The Determination of an Environmental Service for a Contingent Valuation Study – Using R to Compute Estimates

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Introduction

- This research forms part (a very small part) of an eight year study determining the value of freshwater inflow into South African estuaries

- In total 40 estuaries surveyed

- These results are for the Bushman's estuary, on the Southern coast of South Africa

STUDY AREA: The Bushmans Estuary
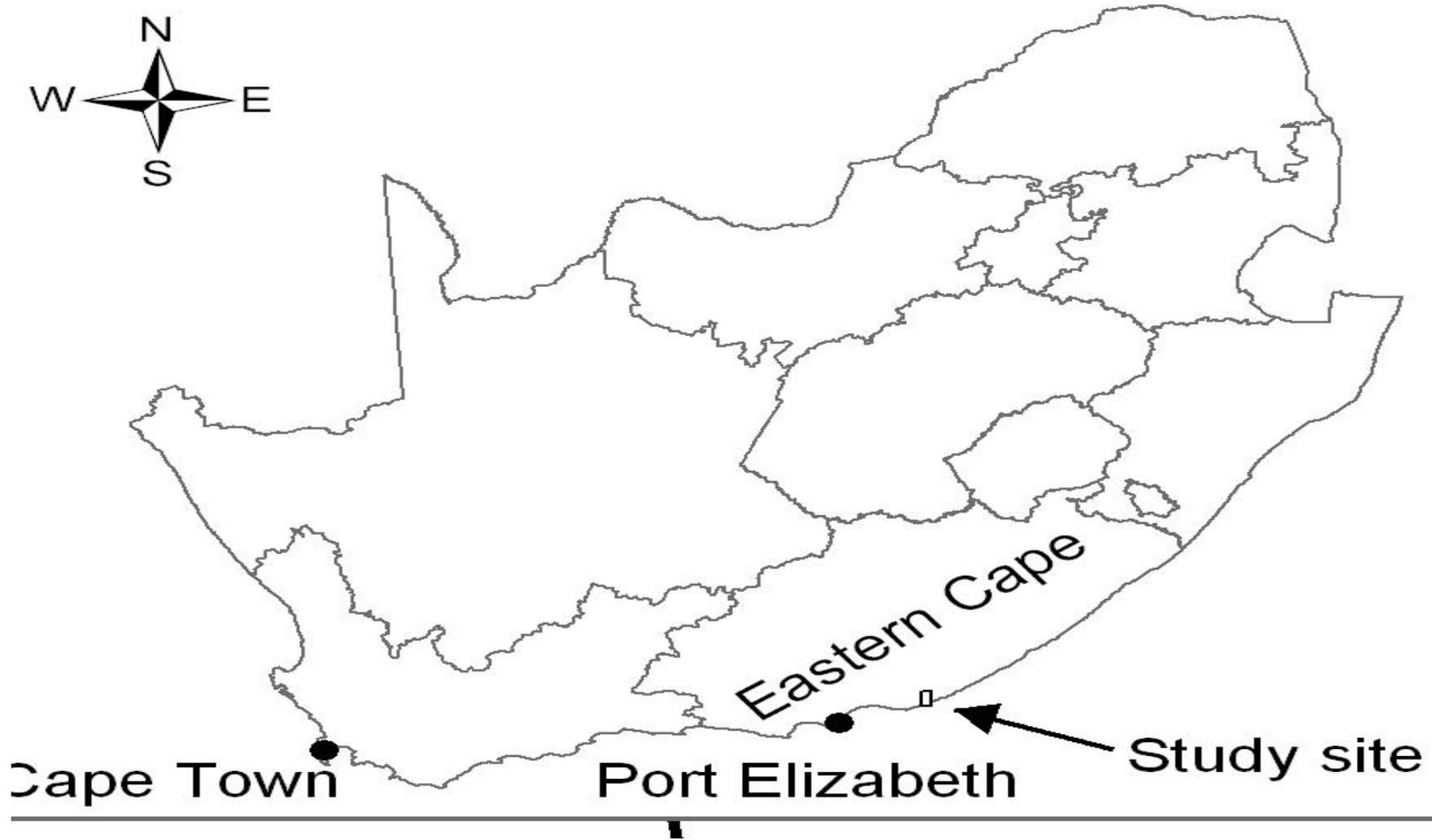
Background

- Used a survey method, contingent valuation to determine people's willingness to pay for a hypothetical scenario
- Administered 300 questionnaires, 71 protests, 229 valid questionnaires
- Initial analysis H van der Westhuizen (Masters degree)
- Used Excel, Statistica and EViews

Methodology

- Used R to
  - Estimate a linear model
  - Predict dependent variable values
  - Bootstrapped predicted values
  - Obtained bootstrapped densities for three estimates; mean, median and trimmed mean
  - Compared bootstrapped CI for mean, median and trimmed mean

DATA COLLECTED

- Dependent variable – WTP
- Independent variables – 11
  - Continuous (6)
    - Household size, income, frequency of use, annual levies, distance travelled & value of equipment
  - Discrete (5)
    - Race, gender, visitor, environmental knowledge & return

Results of H van der Westhuizen

Dependent Variable: ln(WTP)				
Model: Reduced : Observations: 229				
Method:	Least Squares			
Variable	Coefficient	Std. Error	t-Statistic	Probability
RACE	4.5132	0.6436	7.0126	0.0000
VISITOR	1.1440	0.4573	2.5015	0.0131
KNOW	1.0997	0.4598	2.3916	0.0176
ln(**LEVIES**)	0.2123	0.0430	4.9320	0.0000
C	-1.5878	0.4484	-3.5412	0.0005
R-squared	0.5787			
Adjusted R-squared	0.5712			
Probability (F-statistic)	0.0000			

Results of H van der Westhuizen

- Model: Reduced LS

- Mean predicted WTP: R253
- Median predicted WTP: R118

STATISTICAL CRITICISMS

- Skewed data – which measure of central tendency?

  – Solution – can compromise and use a more robust measure, i.e. trimmed mean

- Point estimates of WTP, prefer interval estimates.

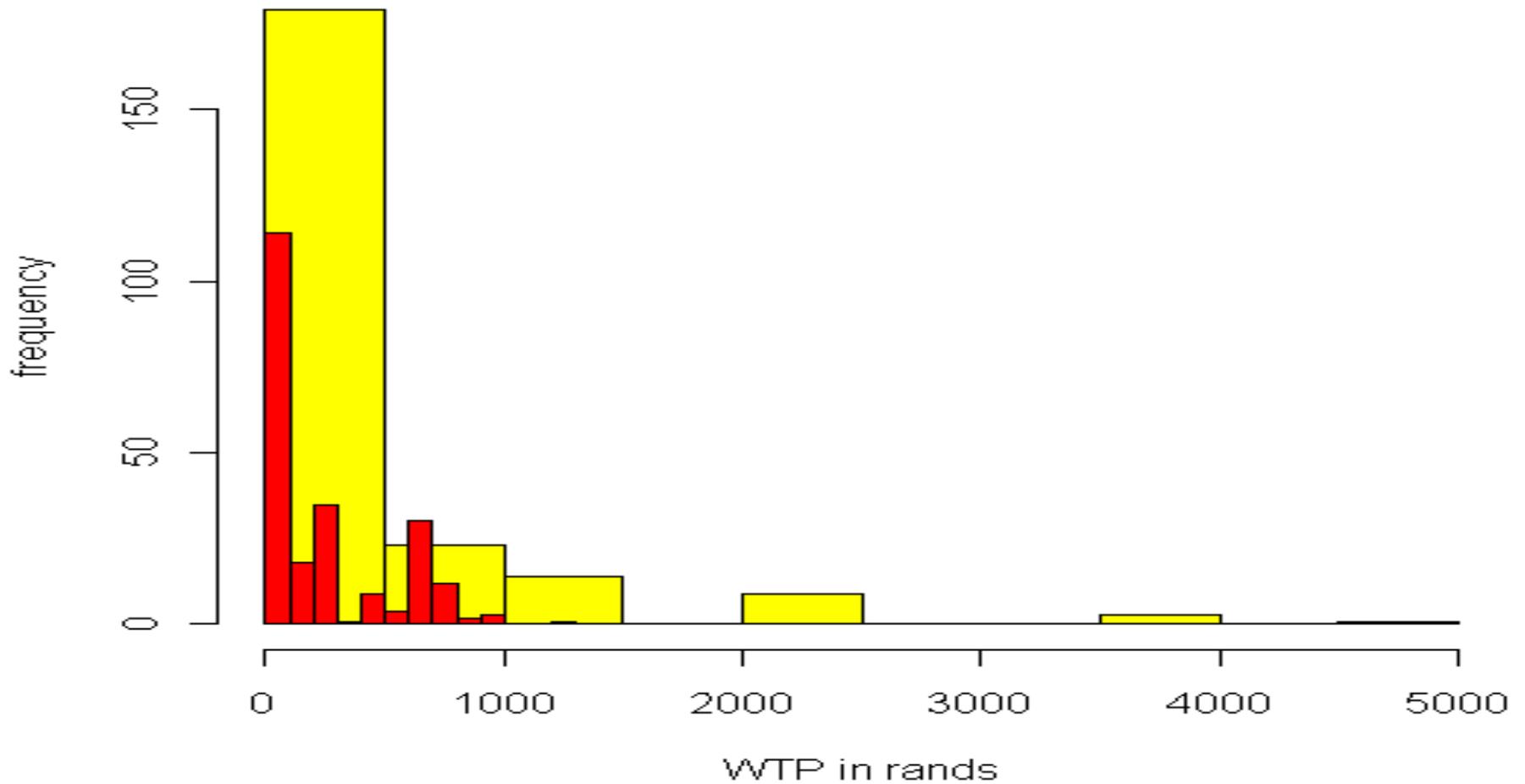 – Solution – use of resampling (bootstrapping) method to obtain interval estimate

Results from R

- Coefficients:
-              Estimate Std. Error   t value Pr(>|t|)
- (Intcept) -1.58711   0.44844 -3.539   0.000488 ***
- Race   4.51322   0.64359 7.013   2.73e-11 ***
- Visitor   1.14407   0.45731 2.502   0.013073 *
- Know   1.09969   0.45983 2.392   0.017605 *
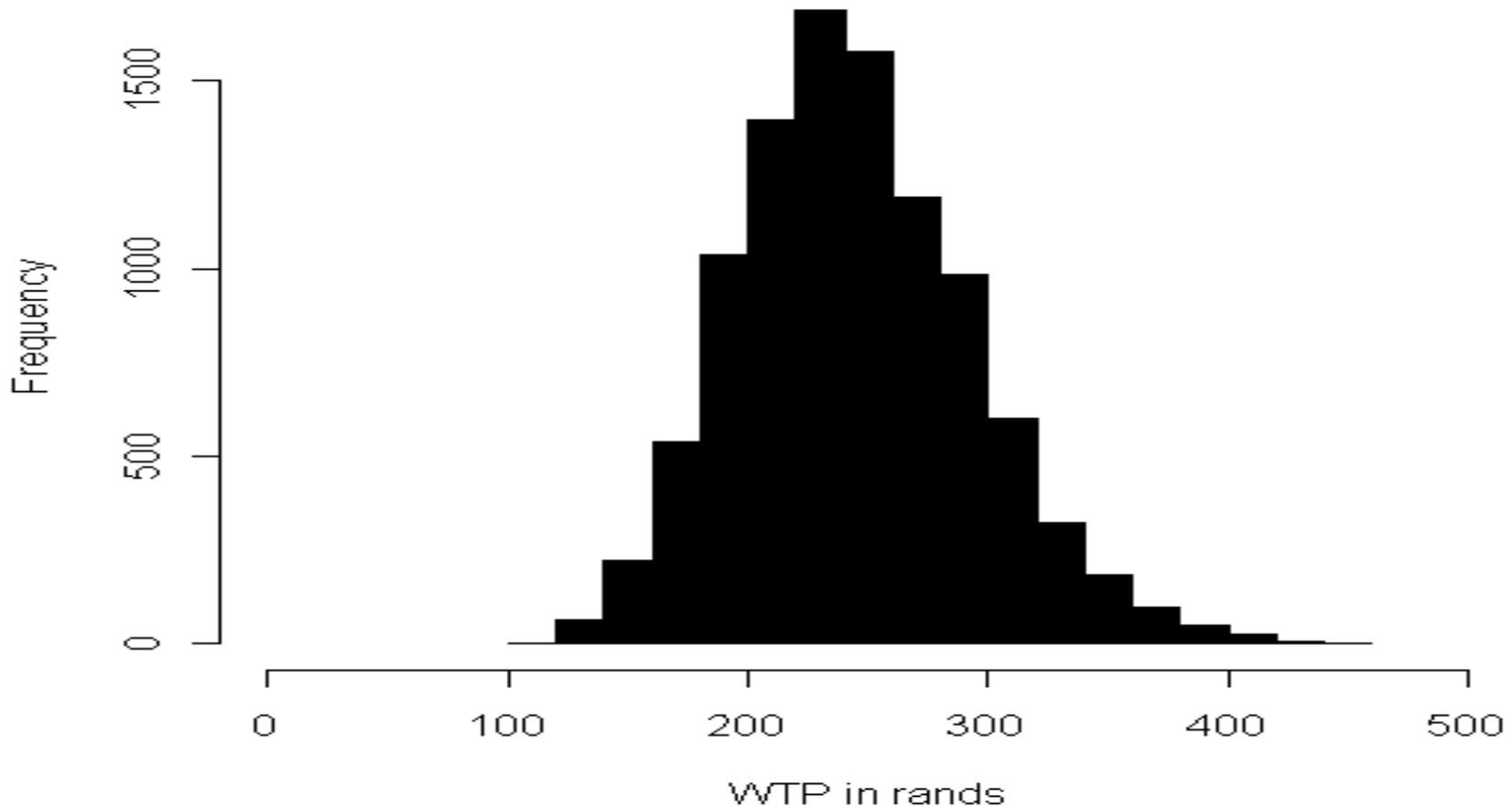- In.levies 0.21216   0.04302   4.932   1.59e-06 ***

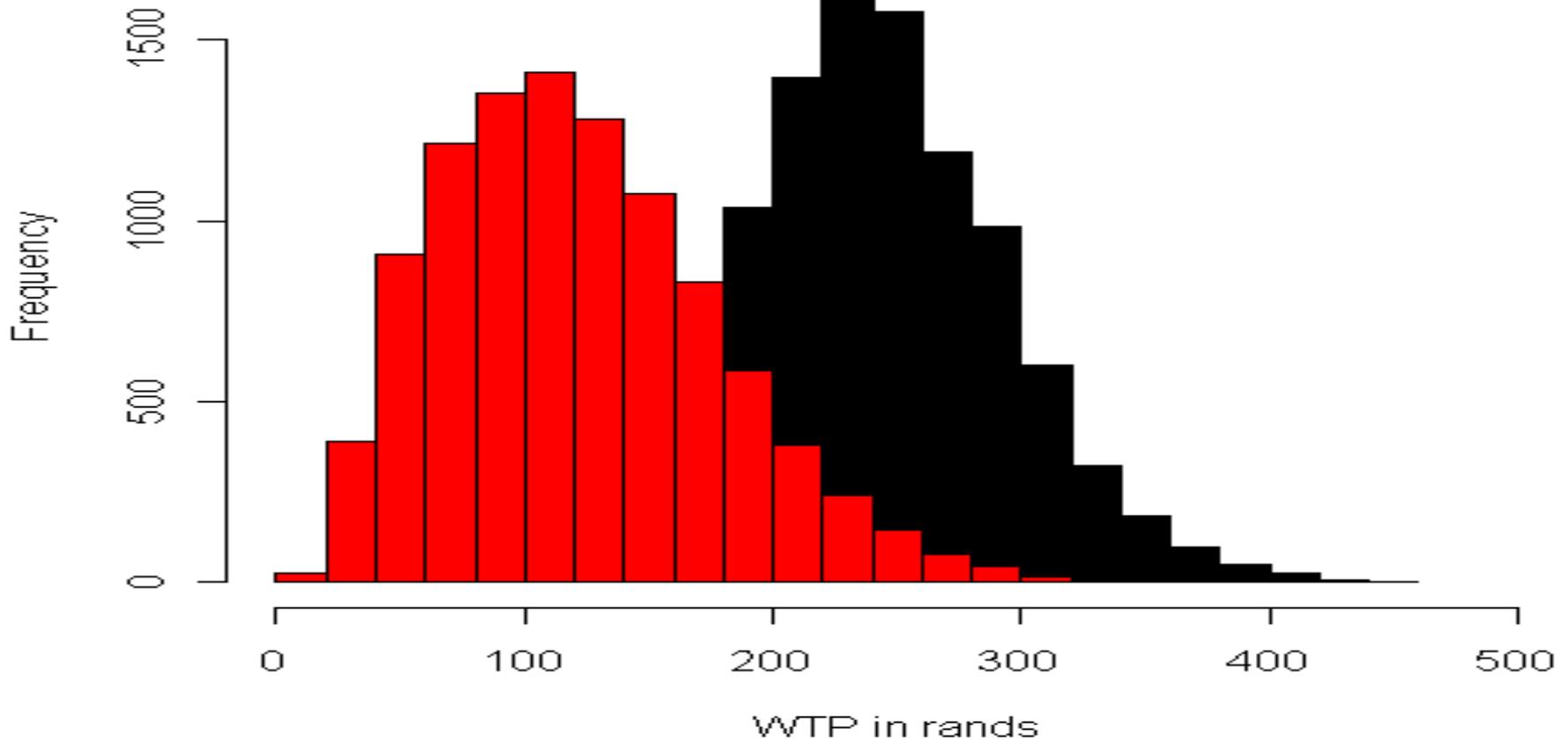# Results from R

Mean WTP

Histogram bootstrapped means
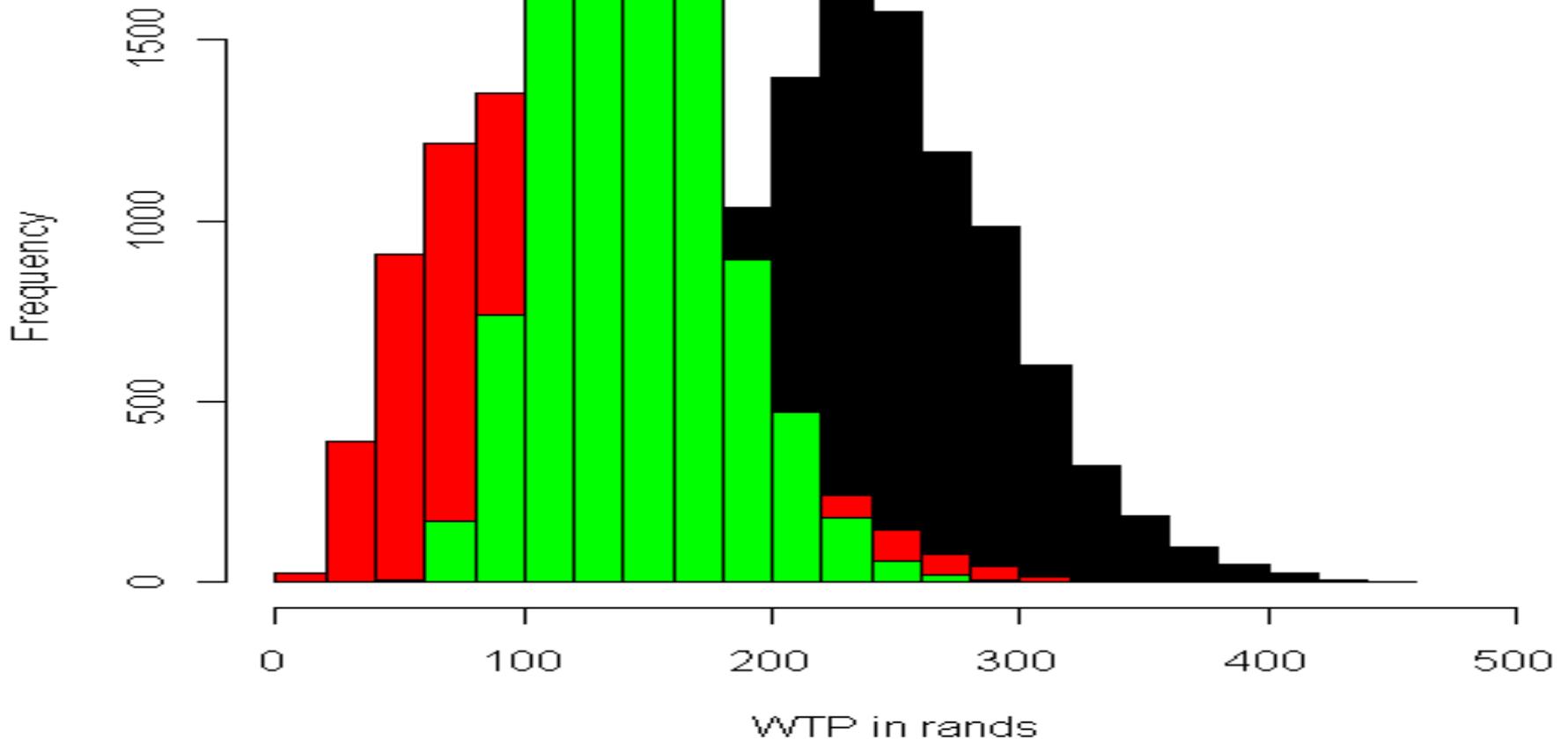

Bootstrapped histograms of WTP

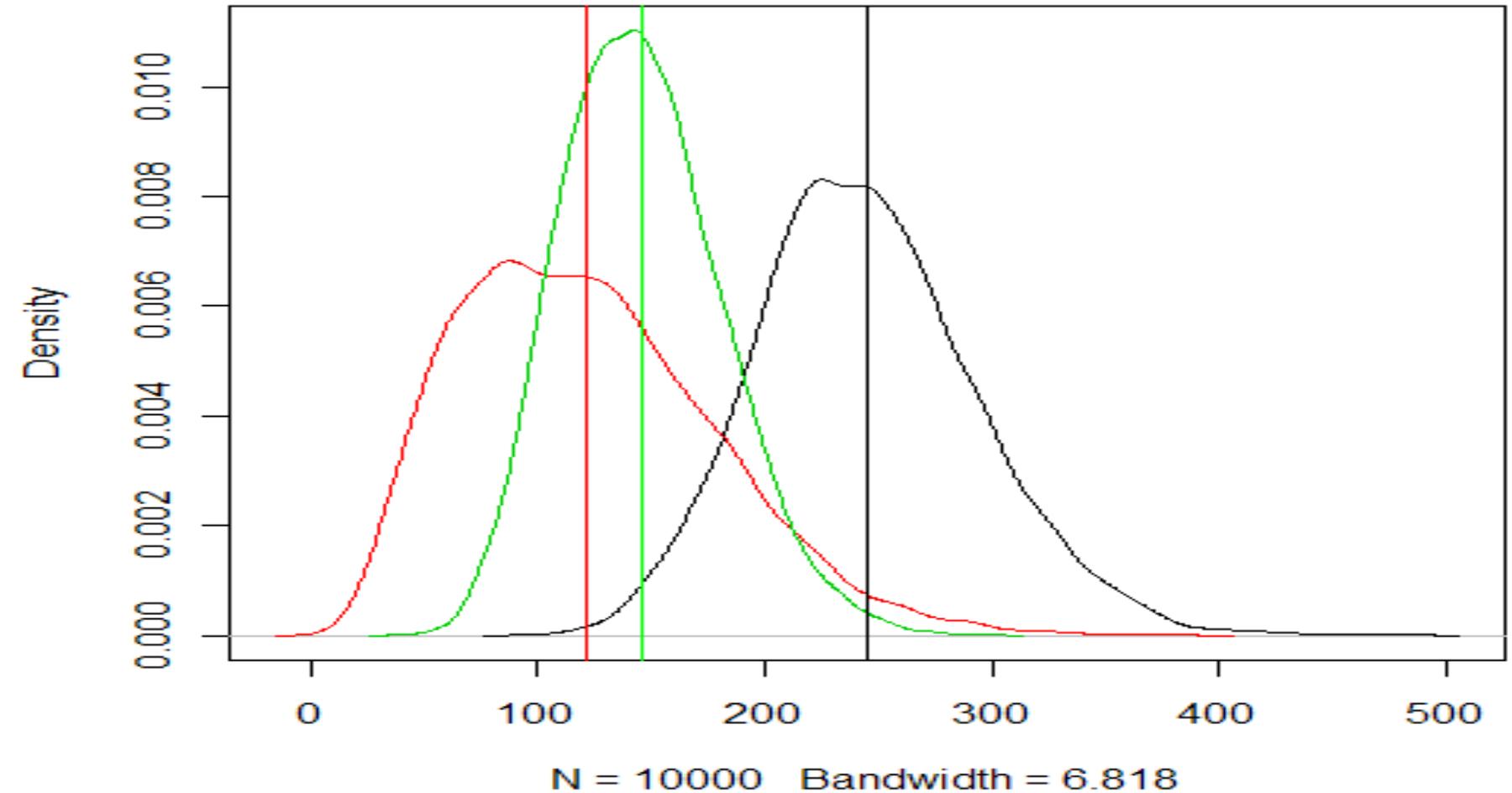# Histogram bootstrapped median

Bootstrapped histograms of WTP

Histogram bootstrapped 25% trimmed means

Bootstrapped histograms of WTP

WTP: DENSITY PLOTS

N = 10000   Bandwidth = 6.818

Results

	Mean	Median	Lower 95%	Upper 95%
Mean	245.54	242.19	159.15	351.44
Trimmed mean	146.01	142.65	83.56	224.79
Median	119.93	113.64	35.47	245.85

Conclusions

- This valuation provides conservationists with a method for attaching an economic value for a recreational service.

- R very useful and FREE

- Do not think this would have been possible with Statistica (perhaps possible with EViews)

(My) Experience with R

- Steep learning curve
- Graphic labelling not easy
- Interesting
- Will encourage others to start using the software
- Colleague quite proficient – helpful with guidance
- Use or lose – my type of problem

The End

- Thanks to
  - My co-authors who all made contributions along the way
  - The National Research Foundation (NRF) and Water Research Council (WRC) for financial assistance
  - The R community/developers for making available a very useful package