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

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| 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! | I have tried to deal with these two points together. The text now reads:  “...We Implement a factor analysis decomposition to describe trends in spatiotemporal dynamics of the different species as a function of latent variables {Thorson2015} representing spatial variation (9 factors; which we call 'average' spatial variation) and spatio-temporal variation (9 factors) for encounter probability and positive catch rates (which we describe as 'positive density') separately {Thorson2015a}. We use the resultant exploratory factor analysis to identify community dynamics and drivers common among 18 species-groups and present results through transformation of the loading matrices through PCA rotation. By describing the species-groups dynamics through underlying contributory spatiotemporal factors we can take account of how the factors contribute to affect catches of the species-groups in mixed fisheries….” |
| 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)” | Done |
| 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. | Done – trimmed/combined |
| 106 – “the first factor (after PCA-rotation)”, i.e., please remind the reader that presented factor values and loadings matrices are after rotation. | Done |
| 109 – I’d change “positive coefficient” to “positive value” | Done |
| 110 – I’d change “negative association” to “negative value”, or regardless maintain consistency with earlier terminology. | Done |
| 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. | Good spot! Is corrected with the right values for the positive density results – was a typo in the plot code |
| Fig. 3 caption – what confidence interval was used to define which spanned zero? | +- 1.96 \* SE : added this to the figure legend |
| 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). | I have added a colour bar for for each panel under the title of each plot.  The representation is the differences between the standardised (i.e. den(i) / sum(den)) for each species pairs at each location : added this to the figure legend |
| 116 – “on the second [spatial] factor [for encounter probability]” | Done |
| 127 – “with the positive [values]”; again, you could use some other term, but hope we’re consistent throughout. | Done |
| 131 – Change “while a factor composition” to “While this exploratory factor analysis” | Done |
| 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. | Done |
| 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. | Yes, this was not working / improving the model. I’m unsure why this was, it may have been I was not implementing it correctly...but I tried a few ways and it didn’t reduce the AIC. May be something we get called on, but I’ve for now included a sentence as suggested:  “While depth was incorporated as a covariate in an alternative model formulation (see Methods), it was found not to improve predictions. The utility of these variables as predictors of species distributions has been identified in other marine species distribution models \cite{Robinson2011}; the advantage to the approach taken here is that, where such data is unavailable at appropriate spatial resolution, the spatial factor analysis can adequately characterise these influences on species dynamics.” |
| 162 – “This suggests that [one or more] common environmental driver[s]” | Done |
| 223 – “through megrim has a stable density across the modeled area as indicated” | Done |
| 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. | Have added a sentence:  “Otter trawl gears are known to have higher catch rates of roundfish due to the higher headline and wider sweeps which herd demersal fish into the net. Conversely, beam trawls, which employ chain mesh to 'dig' benthic flatfish species, have higher catch rates for these species {Fraser2008}.” |
| 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. | Great, I have incorporated a sentence on this – the full paragraph now reads:  “A role that science can play in supporting effectiveness of spatio-temporal avoidance could be to provide probabilistic advice on likely hotspots for species occurrence and high species density which can inform fishing decisions.  Previous modelling studies have shown how spatiotemporal models could improve predictions of high ratios of bycatch species to target species \cite{Ward2015, Cosandey-Godin2015, Breivik2016}, and geostatistical models are well suited to this as they incorporate spatial dependency while providing for probabilities to be drawn from posterior distributions of the parameter estimates. We posit that such advice could be supported by integrating data obtained directly from commercial fishing vessels at a higher temporal resolution, providing real-time forecasts to inform fishing choices that also captures seasonal differences in distributions. |
| 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. | I have reworded as follows:  “Our model captures differences between location fished for two gear types and their broad scale effect on catch composition; information which could be used to inform decisions on the contribution spatial avoidance can make in implementing the landing obligation. However, it likely the analysis reflects a lower bound on the utility of spatial avoidance as fine scale behavioural decisions which such as time-of-day, gear configuration and location choices also be used to affect catch\cite{Abbott2015, Thorson2016}. Results observed elsewhere\cite{Branch2008, Kuriyama2016}, suggest limits to their effectiveness and our framework could be used to simulate different fishing effort scenarios to identify optimum fishery production\cite{Reimer2017} for what such a lower bound might be when making management decisions\cite{Ulrich2017}. Identifying the limits of spatial targeting and avoidance could then contribute to meeting the goal of maximising catches in mixed fisheries within single stock quota constraints. It may also inform the extent to which measures such as gear changes and time-area closures are needed to support transition to the new management system. |
| 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. | OK, have amended to reflect.  “Spatial variation is captured through a Gaussian Markov Random Field, while we model random variation among species and years. Covariates affecting catchability (to account for differences between fishing surveys) and density (to account for environmental preferences) can be incorporated for predictions of presence and positive density.” |
| 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) | Corrected |
| 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. | Corrected |
| 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”) | Cool – done |

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