The Scout's Warning: The Mercury Audit

The Mission: You are a Lead Scout monitoring the health of the platypus population downstream from an old gold mine. Mercury (*Hg*) is a cumulative toxin.

The Safety Threshold

Environmental toxicologists have established a strict **Danger Zone**. Any individual specimen with a mercury concentration above **15.0 mg/kg** is at risk of neurological failure and cannot be safely handled without specialized protective gear.

Primary Objective

Determine if the creek is "safe." If even a small percentage of individuals are likely to be in the Zone (**15.0 mg/kg**), you must issue a formal Warning to all field staff.

The Situation: Riley's Report

Your junior researcher, Scout Riley, has processed 218 specimens from the `PlatypusData1` dataset. She hands you a summary of her 95% Confidence Interval:

95% Confidence Interval: [6.10, 8.28] mg/kg

"The data is in! Even the absolute highest mercury levels in this population are only 8.28 mg/kg. We are miles away from the 15.0 mg/kg Danger Zone. The creek is safe!" — Riley

Initial Reaction: Based *only* on Riley's quote and the **15.0 mg/kg** threshold, does her logic seem sound to you? Why or why not?

Step 1: Consult the Manual

To understand why Riley's report might be flawed, you need to understand the difference between estimating a *population* and predicting an *individual*.
Action: Open your laptop and navigate to **r.statypus.org** $\rightarrow$ **Section 10.3.3**. Read this section—specifically **Example 10.10**—before moving forward.

> **Bill the Statypus says:** *"Confidence Intervals are for populations, but Prediction Intervals (PI) are for individuals. I wrote the* `ConfIntFromSample` *function so you can see both lenses at once."*

Run the code:

```
load(url("https://statypus.org/files/StatypusCh10.RData"))
ConfIntFromSample(PlatypusData1$concentration)
```

Step 2: The Data Audit (Include Units: mg/kg)

Mean ($\bar{x}$): _____ **95% CI:** [_____, _____]
95% Prediction Interval (PI): [_____, _____]

Step 3: The Field Sketch

The plot in R displays a wide range to show every outlier; for your sketch below, please focus on and **draw only the portion** of the distribution between **0 and 30 mg/kg**. Within this range, mark the **mean**, draw the **CI** bar, the **PI** bracket, and the **15.0 mg/kg Danger Zone**. Refer to Section 10.3.3 in the manual for visual guidance.

STOP HERE. Show your sketch to your instructor to receive **Page 3**.

Lead Scout's Risk Assessment: Final Verdict

1. **The Fatal Flaw:** Riley claimed the "highest mercury levels" were **8.28 mg/kg**. According to your **Prediction Interval**, what is the actual estimated high-end for an individual?

2. **The Definition of Confidence:** Based on your reading of **Section 10.3.3**, why does a safe population mean **not** guarantee that every individual platypus is safe?

3. **The Prediction Floor:** Why is the PI so much wider than the CI? (Hint: Re-read the textbook discussion regarding the difference between guessing a group average vs. a single animal).

Reflection 4: The Final Verdict

A student researcher asks: *"Riley said the average is safely below 15.0 mg/kg, so I don't need heavy gloves, right?"*

Flip this page over and write your response on the back. Use your **PI** results and the **15.0 mg/kg** threshold to justify your safety protocol.