**CREDIBLE SCIENCE**: Key Points Worksheet 1

**REPLICABILITY CRISIS**

Submit your completed worksheet to the Canvas assignment

# “[1,500 scientists lift the lid on reproducibility](https://www.nature.com/news/1-500-scientists-lift-the-lid-on-reproducibility-1.19970)”

Monya Baker describes possible reasons behind the replicability crisis (Baker 2016).

List at least three reasons you find plausible.

Pressure to publish (relatively low value accorded to replication efforts)

Low statistical power – especially in ecology

Methods/code unavailable – again, especially in ecology

She also mentions difficulties associated with conducting a replicative study. Describe at least two.

Repeating studies within the lab – doubles (at least) the cost and time of a study. This is especially salient to ecology, where re-doing a study wholesale might be impossible given the amount of land or scarcity of organisms involved.

Pre-registering studies involves an additional step that is not yet the norm in ecology.

Finally, she mentions procedures and factors that could help improve replicability. Describe at least 3 of them. In addition, highlight whether the solutions you picked are likely to resolve the problem you described above.

Provide incentives for formal reproduction – I think placing higher value on replication studies is the most important, but the hardest, solution. There is intense pressure to come up with entirely novel framing, even when a study is probably most useful because it looks for a documented pattern in a new context or even the same context.

Journals enforcing standards – including standards for code and data availability and review. This is especially important for meta-analyses and computational studies.

Better mentoring/supervision – although I think this has less leverage than the above two, documenting and teaching protocols as lab personnel turn over is important for consistency.

Bonus point: “More than 70% of researchers have tried and failed to reproduce another scientist's experiments, and more than half have failed to reproduce their own experiments [but] most say that they still trust the published literature.” Why do you think researchers still trust the published literature?

Meta-analyses and similar excepted, no single study (should) be taken as proof of anything more general. One could argue that studies that are wrong are equally likely to be wrong in all directions, so the wrong-ness balances out over time and only real signals emerge. But this argument only holds if there is no bias towards publishing results that are surprising or that conform to our prior beliefs.

# “[Striving for transparent and credible research: practical guidelines](https://academic.oup.com/beheco/article/28/2/348/3069145)”

Ihle and colleagues describe how the lack of reliability and reproducibility results in lack of replicability and credibility (Ihle et al. 2017)

Define in your own words what *reliability* involves mentioning at least two researcher’s degrees of freedom.

Reliability involves following a pre-determined protocol throughout the cycle of a research project, rather than changing one’s question or statistical analysis in light of the results.

Define in your own words what *reproducibility* involves mentioning at least one tool that would help improve or maintain the reproducibility of your scientific workflow (explaining how).

A study is reproducible if another party, given the same data and research pipeline, could step through the pipeline and come to the same results. I’m currently working on documenting R package and data versions in my own work, because I have already found that some of my analyses break or come to different results because of updates to the packages I use.

Describe why *replications* could be useful and at least one way they could be incentivized.

Replications would increase the amount of weight we can place on findings from each experiment, arguably improving the overall state of knowledge more than one more possibly-flimsy but more ‘novel’ study. Placing more value on replications for hiring, tenure, etc. is one possible way to incentivize replications, but I think we also need to learn how to have the conversations that ensue when a replication *fails*. If replication efforts are viewed as challenges and failures reflect poorly on the original authors, replication studies will be strongly dis-incentivized

List at least one burden and one advantage of opening up raw data.

Open data supports synthesis across many study units, and lets future researchers ask completely new, un-thought-of questions using data that already exists.

One of the major challenges to open data is appropriate attribution. Collecting data is expensive and challenging, and data authors understandably want to be credited when their data is used. Ecology is moving towards developing standards for crediting authors of even large and long-term data sets, but we haven’t yet achieved a consensus.

# References

Baker M. 2016. 1,500 scientists lift the lid on reproducibility. Nature | News Feature

[http://www.nature.com/news/1-500-scientists-lift-the-lid-on- reproducibility-1.19970](http://www.nature.com/news/1-500-scientists-lift-the-lid-on-reproducibility-1.19970). Accessed 27 November 2018.

Ihle, M., Winney I. S., Krystalli A. & Croucher M. (2017). Striving for transparent and credible research: practical guidelines for behavioral ecologists. ***Behavioral Ecology*** 28(2): 348-354.