



THE MARINE ENVIRONMENTAL MONITORING PLAN (MEMP) FOR SCOTLAND'S FIRST OFFSHORE WIND FARM: ROBIN RIGG, SOLWAY FIRTH, SCOTLAND

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MEMP is to comply with condition 6.4 of Section 36 Consent Condition, of the Electricity Act and states:

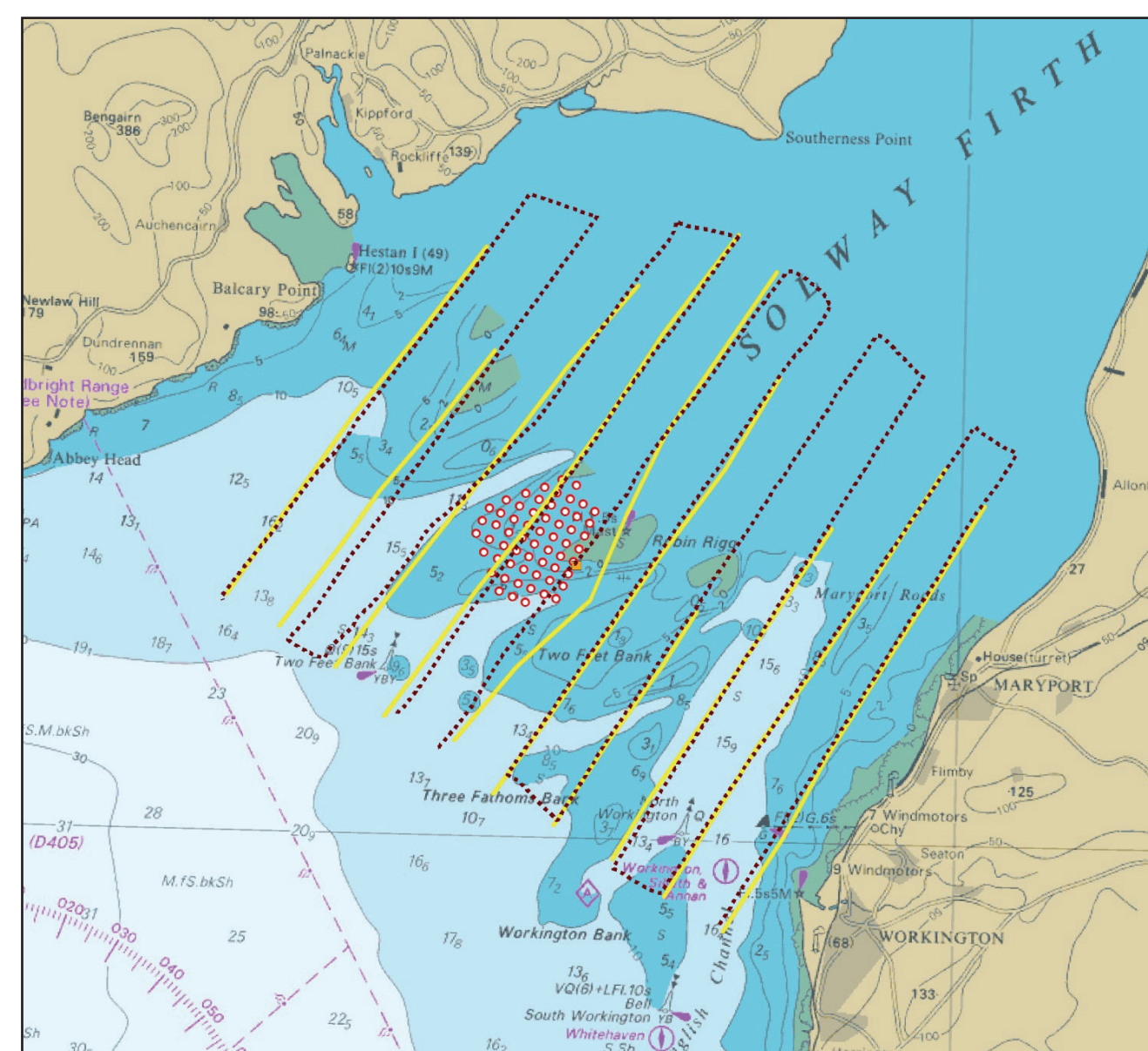
"The remit of the Monitoring Programme will be to allow changes to the physical and ecological environment caused by the construction and operation of the wind farm to be recorded principally in areas where there is some uncertainty in the effects of the wind farm on the receiving environment, where those effects are potentially damaging. The monitoring programme should be designed so that if potentially adverse significant impacts are predicted which can be reasonably attributed to the wind farm, mitigation measures can be adopted in time to avoid irreversible significant impacts"

Scope of MEMP:

"The MEMP should be sufficiently robust to detect and/or predict direct and indirect adverse impacts, likely to have a significant effect on the marine environment, arising from pre-construction, construction, operation and decommissioning".

BIRD & MARINE MAMMAL SURVEYS

- Boat-based surveys collected on monthly basis:
- One survey per month pre-construction;
- Two surveys conducted each month during construction phase, one at high tide and one at low tide
- 10 transects surveyed, each about 18 km long, 2 km apart
- Primary vessel used 16 m long with viewing height of 4 m above sea level (below COWRIE guidelines but depth restrictions on site)



PRE-CONSTRUCTION VS. CONSTRUCTION PERIOD: STATISTICAL ANALYSIS

- Changes in abundance: Generalised Linear Model (GLM) with Poisson (birds) and binomial (marine mammals) error structure: Used to compare numbers of animals pre- and during construction.
- Changes in distribution: Density plots
- Influence of environment and construction activities: GLM with Poisson/binomial errors: Used to compare number and position of animals relative to turbines pre- and during construction and environmental variables (e.g. sea state, sea depth, proximity to coast, sediment type)
- Effect of piling: Additional GLM's performed on during construction data incorporating construction activities (piling, cable laying and scour)



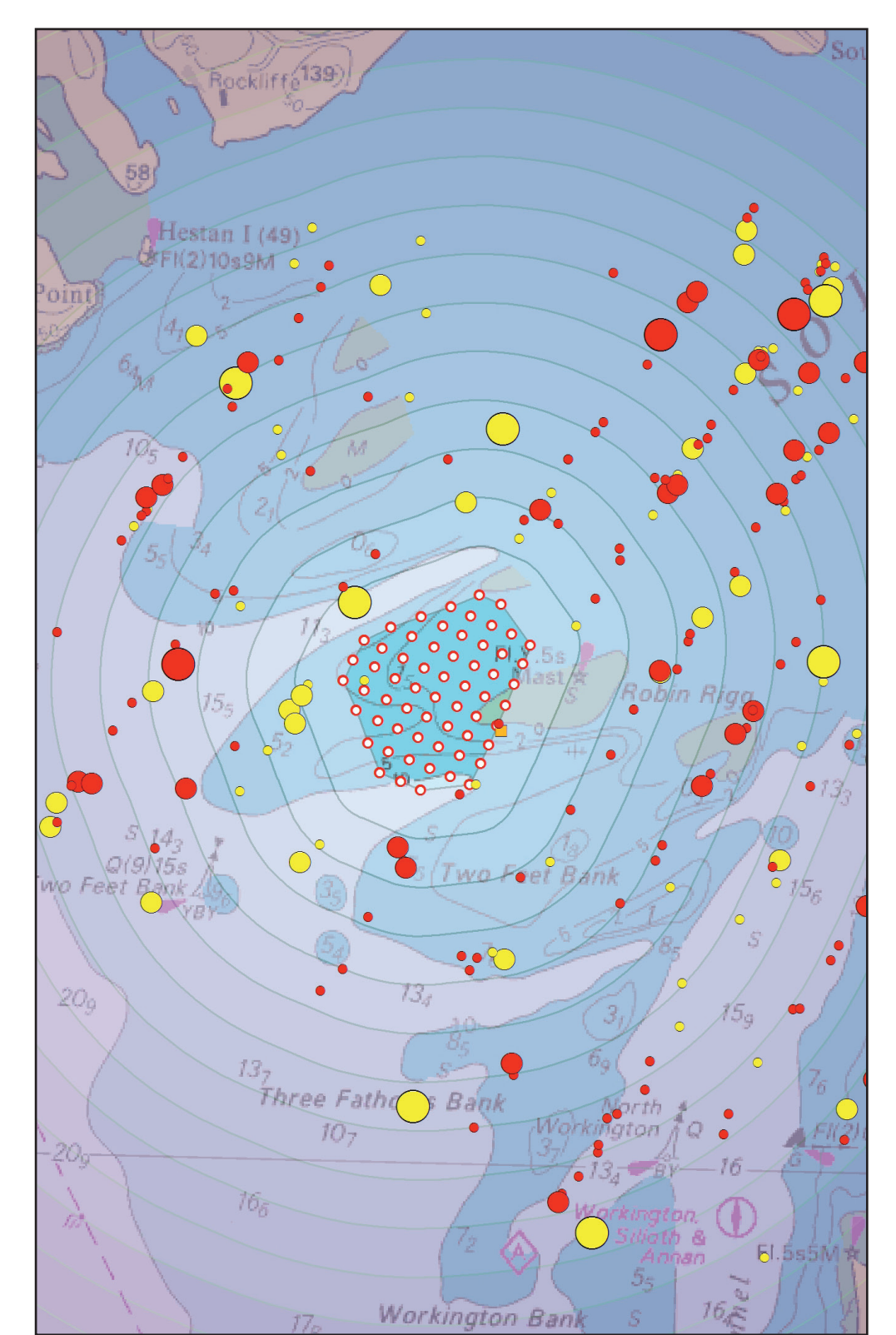
DATA PROCESSING

- 'Sampling units' of 10 minutes (variable length) and either 600 m (birds) or 2 km (mammals) width:
- uses area to take into account difference in sampling effort per sampling unit
- average values for variables of interest calculated per sampling unit (i.e. geology, depth)
- Link birds and mammals recorded each day with sampling units of each individual survey section for the corresponding day



RESULTS OF PRE-CONSTRUCTION VS. CONSTRUCTION ANALYSIS ON HARBOUR PORPOISE

- Raw data shows decrease in number of harbour porpoise observed in the survey area during construction compared to the pre-construction period
- When other factors are taken into account, no evidence for a change in harbour porpoise observations due to construction activity. Factors predicting numbers of harbour porpoise observed included sea state ($\chi^2_1 = 23.45, P = <0.001, 1 \text{ df}$) and depth ($\chi^2_1 = 3.92, P = 0.049, 1 \text{ df}$)
- No evidence for a change in porpoise location relative to the turbine area between the periods due to construction activity ($\chi^2_1 = 1.01, P = 0.32, 1 \text{ df}$)



EFFECTS OF PILING

- Significant positive relationship between porpoise presence and number of days since piling activity ($\chi^2_1 = 7.54, P = 0.006, 1 \text{ df}$)
- Stronger relationship between porpoise presence and days since either piling, cable laying or scour protection has taken place ($\chi^2_1 = 9.75, P = 0.002, 1 \text{ df}$)
- Sea state, depth and year also significant

