Note: I’m trying to avoid commenting on small editorial differences.

67-83 – In the main text here somewhere, could you please indicate (1) whether you are including factors for spatial variation, spatio-temporal variation, or both, (2) how many factors you are including for each model component, and (3) what rotation you are using when presenting results (from the following it looks like PCA rotation)? I think it would only need 1 sentence, and you could reference the Methods for details. Or: maybe this is a bad idea, I’m not really used to writing for journals with this Methods-last format!

line 74-76 – Please rephrase, the wording is awkward as-is. I think you mean that the estimated factors can then be compared with measured covariates to refine hypotheses regarding what is driving observed covariation?

82 – perhaps change “such as survey catch rate differences” to “such as differences in survey sampling efficiency (a.k.a. catchability)”

86 – This sentence seems redundant given the greater detail provided later in the paragraph regarding the number of species in commercial catch, I suggest combining with the sentence starting on line 87.

106 – “the first factor (after PCA-rotation)”, i.e., please remind the reader that presented factor values and loadings matrices are after rotation.

109 – I’d change “positive coefficient” to “positive value”

110 – I’d change “negative association” to “negative value”, or regardless maintain consistency with earlier terminology.

Fig. 1 – are you sure that the values are right for variance-explained in panel A vs. panel B? It seems unlikely that they would be identical to the 3rd digit for each factor.

Fig. 3 caption – what confidence interval was used to define which spanned zero?

Fig. 4 – I couldn’t really figure out the rationale for the coloring used in panels A-G without reference to the text. E.g., clearly panel F has pink and brown, corresponding to megrim and anglerfishes in panel H. However, each map shows spatial variable (perhaps the log-ratio of expected megrim to anglerfishes), so is pink indicating areas where E[megrim] > E[anglerfishes] and brown the opposite? It would be good to explain the color-coding in more detail, including the scale used for colors in each panel (perhaps by including an insert colorbar in each panel A-G).

116 – “on the second [spatial] factor [for encounter probability]”

127 – “with the positive [values]”; again, you could use some other term, but hope we’re consistent throughout.

131 – Change “while a factor composition” to “While this exploratory factor analysis”

134 – Perhaps change “density” to “positive density”, and use “positive density” throughout to reference the 2nd component of the delta model. I think “density” is a bit too non-specific to me a good moniker for this model component.

143 – Hmm. Just as a discussion point, you’re aware that you could include depth as an explicit “dynamic habitat covariate” (which specifying that it doesn’t change among years), and treat the species-specific depth coefficient as a “factor loading” while still calculating covariane arising from factors + covariates? I think our current approach is fine, but want you to be aware of the alternative path we could follow. NOTE: I see in the Methods that you explored this other model specification. Perhaps add a sentence stating that you explored this, and reference the methods or Suppl Mat section where it is dealt with in more detail.

162 – “This suggests that [one or more] common environmental driver[s]”

223 – “through megrim has a stable density across the modeled area as indicated”

230-239 – I think this presentation is very cool! Could you add 1-2 sentences to the introduction foreshadowing this difference in relative catch rate among gear types? I’d be curious about the mechanistic properties of otter vs. beam trawls (are they fishing closer to the bottom, or have a higher headrope to herd pelagic species?) to interpret this, even in just a post-hoc way.

257-262 – please see Breivik et al. 2016 CJFAS (don’t have citation info on this computer, but studied bycatch in Norwegian shrimp fishery using fine-scale spatio-temporal models), or (Cosandey-Godin et al. 2014, Ward et al. 2015) for examples discussing this approach.

267-274 – I think a stronger way to word this is: we assume that fisheries can achieve roughly the same catch as the survey at a given place and time. Therefore, this analysis shows how much locational decisions can separate catches of different species in a mixed fishery. However, in practice fishers can also separate amongst species using fine-scale behaviors (gear deployment, time-of-day, fine-spatial scale, bottom sensor, etc.), see (Abbott et al. 2015, Thorson et al. 2016). So in practice, this analysis provides a lower-bound on how much species can be avoided.

288 – Its technically a 2D Gaussian Markov random field, and then the third dimension (time) is treated as 0th order Markov (i.e., IID). NOTE: later I see that you maybe mean species as the 3rd dimension (not time). At any rate, perhaps rephrase to state that you have a GMRF across space, but also model random variation among species and years.

Eq. 2-3 – This is missing a symbol for spatial factors, which appear to be included in the model. Also, given that you later explore including depth as a “density covariate”, I would include a symbol for “density covariates” in these equations, which explaining that this was used to explore including depth during a model-selection step.

Eq. 3 – There’s a log-link here on the left-hand side (instead of the gamma distribution), and then I recommend adding an Eq. 4 showing the Gamma distribution and delta-model formulation (i.e., the probability function for the data given p and r)

314 – V is a covariance matrix (this is important, because a Kroenecker product of two correlation matrices would still be a correlation matrix, and hence would be missing information regarding the magnitude of spatio-temporal variation)

353 – Please rephrase: there’s a log-link for the linear predictor for positive density and a logit-link for the linear predictor for encounter probability.

359 – I would say it included 130,950 “coefficients”, and use the term “parameter” to refer specifically to fixed effects. This use of coefficients to indicate both fixed and random effects, is why I prefer the term “value” for the numerical value predicted for each random effect (i.e., “factor values” instead of “factor coefficients”)

Abbott, J. K., A. C. Haynie, and M. N. Reimer. 2015. Hidden Flexibility: Institutions, Incentives, and the Margins of Selectivity in Fishing. Land Economics 91:169–195.

Cosandey-Godin, A., E. T. Krainski, B. Worm, and J. M. Flemming. 2014. Applying Bayesian spatiotemporal models to fisheries bycatch in the Canadian Arctic. Canadian Journal of Fisheries and Aquatic Sciences 72:186–197.

Thorson, J. T., R. Fonner, M. A. Haltuch, K. Ono, and H. Winker. 2016. Accounting for spatiotemporal variation and fisher targeting when estimating abundance from multispecies fishery data. Canadian Journal of Fisheries and Aquatic Sciences:1–14.

Ward, E. J., J. E. Jannot, Y.-W. Lee, K. Ono, A. O. Shelton, and J. T. Thorson. 2015. Using spatiotemporal species distribution models to identify temporally evolving hotspots of species co-occurrence. Ecological Applications 25:2198–2209.