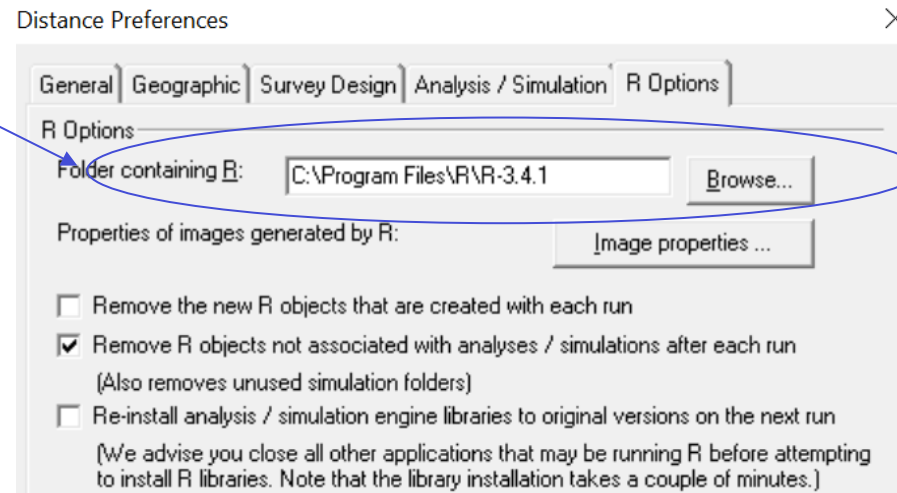


Mark-recapture distance sampling (MRDS) in Distance 7.1

- Setting up Distance for MRDS
- Setting up a Distance project for MRDS
- Data requirements
- MRDS analyses

Setting up Distance

- You need a copy of R installed on your computer <http://www.r-project.org/>
- Currently, the required version is R 3.4.1
 - Check:



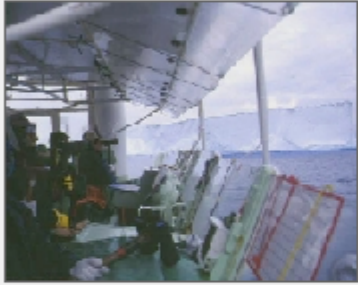
- Distance automatically installs mrds R library when you run an MRDS analysis

Project setup

- Choose “Double observer” in New project Setup Wizard

New Project Setup Wizard - Step 3: Survey Methods

In this screen, you tell Distance about your survey methods. Click 'Help' to find out more about each option.



Minke whale line transect surveys, Antarctic Ocean
Photo: Peter Corkeron

Type of survey

- Line transect
- Point transect
- Cue count

Observer configuration

- Single observer
- Double observer

Distance measurements

- Perpendicular distance
- Radial distance and angle

Sampling fraction

This option has been moved to the Multipliers page.

Observations

- Single objects
- Clusters of objects

Help Cancel < Back Next > Finish

Project setup

- This causes 3 extra fields to be added to the Observation layer

Observation					
ID	Perp distance	Cluster size	object	observer	detected
ID	Decimal	Decimal	Integer	Integer	Integer
n/a	m	[None]	[None]	[None]	[None]
Int	Int	Int	Int	Int	Int

- And their roles defined in the default Survey object

Survey Properties: [New Survey] Set: [Set 1]

Survey methods | Data layers | Data fields

Field definitions

These definitions specify where the numerical engines look for the data they need. Press F1 for more information.

Role	Layer name	Field name
Area	Region	Area
Effort	Line transect	Line length
Perp distance	Observation	Perp distance
Radial distance	Observation	[None]
Angle	Observation	[None]
Cluster size	Observation	Cluster size
Object	Observation	object
Observer	Observation	observer
Detected	Observation	detected

Defaults OK Cancel

Data requirements

- Observation data must have:
 - 2 rows per object – one for Observer 1 and one for Observer 2
 - Fields for:
 - object ID
 - observer (1 or 2)
 - detected (1=yes, 0=no)
- Additional covariate data can go in fields at the appropriate level
- Example: (golf tee project)

the 3 new required fields

Region		Line transect			Observation							
Label	Area	ID	Label	Line length	ID	Perp distance	Cluster size	object	observer	detected	sex	exposure
n/a	m2	n/a	n/a	m	n/a	m	[None]	[None]	[None]	[None]	[None]	[None]
Int	Int	Int	Int	Int	Int	Int	Int	Int	Int	Int	Int	Int
					111	2.41	1	56	1	0	1	1
					112	2.41	1	56	2	1	1	1
					113	1.29	1	57	1	0	0	0
					114	1.29	1	57	2	1	0	0
Default	1680	1	Default	210	115	2.95	3	58	1	0	1	0
					116	2.95	3	58	2	1	1	0
					117	2.19	1	59	1	1	1	1
					118	2.19	1	59	2	1	1	1
					119	1.27	3	60	1	1	1	0
					120	1.27	3	60	2	1	1	0

observation-level covariates – fields created during data import

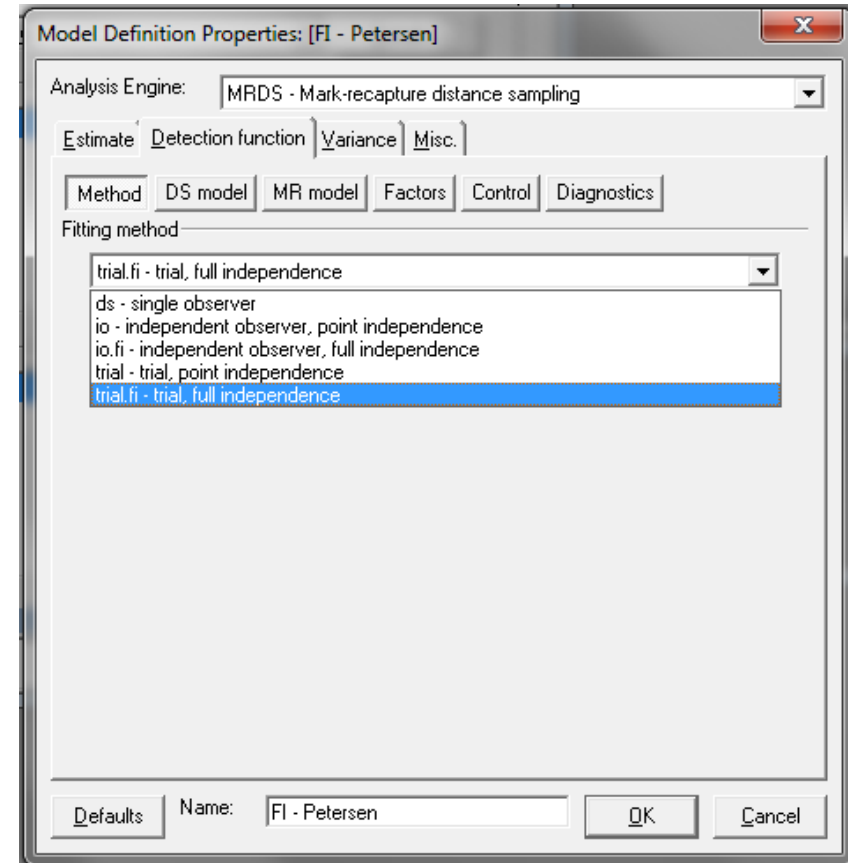
MRDS analyses

- Select MRDS engine in Model Definition
- Estimate tab
 - Stratification options as for CDS/MCDS engines – but no post-stratification for now
 - Quantities to estimate
 - Can choose not to estimate density (saves time during model selection)
 - Can choose to estimate a detection function, or to use a fitted function from a previous analysis.
 - Useful to apply a detection function estimated with all data to a subset of the data
 - See manual for details.

The screenshot shows the 'Model Definition Properties: [FI - Petersen]' dialog box. The 'Analysis Engine' is set to 'MRDS - Mark-recapture distance sampling'. The 'Estimate' tab is selected, with sub-tabs for 'Detection function', 'Variance', and 'Misc.'. Under 'Stratum definition', 'No stratification' is selected. Under 'Sample definition (for encounter rate)', 'Use layer type: Sample' is selected. In the 'Quantities to estimate' section, 'Estimate density / abundance' is checked. Under 'Detection function', 'Estimate detection function' is selected, and 'Analysis number' is set to 0. The 'Name' field at the bottom is 'FI - Petersen'. Buttons for 'Defaults', 'OK', and 'Cancel' are visible.

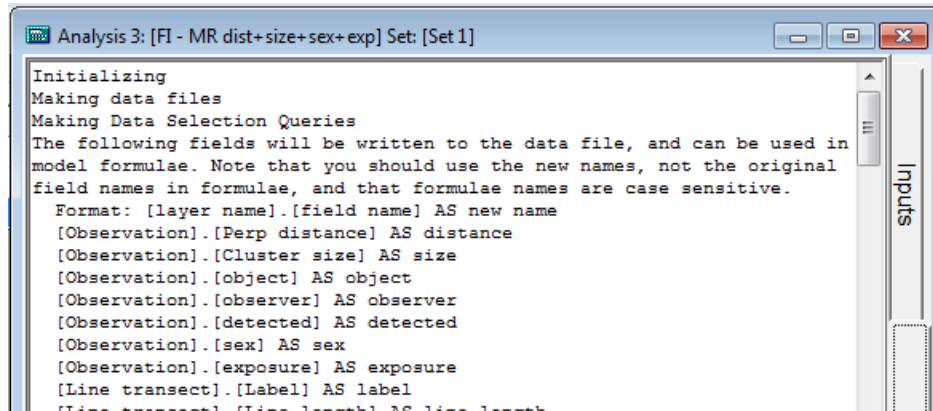
Detection function tab

- 5 methods at present
 - ds – CDS and MCDS (but no adjustment terms)
 - IO (independent observer) – both point and full independence
 - Trial – both point and full independence
- Choice of method determines which model you need
 - DS model = distance sampling model.
 - half-normal or hazard rate, optionally with covariates in the scale parameter
 - MR model = mark recapture model
 - GLM with logit link

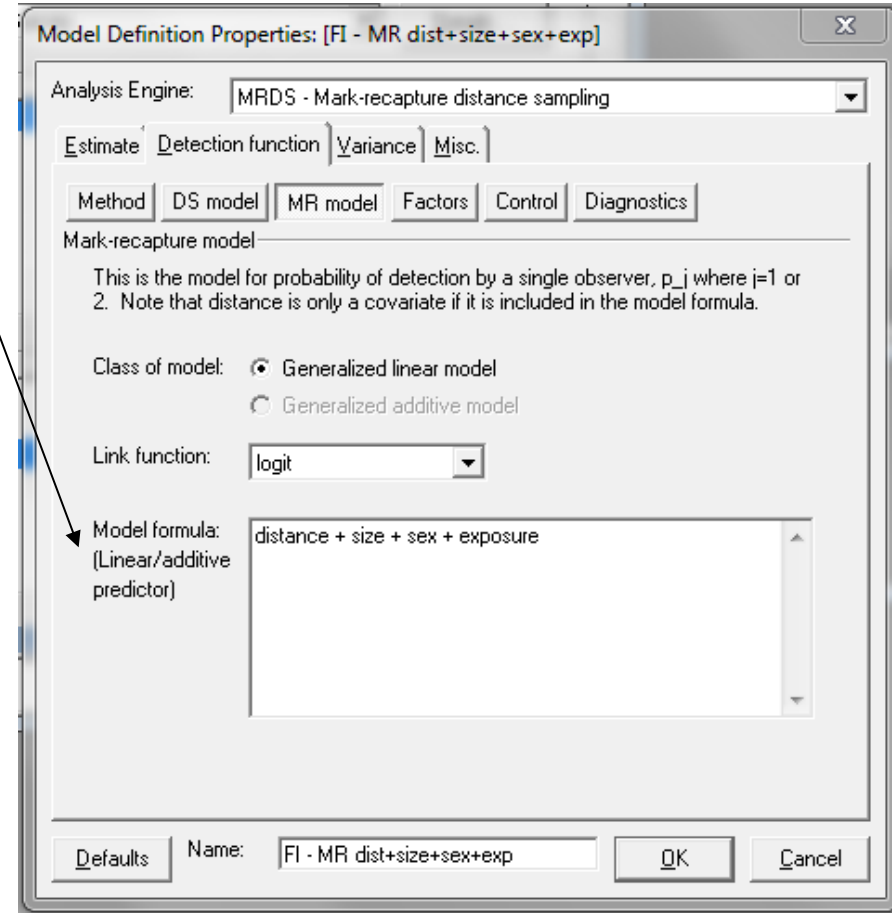


Model formulae

- Type in variable names joined by “+” (main effect), “:” (interaction), “*” (main effect + interaction)
- Note that some fields get renamed:
 - distance, size, object, observer, detected
 - fields from layers above the observation layer
- Tip – look in Analysis Details log to see new names

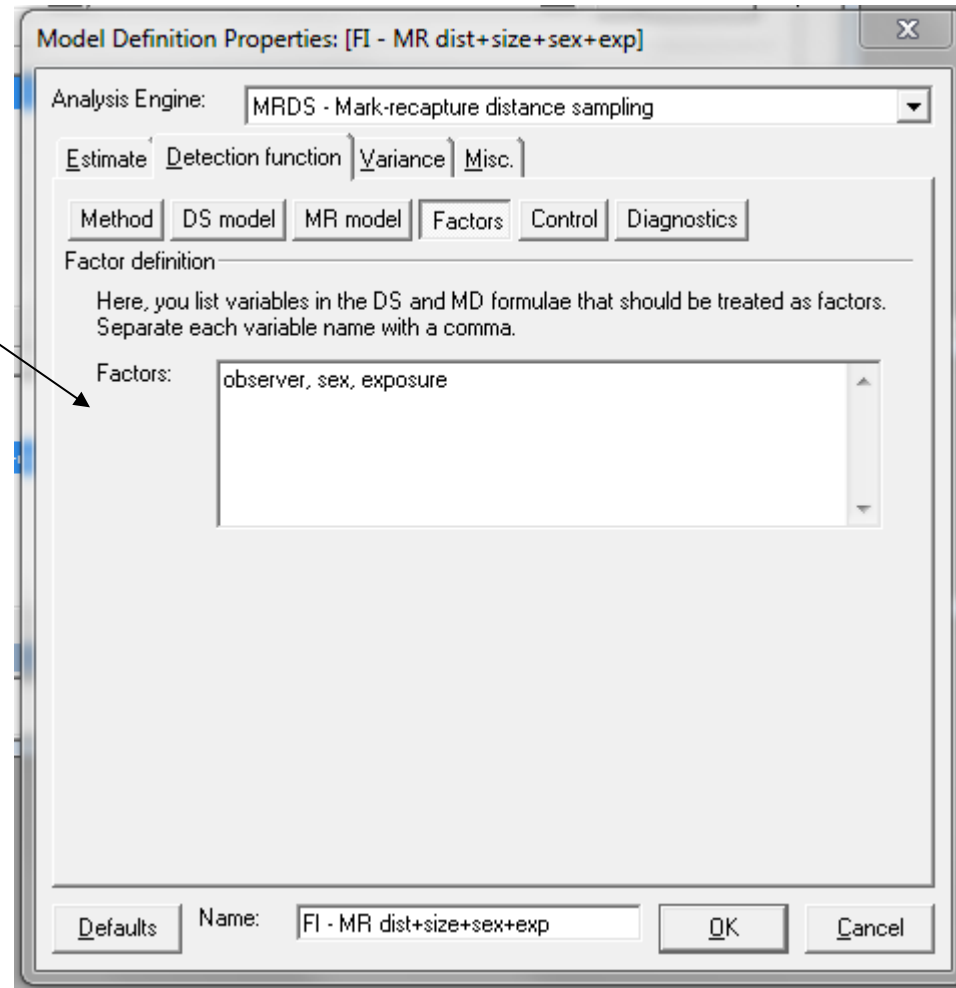


```
Analysis 3: [FI - MR dist+size+sex+exp] Set: [Set 1]
Initializing
Making data files
Making Data Selection Queries
The following fields will be written to the data file, and can be used in
model formulae. Note that you should use the new names, not the original
field names in formulae, and that formulae names are case sensitive.
Format: [layer name].[field name] AS new name
[Observation].[Perp distance] AS distance
[Observation].[Cluster size] AS size
[Observation].[object] AS object
[Observation].[observer] AS observer
[Observation].[detected] AS detected
[Observation].[sex] AS sex
[Observation].[exposure] AS exposure
[Line transect].[Label] AS label
[Line transect].[Line length] AS line length
```



Factors

- Need to specify which variables in the formulae are factors
 - Tip: type in all possible factors in the first Model Definition and this will be used as the basis of all subsequent definitions



Results

- Produces
 - diagnostics (qq plots, detection function plots, goodness-of-fit tests)
 - parameter estimates, and estimated density and abundance
- Can customize plots (in Preferences)
- Plots stored as graphics files in a folder “R” within project data folder
- Results optionally stored in an .Rdata file in the “R” folder, so if you know R software you can access them (Preferences)

