Questionable Research Practices in non-hypothesis testing research: Ecological models for conservation decision-making

What do Questionable Research Practices (QRPs) entail?

QRPs refer to a sequence of non-randomized analytic decisions or choices made by the modeller to arrive at a desired result obtained for a model, its predictions, and/or evaluation criteria, without reporting all assumption checking or evaluating the model. Choosing to report only the best performing scenario that make the model viewed fit for purpose. Changing the model, purpose after running scenario analyses.

QRPs can occur at multiple decision points, multiple QRPs might depend on the specified model structure.

QRPs when modelling?

Some decisions are necessarily dependent on previous analytic decisions in the modelling workflow, e.g., an appropriate model-fitting method to derive $M_j$ might depend on the specific model structure.

What are some plausible QRPs when modelling?

Model fitting process results not in a single "result", but a suite of model components, which, collectively inform the subjective attributes of a model that determine its publishability.

How do we define Questionable Research Practices for model-based research?

A sequence of many analytic decisions or choices $C_j$ are made by the modeller to derive $M_j$ from $M$, and are the effects of QRPs on a model?

What are the effects of QRPs on a model?

Towards a Conceptual Framework of QRPs in Model-Based Research

Model Outputs

The Model, $M$, or Model Outputs, $M_j$

Model Credibility or Utility, by selecting reporting or "fishing".

No QRP, pre-specified analytical decisions:

$C(y,M;\phi_M)$

$C(y,M;\phi_{M_j}(y,M_j))$

Data-dependent analytic decisions that artificially increase the accuracy or precision of a model, its predictions, and/or evaluation tests to the effect that the model is perceived to be more credible than it would be if the QRP did not occur, or practices that lead to consumers of the model placing false belief in the reliability, validity and utility of the model than would be warranted without the QRP.

> define “QRP” for models

> Data-dependent analytic decisions that artificially increase the accuracy or precision of a model, its predictions, and/or evaluation tests to the effect that the model is perceived to be more credible than it would be if the QRP did not occur, or practices that lead to consumers of the model placing false belief in the reliability, validity and utility of the model than would be warranted without the QRP.

> What technical solutions other than pre-registration may mitigate QRPs?

> Many opportunities for undiscovered “Researcher Degrees of Freedom” in model-based research

> QRPs can occur at multiple decision points, multiple QRPs possible at each modelling step

> Direct analogues between NHST and non-NHST research, but also some specificities

> Open Questions and Next Steps

> What is the prevalence and extent of QRPs in the published ecological modelling literature?

> What technical solutions other than pre-registration may mitigate QRPs?

> Is pre-registration an appropriate solution to model-based QRPs? What form would it take?