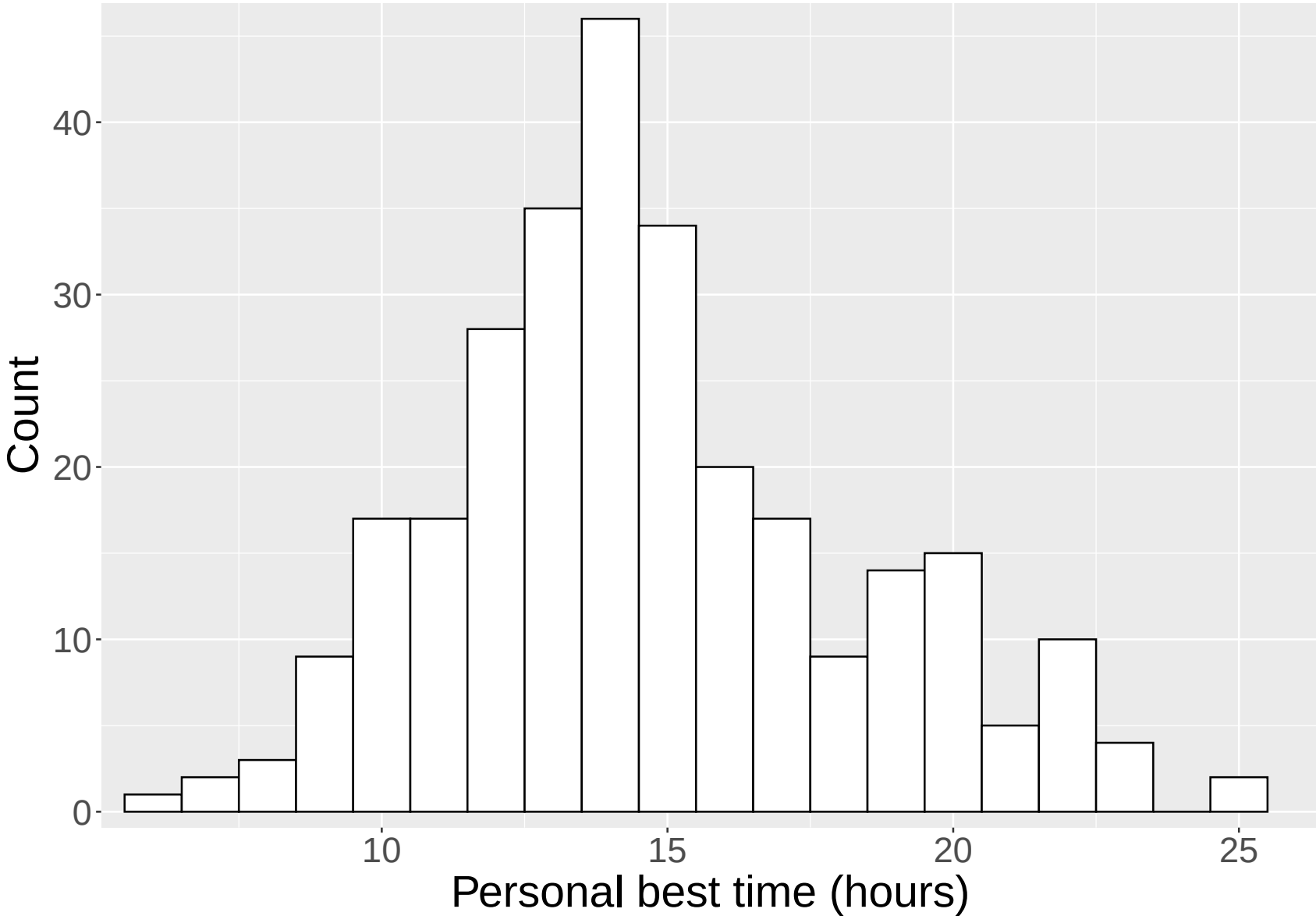
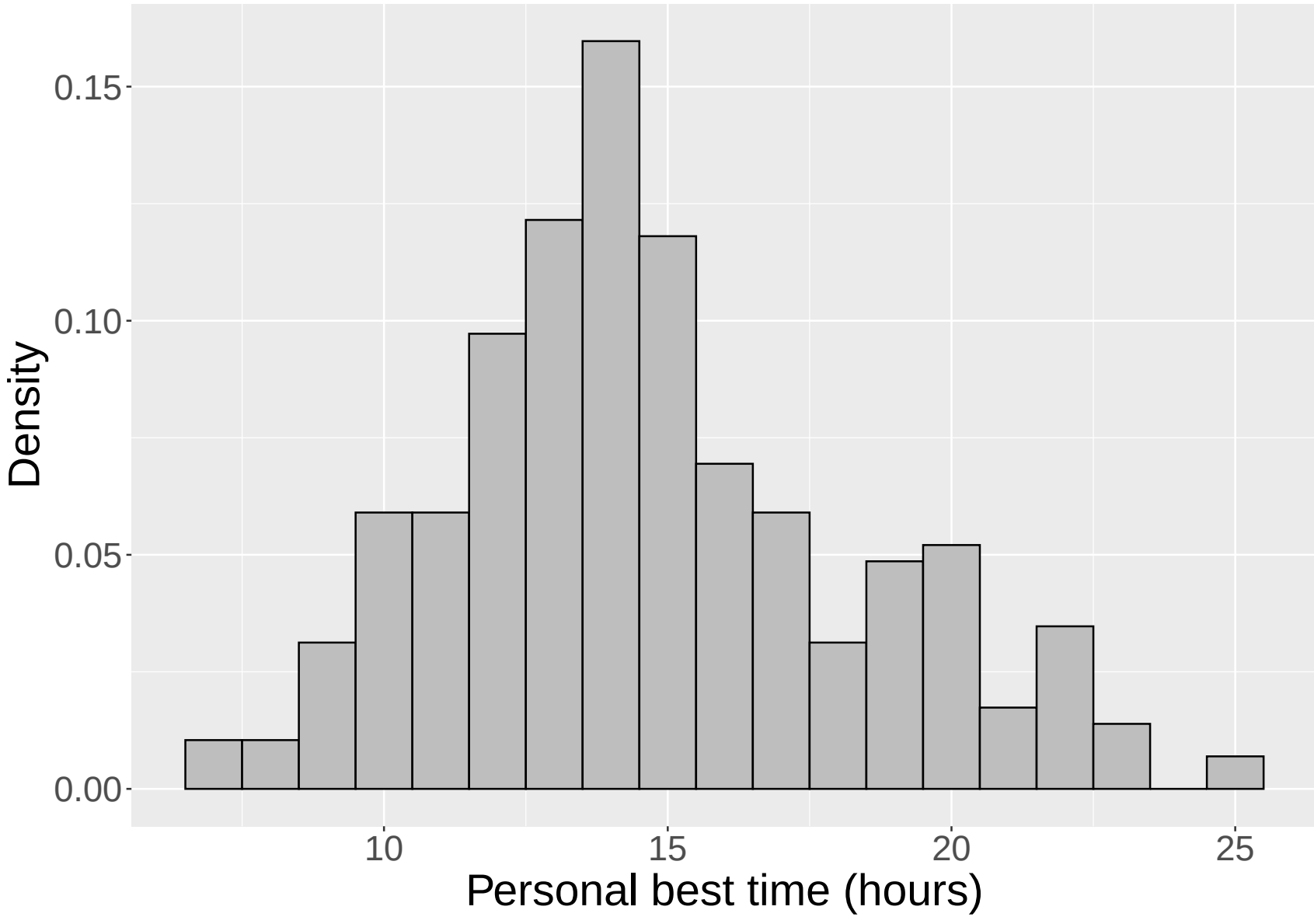
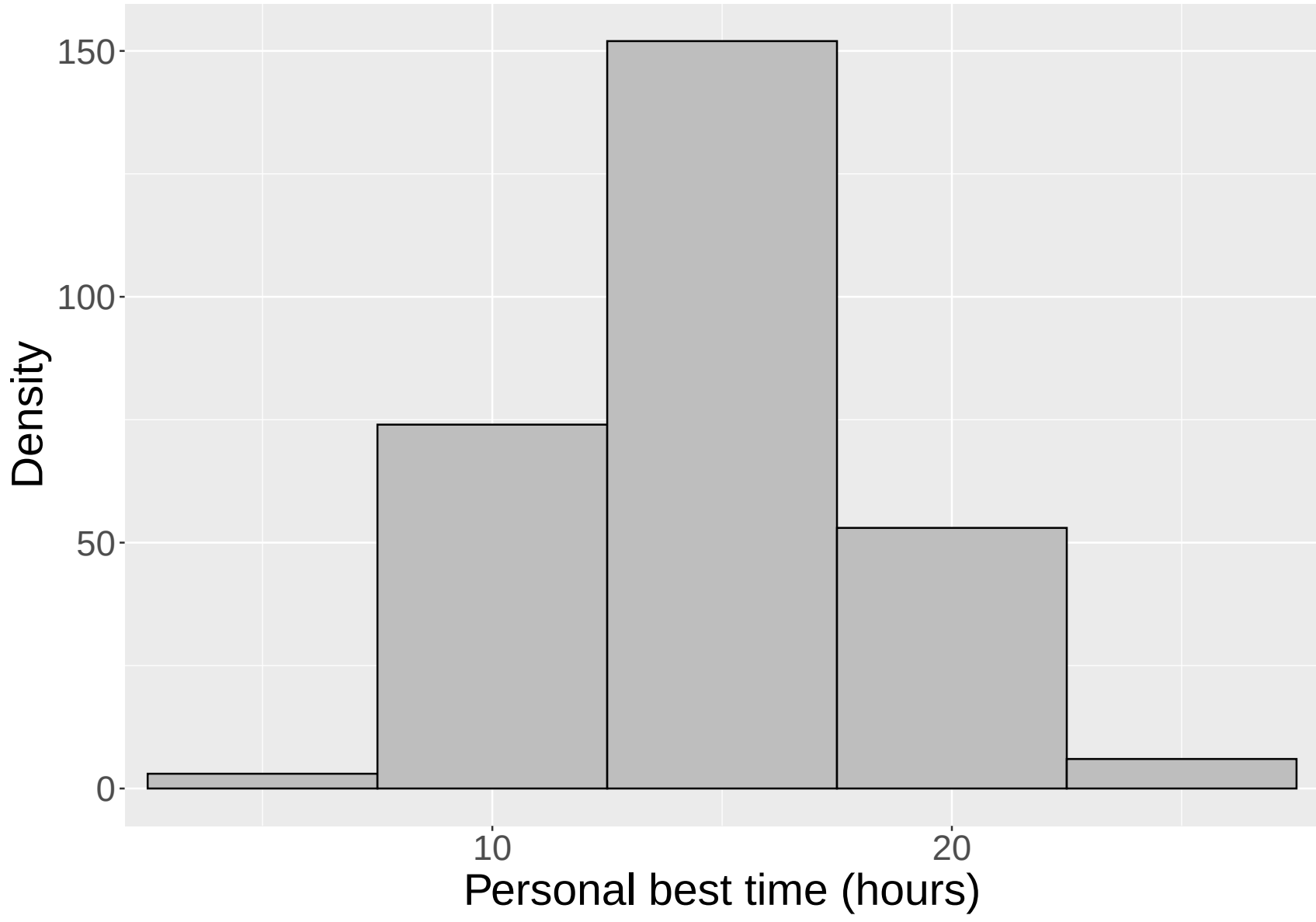

Count
40
30
20
10
0
10
15
20
25
Personal best time (hours)

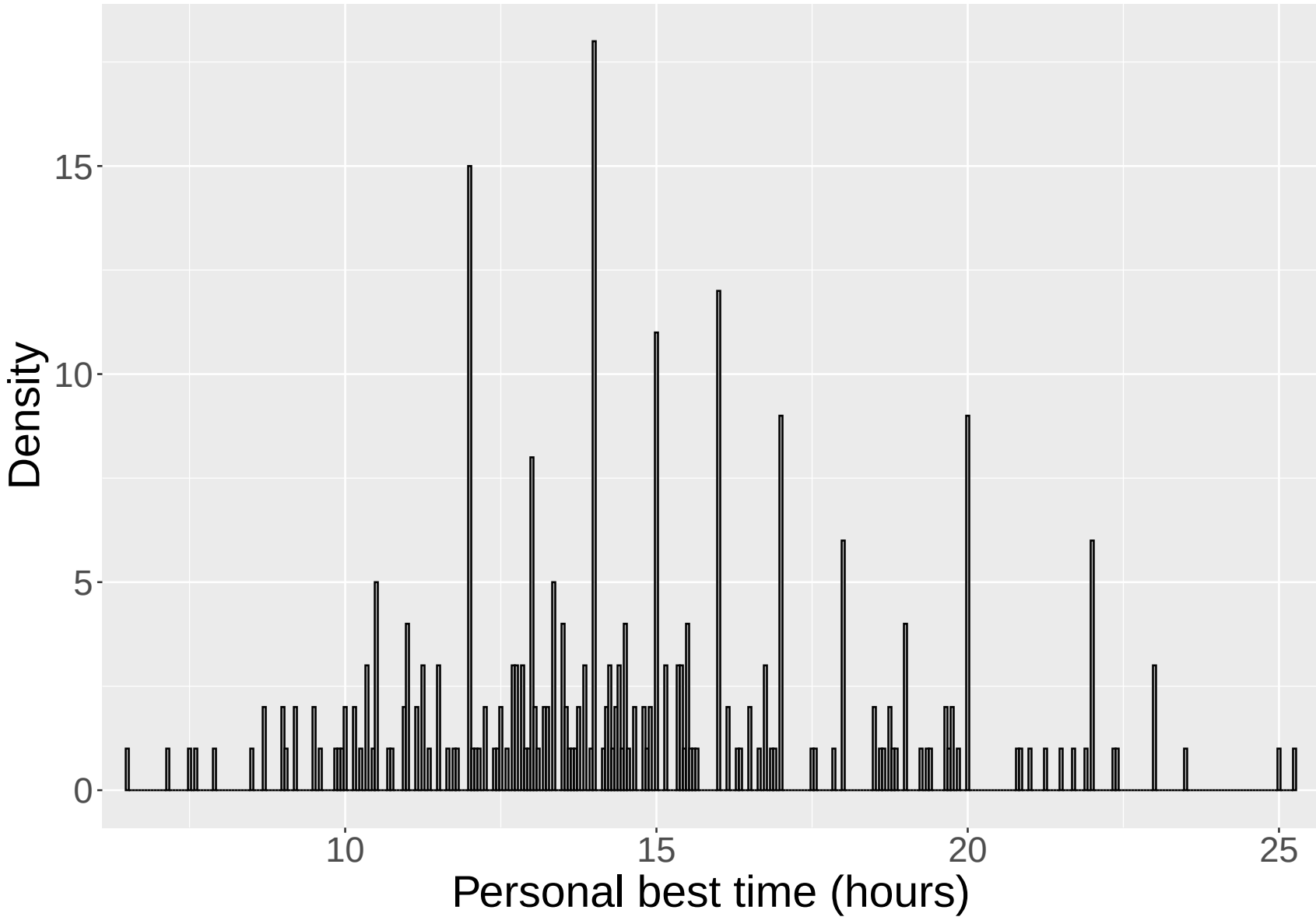
Counts vs density



Bin width of 5 hours (too large!)



Bin width of 3 minutes (too small!)



Boxplots

References

Samtleben, E. (2023) Ultrarunning dataset. Teaching of Statistics in the Health Sciences Resource Portal, Available at https://www.causeweb.org/tshs/ultra-running/.