

# Finding out the fate of displaced birds using *SeabORD*

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# Displacement effects

- **Very strong negative** – divers
- **Strong negative** – gannets, grebes
- **Moderate negative** – shearwaters, auks
- **Equal avoidance/attraction** – kittiwakes, terns
- **Weak attraction** – large gulls
- **Strong attraction** – cormorants and shags

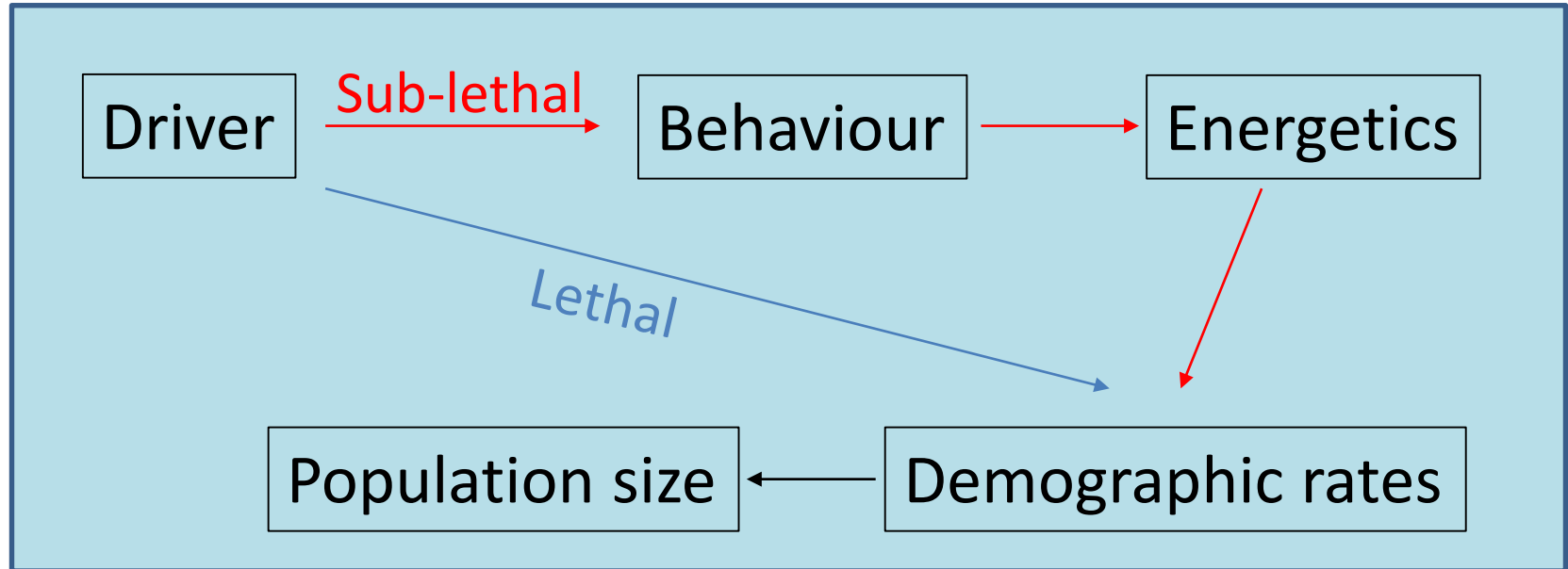
# Barrier effects

- **Strong** - gannets, divers
- **Moderate** - auks, small gulls
- **Weak** - large gulls, terns

# Limitations

- Limitations of studies of displacement and barrier effects:
  - Changes in distribution  $\sim$  displacement
  - Largely on wintering birds
  - Lack of connectivity
  - Assumptions about population-level effects

# Renewable effects: impacts on colonies



# Project Background

Two projects on displacement effects on seabirds funded by *The Scottish Government's Contract Research Fund*.

Searle et al (2014):

- Individual-based model to predict the time/energy budgets of breeding seabirds during the chick-rearing period
- Optimal foraging theory
- Uses GPS tracking data or density decay functions
- Effects on adult annual survival and productivity

Searle et al (2018):

- User friendly tool (***SeabORD***)
- Refinements to the model
- Method for translating observations at sea to average demographic consequences

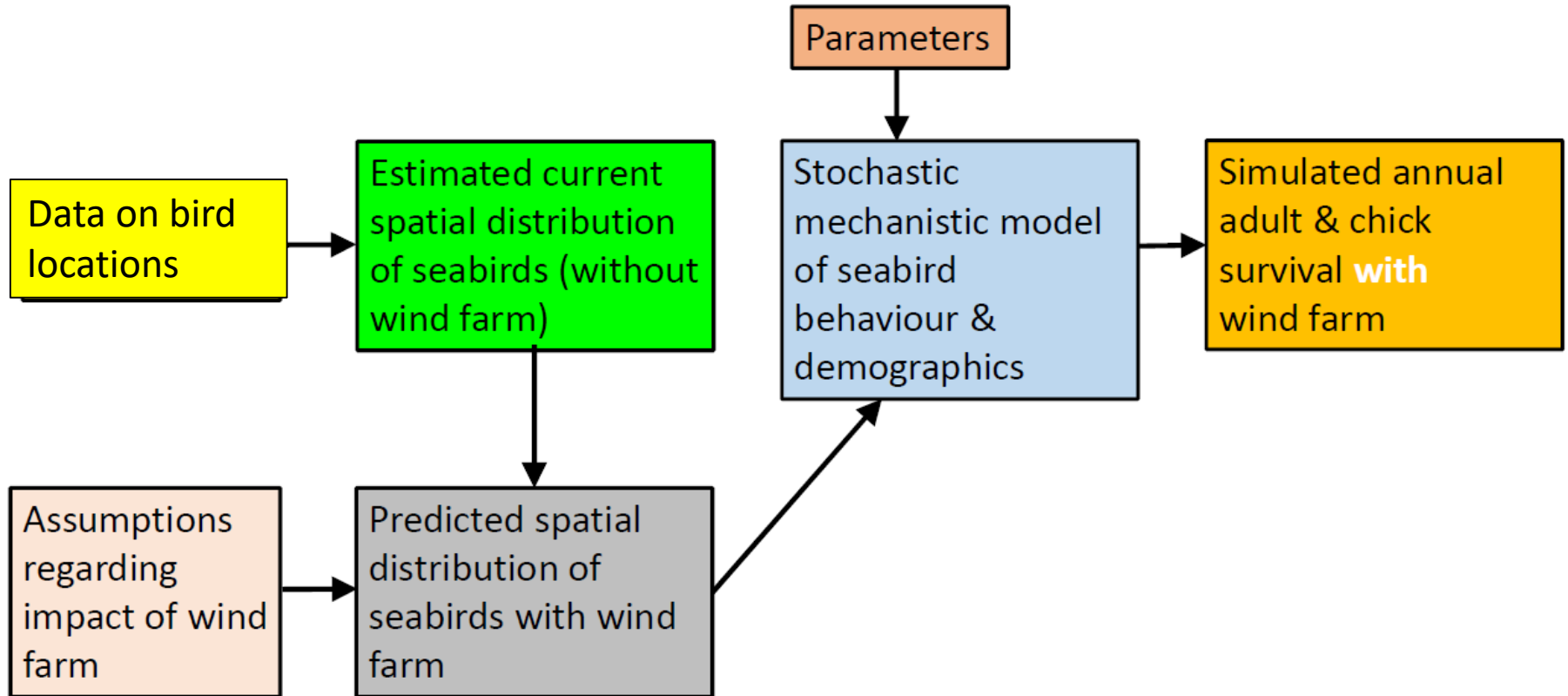
# Isle of May long term study

- Data collected on:
  - Demography
  - Diet and behaviour



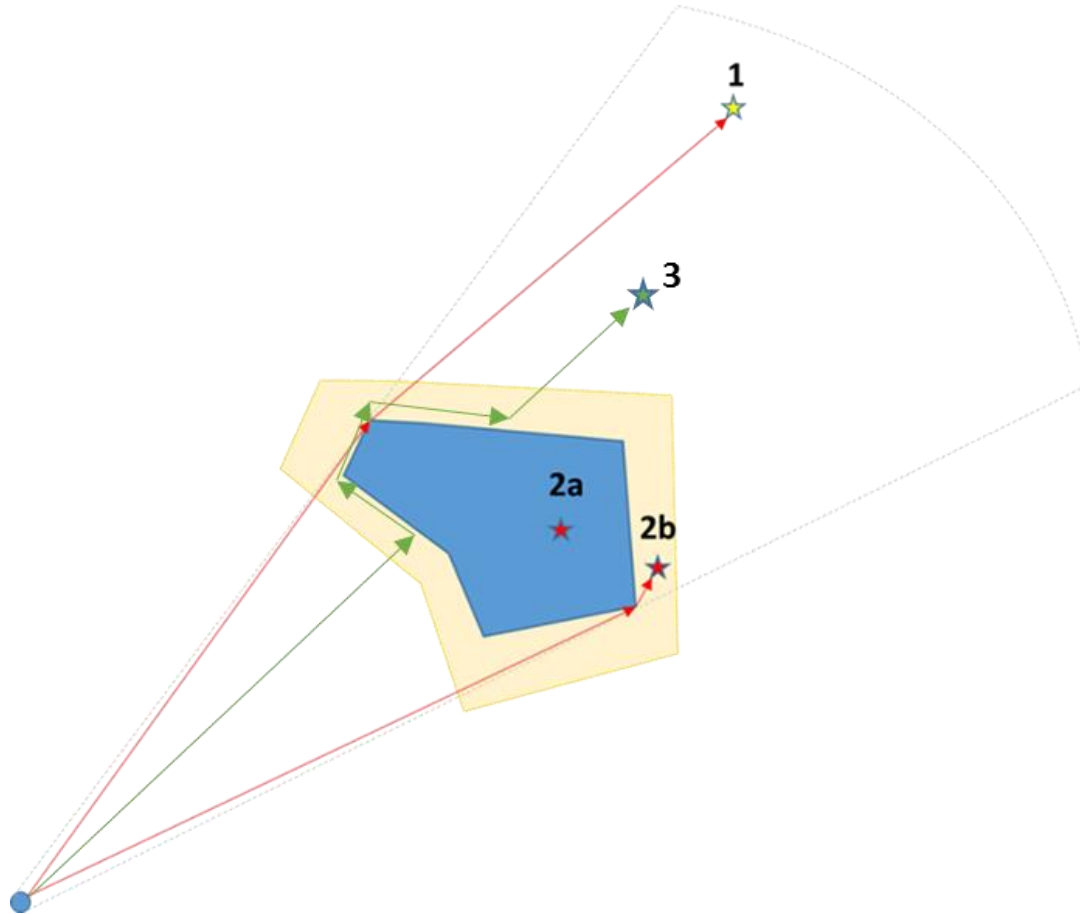
Photos: CEH / Akinori Takahashi

# Foraging simulation model

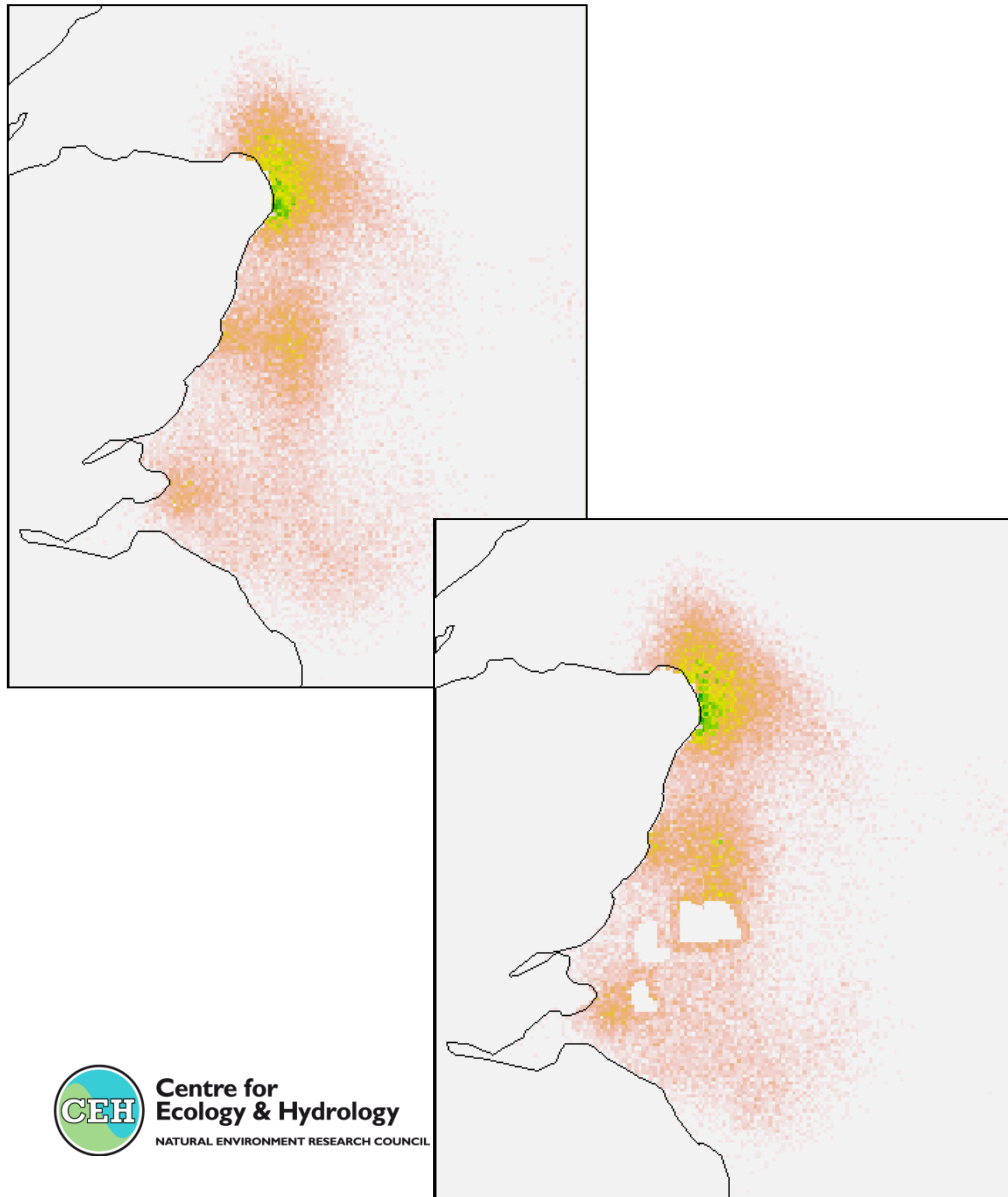




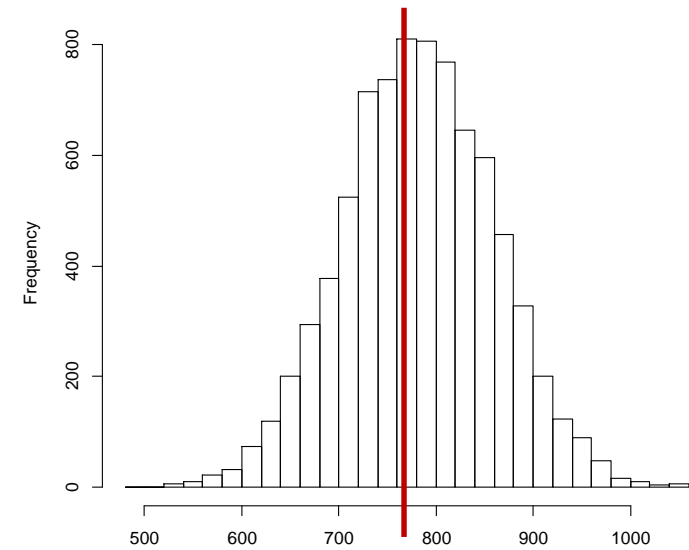
# Model updates: flight paths



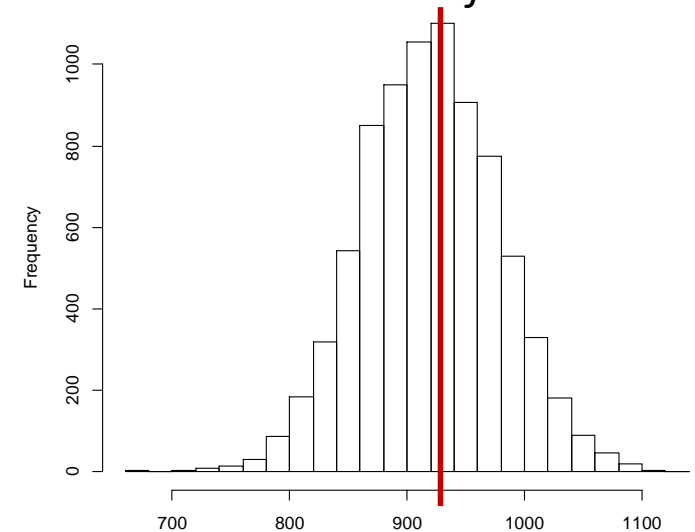
# Modelling impacts in the Forth/Tay region



*Wind farm*



*No wind farm*



# SeabORD

SeabORD Check-in

## SeabORD v1.2 Model - Check-in

Set-up details and input parameters for the Seabird model created by the Centre for Ecology & Hydrology

Input file main folder:

Colony	Species	ORDs	Prey	Additional Information	Simulation
Colony data file: <input type="text" value="Forth and Tay.xlsx"/> <input type="button" value="Browse"/>					
Bounding box (degrees)					
North		<input type="text" value="58.9634"/>			
West		<input type="text" value="-4.1130"/>	<input type="text" value="1.0387"/>		East
South		<input type="text" value="54.5704"/>			
Area name (for output): <input type="text" value="Forth and Tay"/>					
Colonies					
No	<input type="checkbox"/>	Yes	Boddam to Collieston		
No	<input type="checkbox"/>	Yes	Fowlsheugh		
No	<input type="checkbox"/>	Yes	Isle of May		
No	<input type="checkbox"/>	Yes	St Abb's Head		
No	<input type="checkbox"/>	Yes	colony name		
No	<input type="checkbox"/>	Yes	colony name		

**Check-in Messages**

Ready

(amber text indicates a file that will have to be generated before the model can run)

23 files out of the required 24 exist

Zone map files exist

Flightpath files exist

Zone files exist

dataWindfarmWFA\_WGS84.shp

dataWindfarmWFB\_WGS84.shp

dataWindfarmWFC\_WGS84.shp

Obstructed flightpath (perimeter) files exist

Press 'Run Simulation' when you are ready!

Colony

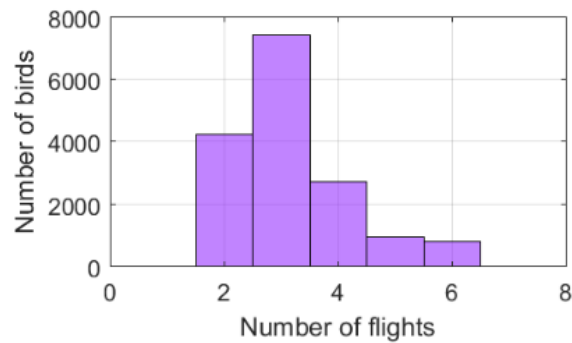
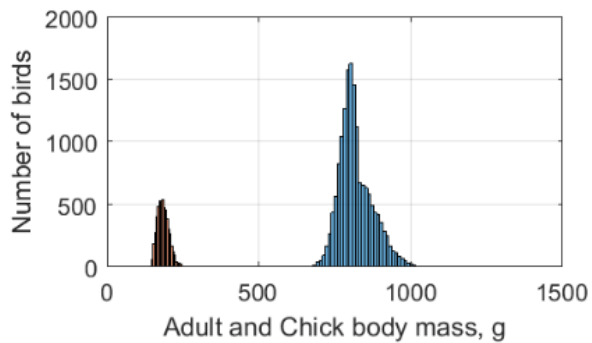
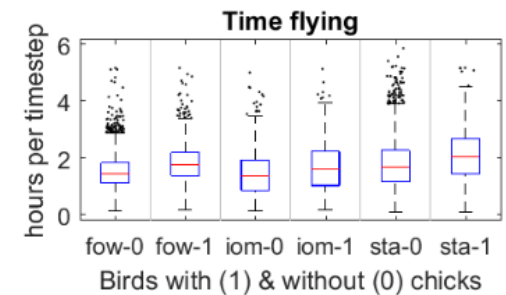
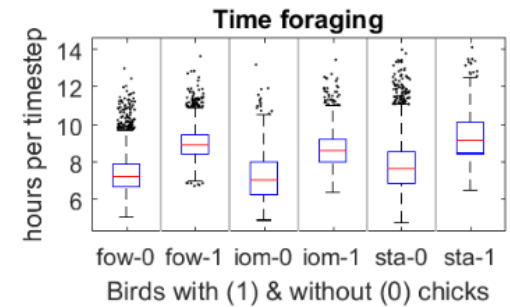
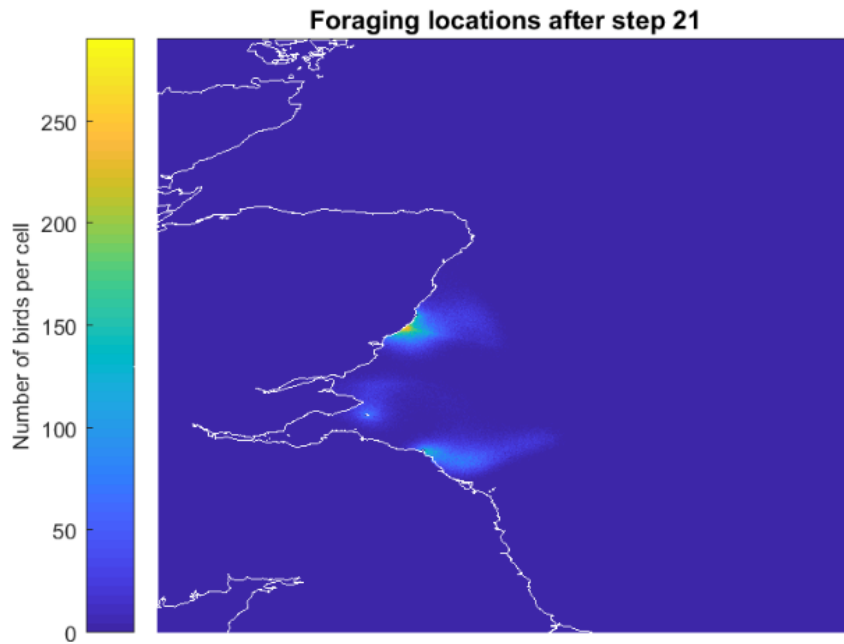
Species

ORDs

Prey

Run

# SeabORD

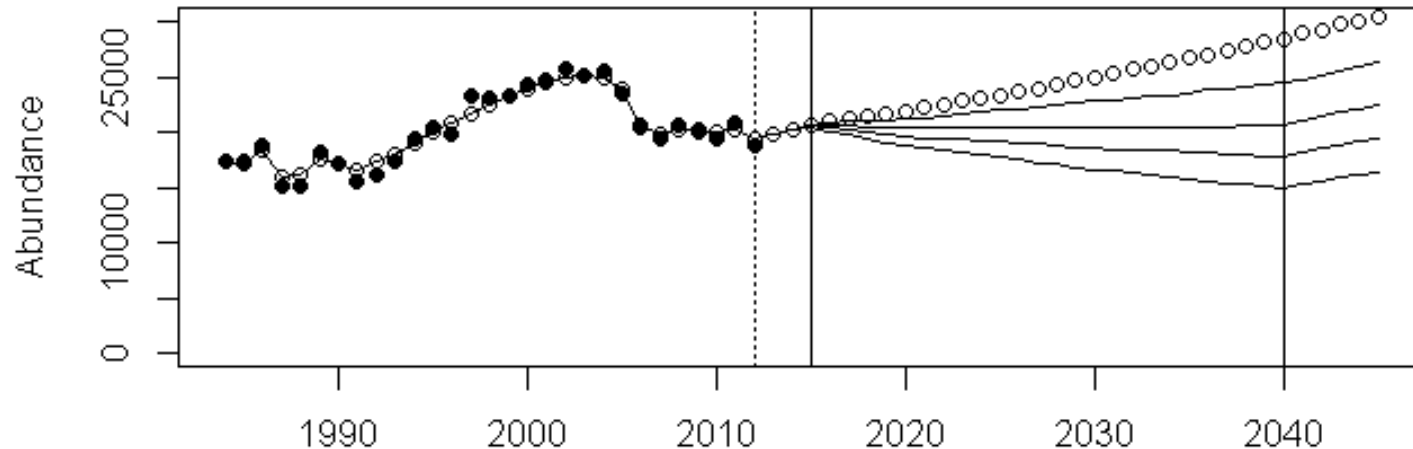


Finished!

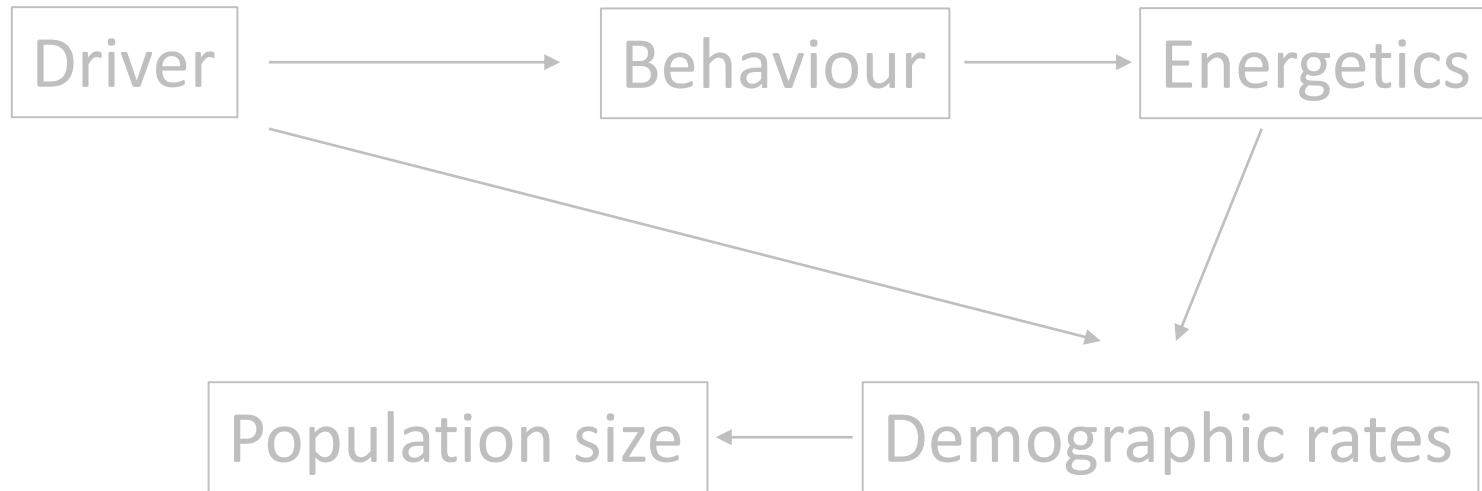
Executing BASE run: 1

# Population modelling in the Forth/Tay region

- Average change in adult survival and productivity
- Number of birds die relative to number of birds seen in an at-sea survey
- Input to population models



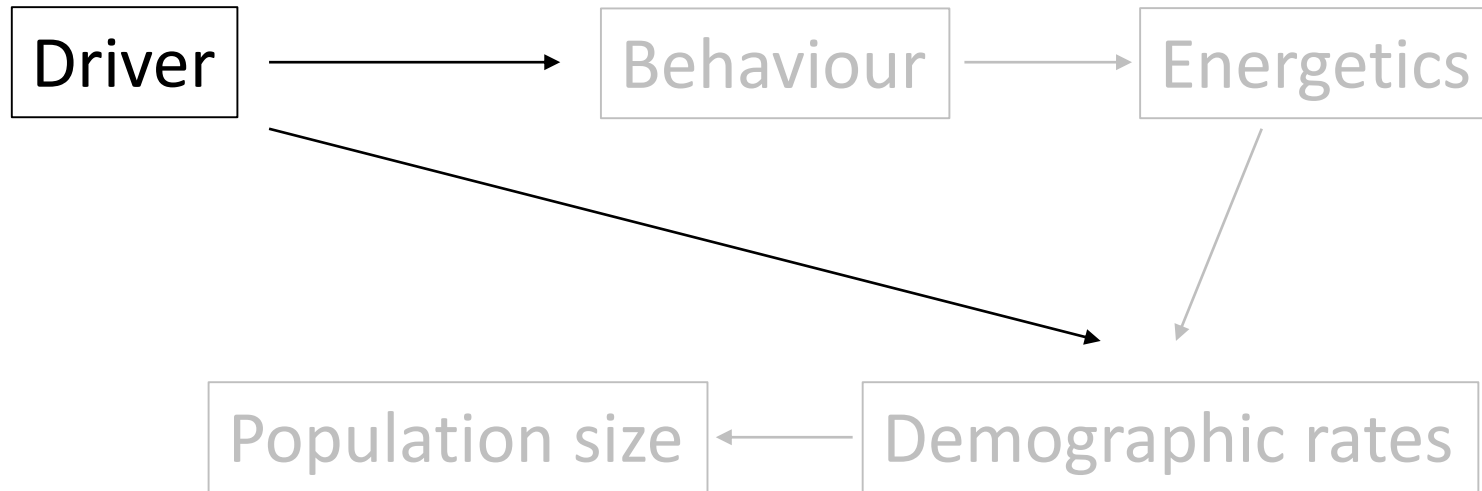
# Measurement replacing modelling: past/current



*Grey = modelling*

*Black = measuring*

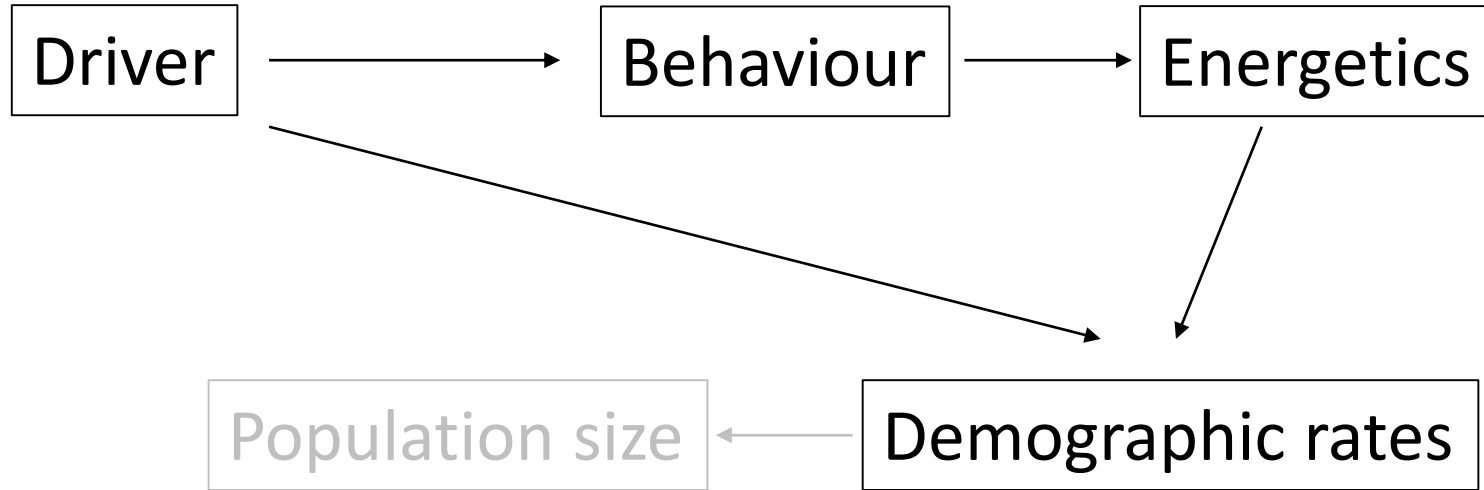
# Measurement replacing modelling: current/future



*Grey = modelling*

*Black = measuring*

# Measurement replacing modelling: future aspiration



*Grey = modelling*

*Black = measuring*



# Prevailing drivers of change

- Climate change
- Pollution
- Fisheries
- Mammalian predators

Species	2000-2015
Fulmar	-31%
Shag	-34%
Arctic skua	-64%
Kittiwake	-44%
Little tern	-18%
Common tern	-10%

*Source: JNCC's SMP*

# CONCLUSIONS

- Displacement and barrier effects of considerable concern in some species
- ***SeabORD*** is a user friendly tool for estimating effects of demography
- Further refinements can be made when empirical estimates are available



# Thank you

- The Scottish Government's Contract Research Fund
- RSPB for useful discussions
- Mike Harris
- Sarah Wanless
- Mark Newell
- Staff, students and volunteers

