ARDERSIER PORT ENERGY TRANSITION FACILITY PORT EXTENSION

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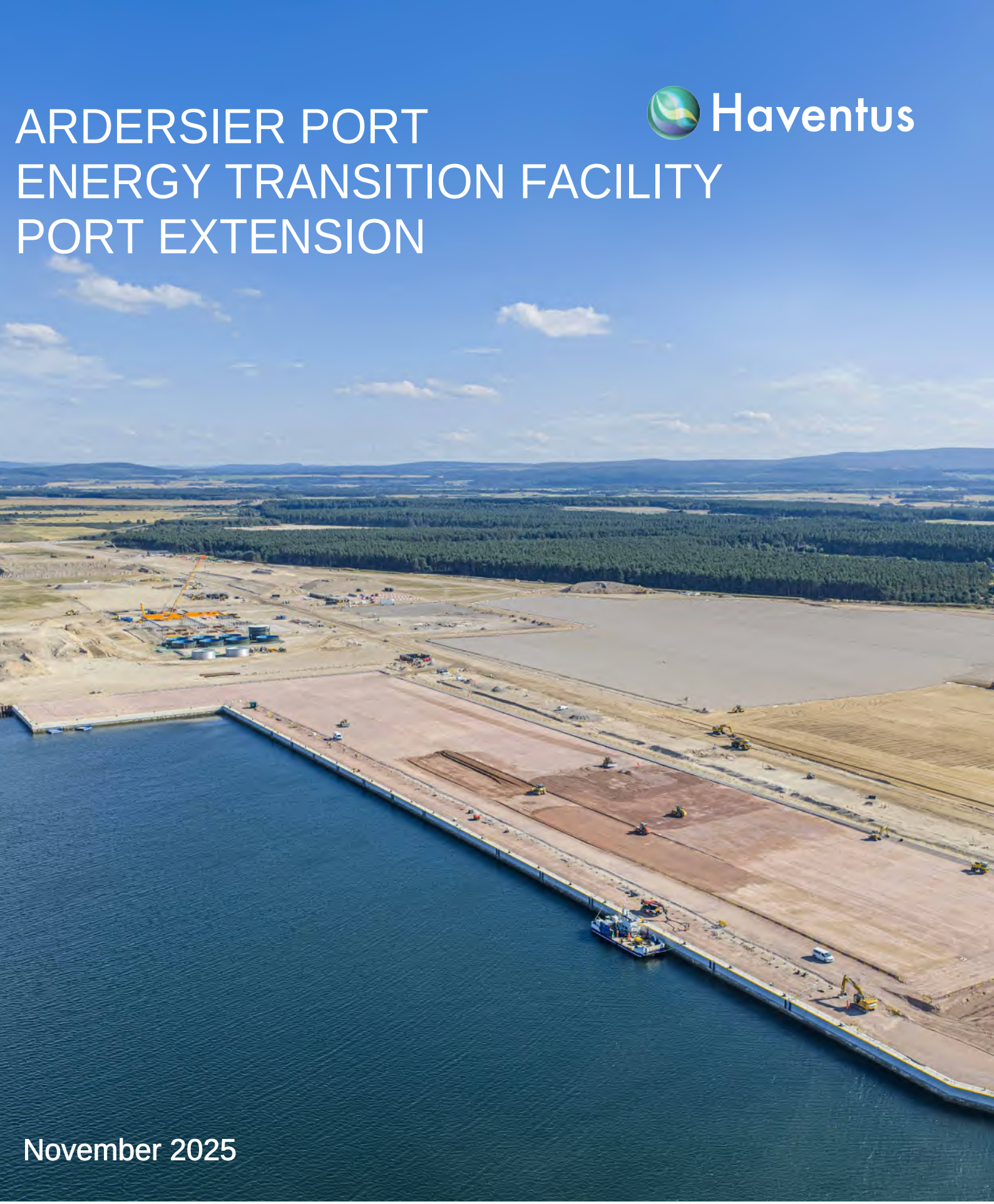

November 2025

Appendix 11.7: Draft Marine Mammal Mitigation Plan

SMRU Consulting

understand ♦ assess ♦ mitigate

Ardersier Port Extension
EIAR Appendix 11.7: Draft Marine Mammal Mitigation Plan

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1 Introduction

This draft Marine Mammal Mitigation Plan (MMMP) has been developed to ensure that all parties involved in the Port of Ardersier Energy Transition Facility (ETF) Extension are aware of the potential impacts to the marine mammal species of concern. The mitigation developed and included as part of this MMMP is to ensure the protection of marine mammals during the installation of three mooring dolphins using impact piling or vibropiling and dredging and spoil disposal operations. Construction activities are planned to take place sometime between 2026 and 2028, with piling operations expected to take place at any point during this time period. Dredging and spoil disposal activities are expected to take place between March and October, sometime between 2027 and 2029. Dredging activities shall predominantly take place within the inner harbour, 0.8 – 1.8 km away from the harbour entrance.

The mitigation measures presented in this MMMP are informed by the data presented in:

- EIAR Chapter 11: Marine Mammals;
- EIAR Appendix 11.1: Legislation, Policy and Guidance;
- EIAR Appendix 11.2: Marine Mammal Assessment Methodology;
- EIAR Appendix 11.3: Marine Mammal Baseline Characterisation;

- EIAR Appendix 11.4: Marine Mammal Impact Assessment;
- EIAR Appendix 11.5: Underwater Noise Modelling; and
- EIAR Appendix 11.6: Habitat Regulations Appraisal.

The draft MMMP summarises the worst-case scenarios considered in the EIAR together with a summary of impacts and current available mitigation measures.

2 Marine Mammal Species

Mitigation measures will be applied to any marine mammal species observed during construction activities. Evidence suggests that there is the potential for various marine mammal species within the area of the development and within the impact range of the piling, dredge, and spoil disposal locations. Species regularly present within the work areas include harbour porpoise, bottlenose dolphins, minke whales, harbour seals and grey seals. Furthermore, there are a number of marine mammal designated sites located in and around the Port of Ardersier. These are:

- Moray Firth Special Area of Conservation (SAC) designated for bottlenose dolphins;
- Whiteness Sands (Ardersier) seal haul-out site designated for grey and harbour seals; and
- Dornoch Firth and Morrich More SAC designated for harbour seals.

Whales, porpoise and dolphins are classed as European Protected Species (EPS) and are fully protected under the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended), whilst the main legislation with regard to the protection of seals is The Marine (Scotland) Act 2010, which provides for Scottish Ministers to designate 'seal conservation areas.' Seal haul-out sites are designated under section 117 of Marine (Scotland) Act 2010. Both the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) and The Marine (Scotland) Act 2010 prohibit the disturbance, injury or killing (intentionally or recklessly) of cetaceans and seals respectively, thus requiring mitigation to be implemented.

3 Impact Piling Mitigation Plan

This draft piling MMMP has been prepared to support both the future anticipated Marine Licence application and future anticipated EPS Licence applications for the mitigation of pile driving operations to install three mooring dolphins within the Proposed Development. Piling activities are expected to take place over 12 days, sometime between 2026 and 2028 (timings are still to be confirmed). Piling shall take place during daylight hours only.

The mitigation measures proposed during impact piling activities are presented below and summarised in a flowchart in Appendix 1.

3.1 Piling scenario

Subacoustech Environmental Ltd conducted underwater noise modelling for both impact piling and vibropiling. Only impact piling will be considered in this draft MMMP as these impacts represent the worst-case scenario underwater piling noise on marine mammals. The three mooring dolphins will be installed using 12 piles each 1,200 mm in diameter. One pile will be installed per day over a period of 10 hours. The maximum hammer energy during impact piling is expected to be 294 kJ.

The anticipated soft-start modelled for impact piling comprised six blows per minute for the first 20 minutes (20% of the maximum), then increases to 30 blows per minute for the remainder of the ramp-up procedure. Assuming a signal duration of around 0.5 seconds per pile strike, the initial soft-start

procedure will be a 5% duty cycle (0.5 second pulse followed by 9.5 seconds of silence) and the ramp-up will be a 25% duty cycle (0.5 second pulse followed by 1.5 seconds of silence).

3.2 Piling impact ranges

The maximum instantaneous PTS-onset range from pile driving was 60 m for harbour porpoise and less than 10 m for all other species groups (Table 1).

Table 1 Predicted impact ranges associated with impact piling, using the Southall et al. (2019) $L_{p,pk}$ PTS criteria in marine mammals for impulsive noise sources.

		Instantaneous PTS		Cumulative PTS	
Hearing group	**Species**	**Southall et al. (2019) PTS criteria $L_{p,pk}$ (impulsive)**	**Maximum impact range (m)**	**Southall et al. (2019) PTS criteria SEL_{cum} (impulsive)**	**Maximum impact range (m)**
Very high frequency cetaceans	Harbour porpoise	202 dB	60	155 dB	<10
High frequency cetaceans	Bottlenose dolphins	230 dB	No predicted exceedance	185 dB	<10
Low frequency cetaceans	Minke whales	219 dB	<10	183 dB	<10
Pinnipeds in water	Harbour and grey seals	218 dB	<10	185 dB	<10

3.3 Mitigation guidelines

The current guidance on minimising the risk of injury to marine mammals from piling noise is provided in JNCC (2010). These mitigation guidelines are supplemented by the JNCC guidance for the use of PAM in UK waters (JNCC 2023). Developers may also follow the guidance in JNCC (2010) by providing the "Best available technique" to be used.

This draft MMMP outlines the current mitigation measures anticipated for the worst-case scenario impact piling parameters. JNCC have advised that an addendum to provided updates to the JNCC (2010) piling guidelines is currently in preparation and, therefore, new advice may be available prior to the finalising of the piling MMMP.

3.4 Mitigation methods

3.4.1 Mitigation Monitoring

Piling shall take place during daylight hours only. Monitoring for marine mammals will be conducted by a Marine Mammal Observer (MMO). Passive Acoustic Monitoring (PAM) conducted by a PAM Operator will be used to supplement or replace visual observations when visibility is poor (e.g. sea state >4, foggy conditions). Sufficient mitigation personnel should be provided to ensure a adequate coverage of the mitigation zone (MZ) during visual monitoring periods. Details of the PAM system used will be provided in the final MMMP.

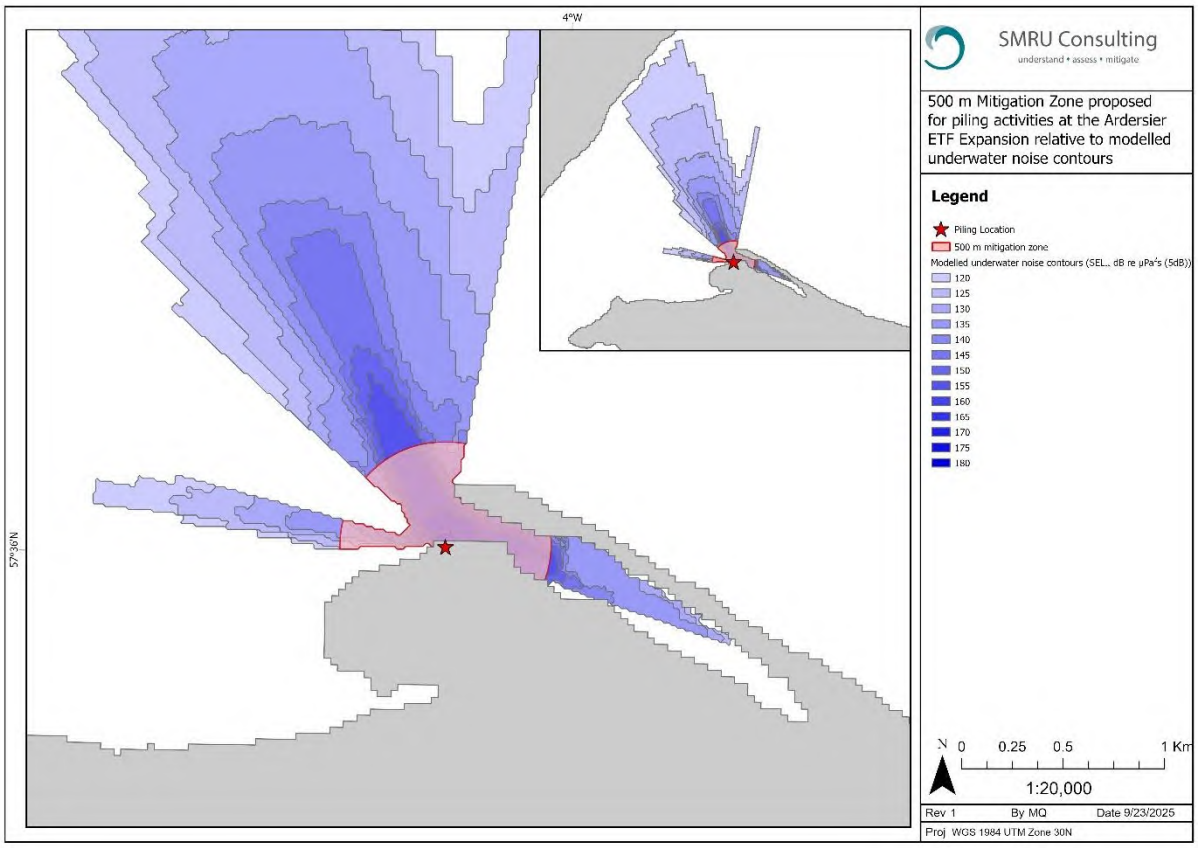
The MMO and PAM Operator will be required to advise contractors and/or crews on the implementation of procedures to ensure compliance.

3.4.2 Mitigation Zone

The minimum mitigation zone (MZ) that should be monitored for piling is recommended in JNCC (2010) as 500 m. The maximum potential instantaneous PTS-onset impact range for piling is 60 m for harbour porpoise which is less than the minimum 500 m MZ recommended by the JNCC (2010). Therefore, a 500 m MZ is considered sufficient to ensure that instantaneous PTS can be effectively mitigated.

The MZ shall extend 500 m from the modelled piling location, and only include areas for which noise contours are predicted to extend, and for which areas of water are thus in 'line of sight'. The proposed 500 m MZ is shown in Figure 1.

Figure 1: A 500 m MZ for piling activities during the proposed development.



3.4.3 Pre-piling Search

A pre-piling search of the 500 m MZ will be conducted for a minimum of 30 minutes prior to the commencement of piling by an MMO and/or PAM Operator.

In the event of a marine mammal detection within the MZ during the pre-piling search, the soft-start will be delayed for a minimum of 20 minutes after the last detection within the mitigation zone and the full 30 minute pre-piling search has been completed to ensure any marine mammals have left the area when piling activities commence.

3.4.4 Soft-start Procedure

Following the completion of the pre-piling search, a soft-start procedure will commence. This is where the piling hammer energy will gradually increase over a minimum of 20 minutes so that if any marine

mammals are still present in the vicinity of the piling location, they are encouraged to leave by the initial low levels of underwater noise prior to the noise reaching levels which could cause PTS-onset.

If a marine mammal enters the MZ during the soft-start, then the piling operation should either stop (if technically feasible), or the hammer energy should not be further increased until the marine mammal exits the MZ, and there is no further detection for 20 minutes.

Once the soft-start has been completed, there is no requirement under the JNCC (2010) guidelines to stop piling or reduce the hammer energy if a marine mammal is detected in the MZ as the animal is deemed to have entered voluntarily entered. The JNCC (2010) guidelines also acknowledge that it may not be operationally feasible to stop piling at full power until the pile is fully installed.

3.4.5 Breaks in Piling

Breaks in piling activity could provide the potential for marine mammals to re-enter the MZ. The guidance provided in JNCC (2010) which piling operations will comply with, states that '*If there is a pause in the piling operations for a period of greater than 10 minutes, then the pre-piling search and soft-start procedure should be repeated before piling recommences*'. Any monitoring conducted prior to the break in operations can count towards the 30 minute pre-piling search, meaning that, providing monitoring has been maintained and it is confirmed there are no marine mammals in the MZ, operations can restart as soon as required. If the break in piling is less than 10 minutes, piling activities can continue as normal using the previous hammer energy and strike rate.

3.4.6 Communication

Effective lines of communication between mitigation personnel and the crew conducting piling operations are essential. The communications protocol established will include, but not be limited to:

- Procedure to notify the MMO and/or PAM Operator to begin the 30-minute pre piling search prior to soft-start commencing;
- Procedure for the MMO and/or PAM Operator to notify the installation manager that soft start can commence;
- Procedure for the MMO and/or PAM Operator to notify installation manager that a marine mammal has been detected in the mitigation zone; and
- Procedure to notify MMO and/or PAM Operator that the piling operations have been successfully completed.

3.4.7 Reporting

All reporting will be in line with the best practice procedure outlined in the JNCC (2010) guidelines. Reports detailing the piling activity and marine mammal mitigation should be provided to JNCC and MD-LOT. Reports will include:

- Record of piling operations including date and location, duration of pre-piling and soft-start procedures and instances where operations were delayed or stopped due to presence of marine mammals;
- Details of watches made for marine mammals, including details of any sightings, details of the PAM equipment and detections, and details of the piling activity during the watches
- Completed Marine Mammal Recording Forms, detailing any incidental marine mammal sightings (i.e. species, distance);

- Details of problems encountered i.e. non-compliance with agreed protocols, and any recommendations for amendments to the protocols; and
- Any recommendations for amendments to the protocol.

Further, it is good practice to report any dead marine mammals observed to Scottish Marine Mammal Stranding Scheme (SMASS) and live strandings to British Divers Marine Live Rescue (BDMLR), even if they are not attributed to the works. In addition, the MMO and PAM Operator should keep a record of marine mammal sightings and/or acoustic detections out with the MZ, to be submitted to NatureScot for biodiversity data collection purposes.

4 Dredging Mitigation Plan

This draft dredging MMMP has been prepared to support dredging activities at the Port of Ardersier which are expected to take place between March and Octobersometime between 2027 and 2029. Dredging activities shall predominantly take place within the inner harbour, 0.8 – 1.8 km away from the harbour entrance. . There are currently no mitigation guidelines specific to dredging and, therefore, the mitigation measures proposed are adapted from the JNCC (2010) piling guidelines. Any additional conditions included within the license for dredging activities at the Port of Ardersier will also be included in the final MMMP.

The mitigation measures proposed during dredging activities are presented below and summarised in a flowchart in Appendix 2.

4.1 Dredging impact ranges

Subacoustech Environmental Ltd conducted underwater noise modelling for cutter suction dredging. The maximum PTS-onset range from dredging <10 m for all species (Table 2).

Table 2 Predicted impact ranges associated with impact piling, using the Southall et al. (2019) SEL_{cum} PTS criteria in marine mammals for impulsive noise sources.

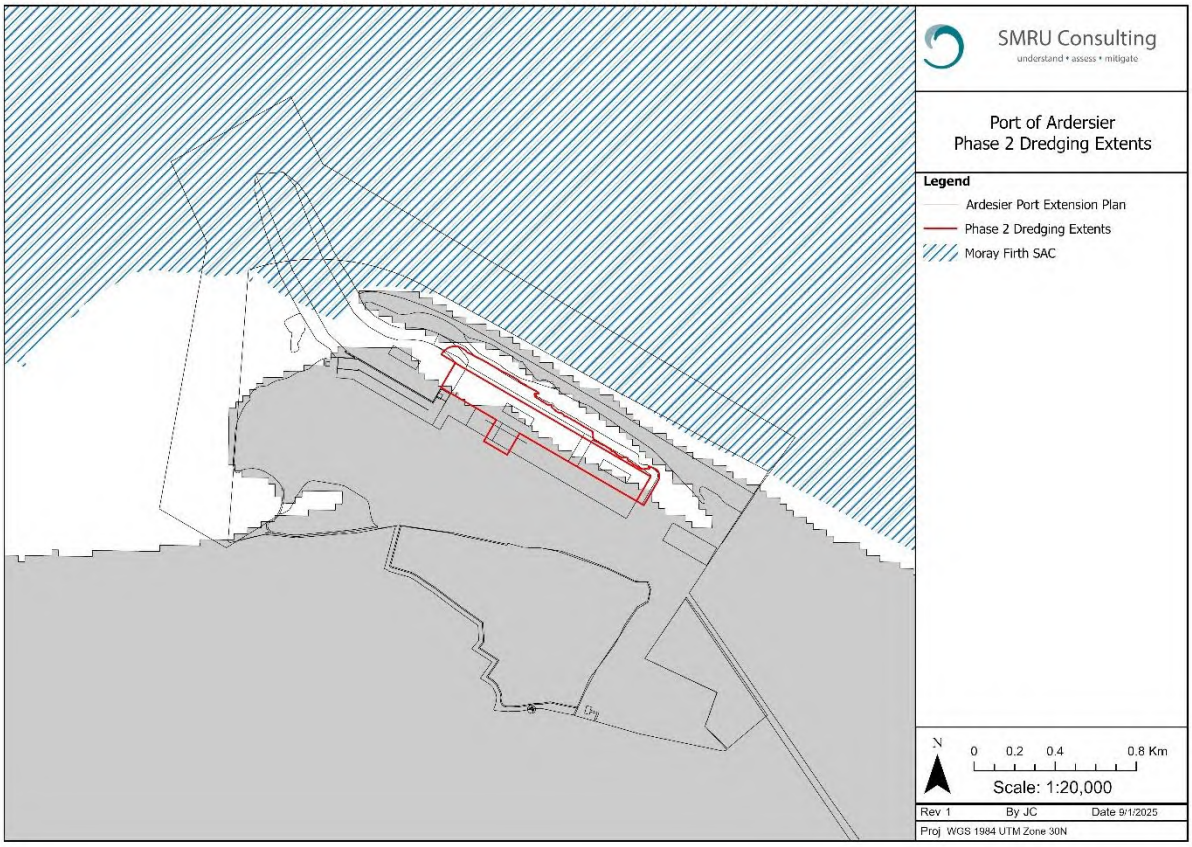
Hearing group	Species	Southall et al. (2019) PTS criteria SEL_{cum} (impulsive)	Maximum estimate impact range (m)
Very high frequency cetaceans	Harbour porpoise	173 dB	<10 m
High frequency cetaceans	Bottlenose dolphins	198 dB	<10 m
Low frequency cetaceans	Minke whales	199 dB	<10 m
Pinnipeds in water	Harbour and grey seals	201 dB	<10 m

4.2 Mitigation methods

As dredging activity shall largely take place deeper within the inner harbour (approximately 0.8 – 1.8 km from the harbour entrance and the Moray Firth SAC, see Figure 2), away from where marine mammals are typically encountered (see Appendix 11.3), the number of interactions between the dredging vessel itself and marine mammals shall be minimal. Further, the applicant notes that, aside from occasional sightings of individual seals within the inner harbour, no other marine mammal species have been recorded within the inner harbour during Port of Ardersier's operations.

The most seaward extent of the dredging activity is proposed to be very close to land (i.e., Whiteness Point) which will likely create a strong barrier effect for any noise propagation, as will the inner harbour walls. Thus, the JNCC protocol currently provides a disproportionate level of mitigation for the proposed dredging works, which is not justified by the perceived risk to marine mammals (see Section 3.4.2 of Appendix 11.4). Accordingly, the likelihood of significant marine mammal–vessel interactions within the development footprint in the inner harbour is considered to be very limited. During dredging, the operation of the dredge vessel, associated spoil disposal vessels, and routine port activities will contribute to elevated underwater noise levels within the inner harbour. As such, the JNCC protocols have been modified in order to ensure the marine mammal mitigation protocol for dredging activity is proportionate to the perceived risk to marine mammals, and not unduly restrictive.

Figure 2: The proposed development Phase 2 dredging extents



4.2.1 Mitigation Monitoring

Due to the extremely low likelihood of cetacean presence within the inner harbour, monitoring for marine mammals will be conducted by an MMO only. Monitoring conducted by an MMO shall be required during daylight hours only. Sufficient mitigation personnel should be provided to ensure a 360 degree coverage of the inner harbour dredge area during visual monitoring periods. The MMO will be required to advise contractors and/or crews on the implementation of procedures to ensure compliance.

4.2.2 Mitigation Zone

It is proposed that there shall be no distance-specific MZ around the dredge vessel. Instead, it is proposed that prior to dredging operations commencing, the MMO will be required to conduct a pre-dredging search of the inner harbour. This ensures that the inner harbour area is monitored for the

presence of seals (the species most likely to be present within the inner harbour area) and other marine mammals.

4.2.3 Pre-dredging Search

As per the JNCC (2010) guidelines, a pre watch is designed to maximise detection probability within a MZ, and thus, a pre-dredging search of the inner harbour is required prior to the commencement of dredging. This shall be conducted for a minimum of 10-minutes by an MMO. A 10-min watch is considered to be sufficient to ensure the inner harbour is clear of marine mammals, as a 30-min watch will not increase detection probability within the inner harbour, particularly when considering the behaviour of seals in the area. The 10-minute pre-watch shall take place during the 'powering-on' phase of the dredge vessel. This is effectively a 'soft-start' procedure (see Section 4.2.4). Dredging can commence at full-power following the completion of the 10-minute pre-watch should no marine mammal be observed.

If a marine mammal is detected within the inner harbour area, dredging shall not commence/proceed from the 'powering-on' phase until 10 minutes after the last visual detection and/or the MMO is satisfied that the animal has left the inner harbour.

4.2.4 'Powering-On' Procedure

The 'powering-on' phase of the dredge vessel is effectively a 'soft-start' procedure whereby the dredging vessel (in this case, a cutter-suction dredger (CSD)) arrives within the area to be dredged with the main vessel engines already powered-on. Following the arrival of the CSD with the engines powered-on, the suction-cutter pumps (which help remove material from the seabed) begin to operate, and the cutter-head is started and begins to rotate. At this stage, the suction-cutter pumps and cutter-head are operating at no more than 50% of full power, and shall do so for at least 15-minutes. If any marine mammals are still present in the vicinity of the dredging location, they are expected to be encouraged to leave by the initial low levels of underwater noise prior to the noise reaching maximum levels. The 10-minute pre-dredging search as described in Section 4.2.3 shall commence during this period.

The timing of the powering-on procedures for the CSD will be determined in consultation with the dredging engineers depending on what is operationally feasible for the suction cutter.

Once the 10-minute pre-dredging search is complete and the inner harbour is clear of animals, dredging can commence at 'full-power'. If a marine mammal is detected in the inner harbour during the 'powering-on' phase, power will not increase (depending on operational feasibility) until the animal exits the inner harbour and/or there have been no further visual detections for 10 minutes.

Once the 'powering-on' procedure has been completed, there is no requirement to stop dredging or reduce the energy in the cutter suction dredger if a marine mammal is detected in the inner harbour as the animal is deemed to have entered voluntarily entered. Therefore, if a marine mammal enters the inner harbour after full power has been achieved, dredging can continue.

4.2.5 Breaks in Dredging

Breaks in the dredging process could provide the potential for marine mammals to re-enter the inner harbour. Where a pause in dredging occurs during the day or nighttime and the CSD pumps and/or cutter-head are non-operational, or engines have been switched off, the pre-dredging search and 'powering-on' procedure will be required to be repeated to recommence activity. Since only the use of MMOs is proposed for mitigation-monitoring during dredging, should a pause in activity occur

during the nighttime, which constitutes the need for the pre-dredging search and 'powering-on' procedure to be repeated, this should take place during daylight hours only.

If, during the break, the CSD pumps and engines have been operational, dredging activities can continue as normal without the need for a repeat in pre-dredging search or 'powering-on' procedures (even at night).

4.2.6 Communication

Effective lines of communication between mitigation personnel and the dredging crew conducting dredging are essential. The communications shall include:

- The need for the MMO to be informed by the chief dredge operator/vessel master of the proposed dredge start time, at least 15 minutes prior to the start of the CSD pumps and/or cutter-head being powered-on to allow the mitigation personnel to prepare for the pre-dredging search;
- The need to notify the MMO to begin the 10-minute pre-dredging search during the 'powering-on' procedures, but prior to the CSD operating at full-power;
- The need for the MMO to notify the dredging crew that dredging can commence;
- The need for the MMO to notify the vessel master that a marine mammal has been detected in the inner harbour; and
- The need for the dredging crew to notify the MMO that the dredging operations have been successfully completed and/or when a break in dredging operations are expected so pre-dredging watches can commence to minimise down time if necessary, as dependent on the expected duration of break.

4.2.7 Reporting

All reporting will be in line with the best practice procedure outlined in the JNCC (2010) guidelines. Reports detailing the dredging activity and marine mammal mitigation shall be retained and will be available to NatureScot, JNCC and MD-LOT upon conclusion of all dredging operations. Reports will include:

- Record of dredging operations including date and location, duration of pre-dredging and 'powering-on' procedures and instances where operations were delayed or stopped due to presence of marine mammals;
- Details of watches made for marine mammals, including details of any sightings, and details of the dredging activity during the watches;
- Completed Marine Mammal Recording Forms, detailing any incidental marine mammal sightings (i.e. species, distance);
- Details of problems encountered, i.e. non-compliance with agreed protocols, and any recommendations for amendments to the protocols; and
- Any recommendations for amendments to the protocol.

Further, it is good practice to report any dead marine mammals observed to SMASS and live strandings to BDMLR, even if they are not attributed to the works. In addition, the MMO and PAM Operator should keep a record of marine mammal sightings and/or acoustic detections outwith the inner harbour, to be submitted to NatureScot for biodiversity data collection purposes.

5 Spoil Disposal Mitigation Plan

This outline piling MMMP has been prepared to support dredging activities at the Port of Ardersier which are expected to take place over 10 weeks between March and October(sometime between 2027 – 2029). At present, Burghead is considered as the only disposal areas. There are currently no mitigation guidelines specific to spoil disposal and, therefore, the mitigation measures proposed are adapted from the JNCC (2010) piling guidelines. Any additional conditions included within the license for material deposition will also be included in the final MMMP.

The mitigation measures proposed during spoil disposal activities are presented below and summarised in a flowchart in Appendix 3.

5.1 Mitigation methods

It is proposed that a real-time PAM system is utilised for mitigation-monitoring of marine mammals during spoil disposal operations, such that a remote PAM Operator can perform adaptive mitigation-monitoring of the MZ around the spoil disposal ground and/or spoil disposal vessel.

5.1.1 Mitigation monitoring

During daylight hours, monitoring for marine mammals will be conducted by a Marine Mammal Observer (MMO). Passive Acoustic Monitoring (PAM) conducted by a PAM Operator will be used to supplement or replace visual observations when visibility is poor (e.g. darkness and sea state >4). Sufficient mitigation personnel should be provided to ensure a 360 degree coverage of the MZ during visual monitoring periods and to allow for 24 hour monitoring. Details of the real-time PAM system used will be provided in the final MMMP.

The MMO and PAM Operator will be required to advise contractors and/or crews on the implementation of procedures to ensure compliance.

5.1.2 Mitigation Zone

The MZ that will be monitored during spoil disposal operations at the selected disposal site, is a 200 m MZ established around the spoil disposal ground. The MZ that should be monitored during spoil disposal operations on the approach to, and at the spoil disposal site, is a 200 m MZ established around the spoil disposal vessel, with mitigation only being implemented for marine mammal visual observations or acoustic detections within the MZ. This shall be applied for all marine mammal species.

5.1.3 Pre-disposal Search

A pre-disposal search of the 200 m MZ is required prior to the commencement of spoil disposal. This shall be conducted for a minimum of 15 minutes by an MMO and/or the PAM Operator as the vessel is arriving at the disposal location.

Spoil disposal shall not commence if a marine mammal is detected within the 200 m MZ around the disposal location or until the 15 minute search has been completed. If a marine mammal is detected within the MZ, disposal activities will not commence until 10 minutes after the last visual or acoustic detection and both the MMO and/or PAM Operator is satisfied that the animal has left the MZ. If marine mammals are in the MZ, the vessel may also choose to use a different location within the disposal site >200 m from the original intended disposal location and continue the pre-disposal search/delay period at this location instead. The disposal crew shall liaise with the mitigation personnel to ensure that there is a suitable disposal location >200 m from the original intended disposal location.

During spoil disposal when acoustic detection methods are being used (and conditions are not suitable for visual detection methods), if the disposal vessel chooses a different disposal location due to the presence of marine mammals within the 200 m MZ around the original disposal location, the limitations of detecting marine mammals at increasing distances from the real-time PAM monitoring location(s) will be taken into account.

The JNCC (2010) guidelines have been adapted here to reduce the duration of the pre-disposal search, and the delay to commencing activities after the last marine mammal detection. This is due to the reduced area of search when compared with the dredge area itself (i.e., a 200 m MZ versus a 500 m MZ) which is an area that is >80% smaller. However, the timings have only been reduced by 50% as a conservative measure to account for the fact that marine mammals are not always available at the surface for observation and may not be constantly vocalising.

5.1.4 Communication

Effect lines of communication between mitigation personnel and the spoil disposal crew are essential. The communications shall include:

- The need for the MMO and the PAM Operator to be informed by the spoil disposal crew of the proposed disposal start time, at least 30 minutes prior to the start of spoil disposal to allow the mitigation personnel to prepare for the pre-disposal search activity;
- The need to notify the MMO and the PAM Operator to begin the 15-minute pre-disposal search prior to spoil disposal;
- The need for the MMO and the PAM Operator to notify the spoil disposal crew if a marine mammal has been detected in the MZ; and
- The need for the spoil disposal crew to notify the MMO and the PAM Operator that the disposal operations have been successfully completed.

5.1.5 Reporting

All reporting will be in line with the best practice procedure outlined in the JNCC (2010) guidelines. Reports detailing the dredging activity and marine mammal mitigation shall be retained and will be available to NatureScot, JNCC and MD-LOT upon conclusion of all dredging operations. Reports will include:

- Record of spoil disposal operations including date and location and instances where operations were delayed due to presence of marine mammals;
- Details of watches made for marine mammals, including details of any sightings, details of the PAM equipment and detections, and details of the disposal activity during the watches;
- Completed Marine Mammal Recording Forms, detailing any incidental marine mammal sightings (i.e. species, distance);
- Details of problems encountered, i.e. non-compliance with agreed protocols, and any recommendations for amendments to the protocols; and
- Any recommendations for amendments to the protocol.

Further, it is good practice to report any dead marine mammals observed to SMASS and live strandings to BDMLR, even if they are not attributed to the works. In addition, the MMO and PAM Operator should keep a record of marine mammal sightings and/or acoustic detections out with the MZ, to be submitted to NatureScot for biodiversity data collection purposes.

6 Vessel Movement Mitigation Plan

The following guidelines will be adhered to in order to minimise any potential risk to marine mammals during vessel movements.

- All vessels involved in construction activities will comply with the measures set out in the MMMP.
- All vessels will adhere to instructions and guidance from the Harbour Master.
- All vessels will comply with the International Maritime Organisation (IMO)/Maritime Coastguard Agency (MCA) codes for the prevention of oil pollution.
- All movements of vessels, which also include site deliveries, will be coordinated with the Harbour Master.

In addition, vessels should comply with the Scottish Marine Wildlife Watching Code (SMWWC), developed by NatureScot under the Nature Conservation (Scotland) Act 2004 (SNH 2017b) and the Guide to Best Practice for Watching Marine Wildlife (SNH 2017a) which complements it. These includes guidance such as:

- Keep a safe distance from visually observed marine mammals. Recommended minimum approach distances are:
  - 50 metres for dolphins and porpoises
  - 100 metres for whales
  - 200–400 metres for mothers and calves, or for animals that are clearly actively feeding or in transit (moderate to fast swimming in a single direction).
- Do not approach animals directly from behind or cut them off by moving across their path.
- Spend no longer than 30 minutes (or 15 minutes if multiple vessels are present) near the animals e.g., seals, dolphins, porpoise and whales.
- Special care must be taken with mothers and young.
- Maintain a steady direction and a slow ‘no wake’ speed or switch the engine to neutral when animals (e.g., seals, dolphins, porpoise and whales) are present.
- Avoid sudden changes in speed.

Vessel operators should familiarise themselves with the NatureScot Wildlife code of conduct publications which are available on their website.

7 Glossary of Terms, Acronyms and Abbreviations

Term	Description
BDMLR	British Divers Marine Live Rescue
ETF	Energy Transition Facility
EPS	European Protected Species
IMO	International Maritime Organisation

JNCC	Joint Nature Conservation Committee
m	metres
MCA	Maritime Coastguard Agency
MD-LOT	Marine Directorate Licensing and Operations Team
MMO	Marine Mammal Observer
MMMP	Marine Mammal Mitigation Plan
MZ	Mitigation Zone
PAM	Passive Acoustic Monitoring
SAC	Special Area of Conservation
SMASS	Scottish Marine Mammal Stranding Scheme
SMWWC	Scottish Marine Wildlife Watching Code

8 Literature Cited

JNCC. 2010. Statutory nature conservation agency protocol for minimising the risk of injury to marine mammals from piling noise.

JNCC. 2023. JNCC guidance for the use of Passive Acoustic Monitoring in UK waters for minimising the risk of injury to marine mammals from offshore activities.

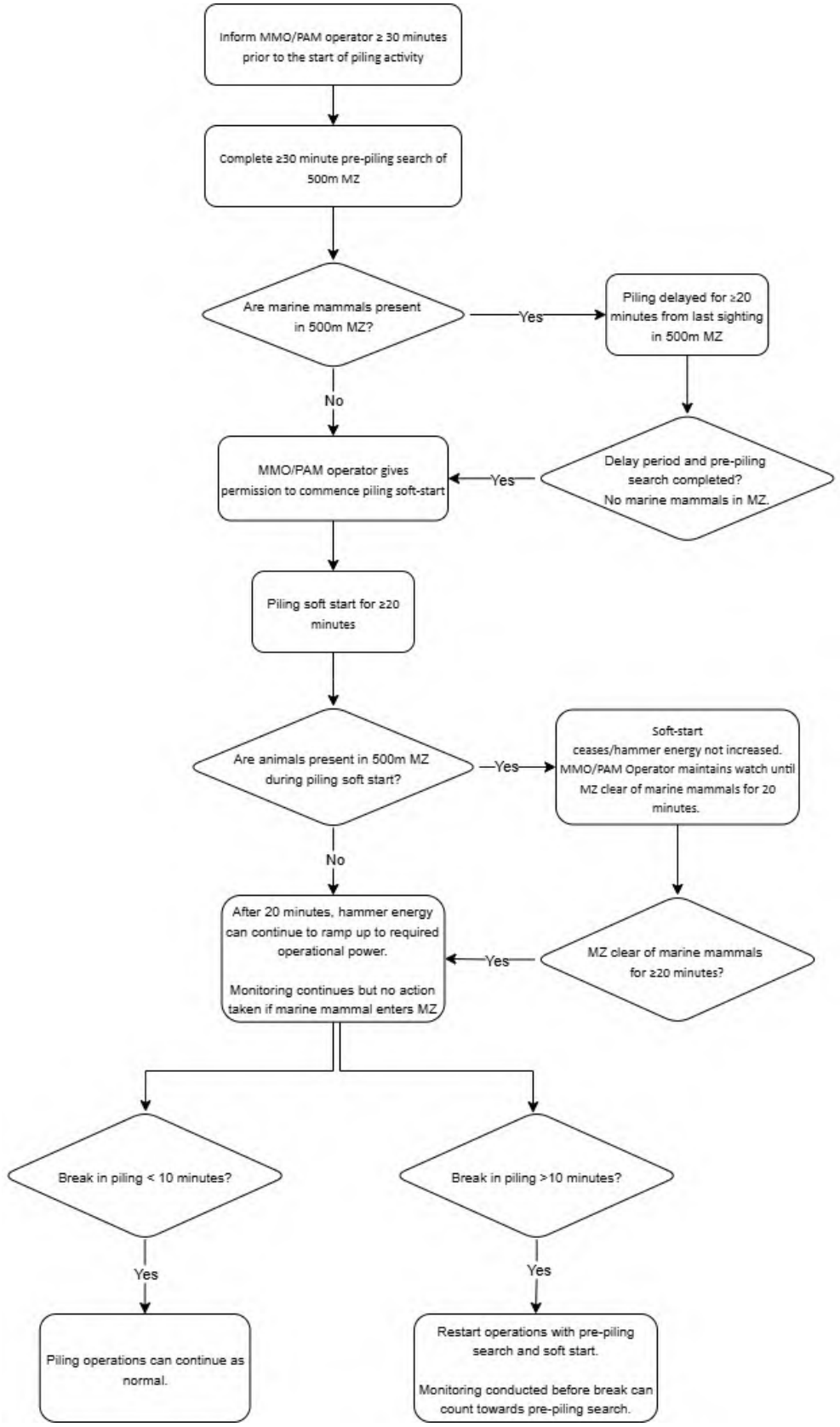
SNH. 2017a. A Guide to Best Practice for Watching Marine Wildlife SMWWC - Part 2. Scottish Natural Heritage.

SNH. 2017b. The Scottish Marine Wildlife Watching Code SMWWC - Part 1. Scottish Natural Heritage.

Southall, B., J. J. Finneran, C. Reichmuth, P. E. Nachtigall, D. R. Ketten, A. E. Bowles, W. T. Ellison, D. Nowacek, and P. Tyack. 2019. Marine Mammal Noise Exposure Criteria: Updated Scientific Recommendations for Residual Hearing Effects. Aquatic Mammals **45**:125-232.

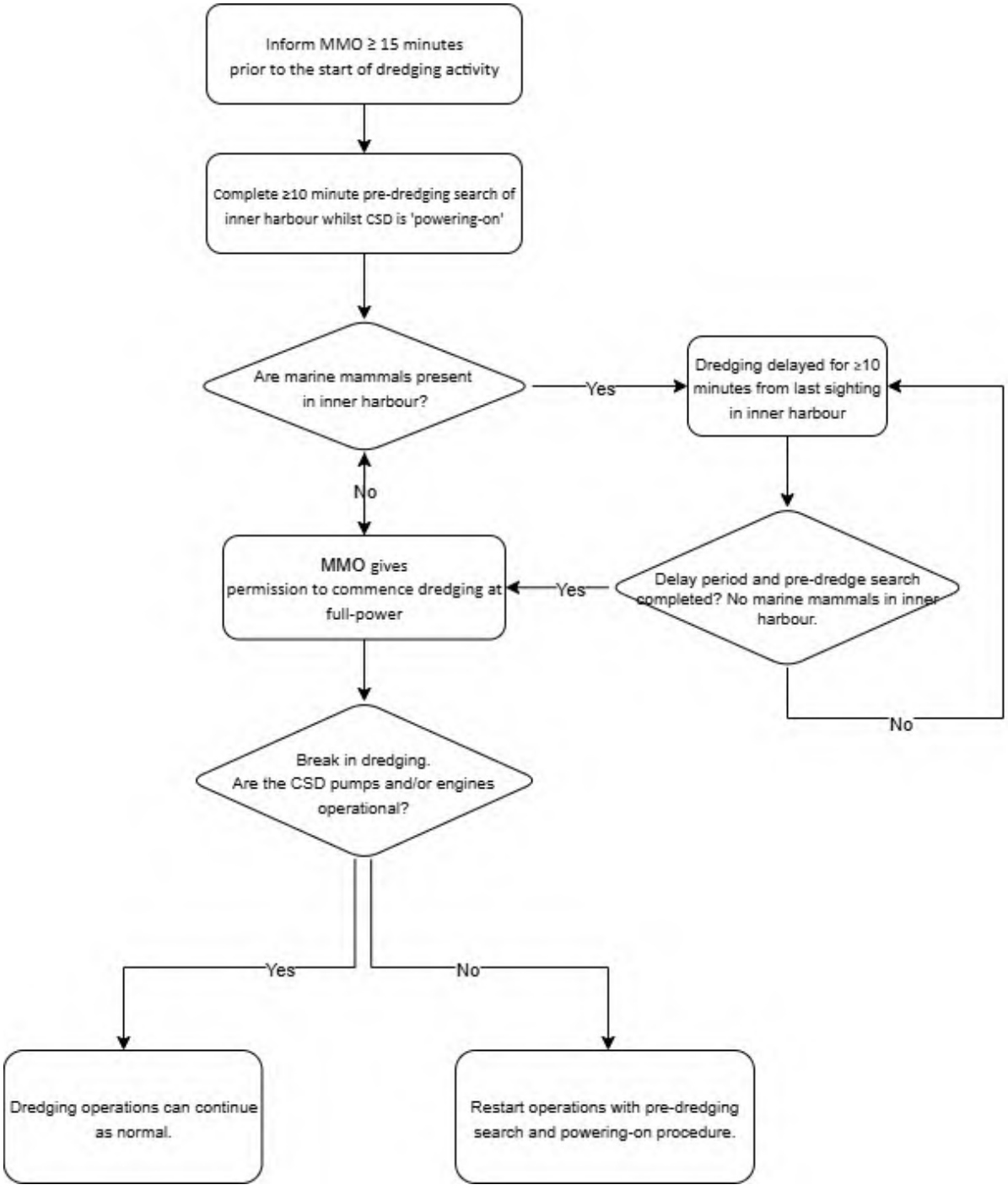
Appendix 1 Impact Piling Flowchart

Figure 3: Flow chart of mitigation procedures during impact piling.



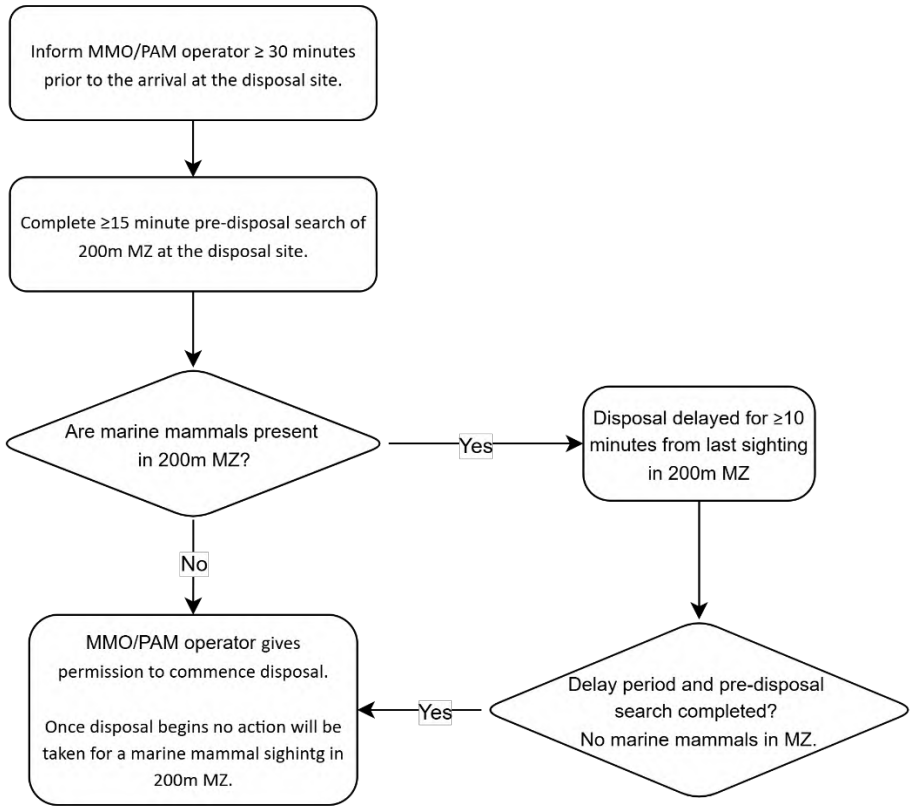
Appendix 2 Dredging Mitigation Flowchart

Figure 4: Flow chart of mitigation procedures during dredging activities.



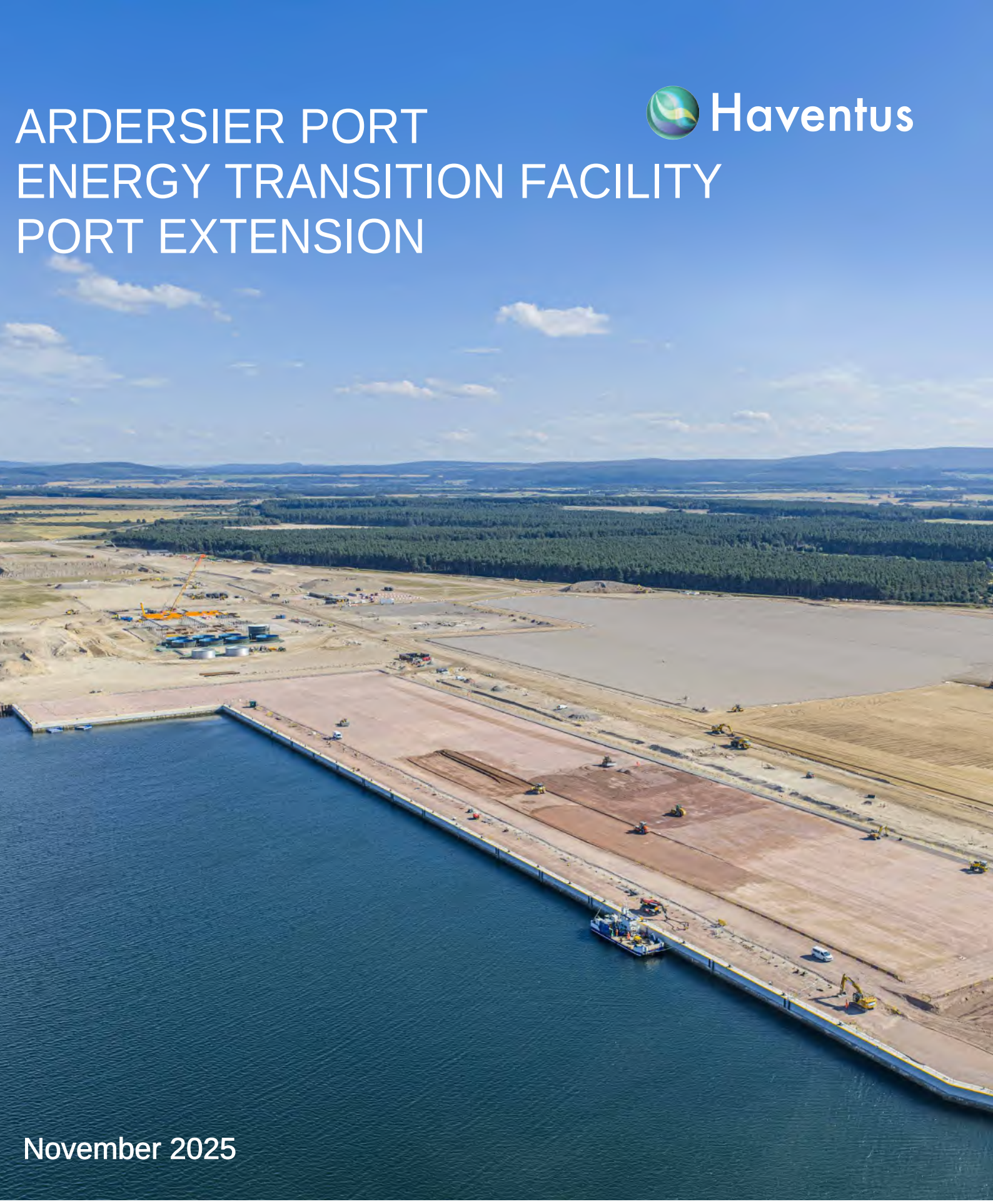
Appendix 3 Spoil Disposal Mitigation Flowchart

Figure 5: Flow chart of mitigation procedures during spoil disposal activities.



ARDERSIER PORT ENERGY TRANSITION FACILITY PORT EXTENSION

Haventus



November 2025

Appendix 11.8 - Cetacean Baseline Distribution, Occurrence and Behaviour in the Moray Firth SAC

Cetacean baseline distribution, occurrence and behaviour in the Moray Firth SAC

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June 2025

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Introduction

The University of Aberdeen's Lighthouse Field Station has been conducting long-term monitoring of cetaceans in the Moray Firth for over three decades. The Moray Firth was designated a Special Area of Conservation for bottlenose dolphins (*Tursiops truncatus*) in 2005 (Cheney et al. 2014). A combination of boat-based photo-identification surveys and passive acoustic monitoring (PAM) has enabled individuals to be identified and estimates of population size and vital rates (Cheney et al. 2014; Cheney et al. 2024; Cheney et al. 2019), and understand their acoustic occurrence and behaviour at varying spatial and temporal scales (Fernandez-Betelu et al. 2019). These techniques have also been used to assess dolphin responses to changes in their environment, due to either natural processes (e.g. Fernandez-Betelu et al. (2023)) or anthropogenic activities (Fernandez-Betelu et al. 2021; Graham et al. 2017). These long-term datasets provide an opportunity to understand the baseline distribution and occurrence of this protected species and inform Environmental Impact Assessment of future coastal developments, such as the expansion of the Port of Ardersier in the Inverness and Cromarty Firth Green Freeport area.

This report provides an overview of the seasonal and annual occurrence of bottlenose dolphins and harbour porpoises (*Phocoena phocoena*) at two long-term PAM sites located in the inner Moray Firth (Sutors and Chanonry, see Figure 1), and three sites in the vicinity of the Port of Ardersier. Also, 19 years of boat-based sightings are examined to characterise bottlenose dolphin spatial distribution in the Moray Firth Special Area of Conservation and compare the number of dolphin encounters, individuals and estimated group size around the Port of Ardersier and the two long-term inshore monitoring sites.

Material and Methods

Passive Acoustic Monitoring in the inner Moray Firth

Data collection

Between 2008 and 2024, a total of 100 PAM deployments were made at five coastal sites around the Sutors, Chanonry and Port of Ardersier located in the inner Moray Firth Special Area of Conservation (SAC) (NE Scotland). Autonomous echolocation click loggers (CPODs, Chelonia Limited) were bottom-moored in shallow waters (up to 24 m), with the hydrophone upward facing between 3 and 5 m from the seabed, to detect cetacean echolocation clicks and monitor the acoustic occurrence of both bottlenose dolphins and harbour porpoises. Further details of field methods are provided in Fernandez-Betelu et al. (2019). Given the main delphinid species occurring in the inner Moray Firth is the bottlenose dolphin, we presume that dolphin clicks detected by CPODs are from this species.

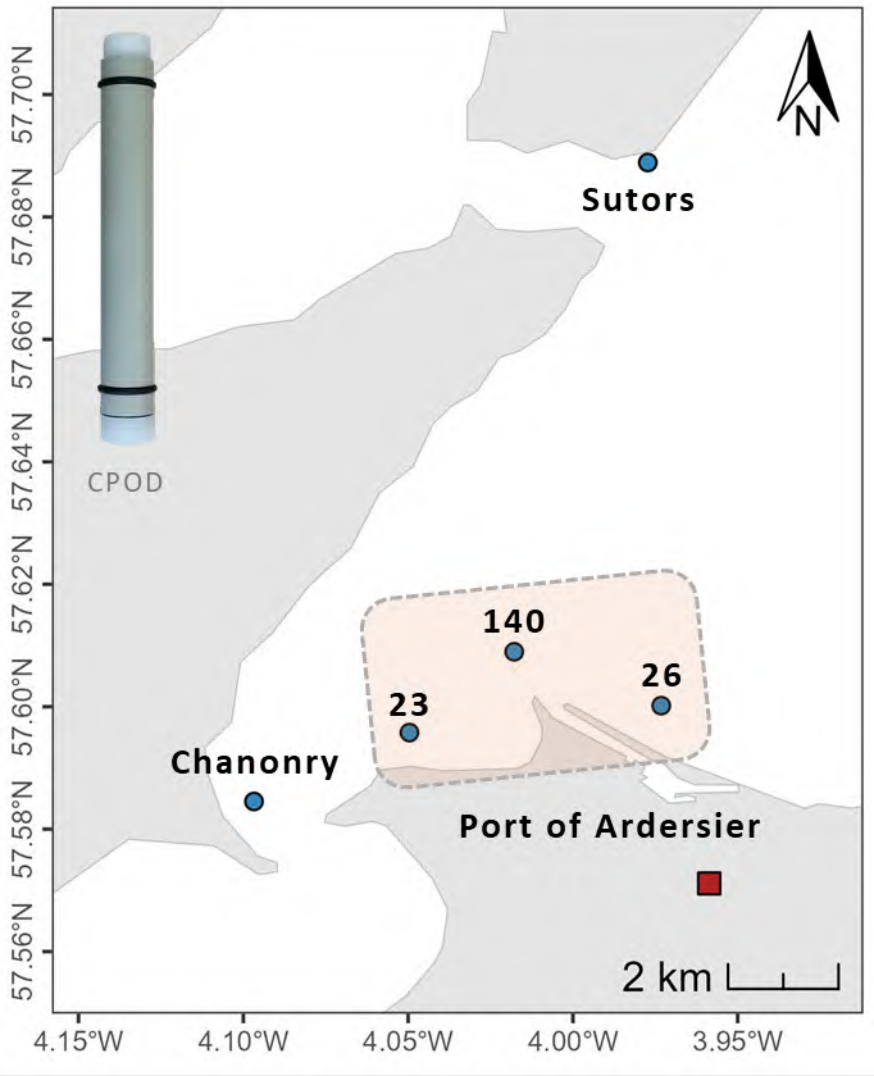

Figure 1. Long-term Passive Acoustic Monitoring (PAM) sites (blue dots) at Chanonry and Sutors (inner Moray Firth, NE Scotland) deployed between 2008 and 2024 and around the Port of Ardersier (red square) where CPODs were deployed intermittently at sites 23, 26 and 140 between 2009 and 2015. The three PAM sites around the Port of Ardersier were grouped for analyses.

Data analyses

The number of hours with bottlenose dolphin and harbour porpoise echolocation click detections were summarised using a daily metric, Detection Positive Hour (DPH) per day. The seasonal and annual variation in bottlenose dolphin and harbour porpoise acoustic occurrence were compared:

a) between the three short-term monitoring sites around the Port of Ardersier to investigate whether these were comparable.
b) between the two long-term monitoring areas at Sutors and Chanonry, and Port of Ardersier.

These comparisons were made for the years and months in which PAM equipment was deployed simultaneously in these areas.

Bottlenose dolphin photo-ID in the Moray Firth SAC

Data collection

Since 1989, bottlenose dolphin surveys in the Moray Firth SAC have used established techniques and protocols to collect data on trends in population size (Cheney et al. 2024) and vital rates (Arso Civil et al. 2019; Cheney et al. 2019). Individual bottlenose dolphins are recognised using their distinct dorsal fin natural marks. Around 20 surveys are made each summer field season (May to September) aiming to target areas that maximise the probability of encountering bottlenose dolphins. On every survey, the track of the boat and locations of encounters with each group of bottlenose dolphins are recorded using a GPS. All survey work is conducted under a NatureScot licence. Boat-based bottlenose dolphin photo-identification data from 2006 to 2024 were included in this report.

Data analyses

To investigate the broad-scale spatial distribution of bottlenose dolphins in the Moray Firth SAC, we summarised the photo-ID survey effort and dolphin encounters within 1 by 1 km and 4 by 4 km grids (Figure 2).

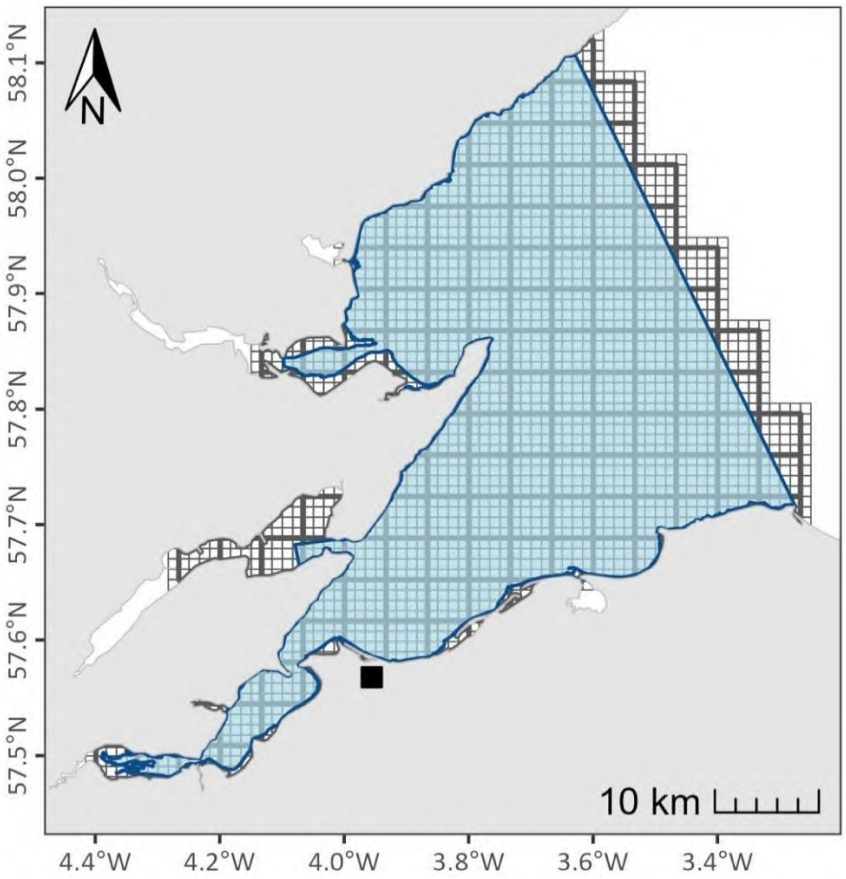

Figure 2 Moray Firth Special Area of Conservation (SAC) for bottlenose dolphins (in blue). 1 km by 1 km and 4 km by 4 km grids that encompass the SAC were created and extended to the west to account for survey effort in the Cromarty Firth. The Port of Ardersier is represented by the black square.

Survey effort

Effort was defined as the time of active search ("on effort") and was calculated using the survey track location and time. Survey GPS points were recorded on average every minute and the number of *on-effort* points within each grid cell was summarised per year and averaged across years, as per hour unit effort. Grid cells with low effort (i.e. only one trip recorded across the survey period, or with less than two minutes of effort per year) were not included in the analyses.

Bottlenose dolphin encounters

The GPS location recorded at the start of each bottlenose dolphin encounter was used to estimate the number of encounters within each grid cell and year. The number of encounters was then divided by the number of hours of effort within each grid cell between 2006 and 2024, and the number of encounters per hour unit effort was averaged across monitoring years.

For each encounter, the best group size estimate was the higher number of individuals either photographed or observed during an encounter (see Cheney et al. (2024)). For 2024, the best group size estimate was derived from the number of individuals observed during the encounter, as the photo-ID data analysis is not yet completed.

To understand how dolphins are using Sutors, Chanonry and the Port of Ardersier, 1 by 1 km grid cells with their centroid within a 2.7 km buffer including the PAM sites deployed at Sutors, Chanonry and Port of Ardersier were extracted (19 to 22 cells, see Figure 3). The number of bottlenose dolphin encounters, individuals identified and group size were compared between these three areas of interest and with the Moray Firth SAC.

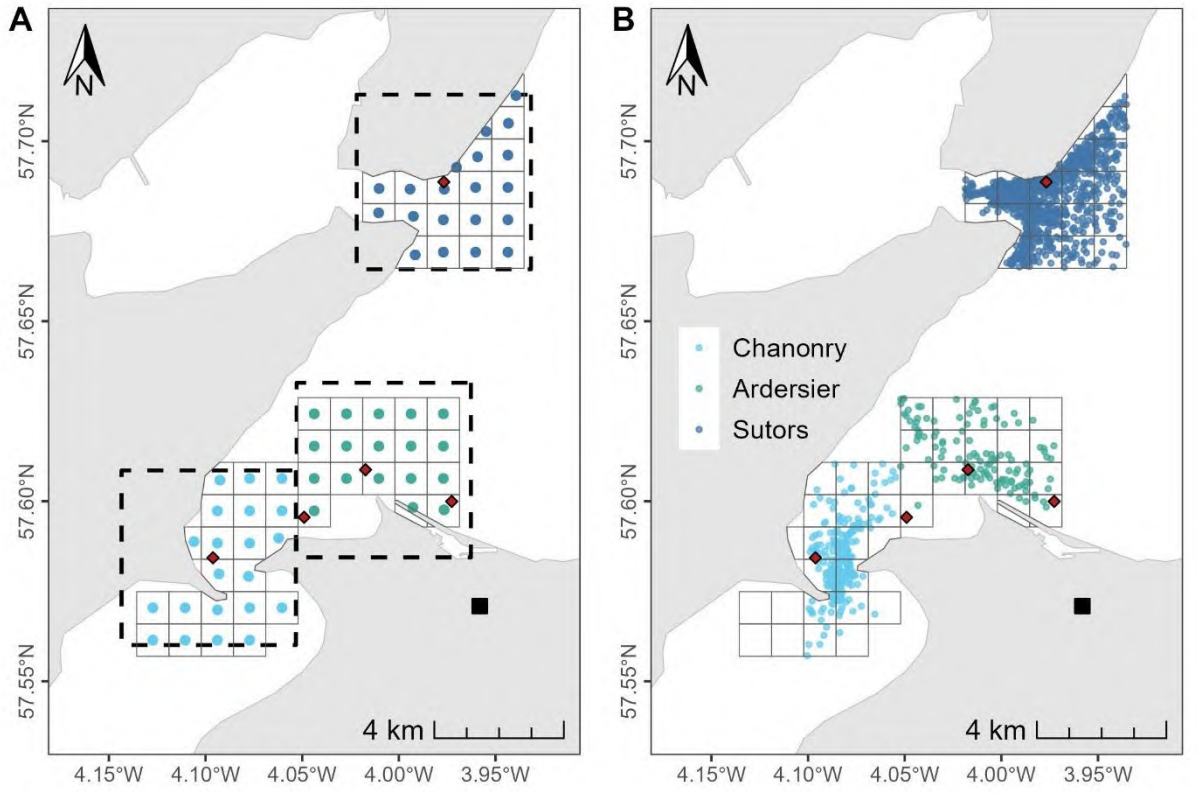

Figure 3 Methodology to extract information on bottlenose dolphin encounters, group size and number of individuals identified around three areas of interest (Sutors, Chanonry and Port of Ardersier (black square)). A) a 2.7 km buffer was created to encompass the Passive Acoustic Monitoring sites (red diamonds) around Sutors, Chanonry and Port of Ardersier. Any 1 km by 1 km grid cells with a centroid falling into one of the three buffer areas were selected for further comparative analyses. B) the bottlenose dolphin encounter locations falling in each buffer area are represented by coloured dots.

Results

Passive Acoustic Monitoring in the inner Moray Firth

Bottlenose dolphin occurrence around the Port of Ardersier

Bottlenose dolphin occurrence around the Port of Ardersier was monitored with CPODs during July to November from 2009 to 2014 on the west side of the Port (site 23) and in 2013 and 2014 on the east side (site 26). At the entrance of the channel (site 140) CPODs were deployed from April to November between 2013 and 2015 (Figure 1A).

Bottlenose dolphin occurrence was significantly higher at the entrance of the Port of Ardersier channel (site 140) than at either the west or east sides of the Port. Annual (Wald test: χ^2 = 7.582, d.f. = 2, p = 0.02, Figure 4) and seasonal (Wald test: χ^2 = 42.92, d.f. = 8, p < 0.001, Figure 5) variations were observed between sites, with a peak in occurrence between June and August. Typically, bottlenose dolphins were seen for a median of 3-6 hours per day at the PAM sites around Ardersier with a peak in 2014 (Figure 4). Within the year, a peak in occurrence was detected in July (Figure 5).

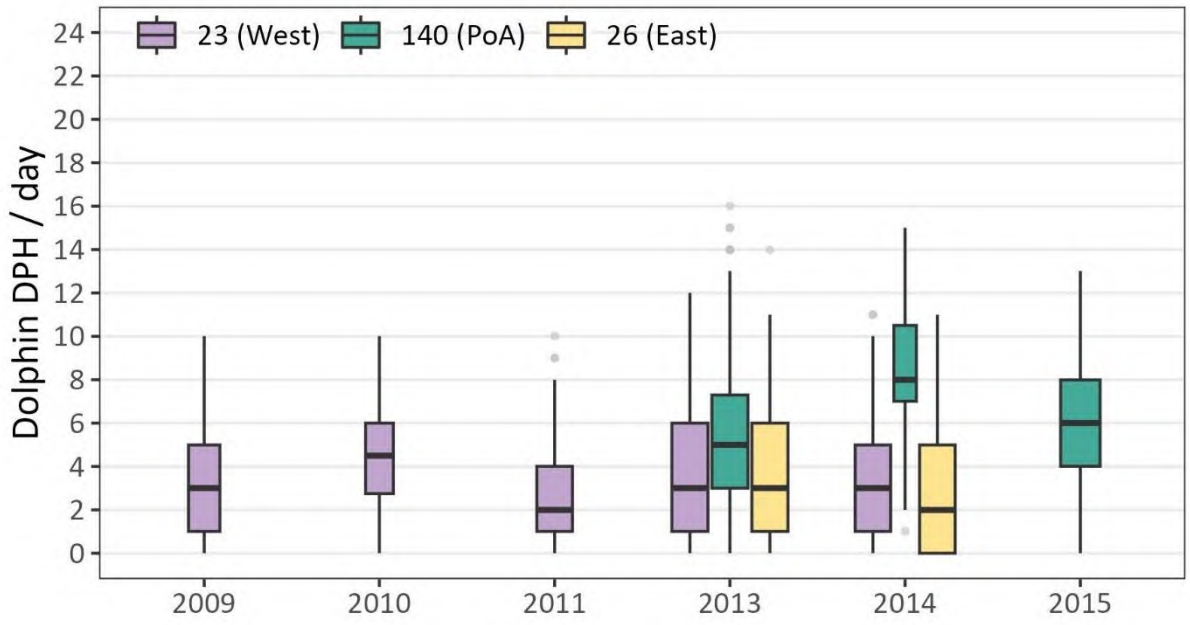

Figure 4 Bottlenose dolphin acoustic detection positive hours (DPH) per day summarised per monitoring year, at the west (site 23; purple boxplot), east (site 26; yellow boxplot) and entrance (site 140; green boxplot) of the Port of Ardersier channel, in the inner Moray Firth, NE Scotland. Boxplots highlight the median and interquartile range. Outliers are represented by grey dots.

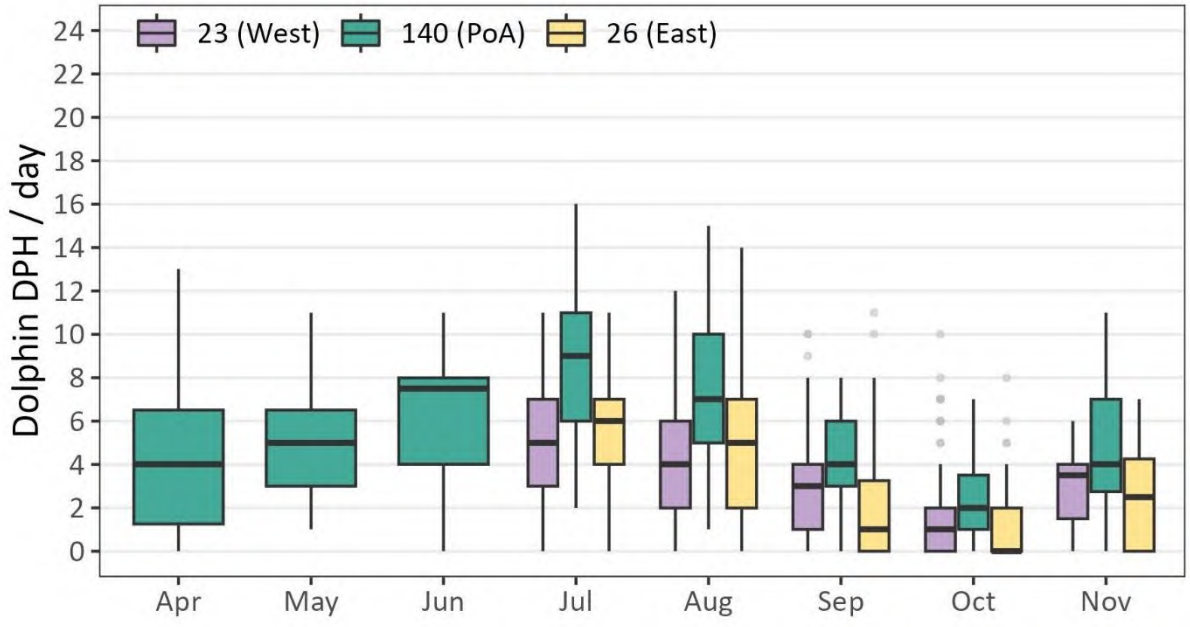

Figure 5 Bottlenose dolphin acoustic detection positive hours (DPH) per day summarised per month (April to November), at the west (site 23; purple boxplot), east (site 26; yellow boxplot) and entrance (site 140; green boxplot) of the Port of Ardersier channel, in the inner Moray Firth, NE Scotland. Boxplots highlight the median and interquartile range. Outliers are represented by grey dots.

Harbour porpoise occurrence around the Port of Ardersier

Harbour porpoises generally occurred less than bottlenose dolphins around the Port of Ardersier and were mainly detected at the east (site 26) and entrance of the channel (site 140). Overall, porpoise acoustic detections ranged from a median of 0 to 1 hour per day at these PAM sites. Porpoise occurrence also varied both annually (Wald test: $\chi^2 = 22.432$, d.f. = 2, $p < 0.001$, Figure 6) and seasonally between sites (Wald test: $\chi^2 = 93.111$, d.f. = 8, $p < 0.001$, Figure 7) with peaks in occurrence detected from April to June and September to November, when dolphin occurrence was lower (c.f. Figure 5).

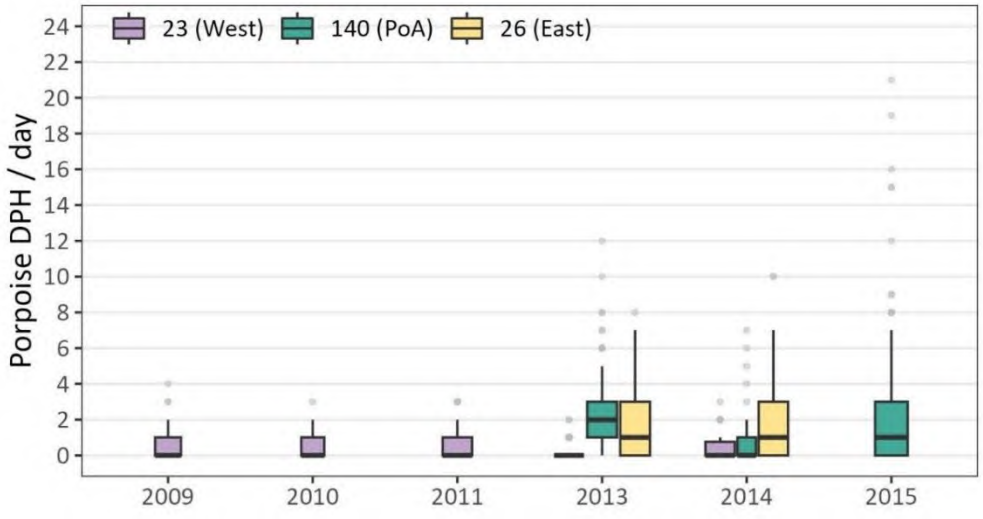

Figure 6 Harbour porpoise acoustic detection positive hours (DPH) per day summarised per monitoring year, at the west (site 23; purple boxplot), east (site 26; yellow boxplot) and entrance (site 140; green boxplot) of the Port of Ardersier channel, in the inner Moray Firth, NE Scotland. Boxplots highlight the median and interquartile range. Outliers are represented by grey dots.

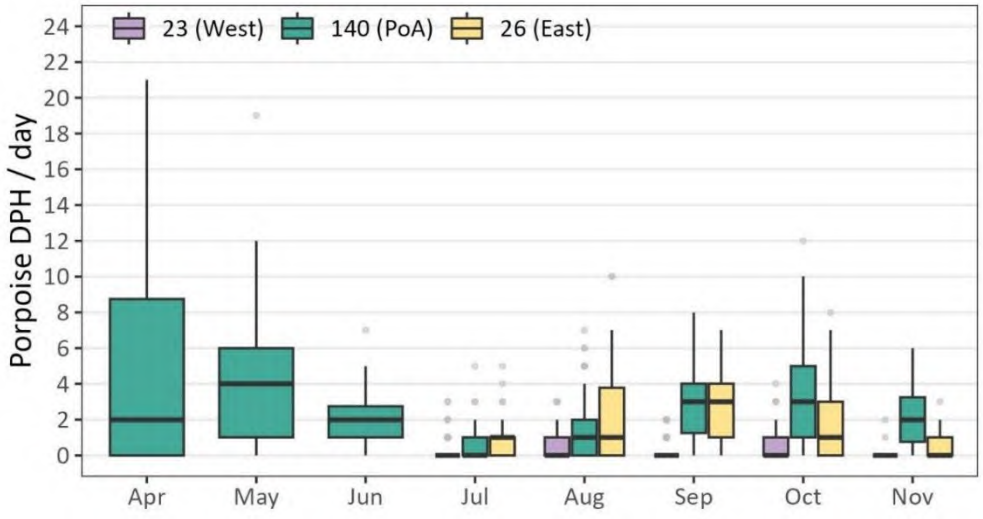

Figure 7 Harbour porpoise acoustic detection positive hours (DPH) per day summarised per month (April to November), at the west (site 23; purple boxplot), east (site 26; yellow boxplot) and entrance (site 140; green boxplot) of the Port of Ardersier channel, in the inner Moray Firth, NE Scotland. Boxplots highlight the median and interquartile range. Outliers are represented by grey dots.

Variability in occurrence between Sutors and Chanonry reference sites and the Port of Ardersier

Bottlenose dolphin and harbour porpoise occurrence were compared between two long-term monitoring sites, Sutors and Chanonry (see Figure 1B), and the three sites around the Port of Ardersier (hereafter called `Ardersier`). Overall bottlenose dolphins were detected for significantly more hours per day at Sutors than Ardersier, but levels of occurrence were similar between Chanonry and Ardersier (Wald test: $\chi^2 = 36.723$, d.f. = 2, $p < 0.001$, Figure 8A). Despite lower levels of harbour porpoise detections at these coastal sites, porpoise occurrence was significantly higher around Ardersier than Sutors and Chanonry (Wald test: $\chi^2 = 36.115$, d.f. = 2, $p < 0.001$, Figure 8B).

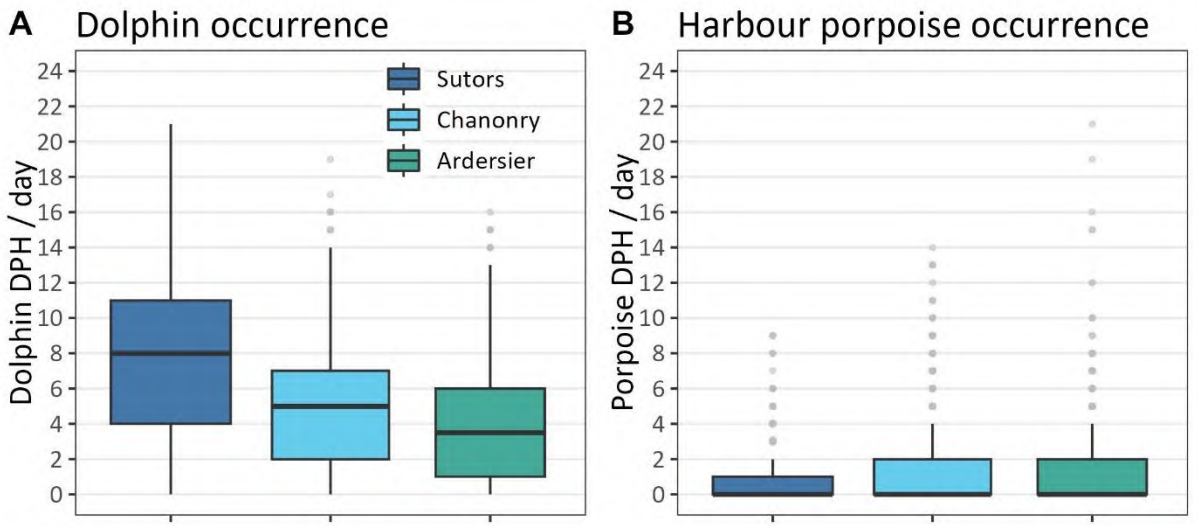

Figure 8 Bottlenose dolphin (A) and harbour porpoise (B) acoustic detection positive hours (DPH) per day summarised per monitoring sites Sutors (dark blue boxplot), Chanonry (light blue boxplot) and Ardersier (teal boxplot), in the inner Moray Firth, NE Scotland. Data included in these analyses were collected from April to November between 2009 and 2015. Boxplots highlight the median and interquartile range. Outliers are represented by grey dots.

Bottlenose dolphin acoustic occurrence varied annually (Wald test: $\chi^2 = 21.692$, d.f. = 10, $p = 0.017$, Figure 9A) and seasonally (Wald test: $\chi^2 = 392.976$, d.f. = 14, $p < 0.001$, Figure 10A). Between 2009 and 2015, bottlenose dolphin occurrence peaked at Sutors between May and August and in October and November, while this second peak in occurrence was not observed (or as pronounced) at Chanonry and Ardersier. Instead, at Chanonry, a gradual increase in occurrence was observed late Spring, which peaked between June and August, followed by a gradual decrease in Autumn (Figure 10A). Similar seasonal patterns were observed at Ardersier, except a drop in occurrence was observed in October.

Harbour porpoise acoustic occurrence was relatively similar between monitoring years (Wald test: $\chi^2 = 21.399$, d.f. = 10, $p = 0.018$, Figure 9A) but varied seasonally (Wald test: $\chi^2 = 312.291$, d.f. = 14, $p < 0.001$, Figure 10B). Porpoises were detected for more hours per day at Ardersier, between April and June, and at Chanonry in September and October (Figure 10).

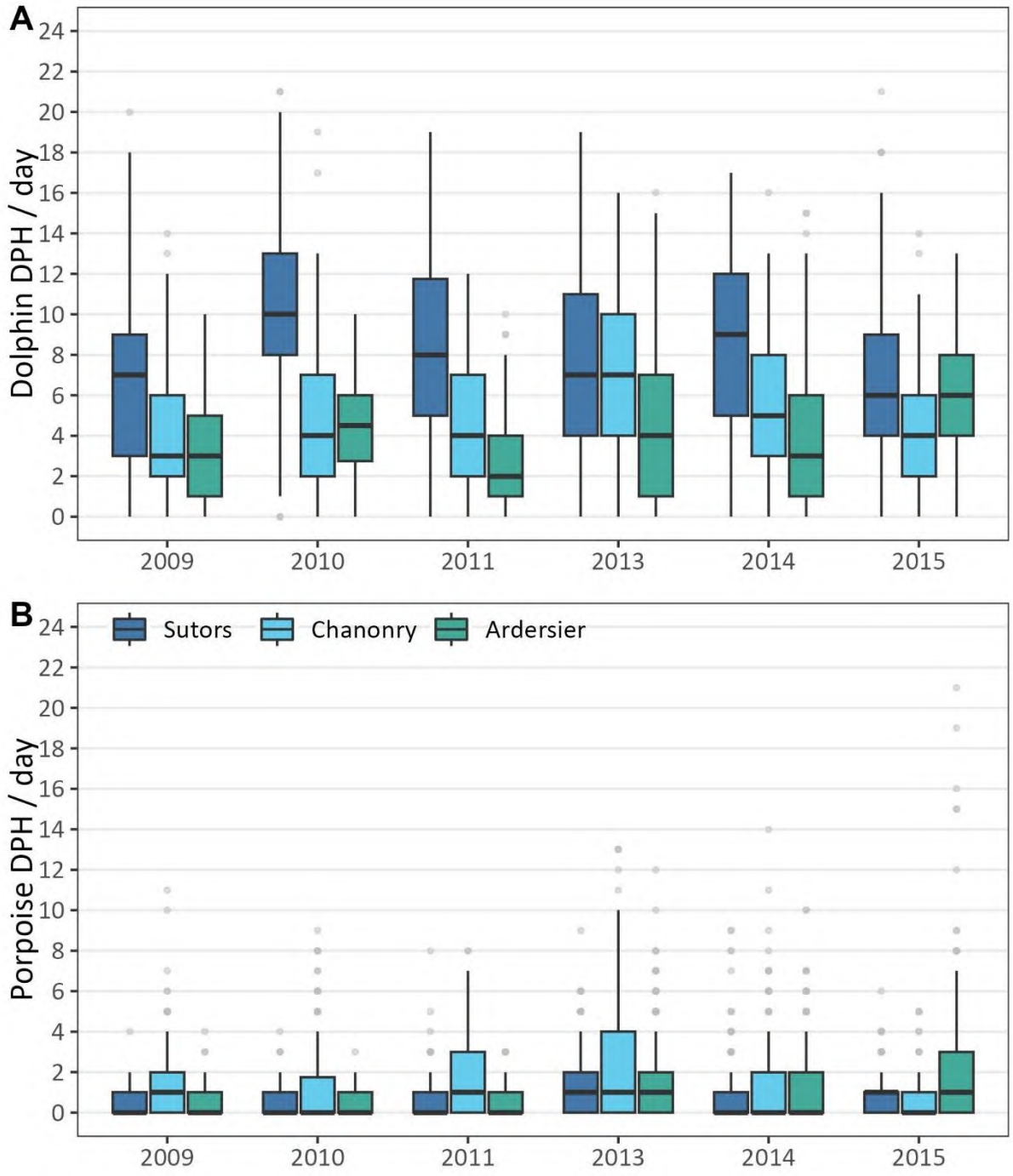

Figure 9 Bottlenose dolphin (A) and harbour porpoise (B) acoustic detection positive hours (DPH) per day summarised per monitoring years and sites at Sutors (dark blue boxplot), Chanonry (light blue boxplot) and Ardersier (teal boxplot), in the inner Moray Firth, NE Scotland. Data included in these analyses were collected from April to November. Boxplots highlight the median and interquartile range. Outliers are represented by grey dots.

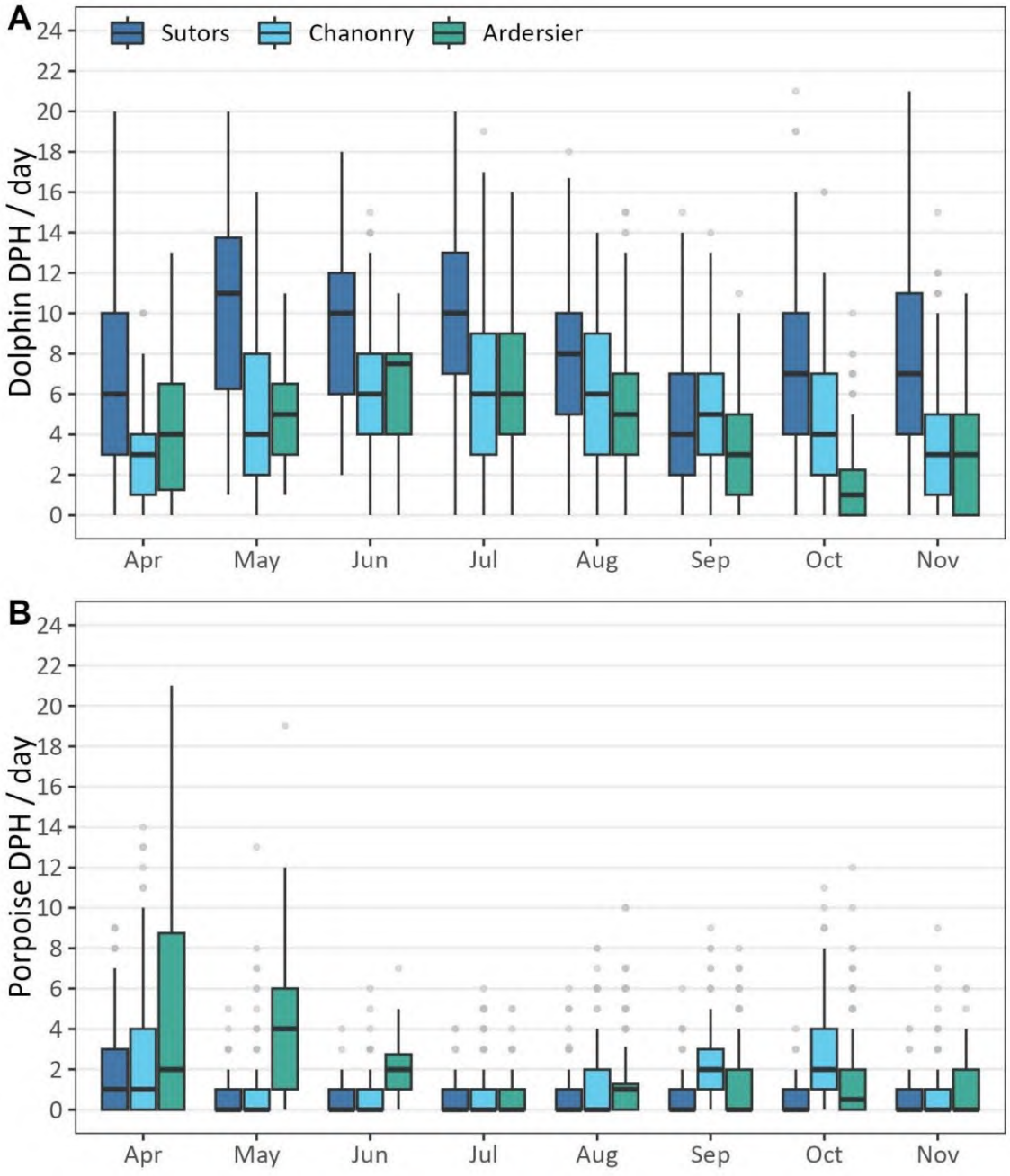

Figure 10 Bottlenose dolphin (A) and harbour porpoise (B) acoustic detection positive hours (DPH) per day summarised per monitoring months and sites at Sutors (dark blue boxplot), Chanonry (light blue boxplot) and Ardersier (teal boxplot), in the inner Moray Firth, NE Scotland. Data included in these analyses were collected between 2009 and 2011 and between 2013 and 2015. Boxplots highlight the median and interquartile range. Outliers are represented by grey dots.

The patterns observed at Chanonry and Sutors between 2009 and 2015 were similar to those observed up to 2024, with bottlenose dolphin occurrence higher at Sutors (Figure S 1A) and harbour porpoise occurrence higher at Chanonry (Figure S 1B). Further, bottlenose dolphin and harbour porpoise occurrence at Sutors and Chanonry between December and March highlight a gradual decrease in dolphin occurrence (Figure S 2A) and a gradual increase in porpoise occurrence (Figure S 2B) throughout winter months.

Bottlenose dolphin photo-ID in the Moray Firth SAC

Between 2006 and 2024, a total of 462 surveys were conducted in the Moray Firth Special Area of Conservation, surveying around 714 km^2 (47 % of the SAC; yearly mean of 336 km^2). The mean number of encounters per hour unit effort within 1 km by 1 km grid cells varied between 0 and 7.5. Overall, most of bottlenose dolphin encounters were located between North Sutor, Chanonry and the eastern side of Port of Ardersier (Figure 11).

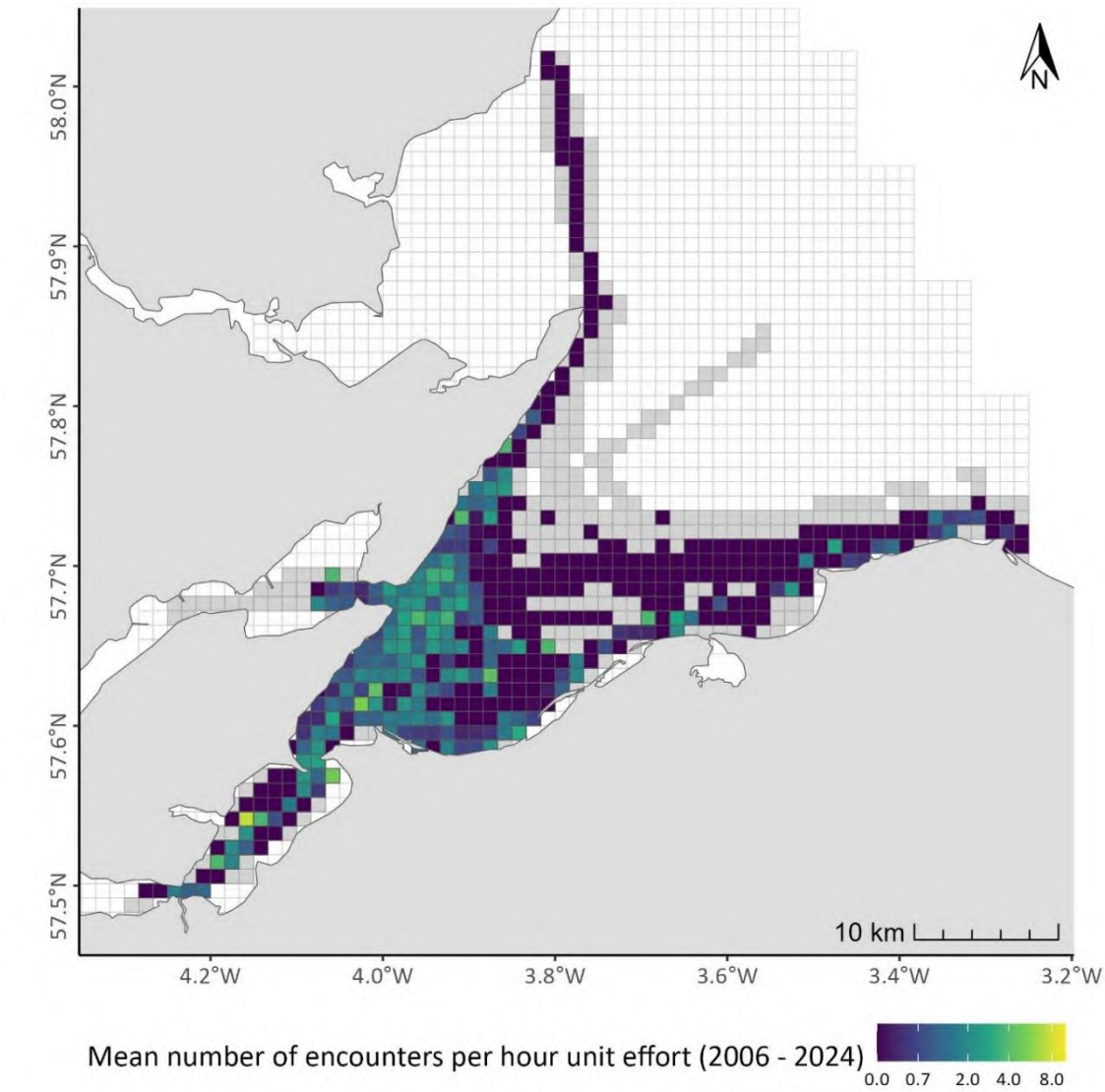

Figure 11 Bottlenose dolphin spatial distribution in the Moray Firth SAC, between 2006 and 2024, based on the number of encounters per hour unit effort within a 1 km by 1 km grid. Grid cells with only one survey and/or with less than two minutes of effort per year are highlighted in grey and were not included in the analyses (see Figure S 3 for individual years).

Between 2006 and 2024, bottlenose dolphins were encountered in groups of between 1 and 56 individuals with an average of 8 individuals (median: 6 individuals) (Figure 12). Group size was similar between monitoring years. However, over the last five monitoring years, median group sizes tended to be slightly higher with less variability, while previously, median group sizes were slightly smaller with greater variability.

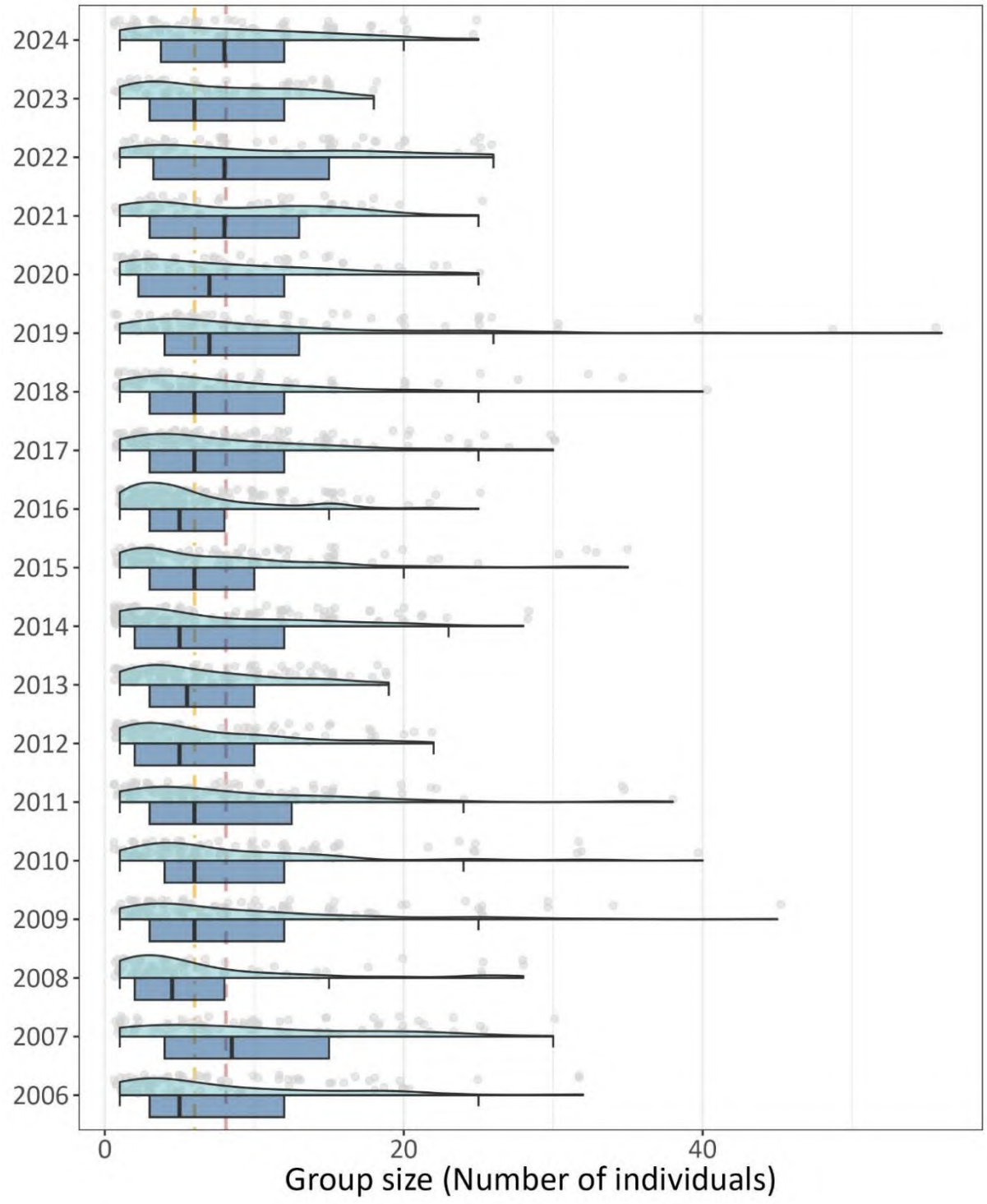

Figure 12 Size of bottlenose dolphin groups encountered in the Moray Firth SAC, between 2006 and 2024. The group size best estimate was the higher number of individuals recorded either during the photo-ID survey or post-hoc from the photo-identification of individuals. Boxplots highlight the median and interquartile range. Violin plots highlight group size distribution and grey dots represent group size estimates recorded each monitoring year. The overall median and mean group size (across the 19 years of data) is represented by the vertical orange dash-dotted line and red dashed line respectively. Nb. The 2024 group sizes were solely estimated with the higher number of individuals recorded during the survey.

At a finer scale, the number of bottlenose dolphin encounters varied between the three areas of interest, with higher encounter rate in Sutors (median = 1.85) in comparison with Chanonry and Ardersier (1.17 and 1.15 respectively, Kruskal-Wallis $\chi^2 = 6.4$, d.f. = 2, p = 0.04) or with the SAC (1.3, Figure 13A). No significant differences in dolphin group sizes were observed between the three monitoring sites (Kruskal-Wallis $\chi^2 = 1.0$, d.f. = 2, p = 0.6, Figure 13B). Median group sizes observed at both Sutors (8.6) and Ardersier (8.3) were similar to the overall SAC group size (8.5), while the group size range in Chanonry (6.6) was more variable but with on average smaller groups observed.

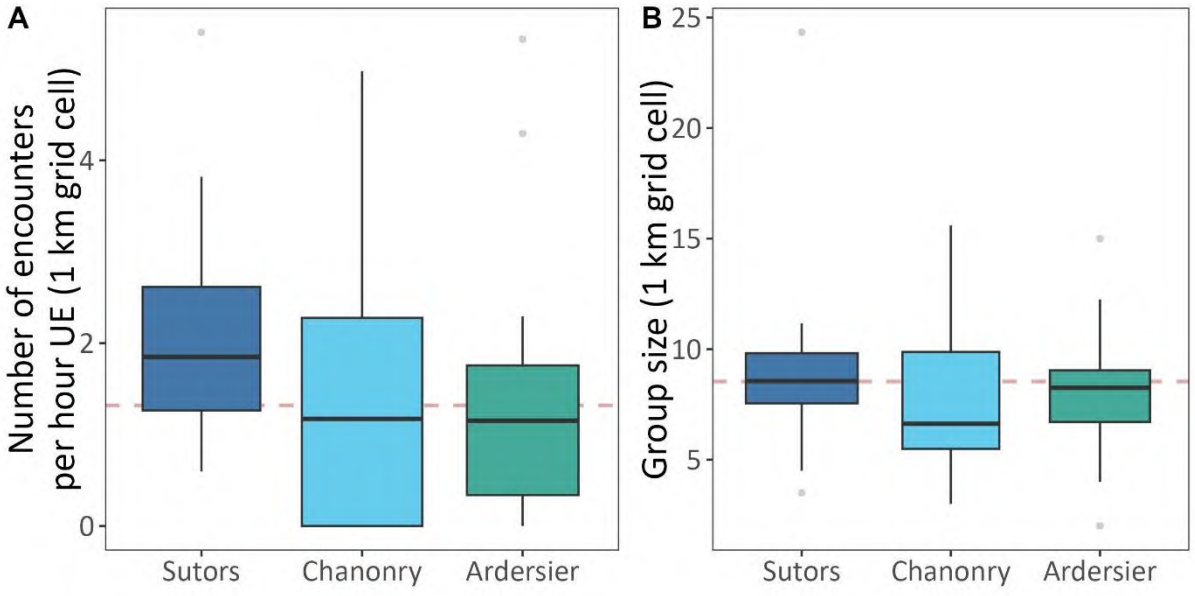

Figure 13 Mean number of bottlenose dolphin encounters per hour unit effort (UE) (A) and mean group size per year (B) within 1 km by 1 km grid cells located around the two long-term monitoring reference sites, Chanonry and Sutors, and Ardersier, across 19 years of data (2006-2024). The median number of encounters (A) and group size (B) within 1 km by 1 km grid cells in the SAC are represented by the red dotted line. Boxplots highlight the median and interquartile range. Outliers are represented by grey dots.

Between 2006 and 2023, a total of 286 bottlenose dolphins were identified in the Moray Firth SAC, with 241 individuals identified at Sutors (84.3 %), 161 around Port of Ardersier (56.3 %) and 158 at Chanonry (55.2%) (Figure 14). The numbers of individuals using each area varyied between monitoring years (Figure S 4), with more than half of the individuals observed in the Moray Firth SAC observed around the Port of Ardersier.

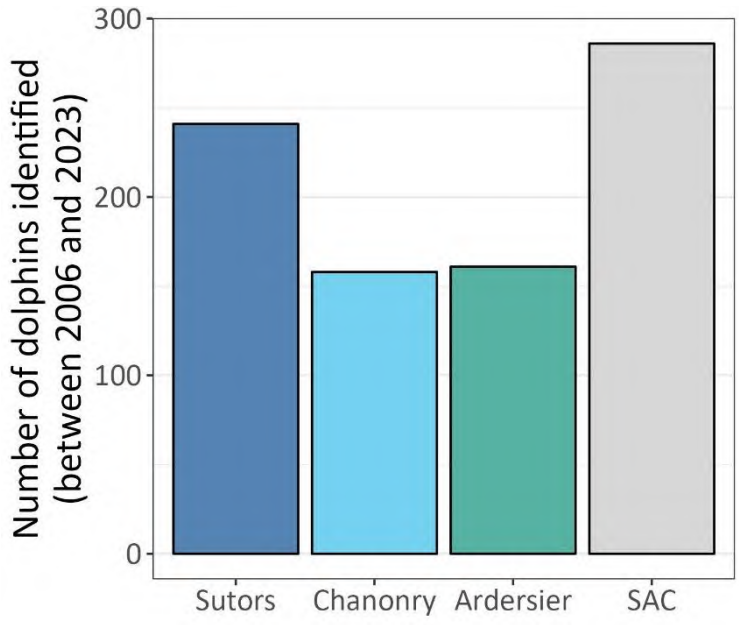

Figure 14 Number of bottlenose dolphins identified around Sutors, Chanonry, Port of Ardersier and within the Moray Firth Special Area of Conservation (SAC), between 2006 and 2023.

Discussion and conclusion

Cetaceans have been monitored in the Moray Firth Special Area of Conservation using a combination of both visual and acoustic techniques for over two decades. In this report, these long-term monitoring datasets have been used to characterise the baseline bottlenose dolphin and harbour porpoise occurrence at Chanonry and Sutors, two known bottlenose dolphin "hotspots" (Wilson et al. 1997) and around the Port of Ardersier. Additionally, bottlenose dolphin distribution, number of encounters, individuals sighted and estimated group size observed in the SAC have been highlighted to inform the Environment Impact Assessment of Port of Ardersier expansion plan.

Between 2006 and 2024, bottlenose dolphins were mainly sighted between the north Sutor, south of Chanonry and east of the Port of Ardersier. Both PAM and photo-ID surveys highlighted that Sutors, Chanony and Ardersier are areas of high occurrence for bottlenose dolphins. Bottlenose dolphin acoustic occurrence, number of encounters per unit effort and number of individuals identified were all slightly higher at the Sutors, with Chanonry and Ardersier areas similar in terms of each of these metrics. Thus, Chanonry could confidently be used as a reference site when assessing potential impact of Port of Ardersier development. Harbour porpoise acoustic occurrence was lower in these coastal areas but seasonally changed with higher occurrence in Spring and Autumn, when bottlenose dolphin occurrence is lower. The continued monitoring of the inner Moray Firth will provide further valuable information on bottlenose dolphin potential response to the Port of Ardersier development as well as any other anthropogenic activities within the Inverness and Cromarty Firth Green Free Port area.

Appendix

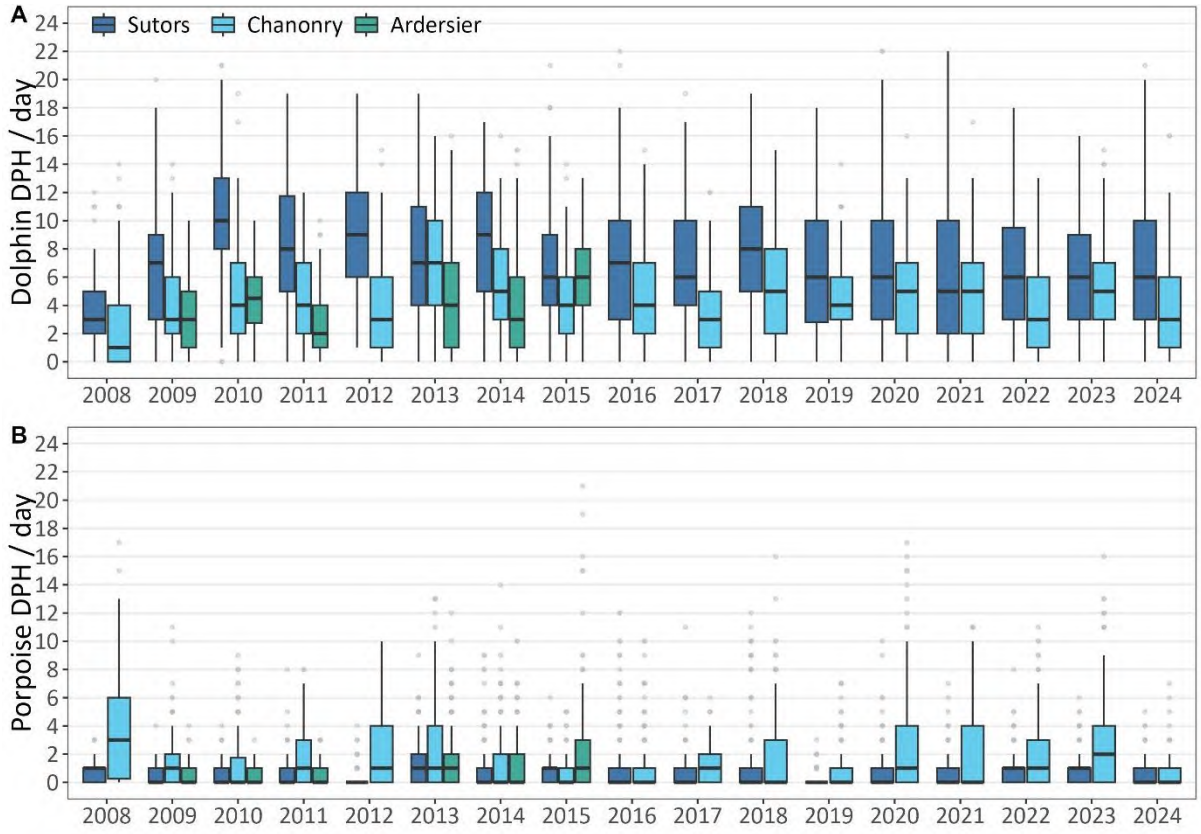

Figure S 1 Bottlenose dolphin (A) and harbour porpoise (B) acoustic detection positive hours (DPH) per day summarised per monitoring year and sites at Sutors (dark blue boxplot), Chanonry (light blue boxplot) and Ardersier (teal boxplot), in the inner Moray Firth, NE Scotland. Data included in these analyses were collected from April to November. No data were collected around Ardersier in 2008, 2012, or after 2015. Boxplots highlight the median and interquartile range. Outliers are represented by grey dots.

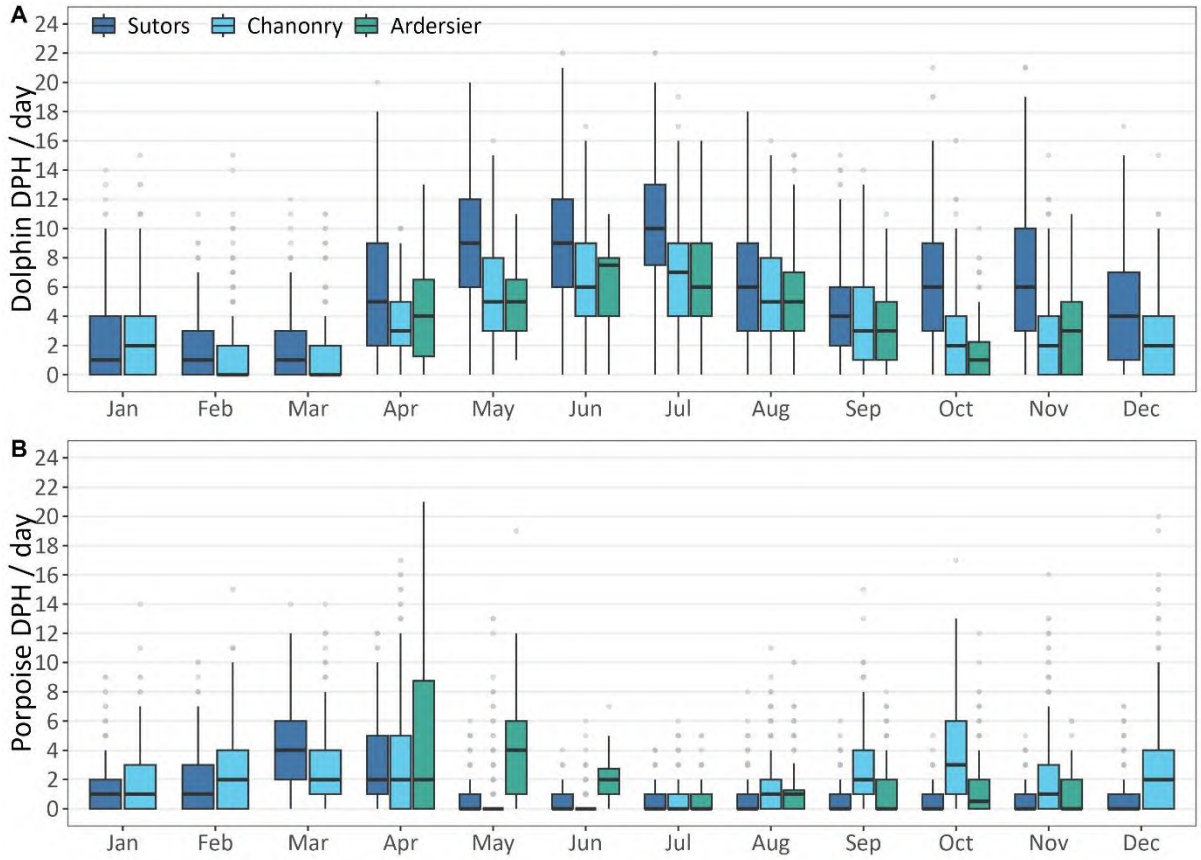

Figure S 2 Bottlenose dolphin (A) and harbour porpoise (B) acoustic detection positive hours (DPH) per day summarised per monitoring months and sites at Sutors (dark blue boxplot), Chanonry (light blue boxplot) and Ardersier (teal boxplot), in the inner Moray Firth, NE Scotland. For Sutors and Chanonry sites, data were collected year-round between 2008 and 2024, and for Ardersier, data were collected between April and November from 2009 to 2011 and from 2013 to 2015. Boxplots highlight the median and interquartile range. Outliers are represented by grey dots.

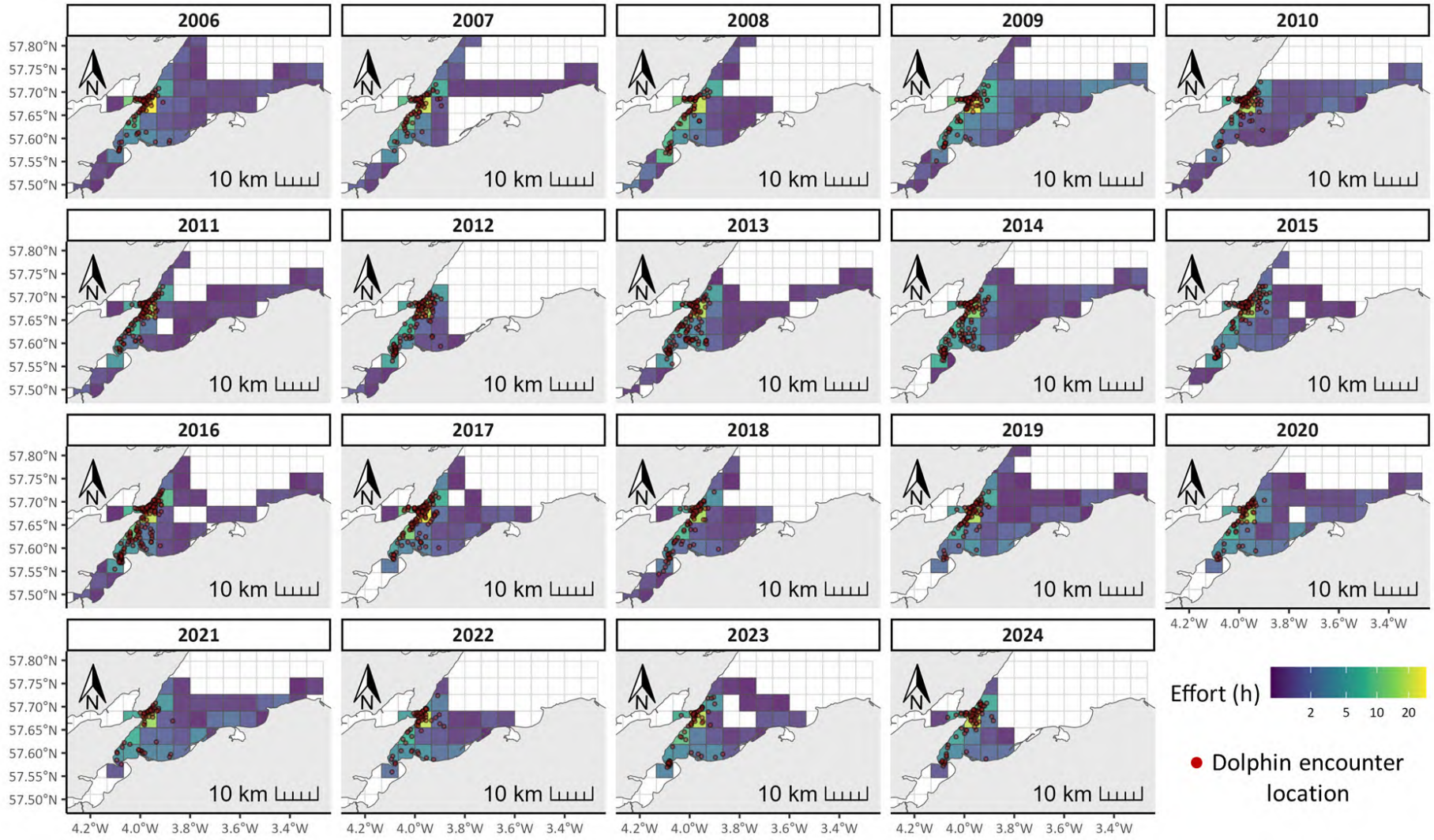

Figure S 3 Mean survey effort (h) per 4 km by 4 km grid cell and bottlenose dolphin encounter locations (red dots) recorded in the inner Moray Firth (NE Scotland) between 2006 and 2024.

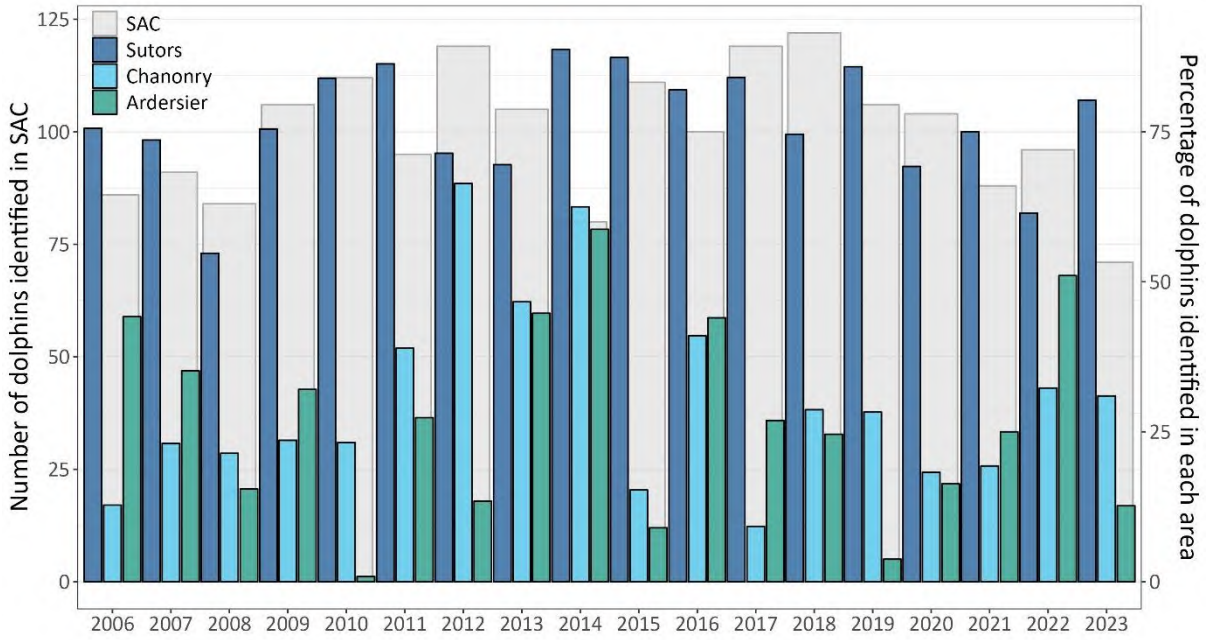

Figure S 4 Number of bottlenose dolphins identified in the Moray Firth Special Area of Conservation (SAC) per year (grey bars). Percentage of bottlenose dolphins identified in each area of interest, Sutors (dark blue), Chanonry (light blue) and Ardersier (teal bars) per year.

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