

Goodman and Lewis, Part I: Conclusions and recommendations

- 1) The elimination of the outlier data point (2003) to determine if this event highly leveraged (i.e., unduly influenced) the NPS correlation was a legitimate and appropriate diagnostic test. MMC was incorrect to reject this diagnostic test.
- 2) The Becker 2011 statistics are leveraged (i.e., unduly influenced) by a single stochastic (random) event -- the rogue elephant seal at Double Point in 2003: when 2003 alone is eliminated, Becker's best models are no longer significant.
- 3) The same conclusions are derived regardless of statistical method: Goodman and Lewis provided head-to-head comparison of GLM using AIC vs. MLR using R squared analysis, and derived the same conclusion: the NPS oyster activity model is entirely supported by the stochastic (and lethal) 2003 event.
- 4) Having rejected the request to ask NPS to do the outlier diagnostic test of their model, MMC instead accepted a different analysis from NPS that was purported to determine the leverage of the 2003 event on the NPS correlation. Rather than subtracting the 2003 event from their correlation, NPS instead added another independent variable that was leveraged by the 2003 event. Instead of effectively testing $2 - 2 = 0$, NPS in essence tested $2 + 2 = 4$. MMC accepted an incorrect test.
- 5) By adding another independent variable entirely leveraged by the lethal 2003 event, NPS essentially doubled down – they tested two variables that were both leveraged by the same event – and no surprise, found an increased R squared.
- 6) Although MMC stated to Kevin Lunny that it had not asked NPS to do the outlier diagnostic test, it actually had asked NPS to test their model without 2003 and 2004. In the absence of 2003, the NPS model was no longer significant.
- 7) The MMC mistakenly accepted the NPS correlation that was highly leveraged by the random 2003 event at Double Point. The MMC made two compounded errors. First, MMC did not request the outlier diagnostic test. Second, MMC allowed NPS to do an inappropriate test that added rather than subtracted the 2003 event and never determined whether it leveraged the oyster activity model.
- 8) The NPS data are too thin, and too highly leveraged by a stochastic event in 2003, to be able to support the NPS correlation between harbor seals and oyster activity. Moreover, the NPS data are inadequate for MMC to affirm the NPS claim of a correlation between harbor seals and oyster activity.
- 9) What was called a long-term displacement OUT of Drakes Estero was actually a short-term displacement INTO Drakes Estero caused by events at Double Point. There is no evidence for long-term spatial displacement of seals and pups OUT of Drakes Estero that can be related to shellfish aquaculture.
- 10) The MMC mistakes could have been avoided had the MMC proceeded with their original open process rather than the insular closed process they conducted. Open dialogue, open discussion, and open exchange could have helped avoid these mistakes. Unfortunately, the closed process led to a flawed MMC Report.

To resolve this issue, we recommend the following: Interested parties (e.g., elected officials, agency or committee staff, and the press) can verify our analysis by consulting with independent statisticians – independent of us, the NPS, marine mammal community, and NGOs. Any professional statistician (e.g., the American Statistical Association) could help resolve this issue. We welcome such an independent analysis.

Goodman and Lewis Part II: Conclusions and recommendations

- 1) The Becker 2011 statistics are leveraged (i.e., unduly influenced) by a single stochastic (random) event -- the rogue elephant seal at Double Point in 2003: when 2003 alone is eliminated (the diagnostic outlier test), Becker's best models are no longer significant.
- 2) In his August 29 report to the MMC, Goodman presented models relying on the seals at Double Point, the total regional seal population, and the 1992 protocols that were three orders of magnitude (1000X) more statistically significant than Becker's best models, and remained statistically significant when 2003 alone was removed (i.e., were robust to the diagnostic outlier test).
- 3) The MMC panel members in their reports in Appendix F of the MMC report cited the ecologic importance of both the total regional harbor seal population dynamic (peaking in 2002-2004) and the stochastic event at Double Point (in 2003 with residual impact in 2004) as potential major influences on the harbor seal population in Drakes Estero, and cautioned that both tended to artificially coincide with the NPS measure of oyster activity.
- 4) The MMC Report rejected Goodman's top models due to built-in and linked dependencies. It is troubling that Dr. Ragen failed to raise the issue with either Dr. Goodman or Mr. Lewis. It is equally troubling that neither MMC nor NPS modified the models themselves.
- 5) The variable dependencies in Goodman's original models were not fatal as stated by the MMC, were easily adjusted, and when modified, gave rise to the same overall statistics and conclusions. In other words, MMC dismissed the Goodman analysis based upon variable dependencies that in the end made no difference. At the same time, when NPS contained similar dependencies, MMC was silent.
- 6) Goodman's modified best model (DP pups + total regional adults + 92 protocols), substituting adults for seals, has an adjusted $R^2 = 0.86$ and a P-value = 0.00001. These values are virtually identical to those generated from the original model, and drive the same overall statistics and conclusions as in Goodman's August 29 report and the Goodman and Lewis October 23 report.
- 7) Dr. Goodman's top model (modified from seals to adults) is three orders of magnitude more statistically significant than Becker's best model (from Becker 2011). Moreover, it remains statistically significant when 2003 alone is removed (the diagnostic outlier test), whereas Becker's best models fail that test.
- 8) Becker's new models, including a mathematical model of the 2003 event at Double Point, may be guilty of the same linked dependency as Goodman's top models, but it appears as if they were not scrutinized in the MMC Report. By adding another independent variable entirely leveraged by the stochastic 2003 event, NPS essentially doubled down -- they tested two variables that were both leveraged by the same event -- and no surprise, found an increased R squared.
- 9) The NPS data are too thin, and too highly leveraged by a stochastic event in 2003, to be able to support the NPS correlation between harbor seals and oyster activity. Moreover, the NPS data are inadequate for MMC to affirm the NPS claim of a correlation between harbor seals and oyster activity.

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