

# Changes in **secr** 5.0

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This document explains the changes in **secr** 5.0 relative to later releases of **secr** 4.6. Version 5.0 is compatible in most respects with earlier versions. See the NEWS file for a complete list of the changes over time.

## Potential Gotchas

These changes may confuse users:

### New names

- `fxi.secr` has been replaced by the generic `fxi` method for `secr` objects

Thus use `fxi(secrdemo.0, i = 1, X = c(365,605))` rather than `fxi.secr(secrdemo.0, i = 1, X = c(365,605))`.

Some other functions with “.” in their name have been renamed to avoid confusion with methods for generics. The old names have been deprecated, but they will continue to work for a while.

Old	New
<code>esa.plot</code>	<code>esaPlot</code>
<code>fxi.contour</code>	<code>fxiContour</code>
<code>fxi.mode</code>	<code>fxiMode</code>
<code>fx.total</code>	<code>fxTotal</code> (generic)
<code>buffer.contour</code>	<code>bufferContour</code>
<code>pdot.contour</code>	<code>pdotContour</code>

## New default

- AIC and related functions now default to criterion = “AIC” instead of criterion = “AICc”

Some of us have been uneasy for a long time about blanket use of the AICc small-sample adjustment to AIC (Hurvich and Tsai 1989). Royle et al. (2014) expressed doubts because the sample size itself is poorly defined. AICc is widely used, but AIC may be better for model averaging even when samples are small (Turek and Fletcher 2012; Fletcher 2019, p. 60).

## New features

### New data **blackbearCH**

**secr** 5.0 includes a new black bear hair snag dataset from the Great Smoky Mountains, Tennessee (thanks to J. Laufenberg, F. van Manen and J. Clark).

### Goodness-of-fit **MCgof**

The method of Choo et al. (2024) for emulating the Bayesian p-value goodness-of-fit test (Gelman 1996, Royle et al. 2014) has been implemented as the generic **MCgof** with a method for ‘secr’ fitted models. I thank Yan Ru Choo for her assistance.

This is a new approach and should be used with caution. Bugs may yet be found, and the power of the tests is limited.

## Extended capability

These overdue features were needed to extend the models covered by **MCgof**:

- **detectpar** optionally returns values for each detector
- **pdot** accepts detector- and occasion-specific detection parameters

## Changes behind the scenes

Several new generic functions are defined, with methods specifically for ‘secr’ fitted models (**esa**, **fxi**, **fxTotal**).

The code for area-search and transect-search models (detector types ‘polygonX’, ‘polygon’, ‘transectX’, ‘transect’) has been streamlined with a view to removing it to another package. Some obscure internal functions are now exported to facilitate that future change. Simulation for these models (functions **sim.caphist**, **sim.detect**) will remain in **secr**, but uses native R functions rather than RcppNumerical of Qiu et al. (2023).

The undocumented detection function ‘HPX’ has been removed.

## References

- Choo, Y. R., Sutherland, C. and Johnston, A. (2024) A Monte Carlo resampling framework for implementing goodness-of-fit tests in spatial capture-recapture model *Methods in Ecology and Evolution* DOI: 10.1111/2041-210X.14386.
- Efford, M. G. (2024) **secr**: Spatially explicit capture-recapture models. R package version 5.0.0. <https://CRAN.R-project.org/package=secr>.
- Fletcher, D. (2019) *Model averaging*. SpringerBriefs in Statistics. Berlin: Springer-Verlag.
- Hurvich, C. M. and Tsai, C. L. (1989) Regression and time series model selection in small samples. *Biometrika* **76**, 297–307.

- Gelman, A., Meng, X.-L., and Stern, H. (1996) Posterior predictive assessment of model fitness via realized discrepancies. *Statistica Sinica* **6**, 733–807.
- Qiu, Y., Balan, S., Beall, M., Sauder, M., Okazaki, N. and Hahn, T. (2023) RcppNumerical: ‘Rcpp’ Integration for Numerical Computing Libraries. R package version 0.6-0. <https://CRAN.R-project.org/package=RcppNumerical>
- Royle, J. A., Chandler, R. B., Sollmann, R. and Gardner, B. (2014) *Spatial capture–recapture*. Academic Press.
- Turek, D. and Fletcher, D. (2012) Model-averaged Wald confidence intervals. *Computational statistics and data analysis* **56**, 2809–2815.