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Guidance for assessing the significance of noise disturbance against Conservation Objectives of harbour porpoise SACs

(England, Wales & Northern Ireland)

Note to users

This guidance document lays out JNCC, Natural England and DAERA’s advice on the assessment of significant disturbance in UK Special Areas of Conservation (SACs) for harbour porpoise. Scottish Natural Heritage will provide separate advice for the Scottish harbour porpoise SAC and Natural Resources Wales will provide separate advice for sites which are their joint responsibility with JNCC and/or Natural England.

1 Introduction

The harbour porpoise is listed on Annex II of the Habitats Directive, which means SACs need to be designated to protect particularly important habitats for the species and contribute to achieving/maintaining Favourable Conservation Status (FCS) of the species.

A suite of five harbour porpoise Special Areas of Conservation (SACs) in Welsh, Northern Irish and English waters were designated in February 2019. There is a further SAC in Northern Irish waters for which harbour porpoise is listed as a qualifying feature: Skerries and Causeway. Statutory Nature Conservation Bodies (SNCBs) have a statutory obligation to establish and advise on the conservation objectives (COs) for the sites as well as advise on those operations capable of adversely affecting site integrity. Under UK regulations[1], relevant potential impacts on these SACs from plans or projects require formal consideration in Habitats Regulations Assessments (HRAs).

The Conservation Objectives for these sites are:

To ensure that the integrity of the site is maintained and that it makes an appropriate contribution to maintaining Favourable Conservation Status (FCS) for Harbour Porpoise in UK waters

In the context of natural change, this will be achieved by ensuring that:

1. Harbour porpoise is a viable component of the site;
2. There is no significant disturbance of the species; and
3. The condition of supporting habitats and processes, and the availability of prey is maintained.

This document sets out the SNCBs’ advice on assessing the risk of significant disturbance as a result of noise and consequently managing noise disturbance within harbour porpoise

[1] The Conservation of Habitats and Species Regulations 2017; The Conservation of Offshore Marine Habitats and Species Regulation 2017; The Conservation (Natural Habitats, etc.) Regulations (Northern Ireland) 1995 (as amended)

sites to avoid a potential adverse effect on site integrity. This advice should be considered by competent authorities when undertaking HRAs. The approach applies to all plans and projects within or affecting a site that could cause significant noise disturbance to harbour porpoise, alone or in combination with other plans or projects.

A number of noise generating activities can potentially result in disturbance and injury to harbour porpoise e.g. geophysical surveys for oil and gas exploration (Pirotta et al. 2014), the detonation of unexploded ordnance (Benda-Beckman et al. 2015), Acoustic Deterrent Devices (ADDs, Northridge et al. 2010), pile driving undertaken for the installation of offshore wind turbines (e.g. Dähne et al 2013), and the construction of marine facilities such as harbours. Those undertaking such activities are required to mitigate against the risk of injury to marine mammals, typically by following the JNCC guidelines/protocol[2]. However, these mitigation protocols primarily address the reduction of the injury risk in close proximity to the noise source and do not address disturbance which can occur many kilometres away from the source.

Activities with the potential to cause non-trivial disturbance (generally larger scale and longer-term plans/projects) are currently assessed by considering the potential impact on harbour porpoise at the population level by using the best available population estimate of the relevant Management Unit (MU, IAMMWG, 2015). Such assessments are typically carried out as part of Strategic and Environmental Impact Assessments, and in support of applications for geological survey consents under The Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001 (as amended) and applications for European Protected Species (EPS) licences to derogate the risk of committing a disturbance (and/or injury) offence under The Conservation of Habitats and Species Regulations 2017, The Conservation of Offshore Marine Habitats and Species Regulations 2017 and The Conservation (Natural Habitats, etc.) Regulations (Northern Ireland) 1995 (as amended). With the designation of SACs for harbour porpoise, site-specific conservation objectives must also ensure that significant disturbance of the species in the designated sites is avoided.

The designation of harbour porpoise SACs will undoubtedly have consequences as to how some activities operate, and measures may need to be put in place to reduce disturbance of harbour porpoises to ensure that the animals' potential usage of the site is maintained. Implementation of any disturbance management is likely to be challenging given the complexity of marine activities, the relevant regulatory arrangements and the scientific uncertainty surrounding the significance of noise impacts on harbour porpoise. The approach recommended by SNCBs in this guidance document should encourage best practice mitigation for noise reduction and is intended to be adaptive, i.e. the guidance parameters can change as new evidence is made available. Discussions with industry on implementation of the guidance are needed to explore ways in which activities can take place within the limits of the guidance but with minimal disruption to operations.

This guidance applies only to regulated activities since consenting processes in place allow for planning and enforcement of conditions. Therefore, certain noisy activities like shipping, for example, are not covered. The advised approach to noise management is considered by the SNCBs to be precautionary (although proportionate and pragmatic) and therefore there should be some leeway for a small amount of noise that may not be covered by the approach. Competent authorities should gather evidence to test this assumption and investigate the need for managing non-regulated noise pressure in SACs and, if applicable, develop processes through which this guidance could be applied.

[2] http://jncc.defra.gov.uk/pdf/jncc_guidelines_seismicsurvey_aug2017.pdf
http://data.jncc.gov.uk/data/31662b6a-19ed-4918-9fab-8fbcff752046/JNCC-CNCB-Piling-protocol-August2010-Web.pdf

The guidance also focusses on activities most likely to result in disturbance to harbour porpoise over large ranges, with peak sound energy in the frequency range of 10Hz to 10 kHz. This follows European Commission monitoring guidance (Dekeling et al. 2014) on the types of activities that could cause disturbance to marine species and aligns itself with the data collated through the UK Marine Noise Registry. The choice of the upper limit of the frequency band (10 kHz) by the European Commission was based on the fact that sounds at higher frequencies do not travel as far as lower frequency noise. Harbour porpoise, however, are sensitive to frequencies higher than 10 kHz, and there is evidence that, for example, some ADDs cause disturbance at medium ranges (McGarry et al. 2020). Therefore, there is some flexibility in the upper frequency limit.

2 Definition of significant noise disturbance within a harbour porpoise SAC

For the purpose of this guidance, noise disturbance within an SAC from a plan/project, individually or in combination, is considered to be significant if it excludes harbour porpoises from more than:

1. 20% of the relevant area[3] of the site in any given day[4], or

2. an average of 10% of the relevant area of the site over a season[5,6].

Any plan or project which, individually or in combination, could breach the area/time thresholds as set out above could be deemed to have an adverse effect on site integrity necessitating noise management measures such as adjustment of activity schedules, the use of alternative technologies and noise abatement. The aim of noise management should be to keep below the thresholds as much as possible.

3 Noise management approach

3.1 Background and development

The European Commission provided guidance[7] on what could constitute significant disturbance of a species in a Natura 2000 site: '*Any event, activity or process contributing to the long-term decline of the population of the species on the site can be regarded as a significant disturbance. (…) Any event, activity or process contributing to the reduction or to the risk of reduction of the range of the species within the site or to the reduction of the size of the available habitat of the species can be regarded as a significant disturbance.*' It also states that the intensity, duration and frequency of repetition of disturbance are important parameters.

The Habitats Directive (Article 3(1)) states that the Natura 2000 network, "composed of sites hosting … habitats of the species listed on Annex II, shall enable the …species' habitats concerned to be maintained or, where appropriate, restored at a favourable conservation status in their natural range". The UK sites for harbour porpoises were identified based on

[3] The relevant area is defined as that part of the SAC that was designated on the basis of higher persistent densities for that season (summer defined as April to September inclusive, winter as October to March inclusive).
[4] To be considered within the Habitats Regulation Assessment and, if needed, licence conditions should ensure that daily thresholds are not exceeded. Day to day monitoring of compliance is not practicable and therefore retrospective compliance monitoring is required to test whether the licence conditions are being adhered to.
[5] Summer defined as April to September inclusive, winter as October to March inclusive
[6] For example, a daily footprint of 19% for 95 days would result in an average of 19x95/183 days (summer) =9.86%
[7]http://ec.europa.eu/environment/nature/natura2000/management/docs/art6/Provisions_Art_._nov_2018_endocx.pdf

habitat models (Heinänen and Skov, 2015) which identified large areas that contained porpoise density within the top 10% of all estimates within the MU (e.g. North Sea) and persistently so over the 1994-2011 period of the analysis, taking into account the degree to which high densities were predicted to occur recently. These areas were identified seasonally, and this was recognised when establishing boundaries for the sites. The assumption is that sites are used differently during summer and winter presumably driven by shifts in prey/prey preferences.

As a mobile and wide-ranging species, density and abundance of harbour porpoise both within and outside the sites vary considerably by season and year and it is therefore not possible or realistic to aim to maintain a given harbour porpoise abundance in the site. This guidance therefore recommends that 'significant disturbance' should be interpreted as a reduction of the range of the species within the site or a reduction in the access to available habitat within the site. Given that disturbance, and therefore access to habitat is usually of a temporary nature[8], management of noise in the sites should ensure that disturbance does not lead to the deterrence of harbour porpoise from a *significant portion* of the site for a *prescribed period of time* thus ensuring the species has sufficient access to habitat within the sites.

3.2 Definition of 'significant portion of the site for a prescribed period of time'

One of the most likely impacts of disturbance on harbour porpoise is the loss of foraging opportunities (Nabe-Nielsen et al. 2018). Wisniewska et al. (2016) reported that tagged porpoises off Denmark foraged almost constantly, 24 hours a day, to meet their energy needs. Some evidence shows that the harbour porpoise has a high metabolic rate compared to terrestrial mammals of similar size (Rojano-Doñate et al. 2018). Failure to acquire sufficient energy may have consequences to animals' vital rates such as survival and reproduction. The small size of the harbour porpoise limits the amount of stored energy it can carry, and it can only survive a few days without feeding (Kastelein et al. 1997). The high feeding rates and wide-ranging diet may confer the species some resilience to disturbance (Booth et al. 2019), if energetic needs can be readily met, i.e. if prey availability is sufficient harbour porpoises may be able to compensate for short periods of fasting (Kastelein et al. 2019).

The effects of displacement or reduction in foraging success occurring in important habitats such as those within SACs are unknown. Animals may be displaced to lower quality habitat, i.e. prey availability/quality encountered may be lower, the risk of predation and both intra- and inter- specific competition may be higher, all of which could have implications on their ability to survive and reproduce. Such habitat reduction or lowered quality can be assumed to result in a reduction of the habitat's carrying capacity[9] (Tougaard et al. 2013). The definition of '*significant portion*' for the purpose of this guidance was, therefore, based on the assumption that the 'loss' of carrying capacity of the site would impact the ability of the site to make a full contribution to achieving/ maintaining FCS of the species. Long-term, permanent reduction in carrying capacity could also manifest itself in population declines (Tougaard et al. 2013).

A small, short-term reduction in available habitat is unlikely to prevent the site from contributing in the best possible way to species' FCS; however, displacement affecting large

[8] Taking pile driving as an example, it is assumed that harbour porpoise will be excluded from an area of habitat for the duration of pile driving and for a period of time after pile driving has ceased. The length of time it takes for porpoises to return after the cessation of pile driving varies: generally, between a few hours (Tougaard et al. 2009; Brandt et al. 2012; Dahne et al. 2013) and up to 3 days (Diederichs et al. 2009; Brandt et al. 2011).
[9] The carrying capacity of a biological species in an environment is the maximum population size of the species that the environment can sustain indefinitely, given the food, habitat, water, and other necessities available in the environment.

areas of the site for long periods of time could do so. In developing this guidance, various approaches to defining acceptable limits of reduction in carrying capacity for marine mammal populations were considered (e.g. The International Whaling Commission and the US Marine Mammal Protection Act). SNCBs chose to use the ASCOBANS[10] precautionary conservation objective for small cetacean populations, i.e. recovery to and/or maintaining ≥ 80% of carrying capacity in the long term as a guide to define 'significant portion'. Whereas this objective was not developed to meet the requirements of the Habitats Directive, nor to be applied to specific locations within the species' range, it does provide an indication of what magnitude of prolonged 'habitat loss' might be considered significant.

For the purpose of this guidance, given the lack of fine scale habitat use information[11], it is assumed that a direct relationship exists between habitat reduction (or loss of quality) and carrying capacity. However, because the ASCOBANS objective applies to the whole of a MU (e.g. North Sea) equally, and the SACs are known to have higher densities of porpoise, it was deemed more appropriate by SNCBs to aim for an average 90% of site availability within the high density season, hence setting the limit of disturbed area at 10%. To allow some flexibility in relation to activities taking place without considerable prolongment but at the same time avoiding consecutive days with large areas of the site disturbed, a daily 20% threshold is also advised. Management of temporary habitat 'loss' to below defined area/time thresholds is therefore designed to ensure that a site continues to contribute in the best possible way to the maintenance of the species at FCS.

Three of the SACs have been identified based on elevated densities of harbour porpoise in either summer (April – September) or winter (October – March) (Heinänen and Skov, 2015, Table 1). The Southern North Sea SAC has both 'winter' and 'summer' areas with a small portion of it having been identified based on elevated densities all year round. The West Wales Marine SAC is mostly a 'summer' site with around a fifth of the site having been identified for year-round elevated densities. The timing of proposed plans or projects should therefore be taken into account when considering whether the disturbance could be significant. Plans or projects potentially resulting in disturbance in the protected sites but operating outside of the season for which it was identified are unlikely to result in significant effects on the site. Since during the 'off season' the area is no different in terms of average densities than the rest of the MU, SNCBs' advice is that the EPS's strict protection measures apply and no additional noise management measures are required. The noise management approach in this guidance should therefore not apply outside the relevant season and this needs to be taken into account when estimating the disturbance footprint in sites with both a summer and winter/or year-round areas. The other conservation objectives for the sites will apply year-round since they address more permanent impacts that could affect the site independently of the time of the year they occurred in (e.g. habitat changes).

Table 1. Harbour porpoise SACs and seasonal areas.

SAC	Season	Area (Km^2)
Southern North Sea	Summer	27028
	Winter	12696
West Wales Marine	Summer	7376
	Winter	1460
Bristol Channel Approaches	Winter	5850
North Anglesey Marine	Summer	3249
North Channel	Winter	1604
Skerries and Causeway	Year round	108

[10] https://www.ascobans.org/en/species/threats/bycatch
[11] The variability in porpoise density within the sites is not well understood. There is also limited information on how porpoises use the site. Future evidence gathering is needed.

3.3 Assessing the range of temporary habitat loss - Effective Deterrence Ranges (EDRs)

The harbour porpoise is a cetacean species that is particularly responsive to noise. Field studies, several around wind farm installation activities and two near a seismic survey, have shown that porpoise density and vocalisations are reduced temporarily for several kilometres around the noise source with gradually less of an effect the further away the observations are made. For the purposes of assessment and management, the advice in this guidance is to use fixed disturbance distances for different activities, based on empirical evidence as opposed to distances estimated from noise modelling. The latter carries considerable uncertainty, in particular: there are currently no agreed quantitative thresholds for disturbance as there are for auditory injury; depending on the choice of numerical models to estimate sound source and propagation one can end up with predictions for disturbance ranges that are several orders of magnitude apart; received sound levels are not the single most influencing factor in triggering disturbance, other characteristics of sound and how they propagate with distance will influence how an animal perceives the noise; behavioural context, individual animal motivation and previous exposure will also all play a role in eliciting response.

The EDRs recommended in this guidance were informed by the published ranges where the bulk of the effect (reduction in porpoise vocal activity or sightings) had been detected. They are not equivalent to 100% deterrence/disturbance in the associated area (i.e. some animals show greater reaction than others) but nor do they represent the limit range at which effects have been detected. Furthermore, different projects have reported the observed effects differently meaning it is not straightforward to use a standard way of deriving an EDR. In addition, the full spectrum of animals' response to the noise has not been or cannot yet be recorded (e.g. physiological changes) and so it is possible that those studies observed only the most visible of effects.

As there are only a handful of field studies of porpoise responses to noise, it is not always possible to match the evidence to the specific characteristics of individual activities. Therefore, most EDRs have been informed by matching a suite of generic activity categories (e.g. monopiles, pin-piles, seismic surveys) to the study(ies) covering an activity with the most similar characteristics and sound levels.

For *large diameter monopiles*, deterrence ranges between 18 and 34 km have been reported for the driving of the piles without noise abatement (Tougaard et al. 2009, Brandt et al. 2011, 2012, 2018, Dahne et al. 2013). There was variation in relation to return times, with some studies showing only a few hours of effect and others up to three days. Based on the evidence at the time, Tougaard et al. (2013) estimated an EDR of 26 km to reflect the overall temporary loss of habitat from the use of monopile foundations. Recent studies (Dahne et al. 2017, Brandt et al. 2018, Rose et al. 2019) found smaller deterrence ranges, between 12 and 17 km, for different types of piling with *noise abatement systems*. For all piling with noise abatement systems, a 15 km EDR is thus recommended, based on the average of the observed maximum distances in field studies. This will result in considerably smaller footprints than for unabated monopile driving.

For *pin piling* (smaller diameter piles that secure marine structures), one study (Graham et al 2019) found a 50% probability of harbour porpoise behavioural response within 7.4 km, in the 12 hours after the piling had ended (the deterrence distance during piling was not reported). The study also showed a 25% probability of response within approximately 18 km. Potential habituation has also been recorded, with response distances decreasing over the duration of the piling operations. Thus, for pin piling a 15 km EDR is recommended to account for the fact that the bulk of the effects while piling was occurring would have likely been detected at distances greater than 7.4 km.

Conductor piling for oil and gas wells also involves much smaller diameters (<1m) units requiring lower hammer energy than monopiles and generating noise of a lower amplitude (Jiang *et al*. 2015, MacGillivray 2018). Thus, a 15 km EDR is recommended, in line with the EDR for pin piling. This is also the distance used by BEIS in HRAs for the oil & gas licensing seaward rounds.

The 26 km EDR is also to be used for the *high order detonation of unexploded ordnance* (UXOs) despite there being no empirical evidence of harbour porpoise avoidance. High order detonation of UXOs results in one of the loudest sources of underwater noise and although a one-off explosion would probably only elicit a startle response and would not cause widespread and prolonged displacement, these detonations are usually part of campaigns with potentially several detonations in the same general area over several days and involving multiple vessels as well as the deployment of ADDs.

For *seismic (airgun array) surveys*, a minimum EDR of 12 km is proposed, based on two studies of harbour porpoise deterrence during seismic surveys: 1) a reduction in acoustic activity within 10 km of a 2D survey using a 470 cubic inch capacity airgun array (Thompson et al. 2013); 2) a reduction in acoustic activity within ranges between 8 and 12 km away from a larger 3D seismic survey (3570 cubic inch) (Sarnocińska et al. 2020). Further studies such as these in the relevant areas are needed to validate this EDR.

For some types of *sub-bottom profilers* (boomers, sparkers, pingers, chirps) and multi-beam echosounders used in geophysical surveys, the sources can be relatively loud with high duty cycles but, on the whole, these are highly directional sources with expected low levels of horizontal sound propagation; many operating at high frequencies and therefore subject to high transmission loss (e.g. Crocker & Fratantonio 2016, Crocker et al. 2019). However, several of these systems produce medium frequencies likely to propagate longer distances and therefore have the potential to cause disturbance to porpoise. There are several different types of sub-bottom profilers, and the available evidence so far comes from noise measurements and modelling and not field observations of porpoise responses, hence a 5 km, likely conservative EDR, is recommended.

A summary of the EDRs recommended for use in assessments is detailed in Table 2.

Table 2. Recommended *Effective deterrence ranges* (EDRs)

Activity	EDR (km)	References in which EDRs were based
Monopile	26	Tougaard et al. 2013; Dähne et al. 2013
Monopile with noise abatement	15	Dahne et al. 2017, Rose et al. 2019
Pin-pile (with and without noise abatement)	15	Graham et al. 2019
Conductor piling for oil & gas wells	15	Jiang *et al*. 2015, MacGillivray 2018, Graham et al. 2019
UXO	26	based on monopile EDR
Seismic (airguns) survey	12	Thompson et al. 2013; Sarnocińska et al. 2020
Other geophysical surveys	5	Crocker & Fratantonio 2016, Crocker et al. 2019

Different EDRs and estimates of the duration of impact may be justified if there is evidence relating to sound levels and propagation, harbour porpoise response, recovery and habituation. Ideally, the choice of EDR should be based on field observations and measurements. The suitability of EDRs used in assessments will be under regular review considering emerging peer-reviewed evidence such as that gathered through monitoring associated with licensed activities.

3.4. Application of the approach in practice

Discussions with industry on implementation of the guidance are needed to explore ways in which, multiple activities can co-occur with as little disruption as possible while keeping within the advised area/time thresholds. To assist in reducing the cumulative daily disturbance footprint, regulated activities should be planned to not overlap in time. If that is not possible, then protocols for communication between operators will need to be established to avoid reaching the daily threshold, e.g. the oil and gas industry already routinely uses time-sharing for seismic surveys for the separate purpose of avoiding signal interference[12].

For sites where two seasonal areas have been identified, the area/time threshold approach applies to activities occurring within an area and in the corresponding season. Therefore, an option might be to undertake an activity (or part of) in the months when the area/time threshold approach does not apply for that area, thus avoiding cumulative seasonal disturbance.

The guidance provides two examples of how the approach could be implemented.

3.4.1. The installation of offshore wind farms in the Southern North Sea SAC

There are two main stages within the processes for development of an offshore wind farm where this approach should be applied:

1. HRA stage of an application prior to the project being given consent; and
2. During the construction phase of the project.

The HRA is carried out by the competent authority with information provided by the applicant, to determine whether the plan/project will have an adverse effect on site integrity (alone or in combination). The HRA may also conclude whether mitigation/management is needed and can be put in place to prevent adverse effects. The HRA will need to ascertain that noise disturbance within the site will not displace harbour porpoise from more than 20% of the relevant area of the SAC on any given day or disturb porpoise from an average of more than 10% of the relevant area of the SAC over a season. However, when the HRA is carried out there may be considerable uncertainty over project design, schedules and other planned developments. In such cases, a pre-construction condition should be attached to the project approval[13] requiring an assessment to be undertaken prior to initiating the works to determine if the activities and schedules of this project and of others (relevant for the in-combination assessment) are still within the parameters used to reach the HRA conclusions. SNCBs will work with Government and regulators to develop this condition, which will be tested, and amended if needed, as projects progress. There should be enough time between the assessment and the start of construction to allow for the effective implementation of any further mitigation/management considered necessary to satisfy the authorities that the SAC will not be adversely affected, which could include:

1. Careful spatial planning and phasing of noisy activities (e.g. concurrent piling of adjacent foundations in order to reduce footprint).

[12] http://web.iagc.org/External/WCPages/WCWebContent/WebContentPage.aspx?ContentID=1684

[13] For example paragraph 18.2 in: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/753026/RoC_SNS_cSAC_HRA_5.0.pdf

2. Use of alternative foundations that do not require pile driving (e.g. suction buckets, gravity bases), noting that these may have other impacts.

3. Use of alternative methods of installation that would reduce the noise impact footprint.

4. Use of technology to reduce the sound levels at source or to minimise sound propagation and reduce the noise footprint.

The implementation of the proposed area/time disturbance thresholds during the construction phase is designed to ensure that significant disturbance does not occur (either alone or in combination). However, it is recognised that it is challenging for regulators or industry to monitor the daily threshold i.e. 20% limit per day, in ‘real’ time. Therefore, careful planning through the application process is essential. For example, if a plan or project has been consented which could cause noise disturbance up to the allowable maximum daily threshold for a period of time, then no other noise disturbance should take place on those days.

When considering the impact of pile driving used in offshore wind farm construction, the assessment of the extent of noise disturbance in this example is based on an EDR of 26 km for a single monopile (Tougaard et al. 2013; Dähne et al. 2013). The area of harbour porpoise deterrence[14] therefore approximates to 2,124 km^2 during a single unabated pile driving event. Two spatially separate pile driving events[15] or two adjacent/concurrent events*[16] plus a more distant event** wholly within the summer Southern North Sea SAC area on one day could therefore approach the maximum of 20% area of disturbance. In the (smaller) winter area, two adjacent/concurrent pile driving events wholly within the SAC could alone exceed the maximum of 20% disturbance. These scenarios are detailed in Figure 1.

Piling events at the edge (or in some cases beyond the edge) of the site will contribute less to the spatial disturbance footprint within the site. Similarly, EDRs from pile driving events planned near each other would overlap and reduce the spatial footprint, potentially enabling additional activities to take place within the site without causing significant disturbance.

The seasonal threshold, i.e. 10% average, needs to consider the daily activities but it would allow, for example, one pile driving event (or two adjacent) per day over the entire summer season (183 days) in the summer area. Alternatively, in the summer area there could be two distant pile driving events (as in Figure 1A) or two adjacent/concurrent events plus one distant event (as in Figure 1 B) for approximately half (91 days) of the summer season but with no further impulsive noise authorised for the remaining 91 days of the season. If noise abatement is applied to pile driving, and assuming a 15 km EDR, the respective area potentially impacted is reduced by nearly 67%, from 2,124 km^2 to 707 km^2. This would mean that two piling events or potentially two pairs of adjacent events per day could occur over the whole summer season.

[14] To note that whilst displacement is the response that can more easily be observed, there might be other effects of disturbance that are less obvious (e.g. changes in diving patterns).
[15] An ‘event’ is the multiple hammer blows required to sink a single pile.
[16]*Adjacent/concurrent piling events occur on the same day and have overlapping disturbance footprints (the effective deterrence radius far exceeds the distance between adjacent piles).
** a distant piling event would not have overlapping disturbance footprints with other events in the SAC.

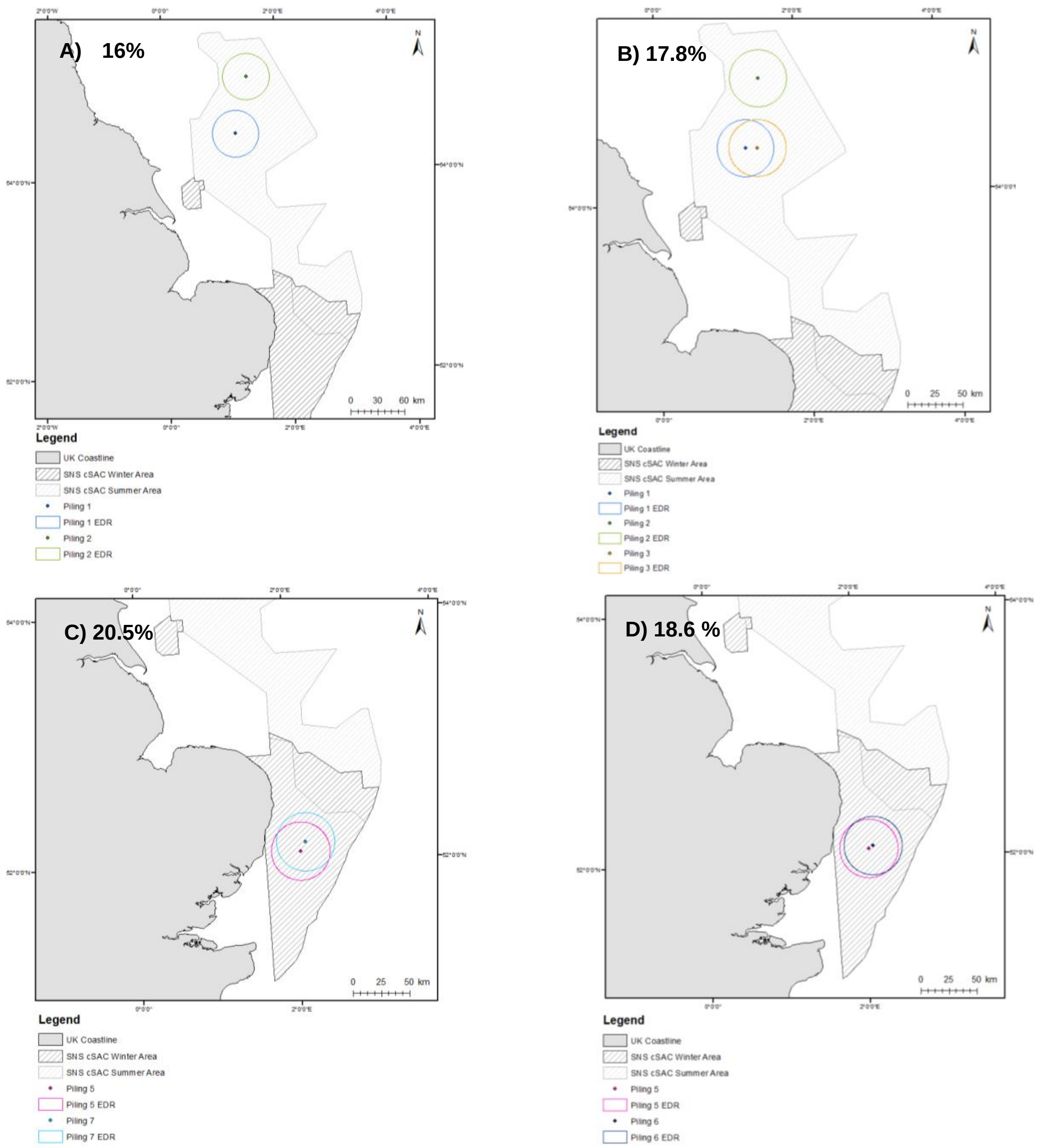

Figure 1: Daily piling scenarios and associated % disturbance for the seasonal areas (A & B = summer; C & D = winter) of the Southern North Sea harbour porpoise SAC. Piling events are separated in (A). The distance between overlapping events are 11 km (B), 9 km (C) and 5 km (D)

<u>3.4.2. Geophysical surveys in the Southern North Sea SAC example</u>

All activities likely to generate noise disturbance should be assessed in the same way as above, but the EDR is likely to be different for different activities. For seismic (airgun array) surveys, a minimum EDR of 12 km is proposed, based on Sarnocińska et al. 2020 and Thompson et al. 2013. Unlike a static pile-driving event, a geophysical source will move over several kilometres in a day. Therefore, the daily disturbance footprint should be calculated using the EDR as a 'buffer' around the predicted survey line (s) that can be completed on a single day.

For example, a single 10 km line in a single day results in ~692.4 km^2 of area if using a 12 km EDR[17]. Unlike piling during the installation of a wind farm that will last for several months/years, geophysical surveys are usually completed in a few weeks. Site surveys and sub-bottom surveys typically last one week, whilst larger regional surveys may last for a month or occasionally longer.

3.5. Adapting the Approach

To ensure that the approach advised by the SNCBs is reasonable and effective it should be periodically evaluated as more evidence becomes available. Industries with relevant plans or projects requiring HRA should be encouraged to contribute to evidence gathering to inform such evaluations. Relevant conditions should therefore be included in future regulatory approvals to obtain that evidence which meets a specific management purpose. A strategic approach arising from the collaboration between industry, government (regulators and SNCBs), academia and NGOs should inform noise management for harbour porpoise sites. In addition, for all relevant activities, retrospective compliance monitoring, making use of data in regulatory returns and the UK Marine Noise Registry for example, should be undertaken to assess whether processes are effective in keeping disturbance below the advised area/time thresholds. Lessons learned from impact and compliance monitoring will be used to improve assessment and management practices in the context of adaptive management.

It is recognised that the approach presented in this document is based on a few assumptions and carries some uncertainty. It will be challenging to administer and will require close working between all stakeholders, particularly the different regulators. However, the threshold approach provides clarity as to the limits industries should work within, is applicable to several industries and noisy activities and allows potential disturbance impacts to be easily calculated. There may, however, be specific noisy activities for which a different approach may be preferable. Where the available evidence supports a different approach, SNCBs will work with regulators to assess relevant applications and it may be appropriate to incorporate relevant information into a future redraft of the guidance. JNCC, NE and DAERA are therefore committed to periodically reviewing this advice to ensure it remains workable, effective and takes account of best available evidence.

4 References

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[17] See HRA for the Spectrum seismic survey in the Southern North Sea SAC for a worked example of how the daily deterrence footprint of a seismic survey should be estimated: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/799521/Spectrum_Seismic_Survey_HRA_Rev_1.3.pdf

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