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Addendum to “Chasing the light: Positive bias in camera-based surveys of groundfish examined as risk-foraging trade-offs” Biological Conservation, 231, 133–138☆

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Research we published in Frid et al. (2019) examined fish behaviours that may bias survey counts conducted with a towed-video camera and parallel laser beams used as distance scalers. We hypothesized that fish perceive the laser dots, which project onto the benthos, as potential food and the camera, which lags behind the dots while moving forward, as a generalized threat. We argued that variation in the probabilities of fish chasing the laser dots could be predicted from predation risk theory, which would help correct for biases in survey counts. We predicted that chase probabilities would decrease with the maximum age (or lifespan) associated with each species and with the group size of individuals, and that these effects would be stronger for benthic than for pelagic feeders. The main analysis consisted of a generalized linear mixed model with a binomial distribution, which included maximum age, group size, depth, season and species primary diet as fixed effects; it also included a random effect for “species” intended to control for interspecific variation not captured by fixed effects. Our results were consistent with predictions (Model 1 of Table 2 and Figs. 2–3 in Frid et al., 2019).

After publication, however, we became aware that our use of “species” as a random effect might have created a correlation with the fixed effect of maximum age. Accordingly, we re-ran the analysis with the same fixed effects (including original interactions) but without the “species” random effect, using a generalized linear model with a binomial distribution implemented in R (R Development Core Team, 2019). As before, we used model selection procedures to select the top model among different candidates. In the revised results, support for the effect of maximum lifespan was strengthened for benthic feeders (slopes became steeper and confidence intervals narrowed) but support for the effect of group size was lost (Fig. 1; Table 1, Supplementary Data). Also in the revised model there was no support for behavioural differences between primary and partial feeders of benthic mobile prey (standard error is larger than the estimate for this parameter: Table 1), whereas in the original analyses there was a slight difference between the two diet groups.

Based on our revised top model (Table 1), the equation for correcting biased counts becomes:

$$C_u = C_b \times (1 - Pr_{m,f,d,s}) \tag{1}$$

where C_u is the unbiased count, C_b the biased count, and $Pr_{m,\,f,\,d,\,s}$ is the chase probability for an individual from a species with maximum age m and primary diet f observed at depth d during season s.

While recognizing that our original analysis made a spurious con-

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☆ This addendum is motivated by feedback that we received after publication, pointing to a correlation between a fixed effect and a random effect in the general linear mixed model originally used, which had potential to produce spurious results. Here we present a revised analysis that solves that problem, increasing support for the key predictor (maximum age) but removing support for a second predictor (group size).

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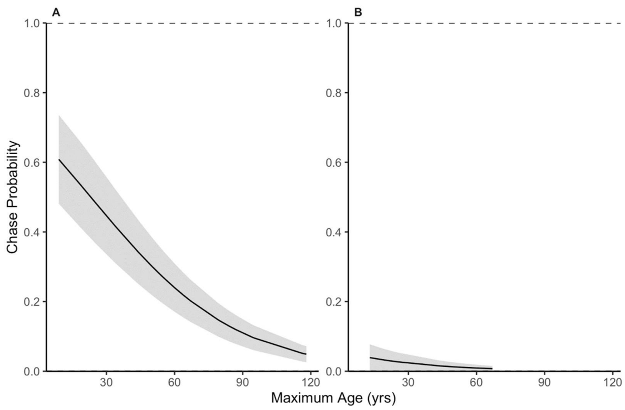

Fig. 1. Revised probability of chasing the laser dots in response to the maximum age and primary diet of different species (Table 1). Panel A represents predators of benthic mobile prey (both primary and partial). Panel B represents non-consumers of benthic mobile prey. (For details of diet groups, see Frid et al., 2019.) The band is the bootstrapped 95% confidence interval based on 500 iterations. Estimates are for depths of 50 m during summer. For each panel, the range of maximum ages corresponds to that of species in the given diet group.

clusion on the effect of group size, the revised analysis strengthens our original argument that maximum age is an important predictor of behaviours that may bias counts in camera-based surveys that use parallel laser beams as distance scalers.

Table 1
Revised results showing the general linear model best supported by AICc model selection (Supplementary Data). Partial predators of benthic mobile prey are the reference for coefficients describing primary diet.

Predictor	Estimate	Std Error
Intercept	−0.9894	0.4048
Benthic predators of mobile prey	0.0797	0.2181
Non-consumers of benthic mobile prey	−3.4343	0.5392
Depth	−0.0181	0.0061
Max Age	−1.0930	0.1137
Season	0.6169	0.2585

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.biocon.2020.108513.

References

Frid, A., McGreer, M., Frid, T., 2019. Chasing the light: positive bias in camera-based surveys of groundfish examined as risk-foraging trade-offs. Biol. Conserv. 231, 133–138.

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