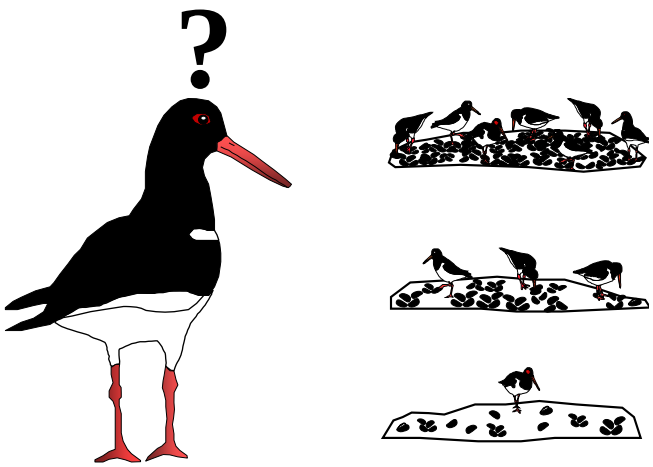
Wader displacement / habitat loss assessment and parallels for seabirds

Richard Stillman, Bournemouth University

Linking behaviour to populations

Behaviour - understand how individual animals respond to changes in the environment

- Foraging behaviour – food competition, food supply
- Response to disturbance – habituation or desperation?
- Decision rules – trading-off costs and benefits



Population - Build computer models to predict how the population of animals will be affected

- based on behavioural research
- models mimic the behaviour of real animals

Individual-based model (MORPH)

The model assumes that individuals

- have daily food requirements
- vary in competitive ability
- behave to maximise survival
- respond behaviourally to environmental change

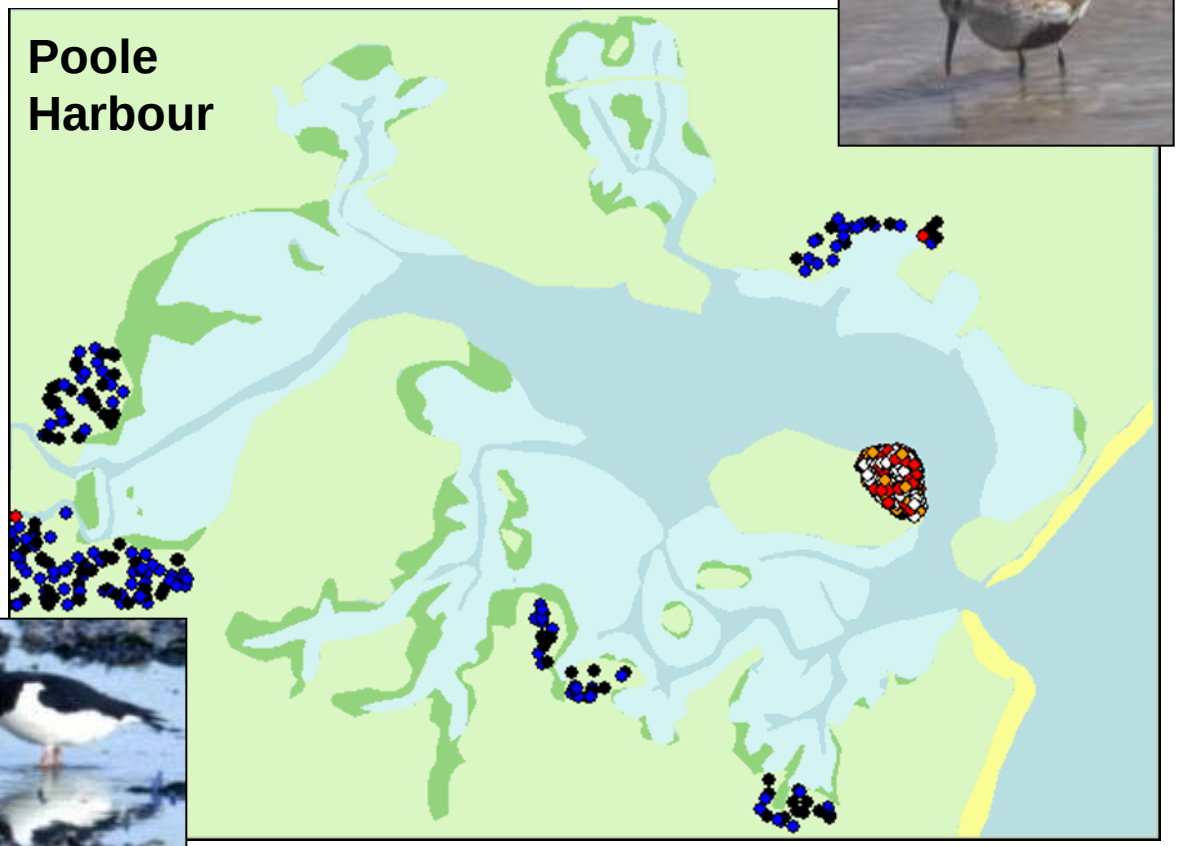
The model predicts

- food selection
- distribution
- time spent feeding
- body mass
- survival

The model's parameter

- food supply
- tidal exposure
- daily food requirements
- feeding rate

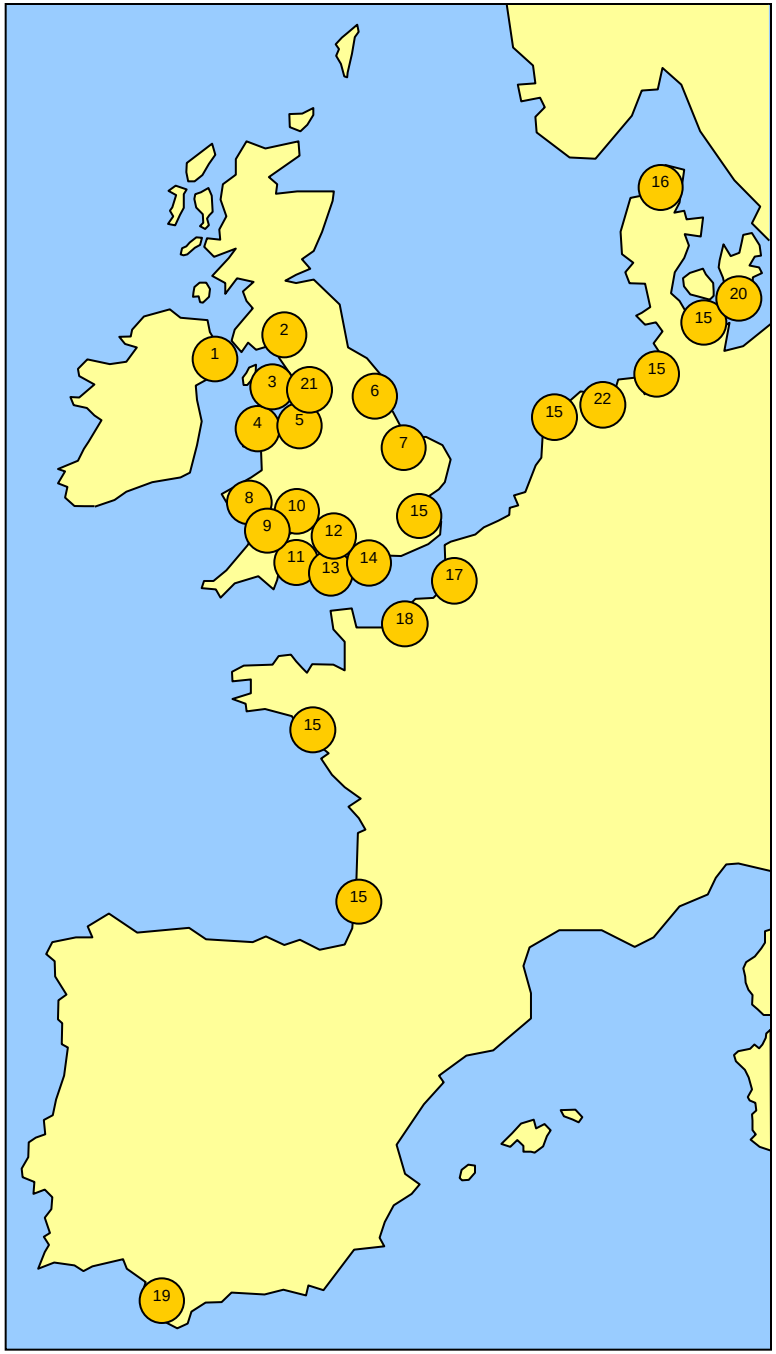
Dunlin



Dunlin Redshank Black-tailed Godwit Oystercatcher Curlew

Oystercatcher

Durell et al. (2006) Biological Conservation

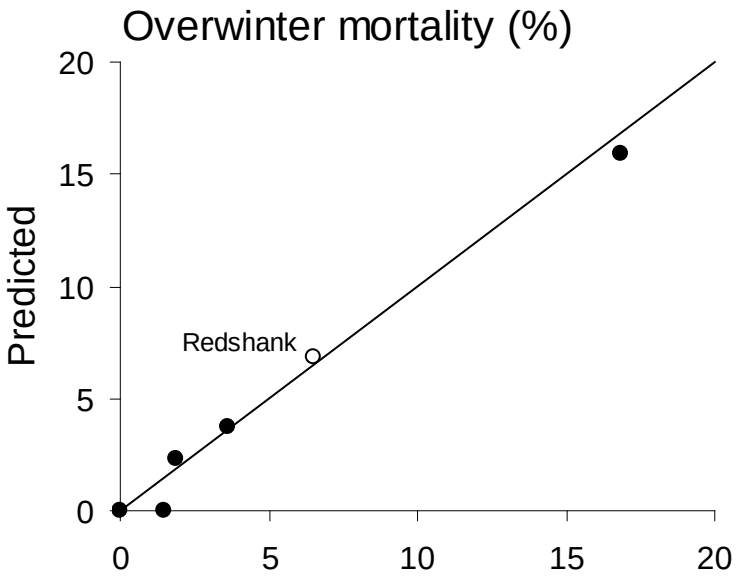


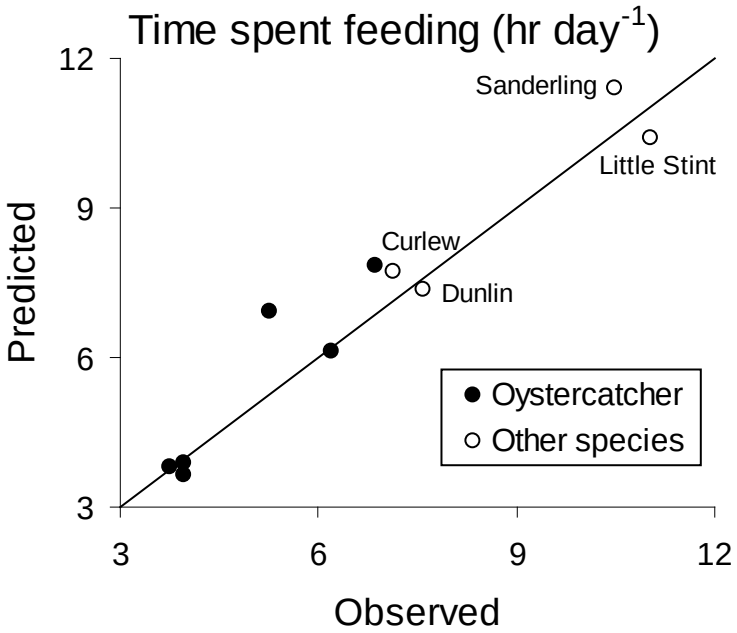
Sites, issues and species for which models have been developed

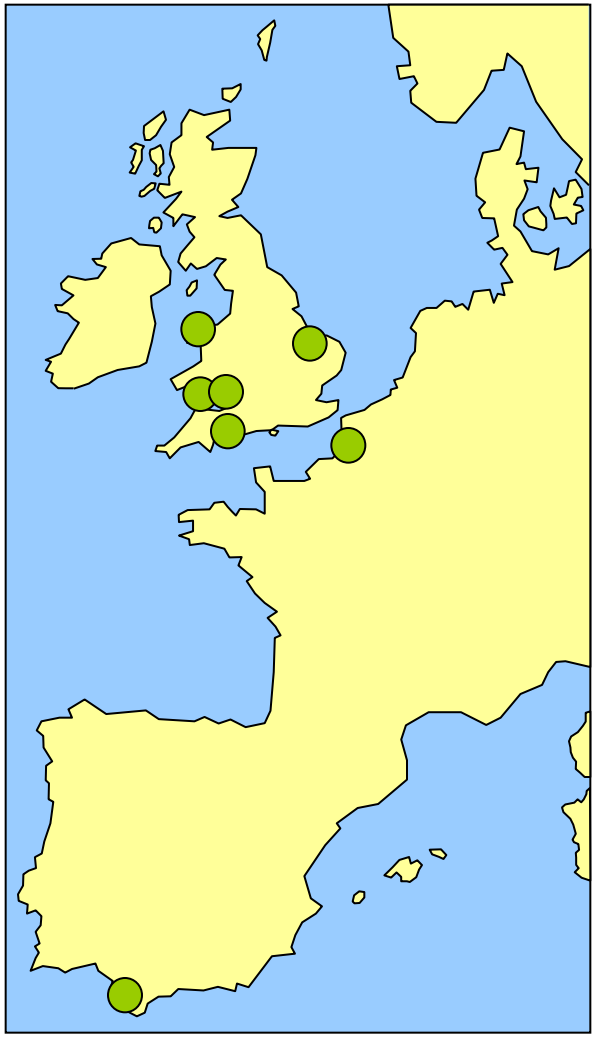
(1) Strangford Lough - Oystercatchers and cockle fishing
(2) Solway Firth - Shorebirds and shellfishing
(3) Liverpool bay - Scoter ducks and wind farms
(4) Menai Straits - Oystercatchers and mussel fishing
(5) Dee estuary - Oystercatchers and shellfishing
(6) Humber estuary - Shorebirds climate change and habitat loss
(7) Wash and North-Norfolk - Oystercatchers, Eiders and Brent geese
(8) Burry Inlet - Oystercatchers and shellfishing
(9) Cardiff Bay - Shorebirds and habitat loss
(10) Severn estuary - Shorebirds and tidal barrage development
(11) Exe Estuary - Shorebirds, shellfishing and disturbance
(12) River Frome - Mute swan grazing in chalk streams
(13) Poole Harbour - Shorebirds, shellfishing and disturbance
(14) Southampton Water - Shorebirds, habitat loss and disturbance
(15) Brent goose sites - Multi-site model of Brent geese
(16) Denmark - Pink-footed goose migration
(17) Baie de Somme - Hunting, shellfishing and shorebirds
(18) Baie de Seine - Shorebirds, port development and habitat creation
(19) Bahia de Cadiz - Fish farms, shellfishing, disturbance and shorebird
(20) Fehmarn Belt - Sea ducks and bridges
(21) Morecambe Bay - Oystercatchers, Knot and Shellfishing
(22) Lauwersmeer - Bewick's Swan and habitat choice

(21) Tasmania - Pied Oystercatchers and habitat loss

Testing predictions







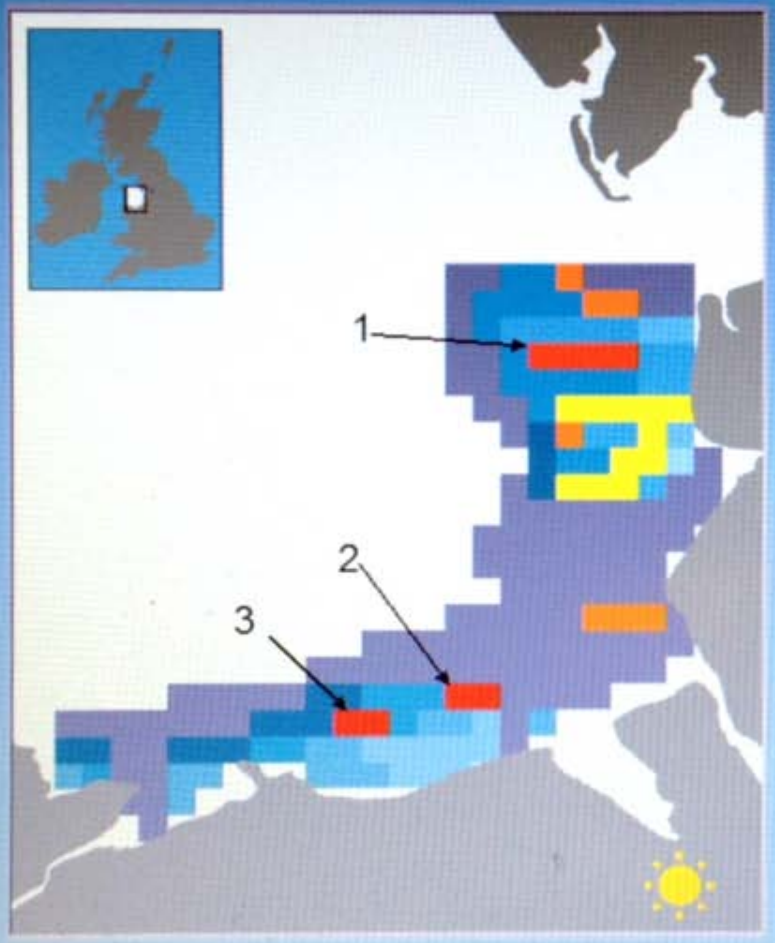
Sites on which model predictions have been tested

Sites, species, issues and tests

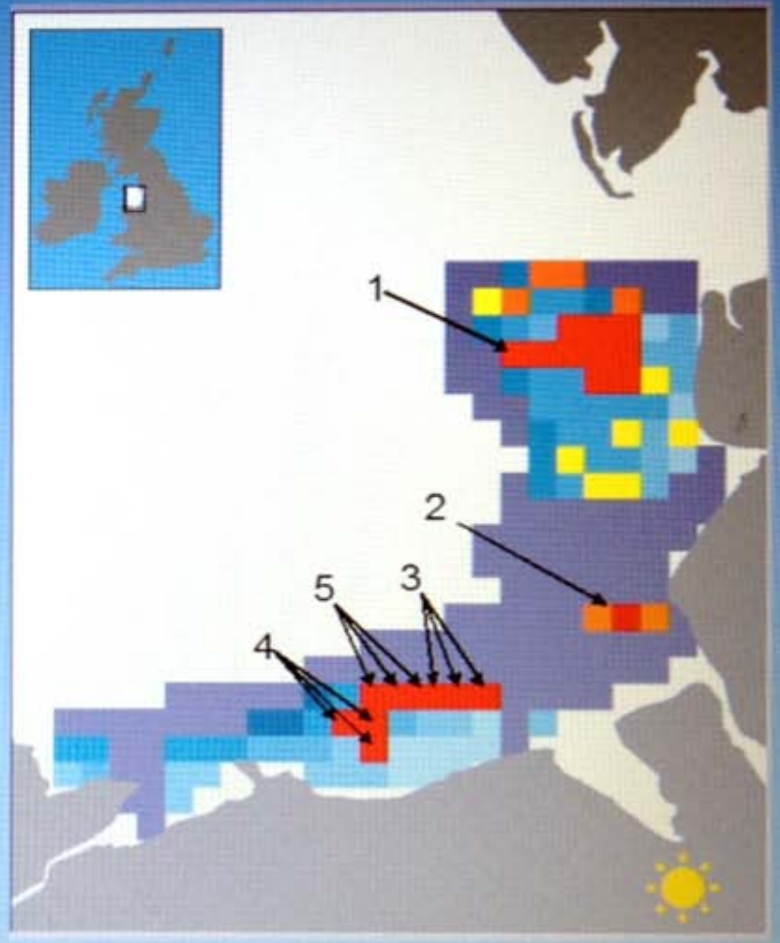
			Tests				
Site	**Species**	**Issues**	**Feed**	**Diet**	**Dist**	**Cond**	**Mort**
Burry Inlet, UK	oystercatcher, knot	Shellfishing, site quality	✓	✓	✓	-	✓
Bahia de Cadiz, Spain	nine shorebird species	Salinas, fish farms, shellfishing, disturbance	✓×	✓×	✓	-	-
Caerlaverock, UK	barnacle goose	Habitat change	-	-	✓	✓	-
Cardiff Bay, UK	redshank	Habitat loss	-	-	-	-	✓
Dee estuary, UK	knot, oystercatcher	Shellfishing	-	-	-	-	-
Exe estuary, UK	oystercatcher	Shellfishing	✓	✓	✓	✓	✓
Exe estuary, UK	six shorebird species	Disturbance, site quality, sea level rise	-	-	✓	-	-
Humber estuary, UK	nine shorebird species	Sea-level rise, port development, habitat loss	-	✓	✓	-	-
Liverpool bay, UK	common scoter	Wind farms, habitat loss, disturbance	-	-	✓	-	-
Menai Straits, UK	oystercatcher	Shellfishery management	✓	-	✓×	-	-
Poole Harbour, UK	five shorebird species	Sea-level rise, site quality	-	-	✓×	-	-
Poole Harbour, UK	oystercatcher	Shellfishing, invasive species	-	✓	✓	-	-
Baie de Seine, France	dunlin, oystercatcher, curlew	Port development, habitat creation	-	✓	✓	-	-
Solway Firth, UK	knot, oystercatcher	Shellfishing	-	-	-	-	-
Baie de Somme, France	dunlin, oystercatcher, curlew	Hunting, shellfishing, sedimentation, site quality	✓	-	✓×	-	-
Southampton Water, UK	eight shorebird species	Port development, habitat loss, site quality	-	✓	✓	-	-
Strangford Lough, UK	oystercatcher	Shellfishing	-	-	-	-	-
Wash, UK	oystercatcher	Shellfishing	-	-	-	-	✓
Wash, UK	eight shorebird species	Site quality	-	✓	-	-	-
Wash, UK	eider	Shellfishing	✓	✓	✓	-	-
Western Europe	brent goose	Agriculture, habitat loss, hunting, disturbance	✓	✓×	✓×	✓	✓

From Stillman & Goss-Custard (2010) Biological reviews

Windfarm scenarios modelled



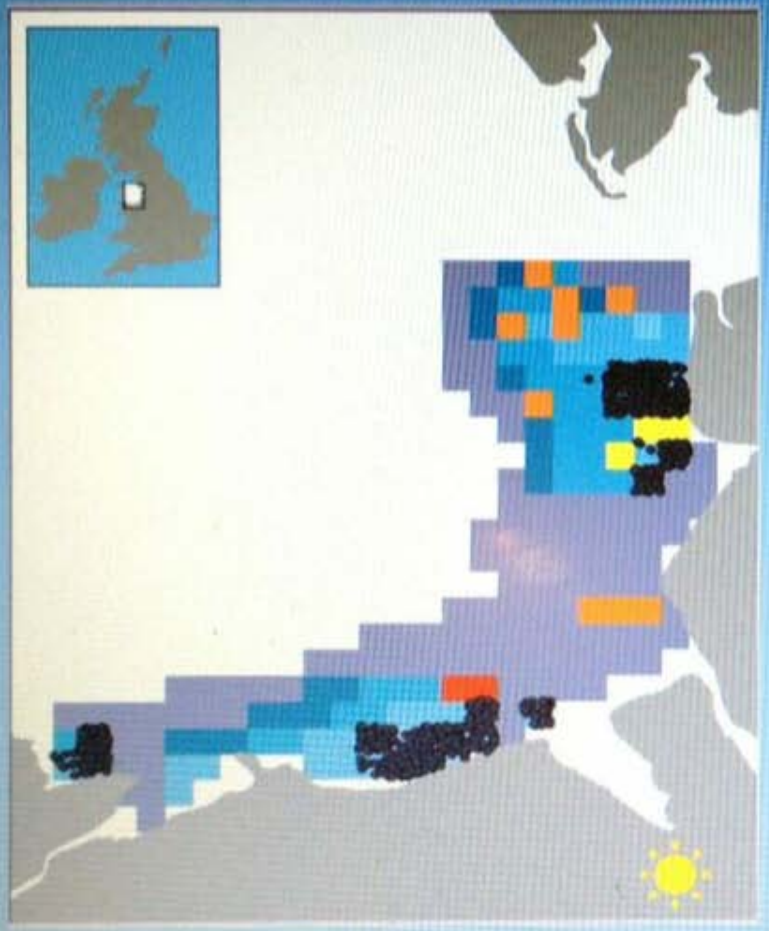
0 km buffer zones



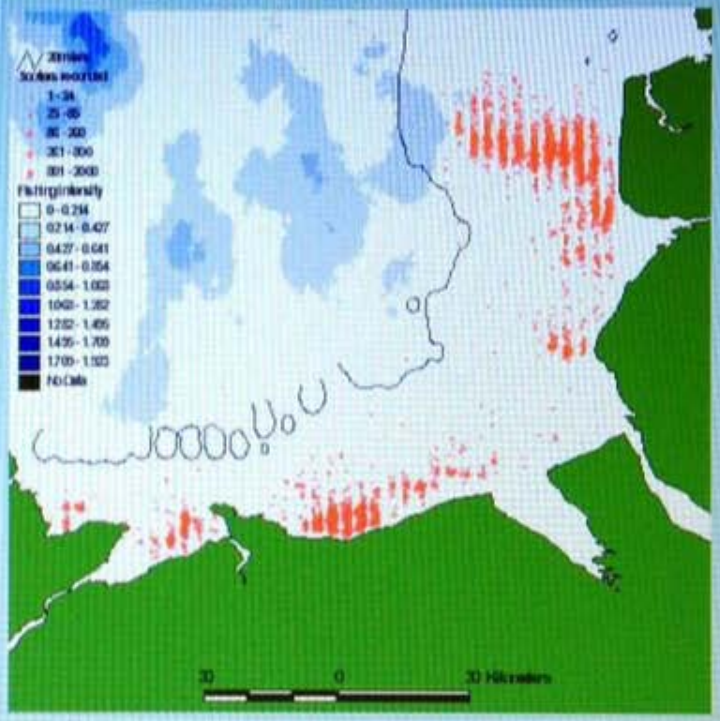
2 km buffer zones

COWRIE

Model calibration and validation



Snapshot of model running



Over flight data

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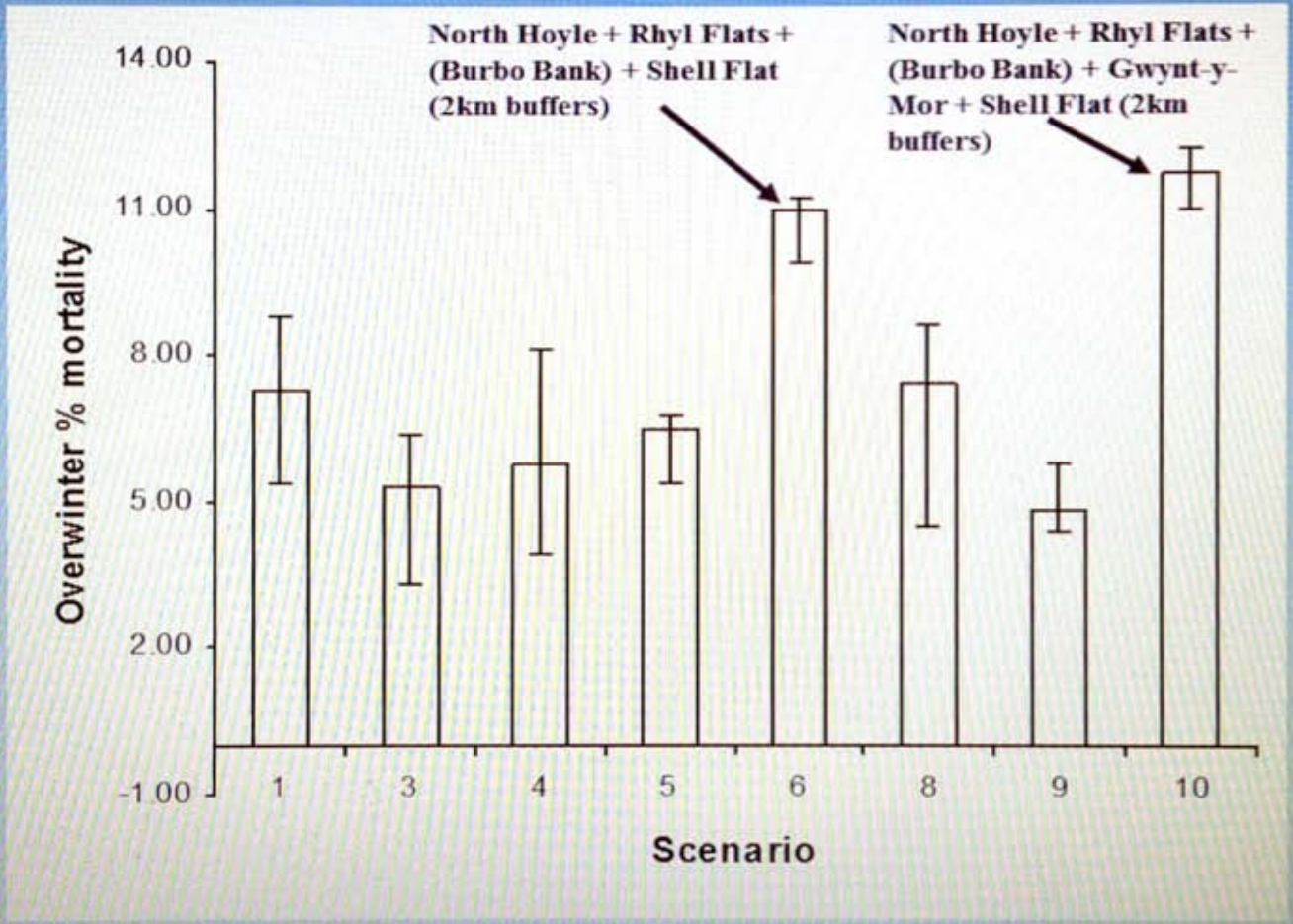
Predicted affects of windfarms

Predicted % over-winter mortality



COWRIE

Displacement Assessment Framework should ideally include:

- Fitness-maximizing behaviour of birds (and prey)
- Ability of birds to compensate for displacement
  - due to location, quantity, quality and availability of prey
  - due to number of birds (density dependence)
  - ease with which birds meet requirements in the absence of change
- Environmental proxies for habitat quality
  - could be used in the absence of prey-specific data
  - e.g. sediment type, water depth, current flow
- Validation
  - e.g. using monitoring from existing developments
- Flexibility
  - to allow application to multiple species and locations