



ScotMER East Coast Offshore Wind Farms Symposium

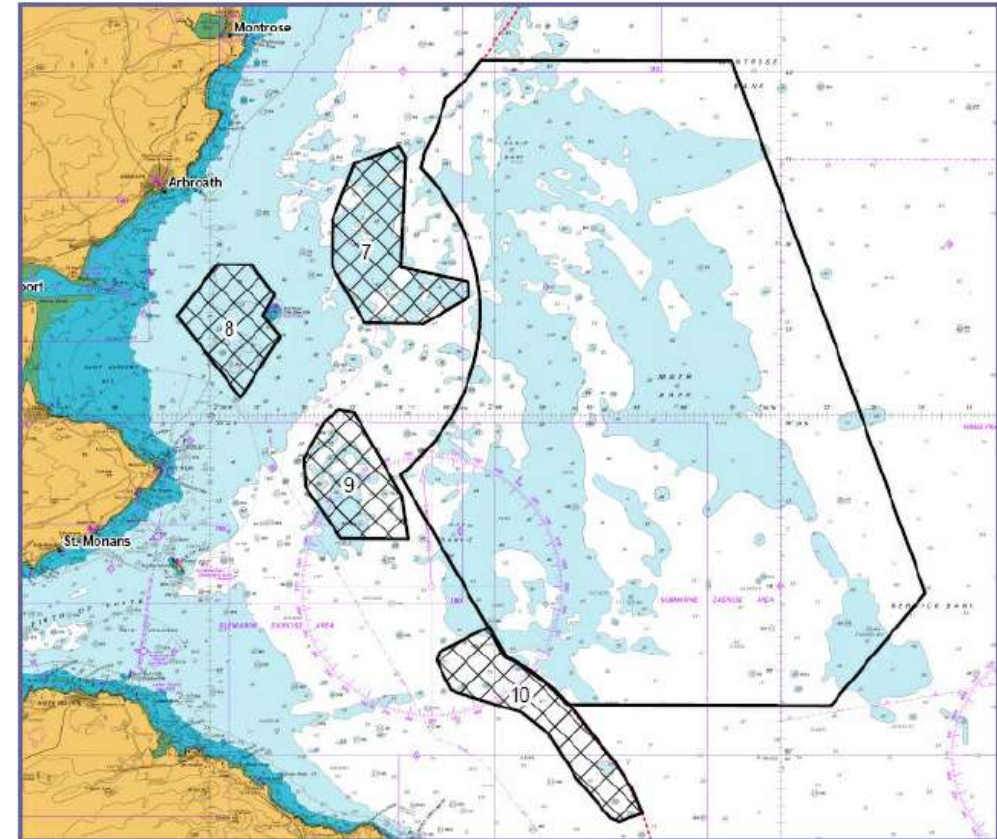
Forth and Tay Projects

Introduction - Nick Brockie, SSE Renewables

3rd March 2020

Forth and Tay Projects - Introduction

- 2009/10 – Crown Estate AfL awards
- Forth & Tay Offshore Wind Developers Group - FTOWDG
- Initial collaboration between developers for a range of topics (2010-2012)
- CDD 1 & 2, seabird tracking; seal data mapping, underwater noise modelling, shipping, fisheries, cumulative SLVIA, etc.
- Consent applications 2012/13

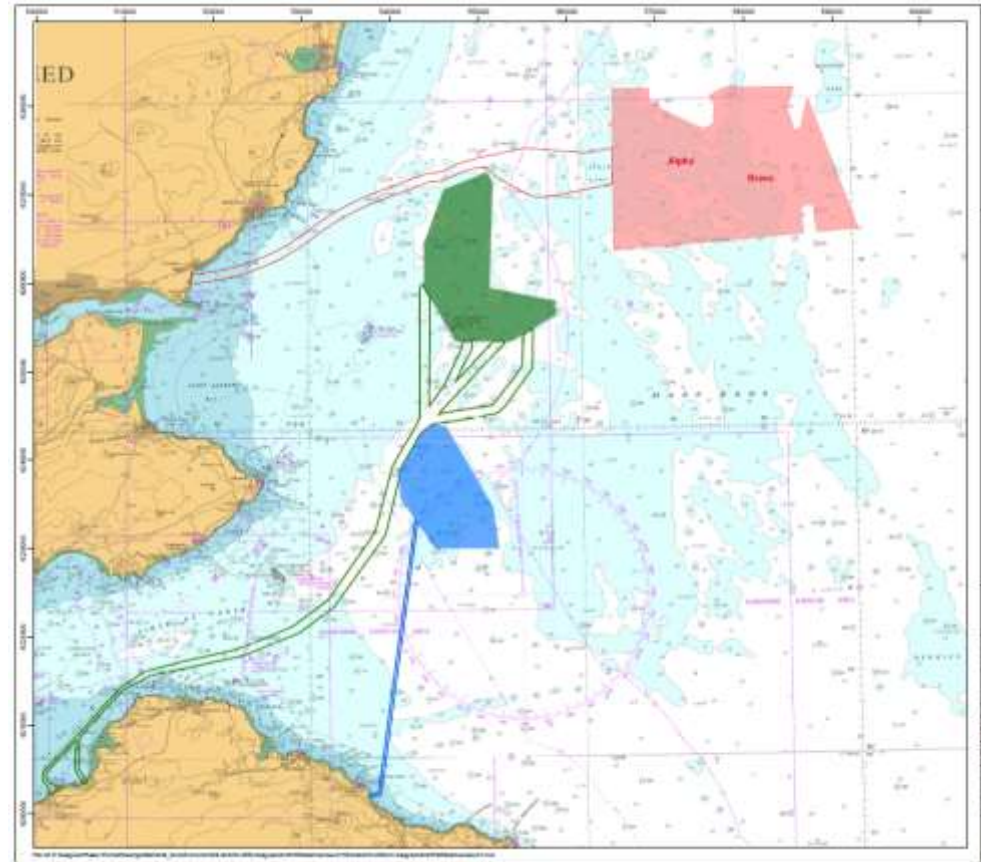


Scottish Territorial Waters Offshore Wind Farms - East Coast
Discussion Document - Cumulative Effects

Forth and Tay Projects - Introduction

- 2014 Consent determination
- 2015 Neart na Gaoithe CfD
- 2017 Consents confirmed
- 2019 Seagreen Alpha & Bravo CfD
- 2019/2020 Consent plans submitted and approved

	2020	2021	2022	2023	2024
NNG	■	■	■	■	■
Seagreen	■	■	■	■	■
Inch Cape	■	■	■	■	■



2019 - Resumed collaboration on strategic studies



Scottish Marine Energy Research (ScotMER)

Displacement, barrier and population effects
Digital Aerial Survey

Mike Armitage, RPS

3rd March 2020

F&T Monitoring Collaboration

INTRODUCTION

- A combined approach to monitoring across the Forth & Tay.
 - Digital aerial survey
 - GPS tracking and colony monitoring
 - Collision/Avoidance study
 - Gannet adult survival study



Digital Aerial Survey

INTRODUCTION

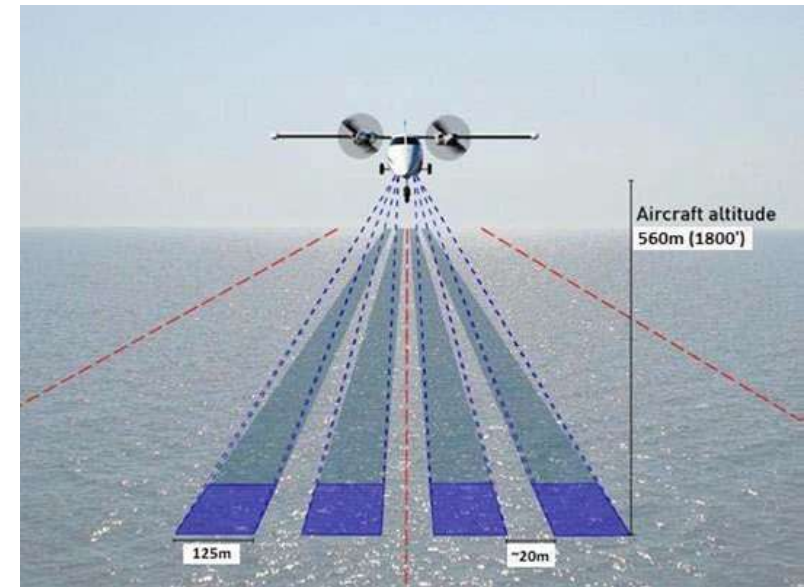
- HiDef digital aerial survey. Two areas covered in the Forth & Tay:
 - **Combined Area** (NnG, Inch Cape, Seagreen 1)
 - **Seagreen 2&3**
- Combined Area surveys commenced April 2019 across all wind farms plus buffers (Seagreen 1 from March 2019, NnG from June 2018).
- Seagreen 2&3 surveys commenced March 2019.



Digital Aerial Survey

SURVEY METHODS

- Monthly surveys.
- 2 km transect spacing.
- Transect: 4 x cameras, each sampling 125m strip. Data from 2 cameras processed (12.5% coverage).
- 2 additional cameras in case of failure, or processed if there is a need to plug gaps to achieve 12.5% coverage.



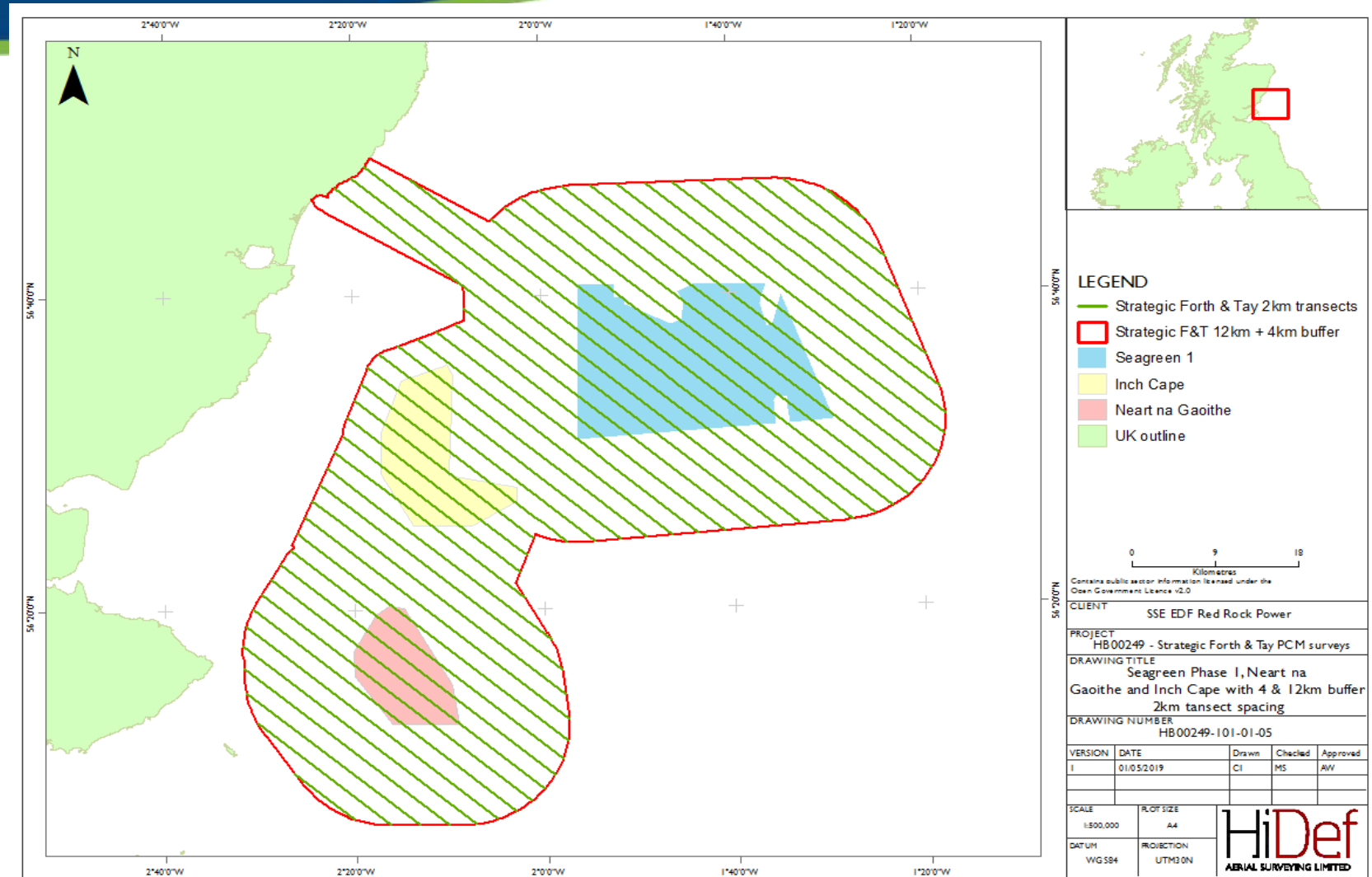
Digital Aerial Survey

COMBINED AREA:

- NNG +12km
- Inch Cape +4km
- Seagreen1 +12km

- Single day

- 3,410 km²



Digital Aerial Survey

COMBINED AREA:

- April to September; 2 aircraft



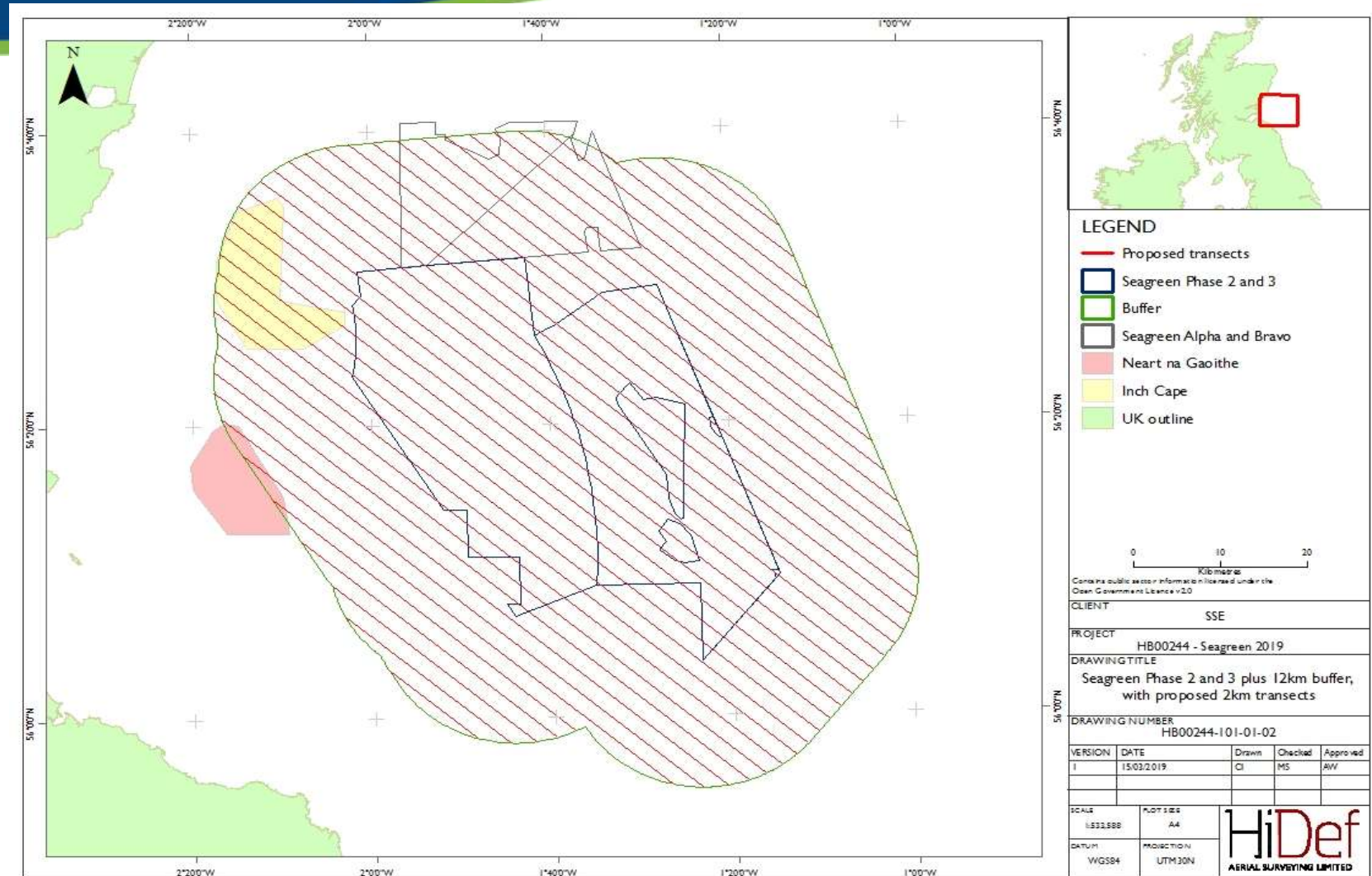
COMBINED AREA:

- October to March; 3 aircraft

Digital Aerial Survey

Seagreen 2&3:

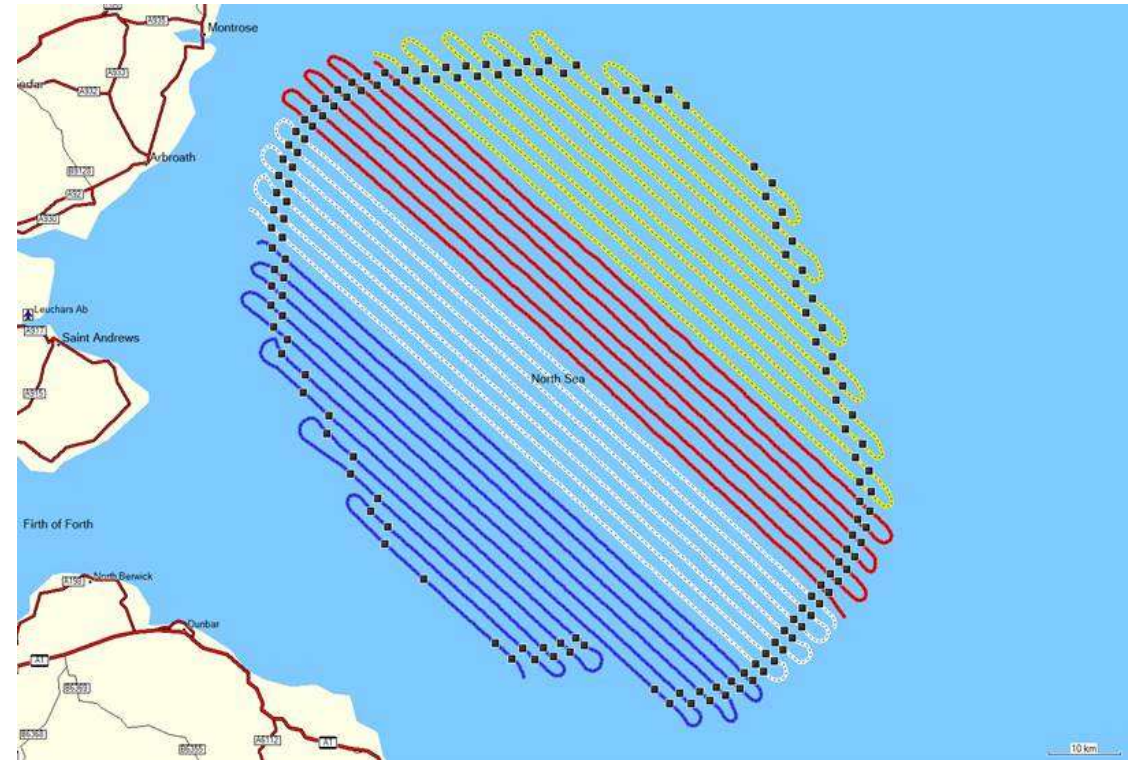
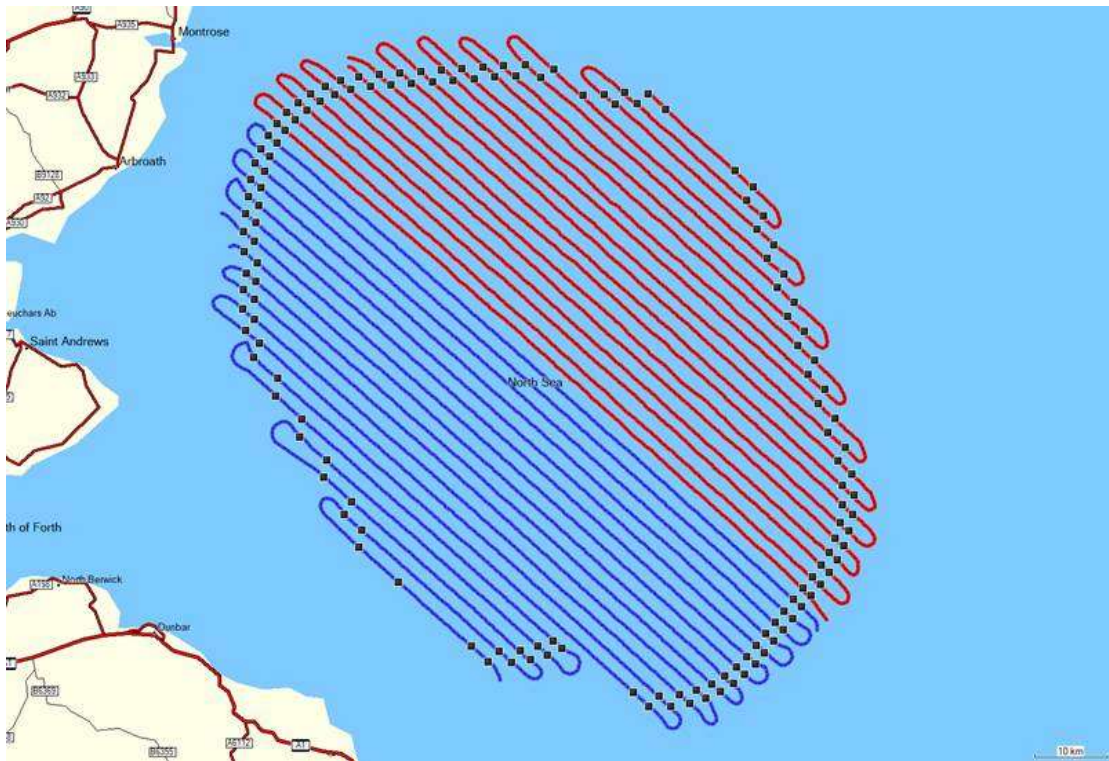
- 12km buffer
- Single day
- 4,980 km²



Digital Aerial Survey

Seagreen 2&3:

- April to September; 2 aircraft



Seagreen 2&3:

- October to March; 4 aircraft

Digital Aerial Survey

LOGISTICAL CHALLENGES – COMBINED AREA

- Good coverage
- Large survey area, weather, industrial action

Flight date	No. transects incomplete	Comment	Single day coverage with 2 cameras	Coverage with 4 cameras,
21/05/2019	0	Complete	12.49%	24.98%
23/06/2019	0	Complete	12.49%	24.98%
05/08/2019	11	Section not flown at Inch Cape/ NnGOWL. Southern area re-flown 24/08/19	9.50%	19.00% (over both dates)
18/08/2019	0	Complete	12.49%	24.98%
13/09/2019	0	Complete	12.49%	24.98%
12/10/2019	0	Complete	12.49%	24.98%
09/11/2019	0	Complete	12.49%	24.98%
17/12/2019	2	Two incomplete transects due to weather	11.54%	23.08%

Figure 6 Flight path flown on 5 August



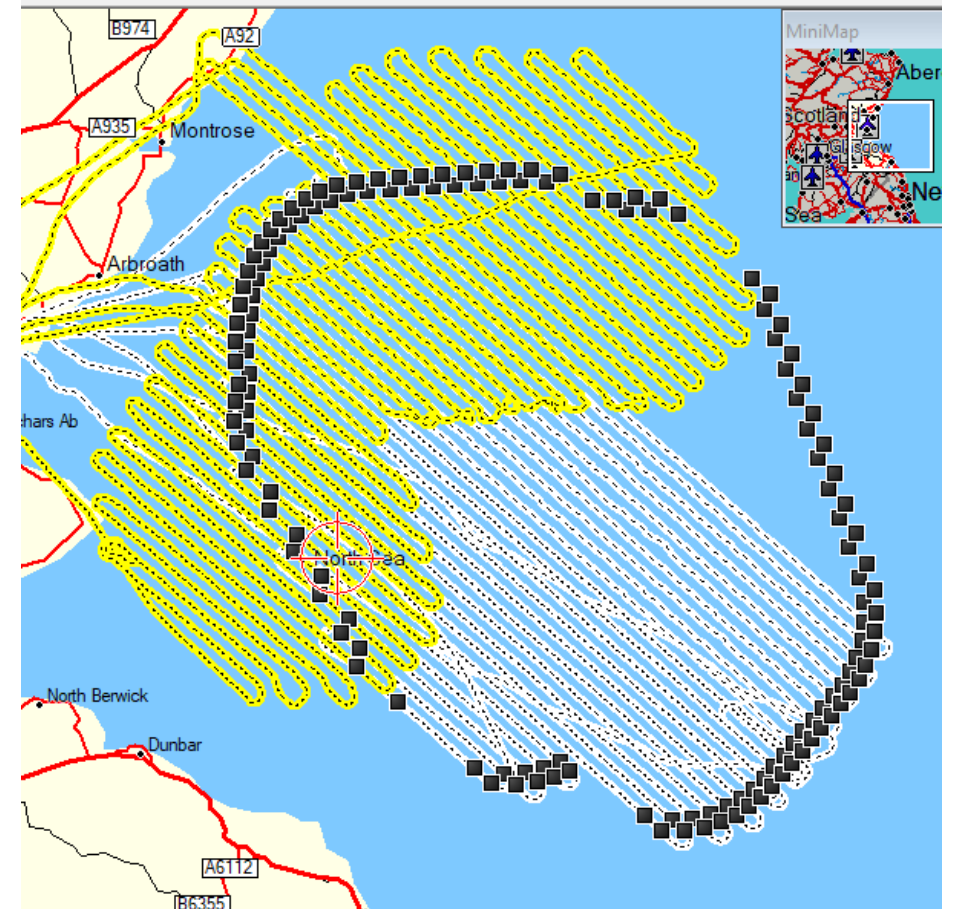
Figure 7 Flight path flown on 24 August



Digital Aerial Survey

LOGISTICAL CHALLENGES – Seagreen 2&3

SEAGREEN 2&3		
Flight date	No. transects missed	Reason
28/03/2019	2	Camera faults
April 2019	No survey	Poor weather during scheduled survey dates.
14/05/2019	0	
21/06/2019	0	
23/07/2019	8	North eastern transects not completed due to industrial action at Dundee Airport meaning plane had to divert to Aberdeen.
06/08/2019	2	Not flown.
15/09/2019	0	
17/10/2019	12	North eastern transects not completed due to industrial action at Dundee Airport meaning plane had to divert to Aberdeen.
19/11/2019	4	All four aircraft were stalled at Dundee Airport leading to late starts on all routes (ice)



October 2019: Seagreen 2/3 survey coverage & Combine Area survey coverage

Digital Aerial Survey

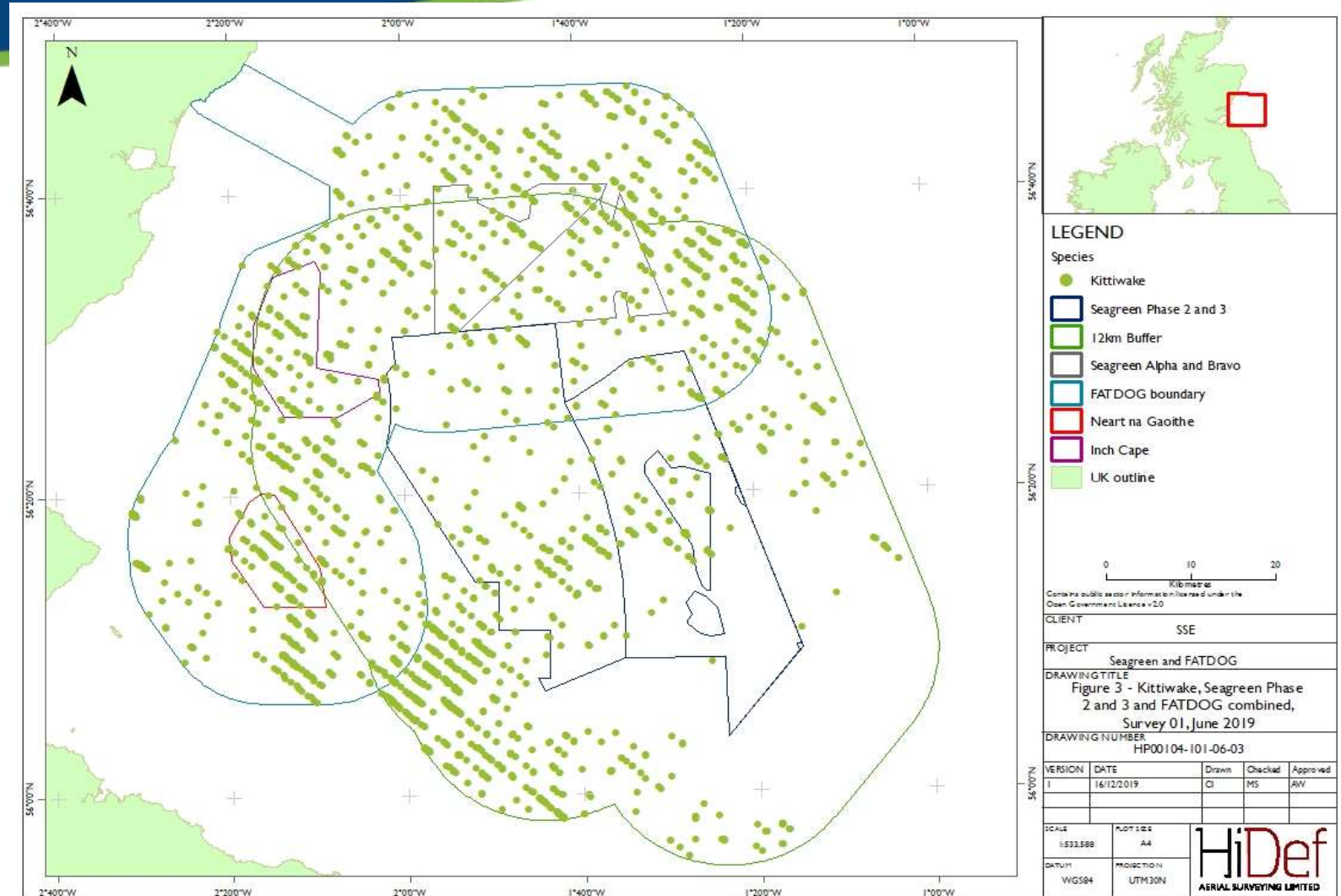
FILLING GAPS IN COVERAGE

- Approaches discussed with MS and SNH.
- Low number of missing transects (e.g. <5): add data from additional camera sweep on adjacent transects to maintain overall % coverage of survey area.
- Higher number of missing transects (>5) and gap in spatial coverage (e.g. October 2019): patch in data from overlapping transects flown for Seagreen 1 or Inch Cape, as well as use of additional camera data on adjacent transects. Some gaps in cover may still occur, currently restricted to buffer zone.
- Seagreen 2&3 April 2019 survey: double survey in April 2020. [There is also good historical coverage from boat surveys in 2010-11]

Digital Aerial Survey

EXAMPLE RAW DATA

- Kittiwake (June '19)
- SG1+NNG+IC and SG2&3
- Data for different survey areas/dates combined



Digital Aerial Survey

COLLABORATIVE APPROACH

- Unique large data set – Combined Area surveys completed on a single day each month.
- Cost effective – overlapping buffer areas between developments.
- Repeatable, comparable analysis between sites in Forth & Tay.
- Excellent baseline for future monitoring of change.



Digital Aerial Survey

ONGOING SURVEY STRATEGY – beyond March 2020

- Combined Area:
 - NnG: to continue up to and throughout construction
 - Seagreen 1: continuing in breeding season up to and during construction
 - Inch Cape: current timescales result in uncertainty beyond March 2020
- Repeatable survey to assess change in operational period – 2 years
- Seagreen 2&3:
 - Monthly baseline digital aerial survey continuing until March 2021

GPS tracking in the Forth/Tay region

Aly McCluskie, Francis Daunt & Saskia Wischnewski,
SCOTMER 3rd February 2020



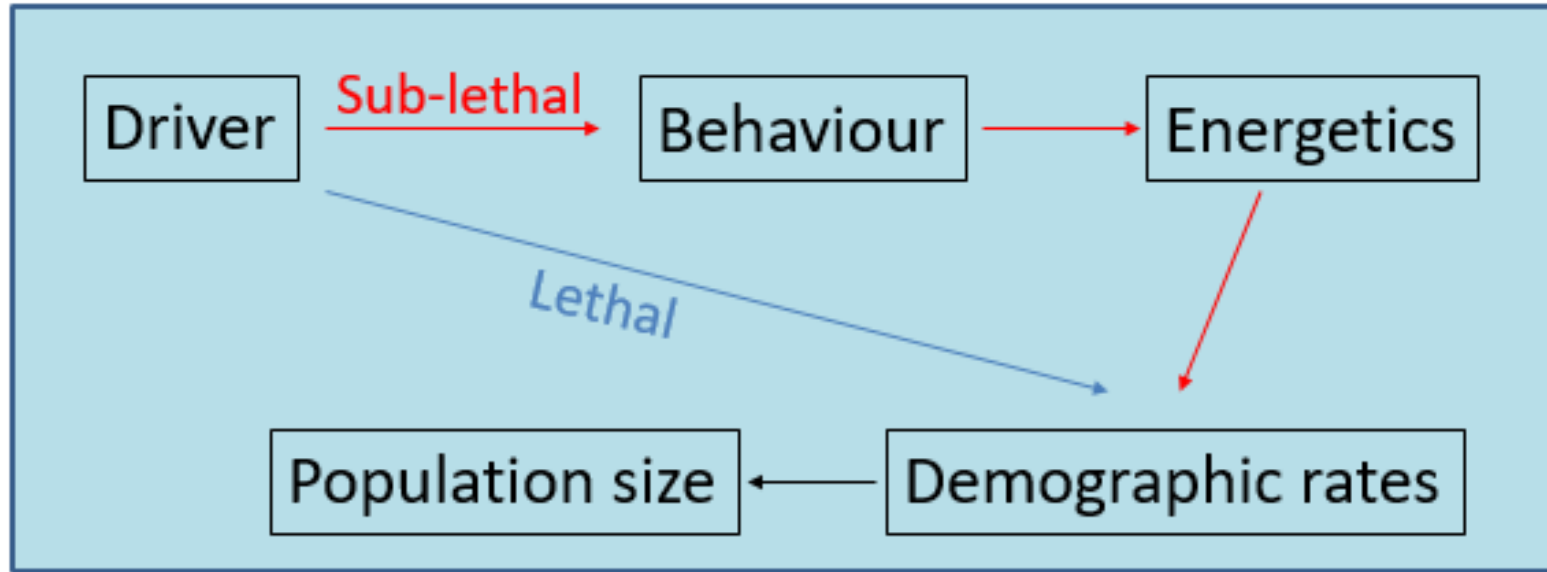
Anke Addy

Effects of offshore renewables: key questions

- Is there evidence for collisions, displacement, barrier effects or other factors?
- Are the affected individuals from colony SPAs?
- Are there consequences of these effects on SPA populations?



Effects of offshore renewables



Effects of offshore renewables

- Collisions:
 - collisions: direct observations
 - microavoidance and mesoavoidance: GPS, direct observations
- Barrier effects/macroavoidance
 - GPS tracking
 - other methods
- Displacement:
 - GPS tracking
 - At-sea surveys



Individual-based approach

- Allows tracking the fate of individuals that interact with OWFs to a greater or lesser extent
- Integrate sub-lethal and lethal effects at the individual level
- For sub-lethal effects, follow change in behaviour, energetics and demography at the individual level
- Combine individual-level effects to obtain a population-level assessment
- Much more powerful for detecting effects than using population-level information from the outset

Methods for quantifying at the individual level

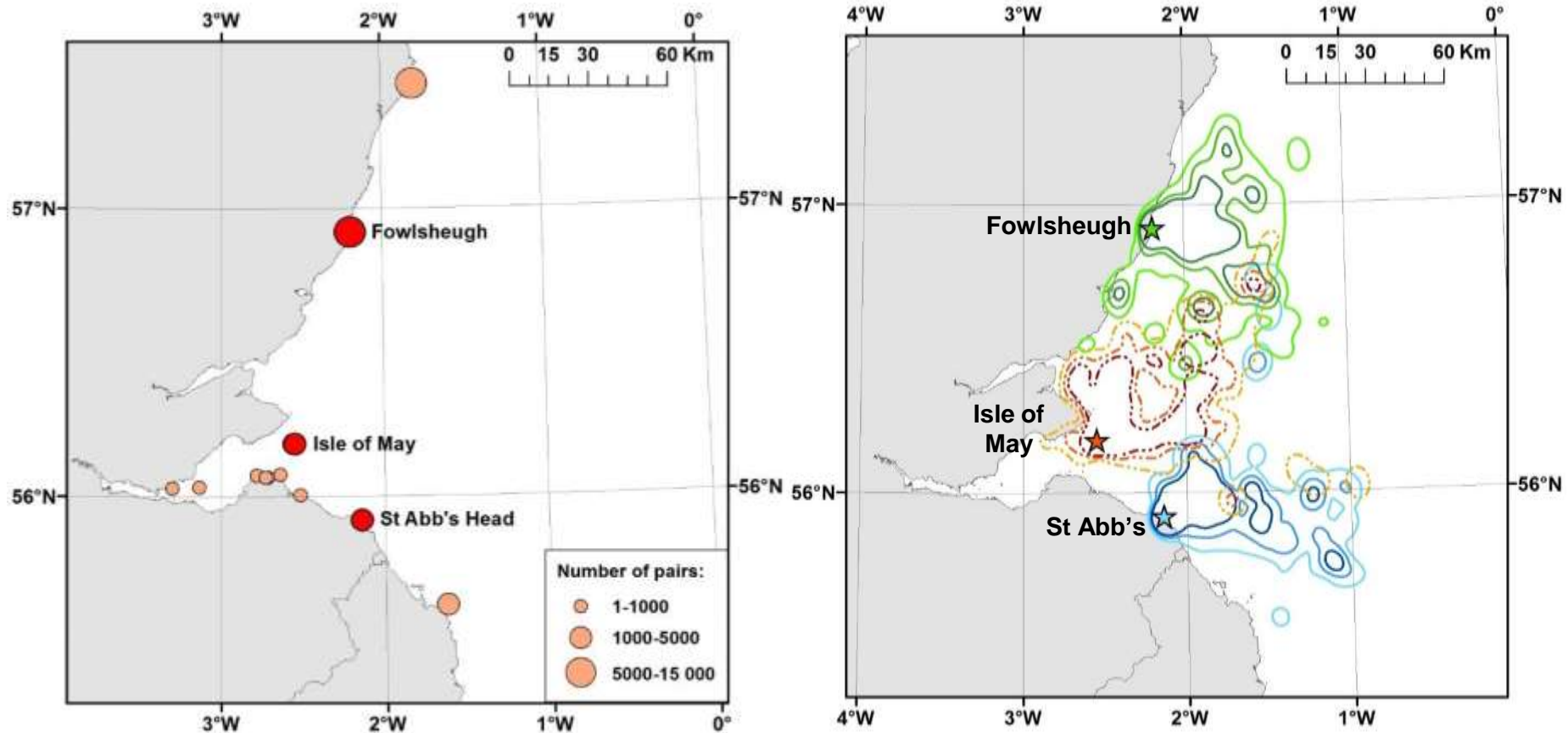
- GPS tracking offers a powerful method for undertaking these measures at the individual level
- It can also be built into individual-based models which capture all key processes including those that are challenging to measure empirically
- The best outcome is where as many steps as possible are measured empirically



Collision risk

- Estimates of collision mortality have been hampered by the lack of detailed understanding of the three dimensional movements of birds
- Focus has been on avoidance rates, flight heights and flight speeds, as inputs to Band model rather than as cohesive behaviour
- Such behaviour can vary with location, weather conditions, time of day and other factors
- Measuring 3D movements will bring biological reality
- Combining data from before, during and after construction allows to compare changes in 3D behaviour as birds react to presence of turbines

Multiple SPAs in 2020



- Shared empirical and analytical approaches on kittiwakes
- Effects of OWFs across multiple SPAs interacting with the wind farms
- Expanding baseline monitoring at Fowlsheugh and St Abbs to match Isle of May

New logger functionality

- GPS tracking to estimate distribution and flight lines
- Accelerometry to quantify behaviour at each fix
- Barometry to quantify
 - 3D flight movements (kittiwakes)
 - Depth (auks)
- Longer term attachment

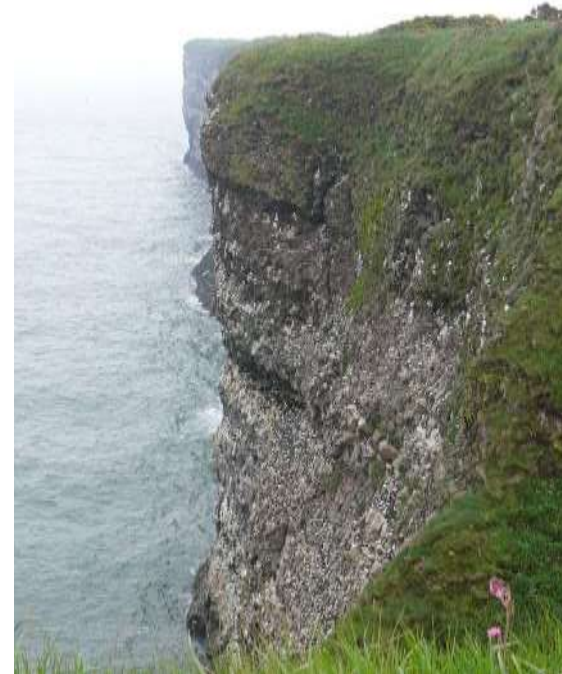


Key measures

- Behaviour
 - time activity at sea
 - 3D movements
- Energetic measures:
 - at-sea energy budgets
 - chick and adult condition
- Demography
 - Chick survival
 - Adult survival
- Striking the right balance
 - Disturbance effects on birds
 - Device effects



Upscaling monitoring at St Abbs and Fowlsheugh



Data tidying and inputting

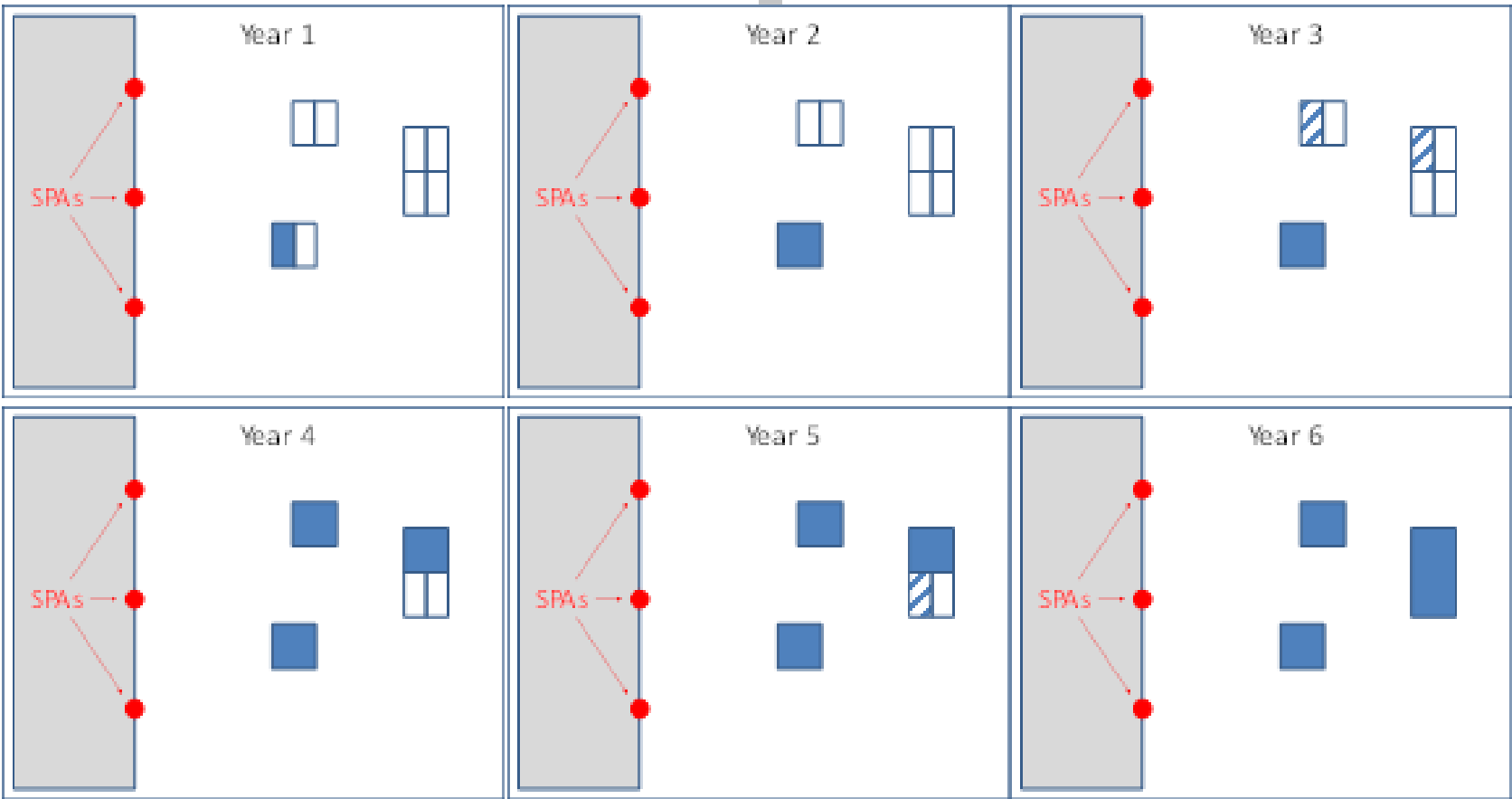
Made digital copies of all St. Abb's seabird productivity monitoring data.

Catalogued St. Abb's and Fowlsheugh's seabird productivity monitoring and census data.

Digitised

- 29 years of Fowlsheugh Kittiwake productivity monitoring data.
- 25 years of St. Abb's Kittiwake productivity monitoring data.
- 6 years of Razorbill productivity monitoring data.
- 21 years of Shag productivity monitoring data.

Construction and Operation: beyond 2020



Project plan: conclusions

- Value of an individual-based approach to quantifying population-level consequences of effects
 - Is there evidence for collisions, displacement and barrier effects?
 - Are the affected individuals from colony SPAs?
 - Are there consequences of these effects on SPA populations?
- Opportunity for state-of-the-art study of effects of multiple offshore developments on seabirds in the best studied region in the UK
- Requires a long-term, strategic approach tackling shared questions
- Constructed a research plan for 2020 and beyond spanning the pre-construction, construction and operation phases of the four wind farms in the region for FTRAG



ScotMER East Coast Offshore Wind Farms Symposium

Forth and Tay Projects

Seabird Collisions/Avoidance and Population Effects

Polly Tarrant – EDF Renewables



Collision and/or avoidance study

- A joint study between NnG, Seagreen One and Inch Cape
 - To be located at NnG
- Operational study, but tender process to commence imminently to allow incorporation into the design and construction of the NnG windfarm
- Commencing tender process with an expressions of interest call, followed by an ITT.
- Established an Advisory Group of members from MS, SNH, RSPB and JNCC.
- Priority is on kittiwake and gannets
- Details of the study to come out of the tender process.....



Gannet adult survival study

- A joint study between NnG, Seagreen One and Inch Cape
- Long-term study of adult gannet survival rates
 - Colour ringing and re-sighting adult gannets to measure survival at colonies close to and distant from offshore wind farms, to indicate whether the presence of the windfarms has a detectable effect on adult survival.
 - 2020: supporting ongoing colour-ringing and re-sightings of adult gannets on both the Bass Rock and Grassholm colonies.
- Ongoing consideration of a third colony: Hermaness, Skule Skerry, Alisa Craig.
- Length and management of the study is subject to future discussions and analysis
 - Power analysis of post-construction monitoring data
 - Strategic study – pertinent to not just the F&T windfarms



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Forth and Tay Projects

Marine Mammal Monitoring

Nick Brockie, SSE Renewables

4th March 2020

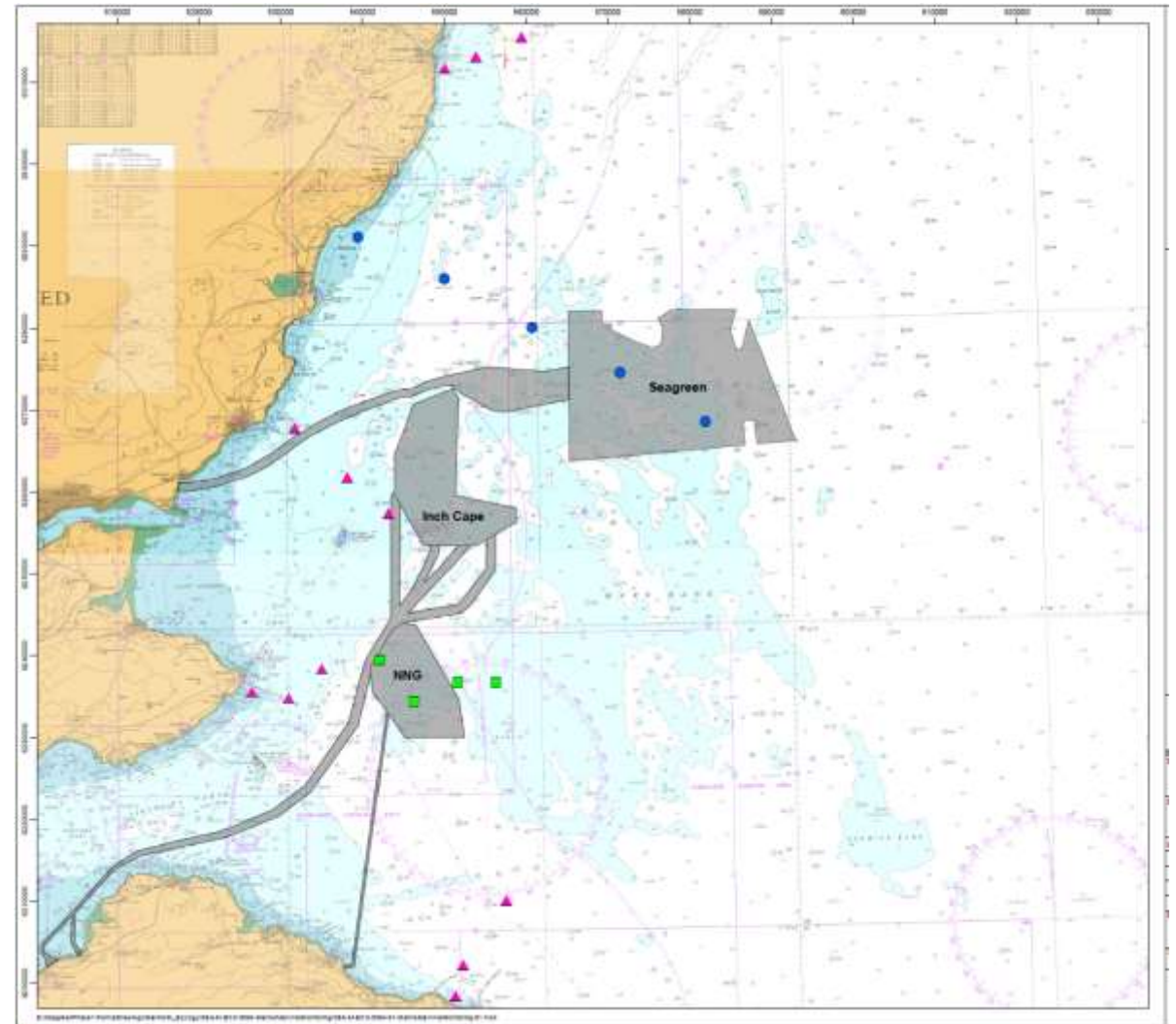
Forth & Tay Marine Mammal Monitoring

- MMMP required by consent – included in Project Environmental Monitoring Programme (PEMP)
- Seagreen pre-construction PEMP approved by Scottish Ministers November 2019
- Neart na Gaoithe PEMP submitted November 2019
- Proposed marine mammal monitoring included augmentation of the existing ECOMMAS network with additional locations
- Approach agreed with MS-LOT, MSS and SNH – FTRAG-MM
- Deployment and servicing by MSS. Coordination with ECOMMAS welcomed

Forth & Marine Mammal Monitoring

Rationale:

- Monitor noise at a variety of ranges from construction = validates noise modelling and predictions of exposure
- Detection of cetacean activity in Before-After-Gradient (BAG) design to look at changes as a result of pile driving and other construction activities
- Extends monitoring further offshore (more potential chance of detecting other species, e.g. minke whales)
- Fills the 'gap' or extends existing sets of ECOMMAS monitoring stations
- CPOD and broadband noise recorder at each location



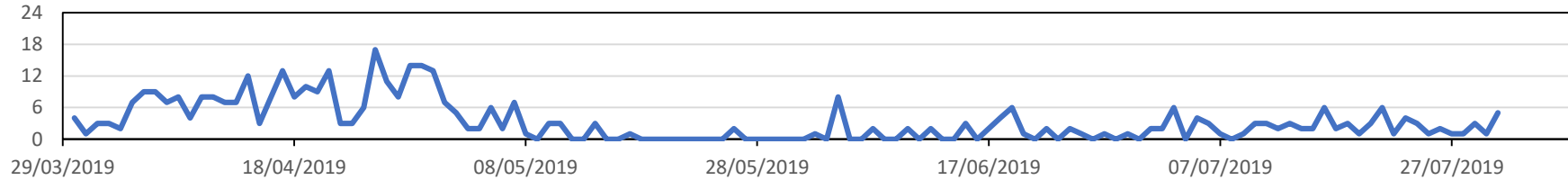
Forth & Tay Marine Mammal Monitoring

- Current status
 - Initial deployments - Seagreen March 2019; Neart na Gaoithe November 2019
 - Service visit July 2019 – Data from locations 1, 3 and 5
 - Service visit November 2019 – Data from all 5 Seagreen locations
 - Next service visit April 2020
- Planned extension of agreements to continue monitoring for further 12 months
- Full year 1 report on noise and CPOD data following data retrieval after next service visit (Apr 2020)
- Proposed to incorporate wider ECOMMAS data with Seagreen and Neart na Gaoithe data to help interpret spatial and temporal patterns in Forth & Tay area?

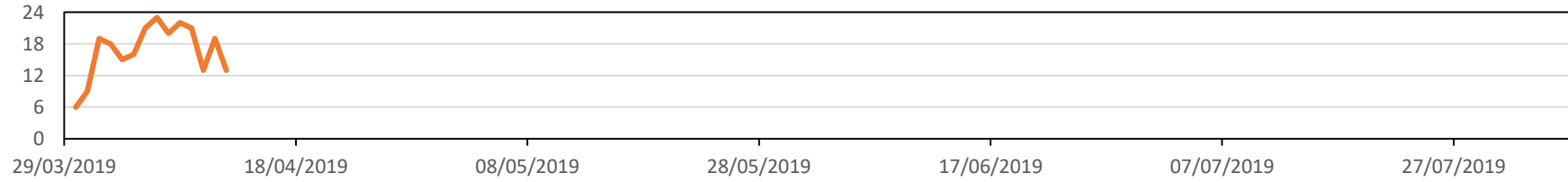
Forth & Tay Marine Mammal Monitoring

Data Summary 1st Seagreen Deployment
April/May/June/July

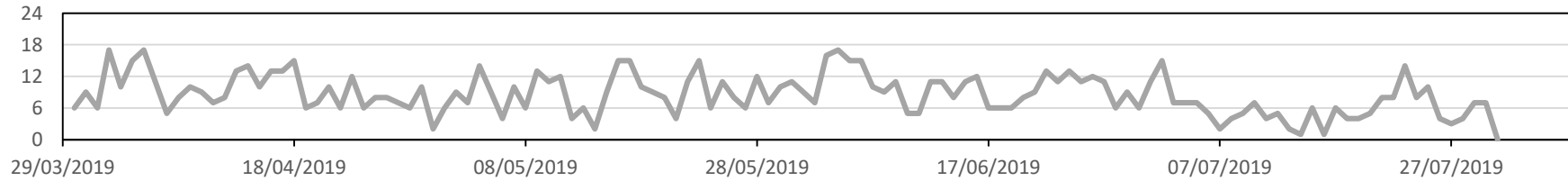
Porpoise positive hours per day



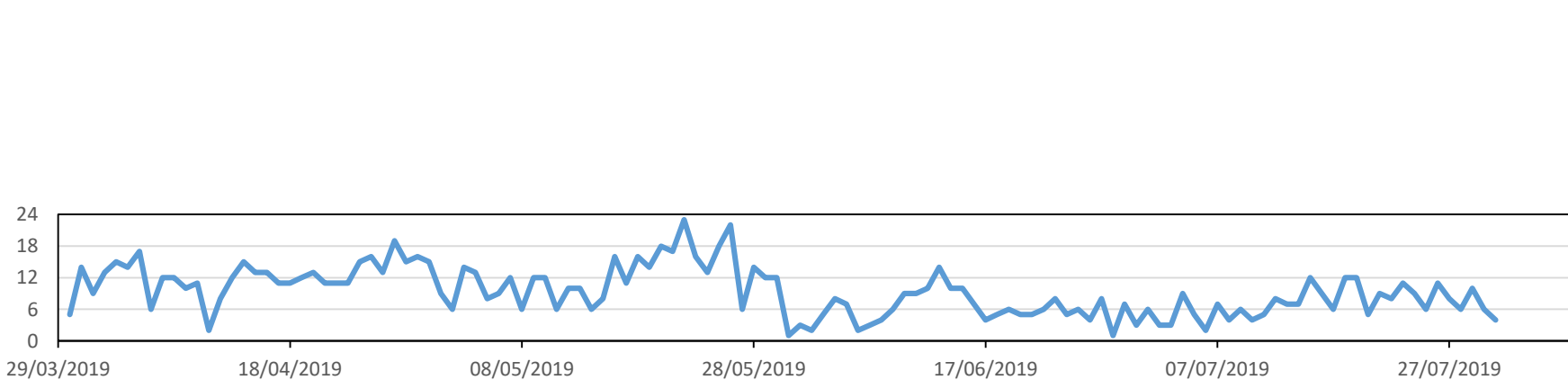
S1



S2



S3

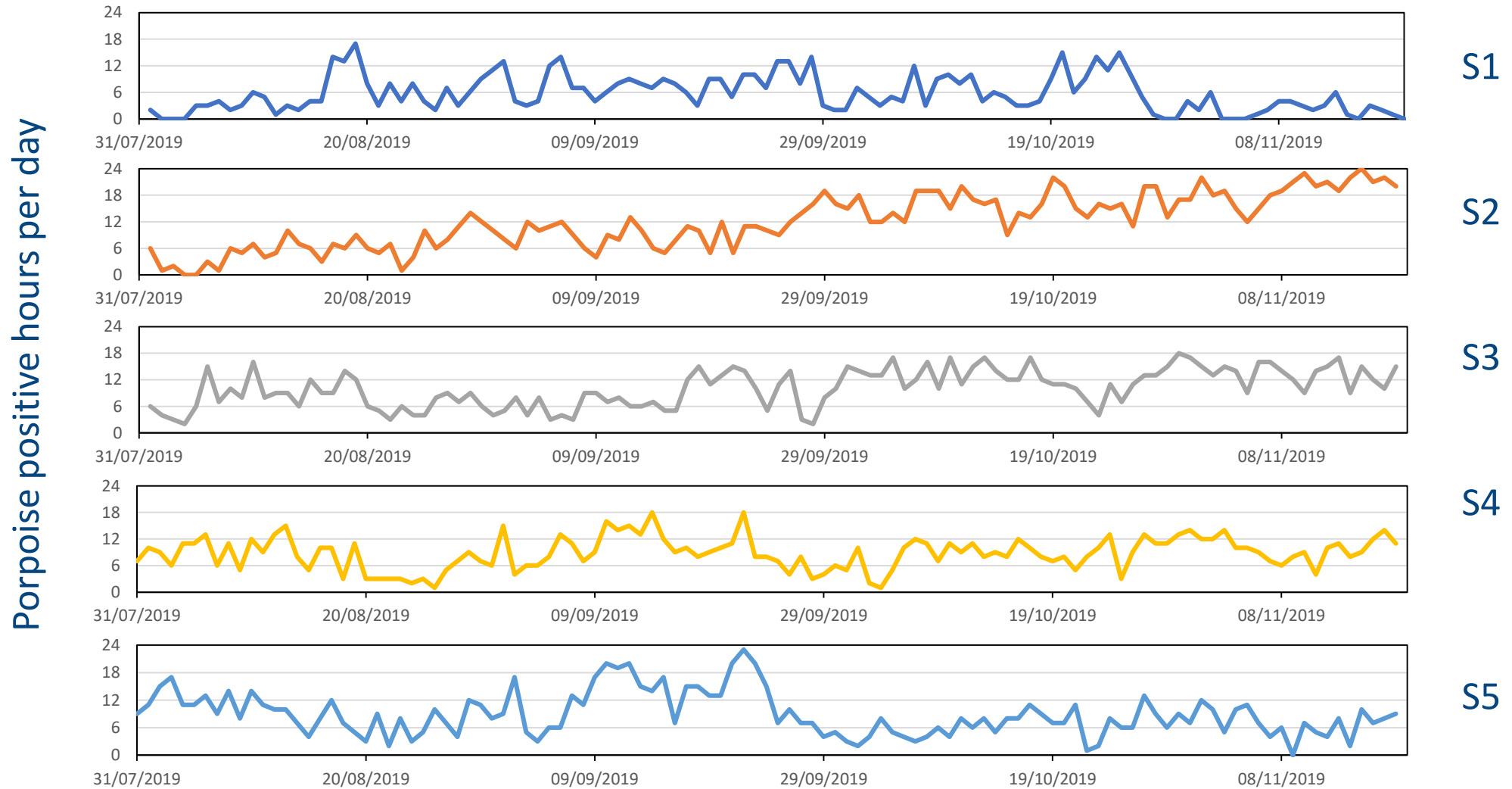


S4

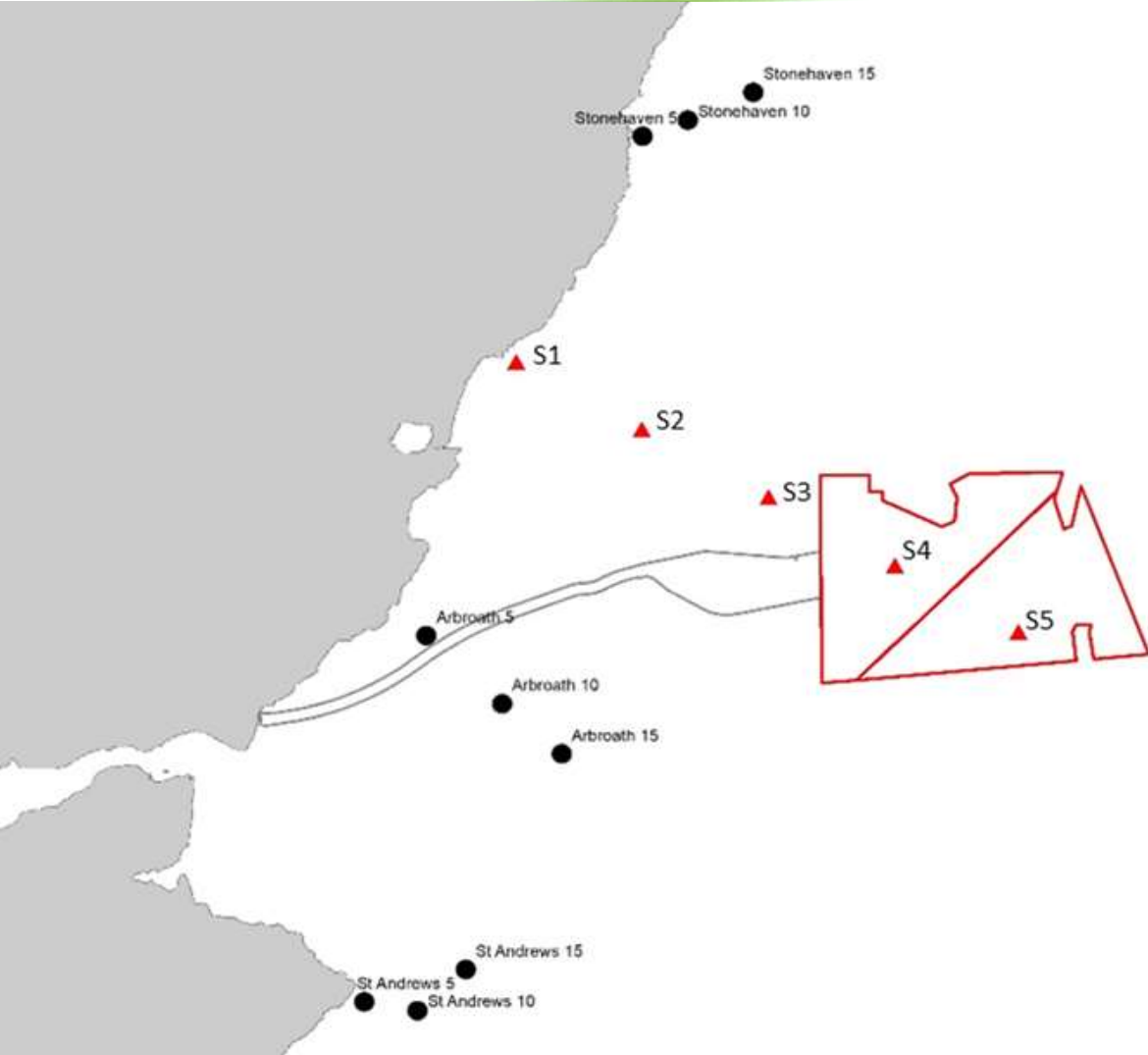
S5

Forth & Tay Marine Mammal Monitoring

Data Summary 2nd Seagreen Deployment
Aug/Sept/Oct/Nov



Forth & Tay Marine Mammal Monitoring

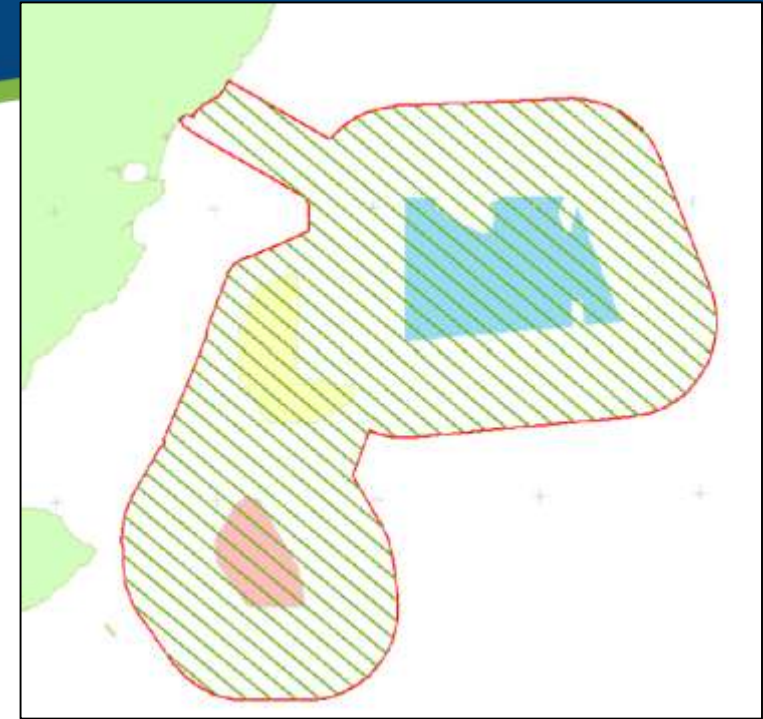


Seagrass Data Summary

	S1	S2	S3	S4	S5
Porpoise click positive days	81%	98%	100%	100%	99.6%
Average Porpoise DPH per day (95% CI)	4.47 (0.53)	12.56 (1.08)	9.33 (0.52)	8.80 (0.68)	9.13 (0.59)
Dolphin click positive days	1.3% (3 days: 12/8 3/9 17/11)	0	0	0	0

Analysis of underwater noise data in progress - including dolphin whistle detection

Forth & Tay Marine Mammal Monitoring

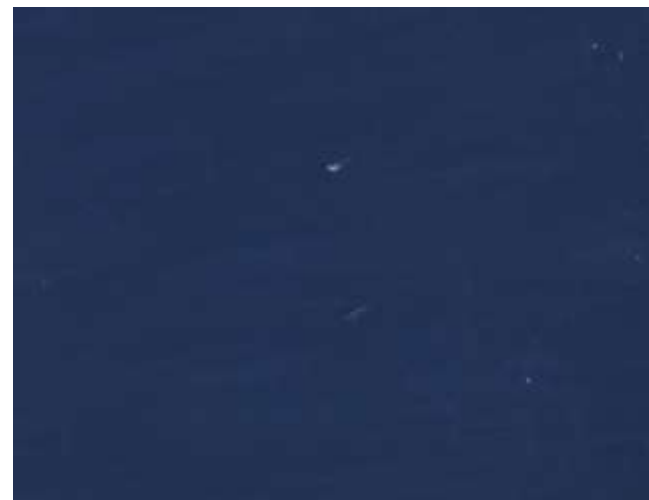


Other activities

- Ornithology aerial survey transects include Seagreen and Neart na Gaoithe PAM arrays.
- Marine mammal observations being recorded and will be included in reporting
- Potential to correlate with acoustic detections



Minke whale



Harbour porpoise



Swordfish!

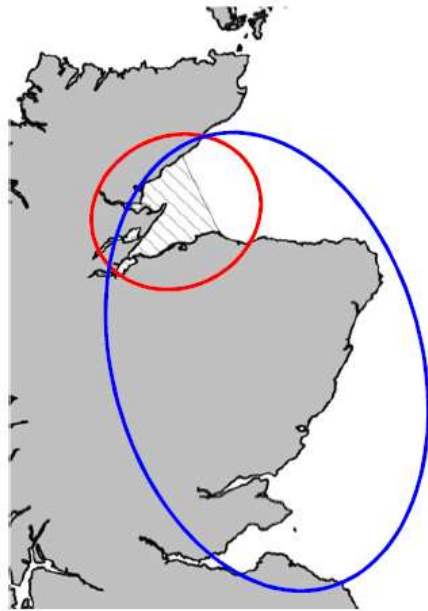
Forth & Tay Marine Mammal Monitoring

Bottlenose dolphin photo id surveys – since 1990

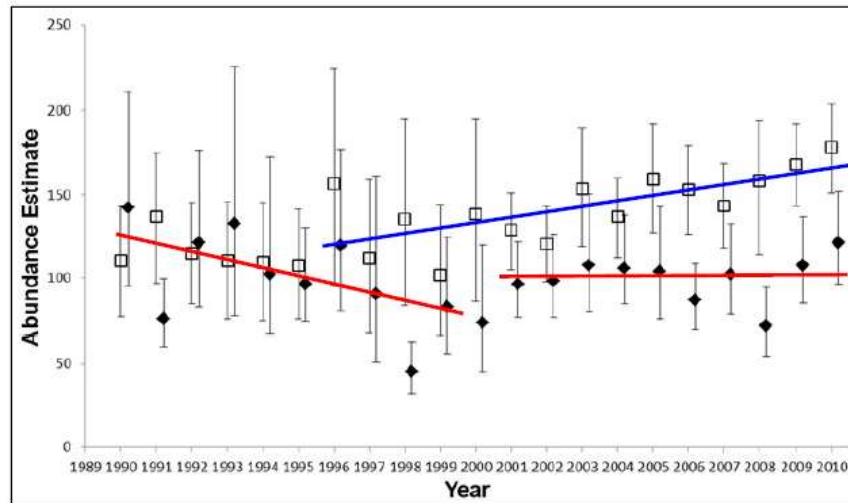
The composite image illustrates the monitoring process. On the left, a map of the Moray Firth SAC shows the coastline with several bottlenose dolphins swimming in the water. Two blue dots on the map indicate survey locations. At the top right, the logos for the University of Aberdeen and the Sea Mammal Research Unit are displayed. To the right of the map, the text '1990 – 2019 surveys' is written. Three photographs are included: a white survey boat with two people on board, a researcher sitting at a desk with a laptop and a grid of photos, and a close-up of a dolphin's dorsal fin.

Forth & Tay Marine Mammal Monitoring

Population trends

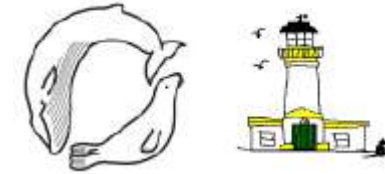


◆ Moray Firth □ East coast Scotland



Cheney, B *et al.* (2014). *Global Ecology and Conservation* 2: 118-128.

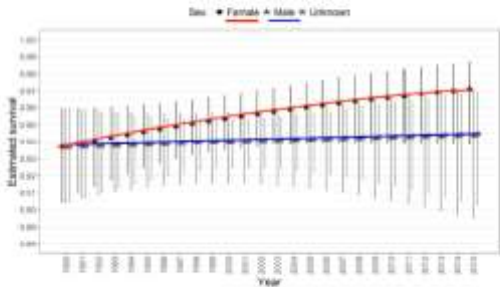
Forth & Tay Marine Mammal Monitoring



Current knowledge

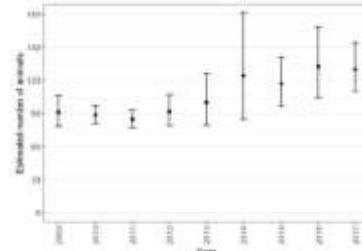
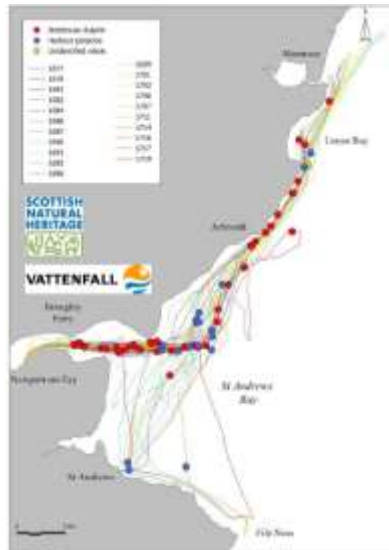
Population birth and survival rates

- Annual survival rate (1989-2015)
 - Male = 0.94 (mortality rate = 6%)
 - Female increase from 0.94 to 0.97
 - i.e. mortality rate declined from 6% to 3%

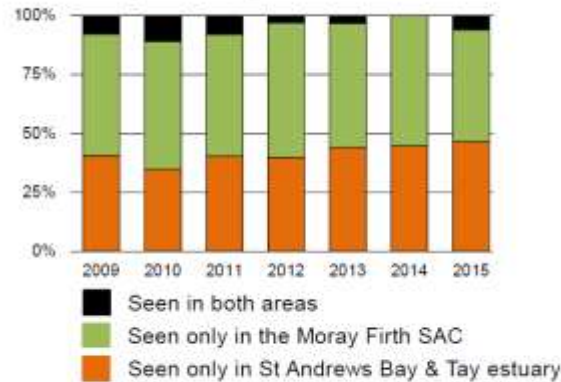


Arso Civil, M. et al. (2017). Ecosphere 8(4): e01796.
 Arso Civil, M. et al. (2019). Ecology and Evolution 9: 533-544.

Individual movements – between Moray Firth & Tay area



Proportion of dolphins seen in each or both areas



5.6% (0-10.9%) of marked animals seen in both areas every summer

50% in Tay every summer
 Over whole period ~30% seen in both areas

Range expansion

Public sightings keep being reported south of Firth of Forth into NE England



Adult females last seen in 2015 + public sighting 2018

Forth & Tay Marine Mammal Monitoring

- Current effort is unable to continue monitoring whole population
- What are the implications of continued southwards expansion of the population range?
- Is there potential for negative bias in population trends, survival and birth rate estimates?
- Is there any population response to wind farm construction in the Forth and Tay area



Forth & Tay Marine Mammal Monitoring

- Seagreen, Inch Cape and Neart na Gaoithe joint support over period 2020-2023
 - Continuation of Firth of Tay monitoring
 - Systematic monitoring in Firth of Forth
 - Engagement with citizen science initiative in Berwickshire/Northumberland
- Aims
 - Continue to support population analyses
 - Understanding of continuing population expansion
 - Investigate population responses to wind farm construction
- Discussion and agreement at FTRAG-MM, January 2020

