How did PCBs pollution concentration impact the marine mammals in European waters?

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STRUCTURE

- Background Information
- Exploratory Analysis
- Main Model Result
- Conclusion

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BACKGROUND

PCBs, or Polychlorinated biphenyls, in marine mammals is considered to have potentially very significant health effects.

PCBs have well-established dose-dependent toxicities to birds, fish and mammals in experimental studies, but the actual impact of OC pollutants on European marine top predators remains unknown.

We want to explore the factors associated with the concentration of PCBs in different marine mammals.

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EXPLORATORY ANALYSIS

- PCBs : concentrations of PCBs (mg/kg lipid)
- Species : four types of marine animals
- Country : seven countries along the sea
- Length : the body length for individuals (ft)
- Body Weight : the body weight for individuals (lb.)
- Sex : Male and Female
- Maturity : status group by age
- Year : data collection year

PCBs — Histograms of Polychlorinated biphenyls

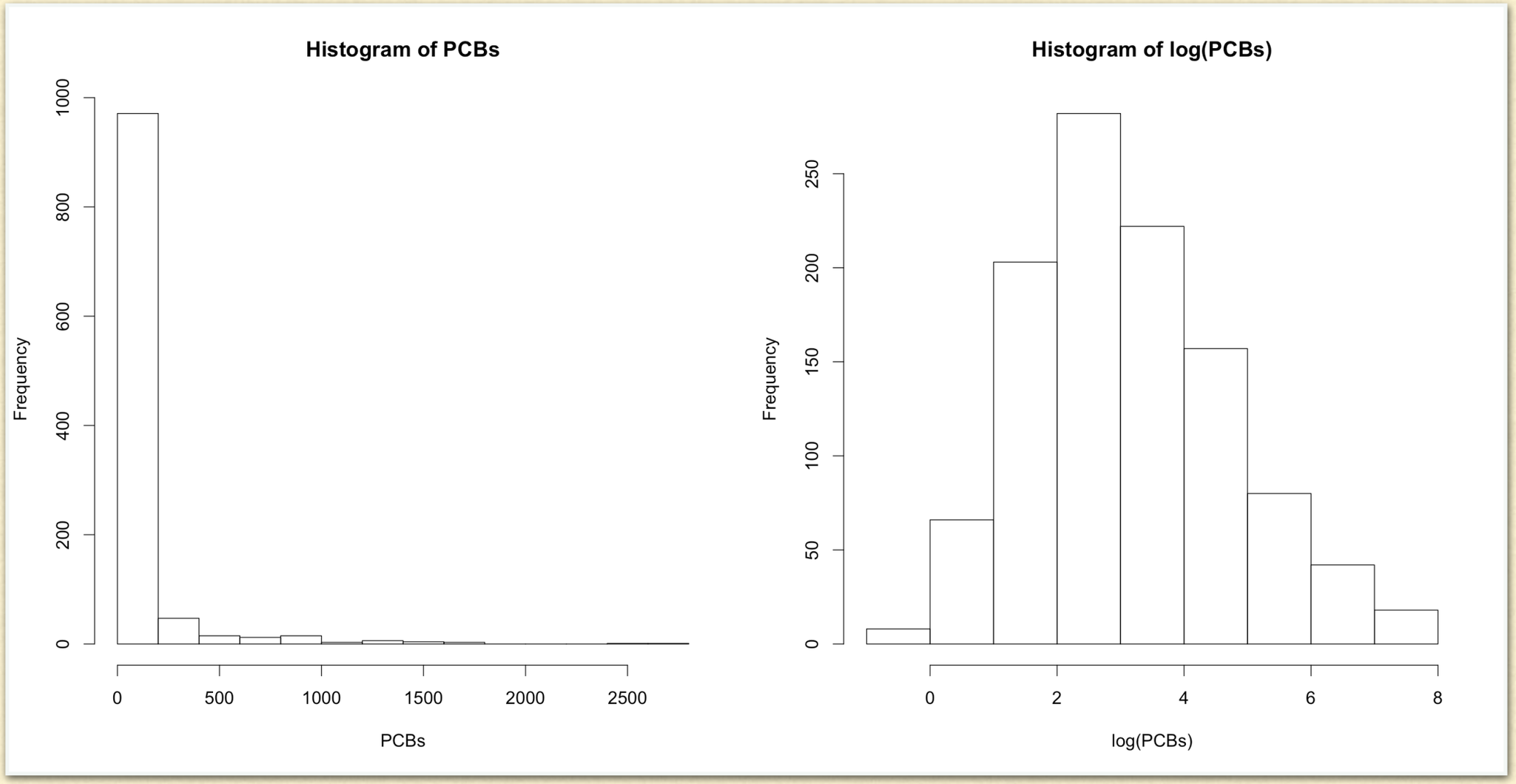

Figure 1

The first histogram of original PCBs are right-skewed.

Using log transformation, we get a nearly normal distribution as shown in the second plot.

Bar-plot for different species

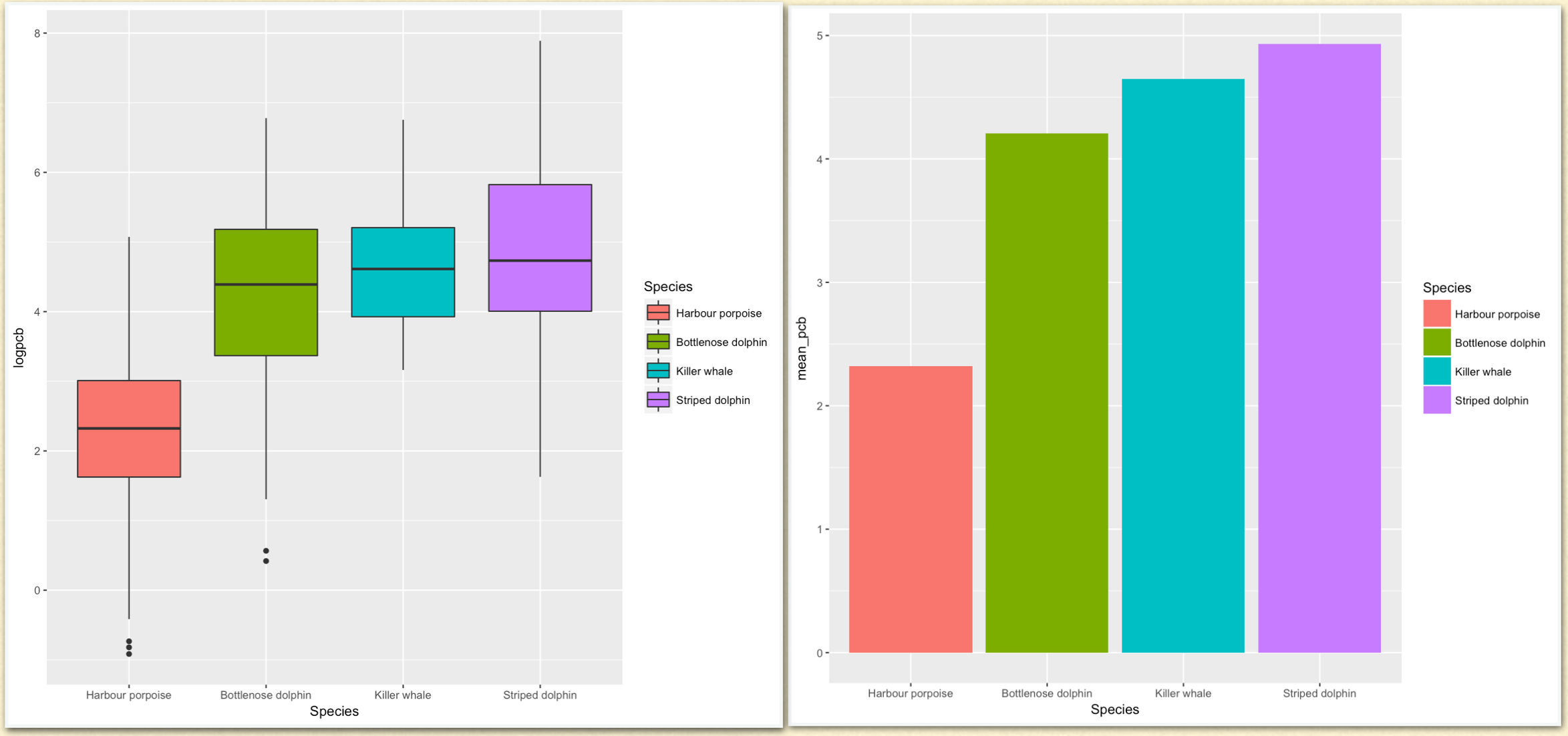

Figure 2

The plots shows that the values of Harbour Porpoise are smaller than the other three species. (the mean of Striped Dolphin is nearly doubled than that of HP)

Mean logPCBs concentration in male and female

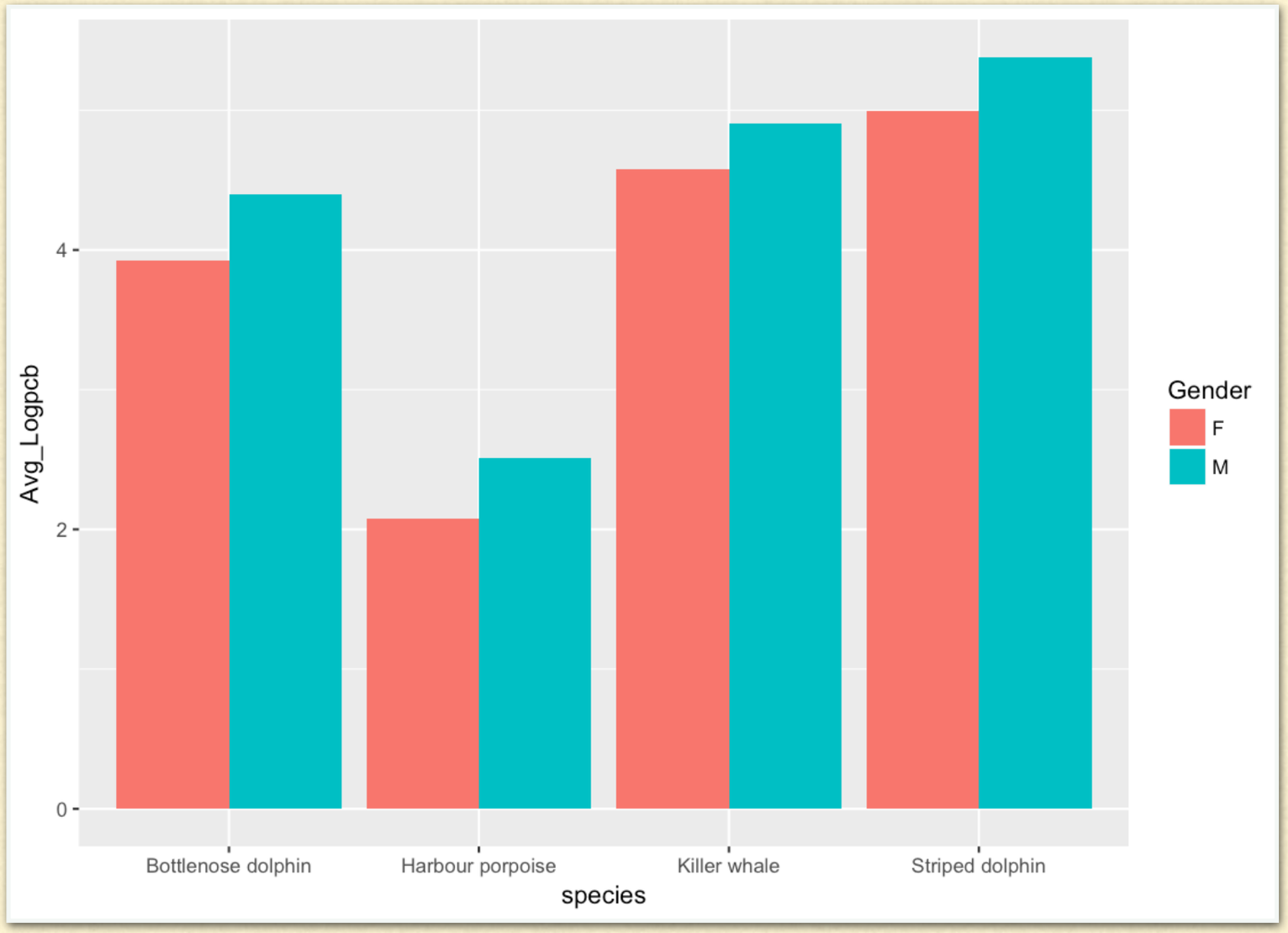

Figure 3

The PCBs concentrations threshold (41.0 mg/kg lipid), equivalent to logPCBs = 3.71, is the highest PCB toxicity threshold published for marine mammals.

Bar-plot for different Countries

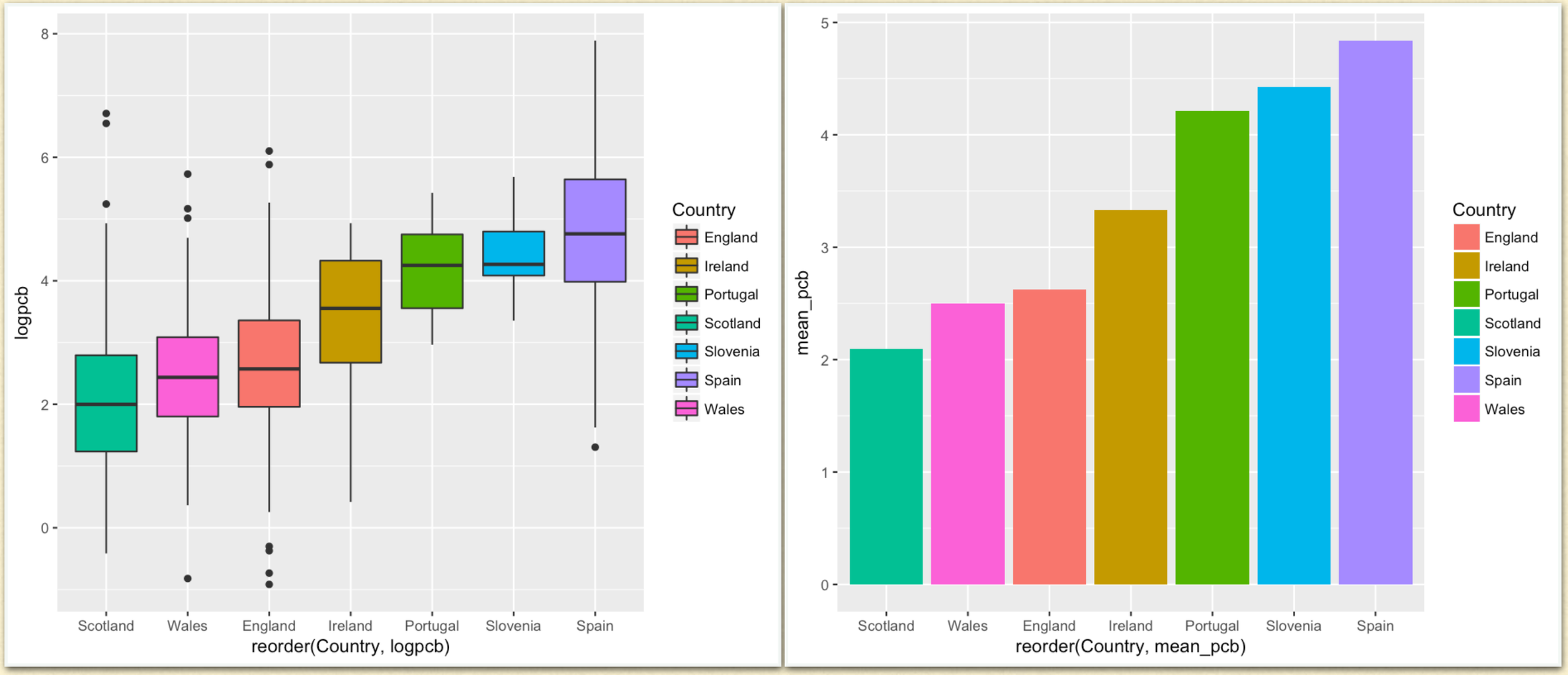

Figure 4

The pollution condition in UK is better in terms of the mean value of PCBs, while the condition in Spain is most serious.

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MAIN MODEL RESULT

Temporal trends in PCBs in Harbour Porpoise and Striped Dolphins.

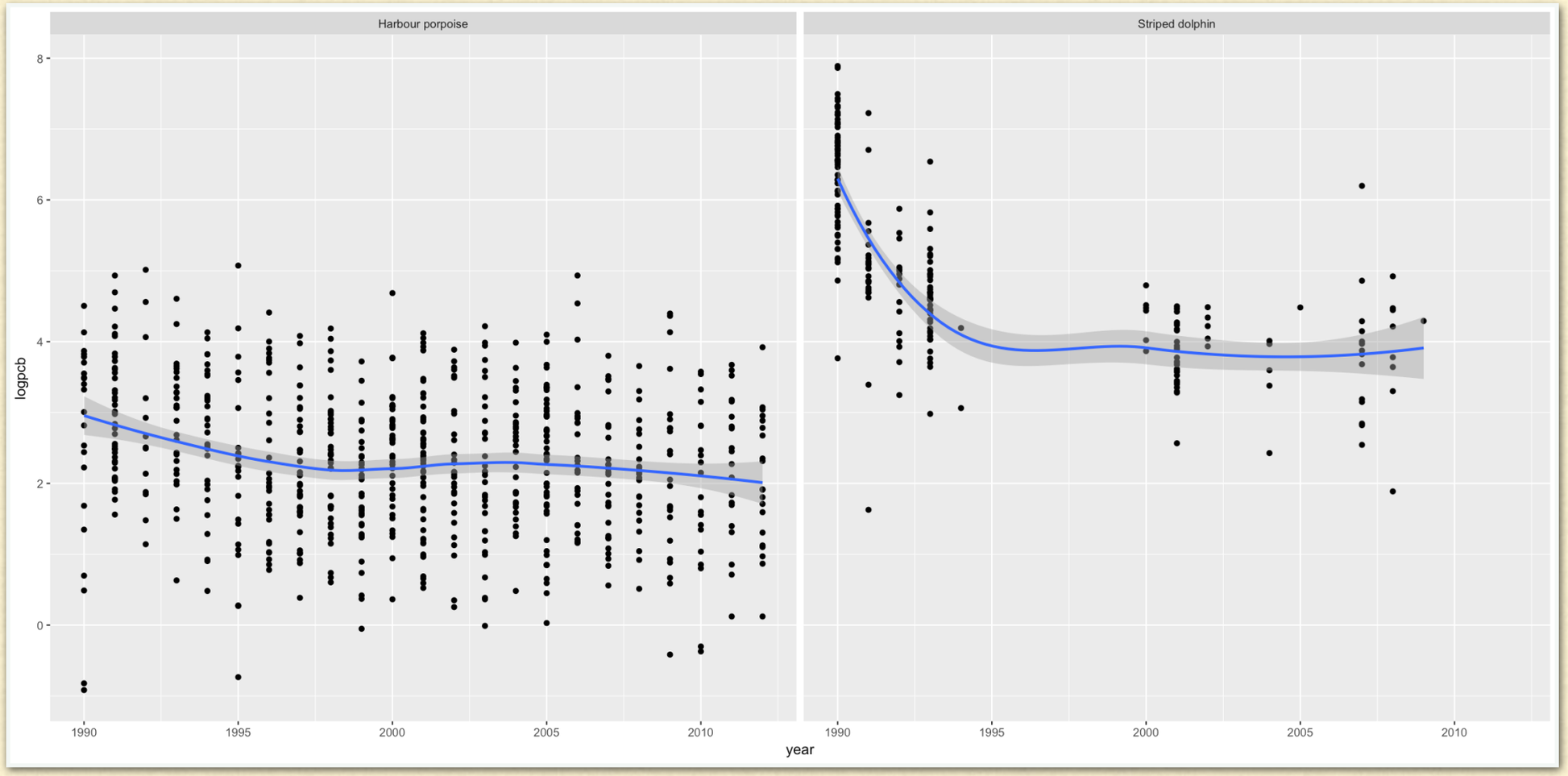

Figure 5

Using GAM regression here.

The trend for HP is significant with $p < 0.001$, $F = 11.76$, residual df $= 701.97$, trend df $= 3.03$.

The trend for SD is significant with $p < 0.001$, $F = 55.45$, residual df $= 212.03$ trend df $= 6.97$.

Relationship between PCBs and Length(ft)

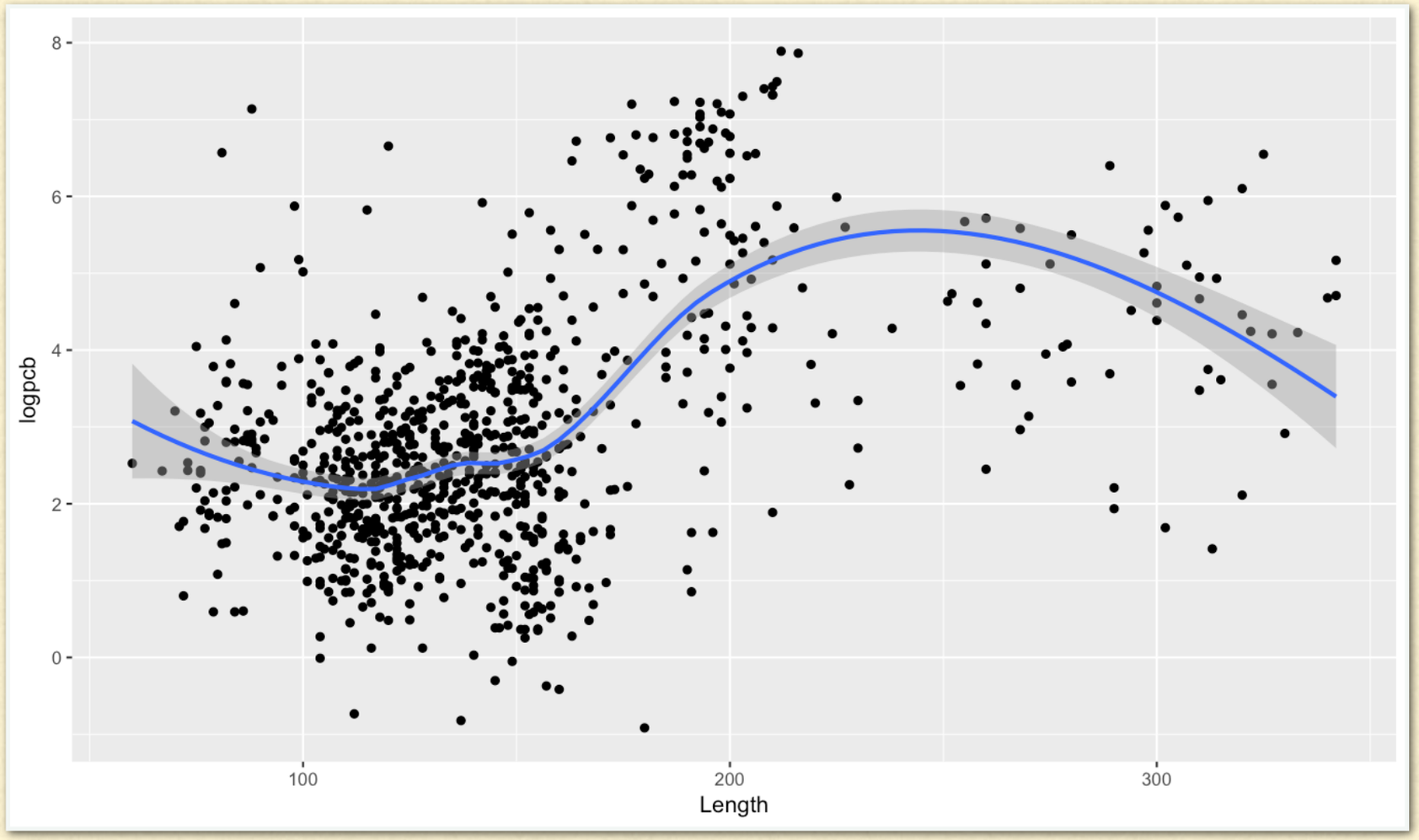

Figure 6

Using Loess method (local regression) regression here.
With $p < 0.001$, we can conclude that the length has significant relationship with the PCBs absorption.

Relationship between PCBs and Body weight(lb)

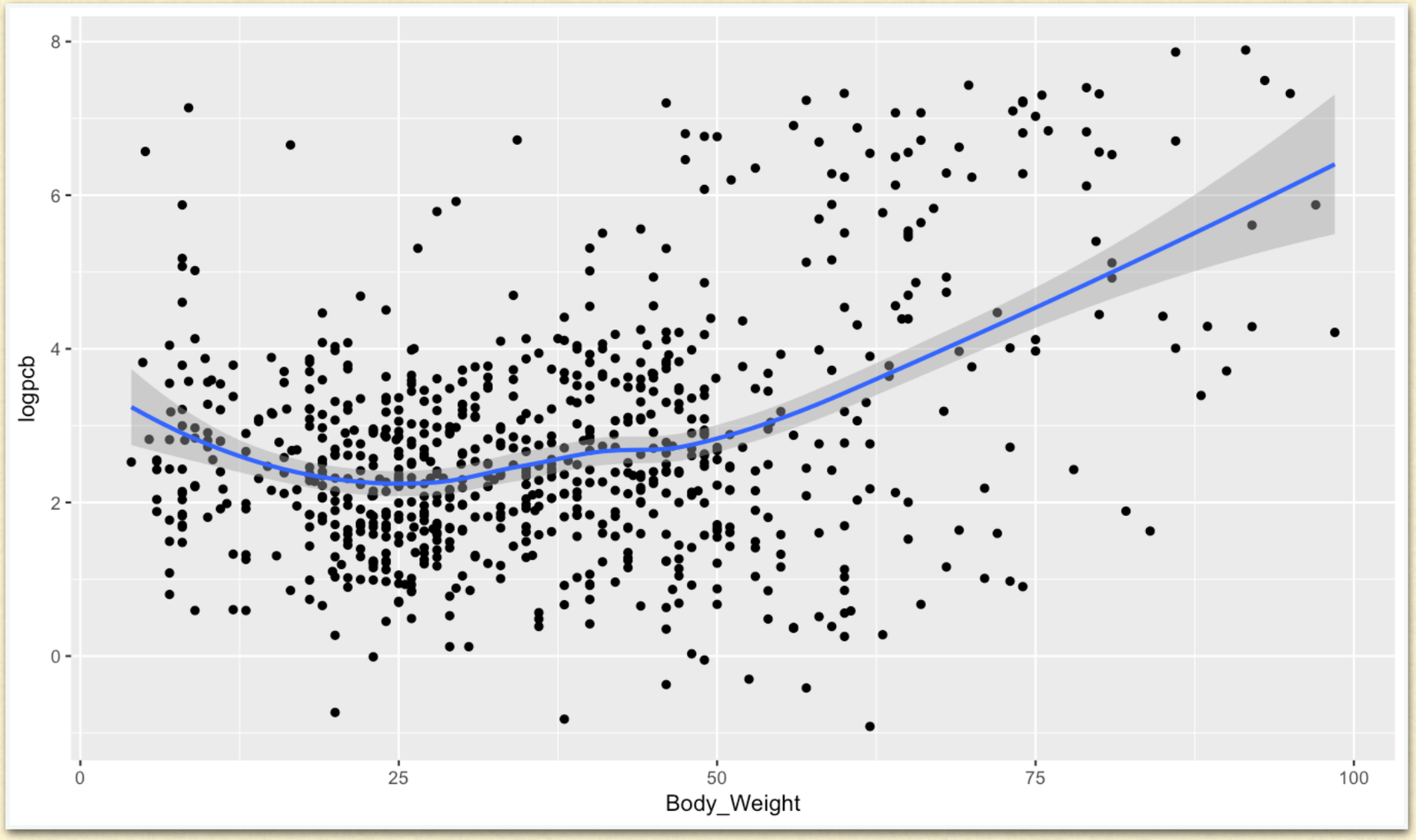

Figure 7

Using Loess method (local regression) here, and the relationship is significant with $p < 0.05$. When the weight is small, the relationship is slightly negative; when the weight is larger than 25 lb, the relationship is positive.

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CONCLUSTION

- The PCBs concentrations are largest in Striped Dolphins and Spain.
- Three species have exceed the largest PCBs threshold.
- Temporal trends in PCBs is significant.
- Length and body weight all contribute to the change of PCBs concentration.

THANK YOU