NEWS for VAST 3.10.0

Purpose of document:

This document lists substantial changes in R package VAST for each numbered release starting at 3.5.0. VAST depends upon utility functions within package FishStatsUtils, and this document therefore lists new features, bug fixes, deprecated features, and other changes occurring via edits to both VAST and FishStatsUtils.

CHANGES IN VAST 3.10.0

CHANGING DEPENDENCIES

- Requires FishStatsUtils version >= 2.12.0

NEW FEATURES

- Adding plotting function `plot_similarity` to allow automated plots for correlation, covariance, dissimilarity, and hierarchical clustering associated with each covariance matrix
- Adding function `reload_model`, which allows users to load a fitted model and relink the DLLs to use it as if it were run originally in that R session.
- Adding plotting function `plot_clusters` to allow efficient plots of hierarchical clustering of spatial variables including `D_gct`, `Omega_gc`, and `Epsilon_gct`
- Adding `project_model` to allow rapid exploration of future climate scenarios using end-of-century climate model output without iteratively re-fitting the model.
- Adding plotting function `plot_residual_semivariance`, which takes quantile residuals, converts to an approximate normal distribution, calculates a two-dimensional semivariance in space and time, and then plots this. The normal-

transformed residual semivariance should be approximately 1.0 at all spatial and temporal lags.

- Adding integrated-test using Bering Sea pollock index model for all installed versions to ensure backwards compatibility is functional at least for this minimal case.

BUG FIXES

- Fixes bug in unconditional simulation of {beta1/beta2/epsilon1/epsilon2} components when they were specified as having a random-walk or autoregressive structure over time. These were previously simulated while using as mean the *estimated* value from the previous time. The corrected behaviour is to simulate these while using as mean the *simulated* value from the previous time.
- Fixes small bug in labelling in `amend_output`

DEPRECATED

- While fixing the unconditional simulation of {beta1/beta2/epsilon1/epsilon2}, the package author has disabled the Vector Autoregressive features specified via `VamConfig`. These could easily be re-added in the future, and the author invites an email if anyone is interested in exploring the `VamConfig` options.
- Removing CPP versions prior to V8.0.0

CHANGES IN VAST 3.9.1

BUG FIX:

- Update `make_data` to specify appropriate default value for correlations over land vs. water for use in Method = "Barrier" feature. The previous defaults resulted in faster decorrelation over water than land, i.e., stronger correlations via land than water

CHANGES IN VAST 3.9.0

CHANGING DEPENDENCIES

- Requires FishStatsUtils version >= 2.11.0

NEW FEATURES

- Replacing extrapolation grids for eastern and northern Bering Sea, and Bering Slope, using updates endorsed by Bering Sea team of Groundfish Assessment Program at Alaska Fisheries Science Center.

CHANGES IN VAST 3.8.2

CHANGING DEPENDENCIES

- Requires FishStatsUtils version >= 2.10.2

BUG FIXES

- Fixes plotting but in `calculate_proportions` that was introduced in VAST 3.8.0, which previously resulted in an uninformative error message

CHANGES IN VAST 3.8.1

CHANGING DEPENDENCIES

- Requires FishStatsUtils version >= 2.10.1

BUG FIXES

- Update .onAttach to download FishStatsUtils >= 2.10.1

CHANGES IN VAST 3.8.0

CHANGING DEPENDENCIES

- Requires FishStatsUtils version >= 2.10.0
- Requires package `units`
- Eliminate dependency `plotKML`, which has been removed from CRAN

NEW FEATURES

- Removed p-values from DHARMa plots, pending validation or improvements, and based on preliminary research suggesting that they are not particularly useful (conservative or anti-conservative, depending upon specifics of model)
- Added a "generalized gamma" distribution as new distribution, which involves two variance parameters and can continuously transition between gamma and lognormal distributions.
- Improve `Effect.fit_model` used in marginal-effects plots to allow visualizing covariate response curves in multivariate models (`Effect.fit_model` previously only worked with univariate models).
- Improve `plot_data` to use specified `projargs` input, i.e., to work well with nonstandard projections.
- Adds new calculation of deviance in the Report for gamma and lognormal delta models, which can be used to calculate percent-deviance-explained as a metric of model explanatory power for comparison across models or with other software packages.
- Allows new spatially-varying density dependent effect via `X1config_cp[,]=4` or `X2config_cp[,]=4`, which replaces a given covariate with the sum of both temporal terms (beta1+beta2) and then estimates a zero-centered spatially varying response to that temporal term.
- Allows users to implement a necessary identifiability constraint when estimating a loadings matrix for spatio-temporal variation across both years and species.
- Allows users to specify units for inputs `b_i` and `a_i`, as well as `a_el` from `make_extrapolation_info`, and then displays correct units in resulting index; if these

inputs are missing an explicit units designation, then the model coerces them to have units `kg`, `km^2` and `km^2` respectively.

BUG FIXES

- Allow calculation of Dunn-Smyth simulation residuals even for models including some instances where `b_i=NA`, i.e., in cases involving forecasting. These instances previously caused an uninformative error message and terminated plotting.

CHANGES IN VAST 3.7.1

CHANGING DEPENDENCIES

- Requires FishStatsUtils version >= 2.9.1

NEW FEATURES

- Change `fit_model` to include `getJointPrecision=TRUE` by default, so that range-edge metrics are computed by default.

BUG FIXES

- Change the default `projargs` used when plotting to Lon-Lat, to avoid errors arising from applying custom projections to global coastline maps without also specifying a reduced subset of countries.

CHANGES IN VAST 3.7.0

CHANGING DEPENDENCIES

- Requires FishStatsUtils version >= 2.9.0

NEW FEATURES

- Integrate package `effects` to plot covariate-response curves based on user-specified formulae for density and catchability covariates (including basis-spline, polynomial, interaction or other basis-expansion methods) along with confidence intervals.

- Improve `predict` feature added in release 3.6.0 including: (1) adding an integrated-test to confirm that it behaves identically to `predict.glm` in some simple cases; (2) improving documentation; and (3) confirming that it can be integrated with package `pdp` to make partial dependence plots.
- Re-adding continuous integration: (1) eliminating usage of TravisCI and instead (2) adding files to trigger the GitHub "CI" Action (based on substantial contributions from Cole Monnahan).
- Adding a simplified user-interface for seasonal spatio-temporal models (based on substantial contributions from Andrew Allyn).

BUG FIXES

- Update `plot_quantile_residuals` to ensure that a residual >0.5 corresponds to data above the median from the predictive distribution, and a residual <0.5 corresponds to data below the median from the predictive distribution (the previous version had that swapped due to the sign-change caused by using a uniform-to-chi-squared function for aggregating quantile residuals).

CHANGES IN VAST 3.6.1

BUG FIXES

- Update `map` object which was generated incorrectly for several topics related to backwards compatibility, as well as for some types of spatially varying coefficient model.

CHANGES IN VAST 3.6.0

CHANGING DEPENDENCIES

- Requires FishStatsUtils version >= 2.8.0

NEW FEATURES

- Expanding use of formula interface to specify covariates. A separate formula is now specified for each linear predictor for density (X1_formula/X2_formula) or catchability (Q1_formula/Q2_formula). Catchability formulas are parsed by user-supplied data frame `catchability_data`. However, the user can still use previous interface, either by passing X_itp / X_gtp directly, or by passing a single formula.
- Allowing user to specify spatially varying coefficients for each density linear predictor separately (X1config_cp / X2config_cp), and adding new feature to allow users to specify a spatially varying catchability covariate (Q1config_k / Q2config_k). This allows users to, for example, estimate a differences in gear performance between two surveys where gear performance varies spatially as a random field.
- Adding generic predict function for S3 class `fit_model`; the function is very slow but could be expanded in the future to be similar to predict functions for other common regression packages.

ISSUES RESOLVED

- Identify issue whereby VAST was giving different results when run using R version >= 4.0.0, compared with earlier R versions. This occurred due to changes in base-R with how integers are sampled, as documented in issue #244. A new option `calculate_kmeans( …, backwards_compatible_kmeans=FALSE)` has been added for users wanting to generate an identical k-means object to previous R versions; this is used e.g., in integrated-tests to ensure that results from prior versions can be replicated exactly.

BUG FIXES

- Update `projargs` strings passed to package sp / RGDAL, to keep up with changes to using PROJ6. The previous use of projargs strings was throwing annoying warning messages, but the change did not appear to impact functionality.

CODE AND STABILITY IMPROVEMENTS

- Omega (spatial random effects), Epsilon (spatio-temporal random effects), and Delta (overdispersion random effects) are now built to have zero-length when these features are not needed (by making one dimension have length-0). This is intended to (1) decrease memory required in the former approach of mapping these off, and (2) eliminating the chance that users might inadvertently set starting values to non-zero values, which would previously have resulted in incorrect results.
- `make_covariates(.)` has been re-structured to change the order of operations, resulting in a more stable implementation for use with factors and interactions

CHANGES IN VAST 3.5.1

BUG FIXES

- Fix error in compiling CPP version 9.3.0 and 9.4.0, which occurred using rtools40 as required by R version >= 4.0.0. This involved change function `abs(.)` to `fabs(.)` in these CPP files.

CHANGES in VAST 3.5.0

CHANGING DEPENDENCIES

- Requires FishStatsUtils version >= 2.7.0
- Requires R package DHARMa

NEW FEATURES

- Added a feature for barrier-SPDE, where vertices of the SPDE mesh that occur over land have a correlation of zero with nearby vertices.
- Changed density covariates to index by X_gctp (rather than X_gtp), so that manual editing can be used to implement cohort effects.
- Allows probability-integral-transform (PIT) residuals for delta-models, using DHARMa for plotting tools.

DEPRECATED AND DEFUNCT

- Eliminated deprecated and generally unused feature for seasonal modelling, whereby input t_iz is now replaced by t_i. This change simplifies code in CPP files in multiple places. Seasonal modelling is still feasible using the spatially-varying-coefficient features involving covariates.