The best answer is \*\*(D) There is evidence that the herbicide causes higher levels of the enzyme for these fish.\*\* Here's a breakdown of why, considering the rigor expected of a graduate statistics student:

\* \*\*Statistical Significance and Causality:\*\* The core of this question lies in understanding the relationship between statistical significance, experimental design, and causal inference. The student is told that the difference in enzyme levels is statistically significant. This means the observed difference is unlikely to have occurred by random chance alone. Because the experiment was well designed, it allows for valid conclusions about causal effects.

\* \*\*Why (D) is Correct:\*\*

\* \*\*Random Assignment:\*\* The key element supporting a causal conclusion is the random assignment of fish to treatment and control groups. Random assignment eliminates, on average, the influence of lurking variables. This means that, on average, the only major difference between the treatment and control groups \*before\* the experiment should be the herbicide exposure.

\* \*\*Controlled Experiment:\*\* Since the experiment was controlled (presumably, the fish were kept in similar environments, fed the same diet, etc., except for the herbicide), it provides a strong foundation to attribute the observed difference in enzyme levels to the herbicide.

\* \*\*"For These Fish":\*\* This phrasing is critical. The conclusion is not a universal, absolute "proof." It acknowledges the limitations of the study: the results apply to \*these\* fish under \*these\* experimental conditions. Extrapolation to other fish populations or environments would require additional studies.

\* \*\*Why the Other Options are Incorrect:\*\*

\* \*\*(A) There is evidence of association, but no causal effect of herbicide on enzyme levels.\*\* This is incorrect. A well-designed, \*controlled\* experiment with random assignment \*is specifically designed to\* provide evidence of a causal relationship. Association (correlation) is a necessary but not sufficient condition for causation. However, the experimental design here allows us to move beyond mere association.

\* \*\*(B) The sample size is too small to draw a valid conclusion.\*\* This is unlikely. While the sample size is a factor, the problem states that a statistically significant difference \*was\* observed. A small sample size can weaken the \*power\* of a test (the ability to detect a real effect if one exists), but if the effect is large enough to be statistically significant, then the sample size \*was\* sufficient to detect it. Moreover, 60 fish (30 per group) is a reasonable sample size for many fish experiments, suggesting the study was adequately designed.

\* \*\*(C) He has proven that the herbicide causes higher levels of the enzyme.\*\* This is too strong. In science, especially with biological systems, "proof" is a difficult term. While the evidence strongly suggests causality, it doesn't eliminate all possible alternative explanations (e.g., a highly unlikely, unseen factor affecting only the treatment group). The conclusion should be worded to reflect the probabilistic nature of scientific inference (i.e., "evidence for" instead of "proof of"). Also, a single study does not "prove" anything. The scientist would still need to replicate the experiment multiple times, preferably at different locations with different fish species, to establish a strong conclusion about the impact of the herbicide.

\*\*In summary, a graduate student in statistics should choose (D) because it correctly acknowledges the causal inference supported by a well-designed, statistically significant experiment while remaining appropriately cautious about overstating the certainty of the conclusion.\*\*